

Report of Cosmic-Ray Neutron Observations in 2014

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WDC for Cosmic Rays

Solar-Terrestrial Environment Laboratory

Nagoya University

World Data Center for Cosmic Rays

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READ_ME

(Starting Point of Data Access)

Data Coverage for Plots (PDF)

Data Coverage for Numerical Data (Longformat data)

Inquiry on the database should be
addressed to:

World Data Center for Cosmic Rays was established in 1957, as a part of the activity of the International Geophysical Year (IGY) , at the Institute of Physical and Chemical Research (RIKEN) to provide with database of cosmic-ray neutron observations in unified formats. The WDC was moved to the Solar-Terrestrial Environment Laboratory (STELAB), Nagoya University, in 1991, and data-management works for the WDC were performed through the collaboration between the STELAB and the Department of Environmental Sciences, Ibaraki University, since 1993. In July 2009, whole activities of the WDC have been moved to the STELAB.

This home page is temporally prepared to open our database in a limited manner. Our database includes world-wide cosmic-ray neutron observations (pressure-corrected 1 hour counts) since 1953. We have opened data in two formats; one is 4096-byte "longformat" data and the other one is 80-byte "cardformat" data. Since the "cardformat" data are prepared only for quick check of data, the "longformat" data, which include information for data usage (constant, factors, etc), should be used for research works. PS files (compressed) of yearly plots are also available.

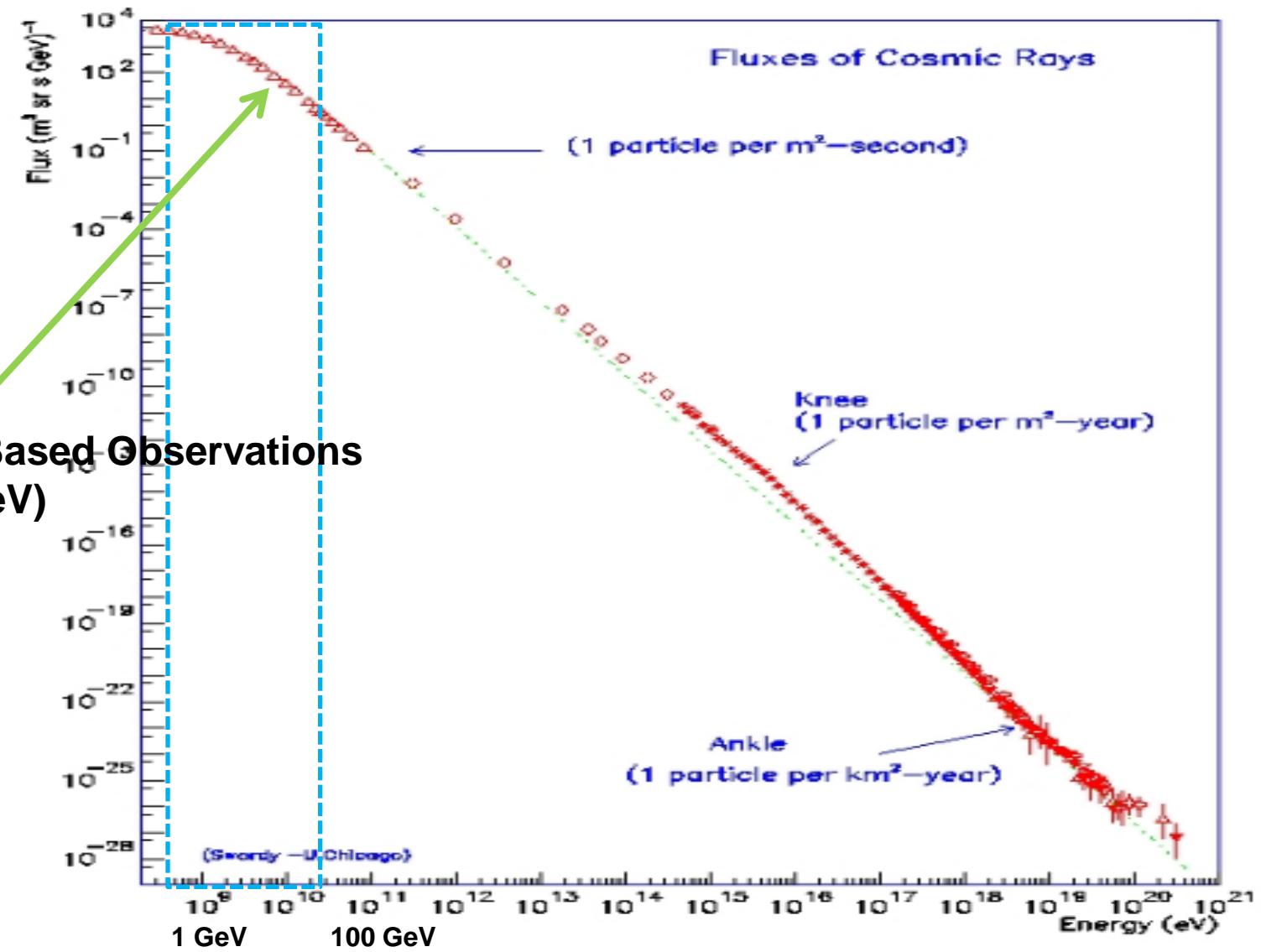
What's New



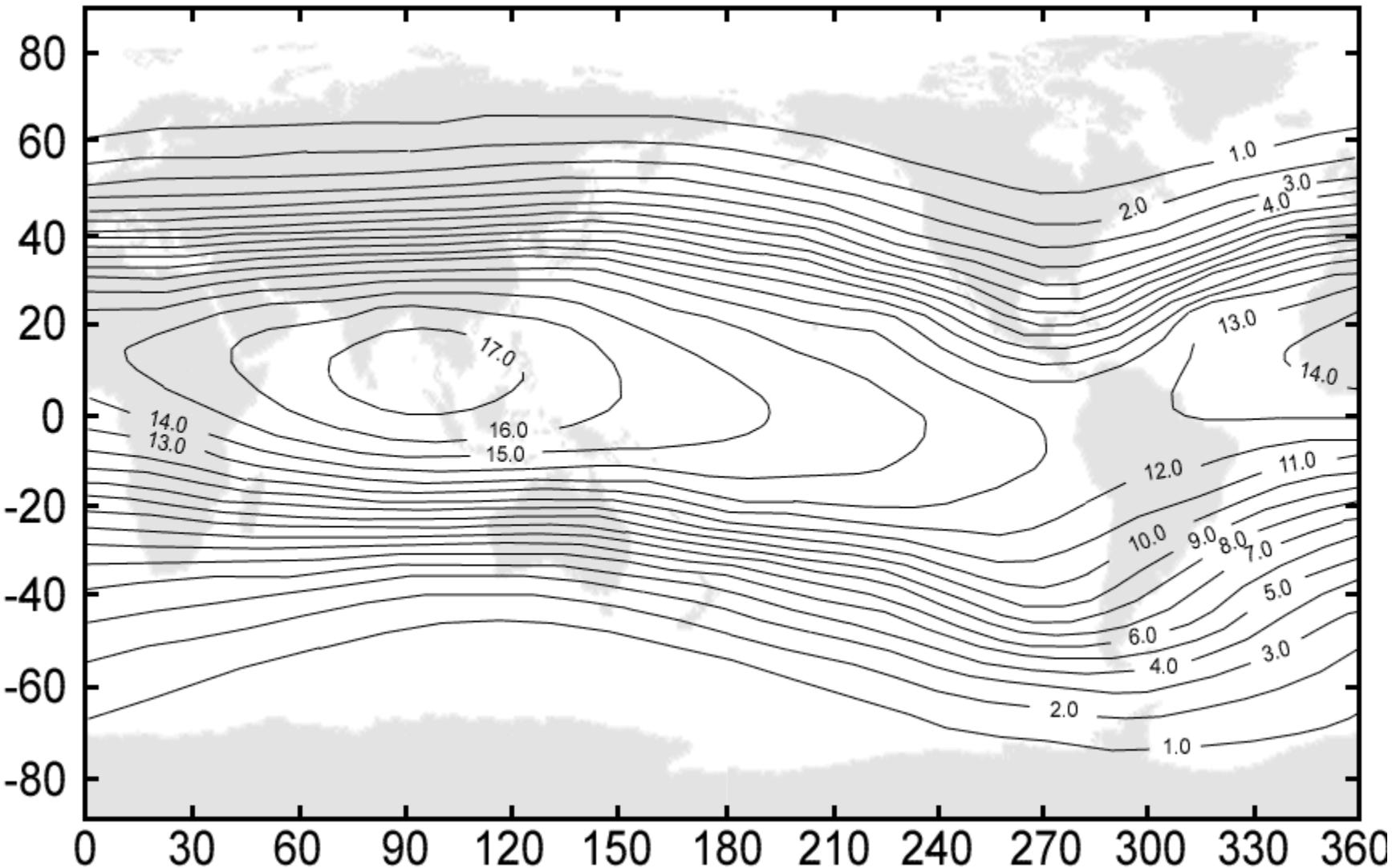
<http://center.stelab.nagoya-u.ac.jp/WDCCR/>

Cosmic-Ray Energy Spectrum

Ground-Based Observations
(1 – 20 GeV)

