

## **Space Weather Highlights** **29 March – 04 April 2010**

**SWO PRF 1805**  
6 April 2010

Solar activity has been at very low levels with isolated B-class flares. The SOHO/LASCO C2 imagery observed an uncorrelated CME on 30 March off the southeast limb. The visible disk was populated with three sunspot groups during the period. Region 1057 (N15, L=324, class/area Dki/290 on 29 March) was the largest group but was in a gradual decay phase. Region 1059 (S23, L=265, class/area Hsx on 29 March) produced the largest event, a long duration B7 flare on 03/0954UTC which was associated with a halo CME. The plane-of-sky speed for this halo CME was estimated to be about 500 km/s. Region 1060 (N24, L=176, class/area Dro/090 on 4 April) was numbered late in the period.

No proton events were observed at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit was at normal levels during 29 March-1 April. Flux levels increased to moderate levels on 2 April. A further increase to high flux levels occurred on 3-4 April.

The Geomagnetic field was at quiet to unsettled levels for most of the period. Solar wind velocities rose from 345-559 km/s throughout the period. Before the rise in the solar wind speed, a solar sector boundary change was observed by the ACE spacecraft early on 31 March. Brief active periods occurred during 28 March, 1-2 April, and 4 April due to the elevated wind speeds. On 2 April, the ACE spacecraft observed a shock at 02/0635Z with wind speeds rising from 435 to 540 km/s. The Boulder magnetometer measured a sudden impulse of 19 nT at 02/0721Z. These effects are most likely from the CME observed on 30 March off the southeast limb.

## **Space Weather Outlook** **07 April – 03 May 2010**

Solar activity is expected to be at very low levels with a chance for C-class events during 07-14 April. As Region 1059 and new Region 1061 (N14, L=232, class/area Dso/050 on 5 April) rotate off the visible disk, activity is expected to decrease to very low levels for the rest of the forecast period.

No proton events are expected at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at very high levels on 7-8 April, high levels on 9-11 April, moderate levels on 12-14 April, and normal levels the rest of the period. However, moderate to high flux levels are possible during 30 April- 3 May.

The Geomagnetic field is expected to be at quiet to active levels with a slight chance for minor storming on 7-8 April due the waning effects of a CME and a coronal hole high speed stream. The geomagnetic field is expected to return to quiet levels for the remainder of the interval 9 April-3 May.



### *Daily Solar Data*

Date	Radio Flux 10.7 cm	Sun spot No.	Sunspot Area (10 <sup>-6</sup> hemi.)	X-ray Background	Flares						
					X-ray Flux			Optical			
					C	M	X	S	1	2	3 4
29 March	83	32	440	A3.6	0	0	0	0	0	0	0 0
30 March	83	32	390	A3.9	0	0	0	0	0	0	0 0
31 March	81	23	320	A3.1	0	0	0	0	0	0	0 0
01 April	79	25	240	A2.8	0	0	0	0	0	0	0 0
02 April	76	28	290	A2.9	0	0	0	0	0	0	0 0
03 April	77	27	250	A3.9	0	0	0	1	0	0	0 0
04 April	79	40	210	A4.2	0	0	0	0	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
29 March	5.7e+05	1.8e+04	4.0e+03		1.1e+05	
30 March	5.3e+05	1.9e+04	4.3e+03		1.7e+05	
31 March	7.6e+05	1.9e+04	4.3e+03		5.6e+05	
01 April	9.4e+05	1.8e+04	4.0e+03		2.3e+05	
02 April	8.0e+05	1.8e+04	3.9e+03		1.2e+07	
03 April	2.7e+06	1.7e+04	3.7e+03		3.4e+07	
04 April	2.5e+06	1.8e+04	3.8e+03		8.4e+07	

### *Daily Geomagnetic Data*

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
29 March	5	2-1-1-1-2-1-0-3	2	0-0-1-1-1-1-0-0	4	2-0-1-1-1-2-0-2
30 March	4	2-1-1-0-1-1-2-2	4	2-1-1-1-0-1-2-2	5	2-1-0-1-1-1-2-2
31 March	5	2-2-1-2-1-0-1-2	6	1-1-1-4-0-0-1-2	4	1-2-0-1-1-1-0-2
01 April	9	3-2-2-1-3-3-1-2	20	2-2-3-3-6-4-1-2	12	3-3-2-2-4-3-1-3
02 April	10	3-2-3-3-2-1-2-2	21	2-3-5-5-4-3-2-1	12	3-2-3-3-2-2-2-3
03 April	5	2-1-0-1-2-2-2-2	9	2-1-1-2-3-3-3-1	8	2-1-1-0-2-3-2-3
04 April	11	3-2-4-1-2-1-2-3	16	3-3-4-2-4-3-2-3	13	3-3-4-1-2-2-3-4

