REPORT UAG-10

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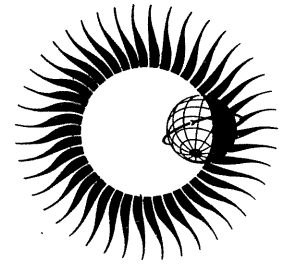
Upper Atmosphere Geophysics

ATLAS OF IONOGRAMS



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WORLD DATA CENTER A

Upper Atmosphere Geophysics

REPORT UAG-10

ATLAS OF IONOGRAMS

Edited by

A. H. Shapley
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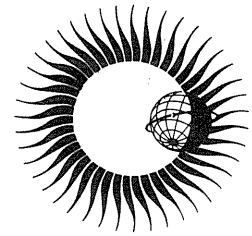
Boulder, Colorado



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FOREWORD

Geophysics is a patently international science, and this is well exemplified by the ionospheric vertical soundings program within which some 40 countries now operate more than 130 stations in a coordinated effort to monitor the highly variable conditions of the upper atmosphere. World networks of observing stations are needed for 24-hour coverage of solar phenomena and for full geographical coverage of geophysical conditions and phenomena observed by ground-based techniques. For adequate interpretation, almost every experiment or series of observations is dependent on data from some other place or some other solar-terrestrial program, data from both ground stations and spacecraft. Thus, for a long time there have been arrangements within the community of solar-terrestrial scientists to share observational results for both scientific and practical objectives. The traditional scientist-scientist exchange has been supplemented in the last decade by more regularized channels better suited to serve the greatly increased volume of data and number of observers and users of the data, in particular workers new to the field who are not on long-standing interchange lists. The success of these efforts depends on the voluntary cooperation of all participants and continuous efforts to keep descriptions of compatible phenomena uniform.

Vigorous coordination efforts were undertaken for the International Geophysical Year (1957-58) by the URSI/AGI Special Committee on Worldwide Ionospheric Soundings (WWSC); since the dissolution of the WWSC, work continued under the auspices of the International Committee on Geophysics (CIG), and the Special Committee for the International Years of the Quiet Sun and the URSI/IQSY Committee, its counterpart in the International Union of Radio Science. Since 1967 the responsibility for detailed guidance of international data exchange has devolved on the Inter-Union Commission for Solar-Terrestrial Physics (IUCSTP) Working Group 1 on Monitoring of Solar-Terrestrial Environment, and the detailed work in vertical soundings has been under the auspices of the URSI/STP Committee, acting principally through its Consultant for Vertical Soundings, a post held throughout by W. R. Piggott. Much work was also done by groups associated with the World Data Centers (WDCs).

One of the results of the WWSC's work for the IGY was an Atlas of Ionograms (June 1957), prepared especially for the guidance of the large number of new station operators then entering the field. This atlas found a still wider audience among many new research workers attracted to geophysics in recent years, but has been out of print for some time. Accordingly, plans were laid for a new atlas that would serve field-station needs in the future and that could also be useful to the research worker as a reference collection.

Although some of the material from the first atlas remains, particularly that concerning special phenomena, the main body of the present work consists of ionograms that were obtained especially for it in response to requests for distribution made under the auspices of the WWSC.

A publication of this type can only be produced by the unselfish cooperation of many people, and represents a great amount of work. Even the selection of ionograms for publication usually takes much more time and effort than would be expected, and the collation, interpretation, and checking have proved to be a major work. But, despite the inordinate delays suffered in the publication of this atlas, in the opinion of the URSI/STP Consultant for Vertical Soundings and others who were polled informally, it should still serve a valuable purpose in its present form, although a number of newer ionosondes based on improved recording techniques are now in operation. The original group that compiled much of the material deserves great credit for the work they carried out and not be thought responsible for the long delay in the completion and publication of the atlas; those responsible for the latter are therefore shown as the editors.

The original organization of the project and collection of many of the ionogram examples were done by J. W. Wright, while the major amount of the detail work was done by Mrs. L. Hayden, both of the former Central Radio Propagation Laboratory, Boulder, Colorado, U.S.A. Martin Nason and May Laughrun greatly assisted the editor in the later stages of the project. The URSI/STP Consultant for Vertical Soundings, W. R. Piggott, has prodded the project to completion and has helped on much of the descriptive text.

A. H. Shapley
April 14, 1970

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INTRODUCTION

Above the present-day peak altitude of manned aircraft or balloons, and below the practical lower altitude limit of earth satellites lies the underside of our planet's ionosphere, roughly from 60 to 300 km above the earth. In this region, important for terrestrial radio communication as well as for most of the chemical, magnetic, photoemission, and dynamic processes resulting from atmospheric absorption of solar radiation, synoptic observations continue to be made by a technique dating back some three decades, the sweep-frequency radio vertical sounding method developed by Breit and Tuve (1926).[1] This method exploits the most intimate interaction between a radio wave and weak plasma that constitutes the ionosphere; it is therefore not surprising that the technique is still in use today, basically unchanged. In fact, it is in the nature of this interaction that the complex spatial structure of the ionosphere is displayed with great sensitivity on these sweep frequency soundings, or ionograms, and it has consequently become possible in recent years to extend this exploitation to the calculation of electron density distributions giving considerable spatial and temporal detail. Although such calculations are essential for most quantitative studies, it has long been sufficient for many purposes to employ ionogram patterns directly in visualizing the highly variable structure of the ionosphere. Thus, day and night, seasonal, geographic, solar-cycle, and disturbance conditions each offer characteristic -- if highly variable -- electron distributions and correspondingly characteristic ionograms.

This atlas is primarily directed to the objective of illustrating these characteristic conditions of the ionosphere, by means of ionograms obtained throughout the world. In a secondary way, it also illustrates some features of the various sounding equipment in use throughout the world, and several extensions and adaptations of the technique. These ionograms represent noon and midnight worldwide conditions at three seasons in the years 1961-1962. Examples of special phenomena are also provided in this work, since experience has shown that many of these are often not recognized on those rare but scientifically very important occasions when they are present at an abnormal latitude, e.g., auroral phenomena at low latitudes. A few typical ionograms have been analyzed to obtain the electron distribution from which the sounding echoes returned.

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[1] Breit, G., and M. A. Tuve, A test of the existence of the conducting layer, Phys. Rev. 28 (3), 554-575, September 1926.

An effort has been made to point out features of many of the ionograms that are typical or atypical, or are of special current research interest. While numerical values of commonly recognized parameters are identified in many cases, an effort has been made to avoid a thorough application of some of the more arbitrary rules currently in use for standard data reduction. We feel that this is largely compensated by the N(h) profiles and accompanying discussion, since these give a more permanently objective view of the information available from the ionogram.

With the advent of satellite measurement and the detailed studies of the electron density profiles by rocket, incoherent (Thomson) scatter, or other ground-based techniques, the need to use a uniform description of ionograms has steadily increased, and care has been taken to show cases that clearly distinguish different phenomena. The detailed rules can be found in the URSI Handbook of Ionogram Interpretation and Reduction,[2] supplemented by the IQSY Manual of Ionospheric Vertical Soundings[3] and reports by the Consultant for Vertical Soundings of the URSI/STP Committee published in the URSI Information Bulletin and Solar Terrestrial Physics Notes.

Typical ionograms from most of the types of ionosonde in use when this atlas was compiled are shown in Section I. Different frequency and height scales introduce some differences in the appearance of the ionograms. A list of stations known to be using each type at the time of compilation is appended to each example, but since the deployment of ionosondes is continuously changing the current world lists or the tables of data produced should be consulted for usage in any given year. Shown with the ionograms are the nominal ionogram times, i.e., the time when the ionosonde swept through 3 MHz. It should be noted that the reproduction of the ionograms can be in either positive or negative form relative to the original ionogram, depending on the form in which duplicates were sent; it is common for prints from film ionograms to be reversed in reproduction.

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[2]Piggott, W. R., and K. Rawer, URSI Handbook of Ionogram Interpretation and Reduction, Elsevier, 1961. (A revised edition is in preparation for publication in the UAG Report series of World Data Center A, Upper Atmosphere Geophysics.)

[3]IQSY Instruction Manual No. 3, Ionosphere, IQSY Secretariat, London, August 1963. (Reprinted in Annals of the IQSY, 1, 58-125, The MIT Press, Cambridge, 1968.)

Since the ionosphere responds to such a wide variety of influences, a truly comprehensive sampling would lead to an impossibly large number of examplary ionograms. Section II gives examples of noon and midnight ionograms for each season for a large number of stations, with the stations grouped by magnetic dip rather than geographic latitude. The important, but often subtle, magnetic control of the ionosphere is thereby represented, although the latitude progression of the solar-controlled features will be out of sequence. The dip latitudes used, illustrated on page ix, refer to the year 1961, but these change only gradually with epoch. For a central dipole field (geomagnetic coordinate system) the relation between the geomagnetic latitude and geomagnetic dip is given by

$$\tan(\text{geomag lat}) = \tfrac{1}{2} \tan(\text{geomag dip}).$$

It is convenient to use the same relation to describe the equivalent latitude for the actual dip field,

$$\tan(\text{mag lat}) = \tfrac{1}{2} \tan(\text{dip}),$$

and this, which is known as the magnetic latitude system, is used here.

Section III shows examples of peculiar phenomena, in particular types of Es, with some stress on distinguishing points between the different types. Also shown are examples of spread F and sequences due to tidal effects of horizontal movements of ionized ridges. It is important that the occurrence of phenomena in geographical locations where they are seldom seen be recognized and reported, particularly phenomena that can be the subject of studies requiring international cooperation, e.g., form parts of the projects of the working groups of the Inter-Union Commission for Solar-Terrestrial Physics.

ACKNOWLEDGMENTS

Ionograms obtained by the following organizations have been used in compiling this atlas; their cooperation is gratefully acknowledged.

Radio Research Laboratories - Kokubunji, Tokyo, Japan
Ionospheric Prediction Service - Millers Point, N. S. W., Australia
Geophysical Observatory - Christchurch, New Zealand
Max-Planck Institut für Physik der Ionosphäre - Lindau, Fed. Rep. of Germany
Astrophysical Observatory - Kodaikanal, India
Institut für Meteorologie und Geophysik - Graz, Austria
Radio Wave Research Laboratories - Taipei, Taiwan, China
Instituto Geofisico e Geodetica - Genova, Italy
Ministerio de Marino - Buenos Aires, Argentina
Institute Scientifique Cherifien, Laboratoire Ionosphere - Rabat, Morocco
Telecommunications Research Laboratory - Johannesburg, South Africa
Laboratoire National de Radioelectricite - Bagneux, France
Försvarets Forskningsanstalt - Stockholm, Sweden
Norwegian Defense Research Establishment - Kjeller, Norway
Escolo Politecnica, University de Sao Paulo - Sao Paulo, Brazil
S. R. C. Radio and Space Research Station - Slough, Bucks, England
Laboratoire National de Radioelectricite - Annexe de Poitiers, Poitiers, France
Defense Research Telecommunications Establishment - Ottawa, Canada
University College - Ibadan, Nigeria
Uppsala Ionosphere Observatory - Uppsala, Sweden
Icelandic Post and Telegraph - Reykjavik, Iceland
Instituto Geofisico - Huancayo, Peru
Geophysical Institute - College, Alaska, U.S.A.
Manila Observatory - Baguio, Philippines
U. S. Army Signal Corps - Fort Monmouth, New Jersey, U.S.A.
ESSA Institute for Telecommunication Sciences - Boulder, Colorado, U.S.A.
(formerly CRPL, National Bureau of Standards)

Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation - Moscow, U.S.S.R.
Physical Research Laboratory - Ahmedabad, India
Institute for Automation and Telecommunications - Belgrade, Yugoslavia
Pontificia Universidad Javeriana - Bogota, Colombia
Ionosphären-Institut - Breisach, Freiburg, Fed. Rep. of Germany
Universidad de Concepcion - Concepcion, Chile
Institut Royal Meteorologique de Belgique - Bruxelle, Belgium
Centre D'Etudes Geophysiques - Garchy, France
Kwame Nkrumah University - Kumasi, Ghana
Technical University of Denmark - Lyngby, Denmark
National Physical Laboratory - New Delhi, India
Deutsche Akademie der Wissenschaften - Juliusruh/Rügen, German Dem. Rep.
Service Meteorologico Nacional - Lisboa, Spain
Ministerio da Marinka - Natal, Brazil
Royal Netherlands Meteorological Institute - DeBilt, Netherlands
Institute of Geophysics of the Czechoslovakian Academy of Science - Prague, Czechoslovakia
Instituto Nazionale Di Geofisico - Roma, Italy
University of Washington - Seattle, Washington, U.S.A.
Geophysical Observatory - Sodankylä, Finland
Direction Generales des Postes Telegraphes et Telephones - Berne, Switzerland
Research Institute of National Defense - Stockholm, Sweden
Observatorio Del Ebro - Tortosa, Spain
Universidad Nacional de Tucuman - Argentina
University of Illinois - Urbana, Illinois, U.S.A.

Compilation has been performed by Lucile S. Hayden under the direction of J. William Wright. She was assisted by H. Irene Brophy, Verda Miller, and Sidney M. Ostrow.

LIST OF STATIONS BY MAGNETIC DIP

MAGNETIC DIP	STATION	GEOGRAPHIC LAT.	GEOGRAPHIC LONG.	GEOMAGNETIC LAT.	GEOMAGNETIC LONG.
89.2N	* RESOLUTE BAY CANADA	74 42N	94 54W	83.0N	289.3
86.9N	NORTH POLE-8 U.S.S.R.	83 38N	142 48W	72.4N	188.8
85.8N	THULE GREENLAND	76 24N	68 19W	87.9N	1.9
84.8S	CAPE HALLETT ANTARCTICA	72 19S	170 13E	74.7S	278.2
84.3N	HEISS ISLAND U.S.S.R.	80 37N	58 03E	71.3N	156.0
83.5N	DIXON ISLAND U.S.S.R.	73 30N	80 24E	63.0N	161.4
83.4S	SCOTT BASE ANTARCTICA	77 51S	166 48E	79.0S	294.2
83.0N	* CHURCHILL CANADA	58 48N	94 12W	68.7N	322.6
82.4S	WILKES ANTARCTICA	66 20S	110 50E	77.7S	179.1
81.9N	GODHAVN GREENLAND	69 16N	53 30W	79.8N	32.5
80.3N	BARROW U.S.A.	71 08N	156 48W	68.5N	241.1
79.6N	SALEKHARD U.S.S.R.	66 32N	66 32E	57.3N	148.9
78.1N	MURMANSK U.S.S.R.	68 57N	33 03E	64.2N	126.5
77.9N	TROMSØ NORWAY	69 39N	18 57E	67.1N	116.8
77.5N	NARSSARSSUAQ GREENLAND	61 11N	45 25W	71.2N	36.8
77.1N	COLLEGE U.S.A.	64 52N	147 49W	64.7N	256.5
77.1N	* WINNIPEG CANADA	49 54N	97 24W	59.6N	322.7
77.0N	KIRUNA SWEDEN	67 50N	20 26E	65.3N	115.5
77.0N	SODANKYLÄ FINLAND	67 22N	26 39E	63.8N	120.0
76.0N	REYKJAVIK ICELAND	64 08N	21 47W	70.2N	70.8
76.0S	CAMPBELL ISLAND NEW ZEALAND	52 33S	169 09E	57.3S	253.2
75.9N	YAKUTSK U.S.S.R.	62 01N	129 43E	50.9N	193.7
75.6S	SOUTH POLE ANTARCTICA	90 00S	-	78.5S	.0
75.4N	LYCKSELE SWEDEN	64 37N	18 40E	62.8N	111.0
75.1S	BYRD STATION ANTARCTICA	80 00S	120 00W	70.6S	336.0
74.9N	* OTTAWA CANADA	45 24N	75 54W	56.8N	351.1
74.7N	TOMSK U.S.S.R.	56 28N	84 56E	45.9N	159.6
74.0N	PROVIDENIE BAY U.S.S.R.	64 23N	173 24W	59.6N	235.7
73.5N	SVERDLOVSK U.S.S.R.	56 44N	61 04E	48.5N	140.7
73.3N	ANCHORAGE U.S.A.	61 10N	149 55W	60.9N	258.1
73.2N	LENINGRAD U.S.S.R.	59 57N	30 42E	56.3N	117.4
73.0N	NURMIJÄRVI FINLAND	60 30N	24 39E	57.9N	112.5
72.8S	HOBART AUSTRALIA	42 55S	147 19E	51.7S	224.3
72.5N	UPPSALA SWEDEN	59 48N	17 36E	58.5N	105.9
71.9N	* ST. JOHN'S CANADA	47 36N	52 42W	58.5N	21.2
71.6N	GORKY U.S.S.R.	56 09N	44 17E	50.3N	126.7
71.4N	FORT MONMOUTH U.S.A.	40 23N	74 08W	51.8N	353.7
71.2N	INVERNESS U.K.	57 27N	04 15W	60.6N	83.3
71.2N	IRKUTSK U.S.S.R.	52 28N	104 02E	41.1N	174.4
71.1N	URBANA U.S.A.	40 02N	88 22W	50.6N	333.0
70.6N	MOSCOW U.S.S.R.	55 28N	37 19E	50.9N	120.5
70.4N	SEATTLE U.S.A.	47 33N	122 21W	53.6N	294.4
70.2N	WASHINGTON (FORT BELVOIR) U.S.A.	38 43N	77 07W	50.1N	350.1
69.6N	WALLOPS ISLAND U.S.A.	37 53N	75 28W	49.2N	348.5
69.0S	GODLEY HEAD NEW ZEALAND	43 34S	172 48E	48.1S	252.8
68.9N	* JULIUSRUH/RÜGEN GERMAN DEM. REP.	54 60N	13 24E	54.5N	98.7
67.8N	BOULDER U.S.A.	40 02N	105 18W	48.9N	316.4
67.7S	SYOWA BASE ANTARCTICA	69 00S	39 36E	69.7S	77.7
67.1N	DE BILT NETHERLANDS	52 06N	05 11E	53.8N	89.4
66.8N	SLOUGH U.K.	51 31N	00 34W	54.3N	84.1
66.6N	LINDAU FED. REP. OF GERMANY	51 39N	10 08E	52.3N	93.9
66.5S	MUNDARING AUSTRALIA	31 59S	116 12E	43.5S	186.1
66.1S	CANBERRA AUSTRALIA	35 18S	149 12E	44.0S	224.3
65.7S	HALLEY BAY ANTARCTICA	75 31S	26 42W	65.8S	24.3
65.5N	DOURBES BELGIUM	50 06N	04 36E	52.0N	87.7
65.3N	PRUHONICE CZECHOSLOVAKIA	49 59N	14 33E	49.9N	97.4
64.2S	CAPE TOWN REP. OF S. AFRICA	34 08S	18 19E	32.8S	79.7
64.1N	ROSTOV U.S.S.R.	47 13N	39 41E	42.5N	119.2
63.9N	ADAK U.S.A.	51 52N	176 39W	47.2N	240.0
63.6N	FREIBURG FED. REP. OF GERMANY	48 03N	07 35E	48.4N	90.0
63.1N	GARCHY FRANCE	47 17N	3 04E	49.6N	84.9
62.6N	GRAZ AUSTRIA	47 04N	15 27E	47.0N	96.9
62.6N	POITIERS FRANCE	46 35N	0 20E	49.5N	81.8
62.3N	SCHWARZENBURG SWITZERLAND	46 59N	06 44E	48.2N	88.2
62.2N	ALMA-ATA U.S.S.R.	43 15N	75 55E	33.4N	150.7
61.5S	JOHANNESBURG REP. OF S. AFRICA	26 04S	28 06E	26.9S	91.3
61.2N	CAPE KENNEDY U.S.A.	28 24N	80 35W	39.6N	346.7
61.1N	YUZHNO-SAKHALINSK U.S.S.R.	47 01N	142 43E	36.9N	206.6
61.0N	BEOGRAD YUGOSLAVIA	44 48N	20 31E	43.8N	101.2
60.2N	GENOVA-MONTE CAPELLINO ITALY	44 33N	08 57E	45.8N	89.6
60.2N	WHITE SANDS U.S.A.	30 24N	106 52W	41.1N	316.9
59.7N	GRAND BAHAMA WEST INDIES	26 40N	78 22W	37.9N	349.6
59.6N	WAKKANAI JAPAN	45 24N	141 41E	35.3N	206.0
58.0S	ARGENTINE ISLAND ANTARCTICA	65 15S	64 16W	53.8S	03.3
57.6S	BRISBANE AUSTRALIA	27 32S	152 55E	35.7S	226.9
57.4N	SAN SALVADOR WEST INDIES	24 00N	74 25W	35.5N	353.8
57.4S	DECEPCION ANTARCTIC	62 59S	60 43W	51.6S	6.1
57.1N	ROMA (S. ALESSIO) ITALY	41 54N	12 30E	42.5N	91.9
56.7N	TORTOSA SPAIN	40 49N	00 30E	43.9N	79.5
55.8N	ASHKHABAD U.S.S.R.	37 55N	58 18E	30.4N	133.3
55.0S	TSUMEB SOUTH WEST AFRICA	19 14S	17 43E	18.2S	82.8
53.7N	AKITA JAPAN	39 44N	140 08E	29.5N	205.4
51.9S	USHUAIA ARGENTINA	54 48S	68 20W	43.3S	00.5
51.1N	PUERTO RICO U.S.A.	18 30N	67 10W	30.0N	02.0
48.9N	TOKYO (KOKUBUNJI) JAPAN	35 42N	139 29E	25.4N	205.4
48.5S	PORT STANLEY FALKLAND ISLANDS	51 42S	57 51W	40.4S	09.1
48.4S	TOWNSVILLE AUSTRALIA	19 19S	146 44E	28.5S	218.8
48.0N	RABAT MOROCCO	33 55N	06 50W	38.6N	69.9
46.5N	MEXICO CITY MEXICO	19 19N	99 33W	29.1N	326.8
44.1N	YAMAGAWA JAPAN	31 13N	130 38E	20.3N	197.8
41.8S	TRELEW ARGENTINA	43 13S	65 18W	31.7S	03.2
41.6N	DELHI INDIA	28 38N	77 13E	18.9N	148.9
38.3N	MAUI HAWAII	20 50N	156 30W	20.9N	268.1
38.2S	RAROTONGA PACIFIC OCEAN	21 12S	159 45W	20.9S	273.6
36.8N	OKINAWA CHINA SEA	26 19N	127 47E	15.3N	195.6
36.4S	CONCEPCION CHILE	36 47S	73 01W	25.1S	356.5
35.0N	TAIPEI TAIWAN	25 00N	121 30E	13.7N	189.8
33.2S	PORT MORESBY NEW GUINEA	9 26S	147 13E	18.6S	217.8
32.8S	BUENOS AIRES ARGENTINA	34 35S	58 29W	23.2S	9.4
31.8N	AHMEDABAD INDIA	23 01N	72 36E	13.8N	143.9
31.7N	BOGOTA COLOMBIA	4 38N	74 05W	15.9N	354.6
31.1N	PARAMARIBO SURINAM	05 49N	55 13W	17.0N	14.4
29.7N	MACAO CHINA SEA	22 12N	113 33E	10.7N	182.4
23.3S	SAO PAULO BRAZIL	23 33S	46 38W	12.8S	21.1
22.8S	TUCUMAN ARGENTINA	26 53S	65 23W	15.4S	03.3
18.5S	BAGUIO PHILIPPINES	16 25N	120 35E	5.1N	189.2
18.3S	SINGAPORE MALAYA	01 19N	103 49E	10.1S	172.7
13.2N	TALARA PERU	04 64S	81 15W	6.6N	347.7
7.4S	KUMASI GHANA	06 42N	01 34W	11.0N	69.0
3.9S	IBADAN NIGERIA	07 26N	3 53E	10.6N	74.7
3.6S	NATAL BRAZIL	5 42S	35 12W	3.9N	33.7
2.4N	KODAIKANAL INDIA	10 14N	77 29E	0.6N	147.1
1.2N	HUANCAYO PERU	12 03S	75 20W	0.6S	353.8

* GEOGRAPHIC LATITUDE AND LONGITUDE FURNISHED IN DEGREES AND TENTHS OF A DEGREE AND CONVERTED TO DEGREES AND MINUTES

LIST OF STATIONS BY ALPHABET

STATION	GEOGRAPHIC LAT.	GEOGRAPHIC LONG.	GEOMAGNETIC LAT.	GEOMAGNETIC LONG.	MAGNETIC DIP
ADAK U.S.A.	51 52N	176 39W	47.2N	240.0	63.9N
AHMEDABAD INDIA	23 01N	72 36E	13.8N	143.9	31.8N
AKITA JAPAN	39 44N	140 08E	29.5N	205.4	53.7N
ALMA-ATA U.S.S.R.	43 15N	75 55E	33.4N	150.7	62.2N
ANCHORAGE U.S.A.	61 10N	149 55W	60.9N	258.1	73.3N
ARGENTINE ISLAND ANTARCTICA	65 15S	64 16W	53.8S	03.3	58.0S
ASHKHABAD U.S.S.R.	37 55N	58 18E	30.4N	133.3	55.8N
BAGUIO PHILIPPINES	16 25N	120 35E	5.1N	189.2	18.5S
BARROW U.S.A.	71 08N	156 48W	68.5N	241.1	80.3N
BEOGRAD YUGOSLAVIA	44 48N	20 31E	43.8N	101.2	61.0N
BOGOTA COLOMBIA	4 38N	74 05W	15.9N	354.6	31.7N
BOULDER U.S.A.	40 02N	105 18W	48.9N	316.4	67.8N
BRISBANE AUSTRALIA	27 32S	152 55E	35.7S	226.9	57.6S
BUENOS AIRES ARGENTINA	34 35S	58 29W	23.2S	9.4	32.8S
BYRD STATION ANTARCTICA	80 00S	120 00W	70.6S	336.0	75.1S
CAMPBELL ISLAND NEW ZEALAND	52 33S	169 09E	57.3S	253.2	76.0S
CANBERRA AUSTRALIA	35 18S	149 12E	44.0S	224.3	66.1S
CAPE HALLETT ANTARCTICA	72 19S	170 13E	74.7S	278.2	84.8S
CAPE KENNEDY U.S.A.	28 24N	80 35W	39.6N	346.7	61.2N
CAPE TOWN REP. OF S. AFRICA	34 08S	18 19E	32.8S	79.7	64.2S
* CHURCHILL CANADA	58 48N	94 12W	68.7N	322.6	83.0N
COLLEGE U.S.A.	64 52N	147 49W	64.7N	256.5	77.1N
CONCEPCION CHILE	36 47S	73 01W	25.1S	356.5	36.4S
DE BILT NETHERLANDS	52 06N	05 11E	53.8N	89.4	67.1N
DECEPCION ANTARCTIC	62 59S	60 43W	51.6S	6.1	57.4S
DELHI INDIA	28 38N	77 13E	18.9N	148.9	41.6N
DIXON ISLAND U.S.S.R.	73 30N	80 24E	63.0N	161.4	83.5N
DOURBES BELGIUM	50 06N	04 36E	52.0N	87.7	65.5N
FORT MONMOUTH U.S.A.	40 23N	74 08W	51.8N	353.7	71.4N
FREIBURG FED. REP. OF GERMANY	48 03N	07 35E	48.4N	90.0	63.6N
GARCHY FRANCE	47 17N	3 04E	49.6N	84.9	63.1N
GENOVA-MONTE CAPELLINO ITALY	44 33N	08 57E	45.8N	89.6	60.2N
GODHAVN GREENLAND	69 16N	53 30W	79.8N	32.5	81.9N
GODLEY HEAD NEW ZEALAND	43 34S	172 48E	48.1S	252.8	69.0S
GORKY U.S.S.R.	56 09N	44 17E	50.3N	126.7	71.6N
GRAND BAHAMA WEST INDIES	26 40N	78 22W	37.9N	349.6	59.7N
GRAZ AUSTRIA	47 04N	15 27E	47.0N	96.9	62.6N
HALLEY BAY ANTARCTICA	75 31S	26 42W	65.8S	24.3	65.7S
HEISS ISLAND U.S.S.R.	80 37N	58 03E	71.3N	156.0	84.3N
HOBART AUSTRALIA	42 55S	147 19E	51.7S	224.3	72.8S
HUANCAYO PERU	12 03S	75 20W	0.6S	353.8	1.2N
IBADAN NIGERIA	07 26N	3 53E	10.6N	74.7	3.9S
INVERNESS U.K.	57 27N	04 15W	60.6N	83.3	71.2N
IRKUTSK U.S.S.R.	52 28N	104 02E	41.1N	174.4	71.2N
JOHANNESBURG REP. OF S. AFRICA	26 04S	28 06E	26.9S	91.3	61.5S
* JULIUSRUH/RÜGEN GERMAN DEM. REP.	54 60N	13 24E	54.5N	98.7	68.9N
KIRUNA SWEDEN	67 50N	20 26E	65.3N	115.5	77.0N
KODAIKANAL INDIA	10 14N	77 29E	0.6N	147.1	2.4N
KUMASI GHANA	06 42N	01 34W	11.0N	69.0	7.4S
LENINGRAD U.S.S.R.	59 57N	30 42E	56.3N	117.4	73.2N
LINDAU FED. REP. OF GERMANY	51 39N	10 08E	52.3N	93.9	66.6N
LYCKSELE SWEDEN	64 37N	18 40E	62.8N	111.0	75.4N
MACAO CHINA SEA	22 12N	113 33E	10.7N	182.4	29.7N
MAUI HAWAII	20 50N	156 30W	20.9N	268.1	38.3N
MEXICO CITY MEXICO	19 19N	99 33W	29.1N	326.8	46.5N
MOSCOW U.S.S.R.	55 28N	37 19E	50.9N	120.5	70.6N
MUNDARING AUSTRALIA	31 59S	116 12E	43.5S	186.1	66.5S
MURMANSK U.S.S.R.	68 57N	33 03E	64.2N	126.5	78.1N
NARSSARSSUAQ GREENLAND	61 11N	45 25W	71.2N	36.8	77.5N
NATAL BRAZIL	5 42S	35 12W	3.9N	33.7	3.6S

STATION	GEOGRAPHIC LAT.	GEOGRAPHIC LONG.	GEOMAGNETIC LAT.	GEOMAGNETIC LONG.	MAGNETIC DIP
NORTH POLE-8 U.S.S.R.	83 38N	142 48W	72.4N	188.8	86.9N
NURMIJÄRVI FINLAND	60 30N	24 39E	57.9N	112.5	73.0N
OKINAWA CHINA SEA	26 19N	127 47E	15.3N	195.6	36.8N
* OTTAWA CANADA	45 24N	75 54W	56.8N	351.1	74.9N
PARAMARIBO SURINAM	05 49N	55 13W	17.0N	14.4	31.1N
POITIERS FRANCE	46 35N	0 20E	49.5N	81.8	62.6N
PORT MORESBY NEW GUINEA	9 26S	147 13E	18.6S	217.8	33.2S
PORT STANLEY FALKLAND ISLANDS	51 42S	57 51W	40.4S	09.1	48.5S
PROVIDENIE BAY U.S.S.R.	64 23N	173 24W	59.6N	235.7	74.0N
PRUHONICE CZECHOSLOVAKIA	49 59N	14 33E	49.9N	97.4	65.3N
PUERTO RICO U.S.A.	18 30N	67 10W	30.0N	02.0	51.1N
RABAT MOROCCO	33 55N	06 50W	38.6N	69.9	48.0N
RAROTONGA PACIFIC OCEAN	21 12S	159 45W	20.9S	273.6	38.2S
* RESOLUTE BAY CANADA	74 42N	94 54W	83.0N	289.3	89.2N
REYKJAVIK ICELAND	64 08N	21 47W	70.2N	70.8	76.0N
ROMA (S. ALESSIO) ITALY	41 54N	12 30E	42.5N	91.9	57.1N
ROSTOV U.S.S.R.	47 13N	39 41E	42.5N	119.2	64.1N
SALEKHARD U.S.S.R.	66 32N	66 32E	57.3N	148.9	79.6N
SAN SALVADOR WEST INDIES	24 00N	74 25W	35.5N	353.8	57.4N
SAO PAULO BRAZIL	23 33S	46 38W	12.8S	21.1	23.3S
SCHWARZENBURG SWITZERLAND	46 39N	06 44E	48.2N	88.2	62.3N
SCOTT BASE ANTARCTICA	77 51S	166 48E	79.0S	294.2	83.4S
SEATTLE U.S.A.	47 33N	122 21W	53.6N	294.4	70.4N
SINGAPORE MALAYA	01 19N	103 49E	10.1S	172.7	18.3S
SLOUGH U.K.	51 31N	00 34W	54.3N	84.1	66.8N
SODANKYLÄ FINLAND	67 22N	26 39E	63.8N	120.0	77.0N
SOUTH POLE ANTARCTICA	90 00S	–	78.5S	.0	75.6S
* ST. JOHN'S CANADA	47 36N	52 42W	58.5N	21.2	71.9N
SVERDLOVSK U.S.S.R.	56 44N	61 04E	48.5N	140.7	73.5N
SYOWA BASE ANTARCTICA	69 00S	39 36E	69.7S	77.7	67.7S
TAIPEI TAIWAN	25 00N	121 30E	13.7N	189.8	35.0N
TALARA PERU	04 34S	81 15W	6.6N	347.7	13.2N
THULE GREENLAND	76 24N	68 19W	87.9N	1.9	85.8N
TOKYO (KOKUBUNJI) JAPAN	35 42N	139 29E	25.4N	205.4	48.9N
TOMSK U.S.S.R.	56 28N	84 56E	45.9N	159.6	74.7N
TORTOSA SPAIN	40 49N	00 30E	43.9N	79.5	56.7N
TOWNSVILLE AUSTRALIA	19 19S	146 44E	28.5S	218.8	48.4S
TRELEW ARGENTINA	43 13S	65 16W	31.7S	03.2	41.8S
TROMSØ NORWAY	69 39N	18 57E	67.1N	116.8	77.9N
TSUMEB SOUTH WEST AFRICA	19 14S	17 43E	18.2S	82.8	55.0S
TUCUMAN ARGENTINA	26 53S	65 23W	15.4S	03.3	22.8S
UPPSALA SWEDEN	59 48N	17 36E	58.5N	105.9	72.5N
URBANA U.S.A.	40 02N	88 22W	50.6N	333.0	71.1N
USHUAIA ARGENTINA	54 48S	68 20W	43.3S	00.5	51.9S
WAKKANAI JAPAN	45 24N	141 41E	35.3N	206.0	59.6N
WALLOPS ISLAND U.S.A.	37 53N	75 28W	49.2N	348.5	69.6N
WASHINGTON (FORT BELVOIR) U.S.A.	38 43N	77 07W	50.1N	350.1	70.2N
WHITE SANDS U.S.A.	30 24N	106 52W	41.1N	316.9	60.2N
WILKES ANTARCTICA	66 20S	110 50E	77.7S	179.1	82.4S
* WINNIPEG CANADA	49 54N	97 24W	59.6N	322.7	77.1N
YAKUTSK U.S.S.R.	62 01N	129 43E	50.9N	193.7	75.9N
YAMAGAWA JAPAN	31 13N	130 38E	20.3N	197.8	44.1N
YUZHNO-SAKHALINSK U.S.S.R.	47 01N	142 43E	36.9N	206.6	61.1N

* GEOGRAPHIC LATITUDE AND LONGITUDE FURNISHED IN DEGREES AND TENTHS OF A DEGREE AND CONVERTED TO DEGREES AND MINUTES

LIST OF STATIONS BY GEOGRAPHIC LATITUDE

GEOGRAPHIC LAT.	GEOGRAPHIC LONG.	STATION	GEOMAGNETIC LAT.	GEOMAGNETIC LONG.	MAGNETIC DIP
83 38N	142 48W	NORTH POLE-8 U.S.S.R.	72.4N	188.8	86.9N
80 37N	58 03E	HEISS ISLAND U.S.S.R.	71.3N	156.0	84.3N
76 24N	68 19W	THULE GREENLAND	87.9N	1.9	85.8N
74 42N	94 54W	* RESOLUTE BAY CANADA	83.0N	289.3	89.2N
73 30N	80 24E	DIXON ISLAND U.S.S.R.	63.0N	161.4	83.5N
71 08N	156 48W	BARROW U.S.A.	68.5N	241.1	80.3N
69 39N	18 57E	TROMSØ NORWAY	67.1N	116.8	77.9N
69 16N	53 30W	GODHAVN GREENLAND	79.8N	32.5	81.9N
68 57N	33 03E	MURMANSK U.S.S.R.	64.2N	126.5	78.1N
67 50N	20 26E	KIRUNA SWEDEN	65.3N	115.5	77.0N
67 22N	26 39E	SODANKYLÄ FINLAND	63.8N	120.0	77.0N
66 32N	66 32E	SALEKHARD U.S.S.R.	57.3N	148.9	79.6N
64 52N	147 49W	COLLEGE U.S.A.	64.7N	256.5	77.1N
64 37N	18 40E	LYCKSELE SWEDEN	62.8N	111.0	75.4N
64 23N	173 24W	PROVIDENIE BAY U.S.S.R.	59.6N	235.7	74.0N
64 08N	21 47W	REYKJAVIK ICELAND	70.2N	70.8	76.0N
62 01N	129 43E	YAKUTSK U.S.S.R.	50.9N	193.7	75.9N
61 11N	45 25W	NARSSARSSUAQ GREENLAND	71.2N	36.8	77.5N
61 10N	149 55W	ANCHORAGE U.S.A.	60.9N	258.1	73.3N
60 30N	24 39E	NURMIJÄRVI FINLAND	57.9N	112.5	73.0N
59 57N	30 42E	LENINGRAD U.S.S.R.	56.3N	117.4	73.2N
59 48N	17 36E	UPPSALA SWEDEN	58.5N	105.9	72.5N
58 48N	94 12W	* CHURCHILL CANADA	68.7N	322.6	83.0N
57 27N	04 15W	INVERNESS U.K.	60.6N	83.3	71.2N
56 44N	61 04E	SVERDLOVSK U.S.S.R.	48.5N	140.7	73.5N
56 28N	84 56E	TOMSK U.S.S.R.	45.9N	159.6	74.7N
56 09N	44 17E	GORKY U.S.S.R.	50.3N	126.7	71.6N
55 28N	37 19E	MOSCOW U.S.S.R.	50.9N	120.5	70.6N
54 60N	13 24E	* JULIUSRUH/RÜGEN GERMAN DEM. REP.	54.5N	98.7	68.9N
52 28N	104 02E	IRKUTSK U.S.S.R.	41.1N	174.4	71.2N
52 06N	05 11E	DE BILT NETHERLANDS	53.8N	89.4	67.1N
51 52N	176 39W	ADAK U.S.A.	47.2N	240.0	63.9N
51 39N	10 08E	LINDAU FED. REP. OF GERMANY	52.3N	93.9	66.6N
51 31N	00 34W	SLOUGH U.K.	54.3N	84.1	66.8N
50 06N	04 36E	DOURBES BELGIUM	52.0N	87.7	65.5N
49 59N	14 33E	PRUHONICE CZECHOSLOVAKIA	49.9N	97.4	65.3N
49 54N	97 24W	* WINNIPEG CANADA	59.6N	322.7	77.1N
48 03N	07 35E	FREIBURG FED. REP. OF GERMANY	48.4N	90.0	63.6N
47 36N	52 42W	* ST. JOHN'S CANADA	58.5N	21.2	71.9N
47 33N	122 21W	SEATTLE U.S.A.	53.6N	294.4	70.4N
47 17N	3 04E	GARCHY FRANCE	49.6N	84.9	63.1N
47 13N	39 41E	ROSTOV U.S.S.R.	42.5N	119.2	64.1N
47 04N	15 27E	GRAZ AUSTRIA	47.0N	96.9	62.6N
47 01N	142 43E	YUZHNO-SAKHALINSK U.S.S.R.	36.9N	206.6	61.1N
46 39N	06 44E	SCHWARZENBURG SWITZERLAND	48.2N	88.2	62.3N
46 35N	0 20E	POITIERS FRANCE	49.5N	81.8	62.6N
45 24N	75 54W	* OTTAWA CANADA	56.8N	351.1	74.9N
45 24N	141 41E	WAKKANAI JAPAN	35.3N	206.0	59.6N
44 48N	20 31E	BEOGRAD YUGOSLAVIA	43.8N	101.2	61.0N
44 33N	08 57E	GENOVA-MONTE CAPELLINO ITALY	45.8N	89.6	60.2N
43 15N	75 55E	ALMA-ATA U.S.S.R.	33.4N	150.7	62.2N
41 54N	12 30E	ROMA (S. ALESSIO) ITALY	42.5N	91.9	57.1N
40 49N	00 30E	TORTOSA SPAIN	43.9N	79.5	56.7N
40 23N	74 08W	FORT MONMOUTH U.S.A.	51.8N	353.7	71.4N
40 02N	105 18W	BOULDER U.S.A.	48.9N	316.4	67.8N
40 02N	88 22W	URBANA U.S.A.	50.6N	333.0	71.1N
39 44N	140 08E	AKITA JAPAN	29.5N	205.4	53.7N
38 43N	77 07W	WASHINGTON (FORT BELVOIR) U.S.A.	50.1N	350.1	70.2N
37 55N	58 18E	ASHKHABAD U.S.S.R.	30.4N	133.3	55.8N
37 53N	75 28W	WALLOPS ISLAND U.S.A.	49.2N	348.5	69.6N

GEOGRAPHIC LAT.	GEOGRAPHIC LONG.	STATION	GEOMAGNETIC LAT.	GEOMAGNETIC LONG.	MAGNETIC DIP
35 42N	139 29E	TOKYO (KOKUBUNJI) JAPAN	25.4N	205.4	48.9N
33 55N	06 50W	RABAT MOROCCO	38.6N	69.9	48.0N
31 13N	130 38E	YAMAGAWA JAPAN	20.3N	197.8	44.1N
30 24N	106 52W	WHITE SANDS U.S.A.	41.1N	316.9	60.2N
28 38N	77 13E	DELHI INDIA	18.9N	148.9	41.6N
28 24N	80 35W	CAPE KENNEDY U.S.A.	39.6N	346.7	61.2N
26 40N	78 22W	GRAND BAHAMA WEST INDIES	37.9N	349.6	59.7N
26 19N	127 47E	OKINAWA CHINA SEA	15.3N	195.6	36.8N
25 00N	121 30E	TAIPEI TAIWAN	13.7N	189.8	35.0N
24 00N	74 25W	SAN SALVADOR WEST INDIES	35.5N	353.8	57.4N
23 01N	72 36E	AHMEDABAD INDIA	13.8N	143.9	31.8N
22 12N	113 33E	MACAO CHINA SEA	10.7N	182.4	29.7N
20 50N	156 30W	MAUI HAWAII	20.9N	268.1	38.3N
19 19N	99 33W	MEXICO CITY MEXICO	29.1N	326.8	46.5N
18 30N	67 10W	PUERTO RICO U.S.A.	30.0N	02.0	51.1N
16 25N	120 35E	BAGUIO PHILIPPINES	5.1N	189.2	18.5S
10 14N	77 29E	KODAIKANAL INDIA	0.6N	147.1	2.4N
07 26N	3 53E	IBADAN NIGERIA	10.6N	74.7	3.9S
06 42N	01 34W	KUMASI GHANA	11.0N	69.0	7.4S
05 49N	55 13W	PARAMARIBO SURINAM	17.0N	14.4	31.1N
4 38N	74 05W	BOGOTA COLOMBIA	15.9N	354.6	31.7N
01 19N	103 49E	SINGAPORE MALAYA	10.1S	172.7	18.3S
04 34S	81 15W	TALARA PERU	6.6N	347.7	13.2N
5 42S	35 12W	NATAL BRAZIL	3.9N	33.7	3.6S
9 26S	147 13E	PORT MORESBY NEW GUINEA	18.6S	217.8	33.2S
12 03S	75 20W	HUANCAYO PERU	0.6S	353.8	1.2N
19 14S	17 43E	TSUMEB SOUTH WEST AFRICA	18.2S	82.8	55.0S
19 19S	146 44E	TOWNSVILLE AUSTRALIA	28.5S	218.8	48.4S
21 12S	159 45W	RAROTONGA PACIFIC OCEAN	20.9S	273.6	38.2S
23 33S	46 38W	SAO PAULO BRAZIL	12.8S	21.1	23.3S
26 04S	28 06E	JOHANNESBURG REP. OF S. AFRICA	26.9S	91.3	61.5S
26 53S	65 23W	TUCUMAN ARGENTINA	15.4S	03.3	22.8S
27 32S	152 55E	BRISBANE AUSTRALIA	35.7S	226.9	57.6S
31 59S	116 12E	MUNDARING AUSTRALIA	43.5S	186.1	66.5S
34 08S	18 19E	CAPE TOWN REP. OF S. AFRICA	32.8S	79.7	64.2S
34 35S	58 29W	BUENOS AIRES ARGENTINA	23.2S	9.4	32.8S
35 18S	149 12E	CANBERRA AUSTRALIA	44.0S	224.3	66.1S
36 47S	73 01W	CONCEPCION CHILE	25.1S	356.5	36.4S
42 55S	147 19E	HOBART AUSTRALIA	51.7S	224.3	72.8S
43 13S	65 18W	TRELEW ARGENTINA	31.7S	03.2	41.8S
43 34S	172 48E	GODLEY HEAD NEW ZEALAND	48.1S	252.8	69.0S
51 42S	57 51W	PORT STANLEY FALKLAND ISLANDS	40.4S	09.1	48.5S
52 33S	169 09E	CAMPBELL ISLAND NEW ZEALAND	57.3S	253.2	76.0S
54 48S	68 20W	USHUAIA ARGENTINA	43.3S	00.5	51.9S
62 59S	60 43W	DECEPCION ANTARCTIC	51.6S	6.1	57.4S
65 15S	64 16W	ARGENTINE ISLAND ANTARCTICA	53.8S	03.3	58.0S
66 20S	110 50E	WILKES ANTARCTICA	77.7S	179.1	82.4S
69 00S	39 36E	SYOWA BASE ANTARCTICA	69.7S	77.7	67.7S
72 19S	170 13E	CAPE HALLETT ANTARCTICA	74.7S	278.2	84.8S
75 31S	26 42W	HALLEY BAY ANTARCTICA	65.8S	24.3	65.7S
77 51S	166 48E	SCOTT BASE ANTARCTICA	79.0S	294.2	83.4S
80 00S	120 00W	BYRD STATION ANTARCTICA	70.6S	336.0	75.1S
90 00S	-	SOUTH POLE ANTARCTICA	78.5S	.0	75.6S

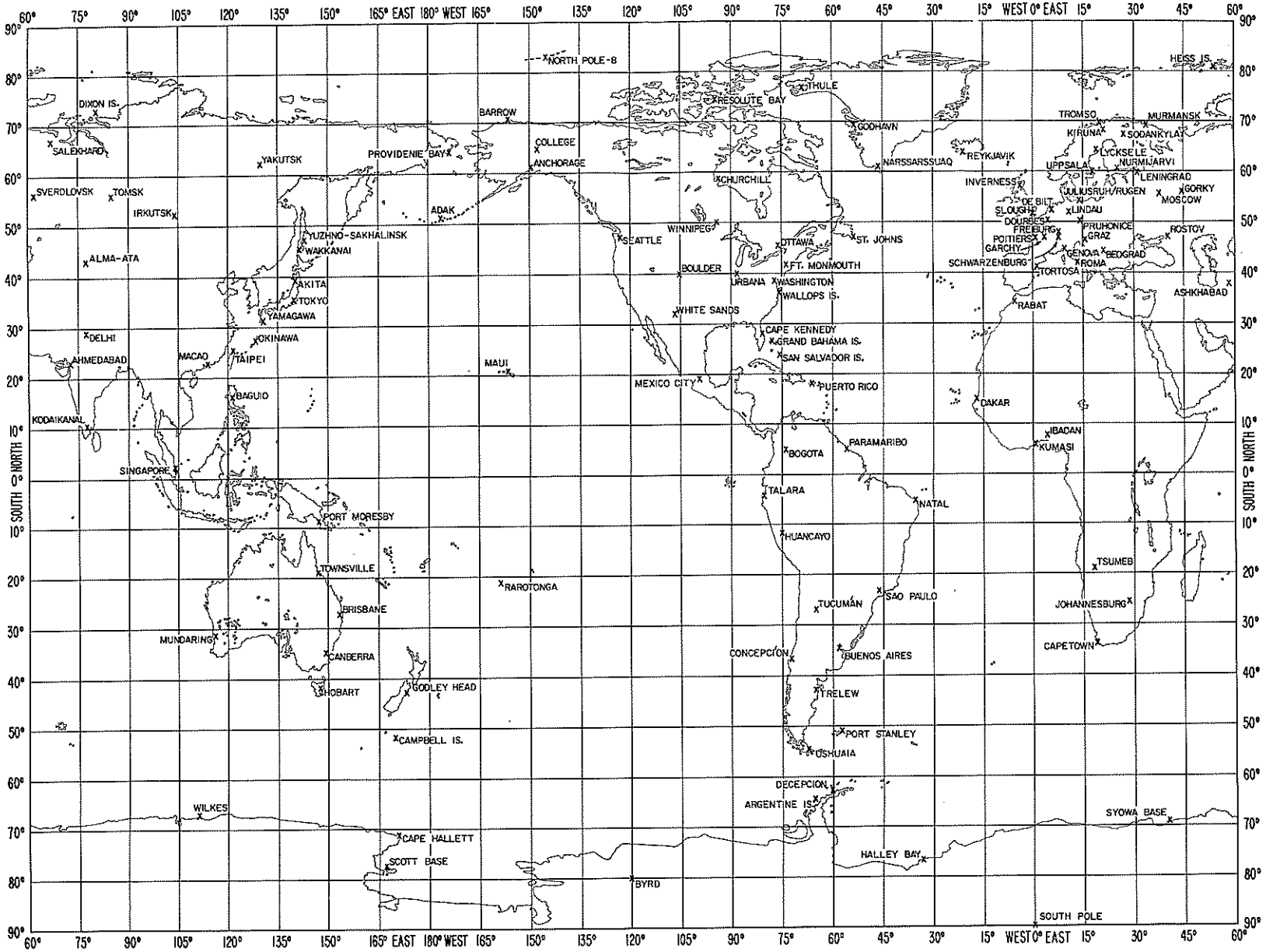
* GEOGRAPHIC LATITUDE AND LONGITUDE FURNISHED IN DEGREES AND TENTHS OF A DEGREE AND CONVERTED TO DEGREES AND MINUTES

LIST OF STATIONS BY GEOMAGNETIC LATITUDE

GEOMAGNETIC LAT.	GEOMAGNETIC LONG.	STATION	GEOGRAPHIC LAT.	GEOGRAPHIC LONG.	MAGNETIC DIP
87.9N	1.9	THULE GREENLAND	76 24N	68 19W	85.8N
83.0N	289.3	* RESOLUTE BAY CANADA	74 42N	94 54W	89.2N
79.8N	32.5	GODHAVN GREENLAND	69 16N	53 30W	81.9N
72.4N	188.8	NORTH POLE-8 U.S.S.R.	83 38N	142 48W	86.9N
71.3N	156.0	HEISS ISLAND U.S.S.R.	80 37N	58 03E	84.3N
71.2N	36.8	NARSSARSSUAQ GREENLAND	61 11N	45 25W	77.5N
70.2N	70.8	REYKJAVIK ICELAND	64 08N	21 47W	76.0N
68.7N	322.6	* CHURCHILL CANADA	58 48N	94 12W	83.0N
68.5N	241.1	BARROW U.S.A.	71 08N	156 48W	80.3N
67.1N	116.8	TROMSØ NORWAY	69 39N	18 57E	77.9N
65.3N	115.5	KIRUNA SWEDEN	67 50N	20 26E	77.0N
64.7N	256.5	COLLEGE U.S.A.	64 52N	147 49W	77.1N
64.2N	126.5	MURMANSK U.S.S.R.	68 57N	33 03E	78.1N
63.8N	120.0	SODANKYLÄ FINLAND	67 22N	26 39E	77.0N
63.0N	161.4	DIXON ISLAND U.S.S.R.	73 30N	80 24E	83.5N
62.8N	111.0	LYCKSELE SWEDEN	64 37N	18 40E	75.4N
60.9N	258.1	ANCHORAGE U.S.A.	61 10N	149 55W	73.3N
60.6N	83.3	INVERNESS U.K.	57 27N	04 15W	71.2N
59.6N	235.7	PROVIDENIE BAY U.S.S.R.	64 23N	173 24W	74.0N
59.6N	322.7	* WINNIPEG CANADA	49 54N	97 24W	77.1N
58.5N	21.2	* ST. JOHN'S CANADA	47 36N	52 42W	71.9N
58.5N	105.9	UPPSALA SWEDEN	59 48N	17 36E	72.5N
57.9N	112.5	NURMIJÄRVI FINLAND	60 30N	24 39E	73.0N
57.3N	148.9	SALEKHARD U.S.S.R.	66 32N	66 32E	79.6N
56.8N	351.1	* OTTAWA CANADA	45 24N	75 54W	74.9N
56.3N	117.4	LENINGRAD U.S.S.R.	59 57N	30 42E	73.2N
54.5N	98.7	* JULIUSRUH/RÜGEN GERMAN DEM. REP.	54 60N	13 24E	68.9N
54.3N	84.1	SLOUGH U.K.	51 31N	00 34W	66.8N
53.8N	89.4	DE BILT NETHERLANDS	52 06N	05 11E	67.1N
53.6N	294.4	SEATTLE U.S.A.	47 33N	122 21W	70.4N
52.3N	93.9	LINDAU FED. REP. OF GERMANY	51 39N	10 08E	66.6N
52.0N	87.7	DOURBES BELGIUM	50 06N	04 36E	65.5N
51.8N	353.7	FORT MONMOUTH U.S.A.	40 23N	74 08W	71.4N
50.9N	120.5	MOSCOW U.S.S.R.	55 28N	37 19E	70.6N
50.9N	193.7	YAKUTSK U.S.S.R.	62 01N	129 43E	75.9N
50.6N	333.0	URBANA U.S.A.	40 02N	88 22W	71.1N
50.3N	126.7	GORKY U.S.S.R.	56 09N	44 17E	71.6N
50.1N	350.1	WASHINGTON (FORT BELVOIR) U.S.A.	38 43N	77 07W	70.2N
49.9N	97.4	PRUHONICE CZECHOSLOVAKIA	49 59N	14 33E	65.3N
49.6N	84.9	GARCHY FRANCE	47 17N	3 04E	63.1N
49.5N	81.8	POITIERS FRANCE	46 35N	0 20E	62.6N
49.2N	348.5	WALLOPS ISLAND U.S.A.	37 53N	75 28W	69.6N
48.9N	316.4	BOULDER U.S.A.	40 02N	105 18W	67.8N
48.5N	140.7	SVERDLOVSK U.S.S.R.	56 44N	61 04E	73.5N
48.4N	90.0	FREIBURG FED. REP. OF GERMANY	48 03N	07 35E	63.6N
48.2N	88.2	SCHWARZENBURG SWITZERLAND	46 39N	06 44E	62.3N
47.2N	240.0	ADAK U.S.A.	51 52N	176 39W	63.9N
47.0N	96.9	GRAZ AUSTRIA	47 04N	15 27E	62.6N
45.9N	159.6	TOMSK U.S.S.R.	56 28N	84 56E	74.7N
45.8N	89.6	GENOVA-MONTE CAPELLINO ITALY	44 33N	08 57E	60.2N
43.9N	79.5	TORTOSA SPAIN	40 49N	00 30E	56.7N
43.8N	101.2	BEOGRAD YUGOSLAVIA	44 48N	20 31E	61.0N
42.5N	91.9	ROMA (S. ALESSIO) ITALY	41 54N	12 30E	57.1N
42.5N	119.2	ROSTOV U.S.S.R.	47 13N	39 41E	64.1N
41.1N	174.4	IRKUTSK U.S.S.R.	52 28N	104 02E	71.2N
41.1N	316.9	WHITE SANDS U.S.A.	30 24N	106 52W	60.2N
39.6N	346.7	CAPE KENNEDY U.S.A.	28 24N	80 35W	61.2N
38.6N	69.9	RABAT MOROCCO	33 55N	06 50W	48.0N
37.9N	349.6	GRAND BAHAMA WEST INDIES	26 40N	78 22W	59.7N
36.9N	206.6	YUZHNO-SAKHALINSK U.S.S.R.	47 01N	142 43E	61.1N
35.5N	353.8	SAN SALVADOR WEST INDIES	24 00N	74 25W	57.4N
35.3N	206.0	WAKKANAI JAPAN	45 24N	141 41E	59.6N
33.4N	150.7	ALMA-ATA U.S.S.R.	43 15N	75 55E	62.2N
30.4N	133.3	ASHKHABAD U.S.S.R.	37 55N	58 18E	55.8N
30.0N	02.0	PUERTO RICO U.S.A.	18 30N	67 10W	51.1N
29.5N	205.4	AKITA JAPAN	39 44N	140 08E	53.7N
29.1N	326.8	MEXICO CITY MEXICO	19 19N	99 33W	46.5N
25.4N	205.4	TOKYO (KOKUBUNJI) JAPAN	35 42N	139 29E	48.9N
20.9N	268.1	MAUI HAWAII	20 50N	156 30W	38.3N
20.3N	197.8	YAMAGAWA JAPAN	31 13N	130 38E	44.1N
18.9N	148.9	DELHI INDIA	28 38N	77 13E	41.6N
17.0N	14.4	PARAMARIBO SURINAM	05 49N	55 13W	31.1N
15.9N	354.6	BOGOTA COLOMBIA	4 38N	74 05W	31.7N
15.3N	195.6	OKINAWA CHINA SEA	26 19N	127 47E	36.8N
13.8N	149.9	AHMEDABAD INDIA	23 01N	72 36E	31.8N
13.7N	189.8	TAIPEI TAIWAN	25 00N	121 30E	35.0N
11.0N	69.0	KUMASI GHANA	06 42N	01 34W	7.4S
10.7N	182.4	MACAO CHINA SEA	22 12N	113 33E	29.7N
10.6N	74.7	IBADAN NIGERIA	07 26N	3 53E	3.9S
6.6N	347.7	TALARA PERU	04 34S	81 15W	13.2N
5.1N	189.2	BAGUIO PHILIPPINES	16 25N	120 35E	18.5S
3.9N	33.7	NATAL BRAZIL	5 42S	35 12W	3.6S
0.6N	147.1	KODAIKANAL INDIA	10 14N	77 29E	2.4N
0.6S	353.8	HUANCAYO PERU	12 03S	75 20W	1.2N
10.1S	172.7	SINGAPORE MALAYA	01 19N	103 49E	18.3S
12.8S	21.1	SAO PAULO BRAZIL	23 33S	46 38W	23.3S
15.4S	03.3	TUCUMAN ARGENTINA	26 53S	65 23W	22.8S
18.2S	82.8	TSUMEB SOUTH WEST AFRICA	19 14S	17 43E	55.0S
18.6S	217.8	PORT MORESBY NEW GUINEA	9 26S	147 13E	33.2S
20.9S	273.6	RAROTONGA PACIFIC OCEAN	21 12S	159 45W	38.2S
23.2S	9.4	BUENOS AIRES ARGENTINA	34 35S	58 29W	32.8S
25.1S	356.5	CONCEPCION CHILE	36 47S	73 01W	36.4S
26.9S	91.3	JOHANNESBURG REP. OF S. AFRICA	26 04S	28 06E	61.5S
28.5S	218.8	TOWNSVILLE AUSTRALIA	19 19S	146 44E	48.4S
31.7S	03.2	TRELEW ARGENTINA	43 13S	65 18W	41.8S
32.8S	79.7	CAPE TOWN REP. OF S. AFRICA	34 08S	18 19E	64.2S
35.7S	226.9	BRISBANE AUSTRALIA	27 32S	152 55E	57.6S
40.4S	09.1	PORT STANLEY FALKLAND ISLANDS	51 42S	57 51W	48.5S
43.3S	00.5	USHUAIA ARGENTINA	54 48S	68 20W	51.9S
43.5S	186.1	MUNDARING AUSTRALIA	31 59S	116 12E	66.5S
44.0S	224.3	CANBERRA AUSTRALIA	35 18S	149 12E	66.1S
48.1S	252.8	GODLEY HEAD NEW ZEALAND	43 34S	172 48E	69.0S
51.6S	6.1	DECEPCION ANTARCTIC	62 59S	60 43W	57.4S
51.7S	224.3	HOBART AUSTRALIA	42 55S	147 19E	72.8S
53.8S	03.3	ARGENTINE ISLAND ANTARCTICA	65 15S	64 16W	58.0S
57.3S	253.2	CAMPBELL ISLAND NEW ZEALAND	52 33S	169 09E	76.0S
65.8S	24.3	HALLEY BAY ANTARCTICA	75 31S	26 42W	65.7S
69.7S	77.7	SYOWA BASE ANTARCTICA	69 00S	39 36E	67.7S
70.6S	336.0	BYRD STATION ANTARCTICA	80 00S	120 00W	75.1S
74.7S	278.2	CAPE HALLETT ANTARCTICA	72 19S	170 13E	84.8S
77.7S	179.1	WILKES ANTARCTICA	66 20S	110 50E	82.4S
78.5S	.0	SOUTH POLE ANTARCTICA	90 00S	-	75.6S
79.0S	294.2	SCOTT BASE ANTARCTICA	77 51S	166 48E	83.4S

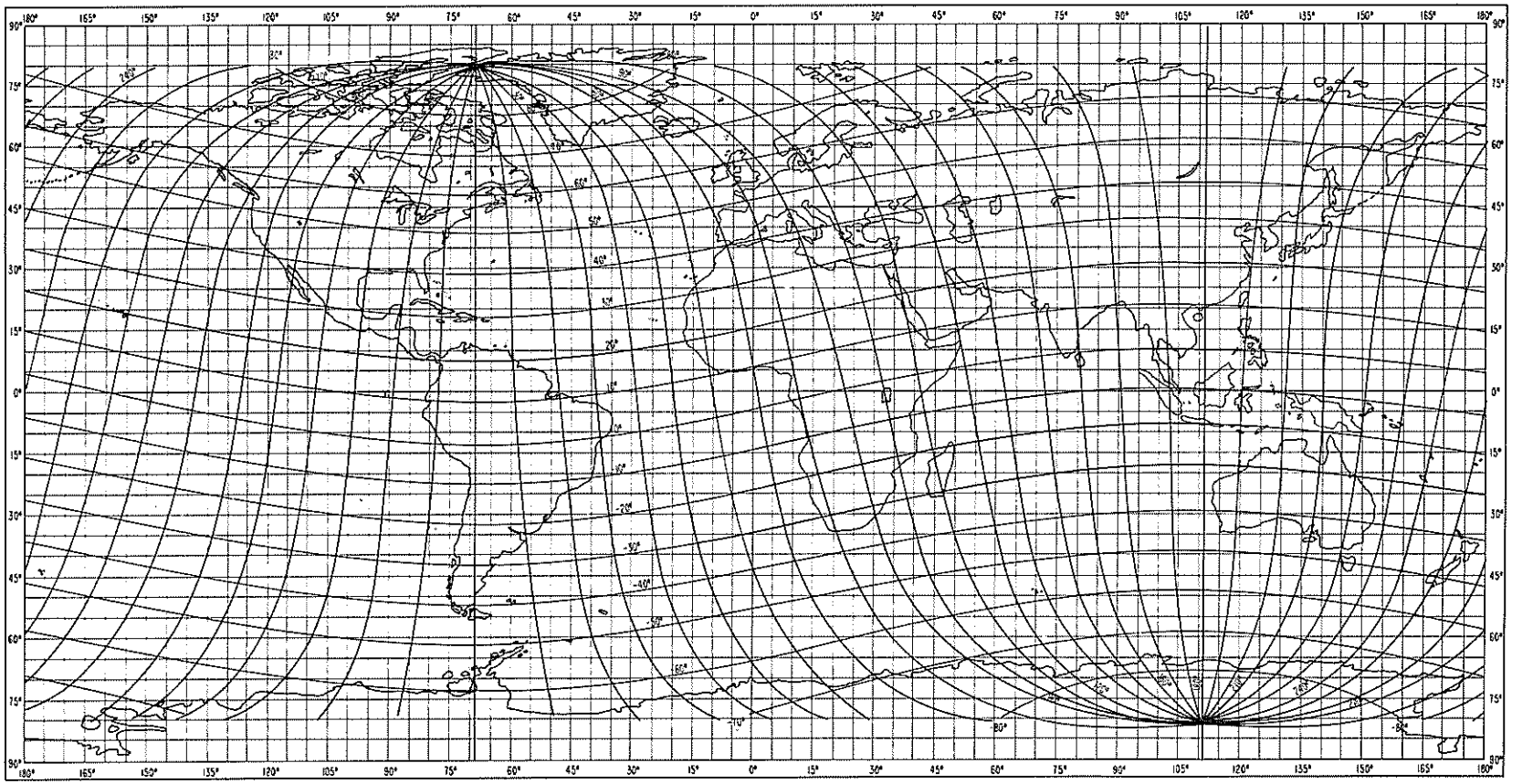
* GEOGRAPHIC LATITUDE AND LONGITUDE FURNISHED IN DEGREES AND TENTHS OF A DEGREE AND CONVERTED TO DEGREES AND MINUTES

IONOSPHERE VERTICAL SOUNDINGS STATIONS ILLUSTRATED IN ATLAS



WORLD MAP

CHART FOR TRANSLATION BETWEEN
GEOGRAPHIC AND GEOMAGNETIC COORDINATES



GEOMAGNETIC COORDINATES

From Matsushita, S., and W.H. Campbell, Eds., Physics of Geomagnetic Phenomena, Academic Press, 1967

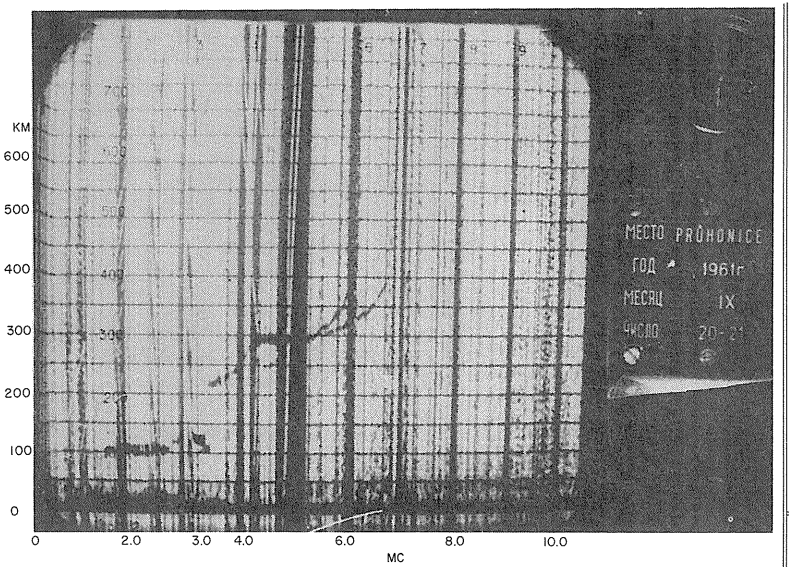
Some ionospheric characteristics form a more intelligible worldwide pattern when arranged according to geomagnetic, rather than geographic, coordinates. This is especially true of F2 parameters and some Es characteristics - notably the Es-type.

The accompanying chart permits rapid translation between these coordinate systems, and thus offers a means of determining which ionograms in this atlas might be expected to illustrate best the ionosphere at some chosen location.

SECTION I

EQUIPMENT

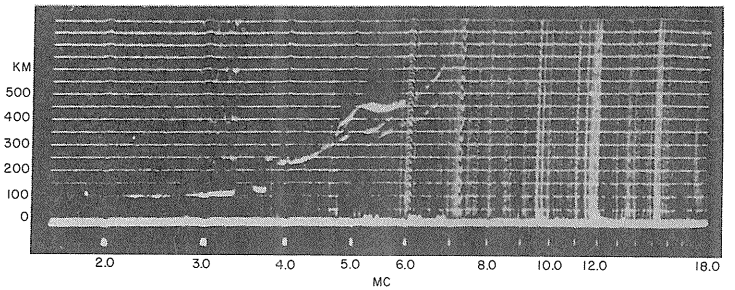
AIS (U.S.S.R.)



IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 TO 10.0 MC AND 1.0 TO 18.0 MC
HEIGHT RANGE: 250, 750, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 SEC AND 20 SEC
LINEAR FREQUENCY SCALE

STATIONS:
ALMA - ATA, U.S.S.R.
DIXON ISLAND, U.S.S.R.
GORKY, U. S. S. R.
HEISS ISLAND, U.S.S.R.
PROVIDENIE BAY, U. S. S. R.
*PRUHONICE, CZECHOSLOVAKIA
ROSTOV, U.S.S.R.
SALEKHARD, U.S.S.R.
SVERDLOVSK, U.S.S.R.
TOMSK, U.S.S.R.
YAKUTSK, U.S.S.R.
YUZHNO-SAKHALINSK, U.S.S.R.

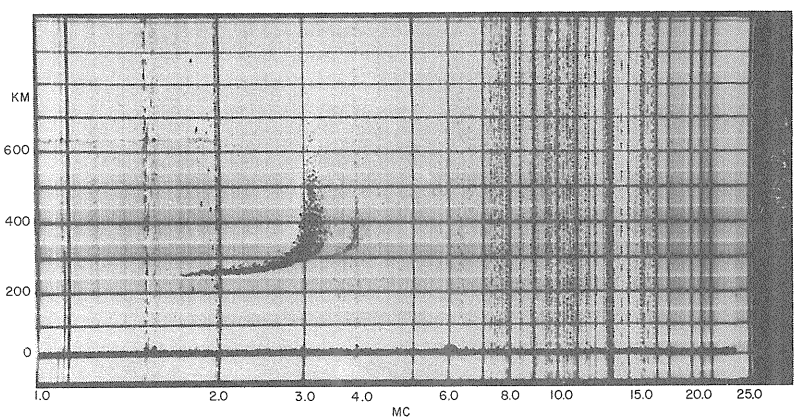
AUTOMATIC (YUGOSLAVIA)



IONOSONDE: TYPE OR DESIGNATION: AUTOMATIC, DUAL CONVERSION
FREQUENCY RANGE: 1.7 MC TO 18 MC
HEIGHT RANGE: 800 KM
POWER: 6 KM
SWEEP TIME: 30 SEC AND 120 SEC
LOGARITHMIC FREQUENCY SCALE

STATION: BEOGRAD, YUGOSLAVIA

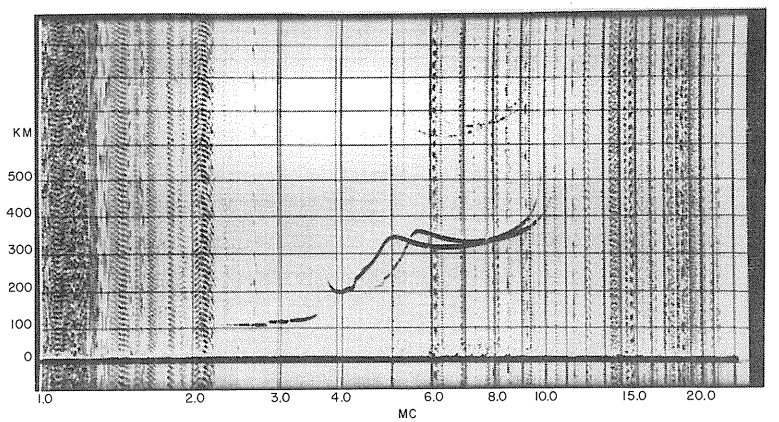
C-2 (U.S.A.)



IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000 KM
POWER: 15 KM
SWEEP TIME: 18 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS:
BAGUIO, PHILIPPINES
*REYKJAVIK, ICELAND
SEATTLE, U. S. A.
SCHWARZENBURG, SWITZERLAND
TAIPEI, TAIWAN
TUCUMAN, ARGENTINA

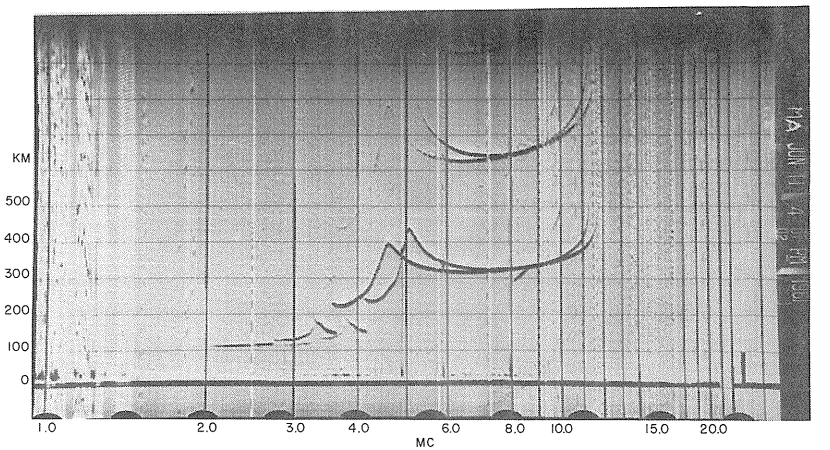
C-3 (U.S.A.)



IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000 KM.
POWER: 20 KW
SWEEP TIME: 27 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS:
ADAK, U. S. A.
ANCHORAGE, U. S. A.
BARROW, U. S. A.
BOULDER, U. S. A.
BYRD, ANTARCTICA
COLLEGE, U. S. A.
FORT MONMOUTH, U. S. A.
NARSSARSSUAQ, GREENLAND
NURMIJARVI, FINLAND
OKINAWA, CHINA SEA
*PUERTO RICO, U. S. A.
SAO PAULO, BRAZIL
SOUTH POLE, ANTARCTICA
TALARA, PERU
WASHINGTON (FORT BELVOIR) U.S.A.
WHITE SANDS, U. S. A.

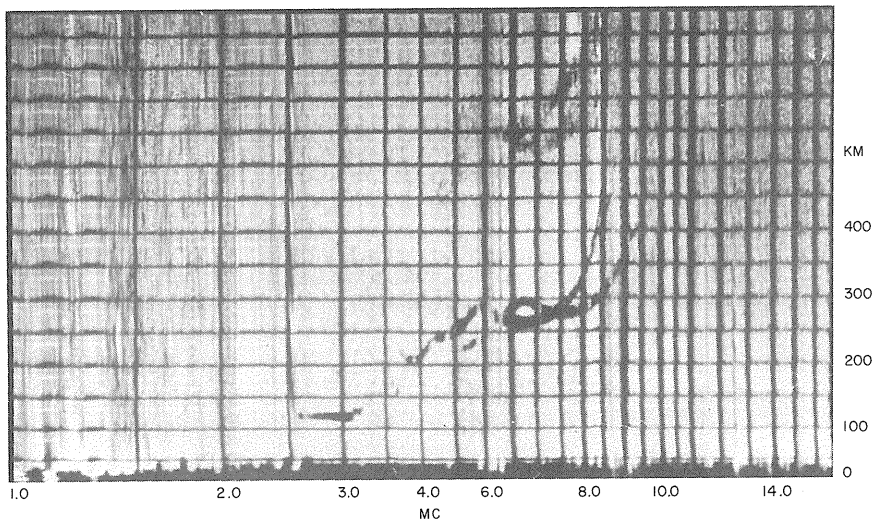
C-4 (U.S.A.)



IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000 KM
POWER: 25 KW
SWEEP TIME: 27 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS:
BOGOTA, COLOMBIA
BUENOS AIRES, ARGENTINA
CAMPBELL ISLAND, NEW ZEALAND
CAPE KENNEDY, U. S. A.
CAPE HALLETT, ANTARCTICA
CONCEPCION, CHILE
DELHI, INDIA
GRAND BAHAMA, WEST INDIES
HUANCAYO, PERU
KODIAKANAL, INDIA
*MAUI, HAWAII
MEXICO CITY, MEXICO
NATAL, BRAZIL
SAN SALVADORE, WEST INDIES
THULE, GREENLAND
WILKES, ANTARCTICA

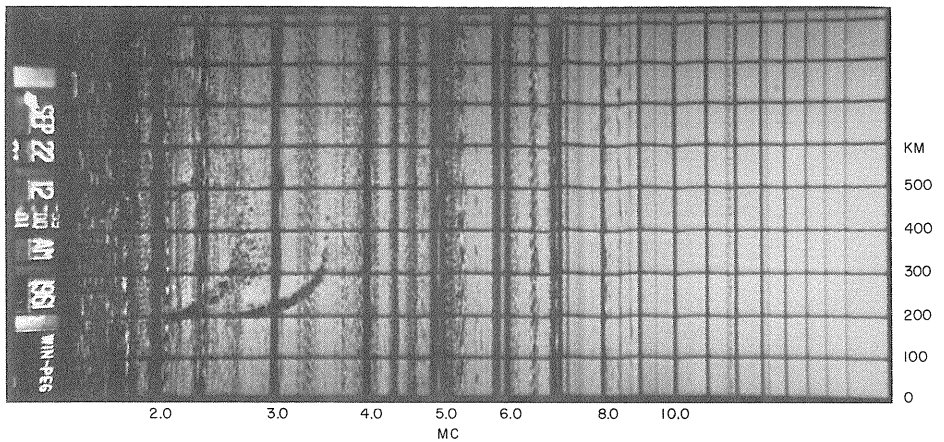
CSIRO (AUSTRALIA)



IONOSONDE: TYPE OR DESIGNATION: MODIFIED CSIRO 1/J28
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
POWER: 1 KW
SWEEP TIME: 1 MIN 55 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS: *BRISBANE, AUSTRALIA
HOBART, AUSTRALIA
TOWNSVILLE, AUSTRALIA

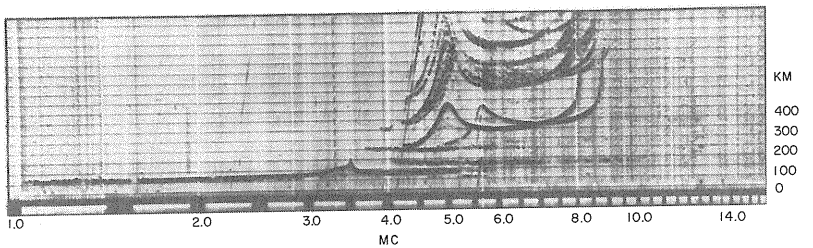
COSSOR (CANADA)



IONOSONDE: TYPE OR DESIGNATION: COSSOR MK 2
FREQUENCY RANGE: 1.6 MC TO 20.0 MC
HEIGHT RANGE: 800 KM
POWER: 1 KW
SWEEP TIME: 15 SEC
APPROXIMATELY LOGARITHMIC FREQUENCY SCALE

STATIONS: GODHAVN, GREENLAND
MUNDARING, AUSTRALIA
ST. JOHN'S, CANADA
URBANA, U. S. A.
*WINNIPEG, CANADA

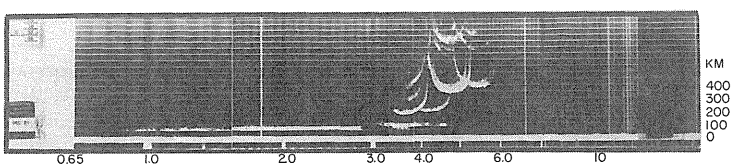
DDA (FED. REP. OF GERMANY)



IONOSONDE: TYPE OR DESIGNATION: DDA IV/54
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 900 KM
POWER: 15 KW
SWEEP TIME: 120, 240, 480 SEC
EQUATION FOR FREQUENCY SCALE: $f = ke^{at}$

STATIONS: * LINDAU, GERMAN FED. REP.
TSUMEB, SOUTH WEST AFRICA

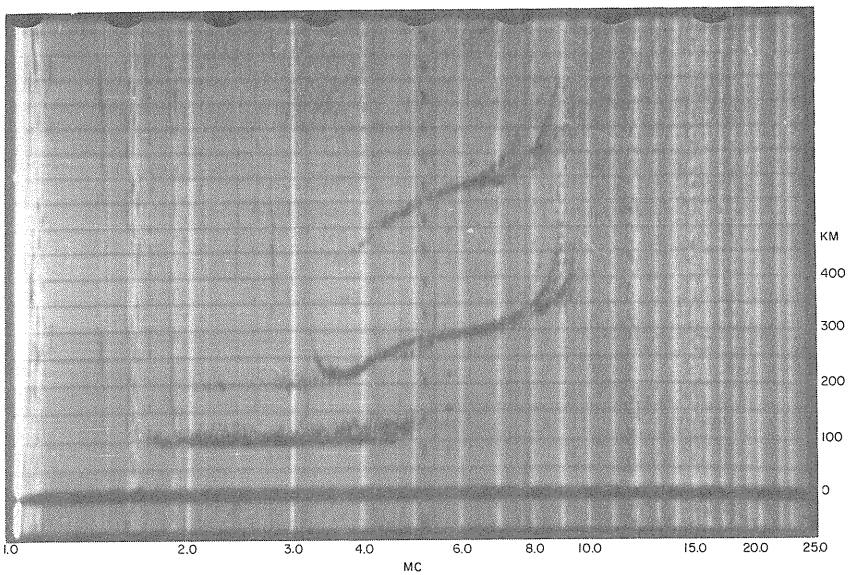
UNION RADIO (U.K.)



IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 MC TO 25.0 MC IN FIVE BANDS
HEIGHT RANGE: 200 - 2800 KM ADJUSTABLE
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND, QUASI LOGARITHMIC RELATION BETWEEN BANDS.

STATIONS: *ARGENTINE ISLAND, ANTARCTICA
HALLEY BAY, ANTARCTICA
INVERNESS, U. K.
PORT STANLEY, FALKLAND ISLANDS
SINGAPORE, MALAYA
SLOUGH, U. K.

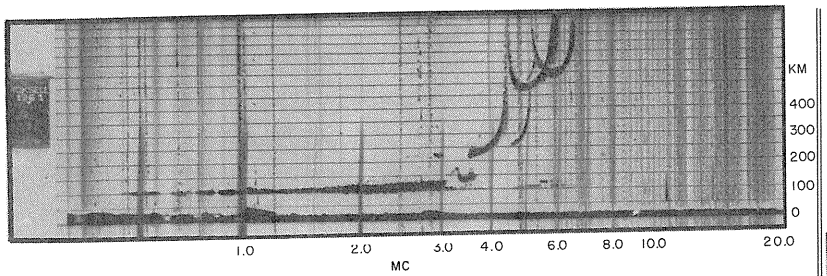
IPS (AUSTRALIA)



IONOSONDE: TYPE OR DESIGNATION: IPS TYPE 3 C
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
POWER: 5 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS: *CANBERRA, AUSTRALIA
PORT MORESBY, NEW GUINEA

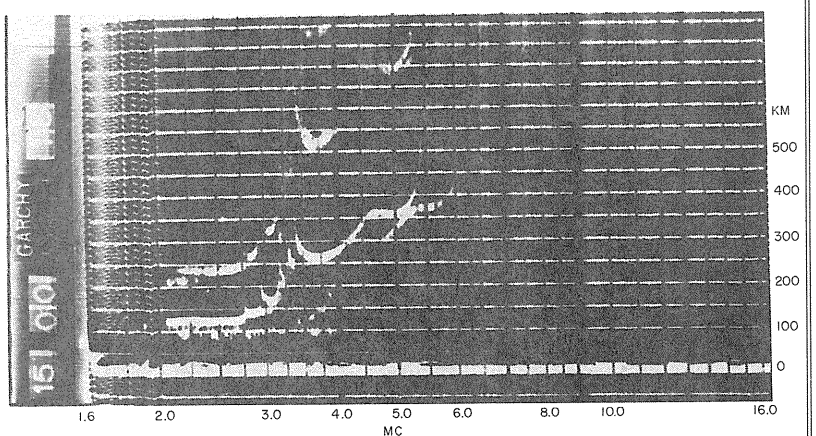
J4 (SWEDEN)



IONOSONDE: TYPE OR DESIGNATION: J4
FREQUENCY RANGE: 0.33 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM
POWER: ~20 KW
SWEEP TIME: 60, 180 SEC
NEARLY LOGARITHMIC FREQUENCY SCALE

STATIONS: *LYCKSELE, SWEDEN
UPPSALA, SWEDEN

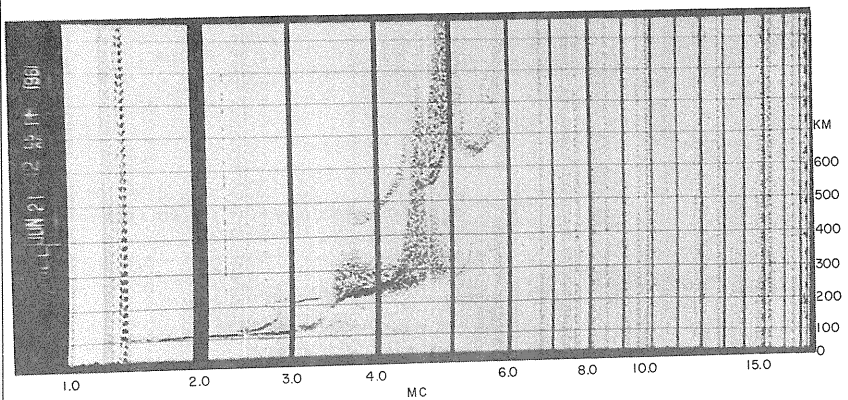
LNR (FRANCE)



IONOSONDE: TYPE OR DESIGNATION: LNR (BAGNEUX)
FREQUENCY RANGE: 1.6 MC TO 16 MC
HEIGHT RANGE: 800 KM
POWER: 2 KW
SWEEP TIME: 60 OR 10 SEC
LOGARITHMIC FREQUENCY SCALE

STATION: GARCHY, FRANCE

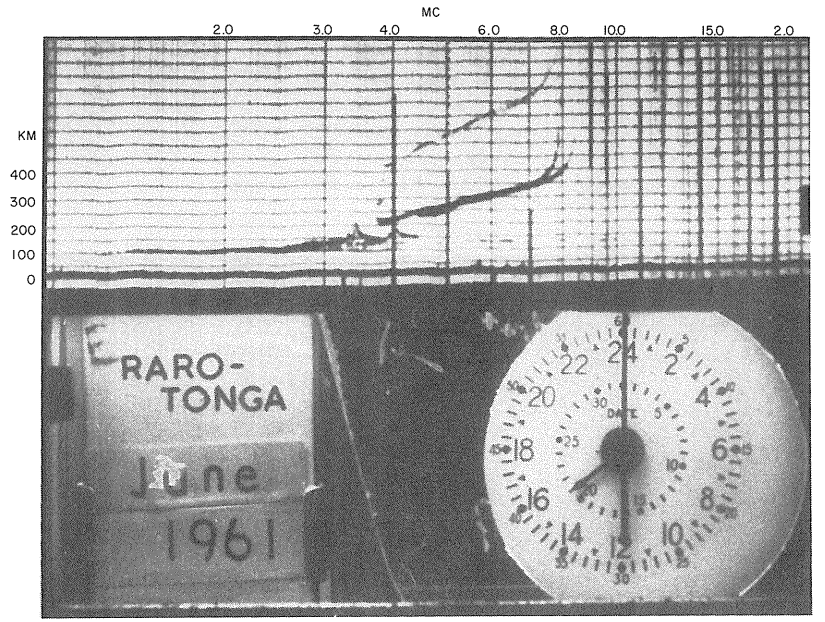
LG-17 (CANADA)



IONOSONDE: TYPE OR DESIGNATION: LG-17 (MODIFIED)
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS: *CHURCHILL, CANADA
OTTAWA, CANADA
RESOLUTE BAY, CANADA

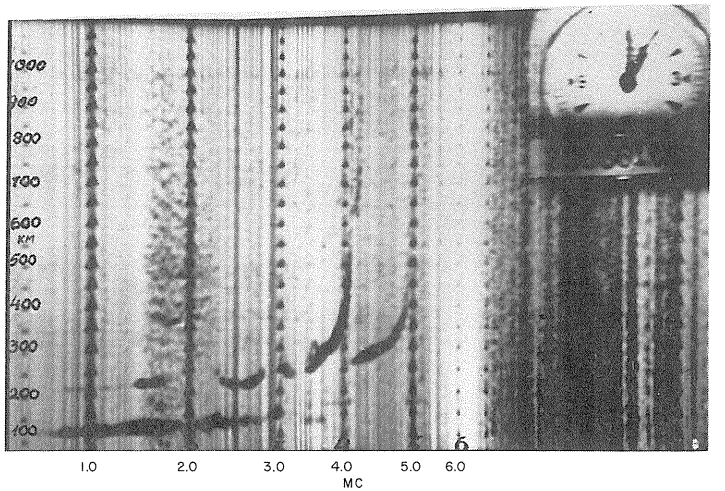
P-2 (NEW ZEALAND)



IONOSONDE: TYPE OR DESIGNATION: P - 2
FREQUENCY RANGE: 1 MC TO 22 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 7.5 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS: GODLEY HEAD, NEW ZEALAND
*RAROTONGA, PACIFIC OCEAN
SCOTT BASE, ANTARCTICA

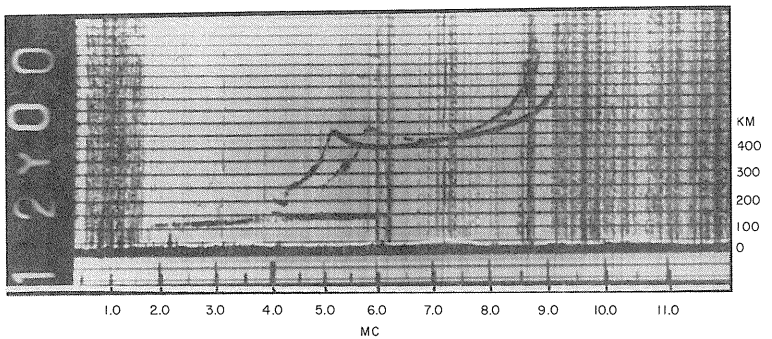
PAIS (U.S.S.R.)



IONOSONDE: TYPE OR DESIGNATION: PAIS
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 1000 KW
POWER: 1 TO 2 KM
SWEEP TIME: 7.5 SEC
LINEAR FREQUENCY SCALE

STATION: NORTH POLE - 8, U. S. S. R.

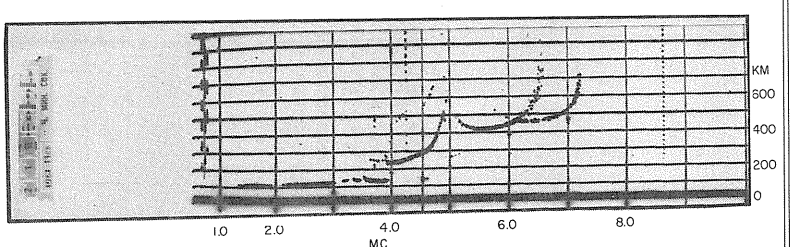
PANORAMIC (JAPAN)



IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

STATIONS:
AKITA, JAPAN
DE BILT, NETHERLANDS
MACAO, CHINA SEA
PARAMARIBO, SURINAM
SYOWA BASE, ANTARCTICA
TOKYO (KOKOBUNJI), JAPAN
WAKKANAI, JAPAN
*YAMAGAWA, JAPAN

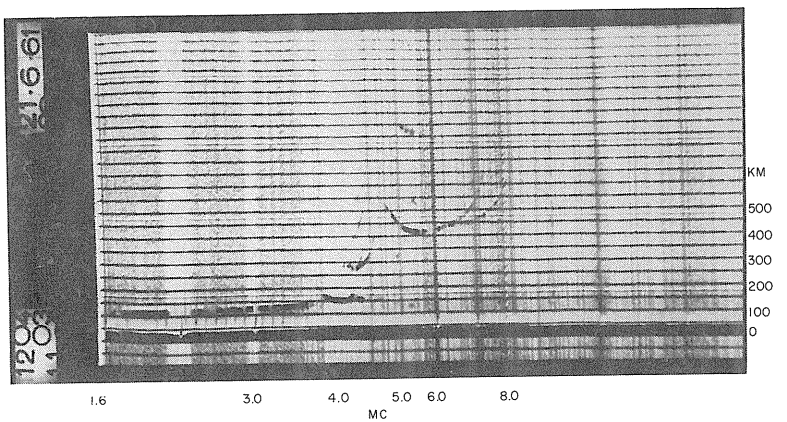
SP-3 (U.S.S.R.)



IONOSONDE: TYPE OR DESIGNATION: SP - 3
FREQUENCY RANGE: 1.0 MC TO 20.0 MC
HEIGHT RANGE: 250, 750, 1500 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LINEAR FREQUENCY SCALE

STATIONS:
ASHKHABAD, U. S. S. R.
LENINGRAD, U. S. S. R.
*MOSCOW, U. S. S. R.

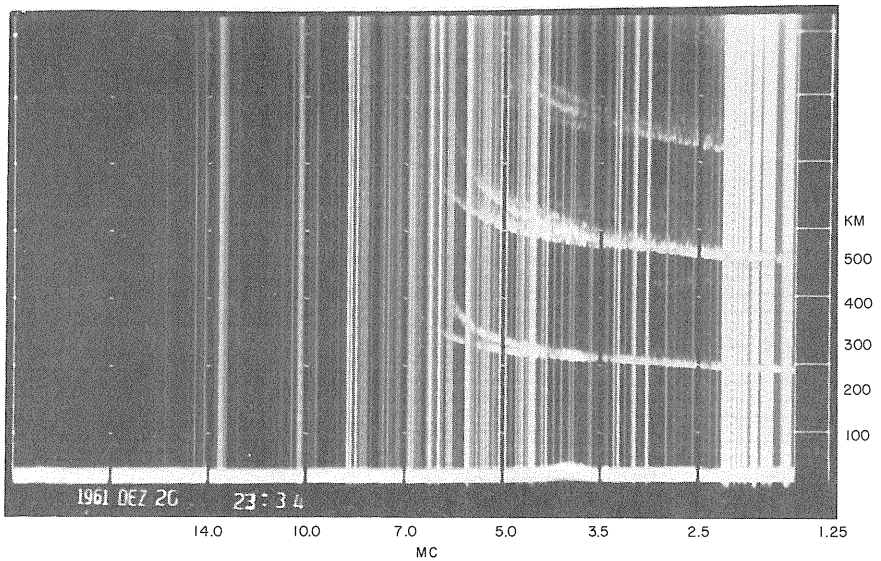
SP-35 (FRANCE)



IONOSONDE: TYPE OR DESIGNATION: SP-35
FREQUENCY RANGE: 1.6 MC TO 17 MC
HEIGHT RANGE: 1000 - 1200 KM (ABOUT)
POWER: 2.6 KW
SWEEP TIME: 60 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS:
*POITIERS, FRANCE
RABAT, MOROCCO
TORTOSA, SPAIN

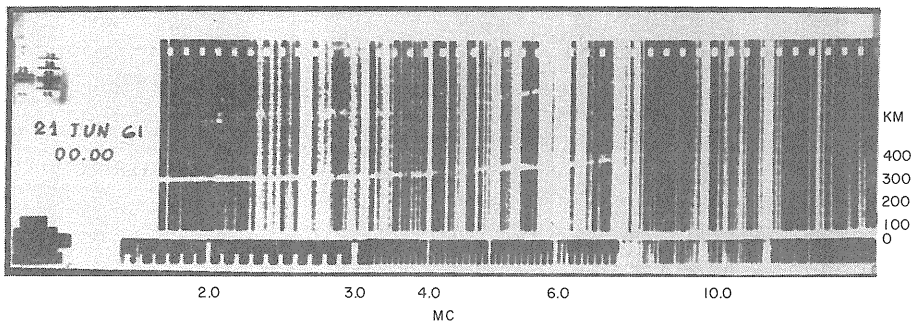
SPIM (FRANCE)



IONOSONDE: TYPE OR DESIGNATION: SPIM - KRDSE 22
FREQUENCY RANGE: 1.25 MC TO 20.0 MC
HEIGHT RANGE: 1100 KM
POWER: 5 KW
SWEEP TIME: 180 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS: DOURBES, BELGIUM
*FREIBURG, FED. REP. OF GERMANY
GENOVA-MONTE CAPELLINO, ITALY

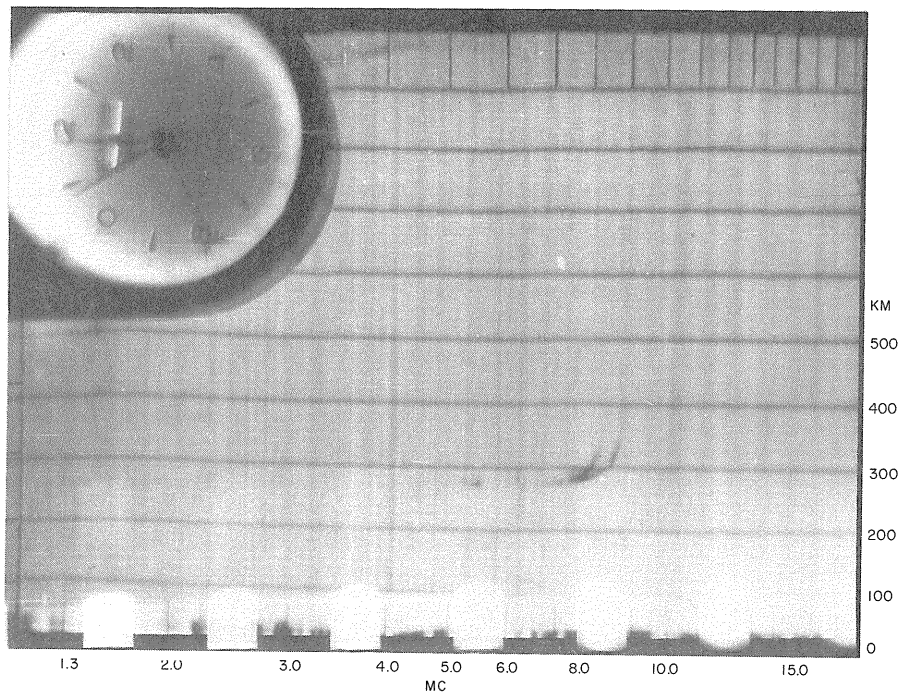
UNION RADIO (U.K.)



IONOSONDE: TYPE OR DESIGNATION: UNION RADIO MK II (MODIFIED)
FREQUENCY RANGE: 0.6 MC TO 25 MC
HEIGHT RANGE: 800 KM
POWER: 1.8 KW
SWEEP TIME: 250 SEC
APPROXIMATELY LOGARITHMIC FREQUENCY SCALE

STATIONS: AHMEDABAD, INDIA
IBADAN, NIGERIA
*ROMA (S. ALESSIO), ITALY
TROMSØ, NORWAY

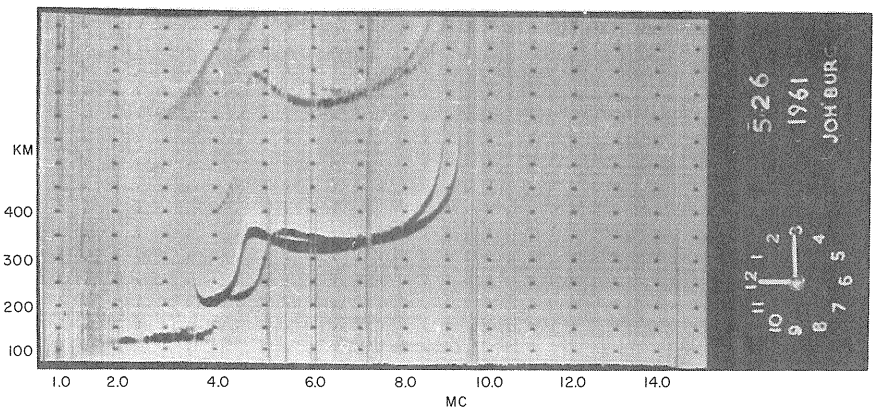
TRIO-2 (ARGENTINA)



IONOSONDE: TYPE OR DESIGNATION: TRIO - 2
FREQUENCY RANGE: 1.3 MC TO 18 MC
HEIGHT RANGE: 1000 KM
POWER: 5 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

STATIONS: DECEPCION, ANTARCTICA
TRELEW, ARGENTINA
*USHUAIA, ARGENTINA

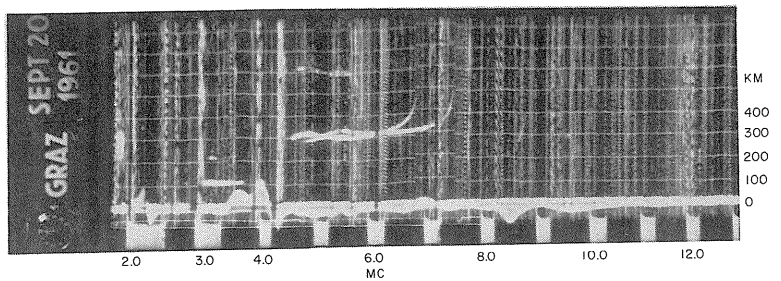
WADLEY (REP. OF S. AFRICA)



IONOSONDE: TYPE OR DESIGNATION: WADLEY
FREQUENCY RANGE: 1.0 MC TO 20.0 MC
(USUALLY SET: 1.0 TO 16.0 MC/S)
HEIGHT RANGE: VARIABLE - USUALLY SET TO 800 KM
POWER: ABOUT 1 KW
SWEEP TIME; FOR NORMAL ROUTINE 90 SEC
APPROXIMATELY LINEAR FREQUENCY SCALE

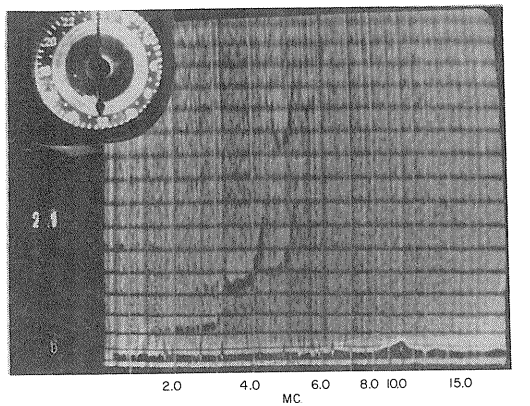
STATIONS: CAPE TOWN, REP. OF S. AFRICA
*JOHANNESBURG, REP. OF S. AFRICA

MISCELLANEOUS



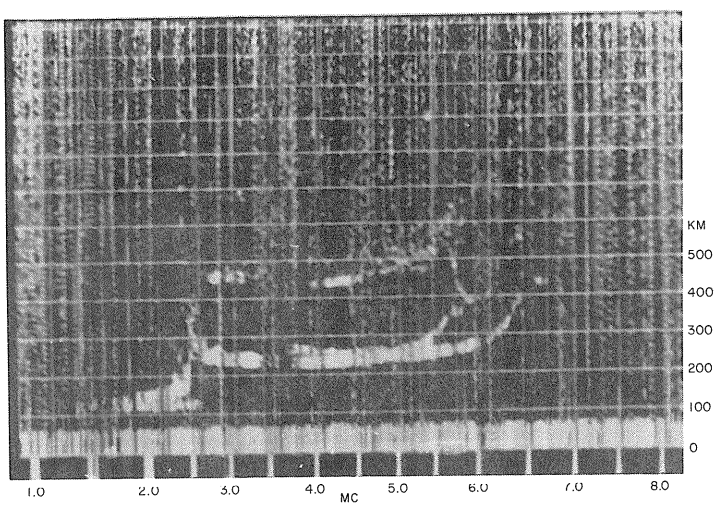
STATION: GRAZ, AUSTRIA

IONOSONDE: TYPE OR DESIGNATION: MADE LOCALLY
FREQUENCY RANGE: 2.0 MC TO 18.0 MC
HEIGHT RANGE: 800 KM
POWER: 1 KW
SWEEP TIME: 50 SEC
NEARLY LINEAR FREQUENCY SCALE



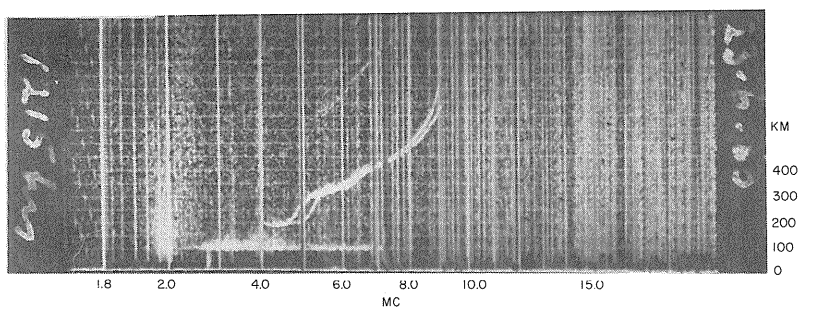
STATION: MURMANSK, U. S. S. R.

IONOSONDE: TYPE OR DESIGNATION: MADE LOCALLY
FREQUENCY RANGE: 1.0 MC. TO 20.0 MC.
HEIGHT RANGE: 150, 500, 1000 KM
POWER: 2 - 5 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE



STATION: JULIUSRUH/RÜGEN, GERMAN DEM. REP.

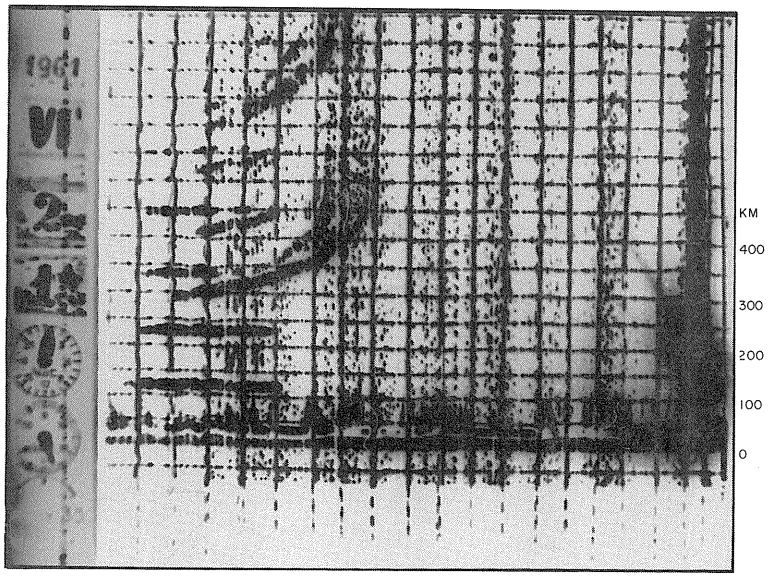
IONOSONDE: TYPE OR DESIGNATION: MADE LOCALLY
FREQUENCY RANGE: 0.8 MC TO 20.0 MC
HEIGHT RANGE: 1200 KM
POWER: ABOUT 15 KW
SWEEP TIME: 30 SEC
LINEAR FREQUENCY SCALE



STATION: KUMASI, GHANA

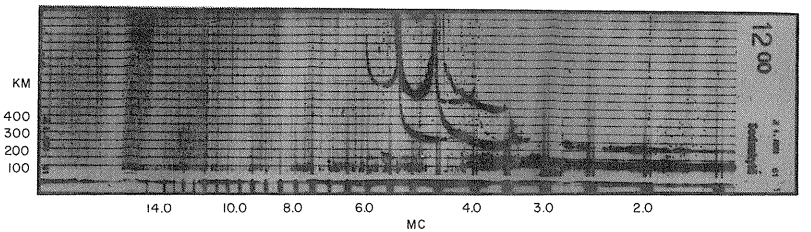
IONOSONDE: TYPE OR DESIGNATION: MADE LOCALLY
FREQUENCY RANGE: 0.9 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM
POWER: 2 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

MISCELLANEOUS



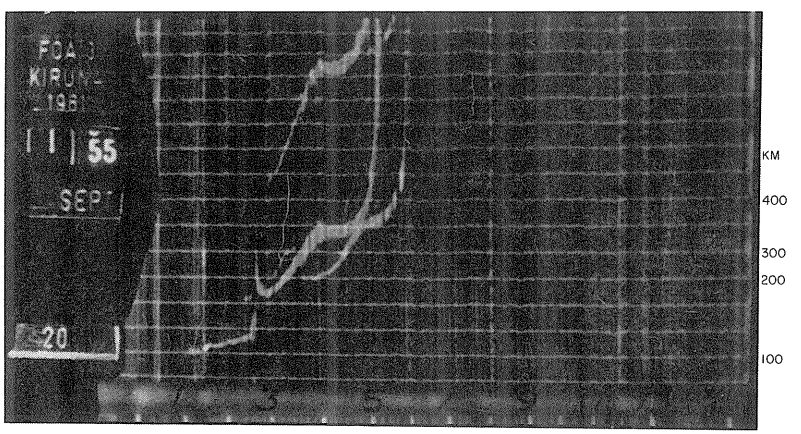
STATION: IRKUTSK, U. S. S. R.

IONOSONDE: TYPE OR DESIGNATION: NO. 285
FREQUENCY RANGE: 0.5 MC. TO 20.0 MC.
HEIGHT RANGE: 200, 300, 500, 750, 1000, 1500, 2000
POWER: 20 KW
SWEEP TIME: 10 TO 20 SEC
LINEAR FREQUENCY SCALE



STATION: SODANKYLÄ, FINLAND

IONOSONDE: TYPE OR DESIGNATION: MADE LOCALLY
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 1000 KM
POWER: 50 KW
SWEEP TIME: 480 SEC
EQUATION FOR FREQUENCY SCALE: $75 \log \frac{f}{MHz}$ mm



STATION: KIRUNA, SWEDEN

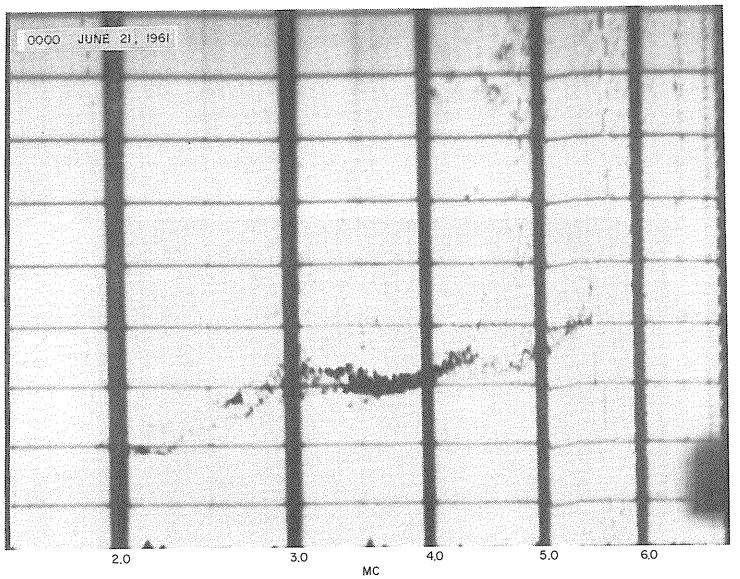
IONOSONDE: TYPE OR DESIGNATION: MADE LOCALLY
FREQUENCY RANGE: 0.5 MC TO 15 MC
HEIGHT RANGE: 750 KM
POWER: 12 KW
SWEEP TIME: 25 SEC.
LINEAR FREQUENCY SCALE

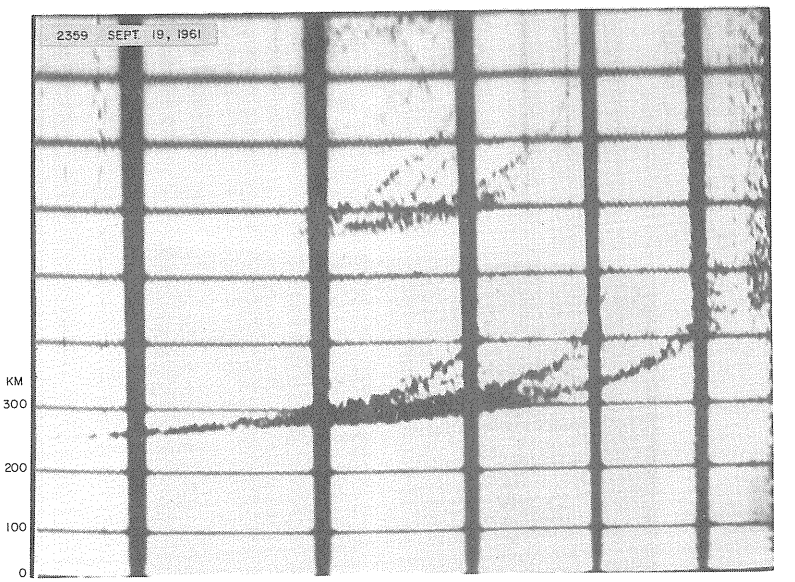
SECTION II-A

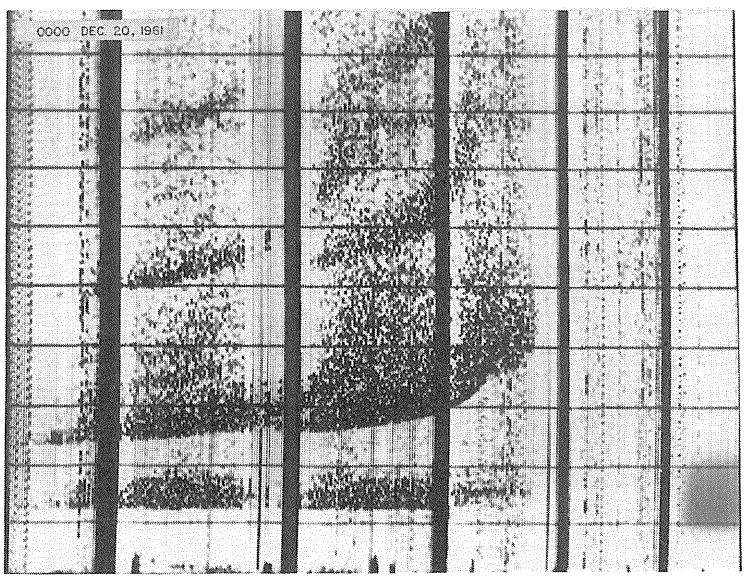
MIDNIGHT IONOGRAMS

STATIONS ARRANGED BY DIP

DIP 89.2° N
RESOLUTE BAY





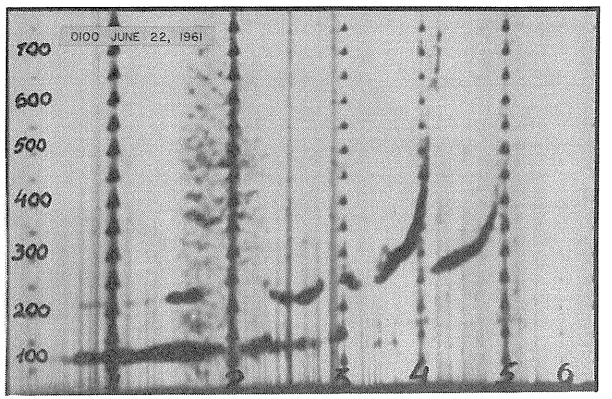


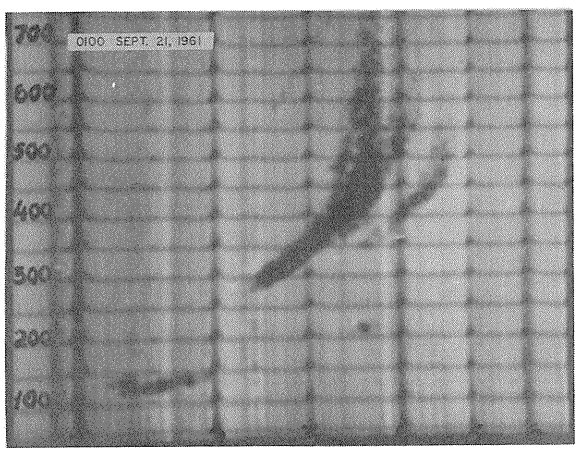
STATION: RESOLUTE BAY CANADA D.O.T./D.R.T.E. AFFILIATION

COORDINATES: GEOGRAPHIC LATITUDE: 74.7°N LONGITUDE: 94°.9W
GEOMAGNETIC LATITUDE: 83.0°N LONGITUDE: 289.3°
MAGNETIC DIP: 89.2°N TIME ZONE: 90°W
GYROFREQUENCY: 1.48 MC AT 200 KM
TOTAL FIELD: 0.58 OERSTED

IONOSONDE: TYPE OR DESIGNATION: LG 17 (MODIFIED)
FREQUENCY RANGE: 1.0 MC. TO 16.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
≈ LOGARITHMIC FREQUENCY SCALE

DIP 86.9°N
NORTH POLE -8



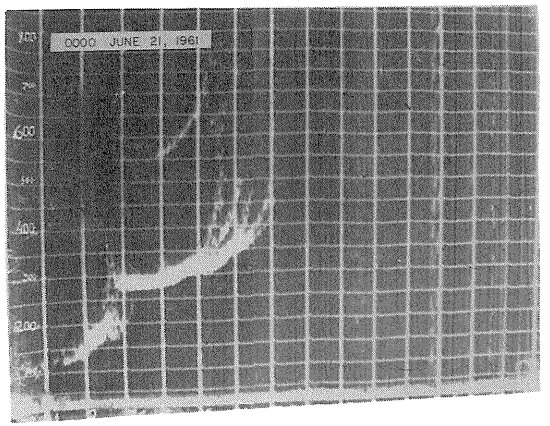


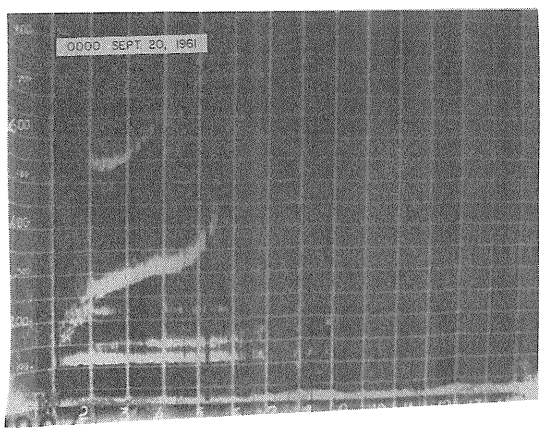
STATION: NORTH POLE - 8 U.S.S.R.

COORDINATES:
- GEOGRAPHIC LATITUDE: ~83°38'N, ~82°37'N
- GEOMAGNETIC LATITUDE: 72.4°N, 71.5°N
- MAGNETIC DIP: 86.9°N, 86.4°N
- LONGITUDE: ~142°48'W, ~144°56'W
- LONGITUDE: ~188.8°, ~192.4°
- TIME ZONE: 135°W

IONOSONDE:
- TYPE OR DESIGNATION: PAIS
- FREQUENCY RANGE: 1.0 - 16.0 MC
- HEIGHT RANGE: 1000 KM
- POWER: 1 - 2 KW
- SWEEP TIME: 7.5 SEC
- FREQUENCY SCALE: LINEAR

DIP 83.5°N
DIXON ISLAND



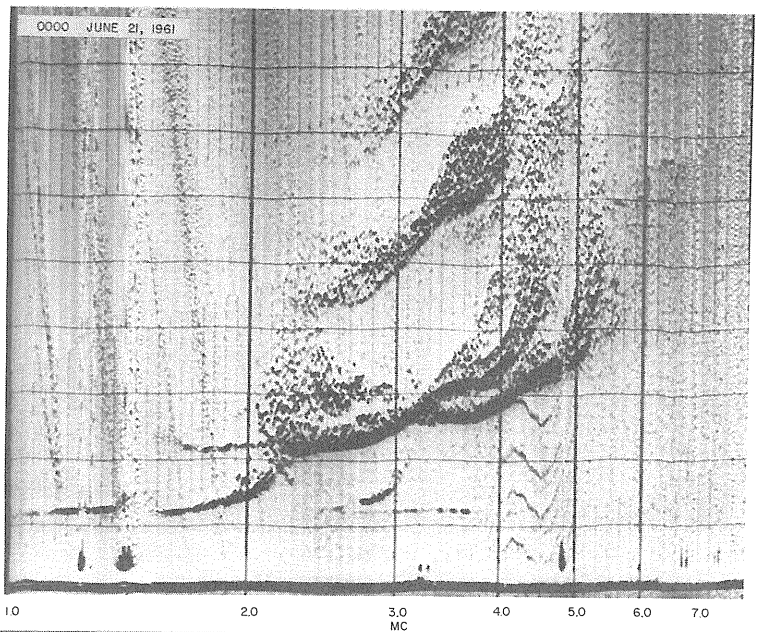


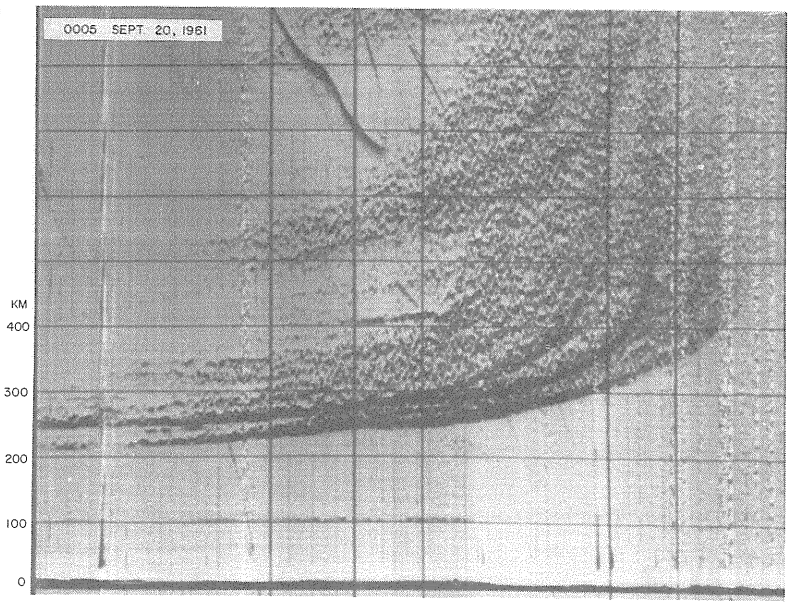
STATION: DIXON ISLAND U.S.S.R.

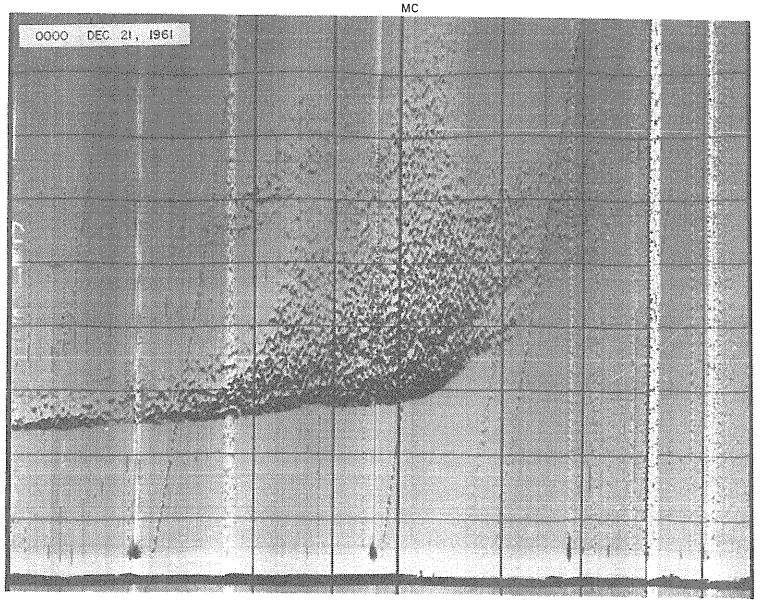
COORDINATES:
- GEOGRAPHIC LATITUDE: 73°30'N
- GEOMAGNETIC LATITUDE: 63.0°N
- MAGNETIC DIP: 83.5°N
- LONGITUDE: 80°24'E
- LONGITUDE: 161.4°
- TIME ZONE: 105°E

IONOSONDE:
- TYPE OR DESIGNATION: AIS
- FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
- HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
- POWER: 10 KW
- SWEEP TIME: 12 - 20 SEC
- FREQUENCY SCALE: LINEAR

DIP 85.8° N
THULE





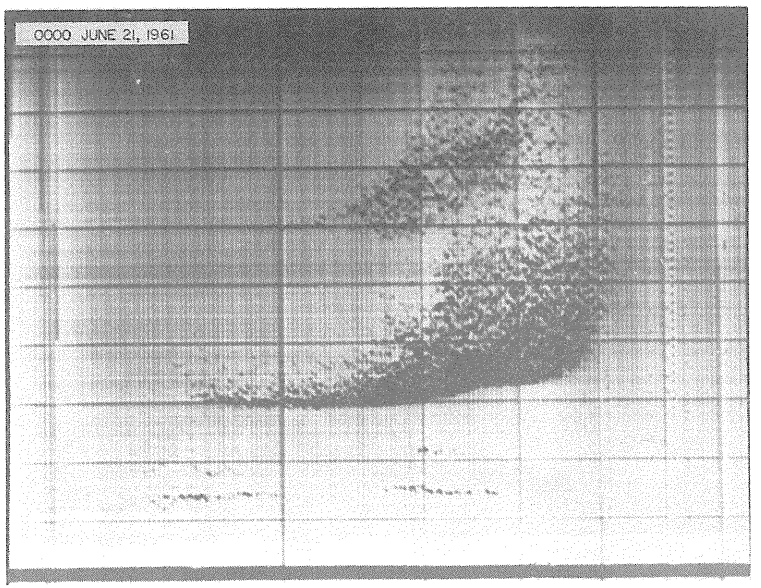


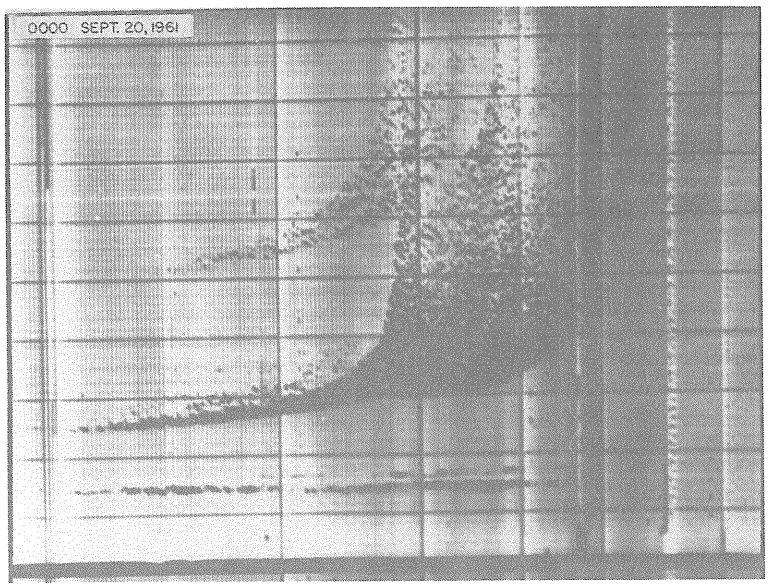
STATION: THULE GREENLAND

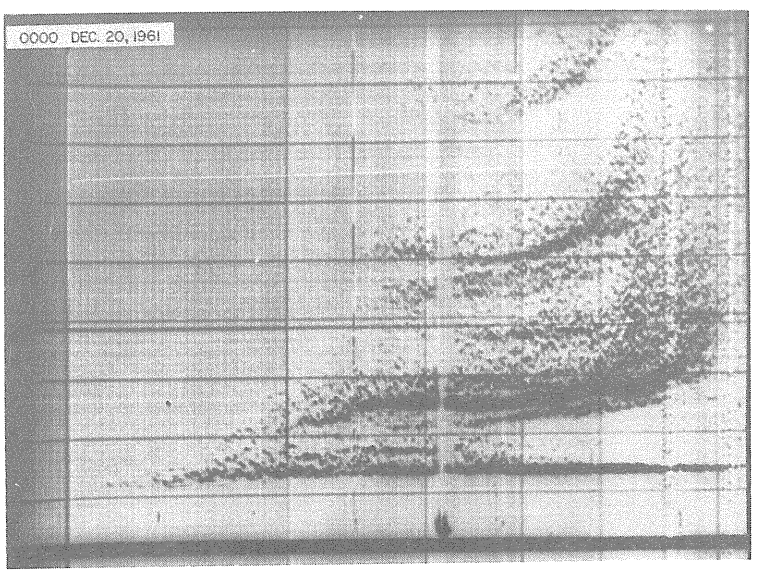
COORDINATES: GEOGRAPHIC LATITUDE: 76°24'N LONGITUDE: 68°19'W
GEOMAGNETIC LATITUDE: 87.9°N LONGITUDE: 1.9°
MAGNETIC DIP: 85.8°N TIME ZONE: 75°W
GYROFREQUENCY: 1.43 MC AT 200 KM
TOTAL FIELD: 0.56 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 84.8° S
CAPE HALLETT





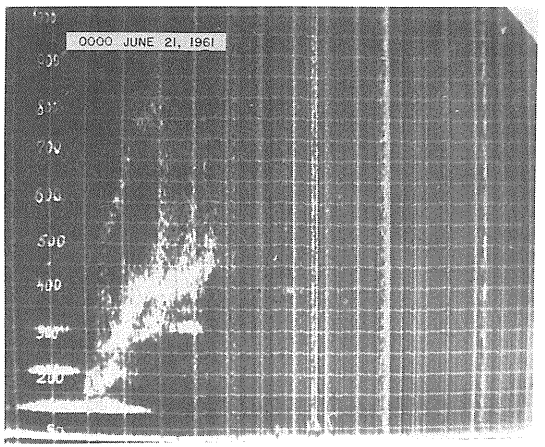


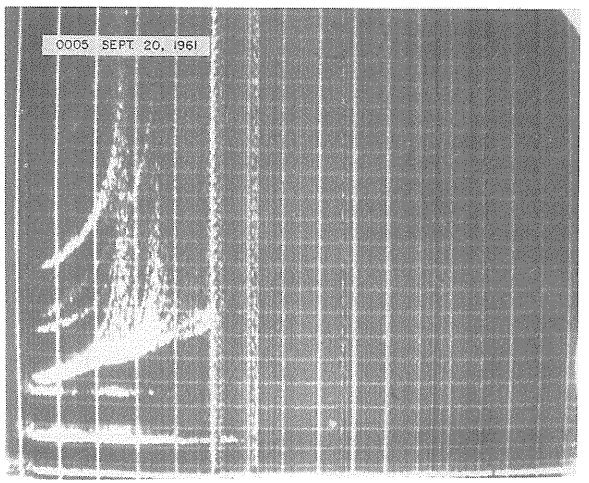
STATION: CAPE HALLETT ANTARCTICA

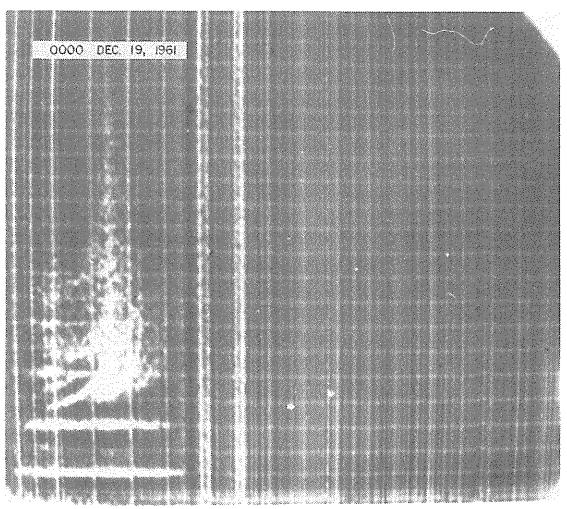
COORDINATES: GEOGRAPHIC LATITUDE: 72°19'S LONGITUDE: 170°13'E
GEOMAGNETIC LATITUDE: 74.7°S LONGITUDE: 278.2°
MAGNETIC DIP: 84.8°S TIME ZONE: 165°E
GYROFREQUENCY: 1.71 MC AT 200 KM
TOTAL FIELD: 0.67 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 84.3°N
HEISS ISLAND





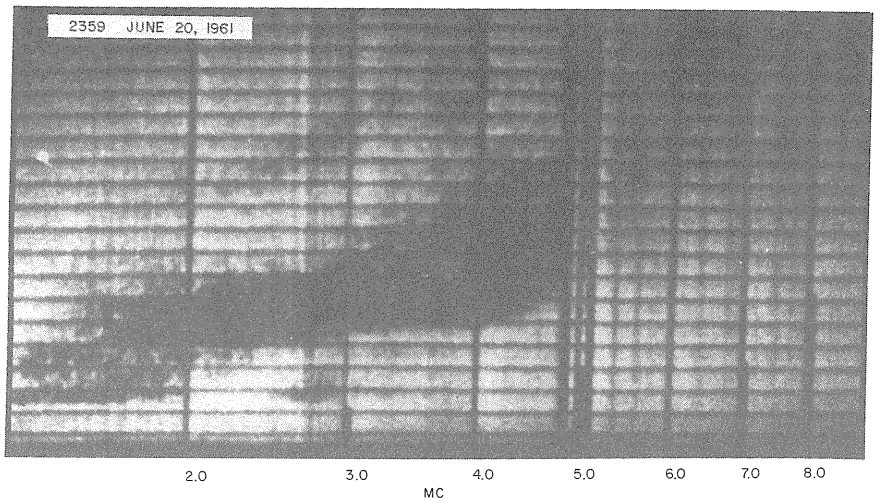


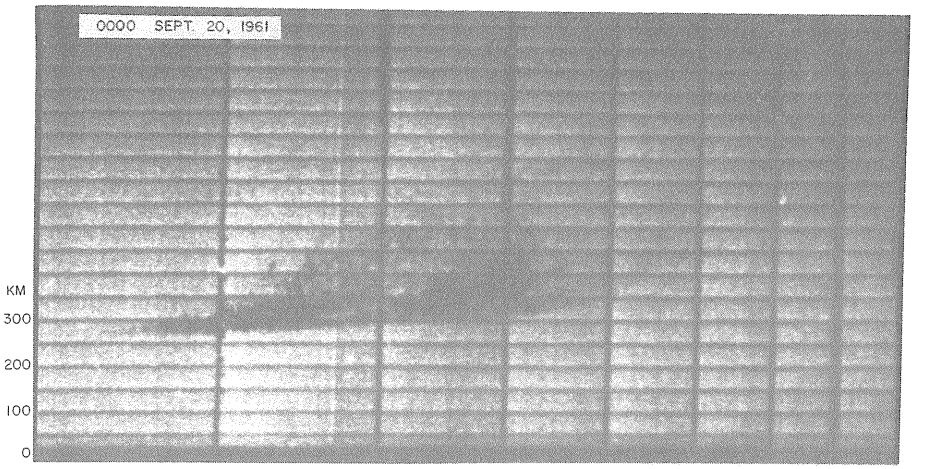
STATION: HEISS ISLAND U.S.S.R.