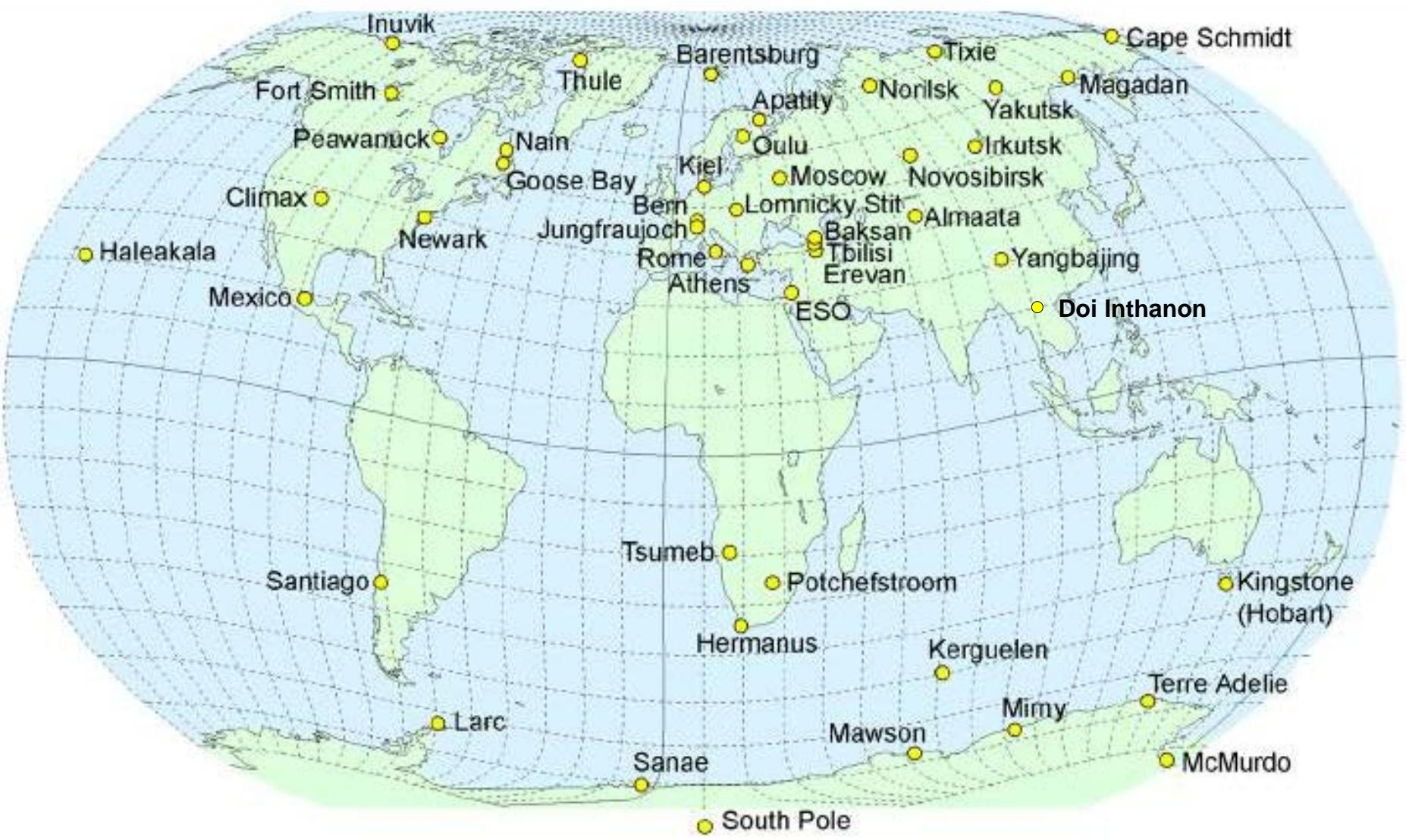


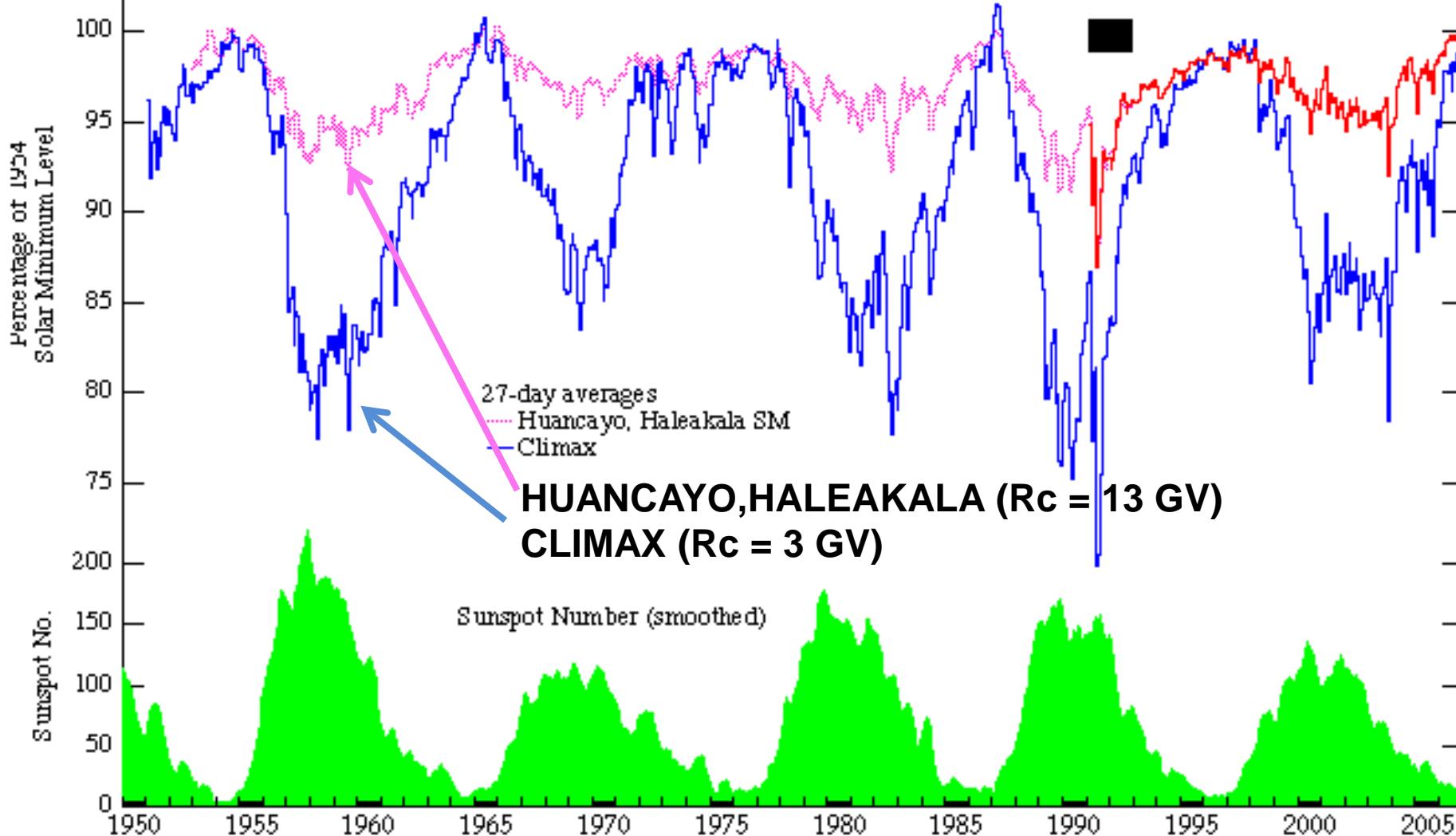
Vertical Cut-Off Rigidities (GV)



D. F. Smart and M. S. Shea, ICRC 2007
<http://dpnc.unige.ch/ams/ICRC-07/icrc0730.pdf>

Neutron Monitors (2010)





The Univ. of New Hampshire / Univ. of Chicago Neutron Monitors

Cosmic Ray Intensity (Bartels solar-rotation averages through SR 2364):

- | | |
|--------|---|
| >3 GV | — Climax, CO (IGY Monitor, 1951-present) |
| >13 GV | Huancayo, Peru (IGY Monitor, 1953-1992) |
| >13 GV | — Haleakala, HI (Supernmonitor, 1991-present) |
| | ■ Smoothed Int'l Sunspot Number (monthly) |

World Data Center for Cosmic Rays

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READ_ME

(Starting Point of Data Access)

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Data Coverage for Numerical Data (Longformat data)

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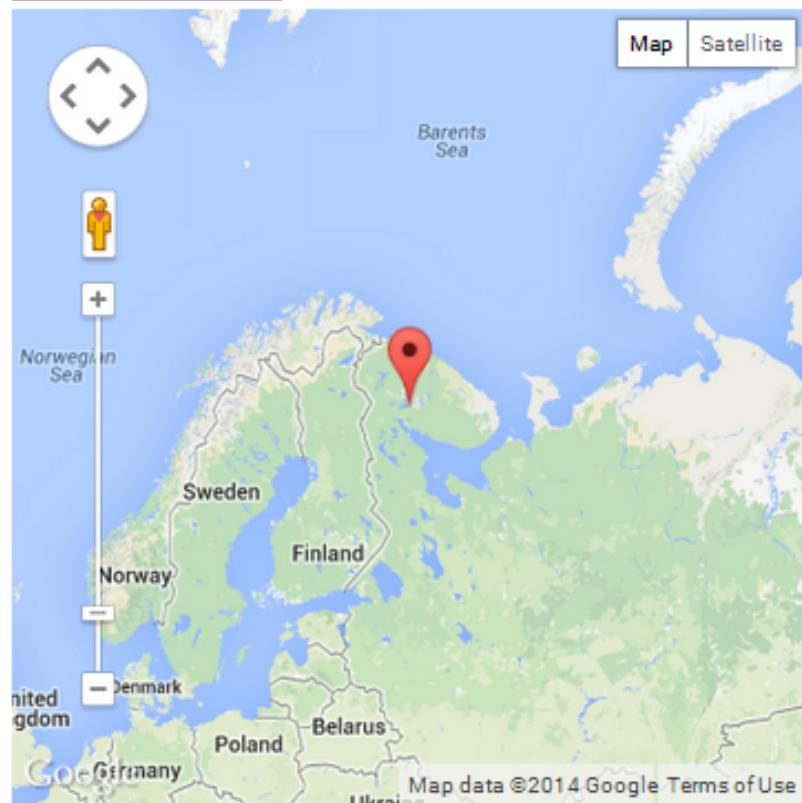
This home page is temporally prepared to open our database in a limited manner. Our database includes world-wide cosmic-ray neutron observations (pressure-corrected 1 hour counts) since 1953. We have opened data in two formats; one is 4096-byte "longformat" data and the other one is 80-byte "cardformat" data. Since the "cardformat" data are prepared only for quick check of data, the "longformat" data, which include information for data usage (constant, factors, etc), should be

Station Information

Station (click for details)	Abbreviation	Lat. (deg.)	Lon. (deg.)	Alt. (m)	Cutt-Off Rigidity (GV)	Monitor	Data Coverage (Click for data files)
Ahmedabad	AHMEDA	23.01	72.61	0	15.94	(until 68.07 IGY) 18NM64	1957-1958, 1964, 1968-1973
Albuquerque	ALBUQU	35.08	-106.62	1567	4.47	12IGY	1964-1965
Alert	ALERT	82.5	-62.33	57	0	18NM64	1965-1988
Alma_A	ALMA_A	43.25	76.92	806	6.61	(until 76.07 IGY) 6NM64	1957-1959, 1962-1998
Alma_B	ALMA_B	43.25	76.92	3340	6.61	18NM64	1973-1995, 1998-
Apatity	APATIT	67.55	33.33	177	0.57	18NM64 (until 68.09 IGY)	1961-
Athens	ATHENS	37.98	23.78	260	8.53	6 NM64	1973-1978, 2001-
Bagnères	BAGNER	43.01	0.02	550	5.45	3NM64	1971
Baksan	BAKSAN	43.28	42.69	1700	5.6	6 NM64	2003-
Barentsburg	BARENT	78.06	14.22	51	0	18 NM64	2003-
Beijing	BEIJIN	39.08	116.26	48	10	18 NM64	1984-2010
Beirut	BEIRUT	33.9	35.47	15	10.42	12IGY	1959
Berkeley	BERKEL	37.87	-122.27	70	4.54	12IGY	1957-1959
Brisbane	BRISBA	-27.43	153.08	0	7.21	12IGY	1969-1973
Buenos Aires	RI IFNOS	-34.6	-58.48	0	10.63	18IGY	1957-1966

