Back to Home

Information on this CD-R

I Introduction

World Data Center for Cosmic Rays (WDCCR) was established in 1957 by the Institute of Physical and Chemical Research (RIKEN), Japan, under the ICSU World Data Center System (Watanabe, 2009). The WDCCR was moved to the Solar-Terrestrial Environment Laboratory (STELAB), Nagoya University, in 1991, and data-management works were performed through the collaboration between the STELAB and the Department of Environmental Sciences, Ibaraki University, in 1993-2009. In July 2009, whole activities of the WDCCR have been moved to STELAB. The STELAB has been reorganized to a new institution under the name of the Institute for Space-Earth Environmental Research (ISEE), Nagoya University.

The WDCCR is providing with long-term and quality-controlled databases of world-wide cosmic-ray neutron observations on our Web page (http://center.stelab.nagoya-u.ac.jp/WDCCR/). The principal data folding of WDCCR is one-hour pressure-corrected counts of cosmic-ray neutrons. This CD-R includes numerical data and plots covering the interval from 1953 to 2013, although a part of new data are provisional.

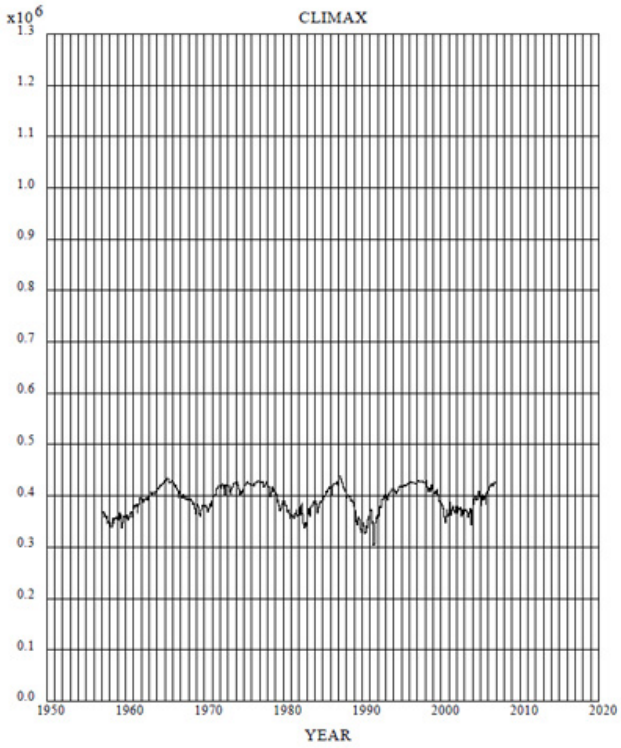
Watanabe, T., WDC Activity in Japan, 2008, Data Sci. J., PS102-S107, 2009.

II Access to Data

This CD-R has three portals shown below to access numerical data (text) and plots (PDF), basing on station or yearly bases. The basic data format employed by the WDCCR is the 4096-byte LONGFORMAT (Section III-1),which can be sorted by the name of a station (Section II-1) or a certain year (Section II-2). Since data in this format are compact but relatively inconvenient to handle with a PC, we have introduced the SHORTFORMAT (Section III-2) in which 12 hourly data are given in one line, instead of "one month data in one line" in the LONGFORMAT. The SHORTFORMAT data can be sorted by the yearly base (Section II-2).

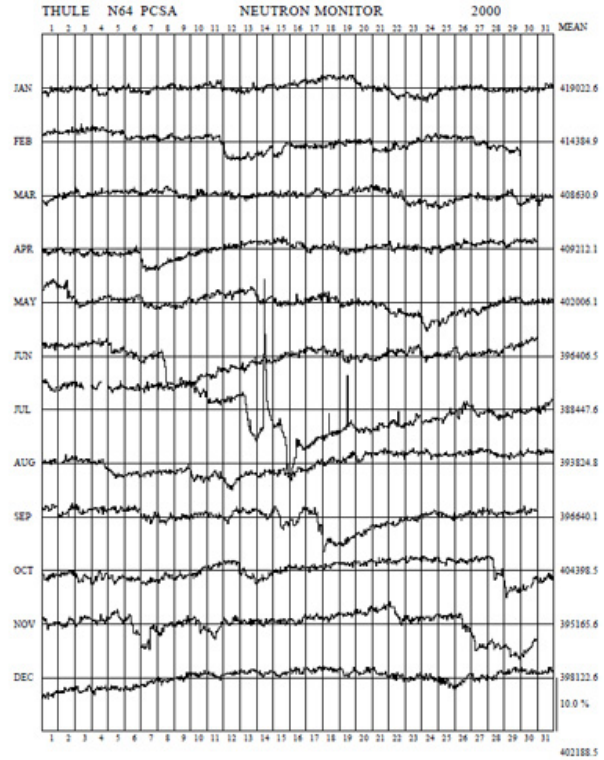
(II-1) List of Stations (Sorting an all-in-one Data by the Name of a Station)