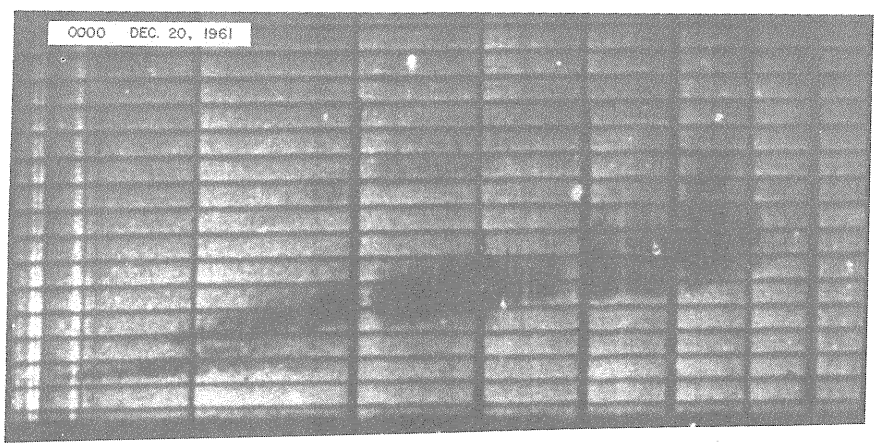
COORDINATES: GEOGRAPHIC LATITUDE: 80°37'N LONGITUDE: 58°03'E
GEOMAGNETIC LATITUDE: 71.0°N LONGITUDE: 156.0°
MAGNETIC DIP: 84.3°N TIME ZONE: 45°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 83.4° S
SCOTT BASE







STATION: SCOTT BASE ANTARCTICA

COORDINATES: GEOGRAPHIC LATITUDE: 77°51'S LONGITUDE: 166°48'E

GEOMAGNETIC LATITUDE: 79.0°S LONGITUDE: 294.2°

MAGNETIC DIP: 83.4°S TIME ZONE: 165°E MMT

GYROFREQUENCY: 1.71 MC AT 200 KM

TOTAL FIELD: 0.67 OERSTED

IONOSONDE: TYPE OR DESIGNATION: P 2

FREQUENCY RANGE: 1.0 MC. TO 22.0 MC

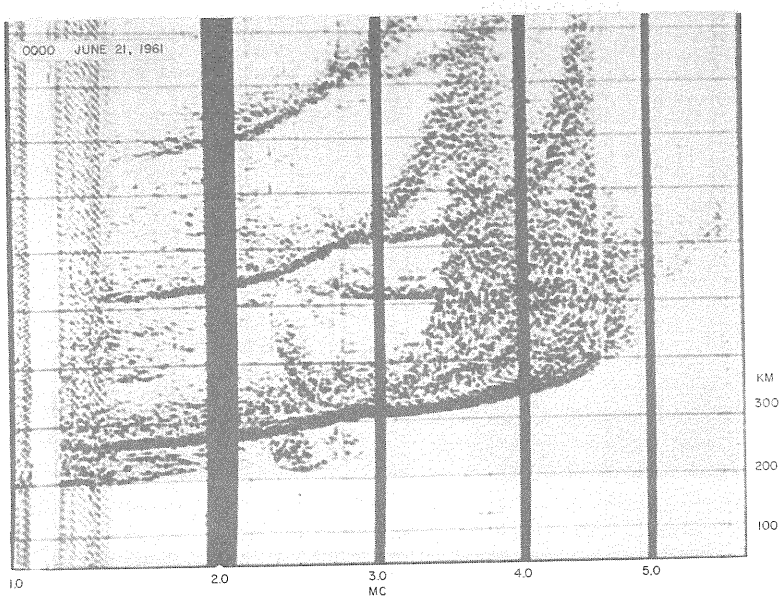
HEIGHT RANGE: 1000 KM

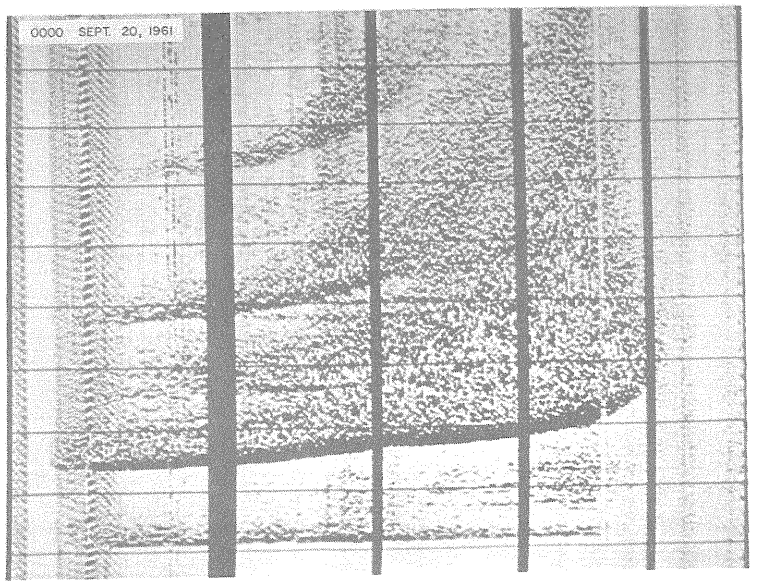
POWER: 10 KW

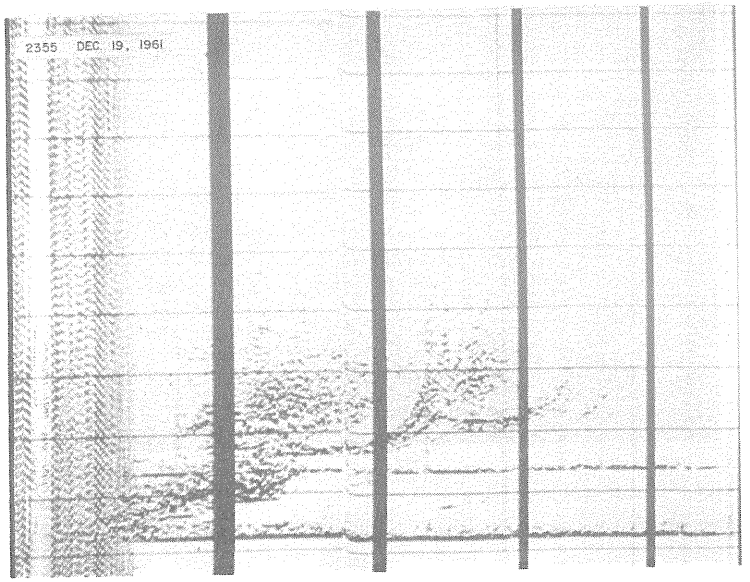
SWEEP TIME: 75 SEC

LOGARITHMIC FREQUENCY SCALE

DIP 83.0° N
CHURCHILL





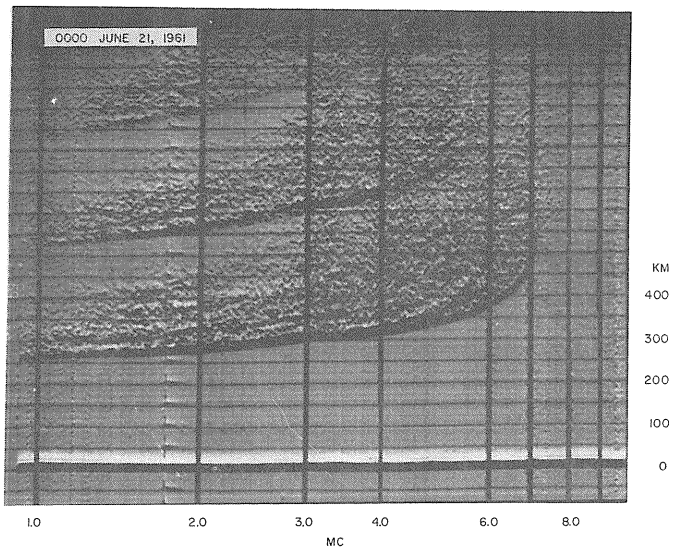


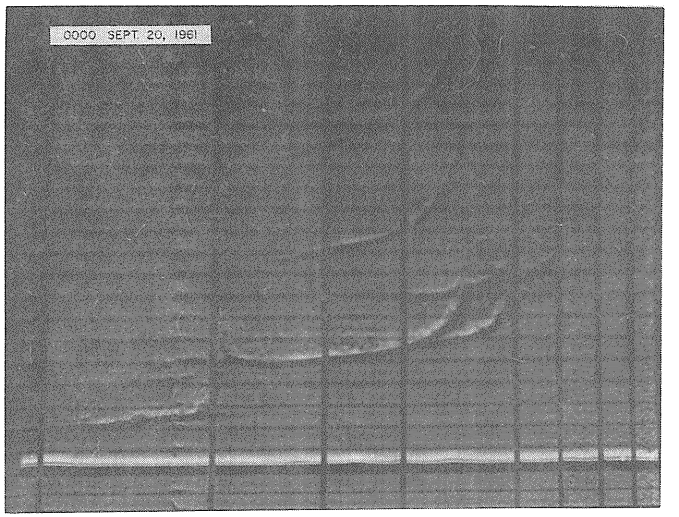
STATION: CHURCHILL CANADA

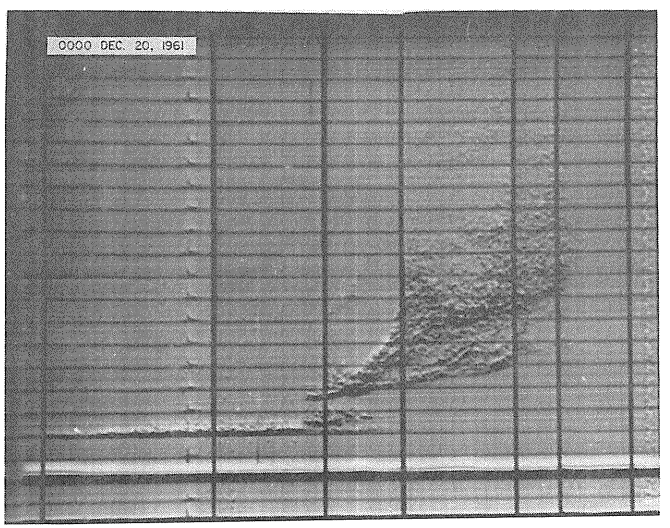
COORDINATES: GEOGRAPHIC LATITUDE: 58.8°N LONGITUDE: 94.2°W
GEOMAGNETIC LATITUDE: 68.7°N LONGITUDE: 322.6
MAGNETIC DIP: 83.0°N TIME ZONE: 90°W
GYROFREQUENCY: 1.56 MC AT 200 KM
TOTAL FIELD: 0.61 OERSTED

IONOSONDE: TYPE OR DESIGNATION: LG 17 (MODIFIED)
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 82.4°S
WILKES





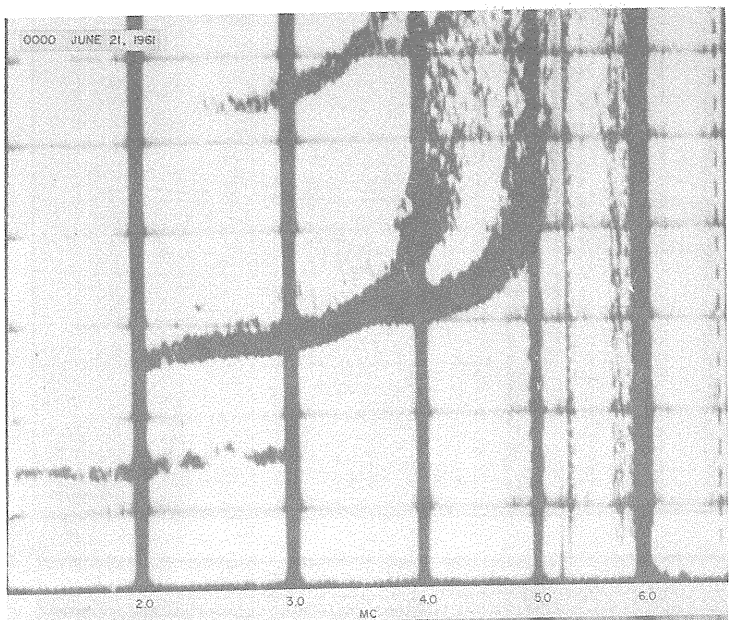


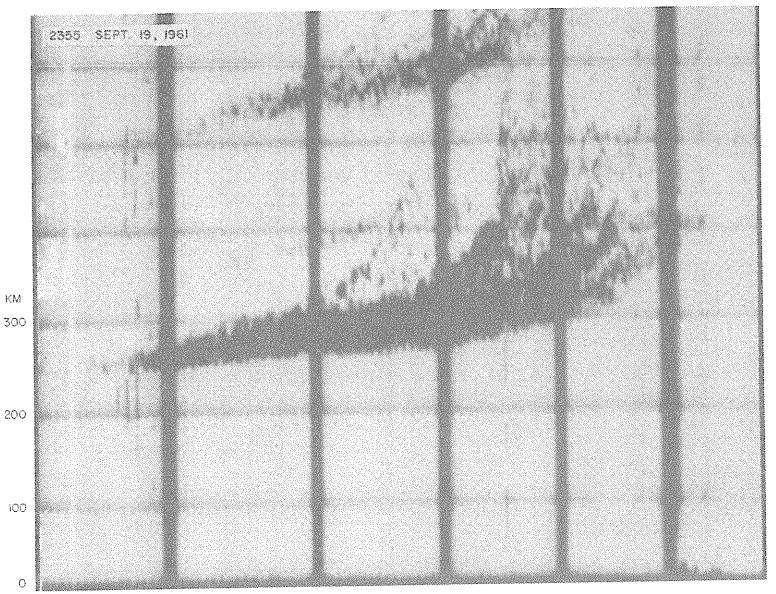
STATION: WILKES ANTARCTICA

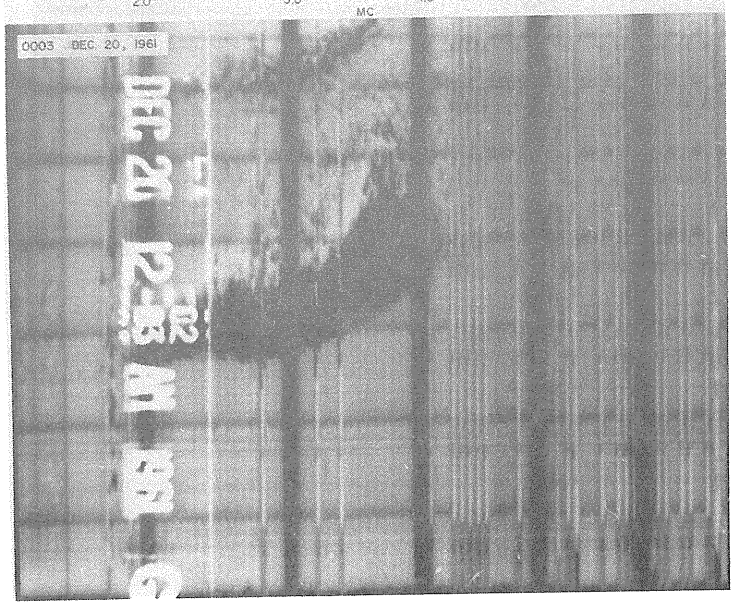
COORDINATES:
GEOGRAPHIC LATITUDE: 66.2°S LONGITUDE: 110°E
GEOMAGNETIC LATITUDE: 77.7°S LONGITUDE: 179.1°
MAGNETIC DIP: 82.4°S TIME ZONE: 105°E

IONOSONDE:
TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 - 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 25 KW
SWEEP TIME: 15 SEC
FREQUENCY SCALE: LOGARITHMIC

DIP 81.9° N
GODHAVN





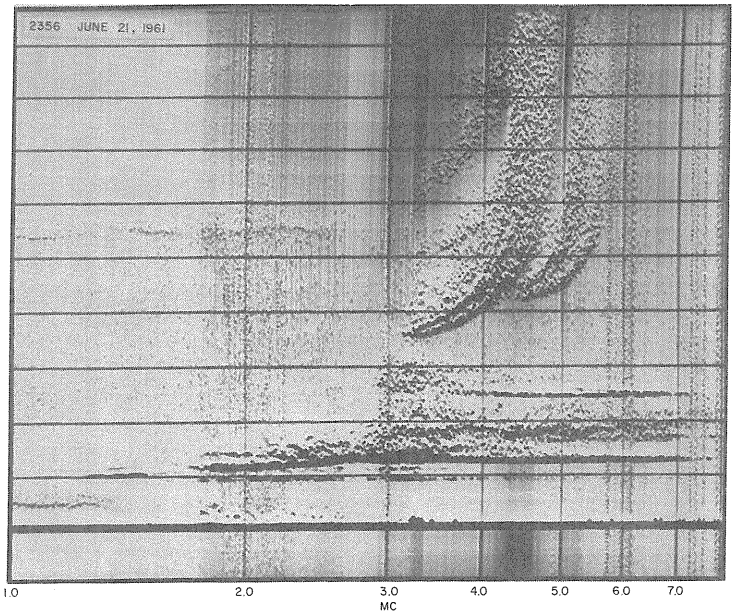


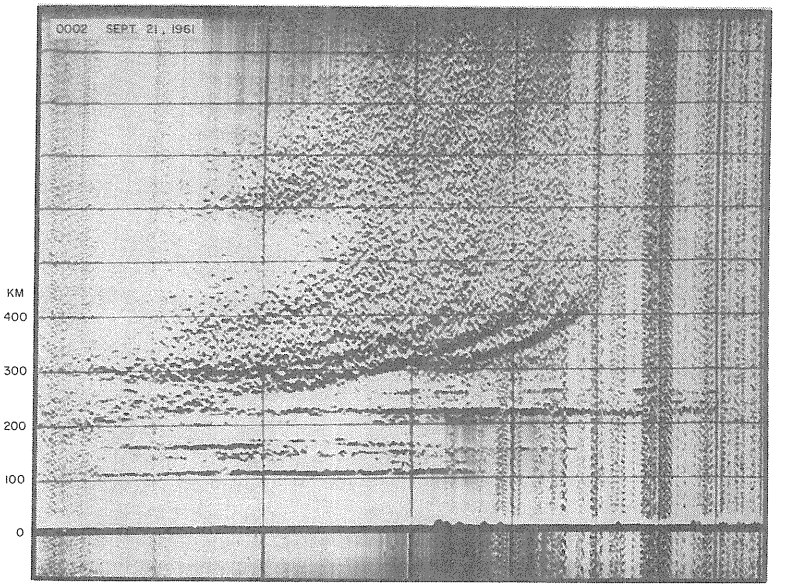
STATION: GODHAVN GREENLAND

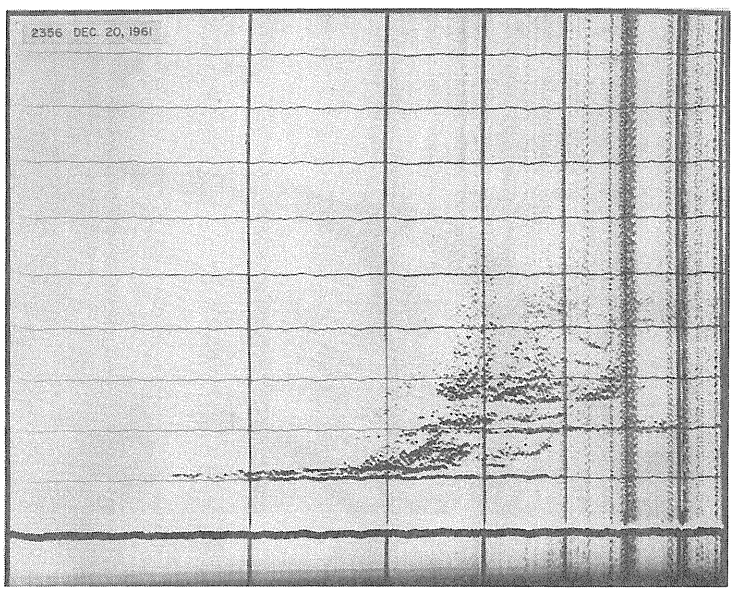
COORDINATES: GEOGRAPHIC LATITUDE: 69°16'N LONGITUDE: 53°30'W
GEOMAGNETIC LATITUDE: 79.8°N LONGITUDE: 32.5°
MAGNETIC DIP: 81.9°N TIME ZONE: 45°W
GYROFREQUENCY: 1.43 MC AT 200 KM
TOTAL FIELD: 0.56 OERSTED (MEASURED AT GROUND LEVEL 1962)

IONOSONDE: TYPE OR DESIGNATION: COSSOR - MOD 7562C
FREQUENCY RANGE: 1.6 MC TO 20.0 MC
HEIGHT RANGE: 800 KM
POWER: 1 KW
SWEEP TIME: 15 SEC
APPROXIMATELY LOGARITHMIC FREQUENCY SCALE

DIP 80.3° N
BARROW





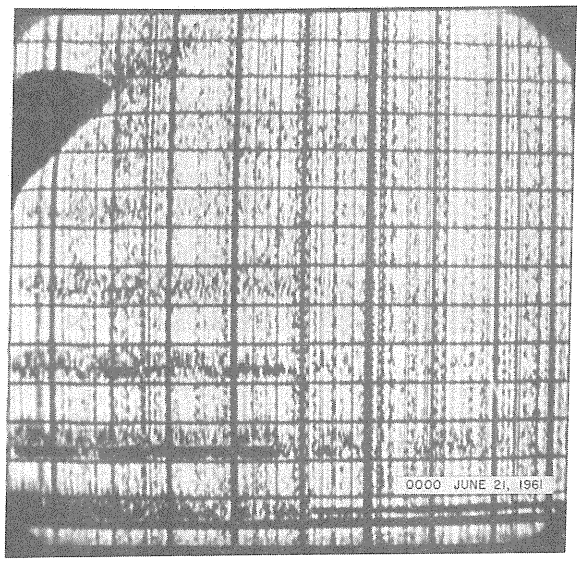


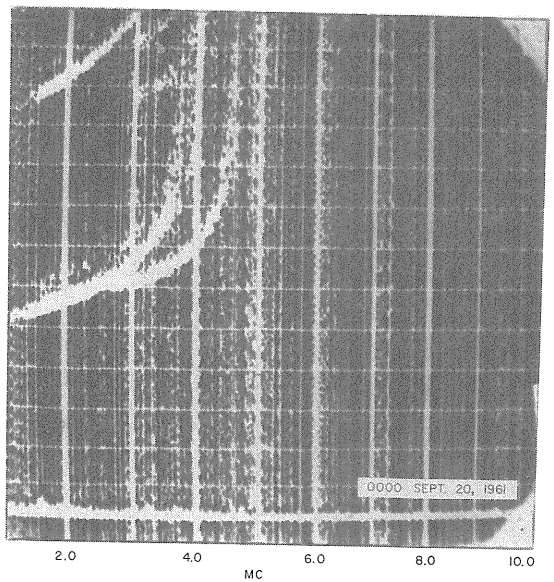
STATION: BARROW U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 71°08'N LONGITUDE: 156°48'W
GEOMAGNETIC LATITUDE: 68.5°N LONGITUDE: 241.1
MAGNETIC DIP: 80.3°N TIME ZONE: 150°W
GYROFREQUENCY: 1.45 MC AT 200 KM
TOTAL FIELD: 0.57 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 13.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 79.6°N
SALEKHARD





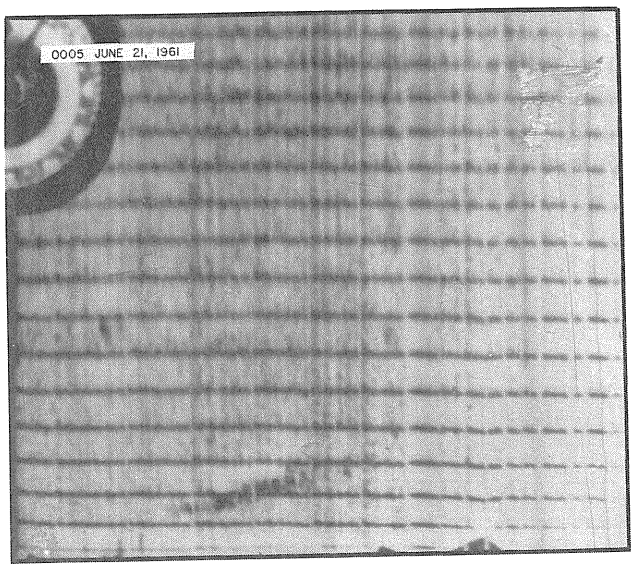
STATION: SALEKHARD U.S.S.R.

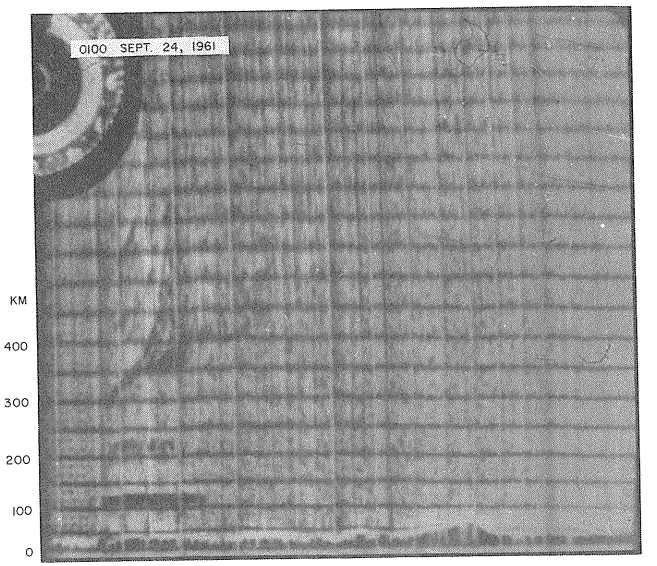
COORDINATES: GEOGRAPHIC LATITUDE: 66°32'N LONGITUDE: 66°32'E
GEOMAGNETIC LATITUDE: 57.3°N LONGITUDE: 148.9°
MAGNETIC DIP: 79.6°N TIME ZONE: 60°E

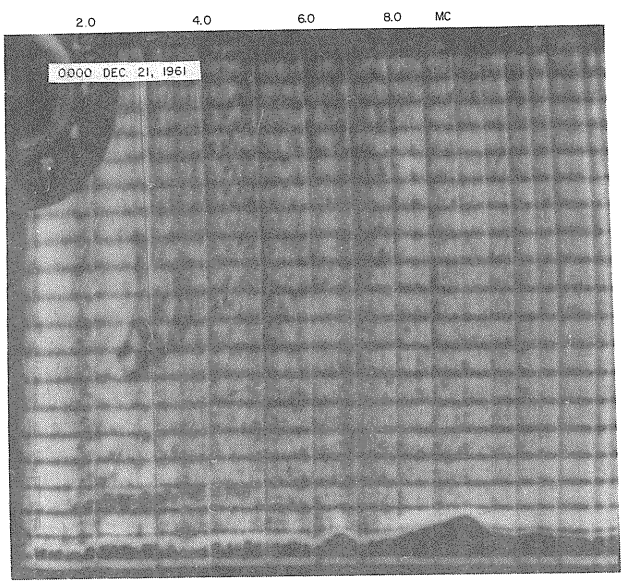
IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 78.1°N

MURMANSK





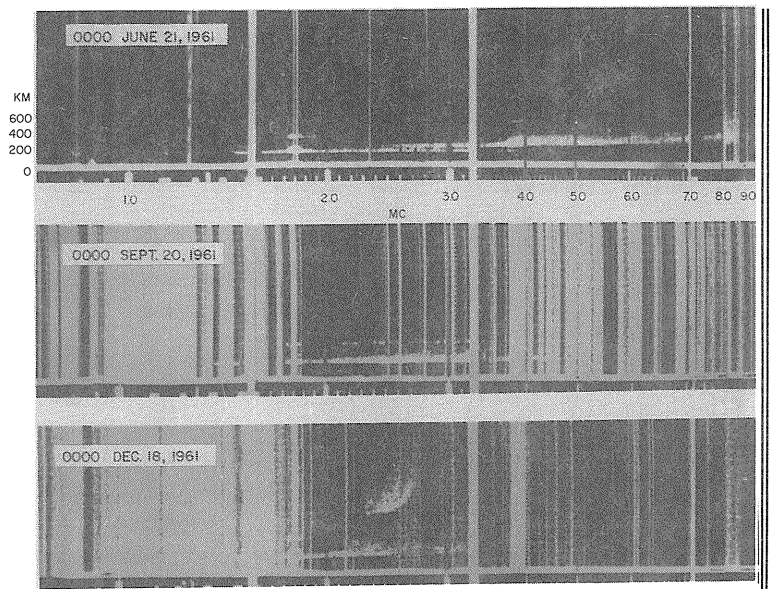


STATION: MURMANSK U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 68°57'N LONGITUDE: 33°03'E
GEOMAGNETIC LATITUDE: 64.2°N LONGITUDE: 126.5°
MAGNETIC DIP: 78.1°N TIME ZONE: 30°E

IONOSONDE: TYPE OR DESIGNATION: OWN CONSTRUCTION
FREQUENCY RANGE: 1.0 - 20.0 MC
HEIGHT RANGE: 150 KM, 500 KM, 1000 KM
POWER: 2 - 5 KW
SWEEP TIME: 30 SEC
FREQUENCY SCALE: LOGARITHMIC

DIP 77.9° N
TROMSØ

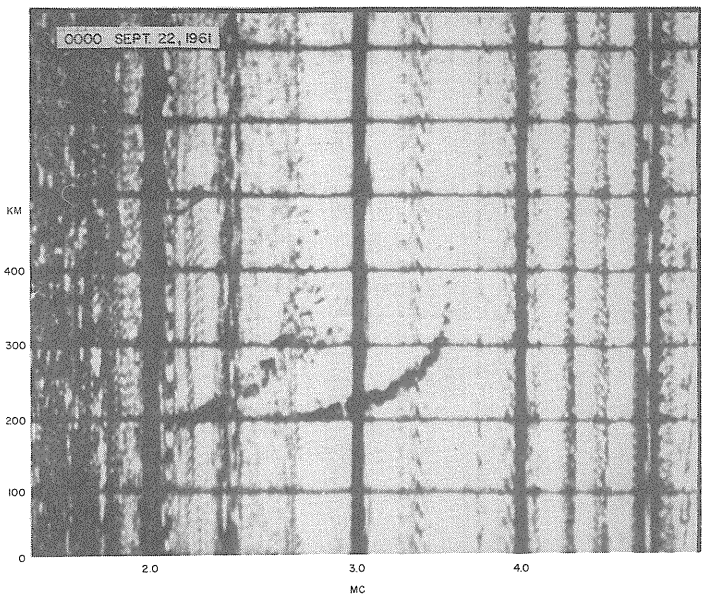


STATION: TROMSØ NORWAY

COORDINATES: GEOGRAPHIC LATITUDE: 69°39'N LONGITUDE: 18°57'E
GEOMAGNETIC LATITUDE: 67.1°N LONGITUDE: 116.8°
MAGNETIC DIP: 77.9°N TIME ZONE: 15°E
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: TYPE OR DESIGNATION: NPL MK II
FREQUENCY RANGE: 0.68 MC TO 24.6 MC
HEIGHT RANGE: 950 KM
POWER: 0.5 KW
SWEEP TIME: 300 SEC
SEMI LOGARITHMIC FREQUENCY SCALE

DIP 77.1° N
WINNIPEG

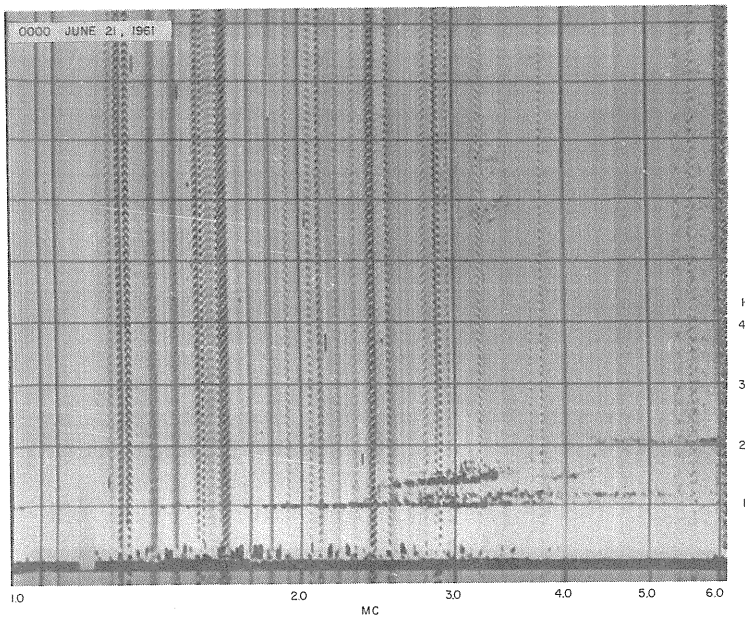


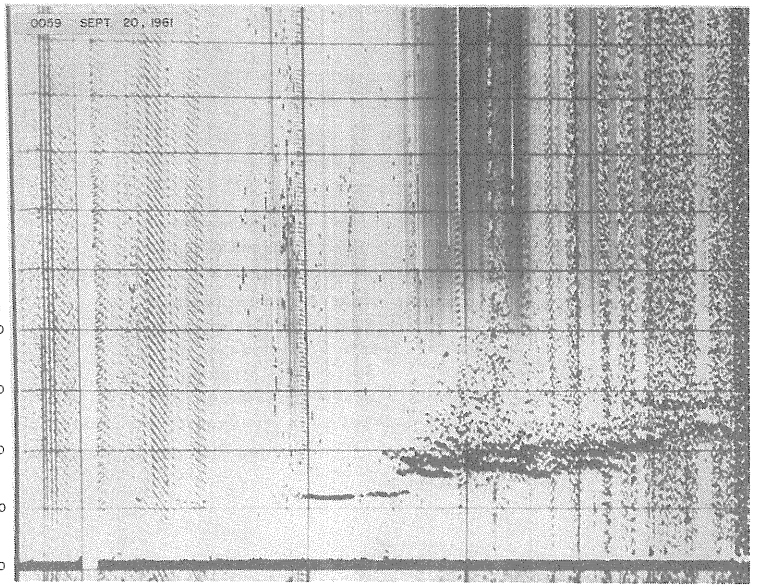
STATION: WINNIPEG CANADA

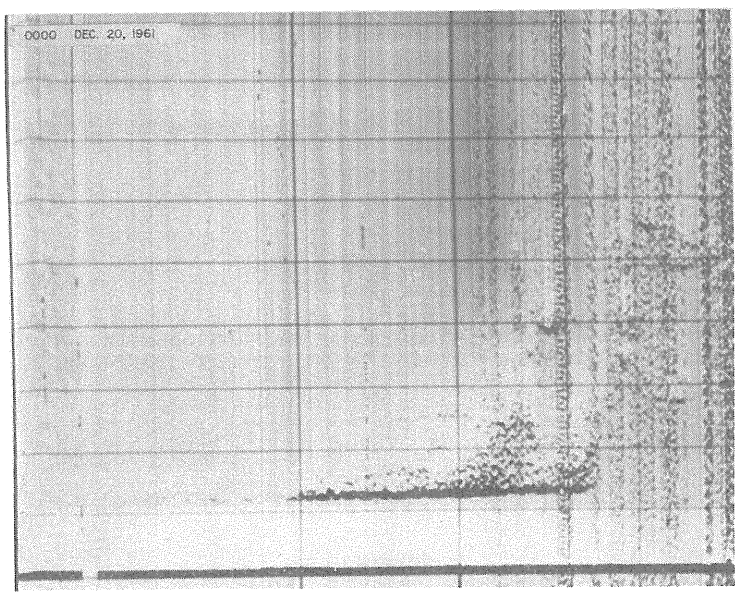
COORDINATES: GEOGRAPHIC LATITUDE: 49.9°N LONGITUDE: 97.4°W
GEOMAGNETIC LATITUDE: 59.6°N LONGITUDE: 322.7°
MAGNETIC DIP: 77.1°N TIME ZONE: 90°W
GYROFREQUENCY: 1.56 MC AT 200 KM
TOTAL FIELD: 0.61 OERSTED
STARTING DATE: APRIL 1951

IONOSONDE: TYPE OR DESIGNATION: COSSOR MK 2
FREQUENCY RANGE: 1.6 MC TO 20.0 MC
SWEEP TIME: 15 SEC

DIP 77.5° N
NARSSARSSUAQ





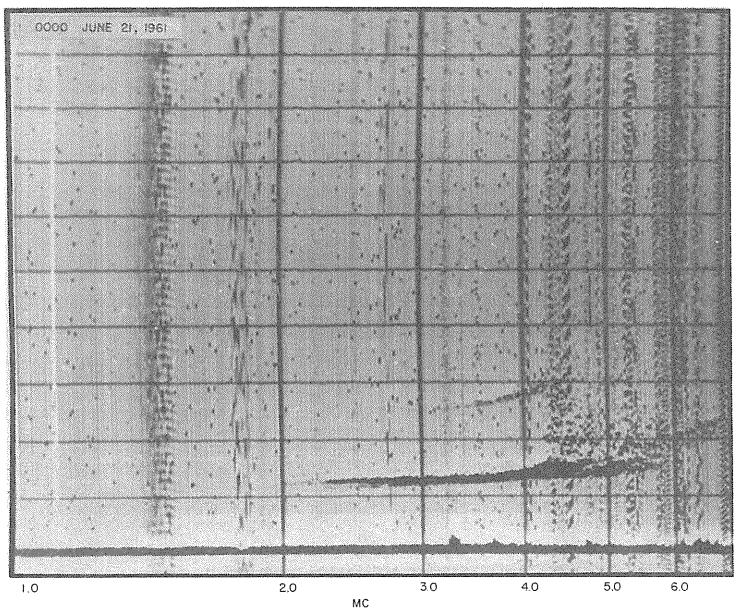


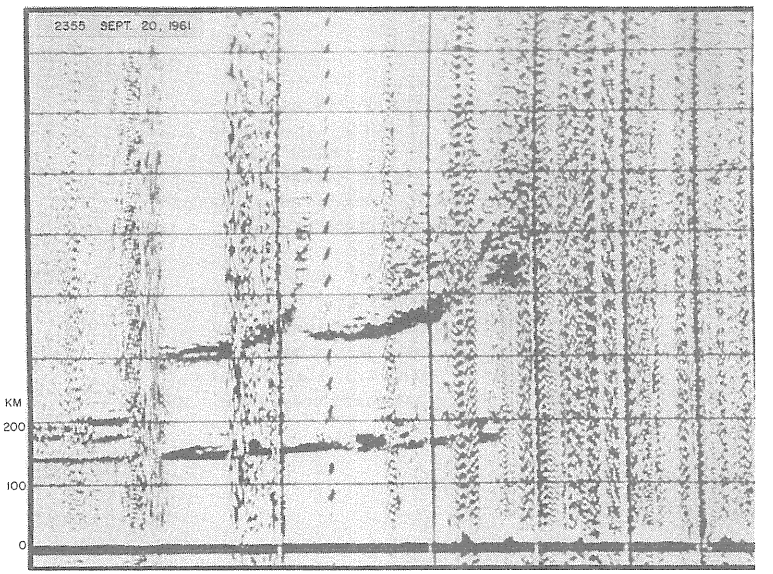
STATION: NARSSARSSUAQ GREENLAND

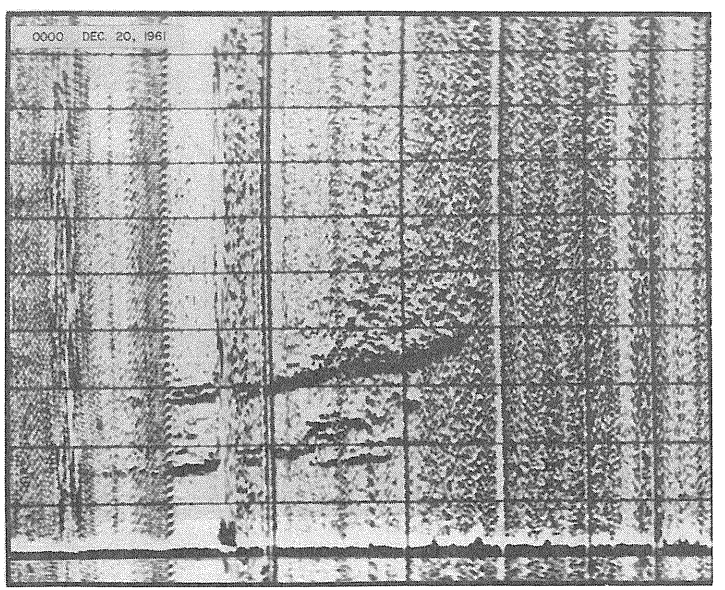
COORDINATES: GEOGRAPHIC LATITUDE: 61°11'N LONGITUDE: 45°25'W
GEOMAGNETIC LATITUDE: 71.2°N LONGITUDE: 36.8°
MAGNETIC DIP: 77.5°N TIME ZONE: 45°W
GYROFREQUENCY: 1.38 MC AT 200 KM
TOTAL FIELD: 0.54 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 10 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 77.1° N
COLLEGE





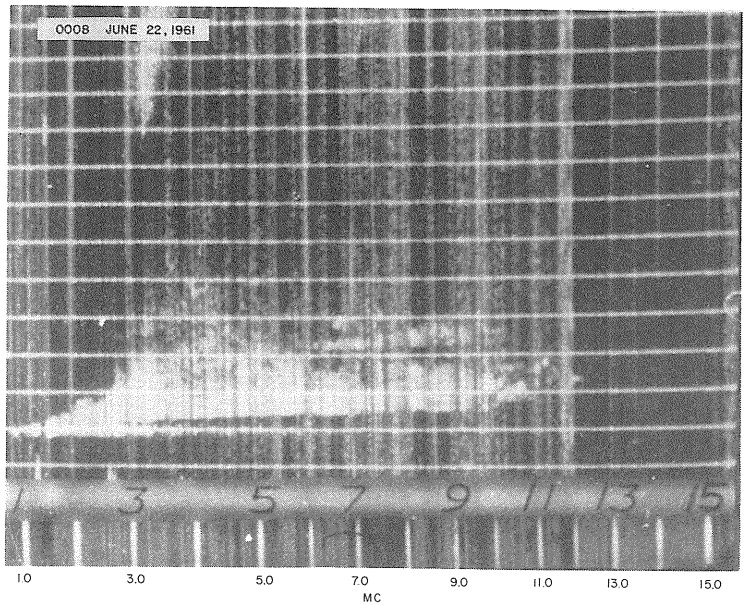


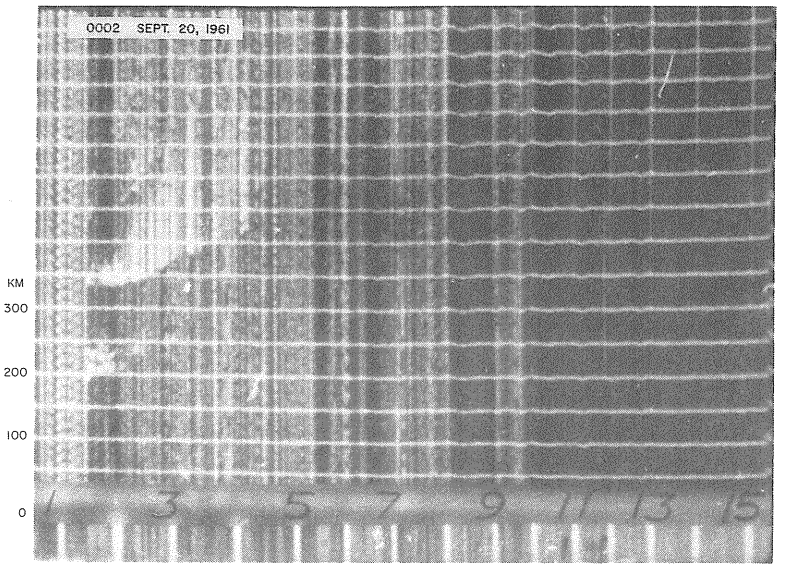
STATION: COLLEGE U. S. A.

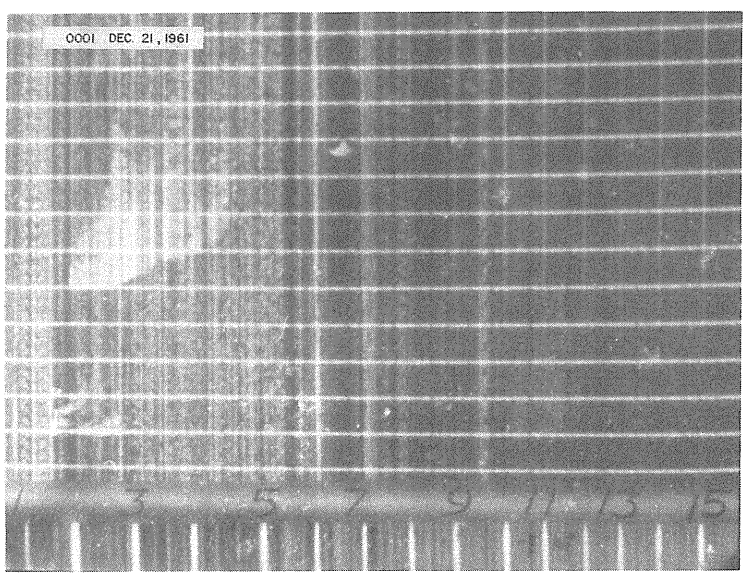
COORDINATES: GEOGRAPHIC LATITUDE: 64°52'N LONGITUDE: 147°49'W
GEOMAGNETIC LATITUDE: 64.7°N LONGITUDE: 256.5°
MAGNETIC DIP: 77.1°N TIME ZONE: 150°W
GYROFREQUENCY: 1.45 MC AT 200 KM
TOTAL FIELD: 0.57 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 13.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 77.0° N
KIRUNA





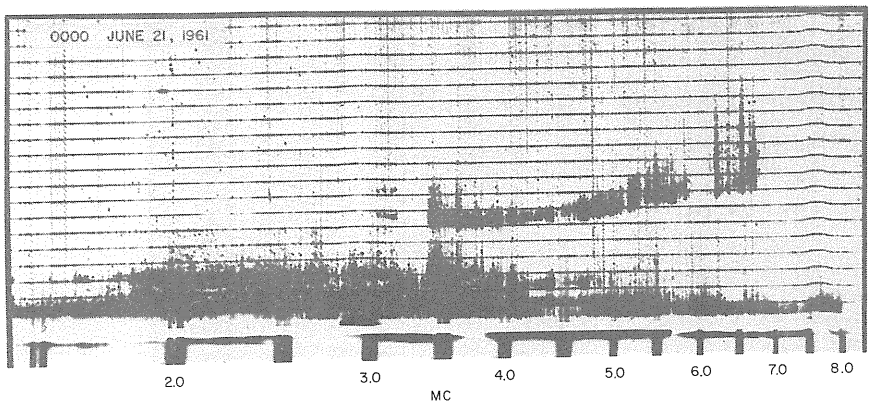


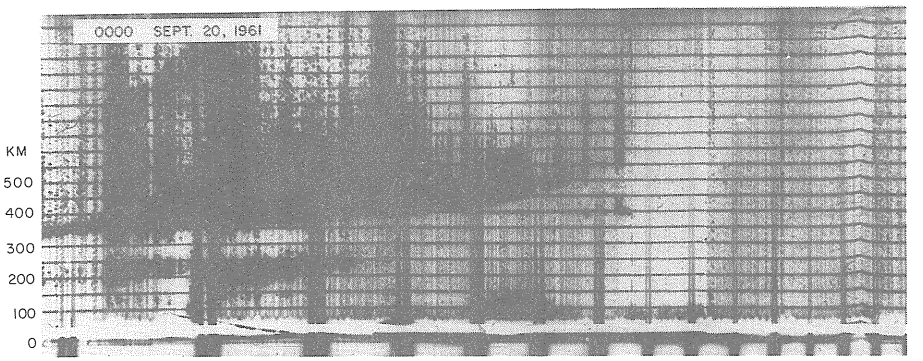
STATION: KIRUNA SWEDEN

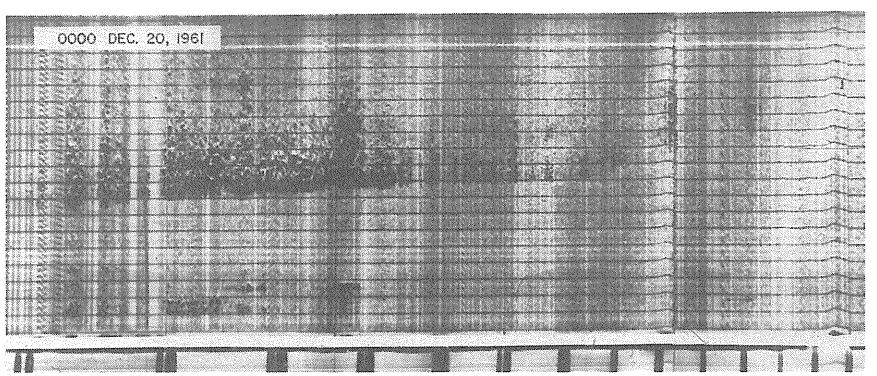
COORDINATES: GEOGRAPHIC LATITUDE: 67°50'N LONGITUDE: 20°26'E
GEOMAGNETIC LATITUDE: 65.3°N LONGITUDE: 115.5°
MAGNETIC DIP: 77.0°N TIME ZONE: 15°E
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: TYPE OR DESIGNATION: OWN CONSTRUCTION
FREQUENCY RANGE: 0.5 MC TO 15 MC
HEIGHT RANGE: 750 KM
POWER: 12 KW
SWEEP TIME: 25 SEC
LINEAR FREQUENCY SCALE

DIP 77.0°N
SODANKYLÄ







STATION: SODANKYLÄ FINLAND

COORDINATES: GEOGRAPHIC LATITUDE: 67°22'N LONGITUDE: 26°39'E

GEOMAGNETIC LATITUDE: 63.8°N LONGITUDE: 120.0°

MAGNETIC DIP: 77.0°N TIME ZONE: 30°E

GYROFREQUENCY: 1.33 MC AT 200 KM

TOTAL FIELD: 0.513 OERSTED

IONOSONDE: FREQUENCY RANGE: 1.0 MC TO 16.0 MC

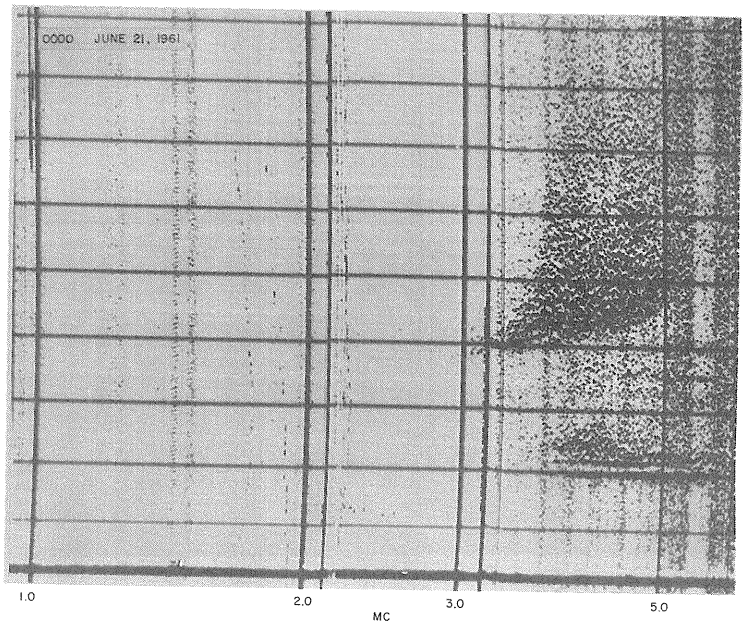
HEIGHT RANGE: 1000 KM

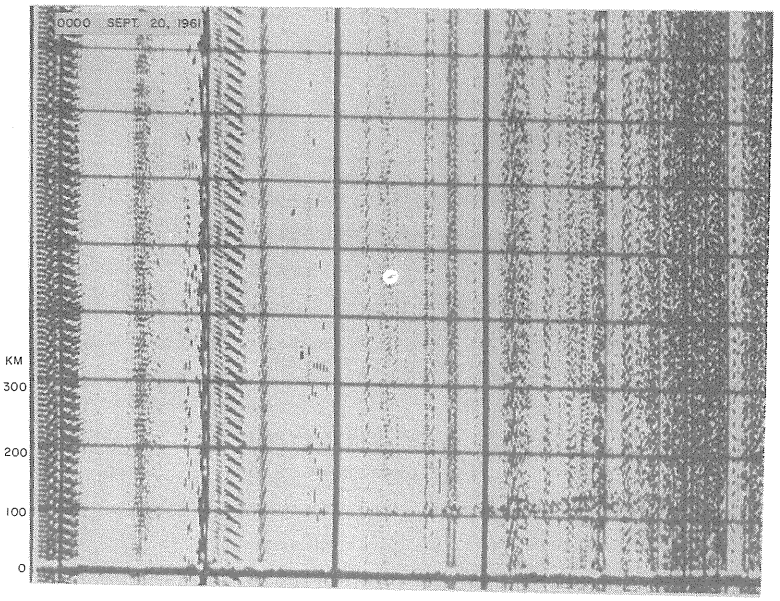
POWER: 50 KW

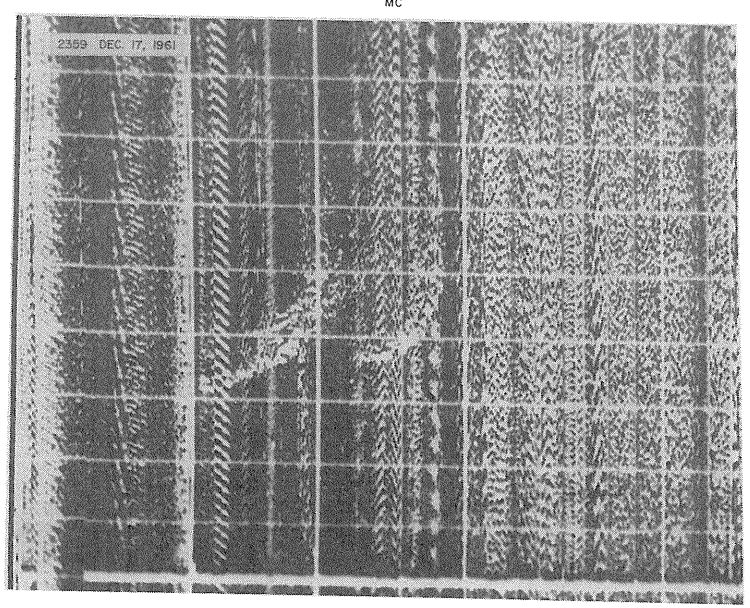
SWEEP TIME: 480 SEC

EQUATION FOR FREQUENCY SCALE: $75 \log \frac{f}{\text{MHz}}$ mm

DIP 76.0° N
REYKJAVIK





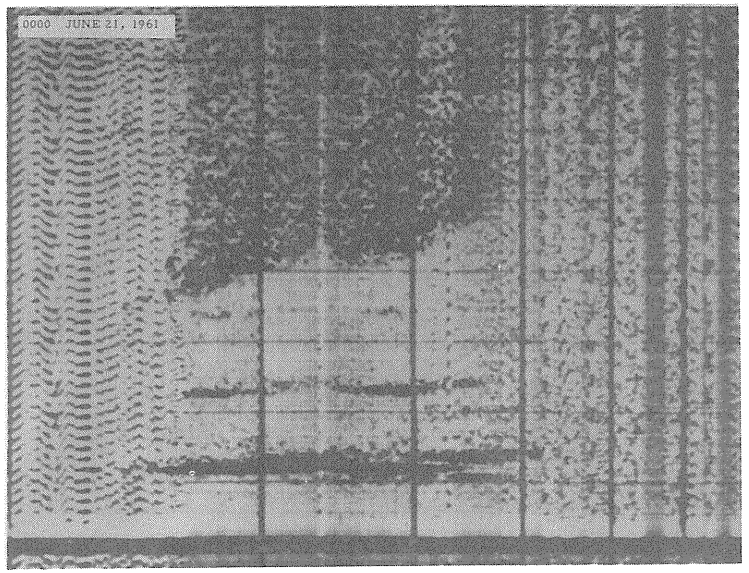


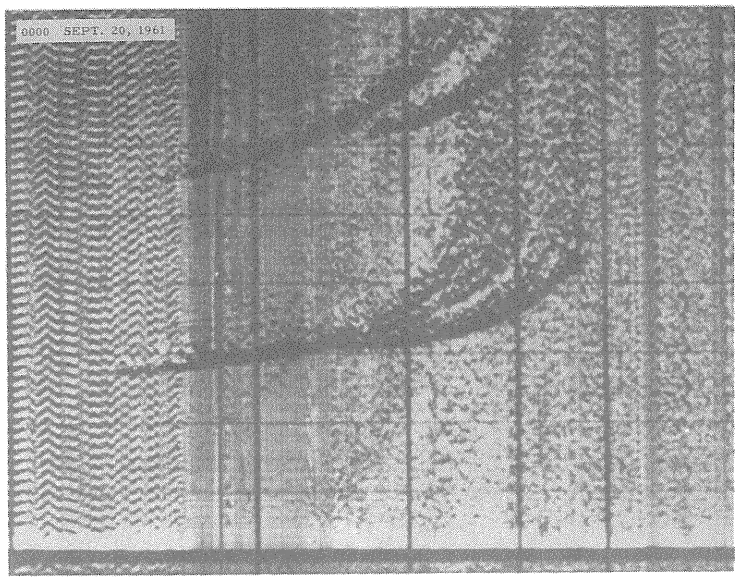
STATION: REYKJAVIK ICELAND

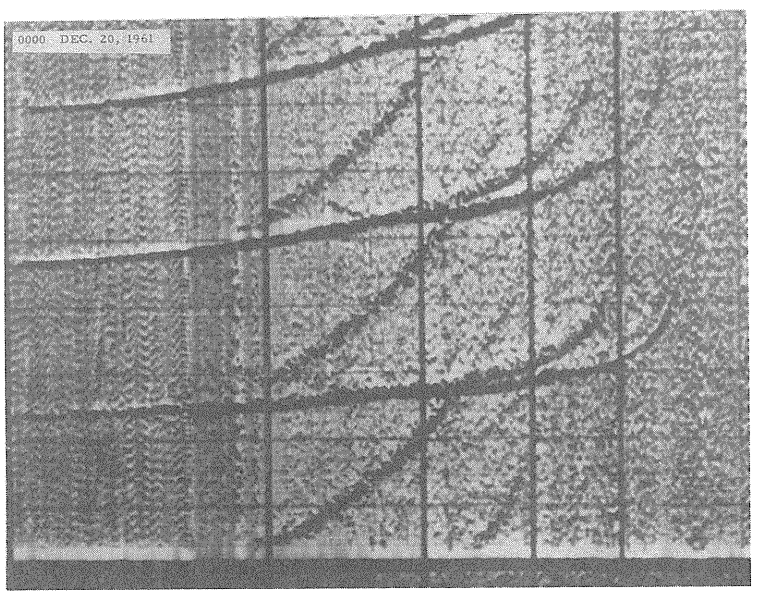
COORDINATES: GEOGRAPHIC LATITUDE: 64°08'N LONGITUDE: 21°47'W
GEOMAGNETIC LATITUDE: 70.2°N LONGITUDE: 70.8°
MAGNETIC DIP: 76.0°N TIME ZONE: 15°W
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 15 KW
SWEEP TIME: 18 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 76.0° S
CAMPBELL ISLAND





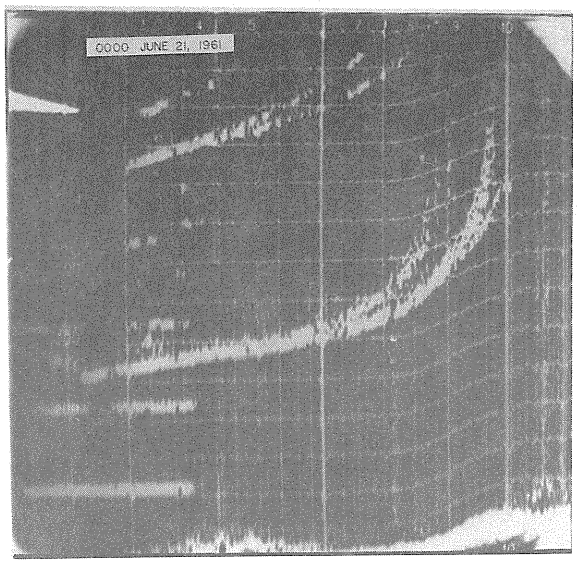


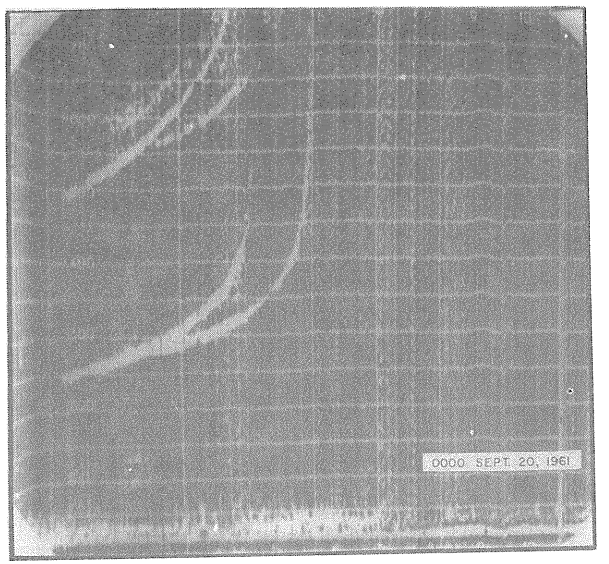
STATION: CAMPBELL ISLAND NEW ZEALAND

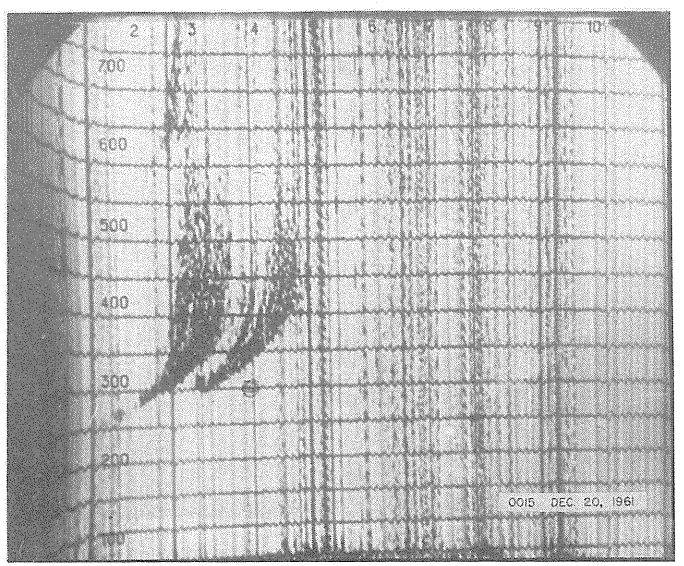
COORDINATES: GEOGRAPHIC LATITUDE: 52°33'S LONGITUDE: 169°09'E
GEOMAGNETIC LATITUDE: 57.3°S LONGITUDE: 253.2°
MAGNETIC DIP: 76.0°S TIME ZONE: 165°E
GYROFREQUENCY: 1.63 MC AT 200 KM
TOTAL FIELD: 0.64 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 75.9°N
YAKUTSK





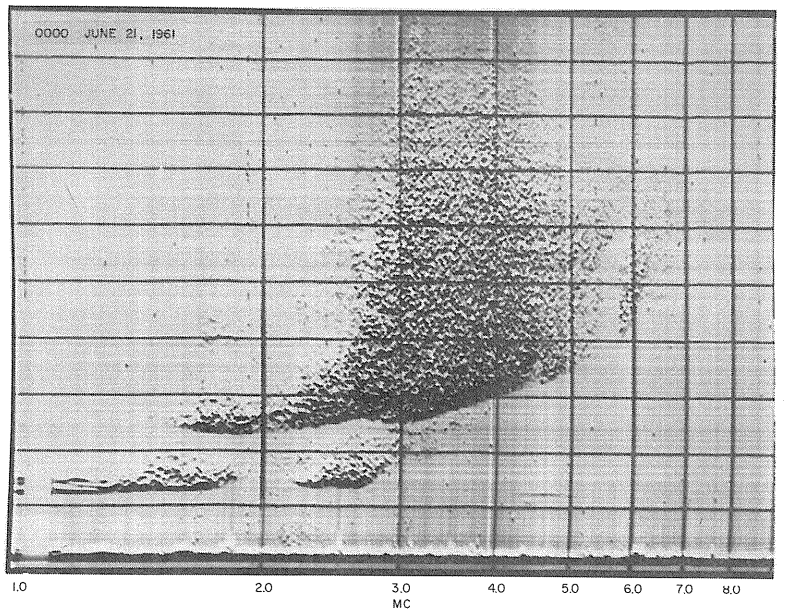


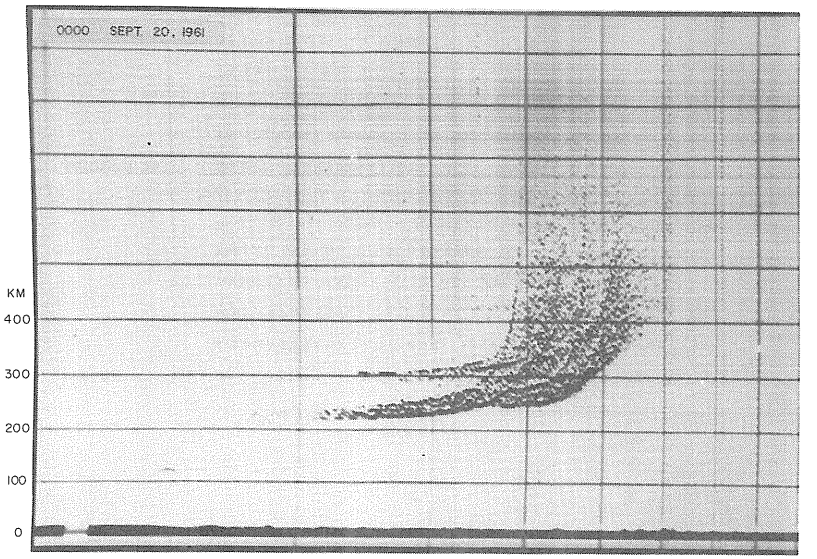
STATION: YAKUTSK U.S.S.R.

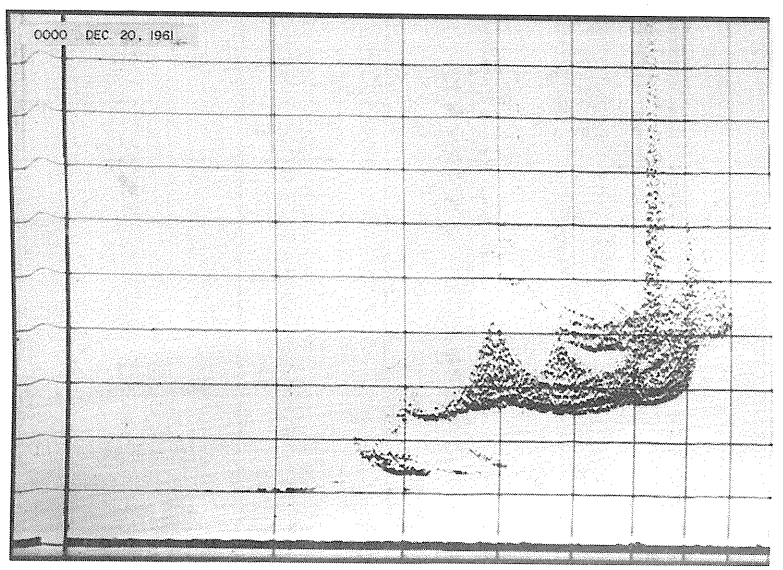
COORDINATES: GEOGRAPHIC LATITUDE: 62°01'N LONGITUDE: 129°43'E
GEOMAGNETIC LATITUDE: 50.9°N LONGITUDE: 193.7°
MAGNETIC DIP: 75.9°N TIME ZONE: 135°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 75.6° S
SOUTH POLE





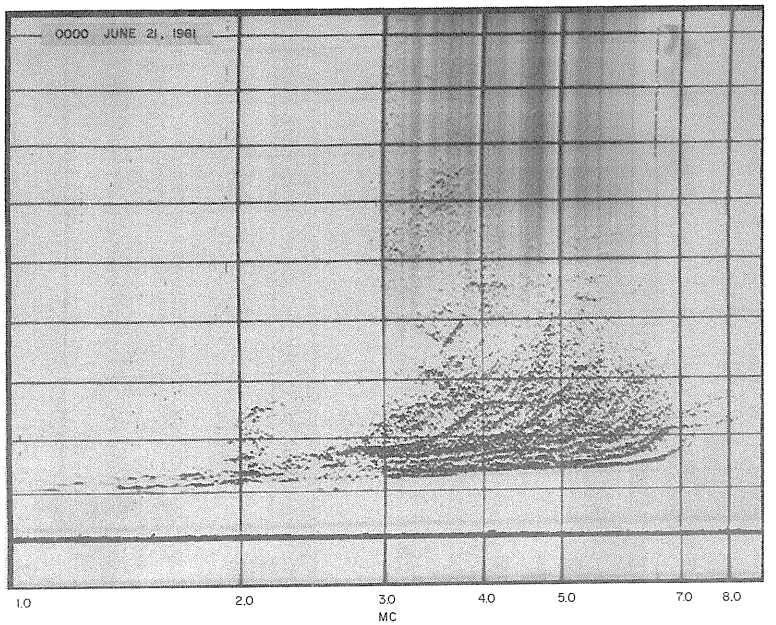


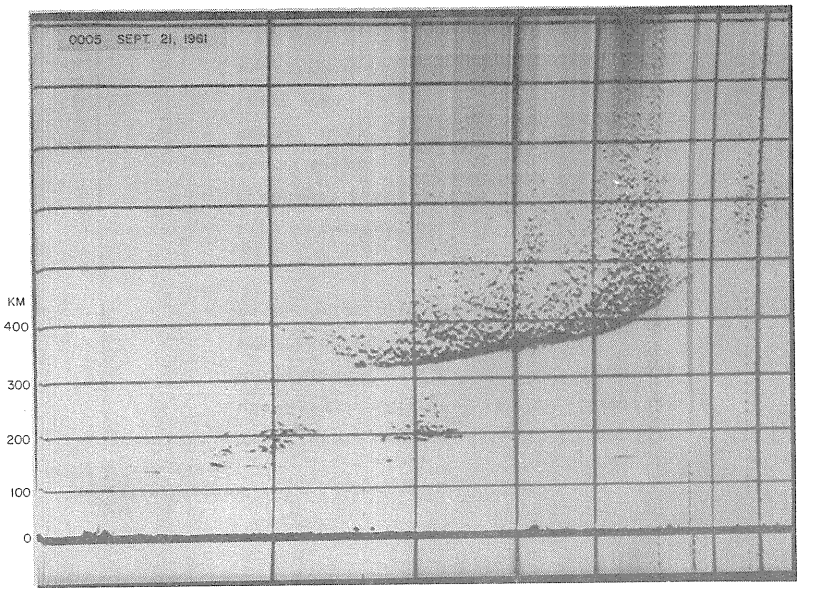
STATION: SOUTH POLE ANTARCTICA

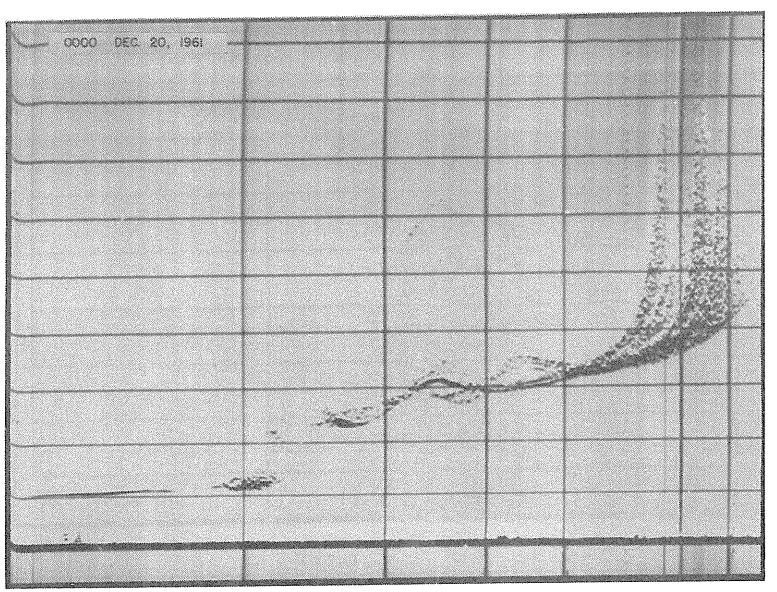
COORDINATES: GEOGRAPHIC LATITUDE: 90°00'S LONGITUDE: -
GEOMAGNETIC LATITUDE: 78.5°S LONGITUDE: 0°
MAGNETIC DIP: 75.6°S TIME ZONE: 0°
GYROFREQUENCY: 1.58 MC AT 200 KM.
TOTAL FIELD: 0.62 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000 KM
POWER: 20 KW
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 75.1° S
BYRD STATION





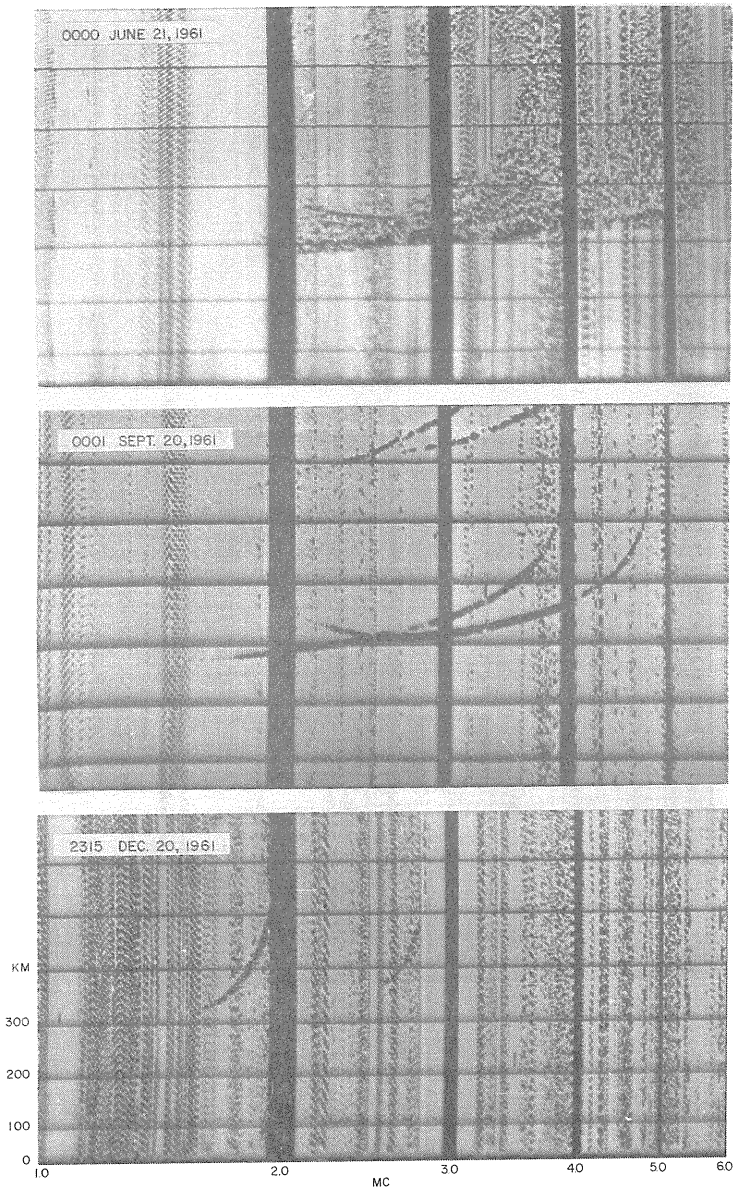


STATION: BYRD STATION ANTARCTICA

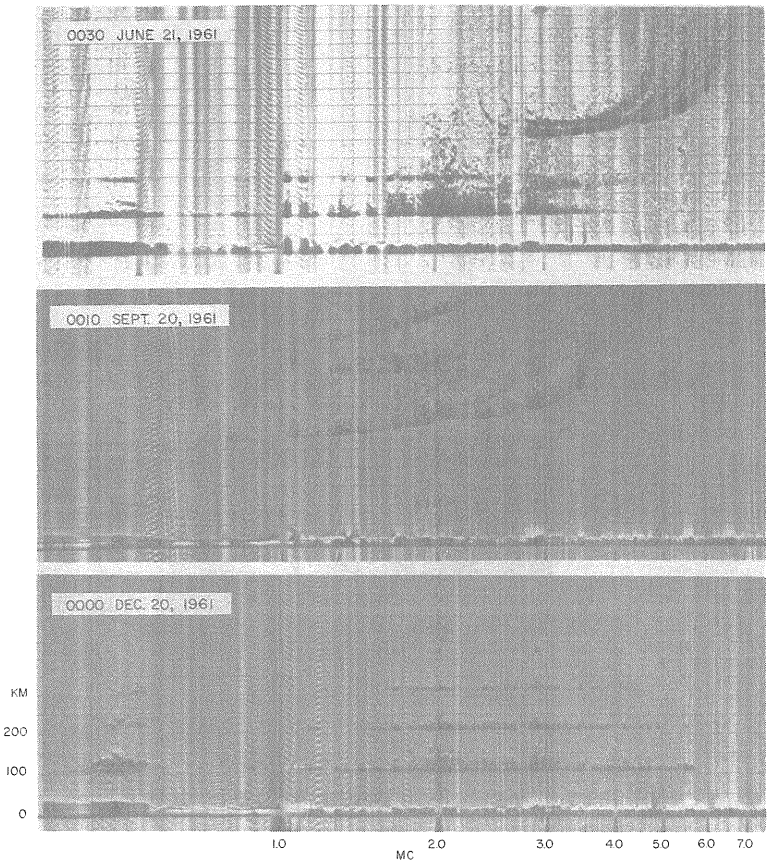
COORDINATES: GEOGRAPHIC LATITUDE: 80°00'S LONGITUDE: 120°00'W
GEOMAGNETIC LATITUDE: 70.6°S LONGITUDE: 336.0°
MAGNETIC DIP: 75.1°S TIME ZONE: 120°W
GYROFREQUENCY: 1.56 MC AT 200 KM
TOTAL FIELD: 0.61 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000 KM
POWER: 20 KW
SWEEP TIME: 13.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 74.9° N
OTTAWA



DIP 75.4° N
LYCKSELE



STATION: LYCKSELE SWEDEN

COORDINATES: GEOGRAPHIC LATITUDE: 64°37'N LONGITUDE: 18°40'E
GEOMAGNETIC LATITUDE: 62.8°N LONGITUDE: 111.0°
MAGNETIC DIP: 75.4°N TIME ZONE: 15°E
GYROFREQUENCY: 1.28 MC AT 200 KM TOTAL FIELD: 0.50 OERSTED

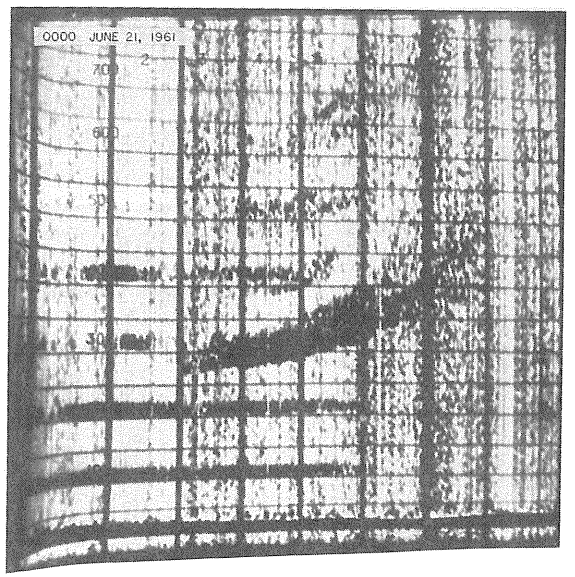
IONOSONDE: TYPE OR DESIGNATION: J4 FREQUENCY RANGE: 0.33 MC. TO 20.0 MC
HEIGHT RANGE: 1000 KM POWER: ~20 KW SWEEP TIME: 60, 180 SEC
NEARLY LOGARITHMIC FREQUENCY SCALE

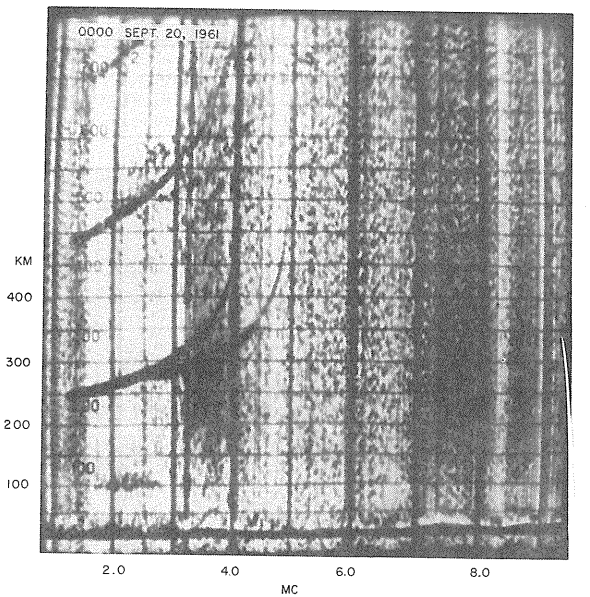
STATION: OTTAWA CANADA

COORDINATES: GEOGRAPHIC LATITUDE: 45.4°N LONGITUDE: 75.9°W
GEOMAGNETIC LATITUDE: 56.8°N LONGITUDE: 351.1°
MAGNETIC DIP: 74.9°N GYROFREQUENCY: 1.48 MC. AT 200 KM.
TOTAL FIELD: 0.58 OERSTED TIME ZONE: 75°W

IONOSONDE: TYPE OR DESIGNATION: L G 17 (MODIFIED)
FREQUENCY RANGE: 1.0 MC TO 16.0 MC HEIGHT RANGE: 1000 KM
POWER: 10 KW SWEEP TIME: 20 SEC. ≈ LOGARITHMIC FREQ. SCALE

DIP 74.7°N
TOMSK



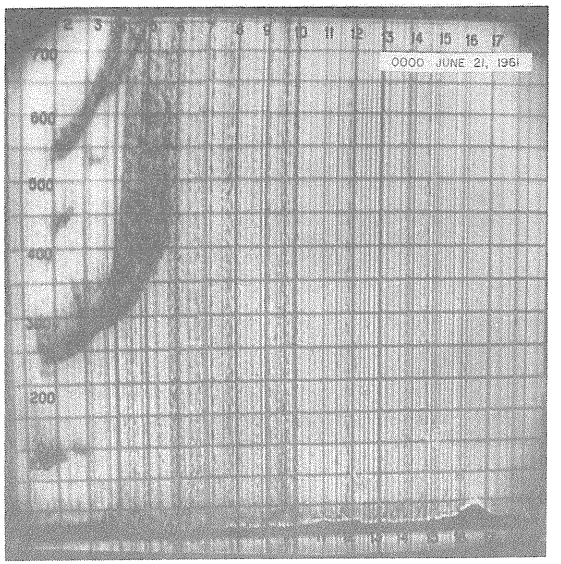


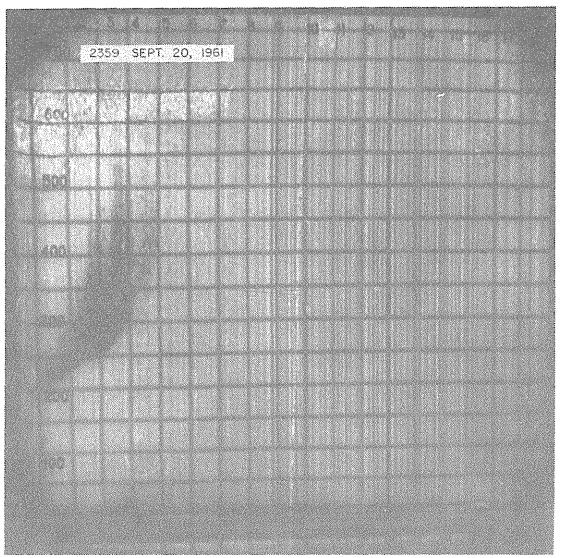
STATION: TOMSK U.S.S.R.

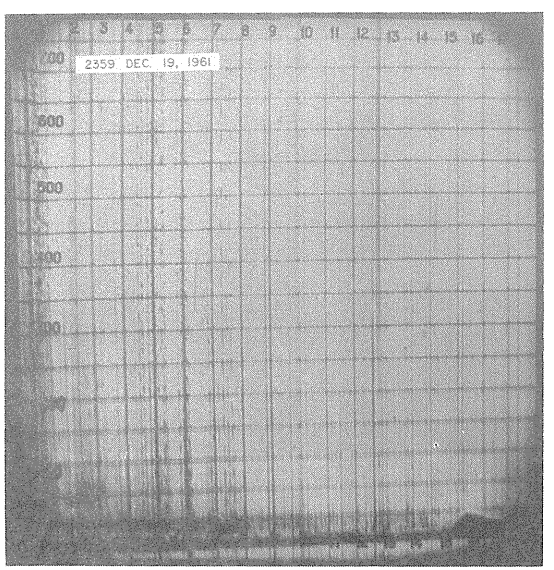
COORDINATES: GEOGRAPHIC LATITUDE: 56°28'N LONGITUDE: 84°56' E
GEOMAGNETIC LATITUDE: 45.9°N LONGITUDE: 159.6°
MAGNETIC DIP: 74.7°N TIME ZONE: 90°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 74.0°N
PROVIDENIE BAY





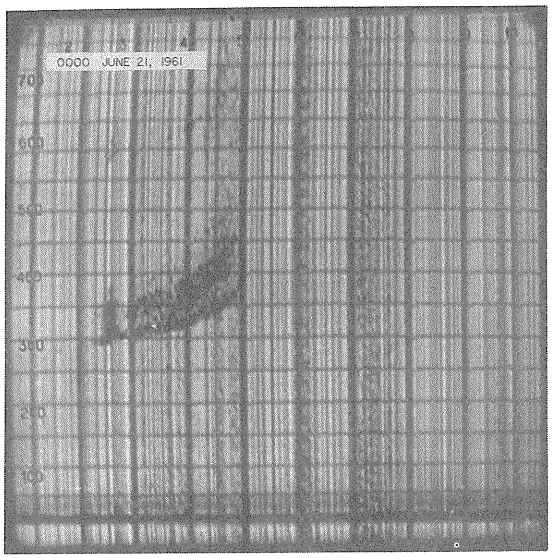


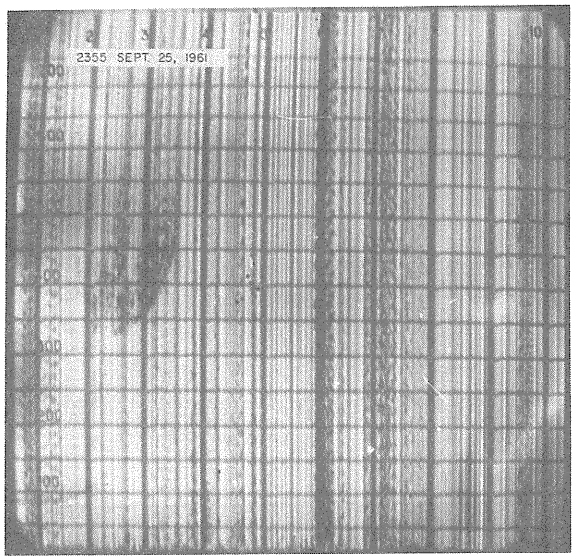
STATION: PROVIDENIE BAY U.S.S.R.

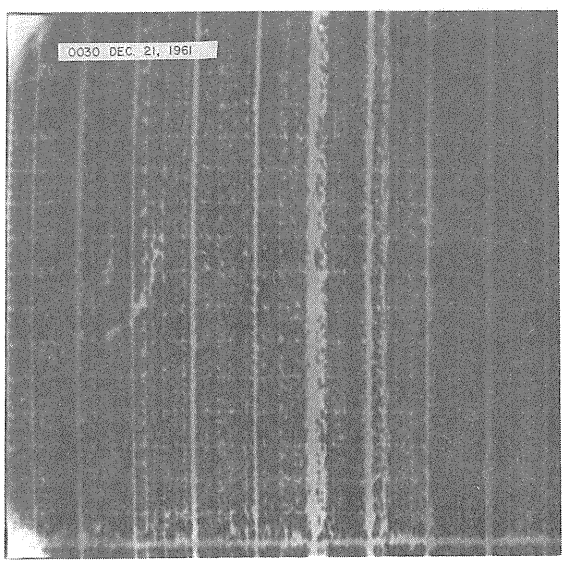
COORDINATES: GEOGRAPHIC LATITUDE: 64°23'N LONGITUDE: 173°24' W
GEOMAGNETIC LATITUDE: 59.6°N LONGITUDE: 235.7°
MAGNETIC DIP: 74.0°N TIME ZONE: 180°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 73.5°N
SVERDLOVSK





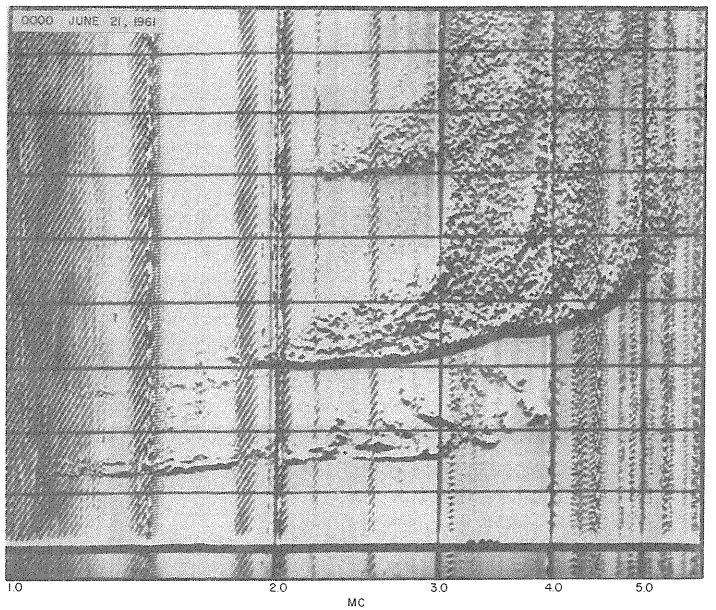


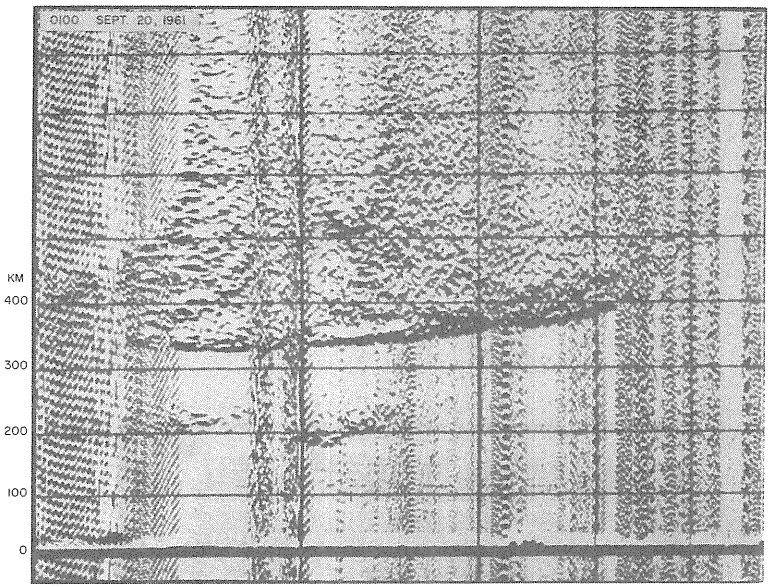
STATION: SVERDLOVSK U.S.S.R.

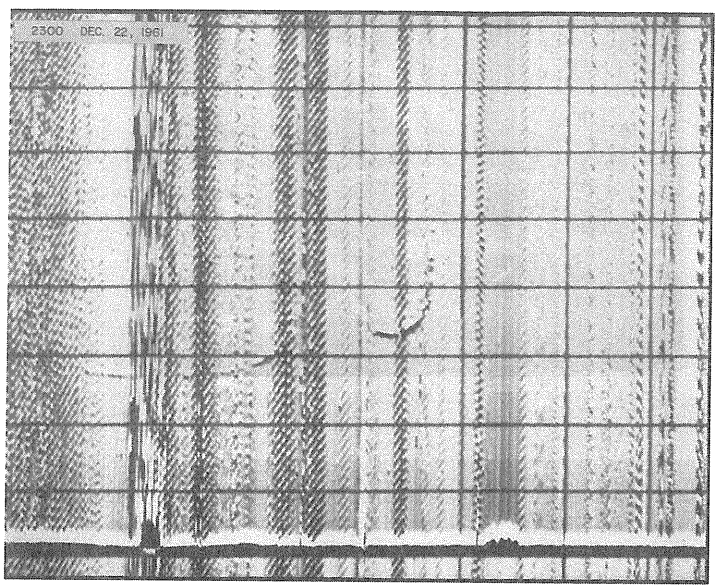
COORDINATES: GEOGRAPHIC LATITUDE: 56°44'N LONGITUDE: 61°04'E
GEOMAGNETIC LATITUDE: 48.5°N LONGITUDE: 140.7°
MAGNETIC DIP: 73.5°N TIME ZONE: 60°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 73.3° N
ANCHORAGE





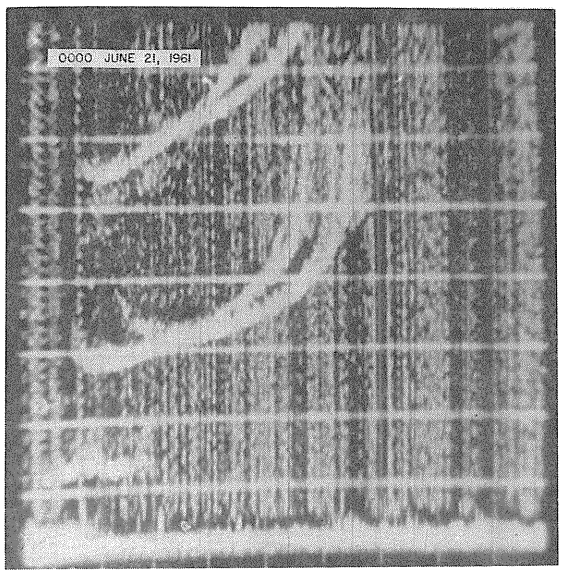


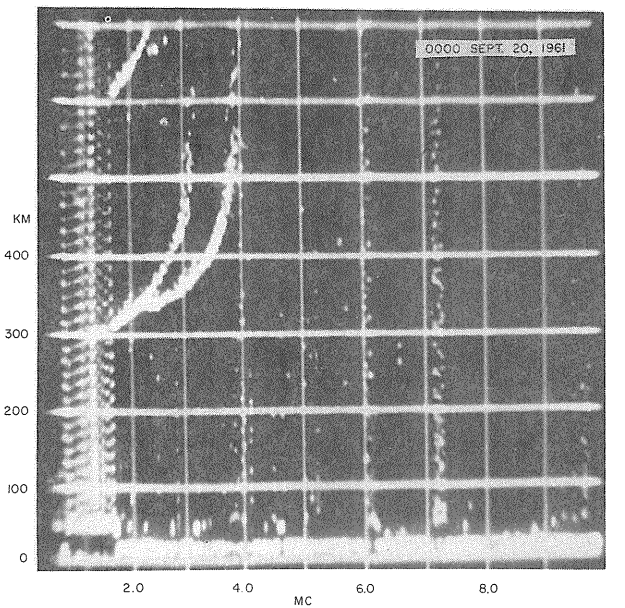
STATION: ANCHORAGE U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 61°10'N LONGITUDE: 149°55'W
GEOMAGNETIC LATITUDE: 60.9°N LONGITUDE: 258.1°
MAGNETIC DIP: 73.3°N TIME ZONE: 150°W
GYROFREQUENCY: 1.40 MC AT 200 KM
TOTAL FIELD: 0.55 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 13.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 73.2°N
LENINGRAD



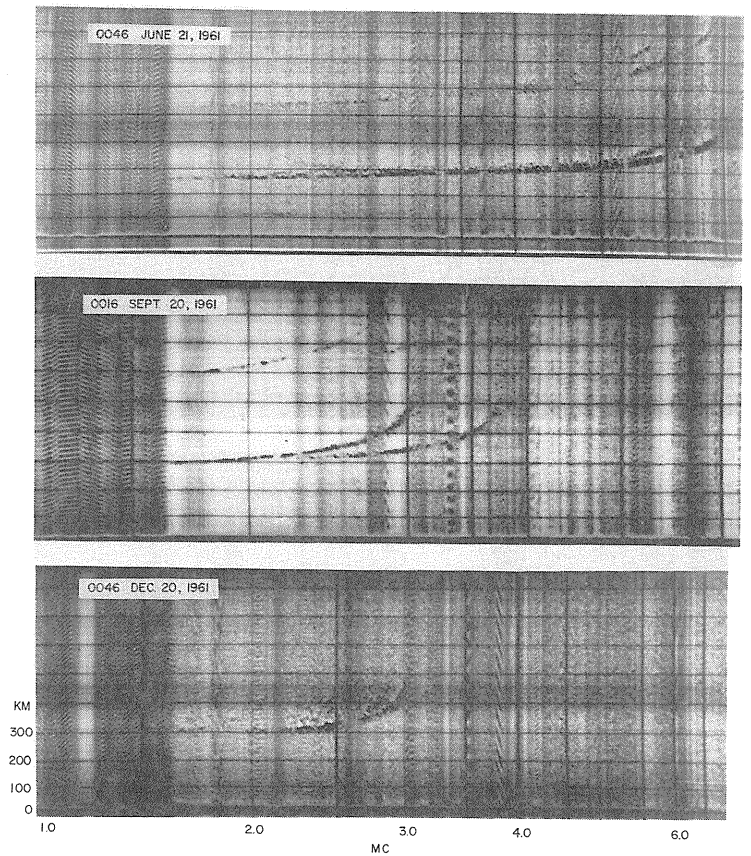


STATION: LENINGRAD U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 59°57'N LONGITUDE: 30°42'E
GEOMAGNETIC LATITUDE: 56.3°N LONGITUDE: 117.4°
MAGNETIC DIP: 73.2°N TIME ZONE: 30°E

IONOSONDE: TYPE OR DESIGNATION: SP-3
FREQUENCY RANGE: 1.0 - 20.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
FREQUENCY SCALE: LINEAR

DIP 73.2° N
NURMIJÄRVI

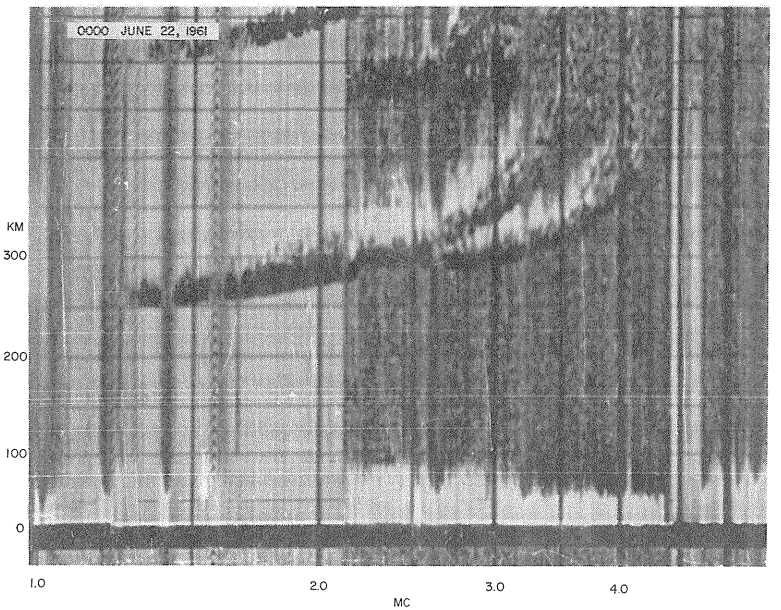


STATION: NURMIJÄRVI FINLAND NURMIJÄRVI GEOPHYSICAL OBSERVATORY AFFILIATION

COORDINATES: GEOGRAPHIC LATITUDE: 60°30'N LONGITUDE: 24°39'E
GEOMAGNETIC LATITUDE: 57.9°N LONGITUDE: 112.5°
MAGNETIC DIP: 73.2°N TIME ZONE: 0°
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3 (MODIFIED)
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 900 KM
POWER: 5 - 10 KW (PULSE POWER)
SWEEP TIME: 60 SEC (NORMAL)
LOGARITHMIC FREQUENCY SCALE

DIP 72.8° S
HOBART

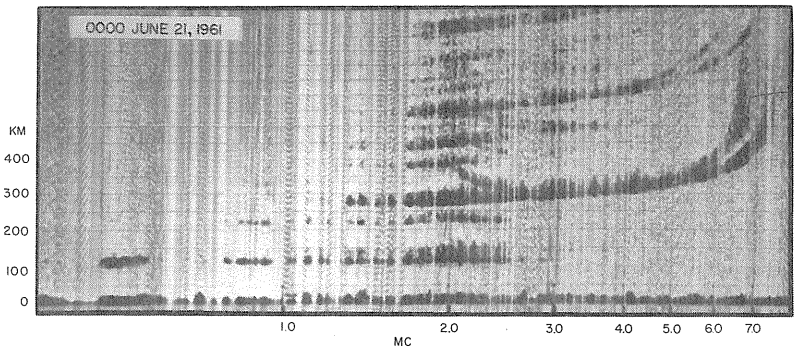


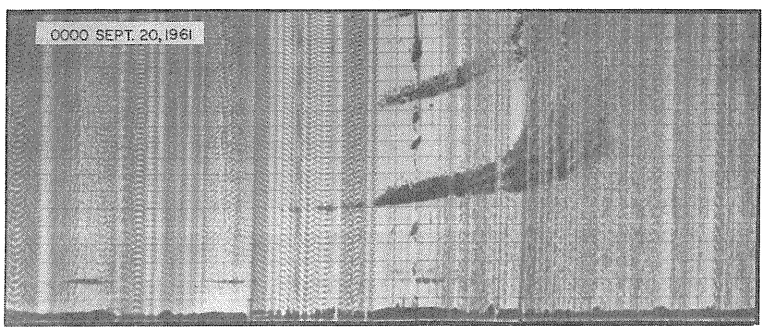
STATION: HOBART AUSTRALIA

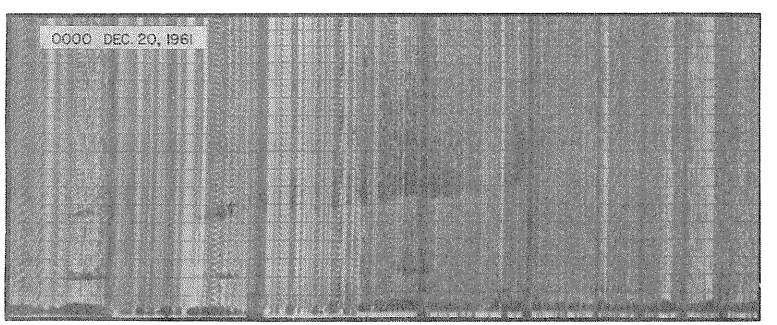
COORDINATES: GEOGRAPHIC LATITUDE: 42°55'S LONGITUDE: 147°19'E
GEOMAGNETIC LATITUDE: 51.7°S LONGITUDE: 224.3°
MAGNETIC DIP: 72.8°S TIME ZONE: 150°E
GYROFREQUENCY: 1.61 MC AT 200 KM
TOTAL FIELD: 0.63 OERSTED

IONOSONDE: TYPE OR DESIGNATION: MODIFIED CSIRO
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
POWER: 3 KW
SWEEP TIME: 1 MIN 55 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 72.5° N
UPPSALA





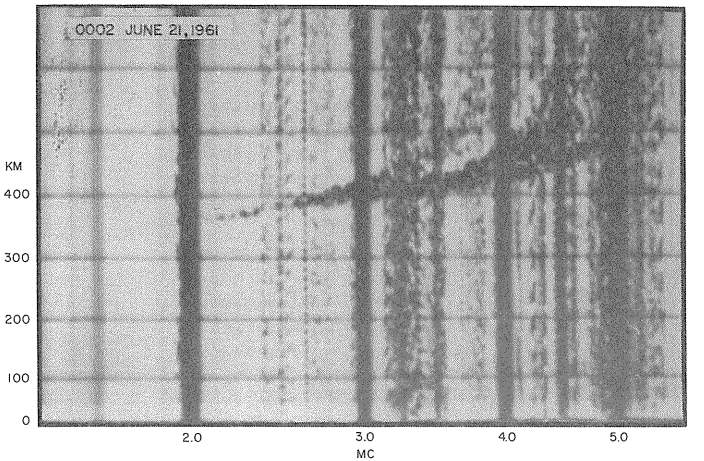


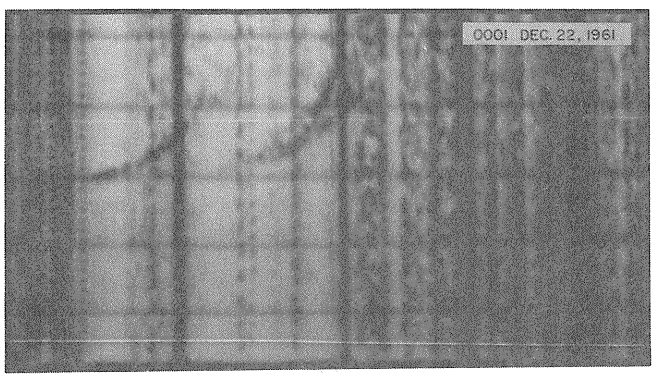
STATION: UPPSALA SWEDEN

COORDINATES: GEOGRAPHIC LATITUDE: 59°48'N LONGITUDE: 17°36'E
GEOMAGNETIC LATITUDE: 58.5°N LONGITUDE: 105.9°
MAGNETIC DIP: 72.5°N TIME ZONE: 15°E (+1.2 hr.)
GYROFREQUENCY: 1.28 MC AT 200 KM
TOTAL FIELD: 0.50 OERSTED

IONOSONDE: TYPE OR DESIGNATION: J 4
FREQUENCY RANGE: 0.33 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM POWER: ~ 20 KW
SWEEP TIME: 60, 180 SEC NEARLY LOGARITHMIC FREQ. SCALE

DIP 71.9° N
ST. JOHN'S



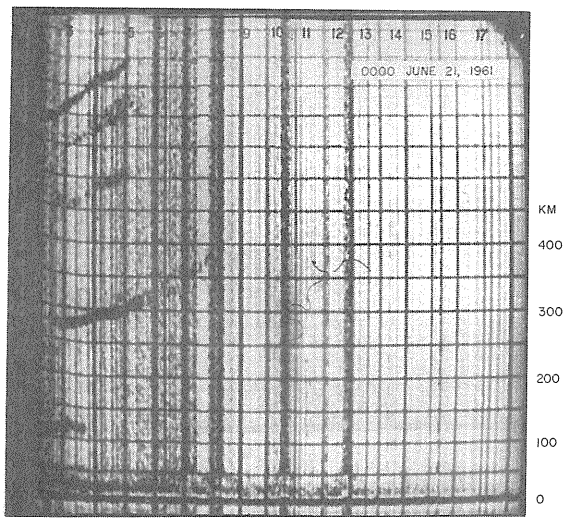


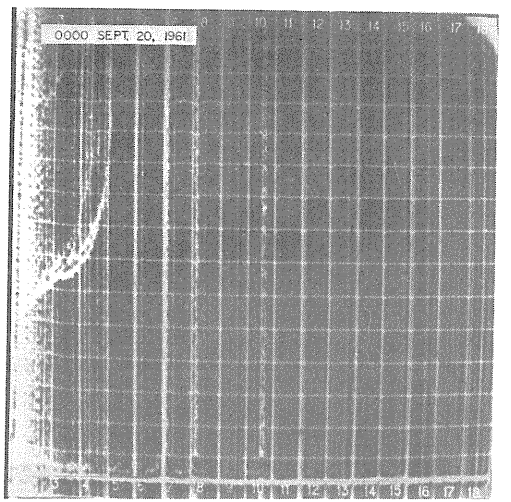
STATION: ST. JOHN'S CANADA

COORDINATES: GEOGRAPHIC LATITUDE: 47.6°N LONGITUDE: 52.7°W
GEOMAGNETIC LATITUDE: 58.5°N LONGITUDE: 21.2°
MAGNETIC DIP: 71.9°N TIME ZONE: 60°W
GYROFREQUENCY: 1.38 MC AT 200 KM
TOTAL FIELD: 0.54 OERSTED

IONOSONDE: TYPE OR DESIGNATION: COSSOR MK 2
FREQUENCY RANGE: 1.6 MC TO 20.0 MC SWEEP TIME: 15 SEC

DIP 71.6°N
GORKY



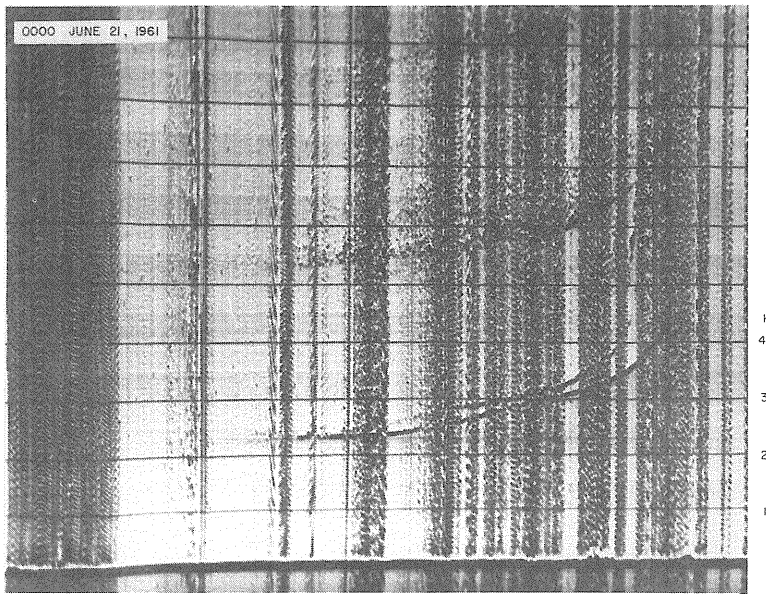


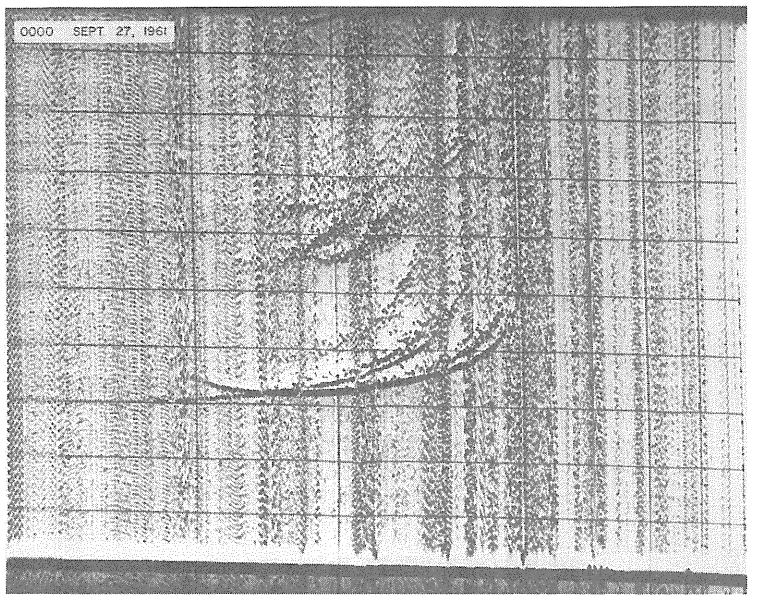
STATION: GORKY U.S.S.R.

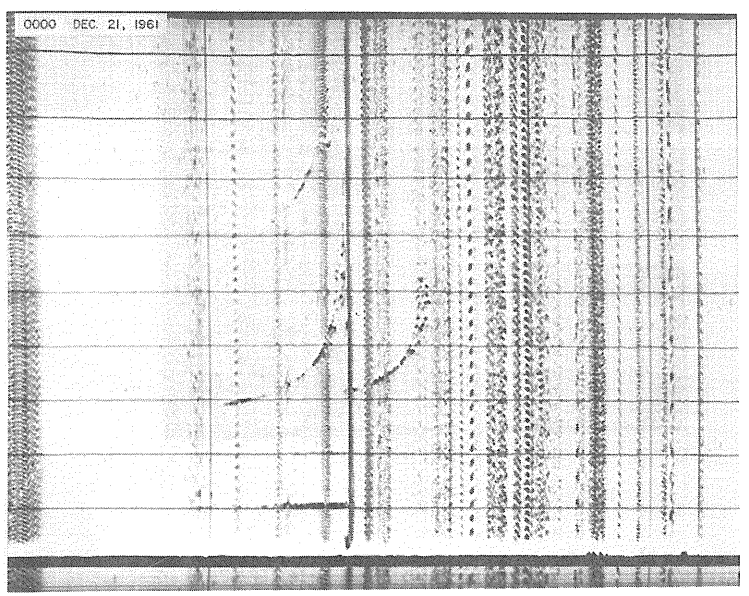
COORDINATES: GEOGRAPHIC LATITUDE: 56°09'N LONGITUDE: 44°17'E
GEOMAGNETIC LATITUDE: 50.3°N LONGITUDE: 126.7°
MAGNETIC DIP: 71.6°N TIME ZONE: 45°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 71.4° N
FORT MONMOUTH





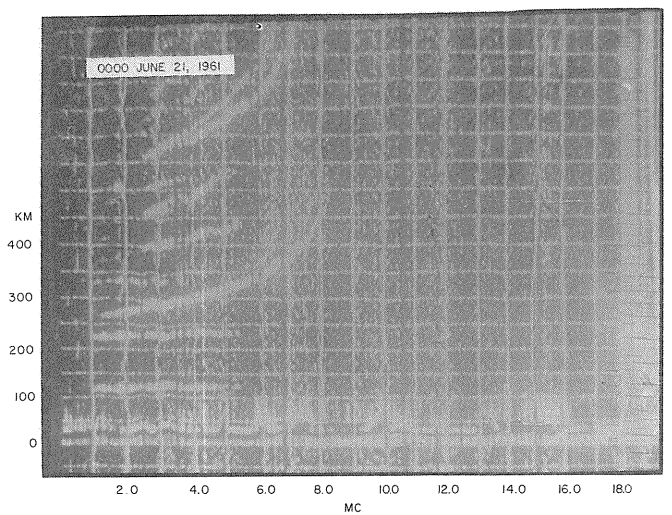


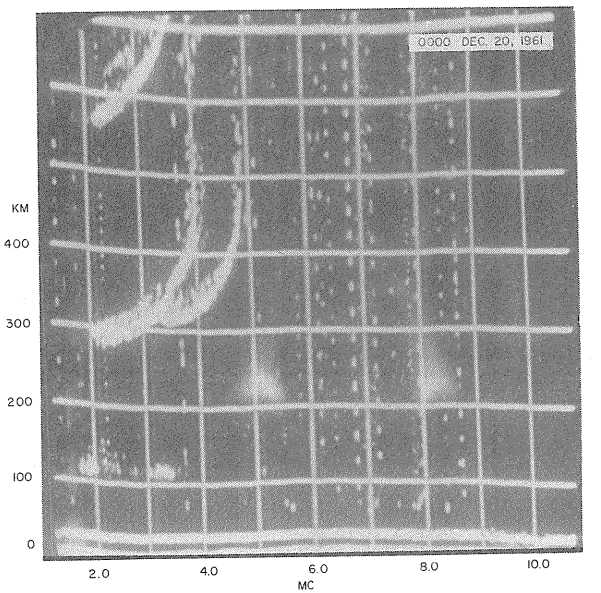
STATION: FORT MONMOUTH U.S.A.

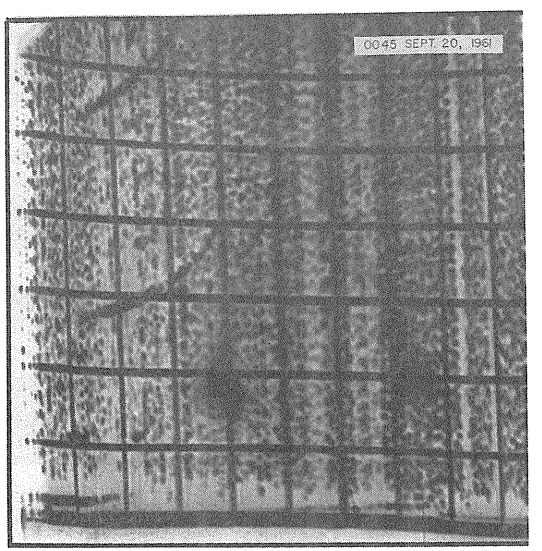
COORDINATES: GEOGRAPHIC LATITUDE: 40°23'26"N LONGITUDE: 74°07'58"W
GEOMAGNETIC LATITUDE: 51.8°N LONGITUDE: 353.7°
MAGNETIC DIP: 71.4°N TIME ZONE: 75°W
GYROFREQUENCY: 1.45 MC AT 200 KM
TOTAL FIELD: 0.57 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 71.2°N
IRKUTSK





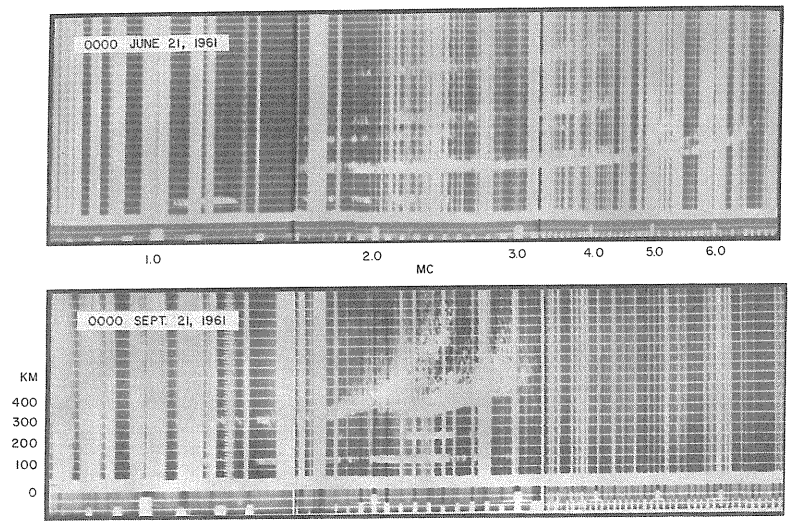


STATION: IRKUTSK U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 52°28'N LONGITUDE: 104°02'E
GEOMAGNETIC LATITUDE: 41.1°N LONGITUDE: 174.4°
MAGNETIC DIP: 71.2°N TIME ZONE: 105°E

IONOSONDE: TYPE OR DESIGNATION: NO. 285
FREQUENCY RANGE: 0.5 - 20.0 MC
HEIGHT RANGE: 200 KM, 300 KM, 500 KM, 750 KM, 1000 KM, 1500 KM, 2000 KM
POWER: 20 KW
SWEEP TIME: FROM 10 TO 30 SEC.
FREQUENCY SCALE: LINEAR

DIP 71.2°N
INVERNESS

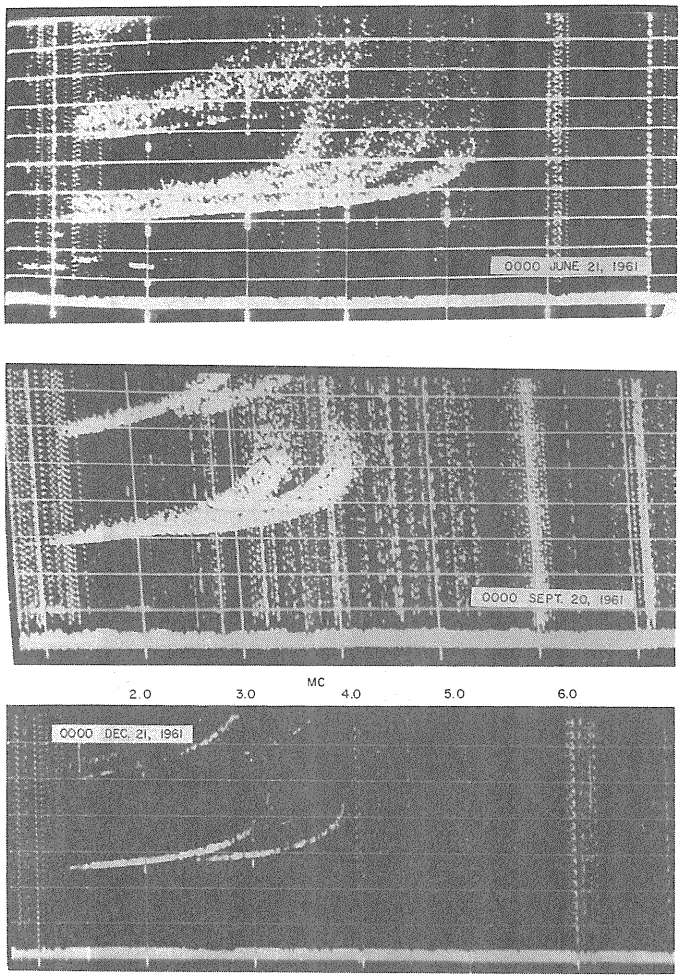


STATION: INVERNESS U. K.

COORDINATES: GEOGRAPHIC LATITUDE: 57°27'N LONGITUDE: 04°15'W
GEOMAGNETIC LATITUDE: 60.6°N LONGITUDE: 83.3°
MAGNETIC DIP: 71.2°N TIME ZONE: 0°
GYROFREQUENCY: 1.28 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1000 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 70.6°N
MOSCOW

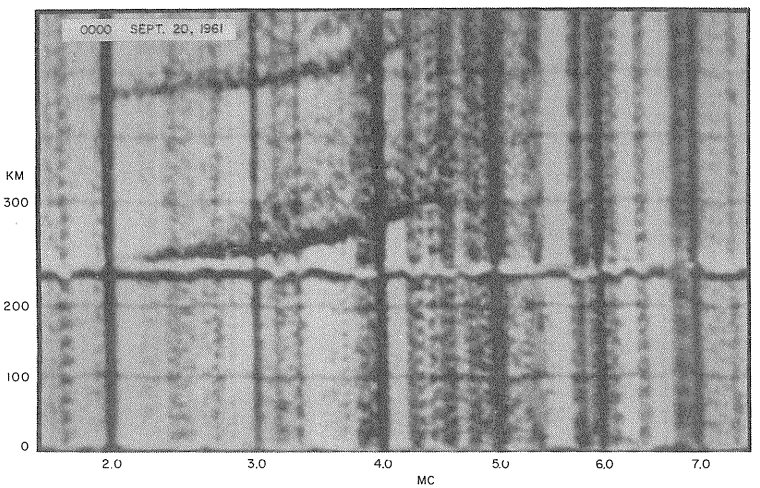


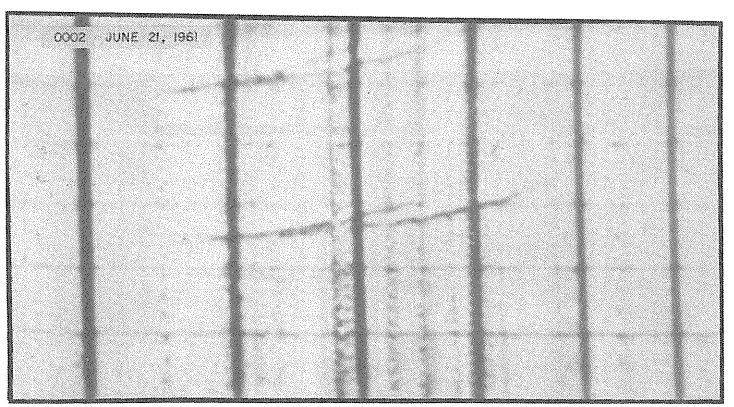
STATION: MOSCOW U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 55°28'N LONGITUDE: 37°19'E
GEOMAGNETIC LATITUDE: 50.9°N LONGITUDE: 120.5°
MAGNETIC DIP: 70.6°N TIME ZONE: 30°E

IONOSONDE: TYPE OR DESIGNATION: SP-3
FREQUENCY RANGE: 1.0 - 20.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
FREQUENCY SCALE: LINEAR

DIP 71.1° N
URBANA



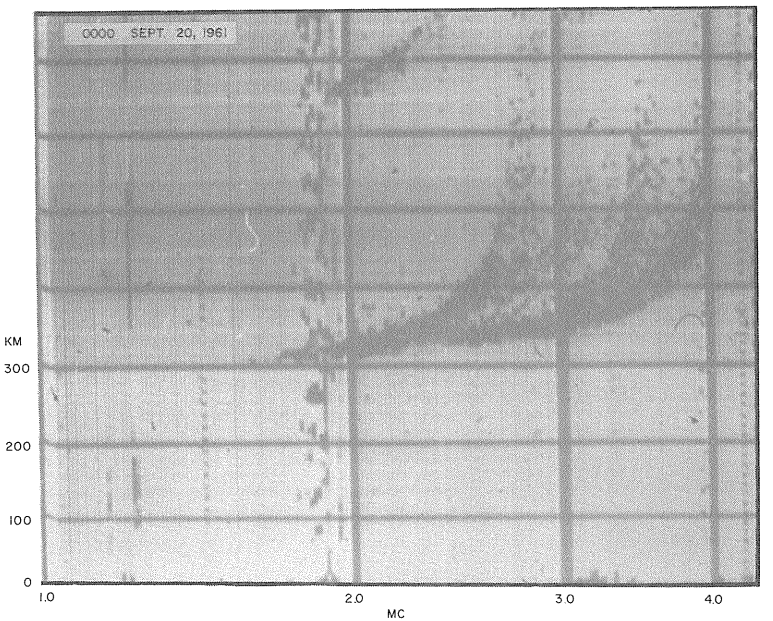


STATION: URBANA U.S.A.

COORDINATES: GEOGRAPHIC LATITUDE: 40°02'58"N LONGITUDE: 88° 22' 50" W
MAGNETIC DIP: 71.1°N TIME ZONE: 90°W
GYROFREQUENCY: 1.48 MC AT 200 KM TOTAL FIELD: 0.58 OERSTED

IONOSONDE: TYPE OR DESIGNATION: COSSOR
FREQUENCY RANGE: 2 MC TO 30 MC POWER: 1 KW

DIP 70.4° N
SEATTLE

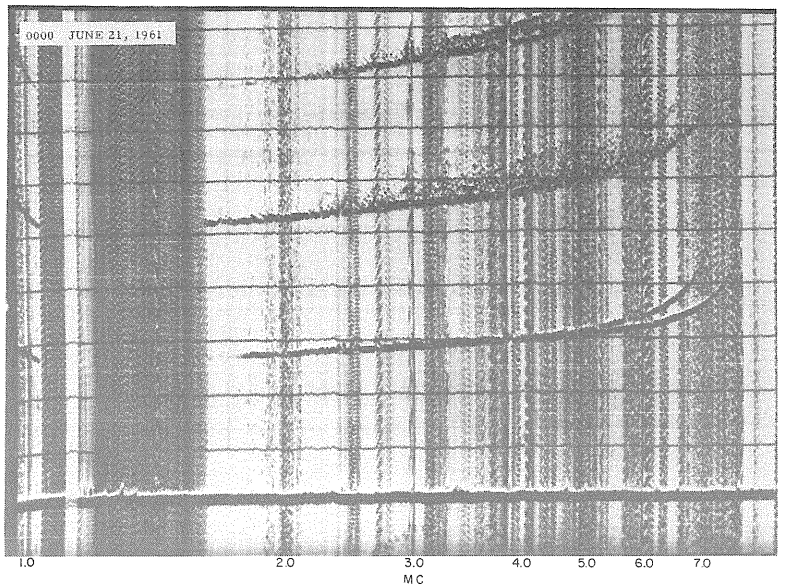


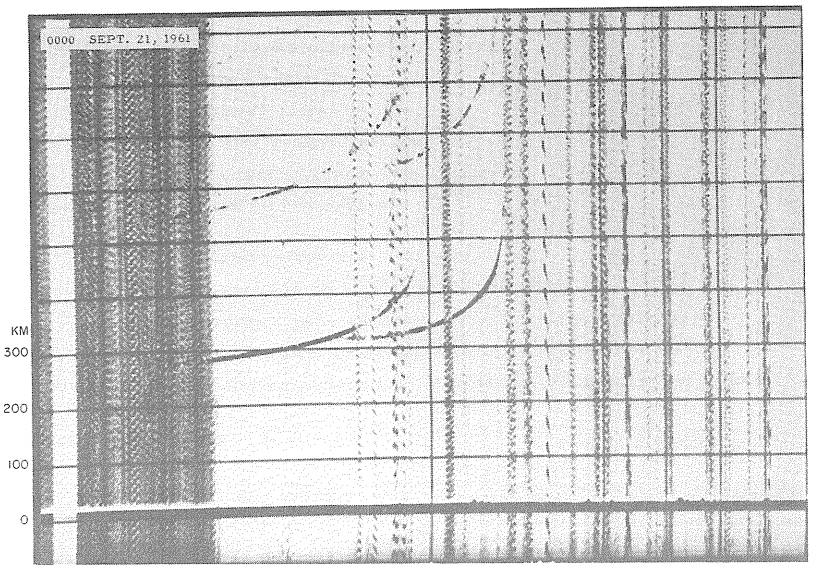
STATION: SEATTLE U. S. A.