Station 'Apatity' Information

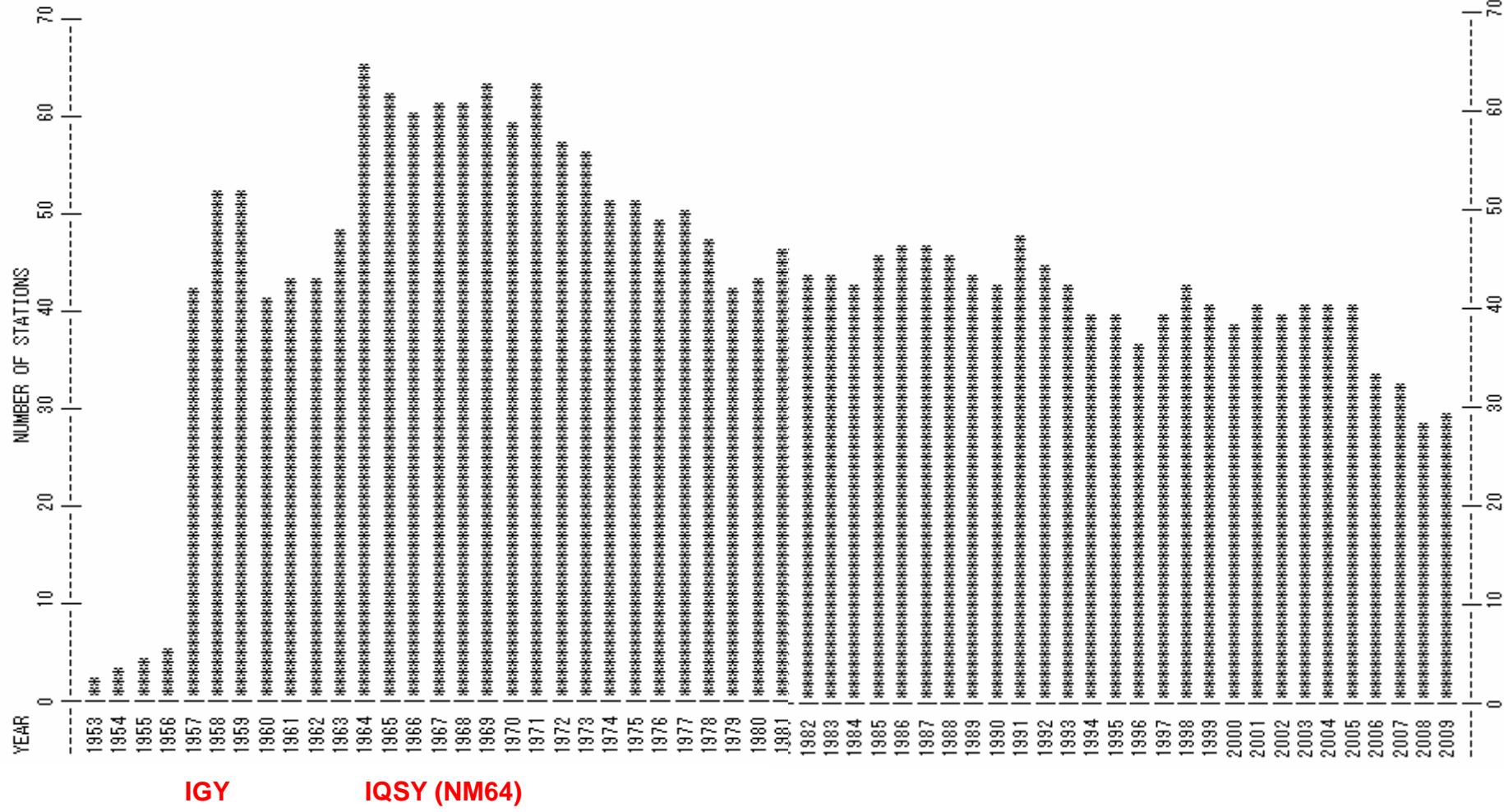
[Back to Station List](#)



Station	Apatity
Abbreviation	APATIT
Monitor	18NM64 (until 68.09 IGY)
Latitude (deg.)	67.55
Longitude (deg.)	33.33
Altitude (m)	177
Cutt-Off Rigidity(GV)	0.57
Data Coverage	1961-
Station name	Polar Geophysical Institute, Apatity
Affiliation	Polar Geophysical Institute, Kola Science Center, Russian Academy of Sciences (PGI KSC RAS)
Country	Russia
Location	Apatity
Data site	
Station Website	http://pgia.ru/CosmicRay/
Affiliation Website	
Memo	

Appendix 2: Yearly Number of Data Sets Held by the WDC-C2

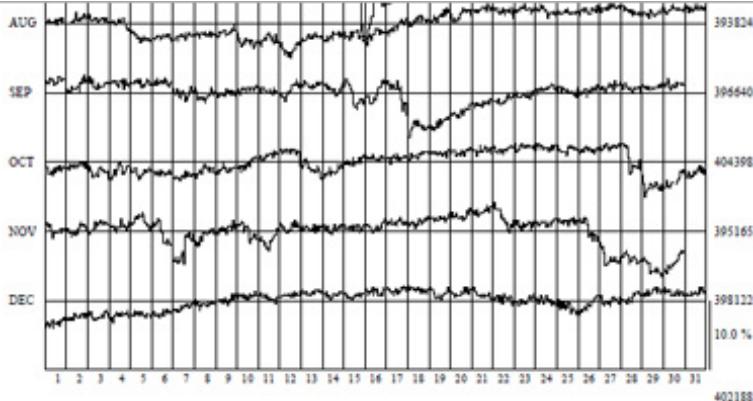
Annual Number of Datasets held by the WDC



Data Coverage for Plots (PDF files)

Data Coverage

*:full coverage + :partial coverage



(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 80-byte "CARDFORMAT" is a simplified format without information on data usage. 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 because LONGFORMAT data are not convenient to manage on a screen. 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, CARDFORMAT, 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.

(1) LONGFORMAT

4096-Byte Monthly Data (longformat)

JUNGFRIGYPCSA109 2 46.55 7.983570.00 4.49 100.0 0.0 0.0 6023.3 JUNGFRAUJOCH (IGY),
SWITZERLAND, PHYSIKALISCHES INSTITUT,UNIVERSITAT BERN 18 IGY NEUTRON MONITOR Corrected to
482mmHg Standard Pressure, Coef=-0.96%/mmHg Snow fall: Days 7–8, 22–23 Snow removed from monitor: Day 8,
23 Detailes are given in <http://cosray.unibe.ch/> 100810 5999 6016 6041 6036 6043 6063 6061
6058 6080 6087 6077 6070 6059 6054 6081 6067 6065 6046 6043 6028 6012 6011 6008 5977 5987 5981 5929 5971
5953 5954 5921 5891 5895 5907 5914 5919 5921 5928 5957 6007 5998 5964 5947 5934 5967 6008 6007 6025 5984
6015 6025 6026 6062 6048 6081 6056 6055 6073 6068 6071 6051 6054 6047 6070 6085 6070 6051 6062 6052 6065
6074 6074 6067 6074 6051 6032 6028 6020 6039 6032 6054 6049 6058 6065 6068 6072 6091 6115 6135 6141 6125
6092 6067 6072 6027 6034 6063 6040 6052 6040 6014 6040 6010 6050 6029 6045 6086 6099 6076 6069 6044 6046
6070 6044 6042 6018 6009 6039 6070 6052 6023 6013 6030 6036 6025 6018 5993 6039 6046 6050 6044 6054 6044
6023 6029 6033 6012 6010 5972 5982 6006 6018 6039 6031 6032 6033 6029 6061 6065 6045 6049 6049 6085 6076
6075 6065 6079 6067 6076 6087 6082 6054 6037 6024 6025 6050 6022 6031 6026 6027 6033 6040 6044 6048 6055
6074 6068 6073 6106 6076 6060 6051 6074 6050 6038 6047 6048 6040 6048 6047 6024 6023 6027 6031 5994 6008
5995 5982 5989 5994 6003 6009 6031 6011 6004 6037 6009 5985 6027 6009 5976 6011 6030 6016 6005 5998 6031
6018 6032 6015 6002 6040 6030 6020 6034 6013 6017 6017 6043 6032 6035 6050 6034 6025 6017 6019 5994 6020
6000 5992 6004 6002 6037 6008 5988 6007 6015 6021 6022 6025 6041 6051 6060 6053 6035 6046 6027 6017 6048
6037 6025 6020 6020 6029 6021 6017 6019 6024 6041 6034 6038 6047 6058 6071 6050 6056 6071 6050 6062 6037
6032 6068 6055 6071 6045 6075 6037 6036 6010 5991 6007 6004 6005 6047 6066 6060 6044 6028 6045 6066 6052
6049 6057 6078 6055 6069 6080 6050 6048 6068 6032 6044 6031 6037 6020 6033 6014 6014 6056 6067 6067 6088
6079 6076 6097 6109 6090 6123 6124 6053 6049 6039 6024 6046 6047 6031 6023 6028 6023 6026 6031 6045 6064
6060 6064 6070 6045 6055 6055 6090 6060 6087 6051 6071 6050 6052 6030 6036 6025 6035 6030 6036 6018 6022
6036 6051 6039 6025 6029 6024 6048 6025 6040 6025 6007 6019 6036 6002 6057 6027 6025 6011 6033 6028 6006
5977 5983 5978 5990 5985 6014 5989 6000 6009 6007 6017 6001 5982 5970 5982 5972 5978 5961 5958 5996 5959
5921 5946 5995 5985 6013 6000 6010 6052 6022 6035 6067 6074 6086 6057 6067 6063 6072 6075 6071 6069 6092
6056 6075 6067 6046 6038 6042 6020 6049 6032 6046 6043 6065 6068 6083 6073 6069 6072 6051 6049 6066 6061
6062 6074 6080 6053 6059 6062 6051 6044 6036 6055 6037 6027 6015 6021 6031 6039 6026 6041 6028 6017 6020
6023 6032 6022 5996 6006 6025 6016 6021 6020 6017 6001 6014 6008 6044 6027 6043 6073 6064 6077 6081 6079
6087 6082 6057 6043 6039 6069 6052 6031 6015 6015 5985 6012 6006 5992 5954 5965 5963 5918 5912 5921 5966
5966 5953 5966 6005 5975 5956 5965 5950 5930 5926 5914 5938 5956 5961 5929 5938 5929 5918 5916 5923 5952

bytes	format	notes
1-6	A6	First six characters of 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
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
371-376	3I2	Date of revision (YYMMDD)
377-4096	744I5	Hourly data (24 x 31=744). 99999: no data

Short format

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: CLIMAX
Station: CLIMAX USA, ENRICO FERMI INST., UNIVERSITY OF CHICAGO, CHICAGO, USA
Instrument: IGY NEUTRON MONITOR, CORRECTED FOR PRESSURE
Latitude (deg.): 39.37 Longitude (deg.): -106.18 Altitude (m): 3400.00
Cut-Off Rigidity (GV): 2.97
Year: 2000 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

Monthly Average: 3854.8

Updated (YYYY MM DD): 2001 07 05

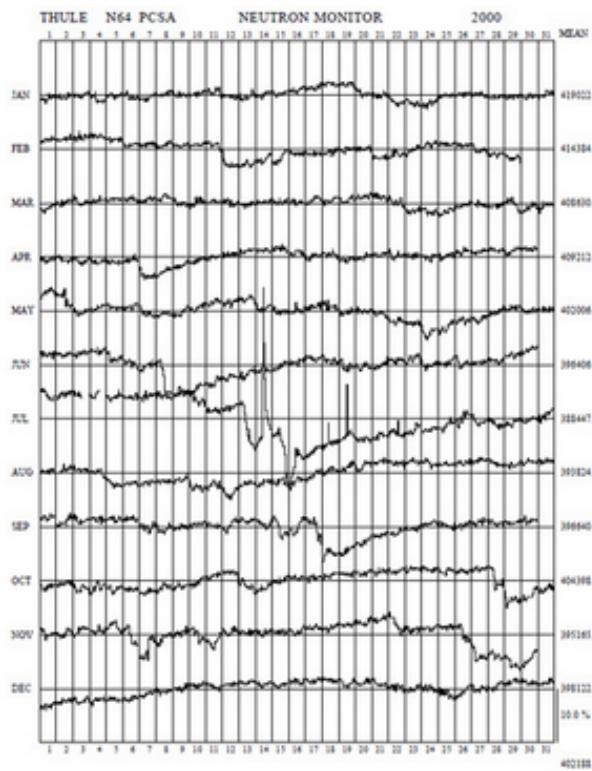
ID YYYY MM DD 1 0 1 2 3 4 5 6 7 8 9 10 11
ID YYYY MM DD 2 12 13 14 15 16 17 18 19 20 21 22 23

CLIMAX 2000 01 01 1 3870 3883 3875 3884 3869 3876 3866 3871 3865 3857 3856 3855
CLIMAX 2000 01 01 2 3851 3869 3874 3867 3876 3867 3868 3915 3895 3886 3882 3885
CLIMAX 2000 01 02 1 3880 3860 3874 3871 3871 3859 3833 3833 3838 3848 3844 3847
CLIMAX 2000 01 02 2 3846 3863 3857 3853 3861 3859 3871 3893 3897 3887 3884 3877
CLIMAX 2000 01 03 1 3883 3867 3871 3877 3861 3847 3855 3844 3864 3855 3855 3872
CLIMAX 2000 01 03 2 3866 3867 3861 3857 3867 3870 3870 3873 3865 3866 3872 3879
CLIMAX 2000 01 04 1 3848 3860 3846 3851 3843 3831 3845 3832 3846 3828 3823 3796
CLIMAX 2000 01 04 2 3834 3816 3820 3827 3831 3831 3814 3806 3811 3836 3823 3830
CLIMAX 2000 01 05 1 3834 3845 3857 3837 3868 3864 3841 3850 3854 3856 3862 3845
CLIMAX 2000 01 05 2 3849 3854 3836 3845 3854 3861 3857 3869 3858 3853 3842 3837



(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.