This portal includes a table of information on each neutron station: name of the station (mainly name of the place of observations), the abbreviated name of the station (6 characters), the geographic latitude (deg.), the geographic longitude (deg.), the altitude above the sea level (meters), the vertical cut-off rigidity (GV), number and type of neutron detectors, and data coverage (years). For several stations with the cut-off rigidity of lower than 1 GV, this value has been set to zero (0.0). From the column of "Data Coverage", you can jump to a PDF image file and a data file named L_all.txt (LONGFORMAT, see Section II-1) which covers all period in which the station was operated. An example of plots is shown below. The horizontal axis is years and the vertical axis is monthly averages of real counts.



(II-2) Data Coverage (Sorting a Yearly PDF Plot by the Name of a Station)

This portal shows a table of yearly data coverage for each station. In this table, a certain year of full data coverage is indicated by a letter (*), and a letter (-) is used for a partly-covered year. You can see the yearly data plot (12 months) by clicking these letters. An example of yearly plots is given below. The horizontal axis is the days of a month (always 31 days), and the vertical axis shows the variations (%) from the monthly average. The monthly average is given on the right-hand side of the 0 % line for each month. The number given in the lower right corner is the yearly average. A data plot of full data coverage for each station can be accessed by clicking "all.pdf" on the right-end of the table.



(II-3) Numerical Data (Sorting Numerical Data by Year or Station)

You can sort numerical datasets from this portal basing on a year or the name of a station. For neutron counts data, two datasets with different formats are installed in this CD-R (see Section II). The principal format is the 4096-byte "LONGFORMAT" which has been currently employed by the WDC for Cosmic Rays. A dataset in this format includes information for data usage in the header section, e. g. factors and constants which are inevitable to calculate real count numbers. The "SHORTFORMAT" in which hourly counts in one day are tabulated in two lines, namely 0h - 11h and 12h - 23h UT. Datasets in this format are convenient to check tabulated values quickly. Detailed descriptions of these two formats are given below.
When you select the "Year" key in the title of this sub-section, you will find LONGFORMAT, SHORTFORMAT, and PDFPLOT folders in a yearly base. From the "Station" key, you can find folders for each station. Each folder consists of LONGFORMAT data file (L_all.txt) and a PDF file. These files cover all period in which the station was operated.

III Data Formats

In this section, details of data formats, which have been used currently at the WDC for Cosmic Rays, are given. All of tabulated counts are hourly values. The first value on each day is the count in the interval from 0:00 UT to 0:59 UT. The last value of the day is that in 23:00 - 23:59 UT. It is important to note that the number of days in each month is always 31 days in our database.

(III-1) LONGFORMAT

The LONGFORMAT data with 4096 bytes for one month is a fundamental dataset of the WDC, having a header section including information on the data source, location, altitude, coefficients and constants which are necessary to calculate real counts. Information on the data source is included also. The number of days in one month is fixed to be 31 days. So that, every years have 31 x 12 = 372 days in our data. Hourly data for days which do not exist in the normal calendar (e.g. "31 April") are filed by 99999, which mean "no data". The data size for one-year data is fixed to be 49152 bytes. An example of data with this format is shown below:

KIEL N64PCSA191 1 54.34 10.12 54.00 2.32 100.0 0.0 0.0 5694.3KIEL, GERMANY, INST. FUER REINE UND ANGEWANDT KERNPHYSIK,UNIV.KIEL,KIEL, GERMANY18-NM-64 NEUTRON MONITOR, CORRECTED FOR PRESSURE TO 755 MM HG, COEF. -.961%/MMHG
950613 5591 5616 5609 5606 5598 5610 5623 5624 5612 5649 5629 5657 5647 5645 5661 5650 5643 5634 5651 5648 5643 5626 5613 5620 5589 5587 5589 5596 5615 5605 5630 5614 5617 5598 5639 5650 5678 5654 5671 5671 5676 5680 5691 5656 5646 5632 5639 5628 5605 5595 5587 5604 5611 5637 5633 5604 5632 5686 5677 5649 5667 5668 5657 5646 5644 5625 5646 5650

.....

