

**Space Weather Highlights**  
**22 March – 28 March 2010**

**SWO PRF 1804**  
30 March 2010

Solar activity began the week at very low levels but increased to low levels on 26-27 March and returned to very low levels on 28 March. The increase in activity on 26-27 March consisted of five impulsive, low-level C-class flares, all originating from Region 1057 (N15, L=322, class/area Eki/410 on 28 March). Region 1057 emerged on the disk on 23 March and grew steadily during the remainder of the week.

No proton events were observed at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit was at normal background levels.

The geomagnetic field began the period at quiet levels. An increase to quiet to unsettled levels was observed on 24 March. Mostly quiet levels predominated for 25-26 March, although there were some isolated unsettled to active periods at a few high latitude sites. Quiet levels prevailed for 27 March, followed by quiet to unsettled levels with some isolated active periods on 28 March. Real-time solar wind observations from the ACE spacecraft showed the onset of a co-rotating interaction region at about 1000 UTC on 25 March, followed by a weak high-speed stream beginning at about 1500 UTC on 25 March. Solar wind velocity remained elevated through the remainder of the week with typical speeds between 380-460 km/s.

**Space Weather Outlook**  
**31 March – 26 April 2010**

Solar activity is expected to be very low with possible isolated periods of low levels during the forecast period. There is a slight chance for an isolated M-class event during the remainder of the disk passage of Region 1057 from 31 March-05 April.

No proton events are expected at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at normal levels through most of the period. However, moderate to high flux levels are possible during 08-11 April and 14-16 April.

The geomagnetic field is expected to be predominantly quiet for 31 March – 06 April. An increase to unsettled levels with a chance for isolated active periods is possible on 07-08 April due to a recurrent high-speed stream. Quiet conditions are expected to prevail for the remainder of the interval from 09-26 April.



### Daily Solar Data

Date	Radio	Sun	Sunspot	X-ray	Flares							
	Flux	spot	Area	Background	X-ray Flux			Optical				
	10.7 cm	No.	(10 <sup>-6</sup> hemi.)		C	M	X	S	1	2	3	4
22 March	82	17	10	A3.1	0	0	0	0	0	0	0	0
23 March	84	26	20	A5.2	0	0	0	0	0	0	0	0
24 March	84	14	250	A4.8	0	0	0	0	0	0	0	0
25 March	86	25	400	A6.0	0	0	0	1	0	0	0	0
26 March	88	27	320	A4.7	1	0	0	0	0	0	0	0
27 March	88	30	500	A6.5	4	0	0	2	0	0	0	0
28 March	86	33	510	A4.5	0	0	0	1	0	0	0	0

### Daily Particle Data

Date	Proton Fluence (protons/cm <sup>2</sup> -day-sr)			Electron Fluence (electrons/cm <sup>2</sup> -day-sr)		
	>1 MeV	>10 MeV	>100 MeV	>.6 MeV	>2MeV	>4 MeV
22 March	5.9e+05	1.9e+04	4.0e+03		4.0e+06	
23 March	6.9e+05	1.9e+04	4.4e+03		4.4e+06	
24 March	7.3e+05	1.9e+04	4.5e+03		3.0e+06	
25 March	7.8e+05	1.8e+04	4.2e+03		4.8e+05	
26 March	3.0e+05	1.8e+04	4.1e+03		9.3e+04	
27 March	3.8e+05	1.8e+04	4.0e+03		1.7e+05	
28 March	4.7e+05	1.8e+04	4.2e+03		8.0e+04	