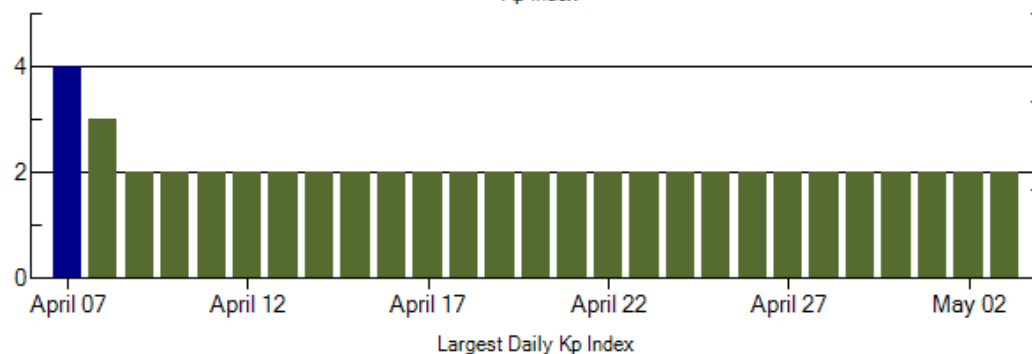
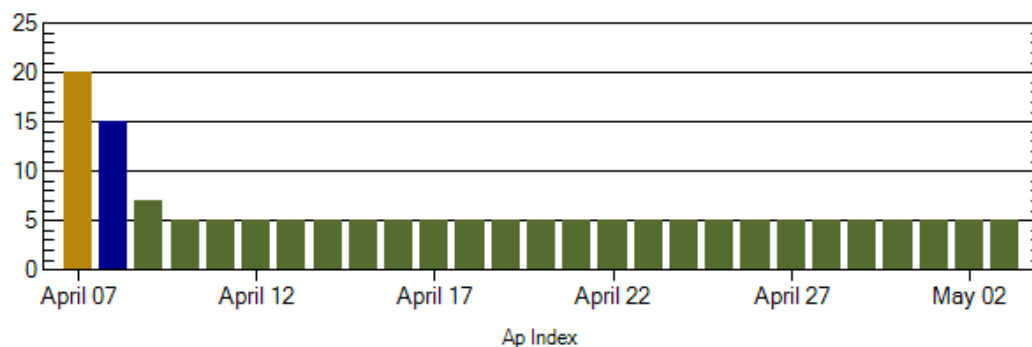
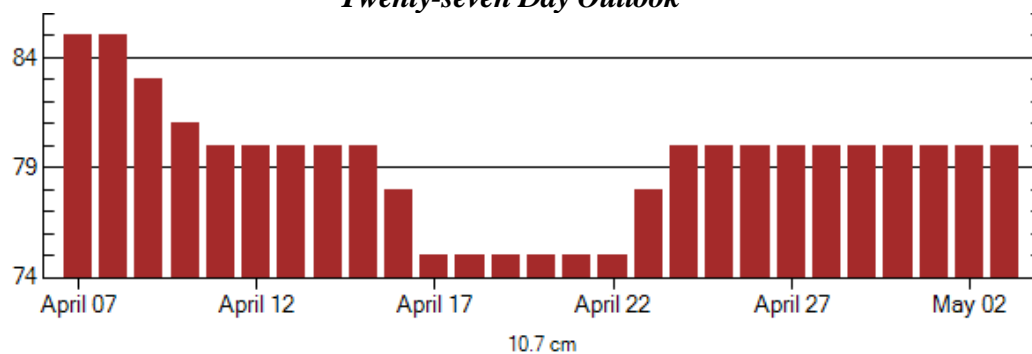


