

**Space Weather Highlights**  
**14 December – 20 December 2009**

**SWO PRF 1790**  
**22 December 2009**

Solar activity was very low during 14-15 December. Activity was low on 16-19 December as Region 1035 (N31, L=250, class/area Bxo/20 on 14 December) produced several C-flares, with numerous B-flares, and associated radio emissions. One event was a C5/sf at 16/0124 UTC with an associated slow moving partial-halo coronal mass ejection. Another C1 at 16/2212 UTC had a very weak Type IV radio sweep associated with it. Two new regions were numbered on 19 December as Region 1036 (S29, L=210, class/area Bxo/10 on 19 December) and Region 1037 (N18, L=137, class/area Bxo/10 on 19 December). On 20 December activity returned to very low and a new region was numbered as Region 1038 (N16, L=204, class/area Axx/10 on 20 December).

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.

The geomagnetic field was predominantly quiet throughout the summary period. The exception was quiet to unsettled levels observed on 14 December between 14/0300 – 1500 UTC. Observations from the ACE spacecraft showed signatures of a solar boundary crossing with an increase in the interplanetary total field and a period of sustained southward Bz.

**Space Weather Outlook**  
**23 December 2009 – 18 January 2010**

Solar activity is expected to be predominantly very low during the first half of the period. Activity is expected to be very to low during the second half of the period.

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 quiet for the forecast period.



### *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
14 December	79	28	30	A2.6	0	0	0	1	0	0	0	0
15 December	82	38	130	A5.0	0	0	0	0	0	0	0	0
16 December	83	30	140	B1.2	3	0	0	3	0	0	0	0
17 December	87	24	210	B1.4	0	0	0	1	0	0	0	0
18 December	84	20	310	A8.3	1	0	0	0	0	0	0	0
19 December	82	43	240	A7.1	1	0	0	2	0	0	0	0
20 December	84	42	330	A9.7	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
	14 December	6.2e+05	2.0e+04	4.5e+03		4.6e+04
15 December	7.2e+05	1.9e+04	4.4e+03		4.1e+04	
16 December	5.3e+05	2.0e+04	4.4e+03		3.8e+04	
17 December	4.1e+05	2.0e+04	4.4e+03		3.5e+04	
18 December	5.2e+05	2.0e+04	4.2e+03		4.2e+04	
19 December	4.7e+05	2.0e+04	4.3e+03		4.3e+04	
20 December	4.5e+05	1.9e+04	4.3e+03		3.7e+04	