### Daily Geomagnetic Data

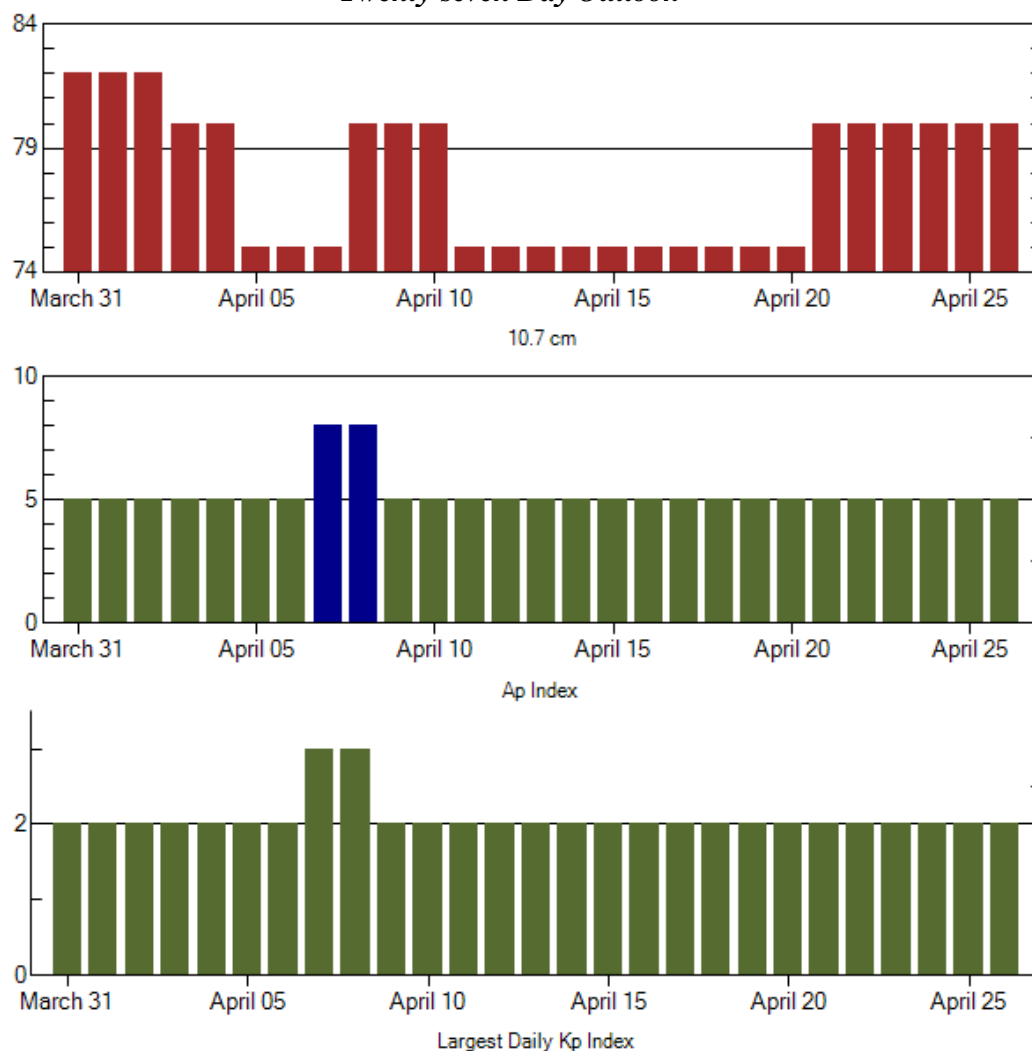
Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
22 March	0	0-0-0-0-0-1-0-0	1	0-0-0-0-0-0-0-2	2	0-0-0-0-0-1-1-1
23 March	0	0-0-0-0-1-0-0-0	0	0-0-0-0-0-0-0-0	2	0-0-0-0-1-1-1-1
24 March	2	0-0-0-0-2-1-0-1	4	0-0-0-0-3-3-0-0	3	0-0-0-0-2-2-0-2
25 March	4	1-2-0-1-2-1-2-1	2	0-0-0-0-1-1-2-0	5	1-1-0-1-2-2-2-1
26 March	2	0-1-1-0-1-0-0-2	8	0-0-2-2-5-0-0-1	4	0-1-1-0-2-0-0-2
27 March	1	1-2-0-0-0-0-0-0	1	1-2-0-0-0-0-0-0	3	2-2-0-0-1-1-1-1
28 March	4	0-3-2-1-1-1-1-0	12	0-3-4-3-4-2-1-0	7	0-3-2-2-2-2-1-1

### Alerts and Warnings Issued

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UTC
25 Mar 0154	ALERT: Type II Radio Emission	25 Mar 0128
28 Mar 0537	ALERT: Geomagnetic K = 4	28 Mar 0536