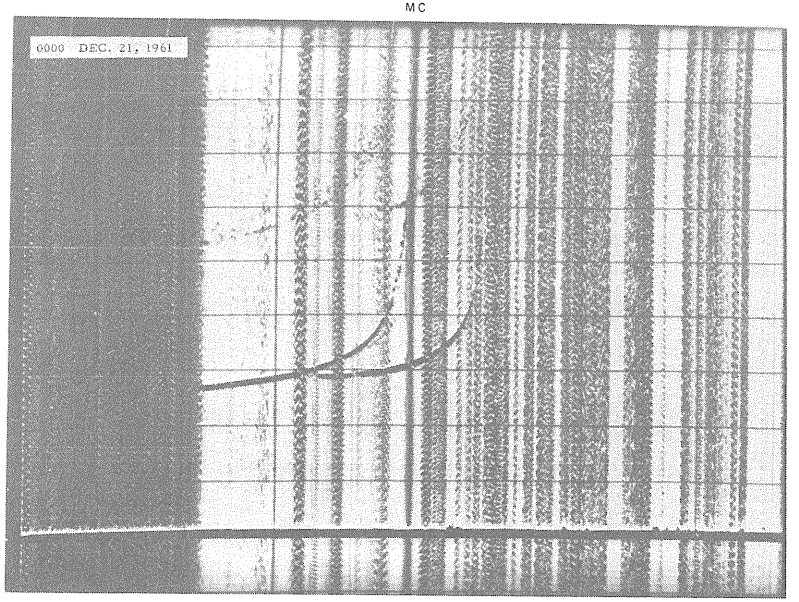
COORDINATES: GEOGRAPHIC LATITUDE: 47°33'48"N LONGITUDE: 122°21'20"W
GEOMAGNETIC LATITUDE: 53.6°N LONGITUDE: 294.4°
MAGNETIC DIP: 70.4°N TIME ZONE: 120°W
GYROFREQUENCY: 1.43 MC AT 200 KM
TOTAL FIELD: 0.56 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1 MC TO 25 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 70.2° N
WASHINGTON





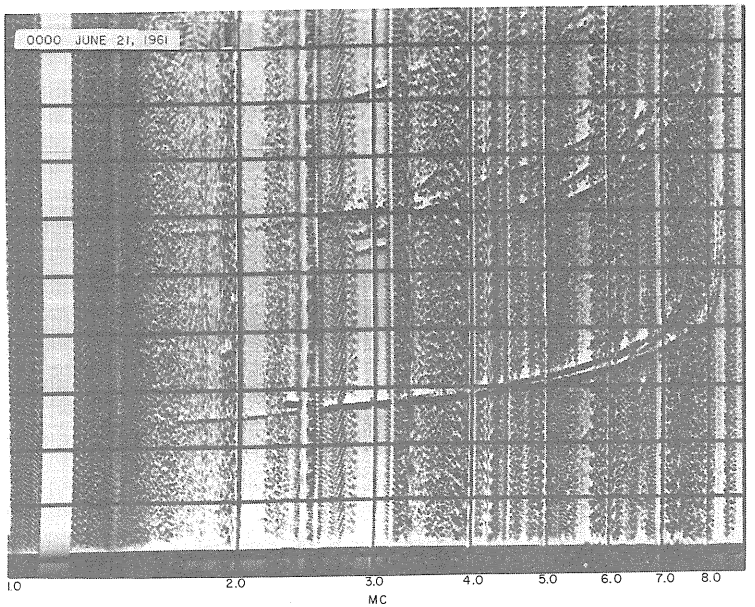


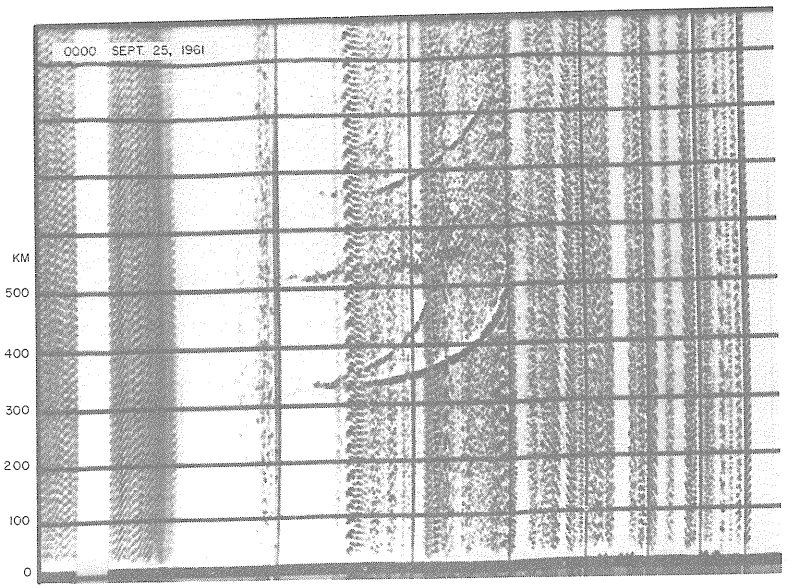
STATION: WASHINGTON (FORT BELVOIR) U. S. A.

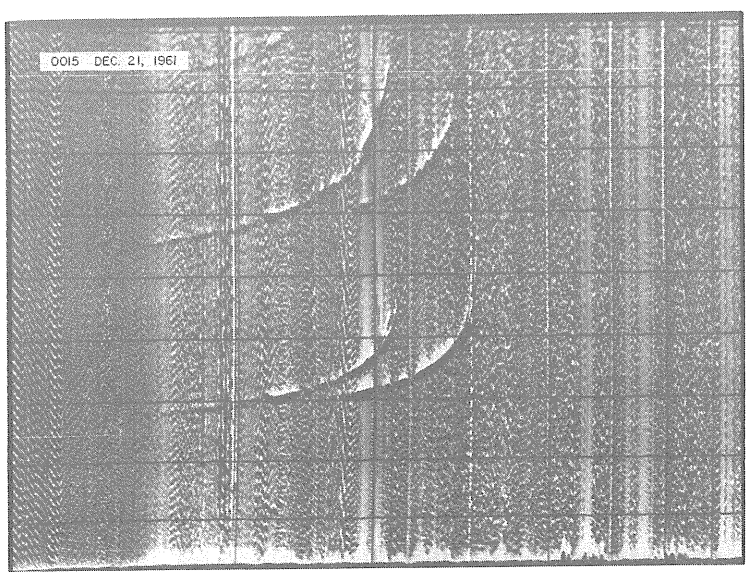
COORDINATES: GEOGRAPHIC LATITUDE: 38°43'47.375"N LONGITUDE: 77°07'39.325"W
GEOMAGNETIC LATITUDE: 50.1°N LONGITUDE: 350.1°
MAGNETIC DIP: 70.2°N TIME ZONE: 75°W
GYROFREQUENCY: 1.45 MC AT 200 KM
TOTAL FIELD: 0.57 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER : 20 KW
SWEEP TIME: 13.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 69.6°N
WALLOPS ISLAND





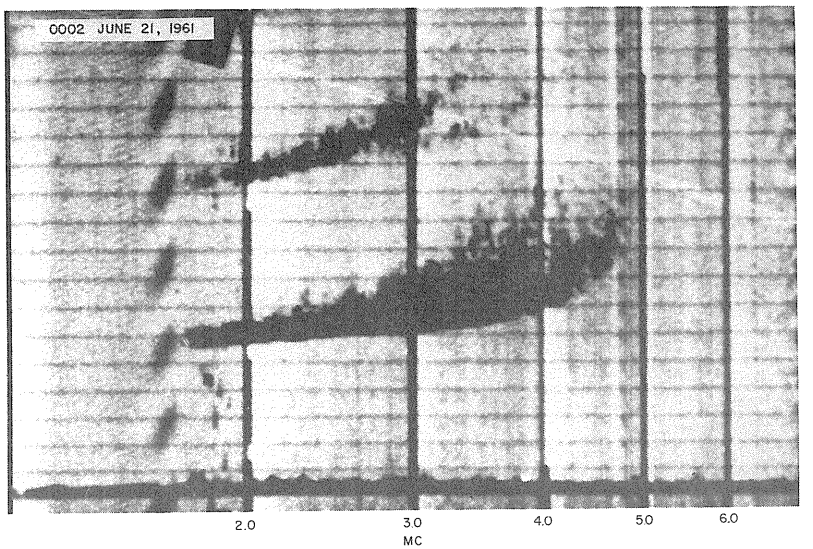


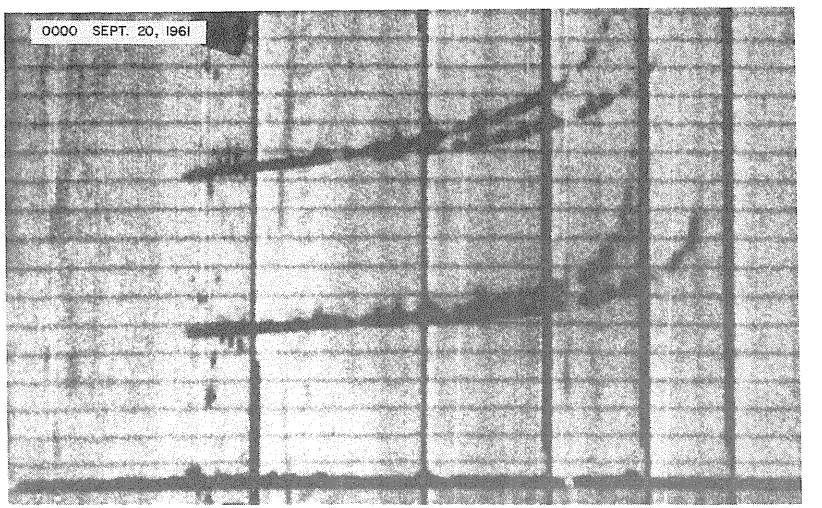
STATION: WALLOPS ISLAND U. S. A.

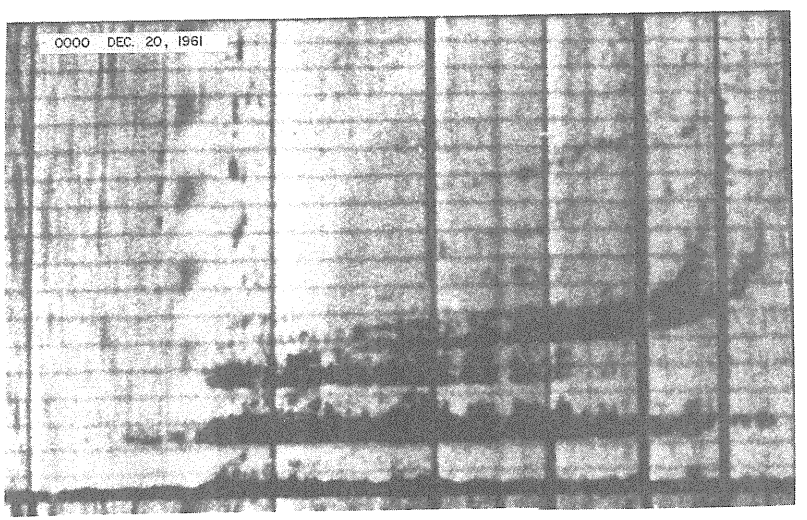
COORDINATES: GEOGRAPHIC LATITUDE: 37°53'N LONGITUDE: 75°28'W
GEOMAGNETIC LATITUDE: 49.2°N LONGITUDE: 348.5°N
MAGNETIC DIP: 69.6° TIME ZONE: 75°W
GYROFREQUENCY: 1.43 MC AT 200 KM
TOTAL FIELD: 0.56 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 15, 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 69.0° S
GODLEY HEAD





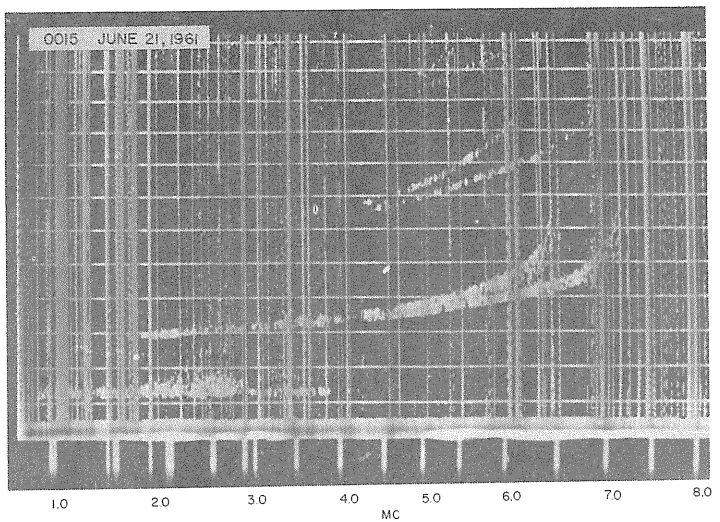


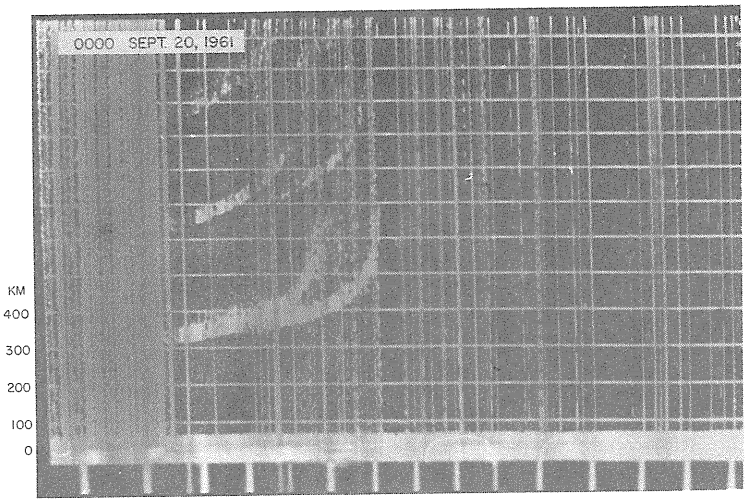
STATION: GODLEY HEAD NEW ZEALAND

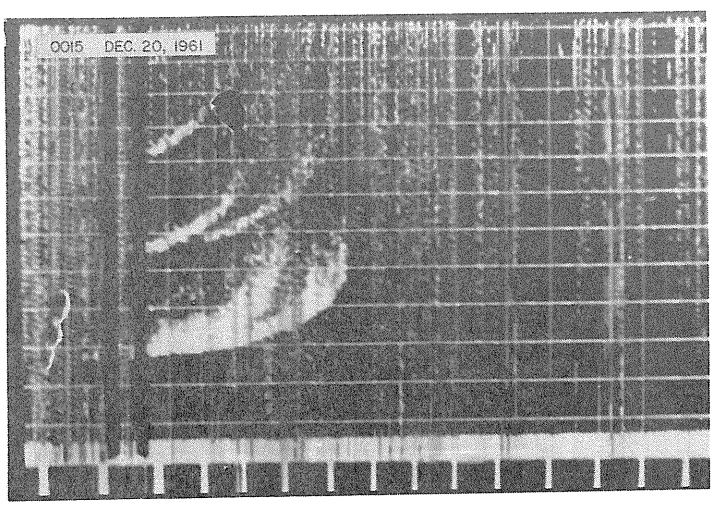
COORDINATES: GEOGRAPHIC LATITUDE: 43°34'S LONGITUDE: 172°48'E
GEOMAGNETIC LATITUDE: 48.1°S LONGITUDE: 252.8°
MAGNETIC DIP: 69.0°S TIME ZONE: 180.0°E Z.T.
GYROFREQUENCY: 1.51 MC AT 200 KM
TOTAL FIELD: 0.59 OERSTED

IONOSONDE: TYPE OR DESIGNATION: P-2
FREQUENCY RANGE: 1 MC TO 22 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 7.5 SEC
EQUATION FOR FREQUENCY SCALE: LOGARITHMIC

DIP 68.9° N
JULIUSRUH / RÜGEN







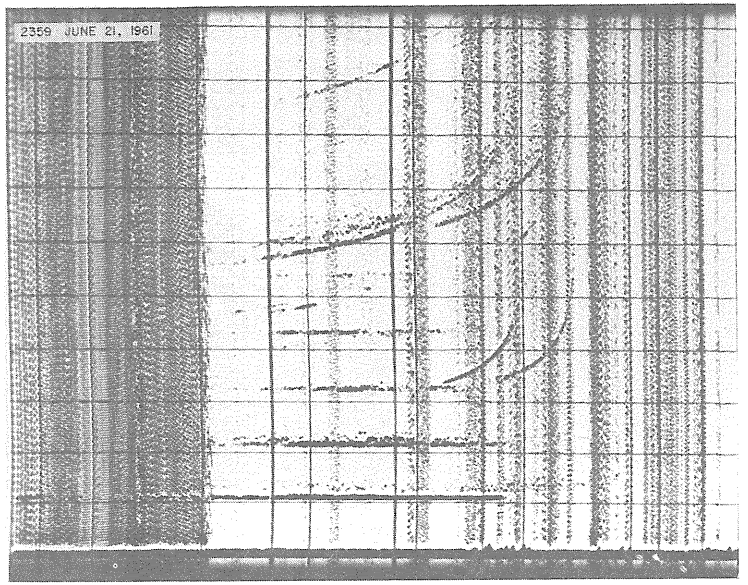
STATION: JULIUSRUH/RÜGEN GERMAN DEM. REP.

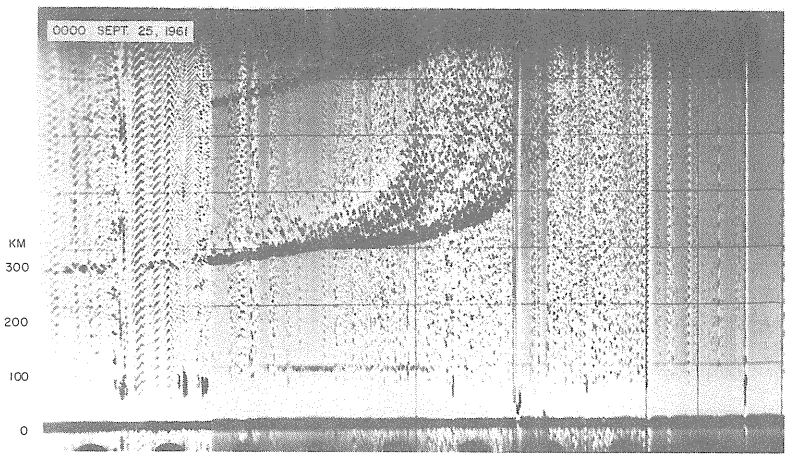
COORDINATES: GEOGRAPHIC LATITUDE: 54.6°N
GEOMAGNETIC LATITUDE: 54.5°N
MAGNETIC DIP: 68.9°N
GYROFREQUENCY: 1.22 MC AT 200 KM
TOTAL FIELD: 0.48 OERSTED

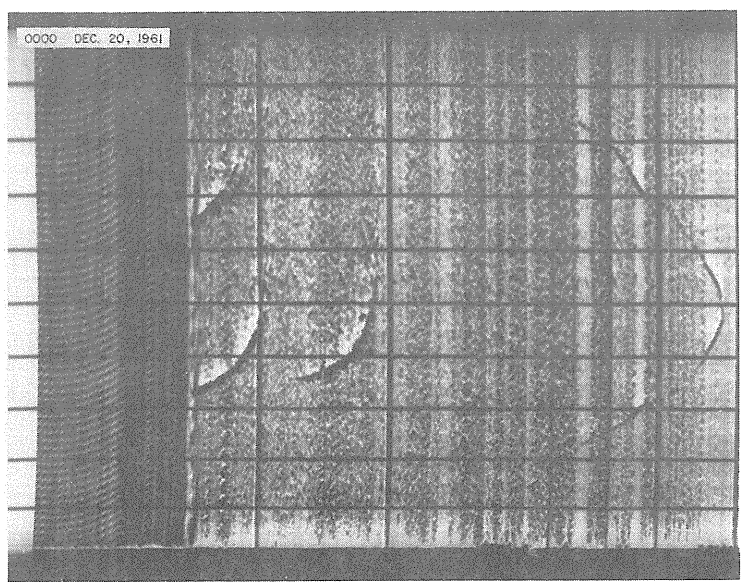
LONGITUDE: 13.4°E
LONGITUDE: 98.7°
TIME ZONE: 15°E

IONOSONDE: TYPE OR DESIGNATION: OWN CONSTRUCTION
FREQUENCY RANGE: 0.8 MC TO 20.0 MC
HEIGHT RANGE: 1200 KM
POWER: ABOUT 15 KW
SWEEP TIME: 30 SEC
LINEAR FREQUENCY SCALE

DIP 67.8° N
BOULDER





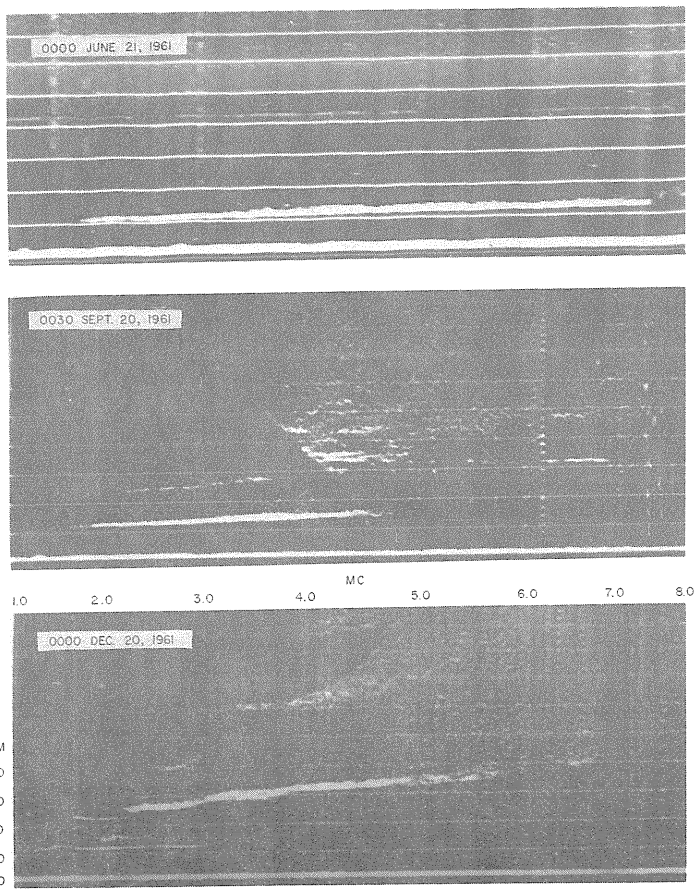


STATION: BOULDER U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 40°02'N LONGITUDE: 105°18'W
GEOMAGNETIC LATITUDE: 48.9°N LONGITUDE: 316.4°
MAGNETIC DIP: 67.8°N TIME ZONE: 105°W
GYROFREQUENCY: 1.43 MC AT 200 KM
TOTAL FIELD: 0.56 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 15, 30, 60, 120 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 67.7°S
SYOWA BASE

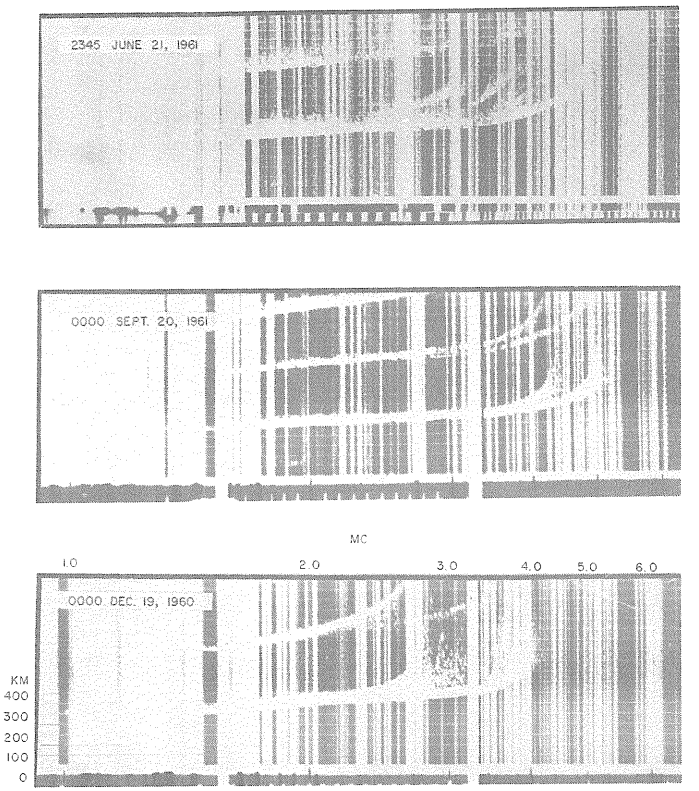


STATION: SYOWA BASE ANTARCTICA

COORDINATES: GEOGRAPHIC LATITUDE: 69°00'S LONGITUDE: 39°35'E
GEOMAGNETIC LATITUDE: 69.7°S LONGITUDE: 77.7°
MAGNETIC DIP: 67.7°S TIME ZONE: 45°E
GYROFREQUENCY: 1.20 MC AT 200 KM
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC POWER: 10 KW
FREQUENCY RANGE: 1.0 - 20.0 MC SWEEP TIME: 20 SEC
HEIGHT RANGE: 1000 KM FREQUENCY SCALE: LINEAR

DIP 66.8°N
SLOUGH

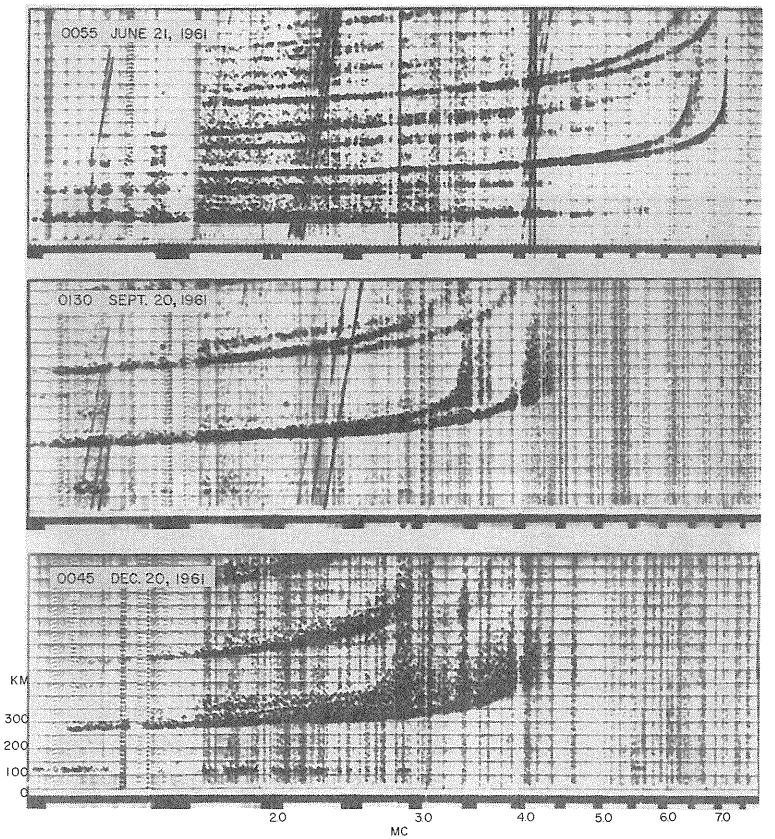


STATION: SLOUGH U. K.

COORDINATES: GEOGRAPHIC LATITUDE: 51°31'N LONGITUDE: 00°34'W
GEOMAGNETIC LATITUDE: 54.3°N LONGITUDE: 84.1°
MAGNETIC DIP: 66.8°N TIME ZONE: 0°
GYROFREQUENCY: 1.22 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1000 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 66.6° N
LINDAU

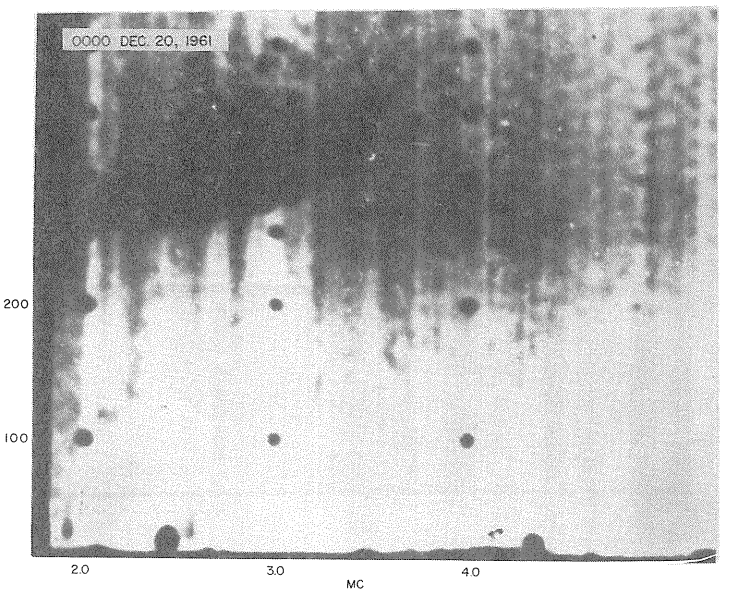


STATION: LINDAU FED. REP. OF GERMANY

COORDINATES: GEOGRAPHIC LATITUDE: 51°39'N LONGITUDE: 10°08'E
GEOMAGNETIC LATITUDE: 52.3°N LONGITUDE: 93.9°
MAGNETIC DIP: 66.6°N TIME ZONE: 15°E
GYROFREQUENCY: 1.20 MC AT 200 KM
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: DDA IV/54
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 900 KM
POWER: 15 KW
SWEEP TIME: 120, 240, 480 SEC
EQUATION FOR FREQUENCY SCALE: $f = ke^{at}$

DIP 67.1° N
DE BILT

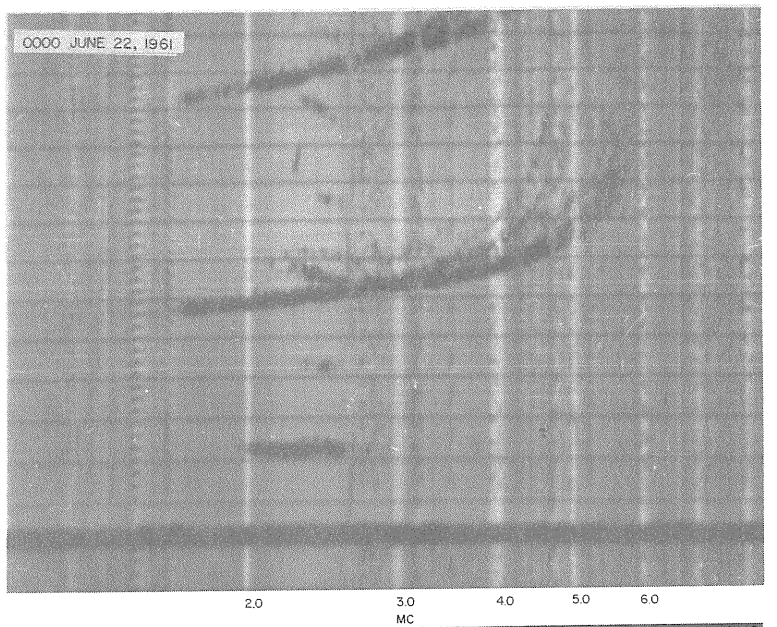


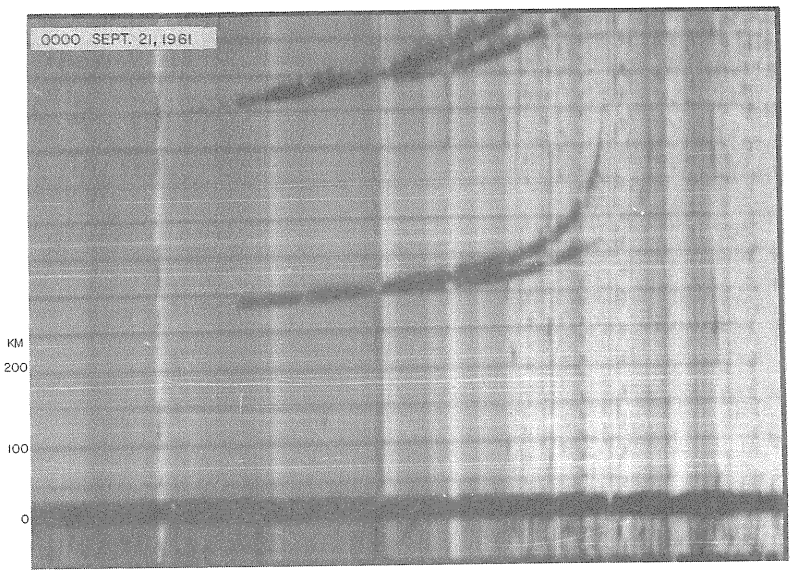
STATION: DE BILT NETHERLANDS

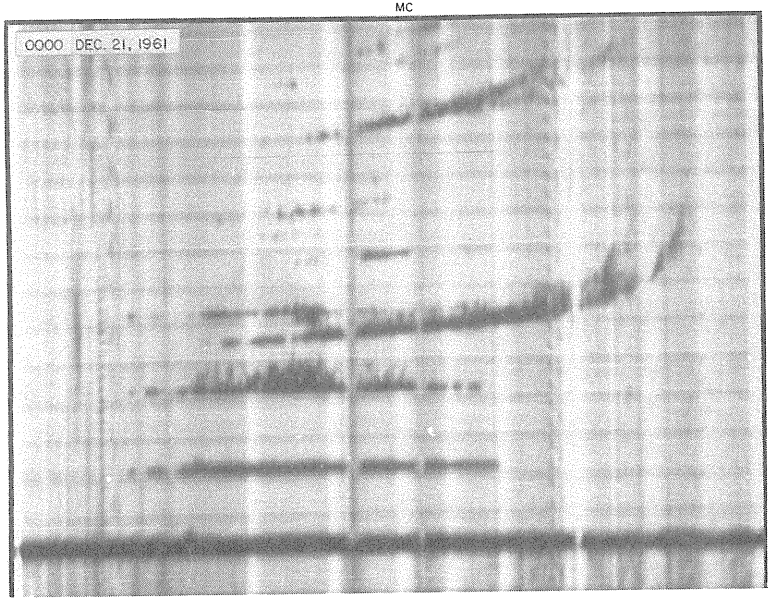
COORDINATES: GEOGRAPHIC LATITUDE: 52°06'N LONGITUDE: 05°11'E
GEOMAGNETIC LATITUDE: 53.8°N LONGITUDE: 89.4°
MAGNETIC DIP: 67.1°N TIME ZONE: 15°E
GYROFREQUENCY: 1.20 MC AT 200 KM.
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.8 MC TO 18 MC
HEIGHT RANGE: 700 KM
POWER: 5 KW
SWEEP TIME: 240 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 66.1° S
CANBERRA





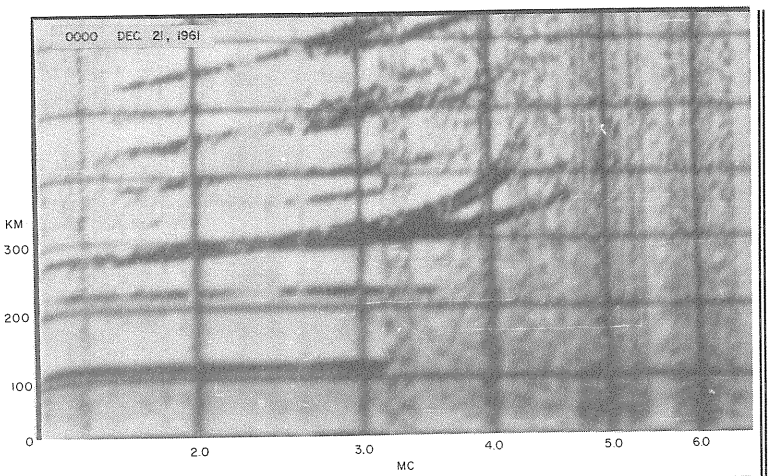


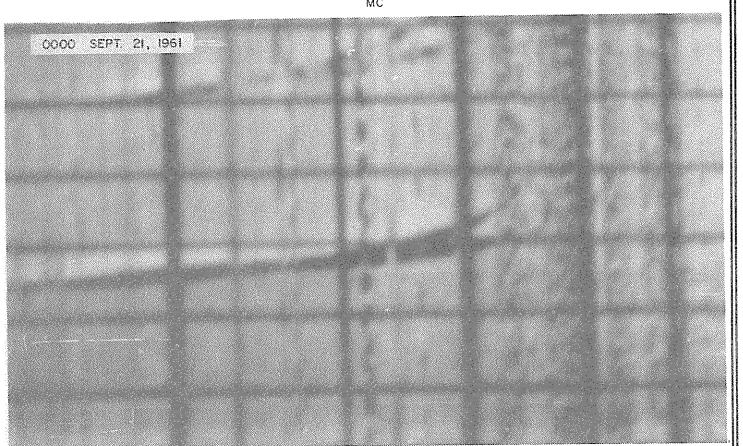
STATION: CANBERRA AUSTRALIA

COORDINATES: GEOGRAPHIC LATITUDE: 35°18'S LONGITUDE: 149°12'E
GEOMAGNETIC LATITUDE: 44.0°S LONGITUDE: 224.3°
MAGNETIC DIP: 66.1°S TIME ZONE: 150°E
GYROFREQUENCY: 1.51 MC AT 200 KM
TOTAL FIELD: 0.59 OERSTED

IONOSONDE: TYPE OR DESIGNATION: IPS TYPE 3 C
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
POWER: 5 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 66.5° S
MUNDARING



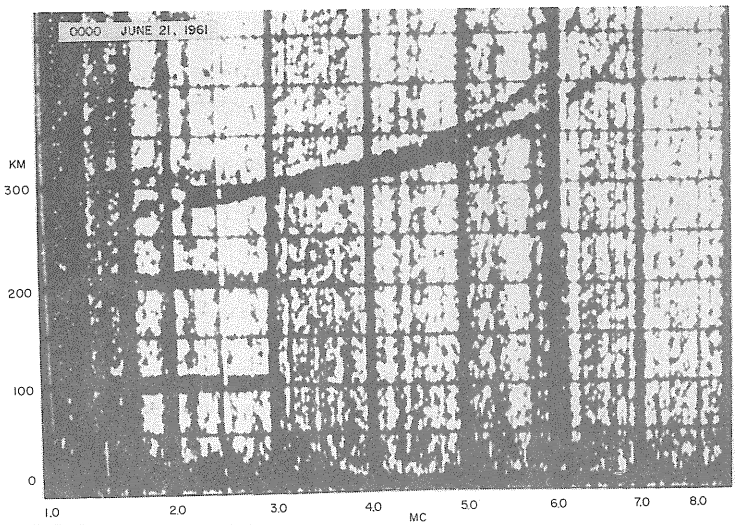


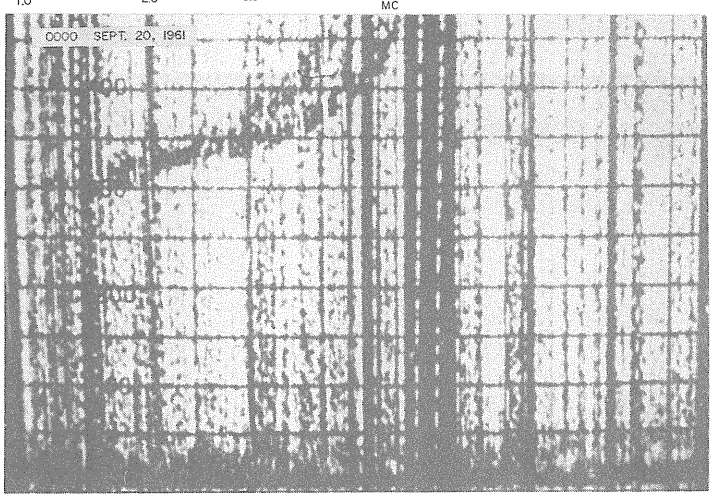
STATION: MUNDARING AUSTRALIA

COORDINATES: GEOGRAPHIC LATITUDE: 31°59'S LONGITUDE: 116° 12' E
GEOMAGNETIC LATITUDE: 43.5°S LONGITUDE: 186.1°
MAGNETIC DIP: 66.5°S TIME ZONE: 120° E
GYROFREQUENCY: 1.51 MC AT 200 KM
TOTAL FIELD: 0.59 OERSTED

IONOSONDE: TYPE OR DESIGNATION: COSSOR 7562C
FREQUENCY RANGE: 1.0 MC TO 20.0 MC
POWER: 1 KW
SWEEP TIME: 18 SEC
APPROXIMATELY LOGARITHMIC FREQUENCY SCALE

DIP 65.3° N
PRUHONICE



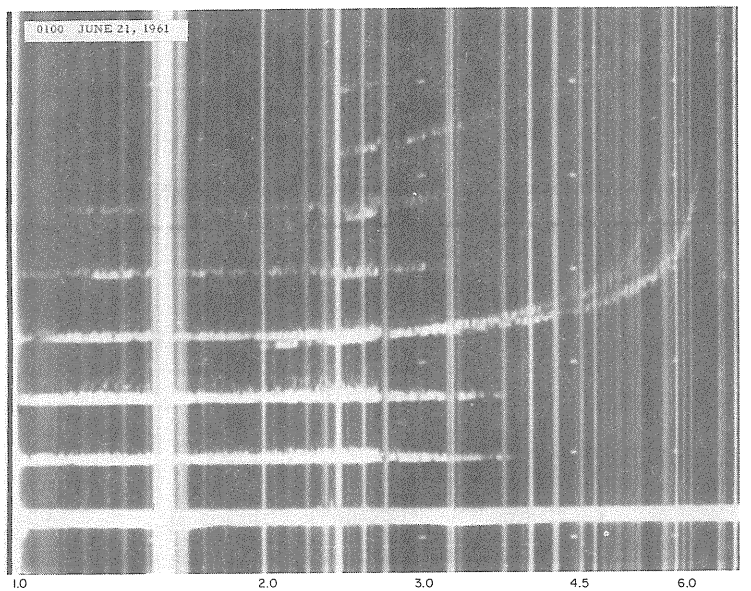


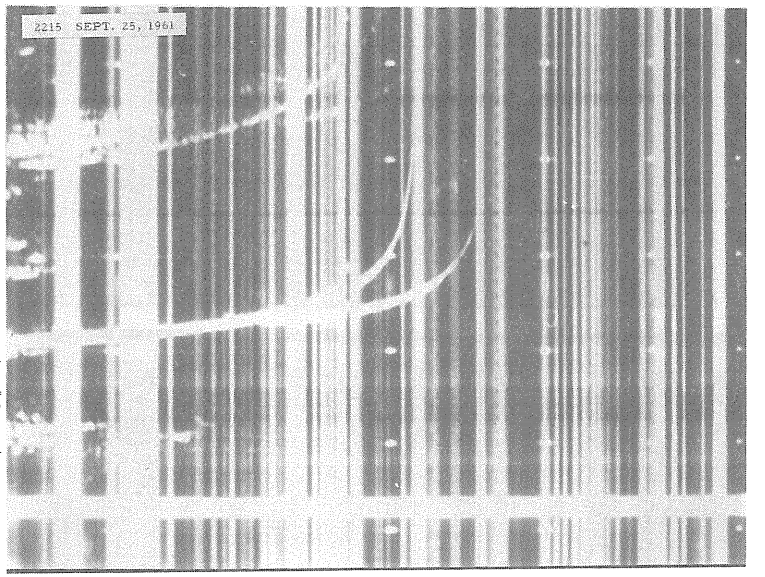
STATION: PRUHONICE CZECHOSLOVAKIA

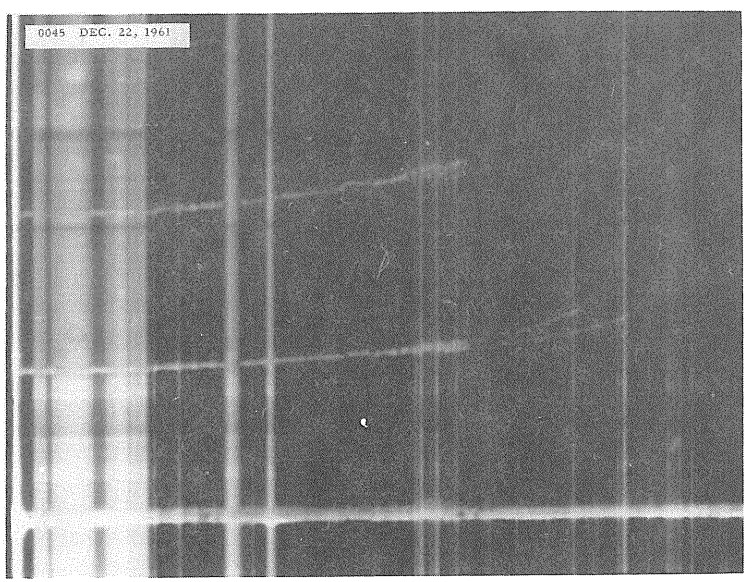
COORDINATES: GEOGRAPHIC LATITUDE: 49°59'N LONGITUDE: 14°33'E
GEOMAGNETIC LATITUDE: 49.9°N LONGITUDE: 97.4°
MAGNETIC DIP: 65.3°N TIME ZONE: 0°
GYROFREQUENCY: 1.21 MC AT 200 KM TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: A I S
FREQUENCY RANGE: 1.0 MC TO 18.0 MC
HEIGHT RANGE: 750 KM USED, 250 OR 1500 POSSIBLE
POWER: 12 KW SWEEP TIME: 20 SEC LINEAR FREQUENCY SCALE

DIP 65.5° N
DOURBES





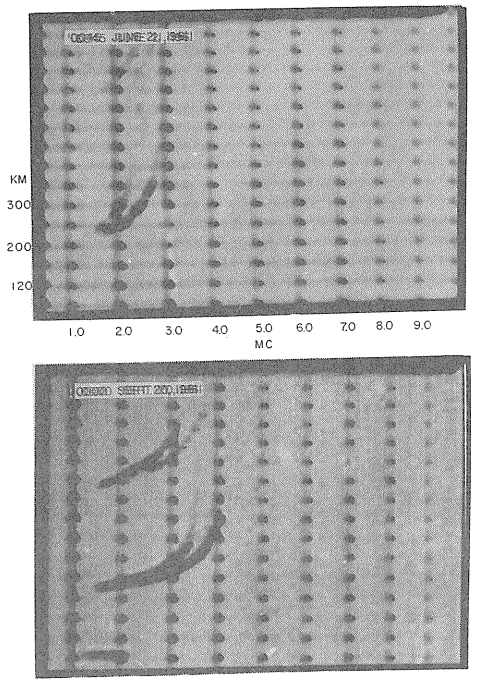


STATION: DOURBES BELGIUM

COORDINATES: GEOGRAPHIC LATITUDE: 50°06'N LONGITUDE: 04°36'E
GEOMAGNETIC LATITUDE: 52.0°N LONGITUDE: 87.7°
MAGNETIC DIP: 65.5°N TIME ZONE: 0°
GYROFREQUENCY: 1.20 MC AT 200 KM
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: FREQUENCY RANGE: 1.0 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM
POWER: 30 KW
SWEEP TIME: 180 OR 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 64.2° S
CAPE TOWN

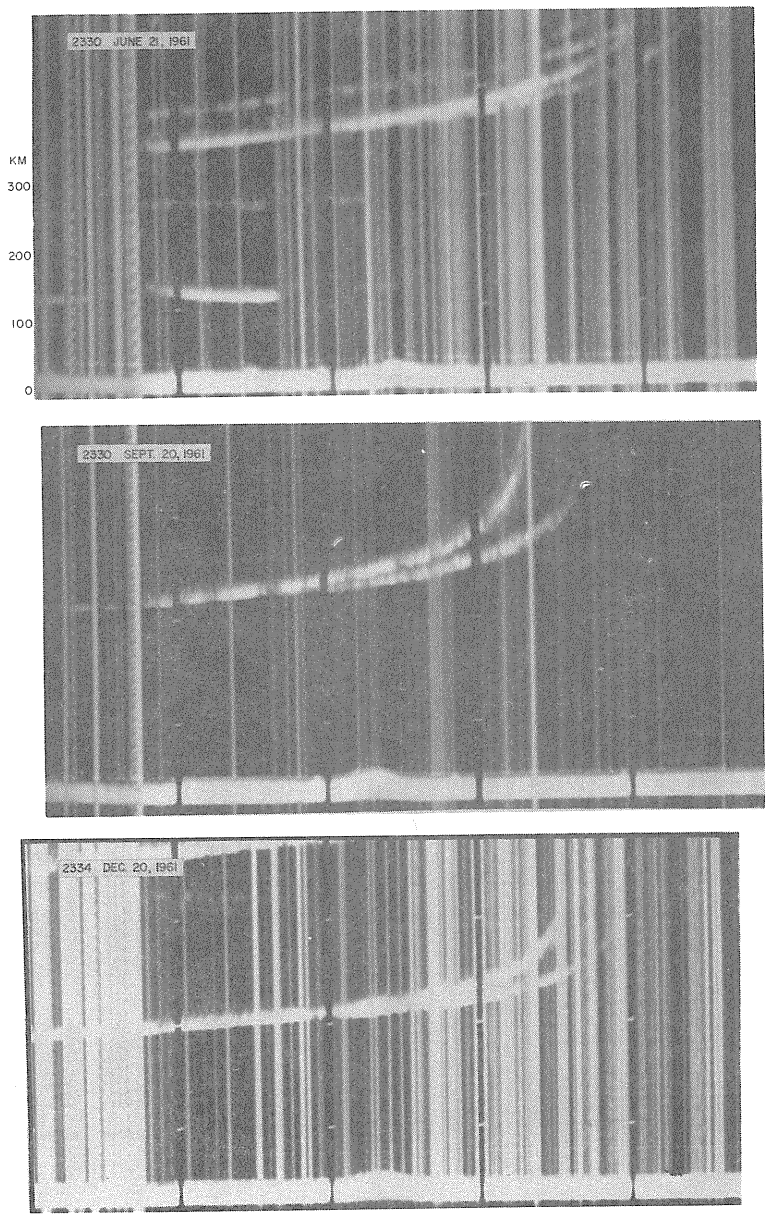


STATION: CAPE TOWN · REP. OF S. AFRICA

COORDINATES: GEOGRAPHIC LATITUDE: 34°08'S LONGITUDE: 18°19'E
GEOMAGNETIC LATITUDE: 32.8°S LONGITUDE: 79.7°
MAGNETIC DIP: 64.2°S TOTAL FIELD: 0.32 OERSTED
GYROFREQUENCY: 0.82 MC AT 200 MC TIME ZONE: 30°E

IONOSONDE: TYPE OR DESIGNATION: WADLEY
FREQUENCY RANGE: 1.0 MC TO 20.0 MC (USUALLY SET 1.0 TO 17.0 MC/S)
HEIGHT RANGE: VARIABLE - USUALLY SET TO 800 KM
POWER: ABOUT 1 KW
SWEEP TIME: 7 SEC
APPROXIMATELY LINEAR FREQUENCY SCALE

DIP 63.6° N
FREIBURG

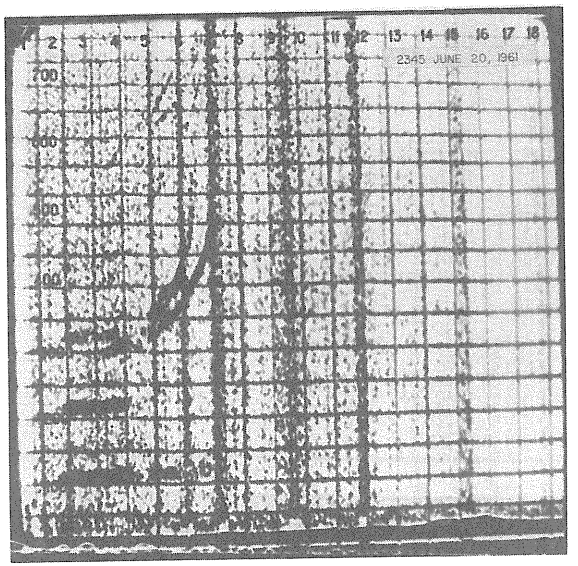


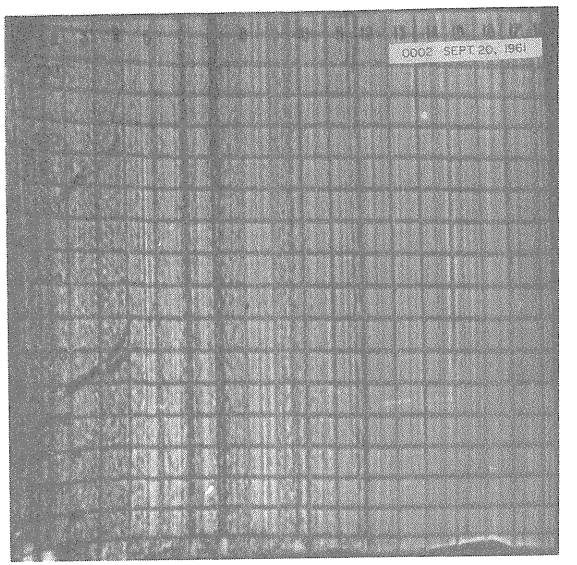
STATION: FREIBURG FED. REP. OF GERMANY

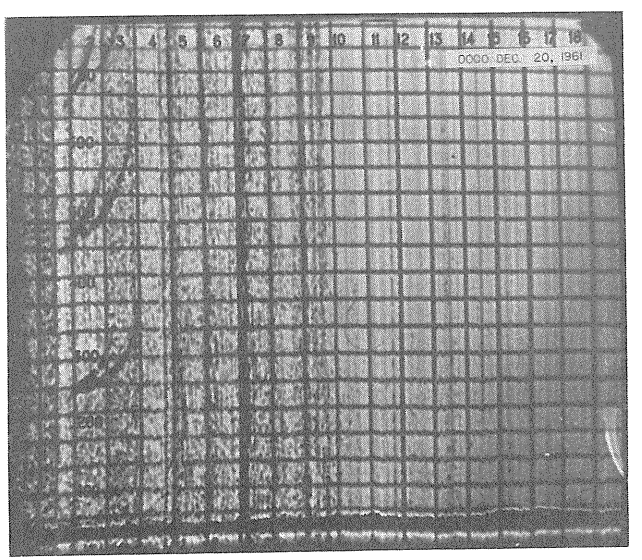
COORDINATES: GEOGRAPHIC LATITUDE: 48°03'N LONGITUDE: 07°35'E
GEOMAGNETIC LATITUDE: 48.4°N LONGITUDE: 90°
MAG. DIP: 63.6°N
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED TIME ZONE: 0°

IONOSONDE: TYPE OR DESIGNATION: SPIM - KRDSE 22
FREQUENCY RANGE: 1.25 MC TO 20.0 MC
HEIGHT RANGE: 1100 KM POWER: 5 KW
SWEEP TIME: 180 SEC LOGARITHMIC FREQUENCY SCALE

DIP 64.1°N
ROSTOV





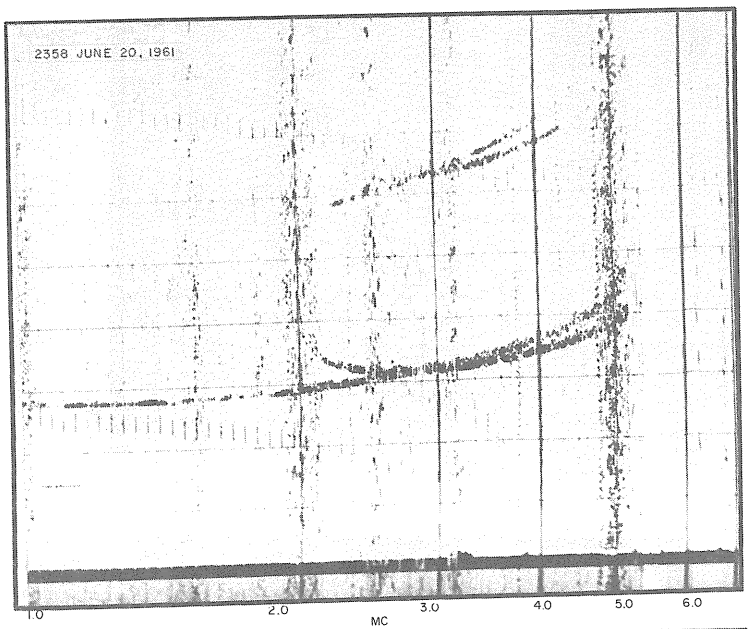


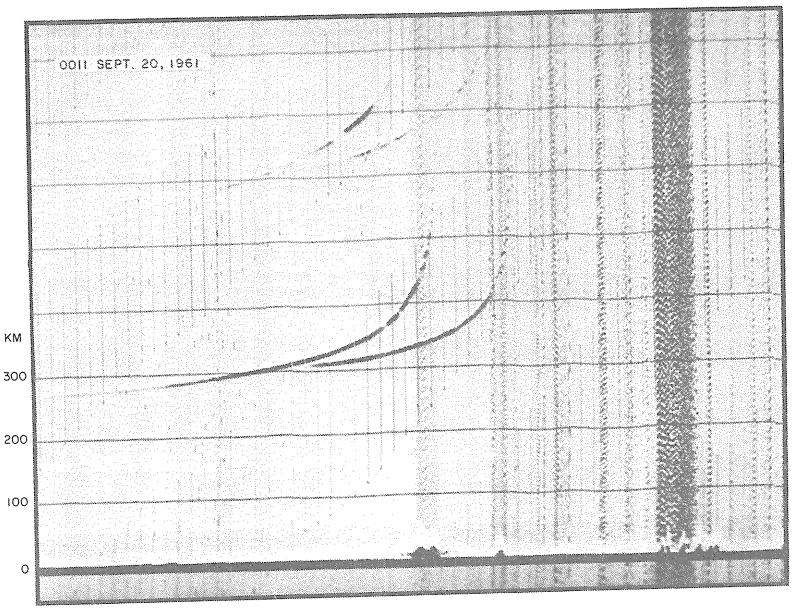
STATION: ROSTOV U.S.S.R.

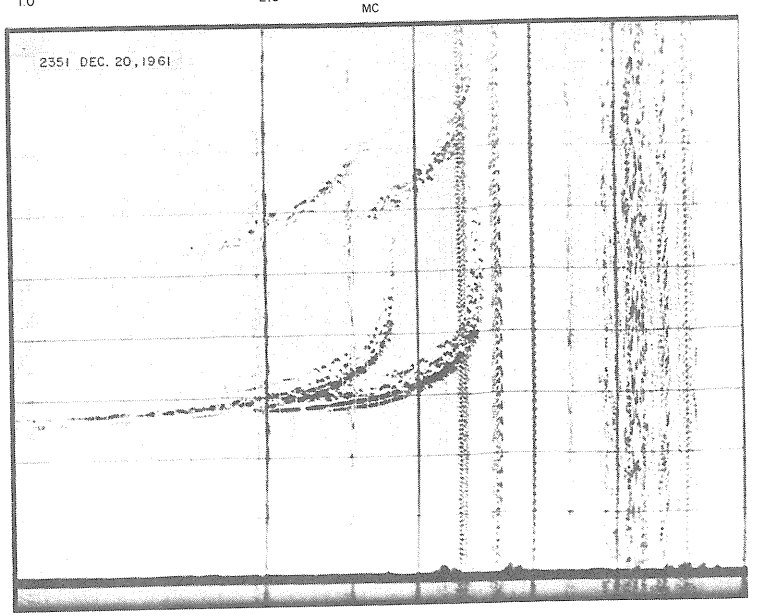
COORDINATES: GEOGRAPHIC LATITUDE: 47°13'N LONGITUDE: 39°41'E
GEOMAGNETIC LATITUDE: 42.5°N LONGITUDE: 119.2°
MAGNETIC DIP: 64.1°N TIME ZONE: 45°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 63.9° N
ADAK





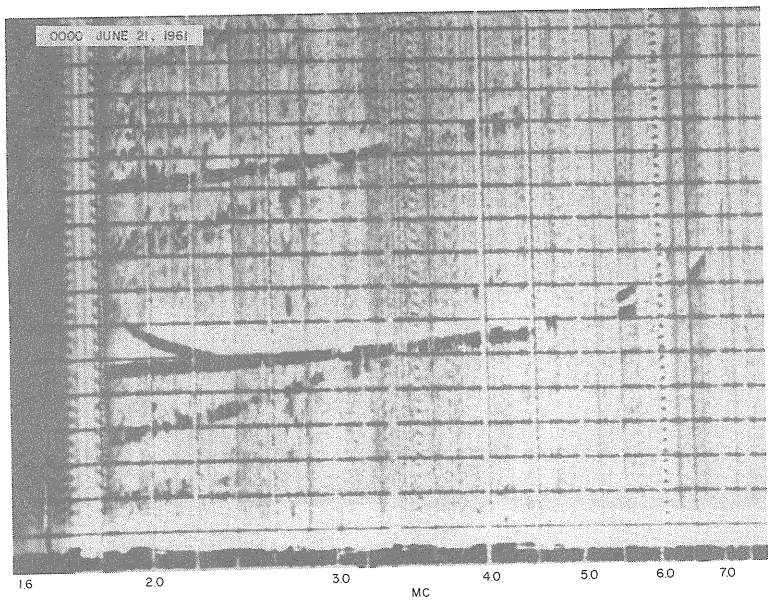


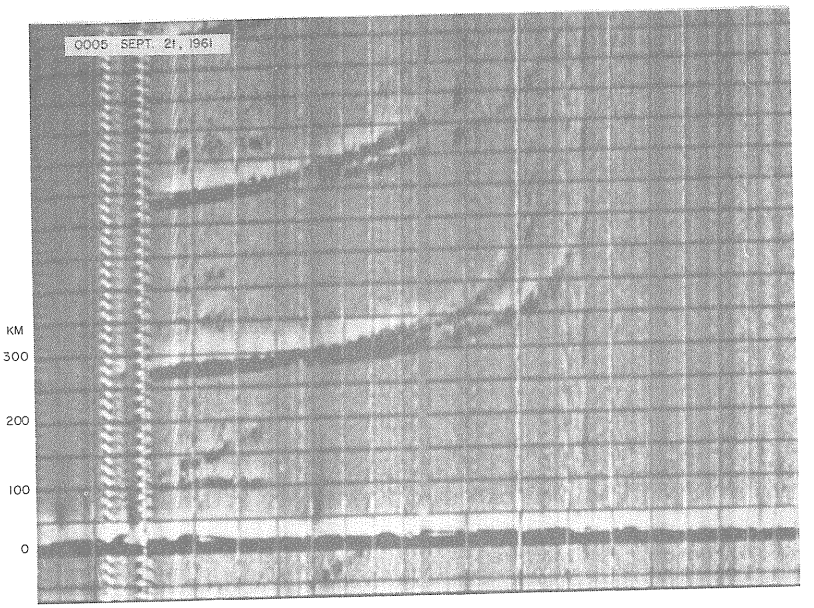
STATION: ADAK U. S. A.

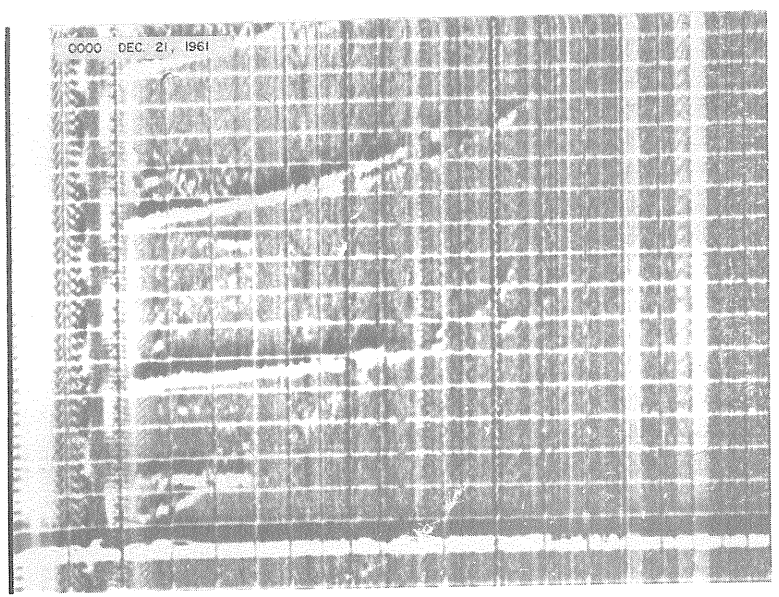
COORDINATES: GEOGRAPHIC LATITUDE: 51°52'N LONGITUDE: 176°39'W
GEOMAGNETIC LATITUDE: 47.2°N LONGITUDE: 240.0°
MAGNETIC DIP: 63.9°N TIME ZONE: 180°W
GYROFREQUENCY: 1.25 MC AT 200 KM.
TOTAL FIELD: 0.49 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 63.1° N
GARCHY







STATION: GARCHY FRANCE

COORDINATES: GEOGRAPHIC LATITUDE: 47°17'N LONGITUDE: 3°04'E

GEOMAGNETIC LATITUDE: 49.6°N LONGITUDE: 84.9°

MAGNETIC DIP: 63.1°N TIME ZONE: 0°

GYROFREQUENCY: 1.3 MC AT 0 KM.

IONOSONDE: TYPE OR DESIGNATION: LNR (BAGNEUX)

FREQUENCY RANGE: 1.6 MC TO 16 MC

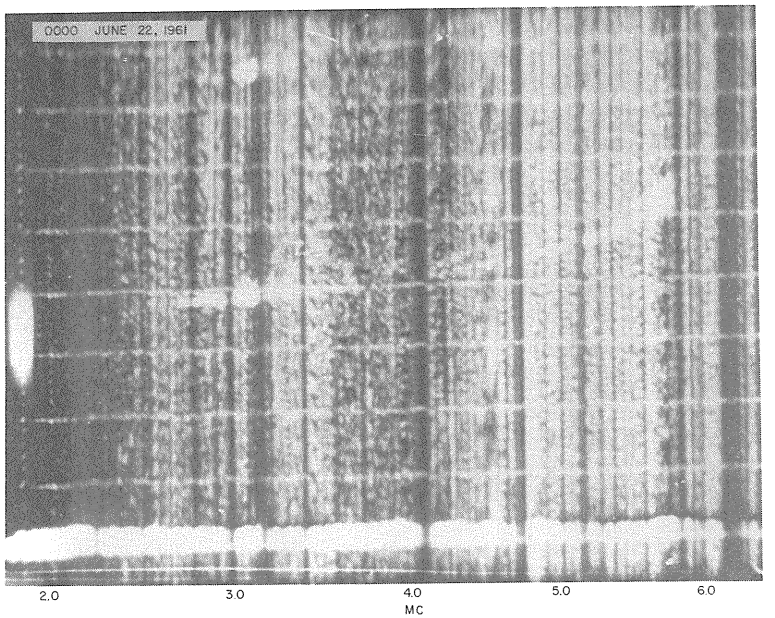
HEIGHT RANGE: 800 KM

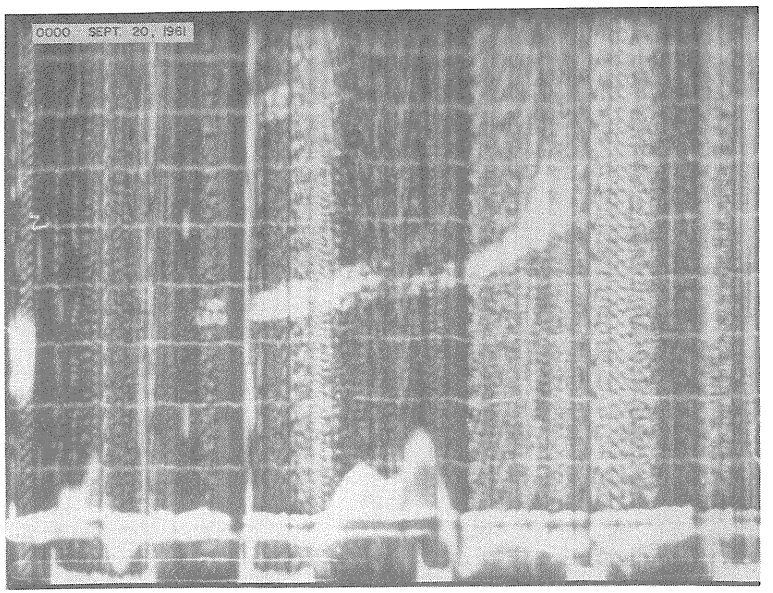
POWER: 2 KW

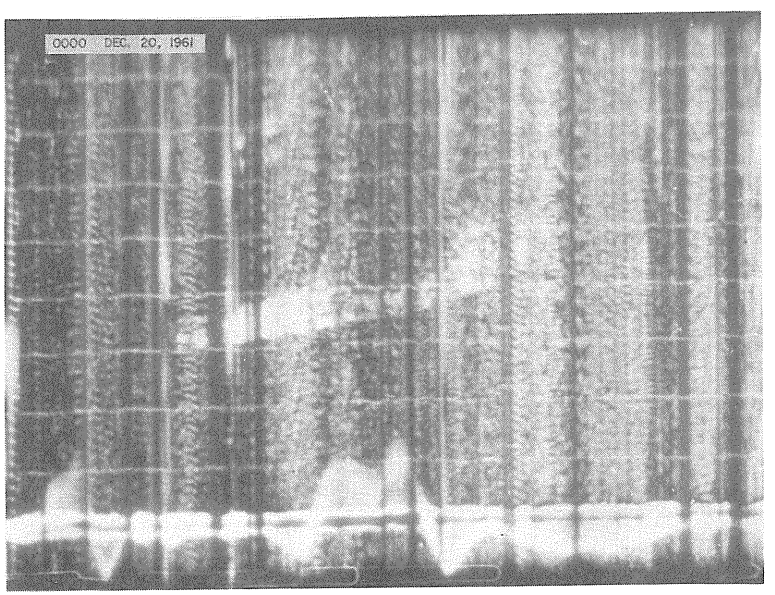
SWEEP TIME: 60 OR 10 SEC

LOGARITHMIC FREQUENCY SCALE

DIP 62.6° N
GRAZ





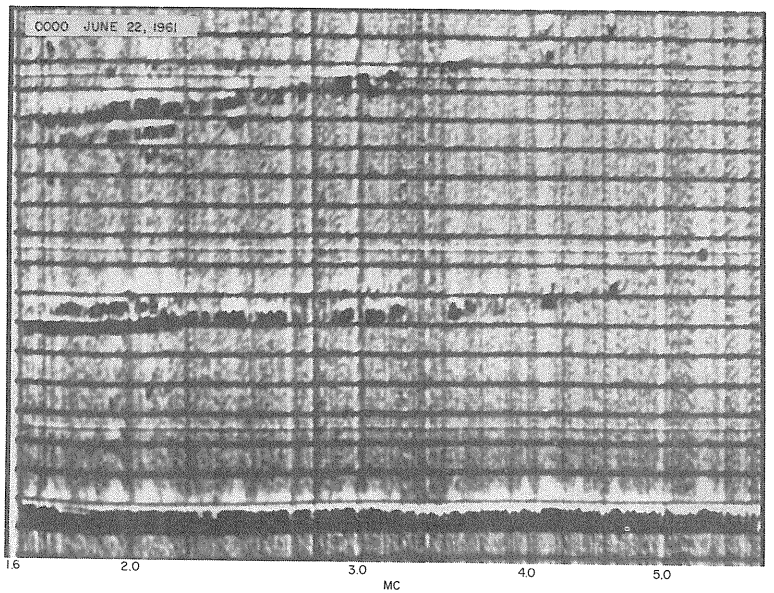


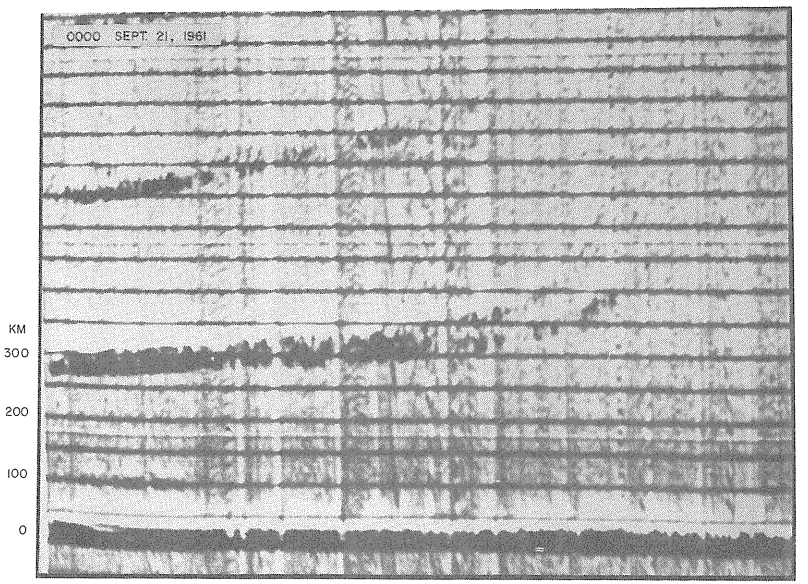
STATION: GRAZ AUSTRIA

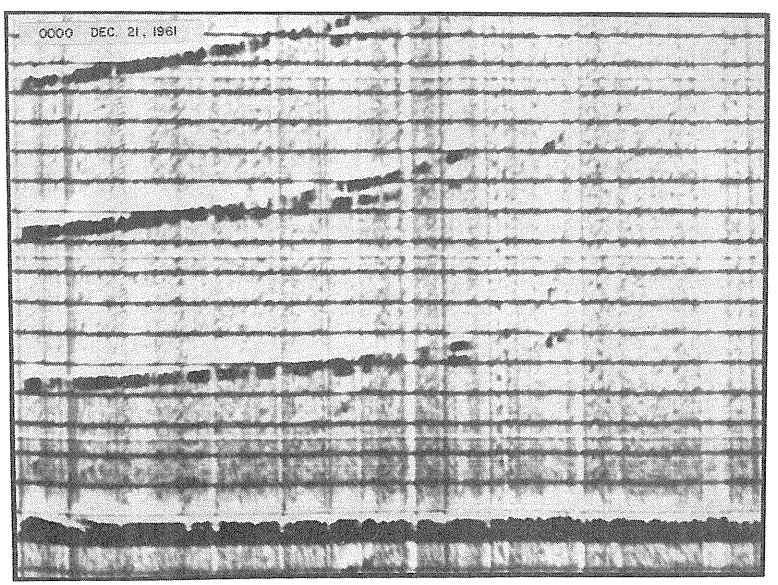
COORDINATES: GEOGRAPHIC LATITUDE: 47°04'38"N LONGITUDE: 15°27'E
GEOMAGNETIC LATITUDE: 47.0°N LONGITUDE: 96.9°
MAGNETIC DIP: 62.6°N TIME ZONE: 15°E
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: TYPE OR DESIGNATION: SELF-PLANNED
FREQUENCY RANGE: 2.0 MC TO 18.0 MC
HEIGHT RANGE: 800 KM
POWER : 1 KW
SWEEP TIME : 50 SEC
NEARLY LINEAR FREQUENCY SCALE

DIP 62.6° N
POITIERS





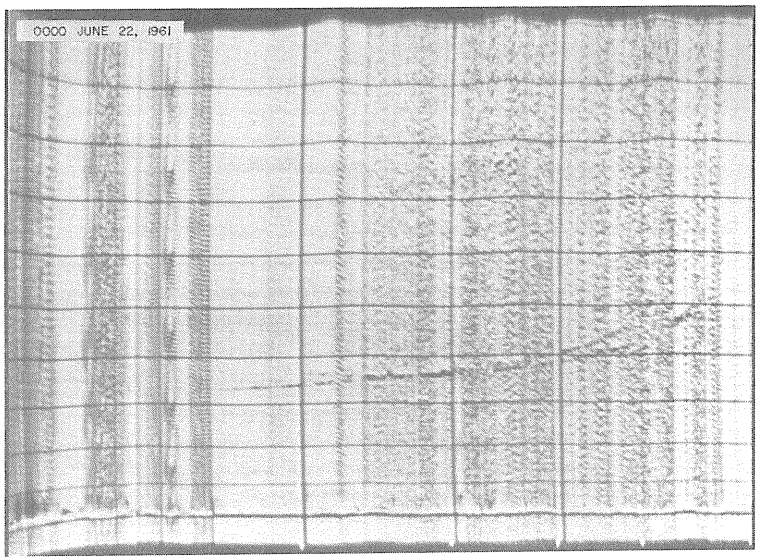


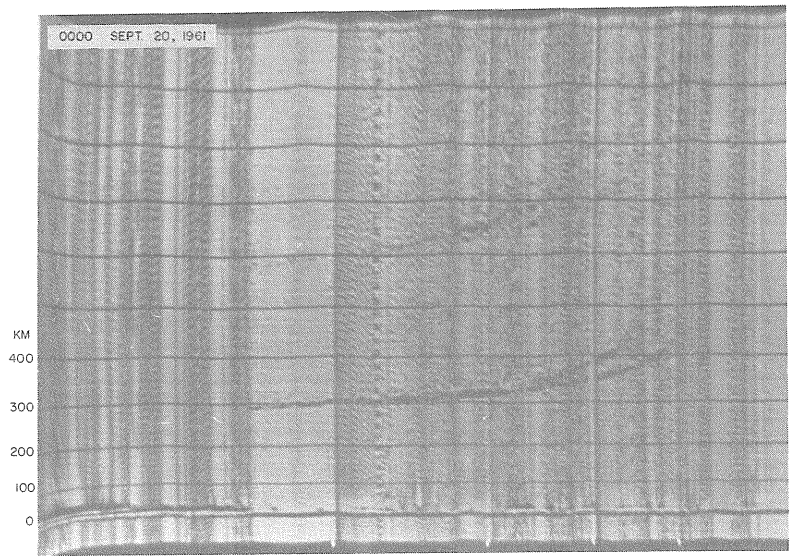
STATION: POITIERS FRANCE

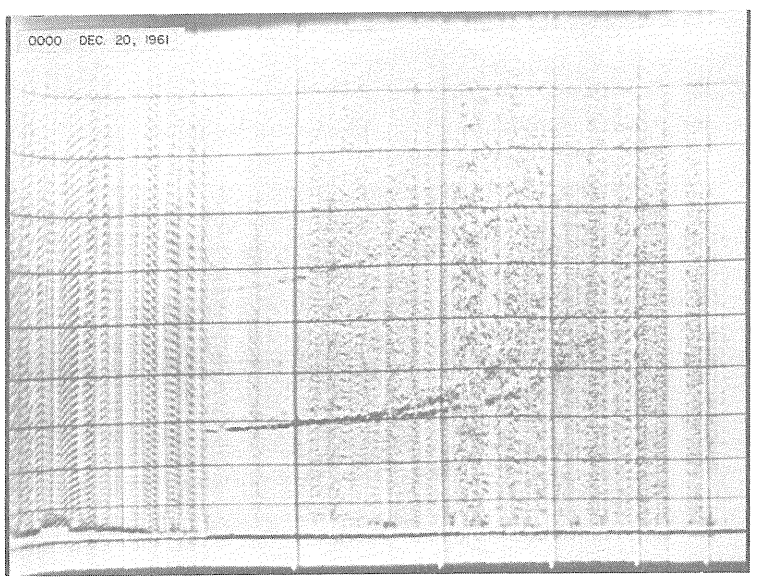
COORDINATES: GEOGRAPHIC LATITUDE: 46°35'N LONGITUDE: 0°20'E
GEOMAGNETIC LATITUDE: 49.5°N LONGITUDE: 81.8°
MAGNETIC DIP: 62.6°N TIME ZONE: 0°
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: TYPE OR DESIGNATION: SP 35-16
FREQUENCY RANGE: 1.6 MC TO 17 MC
HEIGHT RANGE: 1000 - 1200 KM (ABOUT)
POWER: 2.6 KW
SWEEP TIME: 60 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 62.3° N
SCHWARZENBURG





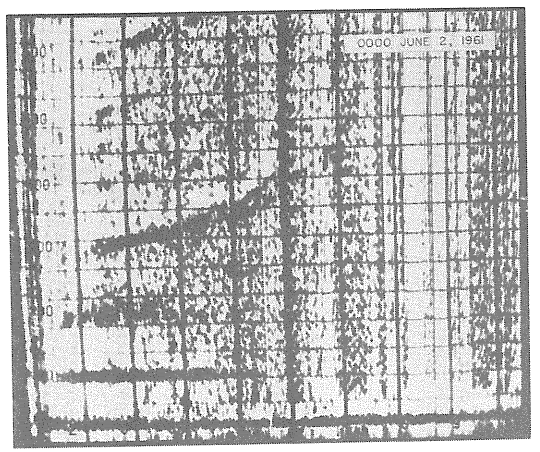


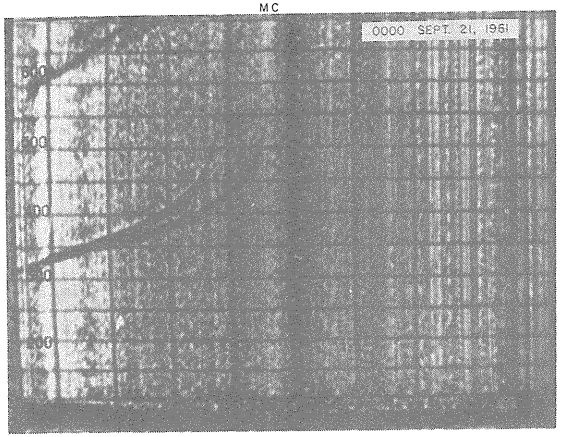
STATION: SCHWARZENBURG (SOTTENS) SWITZERLAND

COORDINATES: GEOGRAPHIC LATITUDE: 46°39'N LONGITUDE: 06°44'E
GEOMAGNETIC LATITUDE: 48.2°N LONGITUDE: 88.2°
MAGNETIC DIP: 62.3°N TIME ZONE: 15°E
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 62.2°N
ALMA-ATA



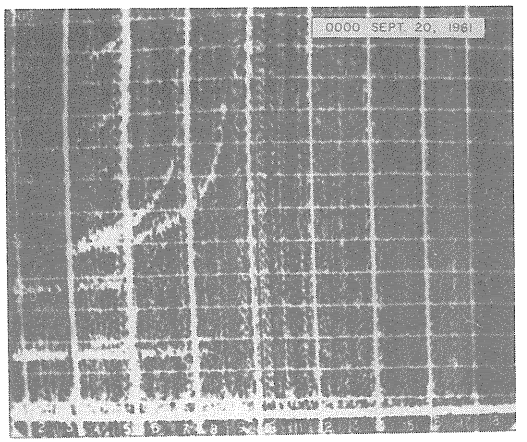


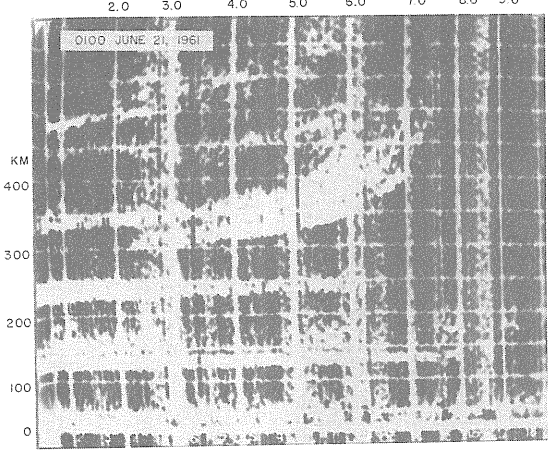
STATION: ALMA-ATA U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 43°15'N LONGITUDE: 76°55'E
GEOMAGNETIC LATITUDE: 33.4°N LONGITUDE: 150.7°
MAGNETIC DIP: 62.2°N TIME ZONE: 75°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 61.1°N
YUZHNO-SAKHALINSK



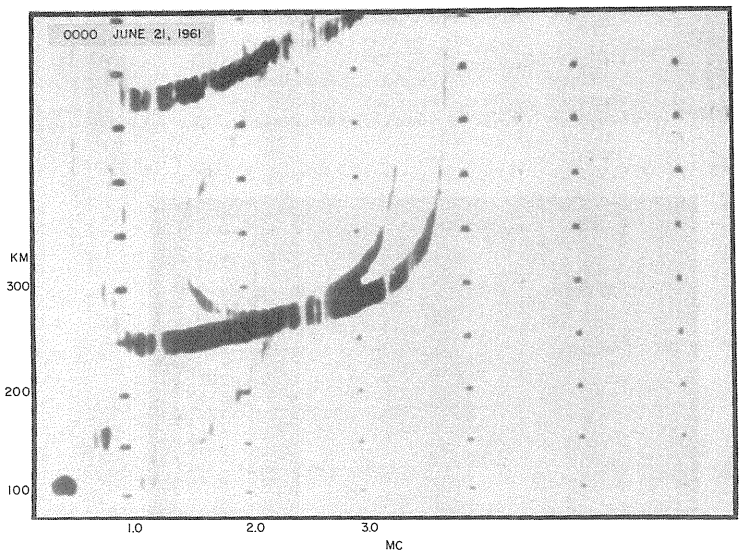


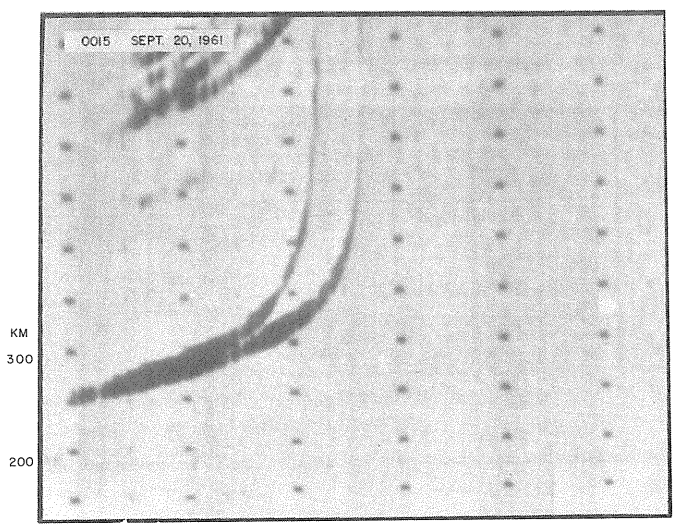
STATION: YUZHNO-SAKHALINSK U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 47°01'N LONGITUDE: 142°43'E
GEOMAGNETIC LATITUDE: 36.9°N LONGITUDE: 206.6°
MAGNETIC DIP: 61.1°N TIME ZONE: 150°E

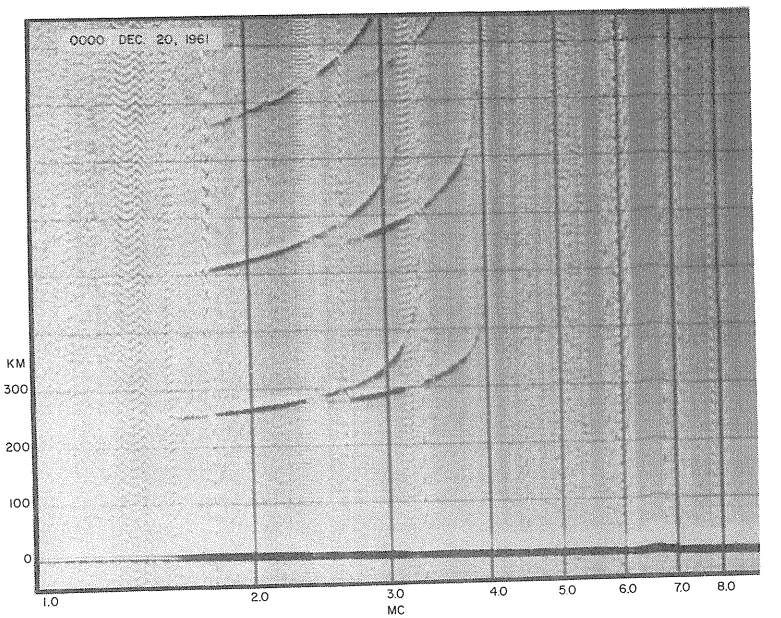
IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 61.5° S
JOHANNESBURG





DIP 61.2° N
CAPE KENNEDY



STATION: CAPE KENNEDY (CAPE CANAVERAL) U.S.A.

COORDINATES: GEOGRAPHIC LATITUDE: 28°24'N LONGITUDE: 80°35'W
GEOMAGNETIC LATITUDE: 39.6°N LONGITUDE: 346.7°
MAGNETIC DIP: 61.2°N TIME ZONE: 75°W
GYROFREQUENCY: 1.33 MC AT 200 KM
TOTAL FIELD: 0.52 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 25 KW
SWEEP TIME: 30 SEC LOGARITHMIC FREQUENCY SCALE

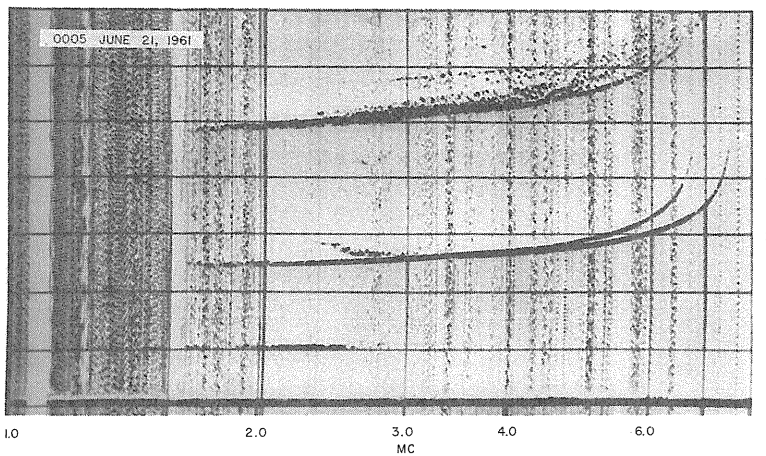
STATION: JOHANNESBURG REP. OF S. AFRICA

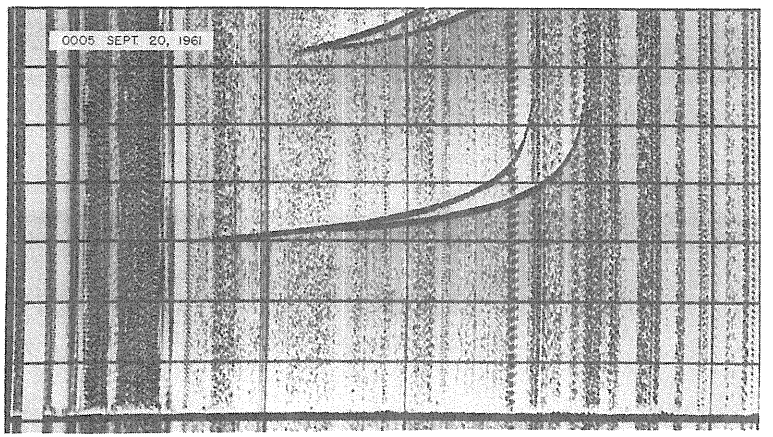
COORDINATES: GEOGRAPHIC LATITUDE: 26°04'S LONGITUDE: 28°06'E GEOMAGNETIC LATITUDE: 26.9°S MAGNETIC DIP: 61.5°S GYROFREQUENCY: 0.84 MC AT 200 KM
TOTAL FIELD: 0.33 OERSTED TIME ZONE: 30°E GEOMAGNETIC LONGITUDE: 91.3°

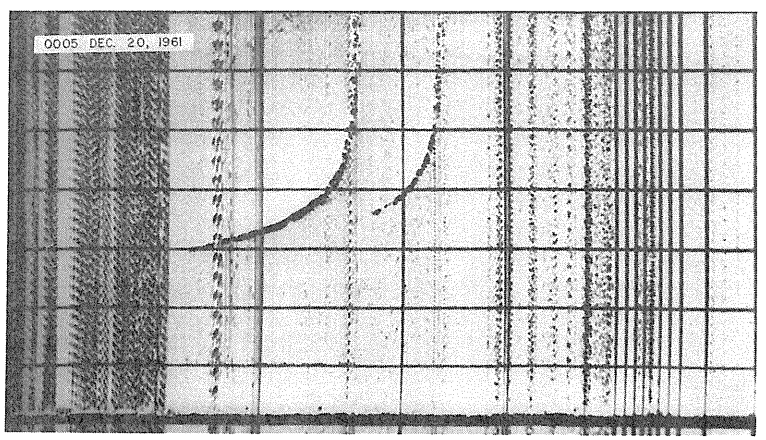
IONOSONDE: TYPE OR DESIGNATION: WADLEY FREQUENCY RANGE: 1.0 MC TO 20.0 MC (USUALLY SET: 1.0 TO 16.0 MC/S)
HEIGHT RANGE: VARRIABLE- USUALLY SET TO 800 KM POWER: ABOUT 1 KW SWEEP TIME: FOR NORMAL ROUTINE 90 SEC

REMARKS: APPROX. LINEAR FREQUENCY SCALE

DIP 60.2°N
WHITE SANDS





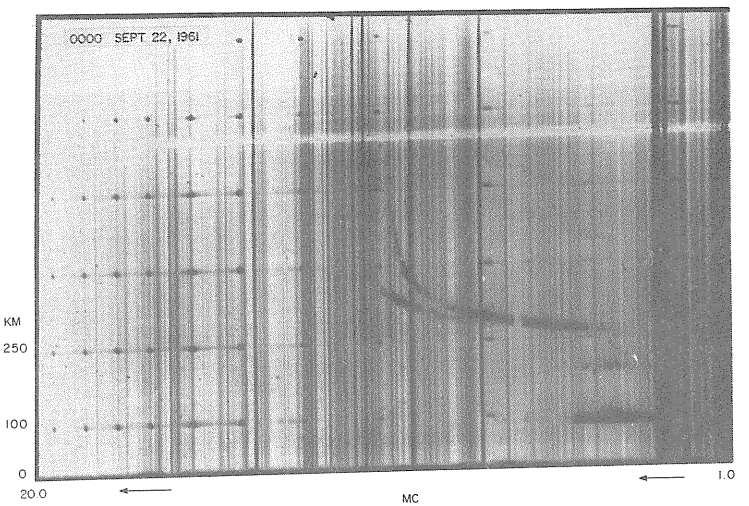


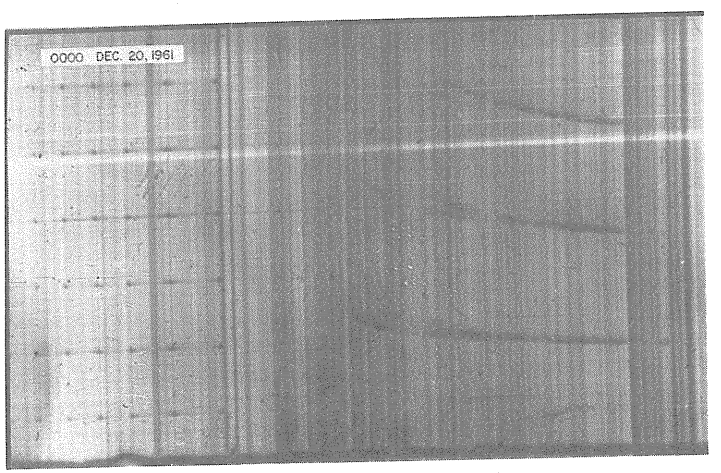
STATION: WHITE SANDS U.S.A.

COORDINATES: GEOGRAPHIC LATITUDE: 30°24'N LONGITUDE: 106°52'W
GEOMAGNETIC LATITUDE: 41.1°N LONGITUDE: 316.9°
MAGNETIC DIP: 60.2°N TIME ZONE: 105°W
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

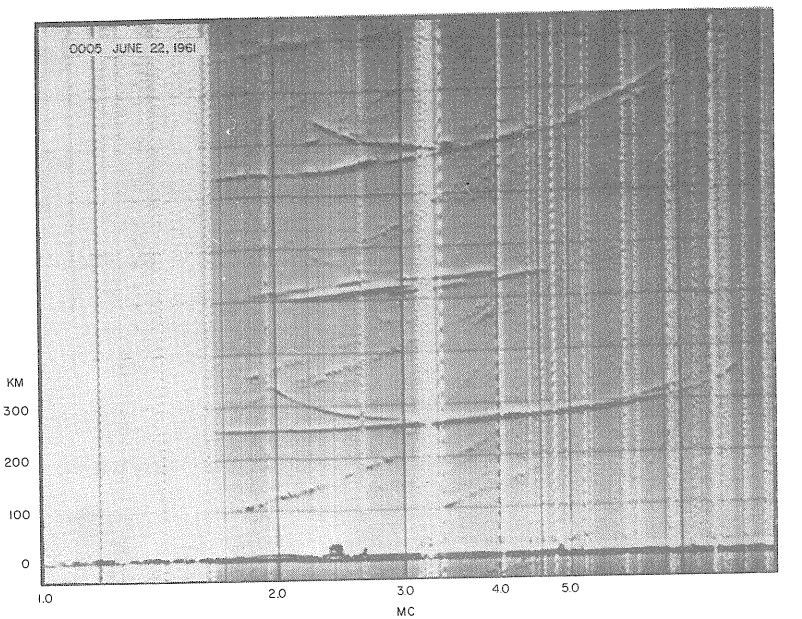
IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 60.2° N
GENOVA





DIP 59.7° N
GRAND BAHAMA



STATION: GRAND BAHAMA WEST INDIES

COORDINATES: GEOGRAPHIC LATITUDE: 26°40'N LONGITUDE: 78°22'W
GEOMAGNETIC LATITUDE: 37.9°N LONGITUDE: 349.6°
MAGNETIC DIP: 59.7°N GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED TIME ZONE: 75°W

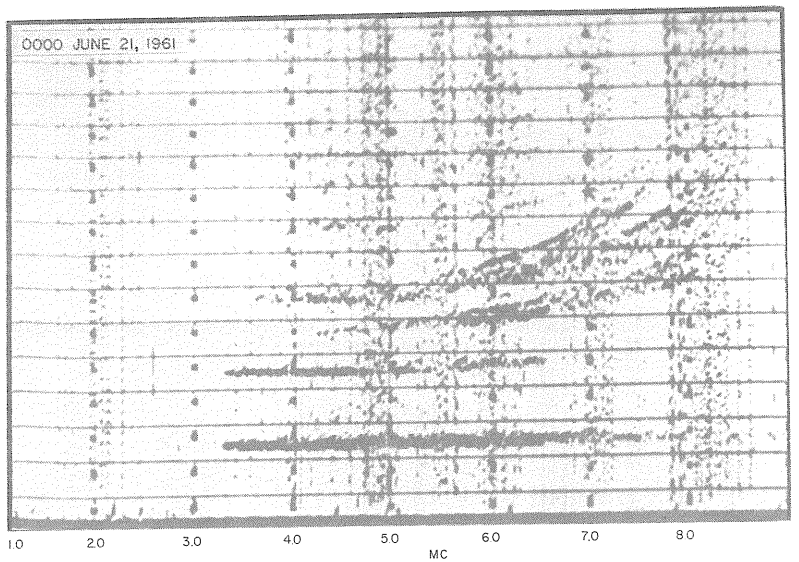
IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 25 KW
SWEEP TIME: 30 SEC LOGARITHMIC FREQUENCY SCALE.

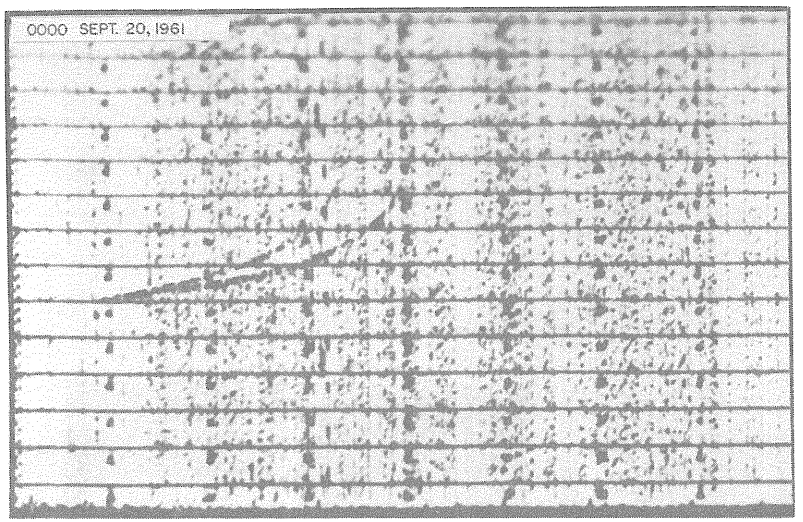
STATION: GENOVA (MONTE CAPELLINO) ITALY

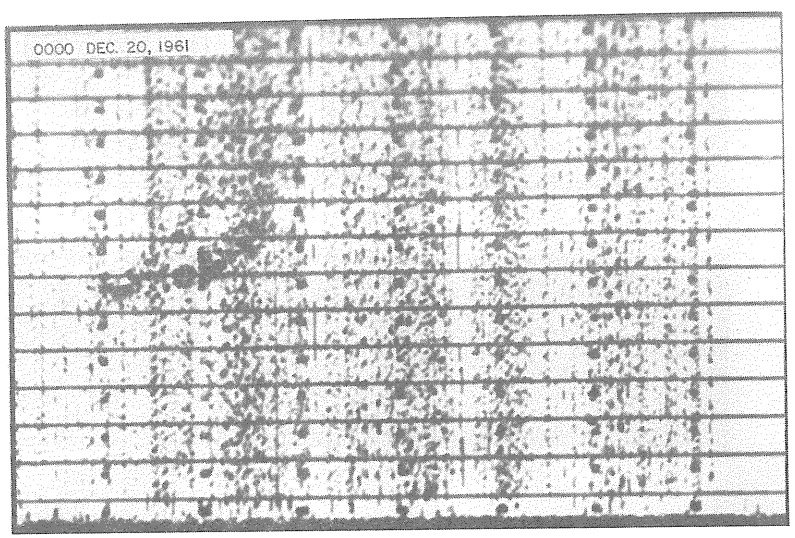
COORDINATES: GEOGRAPHIC LATITUDE: 44°33'N LONGITUDE: 08°57'E GEOMAGNETIC LATITUDE: 45.8°N LONGITUDE: 89.6° MAGNETIC DIP: 60.2°N
TIME ZONE: 15°E GYROFREQUENCY: 1.15 MC AT 200 KM TOTAL FIELD: 0.45 OERSTED

IONOSONDE: TYPE OR DESIGNATION: FREIBURG MODEL
FREQUENCY RANGE: 1.0 MC TO 20.0 MC HEIGHT RANGE: 1000 KM POWER: 10 KW SWEEP TIME: 3 MIN
LOGARITHMIC FREQUENCY SCALE

DIP 59.6° N
WAKKANAI





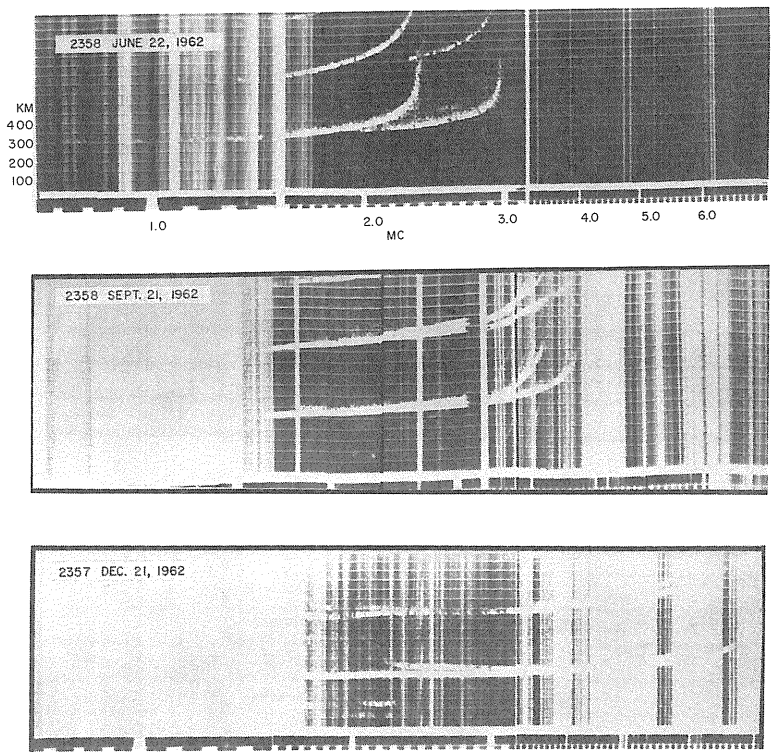


STATION: WAKKANAI JAPAN

COORDINATES: GEOGRAPHIC LATITUDE: 45°24'N LONGITUDE: 141°41'E
GEOMAGNETIC LATITUDE: 35.3°N LONGITUDE: 206.0°
MAGNETIC DIP: 59.6°N TIME ZONE: 135°E
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: FREQUENCY RANGE: 1 MC TO 20 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

DIP 58.0°S
ARGENTINE ISLAND

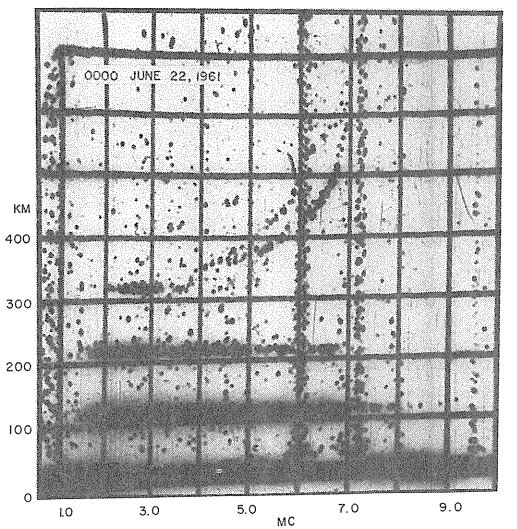


STATION: ARGENTINE ISLAND ANTARCTICA

COORDINATES: GEOGRAPHIC LATITUDE: 65°15'S LONGITUDE: 64°16'W
GEOMAGNETIC LATITUDE: 53.8°S LONGITUDE: 03.3°
MAGNETIC DIP: 58.0°S TIME ZONE: 60°W
GYROFREQUENCY: 1.12 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1000 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 55.8°N
ASHKHABAD

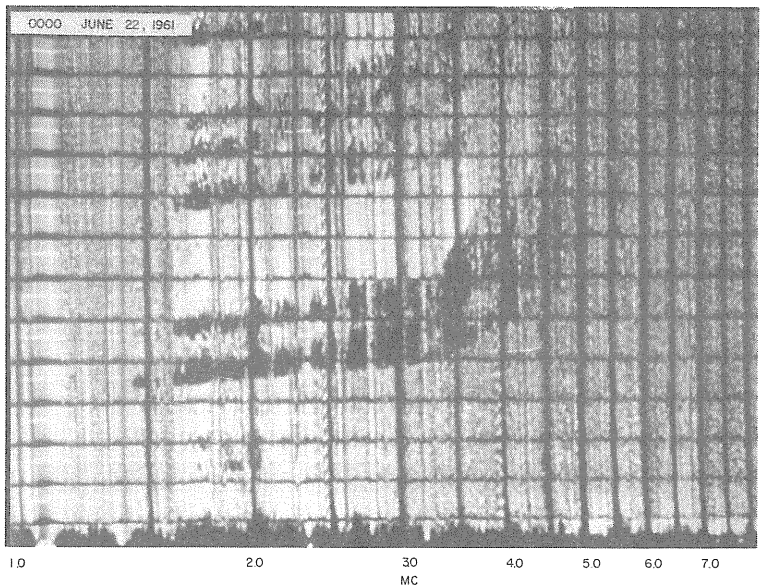


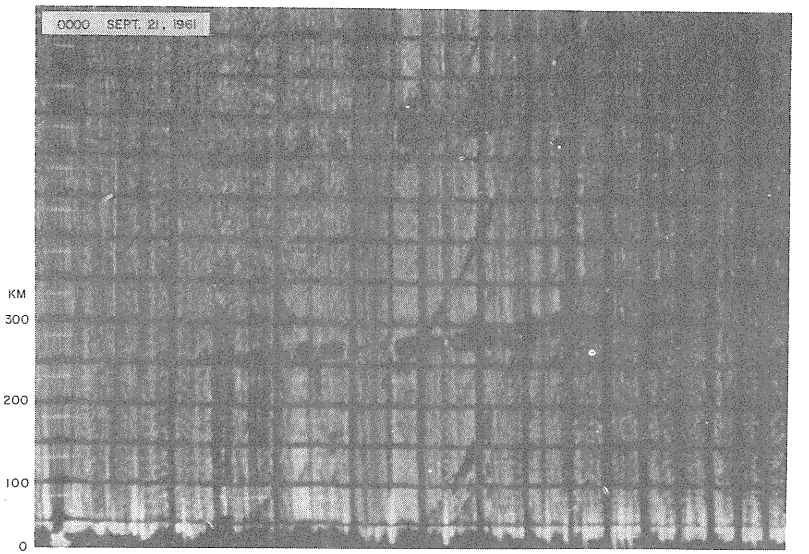
STATION: ASHKHABAD U.S.S.R.

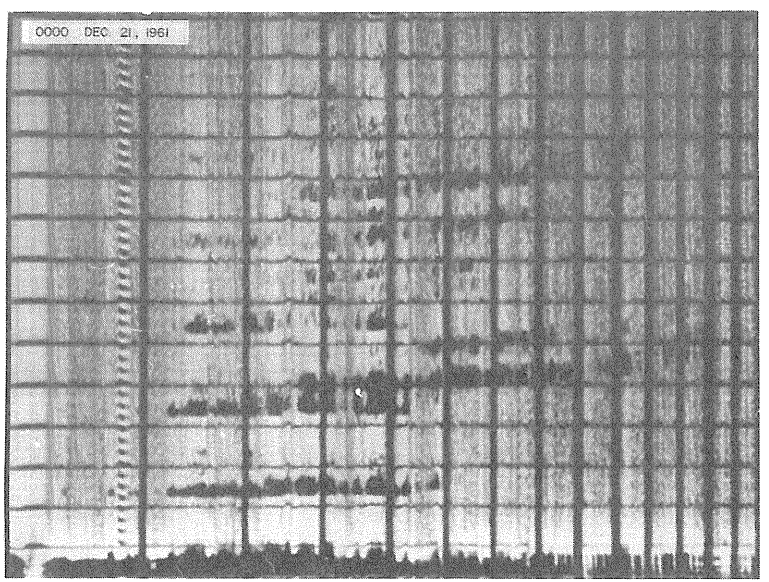
COORDINATES: GEOGRAPHIC LATITUDE: 37°55'N LONGITUDE: 58°18'E
GEOMAGNETIC LATITUDE: 30.4°N LONGITUDE: 133.3°
MAGNETIC DIP: 55.8°N TIME ZONE: 60°E

IONOSONDE: TYPE OR DESIGNATION: SP-3
FREQUENCY RANGE: 1.0 - 20.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM.
POWER: 20 KW
SWEEP TIME: 30 SEC
FREQUENCY SCALE: LINEAR

DIP 57.6° S
BRISBANE





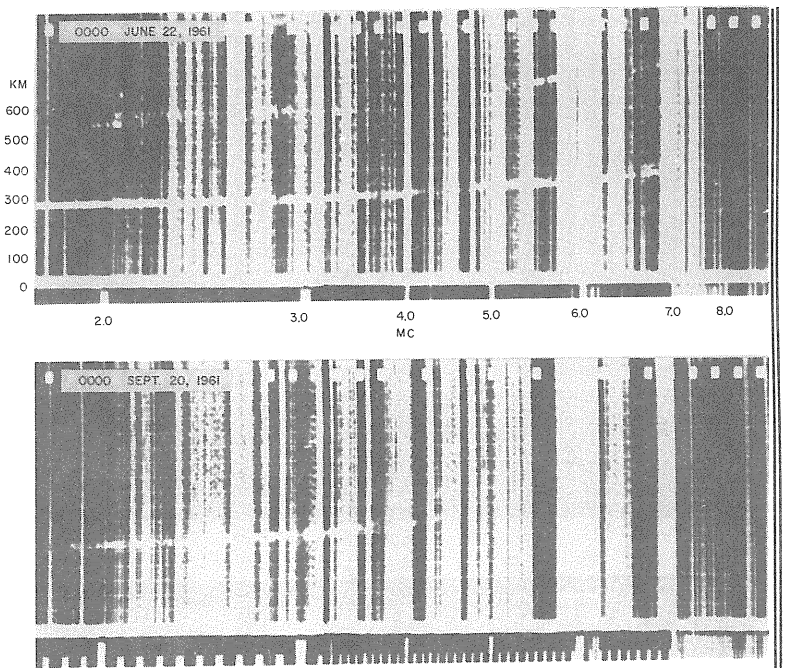


STATION: BRISBANE AUSTRALIA

COORDINATES: GEOGRAPHIC LATITUDE: 27°32'S LONGITUDE: 152°55'E
GEOMAGNETIC LATITUDE: 35.7°S LONGITUDE: 226.9°
MAGNETIC DIP: 57.6°S TIME ZONE: 150°E
GYROFREQUENCY: 1.12 MC AT 200 KM.
TOTAL FIELD: 0.44 OERSTED

IONOSONDE: TYPE OR DESIGNATION: MODIFIED CSIRO 1/J28
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
POWER: 3 KW
SWEEP TIME: 1 MIN 55 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 57.1° N
ROMA

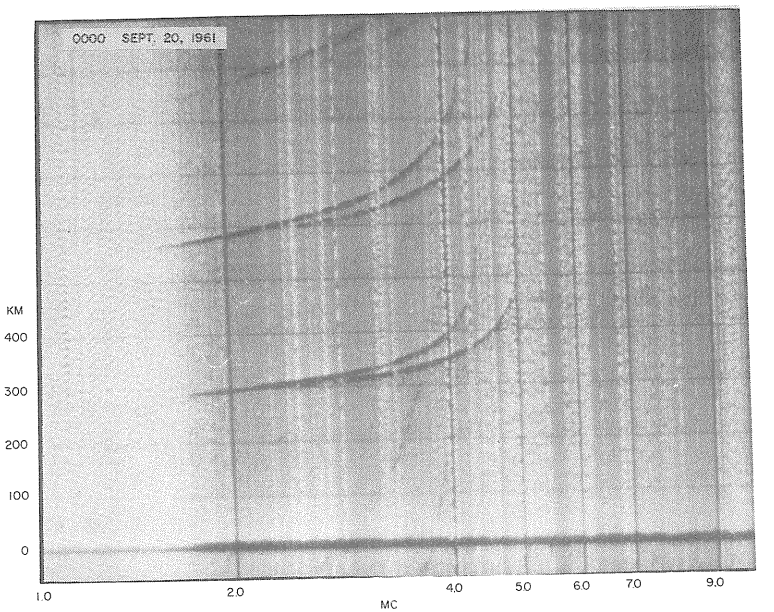


STATION: ROMA(S.ALESSIO) ITALY

COORDINATES: GEOGRAPHIC LATITUDE: 41°54'N LONGITUDE: 12°30'E
GEOMAGNETIC LATITUDE: 42.5°N LONGITUDE: 91.9°
MAGNETIC DIP: 57.1°N TIME ZONE: 15°E
GYROFREQUENCY: 1.15 MC AT 200 KM
TOTAL FIELD: 0.45 OERSTED

IONOSONDE: TYPE OR DESIGNATION: UNION RADIO MK II
FREQUENCY RANGE: 0.6 MC TO 25 MC
HEIGHT RANGE: 800 KM
POWER: 1.8 KW
SWEEP TIME: 250 SEC
APPROXIMATELY LOGARITHMIC FREQUENCY SCALE

DIP 57.4° N
SAN SALVADOR

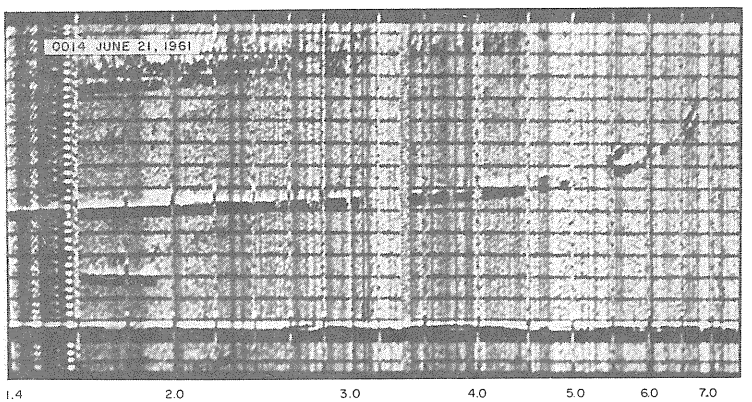


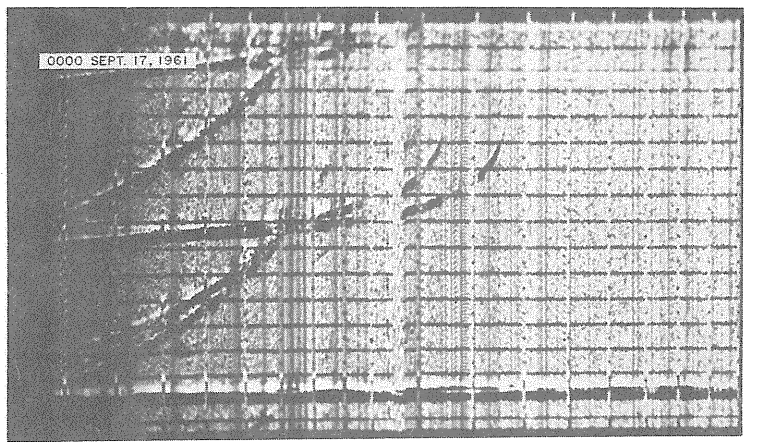
STATION: SAN SALVADOR WEST INDIES

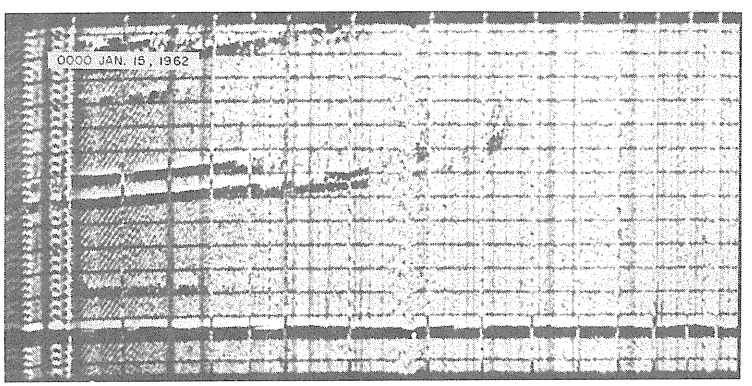
COORDINATES: GEOGRAPHIC LATITUDE: 24°00'N LONGITUDE: 74°25'W
GEOMAGNETIC LATITUDE: 35.5°N LONGITUDE: 353.8°
MAGNETIC DIP: 57.4°N TIME ZONE: 75°W
GYROFREQUENCY: 1.25 MC AT 200 KM
TOTAL FIELD: 0.49 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KW
POWER: 25 KM
SWEEP TIME: 27.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 56.7° N
TORTOSA





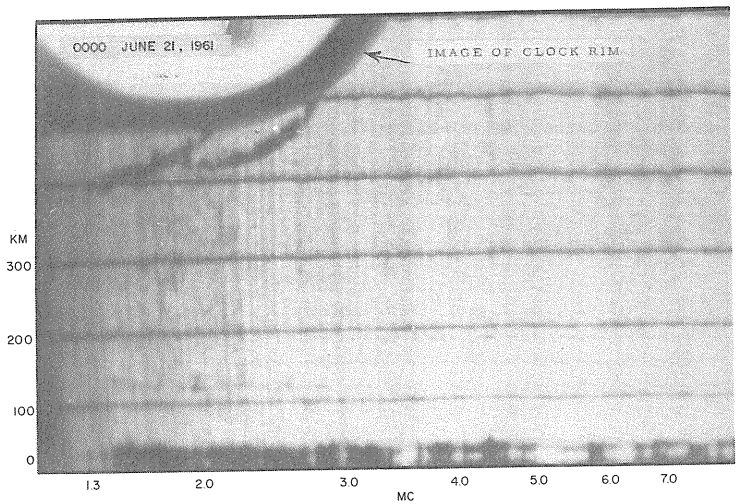


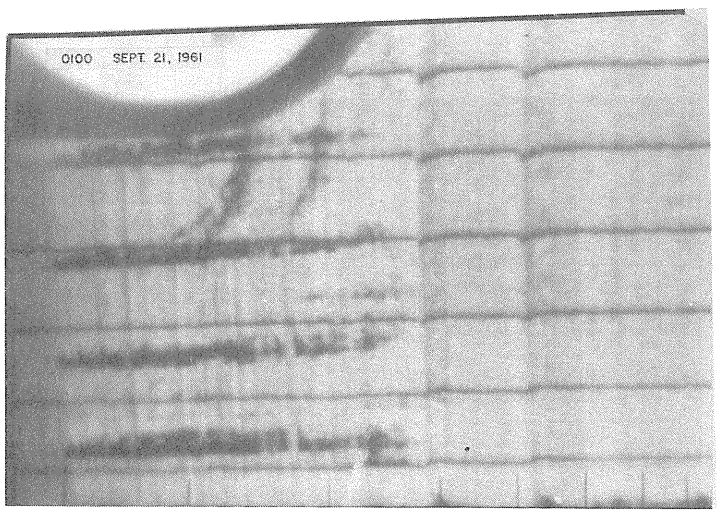
STATION: TORTOSA SPAIN

COORDINATES: GEOGRAPHIC LATITUDE: 40°49'N LONGITUDE: 00°30'E
GEOMAGNETIC LATITUDE: 43.9°N LONGITUDE: 79.5°
MAGNETIC DIP: 56.7°N TIME ZONE: U. T.
GYROFREQUENCY: 1.12 MC AT 200 KM
TOTAL FIELD: 0.44 OERSTED

IONOSONDE: TYPE OR DESIGNATION: SP - 35
FREQUENCY RANGE: 1.2 MC TO 17.0 MC
HEIGHT RANGE: 1000 KM (ADJUSTABLE)
POWER: 3 KW
SWEEP TIME: 60 SEC
EQUATION FOR FREQUENCY SCALE: $f = 1.2\ e^{\frac{o}{136.3}}$

DIP 57.4° S
DECEPCION



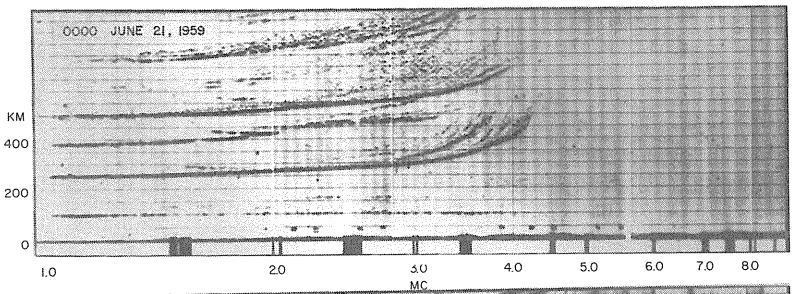


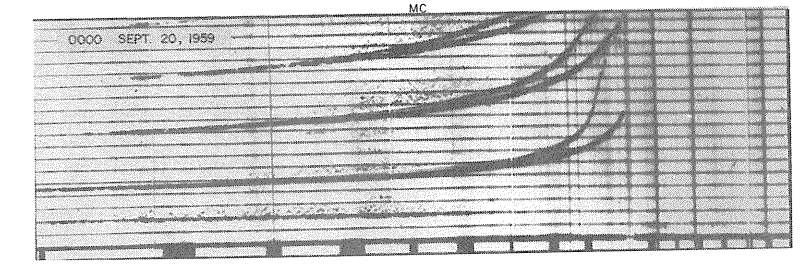
STATION: DECEPCION ANTARCTICA

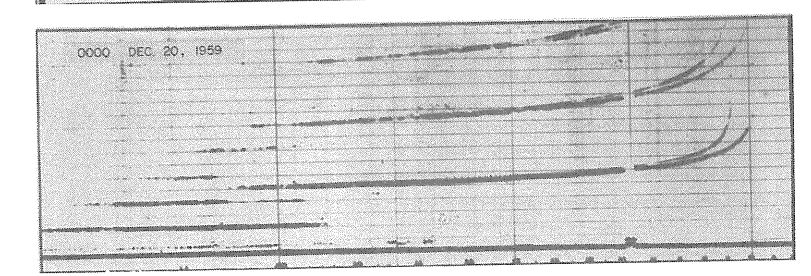
COORDINATES: GEOGRAPHIC LATITUDE: 62°59'S LONGITUDE: 60°43'W
GEOMAGNETIC LATITUDE: 51.6°S LONGITUDE: 6.1°
MAGNETIC DIP: 57.4°S GYROFREQUENCY: 1.10 MC AT 200 KM
TOTAL FIELD: 0.43 OERSTED TIME ZONE: 45°W

IONOSONDE: TYPE OR DESIGNATION: TRIO - 2 AUTOMATIC
FREQUENCY RANGE: 1.3 MC TO 18.0 MC
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 55.0° S
TSUMEB





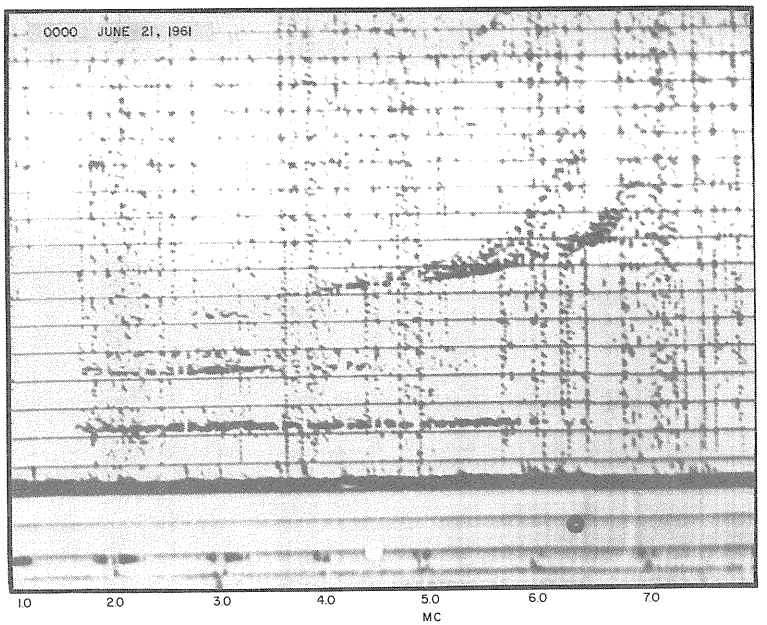


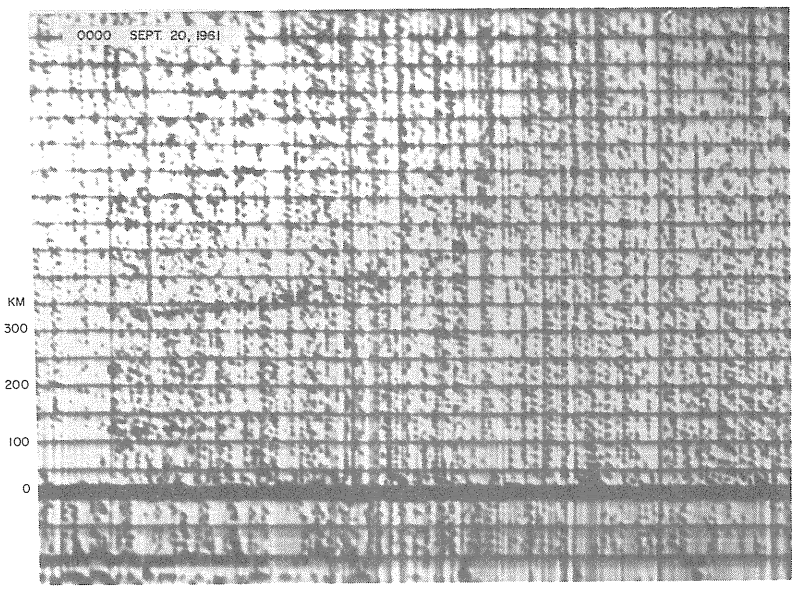
STATION: TSUMEB SOUTH WEST AFRICA

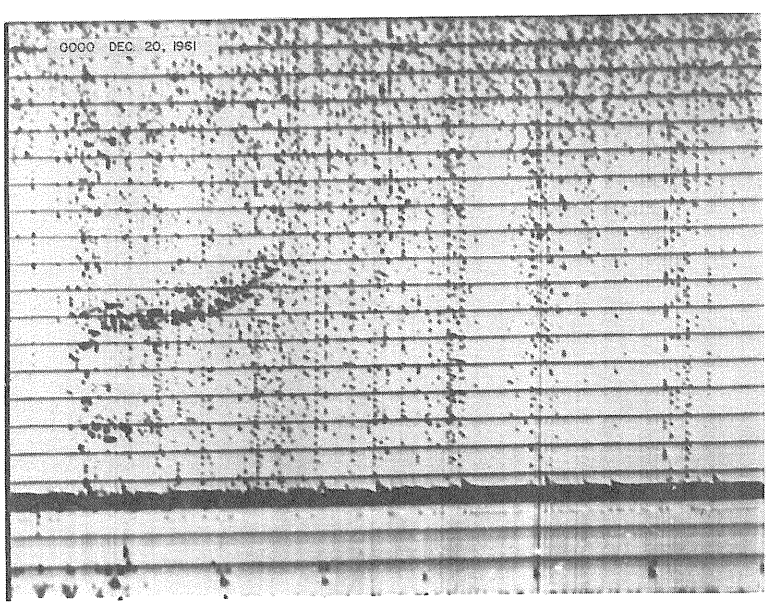
COORDINATES: GEOGRAPHIC LATITUDE: 19°14'S LONGITUDE: 17°43'E
GEOMAGNETIC LATITUDE: 18.2°S LONGITUDE: 82.8°
MAGNETIC DIP: 55.0°S TIME ZONE: 15°E
GYROFREQUENCY: 0.82 MC AT 200 KM
TOTAL FIELD: 0.33 OERSTED

IONOSONDE: TYPE OR DESIGNATION: DDA IV/54 (OWN DESIGN)
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 900 KM
POWER: 15 KW SWEEP TIME: 240 SEC
EQUATION FOR FREQUENCY SCALE: $f = k_c^{\alpha t}$

DIP 53.7° N
AKITA





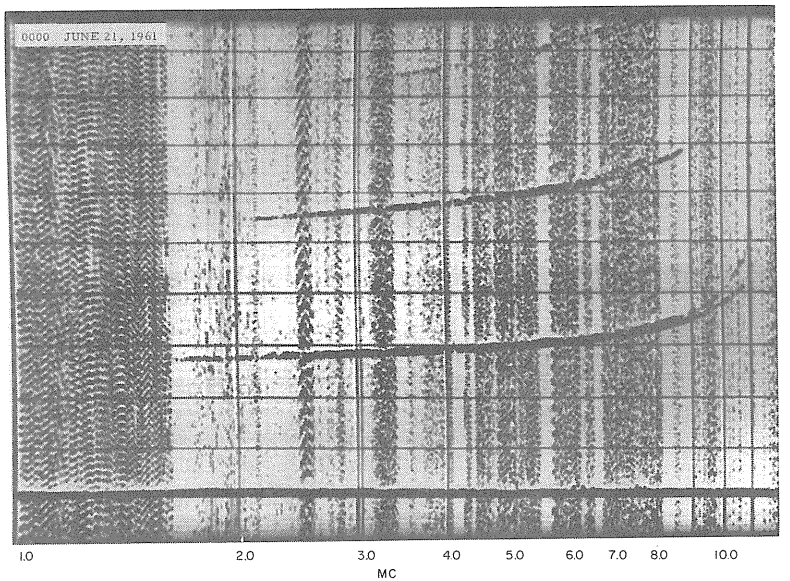


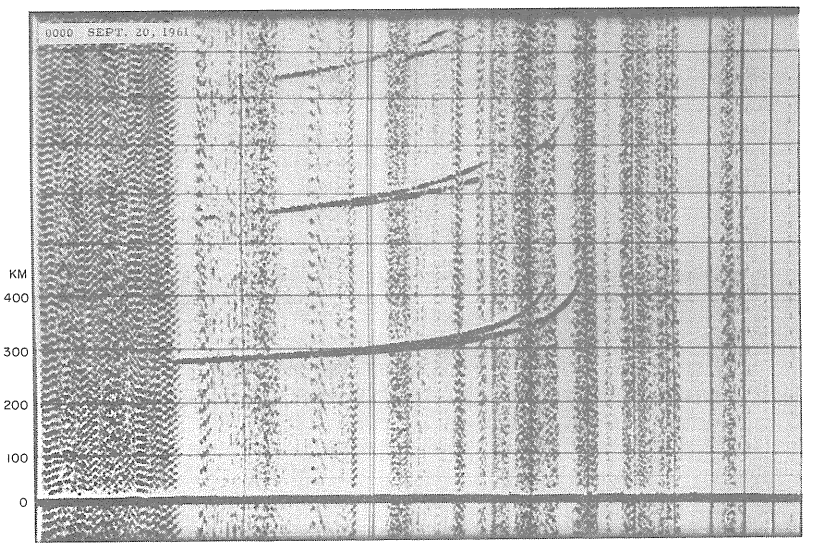
STATION: AKITA JAPAN

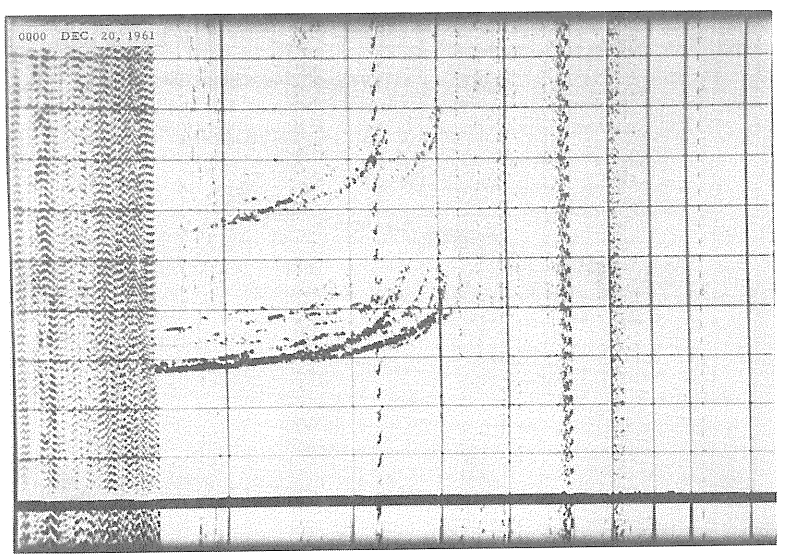
CORDINATES: GEOGRAPHIC LATITUDE: 39°44'N LONGITUDE: 140°08'E
GEOMAGNETIC LATITUDE: 29.5°N LONGITUDE: 205.4°
MAGNETIC DIP: 53.7°N TIME ZONE: 135°E
GYROFREQUENCY: 1.22 MC AT 200 KM
TOTAL FIELD: 0.48 OERSTED

IONOSONDE: FREQUENCY RANGE: 1.6 MC TO 25 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

DIP 51.1° N
PUERTO RICO







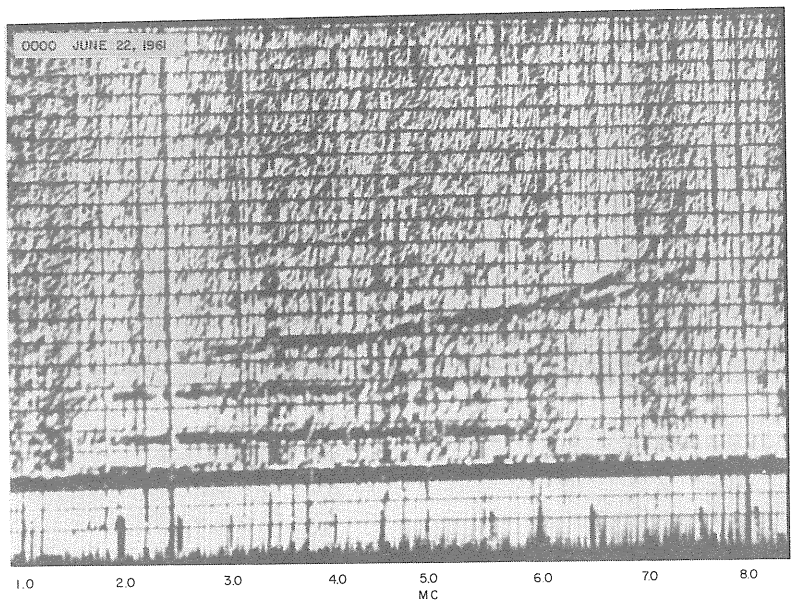
STATION: PUERTO RICO U. S. A.