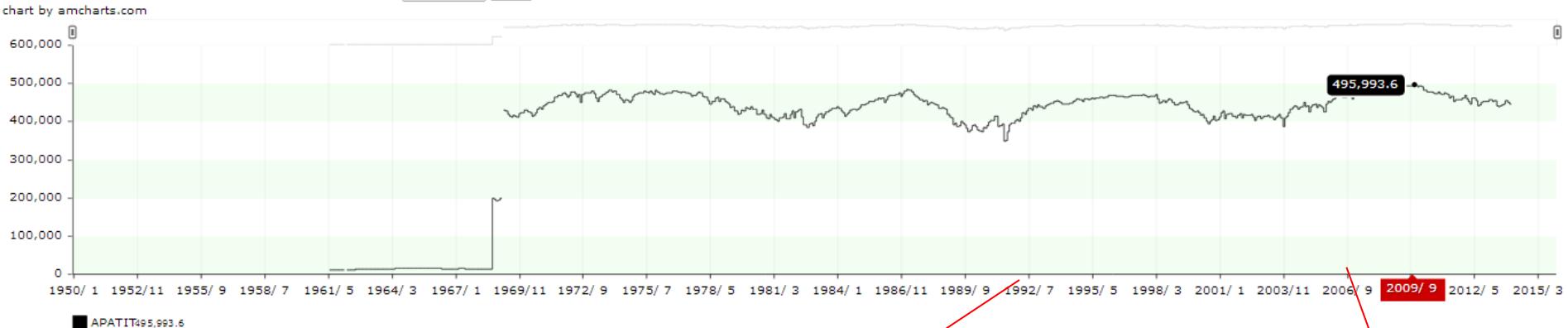


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[Return to Table of Data Coverage](#)**Data plots of full data coverage**

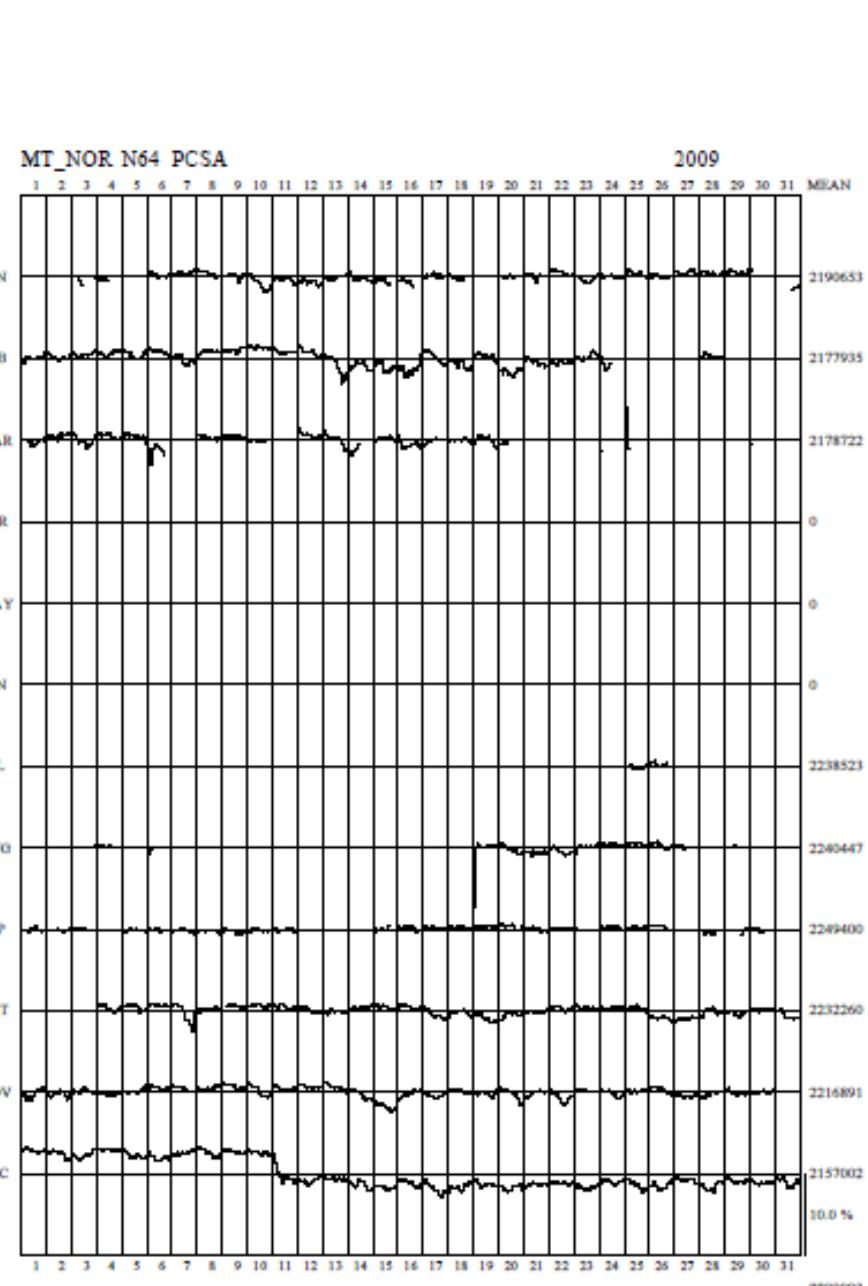
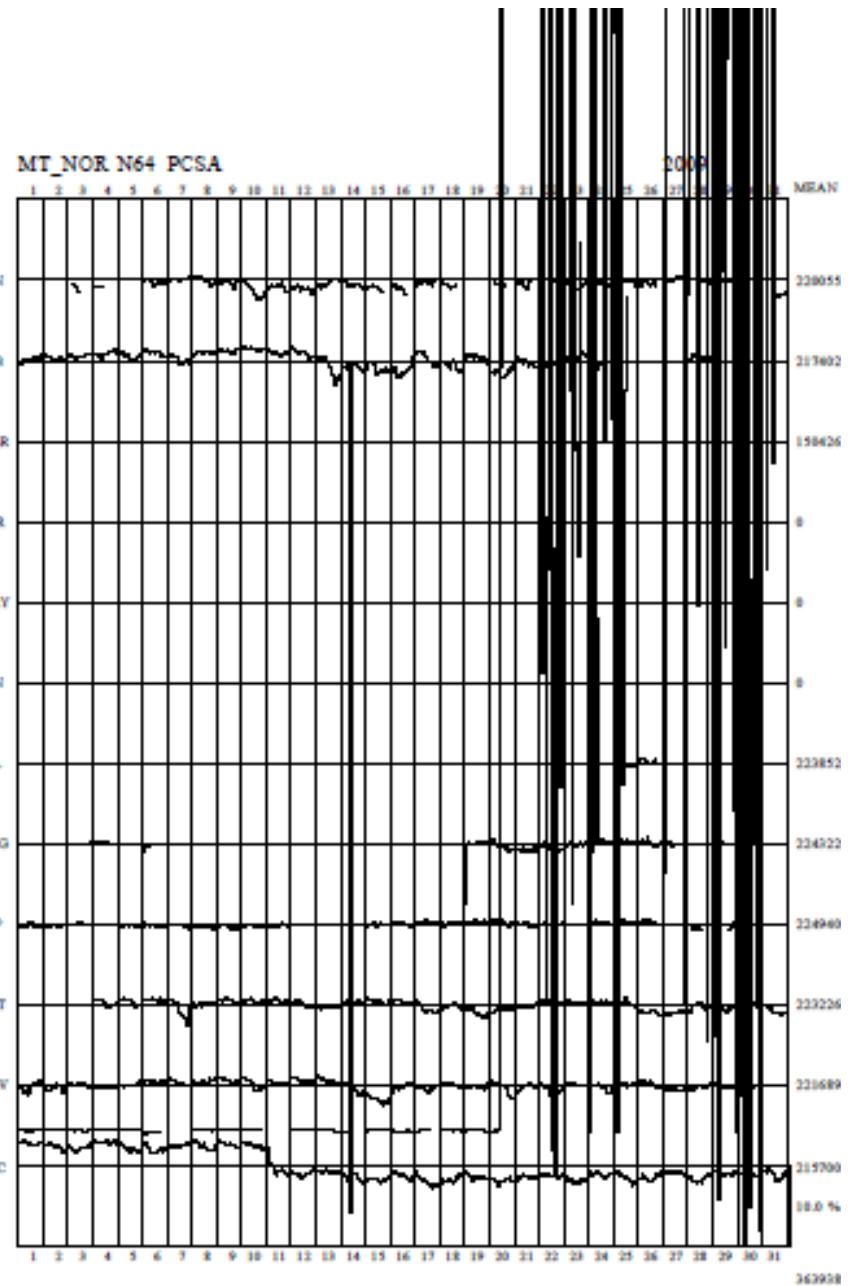
Select Station