### Twenty-seven Day Outlook



Date	Radio Flux 10.7 cm	Planetary A Index	Largest Kp Index	Date	Radio Flux 10.7 cm	Planetary A Index	Largest Kp Index
31 Mar	82	5	2	14 Apr	75	5	2
01 Apr	82	5	2	15	75	5	2
02	82	5	2	16	75	5	2
03	80	5	2	17	75	5	2
04	80	5	2	18	75	5	2
05	75	5	2	19	75	5	2
06	75	5	2	20	75	5	2
07	75	8	3	21	80	5	2
08	80	8	3	22	80	5	2
09	80	5	2	23	80	5	2
10	80	5	2	24	80	5	2
11	75	5	2	25	80	5	2
12	75	5	2	26	80	5	2
13	75	5	2				



### ***Energetic Events***

Date	Time		X-ray		Optical Information			Peak		Sweep Freq	
	$\frac{1}{2}$		Integ		Imp/	Location	Rgn	Radio Flux		Intensity	
	Begin	Max	Max	Class	Brtns	Lat CMD	#	245	2695	II	IV

*No Events Observed*

### ***Flare List***

Date	Time			Optical			Rgn
	Begin	Max	End	X-ray Class.	Imp / Brtns	Location Lat CMD	

22 March	0009	0012	0014	B1.0			
	0139	0144	0148	B1.3			
	0410	0413	0419	B1.0			
	1607	1610	1613	B1.0			
23 March	0859	0910	0917	B2.5			
	1444	1447	1449	B2.5			
	1858	1921	2000	B5.9			
	2258	2301	2303	B2.7			
24 March	1326	1330	1334	B1.3			
	1355	1358	1401	B1.4			
	1431	1434	1441	B1.8			
	1609	1614	1619	B1.8			
25 March	0752	0755	0758	B1.2			
	1053	1106	1116	B3.2			
	1409	1416	1427	B3.6	SF	N16E49	1057
	1432	1437	1443	B6.0			
	1500	1504	1509	B4.5			
	0351	0433	0455	B7.3			
	2239	2244	2247	B1.7			
26 March	0214	0223	0241	B3.0			
	1904	1922	1934	B1.3			
	2108	2116	2119	C2.5			
	2234	2238	2242	B2.0			
27 March	2334	2338	2341	B3.1			
	0008	0011	0015	B2.1			
	0140	0143	0147	B1.7			
	0149	0152	0154	B2.6			
	0434	0437	0441	B2.1			
	0512	0515	0518	C1.2			
	0756	0756	0810	C2.0	SF	N15E27	1057
	0940	0943	0946	B2.4			
	1005	1014	1018	C1.5			
	1217	1221	1224	B3.1			
	1303	1314	1322	B1.8			
	1826	1828	1838	C3.8	SF	N14E22	1057



### Flare List - continued

Date	Time			X-ray Class.	Imp / Brtns	Optical	
	Begin	Max	End			Location Lat CMD	Rgn
28 March	0124	0128	0132	B1.4			
	0327	0334	0339	B3.8			
	0539	0544	0548	B4.0			
	0936	0936	0942	B3.3	SF	N16E12	1057
	1047	1053	1058	B2.8			
	1139	1146	1154	B2.4			

### Region Summary

Date	Location		Sunspot Characteristics					Flares							
	(° Lat ° CMD)	Helio	Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical				
		Lon						C	M	X	S	1	2	3	4
<i>Region 1056</i>															
17 Mar	N17E47	64	20	5	CRO	4	B								
18 Mar	N18E34	64	50	6	CRO	5	B								
19 Mar	N18E22	63	10	2	BXO	3	B								
20 Mar	N18E07	65	30	4	CRO	4	B					1			
21 Mar	N18W06	65	70	7	CSI	15	B					2			
22 Mar	N19W21	67	10	8	BXO	7	B								
23 Mar	N18W34	66	10	7	BXO	3	B								
24 Mar	N17W50	69	10	3	BXO	2	B								
25 Mar	N17W63	69													
26 Mar	N17W76	69													
27 Mar	N17W89	69													

#### Region 1056

17 Mar	N17E47	64	20	5	CRO	4	B								
18 Mar	N18E34	64	50	6	CRO	5	B								
19 Mar	N18E22	63	10	2	BXO	3	B								
20 Mar	N18E07	65	30	4	CRO	4	B				1				
21 Mar	N18W06	65	70	7	CSI	15	B				2				
22 Mar	N19W21	67	10	8	BXO	7	B								
23 Mar	N18W34	66	10	7	BXO	3	B								
24 Mar	N17W50	69	10	3	BXO	2	B								
25 Mar	N17W63	69													
26 Mar	N17W76	69													
27 Mar	N17W89	69													