### *Alerts and Warnings Issued*

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UTC
01 Apr 0407	WARNING: Geomagnetic K = 4	01 Apr 0420 - 1600
01 Apr 1554	WARNING: Geomagnetic K = 4	01 Apr 1555 - 1800
01 Apr 1557	ALERT: Geomagnetic K = 4	01 Apr 1556
02 Apr 0718	WARNING: Geomagnetic Sudden Impulse expected	02 Apr 0720 - 0750
02 Apr 0733	WARNING: Geomagnetic K = 4	02 Apr 0735 - 1200
02 Apr 0745	SUMMARY: Geomagnetic Sudden Impulse	02 Apr 0721
02 Apr 0840	ALERT: Geomagnetic K = 4	02 Apr 0840
02 Apr 1154	EXTENDED WARNING: Geomagnetic K = 4	02 Apr 0735 - 1600
03 Apr 1337	WARNING: Geomagnetic Sudden Impulse expected	03 Apr 1340 - 1415
03 Apr 1906	ALERT: Electron 2MeV Integral Flux $\geq 1000$ pfu	03 Apr 1845
04 Apr 0703	WARNING: Geomagnetic K = 4	04 Apr 0705 - 1600
04 Apr 0706	ALERT: Geomagnetic K = 4	04 Apr 0704
04 Apr 1607	CONTINUED ALERT: Electron 2MeV Integral Flux $\geq 1000$ pfu	03 Apr 1845



# *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
07 Apr	85	20	4	21 Apr	75	5	2
08	85	15	3	22	75	5	2
09	83	7	2	23	78	5	2
10	81	5	2	24	80	5	2
11	80	5	2	25	80	5	2
12	80	5	2	26	80	5	2
13	80	5	2	27	80	5	2
14	80	5	2	28	80	5	2
15	80	5	2	29	80	5	2
16	78	5	2	30	80	5	2
17	75	5	2	01 May	80	5	2
18	75	5	2	02	80	5	2
19	75	5	2	03	80	5	2
20	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	Flux	Brtns	Lat CMD	#	245	2695	II IV

*No Events Observed*

### ***Flare List***

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

29 March	No Flares Observed							
30 March	1235	1240	1244	B1.3				
31 March	No Flares Observed							
01 April	No Flares Observed							
02 April	2357	0002	0004	B1.7				
03 April	0002	0002	0005		SF	N16W63		1057
	0904	0954	1058	B7.4				
04 April	No Flares Observed							

### ***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 1057</i>																
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				
29 Mar	N15W10	324	290	10	DKI	11	B									
30 Mar	N15W22	322	260	10	DHI	10	B									
31 Mar	N16W35	322	250	9	CKO	2	B									
01 Apr	N15W45	320	190	2	CAO	3	B									
02 Apr	N16W59	320	250	4	HHX	4	A									
03 Apr	N16W72	319	200	3	HSX	3	A					1				
04 Apr	N16W84	318	90	5	HSX	3	A									
								5	0	0		5	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	4

#### Region 1058

25 Mar	N27W06	12		1	AXX	1	A								
26 Mar	N25W21	14		1	AXX	1	A								
27 Mar	N25W34	14													
28 Mar	N25W47	14													
29 Mar	N25W60	14													
30 Mar	N25W73	14													
31 Mar	N25W86	14													

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 12

#### Region 1059

27 Mar	S21E73	267	120	2	HSX	1	A								
28 Mar	S22E61	265	100	2	HAX	1	A								
29 Mar	S23E48	265	150	2	HSX	1	A								
30 Mar	S23E36	264	130	2	HAX	2	A								
31 Mar	S22E23	264	70	2	HAX	1	A								
01 Apr	S22E10	264	50	2	HSX	2	A								
02 Apr	S23W03	264	40	2	CSO	4	B								
03 Apr	S22W15	262	50	4	HSX	4	A								
04 Apr	S23W28	262	30	3	HSX	3	A								

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 264

#### Region 1060

04 Apr	N24E58	176	90	4	DRO	4	B								
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0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 176



