MONTHLY SUMMARY OF GEOMAGNETIC ACTIVITY

THE GEOMAGNETIC FIELD. The intensity of the Earth's magnetic field at any point in space and time arises from the MAIN field internal to the planet; from the electrical currents flowing in the ionized upper atmosphere; and from the currents induced within the Earth's crust. The main field component varies slowly in time and can be grossly described as a bar magnet with north and south poles that extend well out into space.

The main field creates a cavity in interplanetary space called the magnetosphere, where the Earth's magnetic field dominates any field carried by the charged particles of the solar wind. The magnetosphere shape resembles a comet--a shape owing to the interaction with the solar wind; it is compressed on the side toward the sun and tail-like on the side away from the sun. The magnetosphere also directs the flow of the particles about the Earth.

Particles flowing in the magnetosphere and ionosphere generate currents, which in turn cause variations in the intensity of the Earth's magnetic field. These EXTERNAL currents generate additional currents in the Earth's upper atmospheric layers, which vary on much shorter time scales than the main field, and they create magnetic changes as large as 10% of the main field.

Certain current systems derive their energy from the regular changing solar radiation throughout the day and year. Other irregular current systems obtain their energy from the interaction of the solar wind with the magnetosphere, from the magnetosphere itself, from the interaction between the magnetosphere and the ionosphere, and from the ionosphere itself. Magnetic activity indices, including those reported below, are designed to describe variations in the Earth's main field caused by these irregular currents.

JANUARY 1989

Cal	Jul	Bart	Rank Q/D	Kp 1	2	3	4	5	6	7	8	Kp Sum	Ap	Cp	sc (UT)	AFR	An	As	Am	N	S	M1	M2
1	1	13		4	3+	3	2+	3	3-	3	3-	24	15	0.9		10	25	24	24	30	26	29	27
2	2	14	Q2	2-	1	2-	2-	1+	1	2+	2	13-	6	0.3		5	11	14	12	16	12	14	14
3	3	15	Q1	0+	0	1	1	1	1+	2	2-	8+	4	0.1		3	6	11	9	9	10	8	12 CC
4	4	16	Q4A	2-	2-	2+	1	2	2-	2+	4-	16+	9	0.5	****	10	16	24	20	16	26	16	26
5	5	17	D4	4+	6-	5	4-	3	5-	4	3-	33	33	1.3	1324	28	51	62	57	55	75	81	49
6	6	18	Q5A	3	3-	3-	2+	2-	1	2	3-	18	10	0.5		8	15	20	17	22	25	28	19
7	7	19	Q7A	3+	2	2	2	2+	3-	3-	2	19	10	0.6		8	20	26	23	23	22	24	21
8	8	20		1	2+	2+	2+	4+	4	4-	4	24	17	0.9		14	29	39	34	31	40	26	46
9	9	21		3-	3	3+	3+	4-	3	3	3	25	16	0.9		15	27	30	29	35	34	32	37
10	10	22		4-	2+	2+	3	3-	3-	2+	2-	21-	12	0.7		10	19	22	21	22	23	24	21
11	11	23	D5	2	1+	1+	1+	4-	6-	6+	6+	28	37	1.4	1205	27	57	71	63	65	58	12	110
12	12	24		6	4	3	2	2	2	2+	2	23+	20	1.0		14	27	29	28	30	20	35	15
13	13	25	Q9A	1-	1-	1-	2+	3+	4-	3+	3	18-	11	0.7		10	20	26	23	23	21	7	37
14	14	26		3+	1	1	1	3-	3-	4-	5-	20	14	0.8		10	25	31	28	35	29	12	52
15	15	27	D3	5-	4+	4-	4	4+	5-	5	6-	36+	38	1.4		31	59	79	69	61	71	47	85
16	16	1	D1	6-	5	6-	4+	4-	4+	5-	5-	38	43	1.5		33	63	69	66	64	64	65	63
17	17	2		4+	3+	4	5	4-	4-	5-	3	32-	28	1.2		24	47	42	45	54	39	42	51
18	18	3		4	3	3	4-	3	2+	2	2	23	15	0.8		11	24	24	24	27	21	28	20
19	19	4	Q3A	2	3-	2+	2-	1-	1+	2	2	15-	7	0.4		4	12	17	14	20	15	18	17
20	20	5	D2	3	2-	2	3-	6+	7-	6-	5	33	45	1.5	1129	33	79	89	84	81	90	22	149
21	21	6		4-	4	4	4	4	5-	4	4+	33-	28	1.2		20	42	51	47	42	46	34	54
22	22	7		4+	5-	5-	3+	5+	4-	3	3	32	30	1.3		21	47	40	47	62	41	47	56
23	23	8		3+	4+	4	3+	4-	4-	3+	3	29-	22	1.1		21	31	33	32	38	33	38	33
24	24	9	Q10A	3-	2+	2	2	2+	3-	3	3-	20-	10	0.6		8	19	19	19	20	21	15	26
25	25	10		2	3	3-	3	3+	2	3-	3-	21+	12	0.7		10	21	21	21	24	19	20	23
26	26	11	Q8A	2+	2-	2+	3	3-	3	2+	2	19+	10	0.6		9	18	21	19	20	22	19	23
27	27	12		3+	4-	3-	3	3	2+	1	1	20	12	0.7		13	22	20	21	24	20	29	15
28	28	13		2	4-	2+	2-	3-	3	4	2+	22-	13	0.8		9	22	24	23	27	26	16	37
29	29	14	Q6A	2+	1+	2-	2+	3	4-	2+	2-	18+	10	0.6		8	20	20	20	22	25	18	29
30	30	15		2+	3	2	3+	3+	3-	2+	2+	21-	12	0.7		11	22	21	21	26	23	21	28
31	31	16		3+	3	3	3+	3+	4+	5+	6	32-	32	1.3		23	45	52	49	23	59	23	59