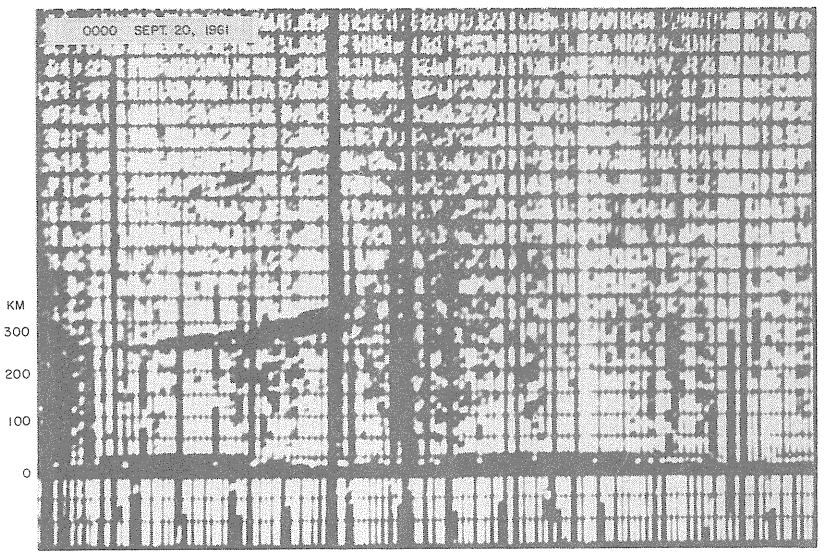
COORDINATES: GEOGRAPHIC LATITUDE: 18°30'N LONGITUDE: 67°10'W
GEOMAGNETIC LATITUDE: 30.0°N LONGITUDE: 2.0°
MAGNETIC DIP: 51.1°N TIME ZONE: 60°W
GYROFREQUENCY: 1.15 MC AT 200 KM
TOTAL FIELD: 0.45 OERSTED

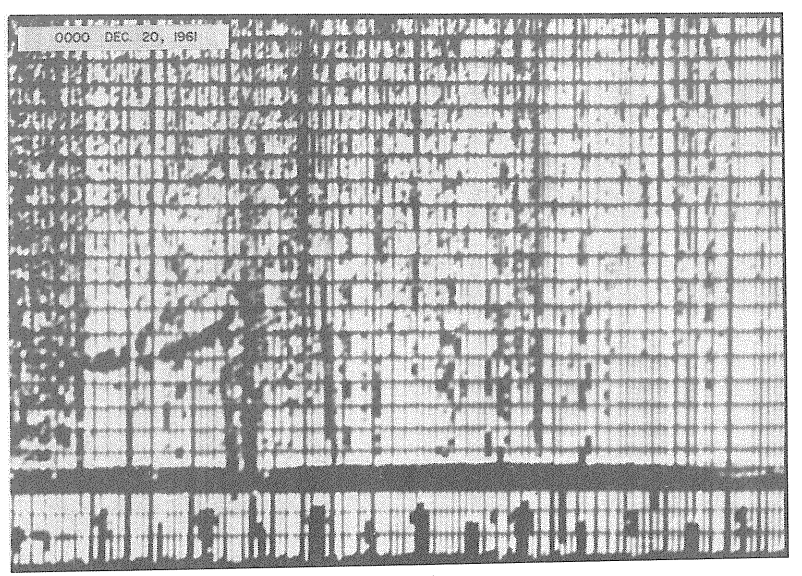
IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 20 KW SWEEP TIME: 27 SEC
LOGARITHMIC FREQUENCY SCALE

REMARKS: STATION CEASED OPERATION ON JUNE 26, 1963.

DIP 48.9° N
TOKYO





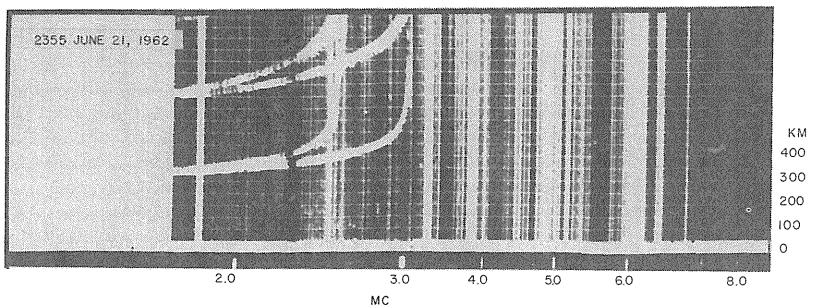


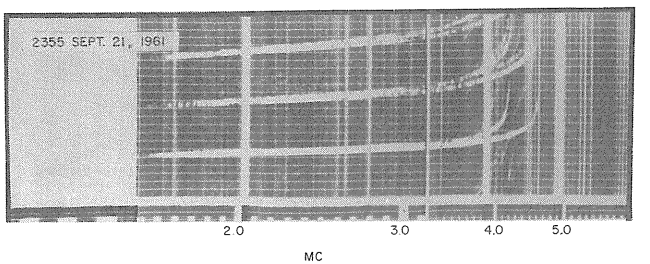
STATION: TOKYO (KOKUBUNJI) JAPAN

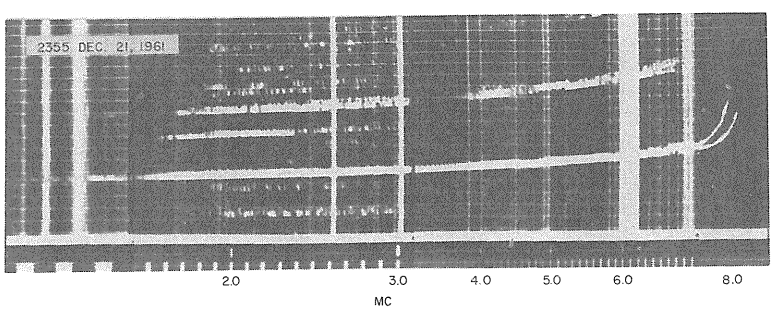
COORDINATES: GEOGRAPHIC LATITUDE: 35°42'N LONGITUDE: 139°29'E
GEOMAGNETIC LATITUDE: 25.4°N LONGITUDE: 205.4°
MAGNETIC DIP: 48.9°N TIME ZONE: 135°E
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: FREQUENCY RANGE: 1 MC TO 25 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

DIP 48.5°S
PORT STANLEY





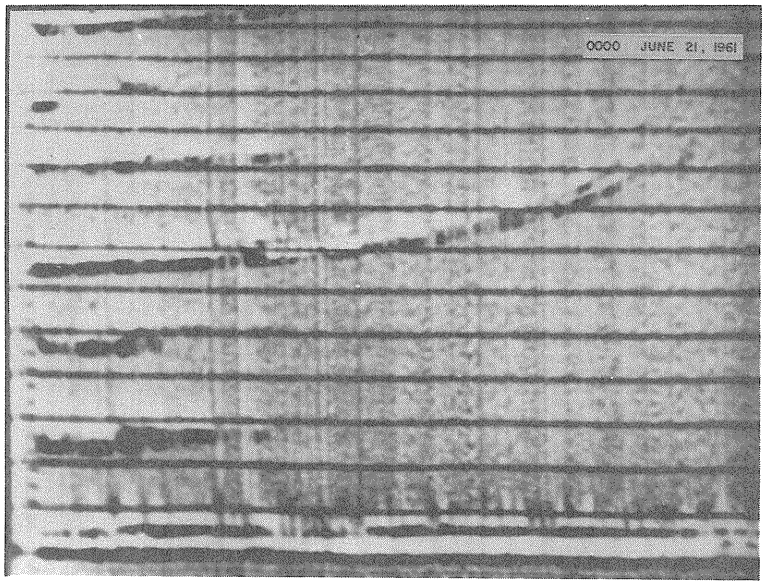


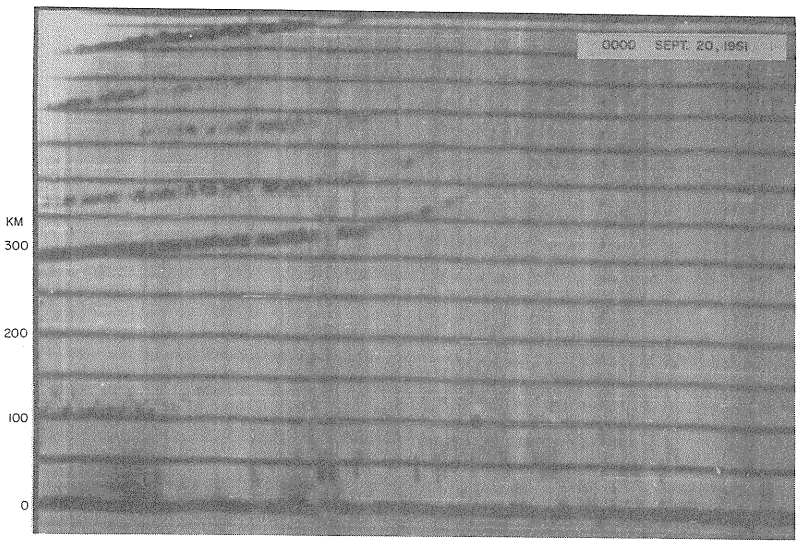
STATION: PORT STANLEY FALKLAND ISLANDS

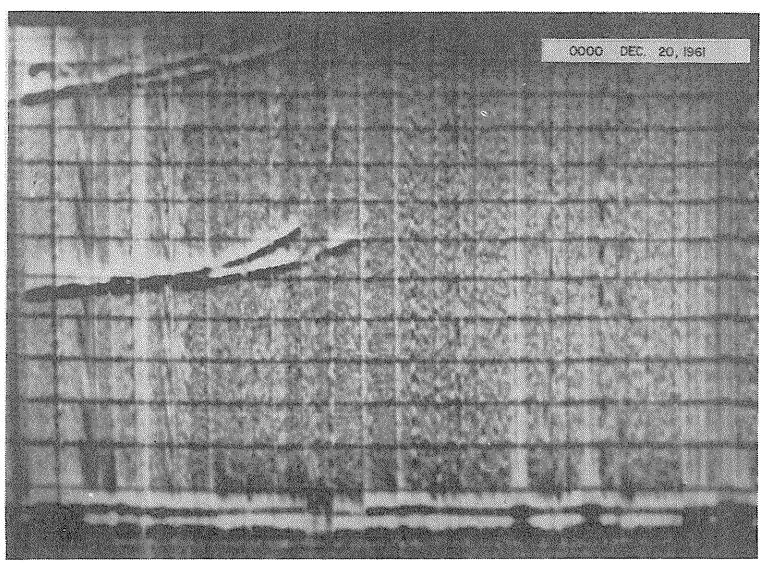
COORDINATES: GEOGRAPHIC LATITUDE: 51°42'S LONGITUDE: 57°51'W
GEOMAGNETIC LATITUDE: 40.4°S LONGITUDE: 09.1°
MAGNETIC DIP: 48.5°S TIME ZONE: 60.0°W
GYROFREQUENCY: 0.91 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1000 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 48.0° N
RABAT





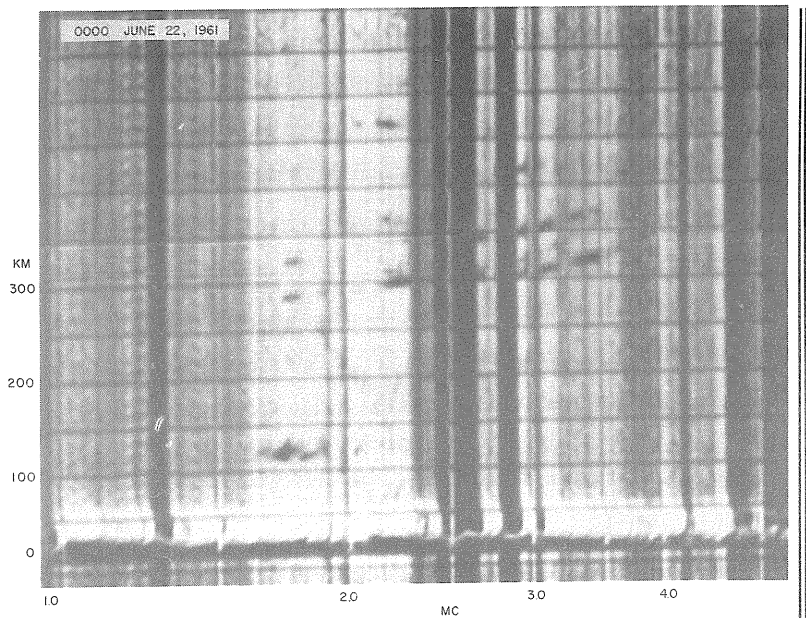


STATION: RABAT MOROCCO

COORDINATES: GEOGRAPHIC LATITUDE: 33°55'N LONGITUDE: 06°50'W
GEOMAGNETIC LATITUDE: 38.6°N LONGITUDE: 69.9°
MAGNETIC DIP: 48.0°N TIME ZONE: U. T.
GYROFREQUENCY: 1.21 MC AT 200 KM
TOTAL FIELD: 0.40 OERSTED

IONOSONDE: TYPE OR DESIGNATION: SP-35
FREQUENCY RANGE: 1.6 MC TO 16 MC
HEIGHT RANGE: 50 KM LINEAR
POWER: 1.3 TO 2.8 KW DEPENDING ON FREQUENCY
SWEEP TIME: 125 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 48.4° S
TOWNSVILLE

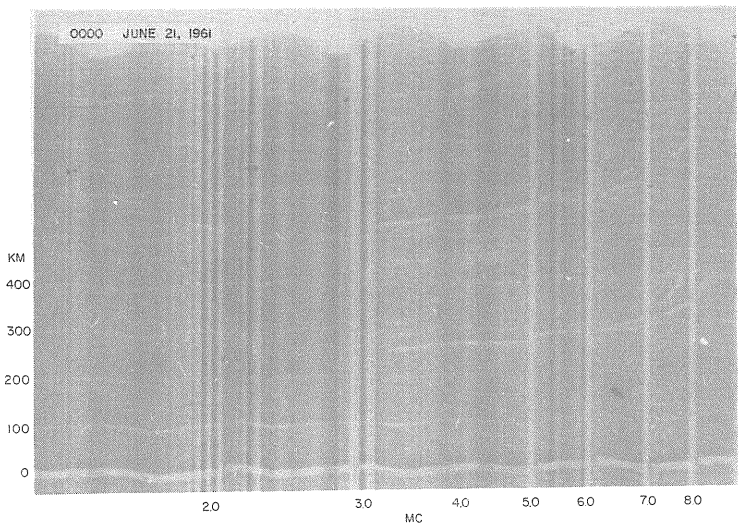


STATION: TOWNSVILLE AUSTRALIA

COORDINATES: GEOGRAPHIC LATITUDE: 19°19'S LONGITUDE: 146°44'E
GEOMAGNETIC LATITUDE: 28.5°S LONGITUDE: 218.8°
MAGNETIC DIP: 48.4°S TIME ZONE: 150°E
GYROFREQUENCY: 1.28 MC AT 200 KM
TOTAL FIELD: 0.50 OERSTED

IONOSONDE: TYPE OR DESIGNATION: CSIRO I/J28
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
POWER: 1 KW
SWEEP TIME: 1 MIN 55 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 41.6° N
DELHI

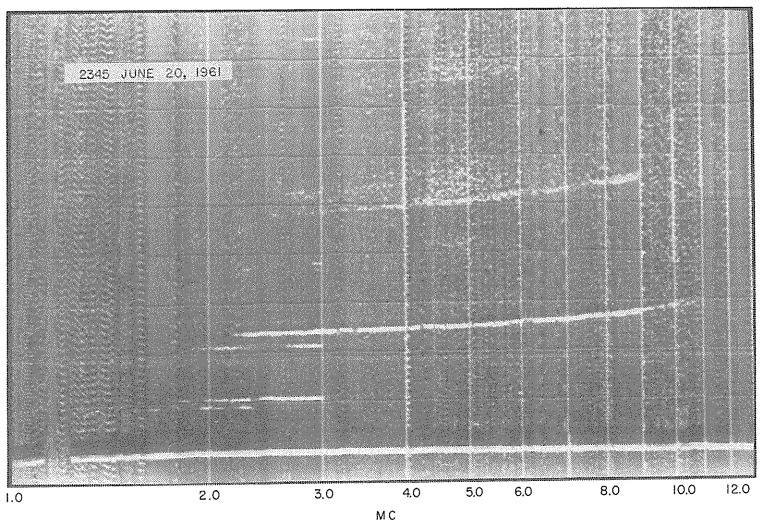


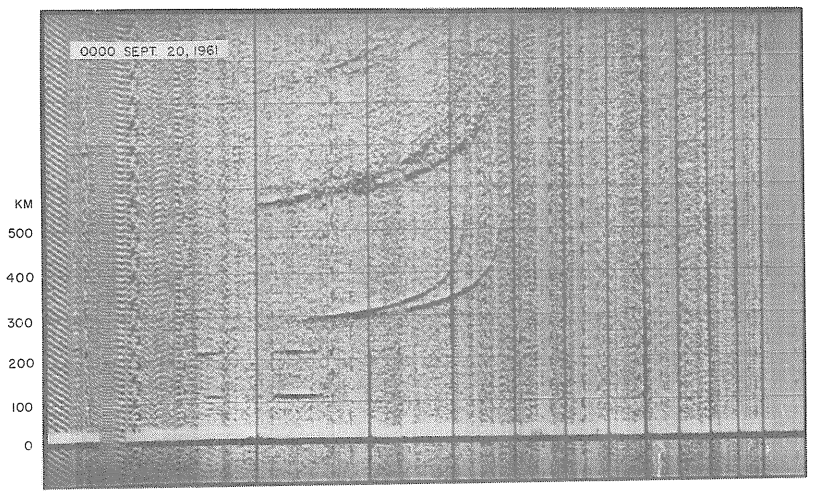
STATION: DELHI INDIA

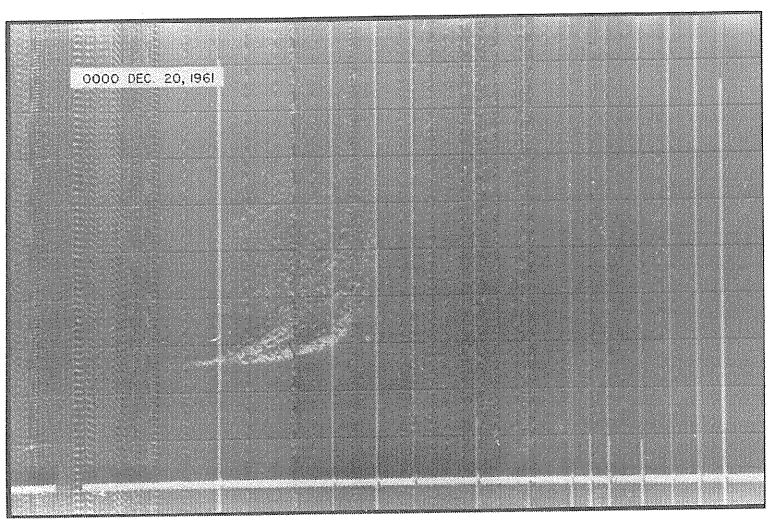
COORDINATES: GEOGRAPHIC LATITUDE: 28°38'N LONGITUDE: 77°13'E
GEOMAGNETIC LATITUDE: 18.9°N LONGITUDE: 148.9°
MAGNETIC DIP: 41.6°N TIME ZONE: 75°E
GYROFREQUENCY: 1.20 MC AT 200 KM
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000, and 4000 KM
POWER: 10 KW (NOMINAL)
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 46.5° N
MEXICO CITY





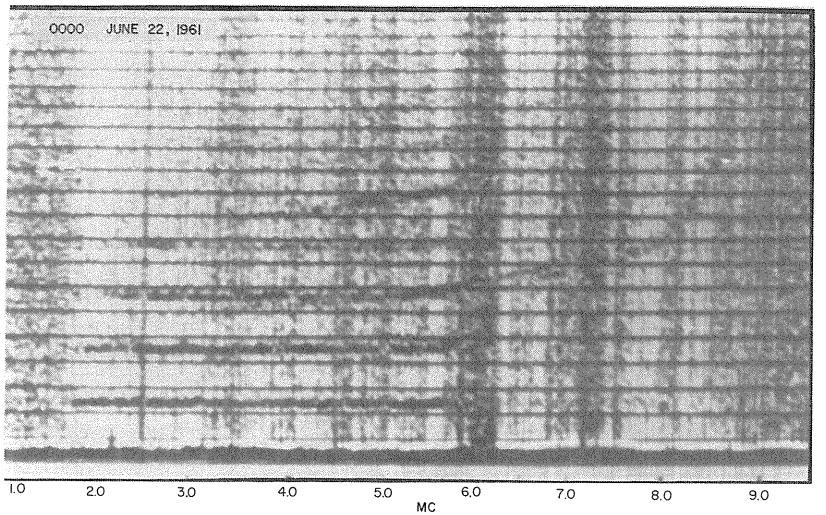


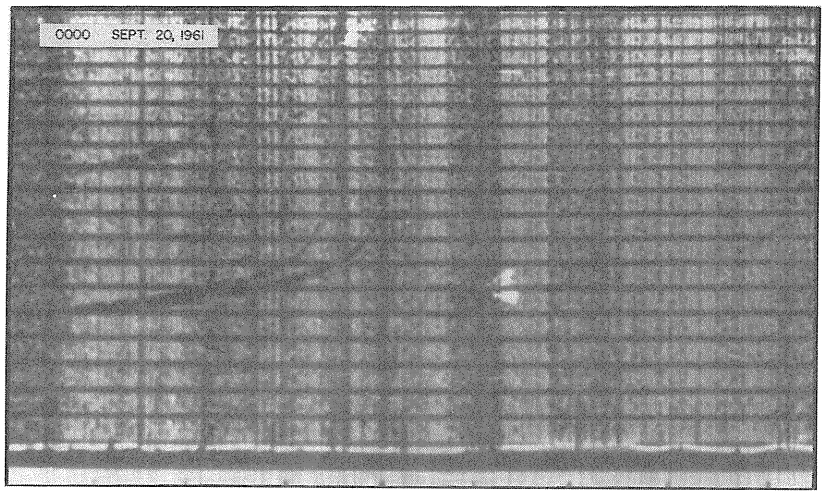
STATION: MEXICO CITY (EL CERILLO) MEXICO

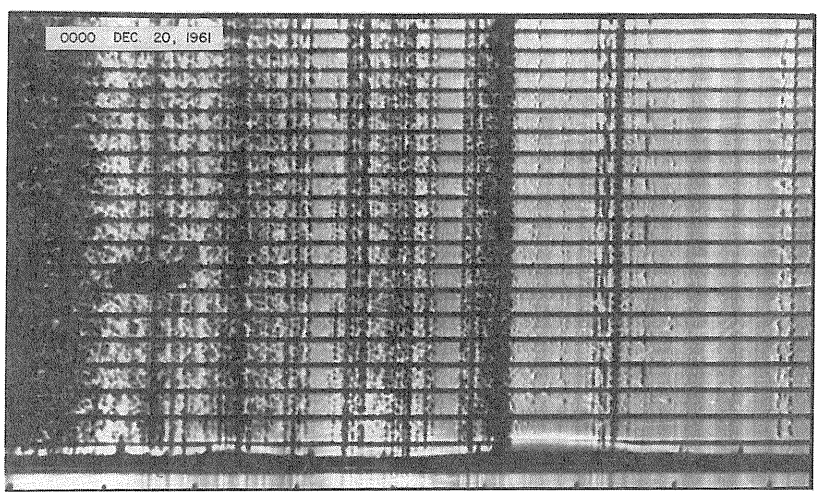
COORDINATES:
GEOGRAPHIC LATITUDE: 19°30'N LONGITUDE: 99°33'W
GEOMAGNETIC LATITUDE: 29.1°N LONGITUDE: 326.8°
MAGNETIC DIP: 46.5°N TIME ZONE: 90°W
GYROFREQUENCY: 1.12 MC AT 200 KM
TOTAL FIELD: 0.44 OERSTED

IONOSONDE:
TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 25 KW
SWEEP TIME: 18 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 44.1° N
YAMAGAWA





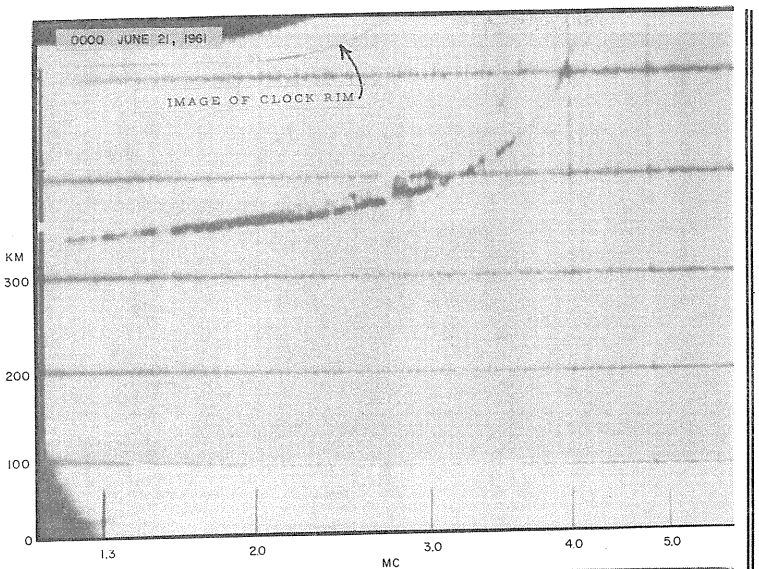


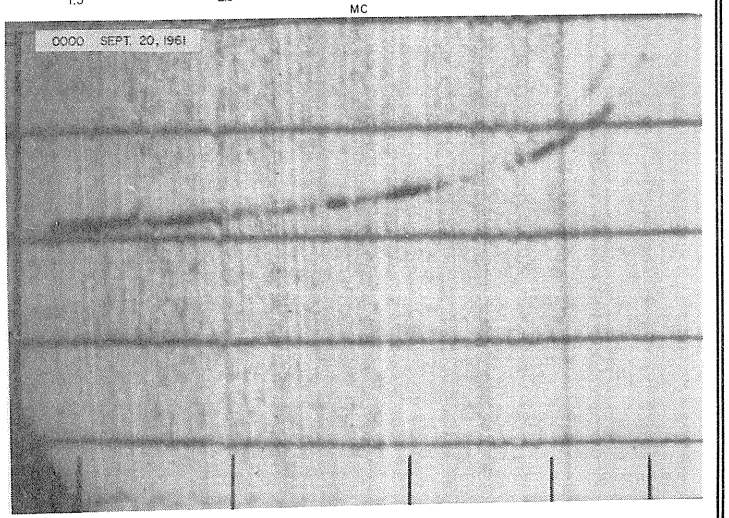
STATION: YAMAGAWA JAPAN

COORDINATES: GEOGRAPHIC LATITUDE: 31°13'N LONGITUDE: 130°38'E
GEOMAGNETIC LATITUDE: 20.3°N LONGITUDE: 197.8°
MAGNETIC DIP: 44.1°N TIME ZONE: 135°E
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

DIP 41.8° S
TRELEW



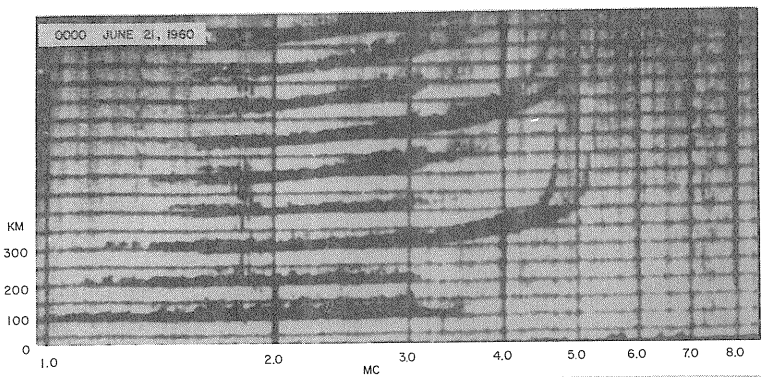


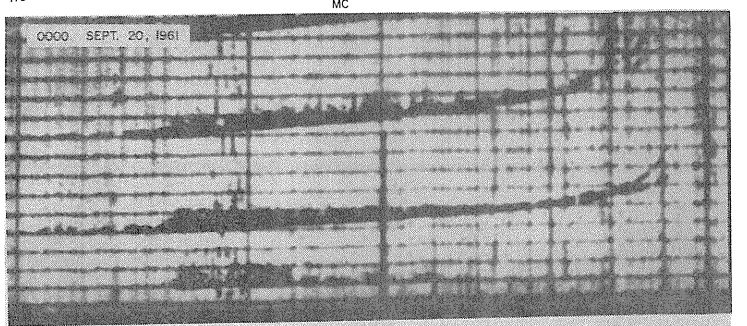
STATION: TRELEW ARGENTINA

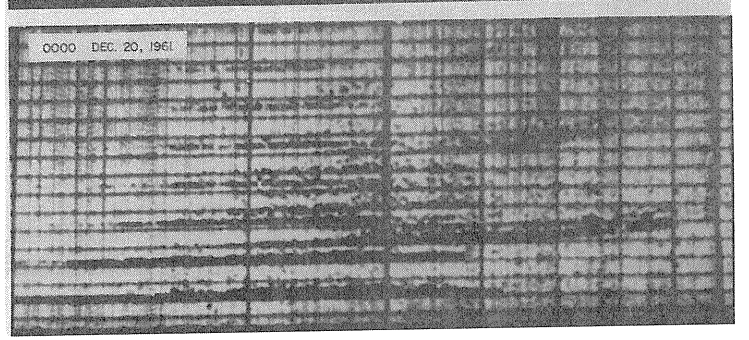
COORDINATES: GEOGRAPHIC LATITUDE: 43°13'S LONGITUDE: 65°18'W
GEOMAGNETIC LATITUDE: 31.7°S LONGITUDE: 3.2°
MAGNETIC DIP: 41.8°S GYROFREQUENCY: 0.82 MC AT 200 KM.
TOTAL FIELD: 0.32 OERSTED TIME ZONE: 60°W

IONOSONDE: TYPE OR DESIGNATION: TRIO - 2 AUTOMATIC
FREQUENCY RANGE: 1.3 MC TO 18.0 MC
SWEEP TIME: 30 SEC LOGARITHMIC FREQUENCY SCALE

DIP 38.2° S
RAROTONGA







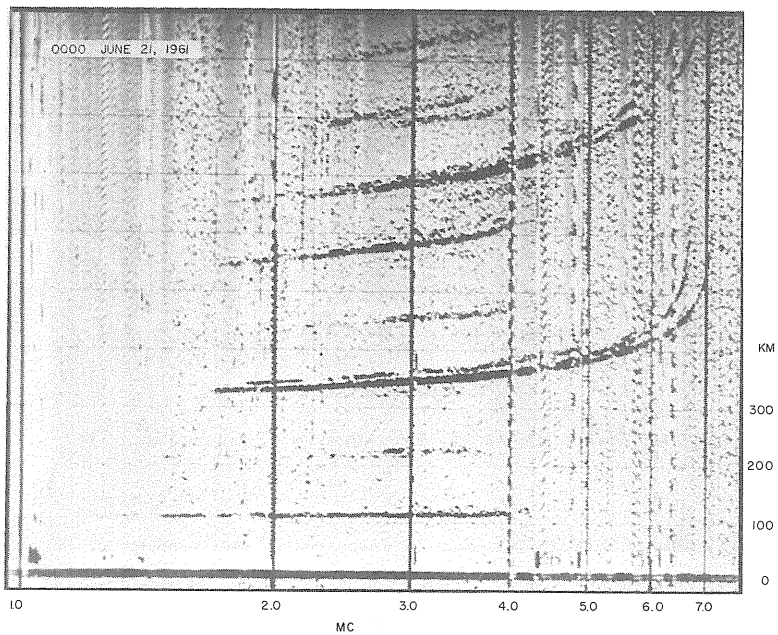
STATION: RAROTONGA PACIFIC OCEAN

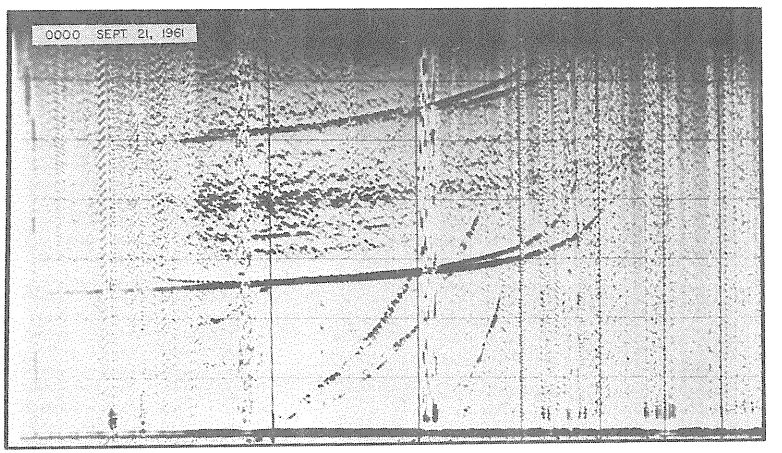
COORDINATES: GEOGRAPHIC LATITUDE: 21°12'S LONGITUDE: 159°45'W
GEOMAGNETIC LATITUDE: 20.9°S LONGITUDE: 273.6°
MAGNETIC DIP: 38.2°S TIME ZONE: 165°W
GYROFREQUENCY: 1.05 MC. AT 200 KM
TOTAL FIELD: 0.41 OERSTED

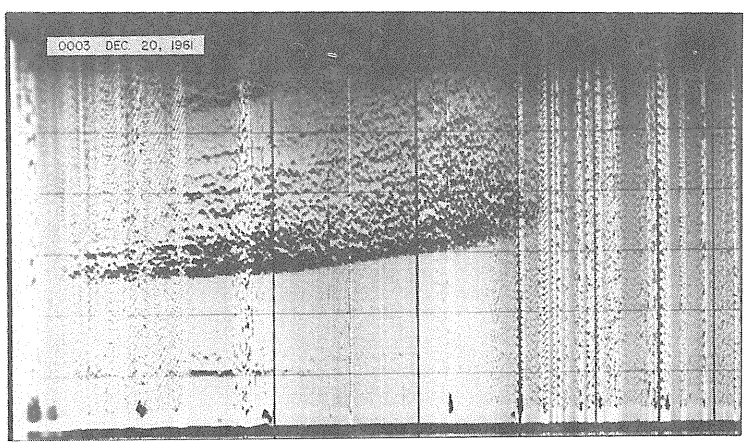
IONOSONDE: TYPE OR DESIGNATION: P 2
FREQUENCY RANGE: .1 MC TO 22 MC HEIGHT RANGE: 1000 KM
POWER: 10 KW. SWEEP TIME: 7.5 SEC. LOGARITHMIC FREQ. SCALE

DIP 38.3°N

MAUI







STATION: MAUI HAWAII

COORDINATES: GEOGRAPHIC LATITUDE: 20°50'N LONGITUDE: 156°30'W

GEOMAGNETIC LATITUDE: 20.9°N LONGITUDE: 268.1°

MAGNETIC DIP: 38.3°N TIME ZONE: 150°W

GYROFREQUENCY: 0.94 MC AT 200 KM.

TOTAL FIELD: 0.37 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4

FREQUENCY RANGE: 0.25 MC TO 20.0 MC

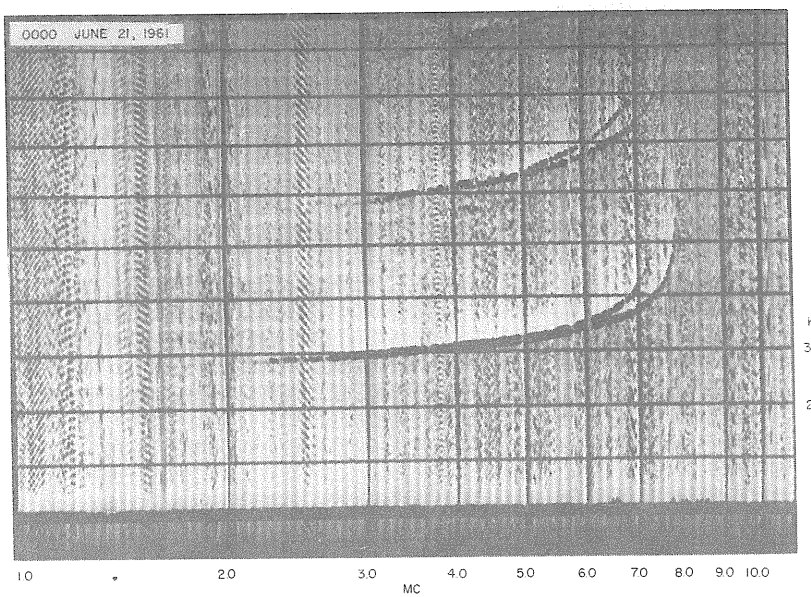
HEIGHT RANGE: 650 KM

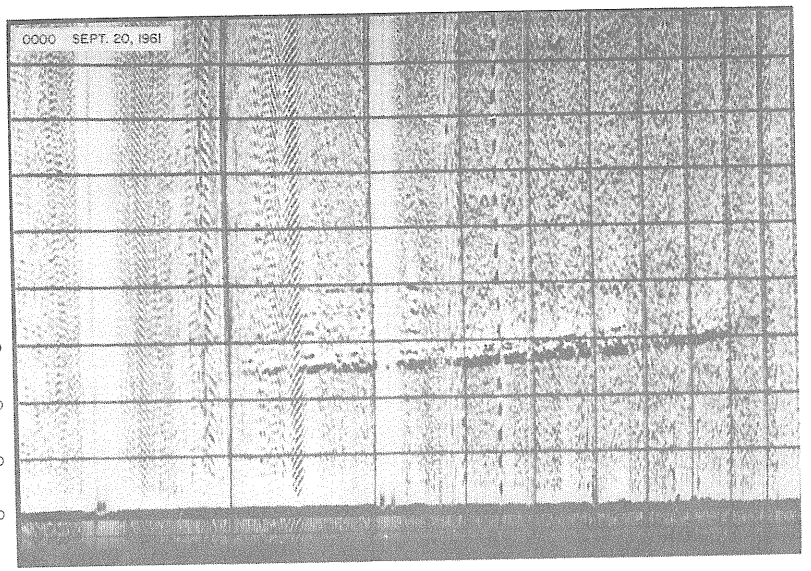
POWER: 25 KW

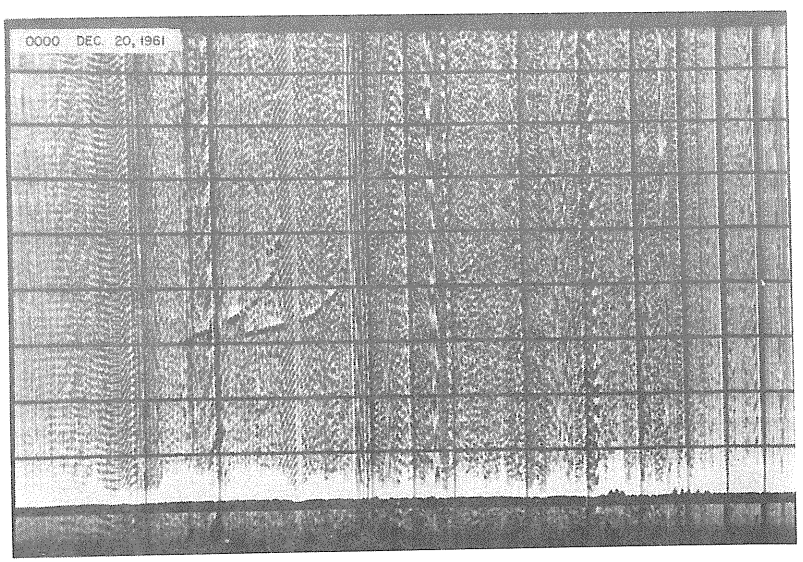
SWEEP TIME: 27 SEC

LOGARITHMIC FREQUENCY SCALE

DIP 36.8° N
OKINAWA





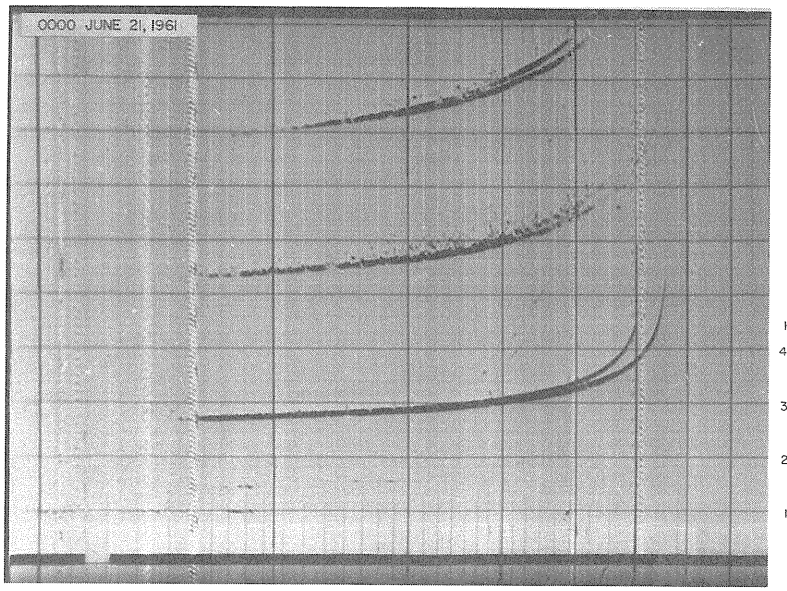


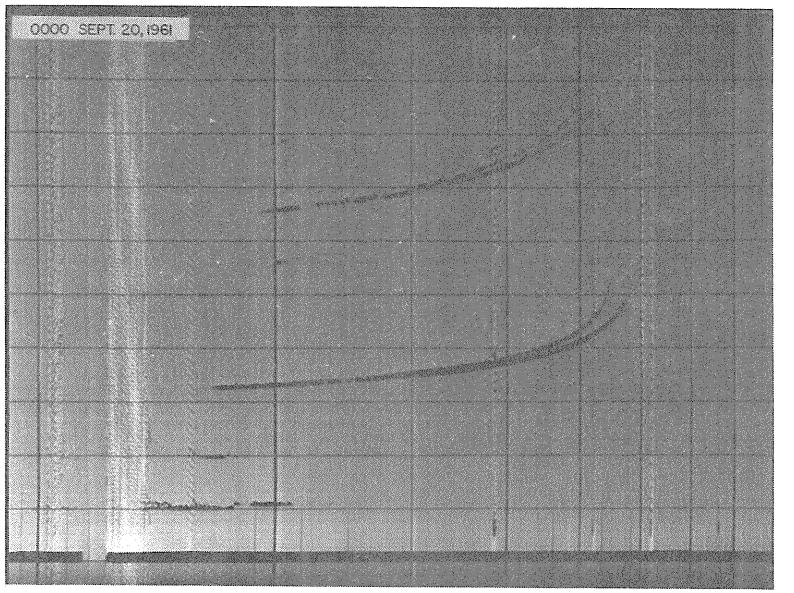
STATION: OKINAWA CHINA SEA

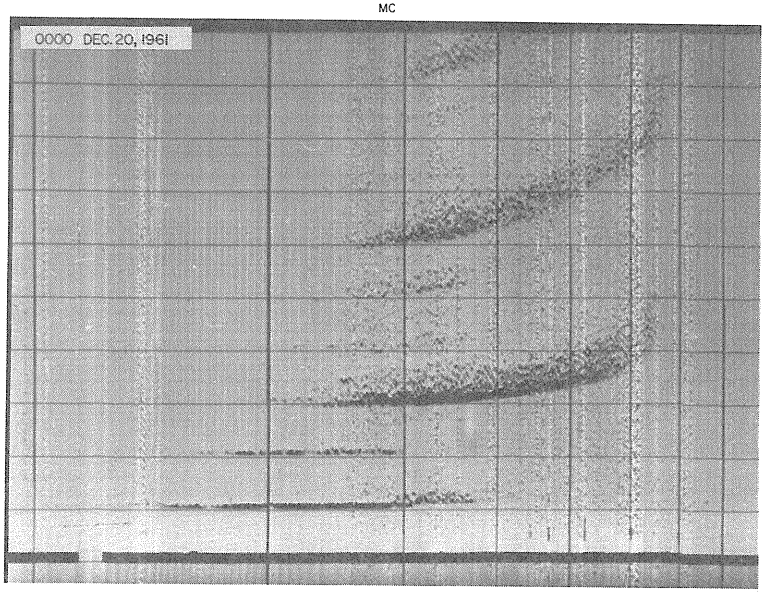
COORDINATES: GEOGRAPHIC LATITUDE: 26°19'N LONGITUDE: 127°47'E
GEOMAGNETIC LATITUDE: 15.3°N LONGITUDE: 195.6°
MAGNETIC DIP: 36.8°N TIME ZONE: 135°E
GYROFREQUENCY: 1.10 MC AT 200 KM
TOTAL FIELD: 0.43 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 36.4° S
CONCEPCION







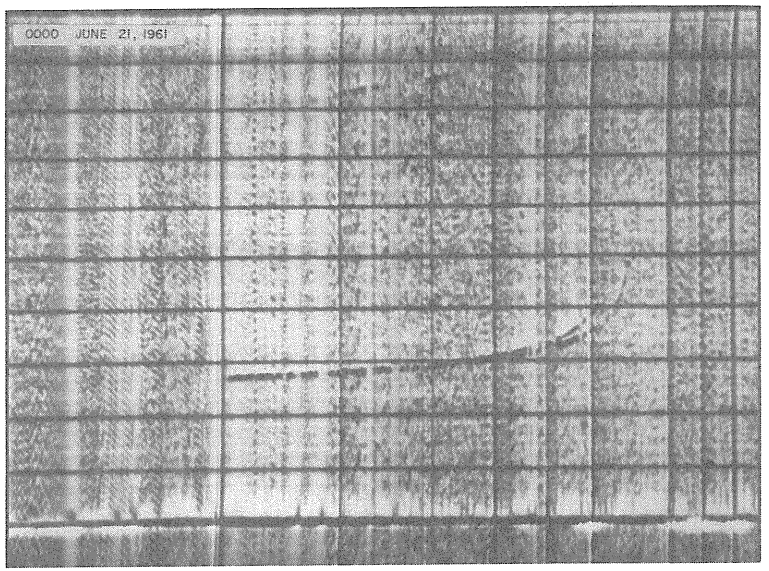
STATION: CONCEPCION CHILE

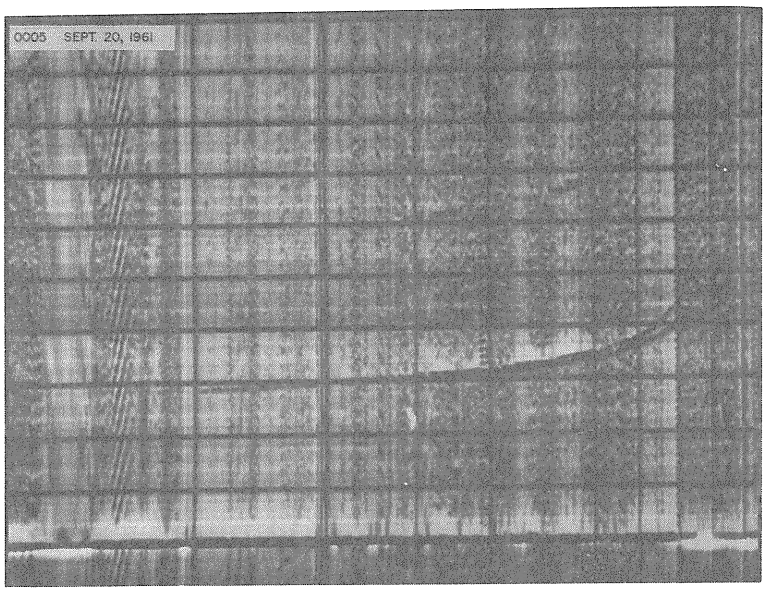
COORDINATES: GEOGRAPHIC LATITUDE: 36°47'S LONGITUDE: 73°01'W
GEOMAGNETIC LATITUDE: 25.1°S LONGITUDE: 356.5°
MAGNETIC DIP: 36.4°S TIME ZONE: 60°W
GYROFREQUENCY: 0.73 MC AT 200 KM
TOTAL FIELD: 0.285 OERSTED

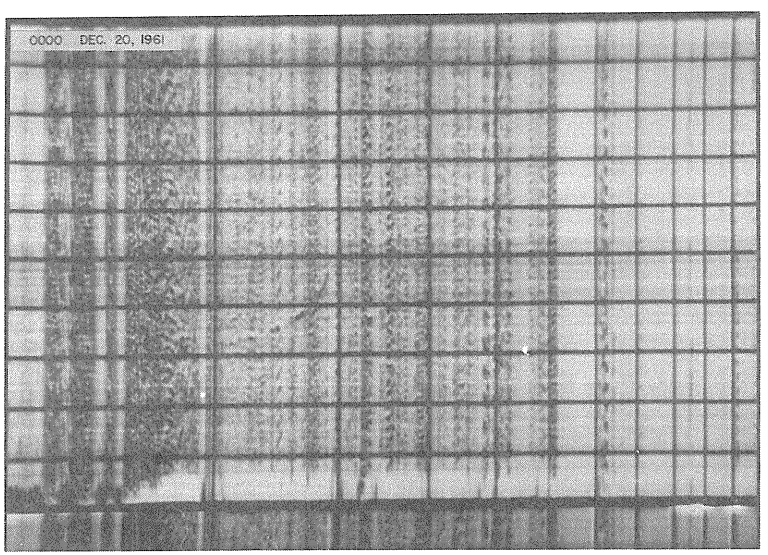
IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 15 KW
SWEEP TIME: 36 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 35.0° N

TAIPEI







STATION: TAIPEI TAIWAN

COORDINATES: GEOGRAPHIC LATITUDE: 25°00'N LONGITUDE: 121°30'E

GEOMAGNETIC LATITUDE: 13.7°N LONGITUDE: 189.8°

MAGNETIC DIP: 35.0°N TIME ZONE: 120°E

GYROFREQUENCY: 1.12 MC AT 200 KM

TOTAL FIELD; 0.44 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-2

FREQUENCY RANGE: 1.0 MC TO 25.0 MC

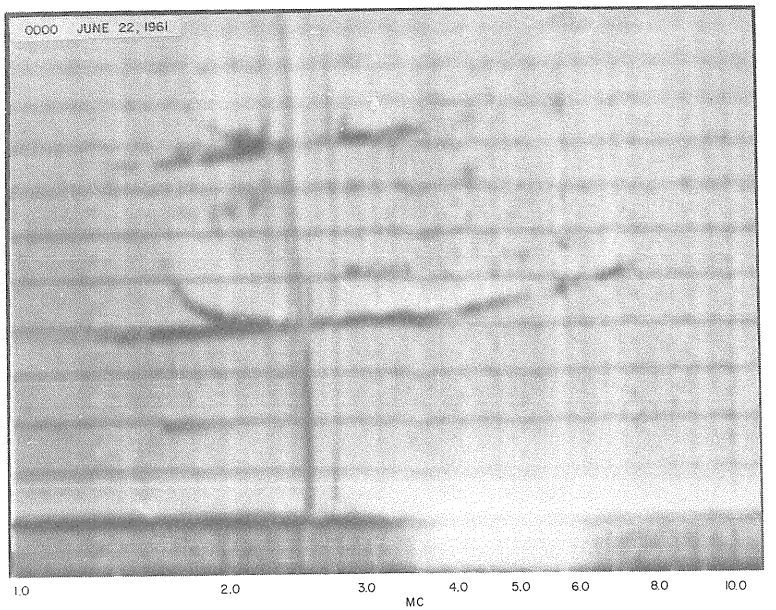
HEIGHT RANGE: 1000 KM

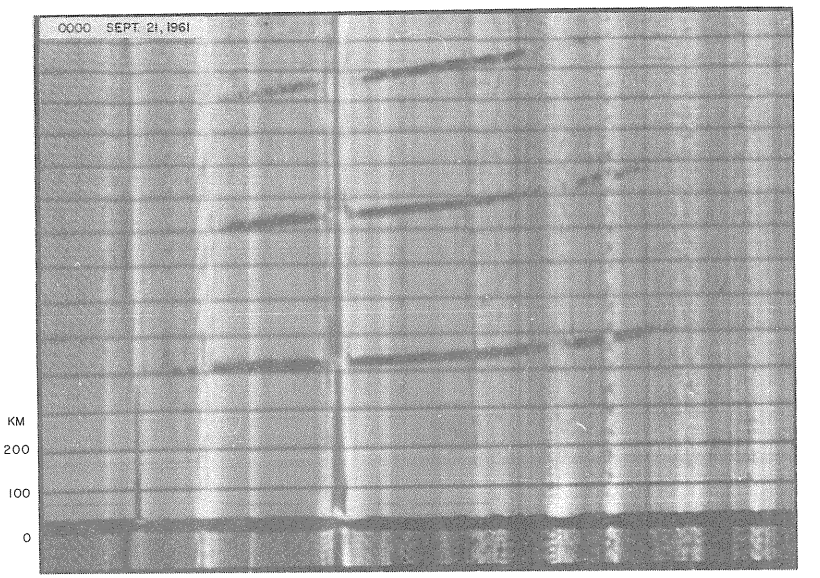
POWER: 15 KW

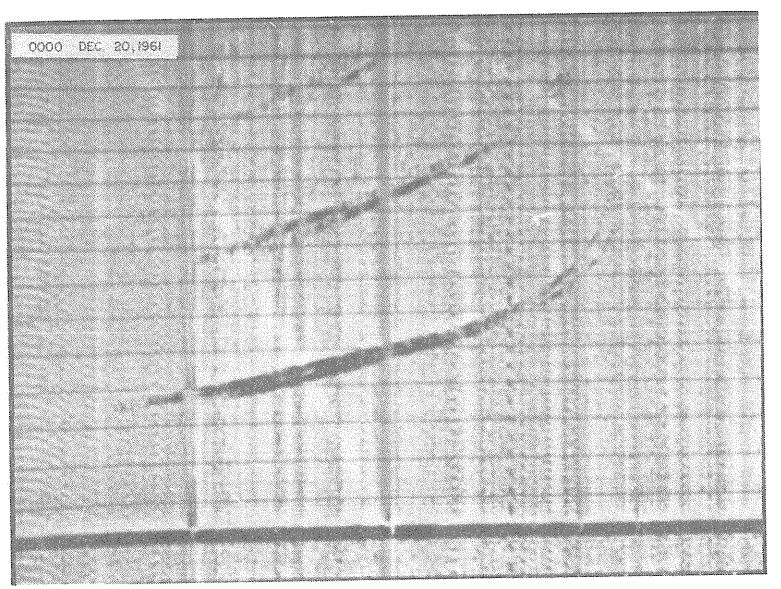
SWEEP TIME: 30 SEC

LOGARITHMIC FREQUENCY SCALE

DIP 33.2° S
PORT MORESBY





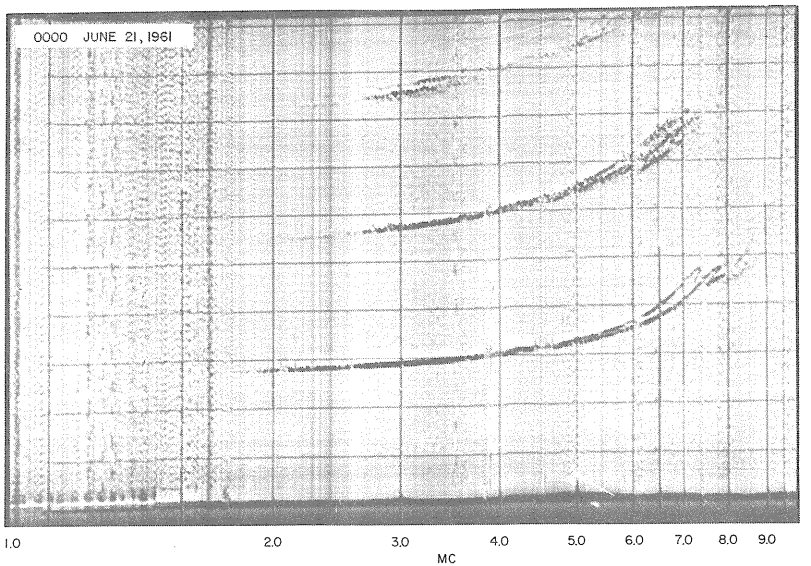


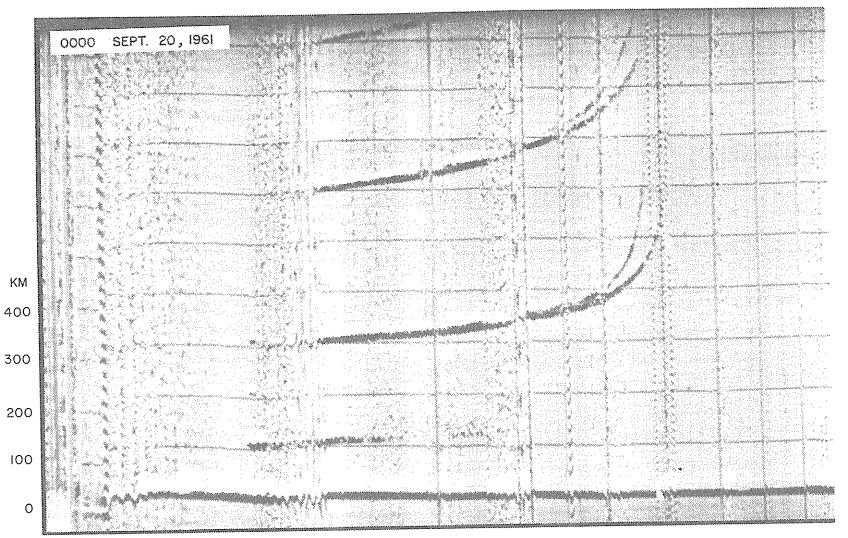
STATION: PORT MORESBY NEW GUINEA

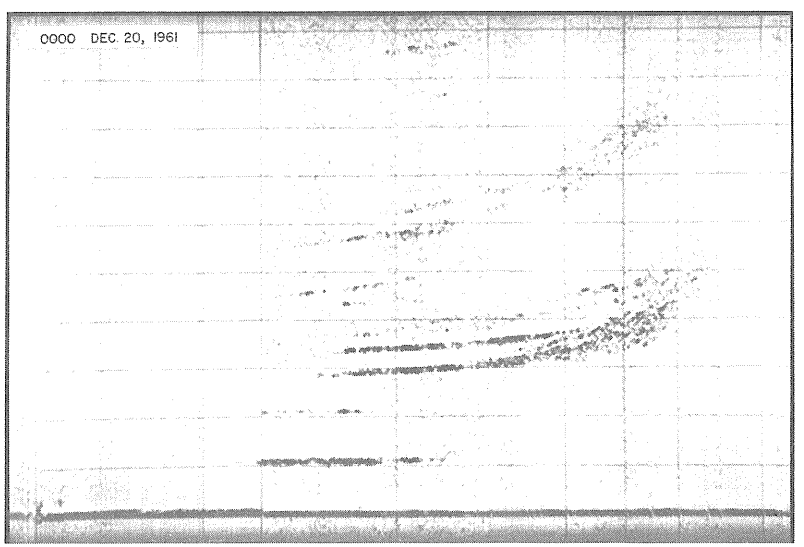
COORDINATES: GEOGRAPHIC LATITUDE: 9°26'S LONGITUDE: 147°13'E
GEOMAGNETIC LATITUDE: 18.6°S LONGITUDE: 217.8°
MAGNETIC DIP: 33.2°S TIME ZONE: 150°E
GYROFREQUENCY: 1.10 MC AT 200 KM
TOTAL FIELD: 0.43 OERSTED

IONOSONDE: TYPE OR DESIGNATION: IPS TYPE 3-C
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
POWER: 5 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 32.8° S
BUENOS AIRES







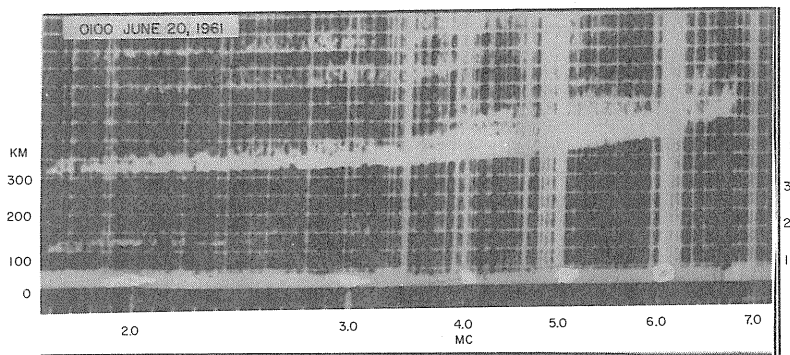
STATION: BUENOS AIRES ARGENTINA

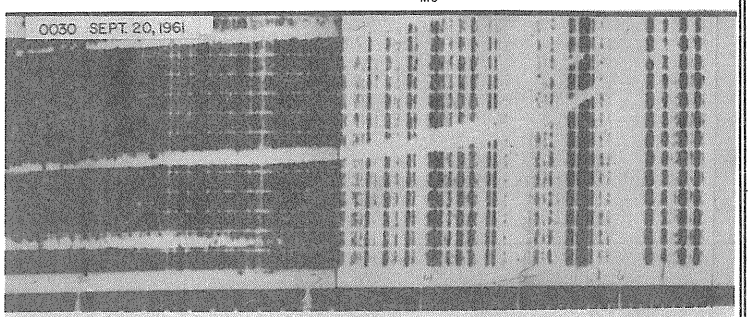
COORDINATES: GEOGRAPHIC LATITUDE: 34°35'S LONGITUDE: 58°29'W
GEOMAGNETIC LATITUDE: 23.2°S LONGITUDE: 9.4°
MAGNETIC DIP: 32.8°S TIME ZONE: 60°W
GYROFREQUENCY: 0.66 MC AT 200 KM

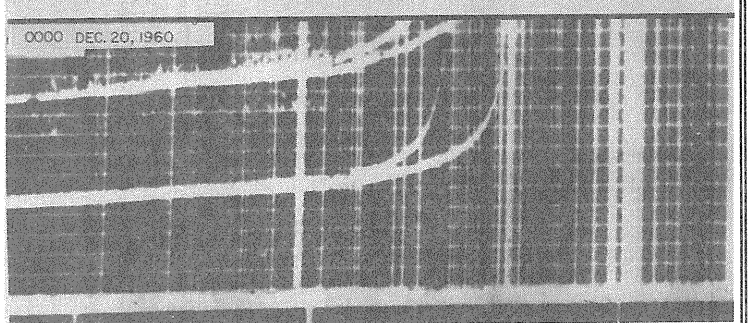
STARTING DATE: JANUARY 1956

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 25KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 31.8° N
AHMEDABAD





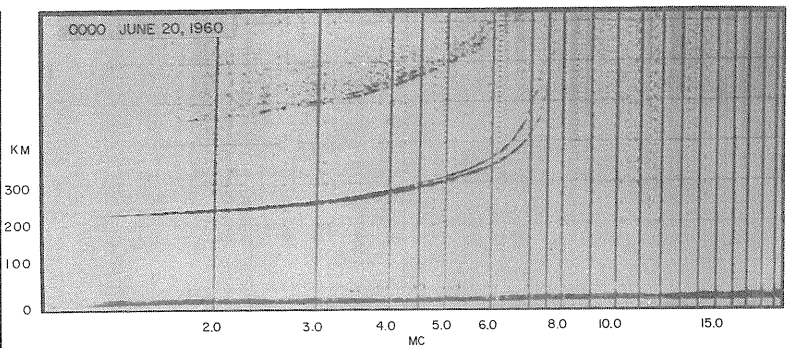


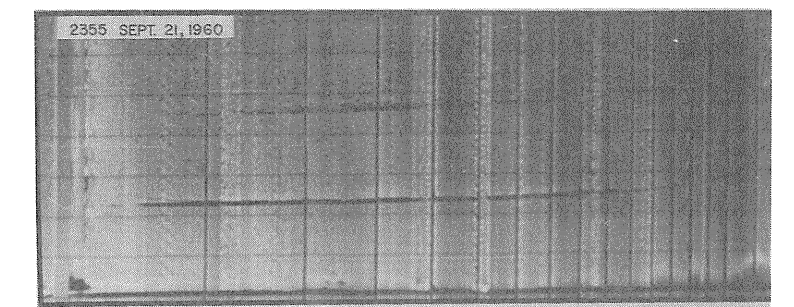
STATION: AHMEDABAD INDIA

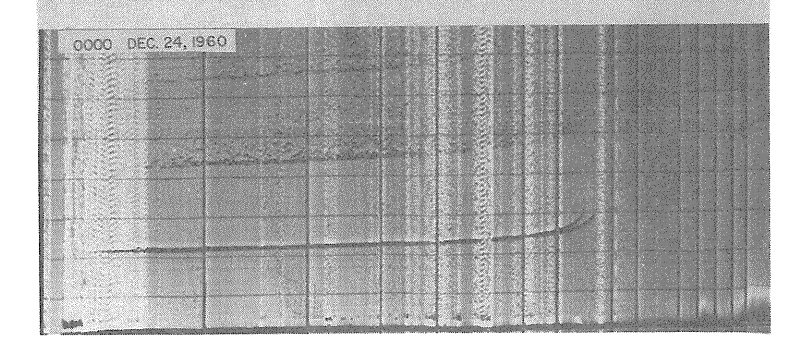
COORDINATES: GEOGRAPHIC LATITUDE: 23°01'N LONGITUDE: 72°36'E
GEOMAGNETIC LATITUDE: 13.8°N LONGITUDE: 143.9°
MAGNETIC DIP: 31.8°N GYROFREQUENCY: 1.12 MC. AT 200 KM
TOTAL FIELD: 0.44 OERSTED TIME ZONE: 75°E

IONOSONDE: TYPE OR DESIGNATION: BRITISH N.P.L. TYPE MK II
FREQUENCY RANGE: 0.6 MC TO 25.0 MC
HEIGHT RANGE: NOT FIXED (NORMALLY KEPT 1000 KM)
POWER: ABOUT 240 WATTS AT H. F. RANGE
ABOUT 1700 WATTS AT L. F. RANGE
SWEEP TIME: 5 MIN (1 MIN PER BAND)
LINEAR FREQUENCY SCALE IN EACH BAND

DIP 31.7° N
BOGOTA





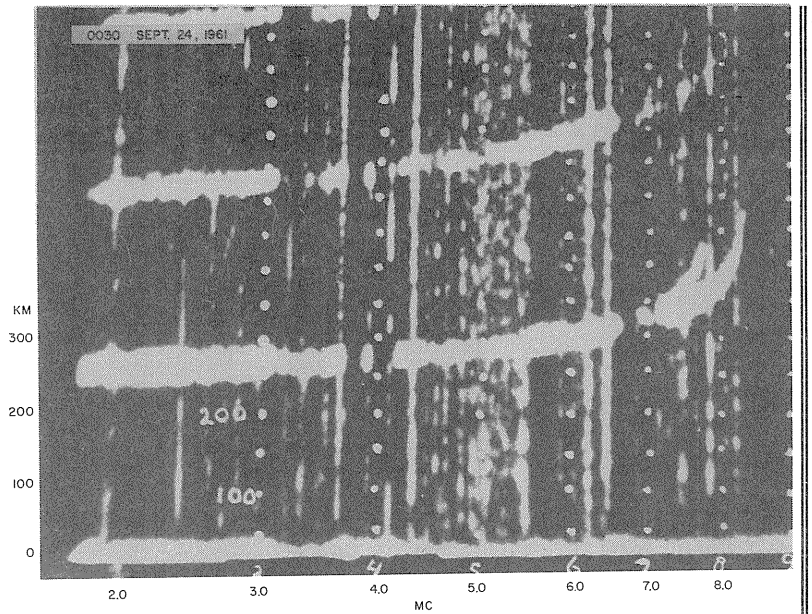


STATION: BOGOTA COLOMBIA

COORDINATES: GEOGRAPHIC LATITUDE: 4°38'N LONGITUDE: 74°05'W
GEOMAGNETIC LATITUDE: 15.9°N LONGITUDE: 354.6°
MAGNETIC DIP: 31.7°N TIME ZONE: 75°W
GYROFREQUENCY: 0.89 MC AT 200 KM
TOTAL FIELD: 0.35 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 25 KW
SWEEP TIME: 13.5 SEC LOGARITHMIC FREQUENCY SCALE

DIP 31.1° N
PARAMARIBO

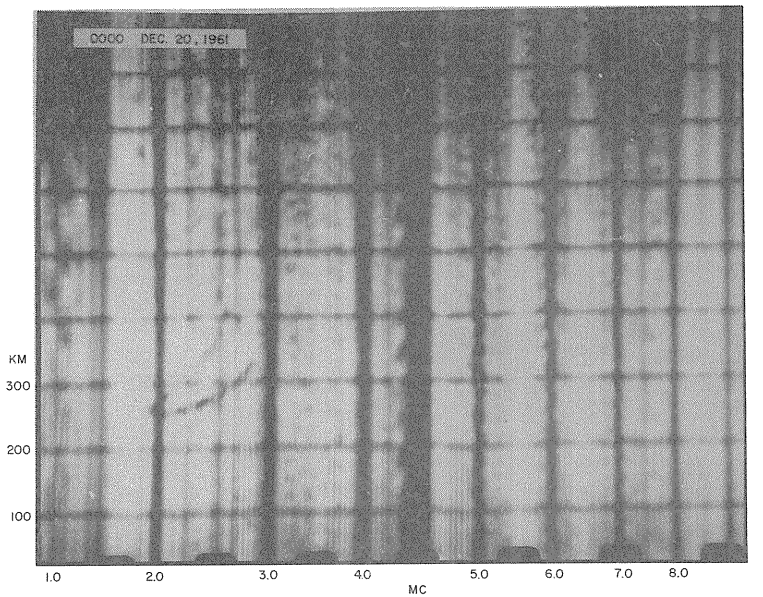


STATION: PARAMARIBO SURINAM

COORDINATES: GEOGRAPHIC LATITUDE: 05°49'N LONGITUDE: 55°13'W
GEOMAGNETIC LATITUDE: 17.0°N LONGITUDE: 14.4°
MAGNETIC DIP: 31.1°N TIME ZONE: 0°
GYROFREQUENCY: 0.87 MC AT 200 KM
TOTAL FIELD: 0.34 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.4 MC TO 20 MC
HEIGHT RANGE: 0 - 1000 KM
POWER: 5 KW
SWEEP TIME: 40 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 29.7°N
MACAO

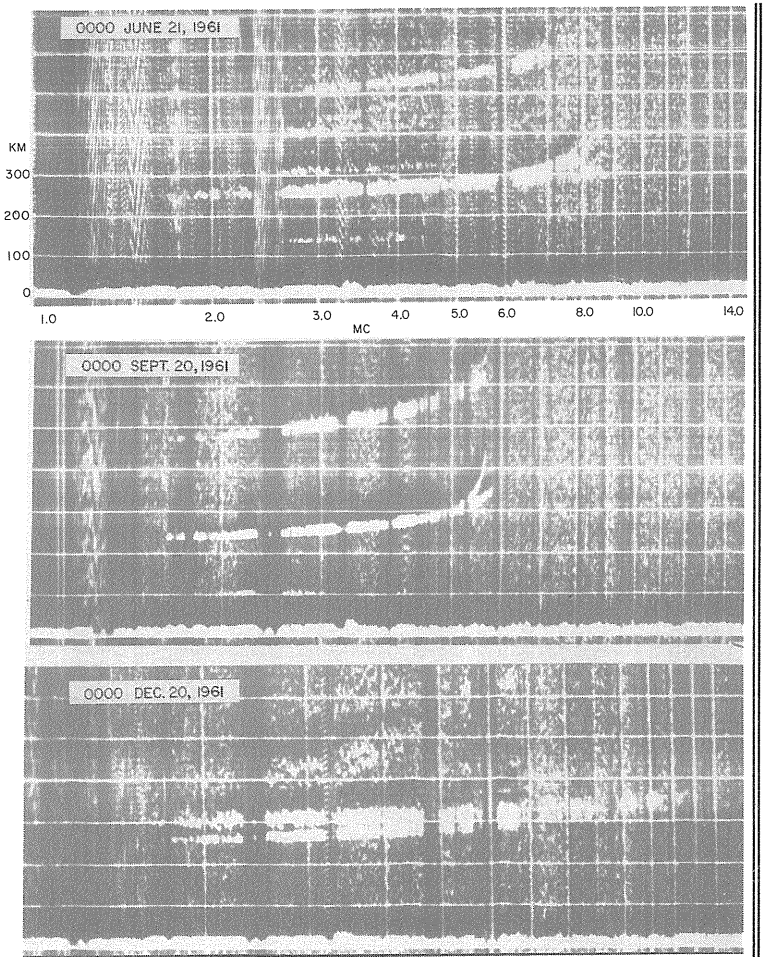


STATION: MACAO (MACAU) CHINA SEA

COORDINATES: GEOGRAPHIC LATITUDE: 22°12'N LONGITUDE: 113° 33' E
GEOMAGNETIC LATITUDE: 10.7°N LONGITUDE: 182.4°
MAGNETIC DIP: 29.7°N TIME ZONE: 120°E
GYROFREQUENCY: 1.12 MC AT 200 KM
TOTAL FIELD: 0.44 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.6 MC TO 20 MC
HEIGHT RANGE: ADJUSTABLE
POWER: 1 KW
SWEEP TIME: 15 SEC
LINEAR FREQUENCY SCALE

DIP 23.3° S
SAO PAULO

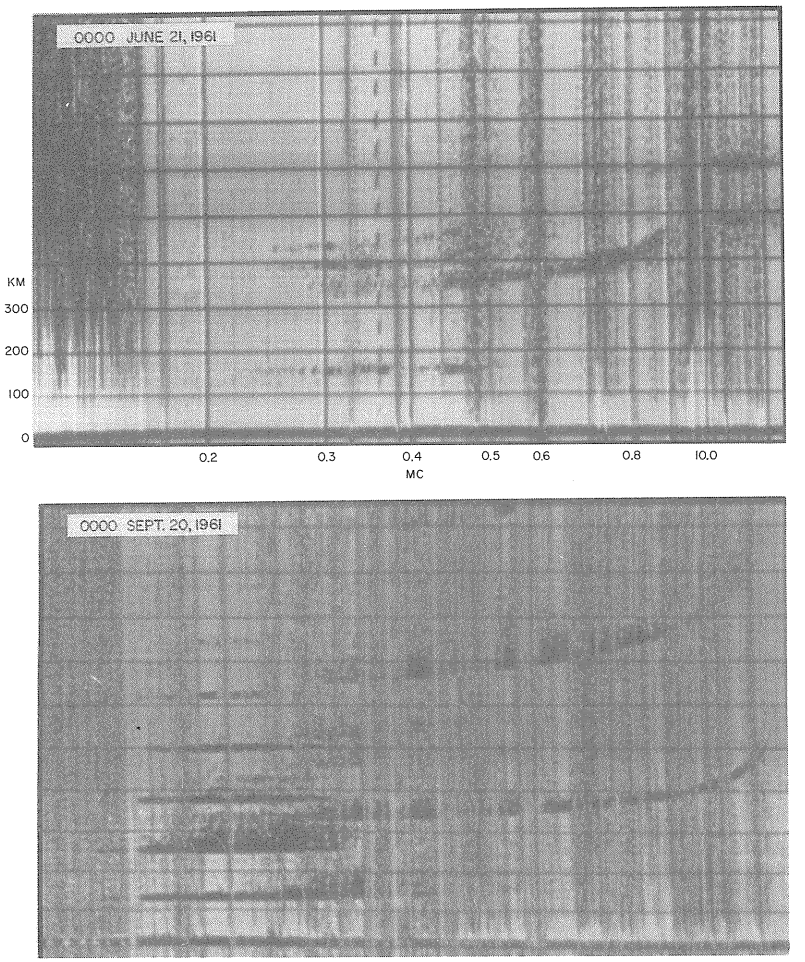


STATION: SAO PAULO BRAZIL

COORDINATES: GEOGRAPHIC LATITUDE: 23°33'S LONGITUDE: 46°38'W
GEOMAGNETIC LATITUDE: 12.8°S LONGITUDE: 21.1°
MAGNETIC DIP: 23.3°S GYROFREQUENCY: 0.61 MC. AT 200 KM.
TOTAL FIELD: 0.24 OERSTED. TIME ZONE: 45°W

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1 MC TO 25 MC
HEIGHT RANGE: 500 - 1000 - 4000 KM POWER: 10 KW
SWEEP TIME: 10 SEC LOGARITHMIC FREQUENCY SCALE

DIP 22.8° S
TUCUMAN

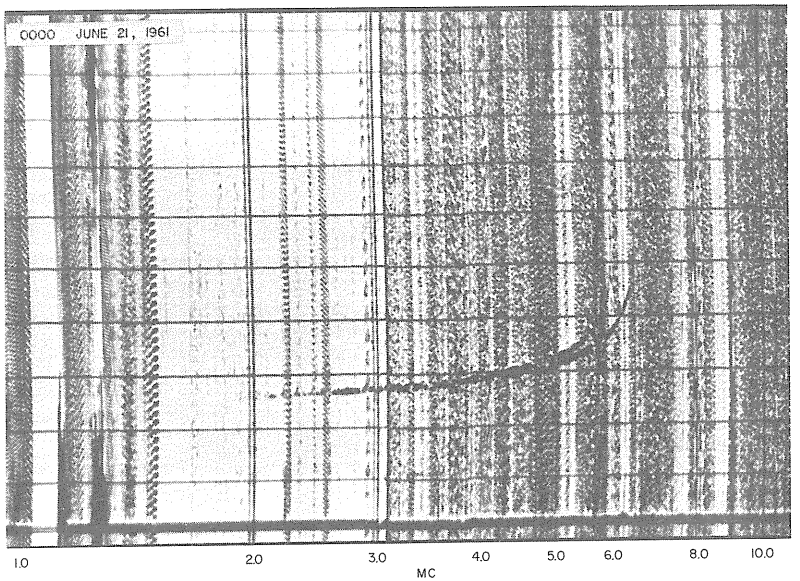


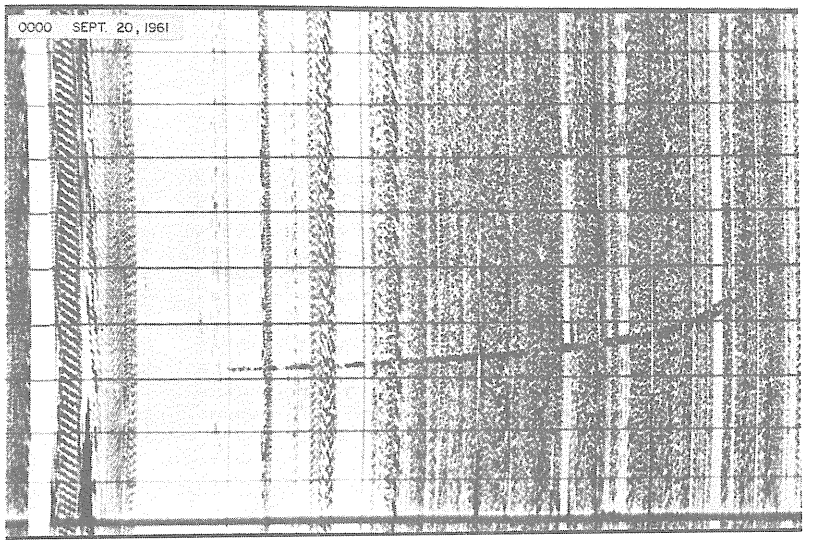
STATION: TUCUMAN ARGENTINA

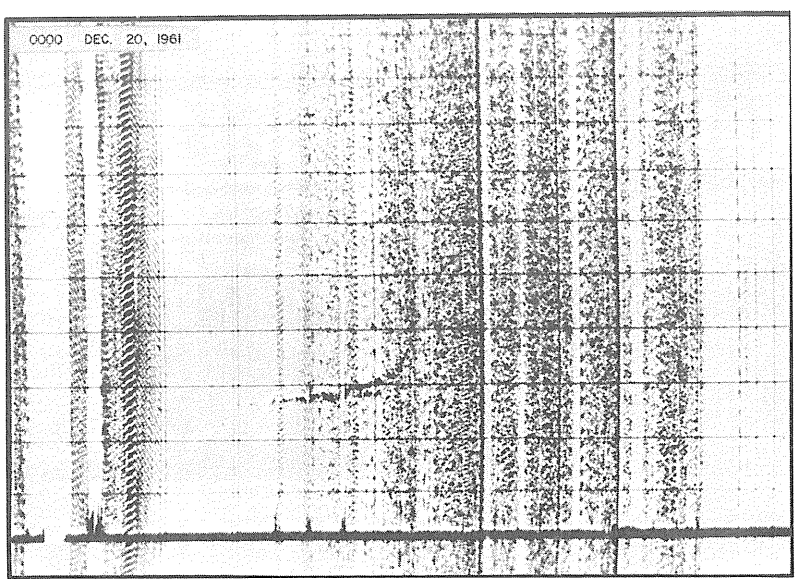
COORDINATES: GEOGRAPHIC LATITUDE: 26°53 S LONGITUDE: 65°23'W
GEOMAGNETIC LATITUDE: 15.4°S LONGITUDE: 3.3°
MAGNETIC DIP: 22.8°S GYROFREQUENCY: 0.69 MC. AT 200 KM
TOTAL FIELD: 0.27 OERSTED TIME ZONE: 60°W

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 23 MC
HEIGHT RANGE: 1000 KM POWER: 10 KW (NOMINAL)
SWEEP TIME: 30 SEC LOGARITHMIC FREQUENCY SCALE

DIP 18.5°N
BAGUIO





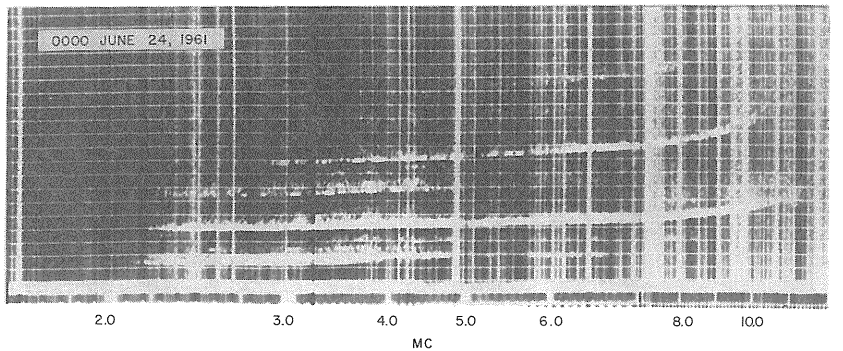


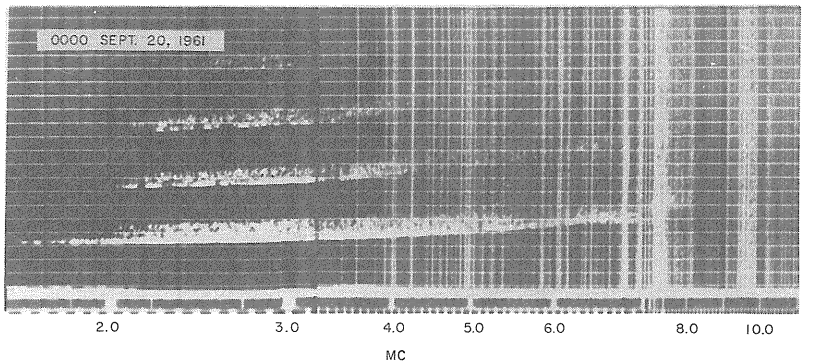
STATION: BAGUIO PHILIPPINES

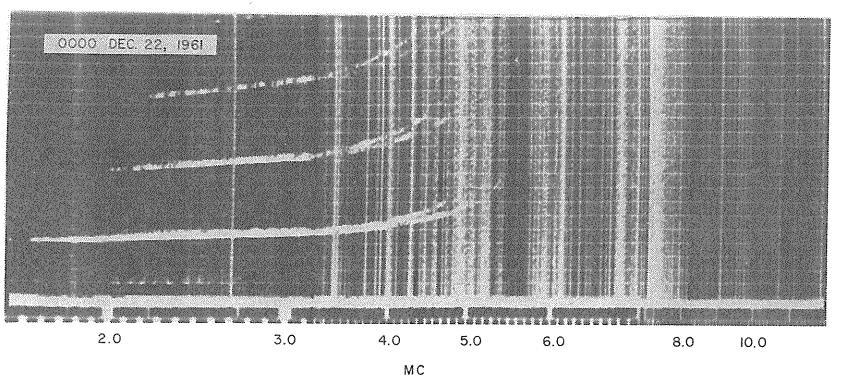
COORDINATES: GEOGRAPHIC LATITUDE: 16°25'N LONGITUDE: 120°35'E
GEOMAGNETIC LATITUDE: 5.1°N LONGITUDE: 189.2°
MAGNETIC DIP: 18.5°N TIME ZONE: 120°E
GYROFREQUENCY: 1.05 MC AT 200 KM
TOTAL FIELD: 0.41 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 8.0 KW
SWEEP TIME: 27 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 18.3°S
SINGAPORE





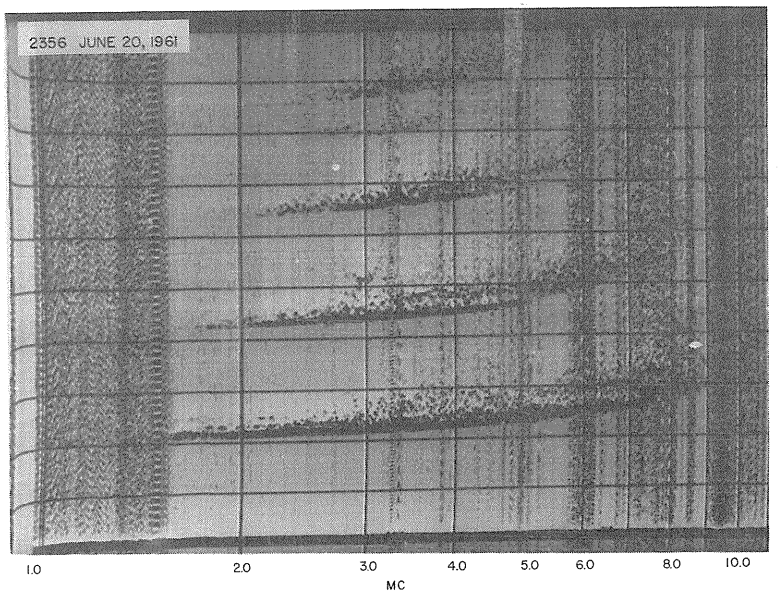


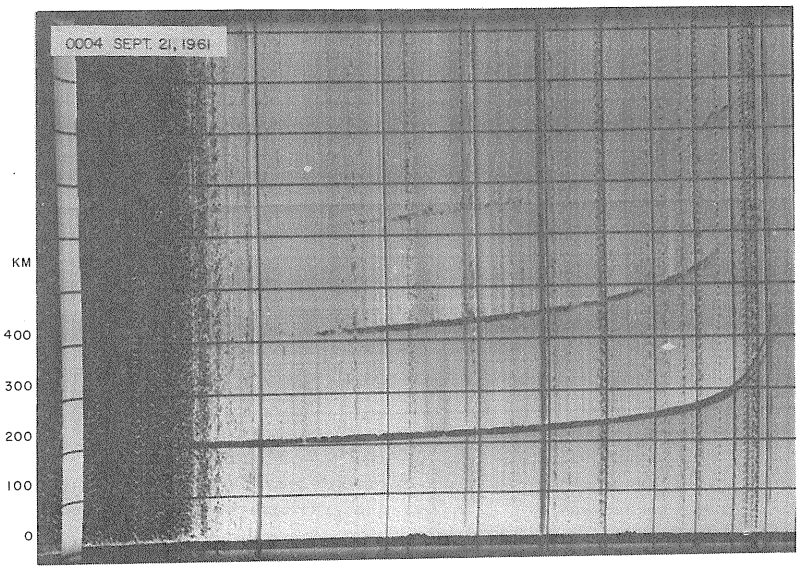
STATION: SINGAPORE MALAYA

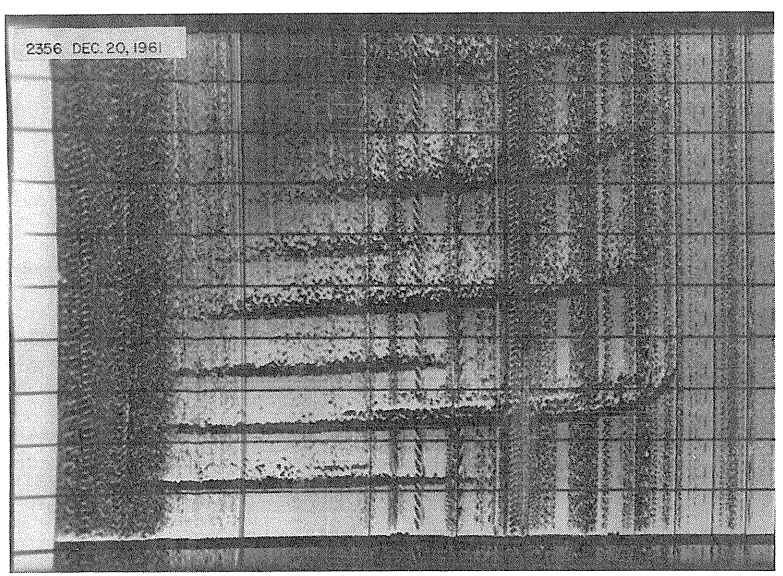
COORDINATES: GEOGRAPHIC LATITUDE: 01°19'N LONGITUDE: 103°49'E
GEOMAGNETIC LATITUDE: 10.1°S LONGITUDE: 172.7°
MAGNETIC DIP: 18.3°S TIME ZONE: 105°E
GYROFREQUENCY: 1.04 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1400 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 13.2° N
TALARA





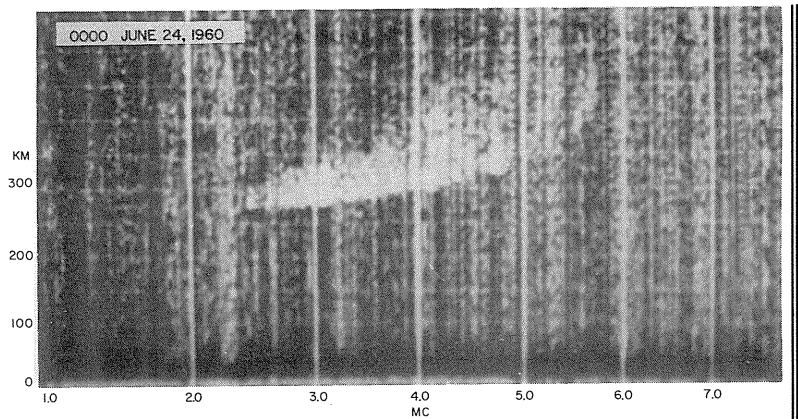


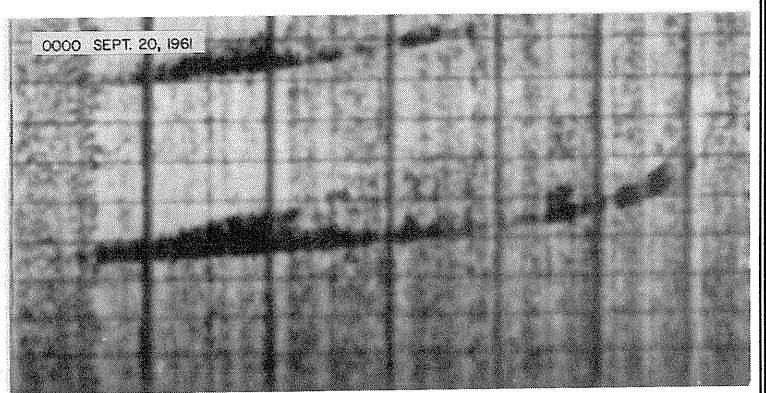
STATION: TALARA PERU U. S. A. AFFILIATION

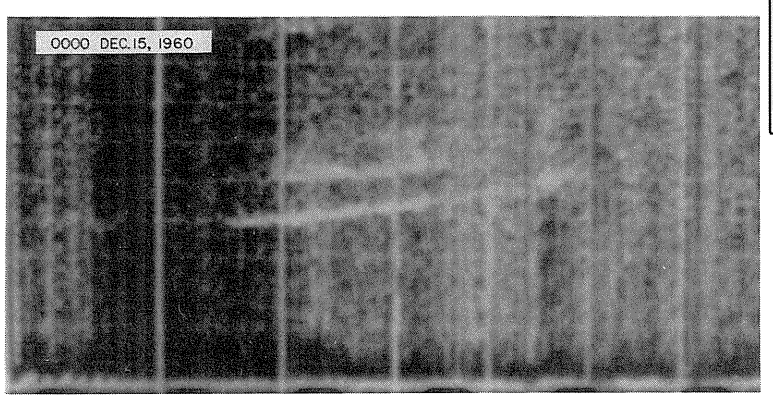
COORDINATES: GEOGRAPHIC LATITUDE: 04°34'S LONGITUDE: 81°15'W
GEOMAGNETIC LATITUDE: 06.6°N LONGITUDE: 347.7°
MAGNETIC DIP: 13.2°N TIME ZONE: 75°W
GYROFREQUENCY: 0.82 MC. AT 200 KM
TOTAL FIELD: 0.32 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 15 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 7.4° S
KUMASI





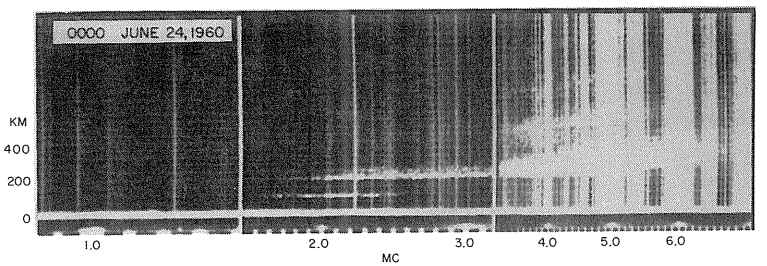


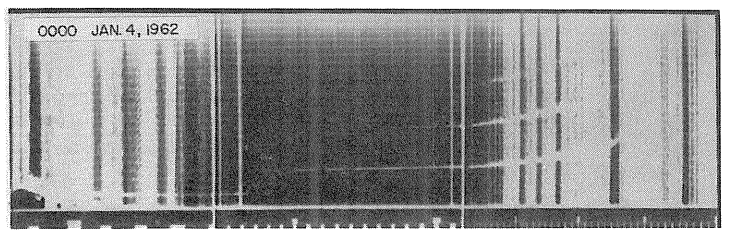
STATION: KUMASI GHANA

COORDINATES: GEOGRAPHIC LATITUDE: 06°42'N LONGITUDE: 01°34'W
GEOMAGNETIC LATITUDE: 11.0°N LONGITUDE: 69.0°
MAGNETIC DIP: 7.4°S GYROFREQUENCY: 0.79 MC. AT 200 KM
TOTAL FIELD: 0.31 OERSTED TIME ZONE: U. T. + 00.00

IONOSONDE: TYPE OR DESIGNATION: STATION'S OWN DESIGN AND CONSTRUCTION
FREQUENCY RANGE: 0.9 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM. POWER: 2 KW
SWEEP TIME: 20 SEC

DIP 3.9° S
IBADAN





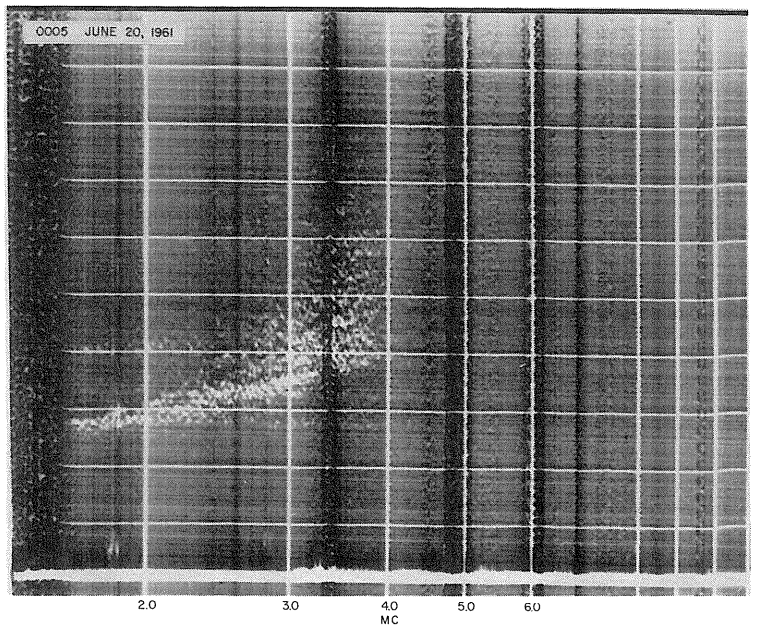
STATION: IBADAN NIGERIA

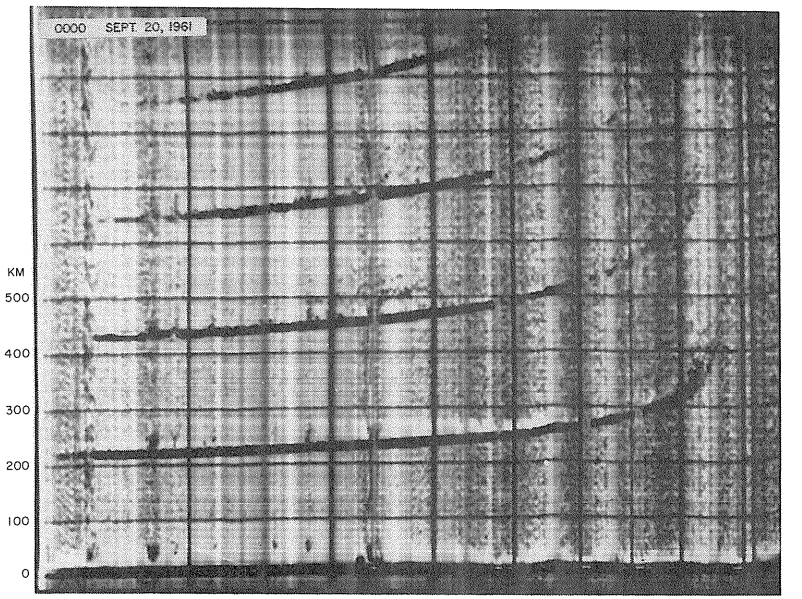
COORDINATES: GEOGRAPHIC LATITUDE: 07°26'N LONGITUDE: 3°53'E
GEOMAGNETIC LATITUDE: 10.6°N LONGITUDE: 74.7°
MAGNETIC DIP: 3.9°S TIME ZONE: 0°
GYROFREQUENCY: 0.82 MC AT 200 KM TOTAL FIELD: 0.32 OERSTED

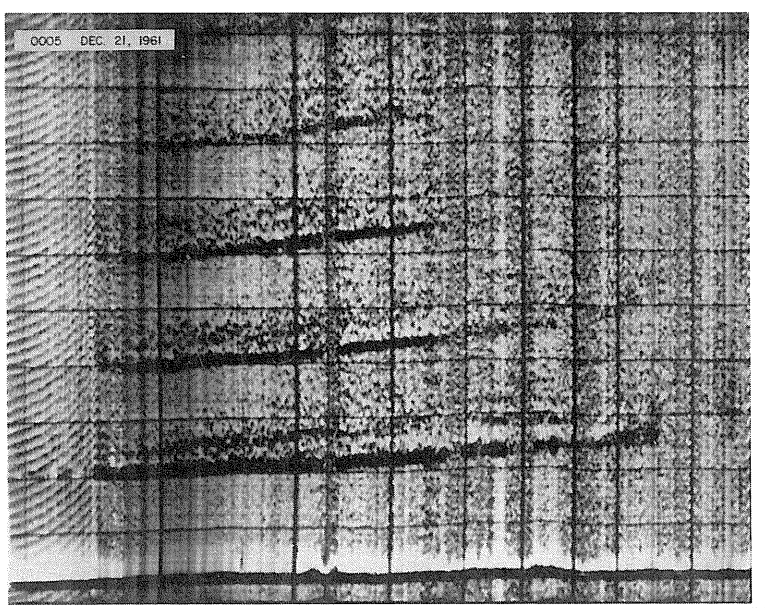
IONOSONDE: TYPE OR DESIGNATION: UNION RADIO MK II
FREQUENCY RANGE: 0.7 MC TO 25 MC HEIGHT RANGE: 600 KM
POWER: ABOUT 1 PEAK KW SWEEP TIME: 300 SEC

DIP 3.6° S

NATAL





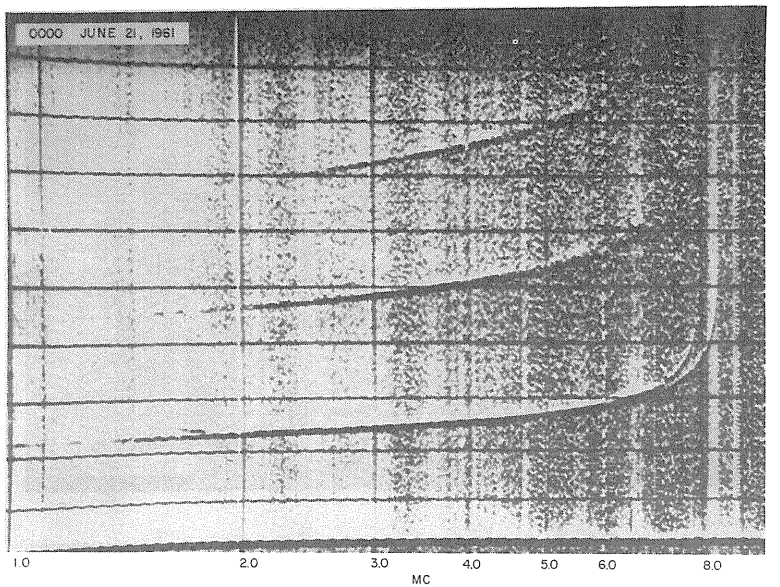


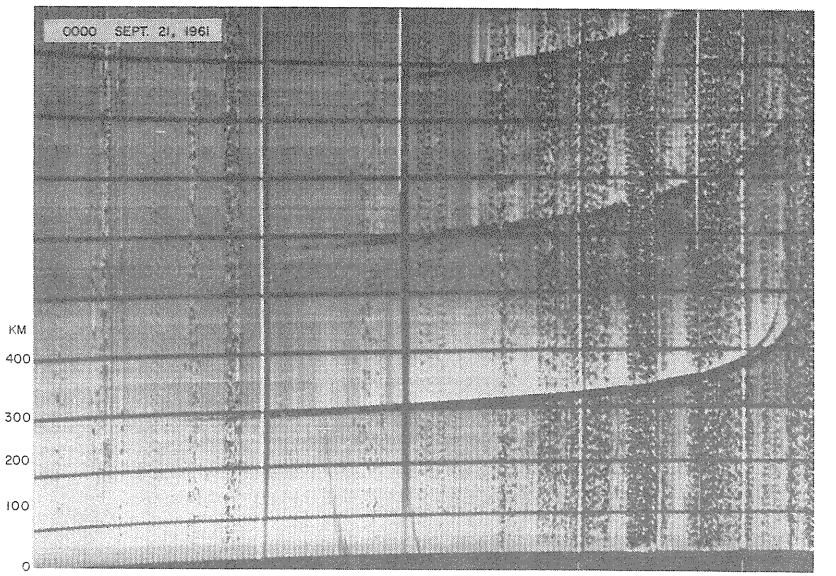
STATION: NATAL BRAZIL

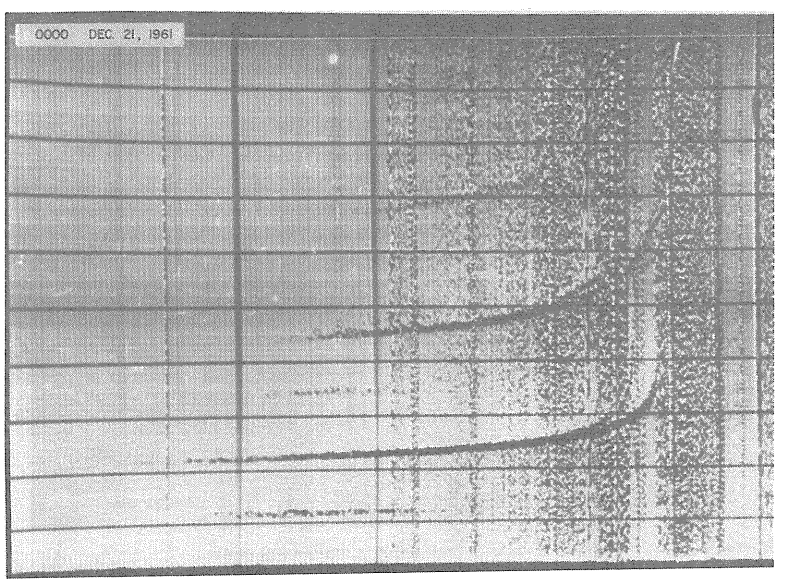
COORDINATES: GEOGRAPHIC LATITUDE: 5°42'S LONGITUDE: 35°12'W
GEOMAGNETIC LATITUDE: 3.9°N LONGITUDE: 33.7°
MAGNETIC DIP: 3.6°S TIME ZONE: 30°W
GYROFREQUENCY: .71 MC AT 200 KM
TOTAL FIELD: 0.28 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 25 KW
SWEEP TIME: 35 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 2.4° N
KODAIKANAL





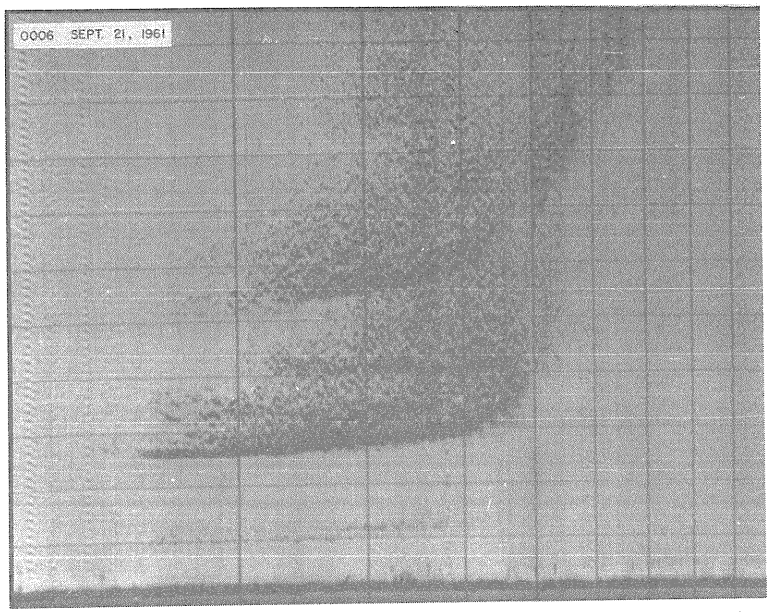


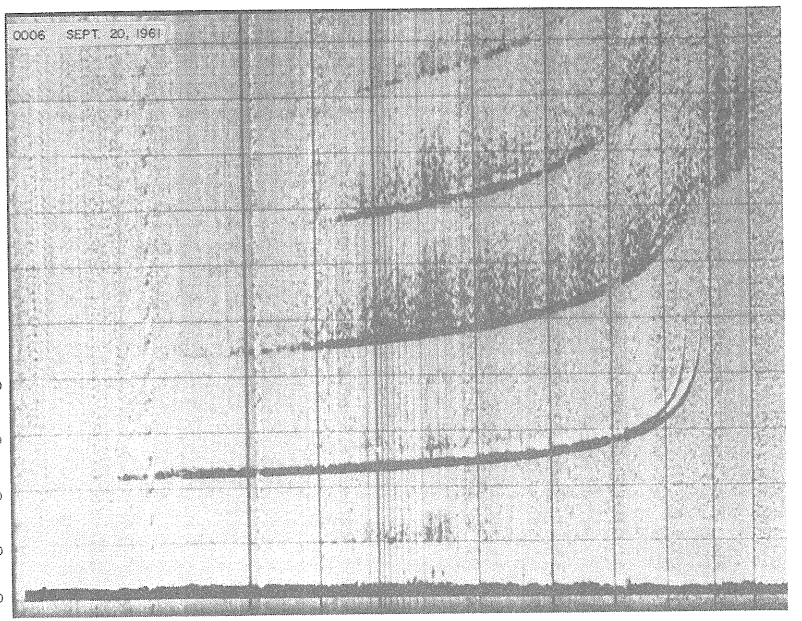
STATION: KODAIKANAL INDIA

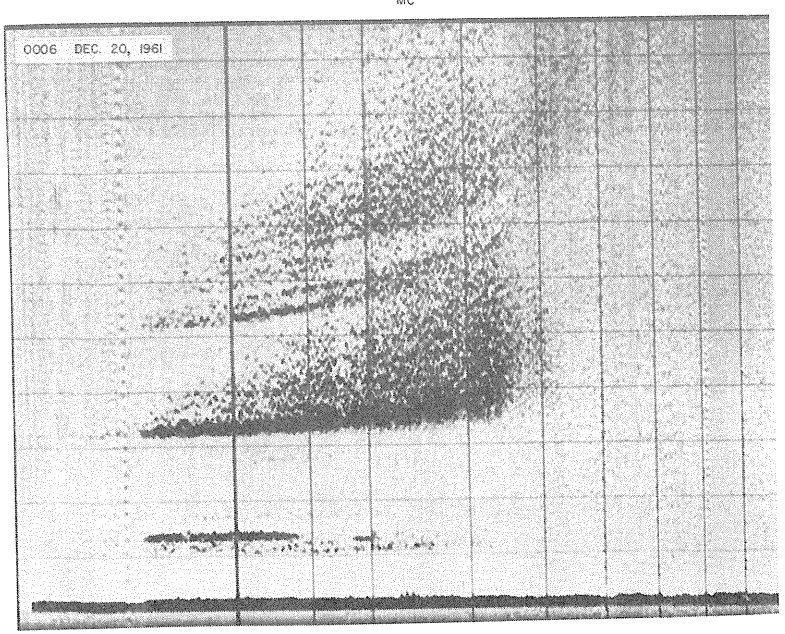
COORDINATES: GEOGRAPHIC LATITUDE: 10°14'N LONGITUDE: 77°29'E
GEOMAGNETIC LATITUDE: 0.6°N LONGITUDE: 147.1°
MAGNETIC DIP: 2.4°N TIME ZONE: 75°E
GYROFREQUENCY: 1.00 MC AT 200 KM
TOTAL FIELD: 0.39 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000, and 4000 KM
POWER: 10 KW (NOMINAL)
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 1.2° N
HUANCAYO







STATION: HUANCAYO PERU

COORDINATES: GEOGRAPHIC LATITUDE: 12°03'S LONGITUDE: 75°20'W
GEOMAGNETIC LATITUDE: 0.6°S LONGITUDE: 353.8°
MAGNETIC DIP: 1.2°N TIME ZONE: 75°W
GYROFREQUENCY: 0.82 MC AT 200 KM
TOTAL FIELD: 0.32 OERSTED

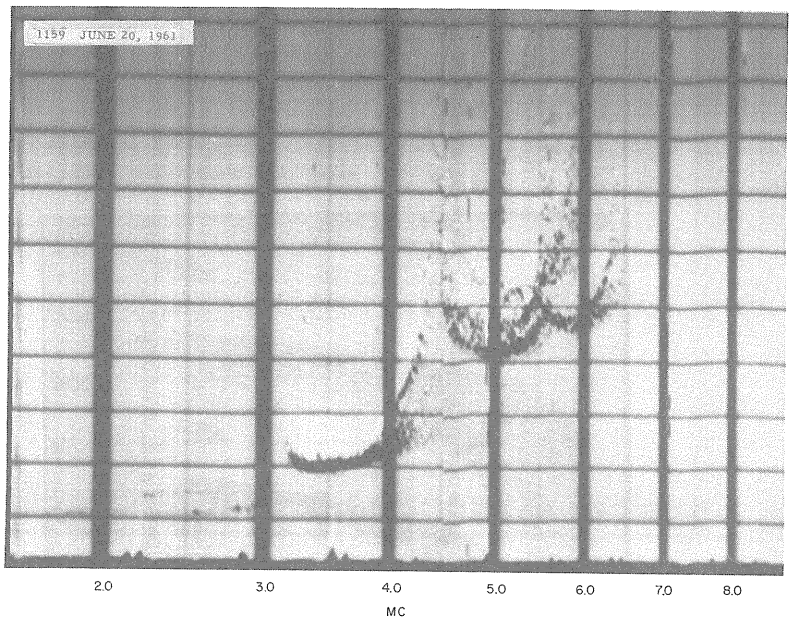
IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 25 KW
SWEEP TIME: 120 SEC
LOGARITHMIC FREQUENCY SCALE

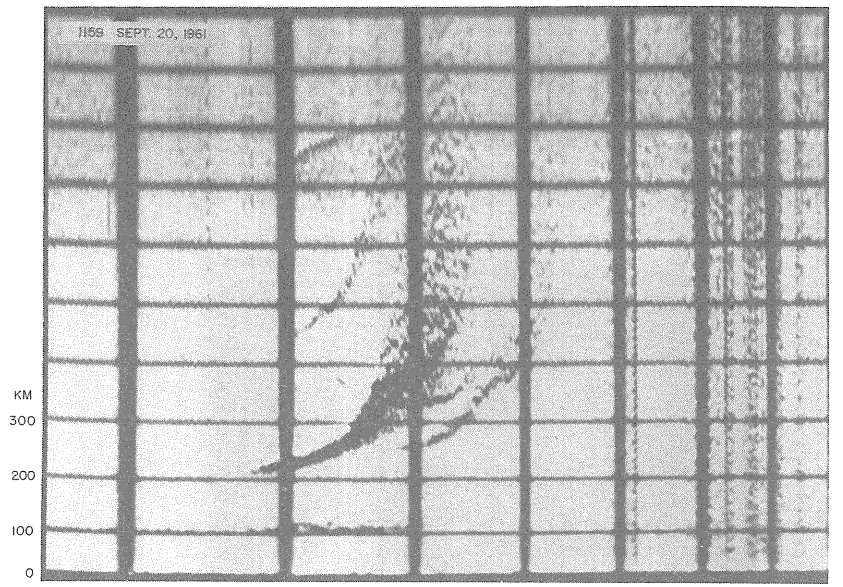
SECTION II-B

NOON IONOGRAMS

STATIONS ARRANGED BY DIP

DIP 89.2° N
RESOLUTE BAY



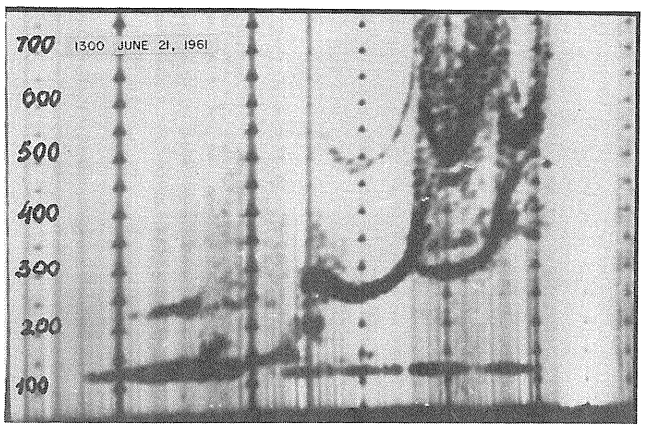


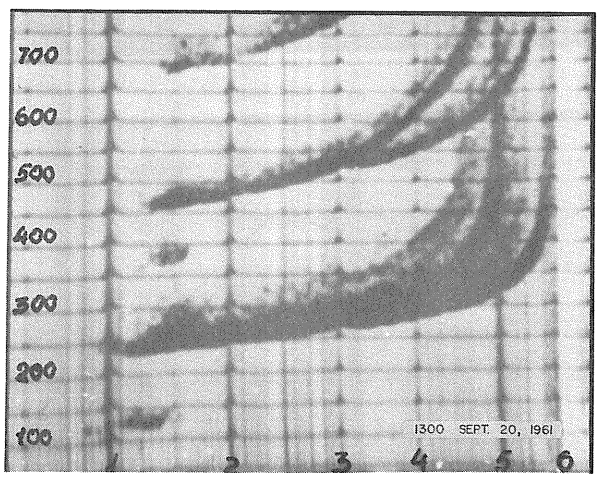
STATION: RESOLUTE BAY CANADA D.O.T./D.R.T.E., AFFILIATION

COORDINATES: GEOGRAPHIC LATITUDE: 74.7°N LONGITUDE: 94°.9 W
GEOMAGNETIC LATITUDE: 83.0°N LONGITUDE: 289.3°
MAGNETIC DIP: 89.2°N TIME ZONE: 90°W
GYROFREQUENCY: 1.48 MC AT 200 KM
TOTAL FIELD: 0.58 OERSTED

IONOSONDE: TYPE OR DESIGNATION: LG-17 (MODIFIED)
FREQUENCY RANGE: 1.0 MC. TO 16.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
≈ LOGARITHMIC FREQUENCY SCALE

DIP 86.9°N
NORTH POLE-8



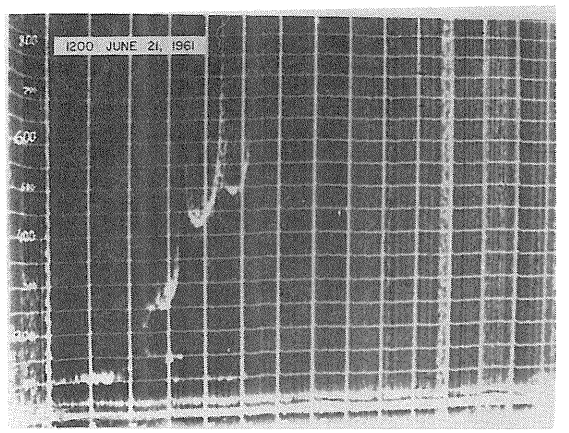


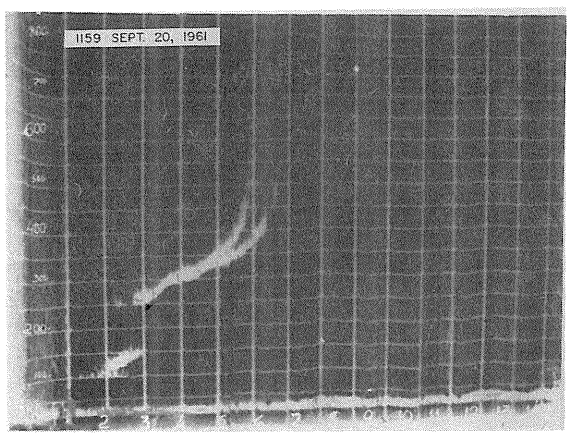
STATION: NORTH POLE - 8 USSR

COORDINATES:
- GEOGRAPHIC LATITUDE: ~83°38'N ~82°37'N — LONGITUDE: ~142°48'W ~144°56'W
- GEOMAGNETIC LATITUDE: 72.4°N 71.5°N — LONGITUDE: ~188.8° ~192.4°
- MAGNETIC DIP: ~86.9°N ~86.4°N — TIME ZONE: 135°W

IONOSONDE:
- TYPE OR DESIGNATION: PAIS
- FREQUENCY RANGE: 1.0 - 16.0 MC
- HEIGHT RANGE: 1000 KM
- POWER: 1 - 2 KW
- SWEEP TIME: 7.5 SEC
- FREQUENCY SCALE: LINEAR

DIP 83.5°N
DIXON ISLAND



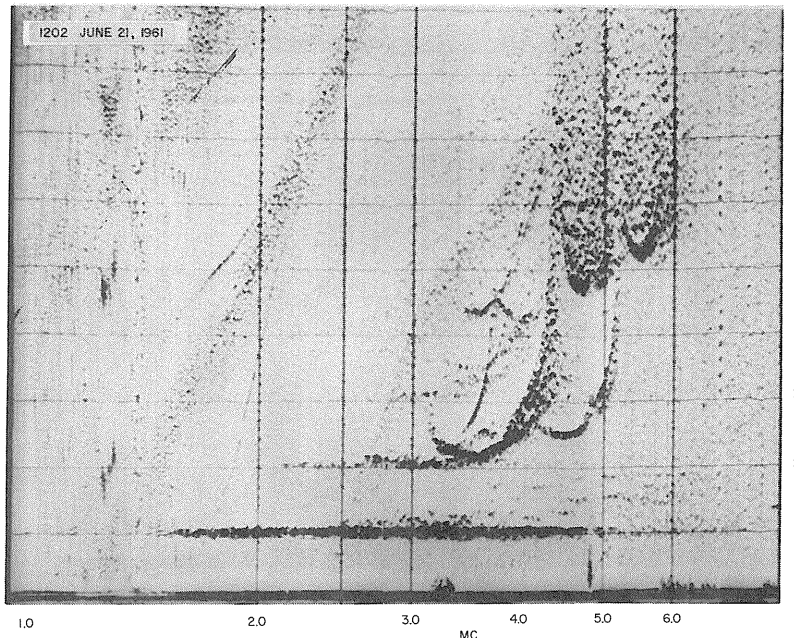


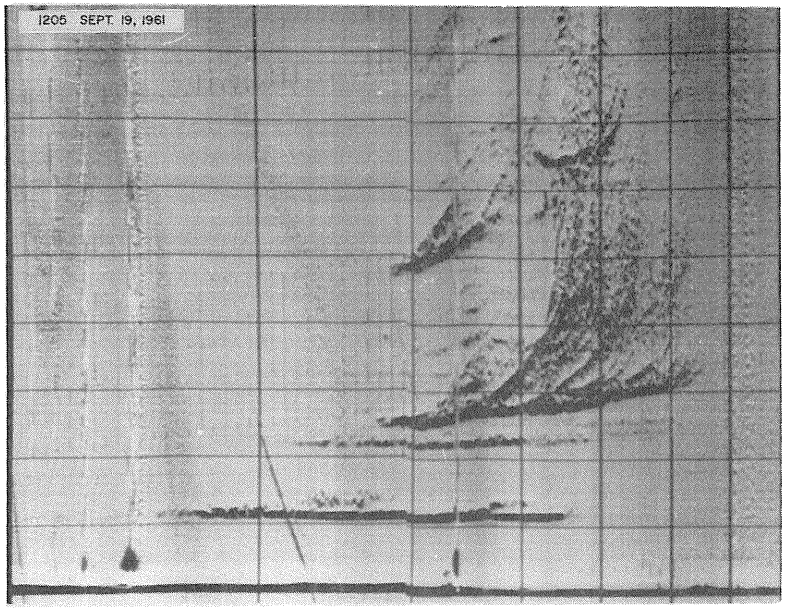
STATION: DIXON ISLAND U.S.S.R.