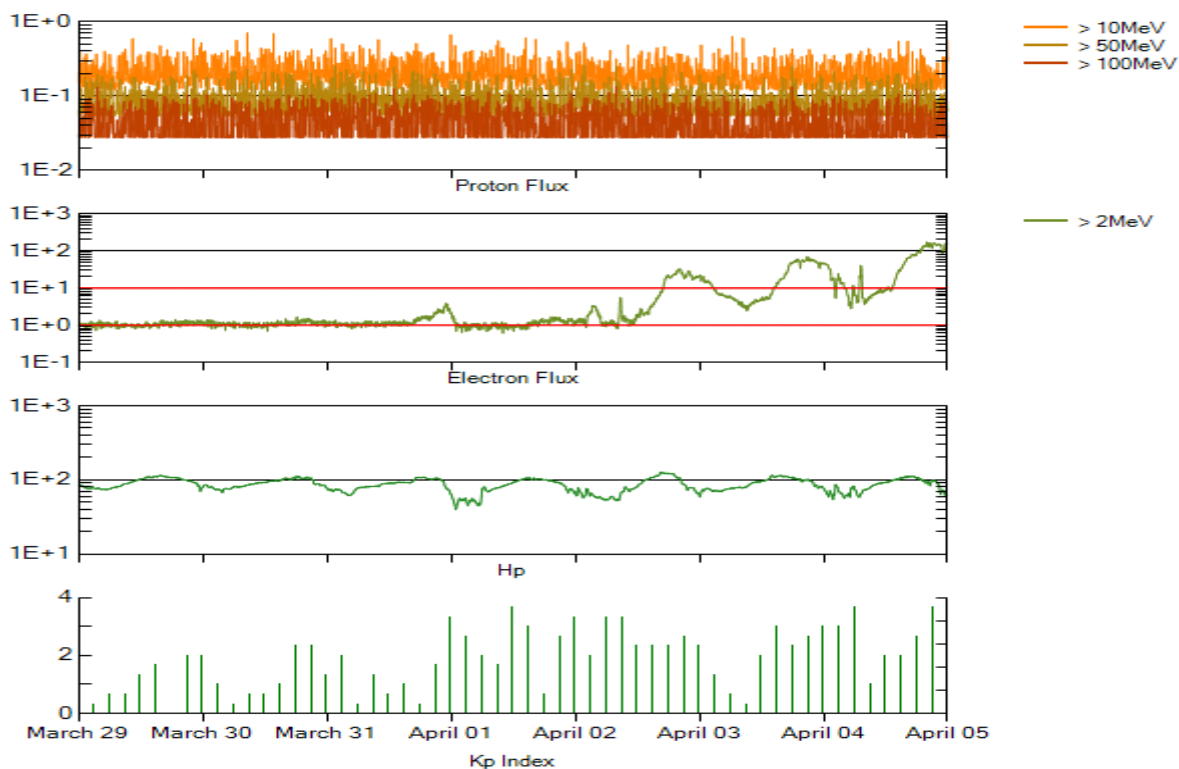
**Recent Solar Indices (preliminary)**  
**Of the observed monthly mean values**

Month	Sunspot Numbers				Radio Flux		Geomagnetic		
	Observed values	Ratio	Smooth values		*Penticton	Smooth	Planetary	Smooth	
	SEC	RI	RI/SEC	SEC	RI	10.7 cm	Value	Ap	Value
2008									
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	9.9	6.1	70.5	73.3	4	3.8
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		5	
March	24.7	15.4	0.62			83.3		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 29 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.