Format of 4096-Byte LONGFORMAT Data of Cosmic-Ray Neutron

bytes	format	notes
1-6	A6	First six characters of abbreviated station name
7-13	A7	Comments on data, e.g.: N64 NM-64 neutron monitor P Pressure-corrected data C Counts S Scaled counts A Absolute values
14	I1	1: Hourly data 2: Two-hour data
15-16	I2	(Year-1900) before 1999, and (Year-2000) after 2000
17-18	I2	Month
19-46	4F7.2	Latitude, Longitude, Altitude, Vertical cut-off rigidity
47-74	4F7.1	Scaling Factor(SF),UT of the beginning of the first data of a given day (for 1-hour data measured in the interval from 00:00 to 01:00, this value is 0), Constant to be added to the tabulated data, Monthly average Real Count = (tabulated value + Constant)*SF
75-364	A290	Information for data usage (see below)

365-370	A6	Warning for discontinuity in monthly data (by 1988) or information on data including contact point
371-376	3I2	Date of revision (YYMMDD)
377-4096	744I5	Hourly data (24 x 31=744). 99999 for "no data"

In the header section from the 75th to 364th characters of each monthly dataset, following information for data usage is given:

1. The full name of the station (the organization conducting the observation, and the address of the organization.
2. Information on the neutron monitor.
3. For pressure-corrected data, the average pressure and the correction factor with which the observed counts are corrected are also given.
4. The number of the operating counters is given by two digits from 155th bytes. From 164th to 364th bytes, information on the pressure correction, description on the normalization, information on data source (e. g. e-mail address) are given. For some stations, additional information concerning special observational situation to be taken it into account in data handling, e.g. heavy snow falls or strong wind, is given in the space.

(III-2) SHORTFORMAT

We have introduced a new format (SHORT FORMAT) to improve inconveniences in handling the 4096-bite LONG FORMAT. The data length is shorten to include 12 one-hour five-digit data in each one line, namely two lines for 24-hour data (line 1 is for the data from the start of 0 UTC to the end of 11 UTC, and line 2 is for those from the start of 12 UTC to the end of 23 UTC). The time of "no data" is shown by 99999. We add also 22-line header section, which includes information, on the top of each monthly dataset. The information included in the header section is almost identical to that of the header section of LONGFORMAT data. The number of days in a month is fixed to be 31 days, and the data for extra days (e.g. 31 April) are filled by 99999. A monthly dataset consists of 84 lines, and 1008 lines for one year, including the header sections. The number of days in a yearly dataset is fixed to 31 x 12 = 372 days.

The structure of the header section of a monthly dataset

Law	Format	Description
1	A92	Name of the Database
2	A92	Collections (name of the database holder)
3	A92	Data Access (URL)
4	A92	Project name (currently ICSU WDC)
5	A92	Citation (information for citation of the database)
6	A12,1X,A5	Station ID
7	A92	Detailed information on the station
8	A92	Type of neutron monitor and parameters for pressure correction
9	A17,F7.2,A20,F7.2,A16,F7.2	Geographical information (Latitude, Longitude, and Altitude)
10	A23,F7.2	Cut-off rigidity (GV)
11	A6,I4,2X,A6,I4	Year and Month
12	A21,F7.1,A21,F7.1	Scaling Factor (SF) and Constant (CONST) Real Counts = (DATA + CONST)*SF
13	A27	Temporal Resolution (usually 1 hour)
14	A16,F7.1	UTC Start Hour (usually 0.0)
15	A80	Information on data
16	A56	Information on data
17	A17,F7.1	Monthly Average
18	A22,I4,1X,I2,1X,I2	Updated (year, month, and day)
19	A92	**********
20	A92	ID YYYY, MM DD 1