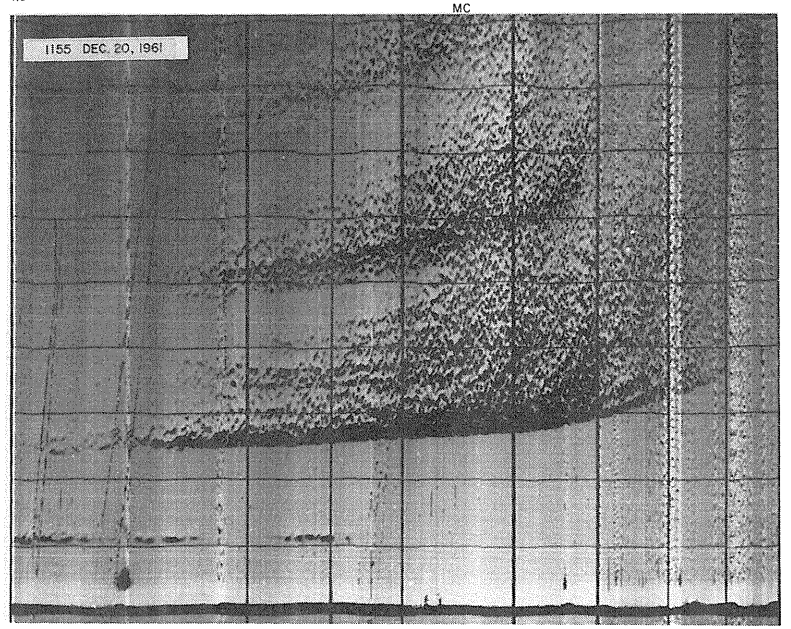
COORDINATES:
- GEOGRAPHIC LATITUDE: 73°30'N — LONGITUDE: 80°24'E
- GEOMAGNETIC LATITUDE: 63.0°N — LONGITUDE: 161.4°
- MAGNETIC DIP: 83.5°N — TIME ZONE: 105°E

IONOSONDE:
- TYPE OR DESIGNATION: AIS
- FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
- HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
- POWER: 10 KW
- SWEEP TIME: 12 - 20 SEC
- FREQUENCY SCALE: LINEAR

DIP 85.8° N
THULE





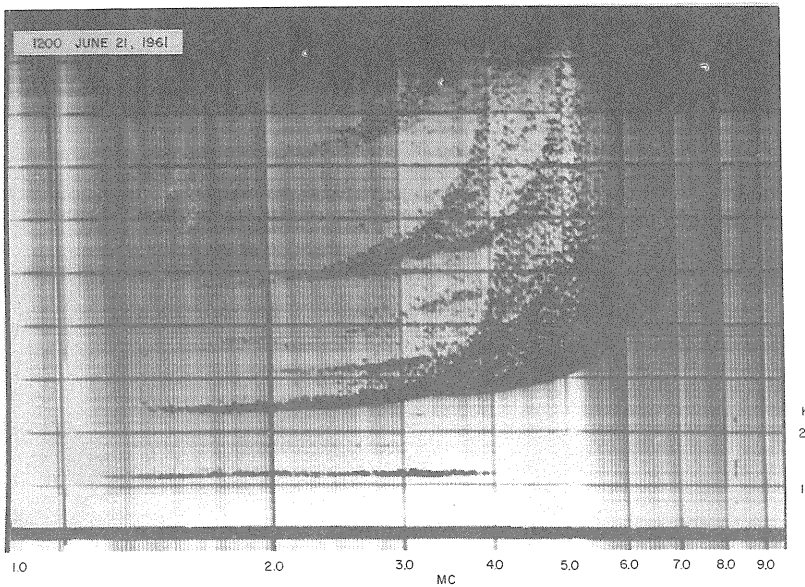


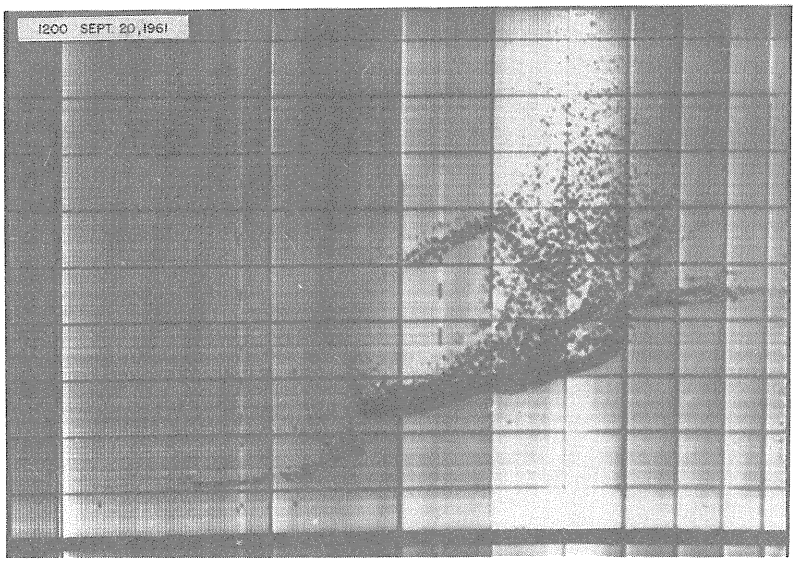
STATION: THULE GREENLAND

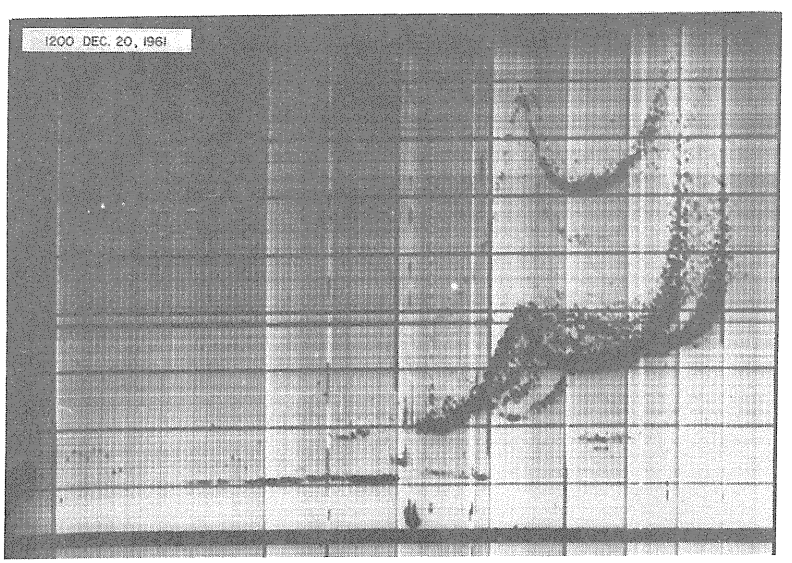
COORDINATES: GEOGRAPHIC LATITUDE: 76°24'N LONGITUDE: 68°19'W
GEOMAGNETIC LATITUDE: 87.9°N LONGITUDE: 1.9°
MAGNETIC DIP: 85.8°N TIME ZONE: 75°W
GYROFREQUENCY: 1.43 MC. AT 200 KM
TOTAL FIELD: 0.56 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 84.8° S
CAPE HALLETT





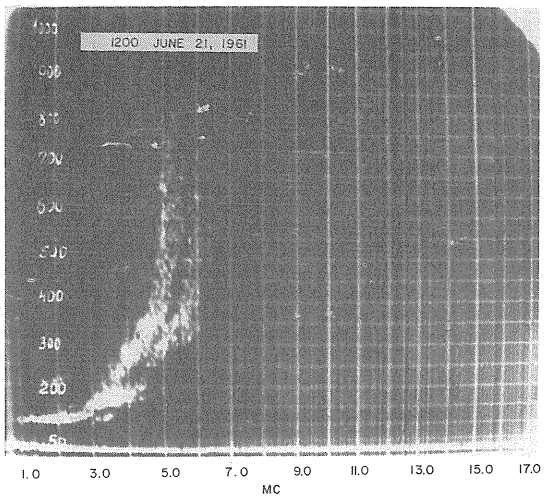


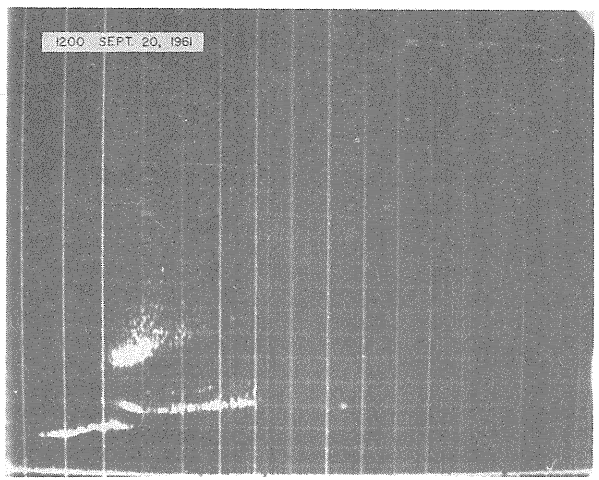
STATION: CAPE HALLETT ANTARCTICA

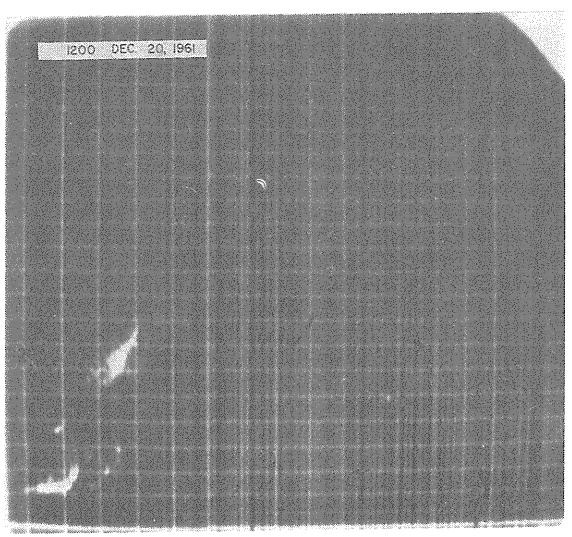
COORDINATES: GEOGRAPHIC LATITUDE: 72°19'S LONGITUDE: 170°13'E
GEOMAGNETIC LATITUDE: 74.7°S LONGITUDE: 278.2°
MAGNETIC DIP: 84.8°S TIME ZONE: 165°E
GYROFREQUENCY: 1.71 MC. AT 200 KM
TOTAL FIELD: 0.67 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 15 SEC.
LOGARITHMIC FREQUENCY SCALE

DIP 84.3°N
HEISS ISLAND





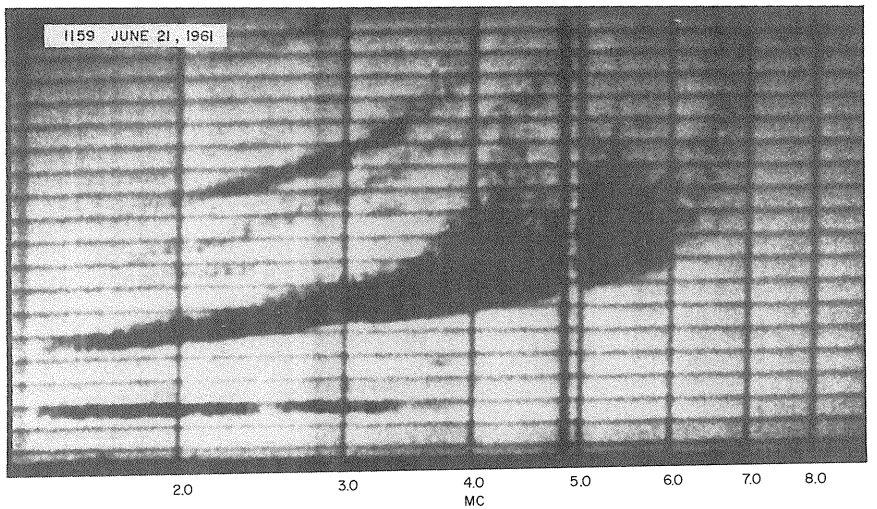


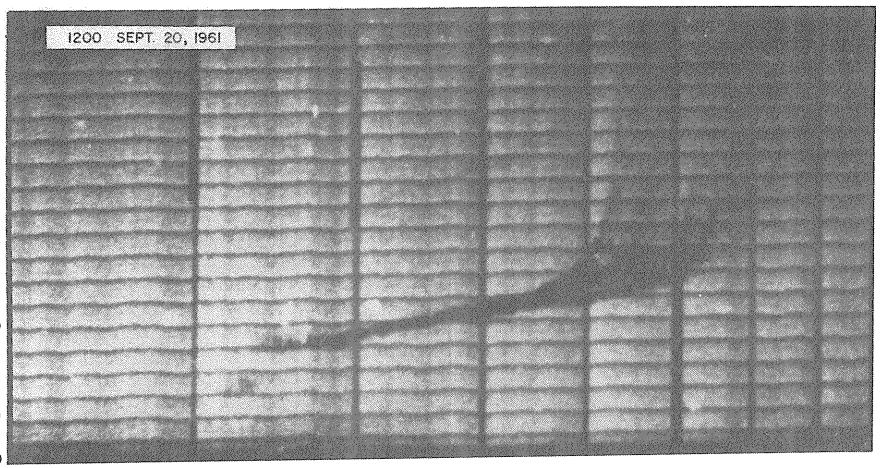
STATION: HEISS ISLAND U.S.S.R.

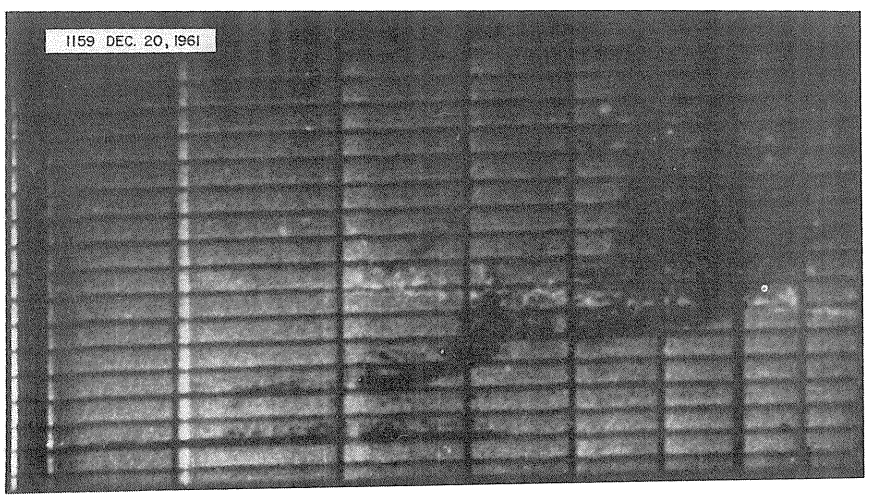
COORDINATES: GEOGRAPHIC LATITUDE: 80°37'N LONGITUDE: 58°03'E
GEOMAGNETIC LATITUDE: 71.0°N LONGITUDE: 156.0°
MAGNETIC DIP: 84.3°N TIME ZONE: 45°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 83.4° S
SCOTT BASE





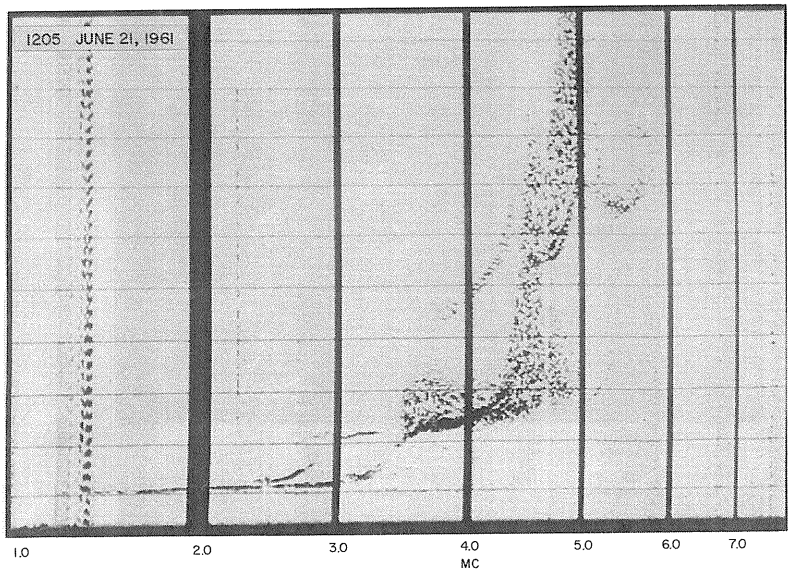


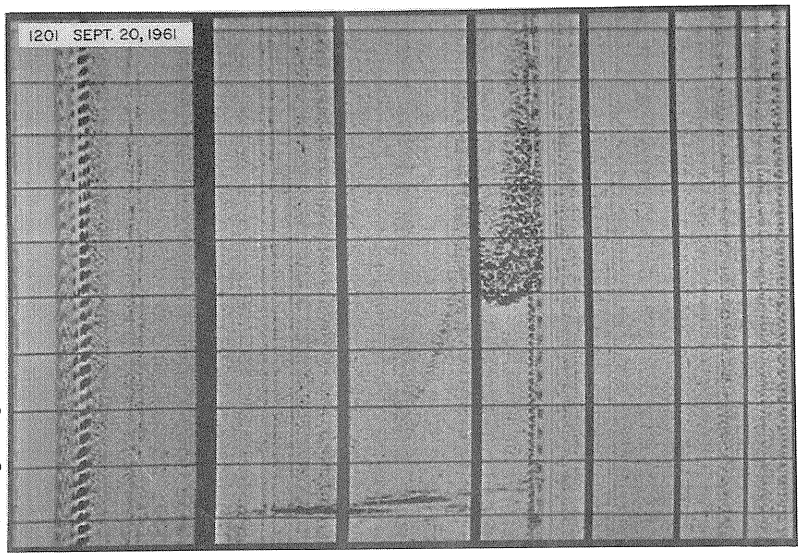
STATION: SCOTT BASE ANTARCTICA

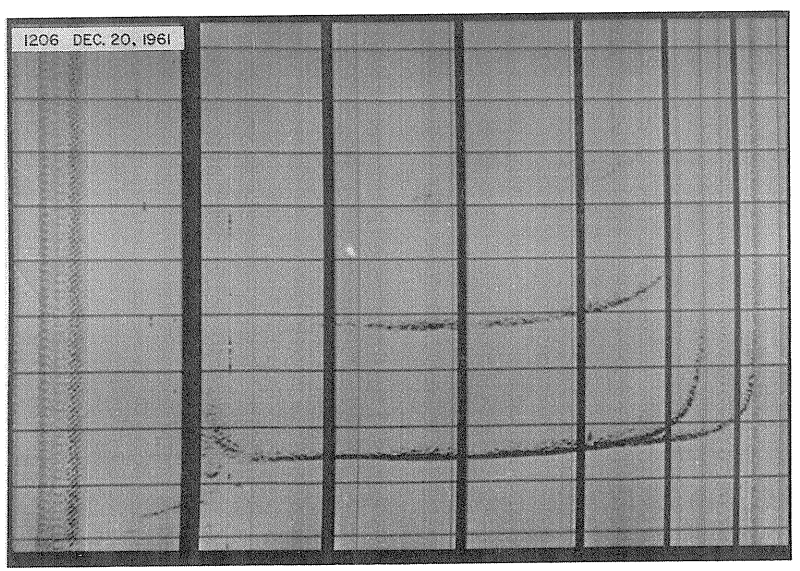
COORDINATES: GEOGRAPHIC LATITUDE: 77°51'S LONGITUDE: 166°48'E
GEOMAGNETIC LATITUDE: 79.0°S LONGITUDE: 294.2°
MAGNETIC DIP: 83.4°S TIME ZONE: 165°E MMT
GYROFREQUENCY: 1.71 MC AT 200 KM
TOTAL FIELD: 0.67 OERSTED

IONOSONDE: TYPE OR DESIGNATION: P-2
FREQUENCY RANGE: 1.0 MC. TO 22.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 75 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 83.0° N
CHURCHILL





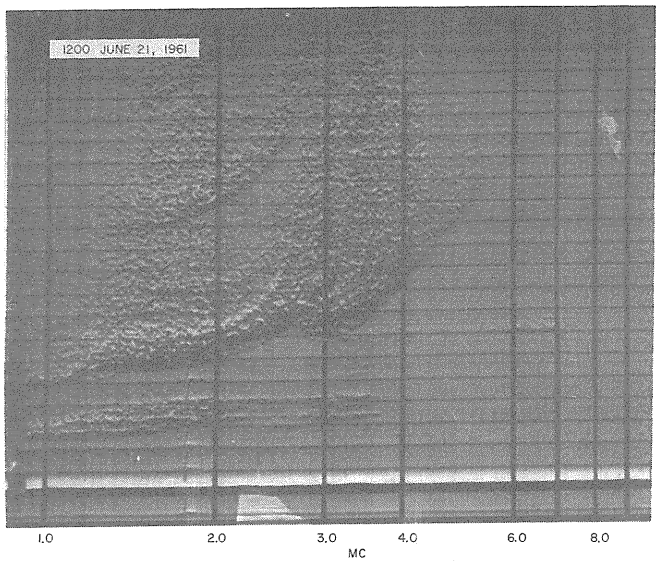


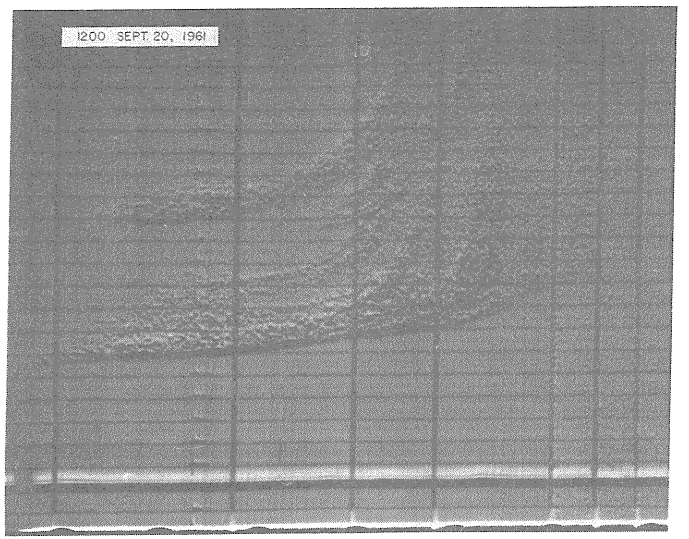
STATION: CHURCHILL CANADA

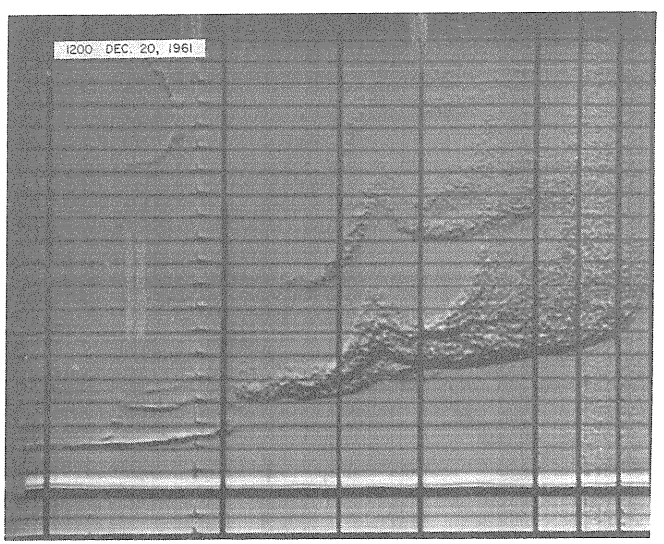
COORDINATES: GEOGRAPHIC LATITUDE: 58.8°N LONGITUDE: 94.2°W
GEOMAGNETIC LATITUDE: 68.7°N LONGITUDE: 322.6
MAGNETIC DIP: 83.0°N TIME ZONE: 90°W
GYROFREQUENCY: 1.56 MC AT 200 KM.
TOTAL FIELD: 0.61 OERSTED

IONOSONDE: TYPE OR DESIGNATION: LG-17 (MODIFIED)
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
≈ LOGARITHMIC FREQUENCY SCALE

DIP 82.4°S
WILKES





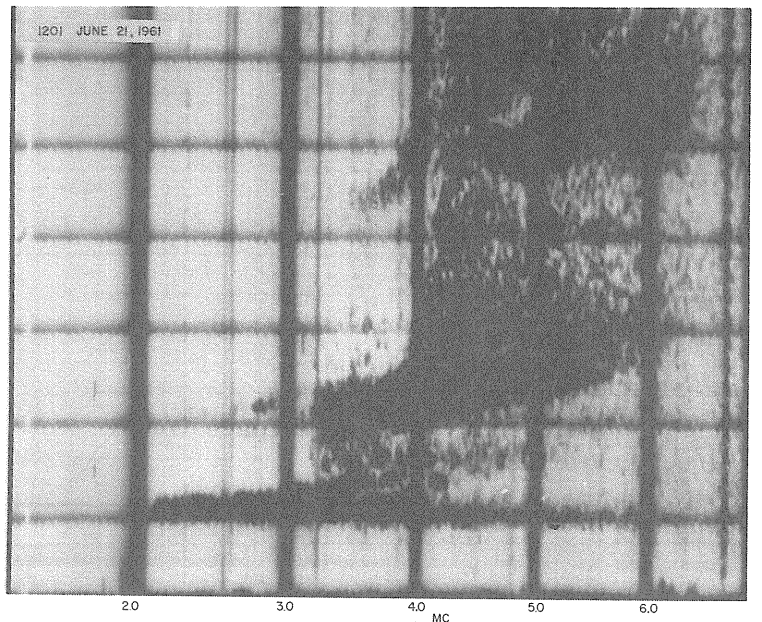


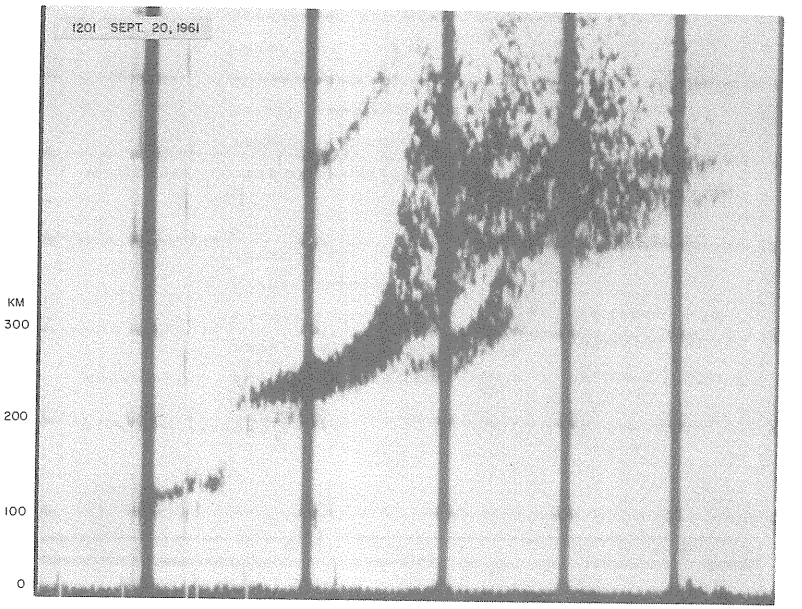
STATION: WILKES ANTARCTICA

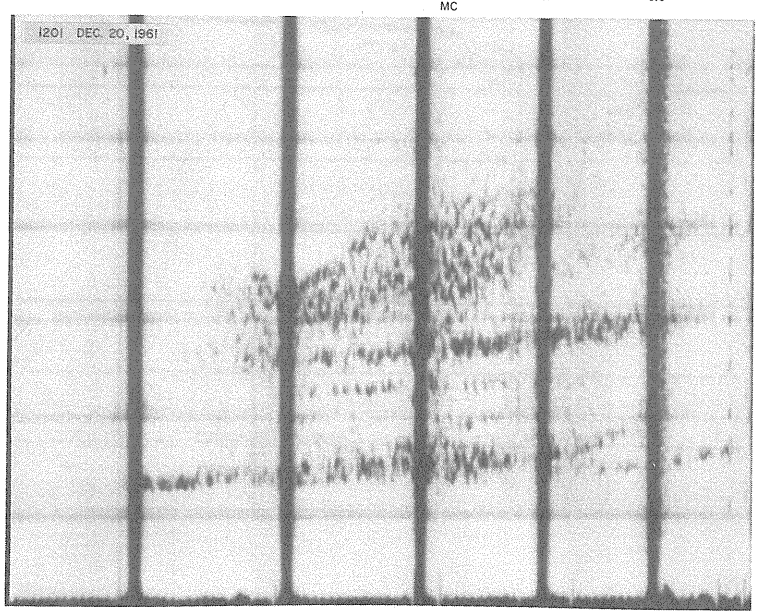
COORDINATES:
GEOGRAPHIC LATITUDE: 66.2°S LONGITUDE: 110°E
GEOMAGNETIC LATITUDE: 77.7°S LONGITUDE: 179.1°
MAGNETIC DIP: 82.4°S TIME ZONE: 105°E

IONOSONDE:
TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 - 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 25 KW
SWEEP TIME: 15 SEC
FREQUENCY SCALE: LOGARITHMIC

DIP 81.9° N
GODHAVN





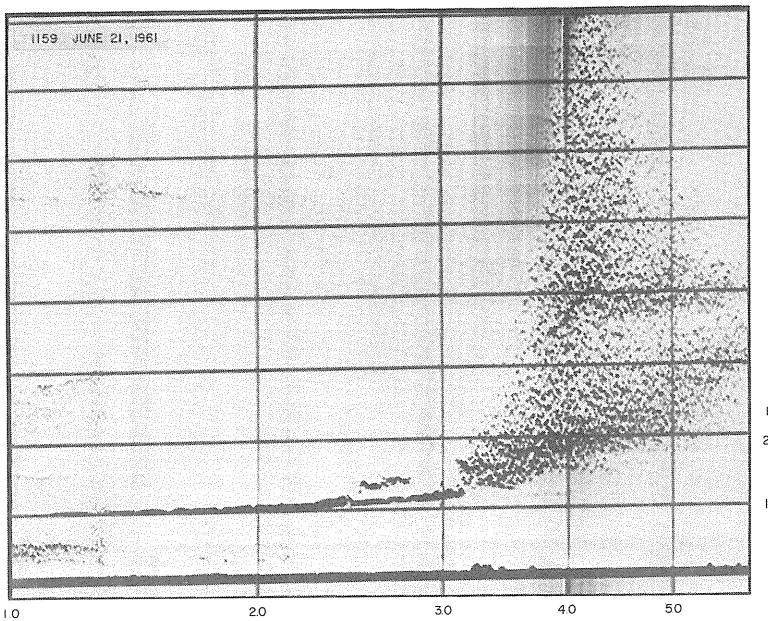


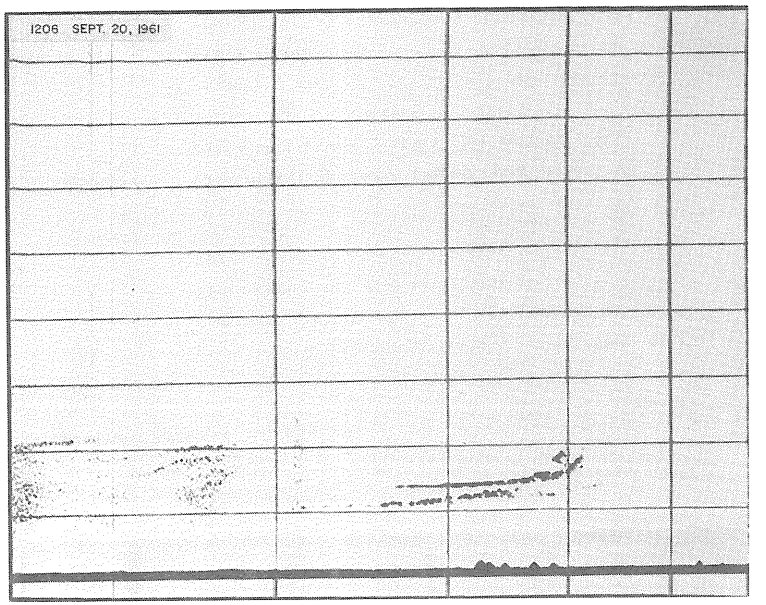
STATION: GODHAVN GREENLAND

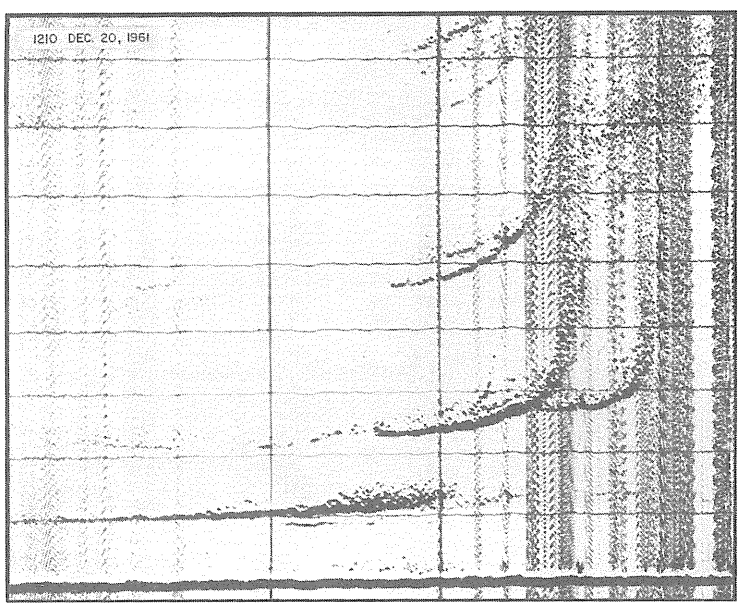
COORDINATES: GEOGRAPHIC LATITUDE: 69°16'N LONGITUDE: 53°30'W
GEOMAGNETIC LATITUDE: 79.8°N LONGITUDE: 32.5°
MAGNETIC DIP: 81.9°N TIME ZONE: 45°W
GYROFREQUENCY: 1.43 MC AT 206 KM
TOTAL FIELD: 0.56 OERSTED (MEASURED AT GROUND LEVEL 1962)

IONOSONDE: TYPE OR DESIGNATION: COSSOR - MOD 7562C
FREQUENCY RANGE: 1.6 MC TO 20.0 MC
HEIGHT RANGE : 800 KM
POWER : 1 KW
SWEEP TIME : 15 SEC
APPROXIMATELY LOGARITHMIC FREQUENCY SCALE

DIP 80.3° N
BARROW





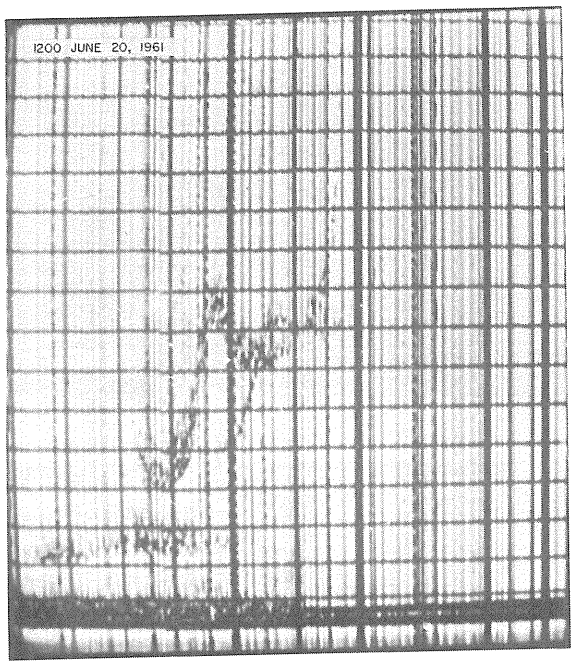


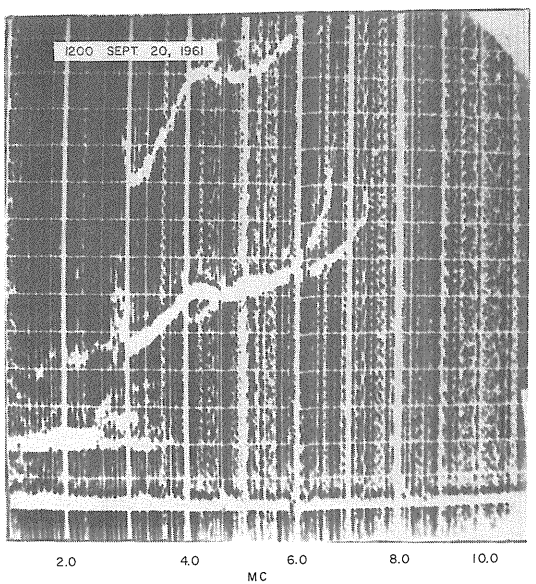
STATION: BARROW U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 71°08'N LONGITUDE: 156°48'W
GEOMAGNETIC LATITUDE: 68.5°N LONGITUDE: 241.1
MAGNETIC DIP: 80.3°N TIME ZONE: 150°W
GYROFREQUENCY: 1.45 MC AT 200 KM
TOTAL FIELD: 0.57 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 13.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 79.6°N
SALEKHARD



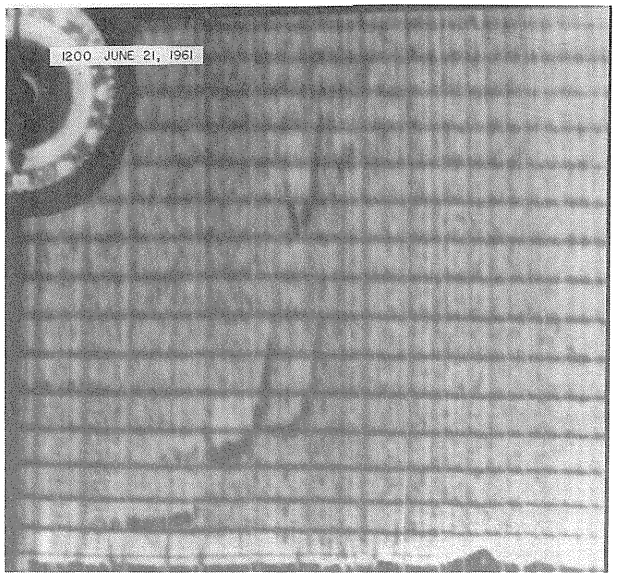


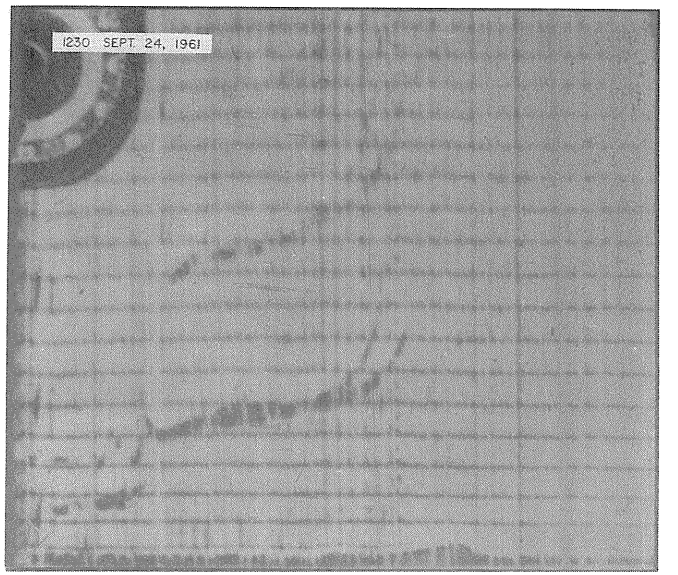
STATION: SALEKHARD U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 66°32'N LONGITUDE: 66°32'E
GEOMAGNETIC LATITUDE: 57.3°N LONGITUDE: 148.9°
MAGNETIC DIP: 79.6°N TIME ZONE: 60°E

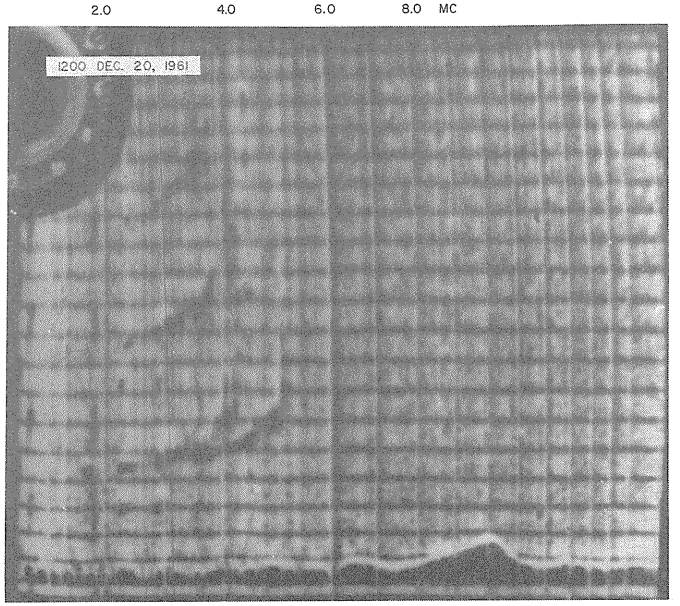
IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 78.1° N
MURMANSK





2.0 4.0 6.0 8.0 MC

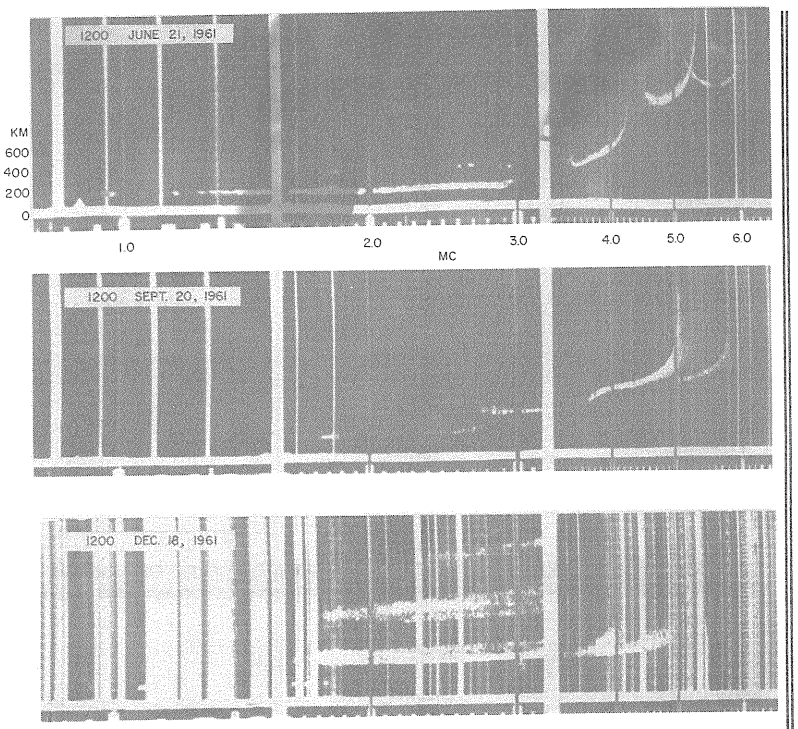


STATION: MURMANSK U.S.S.R.

COORDINATES:
GEOGRAPHIC LATITUDE: 68°57'N LONGITUDE: 33°03'E
GEOMAGNETIC LATITUDE: 64.2°N LONGITUDE: 126.5°
MAGNETIC DIP: 78.1°N TIME ZONE: 30°E

IONOSONDE:
TYPE OR DESIGNATION: OWN CONSTRUCTION
FREQUENCY RANGE: 1.0 - 20.0 MC
HEIGHT RANGE: 150 KM, 500 KM, 1000 KM
POWER: 2 - 5 KW
SWEEP TIME: 30 SEC
FREQUENCY SCALE: LOGARITHMIC

DIP 77.9° N
TROMSØ

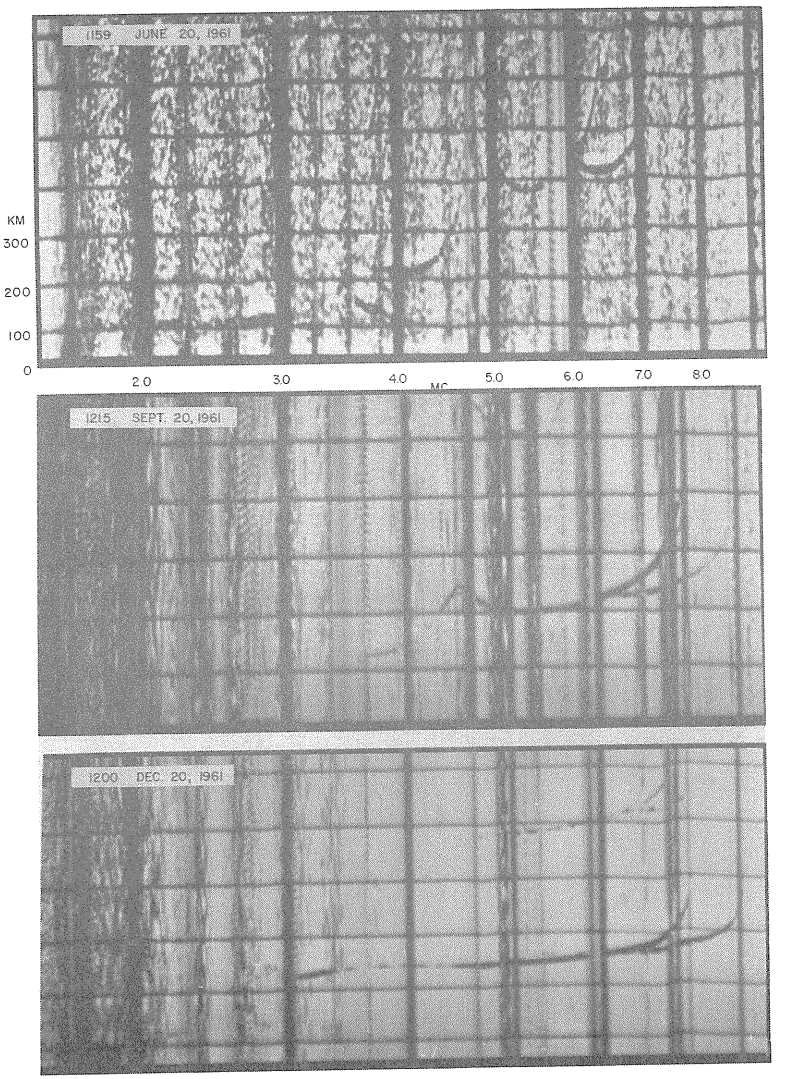


STATION: TROMSØ NORWAY

COORDINATES: GEOGRAPHIC LATITUDE: 69°3' N. LONGITUDE: 18° 57' E
GEOMAGNETIC LATITUDE: 67.1°N LONGITUDE: 116.8°
MAGNETIC DIP: 77.9°N TIME ZONE: 15°E
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: TYPE OR DESIGNATION: NPL MK II
FREQUENCY RANGE: 0.68 MC TO 24.6 MC
HEIGHT RANGE: 950 KM POWER: 0.5 KW
SWEEP TIME: 300 SEC SEMI LOGARITHMIC FREQUENCY SCALE.

DIP 77.1° N
WINNIPEG



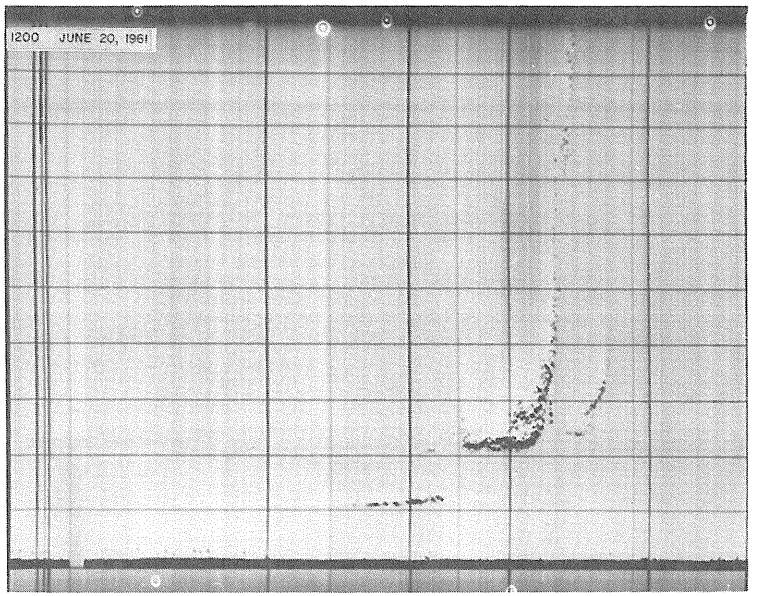
STATION: WINNIPEG CANADA

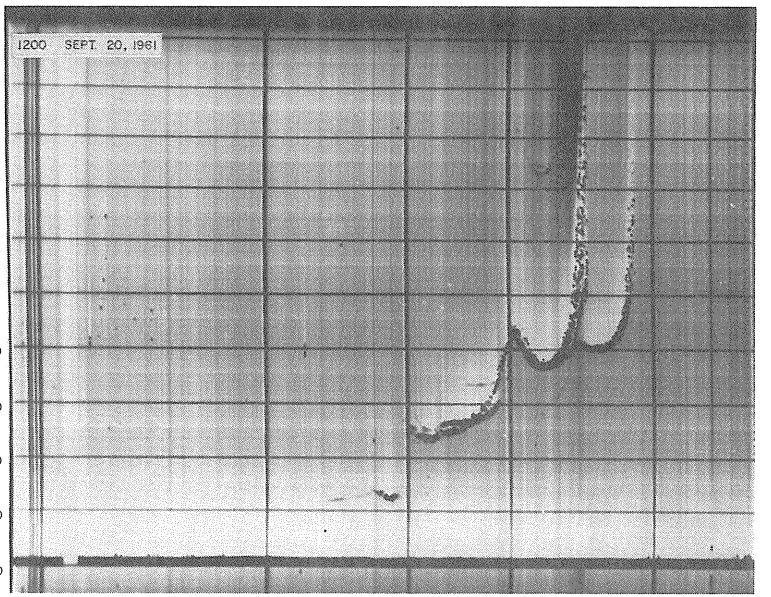
COORDINATES: GEOGRAPHIC LATITUDE: 49.9°N LONGITUDE: 97.4°W GEOMAGNETIC LATITUDE: 59.6°N LONGITUDE: 322.7° MAGNETIC DIP: 77.1°N TIME ZONE: 90°W
GYROFREQUENCY: 1.56 MC AT 200 KM TOTAL FIELD: 0.61 OERSTED

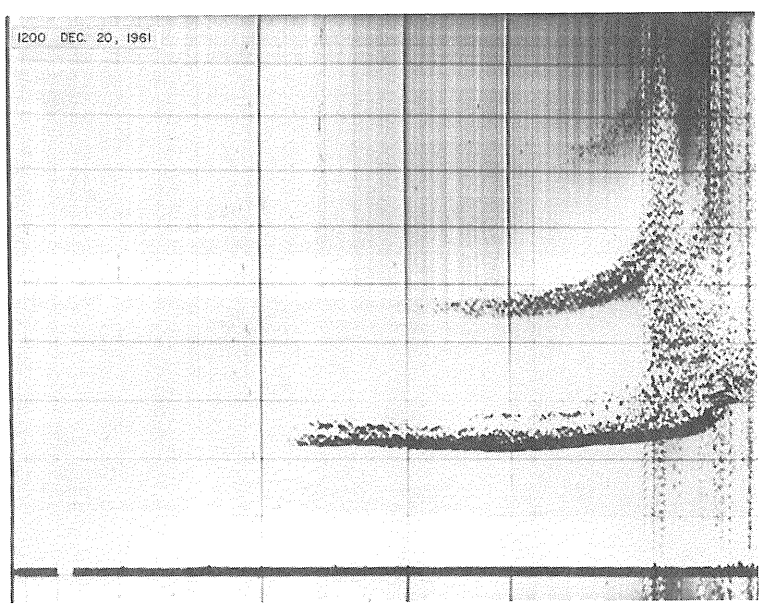
IONOSONDE: TYPE OR DESIGNATION: COSSOR MK 2 FREQUENCY RANGE: 1.6 MC TO 20.0 MC SWEEP TIME: 15 SEC

DIP 77.5° N

NARSSARSSUAQ





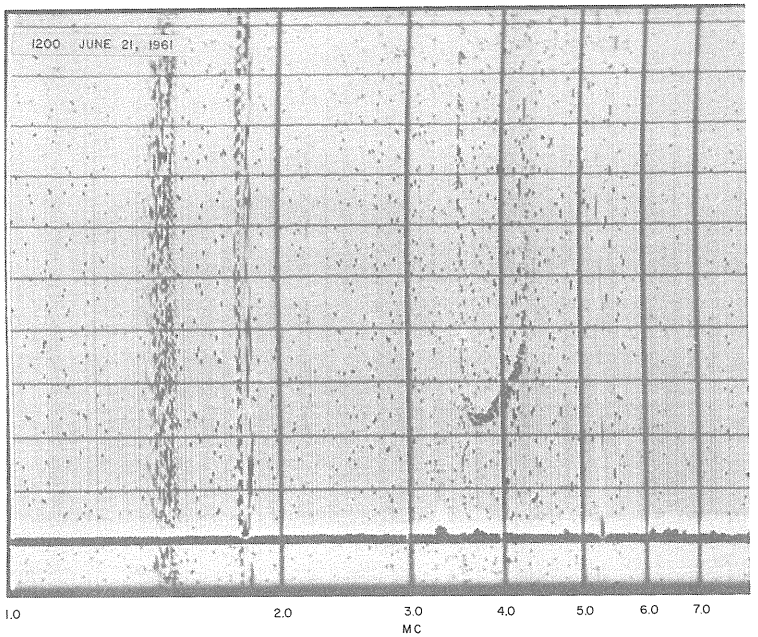


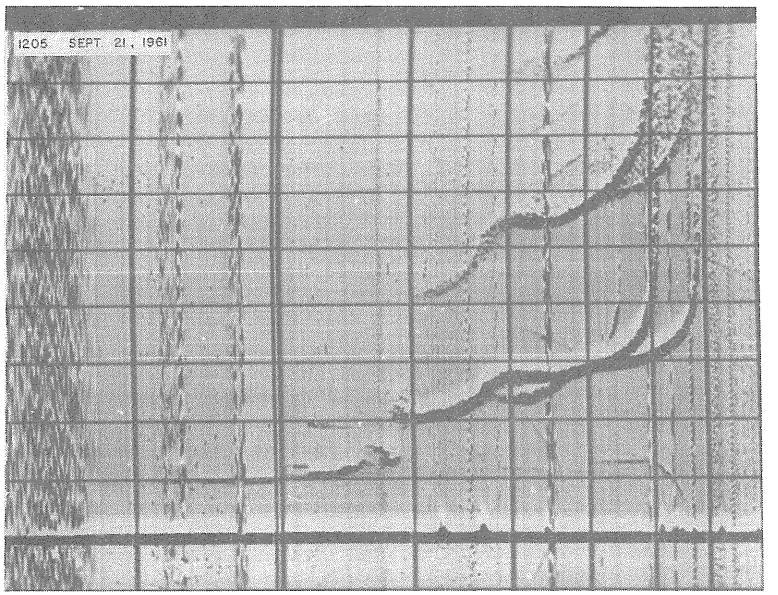
STATION: NARSSARSSUAQ GREENLAND

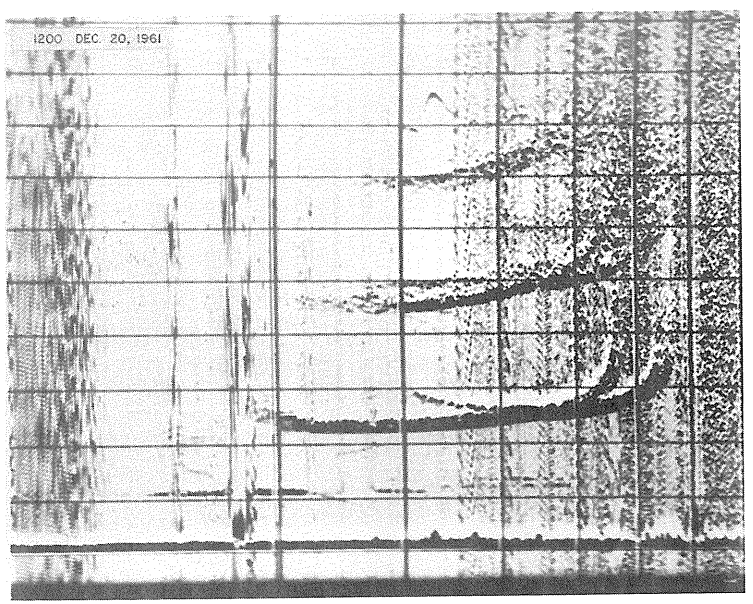
COORDINATES: GEOGRAPHIC LATITUDE: 61°11'N LONGITUDE: 45°25'W
GEOMAGNETIC LATITUDE: 71.2°N LONGITUDE: 36.8°
MAGNETIC DIP: 77.5°N TIME ZONE: 45°W
GYROFREQUENCY: 1.38 MC AT 200 KM
TOTAL FIELD: 0.54 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 10 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 77.1° N
COLLEGE





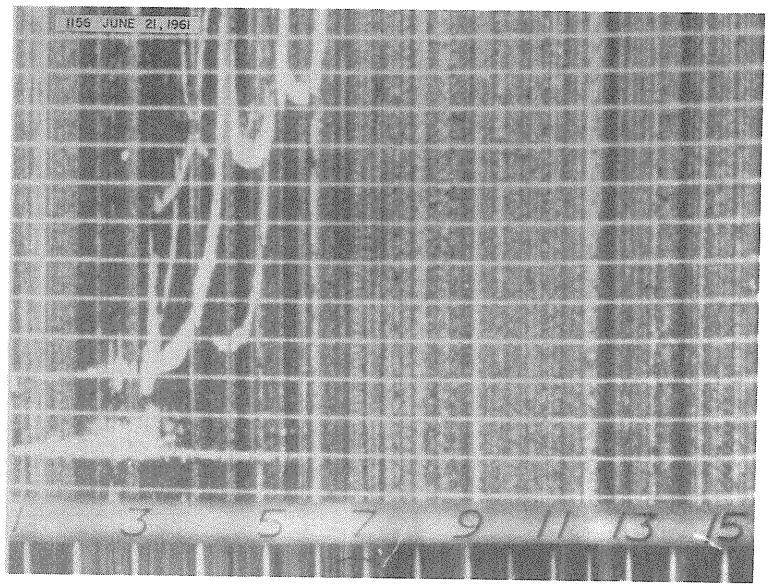


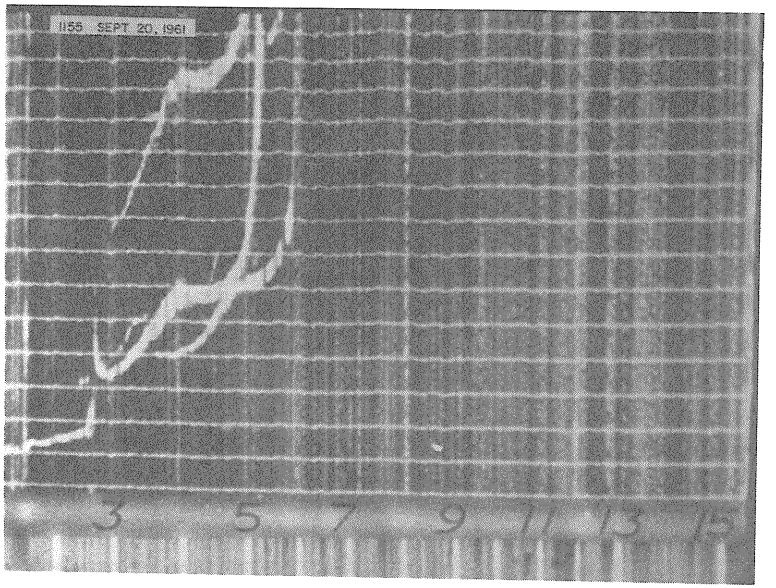
STATION: COLLEGE U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 64°52'N LONGITUDE: 147°49'W
GEOMAGNETIC LATITUDE: 64.7°N LONGITUDE: 256.5°
MAGNETIC DIP: 77.1°N TIME ZONE: 150°W
GYROFREQUENCY: 1.45 MC AT 200 KM
TOTAL FIELD: 0.57 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 13.5 SEC
LOGARITHMIC FREQUENCY SCALE

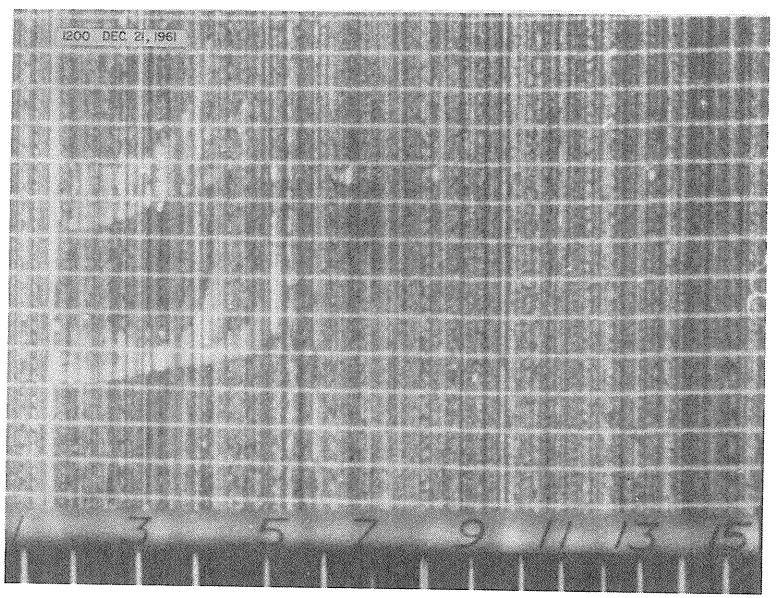
DIP 77.0° N
KIRUNA





KM
200
100
0

1.0 3.0 5.0 7.0 9.0 11.0 13.0 15.0
MC

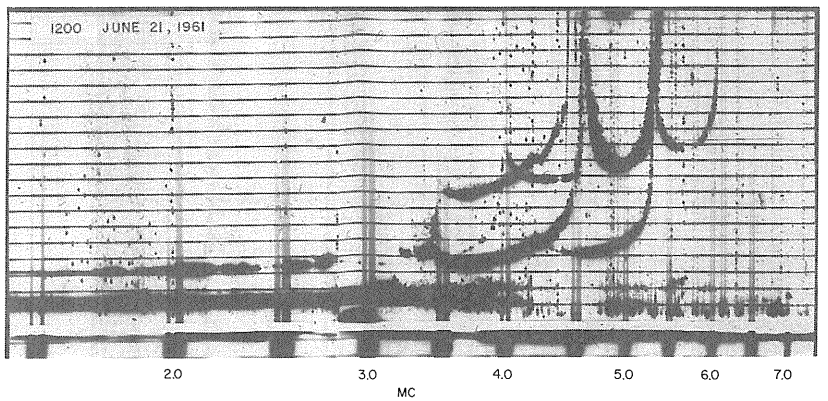


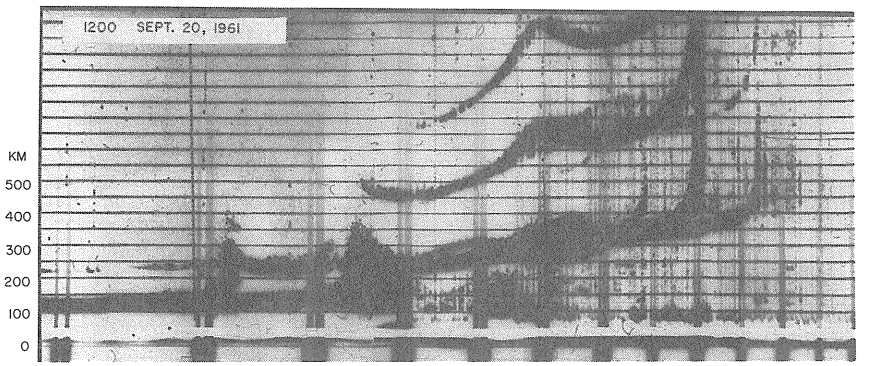
STATION: KIRUNA SWEDEN

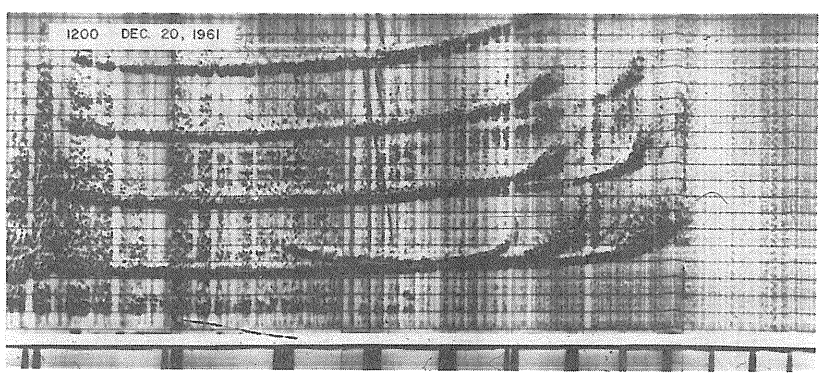
COORDINATES: GEOGRAPHIC LATITUDE: 67°50'N LONGITUDE: 20°26'E
GEOMAGNETIC LATITUDE: 65.3°N LONGITUDE: 115.5°
MAGNETIC DIP: 77.0°N TIME ZONE: 15°E
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: TYPE OR DESIGNATION: OWN CONSTRUCTION
FREQUENCY RANGE: 0.5 MC TO 15 MC
HEIGHT RANGE: 750 KM
POWER: 12 KW
SWEEP TIME: 25 SEC
LINEAR FREQUENCY SCALE

DIP 77.0° N
SODANKYLÄ





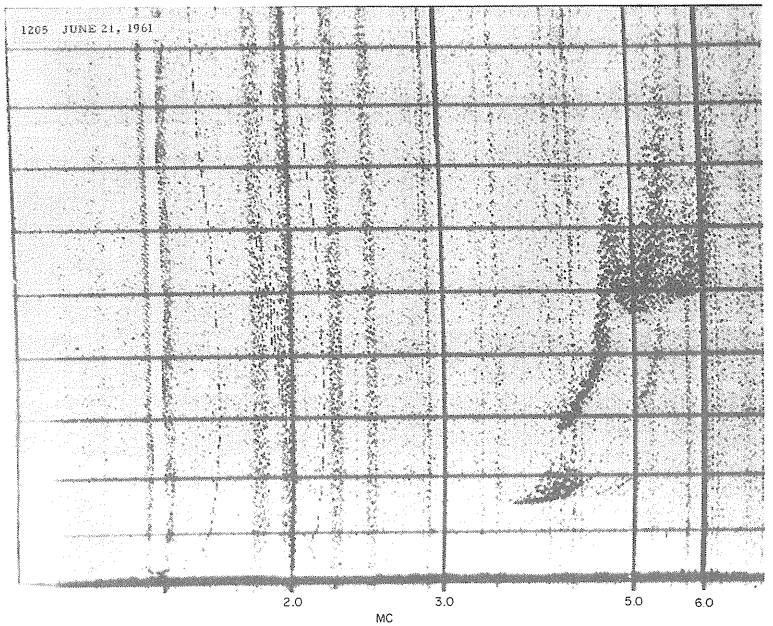


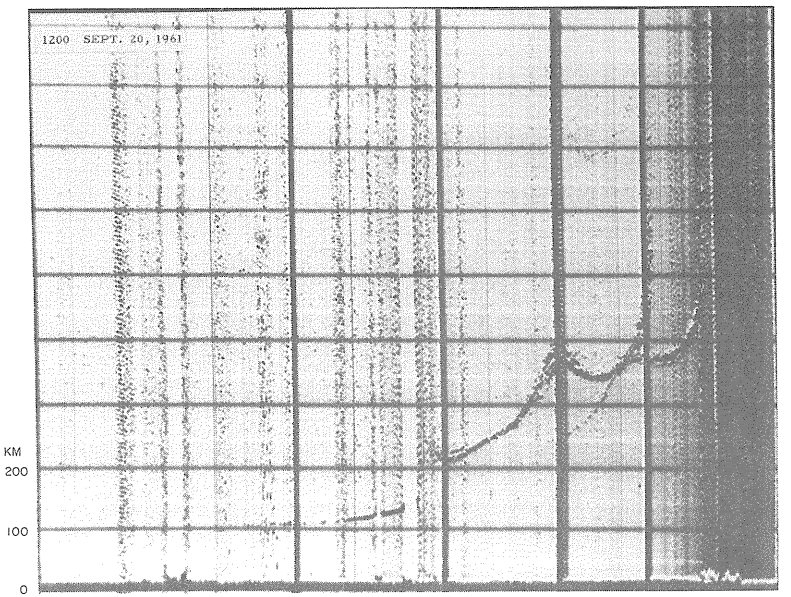
STATION: SODANKYLÄ FINLAND

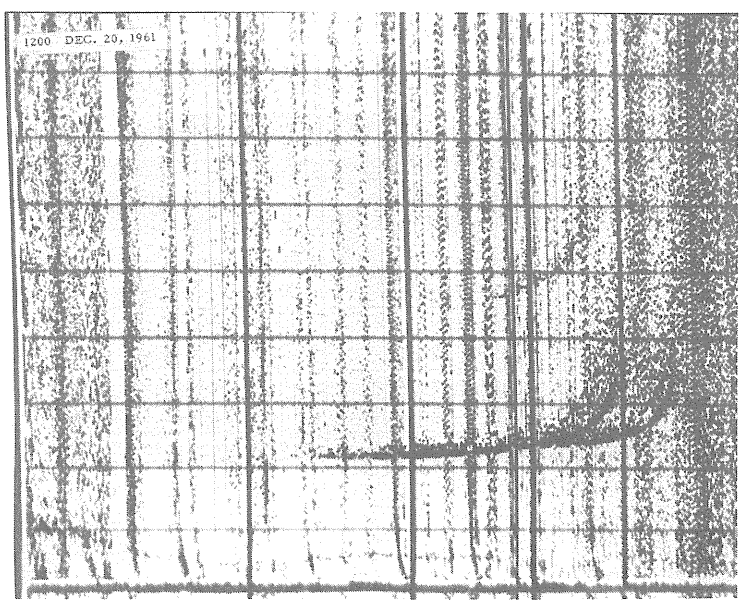
COORDINATES: GEOGRAPHIC LATITUDE: 67°22'N LONGITUDE: 26°39'E
GEOMAGNETIC LATITUDE: 63.8°N LONGITUDE: 120.0°
MAGNETIC DIP: 77.0°N TIME ZONE: 30°E
GYROFREQUENCY: 1.33 MC AT 200 KM
TOTAL FIELD: 0.513 OERSTED

IONOSONDE: FREQUENCY RANGE: 1.0 MC. TO 16.0 MC
HEIGHT RANGE: 1000 KM
POWER: 50 KW
SWEEP TIME: 480 SEC
EQUATION FOR FREQUENCY SCALE: $75 \log \frac{f}{MHz}$ mm

DIP 76.0° N
REYKJAVIK





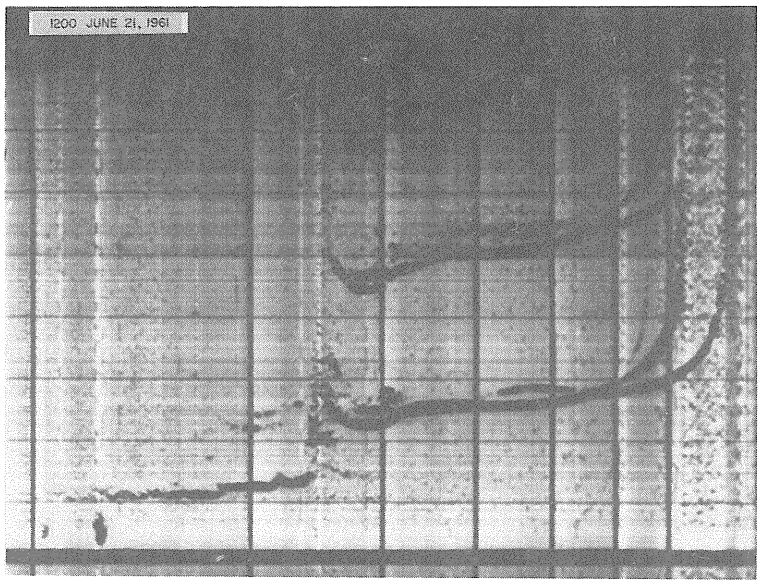


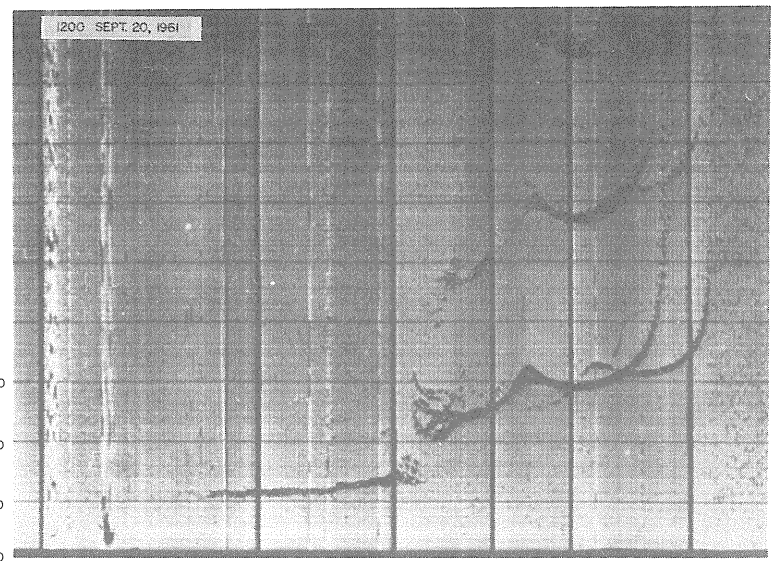
STATION: REYKJAVIK ICELAND

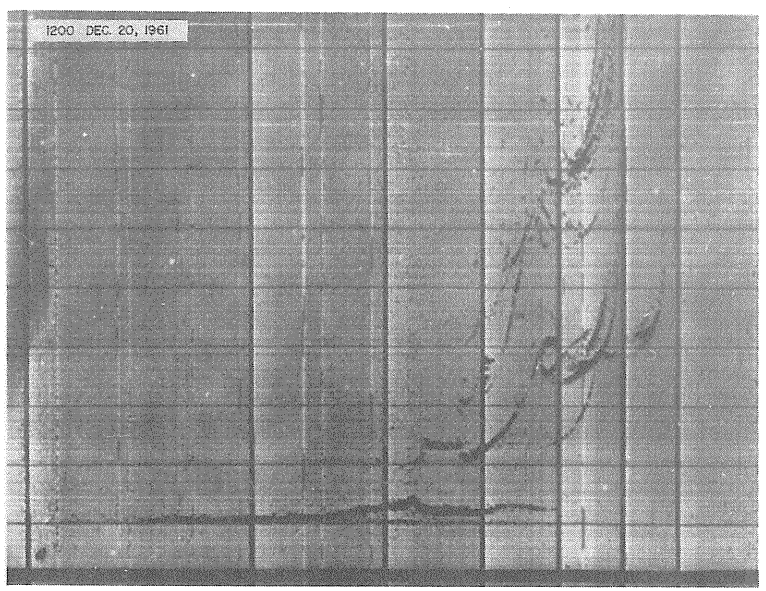
COORDINATES: GEOGRAPHIC LATITUDE: 64°08'N LONGITUDE: 21°47'W
GEOMAGNETIC LATITUDE: 70.2°N LONGITUDE: 70.8°
MAGNETIC DIP: 76.0°N TIME ZONE: 15°W
GYROFREQUENCY: 1.30 MC. AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 15 KW
SWEEP TIME: 18 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 76.0° S
CAMPBELL ISLAND







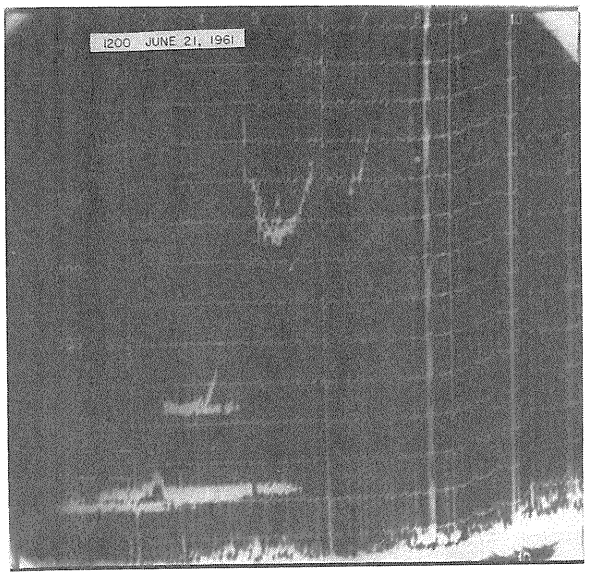
STATION: CAMPBELL ISLAND NEW ZEALAND

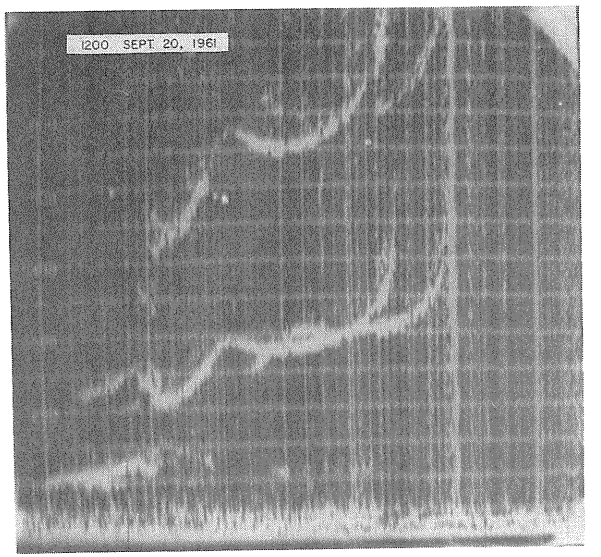
COORDINATES: GEOGRAPHIC LATITUDE: 52°33'S LONGITUDE: 169°09'E
GEOMAGNETIC LATITUDE: 57.3°S LONGITUDE: 253.2°
MAGNETIC DIP: 76.0°S TIME ZONE: 165°E
GYROFREQUENCY: 1.63 MC AT 200 KM
TOTAL FIELD: 0.64 OERSTED

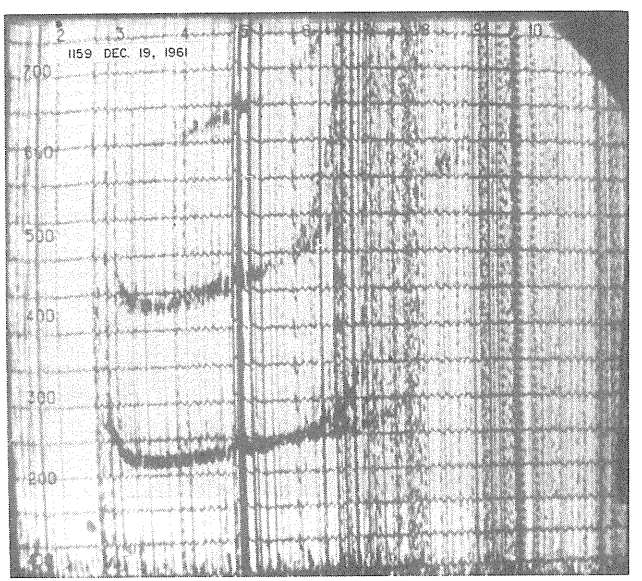
IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 75.9°N

YAKUTSK





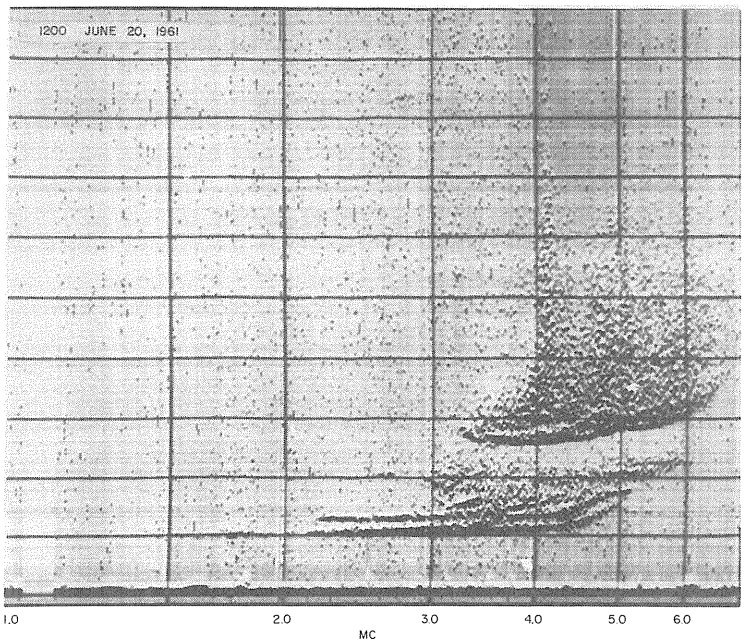


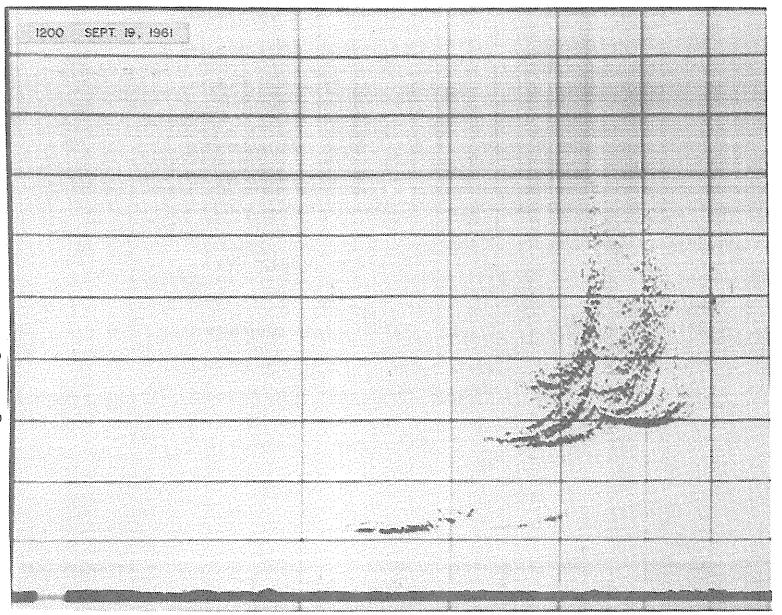
STATION: YAKUTSK U.S.S.R.

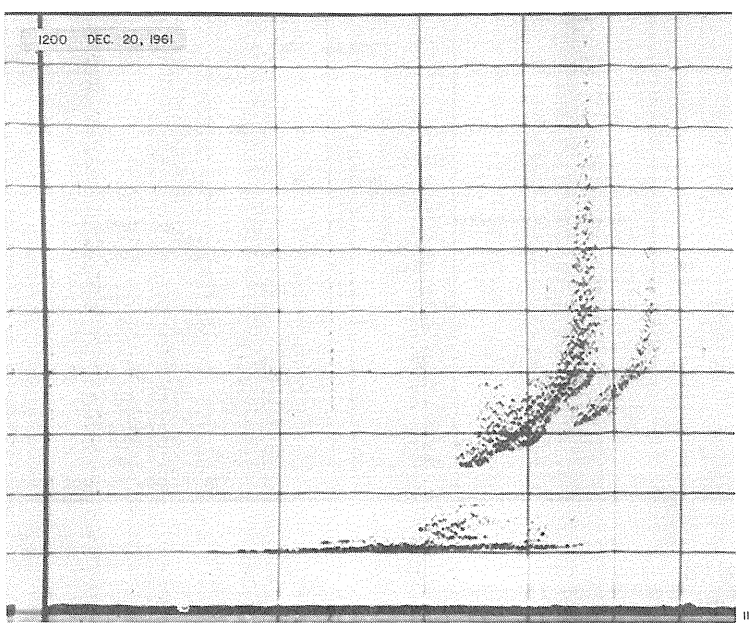
COORDINATES: GEOGRAPHIC LATITUDE: 62°01'N LONGITUDE: 129°43'E
GEOMAGNETIC LATITUDE: 50.9°N LONGITUDE: 193.7°
MAGNETIC DIP: 75.9°N TIME ZONE: 135°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 75.6° S
SOUTH POLE





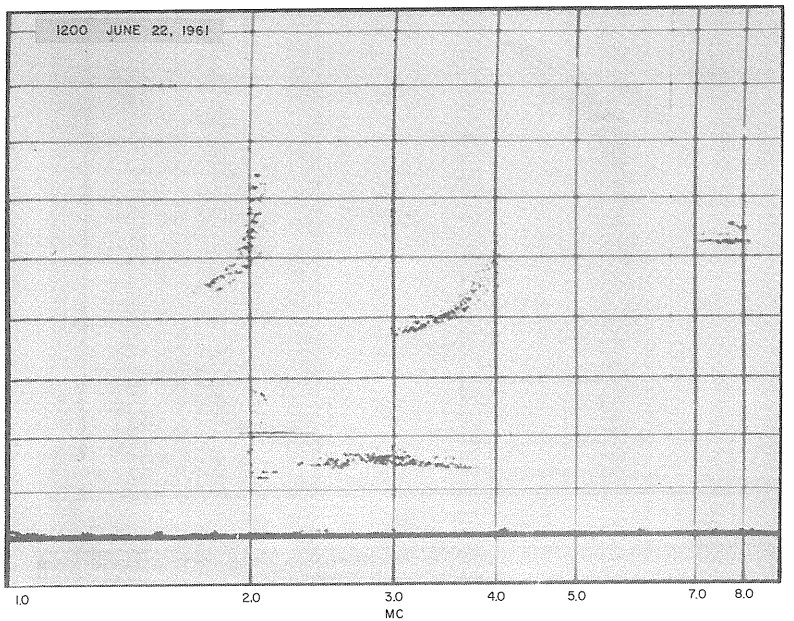


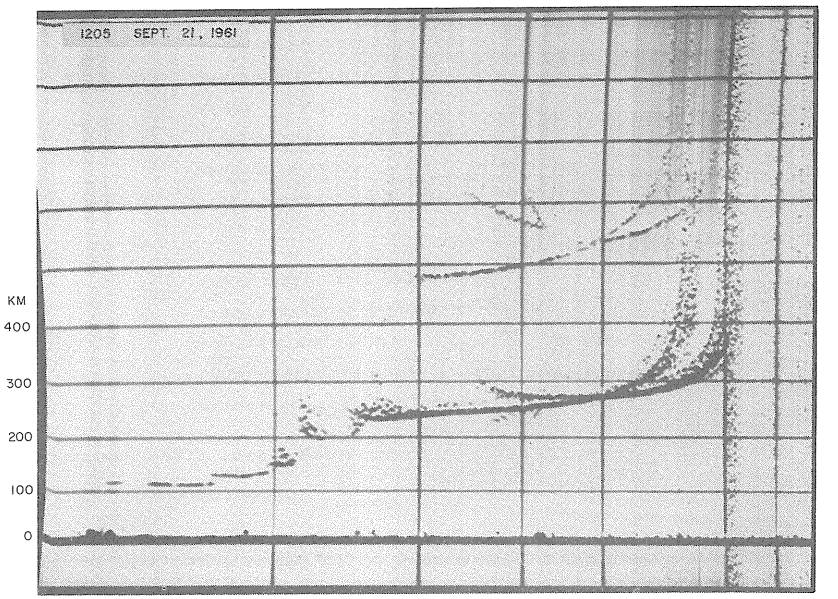
STATION: SOUTH POLE ANTARCTICA

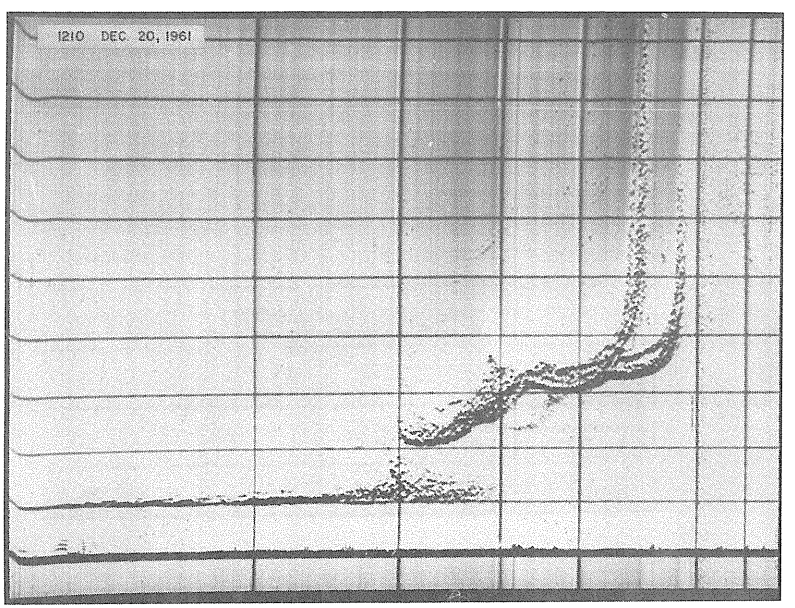
COORDINATES: GEOGRAPHIC LATITUDE: 90°00'S LONGITUDE: -
GEOMAGNETIC LATITUDE: 78.5°S LONGITUDE: 0°
MAGNETIC DIP: 75.6°S TIME ZONE: 0°
GYROFREQUENCY: 1.58 MC AT 200 KM
TOTAL FIELD: 0.62 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000 KM
POWER: 20 KW
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 75.1° S
BYRD STATION





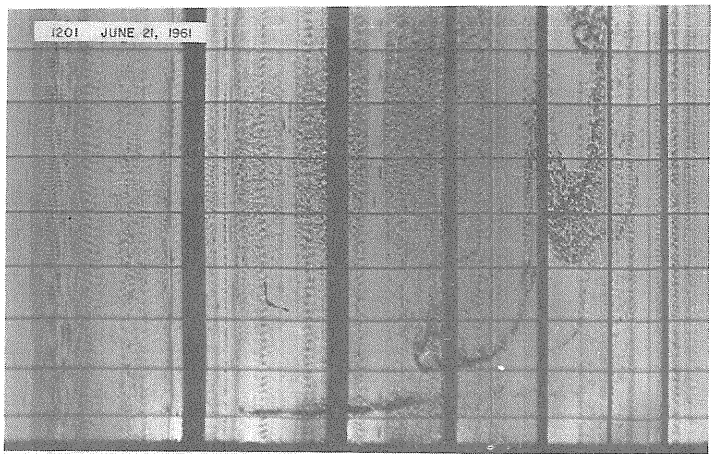


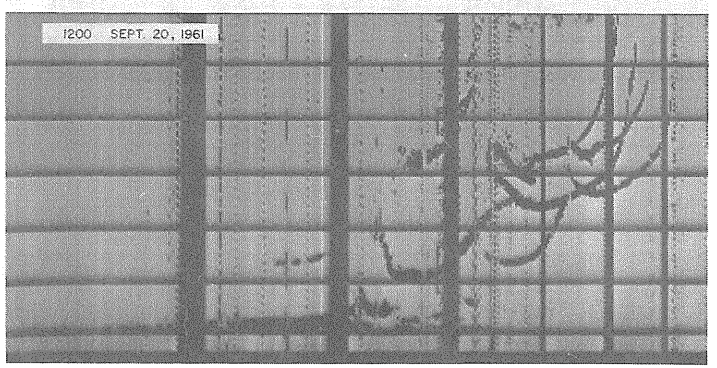
STATION: BYRD STATION ANTARCTICA

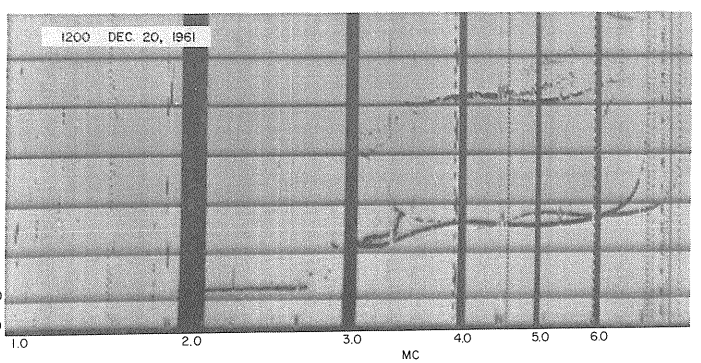
COORDINATES: GEOGRAPHIC LATITUDE: 80°00'S LONGITUDE: 120°00'W
GEOMAGNETIC LATITUDE: 70.6°S LONGITUDE: 336.0°
MAGNETIC DIP: 75.1°S TIME ZONE: 120°W
GYROFREQUENCY: 1.56 AT 200 KM
TOTAL FIELD: 0.61

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE (KM): 500, 1000
POWER (KW): 20
SWEEP TIME (SEC.): 13.5
EQUATION FOR FREQUENCY SCALE: LOGARITHMIC

DIP 74.9° N
OTTAWA





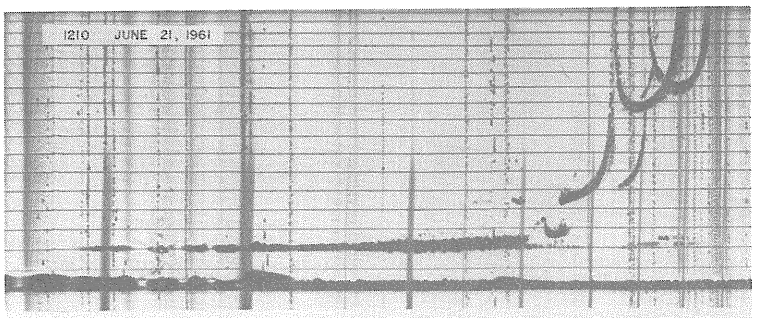


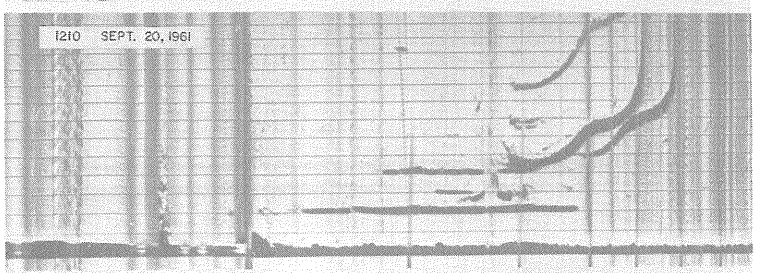
STATION: OTTAWA CANADA

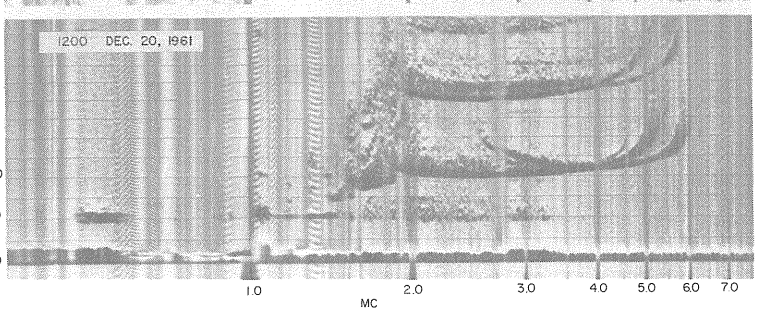
COORDINATES: GEOGRAPHIC LATITUDE: 45.4°N LONGITUDE: 75.9°W
GEOMAGNETIC LATITUDE: 56.8°N LONGITUDE: 351.1°
MAGNETIC DIP: 74.9°N GYROFREQUENCY: 1.48 MC AT 200 KM
TOTAL FIELD: 0.58 OERSTED TIME ZONE: 75°W

IONOSONDE: TYPE OR DESIGNATION: L G 17 (MODIFIED)
FREQUENCY RANGE: 1.0 MC TO 16.0 MC HEIGHT RANGE: 1000 KM
POWER: 10 KW SWEEP TIME: 20 SEC ≈ LOGARITHMIC FREQ. SCALE

DIP 75.4° N
LYCKSELE





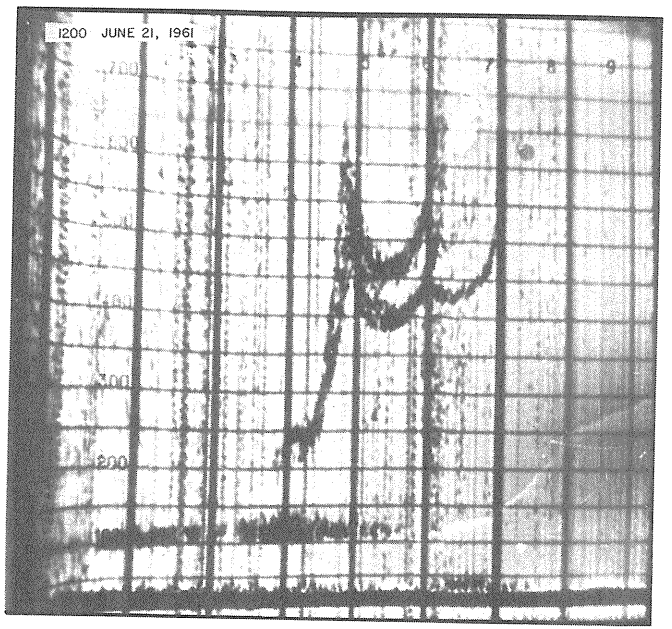


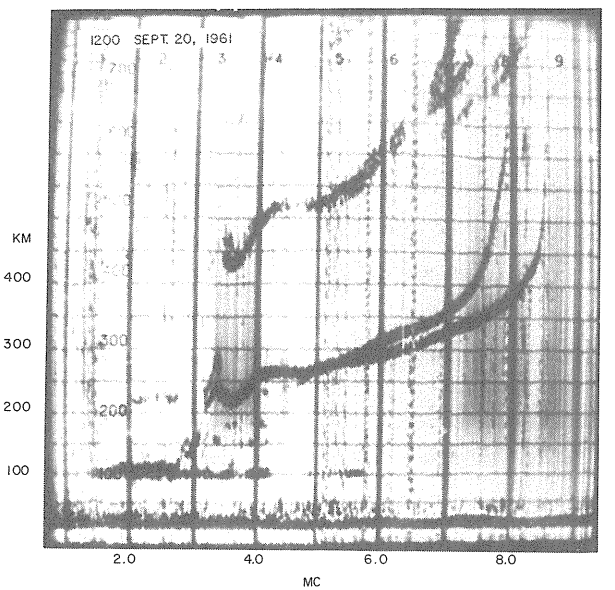
STATION: LYCKSELE SWEDEN

COORDINATES: GEOGRAPHIC LATITUDE: 64°37'N LONGITUDE: 18°40'E
GEOMAGNETIC LATITUDE: 62.8°N LONGITUDE: 111.0°
MAGNETIC DIP: 75.4°N TIME ZONE: 15° E
GYROFREQUENCY: 1.28 MC AT 200 KM TOTAL FIELD: 0.50 OERSTED

IONOSONDE: TYPE OR DESIGNATION: J4 FREQUENCY RANGE: 0.33 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM POWER: ~20 KW SWEEP TIME: 60, 180 SEC
NEARLY LOGARITHMIC FREQUENCY SCALE

DIP 74.7°N
TOMSK



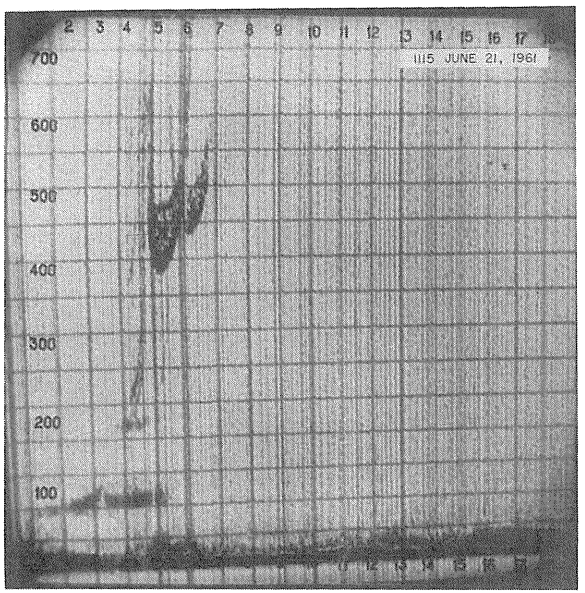


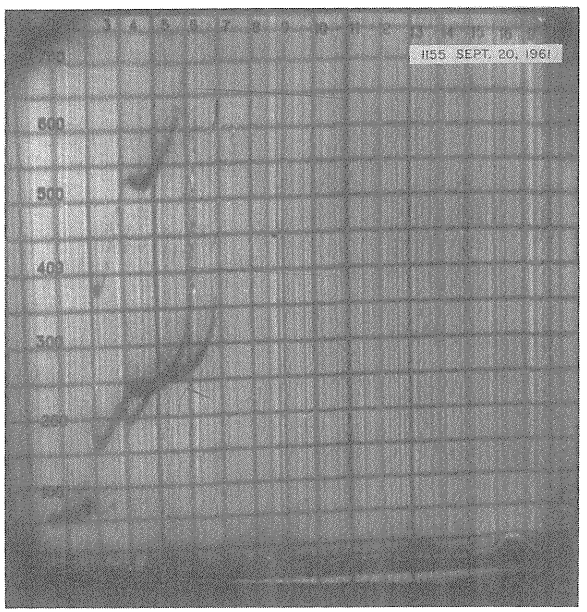
STATION: TOMSK U.S.S.R.

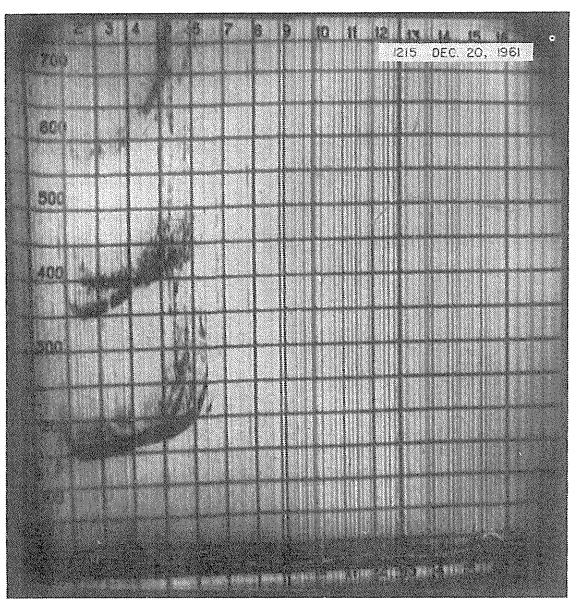
COORDINATES:
GEOGRAPHIC LATITUDE: 56°28'N LONGITUDE: 84°56' E
GEOMAGNETIC LATITUDE: 45.9°N LONGITUDE: 159.6°
MAGNETIC DIP: 74.7°N TIME ZONE: 90°E

IONOSONDE:
TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 74.0°N
PROVIDENIE BAY





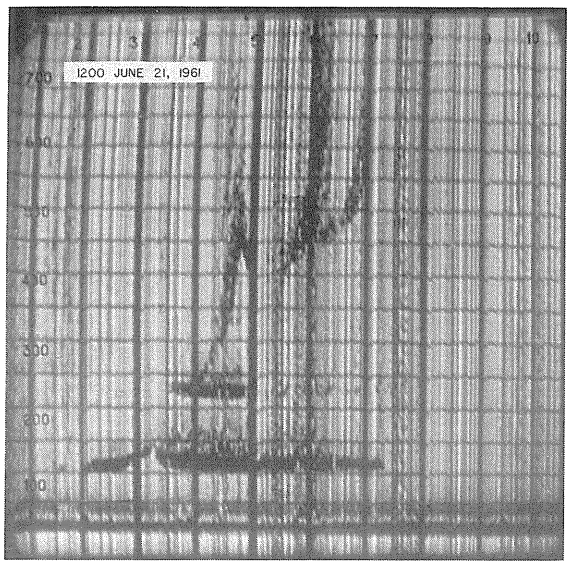


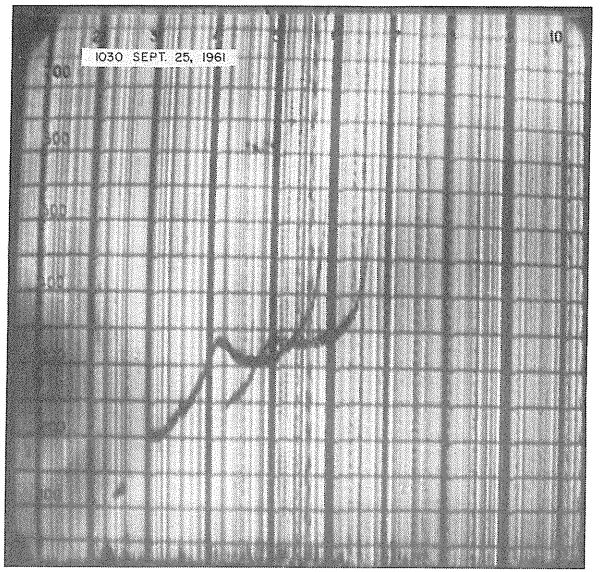
STATION: PROVIDENIE BAY U.S.S.R.

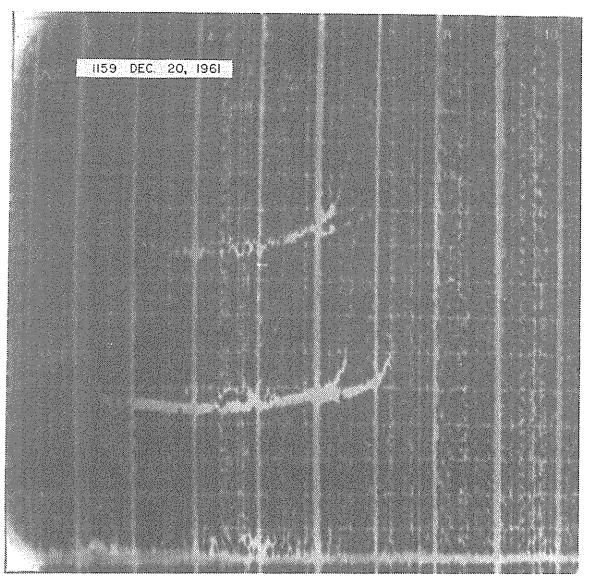
COORDINATES: GEOGRAPHIC LATITUDE: 64°23'N LONGITUDE: 173°24'W
GEOMAGNETIC LATITUDE: 59.6°N LONGITUDE: 235.7°
MAGNETIC DIP: 74.0°N TIME ZONE: 180°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 73.5°N
SVERDLOVSK





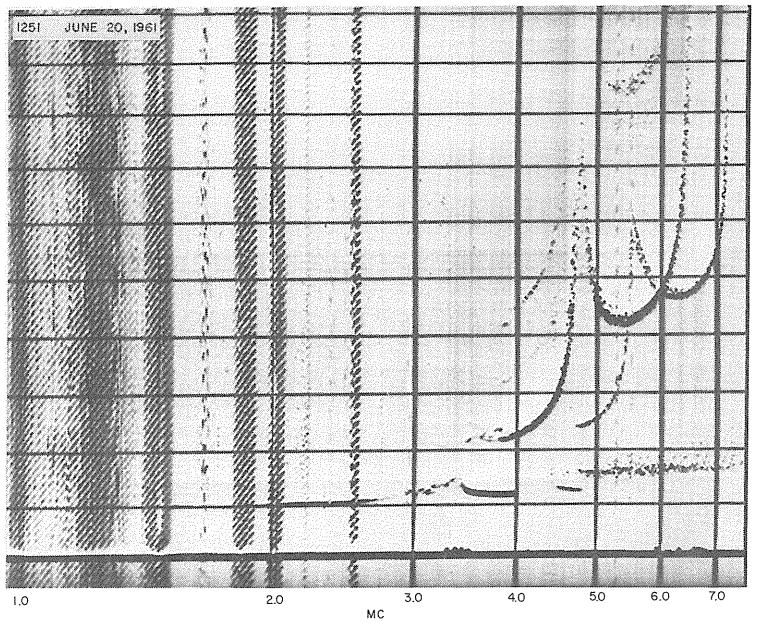


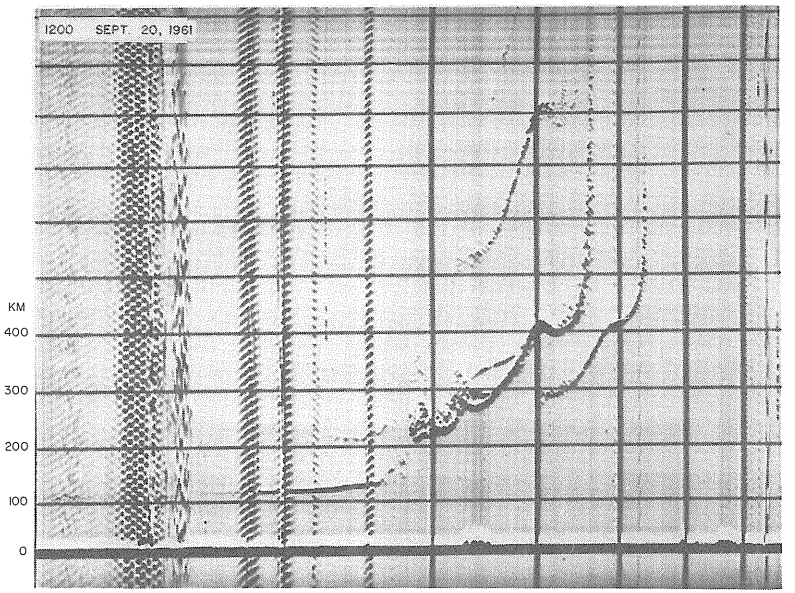
STATION: SVERDLOVSK U.S.S.R.

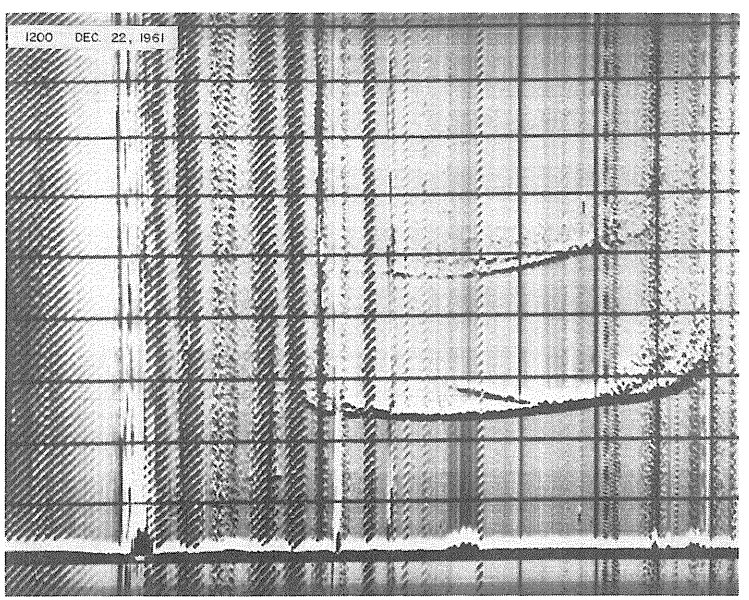
COORDINATES:
GEOGRAPHIC LATITUDE: 56°44'N LONGITUDE: 61°04'E
GEOMAGNETIC LATITUDE: 48.5°N LONGITUDE: 140.7°
MAGNETIC DIP: 73.5°N TIME ZONE: 60°E

IONOSONDE:
TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 73.3° N
ANCHORAGE





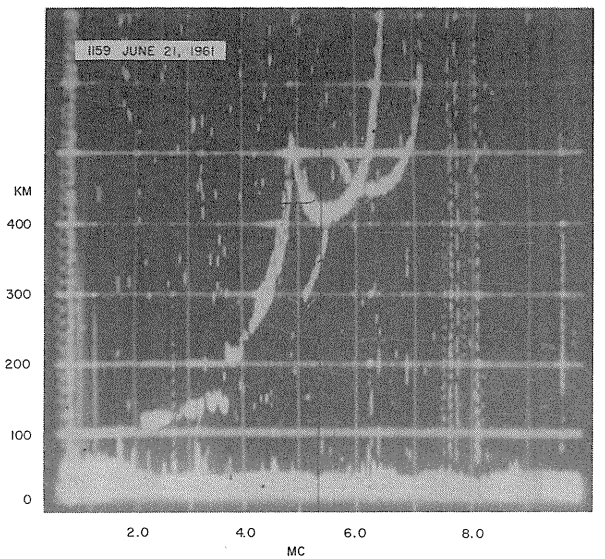


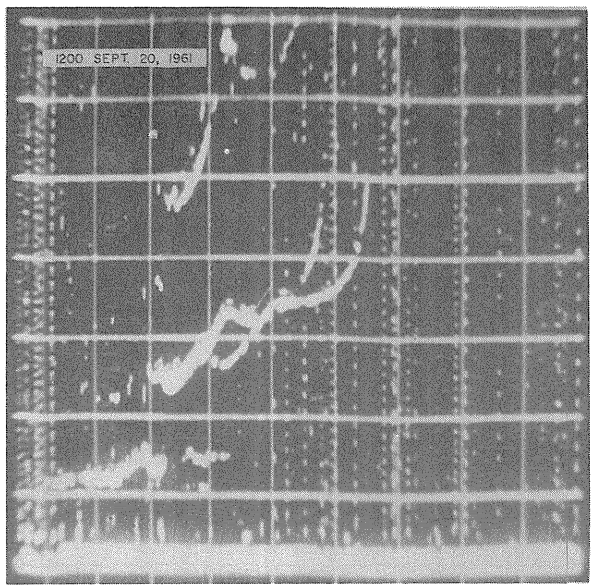
STATION: ANCHORAGE U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 61°10'N LONGITUDE: 149°55'W
GEOMAGNETIC LATITUDE: 60.9°N LONGITUDE: 258.1°
MAGNETIC DIP: 73.3°N TIME ZONE: 150°W
GYROFREQUENCY: 1.40 MC AT 200 KM
TOTAL FIELD: 0.55 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 13.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 73.2°N
LENINGRAD



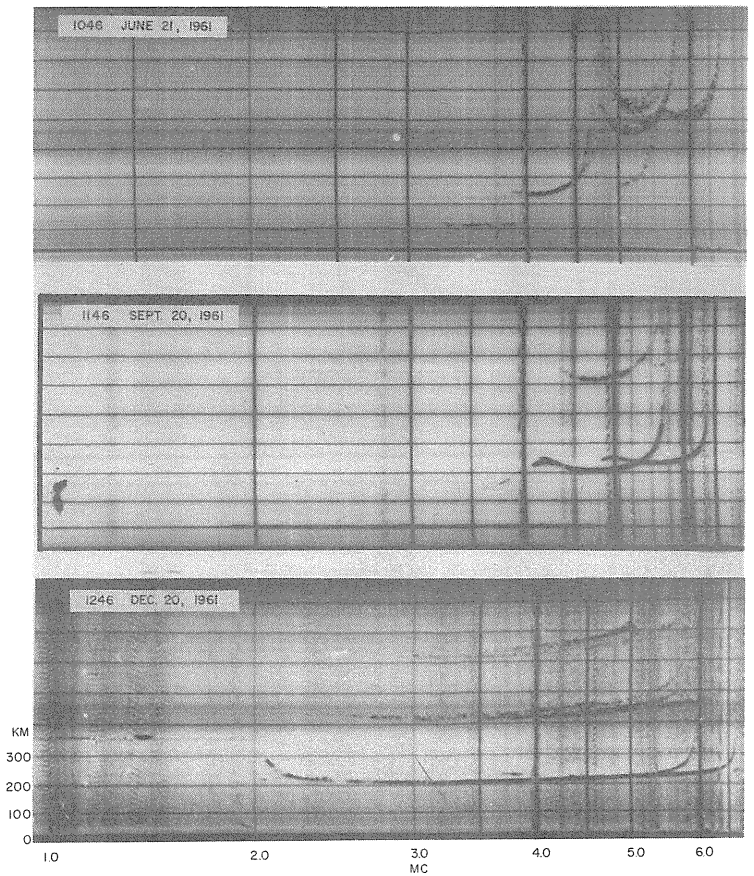


STATION: LENINGRAD U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 59°57'N LONGITUDE: 30°42'E
GEOMAGNETIC LATITUDE: 56.3°N LONGITUDE: 117.4°
MAGNETIC DIP: 73.2°N TIME ZONE: 30°E

IONOSONDE: TYPE OR DESIGNATION: SP-3
FREQUENCY RANGE: 1.0 - 20.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
FREQUENCY SCALE: LINEAR

DIP 73.2° N
NURMIJÄRVI

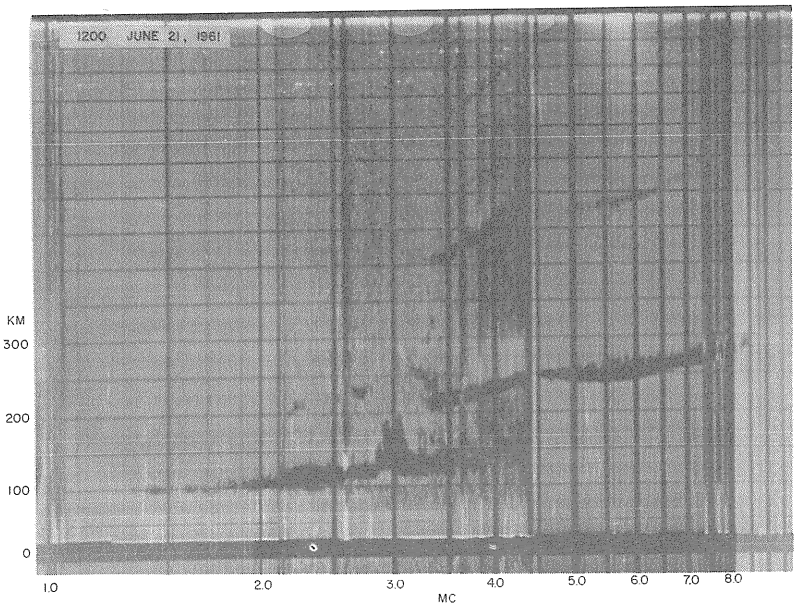


STATION: NURMIJÄRVI FINLAND

COORDINATES: GEOGRAPHIC LATITUDE: 60°30'N LONGITUDE: 24°39'E
GEOMAGNETIC LATITUDE: 57.9°N LONGITUDE: 112.5°
MAGNETIC DIP: 73.2°N TIME ZONE: 0°
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3 (MODIFIED)
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 900 KM
POWER: 5 - 10 KW (PULSE POWER)
SWEEP TIME: 60 SEC (NORMAL)
LOGARITHMIC FREQUENCY SCALE

DIP 72.8° S
HOBART

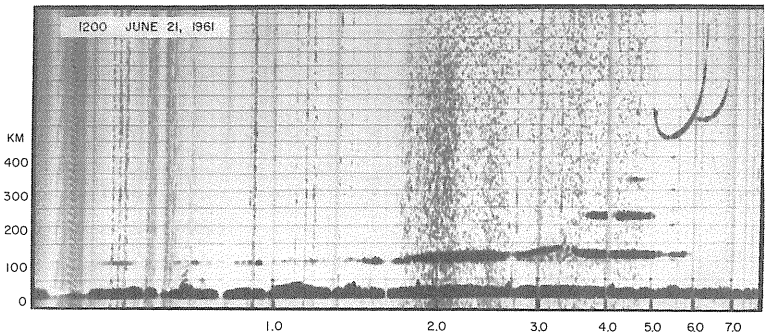


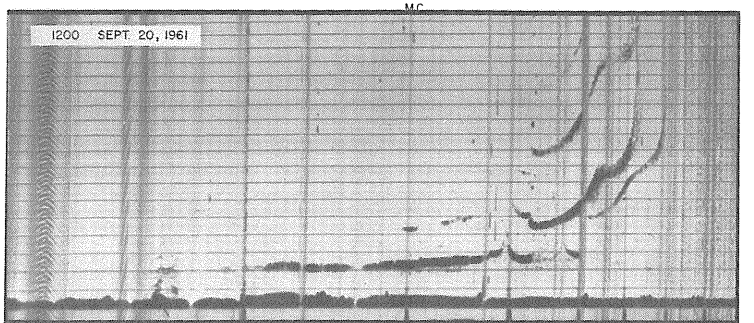
STATION: HOBART AUSTRALIA

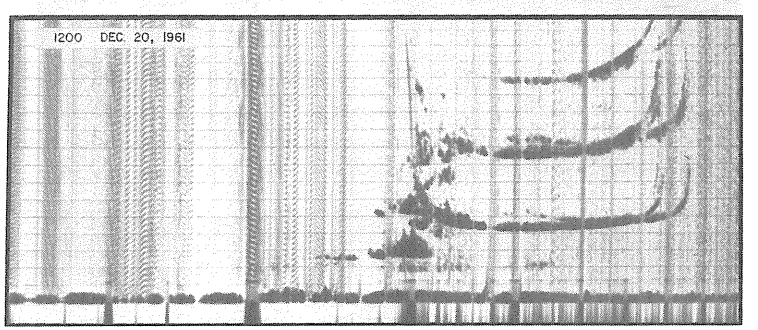
COORDINATES: GEOGRAPHIC LATITUDE: 42°55'S LONGITUDE: 147°19'E
GEOMAGNETIC LATITUDE: 51.7°S LONGITUDE: 224.3°
MAGNETIC DIP: 72.8°S TIME ZONE: 150°E
GYROFREQUENCY: 1.61 MC. AT 200 KM
TOTAL FIELD: 0.63 OERSTED

IONOSONDE: TYPE OR DESIGNATION: MODIFIED CSIRO 1/J28
FREQUENCY RANGE: 1.0 MC. TO 16.0 MC
POWER: 3 KW
SWEEP TIME: 1 MIN 55 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 72.5° N
UPPSALA





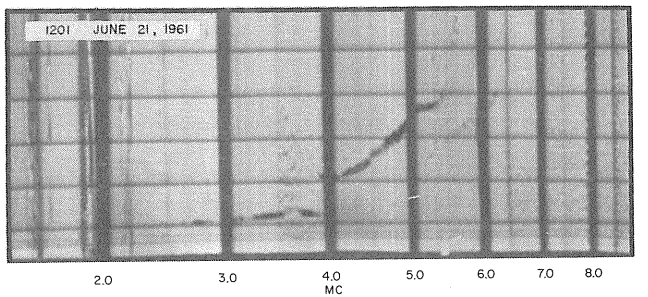


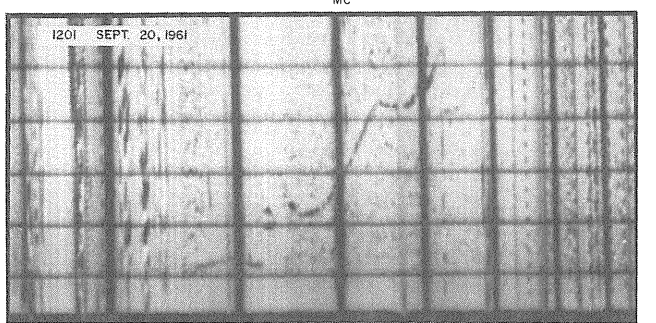
STATION: UPPSALA SWEDEN

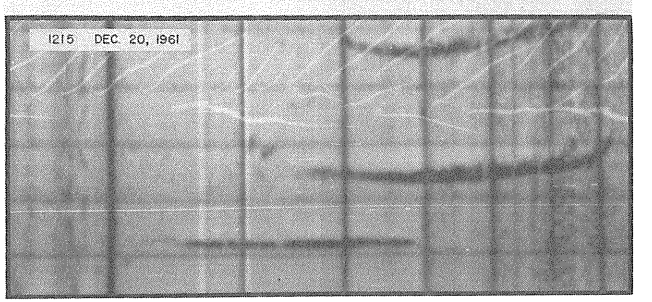
COORDINATES: GEOGRAPHIC LATITUDE: 59°48'N LONGITUDE: 17°36'E
GEOMAGNETIC LATITUDE: 58.5°N LONGITUDE: 105.9°
MAGNETIC DIP: 72.5°N TIME ZONE: 15°E (+1.2 hr.)
GYROFREQUENCY: 1.28 MC. AT 200 KM
TOTAL FIELD: 0.50 OERSTED

IONOSONDE: TYPE OR DESIGNATION: J 4
FREQUENCY RANGE: 0.33 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM POWER: ~ 20 KW
SWEEP TIME: 60, 180 SEC NEARLY LOGARITHMIC FREQ. SCALE

DIP 71.9° N
ST. JOHN'S





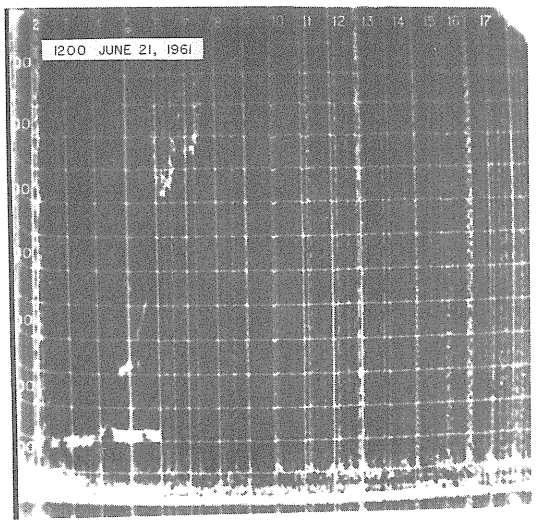


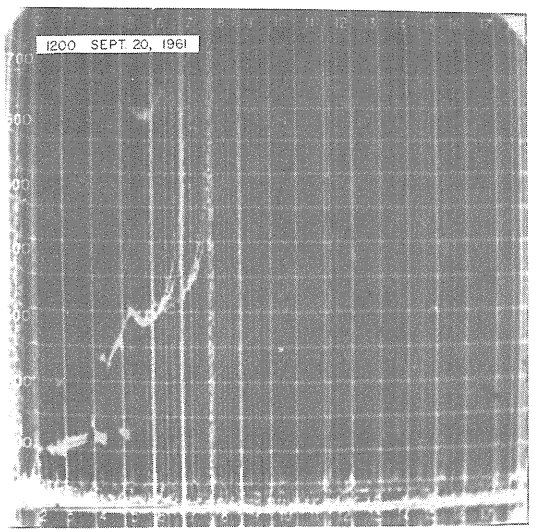
STATION: ST. JOHN'S CANADA

COORDINATES: GEOGRAPHIC LATITUDE: 47.6°N LONGITUDE: 52.7°W
GEOMAGNETIC LATITUDE: 58.5°N LONGITUDE: 21.2°
MAGNETIC DIP: 71.9°N TIME ZONE: 60°W
GYROFREQUENCY: 1.38 MC. AT 200 KM
TOTAL FIELD: 0.54 OERSTED

IONOSONDE: TYPE OR DESIGNATION: COSSOR MK 2
FREQUENCY RANGE: 1.6 MC TO 20.0 MC SWEEP TIME: 15 SEC

DIP 71.6°N
GORKY



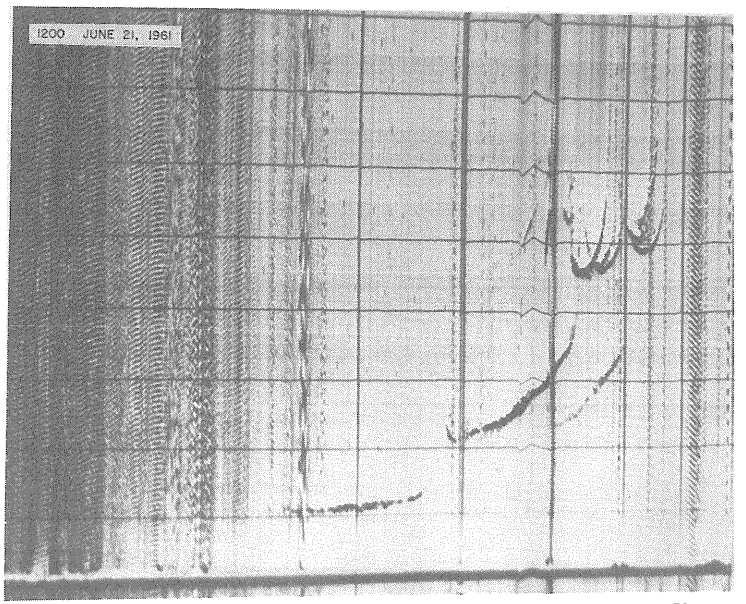


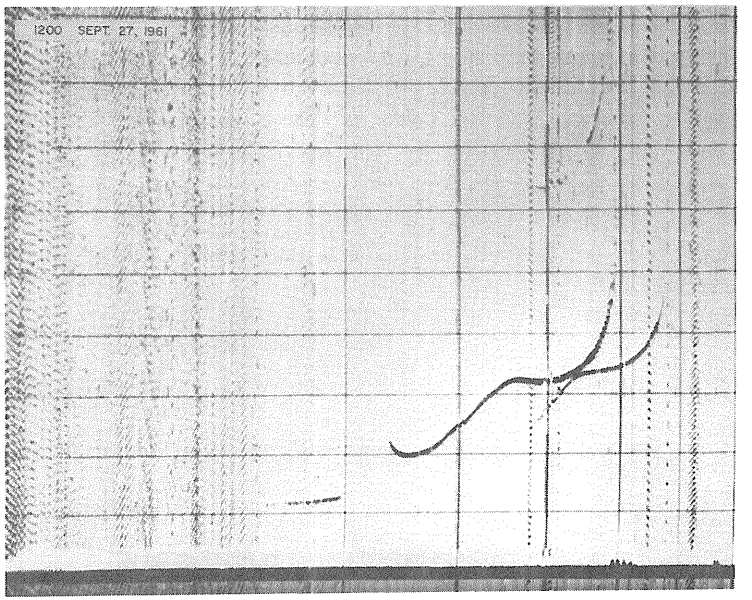
STATION: GORKY U.S.S.R.

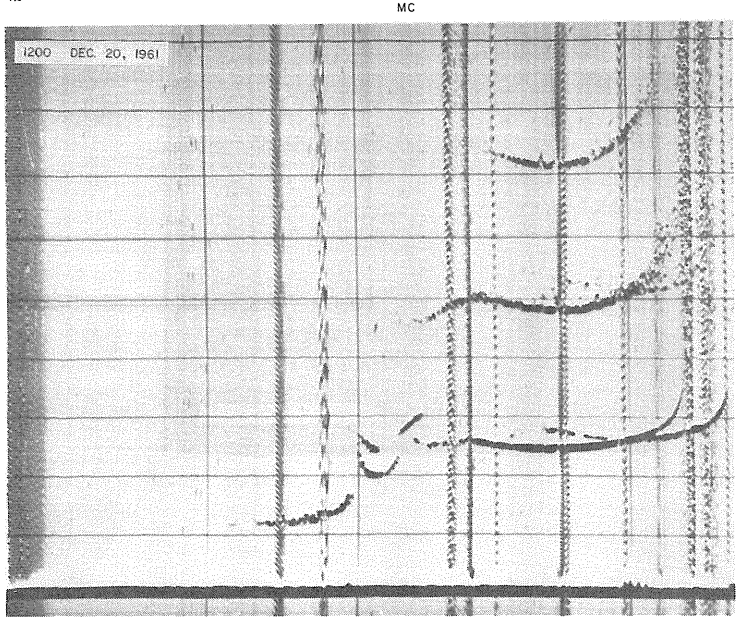
COORDINATES: GEOGRAPHIC LATITUDE: 56°09'N LONGITUDE: 44°17'E
GEOMAGNETIC LATITUDE: 50.3°N LONGITUDE: 126.7°
MAGNETIC DIP: 71.6°N TIME ZONE: 45°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 71.4° N
FORT MONMOUTH





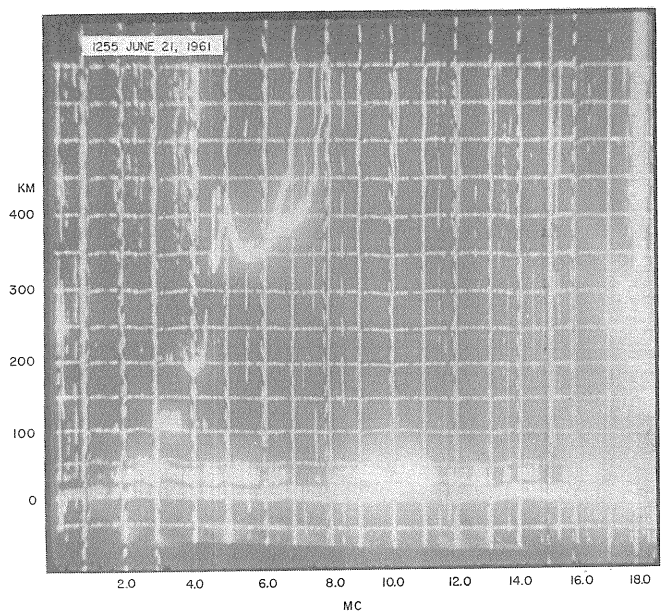


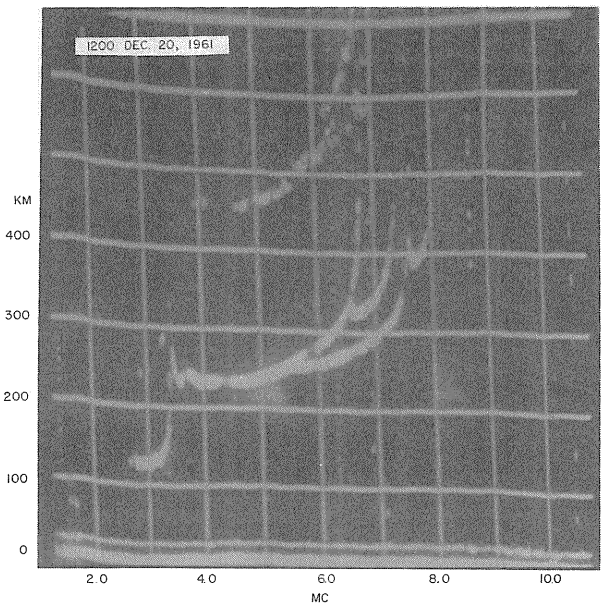
STATION: FORT MONMOUTH U.S.A.

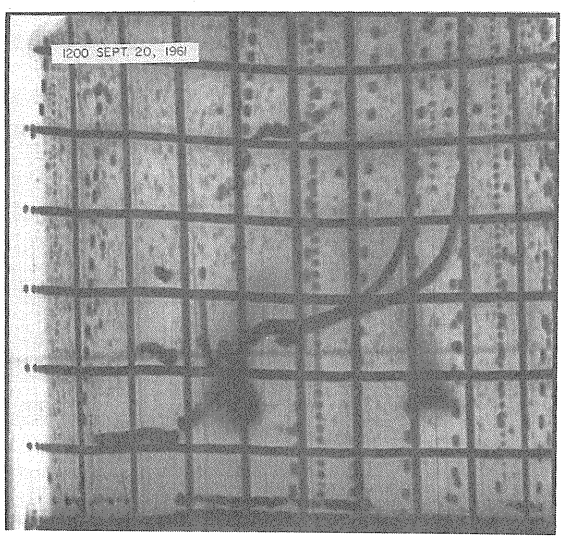
COORDINATES: GEOGRAPHIC LATITUDE: 40°23'26"N LONGITUDE: 74°07'58"W
GEOMAGNETIC LATITUDE: 51.8°N LONGITUDE: 353.7°
MAGNETIC DIP: 71.4°N TIME ZONE: 75°W
GYROFREQUENCY: 1.45 MC. AT 200 KM
TOTAL FIELD: 0.57 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 71.2°N
IRKUTSK





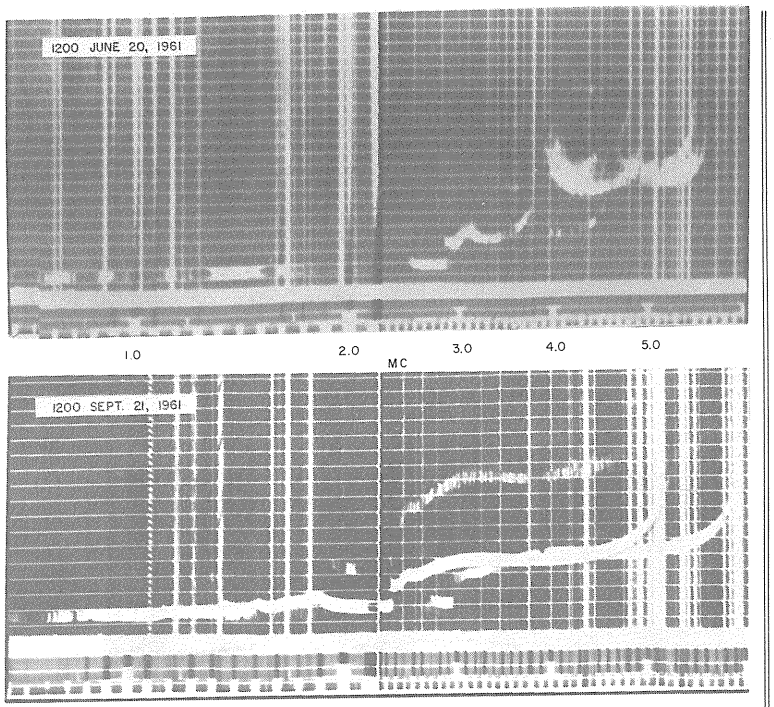


STATION: IRKUTSK U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 52°28'N LONGITUDE: 104°02'E
GEOMAGNETIC LATITUDE: 41.1°N LONGITUDE: 174.4°
MAGNETIC DIP: 71.2°N TIME ZONE: 105°E

IONOSONDE: TYPE OR DESIGNATION: NO. 285
FREQUENCY RANGE: 0.5 - 20.0 MC
HEIGHT RANGE: 200 KM, 300 KM, 500 KM, 750 KM, 1000 KM, 1500 KM, 2000 KM
POWER: 20 KW
SWEEP TIME: FROM 10 TO 30 SEC
FREQUENCY SCALE: LINEAR

DIP 71.2°N
INVERNESS

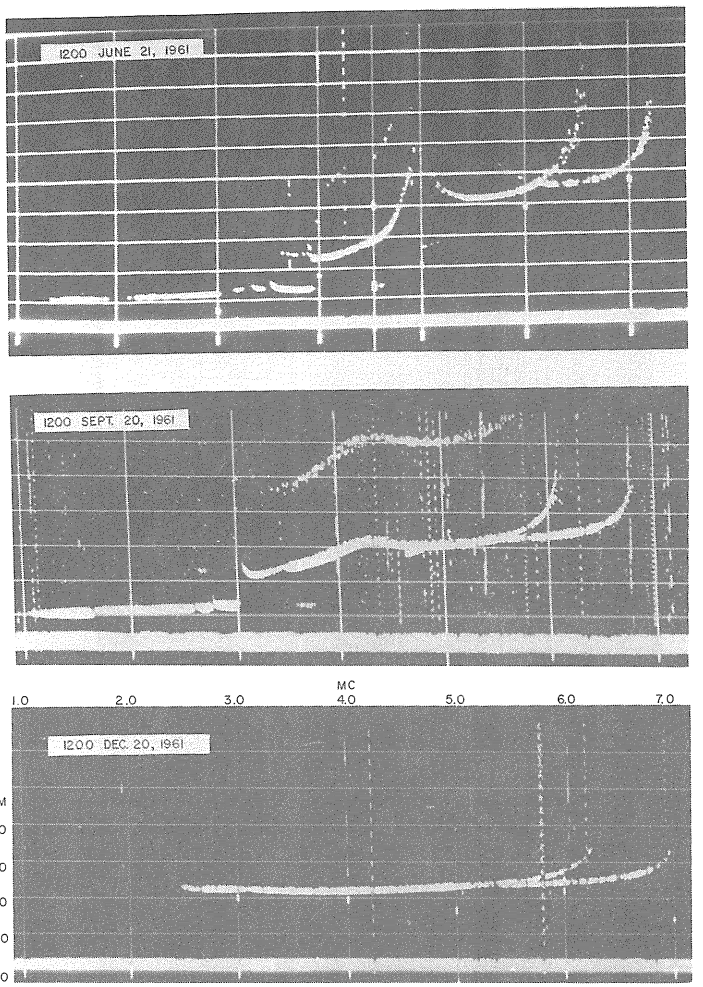


STATION: INVERNESS U. K.