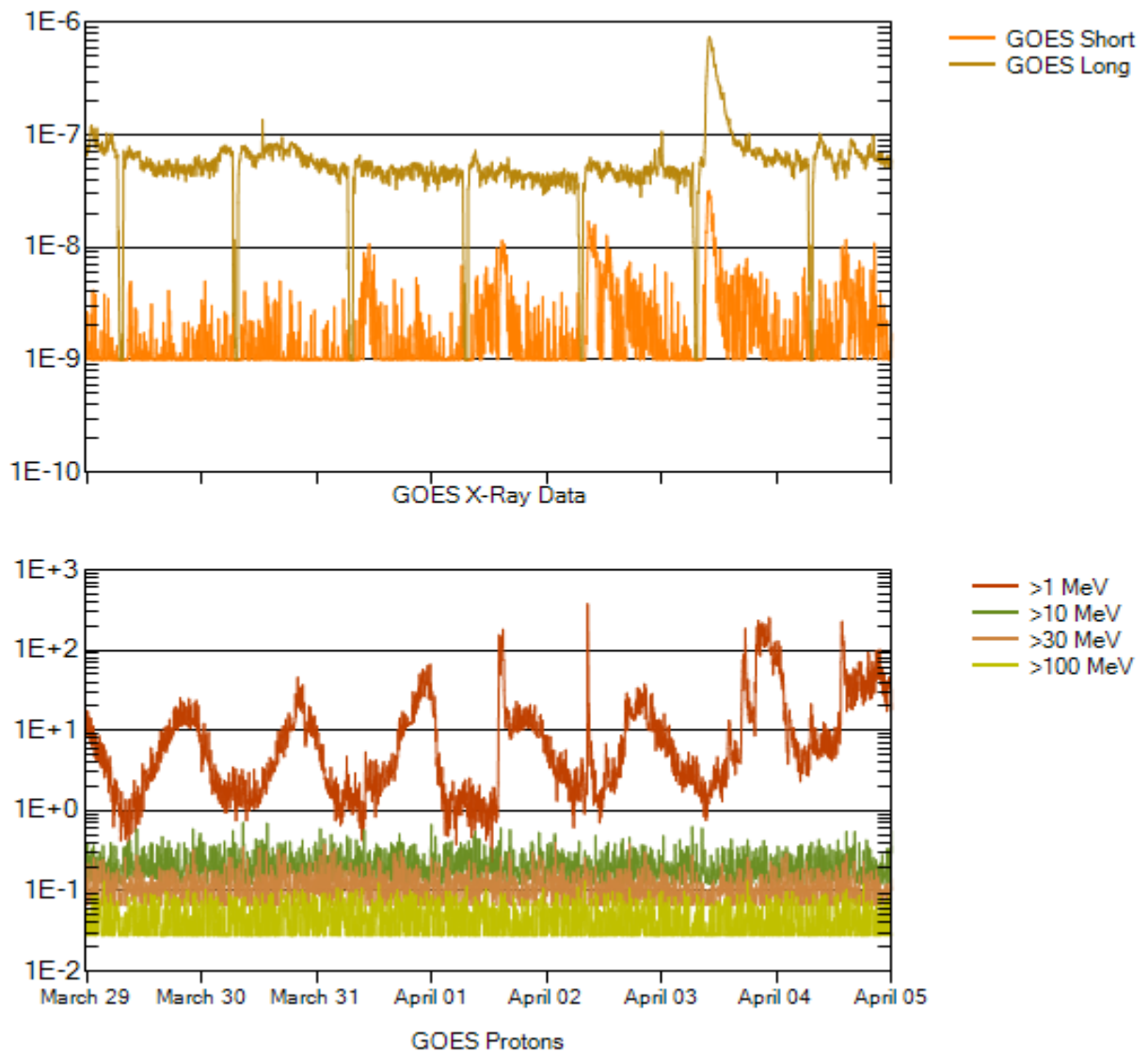
Hp plot contains the five minute averaged magnetic field H - component in nanoteslas (nT) as measured by GOES-11. The H component is parallel to the spin axis of the satellite, which is nearly parallel to the Earth's rotation axis.

Kp plot contains the estimated planetary 3-hour K-index (derived by the Air Force Weather Agency) in real time from magnetometers at Meadok, 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*

