

**Space Weather Highlights**  
**28 December 2009 – 03 January 2010**

**SWO PRF 1792**  
**05 January 2010**

Solar activity was at very low levels during 28 December – 01 January. Solar activity increased to low levels on 02 – 03 January. Region 1039 (S29, L=052, class/area, Dso/220 on 03 January) produced numerous B- and C-class flares, the largest a C3.1/1f event at 02/2312Z. The region maintained a Beta magnetic configuration during its transit.

No proton events were observed at geosynchronous orbit.

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

Geomagnetic field activity was at quiet levels during the entire period. Observations from the ACE spacecraft were consistent with the quiet geomagnetic conditions. During the period, solar wind speed varied between a low of 259 km/s at 31/1142Z to a high of 376 km/s at 28/0037Z as the density increased to a peak of 13 p/cc. The Bz component of the IMF ranged between + and - 7 nT during the period, while density peaked at 9 p/cc near the end of the period.

**Space Weather Outlook**  
**06 January 2010 – 01 February 2010**

Solar activity is expected to be at very low to low levels for the entire forecast period. Isolated moderate activity is possible from 06 – 18 January with the return of old Region 1035 (N30, L=252).

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 the period.

The geomagnetic field is expected to be mostly at quiet levels for the forecast period.



### *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
28 December	76	17	90	A1.4	0	0	0	0	0	0	0	0
29 December	75	17	80	A1.2	0	0	0	0	0	0	0	0
30 December	77	15	50	A1.4	0	0	0	0	0	0	0	0
31 December	80	16	120	A8.5	0	0	0	0	0	0	0	0
01 January	75	16	120	A4.7	0	0	0	0	0	0	0	0
02 January	78	22	190	A5.8	3	0	0	4	1	0	0	0
03 January	76	20	220	A3.9	1	0	0	2	1	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
28 December	5.0e+05	2.0e+04	4.4e+03		3.4e+04	
29 December	5.2e+05	2.1e+04	4.7e+03		4.4e+04	
30 December	7.7e+05	2.1e+04	4.6e+03		3.4e+04	
31 December	6.7e+05	2.0e+04	4.8e+03		4.3e+04	
01 January	8.7e+05	2.0e+04	4.5e+03		3.3e+04	
02 January	8.7e+05	2.0e+04	4.2e+03		4.1e+04	
03 January	7.0e+05	2.1e+04	4.7e+03		3.3e+04	