0 0 0 3 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 65

#### Region 1057

23 Mar	N16E73	319	10	7	BXO	3	B								
24 Mar	N16E57	322	240	6	DAC	5	BG								
25 Mar	N15E45	321	400	7	DHC	4	B				1				
26 Mar	N15E30	323	320	8	DKI	6	B	1							
27 Mar	N15E16	324	380	8	DHI	9	B	4			2				
28 Mar	N15E04	322	410	11	EKI	12	B				1				

5 0 0 4 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 322



## Region Summary - continued

Date	Location		Sunspot Characteristics					Flares						
	(° Lat ° CMD)	Helio	Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical			
		Lon						C	M	X	S	1	2	3
<i>Region 1058</i>														
25 Mar	N27W06	12	0	1	AXX	1	A							
26 Mar	N25W21	14	0	1	AXX	1	A							
27 Mar	N25W34	14												
28 Mar	N25W47	14												

### Region 1058

25 Mar	N27W06	12	0	1	AXX	1	A								
26 Mar	N25W21	14	0	1	AXX	1	A								
27 Mar	N25W34	14													
28 Mar	N25W47	14													

0 0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 12

### Region 1059

27 Mar	S21E73	267	120	2	HSX	1	A								
28 Mar	S22E61	265	100	2	HAX	1	A								

0 0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 265



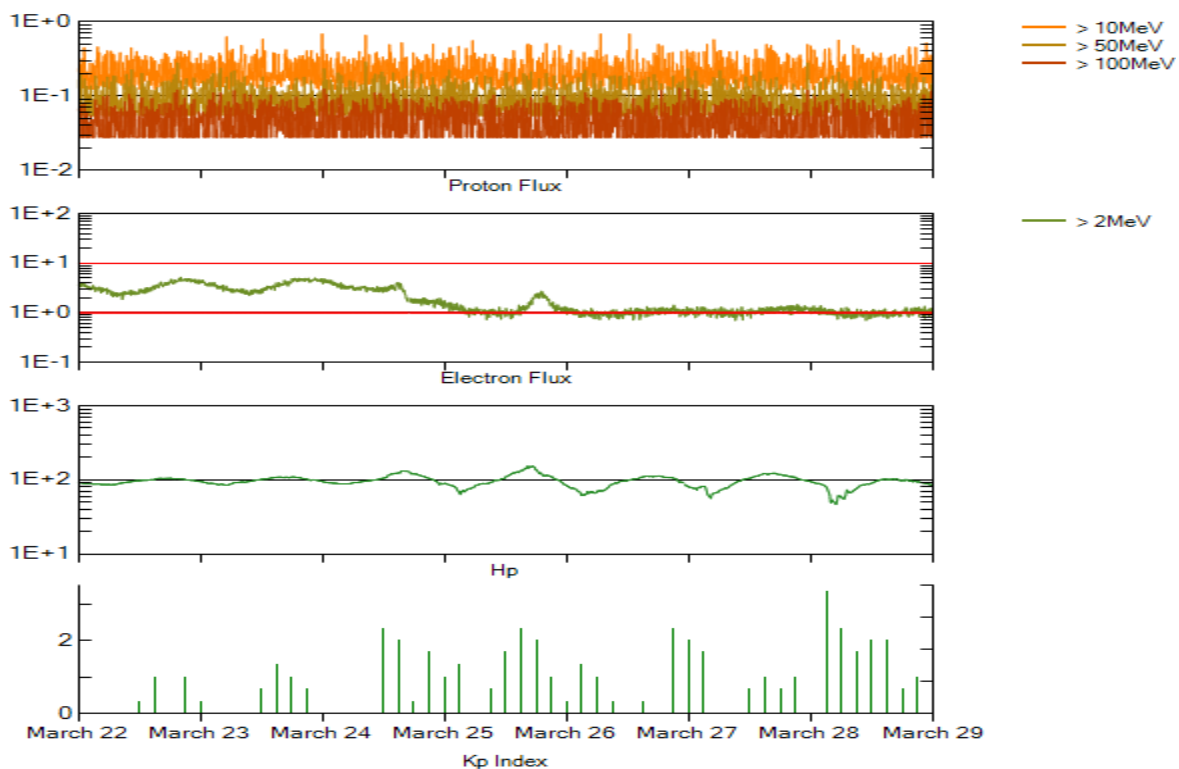
**Recent Solar Indices (preliminary)**  
**Of the observed monthly mean values**