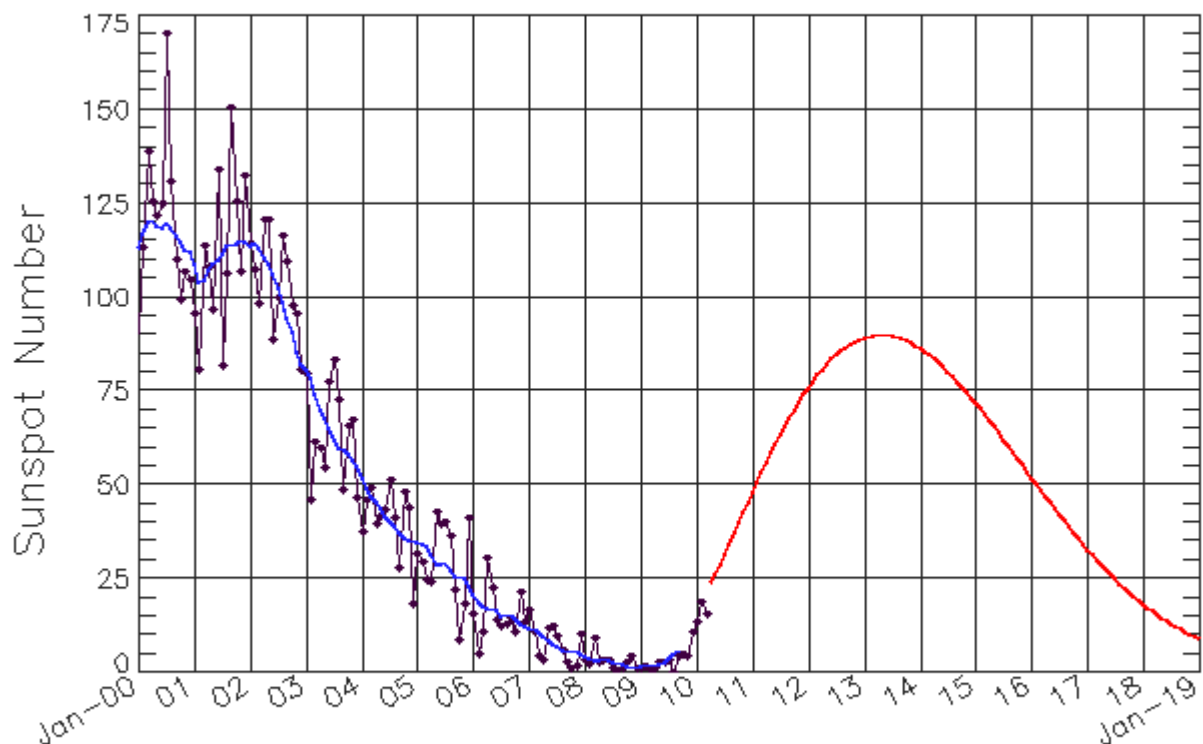
X-ray plot contains five-minute averaged x-ray flux ( $\text{Watts/m}^2$ ) as measured by GOES 14 (W105) in two wavelength bands, 0.05 - 0.4 and 0.1 - 0.8 nm. The letters A, B, C, M and X refer to x-ray event levels for the 0.1 - 0.8 nm band.

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



# ISES Solar Cycle Sunspot Number Progression

Observed data through Mar 2010



— Smoothed Monthly Values —●— Monthly Values — Predicted Values (Smoothed)