| MEAN | | | | | | | | | | | | | 19 | 0.87 | | | 30 | 35 | 33 | 34 | 34 | 34 | |

See back side for definitions of column heading.   **** on day 4 sc at 0847UT and 2305UT

Definitions of Column Headings

Kp   PLANETARY 3-HOUR RANGE INDEX. K-indices were originally defined to measure effects of solar particles on the geomagnetic field. They classify the 3-hour range of the most active horizontal field component at an observatory into disturbance levels from 0 = least to 9 = most disturbed. The levels are related almost logarithmically to the disturbance amplitude range after removal of an estimated quiet-day variation produced by regular ionospheric currents. Kp indices are the average of K indices measured at 11 sub-auroral zone observatories located mainly in Europe.

A   EQUIVALENT AMPLITUDE A-INDEX. The A-index ranges from 0 to 400. The A indices are daily averages of "a" indices, which convert K-values to a linear scale in field units. Ap is the daily average of the eight "ap" indices derived from 3-hourly Kp indices. Similarly, An and As are daily means derived from "an" and "as" indices obtained from groups of Northern Hemisphere (12) and Southern Hemisphere (10) observatories, respectively.

Dst DISTURBANCE AMPLITUDE-STORM TIME. Dst tracks variations in the solar-induced electric currents flowing about 5.6 Earth radii above the equatorial region. Each hourly value is the average symmetric disturbance amplitude, projected onto the equator, of the horizontal component recorded at 4 mid-latitude stations. Values are given in nT and are near 0 during quiet times. A storm sudden commencement (ssc) is seen as a sharp positive peak in Dst before the main phase of the global storm produces large negative values of Dst.

\#   NUMBER. The day number is a simple count of the days of the year, where January 1 = 1 and December 31 = 365 (non-leap year). It is often mistakenly called the "Julian Day".

Bart DAY NUMBER OF BARTELS 27-DAY CYCLE. The recurrence of geomagnetic activity every 27 days reflects the solar source. J. Bartels defined a series of 27-day periods to aid tracking times of unsettled magnetic conditions. He started the sequence in January 1833.

Q/D MAGNETICALLY QUIET AND DISTURBED DAYS. The following criteria are used to rank the 10 most quiet days of the month from most (Q1) to least quiet (Q10) and the 5 most active days from the most (D1) to least disturbed (D5). Criteria used in the rankings include the sum of the eight Kp values, the sum of the squares of the eight Kp values, and the greatest Kp value.

aa   aa INDEX. The aa indices are 3-hourly values computed from K indices of two roughly antipodal observatories (invariant magnetic latitude 50). They provide a quantitative characterization of the global level of magnetic activity. Half-daily and daily values compare closely with the global "ap" and "am" indices (see above). The aa indices are computed for the following cases: N = daily values for the Northern Hemisphere; S = daily values for the Southern Hemisphere; and M1, M2 = half-daily values of aa for the UT day.

NUMEROUS WORLDWIDE INDICES. What is an index and why are there so many for terrestrial magnetism? An index continuously summarizes a complex measurement; its discrete values simplify and clarify the variations. Ideally each geomagnetic index should follow a single class of magnetic disturbance; in reality few do. The bewildering array of magnetic indices reflects many attempts to define measurements that isolate a single source of variation.

The subscript "p" designates a global magnetic activity index. The following 11 observatories, which lie between 46 and 63 north and south geomagnetic latitudes, now contribute to the Kp indices: Lerwick (UK), Eskdalemuir (UK), Hartland (UK), Ottawa (Canada), Meanook (Canada), Fredericksburg (USA), Sitka (USA), Eyrewell (New Zealand), Canberra (Australia), Lovo (Sweden), and Brorfelde (Denmark).