21	A92	ID YYYY MM DD 2
22	A92	**********

An example of dataset is shown below.

```
Cosmic-Ray Neutron Monitor Data (Hourly, Pressure-Corrected and Scale-Adjusted Counts)
Collections: WDC for Cosmic Rays, Solar-Terrestrial Environment Laboratory, Nagoya Univ.
Data Access: http://center.stelab.nagoya-u.ac.jp/WDCCR/index.html
Project: ICSU WDC
Citation: WDC for Cosmic Rays, Solar-Terrestrial Environment Laboratory, Nagoya University
Station ID: KIEL
Station:  KIEL, GERMANY, INST. FUER REINE UND ANGEWANDTE KERNPHYSIK, UNIV. KIEL, GERMANY
Instrument: 18-NM-64 Corrected to 1006.6mb Standard Pressure,Coef=-0.721%/mb EFFICIENCY=100.
Latitude (deg.):   54.30  Longitude (deg.):   10.10  Altitude (m):   54.00
Cut-Off Rigidity (GV):    2.36
Year: 2010  Month:   1
Scaling Factor (SF):   100.0   Constant (CONST):     0.0  Real Counts = (DATA + CONST)*SF
Temporal Resolution: 1 hour
UTC Start Hour:     0.0
DATA FILE IS PREPARED BY IZMIRAN (ftp://cr0.izmiran.rssi.ru/Cosray!/FTP_NM/C/)

Monthly Average: 10960.6
Updated (YYYY MM DD): 2011 03 01
************************************************************************************************
ID     YYYY MM DD 1     0     1     2     3     4     5     6     7     8     9    10    11
ID     YYYY MM DD 2    12    13    14    15    16    17    18    19    20    21    22    23
************************************************************************************************
KIEL   2010 01 01 1 10901 10963 99999 10819 11028 10990 10976 11020 11055 11038 11025 11035
KIEL   2010 01 01 2 10946 11003 10913 10960 10843 11016 10901 10939 10915 99999 10778 10901
KIEL   2010 01 02 1 10856 10841 10836 10851 99999 99999 10849 99999 10924 11149 10841 10935
KIEL   2010 01 02 2 10998 10876 10776 10773 10808 10864 10863 10768 10726 10751 99999 10796
KIEL   2010 01 03 1 10781 10750 99999 10855 10804 99999 10876 10876 10881 10936 10825 10960
KIEL   2010 01 03 2 10954 10983 99999 10905 10893 10881 10903 99999 10791 10821 10906 10810
KIEL   2010 01 04 1 10930 10830 10885 10818 10870 99999 10931 10879 10846 10796 99999 99999
KIEL   2010 01 04 2 11066 10901 10863 11083 10855 10853 10853 10841 10891 10901 10915 10826
```

IV Quality Control

Quality check procedures in a minimum level are applied by the WDC. In addition to a fundamental check for consistency of dating of the original data, we remove apparent erroneous data which were mistakenly included in the data. We are also removing "unnatural" spiky noises exceeding a 3-sigma level of normal fluctuations. Substantial corrections are made after consulting with relevant data sources.

V Remarks for Data Usage

The data in the database are opened to research workers without limitation, following the policy of WDC System (http://www.wdc.rl.ac.uk/wdcmain/). The WDC strongly recommends you, however, to contact with original data sources when you use database in your research works because a part of our datasets, particularly new data obtained in this several years, have been under revision. Revised data are being posted in the Web page of the WDC.

We would appreciate it very much if you could acknowledge the contribution of the WDC in your publication and send us two copies when you publish your work on the basis of the database. Your acknowledgement will be helpful very much for us to enforce the "reason of presence" of the WDC.

VI Contact Point

Inquiry about the database should be addressed to;
Takashi Watanabe (Managing Director)
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Institute for Space-Earth Environmental Research, Nagoya University

Nagoya 464-8601, Japan
e-mail: wdccr21@yahoo.co.jp or wdccr@stelab.nagoya-u.ac.jp

Acknowledgements

We would express our sincere thanks to people who provided us with their cosmic ray data. Without their contribution, the WDC for Cosmic Rays cannot work. The original database covering from 1953 to 1988 was constructed by RIKEN, Japan.

Appendix

Yearly Number of Data Sets Held by the WDC for Cosmic rays
YEAR NUMBER OF STATIONS

```
         10        20        30        40        50        60        70
1953**                                                                          2
1954***                                                                         3
1955****                                                                        4
1956*****                                                                       5
1957******************************************                                 42
1958****************************************************                       52
1959****************************************************                       52
1960*****************************************                                  41
1961*******************************************                                43
1962*******************************************                                43
1963************************************************                           48
1964*******************************************************************        67
1965****************************************************************           64
1966**************************************************************             62
1967***************************************************************            63
1968***************************************************************            63
1969*****************************************************************          65
1970*************************************************************              61
1971****************************************************************           64
1972*********************************************************                  57
1973********************************************************                   56
1974***************************************************                        51
1975***************************************************                        51
1976*************************************************                          49
1977**************************************************                         50
1978***********************************************                            47
1979******************************************                                 42
1980*******************************************                                43
1981************************************************                           48
1982**********************************************                             46
1983**********************************************                             46
1984********************************************                               44
1985***********************************************                            47
1986************************************************                           48
1987************************************************                           48
1988************************************************                           48
1989*********************************************                              45
1990*********************************************                              45
1991************************************************                           48
1992**********************************************                             46
1993**********************************************                             46
1994*********************************************                              45
1995*********************************************                              45
1996*******************************************                                43
1997*********************************************                              45
1998**********************************************                             46
1999*********************************************                              45
2000***********************************************                            47
2001*************************************************                          49
2002************************************************                           48
2003***************************************************                        51
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2004 51
2005 51
2006 48
2007 46
2008 48
2009 47
2010 47
2011 47
2012 43
2013 45
2014 43
2015 38