 [Return to Table of Data Coverage](#)**Data plots of full data coverage**

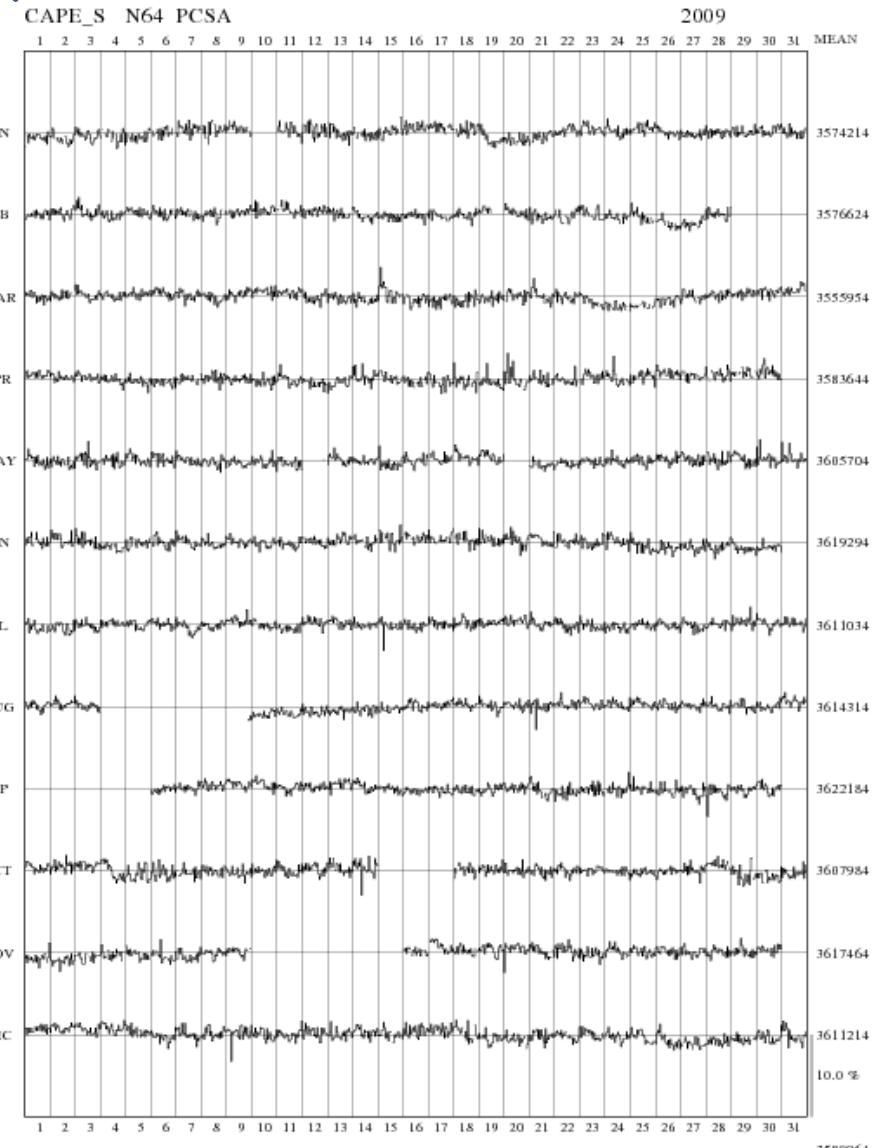
Select Station

Removal of wrong data



Removal of wrong data ($> 3\sigma$)