Updated 2010 Apr 6

NOAA/SWPC Boulder, CO USA

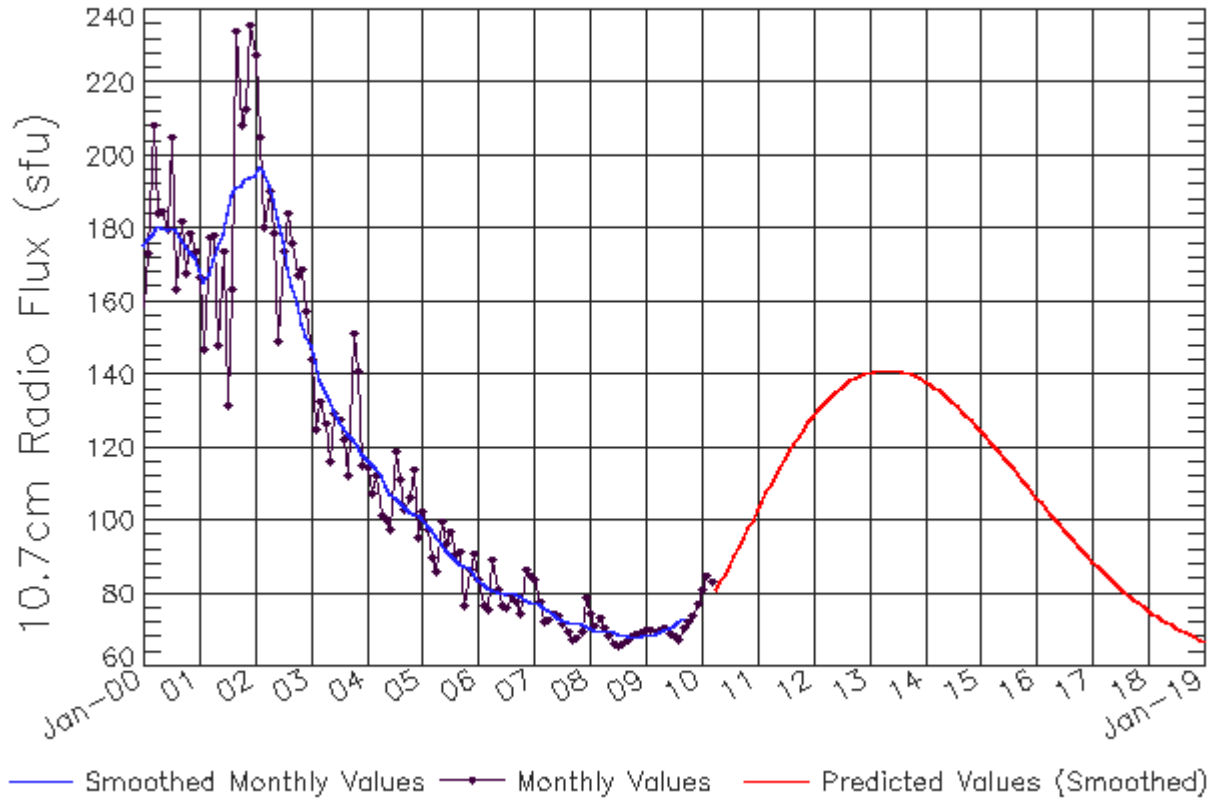
## Smoothed Sunspot Number Prediction

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	2 (***)	2 (***)	2 (***)	2 (***)	2 (***)	3 (***)	4 (***)	5 (***)	6 (***)	8 (1)	10 (2)	12 (3)
2010	14 (5)	17 (5)	19 (6)	22 (7)	25 (7)	28 (8)	31 (9)	34 (9)	37 (10)	40 (10)	43 (10)	45 (10)
2011	48 (10)	51 (10)	53 (10)	56 (10)	59 (10)	61 (10)	63 (10)	66 (10)	68 (10)	70 (10)	72 (10)	74 (10)
2012	76 (10)	78 (10)	79 (10)	81 (10)	82 (10)	84 (10)	85 (10)	86 (10)	87 (10)	88 (10)	88 (10)	89 (10)
2013	89 (10)	90 (10)	90 (10)	90 (10)	90 (10)	90 (10)	90 (10)	89 (10)	89 (10)	89 (10)	88 (10)	87 (10)
2014	86 (10)	86 (10)	85 (10)	84 (10)	83 (10)	81 (10)	80 (10)	79 (10)	78 (10)	76 (10)	75 (10)	73 (10)
2015	72 (10)	70 (10)	69 (10)	67 (10)	65 (10)	64 (10)	62 (10)	60 (10)	59 (10)	57 (10)	55 (10)	54 (10)
2016	52 (10)	50 (10)	49 (10)	47 (10)	45 (10)	44 (10)	42 (10)	40 (10)	39 (10)	37 (10)	36 (10)	34 (10)
2017	33 (10)	31 (10)	30 (10)	29 (10)	27 (10)	26 (10)	25 (10)	24 (10)	23 (10)	21 (10)	20 (10)	19 (10)
2018	18 (10)	17 (10)	16 (10)	15 (10)	15 (10)	14 (10)	13 (10)	12 (10)	12 (10)	11 (10)	10 (10)	10 (10)
2019	9 (10)	8 (10)	8 (10)	7 (10)	7 (10)	6 (10)	6 (10)	6 (10)	5 (10)	5 (10)	4 (10)	4 (10)