COORDINATES: GEOGRAPHIC LATITUDE: 57°27'N LONGITUDE: 04°15'W
GEOMAGNETIC LATITUDE: 60.6°N LONGITUDE: 83.3°
MAGNETIC DIP: 71.2°N TIME ZONE: 0°
GYROFREQUENCY: 1.28 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1000 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 70.6°N
MOSCOW

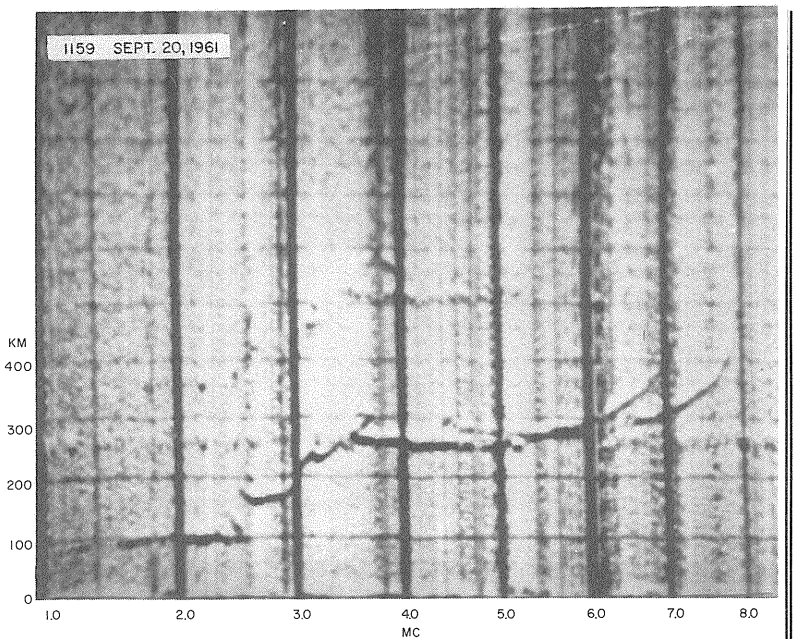


STATION: MOSCOW U.S.S.R.

COORDINATES: GEOGRAPHIC LATITUDE: 55°28'N LONGITUDE: 37°19'E
GEOMAGNETIC LATITUDE: 50.9°N LONGITUDE: 120.5°
MAGNETIC DIP: 70.6°N TIME ZONE: 30°E

IONOSONDE: TYPE OR DESIGNATION: SP-3
FREQUENCY RANGE: 1.0 - 20.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
FREQUENCY SCALE: LINEAR

DIP 71.1° N
URBANA

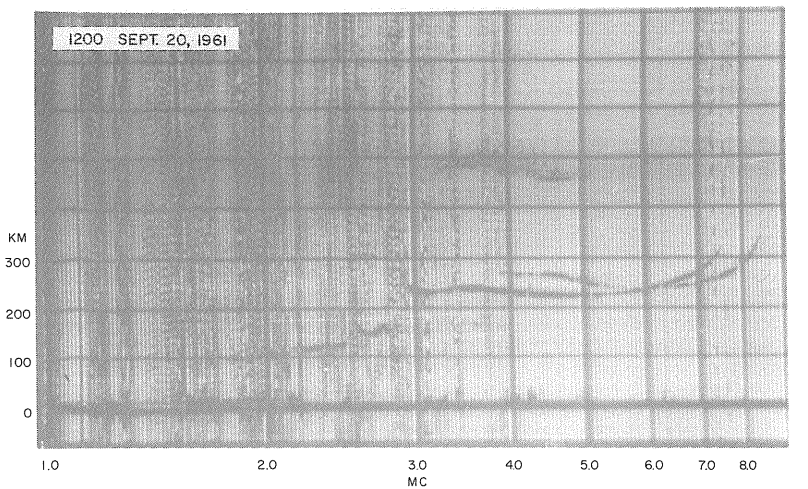


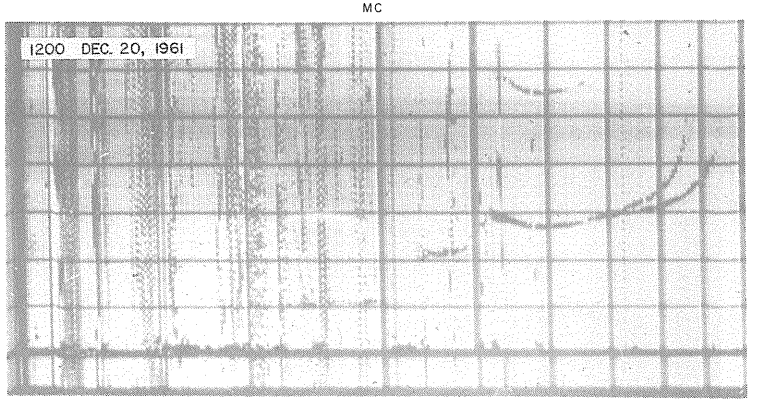
STATION: URBANA U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 40°02'58"N LONGITUDE: 88°22'50"W
MAGNETIC DIP: 71.1°N TIME ZONE: 90°W
GYROFREQUENCY: 1.48 MC AT 200 KM
TOTAL FIELD: 0.58 OERSTED

IONOSONDE: TYPE OR DESIGNATION: COSSOR
FREQUENCY RANGE: 2 MC TO 30 MC
POWER: 1 KW

DIP 70.4° N
SEATTLE



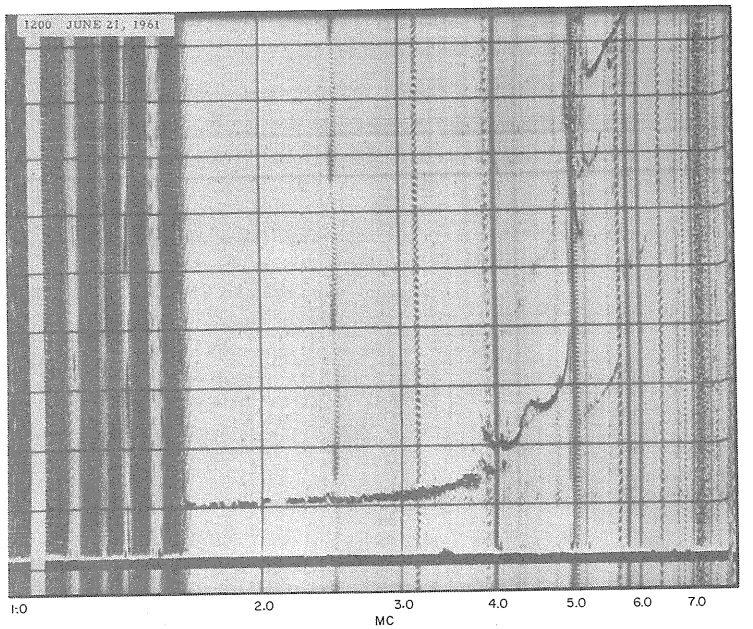


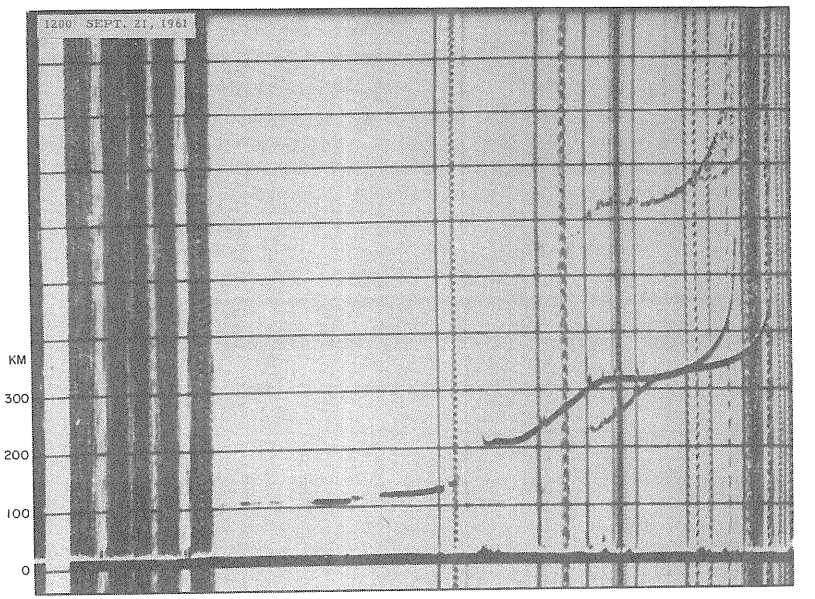
STATION: SEATTLE U.S.A.

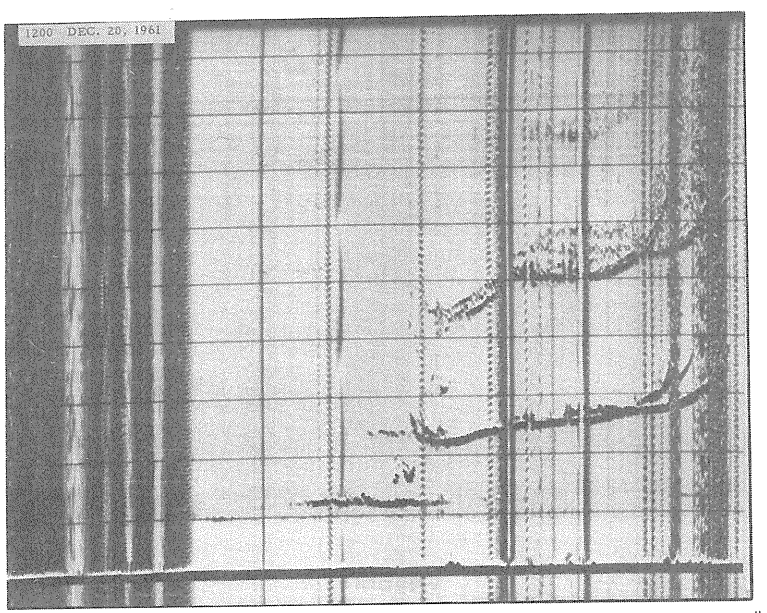
COORDINATES: GEOGRAPHIC LATITUDE: 47°33'48"N LONGITUDE: 122°21'20"W
GEOMAGNETIC LATITUDE: 53.6°N LONGITUDE: 294.4°
MAGNETIC DIP: 70.4°N TIME ZONE: 120°W
GYROFREQUENCY: 1.43 MC AT 200 KM
TOTAL FIELD: 0.56

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1 MC. TO 25 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KM
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 70.2° N
WASHINGTON





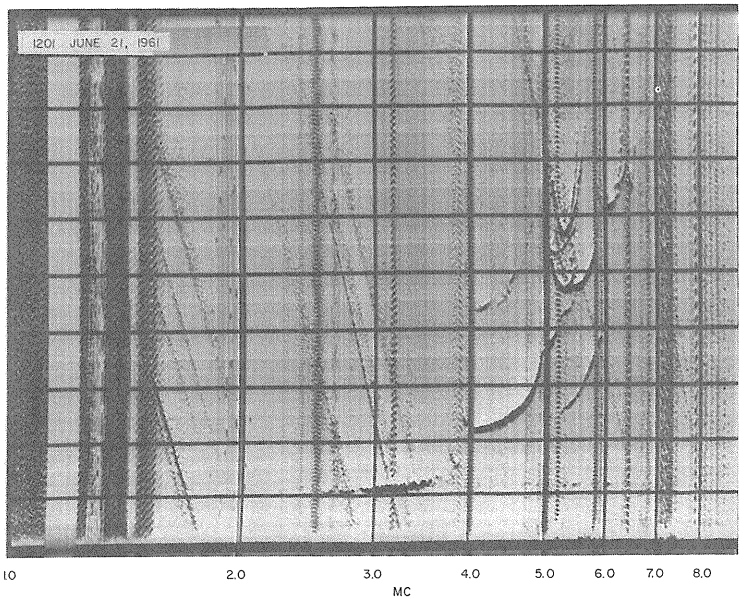


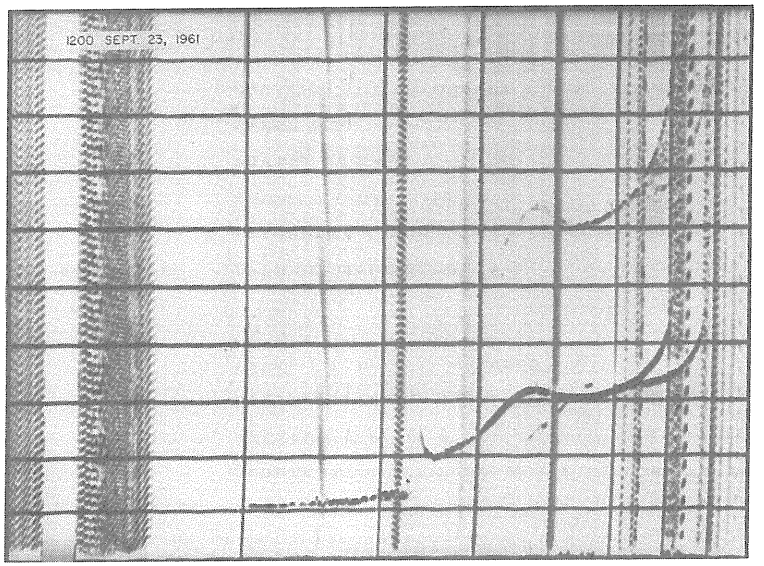
STATION: WASHINGTON (FORT BELVOIR) U. S. A.

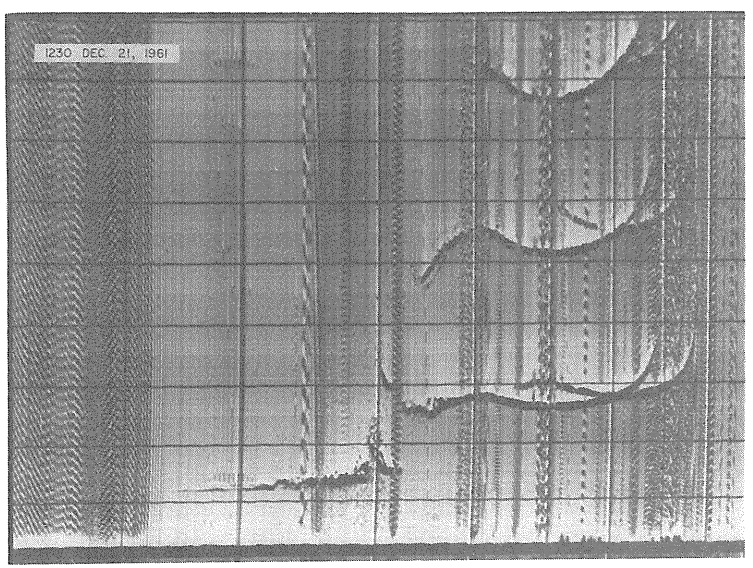
COORDINATES: GEOGRAPHIC LATITUDE: 38°43'47.375"N LONGITUDE: 77°07'39.325"W
GEOMAGNETIC LATITUDE: 50.1°N LONGITUDE: 350.1°
MAGNETIC DIP: 70.2°N GYROFREQUENCY: 1.45 MC AT 200 KM
TOTAL FIELD: 0.57 OERSTED TIME ZONE: 75°W

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC HEIGHT RANGE: 1000 KM
POWER: 20 KW SWEEP TIME: 13.5 SEC LOGARITHMIC FREQ. SCALE

DIP 69.6°N
WALLOPS ISLAND





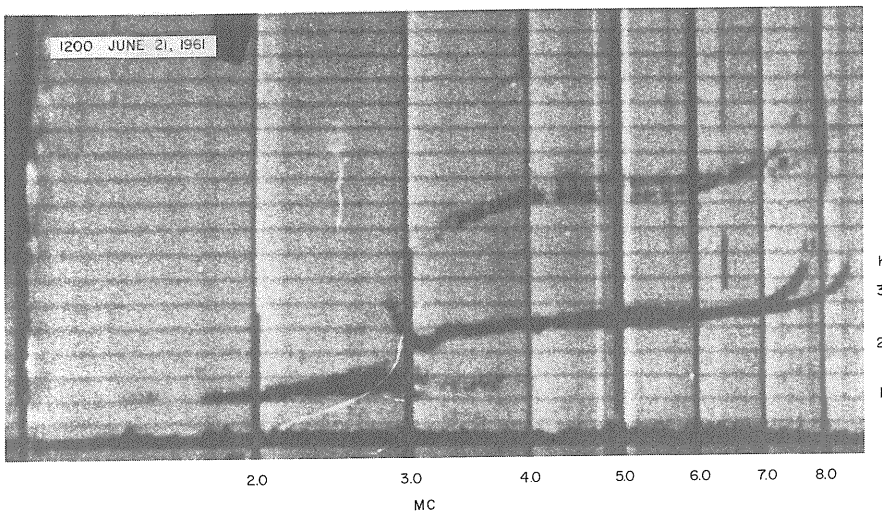


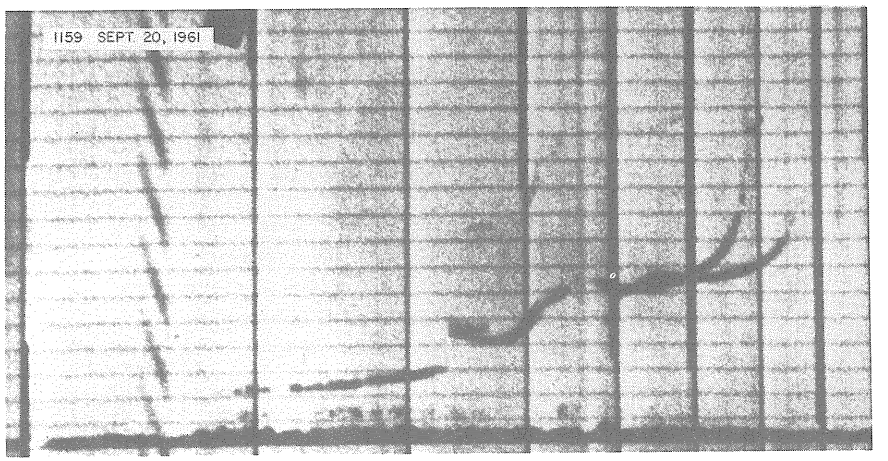
STATION: WALLOPS ISLAND U. S. A.

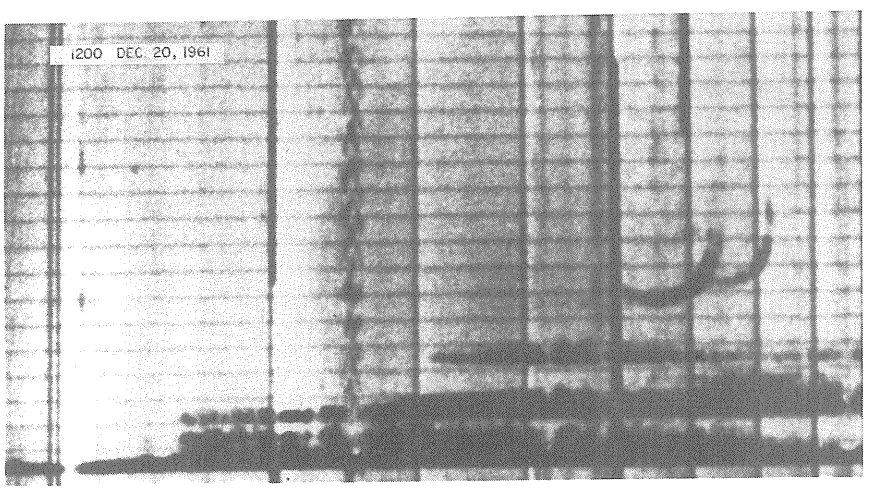
COORDINATES: GEOGRAPHIC LATITUDE: 37°53'N LONGITUDE: 75°28'W
GEOMAGNETIC LATITUDE: 49.2°N LONGITUDE: 348.5°N
MAGNETIC DIP: 69.6°N TIME ZONE: 75°W
GYROFREQUENCY: 1.43 MC. AT 200 KM.
TOTAL FIELD: 0.56 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 15, 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 69.0° S
GODLEY HEAD





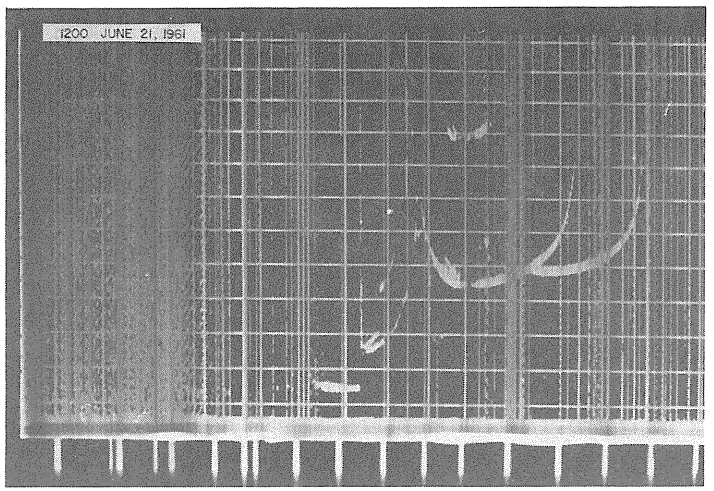


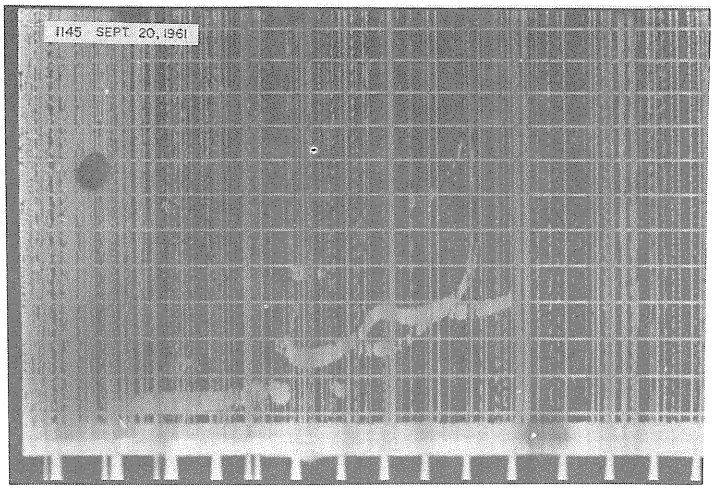
STATION: GODLEY HEAD NEW ZEALAND

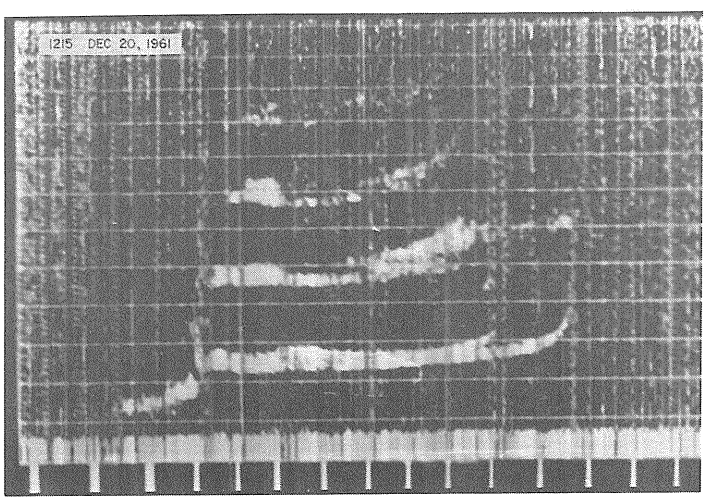
COORDINATES:
GEOGRAPHIC LATITUDE: 43°34'S LONGITUDE: 172°48'E
GEOMAGNETIC LATITUDE: 48.1°S LONGITUDE: 252.8°
MAGNETIC DIP: 69.0°S TIME ZONE: 180.0°E Z.T.
GYROFREQUENCY: 1.51 MC AT 200 KM
TOTAL FIELD: 0.59 OERSTED

IONOSONDE:
TYPE OR DESIGNATION: P-2
FREQUENCY RANGE: 1 MC TO 22 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 7.5 SEC
EQUATION FOR FREQUENCY SCALE: LOGARITHMIC

DIP 68.9° N
JULIUSRUH / RÜGEN





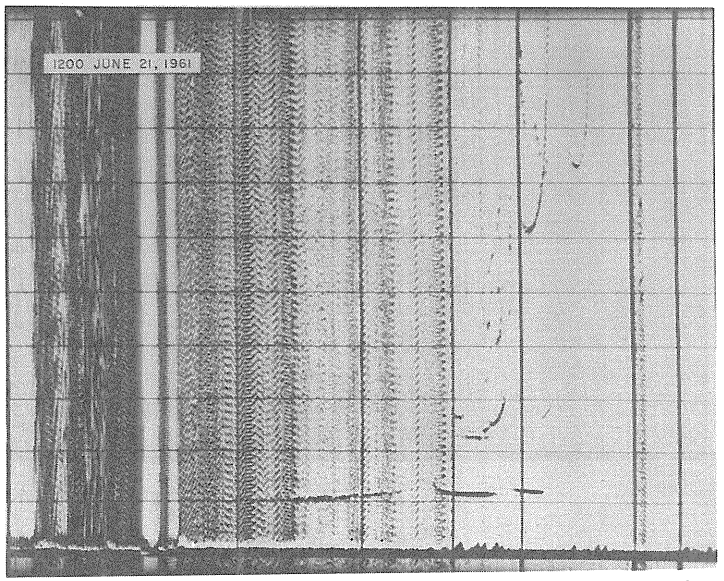


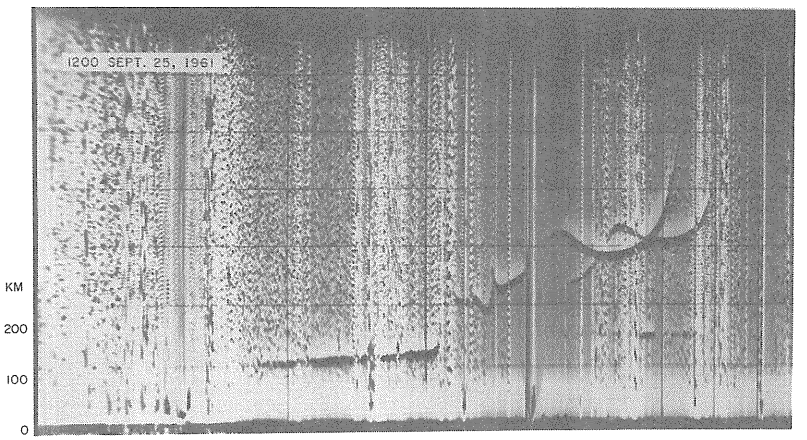
STATION: JULIUSRUH/RÜGEN GERMAN DEM. REP.

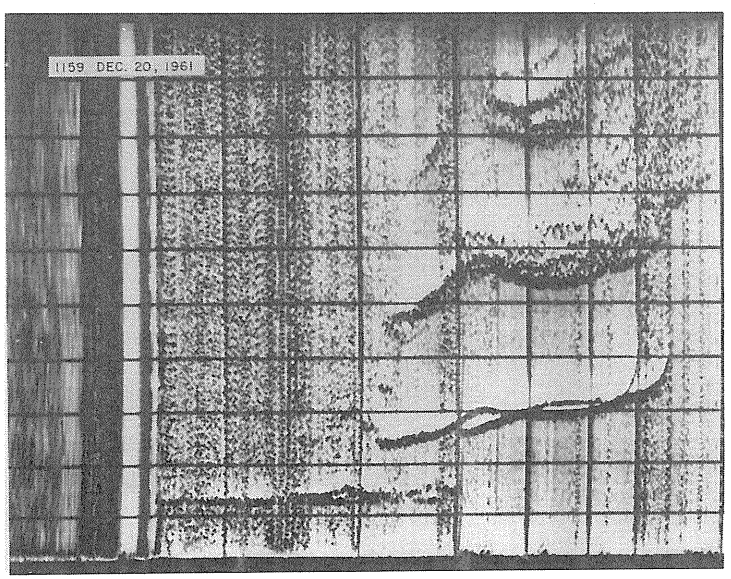
COORDINATES: GEOGRAPHIC LATITUDE: 54.6°N LONGITUDE: 13.4°E
GEOMAGNETIC LATITUDE: 54.5°N LONGITUDE: 98.7°
MAGNETIC DIP: 68.9°N TIME ZONE: 15°E
GYROFREQUENCY: 1.22 MC. AT 200 KM
TOTAL FIELD: 0.48 OERSTED

IONOSONDE: TYPE OR DESIGNATION: OWN CONSTRUCTION
FREQUENCY RANGE: 0.8 MC. TO 20.0 MC
HEIGHT RANGE: 1200 KM
POWER: ABOUT 15 KW
SWEEP TIME: 30 SEC
LINEAR FREQUENCY SCALE

DIP 67.8° N
BOULDER





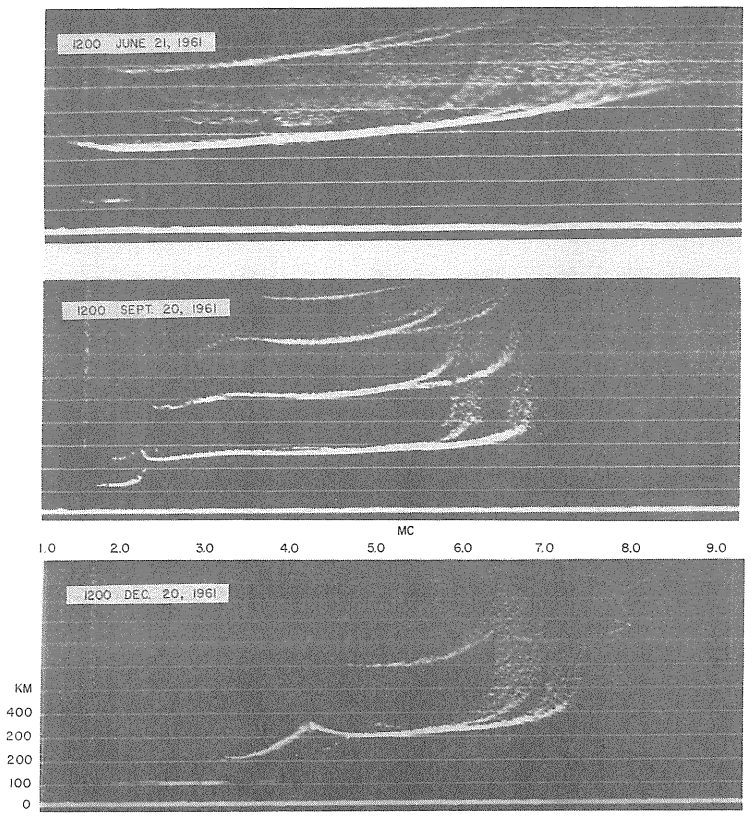


STATION: BOULDER U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 40°02'N LONGITUDE: 105°18'W
GEOMAGNETIC LATITUDE: 48.9°N LONGITUDE: 316.4°
MAGNETIC DIP: 67.8°N TIME ZONE: 105°W
GYROFREQUENCY: 1.43 MC AT 200 KM
TOTAL FIELD: 0.56 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 15, 30, 60, 120 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 67.7°S
SYOWA BASE

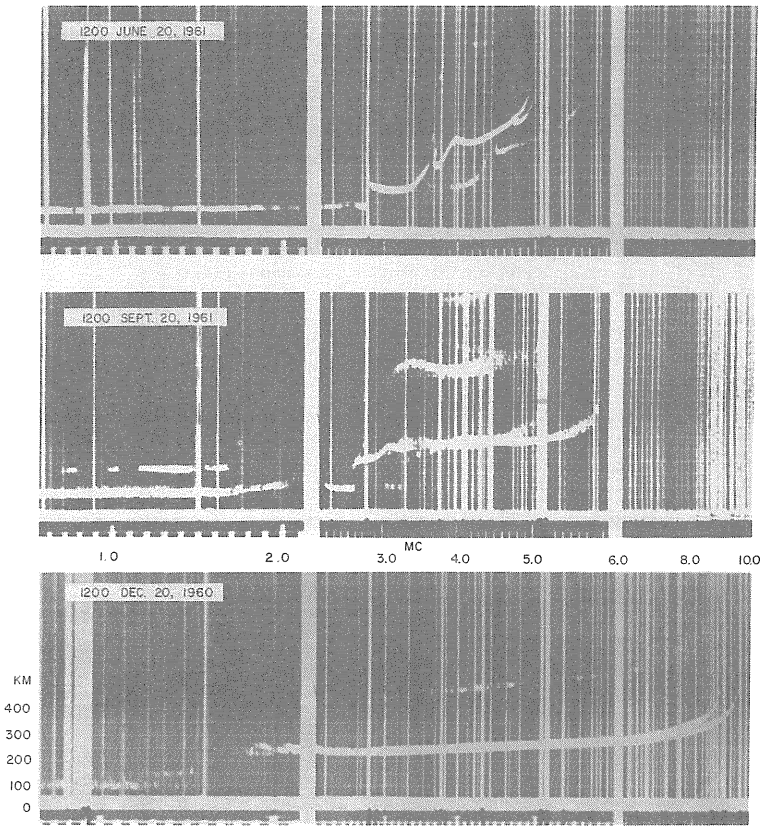


STATION: SYOWA BASE ANTARCTICA

COORDINATES:
- GEOGRAPHIC LATITUDE: 69°00'S — LONGITUDE: 39°35'E
- GEOMAGNETIC LATITUDE: 69.7°S — LONGITUDE: 77.7°
- MAGNETIC DIP: 67.7°S — TIME ZONE: 45°E
- GYROFREQUENCY: 1.20 MC AT 200 KM
- TOTAL FIELD: 0.47 OERSTED

IONOSONDE:
- TYPE OR DESIGNATION: PANORAMIC
- FREQUENCY RANGE: 1.0 - 20.0 MC
- HEIGHT RANGE: 1000 KM
- POWER: 10 KW
- SWEEP TIME: 20 SEC
- FREQUENCY SCALE: LINEAR

DIP 66.8°N
SLOUGH

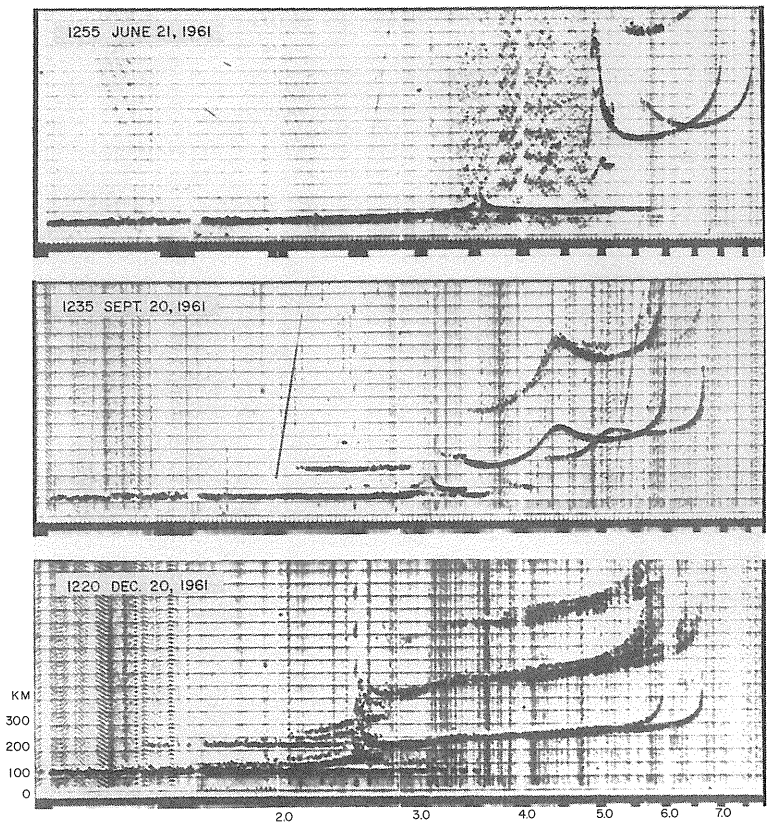


STATION: SLOUGH U. K.

COORDINATES:
- GEOGRAPHIC LATITUDE: 51°31'N — LONGITUDE: 00°34'W
- GEOMAGNETIC LATITUDE: 54.3°N — LONGITUDE: 84.1°
- MAGNETIC DIP: 66.8°N — TIME ZONE: 0°
- GYROFREQUENCY: 1.22 MC AT 200 KM

IONOSONDE:
- TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
- FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
- HEIGHT RANGE: 1000 KM
- POWER: 1 KW
- SWEEP TIME: 1 MIN FOR EACH BAND
- FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
- QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 66.6° N
LINDAU

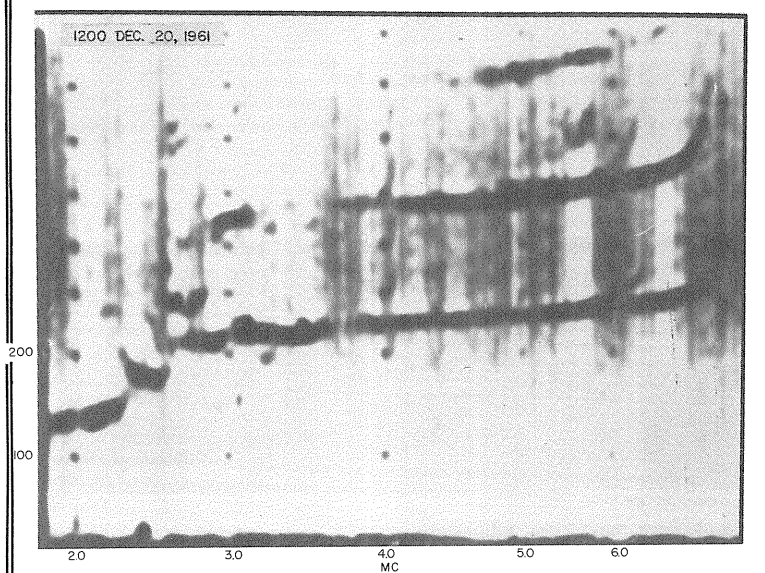


STATION: LINDAU FED. REP. OF GERMANY

COORDINATES: GEOGRAPHIC LATITUDE: 51°39'N LONGITUDE: 10°08'E
GEOMAGNETIC LATITUDE: 52.3°N LONGITUDE: 93.9°
MAGNETIC DIP: 66.6°N TIME ZONE: 15°E
GYROFREQUENCY: 1.20 MC AT 200 KM
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: DDA IV/54
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
HEIGHT RANGE: 900 KM
POWER: 15 KW
SWEEP TIME: 120, 240, 480 SEC
EQUATION FOR FREQUENCY SCALE: $f = ke^{\alpha t}$

DIP 67.1° N
DE BILT

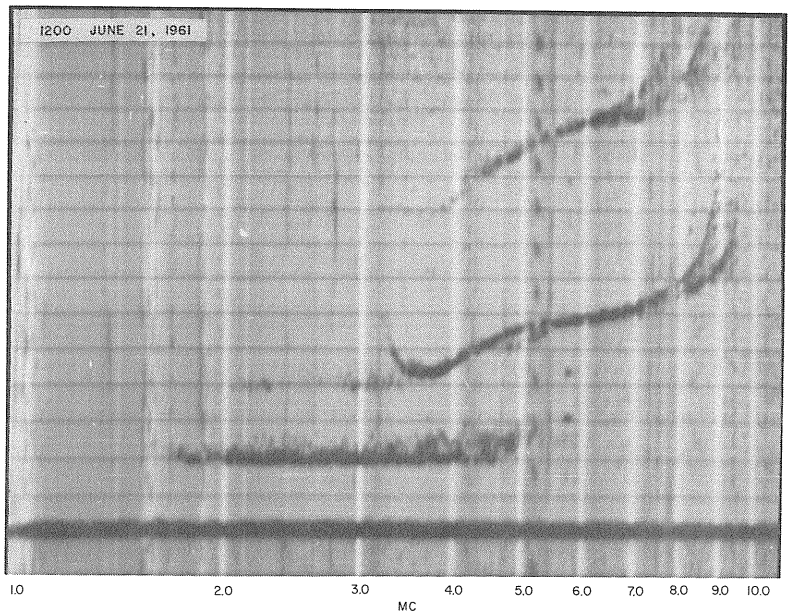


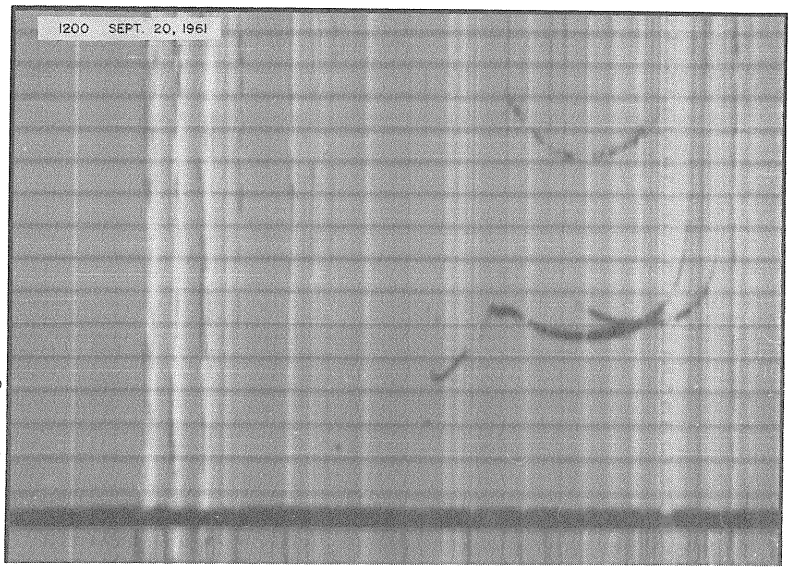
STATION: DE BILT NETHERLANDS

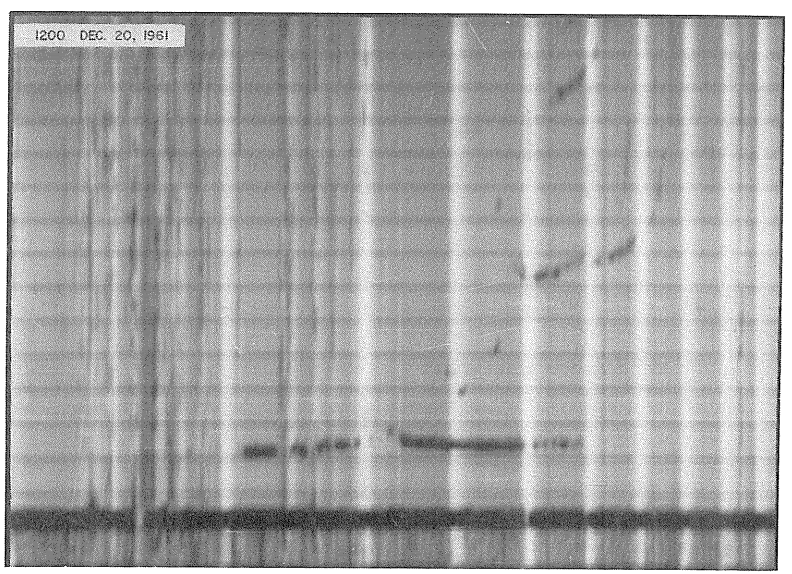
COORDINATES: GEOGRAPHIC LATITUDE: 52°06'N LONGITUDE: 05°11'E
GEOMAGNETIC LATITUDE: 53.8°N LONGITUDE: 89.4°
MAGNETIC DIP: 67.1°N TIME ZONE: 15°E
GYROFREQUENCY: 1.20 MC AT 200 KM
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.8 MC TO 18 MC
HEIGHT RANGE: 700 KM
POWER: 5 KW
SWEEP TIME: 240 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 66.1° S
CANBERRA





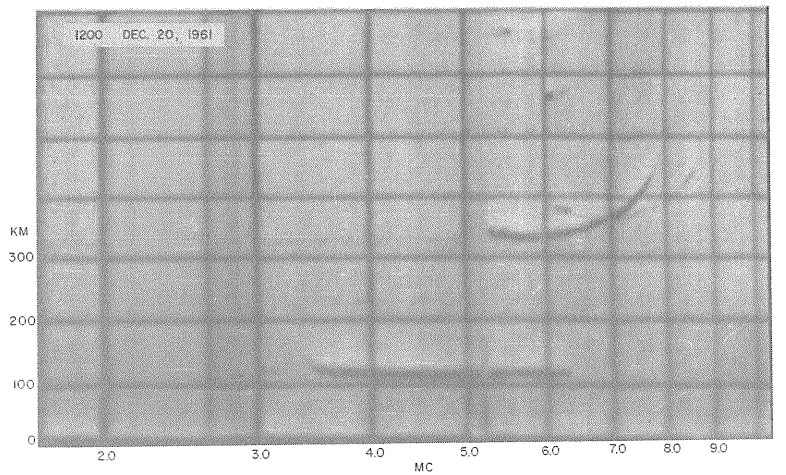


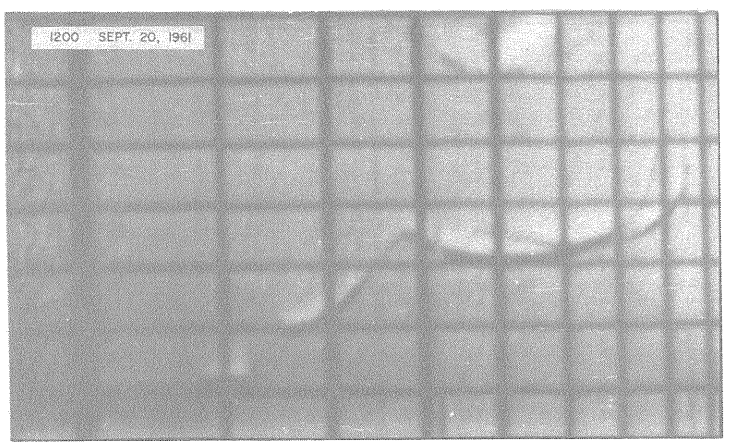
STATION: CANBERRA AUSTRALIA

COORDINATES: GEOGRAPHIC LATITUDE: 35°18'S LONGITUDE: 149°12'E
GEOMAGNETIC LATITUDE: 44.0°S LONGITUDE: 224.3°
MAGNETIC DIP: 66.1°S TIME ZONE: 150°E
GYROFREQUENCY: 1.51 MC AT 200 KM.
TOTAL FIELD: 0.59 OERSTED

IONOSONDE: TYPE OR DESIGNATION: IPS TYPE 3 C
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
POWER: 5 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 66.5° S
MUNDARING



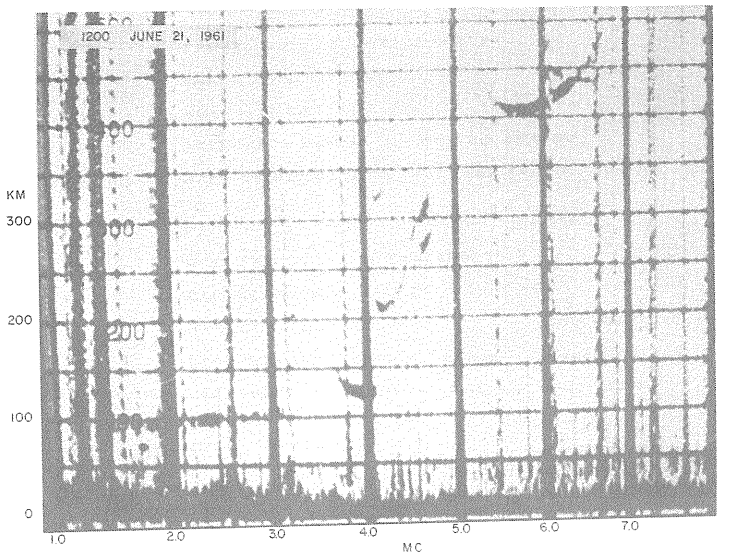


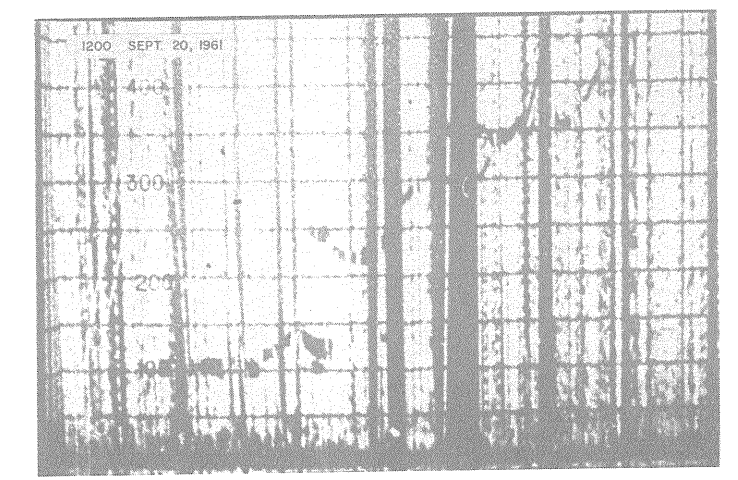
STATION: MUNDARING AUSTRALIA

COORDINATES: GEOGRAPHIC LATITUDE: 31°59'S LONGITUDE: 116°12' E
GEOMAGNETIC LATITUDE: 43.5°S LONGITUDE: 186.1°
MAGNETIC DIP: 66.5°S TIME ZONE: 120 E
GYROFREQUENCY: 1.51 MC AT 200 KM
TOTAL FIELD: 0.59 OERSTED

IONOSONDE: TYPE OR DESIGNATION: COSSOR 7562C
FREQUENCY RANGE: 1.0 MC TO 20.0 MC
POWER: 1 KW
SWEEP TIME: 18 SEC
APPROXIMATELY LOGARITHMIC FREQUENCY SCALE

DIP 65.3° N
PRUHONICE



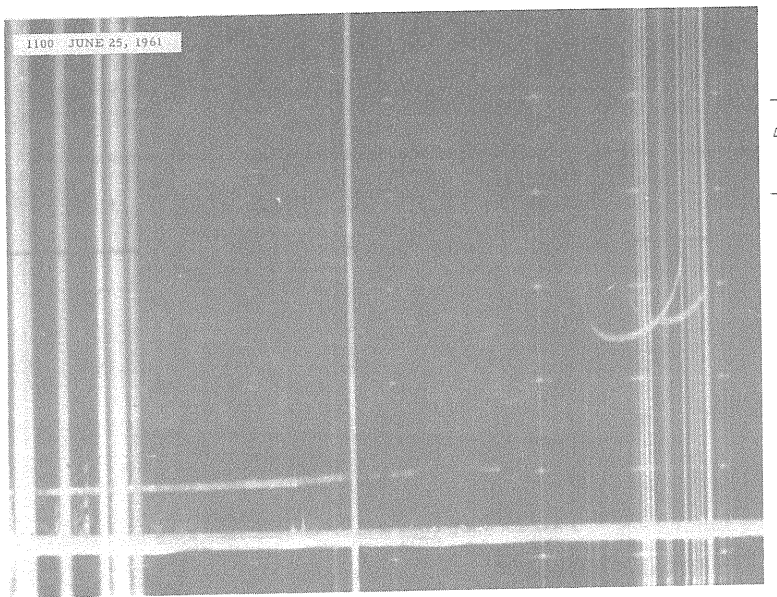


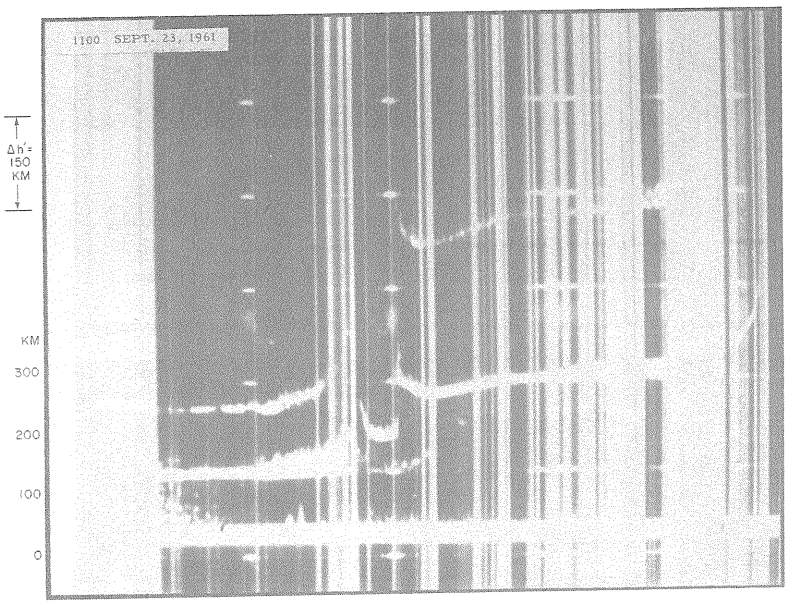
STATION: PRUHONICE CZECHOSLOVAKIA

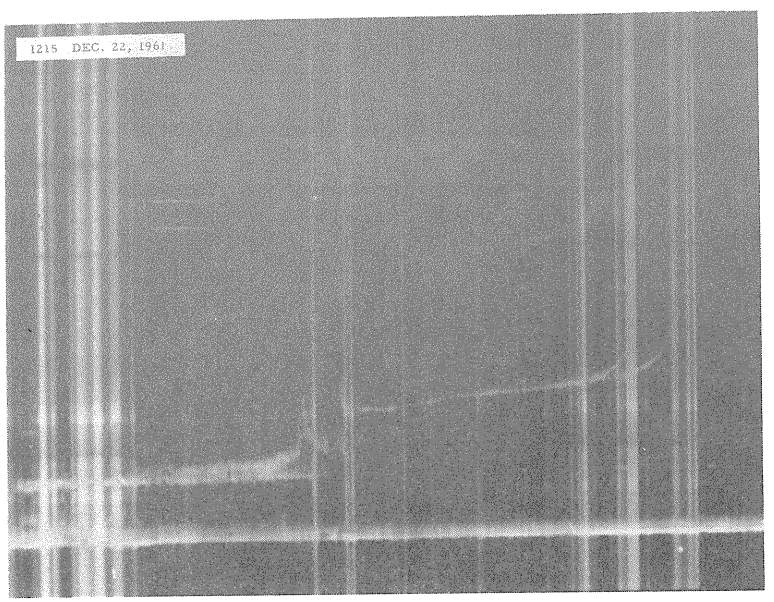
COORDINATES: GEOGRAPHIC LATITUDE: 49°59'N LONGITUDE: 14°33'E
GEOMAGNETIC LATITUDE: 49.9°N LONGITUDE: 97.4°
MAGNETIC DIP: 65.3°N TIME ZONE: 0°
GYROFREQUENCY: 1.21 MC AT 200 KM TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: A I S
FREQUENCY RANGE: 1.0 MC TO 18.0 MC
HEIGHT RANGE: 750 KM USED, 250 OR 1500 POSSIBLE
POWER: 12 KW SWEEP TIME: 20 SEC LINEAR FREQUENCY SCALE

DIP 65.5° N
DOURBES





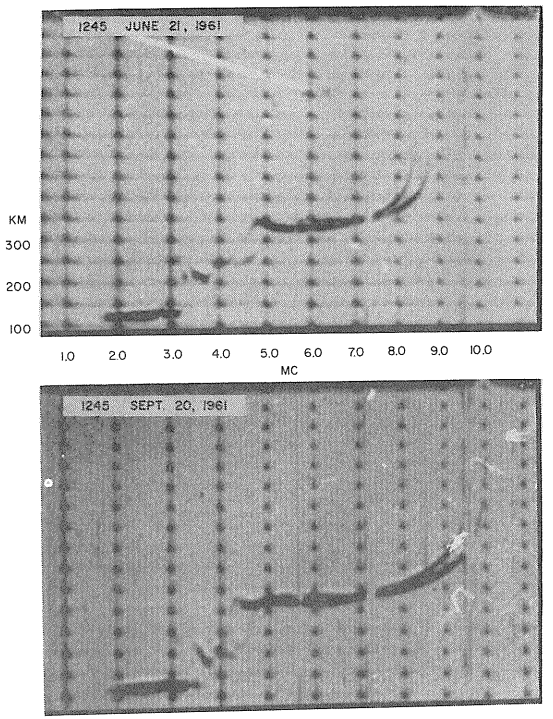


STATION: DOURBES BELGIUM

COORDINATES: GEOGRAPHIC LATITUDE: 50°06'N LONGITUDE: 04°36'E
GEOMAGNETIC LATITUDE: 52.0°N LONGITUDE: 87.7°
MAGNETIC DIP: 65.5°N TIME ZONE: 0°
GYROFREQUENCY: 1.20 MC AT 200 KM
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: FREQUENCY RANGE: 1.0 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM
POWER: 30 KW
SWEEP TIME: 180 OR 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 64.2° S
CAPE TOWN

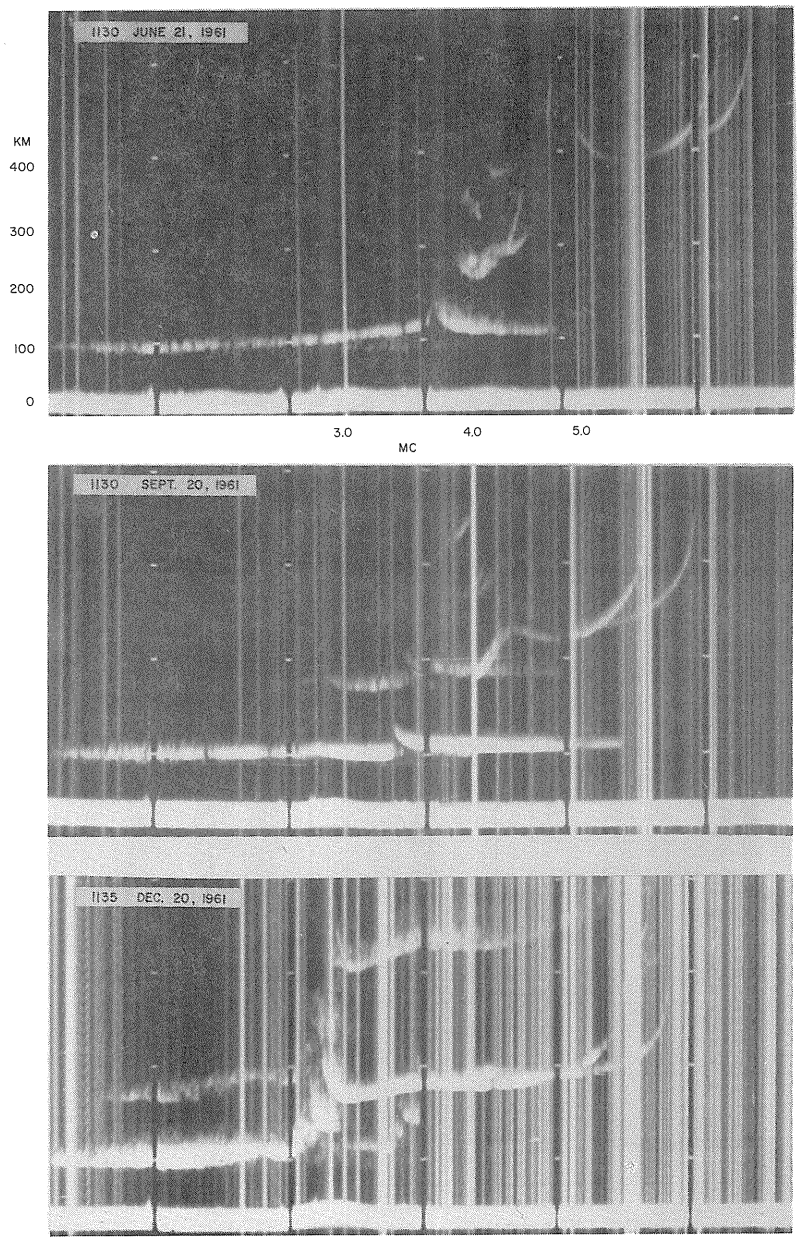


STATION: CAPE TOWN REP. OF S. AFRICA

COORDINATES: GEOGRAPHIC LATITUDE: 34°08'S LONGITUDE: 18°19'E
GEOMAGNETIC LATITUDE: 32.8°S LONGITUDE: 79.7°
MAGNETIC DIP: 64.2°S TOTAL FIELD: 0.32 OERSTED
GYROFREQUENCY: 0.82 MC AT 200 MC TIME ZONE: 30°E

IONOSONDE: TYPE OR DESIGNATION: WADLEY
FREQUENCY RANGE: 1.0 MC TO 20.0 MC (USUALLY SET 1.0 TO 17.0 MC/S)
HEIGHT RANGE: VARIABLE - USUALLY SET TO 800 KM
POWER: ABOUT 1 KW
SWEEP TIME: 7 SEC
APPROXIMATELY LINEAR FREQUENCY SCALE

DIP 63.6° N
FREIBURG

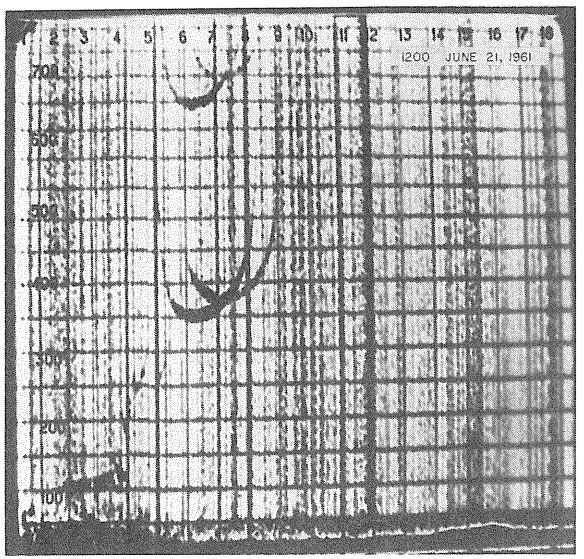


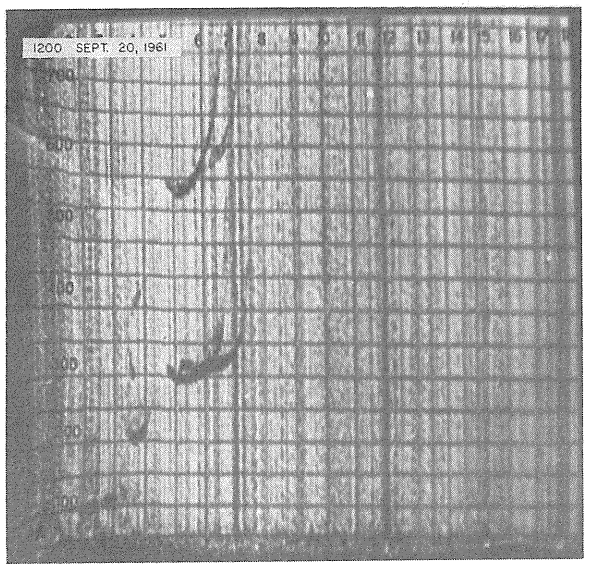
STATION: FREIBURG FED. REP. OF GERMANY

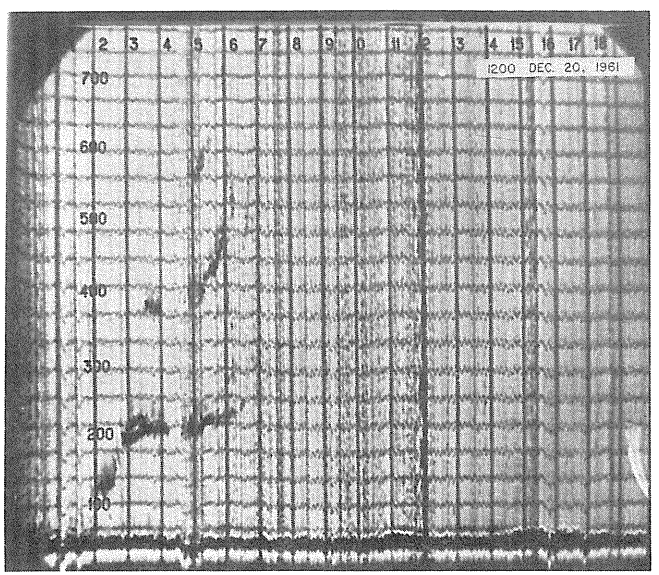
COORDINATES: GEOGRAPHIC LATITUDE: 48°03'N LONGITUDE: 07° 35' E
GEOMAGNETIC LATITUDE: 48.4°N LONGITUDE: 90°
MAG. DIP: 63.6°N
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED TIME ZONE: 0°

IONOSONDE: TYPE OR DESIGNATION: SPIM - KRDSE 22
FREQUENCY RANGE: 1.25 MC TO 20.0 MC
HEIGHT RANGE: 1100 KM POWER: 5 KW
SWEEP TIME: 180 SEC LOGARITHMIC FREQUENCY SCALE

DIP 64.1°N
ROSTOV





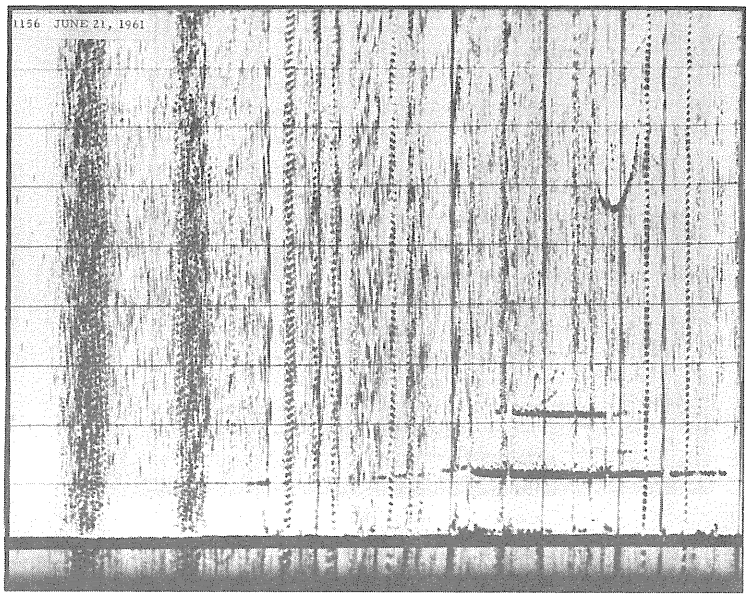


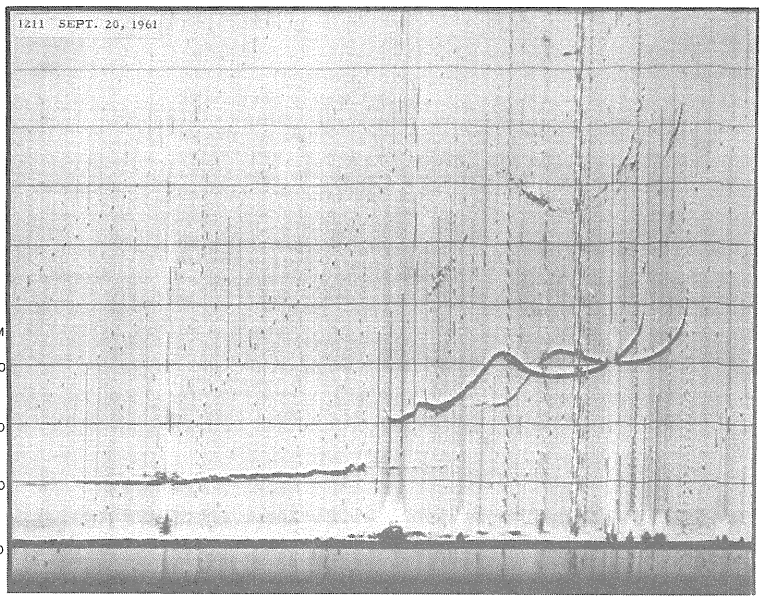
STATION: ROSTOV U.S.S.R.

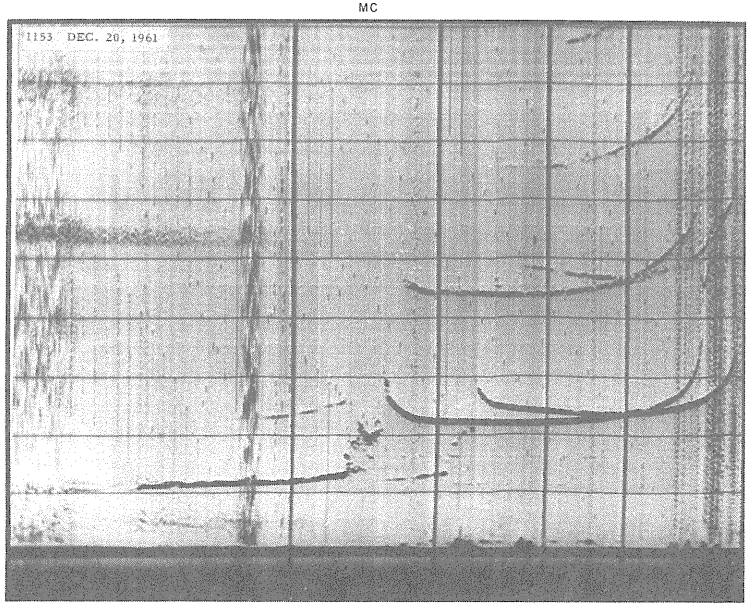
COORDINATES: GEOGRAPHIC LATITUDE: 47°13'N LONGITUDE: 39°41'E
GEOMAGNETIC LATITUDE: 42.5°N LONGITUDE: 119.2°
MAGNETIC DIP: 64.1°N TIME ZONE: 45°E

IONOSONDE: TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC; 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 63.9° N
ADAK





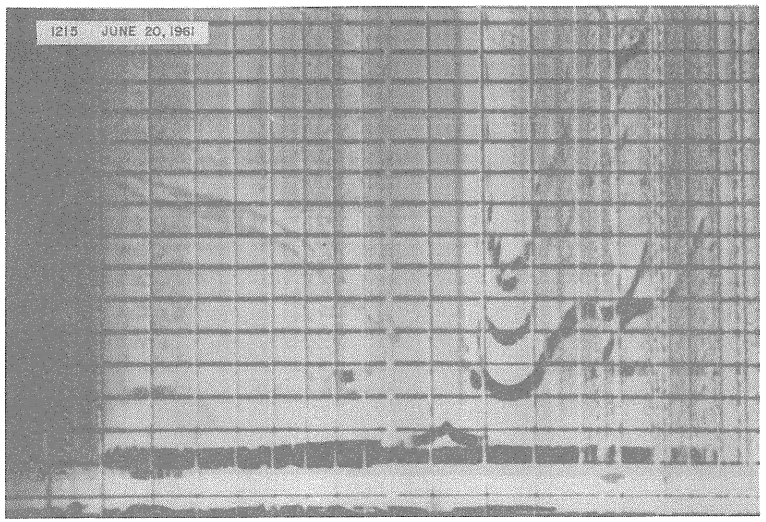


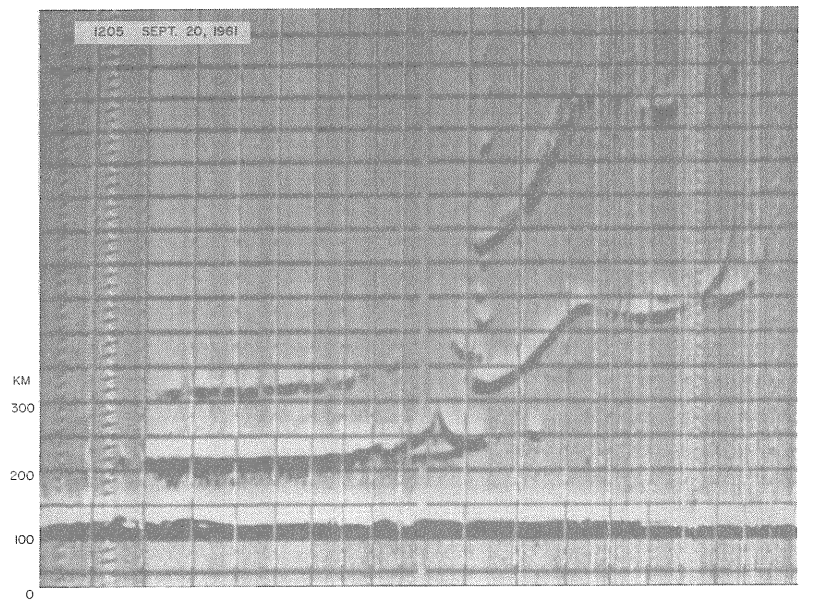
STATION: ADAK U. S. A.

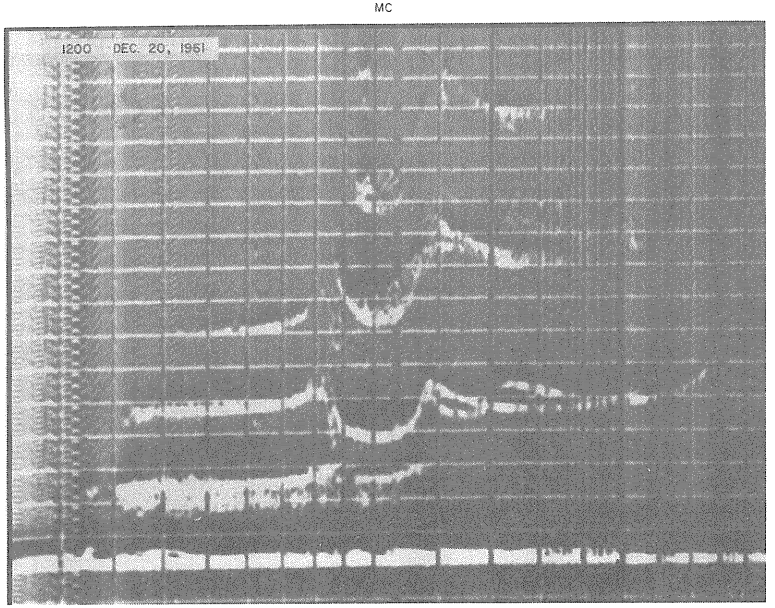
COORDINATES: GEOGRAPHIC LATITUDE: 51°51°52'N LONGITUDE: 176°39' W
GEOMAGNETIC LATITUDE: 47.2°N LONGITUDE: 240.0°
MAGNETIC DIP: 63.9°N GYROFREQUENCY: 1.25 MC. AT 200 KM
TOTAL FIELD: 0.49 OERSTED TIME ZONE: 180°W

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 20 KW
SWEEP TIME: 30 SEC. LOGARITHMIC FREQUENCY SCALE

DIP 63.1° N
GARCHY





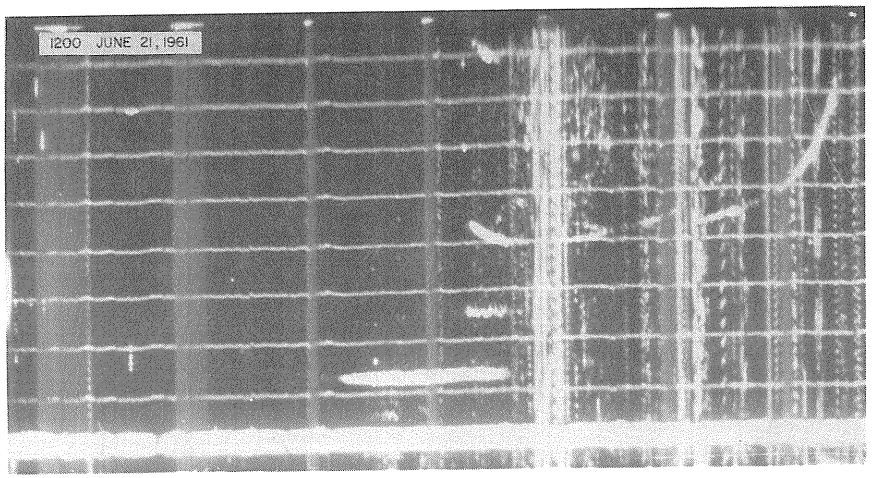


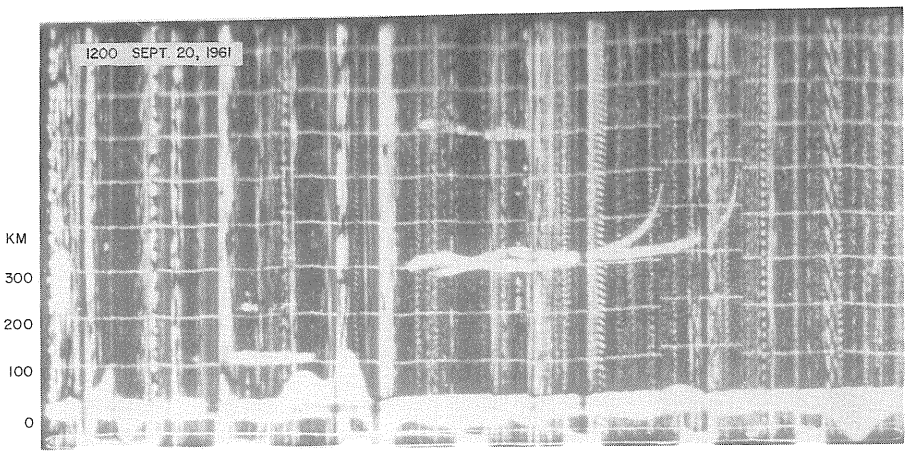
STATION: GARCHY FRANCE

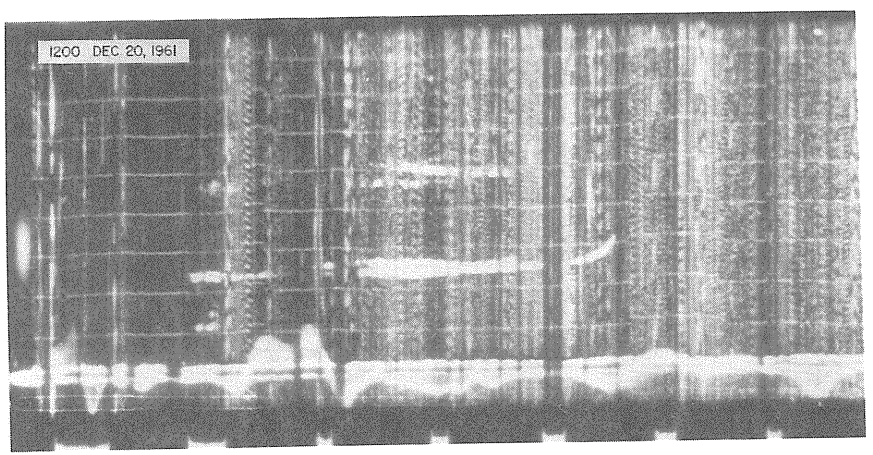
COORDINATES: GEOGRAPHIC LATITUDE: 47°17'N LONGITUDE: 3°04'E
GEOMAGNETIC LATITUDE: 49.6°N LONGITUDE: 84.9°
MAGNETIC DIP: 63.1°N TIME ZONE: 0°
GYROFREQUENCY: 1.3 MC AT 0 KM

IONOSONDE: TYPE OR DESIGNATION: LNR (BAGNEUX)
FREQUENCY RANGE: 1.6 MC TO 16 MC
HEIGHT RANGE: 800 KM
POWER : 2 KW
SWEEP TIME : 60 or 10 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 62.6° N
GRAZ





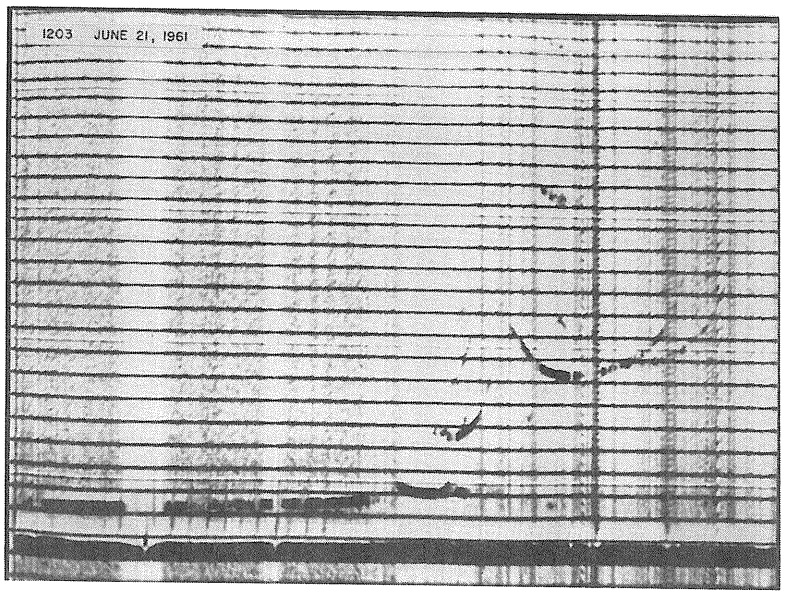


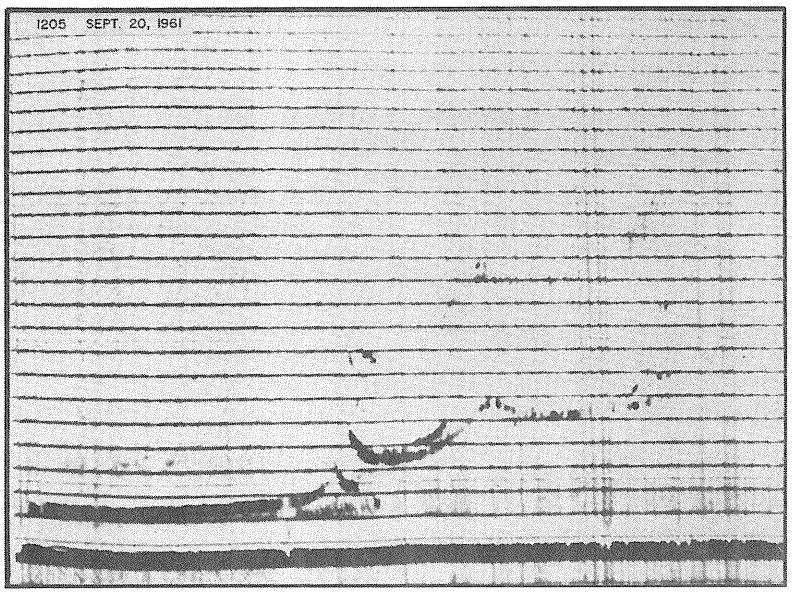
STATION: GRAZ AUSTRIA

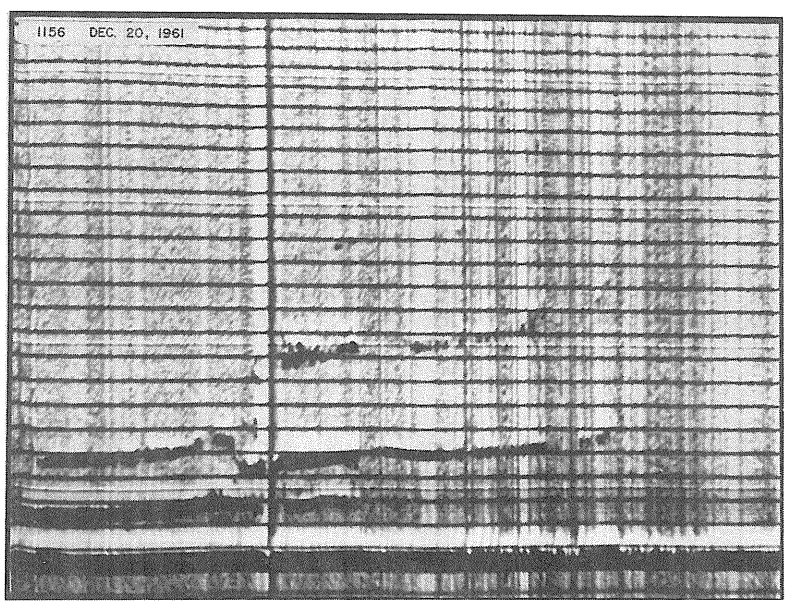
COORDINATES: GEOGRAPHIC LATITUDE: 47°04'38"N LONGITUDE: 15°27'E
GEOMAGNETIC LATITUDE: 47.0°N LONGITUDE: 96.9°
MAGNETIC DIP: 62.6°N TIME ZONE: 15°E
GYROFREQUENCY: 1.17 MC AT 200KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: TYPE OR DESIGNATION: SELF PLANNED
FREQUENCY RANGE: 2.0 MC TO 18.0 MC
HEIGHT RANGE: 800 KM
POWER : 1 KW
SWEEP TIME : 50 SEC
NEARLY LINEAR FREQUENCY SCALE

DIP 62.6° N
POITIERS





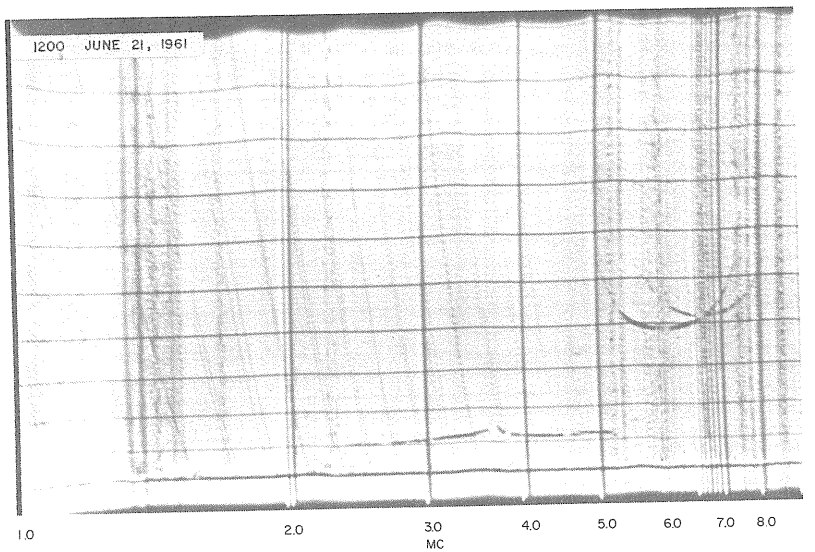


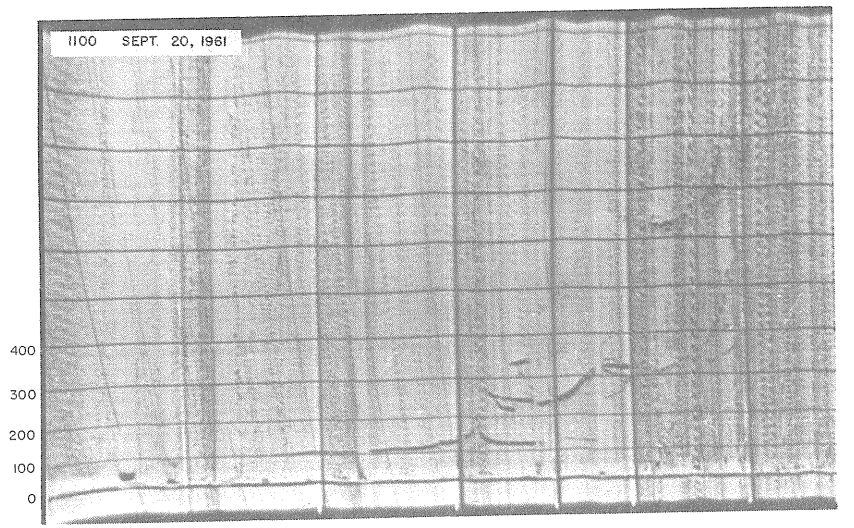
STATION: POITIERS FRANCE

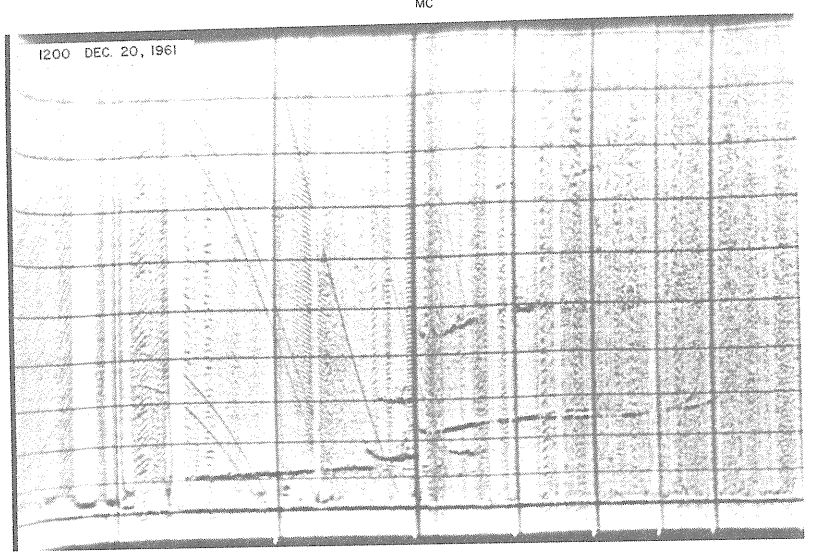
COORDINATES: GEOGRAPHIC LATITUDE: 46°35'N LONGITUDE: 0°20'E
GEOMAGNETIC LATITUDE: 49.5°N LONGITUDE: 81.8°
MAGNETIC DIP: 62.6°N TIME ZONE: 0°
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: TYPE OR DESIGNATION: SP 35-16
FREQUENCY RANGE: 1.6 MC. TO 17 MC
HEIGHT RANGE: 1000 - 1200 KM (ABOUT)
POWER: 2.6 KW
SWEEP TIME: 60 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 62.3° N
SCHWARZENBURG





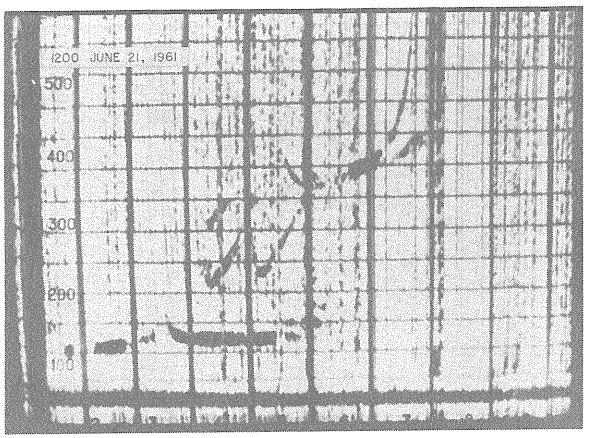


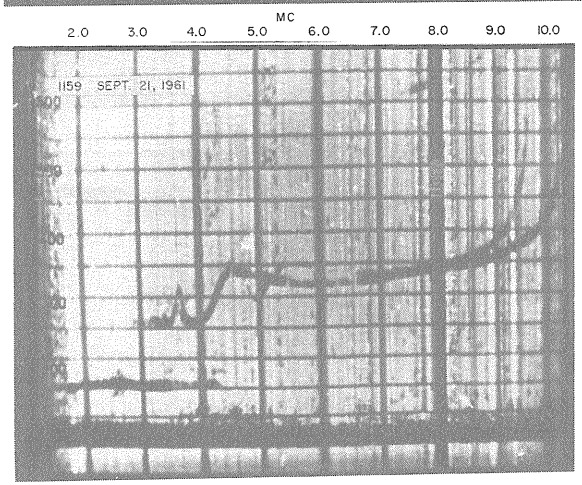
STATION: SCHWARZENBURG (SOTTENS) SWITZERLAND

COORDINATES: GEOGRAPHIC LATITUDE: 46°39'N LONGITUDE: 06°44'E
GEOMAGNETIC LATITUDE: 48.2°N LONGITUDE: 88.2°
MAGNETIC DIP: 62.3°N TIME ZONE: 15°E
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 62.2°N
ALMA-ATA



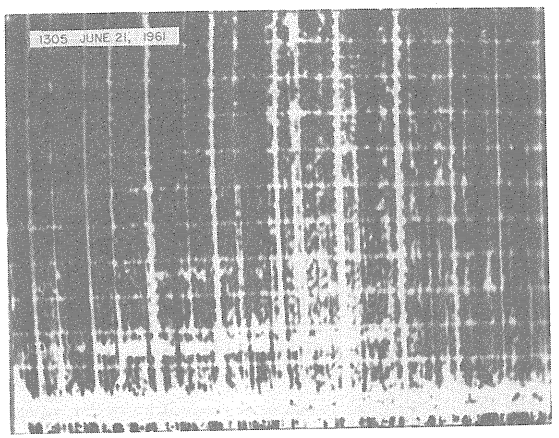


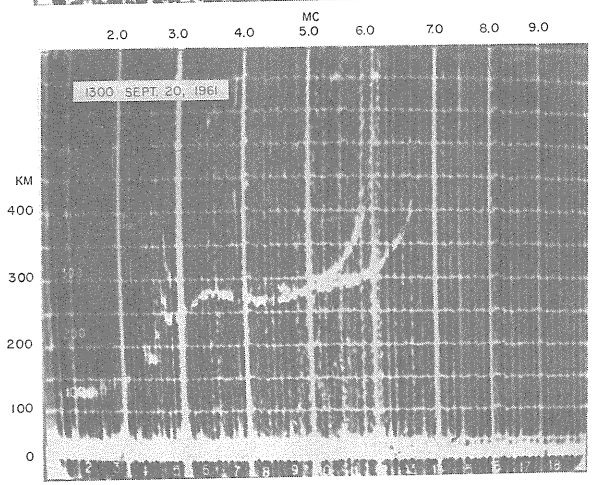
STATION: ALMA-ATA U.S.S.R.

COORDINATES:
GEOGRAPHIC LATITUDE: 43°15'N LONGITUDE: 76°55'E
GEOMAGNETIC LATITUDE: 33.4°N LONGITUDE: 150.7°
MAGNETIC DIP: 62.2°N TIME ZONE: 75°E

IONOSONDE:
TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 61.1°N
YUZHNO-SAKHALINSK



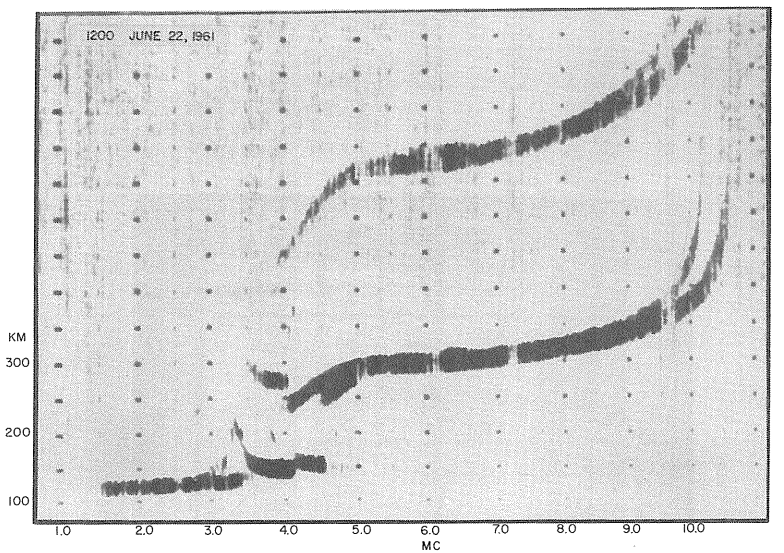


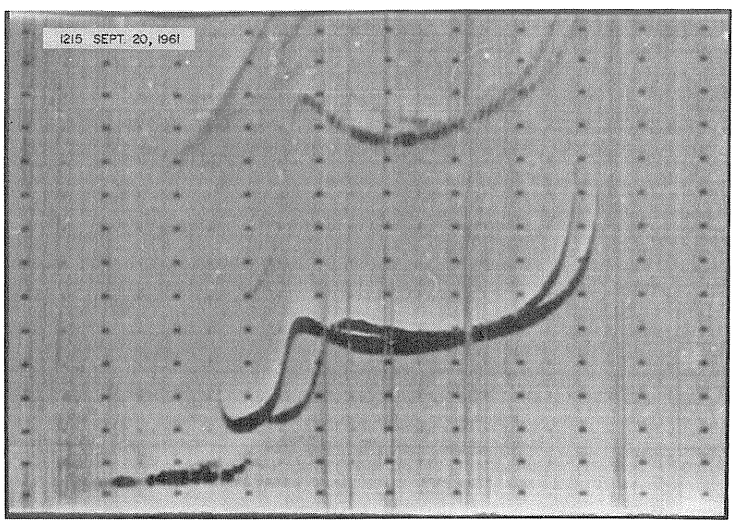
STATION: YUZHNO-SAKHALINSK U.S.S.R.

COORDINATES:
GEOGRAPHIC LATITUDE: 47°01'N LONGITUDE: 142°43'E
GEOMAGNETIC LATITUDE: 36.9°N LONGITUDE: 206.6°
MAGNETIC DIP: 61.1°N TIME ZONE: 150°E

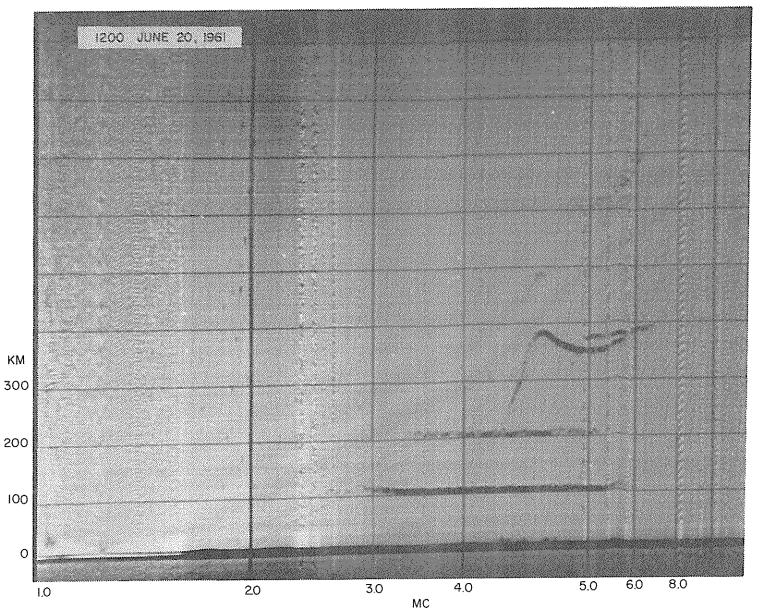
IONOSONDE:
TYPE OR DESIGNATION: AIS
FREQUENCY RANGE: 1.0 - 10.0 MC: 1.0 - 18.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 10 KW
SWEEP TIME: 12 - 20 SEC
FREQUENCY SCALE: LINEAR

DIP 61.5° S
JOHANNESBURG





DIP 61.2° N
CAPE KENNEDY



STATION: CAPE KENNEDY (CAPE CANAVERAL) U. S. A.

COORDINATES: GEOGRAPHIC LATITUDE: 28°24'N LONGITUDE: 80°35'W
GEOMAGNETIC LATITUDE: 39.6°N LONGITUDE: 346.7°
MAGNETIC DIP: 61.2°N TIME ZONE: 75°W
GYROFREQUENCY: 1.33 MC AT 200 KM
TOTAL FIELD: 0.52 OERSTED

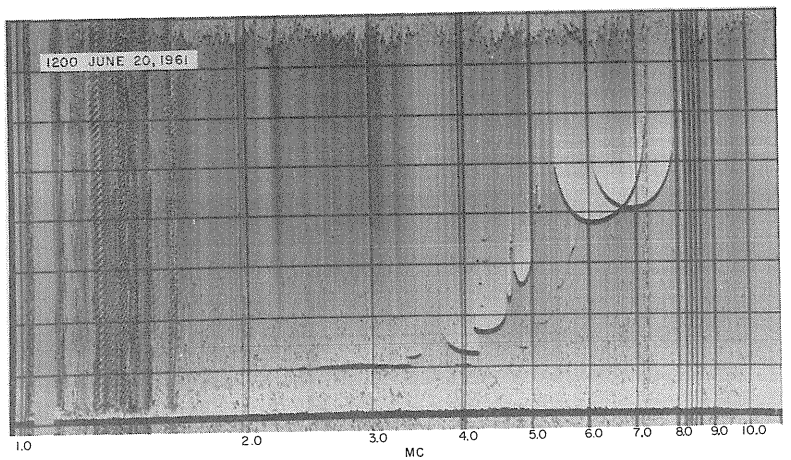
IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 25 KW
SWEEP TIME: 30 SEC LOGARITHMIC FREQUENCY SCALE

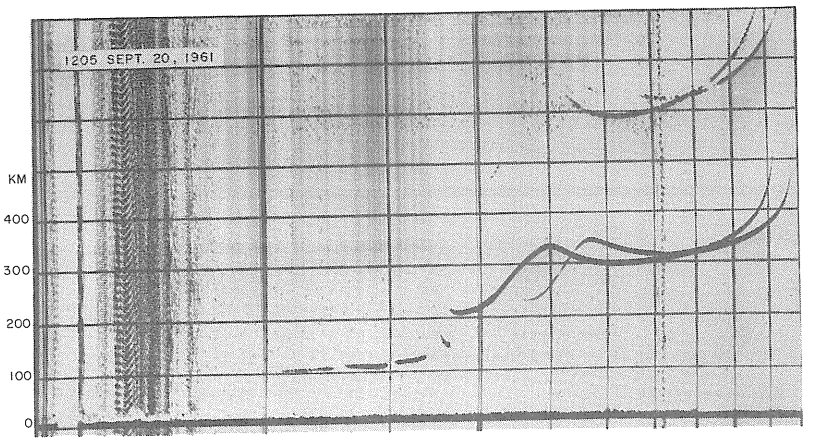
STATION: JOHANNESBURG REP. OF S. AFRICA

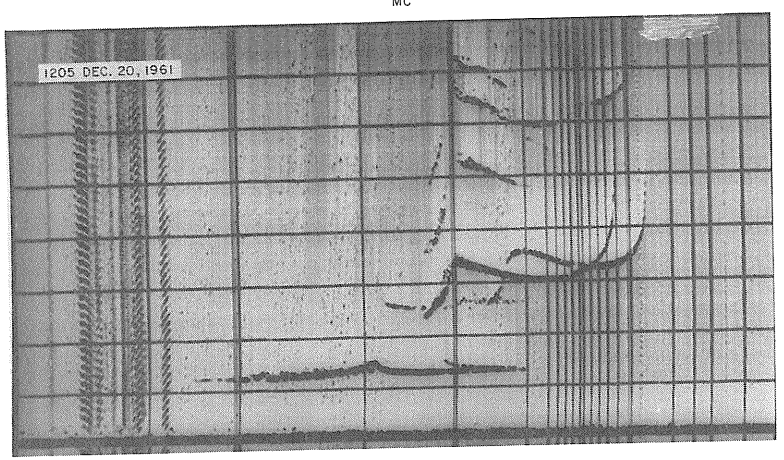
COORDINATES: GEOGRAPHIC LATITUDE: 26 04; S LONGITUDE: 28°06'E. GEOMAGNETIC LATITUDE: 26.9°S. MAGNETIC DIP: 61.5°S GYROFREQUENCY: 0.84 MC AT 200 KM
TOTAL FIELD: 0.33 OERSTED TIME ZONE: 30°E GEOMAGNETIC LONGITUDE: 91.3°

IONOSONDE: TYPE OR DESIGNATION: WADLEY FREQUENCY RANGE: 1.0 MC. TO 20.0 MC (USUALLY SET: 1.0 TO 16.0 MC/S)
HEIGHT RANGE: VARIABLE - USUALLY SET TO 800 KM POWER: ABOUT 1 KW SWEEP TIME: FOR NORMAL ROUTINE 90 SEC
APPROX. LINEAR FREQUENCY SCALE

DIP 60.2° N
WHITE SANDS





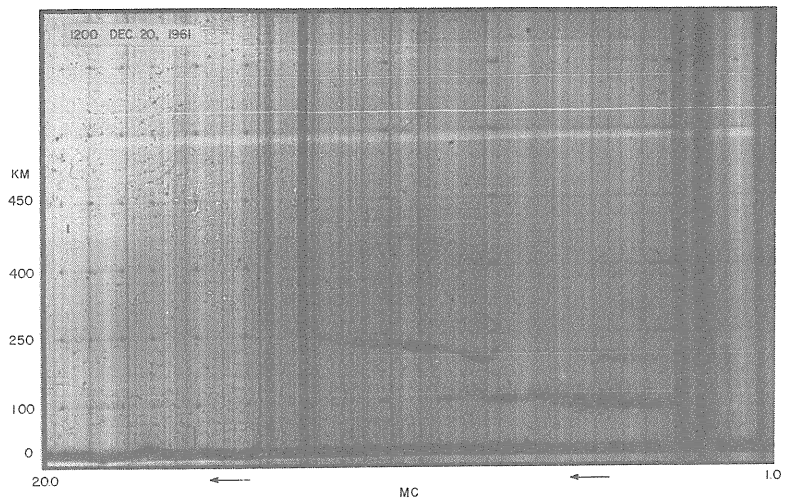


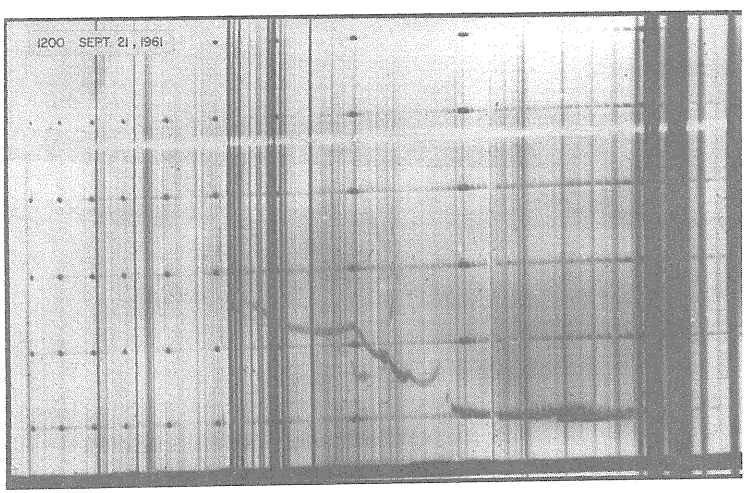
STATION: WHITE SANDS U.S.A.

COORDINATES: GEOGRAPHIC LATITUDE: 30°24'N LONGITUDE: 106°52'W
GEOMAGNETIC LATITUDE: 41.1°N LONGITUDE: 316.9°
MAGNETIC DIP: 60.2°N TIME ZONE: 105°W
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

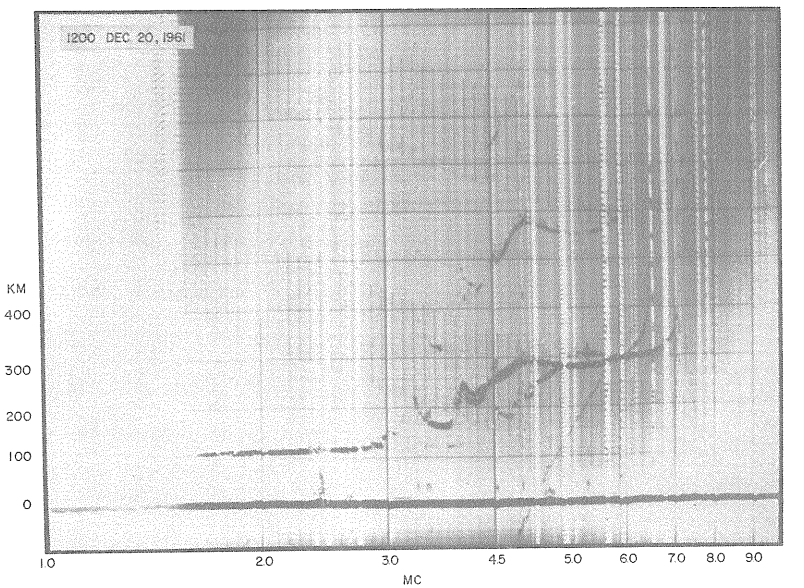
IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 60.2° N
GENOVA





DIP 59.7° N
GRAND BAHAMA



STATION: GRAND BAHAMA WEST INDIES

COORDINATES: GEOGRAPHIC LATITUDE: 26°40'N LONGITUDE: 78°22'W
GEOMAGNETIC LATITUDE: 37.9°N LONGITUDE: 349.6°
MAGNETIC DIP: 59.7°N GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED TIME ZONE: 75°W

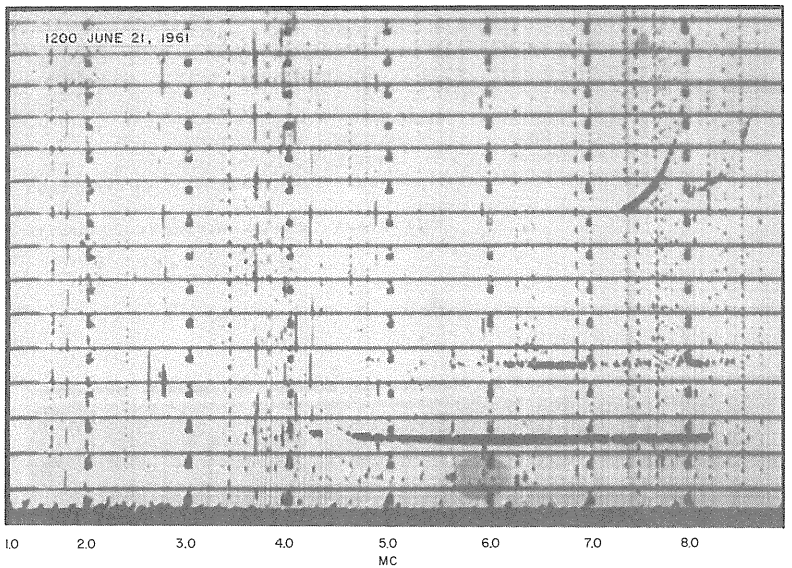
IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC. TO 25.0 MC
HEIGHT RANGE: 1000 KM. POWER: 25 KW
SWEEP TIME: 30 SEC. LOGARITHMIC FREQUENCY SCALE

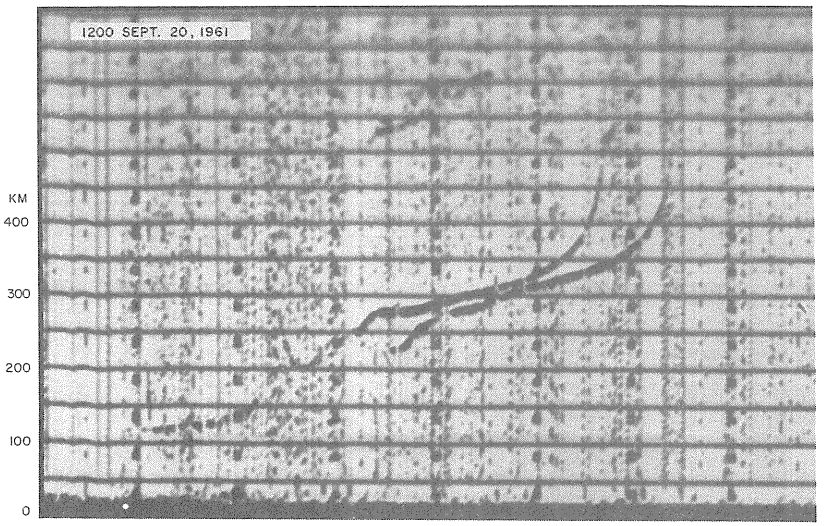
STATION: GENOVA – MONTE CAPELLINO ITALY

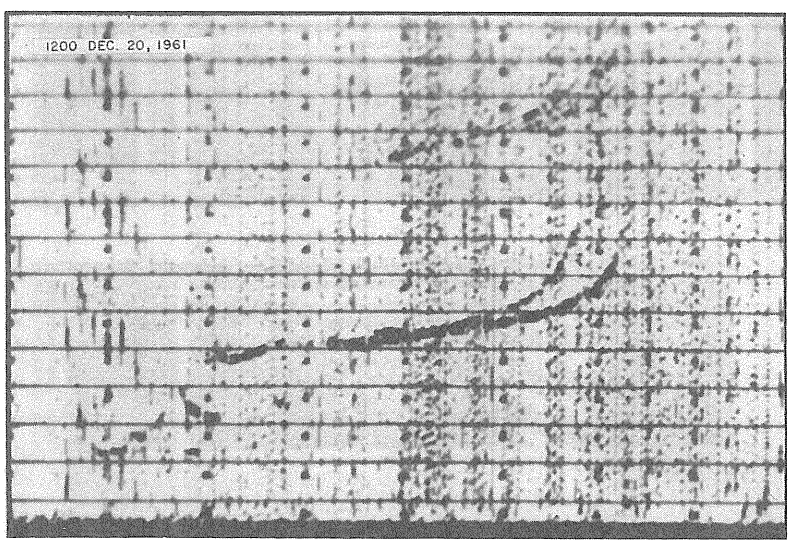
COORDINATES: GEOGRAPHIC LATITUDE: 44°33'N LONGITUDE: 08°57'E GEOMAGNETIC LATITUDE: 45.8°N LONGITUDE: 89.6° MAGNETIC DIP: 60.2°N
TIME ZONE: 15°E GYROFREQUENCY: 1.15 MC AT 200 KM. TOTAL FIELD: 0.45 OERSTED.

IONOSONDE: TYPE OR DESIGNATION: FREIBURG MODEL
FREQUENCY RANGE: 1.0 MC TO 20.0 MC HEIGHT RANGE: 1000 KM POWER: 10 KW SWEEP TIME: 3 MIN
LOGARITHMIC FREQUENCY SCALE.

DIP 59.6° N
WAKKANAI





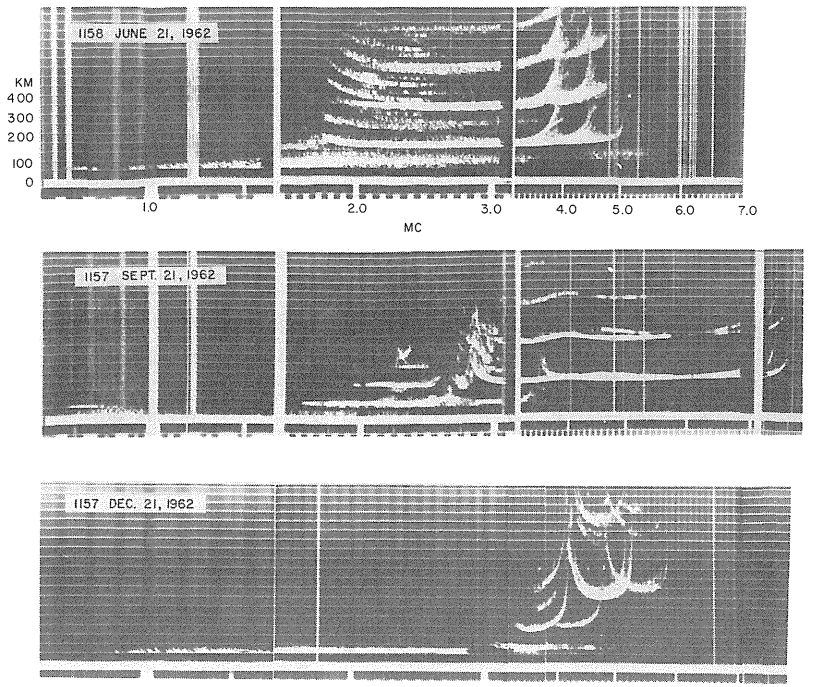


STATION: WAKKANAI JAPAN

COORDINATES: GEOGRAPHIC LATITUDE: 45°24'N LONGITUDE: 141°41'E
GEOMAGNETIC LATITUDE: 35.3°N LONGITUDE: 206.0°
MAGNETIC DIP: 59.6°N TIME ZONE: 135°E
GYROFREQUENCY: 1.30 MC AT 200 KM
TOTAL FIELD: 0.51 OERSTED

IONOSONDE: FREQUENCY RANGE: 1 MC TO 20 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

DIP 58.0°S
ARGENTINE ISLAND

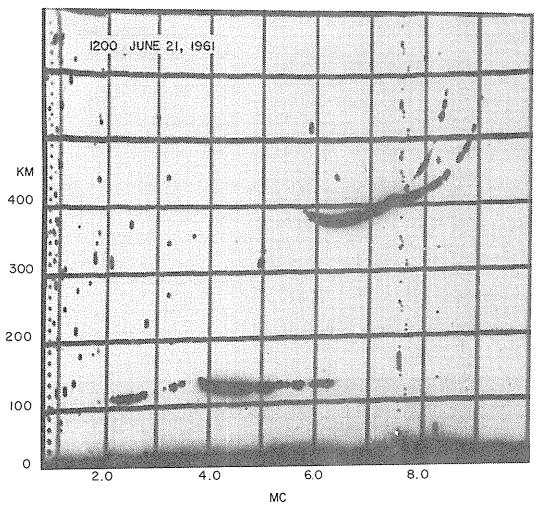


STATION: ARGENTINE ISLAND ANTARCTICA

COORDINATES: GEOGRAPHIC LATITUDE: 65°15'S LONGITUDE: 64°16'W
GEOMAGNETIC LATITUDE: 53.8°S LONGITUDE: 03.3°
MAGNETIC DIP: 58.0°S TIME ZONE: 60°W
GYROFREQUENCY: 1.12 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1000 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 55.8°N
ASHKHABAD

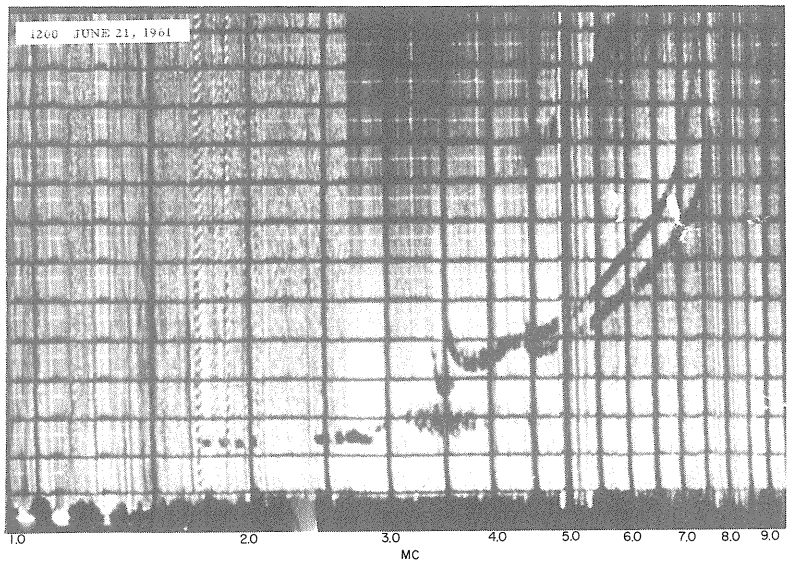


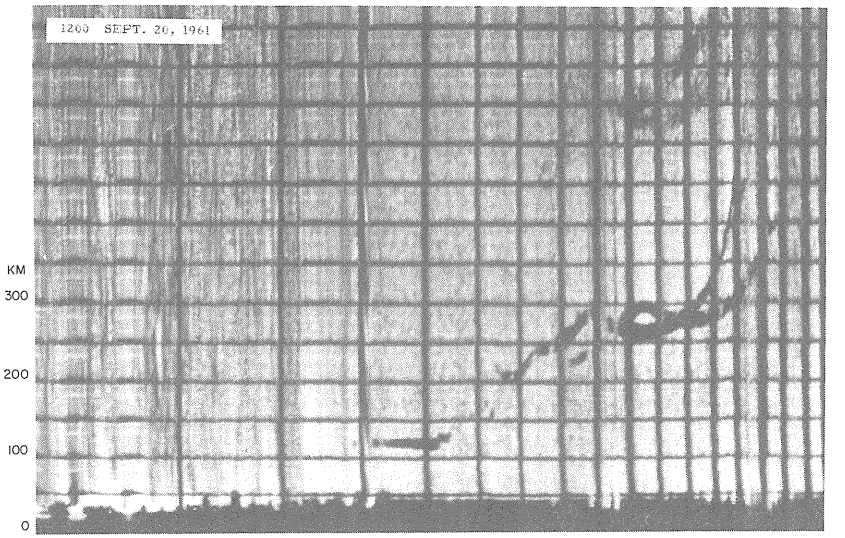
STATION: ASHKHABAD USSR

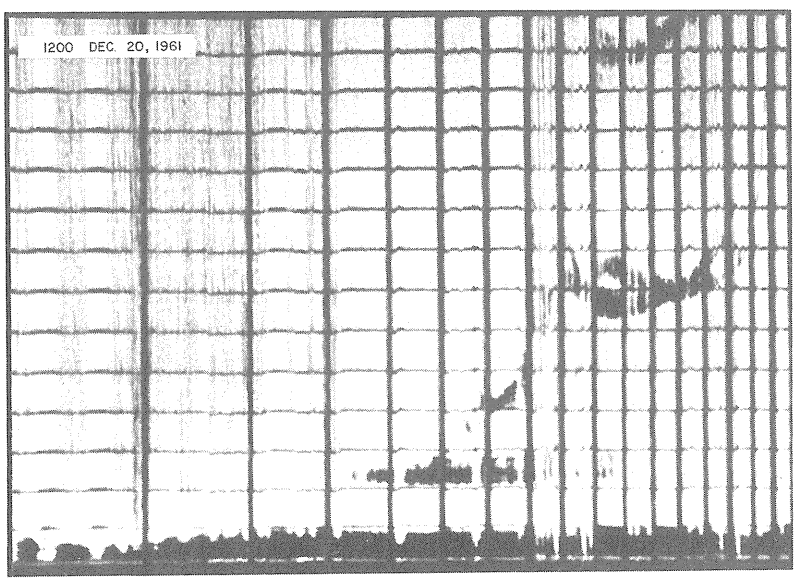
COORDINATES: GEOGRAPHIC LATITUDE: 37°55'N LONGITUDE: 58°18'E
GEOMAGNETIC LATITUDE: 30.4°N LONGITUDE: 133.3°
MAGNETIC DIP: 55.8°N TIME ZONE: 60°E

IONOSONDE: TYPE OR DESIGNATION: SP-3
FREQUENCY RANGE: 1.0 - 20.0 MC
HEIGHT RANGE: 250 KM, 750 KM, 1500 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
FREQUENCY SCALE: LINEAR

DIP 57.6° S
BRISBANE





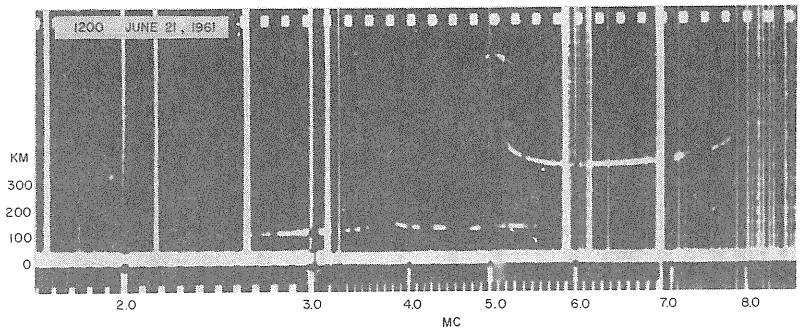


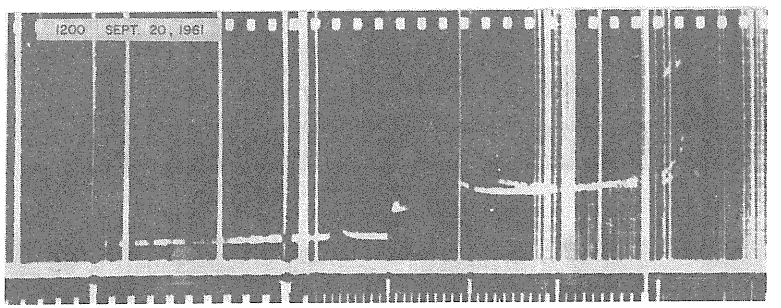
STATION: BRISBANE AUSTRALIA

COORDINATES: GEOGRAPHIC LATITUDE: 27°32'S LONGITUDE: 152°55'E
GEOMAGNETIC LATITUDE: 35.7°S LONGITUDE: 226.9°
MAGNETIC DIP: 57.6°S TIME ZONE: 150°E
GYROFREQUENCY: 1.12 MC AT 200 KM
TOTAL FIELD: 0.44 OERSTED

IONOSONDE: TYPE OR DESIGNATION: MODIFIED CSIRO 1/J28
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
POWER: 3 KW
SWEEP TIME: 1 MIN 55 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 57.1° N
ROMA



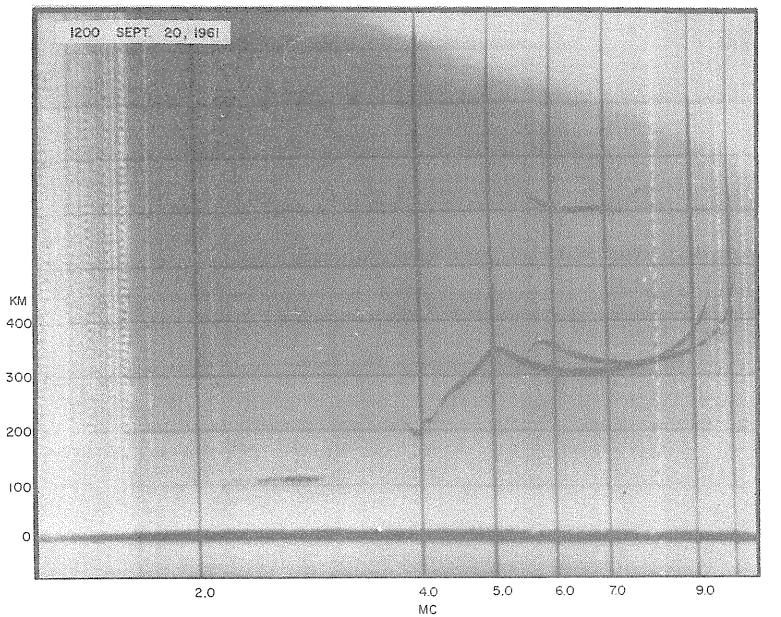


STATION: ROMA(S. ALESSIO) ITALY

COORDINATES: GEOGRAPHIC LATITUDE: 41°54'N LONGITUDE: 12°30'E
GEOMAGNETIC LATITUDE: 42.5°N LONGITUDE: 91.9°
MAGNETIC DIP: 57.1°N TIME ZONE: 15°E
GYROFREQUENCY: 1.15 MC AT 200 KM
TOTAL FIELD: 0.45 OERSTED

IONOSONDE: TYPE OR DESIGNATION: UNION RADIO MK II
FREQUENCY RANGE: 0.6 MC TO 25 MC
HEIGHT RANGE: 800 KM
POWER: 1.8 KW
SWEEP TIME: 250 SEC
APPROXIMATELY LOGARITHMIC FREQUENCY SCALE

DIP 57.4° N
SAN SALVADOR

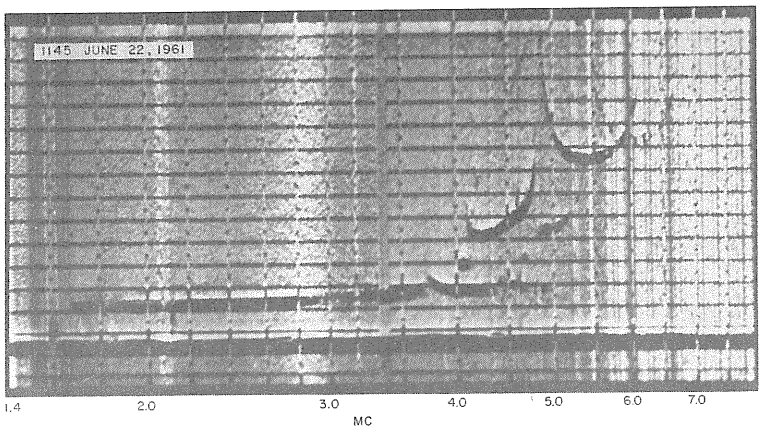


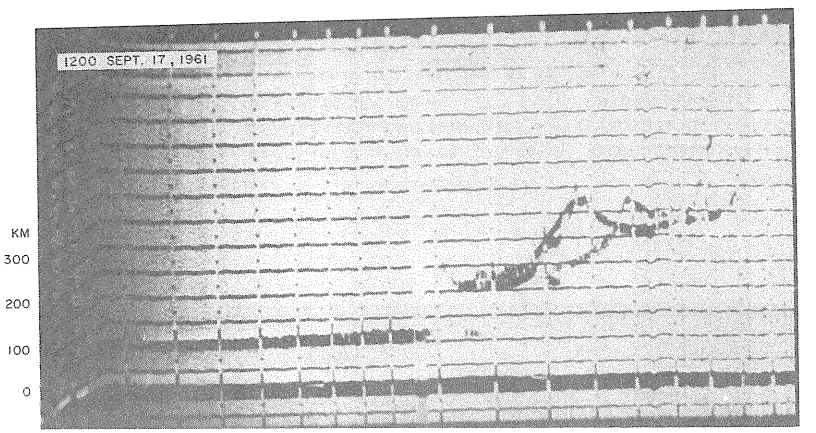
STATION: SAN SALVADOR WEST INDIES

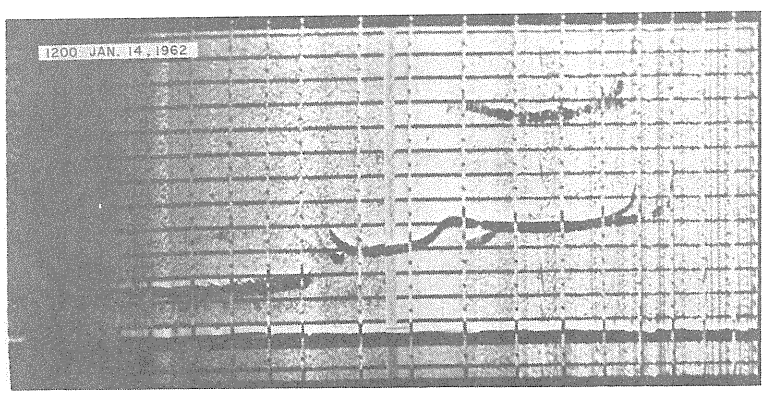
COORDINATES: GEOGRAPHIC LATITUDE: 24°00'N LONGITUDE: 74°25'W
GEOMAGNETIC LATITUDE: 35.5°N LONGITUDE: 353.8°
MAGNETIC DIP: 57.4°N TIME ZONE: 75°W
GYROFREQUENCY: 1.25 MC AT 200 KM
TOTAL FIELD: 0.49 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KW
POWER: 25 KM
SWEEP TIME: 27.5 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 56.7° N
TORTOSA





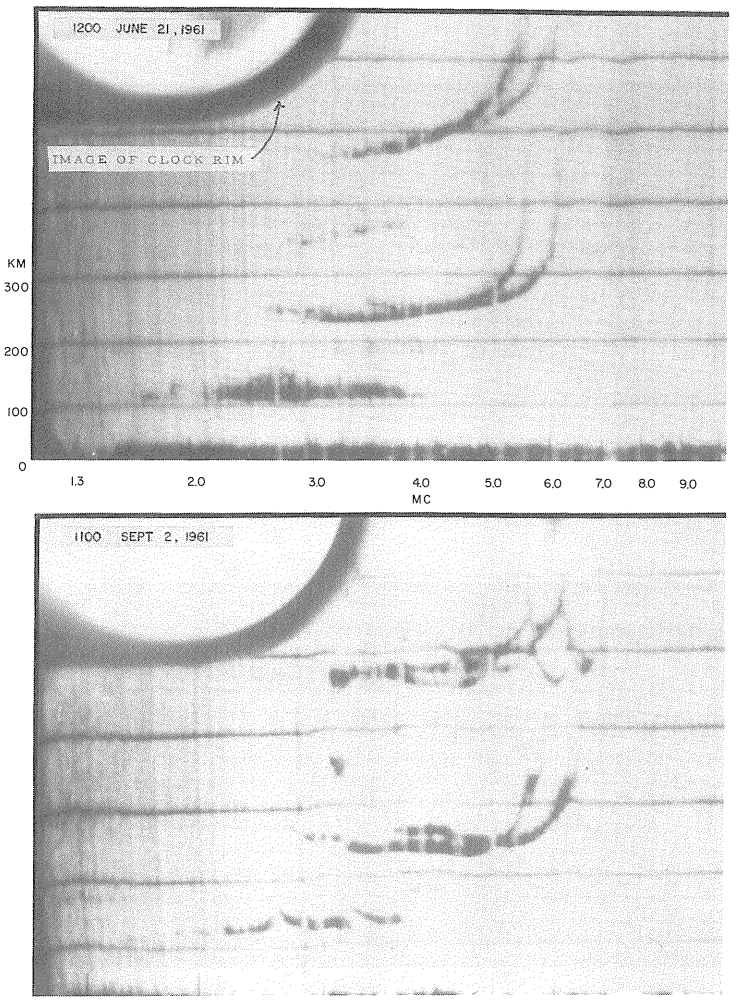


STATION: TORTOSA SPAIN

COORDINATES: GEOGRAPHIC LATITUDE: 40°49'N LONGITUDE: 00°30'E
GEOMAGNETIC LATITUDE: 43.9°N LONGITUDE: 79.5°
MAGNETIC DIP: 56.7°N TIME ZONE: U. T.
GYROFREQUENCY: 1.12 MC AT 200 KM
TOTAL FIELD: 0.44 OERSTED

IONOSONDE: TYPE OR DESIGNATION: S P - 35
FREQUENCY RANGE: 1.2 MC TO 17.0 MC
HEIGHT RANGE: 1000 KM (ADJUSTABLE)
POWER: 3 KW
SWEEP TIME: 60 SEC
EQUATION FOR FREQUENCY SCALE: $f = 1.2\ e^{\frac{e}{136.3}}$

DIP 57.4° S
DECEPCION

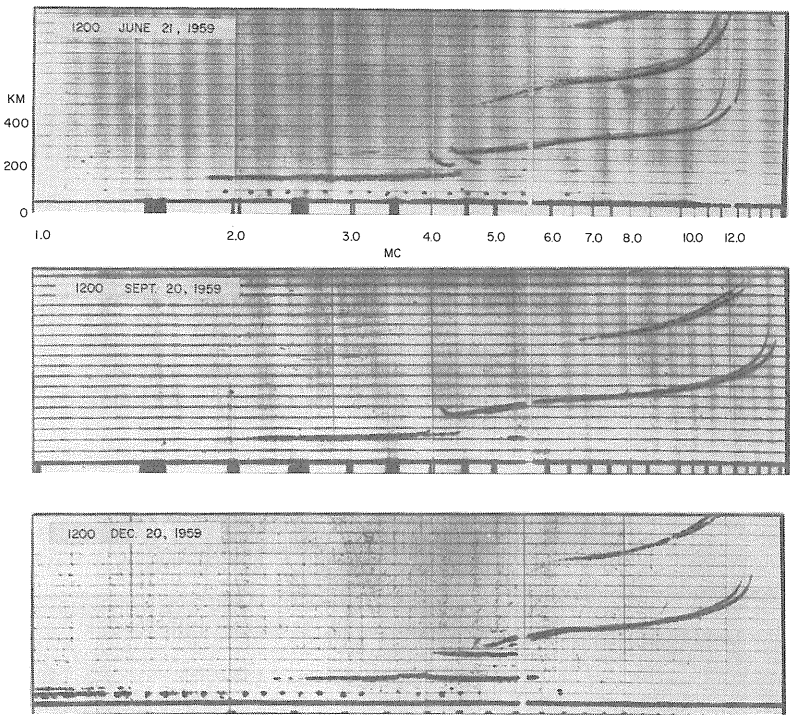


STATION: DECEPCION ANTARCTICA

COORDINATES: GEOGRAPHIC LATITUDE: 62°59'S LONGITUDE: 60°43'W
GEOMAGNETIC LATITUDE: 51.6°S LONGITUDE: 6.1°
MAGNETIC DIP: 57.4°S GYROFREQUENCY: 1.10 MC. AT 200 KM
TOTAL FIELD: 0.43 OERSTED TIME ZONE: 45°W

IONOSONDE: TYPE OR DESIGNATION: TRIO - 2 AUTOMATIC
FREQUENCY RANGE: 1.3 MC TO 18.0 MC
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 55.0° S
TSUMEB



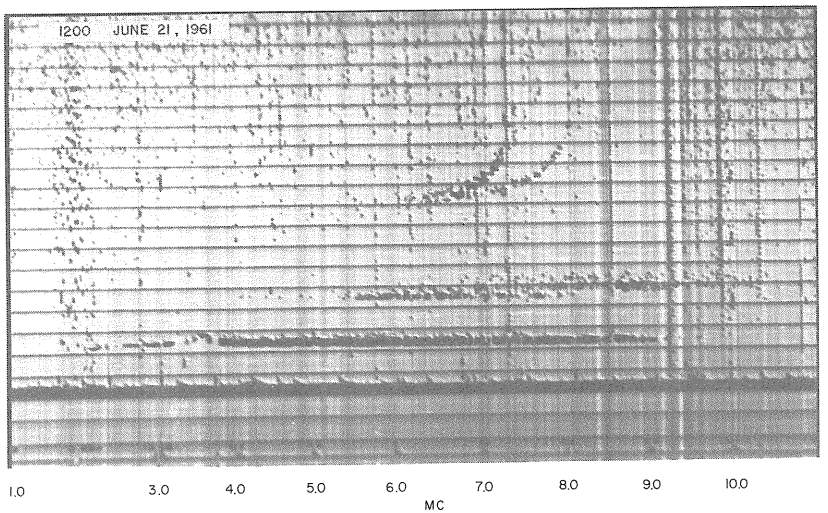
STATION: TSUMEB SOUTH WEST AFRICA

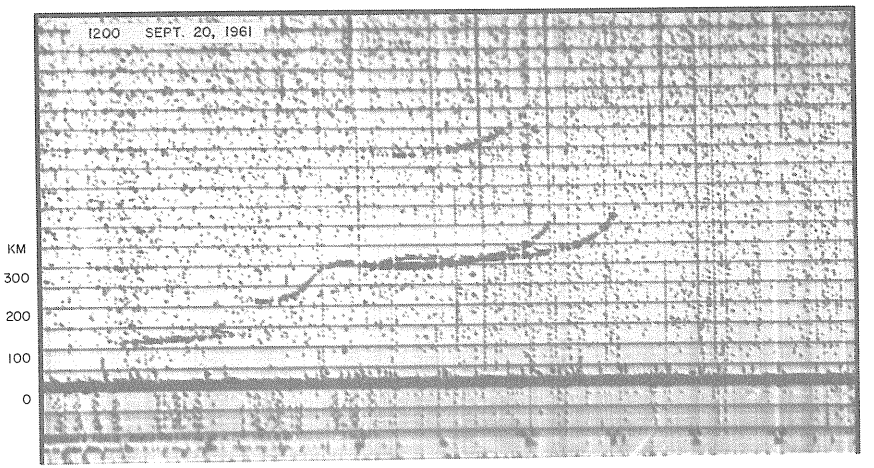
COORDINATES: GEOGRAPHIC LATITUDE: 19°14'S LONGITUDE: 17°43'E
GEOMAGNETIC LATITUDE: 18.2°S LONGITUDE: 82.8°
MAGNETIC DIP: 55.0°S TIME ZONE: 15°E
GYROFREQUENCY: 0.82 MC AT 200 KM
TOTAL FIELD: 0.33 OERSTED

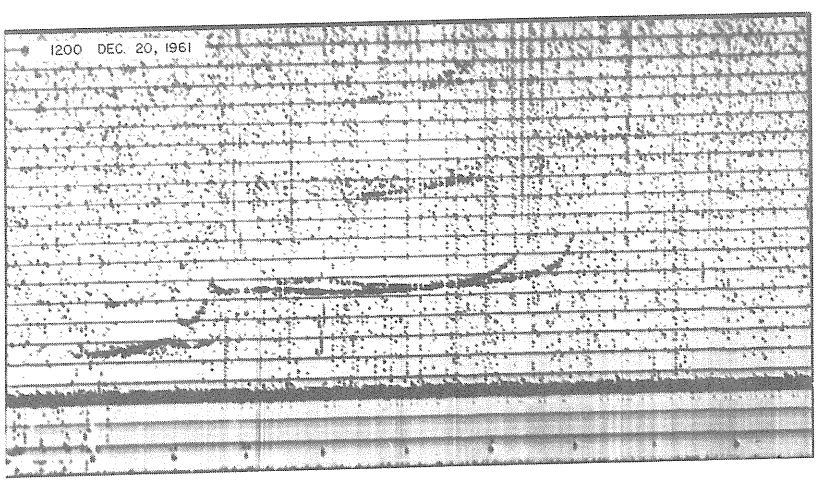
IONOSONDE: TYPE OR DESIGNATION: DDA IV/54
FREQUENCY RANGE: 1.0 MC. TO 16.0 MC
HEIGHT RANGE: 900 KM
POWER: 15 KW SWEEP TIME: 240 SEC
EQUATION FOR FREQUENCY SCALE: $f = k_c^{at}$

DIP 53.7° N

AKITA





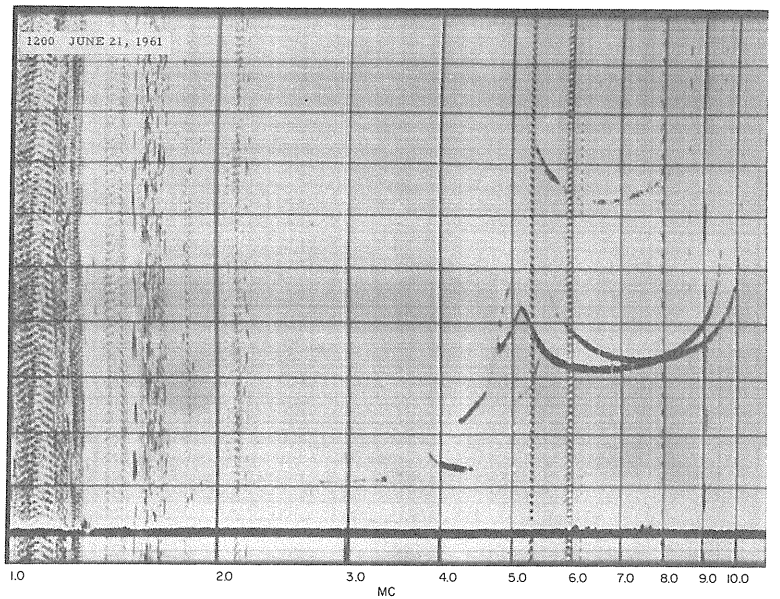


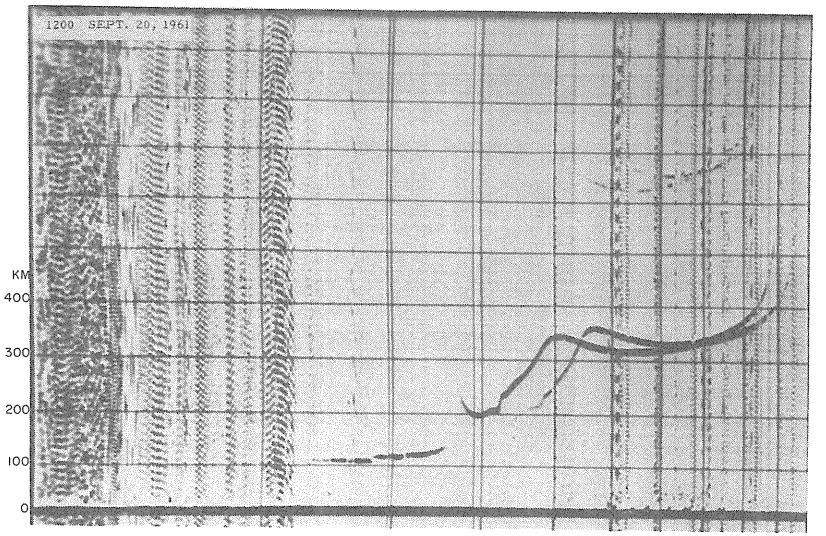
STATION: AKITA JAPAN

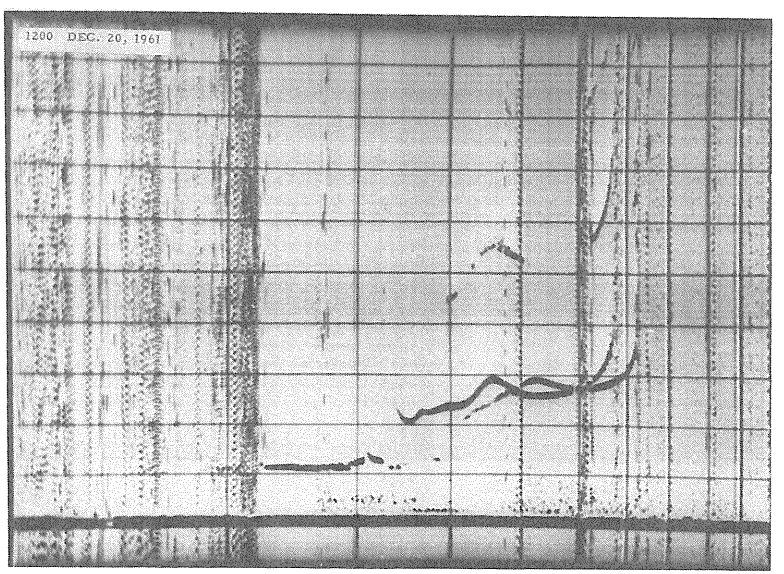
COORDINATES: GEOGRAPHIC LATITUDE: 39°44'N LONGITUDE: 140°08'E
GEOMAGNETIC LATITUDE: 29.5°N LONGITUDE: 205.4°
MAGNETIC DIP: 53.7°N TIME ZONE: 135°E
GYROFREQUENCY: 1.22 MC AT 200 KM
TOTAL FIELD: 0.48 OERSTED

IONOSONDE: FREQUENCY RANGE: 1.6 MC TO 25 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

DIP 51.1° N
PUERTO RICO





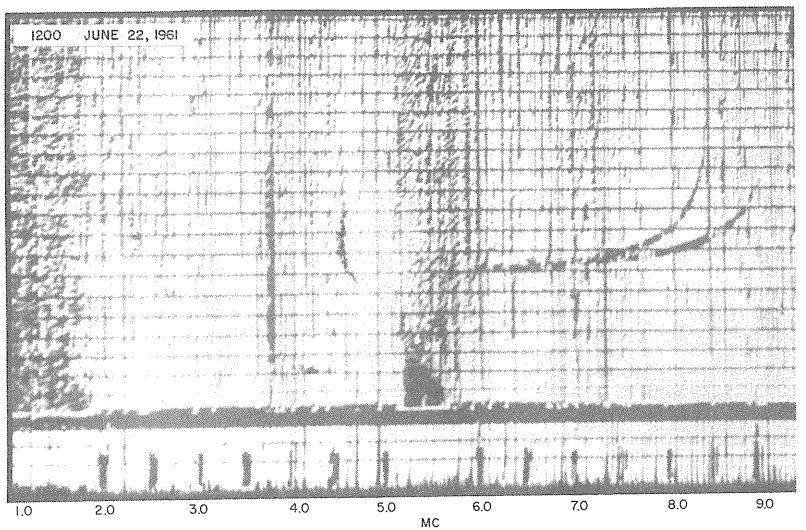


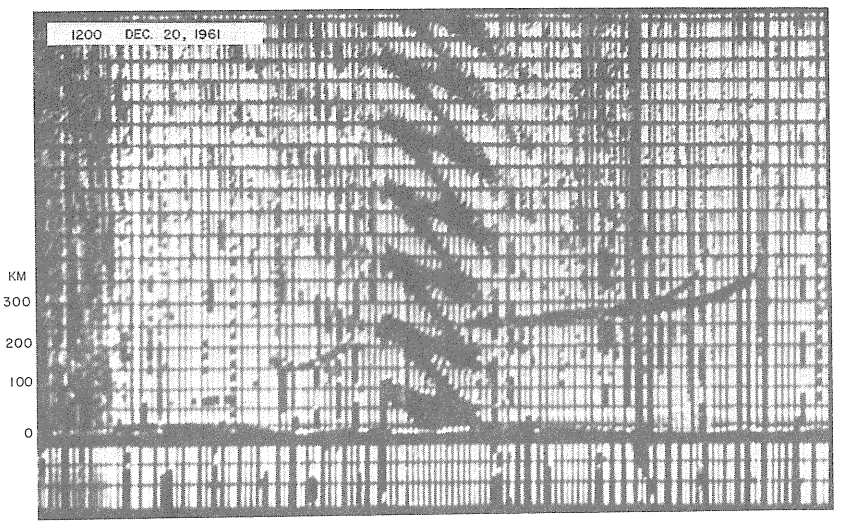
STATION: PUERTO RICO U. S. A.