### *Daily Geomagnetic Data*

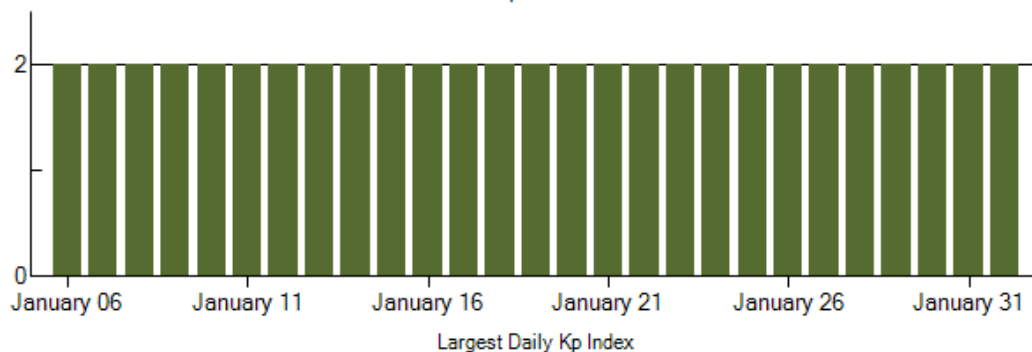
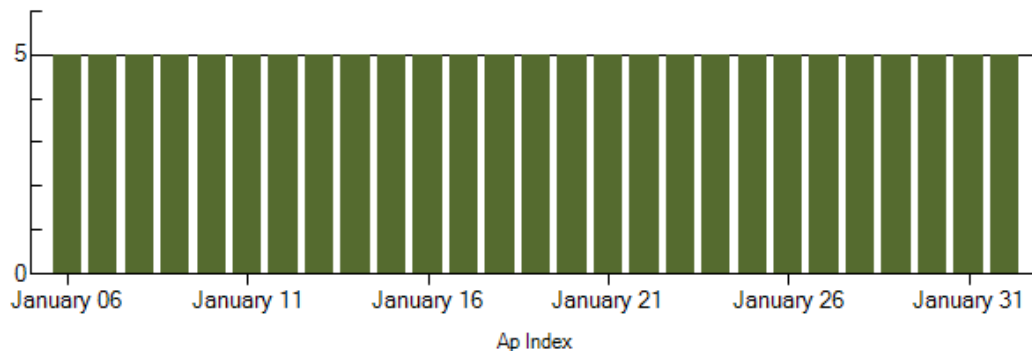
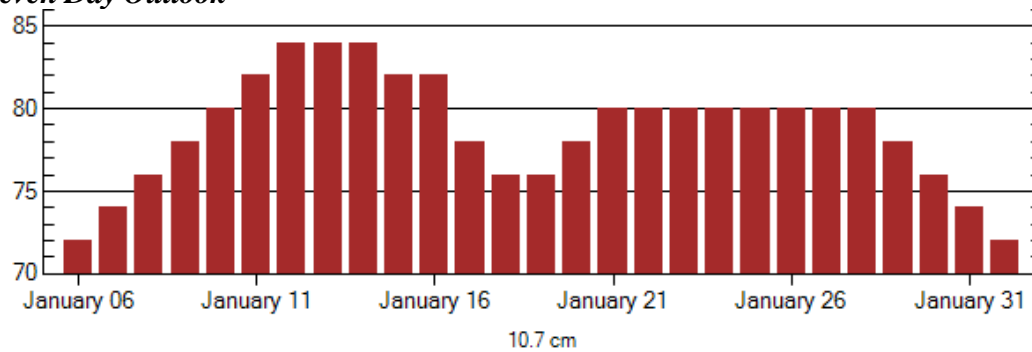
Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
28 December	1	0-0-0-1-0-1-0-0	0	0-0-0-1-0-0-0-0	1	0-0-0-1-0-0-0-0
29 December	0	0-0-0-0-0-1-0-0	0	0-0-0-0-0-0-0-0	0	0-0-0-0-0-0-0-0
30 December	0	0-0-0-0-0-1-0-0	0	0-0-0-0-0-0-0-0	0	0-0-0-0-0-0-0-0
31 December	0	0-0-0-0-0-0-0-0	0	0-0-0-0-1-0-0-0	1	0-0-0-0-0-0-0-0
01 January	2	0-0-0-0-0-1-1-2	0	0-0-0-0-0-0-0-0	1	1-0-0-0-0-0-3-1
02 January	1	0-0-0-0-0-2-1-0	0	0-0-0-0-0-0-0-0	0	0-0-0-0-0-0-0-1
03 January	3	0-1-1-2-2-1-0-0	4	0-0-0-3-3-1-0-0	3	0-1-1-2-2-0-0-0

### *Alerts and Warnings Issued*

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UTC
<i>No Alerts Issued</i>		



## 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
06 Jan	72	5	2	20 Jan	78	5	2
07	74	5	2	21	80	5	2
08	76	5	2	22	80	5	2
09	78	5	2	23	80	5	2
10	80	5	2	24	80	5	2
11	82	5	2	25	80	5	2
12	84	5	2	26	80	5	2
13	84	5	2	27	80	5	2
14	84	5	2	28	80	5	2
15	82	5	2	29	78	5	2
16	82	5	2	30	76	5	2
17	78	5	2	31	74	5	2
18	76	5	2	01 Feb	72	5	2
19	76	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
<i>No Events Observed</i>													