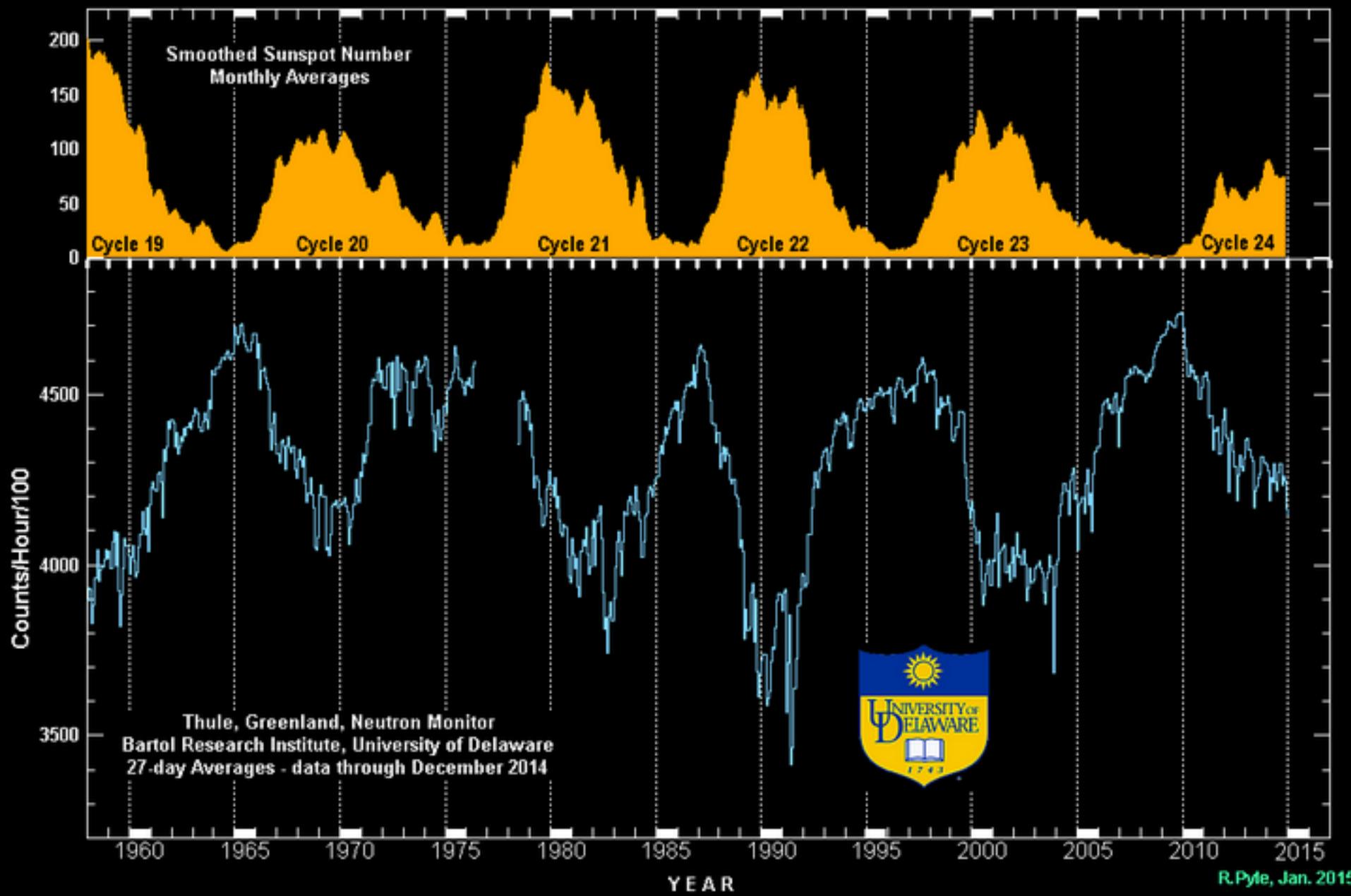
Examples of Wrong Data

Mixture of wrong data



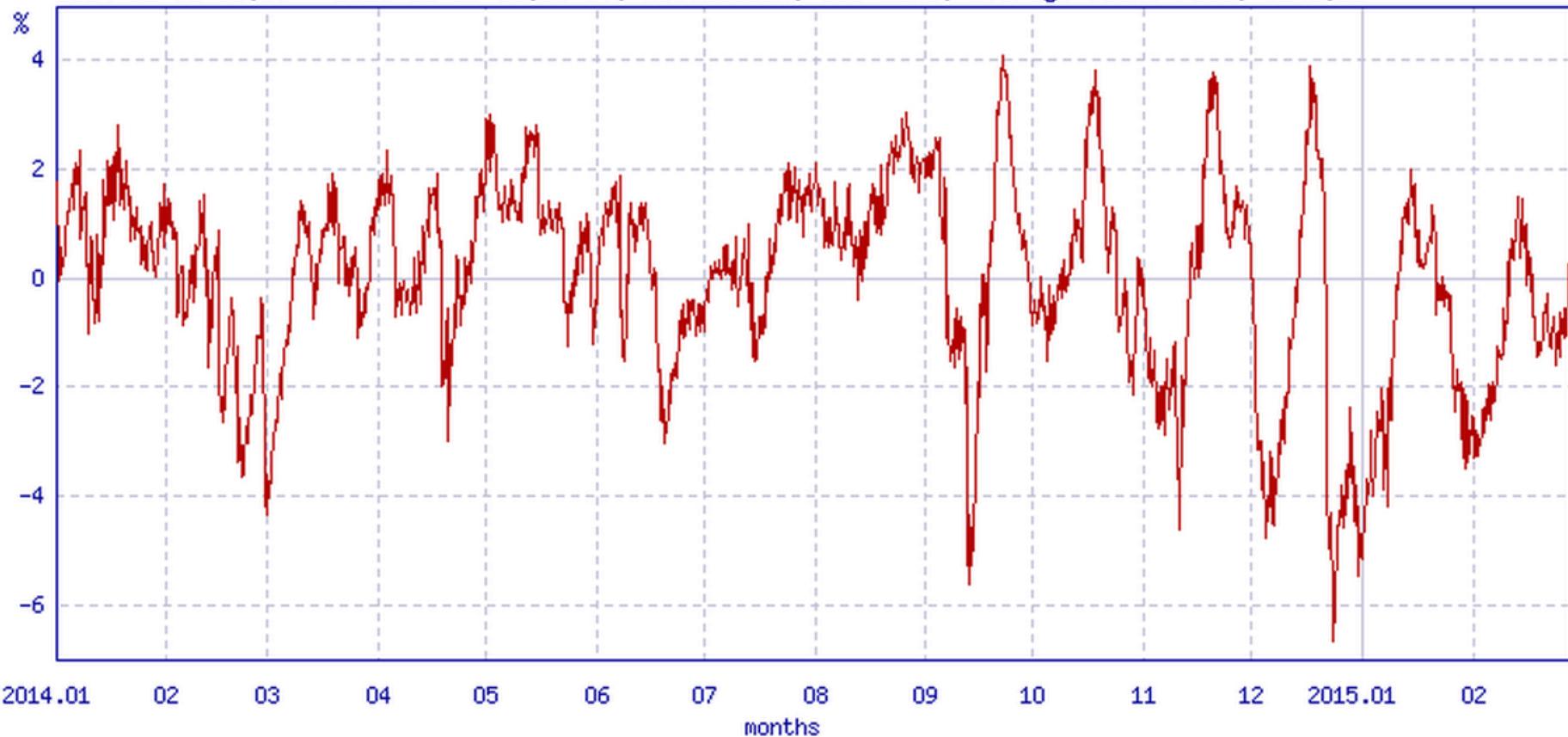
Data of wrong months





Oulu Neutron Monitor Cutt-Off Rigidity (GV) 0.78

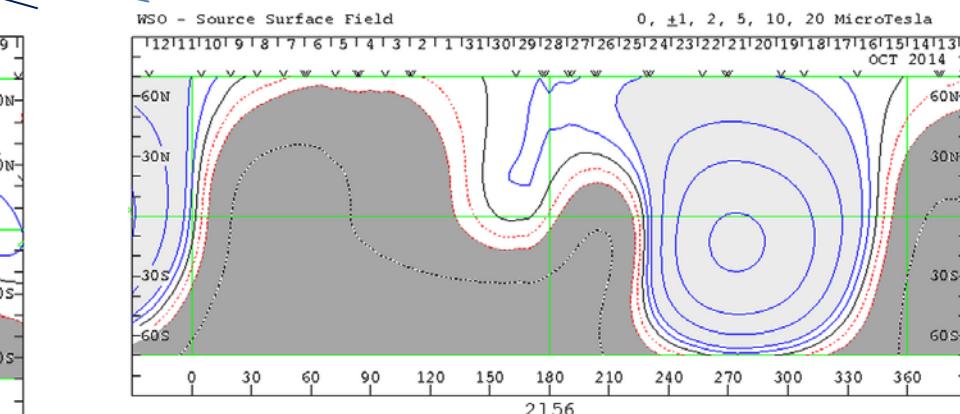
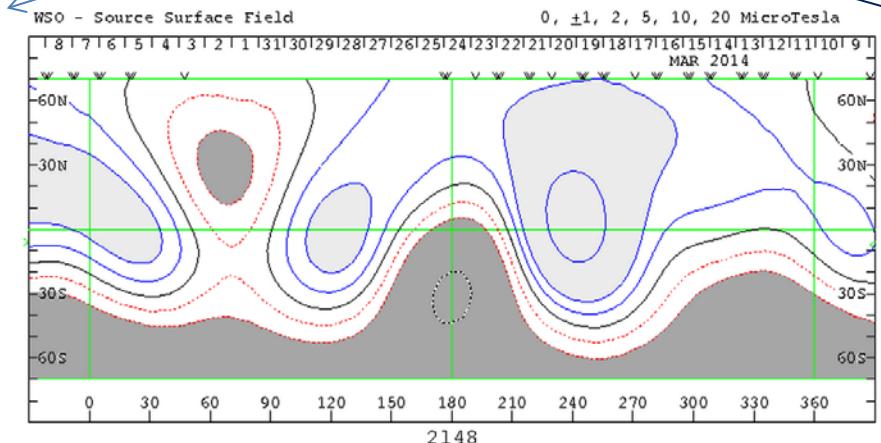
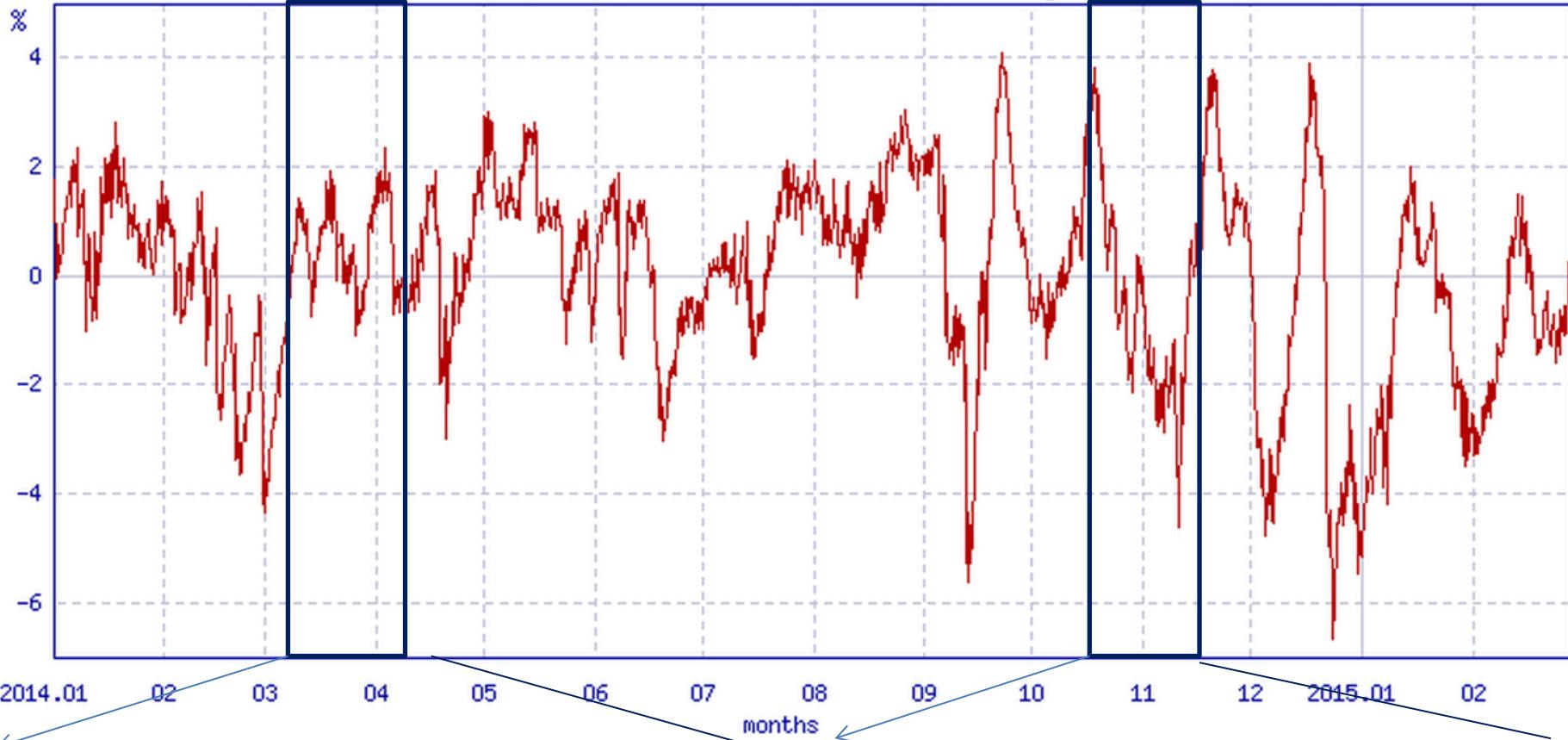
2014-01-01 00:00 - 2015-02-28 00:00 UT. Resolution: 360 mins. Average count rate: 6142.12

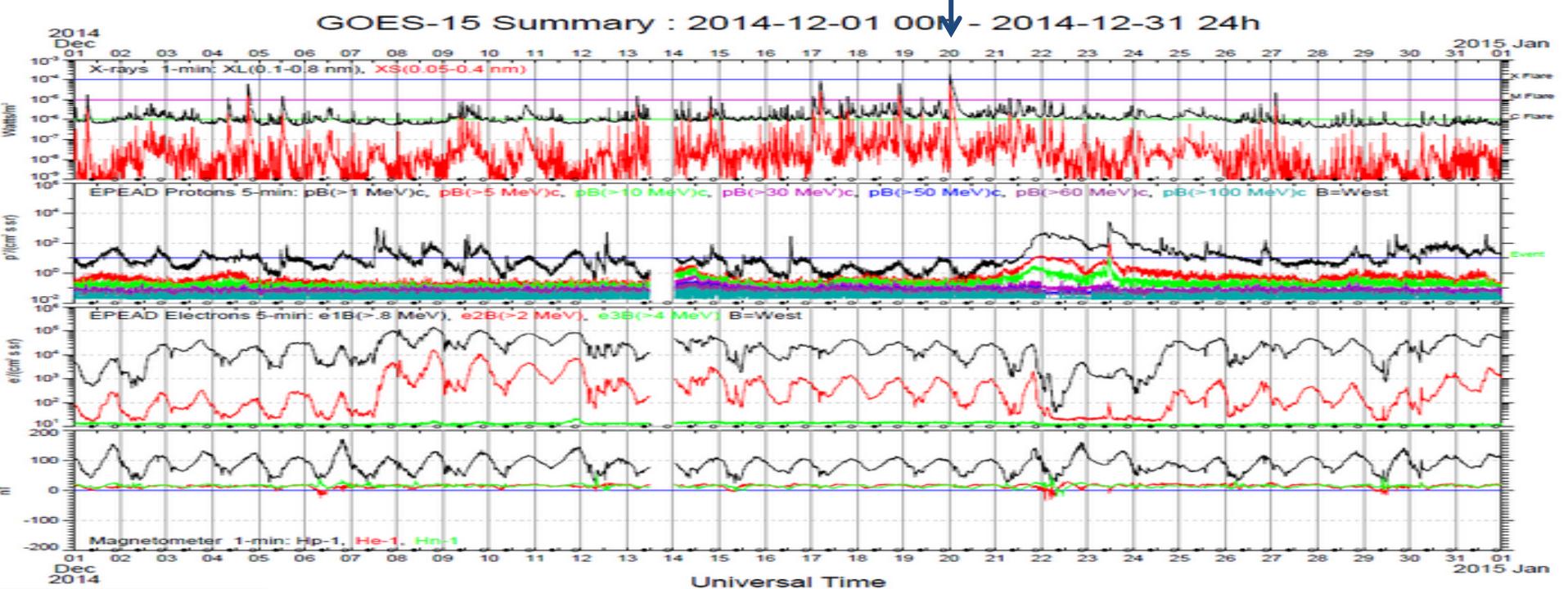
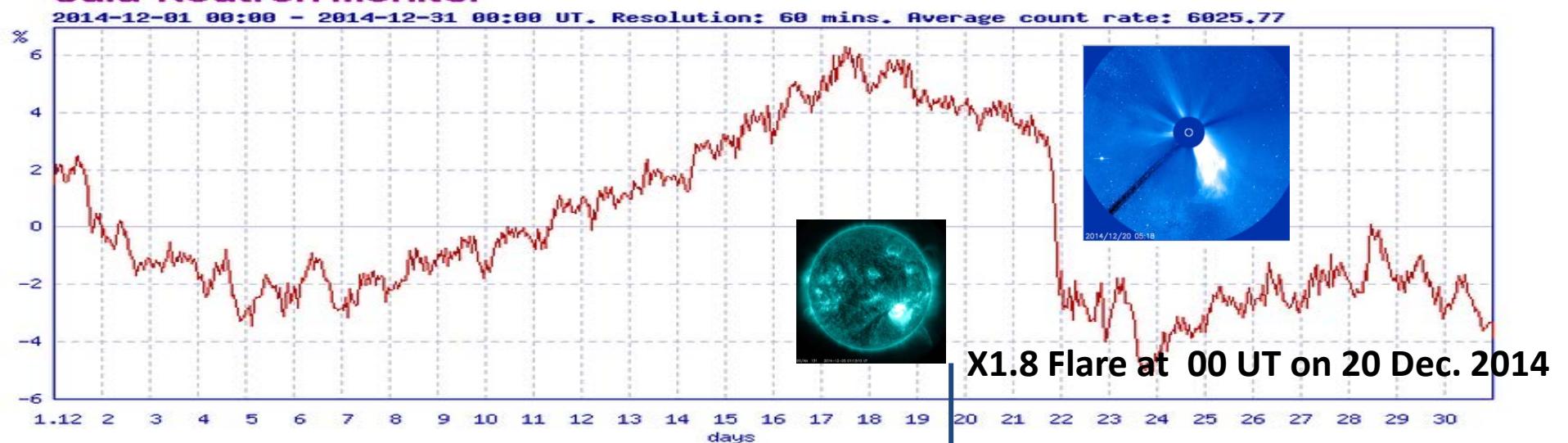


JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR
2014 2015

Oulu Neutron Monitor

2014-01-01 00:00 - 2015-02-28 00:00 UT. Resolution: 360 mins. Average count rate: 6142.12



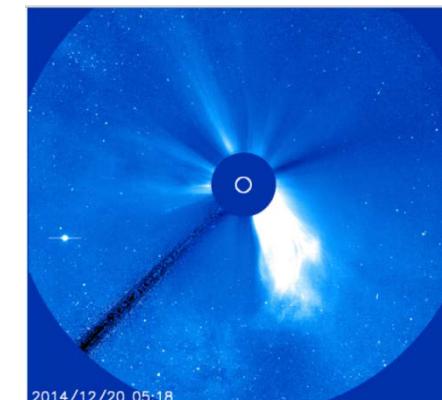
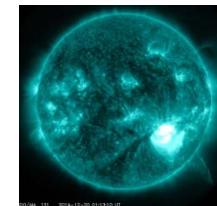