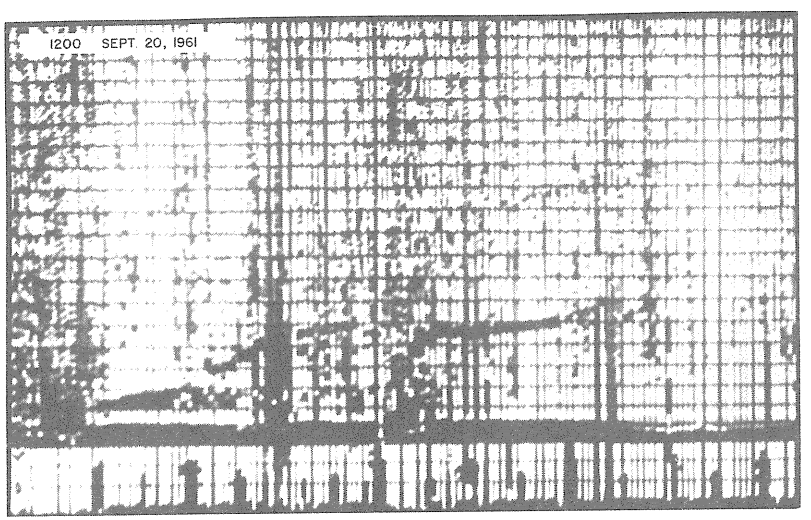
COORDINATES: GEOGRAPHIC LATITUDE: 18°30'N LONGITUDE: 67°10'W
GEOMAGNETIC LATITUDE: 30.0°N LONGITUDE: 2.0°
GYROFREQUENCY: 1.15 MC AT 200 KM
TOTAL FIELD: 0.45 OERSTED TIME ZONE: 60°W
MAGNETIC DIP: 51.1°N

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 27 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 48.9° N
TOKYO





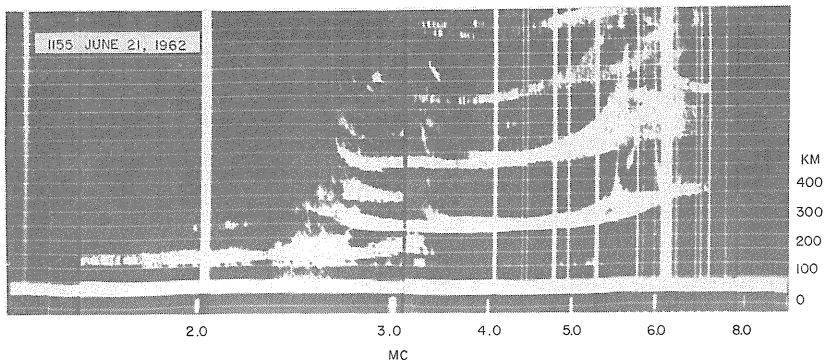


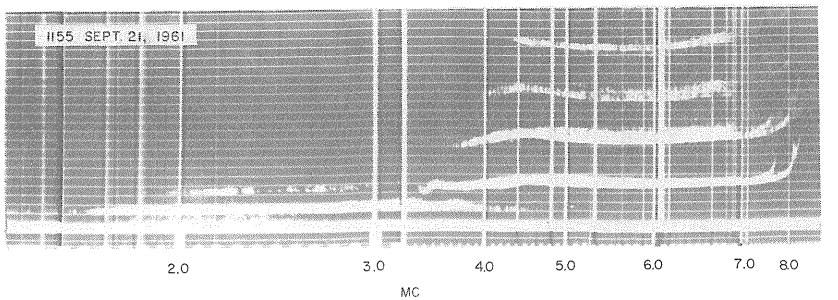
STATION: TOKYO (KOKUBUNJI) JAPAN

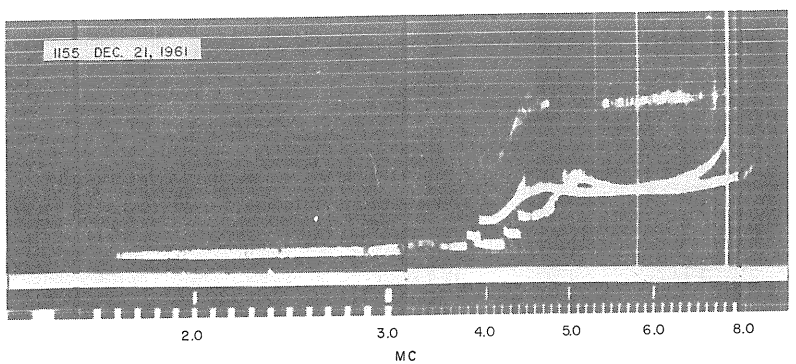
COORDINATES: GEOGRAPHIC LATITUDE: 35°42'N LONGITUDE: 139°29'E
GEOMAGNETIC LATITUDE: 25.4°N LONGITUDE: 205.4°
MAGNETIC DIP: 48.9°N TIME ZONE: 135°E
GYROFREQUENCY: 1.17 MC AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: FREQUENCY RANGE: 1 MC TO 25 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

DIP 48.5°S
PORT STANLEY





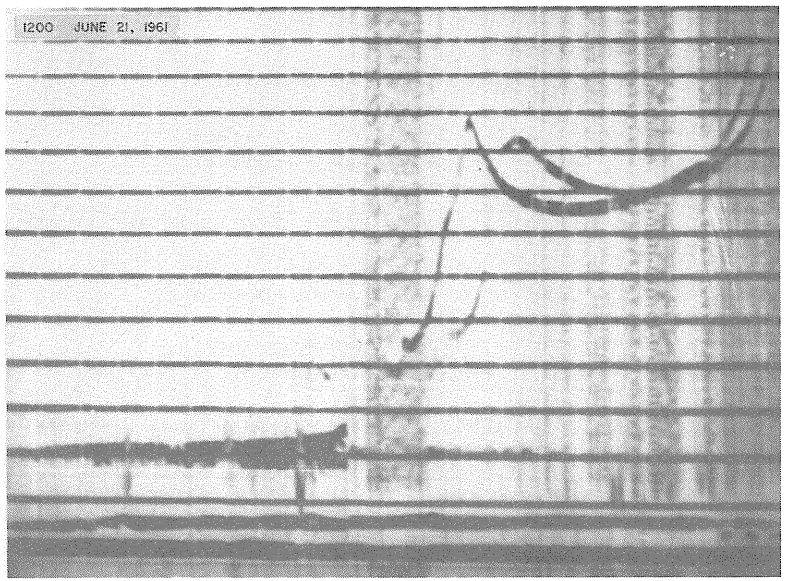


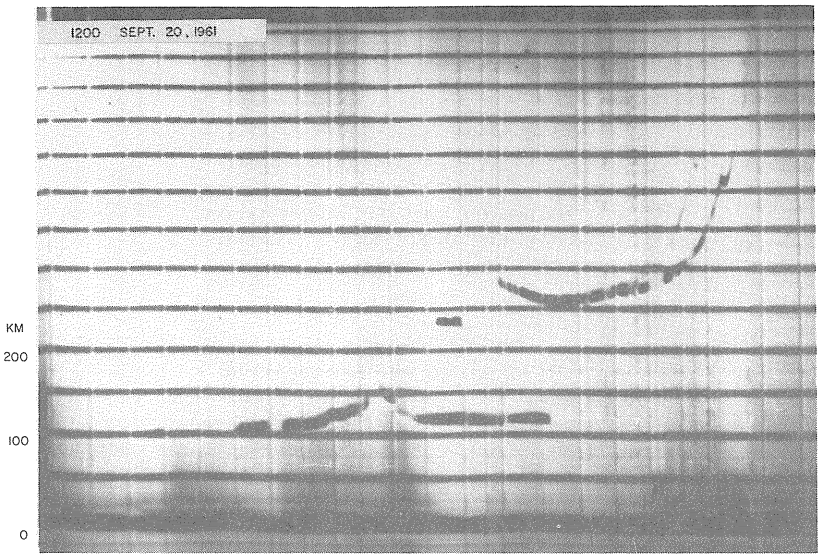
STATION: PORT STANLEY FALKLAND ISLANDS

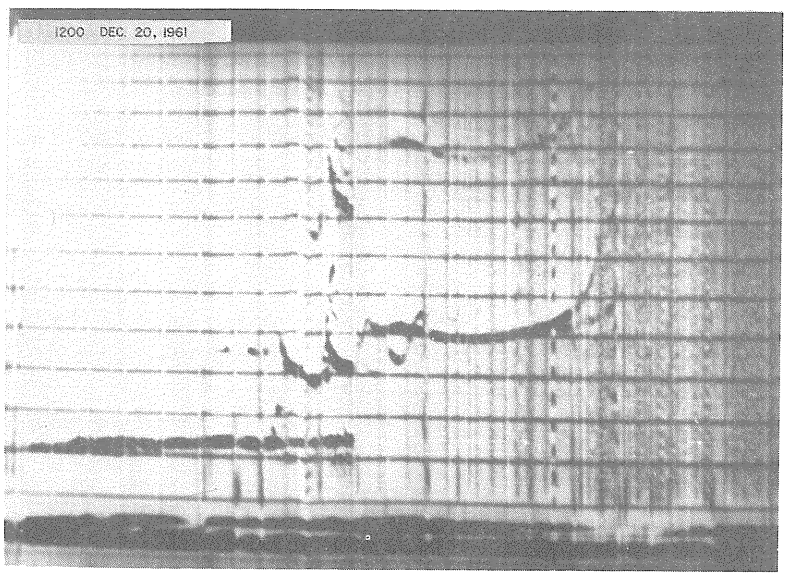
COORDINATES: GEOGRAPHIC LATITUDE: 51°42'S LONGITUDE: 57°51'W
GEOMAGNETIC LATITUDE: 40.4°S LONGITUDE: 09.1°
MAGNETIC DIP: 48.5°S TIME ZONE: 60.0°W
GYROFREQUENCY: 0.91 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1000 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 48.0° N
RABAT





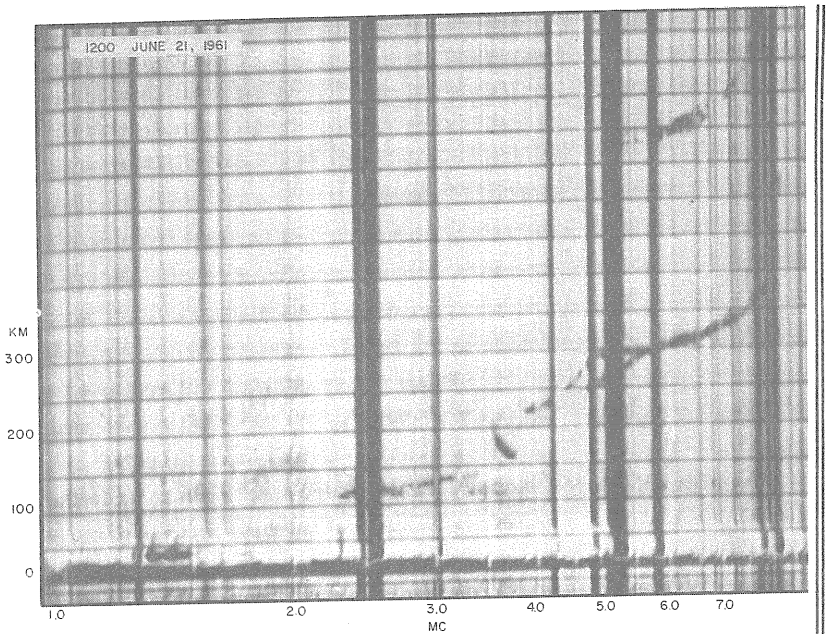


STATION: RABAT MOROCCO

COORDINATES: GEOGRAPHIC LATITUDE: 33°55'N LONGITUDE: 06°50'W
GEOMAGNETIC LATITUDE: 38.6°N LONGITUDE: 69.9°
MAGNETIC DIP: 48.0°N TIME ZONE: U. T.
GYROFREQUENCY: 1.21 MC. AT 200 KM
TOTAL FIELD: 0.40 OERSTED

IONOSONDE: TYPE OR DESIGNATION: S.P. 35
FREQUENCY RANGE: 1.6 MC TO 16 MC
HEIGHT RANGE: 50 KM LINEAR
POWER: 1.3 TO 2.8 KW DEPENDING ON FREQUENCY
SWEEP TIME: 125 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 48.4° S
TOWNSVILLE

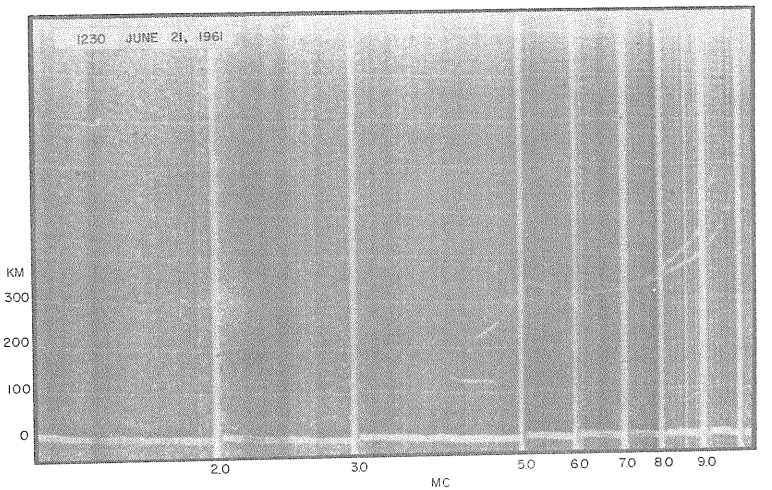


STATION: TOWNSVILLE AUSTRALIA

COORDINATES: GEOGRAPHIC LATITUDE: 19°19'S LONGITUDE: 146°44'E
GEOMAGNETIC LATITUDE: 28.5°S LONGITUDE: 218.8°
MAGNETIC DIP: 48.4°S TIME ZONE: 150°E
GYROFREQUENCY: 1.28 MC. AT 200 KM
TOTAL FIELD: 0.50 OERSTED

IONOSONDE: TYPE OR DESIGNATION: CSIRO 1/J28
FREQUENCY RANGE: 1.0 MC TO 16.0 MC
POWER: 1 KW
SWEEP TIME: 1 MIN 55 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 41.6° N
DELHI

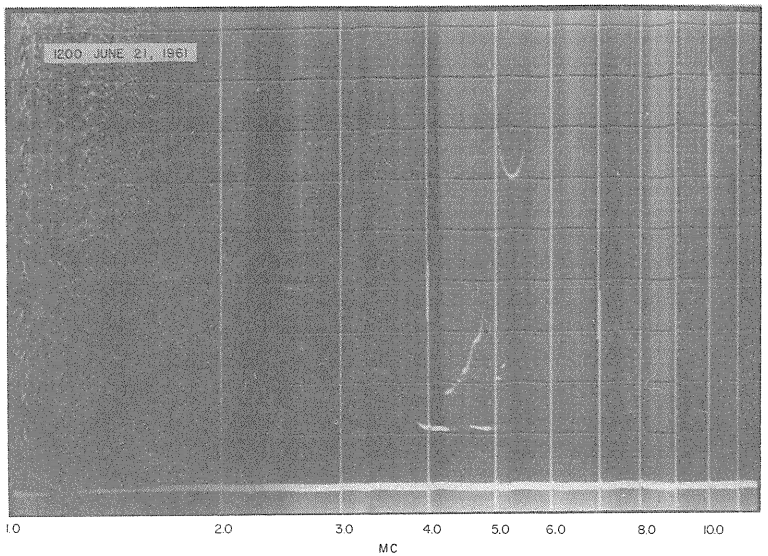


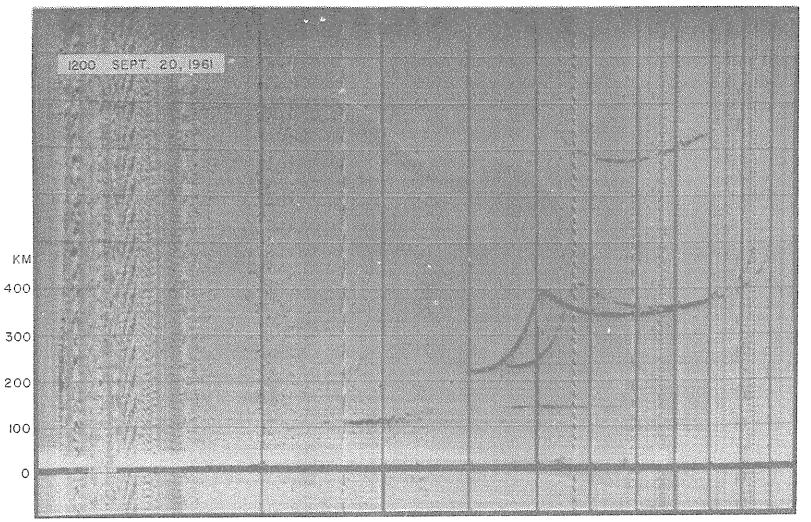
STATION: DELHI INDIA

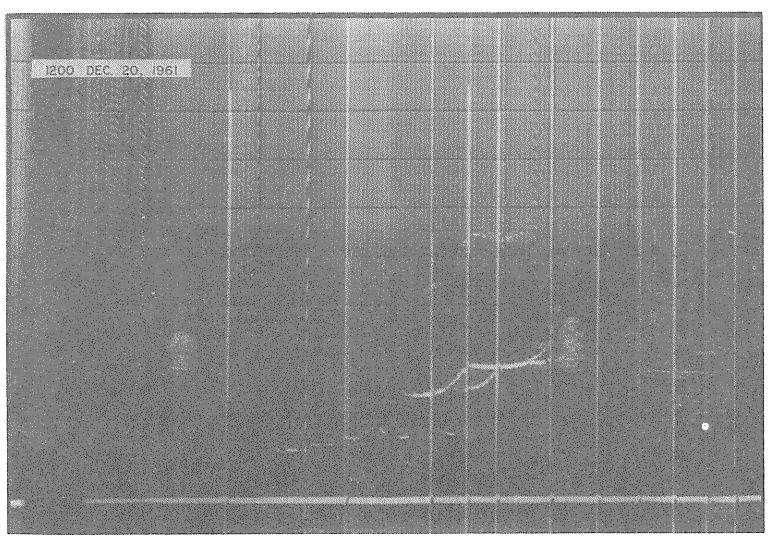
COORDINATES: GEOGRAPHIC LATITUDE: 28°38'N LONGITUDE: 77°13'E
GEOMAGNETIC LATITUDE: 18.9°N LONGITUDE: 148.9°
MAGNETIC DIP: 41.6°N TIME ZONE: 75°E
GYROFREQUENCY: 1.20 MC. AT 200 KM
TOTAL FIELD: 0.47 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 500, 1000, and 4000 KM
POWER: 10 KW. (NOMINAL)
SWEEP TIME: 15 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 46.5° N
MEXICO CITY





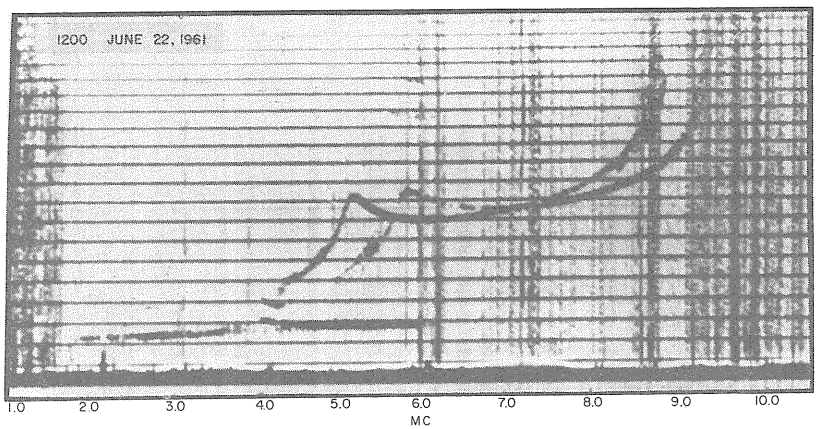


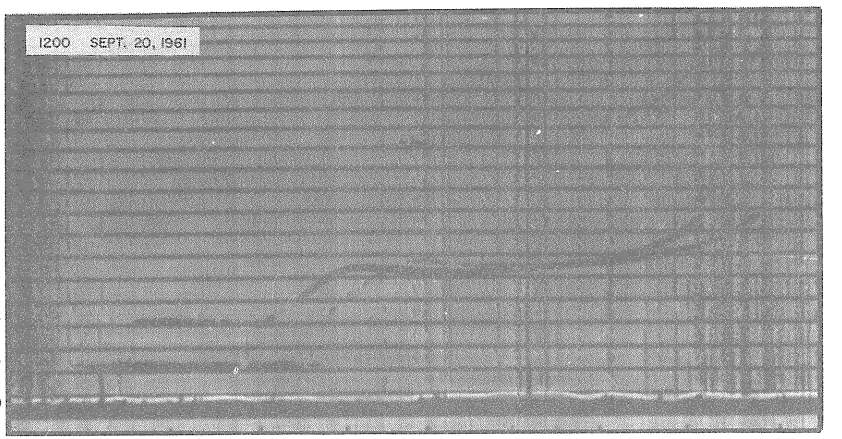
STATION: MEXICO CITY (EL CERILLO) MEXICO

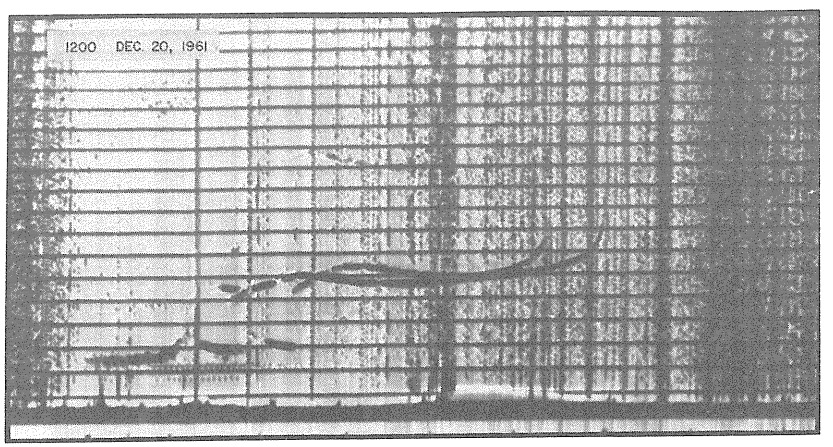
COORDINATES:
- GEOGRAPHIC LATITUDE: 19°30'N LONGITUDE: 99°33'W
- GEOMAGNETIC LATITUDE: 29.1°N LONGITUDE: 326.8°
- MAGNETIC DIP: 46.5°N TIME ZONE: 90°W
- GYROFREQUENCY: 1.12 MC AT 200 KM
- TOTAL FIELD: 0.44 OERSTED

IONOSONDE:
- TYPE OR DESIGNATION: C-4
- FREQUENCY RANGE: 1.0 TO 25.0 MC
- HEIGHT RANGE: 1000 KM
- POWER: 25 KW
- SWEEP TIME: 18 SEC
- LOGARITHMIC FREQUENCY SCALE

DIP 44.1° N
YAMAGAWA





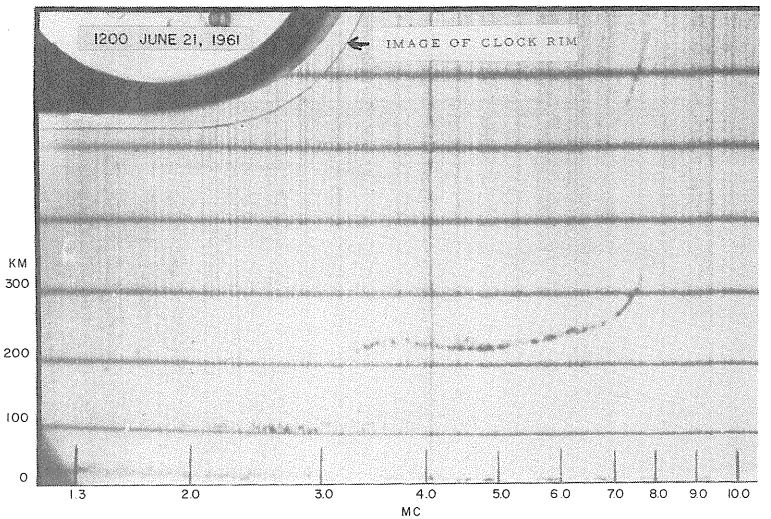


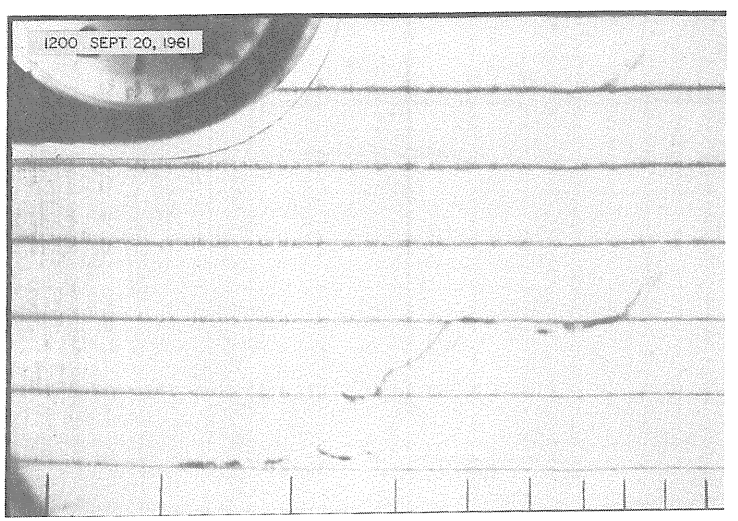
STATION: YAMAGAWA JAPAN

COORDINATES: GEOGRAPHIC LATITUDE: 31°13'N LONGITUDE: 130°38'E
GEOMAGNETIC LATITUDE: 20.3°N LONGITUDE: 197.8°
MAGNETIC DIP: 44.1°N TIME ZONE: 135°E
GYROFREQUENCY: 1.17 MC. AT 200 KM
TOTAL FIELD: 0.46 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 10 KW
SWEEP TIME: 20 SEC
LINEAR FREQUENCY SCALE

DIP 41.8° S
TRELEW



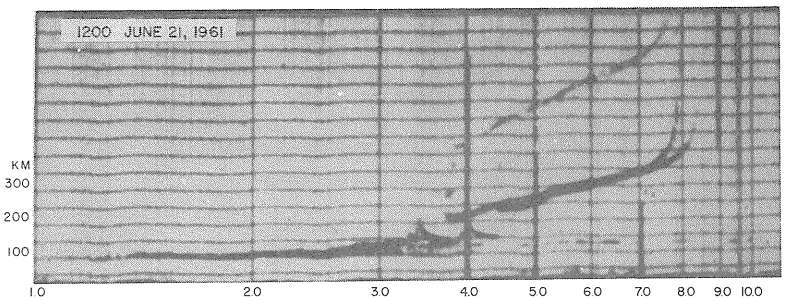


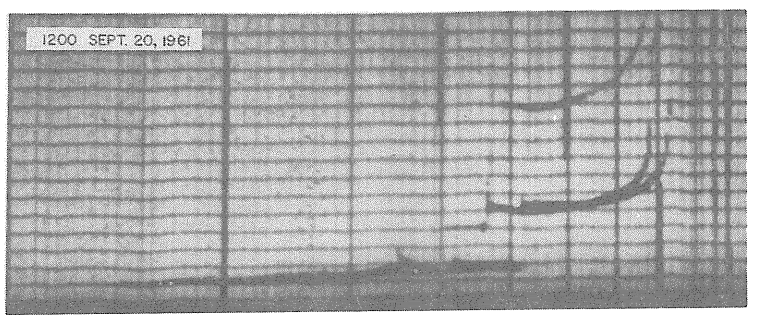
STATION: TRELEW ARGENTINA

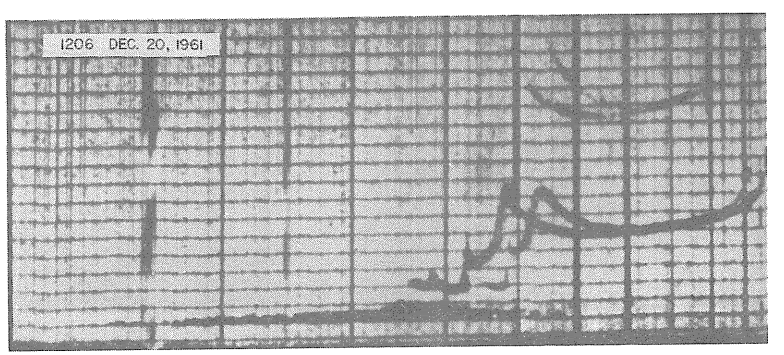
COORDINATES: GEOGRAPHIC LATITUDE: 43°13'S LONGITUDE: 65°18'W
GEOMAGNETIC LATITUDE: 31.7°S LONGITUDE: 3.2°
MAGNETIC DIP: 41.8°S GYROFREQUENCY: 0.82 MC AT 200 KM
TOTAL FIELD: 0.32 OERSTED. TIME ZONE: 60°W

IONOSONDE: TYPE OR DESIGNATION: TRIO - 2 AUTOMATIC
FREQUENCY RANGE: 1.3 MC TO 18.0 MC
SWEEP TIME: 30 SEC LOGARITHMIC FREQUENCY SCALE

DIP 38.2° S
RAROTONGA





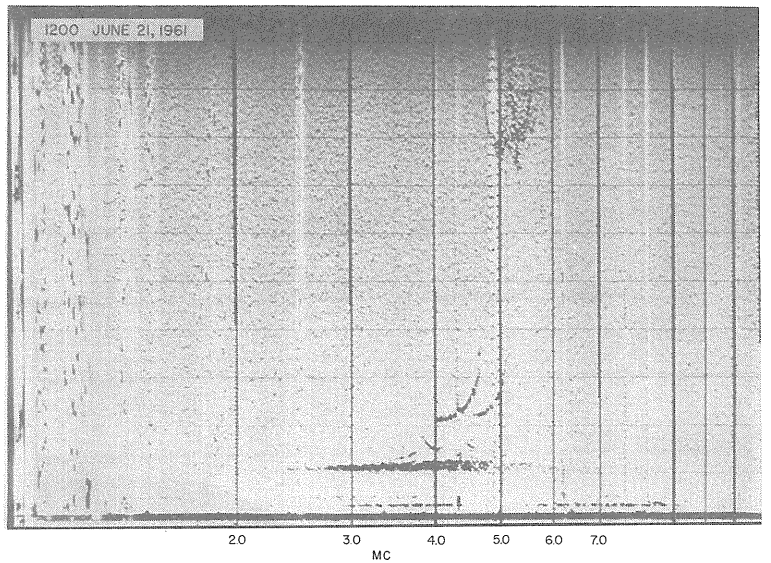


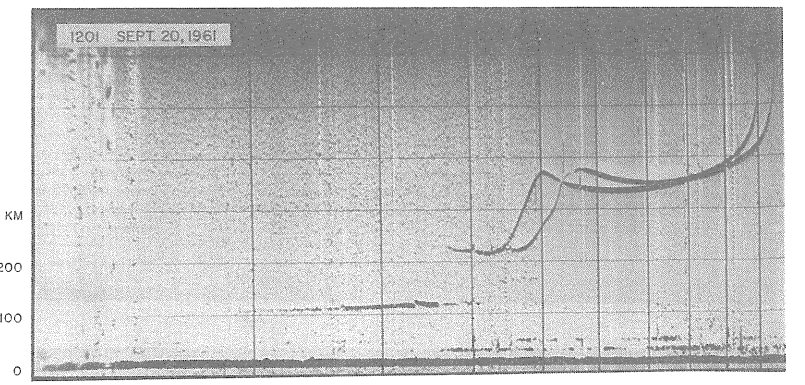
STATION: RAROTONGA PACIFIC OCEAN

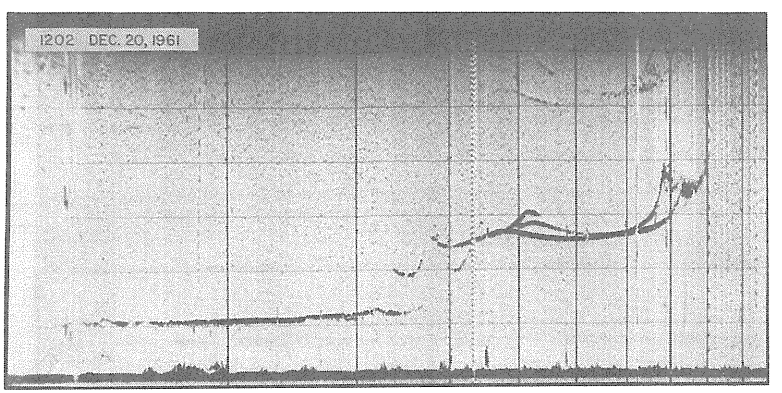
COORDINATES: GEOGRAPHIC LATITUDE: 21°12'S LONGITUDE: 159°45'W
GEOMAGNETIC LATITUDE: 20.9°S LONGITUDE: 273.6°
MAGNETIC DIP: 38.2°S TIME ZONE: 165°W
GYROFREQUENCY: 1.05 MC AT 200 KM
TOTAL FIELD: 0.41 OERSTED

IONOSONDE: TYPE OR DESIGNATION: P. 2
FREQUENCY RANGE: 1 MC. TO 22 MC. HEIGHT RANGE: 1000 KM
POWER: 10 KW SWEEP TIME: 7.5 SEC LOGARITHMIC FREQ. SCALE

DIP 38.3° N
MAUI





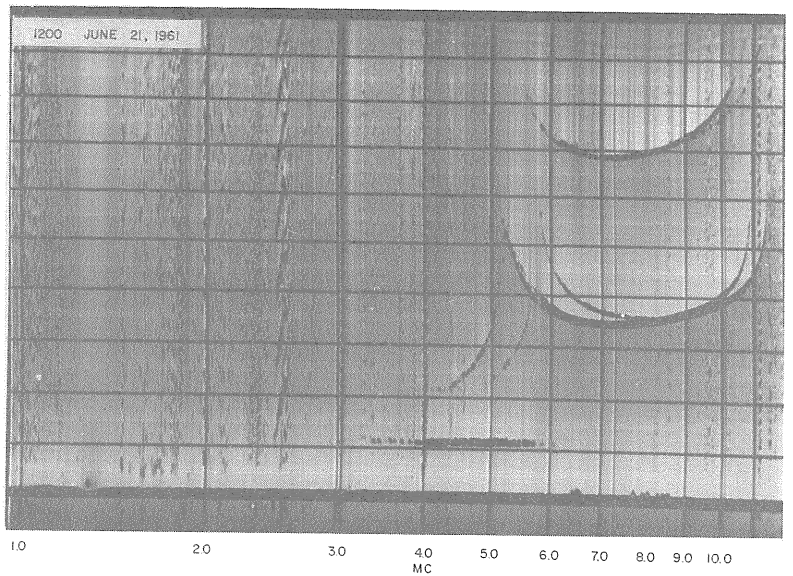


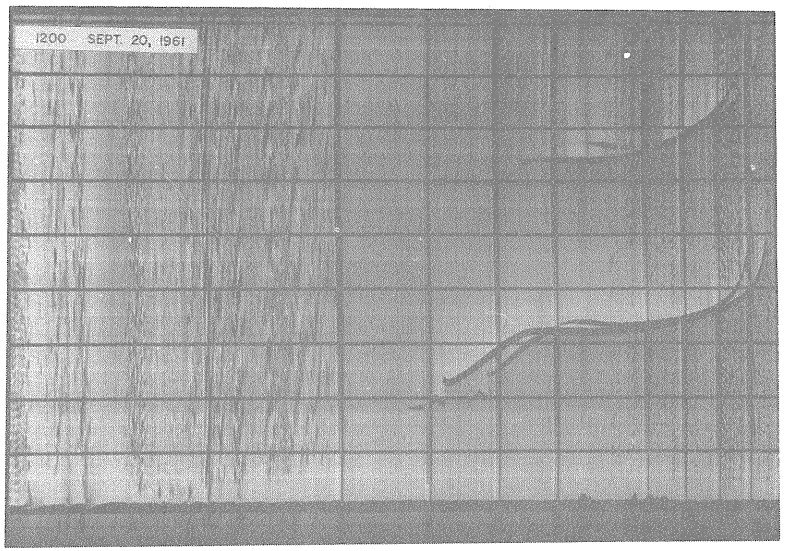
STATION: MAUI , HAWAII

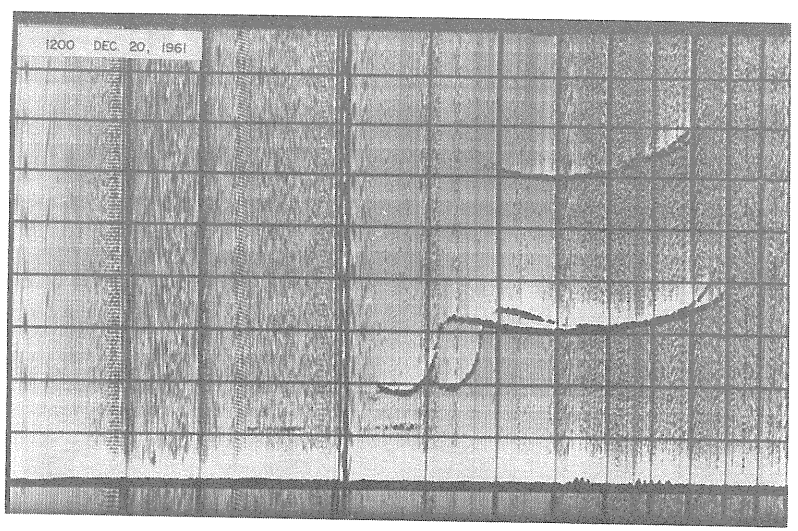
COORDINATES: GEOGRAPHIC LATITUDE: 20°50'N LONGITUDE: 156°30'W
GEOMAGNETIC LATITUDE: 20.9°N LONGITUDE: 268.1°
MAGNETIC DIP: 38.3°N TIME ZONE: 150°W
GYROFREQUENCY: 0.94 MC. AT 200 KM
TOTAL FIELD: 0.37 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 0.25 MC TO 20.0 MC
HEIGHT RANGE: 650 KM
POWER: 25 KW
SWEEP TIME: 27 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 36.8° N
OKINAWA





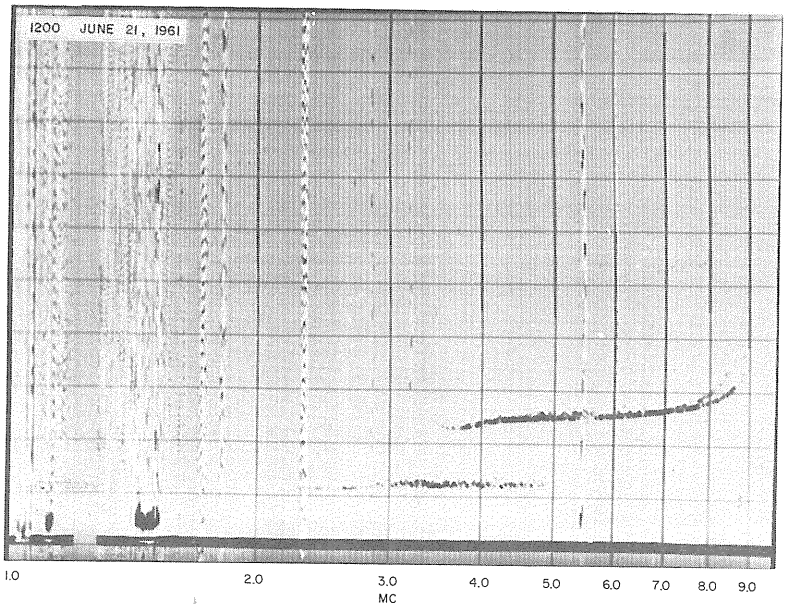


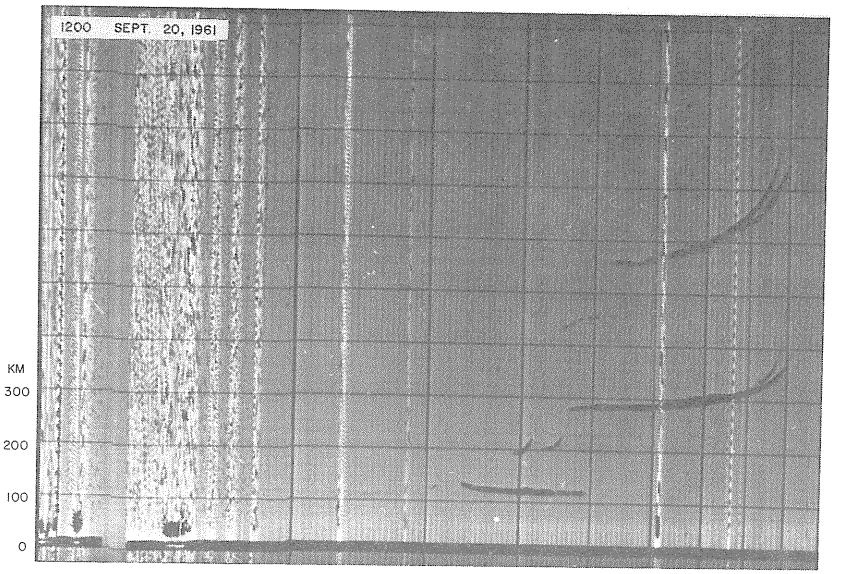
STATION: OKINAWA CHINA SEA

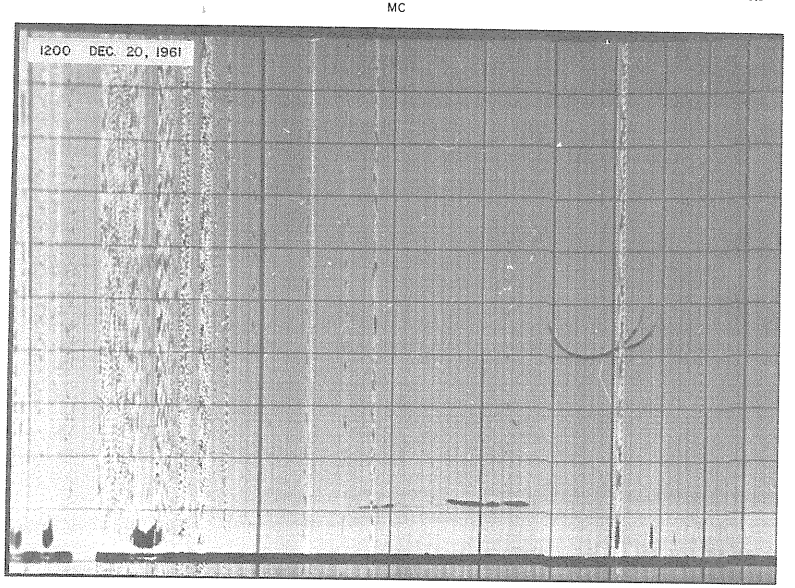
COORDINATES: GEOGRAPHIC LATITUDE: 26°19'N LONGITUDE: 127°47'E
GEOMAGNETIC LATITUDE: 15.3°N LONGITUDE: 195.6°
MAGNETIC DIP: 36.8°N TIME ZONE: 135°E
GYROFREQUENCY: 1.10 MC AT 200 KM
TOTAL FIELD: 0.43 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 20 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 36.4° S
CONCEPCION





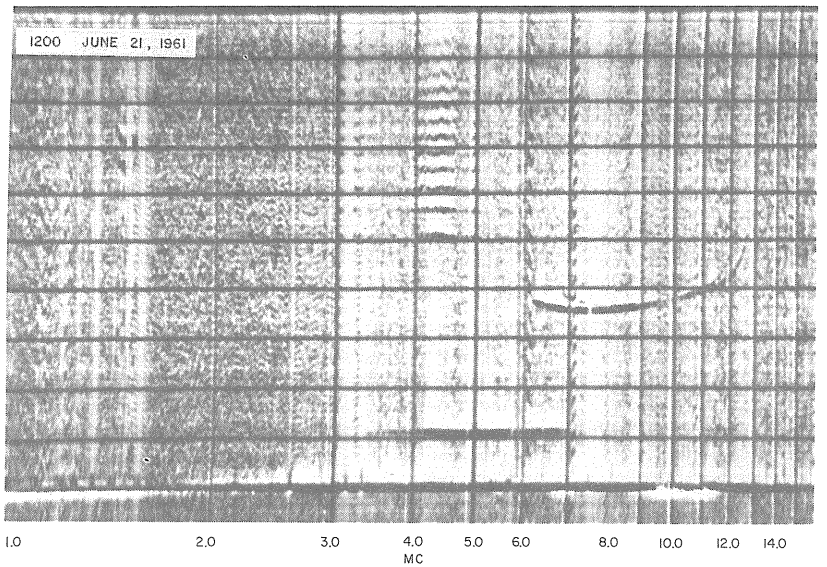


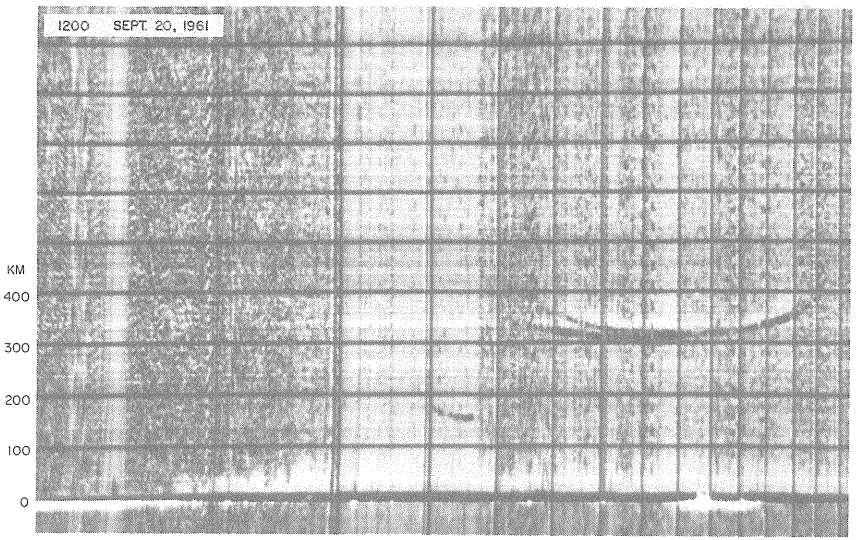
STATION: CONCEPCION CHILE

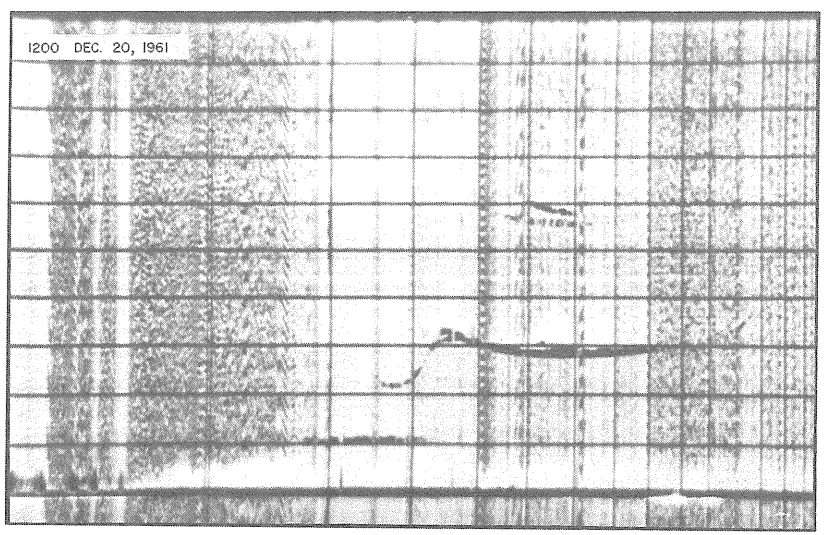
COORDINATES: GEOGRAPHIC LATITUDE: 36°47'S LONGITUDE: 73°01'W
GEOMAGNETIC LATITUDE: 25.1°S LONGITUDE: 356.5°
MAGNETIC DIP: 36.4°S TIME ZONE: 60°W
GYROFREQUENCY: 0.73 MC AT 200 KM
TOTAL FIELD: 0.285 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 15 KW
SWEEP TIME: 36 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 35.0° N
TAIPEI







STATION: TAIPEI TAIWAN

COORDINATES: GEOGRAPHIC LATITUDE: 25°00'N LONGITUDE: 121°30'E

GEOMAGNETIC LATITUDE: 13.7°N LONGITUDE: 189.8°

MAGNETIC DIP: 35.0°N TIME ZONE: 120°E

GYROFREQUENCY: 1.12 MC AT 200 KM

TOTAL FIELD: 0.44 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-2

FREQUENCY RANGE: 1.0 MC TO 25.0 MC

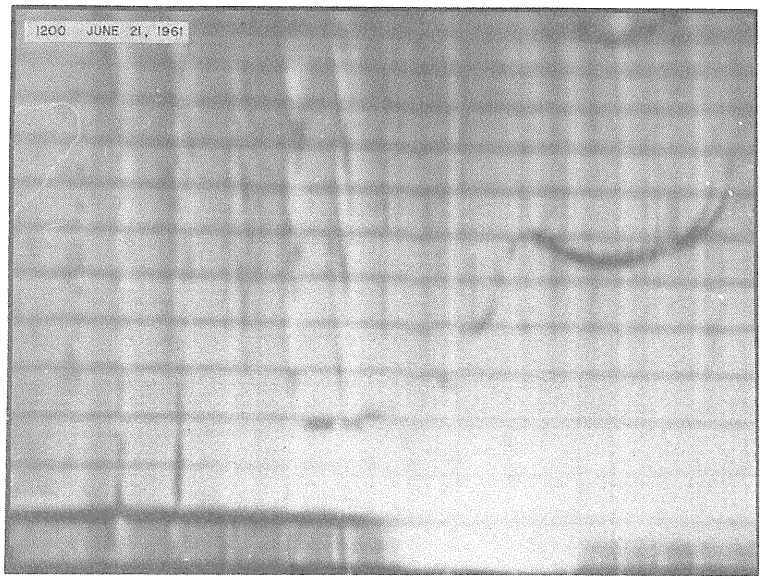
HEIGHT RANGE: 1000 KM

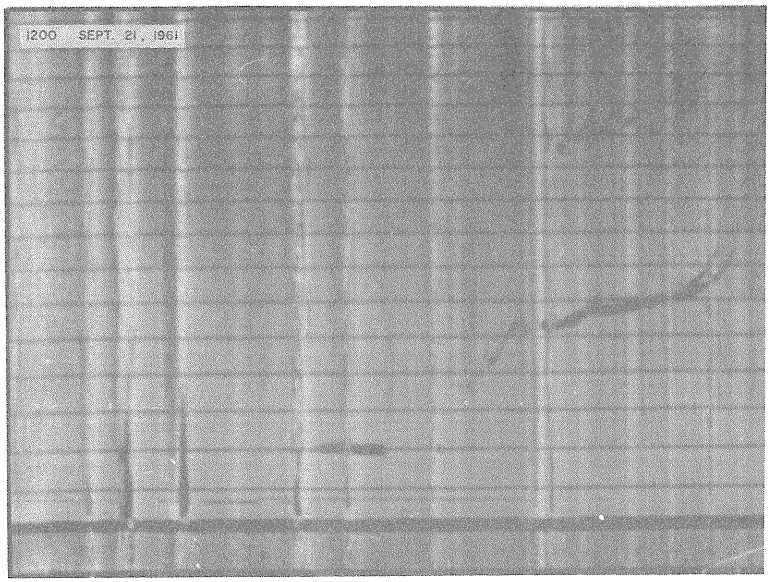
POWER: 15 KW

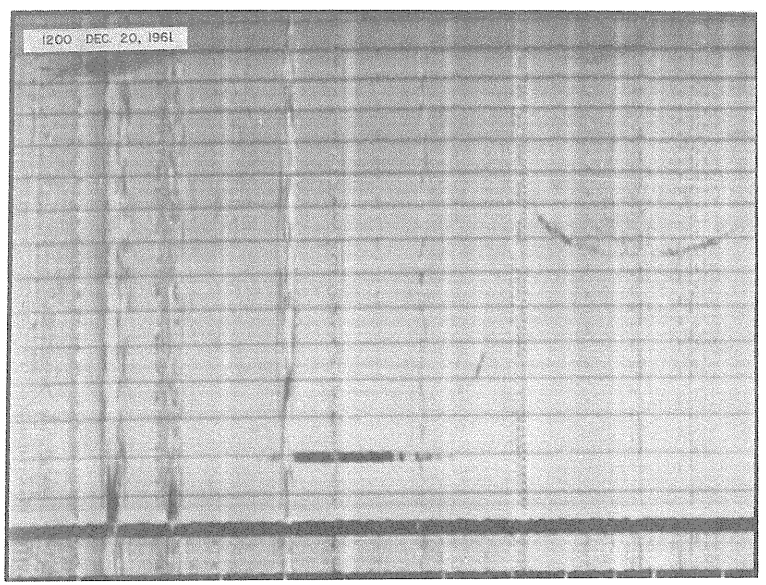
SWEEP TIME: 30 SEC

LOGARITHMIC FREQUENCY SCALE

DIP 33.2° S
PORT MORESBY





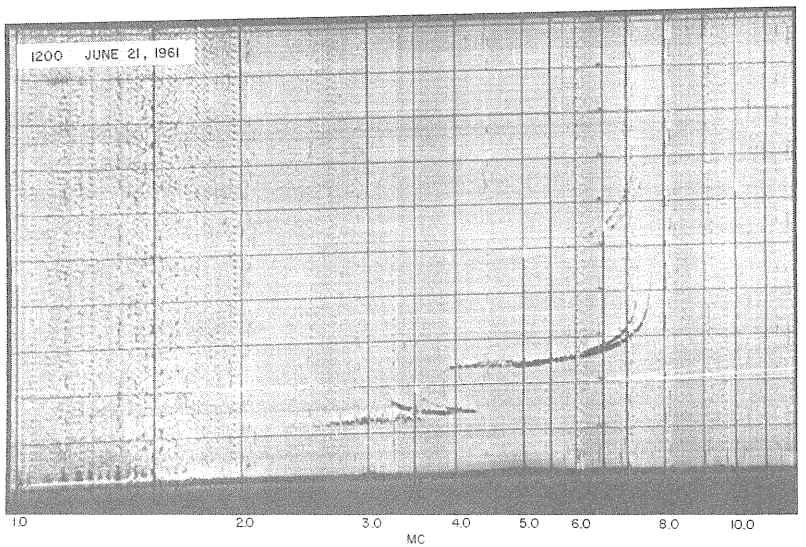


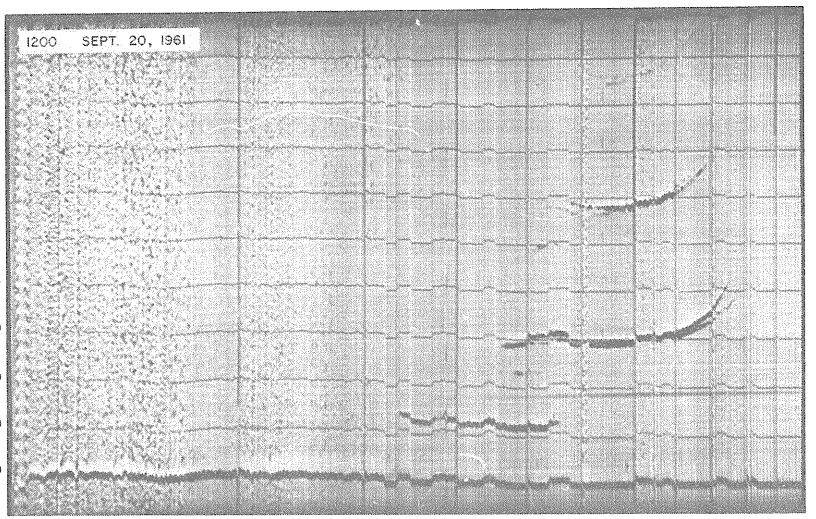
STATION: PORT MORESBY NEW GUINEA

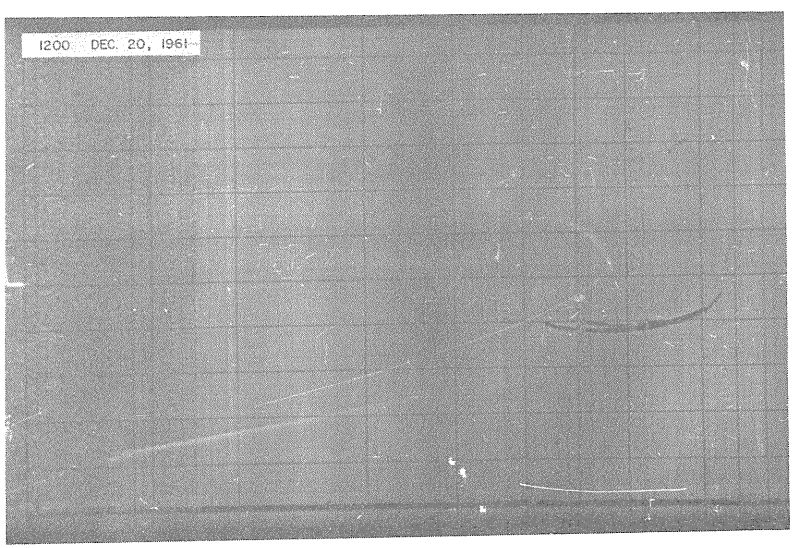
COORDINATES: GEOGRAPHIC LATITUDE: 9°26'S LONGITUDE: 147°13'E
GEOMAGNETIC LATITUDE: 18.6°S LONGITUDE: 217.8°
MAGNETIC DIP: 33.2°S TIME ZONE: 150°E
GYROFREQUENCY: 1.10 MC AT 200 KM
TOTAL FIELD: 0.43 OERSTED

IONOSONDE: TYPE OR DESIGNATION: IPS TYPE 3-C
FREQUENCY RANGE: 1.0 MC. TO 25.0 MC
POWER: 5 KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 32.8° S
BUENOS AIRES





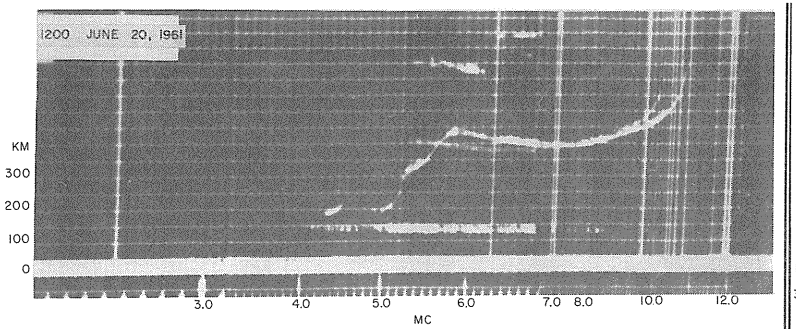


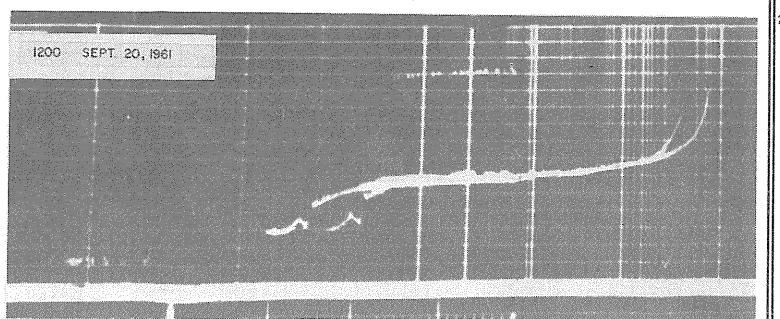
STATION: BUENOS AIRES ARGENTINA

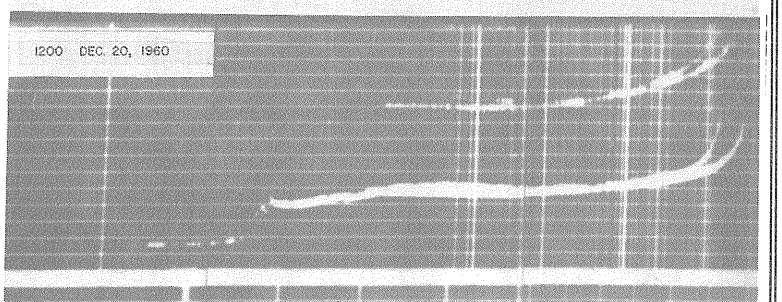
COORDINATES: GEOGRAPHIC LATITUDE: 34°35'S LONGITUDE: 58°29'W
GEOMAGNETIC LATITUDE: 23.2°S LONGITUDE: 9.4°
MAGNETIC DIP: 32.8°S TIME ZONE: 60°W
GYROFREQUENCY: 0.66 MC AT 200 KM
TOTAL FIELD: 0.26 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 25KW
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 31.8° N
AHMEDABAD





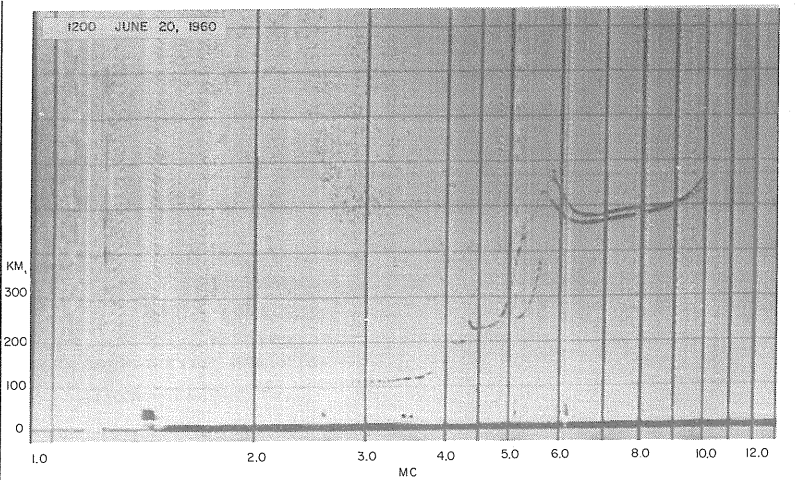


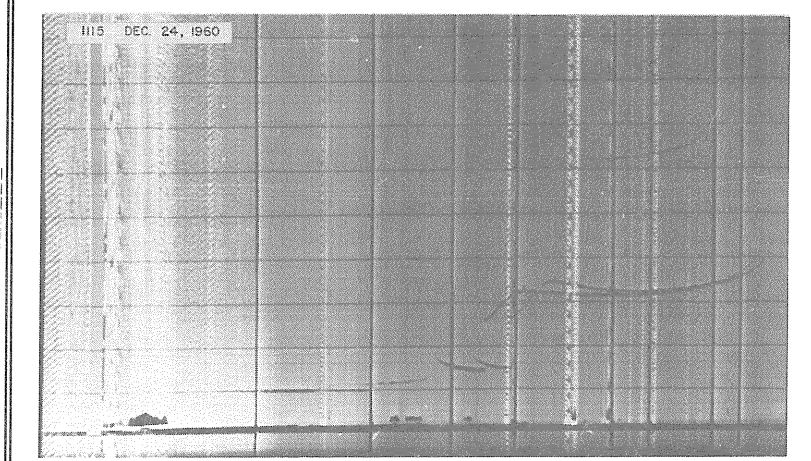
STATION: AHMEDABAD INDIA

COORDINATES: GEOGRAPHIC LATITUDE: 23°01'N LONGITUDE: 72°36'E
GEOMAGNETIC LATITUDE: 13.8°N LONGITUDE: 143.9°
MAGNETIC DIP: 31.8°N GYROFREQUENCY: 1.12 MC. AT 200 KM
TOTAL FIELD: 0.44 OERSTED TIME ZONE: 75°E

IONOSONDE: TYPE OR DESIGNATION: BRITISH N.P.L. TYPE MK II
FREQUENCY RANGE: 0.6 MC. TO 25.0 MC
HEIGHT RANGE: NOT FIXED (NORMALLY KEPT 1000 KM
POWER: ABOUT 240 WATTS AT H. F. RANGE
ABOUT 1700 WATTS AT L. F. RANGE
SWEEP TIME: 5 MIN (1 MIN PER BAND)
LINEAR FREQUENCY SCALE IN EACH BAND

DIP 31.7° N
BOGOTA



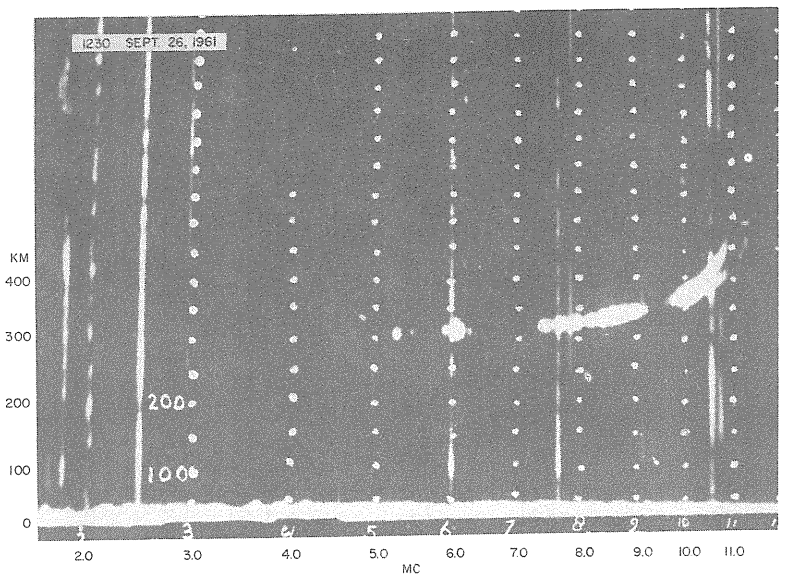


STATION: BOGOTA COLOMBIA

COORDINATES: GEOGRAPHIC LATITUDE: 4°38'N LONGITUDE: 74°05'W
GEOMAGNETIC LATITUDE: 15.9°N LONGITUDE: 354.6°
MAGNETIC DIP: 31.7°N TIME ZONE: 75°W
GYROFREQUENCY: 0.89 MC. AT 200 KM
TOTAL FIELD: 0.35 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM POWER: 25 KW
SWEEP TIME: 13.5 SEC LOGARITHMIC FREQUENCY SCALE

DIP 31.1° N
PARAMARIBO

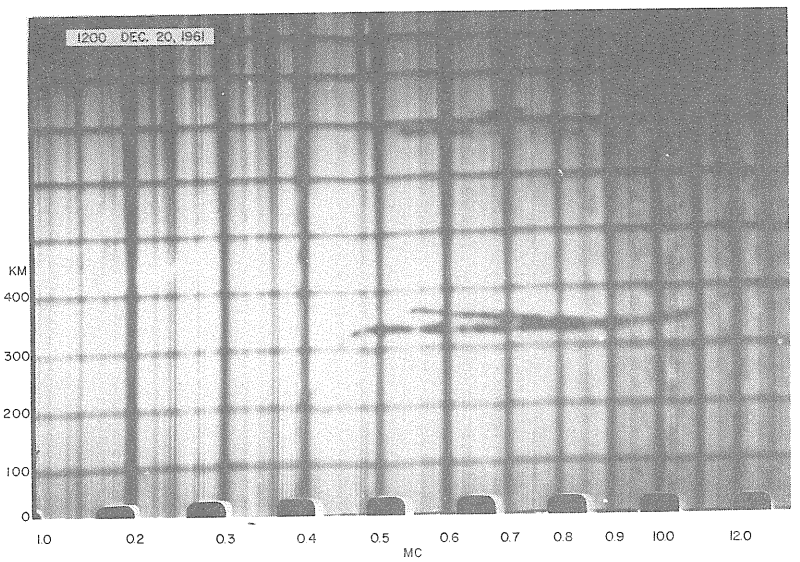


STATION: PARAMARIBO SURINAM

COORDINATES: GEOGRAPHIC LATITUDE: 05°49'N LONGITUDE: 55°13' W
GEOMAGNETIC LATITUDE: 17.0°N LONGITUDE: 14.4°
MAGNETIC DIP: 31.1°N TIME ZONE: 0°
GYROFREQUENCY: 0.87 MC. AT 200 KM
TOTAL FIELD: 0.34 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.4 MC. TO 20 MC
HEIGHT RANGE: 0 - 1000 KM
POWER: 5 KW
SWEEP TIME: 40 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 29.7° N
MACAO

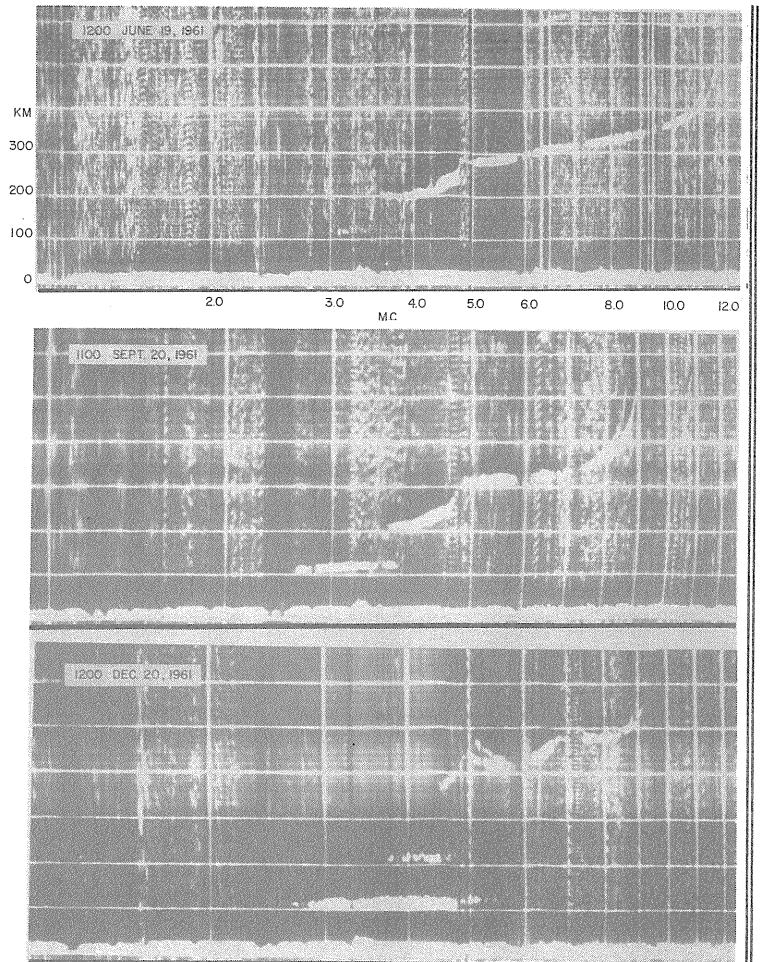


STATION: MACAO (MACAU) CHINA SEA

COORDINATES: GEOGRAPHIC LATITUDE: 22°12'N LONGITUDE: 111° 33' E
GEOMAGNETIC LATITUDE: 10.7°N LONGITUDE: 182.4°
MAGNETIC DIP: 29.7°N TIME ZONE: 120°E
GYROFREQUENCY: 1.12 MC. AT 200 KM
TOTAL FIELD: 0.44 OERSTED

IONOSONDE: TYPE OR DESIGNATION: PANORAMIC
FREQUENCY RANGE: 1.6 MC TO 20 MC
HEIGHT RANGE: ADJUSTABLE
POWER: 1 KW
SWEEP TIME: 15 SEC
LINEAR FREQUENCY SCALE

DIP 23.3° S
SAO PAULO

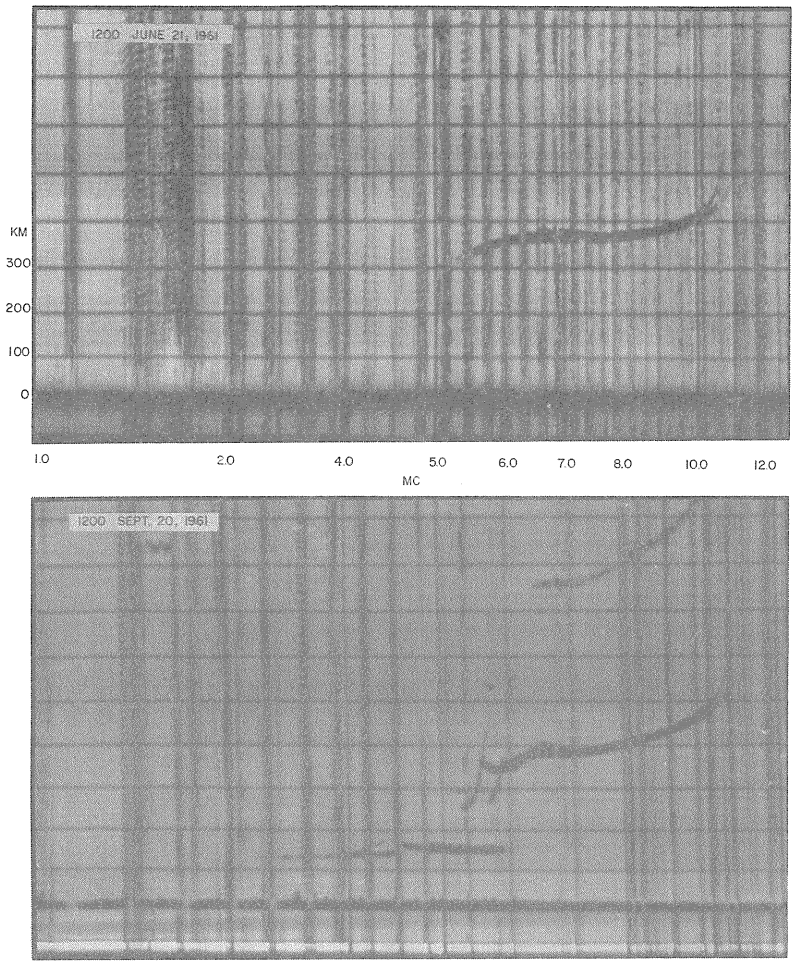


STATION: SAO PAULO BRAZIL

COORDINATES: GEOGRAPHIC LATITUDE: 23°33'S LONGITUDE: 46° 38' W
GEOMAGNETIC LATITUDE: 12.8°S LONGITUDE: 21.1°
MAGNETIC DIP: 23.3°S GYROFREQUENCY: 0.61 MC. AT 200 KM.
TOTAL FIELD: 0.24 OERSTED TIME ZONE: 45°W

IONOSONDE: TYPE OR DESIGNATION: C-3
FREQUENCY RANGE: 1 MC. TO 25 MC
HEIGHT RANGE: 500 - 1000 - 4000 KM POWER: 10 KW
SWEEP TIME: 10 SEC LOGARITHMIC FREQUENCY SCALE

DIP 22.8° S
TUCUMAN

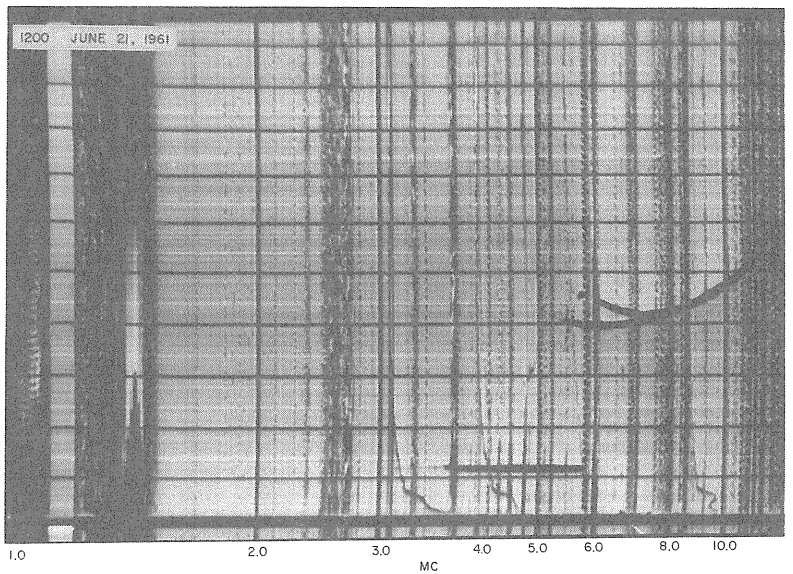


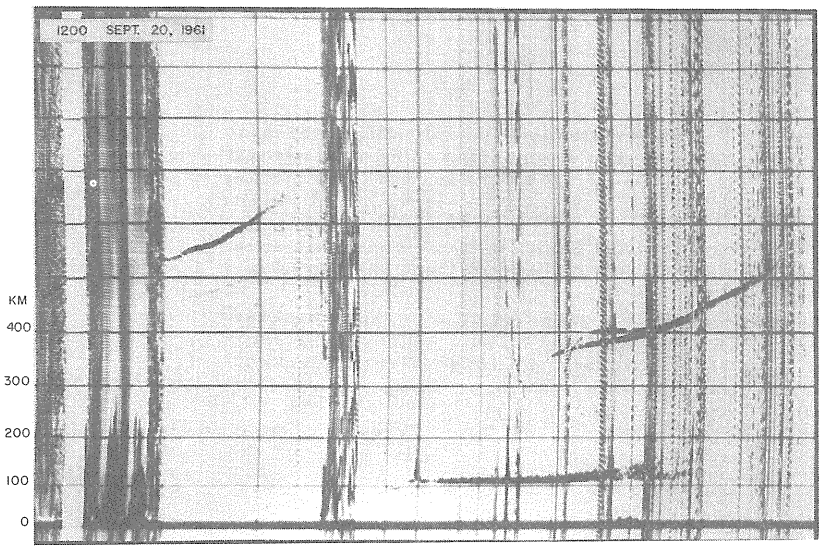
STATION: TUCUMAN ARGENTINA

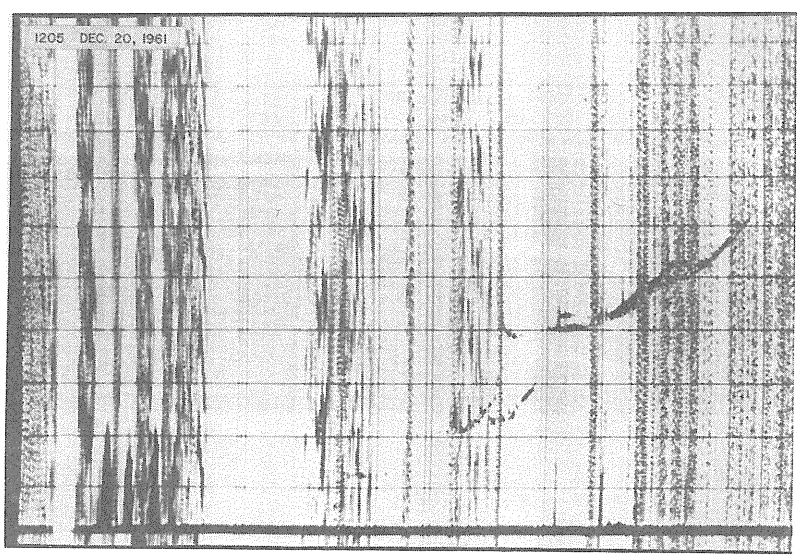
COORDINATES: GEOGRAPHIC LATITUDE: 26°53'S LONGITUDE: 65°23'W
GEOMAGNETIC LATITUDE: 15.4°S LONGITUDE: 3.3°
MAGNETIC DIP: 22.8°S GYROFREQUENCY: 0.69 MC. AT 200 KM
TOTAL FIELD: 0.27 OERSTED TIME ZONE: 60°W

IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 23 MC
HEIGHT RANGE: 1000 KM POWER: 10 KW (NOMINAL)
SWEEP TIME: 30 SEC LOGARITHMIC FREQUENCY SCALE

DIP 18.5° N
BAGUIO







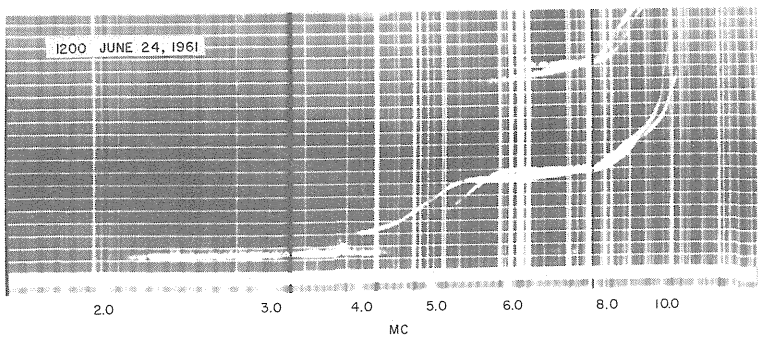
STATION: BAGUIO PHILIPPINES

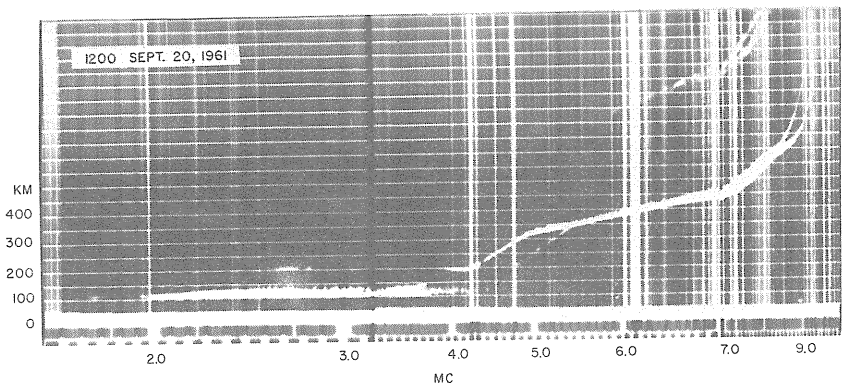
COORDINATES: GEOGRAPHIC LATITUDE: 16°25'N LONGITUDE: 120°35'E
GEOMAGNETIC LATITUDE: 5.1°N LONGITUDE: 189.2°
MAGNETIC DIP: 18.5°N TIME ZONE: 120°E
GYROFREQUENCY: 1.05 MC. AT 200 KM
TOTAL FIELD: 0.41 OERSTED

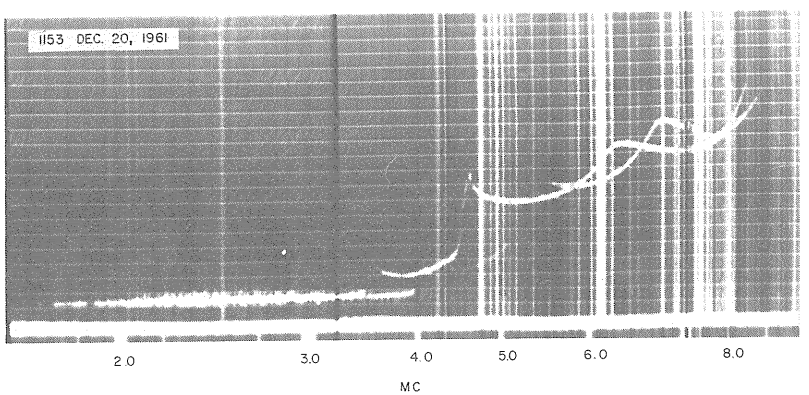
IONOSONDE: TYPE OR DESIGNATION: C-2
FREQUENCY RANGE: 1.0 MC TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 8.0 KW
SWEEP TIME: 27 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 18.3°S

SINGAPORE





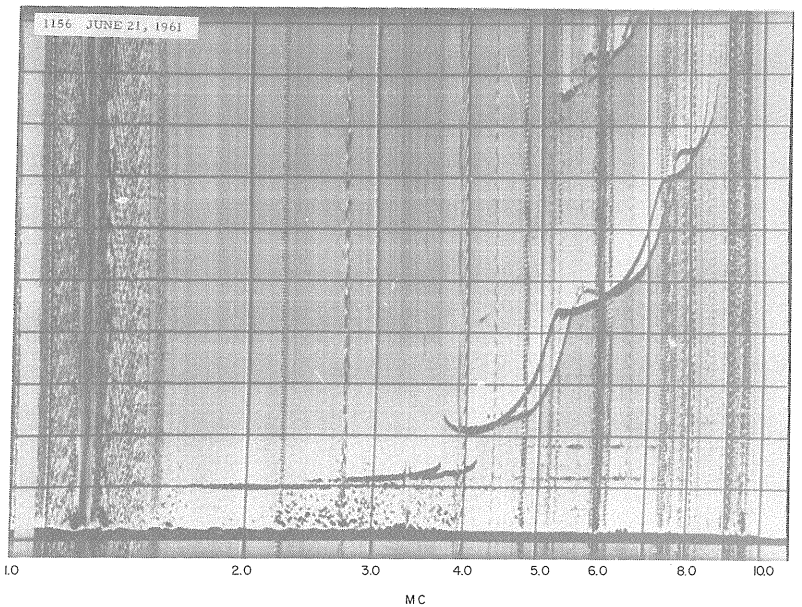


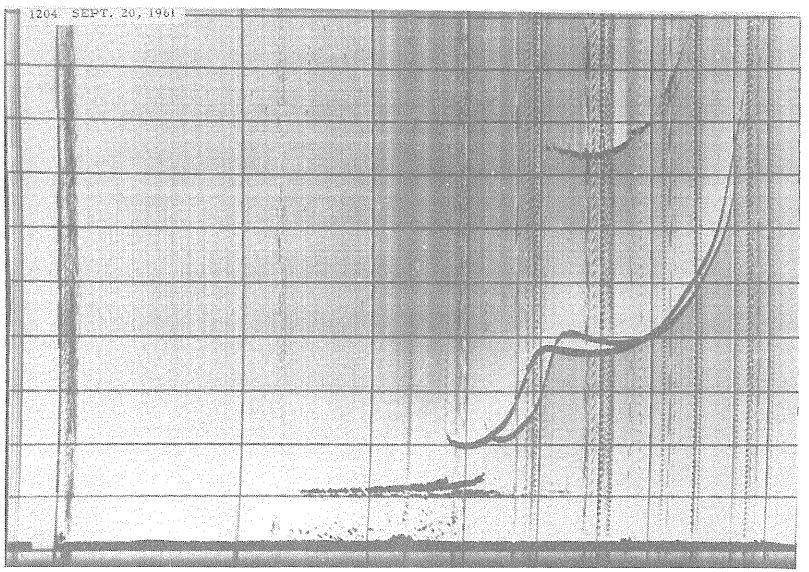
STATION: SINGAPORE MALAYA

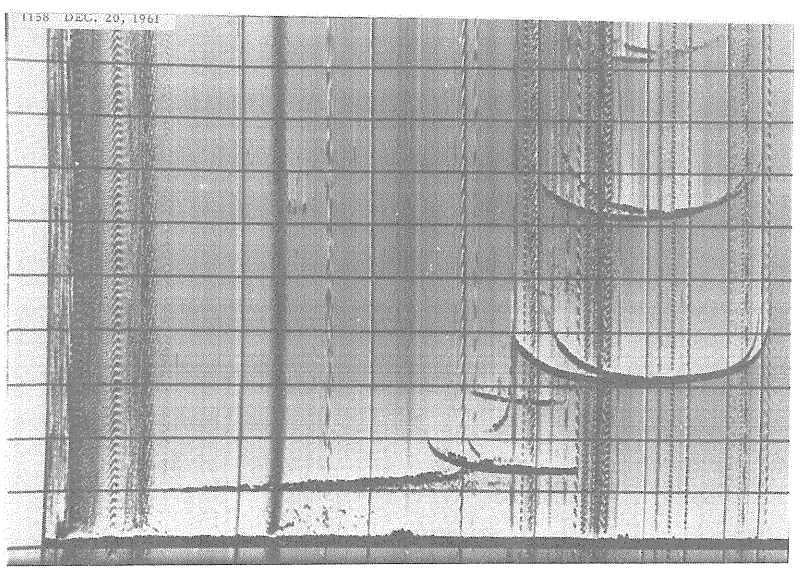
COORDINATES: GEOGRAPHIC LATITUDE: 01°19'N LONGITUDE: 103°49'E
GEOMAGNETIC LATITUDE: 10.1°S LONGITUDE: 172.7°
MAGNETIC DIP: 18.3 TIME ZONE: 105°E
GYROFREQUENCY: 1.04 MC AT 200 KM

IONOSONDE: TYPE OR DESIGNATION: D.S.I.R. MARK II (UNION RADIO CO.)
FREQUENCY RANGE: 0.65 - 25 MC IN 5 BANDS
HEIGHT RANGE: 1400 KM
POWER: 1 KW
SWEEP TIME: 1 MIN FOR EACH BAND
FREQUENCY SCALE: NEARLY LINEAR IN EACH BAND
QUASI LOGARITHMIC RELATION BETWEEN BANDS

DIP 13.2° N
TALARA







STATION: TALARA PERU

COORDINATES: GEOGRAPHIC LATITUDE: 04°34'S LONGITUDE: 81°15'W

GEOMAGNETIC LATITUDE: 06.6°N LONGITUDE: 347.7°

MAGNETIC DIP: 13.2°N TIME ZONE: 75°W

GYROFREQUENCY: 0.82 MC. at 200 KM

TOTAL FIELD: 0.32 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-3

FREQUENCY RANGE: 1.0 MC TO 25.0 MC

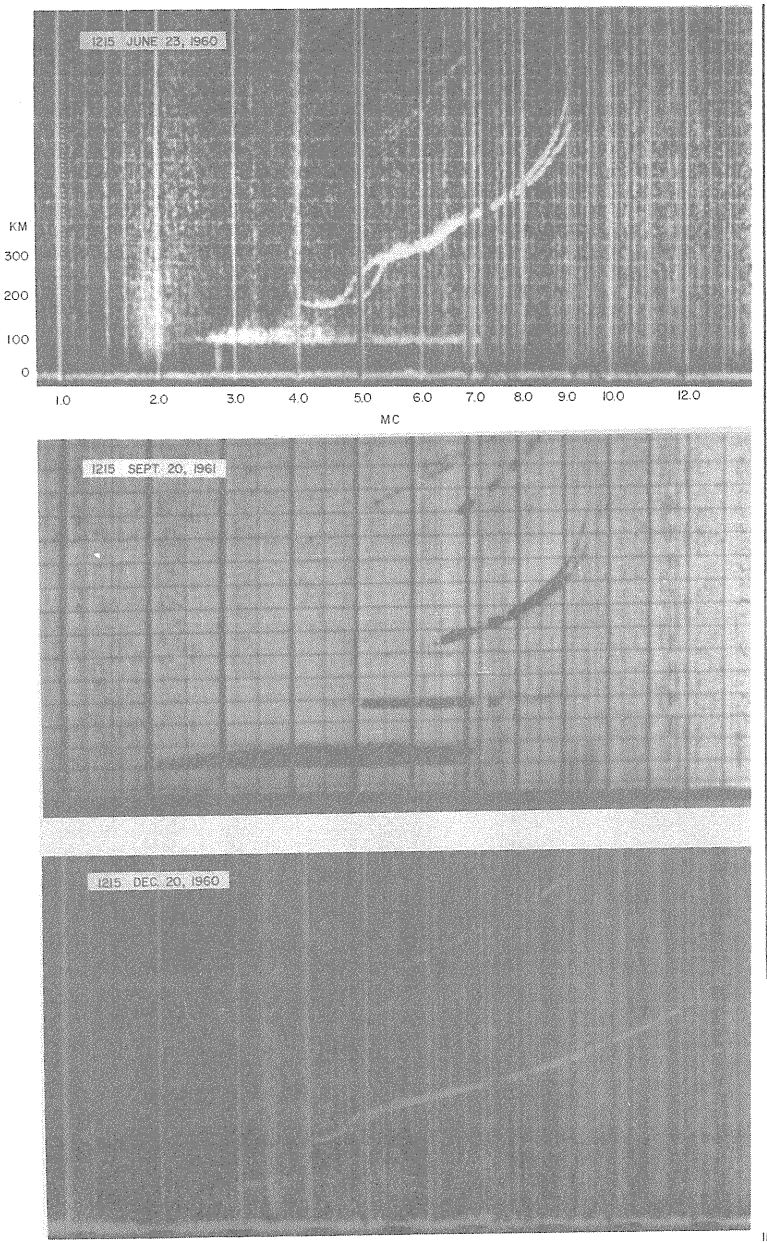
HEIGHT RANGE: 1000 KM

POWER: 15 KW

SWEEP TIME: 30 SEC

LOGARITHMIC FREQUENCY SCALE

DIP 7.4°S
KUMASI

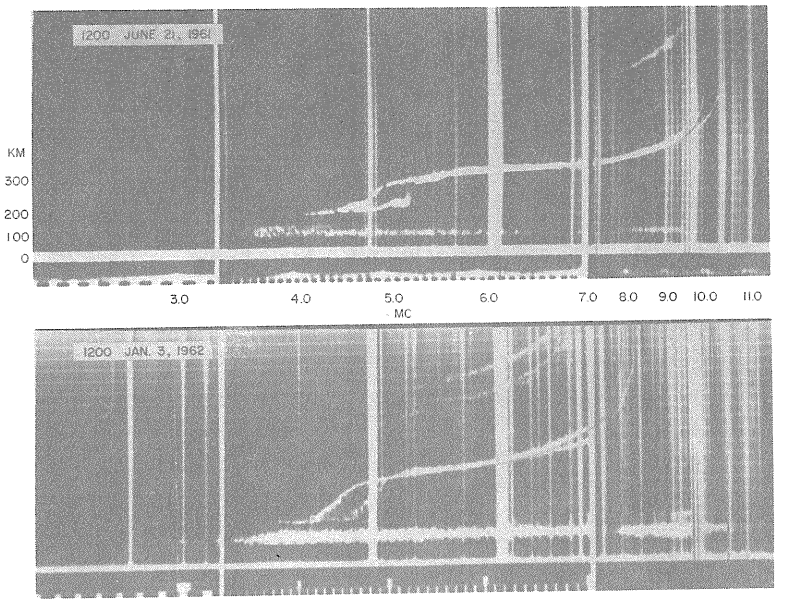


STATION: KUMASI GHANA

COORDINATES: GEOGRAPHIC LATITUDE: 06°42'N LONGITUDE: 01°34'W
GEOMAGNETIC LATITUDE: 11.0°N LONGITUDE: 69.0°
MAGNETIC DIP: 7.4°S GYROFREQUENCY: 0.79 MC AT 200 KM
TOTAL FIELD: 0.31 OERSTED TIME ZONE: U. T. + 00.00

IONOSONDE: TYPE OR DESIGNATION: STATION'S OWN DESIGN AND CONSTRUCTION
FREQUENCY RANGE: 0.9 MC TO 20.0 MC
HEIGHT RANGE: 1000 KM POWER: 2 KW
SWEEP TIME: 20 SEC

DIP 3.9° S
IBADAN



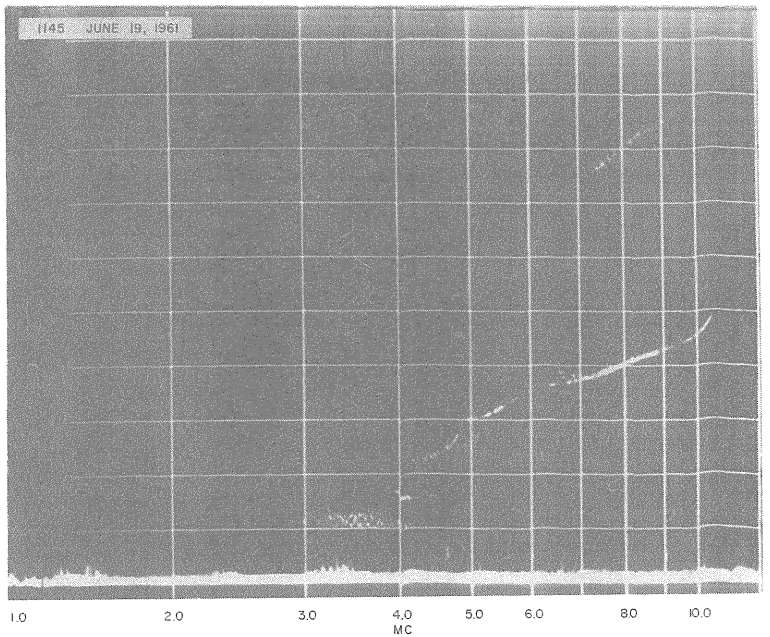
STATION: IBADAN NIGERIA

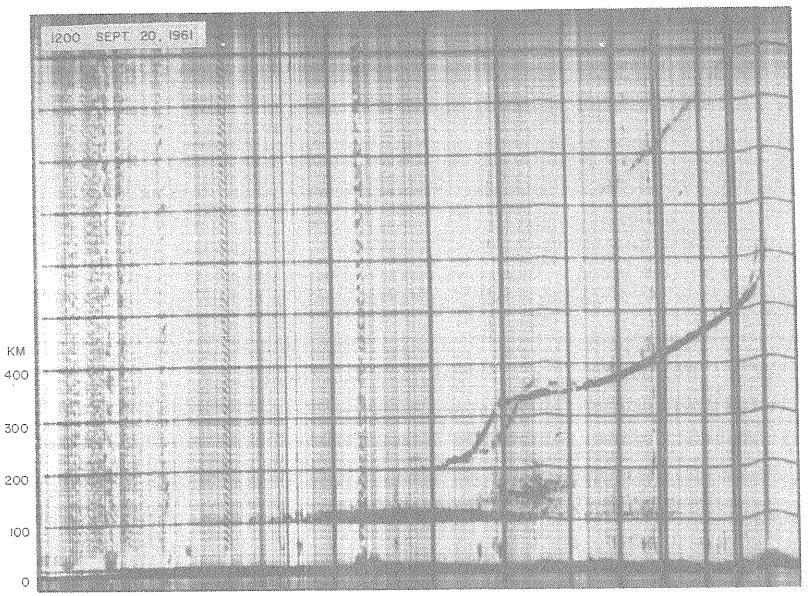
COORDINATES: GEOGRAPHIC LATITUDE: 07°26'N LONGITUDE: 3°53'E
GEOMAGNETIC LATITUDE: 10.6°N LONGITUDE: 74.7°
MAGNETIC DIP: 3.9°S TIME ZONE: 0°
GYROFREQUENCY: 0.82 MC AT 200 KM TOTAL FIELD: 0.32 OERSTED

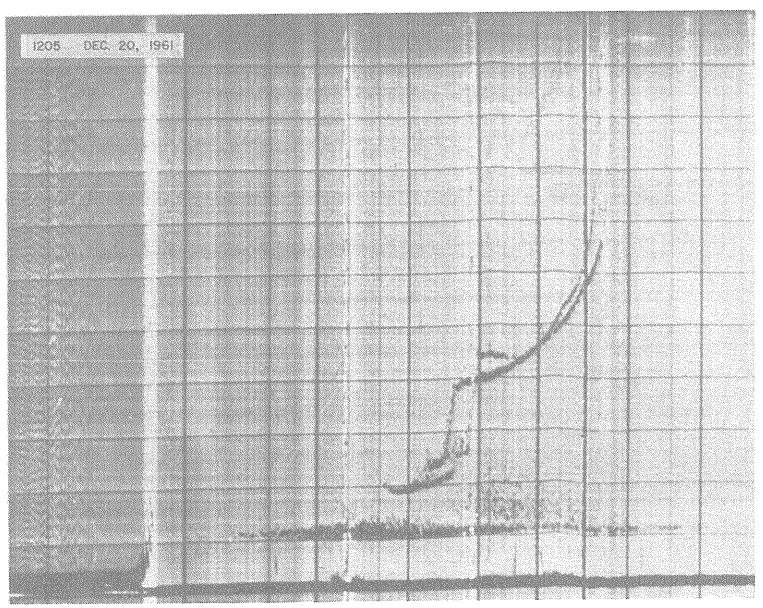
IONOSONDE: TYPE OR DESIGNATION: UNION RADIO MK II
FREQUENCY RANGE: 0.7 MC TO 25 MC HEIGHT RANGE: 600 KM
POWER: ABOUT 1 PEAK KW SWEEP TIME: 300 SEC

DIP 3.6° S

NATAL







STATION: NATAL BRAZIL

COORDINATES: GEOGRAPHIC LATITUDE: 5°42'S LONGITUDE: 35°12'W

GEOMAGNETIC LATITUDE: 3.9°N LONGITUDE: 33.7°

MAGNETIC DIP: 3.6°S TIME ZONE: 30°W

GYROFREQUENCY: .71 MC. AT 200 KM

TOTAL FIELD: 0.28 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4

FREQUENCY RANGE: 1.0 MC. TO 25.0 MC

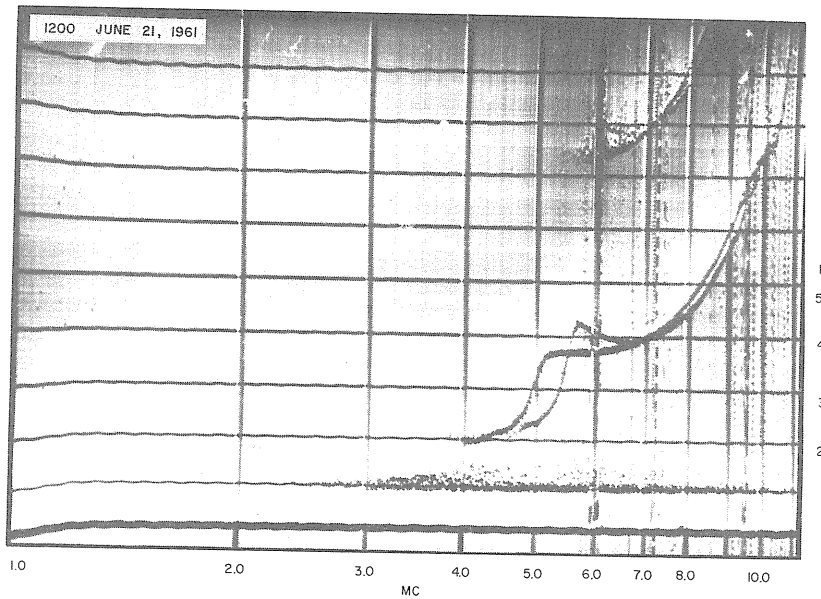
HEIGHT RANGE: 1000 KM

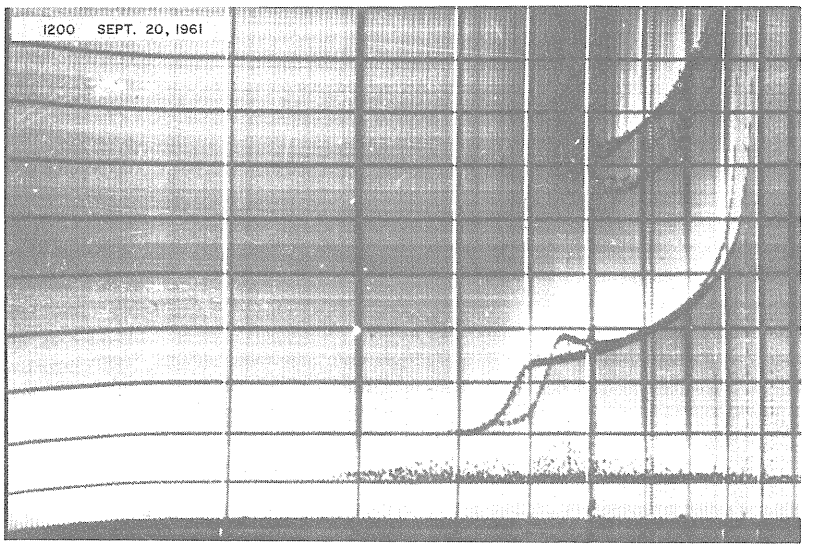
POWER: 25 KW

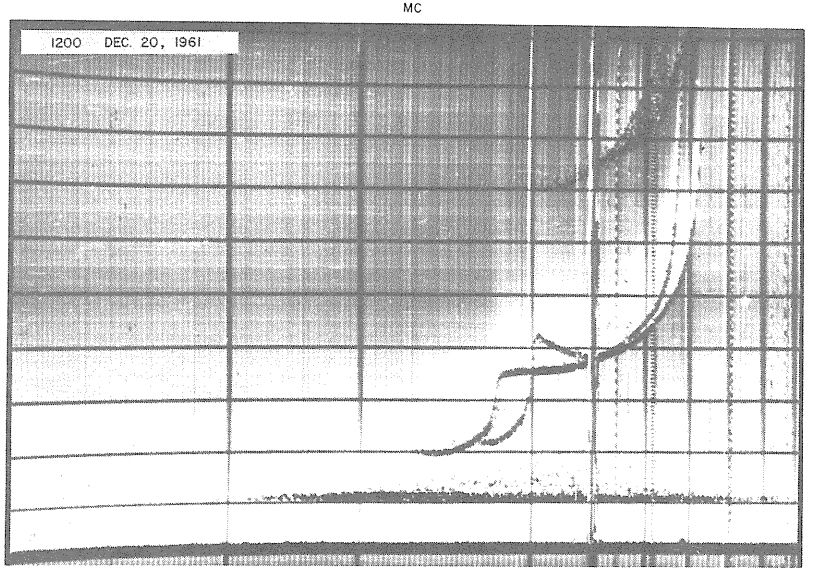
SWEEP TIME: 35 SEC

LOGARITHMIC FREQUENCY SCALE

DIP 2.4° N
KODAIKANAL





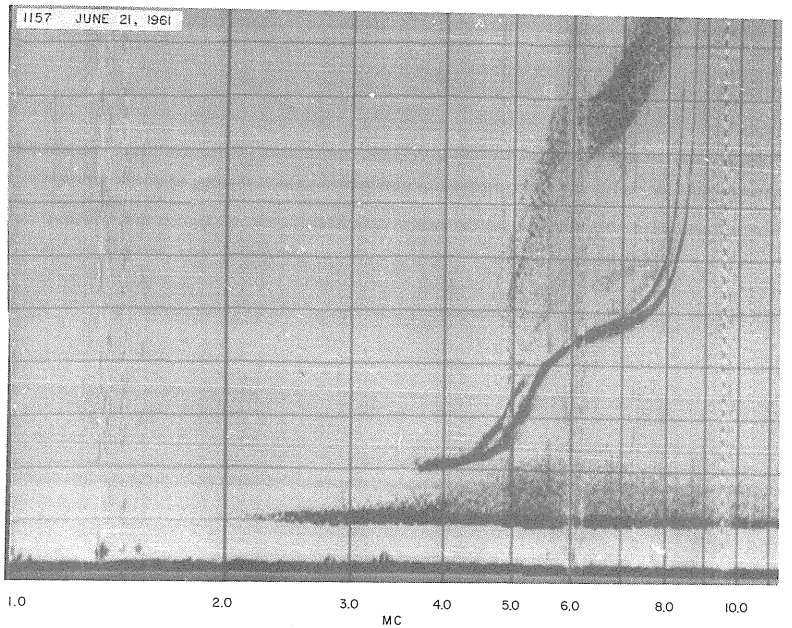


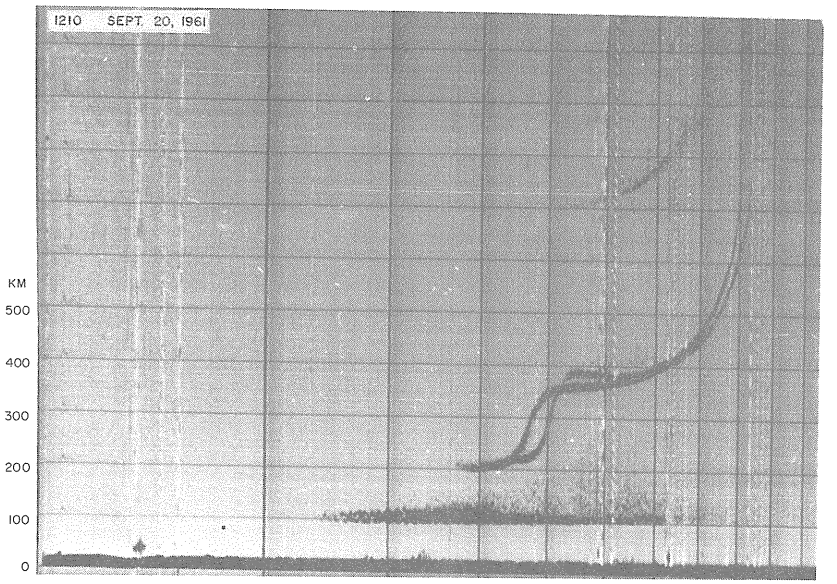
STATION: KODAIKANAL INDIA

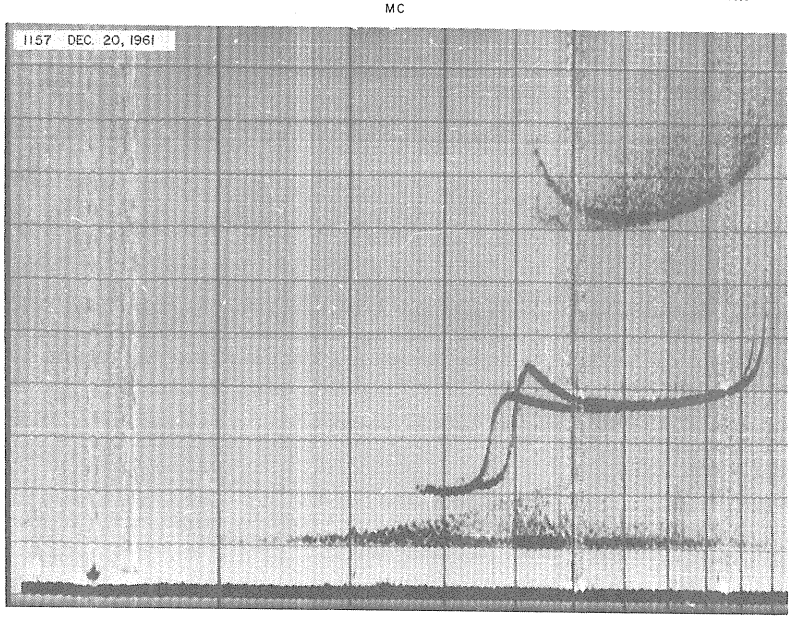
COORDINATES: GEOGRAPHIC LATITUDE: 10°14'N LONGITUDE: 77°29'E
GEOMAGNETIC LATITUDE: 0.6°N LONGITUDE: 147.1°
MAGNETIC DIP: 2.4°N TIME ZONE: 75°E
GYROFREQUENCY: 1.00 MC. AT 200 KM
TOTAL FIELD: 0.39 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC. TO 25.0 MC
HEIGHT RANGE: 500, 1000, and 4000 KM
POWER: 10 KW (NOMINAL)
SWEEP TIME: 30 SEC
LOGARITHMIC FREQUENCY SCALE

DIP 1.2° N
HUANCAYO







STATION: HUANCAYO PERU U. S. A., AFFILIATION

COORDINATES: GEOGRAPHIC LATITUDE: 12°03'S LONGITUDE: 75°20'W
GEOMAGNETIC LATITUDE: 0.6°S LONGITUDE: 353.8°
MAGNETIC DIP: 1.2°N TIME ZONE: 75°W.
GYROFREQUENCY: 0.82 MC. AT 200 KM
TOTAL FIELD: 0.32 OERSTED

IONOSONDE: TYPE OR DESIGNATION: C-4
FREQUENCY RANGE: 1.0 MC. TO 25.0 MC
HEIGHT RANGE: 1000 KM
POWER: 25 KW
SWEEP TIME: 120 SEC
LOGARITHMIC FREQUENCY SCALE

SECTION III

SPECIAL PHENOMENA AND MISCELLANEOUS

Es TYPES

The standard categories of Es were recommended by the URSI Worldwide Soundings Committee and are explained in detail in the URSI Handbook of Ionogram Interpretation and Reduction by W. R. Piggott and K. Rawer, pp. 58-59, Elseview 1961. An additional type,"d," was defined in Jens K. Olesen's and J. W. Wright s paper, "The Relationship of Low-Height Ionosonde Echoes in Auroral Zone Absorption and VHF D Scatter," Journal of Geophysical Research, Vol. 4, April 1961. The explanations following are abstracted from these sources. Page numbers for each type are given, with the principal reference underlined.

f. An Es trace that shows no appreciable increase in height with frequency. The trace is usually relatively solid at most latitudes. This classification may only be used at night when a thick E layer trace is absent. See pages III-3 and III-9.

ℓ A flat Es trace at or below the normal E layer minimum virtual height in the day or below the night E layer minimum virtual height at night. See pages III-3, III-5, and III-9.

c. An Es trace showing a relatively symmetrical cusp at or below foE. This is usually continuous with the normal E trace, although when the deviation absorption is large, part or all of the cusp may be missing. See pages III-4, and III-9.

h. An Es trace showing a discontinuity in height with the normal E layer trace at or above foE. The cusp is not symmetrical, the low frequency end of the Es trace lying clearly above the high frequency end of the normal E trace. See pages III-4 and III-5.

q. An Es trace that is diffuse and nonblanketing over a wide frequency range. The spread is most pronounced at the upper edge of the trace (during the daytime, the type is common in the vicinity of the magnetic equator). See page III-8.

r. An Es trace that that shows an increase in virtual height at the high frequency and similar to group retardation but is nonblanketing over part or all of its frequency range. This is distinguished from the usual group retardation (as in case of an occulting thick E layer) by the lack of group retardation in the F-layer traces at corresponding frequencies and the lack of complete blanketing. See pages III-7 and III-9.

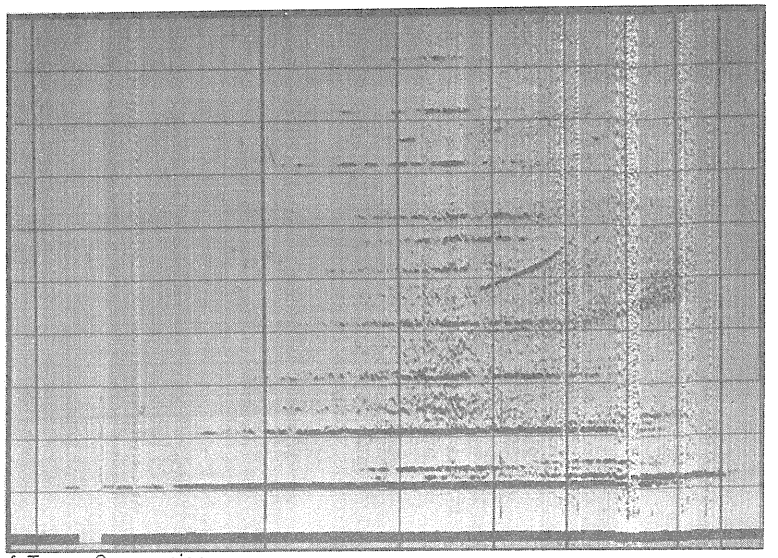
a. An Es having a well-defined flat or gradually rising lower edge with stratified and diffuse (spread) traces present above it. These sometimes extend over several hundred kilometers of vertical height. See pages III-6 and III-10.

s. A diffuse Es trace that rises steadily with frequency and usually emerges from another type Es trace. The rising trace alone is classified as "s"; the horizontal trace is classified separately. Type s is never used to determine foEs, h'Es, or fbEs. The slant trace is sometimes observed to start at foE without echoes clearly identifiable as Es echoes being seen. See pages III-7. III-8, and III-9.