*No Events Observed*

### ***Flare List***

Date	Time			X-ray	Imp /	Optical		Rgn
	Begin	Max	End			Location	Lat CMD	
28 December	No Flares Observed							
29 December	No Flares Observed							
30 December	2241	2245	2247	B2.8				
	2348	2351	2353	B2.3				
	2354	0002	0008	B1.6				
31 December	0042	0048	0100	B2.6				
	0107	0112	0116	B3.1				
	0330	0417	0439	B2.6				
	0742	0747	0750	B2.9				
	1024	1027	1029	B1.9				
	1054	1059	1106	B1.6				
	1115	1120	1131	B1.9				
	1429	1432	1451	B1.3				
	1537	1542	1546	B1.5				
	1902	1906	1910	B1.8				
01 January	1202	1209	1218	B1.9				
	1233	1243	1300	B2.3				
	2329	2333	2342	B1.1				
02 January	0310	0313	0319	B1.1				
	0721	0723	0746	C1.0	SF	S29W37		1039
	0803	0803	0811	B6.4	SF	S29W37		1039
	0905	0917	0921	B4.5	SF	S29W39		1039
	1159	1209	1224	B4.8				
	1408	1416	1424	C2.6				
	2241	2246	2259	B4.3	SF	S27W44		1039
03 January	2301	2312	A0000	C3.1	1F	S32W48		1039
	0120	0121	0155	C2.0	1N	S30W52		1039
	0353	0407	0421	B6.1				
	0743	0746	0754	B1.5				
	1050	1103	1109	B1.5				
	1201	1212	1228	B7.1				
	1443	1448	1451	B1.1				
	1529	1535	1541	B1.3				
	1601	1601	1611	B6.7	SF	S27W58		1039
	1859	1902	1904	B1.0				
	2047	2047	2051	B3.3	SF	S27W61		1039



## 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
Region 1037															
19 Dec	N18E54	137	10	6	BXO	2	B								
20 Dec	N18E41	137													
21 Dec	N18E28	137													
22 Dec	N18E15	137													
23 Dec	N18E02	137													
24 Dec	N18W11	137													
25 Dec	N18W24	137													
26 Dec	N18W37	137													
27 Dec	N18W50	137													
28 Dec	N18W63	137													
29 Dec	N18W76	137													
30 Dec	N18W89	137													
								0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 137

<i>Region 1039</i>															
26 Dec	S26E45	53	10	6	BXO	3	B								
27 Dec	S27E31	54	100	7	DSO	7	B								
28 Dec	S28E18	54	90	8	DSO	7	B								
29 Dec	S28E06	53	80	9	DAO	7	B								
30 Dec	S27W08	54	50	6	DSO	5	B								
31 Dec	S28W21	54	130	6	DAI	8	B								
01 Jan	S27W35	54	120	9	DSO	6	B								
02 Jan	S28W46	52	190	8	DSO	12	B	2			4	1			
03 Jan	S29W59	52	220	7	DSO	10	B	1			2	1			
								3	0	0	6	2	0	0	0

Still on Disk.

Absolute heliographic longitude: 53



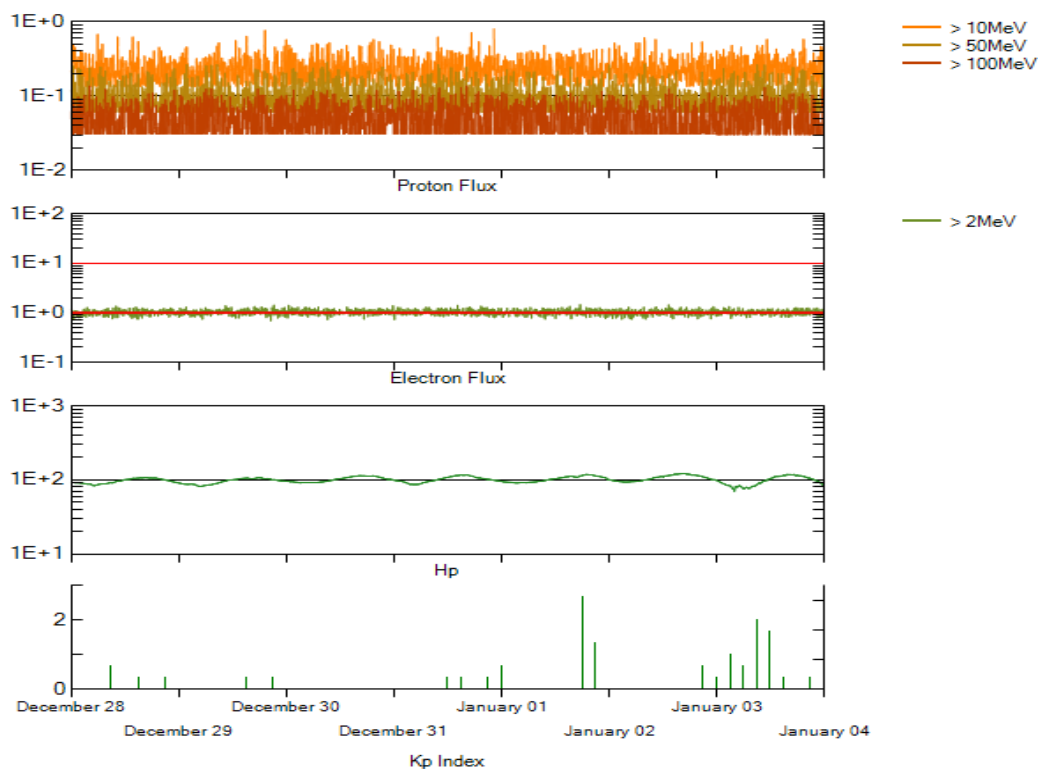
**Recent Solar Indices (preliminary)**  
**Of the observed monthly mean values**