### *Daily Geomagnetic Data*

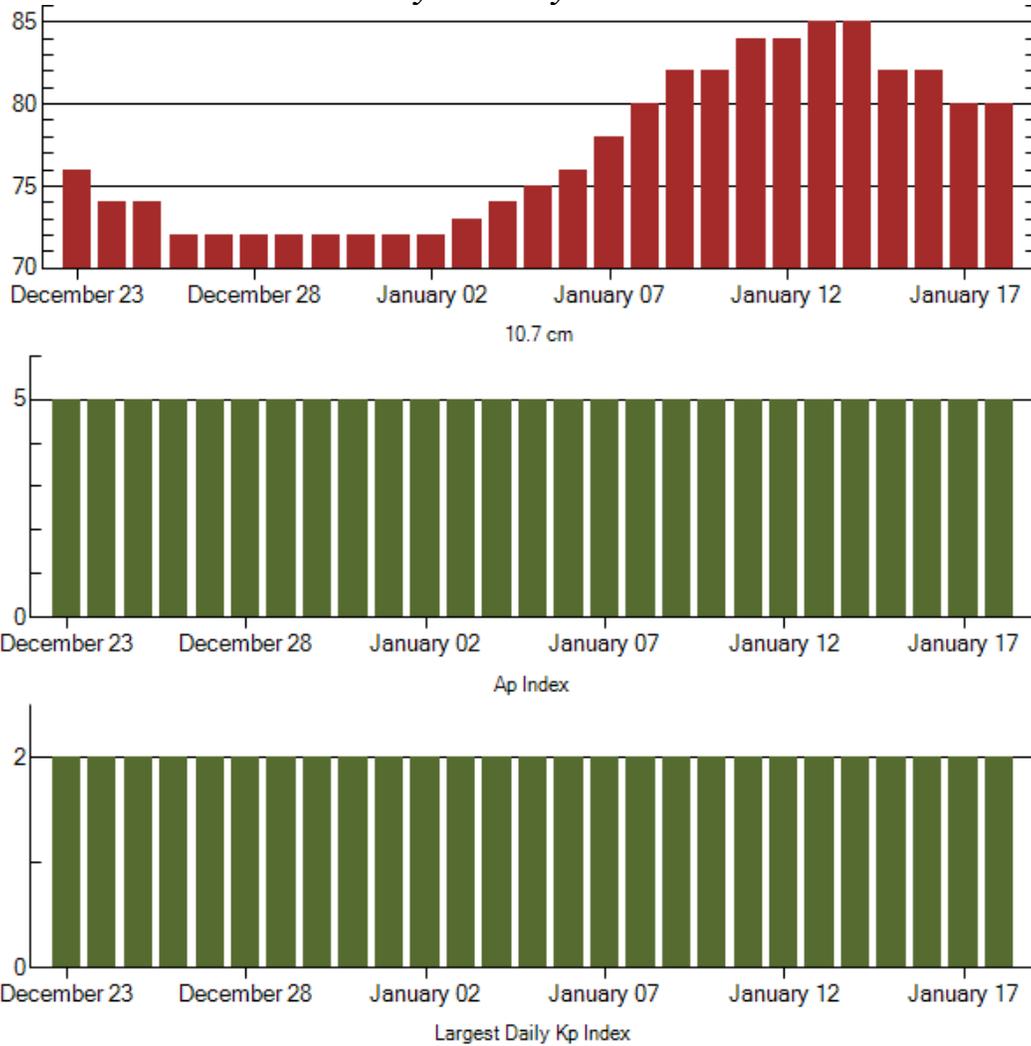
Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	14 December	4	1-3-1-1-0-1-1-0	4	0-2-2-3-0-0-0-0	4
15 December	0	0-0-0-0-0-0-0-1	0	0-0-0-0-0-0-0-0	0	0-0-0-0-0-0-0-1
16 December	2	1-1-0-1-1-2-0-0	2	0-0-0-2-1-1-0-0	3	2-1-0-1-1-1-0-0
17 December	2	0-0-0-1-1-1-1-0	0	0-0-0-1-0-0-0-0	1	0-0-0-1-0-1-0-0
18 December	2	0-0-1-1-1-2-0-0	2	0-0-2-2-0-0-0-0	2	0-0-1-1-0-0-0-0
19 December	0	0-0-0-0-0-0-0-0	0	0-0-0-1-0-0-0-0	1	0-0-0-0-0-0-0-0
20 December	2	0-0-0-1-1-2-0-0	1	0-0-0-1-1-1-0-0	1	0-0-0-0-1-1-0-0

### *Alerts and Warnings Issued*

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UTC
17 Dec 1556	ALERT: Type IV Radio Emission	16 Dec 2212



### 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
23 Dec	76	5	2	06 Jan	76	5	2
24	74	5	2	07	78	5	2
25	74	5	2	08	80	5	2
26	72	5	2	09	82	5	2
27	72	5	2	10	82	5	2
28	72	5	2	11	84	5	2
29	72	5	2	12	84	5	2
30	72	5	2	13	85	5	2
31	72	5	2	14	85	5	2
01 Jan	72	5	2	15	82	5	2
02	72	5	2	16	82	5	2
03	73	5	2	17	80	5	2
04	74	5	2	18	80	5	2
05	75	5	2				



***Energetic Events***

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

*No Events Observed*

***Flare List***

Date	Begin	Time		X-ray Class.	Imp/ Brtns	Location Lat CMD	Rgn
		Max	End				
14 December	0844	0848	0850	B1.44			
	0855	0858	0900	B1.7			
	1815	1816	1817	B1.4	SF	N29E11	1035
	2335	2339	2342	B4.1			
	1948	2017	2025	B2.7			
15 December	0039	0046	0057	B1.2			
	0401	0406	0415	B1.05			
	1114	1117	1120	B1.0			
	1254	1257	1259	B1.2			
	1328	1334	1339	B1.3			
	1514	1520	1532	B2.04			
	2317	2323	2337	B2.7			
16 December	0115	0121	0143	C5.3	SF	N30W06	1035
	0317	0320	0326	B6.4			
	0725	0728	0734	B3.0			
	0745	0801	0816	B6.9			
	0837	0837	0840	B8.6	SF	N31W09	1035
	1028	1036	1042	B7.8			
	1101	1104	1107	B3.9			
	1236	1302	1320	C3.7			
17 December	2135	2144	2205	C1.4	SF	N29W17	1035
	0306	0310	0316	B5.1			
	0712	0715	0718	B4.6			
	0933	0937	0941	B7.0			
	1152	1156	1159	B4.6			
	1512	1512	1516	B9.7	SF	N28W28	1035
	1656	1700	1703	B2.5			
18 December	2112	2121	2128	B2.4			
	0109	0132	0158	B2.0			
	0204	0213	0217	B5.6			
	0429	0433	0439	B3.1			
	0745	0748	0752	B2.5			
	1030	1038	1044	B2.2			
	1116	1122	1125	B1.8			