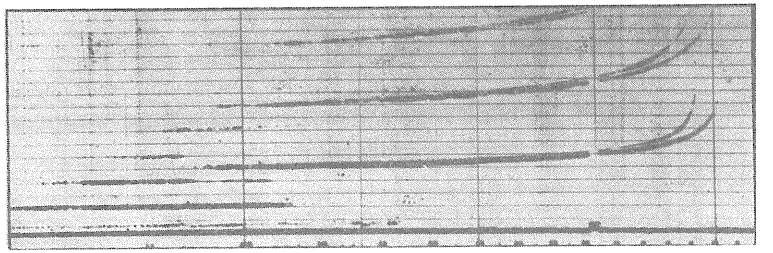
d. A weak diffuse Es trace at heights between 64 and 84 km, this is most common in the auroral zone, often also associated with very high absorption at temperate latitudes. It is often seen during complete blackouts of normal reflections. Type d is never used to determine foEs, h'Es, or fbEs. See page III-10.

Night E It is important to distinguish between Es type r and night E and some examples of night E are shown on page III-7 for this purpose.

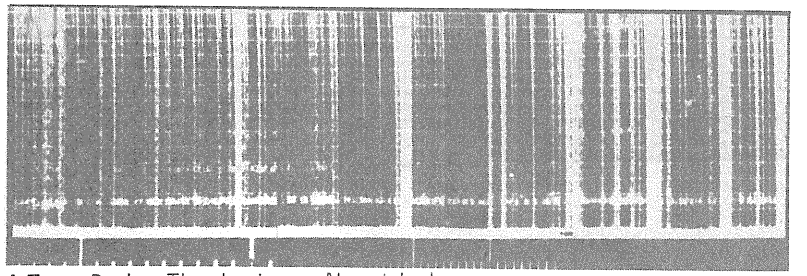
Es TYPES



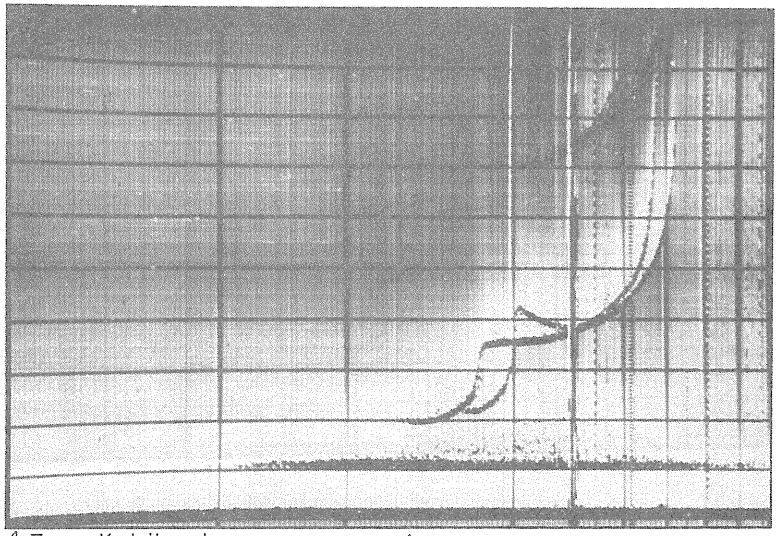
f-Type, Concepcion



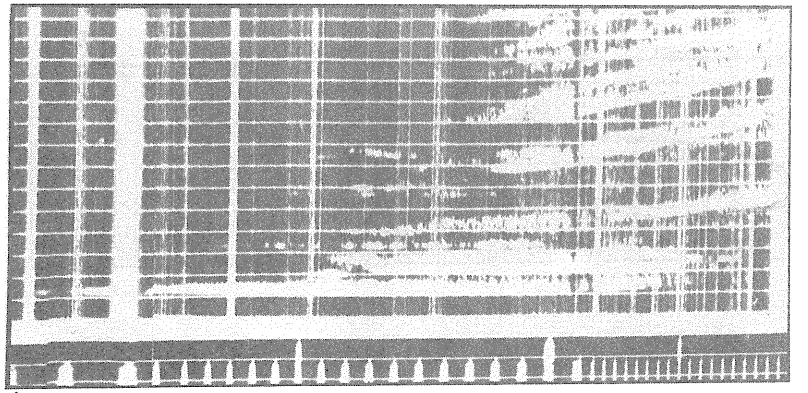
f-Type, Tsumeb



f-Type, During Thunderstorm, Ahmedabad

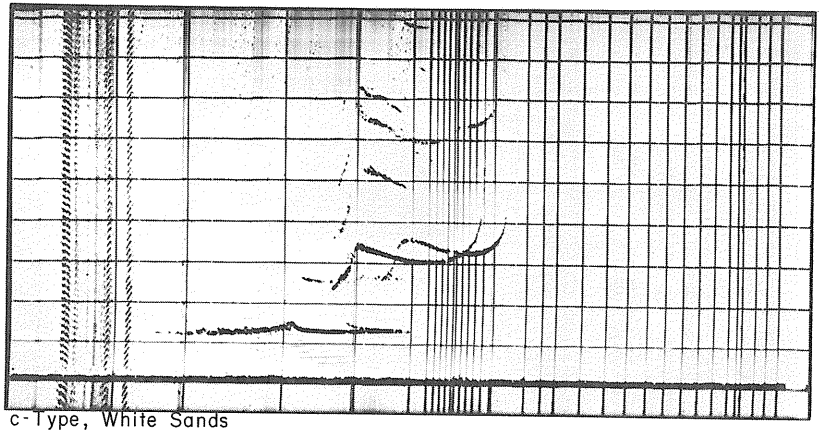


l-Type, Kodaikanal q TYPE Es WITH *l* TYPE AT LOWER FREQUENCIES BLANKETING NORMAL E TRACE.

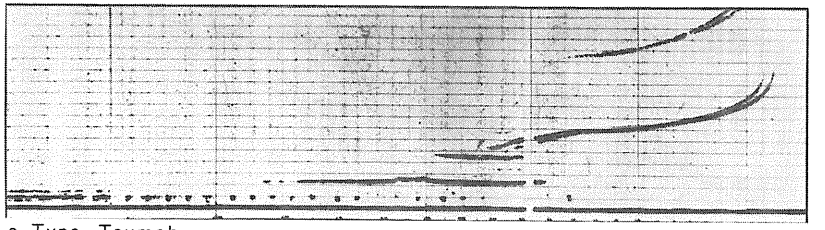


l and h-Types, Ahmedabad

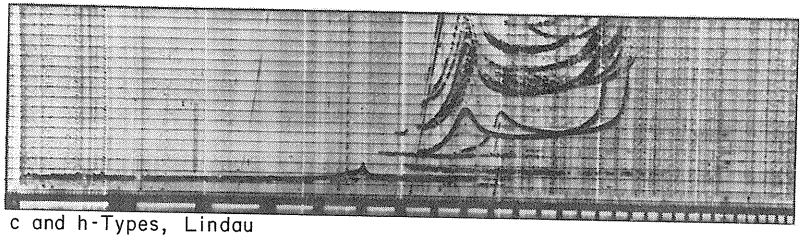
Es TYPES



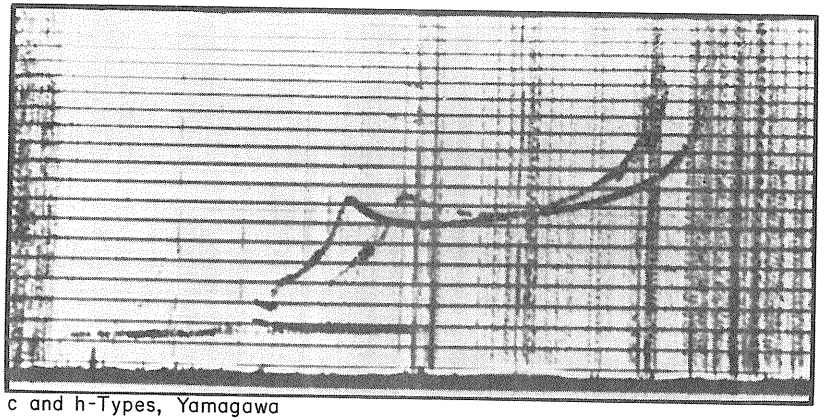
c-Type, White Sands



c-Type, Tsumeb

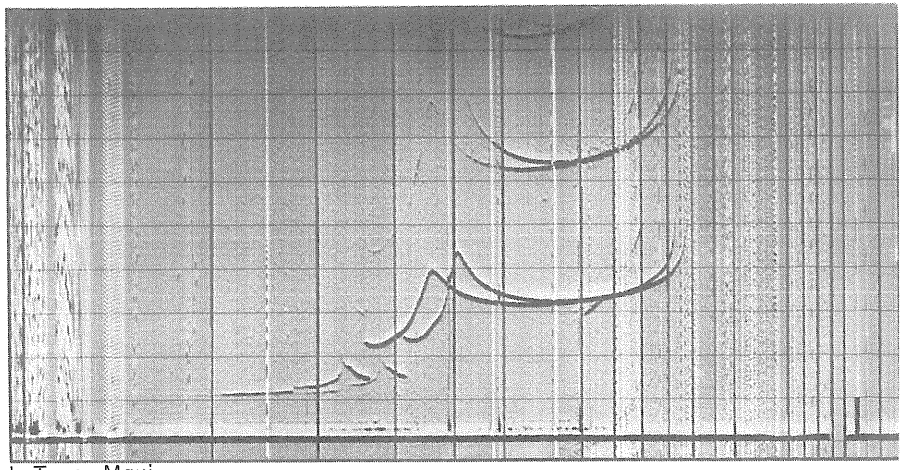


c and h-Types, Lindau

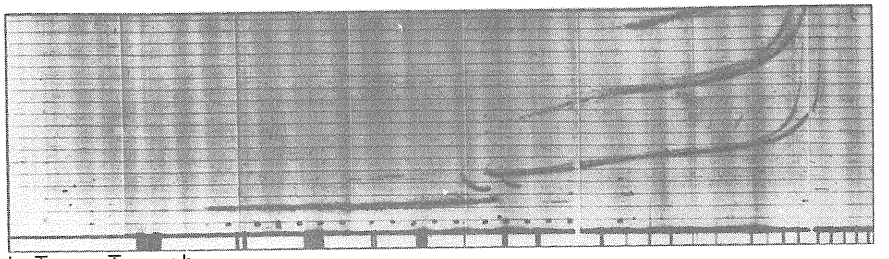


c and h-Types, Yamagawa

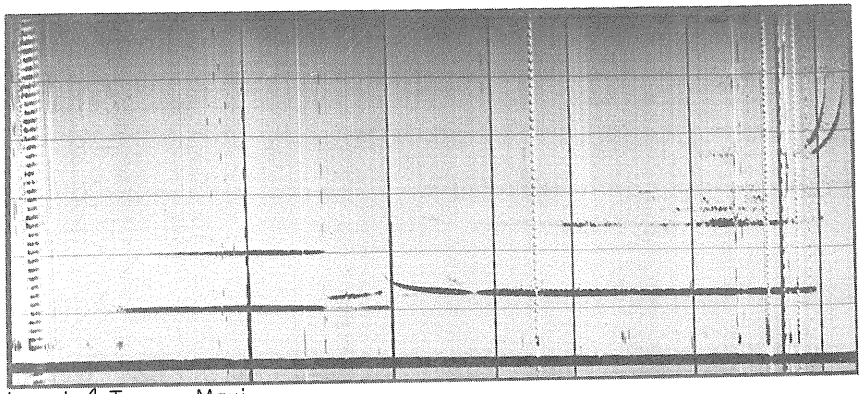
Es TYPES



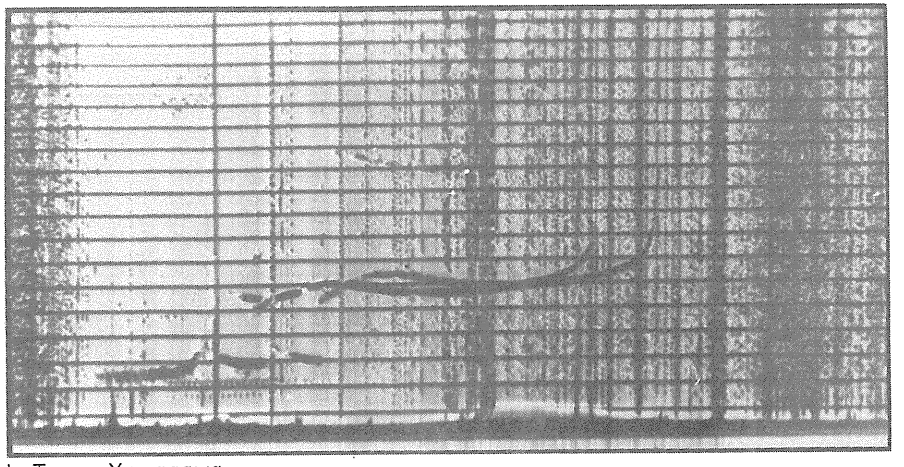
h-Type, Maui



h-Type, Tsumeb

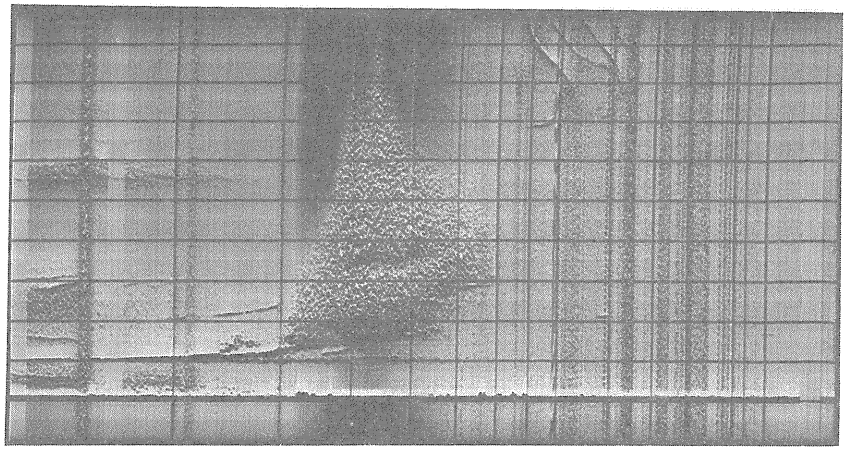


h and ℓ-Types, Maui

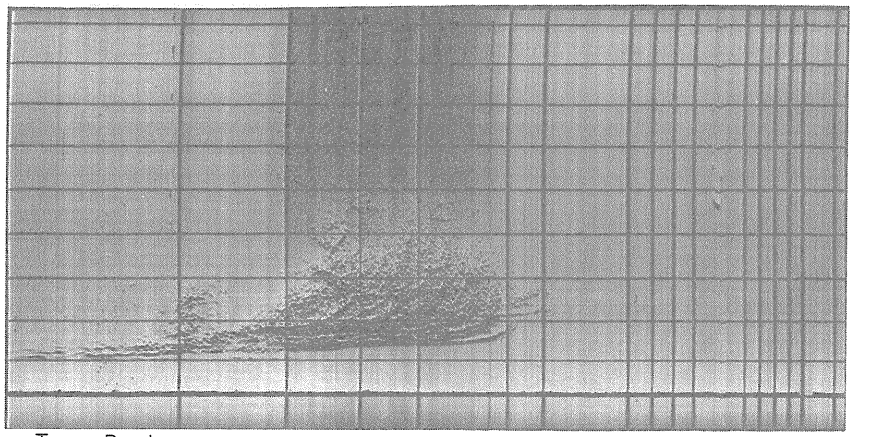


h-Type, Yamagawa

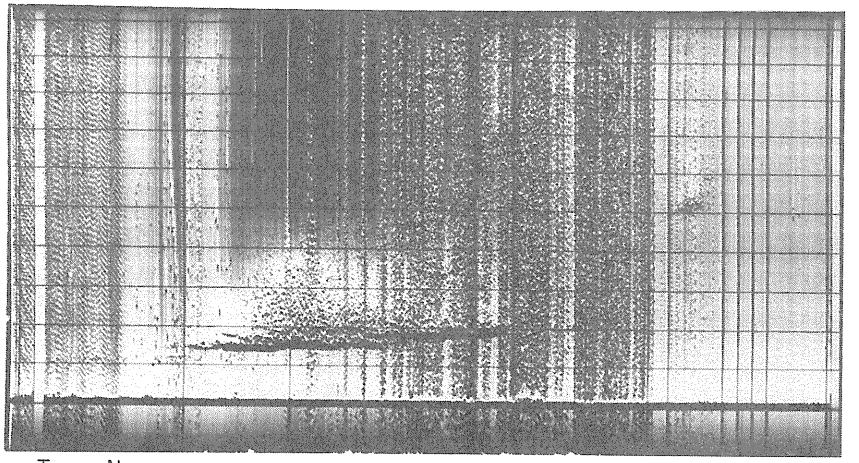
Es TYPES



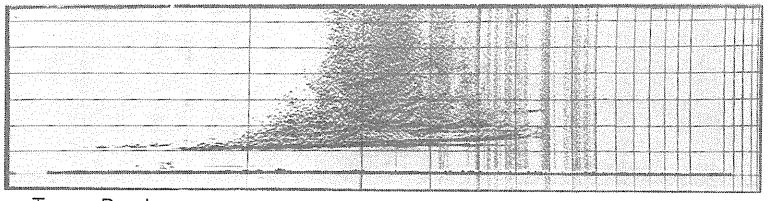
a-Type, Barrow



a-Type, Byrd

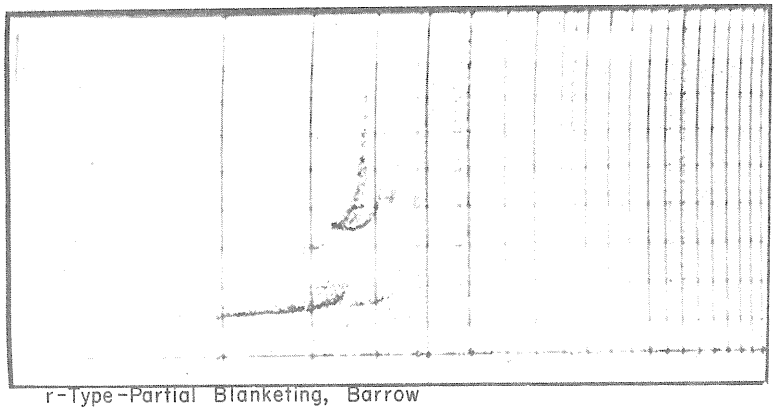


a-Type, Narssarssuaq

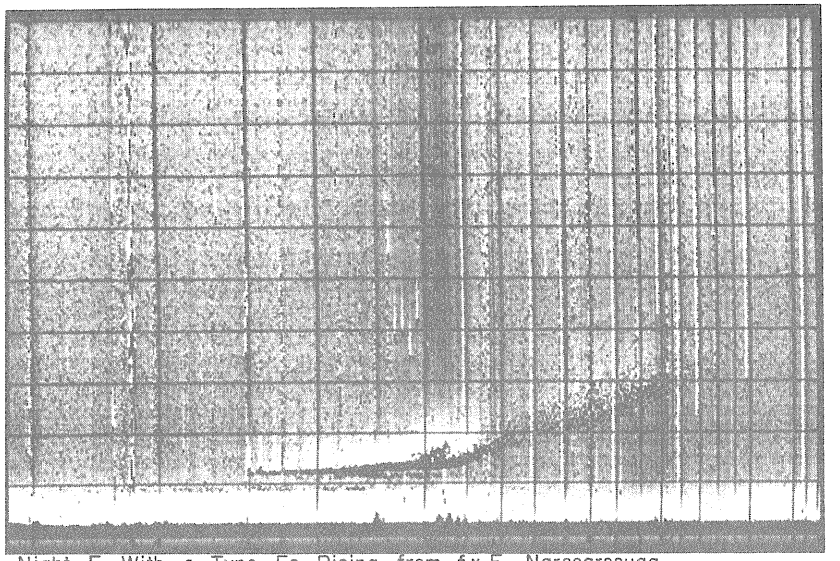


a-Type, Byrd

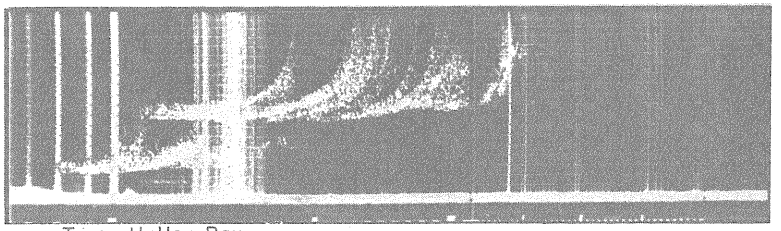
Es TYPES



r-Type-Partial Blanketing, Barrow

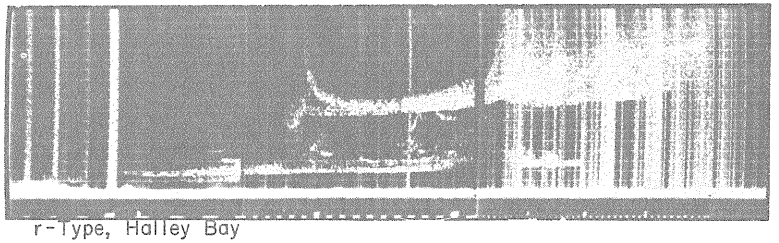


Night E With s-Type Es Rising from f x E, Narssarssuaq



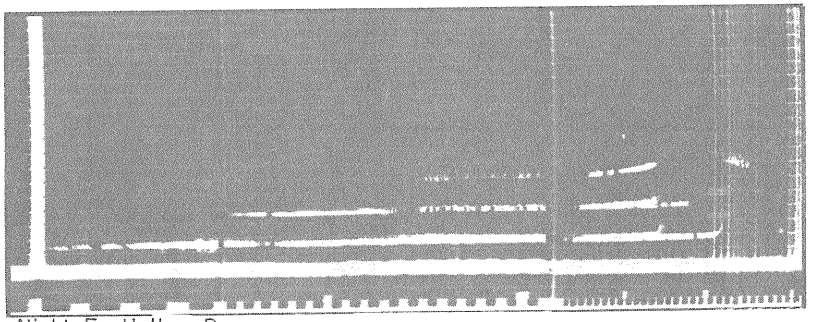
r-Type, Halley Bay

NOTE NO RETARDATION OF F TRACE AT foEs OR fxEs.



r-Type, Halley Bay

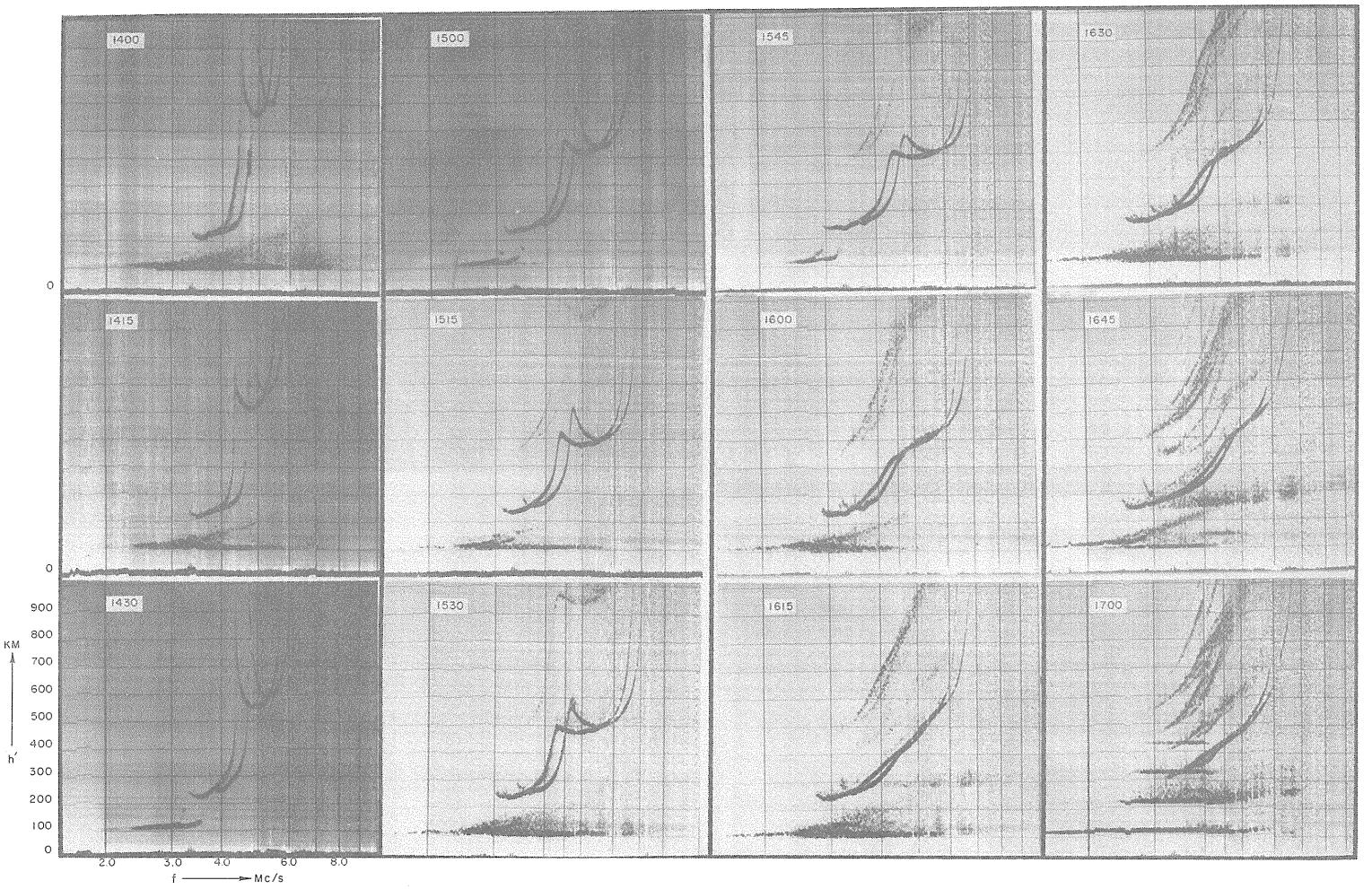
NOTE PARTIAL BLANKETING. ON ORIGINAL IONOGRAM WEAK NIGHT E TRACES CAN BE SEEN ABOVE THE Es-r TRACE BUT PROBABLY OBLIQUE WITH foE 1.8 MC.



Night E, Halley Bay

STRONG MULTIPLE REFLECTIONS UP TO foE SHOW THIS IS NIGHT E AND NOT r-TYPE Es.

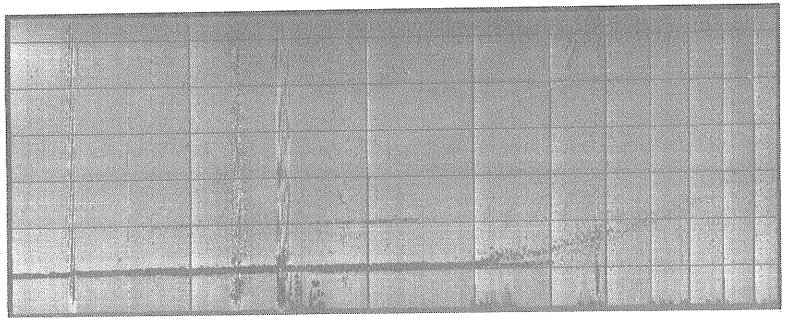
Es TYPES
q AND s TYPES
HUANCAYO JULY 27, 1961



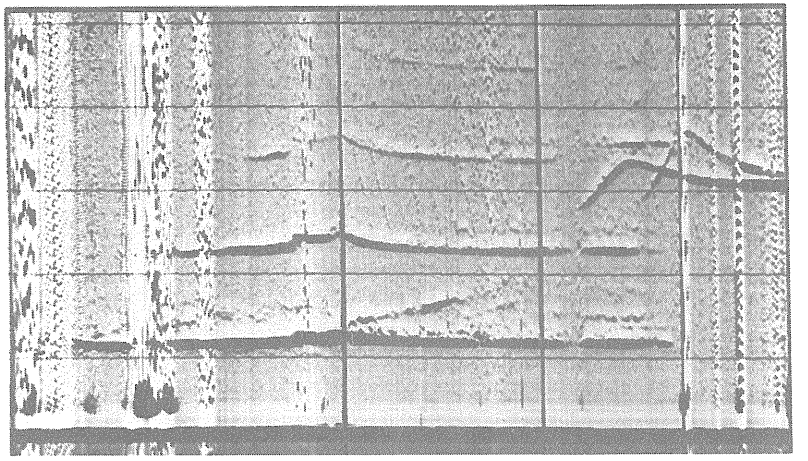
A DISTINCTIVE TYPE OF SPORADIC E IS OFTEN OBSERVED IN DAYTIME NEAR THE MAGNETIC EQUATOR AND VERY OCCASIONALLY AT OTHER LATITUDES. THIS IS THE EQUATORIAL Es (TYPE Esq). EXAMPLES CAN BE SEEN IN THE IONOGRAMS FOR 1400, 1415, 1515, 1530, 1600, 1615, AND 1630. IT MAY BE ACCOMPANIED BY SLANT Es, SOME TYPICAL EXAMPLES OF WHICH ARE SHOWN IN THE IONOGRAMS FOR 1400, 1415, 1530, 1600, 1630, AND 1645. NOTE THAT AT 1645 THE SLANT TRACE RISES FROM A NORMAL E TRACE. THE Es TRACES AT 1700 ARE TYPE f AS THEY ARE CLEARLY TOTALLY REFLECTING. THE Esq TRACE AT 1645 IS NOT TYPICAL BUT IT IS CLEARLY PARTIALLY REFLECTING AT THE LOWER FREQUENCY END, A TYPICAL CHARACTERISTIC OF Esq. SLANT Es IS TO BE NOTED IN THE TABLES AND IONOGRAM SCALINGS DESPITE IT BEING AN OBLIQUE TRACE, BECAUSE IT IS USEFUL FOR DETECTING IRREGULARITIES IN THE E LAYER WHICH ARE NOT OVERHEAD. THEORY ON SLANT Es HAS BEEN GIVEN BY SMITH AND KNECHT, 1956.

MATSUSHITA, S., LUNAR EFFECTS ON THE EQUATORIAL Es, JATP, 10, 163, 1957.
KNECHT, R. W., AN ADDITIONAL LUNAR INFLUENCE ON EQUATORIAL Es AT HUANCAYO, JATP 14, 348, 1959.
SMITH, E. K. AND R. W. KNECHT, SOME DUPLICATION OF SLANT-Es, JATP SPECIAL SUPPLEMENT, 1956
FARLEY, D T., TWO-STREAM PLASMA INSTABILITY AS A SOURCE OF IRREGULARITIES IN THE IONOSPHERE, PHYS. REV. LETTERS 10, 7, 1963.

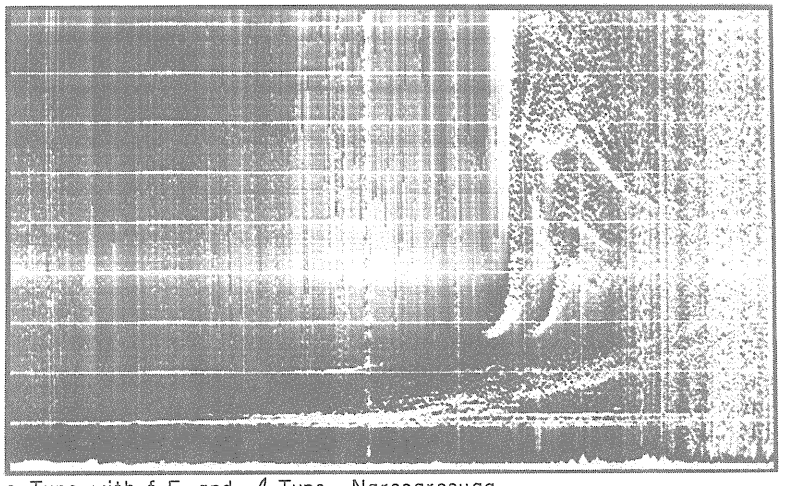
Es TYPES



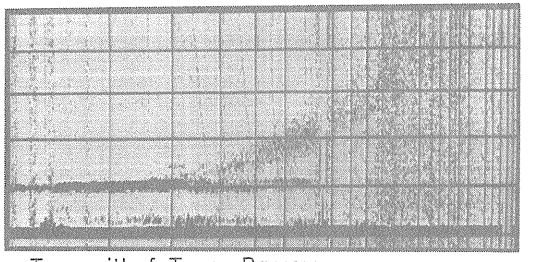
s-Type with r-Type, Thule



s-Type with foE and c-Type, Maui

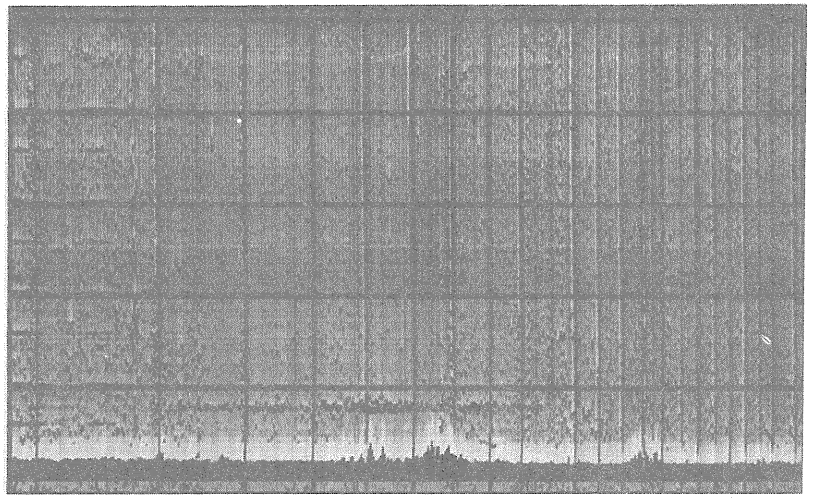


s-Type with foE and ℓ-Type, Narssarssuaq

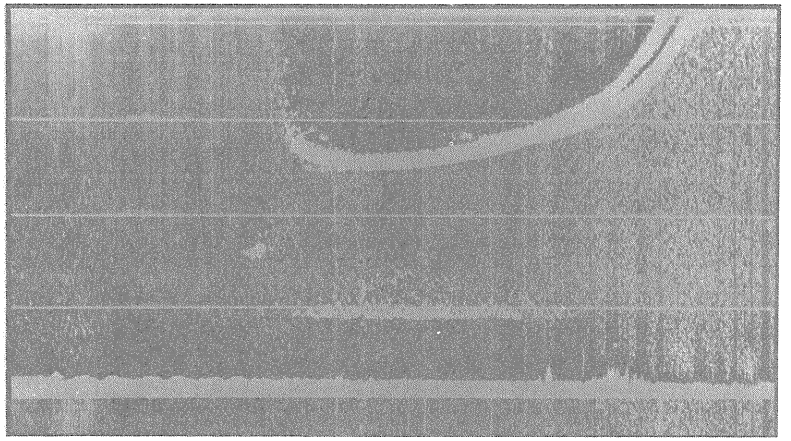


s-Type with f-Type, Barrow

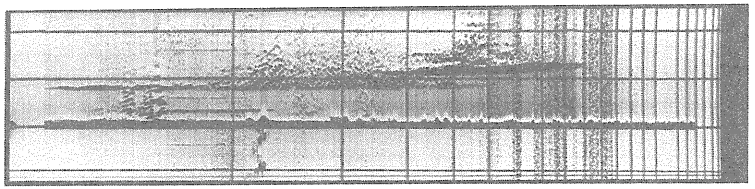
Es TYPES



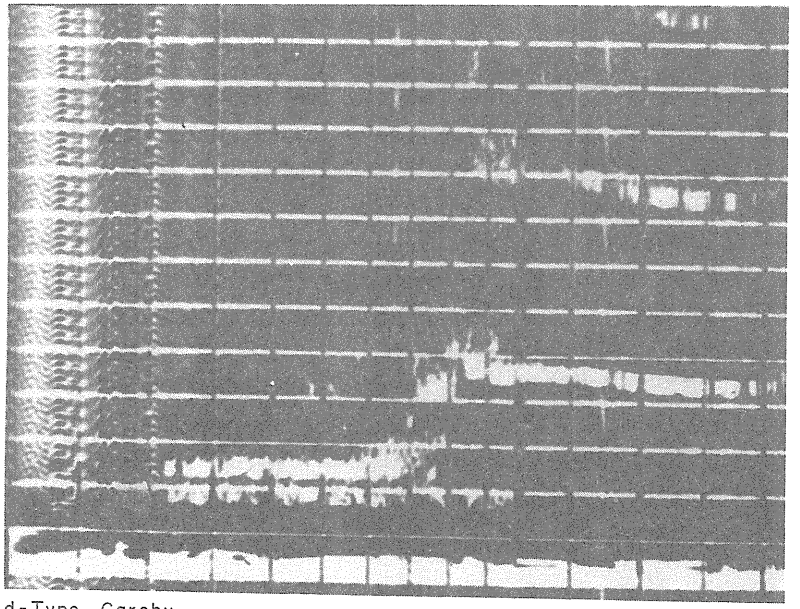
d-Type, During Blackout, Narssarssuaq



d-Type, Narssarssuaq



d and a Types, Byrd



d-Type, Garchy

DEVELOPMENT OF A SPORADIC E LAYER

Certain cases of Sporadic E seem to be formed by a redistribution of the more normal E- and F-region ionospheric structure. This is well illustrated by the sequence shown here. The first ionogram of the sequence (0845) corresponds to a nearly normal E and F structure, with two exceptions: The E layer is variously stratified (note the cusps at 12.5 and 2.7 Mc/s), and small irregularities exist in the form of the lower F-region. These are exaggerated in the virtual height curves, and are the precursors of the Sporadic E layer. On succeeding ionograms, the irregularities become more and more enhanced until (1000) a truly separate layer exists between the E peak and the F-region. Curiously, this layer contains a small but abrupt increase in density gradient, as evidenced by the cusp (3.8 Mc/s) at 1100, for example, a feature typical of such sequences. At later times, the layer appears to descend through the E layer, all the while developing a larger density gradient and apparently higher peak density. The "nose" of the layer simultaneously appears to become sharper, as shown by the lack of group retardation at the penetration frequency from about 1330 on. It is at this rather arbitrary point that the layer becomes "Sporadic E" (type h) by the customary definition of the term. After 1530 (and perhaps as early as 1330), the Es layer is below the E peak, and would be called "Es-c." Of course, this change may represent merely a redistribution of the E-layer profile. It should be noted that the layer at all times is opaque, except for a small frequency interval near its peak.

It is probable that the redistribution of ionization occurring here is the result of vertical drifts of ionization caused by strong winds in the neutral atmosphere. The pertinent theory[1, 2] shows that ionization should concentrate at the East into West nodes of the neutral wind profile, and this has been verified by Rosenberg et al.[3] in a case similar to that shown here. The present example is remarkable in that the development takes an entire day; typically it occurs much faster, and only snapshots of the process are recorded in the station's usual quarter-hour observing schedule.

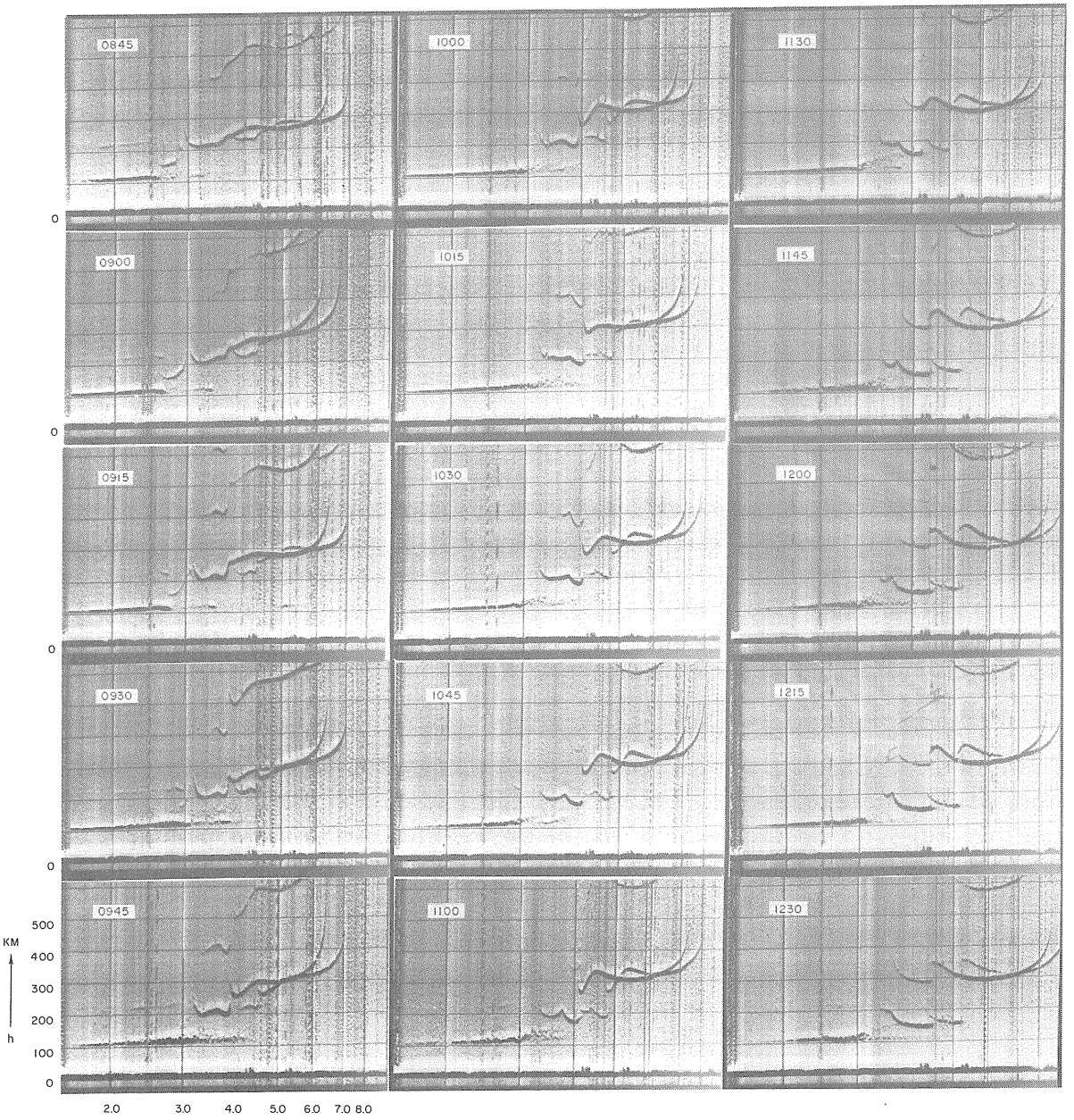
---

[1] Whitehead, J. D., The formation of the sporadic-E layer in the temperate zones, JATP, 19, 38, 1961.

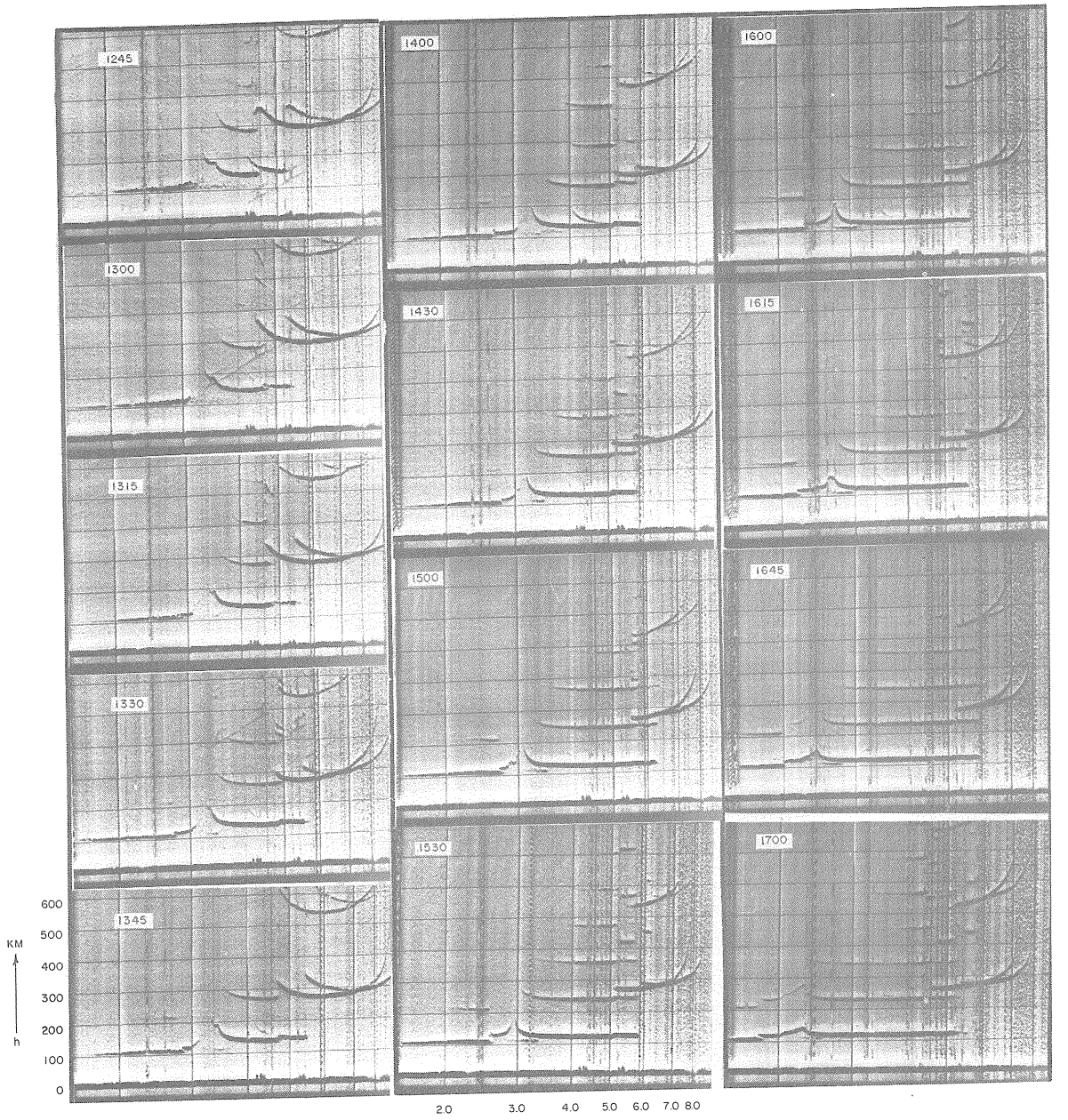
[2] Axford, W. I., The formation and vertical movement of dense ionized layers in the ionosphere due to neutral wind shears, JGR, 68, 769, 1963.

[3] Rosenberg, N. W., H. D. Edwards, and J. W. Wright, Ionospheric winds; motions into night and sporadic E correlations, Space Res., IV, 171, 1963.

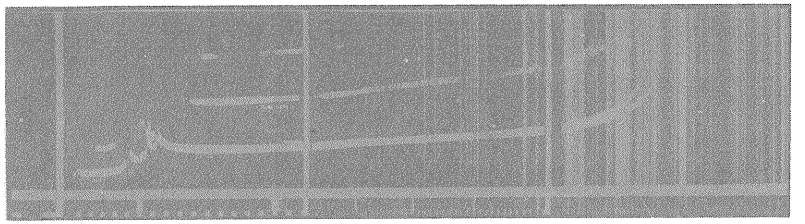
SEQUENTIAL SPORADIC E
GBI MARCH 19, 1963



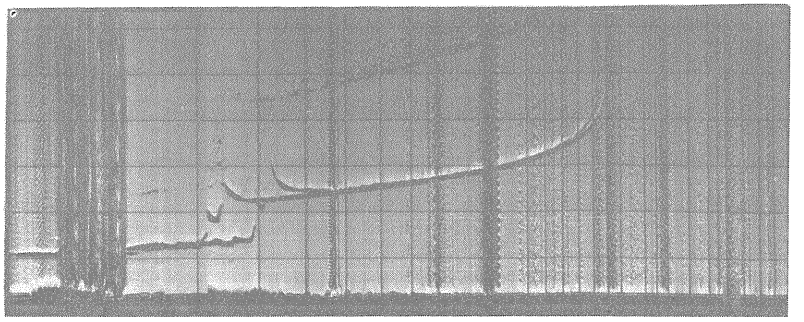
SEQUENTIAL SPORADIC E, CONT'D
GBI MARCH 19, 1963



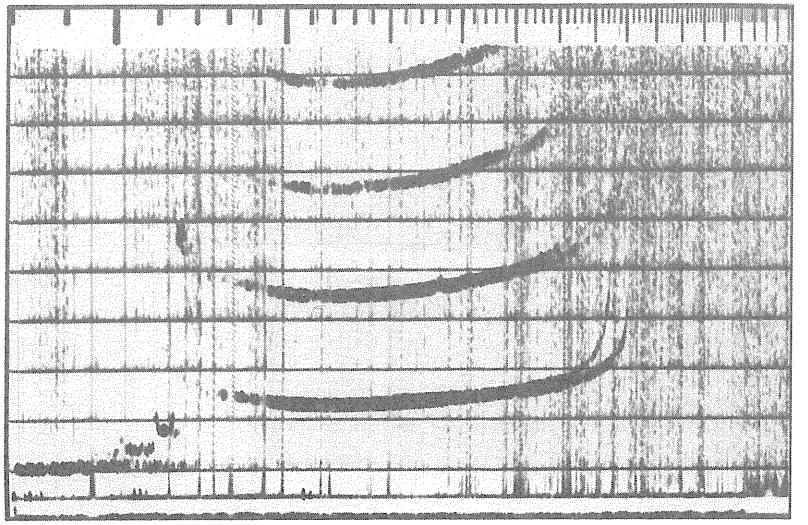
EXAMPLES OF E REGION STRATIFICATIONS



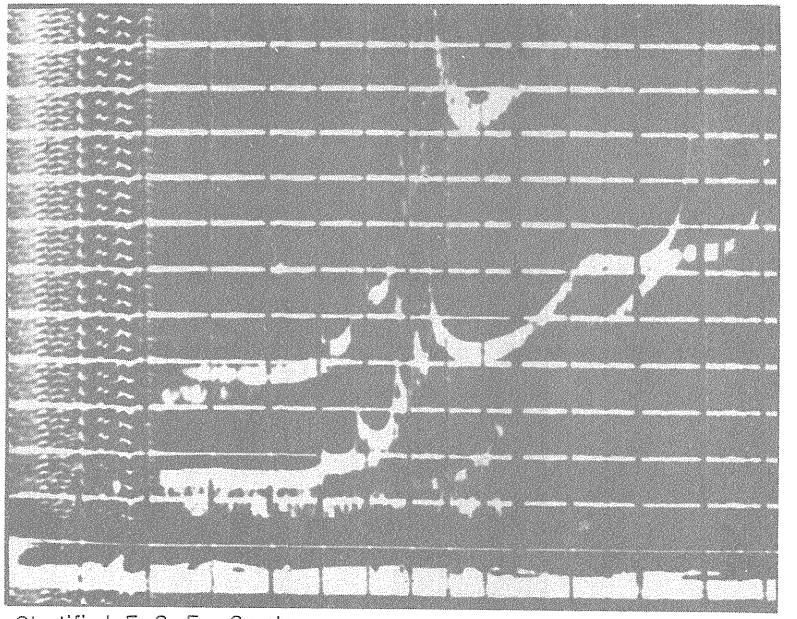
E_2-Argentine Islands



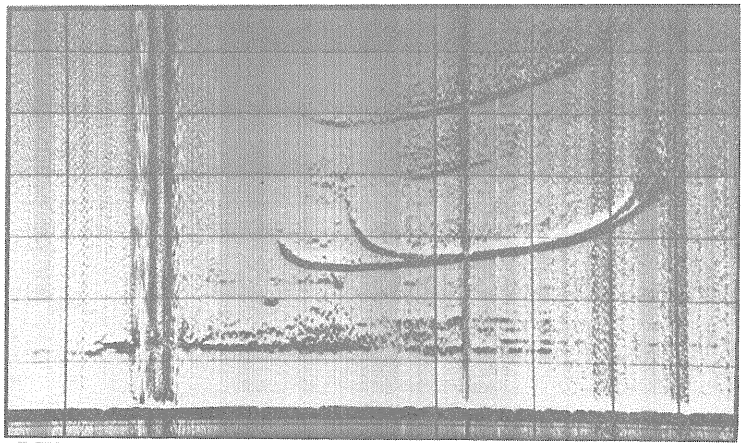
E_2-Huancayo



E_2-DeBilt



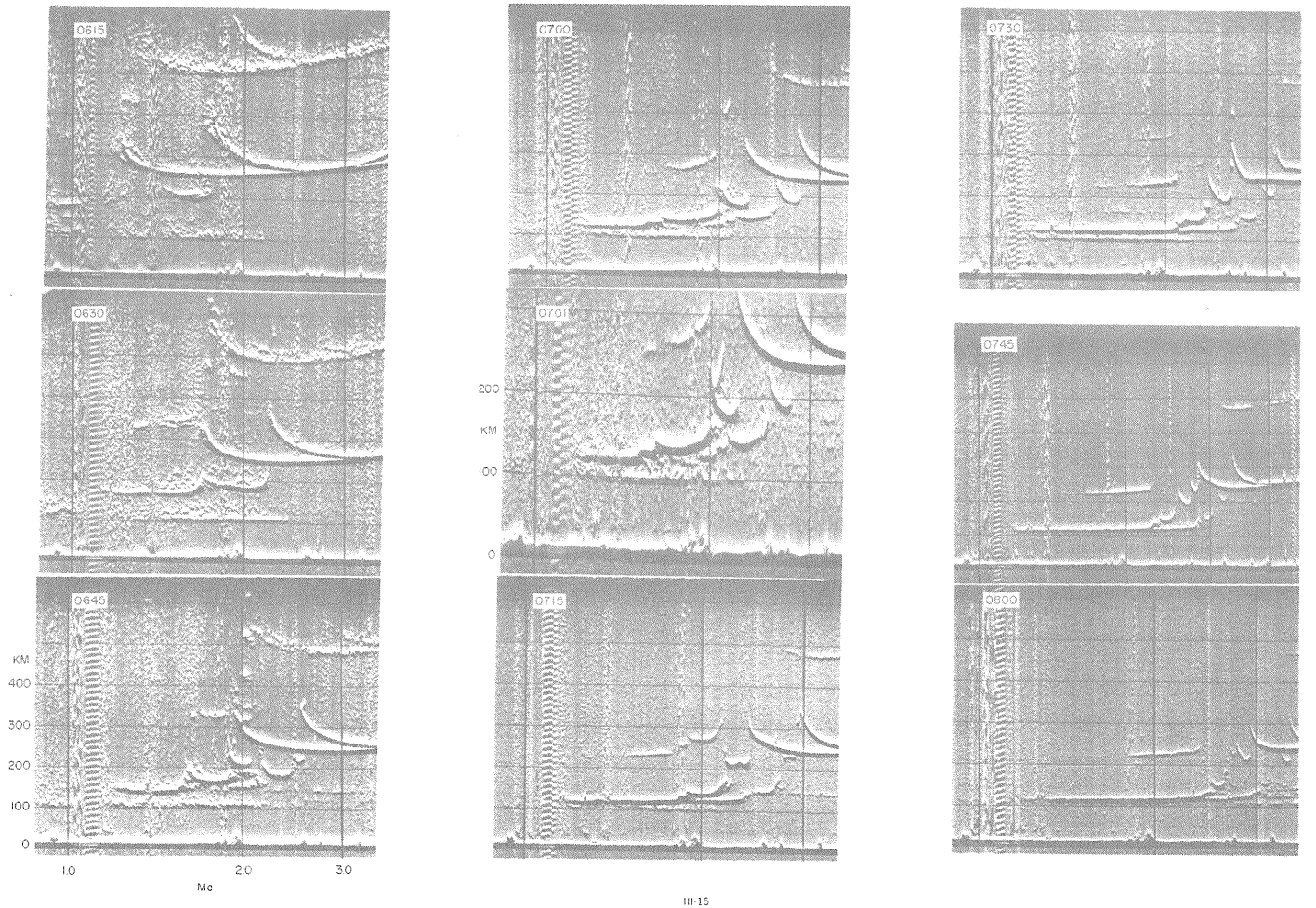
Stratified E & E_2-Garchy



E Region During Meteor Shower-Huancayo

STRATIFICATION IN E REGION NEAR SUNRISE
MAUI MARCH 25, 1962

AT SUNRISE AND SUNSET, DIFFERENT PROCESSES CONTRIBUTING TO THE E LAYER OCCUR AT DIFFERENT HEIGHTS AND ARE ESPECIALLY EASY TO STUDY AT SUNRISE. TRANSIENT EFFECTS, SUCH AS THOSE DUE TO TRAVELING DISTURBANCES, ARE ALSO OFTEN PROMINENT BUT CAN BE SEPARATED BY MAKING *f*-PLOTS FROM CLOSE SPACED SEQUENCES OF IONOGRAMS ON SUCCESSIVE DAYS (SEE PIGGOTT AND RAWER). IT IS SELDOM POSSIBLE TO DEDUCE f_oE FROM f_xE WHEN THE LATTER APPROACHES THE GYROFREQUENCY, f_H. THE X TRACE IS SIMILAR TO THAT FOR A VERY THICK TRACE AND CANNOT BE EXTRAPOLATED TO THE CRITICAL FREQUENCY WITH ADEQUATE ACCURACY AT THESE TIMES TO DEDUCE f_oE.



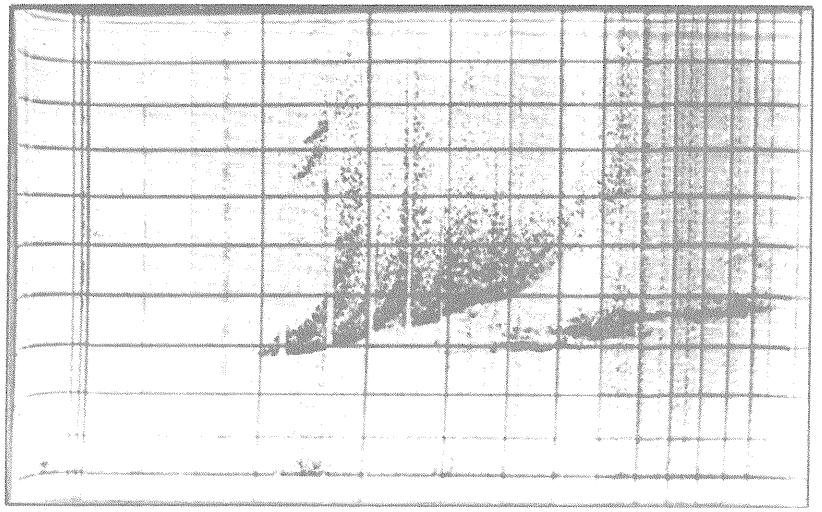
SPREAD F

A new parameter, not described by Piggott and Rawer, has been adopted for measuring the top frequency of spread F, polar spurs and slant F. This is primarily needed for practical purposes - the Maximum Usable Frequency (MUF) to any distance being more closely determined by this than by foF2 when spread echoes are present. It is also useful for some scientific studies. The top frequency is called the spread F frequency, fxI (originally fxS, which could cause confusion with the plasma frequency at the satellite, which has prior claim). Since a radio wave can find a ridge of high foF2 that is not at the midpoint of the path, fxI should give the highest frequency directly reflected in the ionosphere whether overhead or not. When polar or equatorial spurs, slant F (not slant 2F, which involves an earth reflection), or spread F are present, fxI is the top frequency seen, increased by fH/2 if strong absorption is present so that the o-mode and not the x-mode is observed.

Some groups have also adopted, for local use and voluntary interchange, the spread in frequency over which near-vertical spread traces can be observed. This refers to near-overhead traces, i.e., polar spurs and slant F are omitted. These can be denoted by dfS.

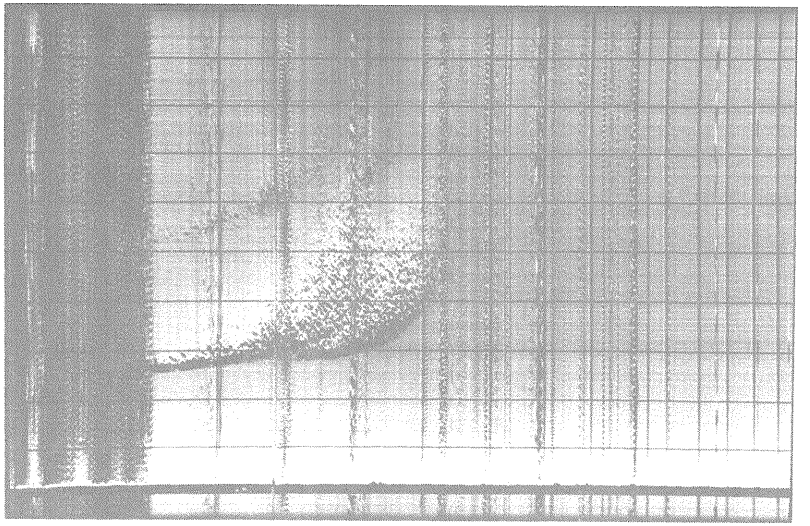
SPREAD F

HIGH LATITUDE

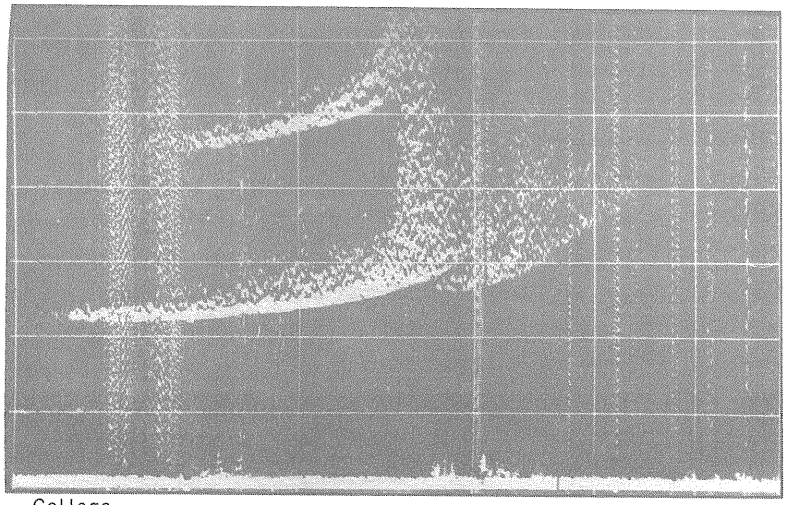


Barrow

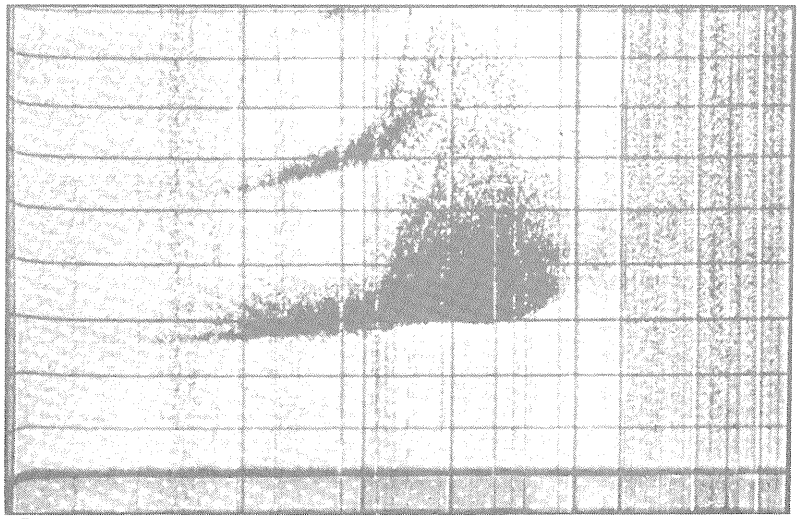
MID LATITUDE



Washington



College



Buenos Aires

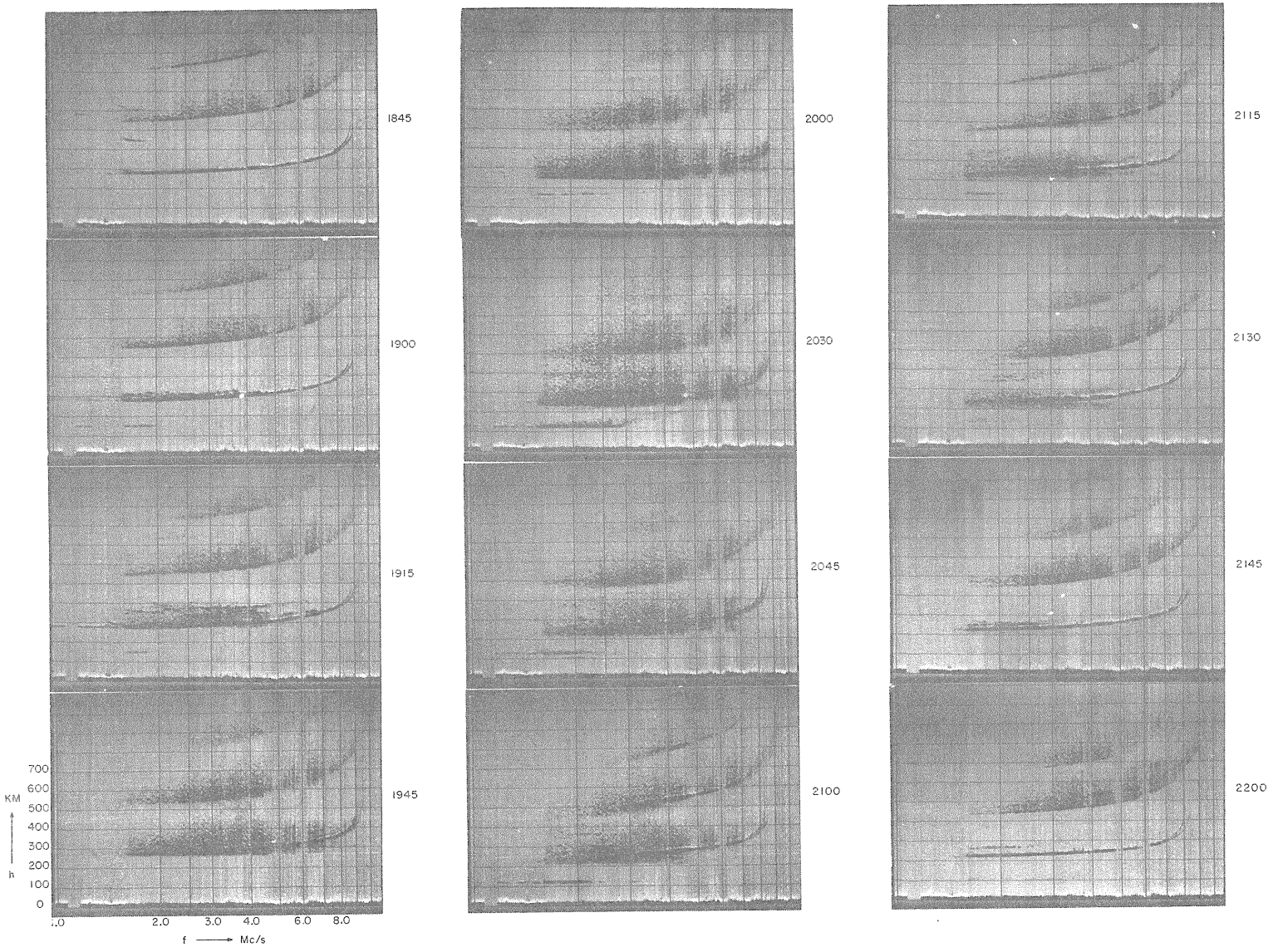
EQUATORIAL SPREAD F

At stations near the dip equator a special type of spread F is found at night, which is known as equatorial spread F. The sequence of events after sunset is first a rise in the height of the F layer as shown by increases in h'F, h_c or decreases in the MUF factor. These are most evident in magnetically quiet periods. Very often considerable tilting of the layer occurs, giving oblique reflected traces as well as the normal trace. The second order reflection is often diffuse owing to multiple reflection paths. A zone of severe turbulence progresses from East to West across the station, often first giving diffuse traces at oblique incidence and then overhead. The number of multiple reflections recorded drops at the same time, not because of an increase in absorption (f-min is unaltered), but because the reflecting layer is partly transparent over a wide band of frequencies. In severe cases only one reflection is present, appearing as a wide diffuse trace (range spreading) with little or no evidence of group retardation near the top frequencies. The interpretation is that the F layer has become unstable and has broken up into large numbers of patches or columns of ionization with very low electron density in the gaps between the patches. On high sensitivity wide frequency range equipment, the residual layer can sometimes be detected, the values of foF2 being about 1 Mc/s when the top frequency of the spread is between 5 and 10 Mc/s. This type of scatter appears to be predominately overhead, and the top frequency then only varies slowly with power.

As the night progresses, the layer moves down and the irregularities gradually die out, sometimes to the extent that the critical frequencies can again be measured.

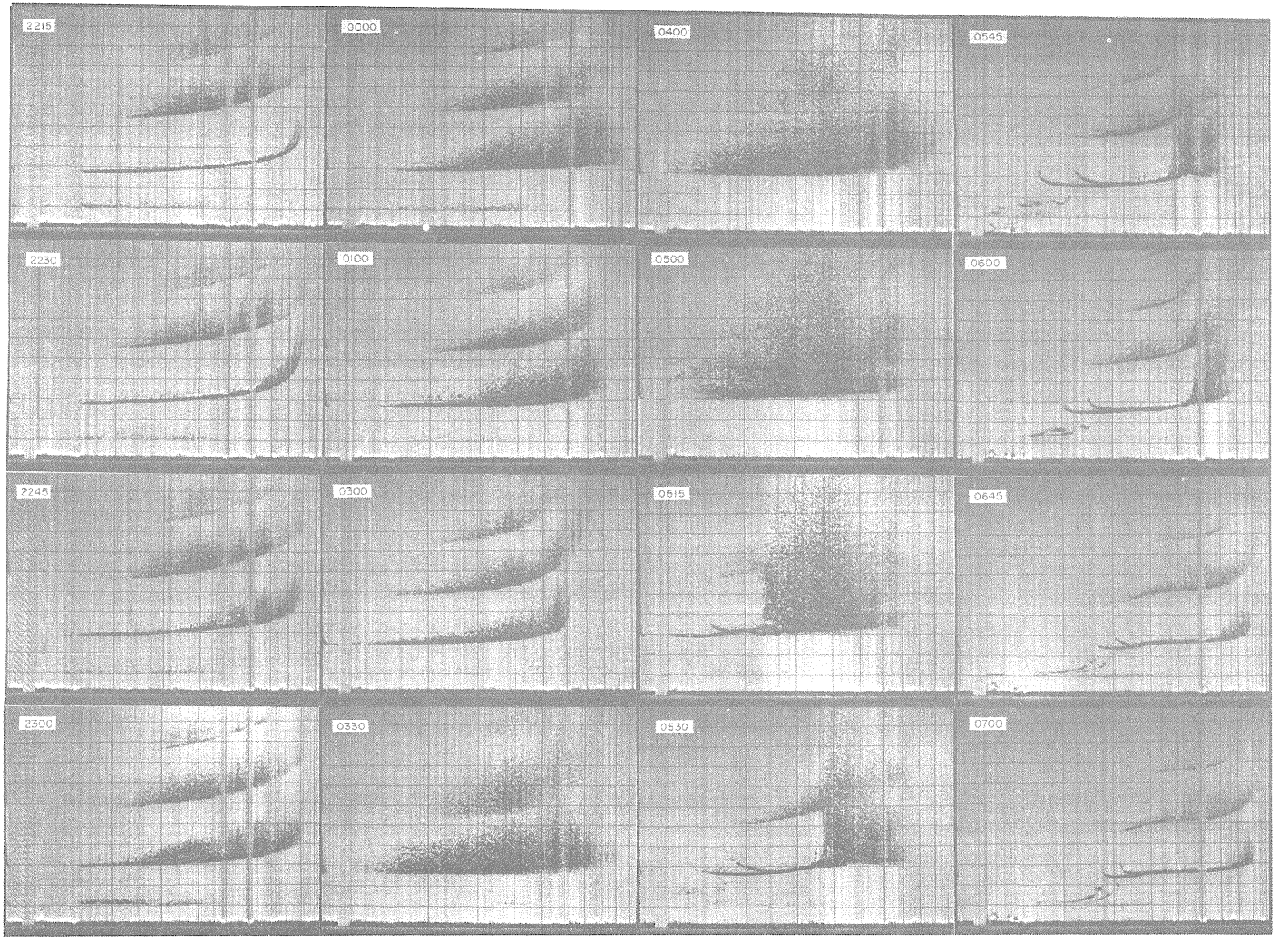
For operational use the top frequency is more important than foF2, and this should be recorded in the table for fxI at all stations where it is observed.

EQUATORIAL SPREAD F
HUANCAYO SEPTEMBER 16, 1962



EQUATORIAL SPREAD F

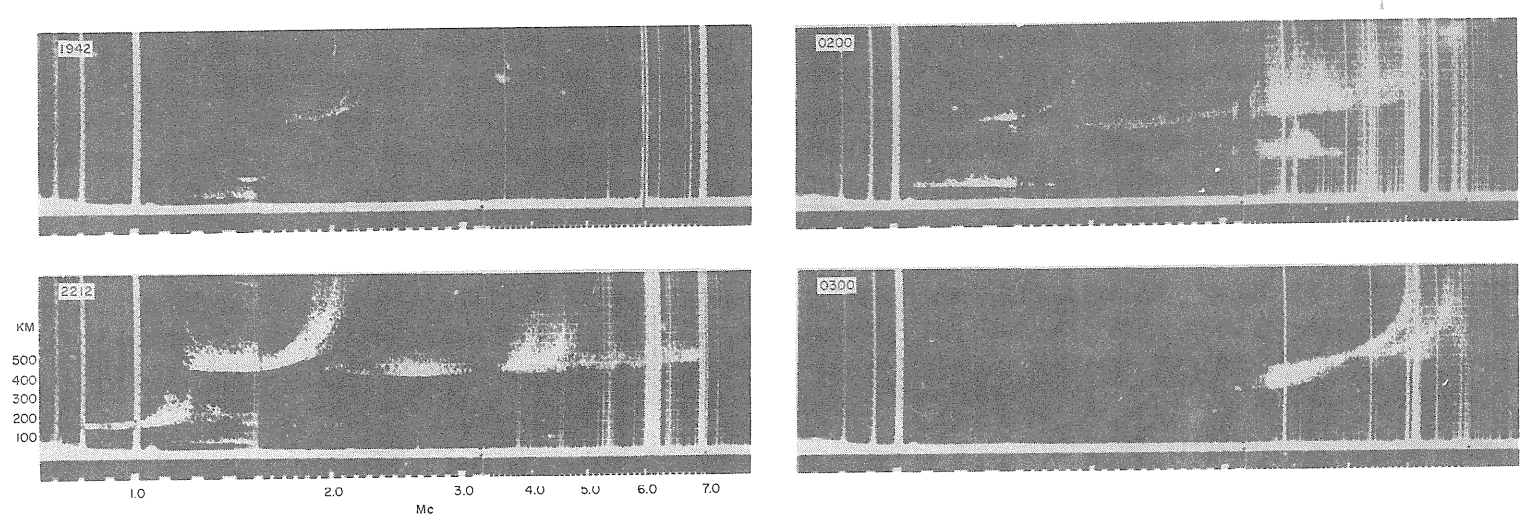
HUANCAYO NOVEMBER 4-5, 1962



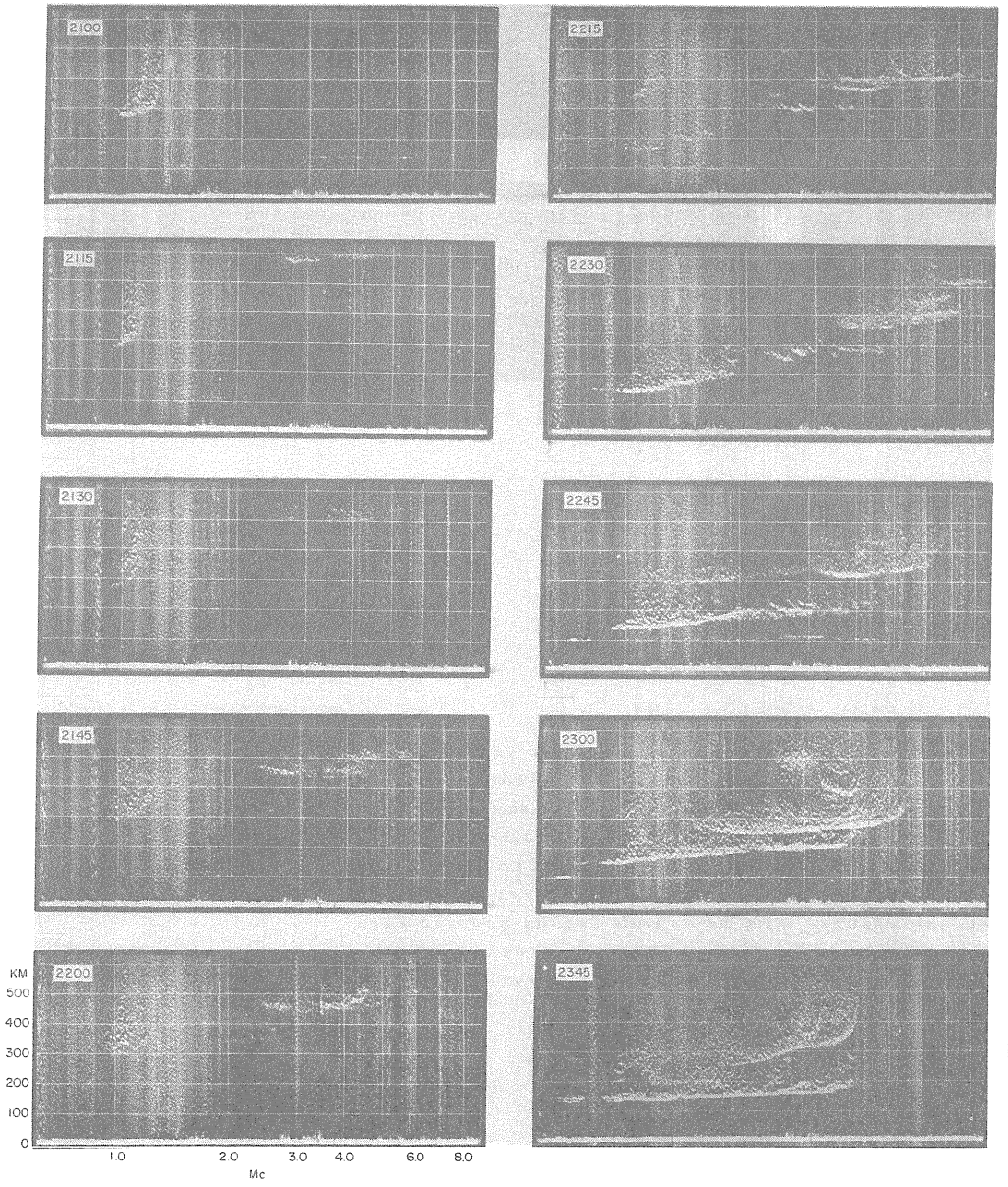
REPLACEMENT LAYER SEQUENCE
HIGH LATITUDE

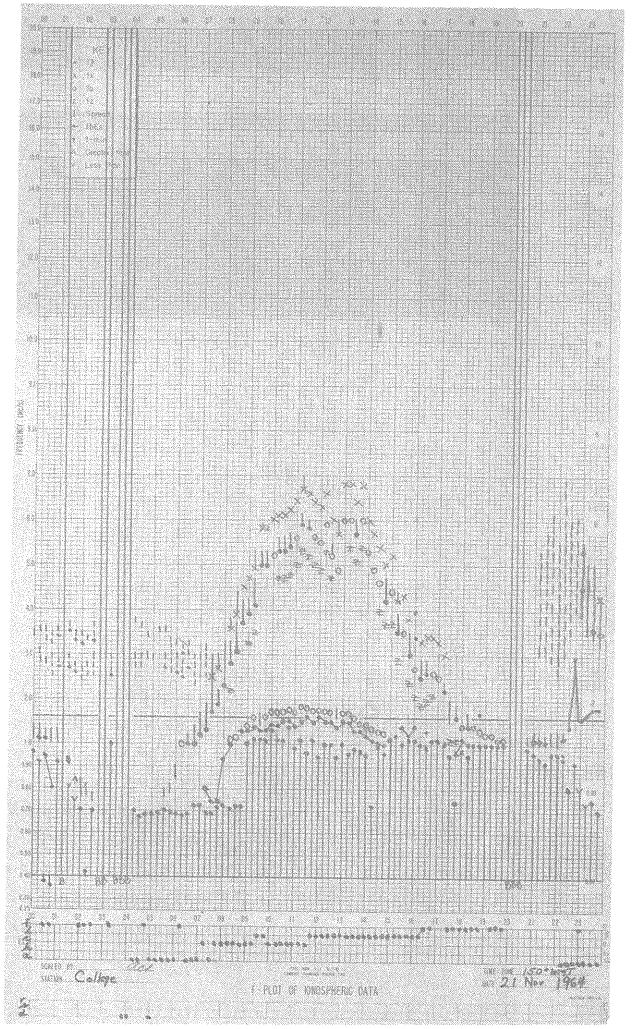
IN AND NEAR THE AURORAL ZONES, IT IS NOT UNUSUAL DURING NIGHT HOURS WHEN THE OVERHEAD ECHO OF foF1 HAS DROPPED VERY LOW IN FREQUENCY TO HAVE OBLIQUE ECHOES APPEAR AT HIGH FREQUENCIES. THESE OBLIQUES APPEAR ON THE IONOGRAM AS F^2 TRACES AT GREAT VERTICAL HEIGHTS ALTHOUGH THEY ARE REALLY AT A LARGE SLANT RANGE. THE HEIGHT (OR RANGE) OF THE OBLIQUE WILL USUALLY CHANGE FROM ONE IONOGRAM TO THE NEXT AS THE F^2 TARGET MOVES TOWARDS OR AWAY FROM THE OBSERVING STATION. MOTION TOWARDS THE STATION IS MOST COMMON, WITH STEADILY DECREASING RANGE, AND IF THE F^2 TARGET MOVES OVERHEAD IT REPLACES THE PREVIOUSLY PRESENT OVERHEAD ECHO.

HALLEY BAY JUNE 11 & 12, 1958

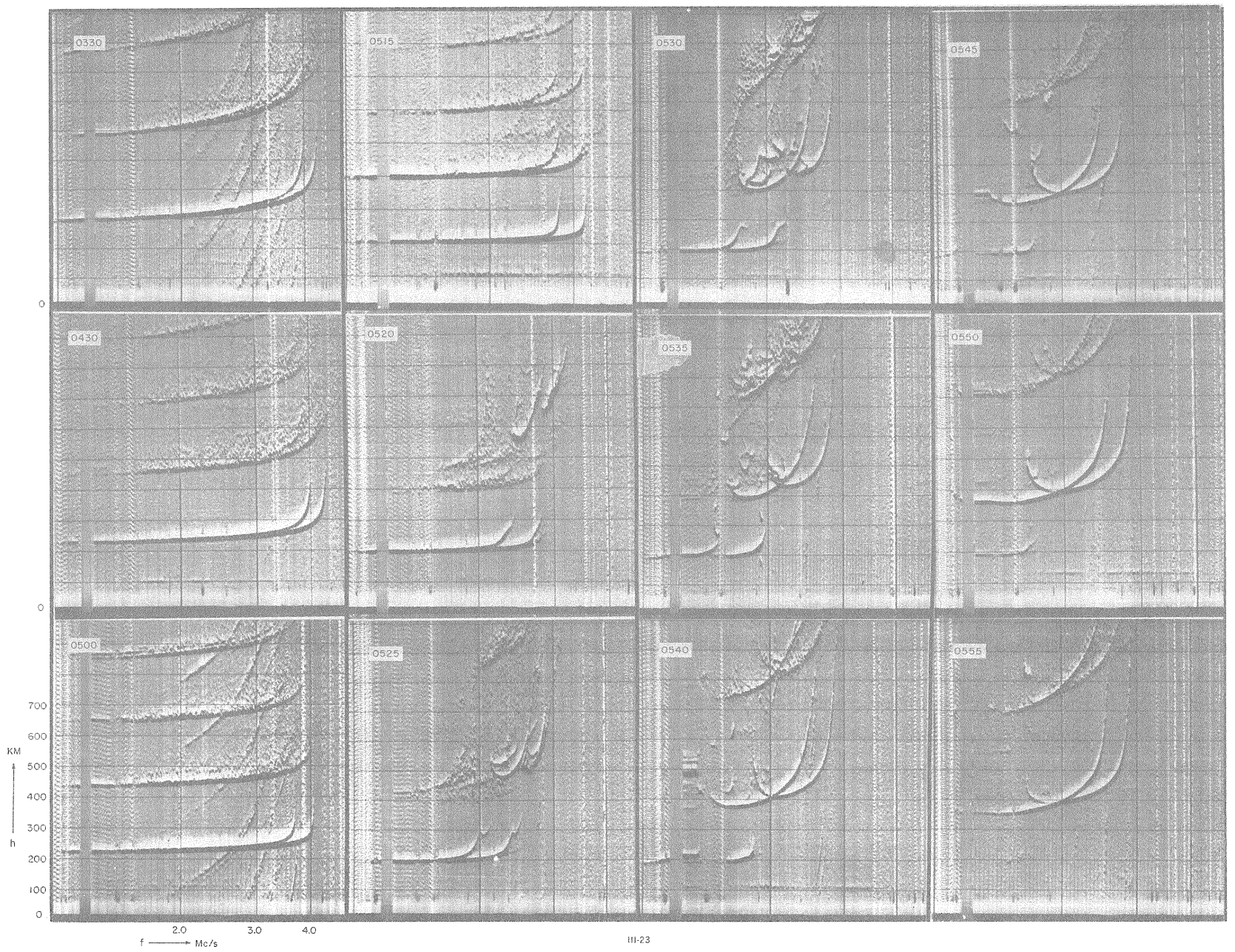


REPLACEMENT LAYER SEQUENCE
HIGH LATITUDE, CONT'D
COLLEGE NOV. 21, 1964



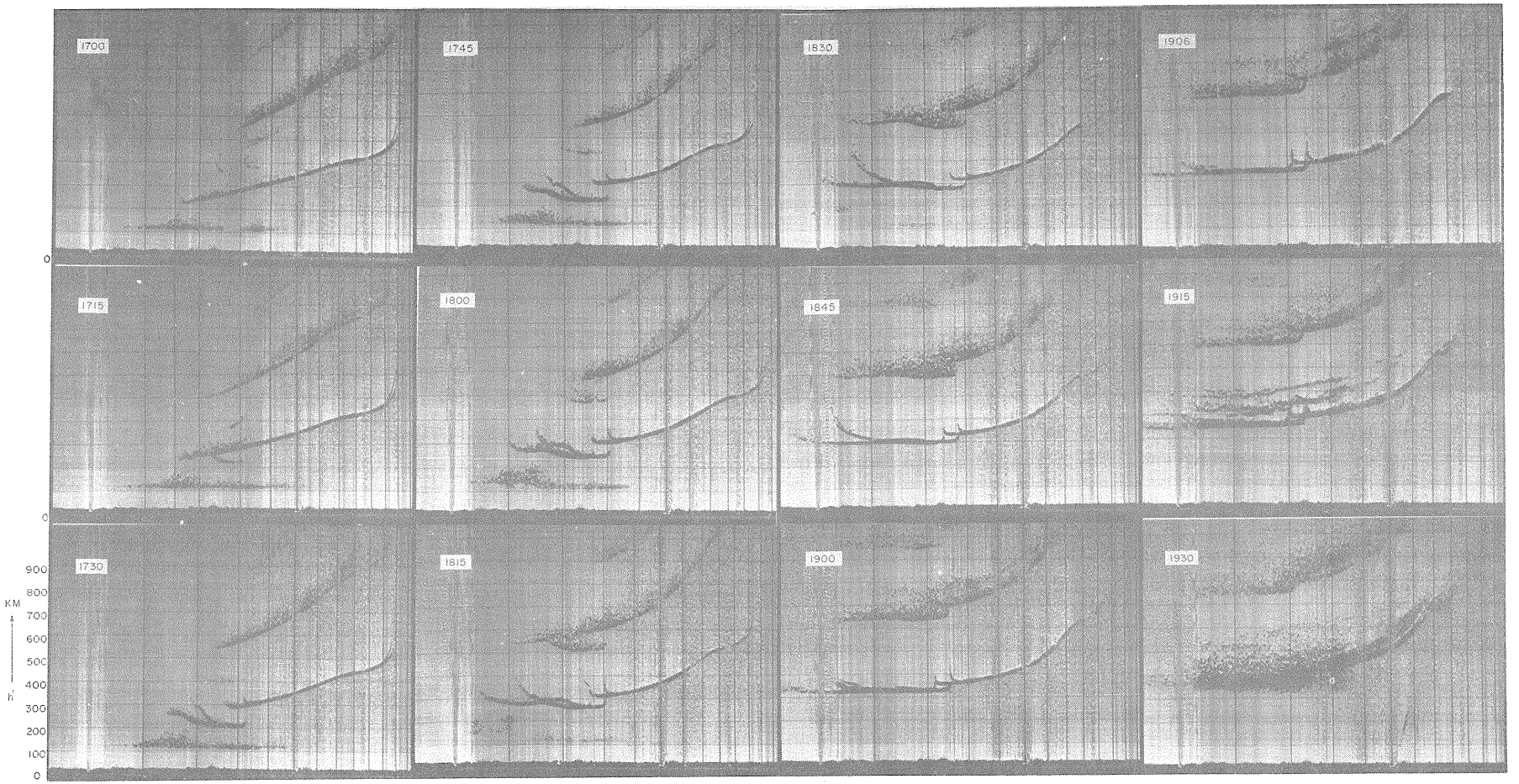


PRE-SUNRISE SEQUENCE, MIDLATITUDE
CONCEPCION JULY 13, 1960

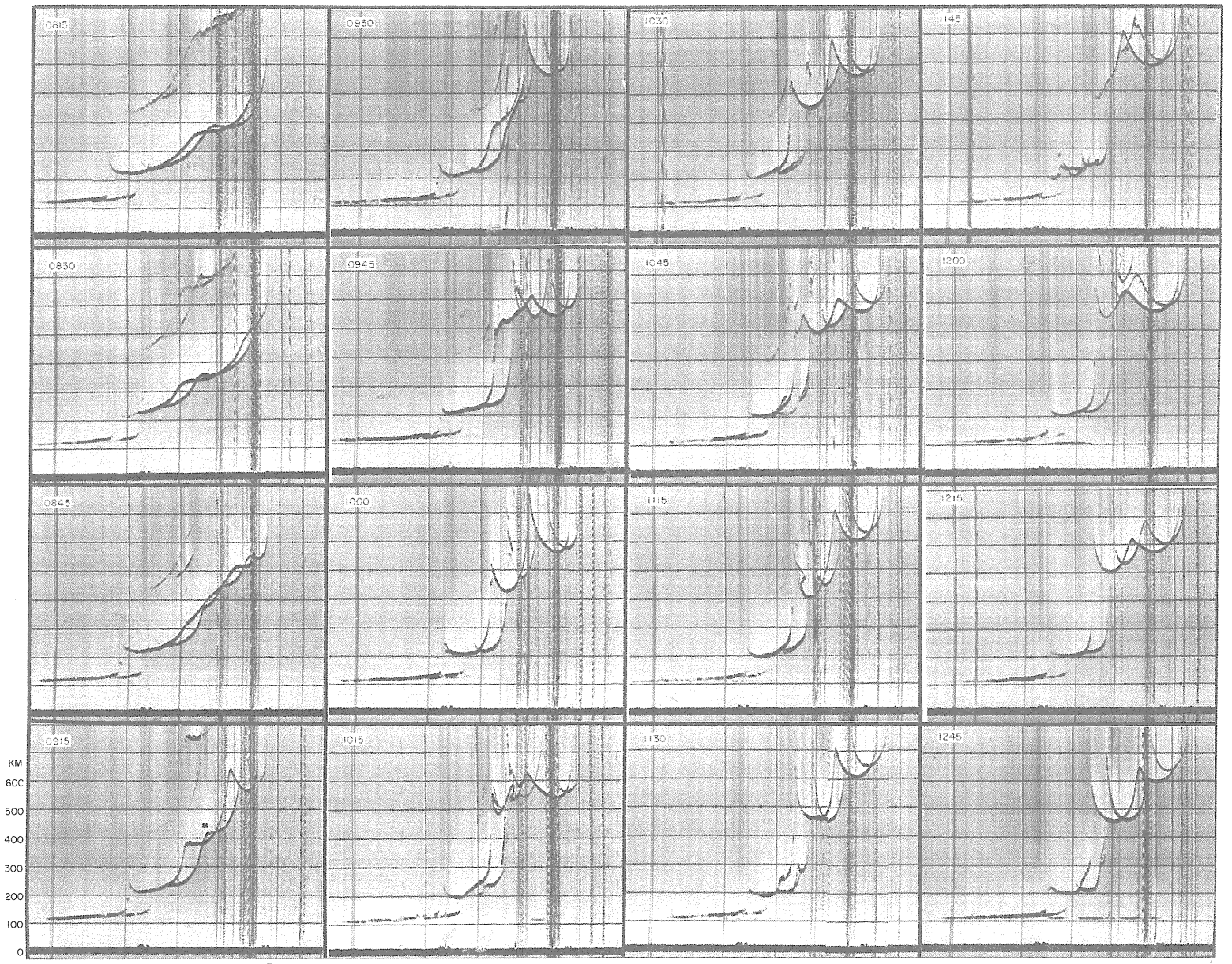


EXAMPLE OF STRATIFICATIONS DUE TO TILTS
HUANCAYO MARCH 3, 1961

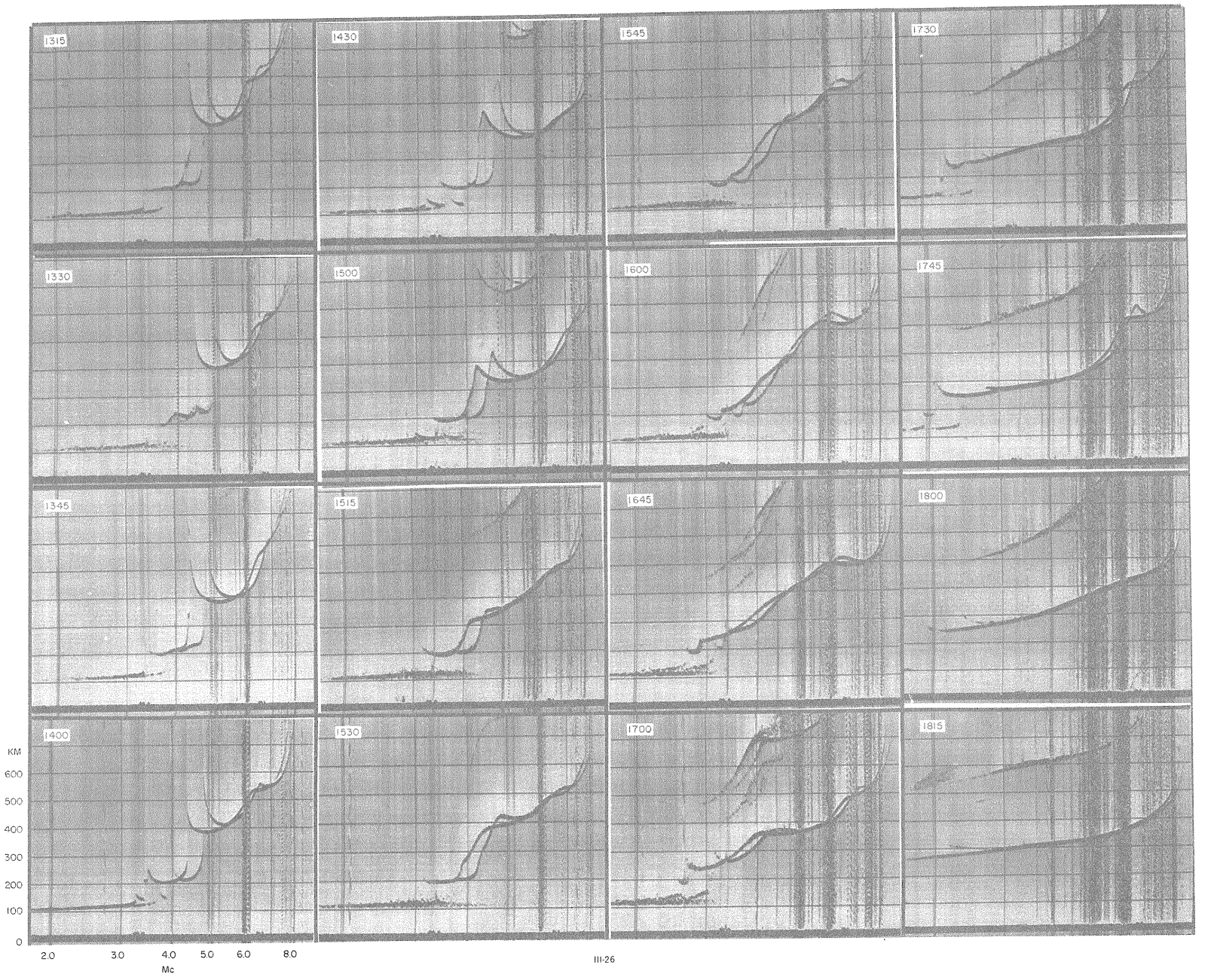
THE IONOGRAM AT 1700 IS NORMAL, WITH F, E, AND Es q TRACES PRESENT. AT 1715 AN OBLIQUE TRACE IS SEEN BELOW THE F TRACE WHICH BY 1730 SHOWS TYPICAL TILT PHENOMENA. NOTE THAT THE E LAYER RETARDATION OF THE NEW TRACE IS ABNORMAL, THE TRACE TURNING HORIZONTAL INSTEAD OF VERTICAL. THIS IS MORE OFTEN SEEN AT THE CRITICAL FREQUENCY OF THE F2 LAYER WHEN SEVERE HORIZONTAL GRADIENTS OF IONIZATION ARE PRESENT. THE NEW LAYER TRACE SHOWS A SMALL BUT CLEAR RETARDATION AT THE UPPER FREQUENCY END WHICH MATCHES THAT OF THE F TRACE, SUGGESTING THAT THE REFLECTION IS VERTICAL AT THIS FREQUENCY. THE SECOND REFLECTION CONFIRMS THIS. THE REASONABLE AGREEMENT BETWEEN O AND X TRACES SUGGESTS LITTLE NORTH-SOUTH GRADIENT BUT POSSIBLY CONSIDERABLE EAST-WEST GRADIENTS. THUS AT 1815 AN UNPERTURBED 2F REFLECTION CAN BE SEEN AS WELL AS THE SECOND ORDER OF THE NEW LAYER. BY 1915 OBLIQUE REFLECTIONS FROM AT LEAST THREE LONGITUDES ARE PRESENT TOGETHER (THE O TRACES OF THE FIRST ORDER MODE ARE STILL CONSISTENT SO THE GRADIENT IS E-W) AND BY 1930 MANY REFLECTION PATHS ARE PRESENT.



LUNAR STRATIFICATION
TALARA JULY 31, 1962



LUNAR STRATIFICATION, CONT'D
TALARA JULY 31, 1962



SOLAR ECLIPSE EFFECTS
JULY 20, 1963

ECLIPSES OF THE SUN INTERRUPT THE SOLAR IONIZING RADIATIONS AND AFFORD UNUSUAL OPPORTUNITIES FOR STUDYING THE RELATIONSHIPS BETWEEN IONIZATION, RECOMBINATION AND ATTACHMENT PROCESSES AT VARIOUS LEVELS IN THE IONOSPHERE. THE ACCOMPANYING FIGURES, PRESENTING SOME OF THE IONOSPHERIC OBSERVATIONS MADE DURING THE ECLIPSE OF JULY 20, 1963, ILLUSTRATE SOME TYPICAL ECLIPSE EFFECTS.

IN THE E-LAYER, THE ATMOSPHERIC DENSITY IS HIGH ENOUGH FOR THE ELECTRON REMOVAL PROCESSES OF RECOMBINATION OR ATTACHMENT TO PROCEED RELATIVELY RAPIDLY. THEREFORE, AS THE MOTION OF THE MOON'S SHADOW CHANGES THE AMOUNT OF IONIZING RADIATION FALLING ON THE E-LAYER, THERE IS ONLY A SMALL TIME LAG BETWEEN THE VARIATION OF FoE AND THE CHANGE IN PERCENTAGE OF OBSCURATION OF THE SOLAR DISK. THIS CAN BE SEEN IN FIGURE 1, AN F-PLOT SHOWING THE VARIATION OF CRITICAL FREQUENCIES AT CHURCHILL. THE TIME OF MAXIMUM OBSCURATION (91.3%) IS INDICATED BY THE ARROW. THE DECREASE OF FoE FOLLOWS THE INCREASING OBSCURATION OF THE SUN FAIRLY CLOSELY, AND THE MINIMUM OF FoE OCCURS WITHIN A FEW MINUTES OF THE TIME OF ECLIPSE MAXIMUM, AND RECOVERY TO NORMAL ALSO PROCEEDS AT APPROXIMATELY THE SAME RATE AS THE DECREASE OF SOLAR OBSCURATION. OCCASIONALLY, WHEN THERE ARE ONE OR MORE PARTICULARLY ACTIVE AREAS ON THE SUN, A SMALL JUMP IN THE DECREASE OR INCREASE OF FoE IS OBSERVED AS AN ACTIVE SOLAR REGION IS COVERED OR UNCOVERED BY THE MOON. SOME OF THESE CAN BE SEEN IN FIGURE 1. A SIMILAR PATTERN OF BEHAVIOR IS ALSO OBSERVED IN THE F1 REGION, FOR SIMILAR REASONS, AND THIS IS EVIDENT IN THE VARIATION OF FoF1 IN FIGURE 1. FOR BOTH THE E- AND F1-LAYERS, THIS PATTERN OF BEHAVIOR DURING AN ECLIPSE IS PRESENT AT ALL LOCATIONS, ALTHOUGH SOMETIMES IT IS OBSCURED BY SPORADIC E, AS ILLUSTRATED BY FIGURES 2B AND 2C, SHOWING RESPECTIVELY, THE VARIATION OF FoF1 AND FoE DURING THE ECLIPSE FOR SEVERAL STATIONS NEAR THE 75° W MERIDIAN.

IN THE F2 LAYER, BECAUSE THE MEAN FREE PATHS OF ELECTRONS, IONS, AND NEUTRAL MOLECULES ARE LONGER THAN AT LOWER LEVELS, BECAUSE OF LOWER ATMOSPHERIC DENSITY, THE EFFECTS OF TRANSPORT PROCESSES MAY BE IMPORTANT IN ADDITION TO IONIZATION, RECOMBINATION AND ATTACHMENT. ALSO, BECAUSE THE F2 LAYER VARIABILITY IS MUCH GREATER THAN FOR THE E- AND F1-LAYERS, IT IS MUCH MORE DIFFICULT TO IDENTIFY ECLIPSE EFFECTS. THE RESPONSE OF THE F2 - LAYER TO AN ECLIPSE DEPENDS ON THE LOCATION, TIME OF DAY, SEASON, AND STATE OF THE F2 - LAYER AT THE TIME OF THE ECLIPSE. IN FIGURE 2A, THE VARIATION OF FoF2 DURING THE ECLIPSE IS SHOWN FOR SEVERAL STATIONS NEAR THE 75° W MERIDIAN. THE PERCENTAGE OF TOTALITY AT MAXIMUM OF THE ECLIPSE IS INDICATED FOR EACH STATION. AT THE 75° W MERIDIAN, THE ECLIPSE OCCURRED IN THE LATE AFTERNOON. IN FIGURE 3, THE VARIATION OF FoF2 IS SHOWN FOR STATIONS NEAR 90° W, FOR WHICH THE ECLIPSE OCCURRED EARLIER IN THE AFTERNOON. IN FIGURE 4, THE VARIATION OF FoF2 IS SHOWN FOR STATIONS NEAR 150° W, FOR WHICH THE ECLIPSE OCCURRED IN THE MORNING.

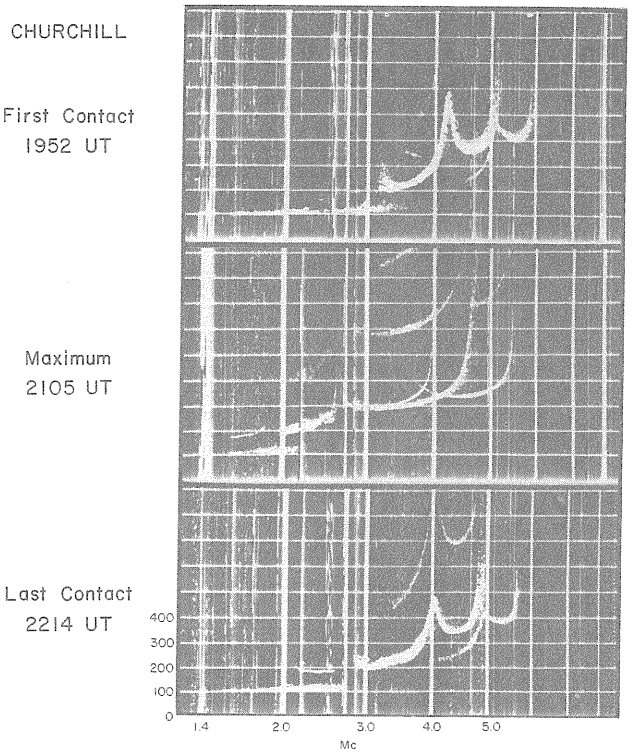


Figure 1

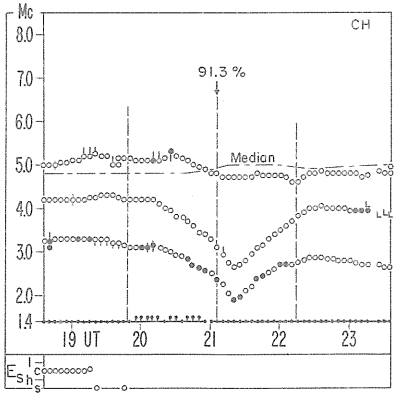
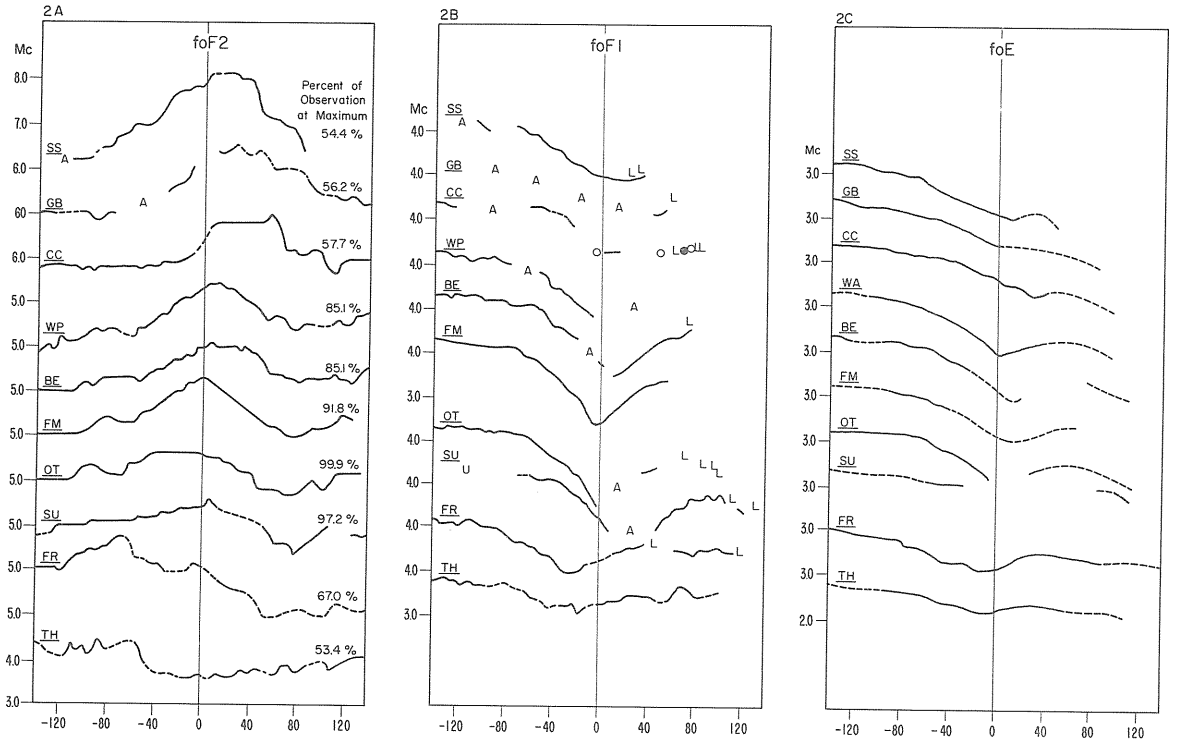


Figure 2 75°W



Time Relative to Eclipse Maximum at 200 km in Minutes

Figure 3 90°W

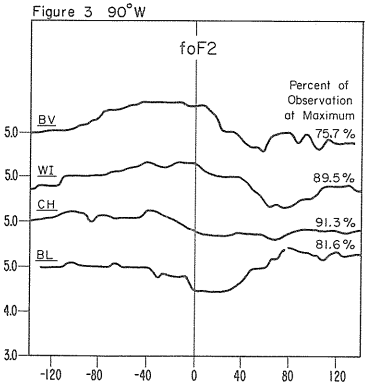
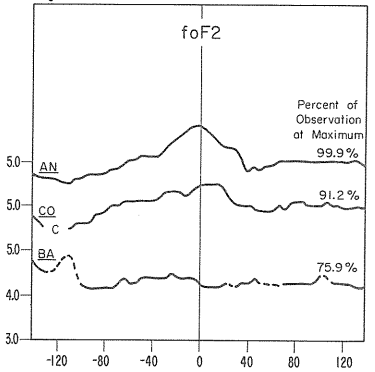
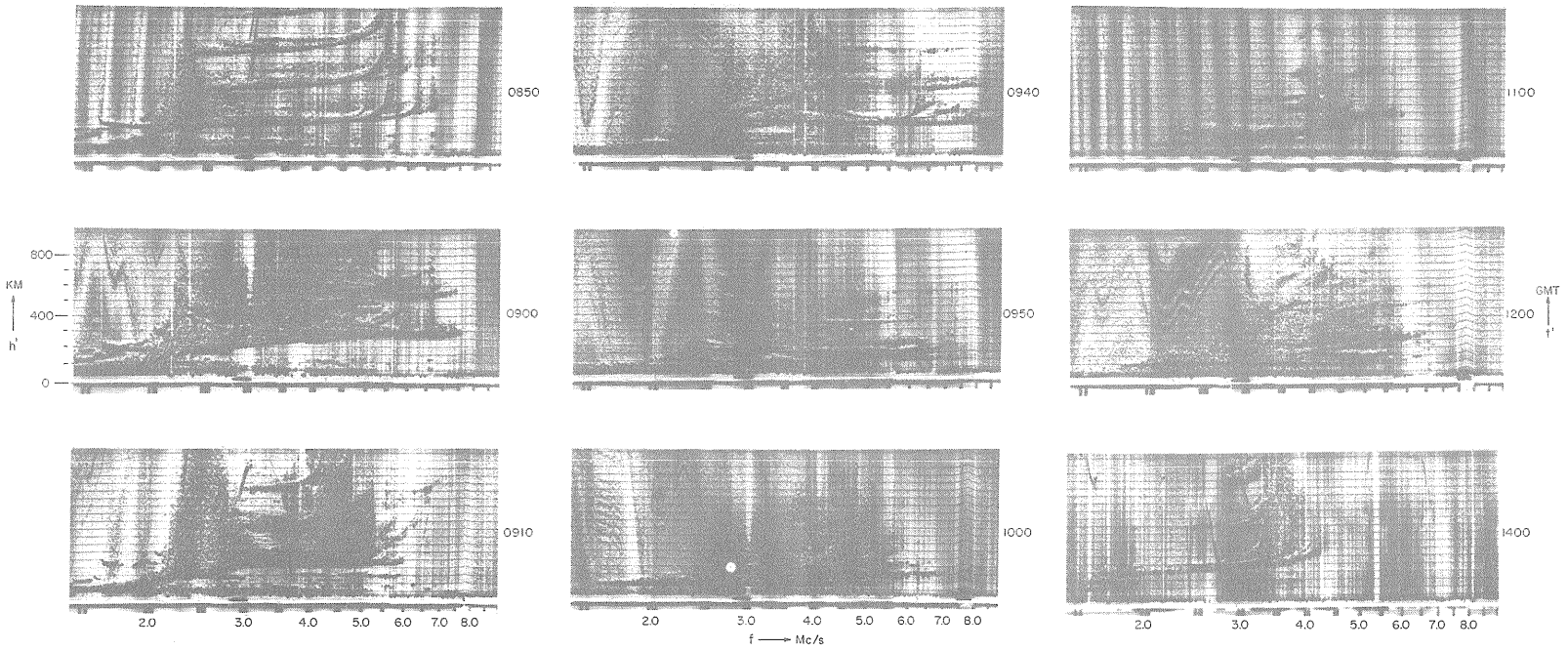


Figure 4 150°W



IONOSPHERIC EFFECTS OF TROPOSPHERIC NUCLEAR EXPLOSION
SODANKYLÄ OCTOBER 31, 1961, GMT

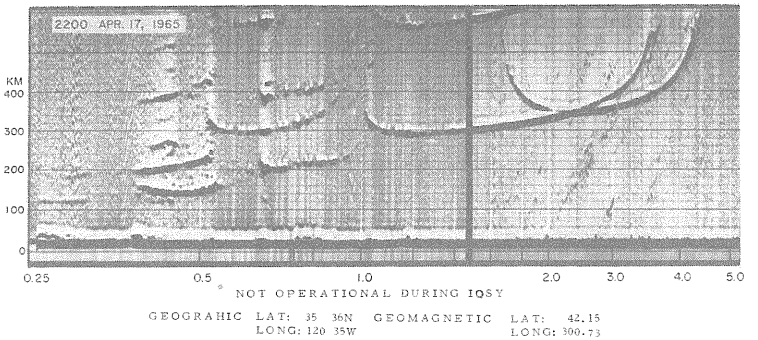


IONOSPHERIC EFFECTS OF TROPOSPHERIC NUCLEAR EXPLOSIONS

THE VERY LARGE NUCLEAR EXPLOSION CONDUCTED BY THE SOVIET UNION ON OCTOBER 30, 1961 OCCURRED AT 0833.33 GMT AT NOVAYA ZEMLYA 1,160 KM AWAY FROM AN IONOSPHERE STATION AT SODANKYLÄ, FINLAND. THE IONOSPHERIC EFFECTS HAVE BEEN DESCRIBED BY ROSE, OKSMAN, AND KATAJA (1961), AND HAVE BEEN PROVIDED BY MR. OKSMAN FOR INCLUSION HERE. THE SUDDEN IONOSPHERIC CHANGES CARRIED BY THE EXPLOSION MAY BE SEEN BY COMPARING THE IONOGRAMS AT 0850 AND AT 0900. WHILE NO APPRECIABLE INCREASE OF IONIZATION IS EVIDENT, A VERY LARGE INCREASE IN THE NUMBER OF REFLECTING RAY PATHS TO THE IONOSPHERE IS SEEN. THE AUTHORS ATTRIBUTE THIS TO A SHOCK WAVE PASSING OVER SODANKYLA AT IONOSPHERIC HEIGHTS, AND ESTIMATE ITS VELOCITY AT 420 M/SEC., CORRESPONDING TO A ROUND-THE-WORLD TRAVEL TIME OF 27 HOURS. INDEED, A SIMILAR DISTURBANCE IS SEEN ON THE FOLLOWING DAY BETWEEN 0950 - 1140 GMT.

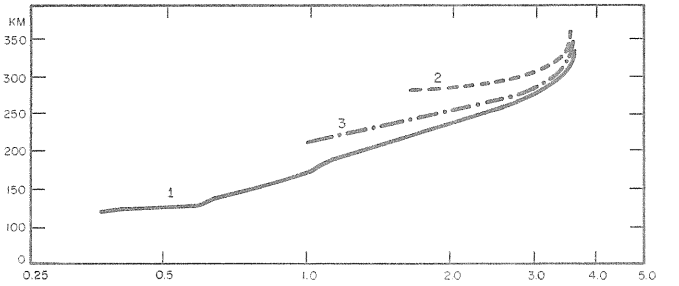
N(h) EXAMPLES

(1a)



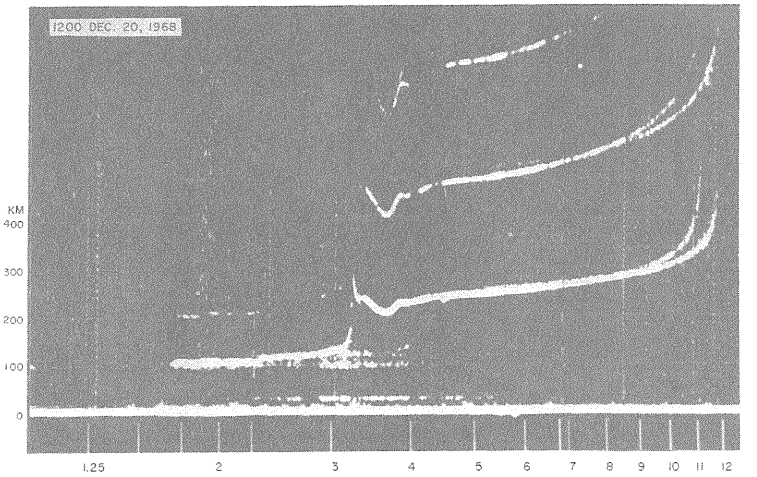
NOT OPERATIONAL DURING IQSY

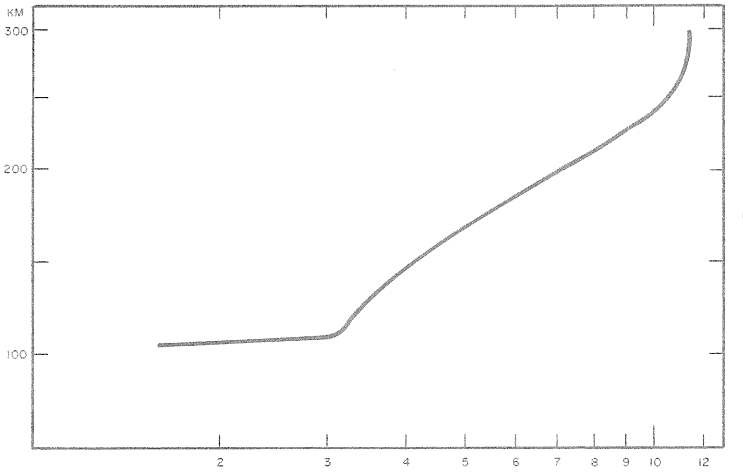
GEOGRAPHIC LAT: 35 36N GEOMAGNETIC LAT: 42.15
LONG: 120 35W LONG: 300.73



(1b)

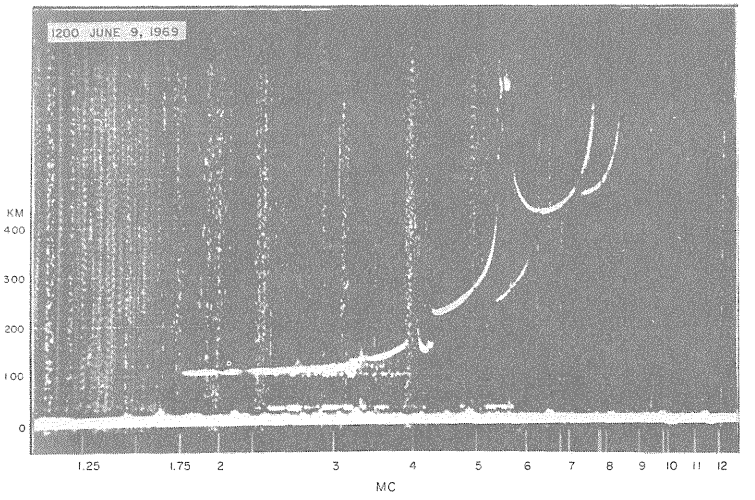
(2a)

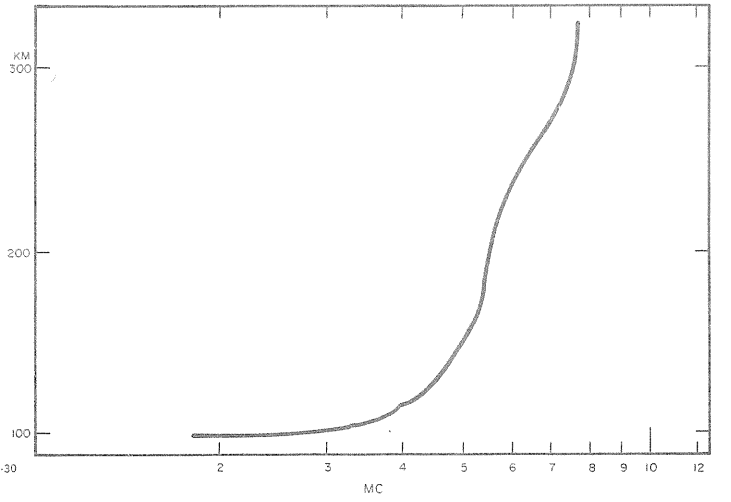




(2b)

(3a)





(3b)

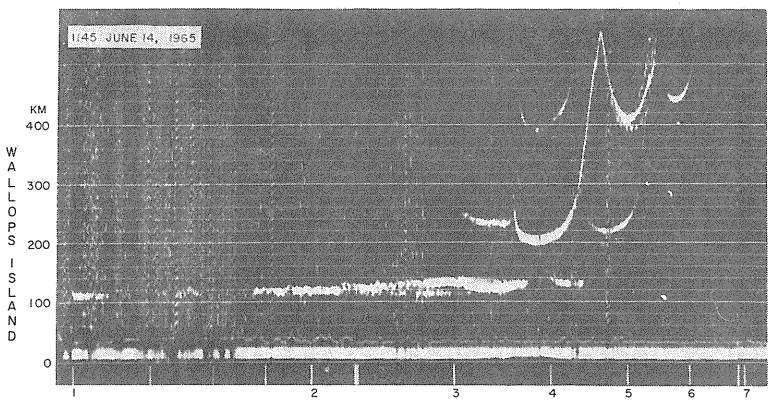
Figure 1 shows the ionogram (a) and calculated N(h) profiles (b) for a spring nighttime, midlatitude case where the N(h) result depends on the assumptions made in the profile calculation process. This nighttime ionogram shows the kind of E-layer development that is most pronounced during disturbed geomagnetic conditions (Wakai, 1967). Curve 1 in Figure 1(b) shows the complete N(h) curve calculated assuming a monotonic electronic density distribution, which therefore fails to allow properly for the possibility of "valleys" or height-steps in the profile. Curve 2 shows the N(h) profile calculated from the ordinary ray alone, but assuming no h'(f) information to be available below 1.6 MHz; this is a common lower limit of practical operations of older ionosonde and antenna systems. Curve 3 was calculated on the same assumption, but included an extraordinary-ray correction for underlying ionization (Paul and Wright, 1963). Curves 1 and 2 are the lower and upper limits of the true F-region N(h) distribution, corresponding to maximum and minimum underlying ionization, respectively. Curve 3 indicates the existence of one or more valleys between the layers, the total valley width being approximately 80 km; this is consistent with the findings by Wakai (1967).

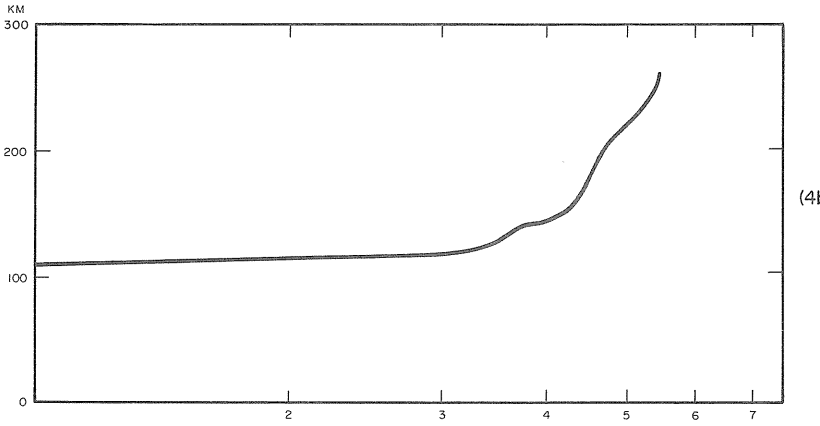
Figure 2 shows a winter, midlatitude, daytime ionogram and the resulting N(h) profile assuming a monotonic electron density distribution. The monthly mean sunspot number ($\overline{R}$) is 109.8. Under these circumstances the F-region is relatively low, thin, and densely ionized.

Figure 3 shows a summer midlatitude ionogram and N(h) profile ($\overline{R}$ = 102.1). Comparing Figures 2 and 3, one should note that the summer NmaxF2 is less than the winter NmaxF2 for comparable sunspot number, while summer NmaxE is greater than winter NmaxE as would be expected from the E layer's strong dependence on solar zenith angle. Summer hmaxF2 is higher than winter hmaxF2, which is typical midlatitude behavior and is one of the important factors in explaining the "summer anomaly" (Wright, 1962). The very prominent F1 feature on the ionogram in Figure 3 becomes identified with an inflection point on the N(h) curve. This illustrates the ability of the ionogram to serve as a sensitive indication of the changes of curvature (i.e., the third height derivative) of the profile; the consistency of such features (cf.the extensive F1 and F1 1/2 layer literature) is rooted in the photochemistry of the region (King, 1961) and is of considerable importance.

N(h) EXAMPLES

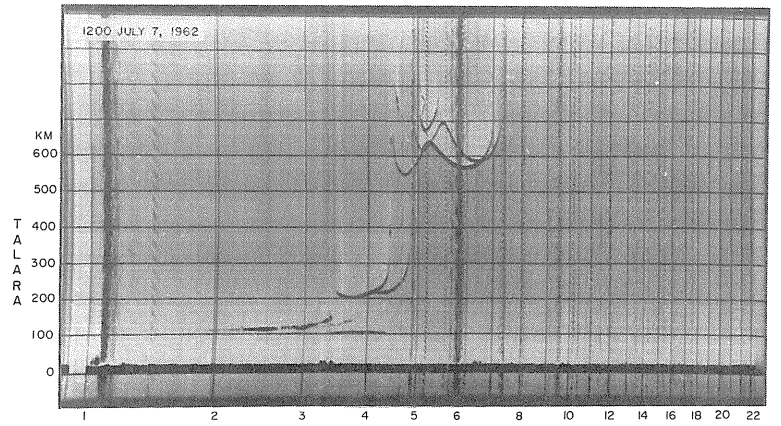
(4a)

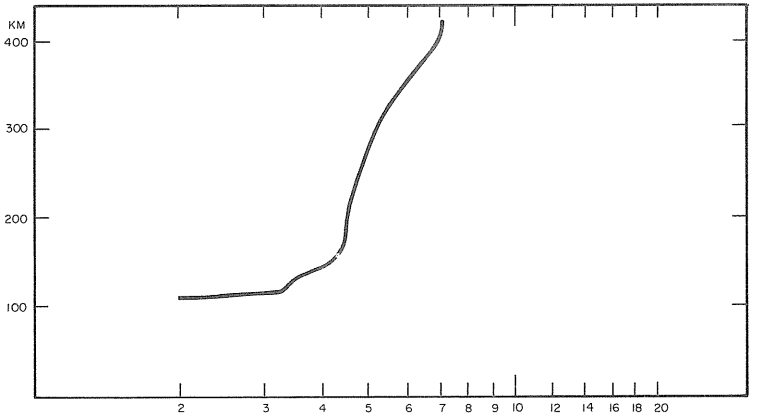




(4b)

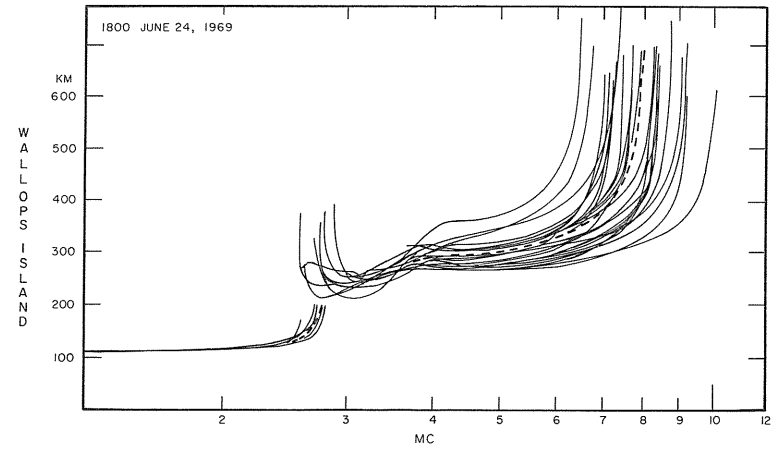
(5a)

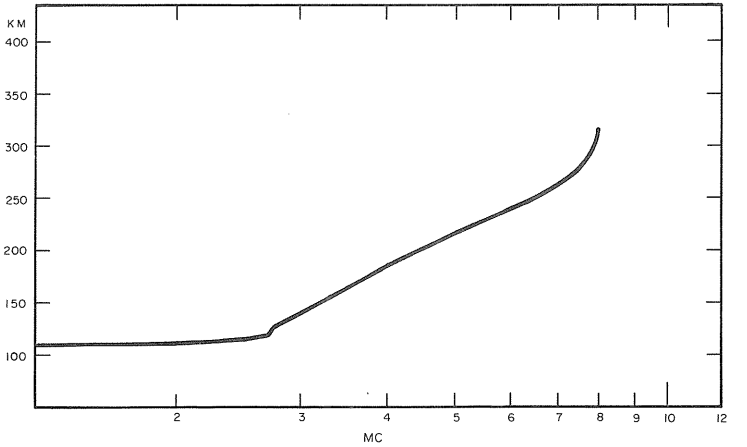




(5b)

(6a)





(6b)

Figure 4 shows a summer, midlatitude ionogram and N(h) profile for low solar activity ($\overline{R} = 15.9$). NmaxF2, NmaxF1, and NmaxE are all reduced compared with the high solar activity case, as are hmaxF1 and hmaxF2. The changes of curvature within the profile are more marked than in Figure 3, and this results in a more sharply defined h'(f) cusp on the ionogram.

Figure 5 shows a low-latitude ionogram and N(h) curve. The solar activity ($\overline{R} = 21.8$) is comparable to the previous example, and the season is comparable to the example in Figure 2, but the F-region properties are to a considerable extent peculiar to the magnetically equatorial regions. The "F1 1/2 layer" evident on the ionogram is a minor (but not meaningless) change of curvature in the profile, and cannot be distinguished on the plotted N(h) curve; however, quantitative information about it is preserved by sophisticated N(h) methods in numerical values for the higher profile derivatives.

Figure 6 shows the h'(f) curves for 1800 (local time) superimposed, for all available days in a single month. This superposition is widely used in a method of obtaining "median" N(h) profiles (Laird and Wright, 1967). The median h'(f) curve is indicated by the heavy dashed curve. Note the relative agreement among the h'(f) curves in the lower frequency range of the ionograms, and the greater variation among the h'(f) curves near foF2. The N(h) curve corresponding to the median is shown in Figure 6(b). The median NmaxF2 at 1800 is greater than NmaxF2 at 1200 (Figure 2), a regular occurrence in summer at midlatitudes.

King, G. A. M., Analysis of the F1 - F2 transition region, J. Geophys. Res., 66, 2757-2762, 1961.

Laird, A. R. and J. W. Wright, Computation and application of synoptic ionospheric profiles, Radio Science, 2, 1255-1261, 1967.

Paul, A. K., and J. W. Wright, Some results of a new method for obtaining ionospheric N(h) profiles and their bearing on the structure of the lower F region, J. Geophys. Res., 68, 5413-5420, 1963.

Wakai, N., Quiet and disturbed structure and variation of the nighttime E-region, J. Geophys. Res., 72, 4507-4517, 1967.

Wright, J. W., Diurnal and seasonal changes in structure of the midlatitude quiet ionosphere, J. Res. NBS (Radio Prop.), 66D, No. 3, 297-312, 1962.

SECTION IV

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