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
January	5.1	3.3	0.65	6.9	4.2	74.3	70.3	8	7.8
February	3.8	2.1	0.55	5.9	3.6	71.1	69.9	11	7.6
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	1.9	68.3	68.2	7	5.4
November	6.8	4.1	0.60	2.7	1.8	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
<b>2009</b>									
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	1.2	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	2.6	0.39	4.4	2.7	68.6	70.2	4	4.0
July	5.0	3.5	0.70			68.2		4	
August	0.3	0.0	0.00			67.4		5	
September	6.6	4.2	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		1	

**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 less than RI value, so a ratio could not be computed.





*Weekly Geosynchronous Satellite Environment Summary  
Week Beginning 28 December 2009*

**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.

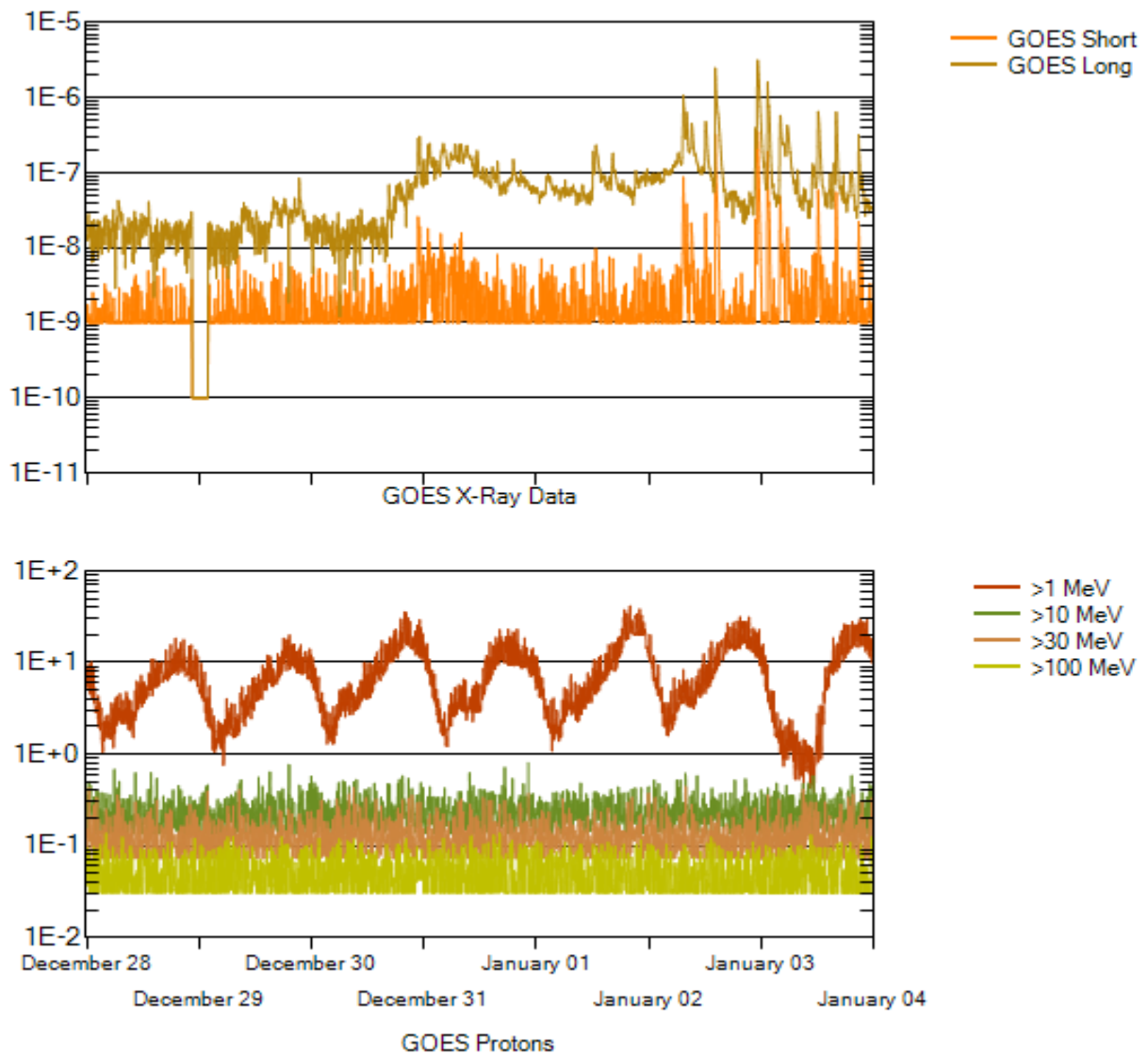
Electrons plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>–sec–sr) with energies greater than 2 MeV at GOES-11.