Month	by the observed monthly mean values					Radio Flux		Geomagnetic	
	Sunspot Numbers								
	Observed values	Ratio		Smooth values		*Penticton	Smooth	Planetary	Smooth
	SEC	RI	RI/SEC	SEC	RI	10.7 cm	Value	Ap	Value
2008									
March	15.9	9.3	0.58	5.3	3.3	72.9	69.8	11	7.5
April	4.9	2.9	0.59	5.3	3.4	70.2	69.8	9	7.3
May	5.7	3.2	0.56	5.7	3.5	68.4	69.8	6	7.2
June	4.2	3.4	0.81	5.2	3.3	65.9	69.4	7	7.0
July	1.0	0.8	0.80	4.5	2.8	65.7	68.8	5	6.8
August	0.0	0.5	**	4.4	2.7	66.3	68.6	5	6.3
September	1.5	1.1	0.73	3.7	2.3	67.1	68.4	6	5.8
October	5.2	2.9	0.56	2.9	1.8	68.3	68.2	7	5.4
November	6.8	4.1	0.60	2.7	1.7	68.6	68.3	4	5.1
December	1.3	0.8	0.62	2.7	1.7	69.2	68.5	4	4.9
2009									
January	2.8	1.3	0.46	3.0	1.8	69.8	68.7	4	4.7
February	2.5	1.4	0.56	3.1	1.9	70.0	68.8	5	4.7
March	0.7	0.7	1.00	3.4	2.0	69.2	69.0	5	4.6
April	1.2	0.8	1.00	3.7	2.2	69.7	69.3	4	4.3
May	3.9	2.9	0.74	3.8	2.3	70.5	69.7	4	4.1
June	6.6	2.9	0.39	4.4	2.7	68.6	70.2	4	4.0
July	5.0	3.2	0.70	5.8	3.6	68.2	71.0	4	3.9
August	0.3	0.0	0.00	7.7	4.8	67.4	72.1	5	3.8
September	6.6	4.3	0.64			70.5		4	
October	7.0	4.6	0.66			72.3		3	
November	7.7	4.2	0.55			73.6		3	
December	15.7	10.6	0.68			76.8		2	
2010									
January	21.3	13.1	0.62			81.1		3	
February	31.0	18.6	0.60			84.7		4	

**NOTE:** Values are final except for the most recent 6 months which are considered preliminary. Cycle 23 started in May 1996 with an RI=8.0. Cycle 23 maximum was April 2000 with an RI=120.8.

\*\* SWPC sunspot number was zero so a ratio could not be computed.





*Weekly Geosynchronous Satellite Environment Summary*  
*Week Beginning 22 March 2010*

**GOES-11 designated Primary Proton and Electron Satellite.**

Protons plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>–sec–sr) as measured by GOES-11 (W135) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

Electrons plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>–sec–sr) with energies greater than 2 MeV at GOES-11.