*Flare List - continued*

Date	Time			X-ray Class.	Imp / Brtns	Optical	
	Begin	Max	End			Location Lat CMD	Rgn
18 December	1404	1410	1416	B3.1			
	1610	1623	1631	B5.1			
	1659	1703	1706	B2.5			
	1820	1827	1830	B5.4			
	1848	1855	1858	C7.6			
	1917	1920	1923	B2.8			
	2032	2038	2042	B2.7			
	2116	2124	2127	B3.6			
	2158	2202	2205	B1.9			
	2337	2343	2345	B2.0			
	2353	2358	0001	B3.1			
	19 December	0014	0014	0019	C2.9	SF	N30W46
0049		0053	0055	B2.3			
0104		0109	0112	B7.4			
0151		0153	0158	B9.1	SF	N31W45	1035
0648		0653	0656	B1.4			
0716		0719	0722	B1.2			
1030		1035	1039	B1.5			
20 December	1108	1113	1119	B6.6			
	1140	1145	1149	B1.5			
	1416	1420	1425	B2.3			
	1540	1543	1546	B1.9			
	1737	1741	1743	B1.6			
	2027	2031	2037	B2.6			
	2320	2324	2330	B2.7			





## Region Summary

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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

### Region 1037

19 Dec	N18E54	137	10	6	BXO	2	B											
20 Dec	N18E41	137																
									0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 137

### Region 1038

20 Dec	N16W26	204	10	2	AXX	2	A											
									0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 204

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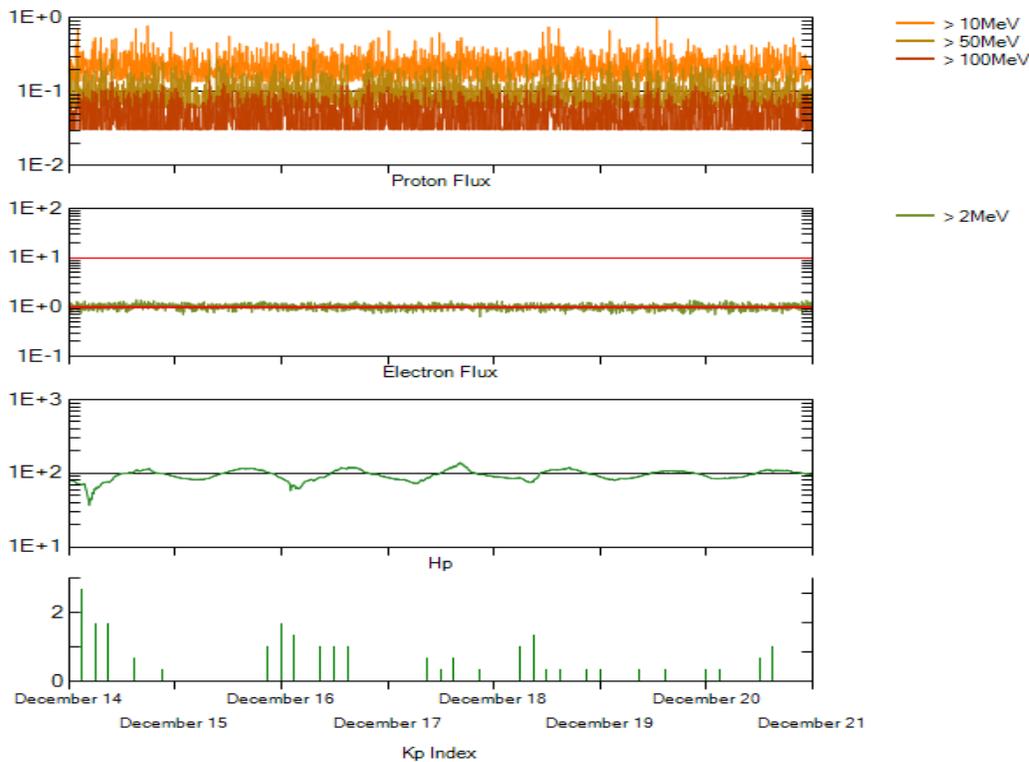
**Recent Solar Indices (preliminary)**  
**Of the observed monthly mean values**