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.

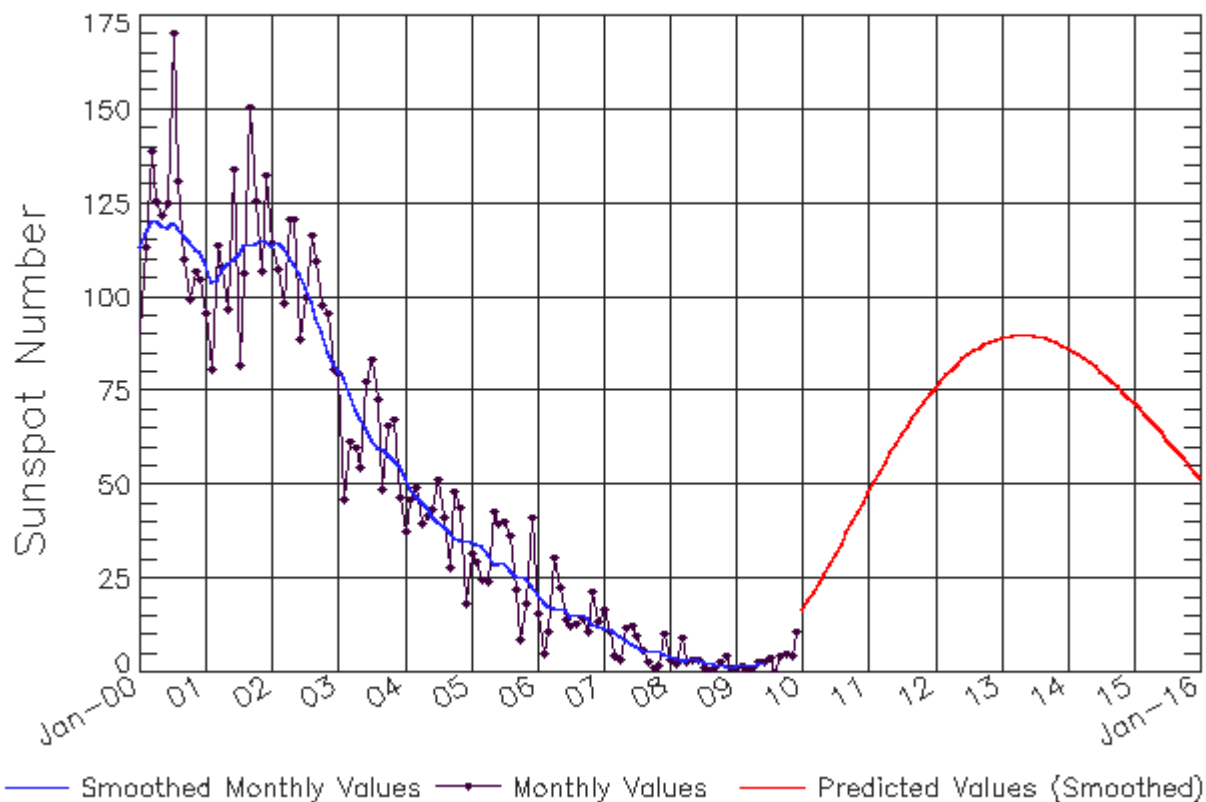
Proton plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>-sec-sr) as measured by GOES-11 for each of the energy thresholds:  $>1$ ,  $>10$ ,  $>30$  and  $>100$  MeV. P10 event threshold is 10 pfu (protons/cm<sup>2</sup>-sec-sr) at greater than 10 MeV.