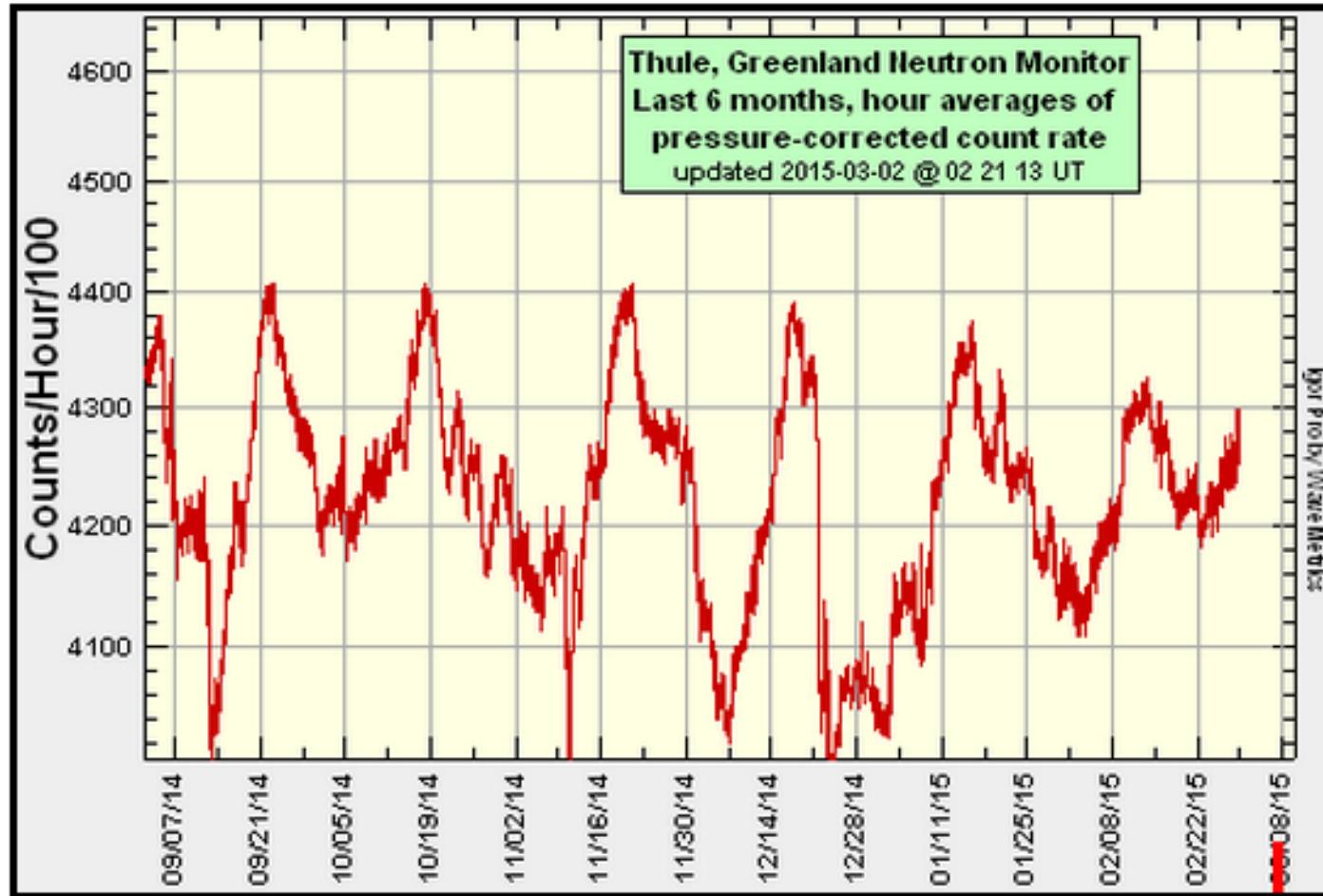
Oulu Neutron Monitor

2014-10-01 00:00 - 2015-02-28 23:00 UT. Resolution: 120 mins. Average count rate: 6096.8



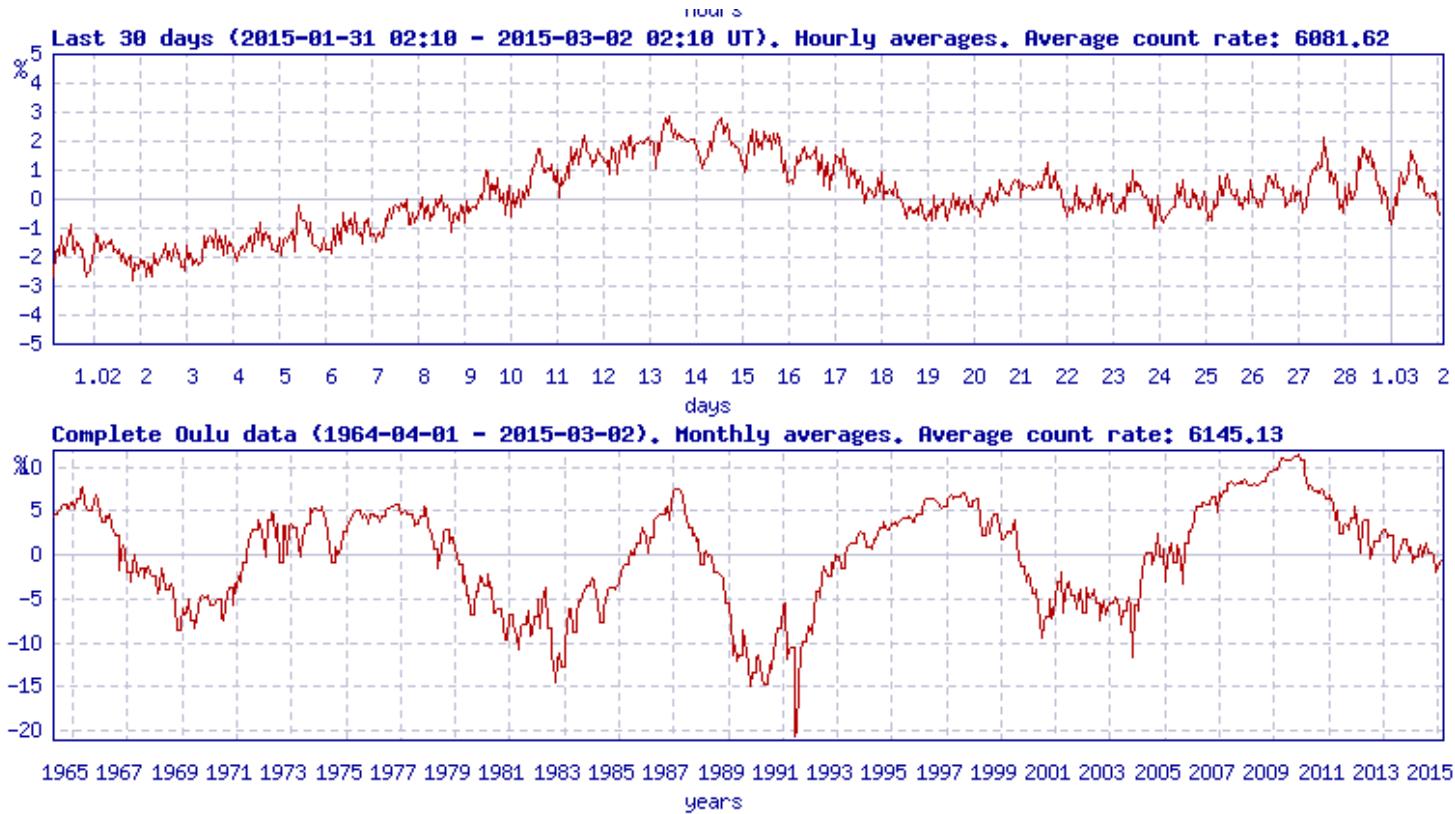
X1.8 Flare at 00 UT on 20 Dec. 2014





The Thule neutron monitor is supported by the University of Delaware and the Bartol Research Institute





Real-time Oulu NM count rate, updated every five minutes. Data for the last 24-hr is **PRELIMINARY**

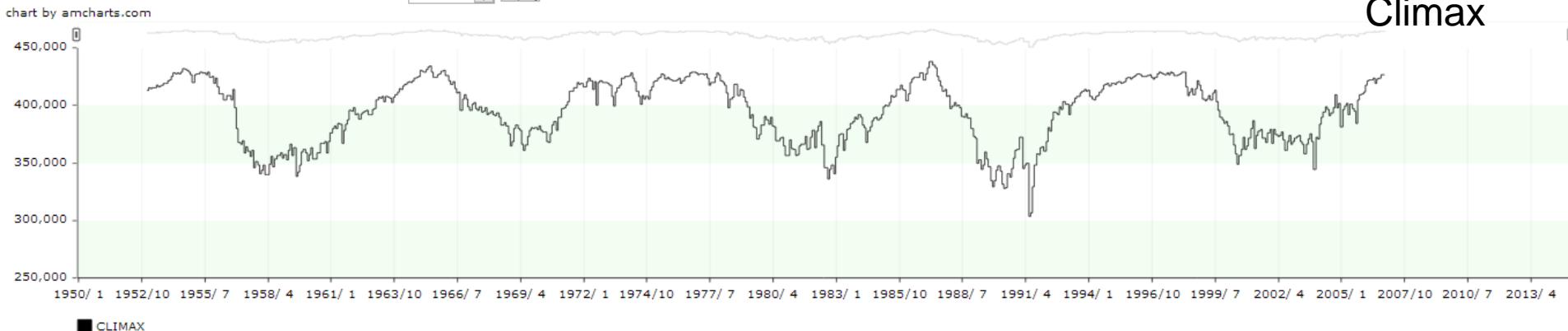
[Return to Table of Data Coverage](#)

Data plots of full data coverage

Select Station

CLIMAX

Climax



CLIMAX

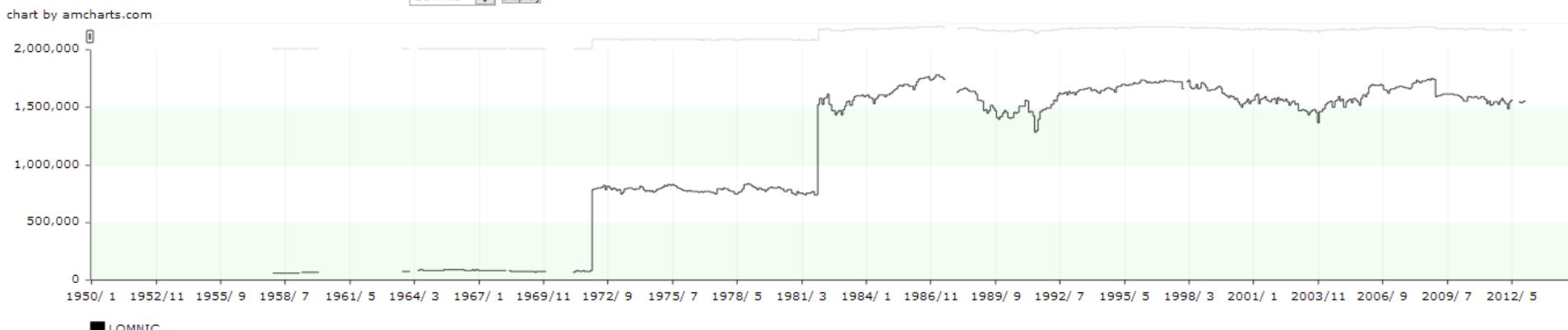
World Data Center for Cosmic Rays, Solar-Terrestrial Environment Laboratory, Nagoya University
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Lomnický

Data plots of full data coverage

Select Station

LOMNIC 

LOMNIC

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Data Coverage for Numerical Data (Long-format files)

Data Coverage

*:full coverage+partial coverage

長期間宇宙線データの解析における注意点

- 観測装置の変化(モニターの形式・本数の変更、経年変化等)
- 気圧補正アルゴリズムの変更
- 観測環境の変化(積雪、風など)
- 地磁気(+太陽圏磁場)の長短期変化(Rcに影響)

The NM count rate in the database is normalized to the count rate before 1985 so that

$$I_{\text{normalised}} = I_{\text{measured}} * F_C$$

where F_C is the efficiency correction factor (see below).