# ISES Solar Cycle F10.7cm Radio Flux Progression

Observed data through Mar 2010



Updated 2010 Apr 6

NOAA/SWPC Boulder, CO USA

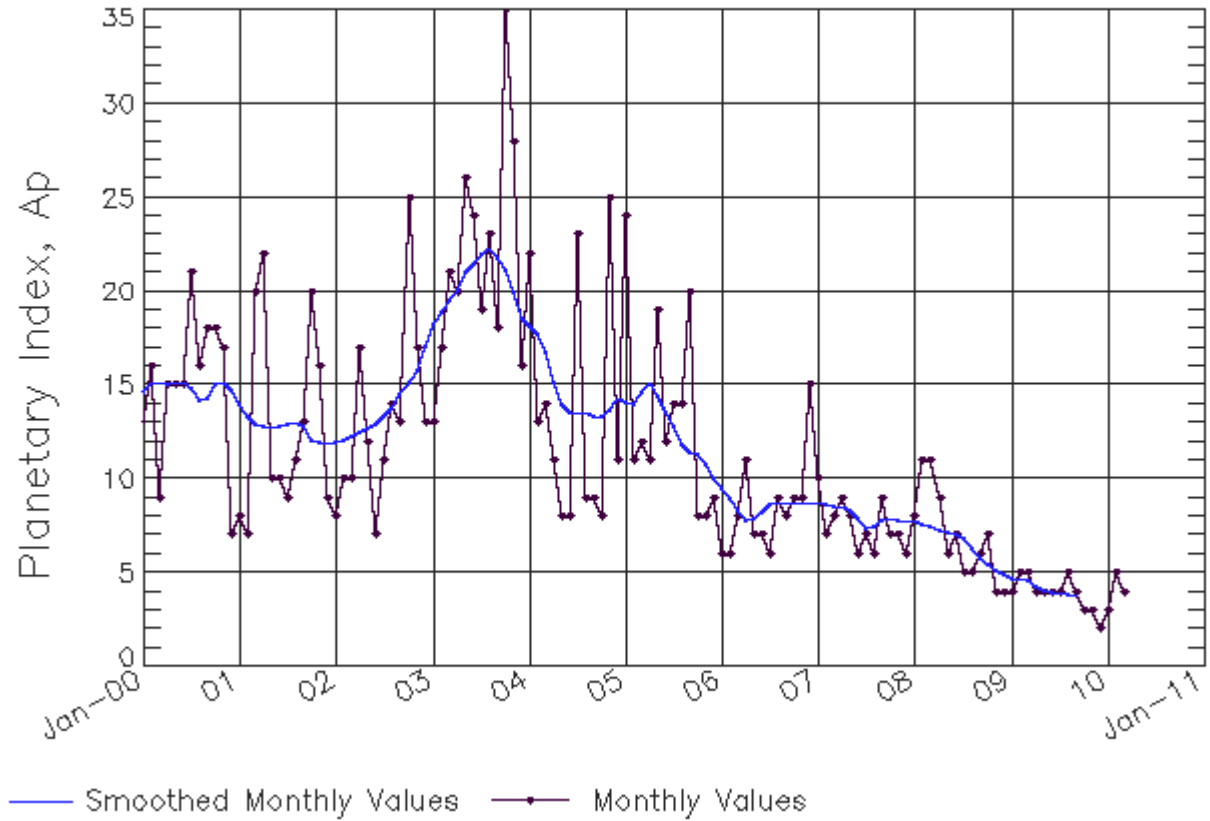
## Smoothed F10.7cm Radio Flux Prediction

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	69 (***)	69 (***)	69 (***)	69 (***)	70 (***)	70 (***)	71 (***)	72 (***)	73 (***)	74 (1)	75 (1)	77 (2)
2010	78 (3)	80 (4)	82 (4)	84 (5)	86 (6)	88 (7)	89 (8)	91 (8)	93 (9)	95 (9)	98 (9)	100 (9)
2011	103 (9)	105 (9)	108 (9)	110 (9)	112 (9)	115 (9)	117 (9)	119 (9)	121 (9)	123 (9)	125 (9)	127 (9)
2012	128 (9)	130 (9)	132 (9)	133 (9)	134 (9)	135 (9)	136 (9)	137 (9)	138 (9)	139 (9)	140 (9)	140 (9)
2013	141 (9)	141 (9)	141 (9)	141 (9)	141 (9)	141 (9)	141 (9)	141 (9)	140 (9)	140 (9)	139 (9)	139 (9)
2014	138 (9)	137 (9)	136 (9)	136 (9)	135 (9)	134 (9)	132 (9)	131 (9)	130 (9)	129 (9)	127 (9)	126 (9)
2015	125 (9)	123 (9)	122 (9)	120 (9)	119 (9)	117 (9)	116 (9)	114 (9)	113 (9)	111 (9)	110 (9)	108 (9)
2016	106 (9)	105 (9)	103 (9)	102 (9)	100 (9)	99 (9)	97 (9)	96 (9)	94 (9)	93 (9)	92 (9)	90 (9)
2017	89 (9)	88 (9)	86 (9)	85 (9)	84 (9)	83 (9)	82 (9)	80 (9)	79 (9)	78 (9)	77 (9)	76 (9)
2018	75 (9)	75 (9)	74 (9)	73 (9)	72 (9)	71 (9)	71 (9)	70 (9)	69 (9)	69 (9)	68 (9)	67 (9)
2019	67 (9)	66 (9)	66 (9)	65 (9)	65 (9)	65 (9)	64 (9)	64 (9)	63 (9)	63 (9)	63 (9)	63 (9)



# ISES Solar Cycle Ap Progression

Observed data through Mar 2010



Updated 2010 Apr 6

NOAA/SWPC Boulder, CO USA

***The Solar Cycle Comparison charts are temporarily unavailable. 2010 charts will be published at a later date. 02 Feb 2010***