# ISES Solar Cycle Sunspot Number Progression

Data Through Dec 09



Updated 2010 Jan 5

NOAA/SWPC Boulder, CO USA

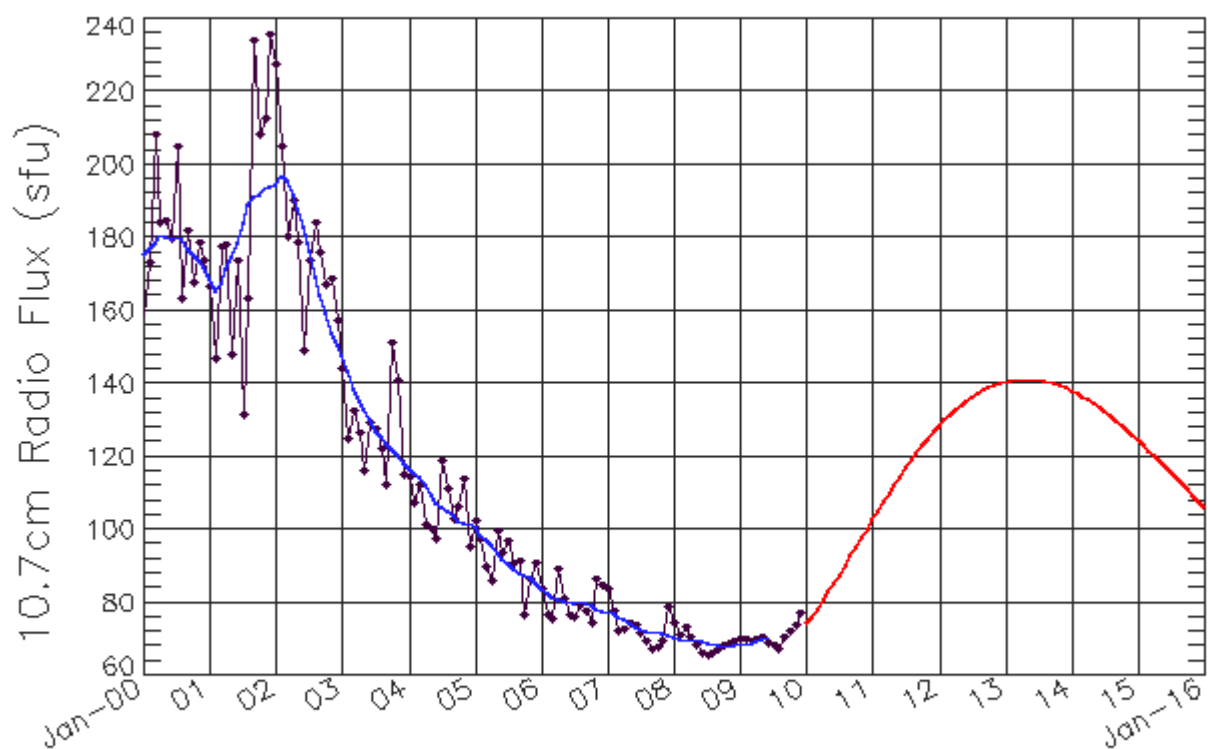
## Smoothed Sunspot Number Prediction

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	4 (***)	4 (***)	3 (***)	3 (***)	4 (***)	3 (***)	3 (***)	3 (***)	2 (***)	2 (***)	2 (***)	2 (***)
2009	2 (***)	2 (***)	2 (***)	2 (***)	2 (***)	3 (***)	4 (1)	5 (2)	7 (3)	9 (5)	10 (5)	13 (6)
2010	15 (7)	17 (7)	20 (8)	23 (9)	26 (9)	29 (10)	32 (10)	34 (10)	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)