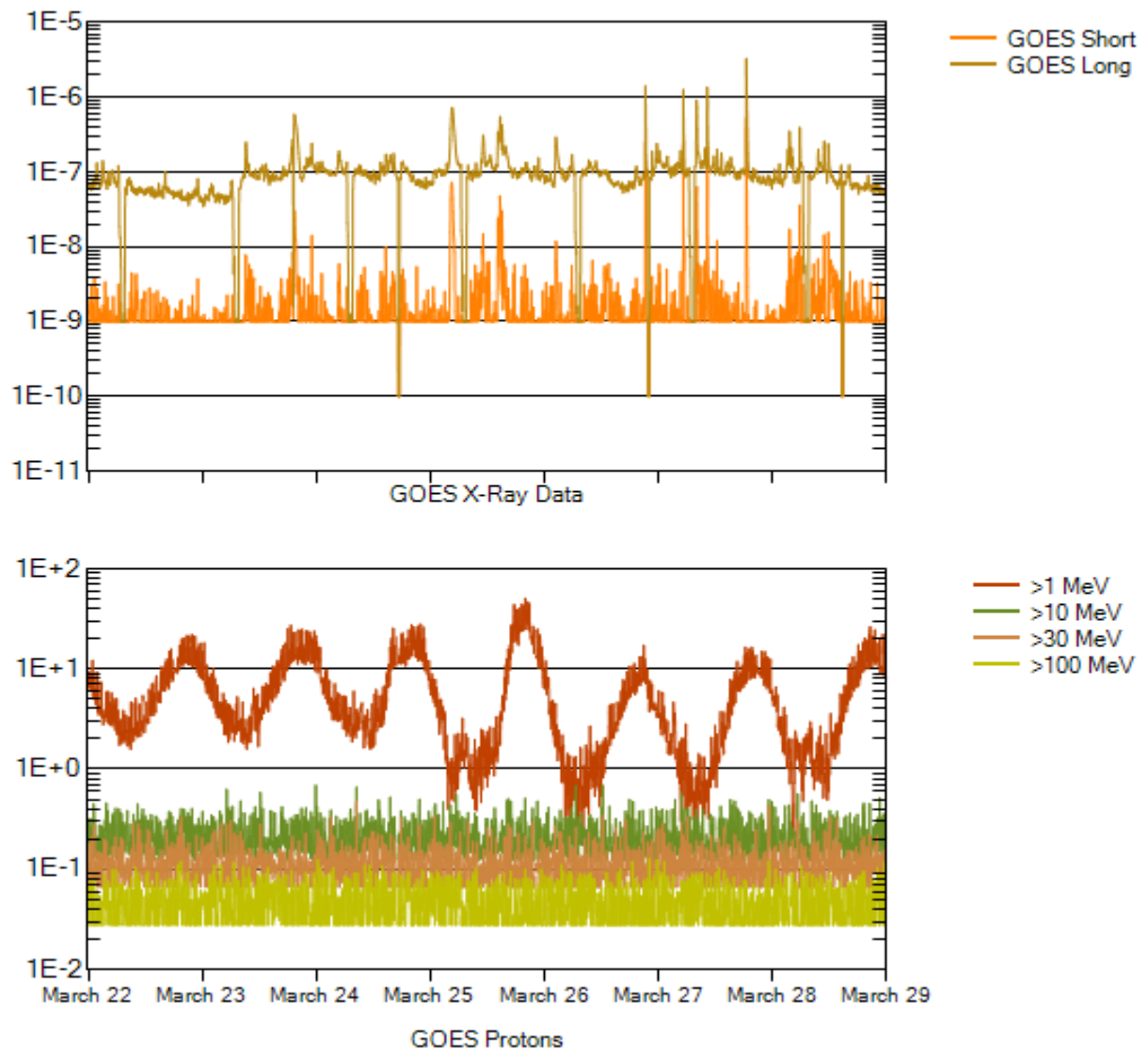
Hp plot contains the five minute averaged magnetic field H - component in nanoteslas (nT) as measured by GOES-11. The H component is parallel to the spin axis of the satellite, which is nearly parallel to the Earth's rotation axis.

Kp plot contains the estimated planetary 3-hour K-index (derived by the Air Force Weather Agency) in real time from magnetometers at Meanook, Canada; Sitka, AK; Glenlea, Canada; St. Johns, Canada; Ottawa, Canada; Newport, WA; Fredericksburg, VA; Boulder, CO; Fresno, CA and Hartland, UK. These data are made available through cooperation from the Geological Survey of Canada (GSC), British Geological Survey (BGS) and the US Geological Survey. These may differ from the final Kp values derived from a more extensive network of magnetometers.

The data included here are those now available in real time at the SWPC and are incomplete in that they do not include the full set of parameters and energy ranges known to cause satellite operating anomalies. The proton and electron fluxes and Kp are “global” parameters that are applicable to a first order approximation over large areas. H parallel is subject to more localized phenomena and the measurements generally are applicable to within a few degrees of longitude of the measuring satellite.







### *Weekly GOES Satellite X-ray and Proton Plots*

X-ray plot contains five-minute averaged x-ray flux (Watts/m<sup>2</sup>) as measured by GOES 14 (W105) in two wavelength bands, 0.05 - 0.4 and 0.1 - 0.8 nm. The letters A, B, C, M and X refer to x-ray event levels for the 0.1 - 0.8 nm band.

Proton plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>-sec-sr) as measured by GOES-11 for each of the energy thresholds: >1, >10, >30 and >100 MeV. P10 event threshold is 10 pfu (protons/cm<sup>2</sup>-sec-sr) at greater than 10 MeV.