Period	F_C	Reason
01/1964 – 30/09/1985	1.00000	
01/10/1985 – 31/12/1994	1.00674	New automatic digital barometer
01/01/1995 – 31/12/1999	1.01147	New data collecting system
01/01/2000 – 31/05/2003	1.00914	replacement of section A high voltage system
01/06/2003 – 31/07/2008;	1.00813	adjustment of section A high voltage system
01/08/2008 – 31/10/2009;	1.0029	New data registration system
since 01/11/2009 ;	1.0019	Change of the station environment (Muon detector is installed)

Oulu におけるNormalization Factor (Fc) の変化

/pub/WDCCR/YEARLY/ のインデックス

名前	サイズ	更新日
[親ディレクトリ]		
CARDFORMAT/		14/02/06 2:36:00
LONGFORMAT/		14/02/06 2:48:00
PDFPLOT/		14/02/06 2:59:00
PSPLT/		14/02/06 3:12:00

/pub/WDCCR/YEARLY/LONGFORMAT/ のインデックス

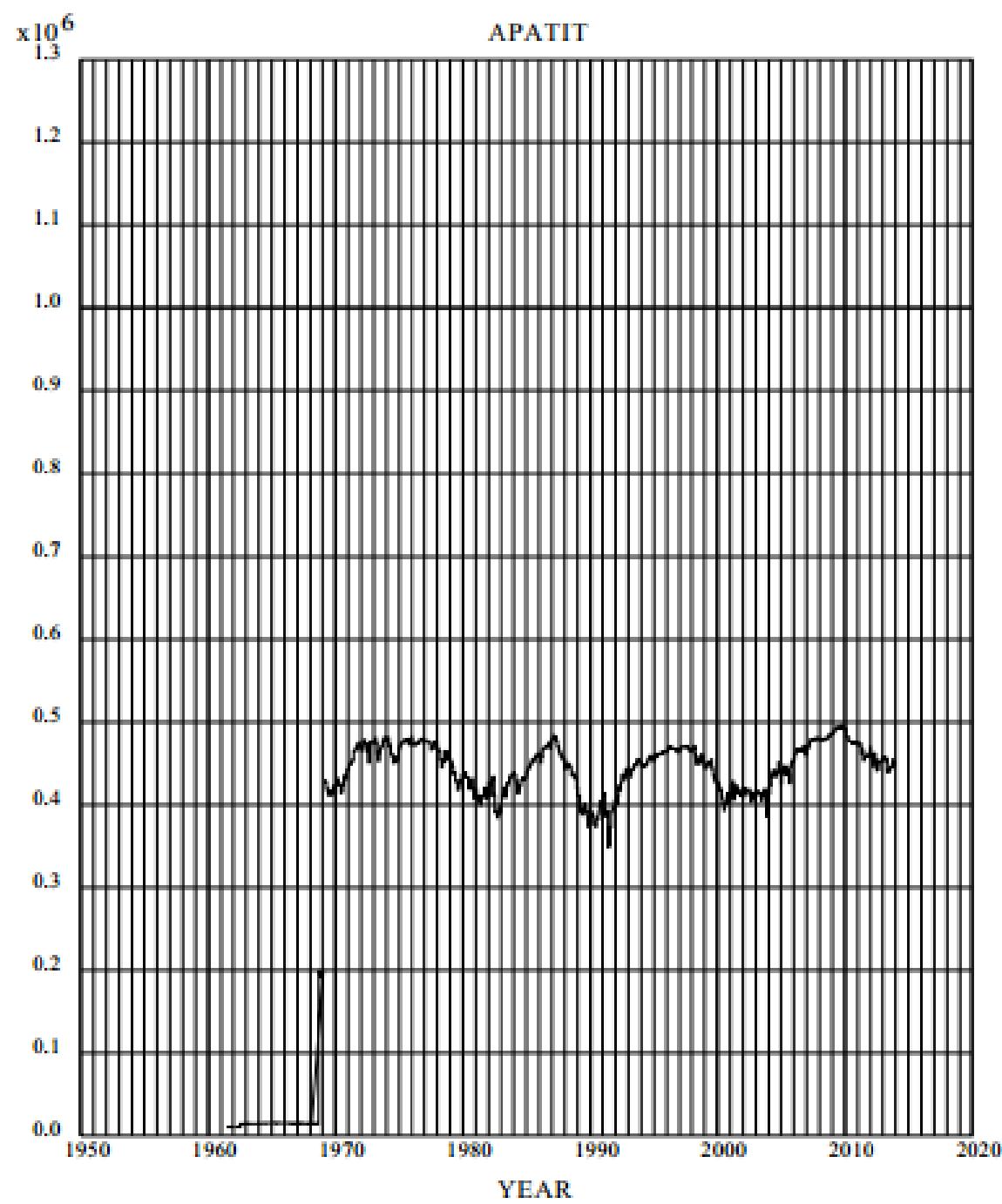
名前	サイズ	更新日
[親ディレクトリ]		
L1953/		14/02/06 2:36:00
L1954/		14/02/06 2:36:00
L1955/		14/02/06 2:36:00
L1956/		14/02/06 2:36:00
L1957/		14/02/06 2:36:00
L1958/		14/02/06 2:37:00
L1959/		14/02/06 2:37:00
L1960/		14/02/06 2:37:00

/pub/WDCCR/YEARLY/LONGFORMAT/L1964/ のインデックス

名前	サイズ	更新日
[親ディレクトリ]		
L_AHMEDA_1964.txt	24.0 kB	13/09/17 6:12:00
L_ALBUQU_1964.txt	44.0 kB	13/09/17 6:12:00
L_ALMA_A_1964.txt	48.0 kB	14/01/22 1:47:00
L_APATIT_1964.txt	48.0 kB	14/01/22 1:47:00
L_BUENOS_1964.txt	48.0 kB	13/09/17 6:12:00
L_CALGAR_1964.txt	48.0 kB	13/09/17 6:12:00
L_CHICAG_1964.txt	48.0 kB	13/09/17 6:12:00
L_CHURCH_1964.txt	48.0 kB	13/09/17 6:12:00
L_CLIMAX_1964.txt	48.0 kB	13/09/17 6:12:00
L_COLLEG_1964.txt	48.0 kB	13/09/17 6:12:00
L_CORDOB_1964.txt	24.0 kB	13/09/17 6:12:00
L_DALLAS_1964.txt	42.0 kB	13/09/17 6:12:00

/pub/WDCCR/STATIONS/APATIT/ のインデックス

名前	サイズ	更新日
親ディレクトリ		
APATIT.all.pdf	8.2 kB	14/01/22 15:00
CARDFORMAT/		14/02/06 3:20:00
LONGFORMAT/		14/02/06 3:20:00
L_all.txt	2.5 MB	14/01/22 15:00
OLD/		14/02/06 3:20:00

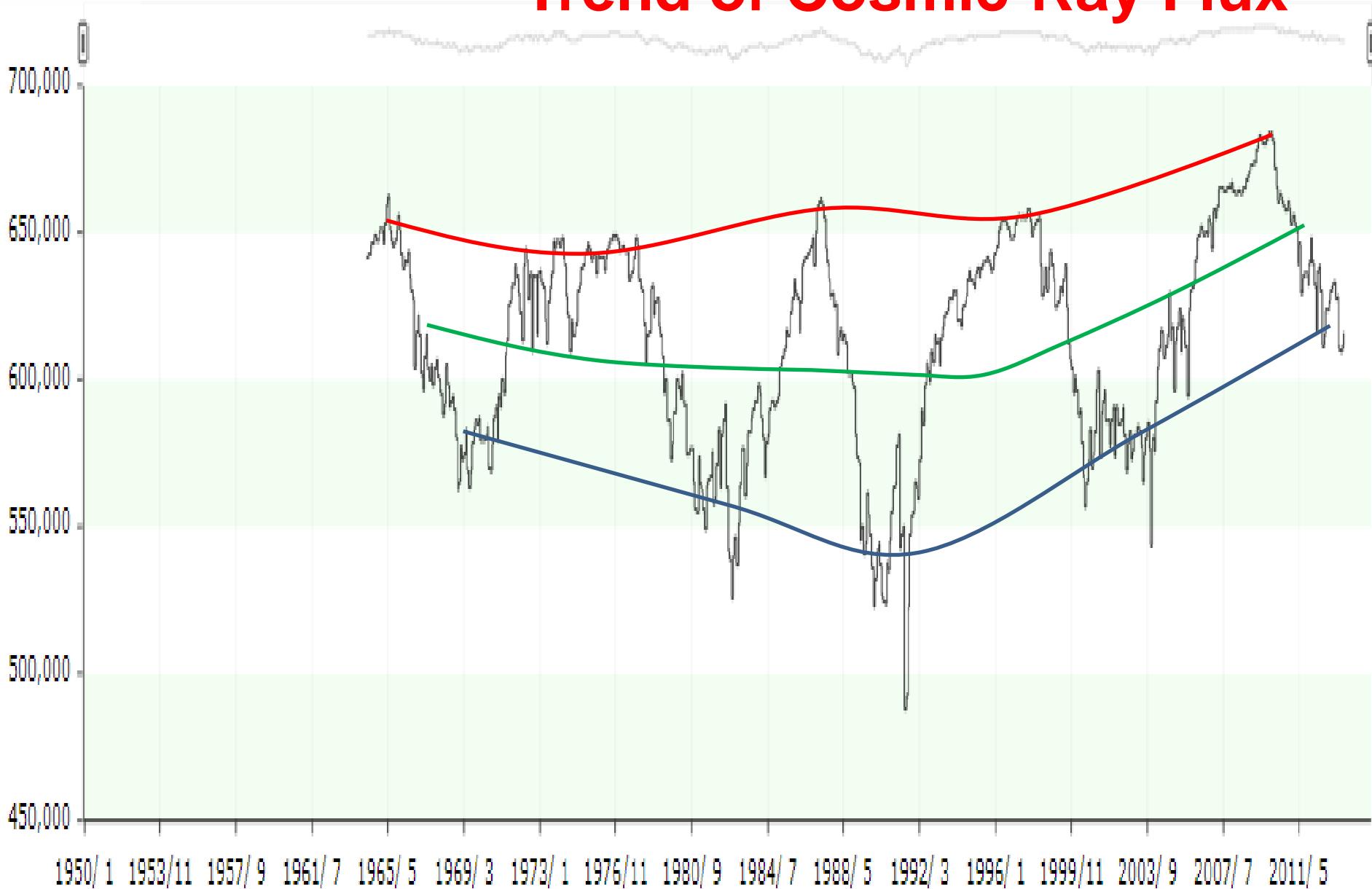


OU LU Display

chart by amcharts.com

Rc=0.78 GV

Long-term Increasing Trend of Cosmic-Ray Flux



ALMA_B N64 PCSA

2013