# ISES Solar Cycle F10.7cm Radio Flux Progression

Data Through Dec 09



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

Updated 2010 Jan 5

NOAA/SWPC Boulder, CO USA

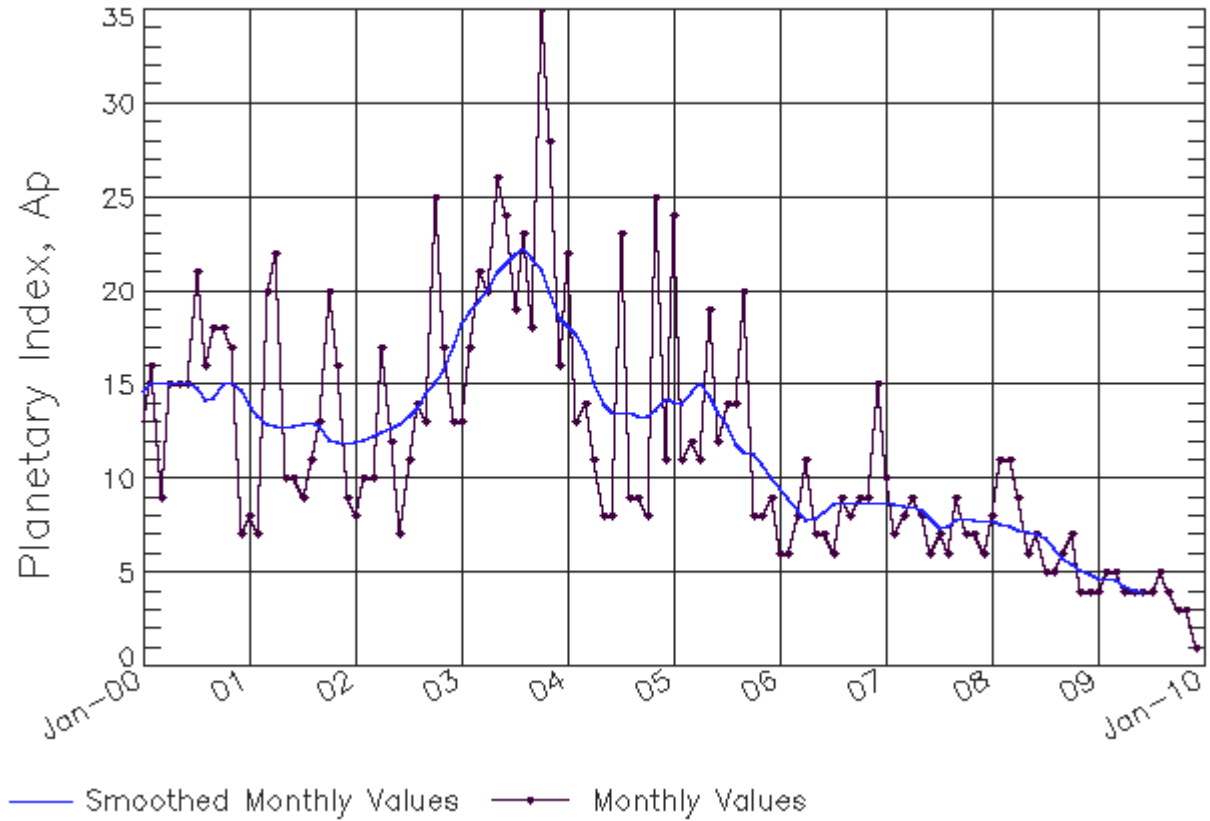
## Smoothed F10.7cm Radio Flux Prediction

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	70 (***)	70 (***)	70 (***)	70 (***)	70 (***)	69 (***)	69 (***)	69 (***)	68 (***)	68 (***)	68 (***)	69 (***)
2009	69 (***)	69 (***)	69 (***)	69 (***)	70 (***)	70 (***)	71 (1)	71 (1)	72 (2)	73 (3)	74 (4)	75 (4)
2010	76 (5)	78 (6)	80 (7)	82 (8)	84 (8)	86 (9)	88 (9)	90 (9)	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)



# ISES Solar Cycle Ap Progression

Data Through Dec 09



Updated 2010 Jan 5

NOAA/SWPC Boulder, CO USA