Month	Sunspot Numbers			Smooth values		Radio Flux		Geomagnetic	
	Observed SEC	values RI	Ratio RI/SEC	SEC	RI	*Penticton 10.7 cm	Smooth Value	Planetary Ap	Smooth Value
<b>2007</b>									
December	16.2	10.1	0.62	8.1	4.9	78.5	70.8	6	7.8
<b>2008</b>									
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			68.6		4	
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	

**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 14 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.

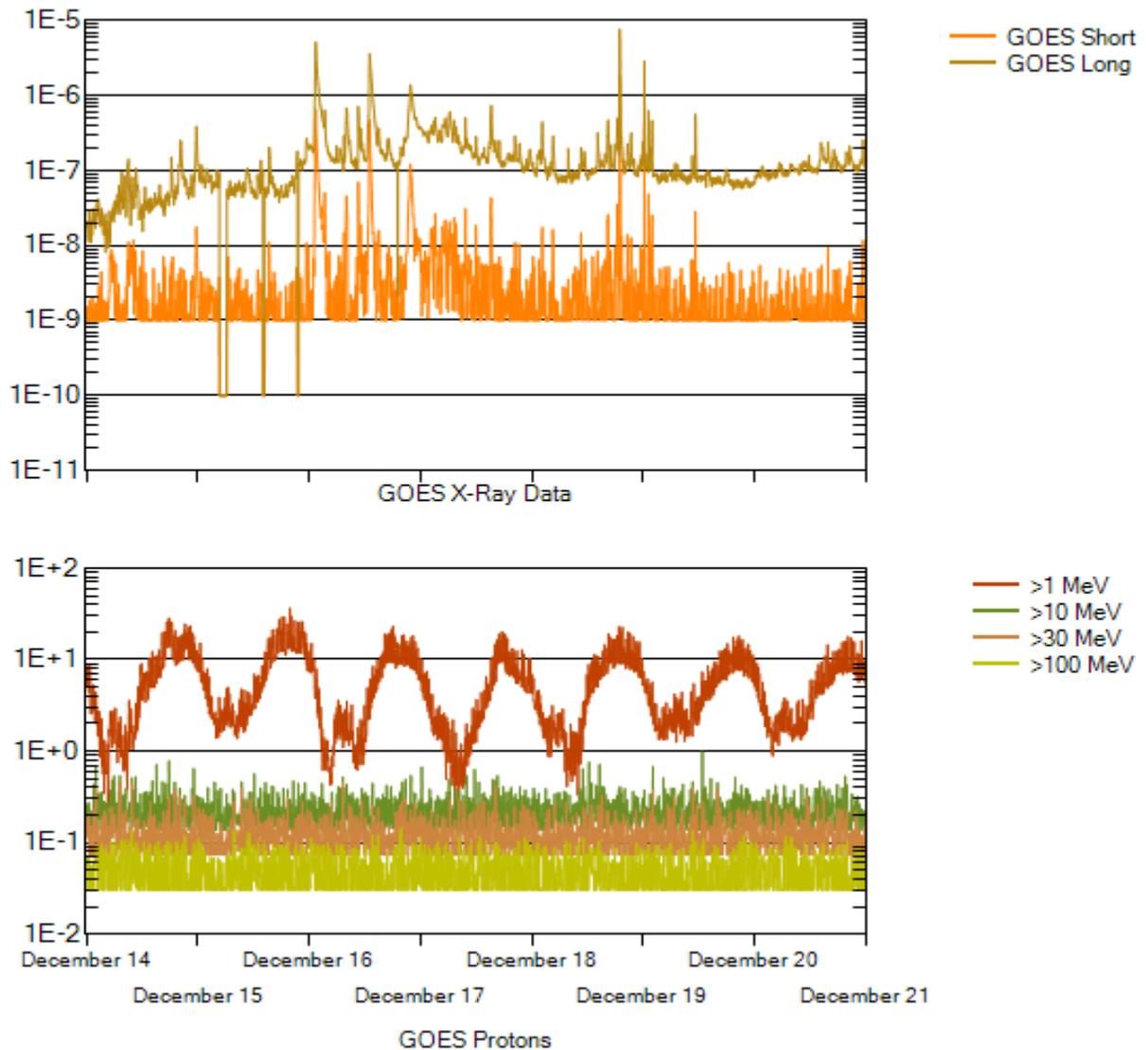
Electrons plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>-sec -sr) with energies greater than 2 MeV at GOES-11.

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.

