

**Space Weather Highlights**  
**20 – 26 December 2004**

**SWO PRF 1530**  
**28 December 2004**

Solar activity was very low to low this period. The period began with very low conditions on 20 and 21 December. Region 713 (S09, L=124, class/area, Eai/210, on 20 December) developed a beta gamma magnetic classification early in the period and produced several C-class events on 22 and 23 December. The largest of these flares was a C5 at 23/1008Z. On 24 December, a C1 long duration flare occurred from a spotless area in the southeast quadrant at 0356Z. A CME on LASCO imagery was likely associated with this flare but was not earth directed. On 25 and 26 December, very low levels were experienced again as Region 713 showed signs of decay in both sunspot number and area.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft during most of the summary period. The period began with solar wind speed near 400 km/s. Solar wind speed was in a decline phase following a geoeffective coronal hole high speed stream (HSS). On 21 December, ACE data indicated the presence of a co-rotating interaction region (CIR) with the IMF Bz fluctuating between +10 and -14 nT. This CIR was followed on 22 December by a high speed stream from a geoeffective coronal hole. Wind speed reached approximately 550 km/s on 22 December and declined to 400 km/s by the end of the UTC day on 23 December. ACE data indicated the onset of another weak CIR and coronal hole HSS on 25 December. Solar wind speed climbed to approximately 500 km/s and remained above 500 km/s through the end of the reporting period.

No greater than 10 MeV proton events were observed this period.

The greater than 2 MeV electron flux at geosynchronous orbit increased to high levels on 20 December.

The geomagnetic field ranged from quiet to minor storm levels with isolated major storm periods at high latitudes. The period began with quiet levels. On 21 and 22 December, mostly quiet to unsettled levels with isolated periods of minor storming, and major storm periods at high latitudes, were observed due to a high speed stream. Quiet conditions prevailed on 23 and 24 December. On 25 December, quiet to active conditions were observed due to the influence of another high speed stream. This stream continued to influence the geomagnetic field on 26 December, however only quiet to unsettled conditions were experienced.

**Space Weather Outlook**  
**29 December 2004 - 24 January 2005**

Solar activity is expected to be very low to low with a chance of M-class activity from Region 713 and 715 (N04, L=339, class/area, Dao/80, on 28 December). Region 713 will be departing the visible disk on 30 December and Region 715 will be departing on 10 January. Expect very low to low conditions after 10 January.

A greater than 10 MeV proton event is not expected.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at high levels on 03-04, 14-15, 18-19, and 22-23 January.

The geomagnetic field is expected to range from mostly quiet to active levels with isolated minor storm periods. High speed coronal hole streams are expected to produce occasional storm periods on 02-03, 13-14, 17-18, and 21-22 January. Otherwise, expect quiet to unsettled conditions.



### *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	
20 December	94	30	210	B1.3	0	0	0	0	0	0	0	0	0
21 December	101	25	210	B1.5	0	0	0	0	0	0	0	0	0
22 December	99	47	200	B1.3	2	0	0	2	0	0	0	0	0
23 December	96	47	230	B1.1	2	0	0	0	0	0	0	0	0
24 December	97	42	210	B1.3	1	0	0	2	0	0	0	0	0
25 December	93	26	100	B1.0	0	0	0	0	0	0	0	0	0
26 December	92	16	90	A9.2	0	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)		
	>1MeV	>10MeV	>100MeV	>.6MeV	>2MeV	>4MeV
	20 December	1.4E+6	1.5E+4	3.5E+3		8.2E+7
21 December	1.4E+6	1.5E+4	3.4E+3		1.6E+7	
22 December	1.0E+6	1.6E+4	3.4E+3		3.2E+6	
23 December	3.8E+5	1.5E+4	3.7E+3		2.4E+6	
24 December	5.4E+5	1.5E+4	3.6E+3		3.6E+6	
25 December	1.0E+6	1.5E+4	3.4E+3		1.4E+6	
26 December	3.6E+5	1.5E+4	3.4E+3		2.7E+6	

### *Daily Geomagnetic Data*

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	20 December	2	1-1-0-1-1-0-0-0	2	2-0-0-1-1-0-0-1	4
21 December	6	1-0-2-3-2-1-1-2	18	2-0-1-6-3-4-2-2	12	2-1-3-5-2-3-2-2
22 December	12	2-4-3-4-2-2-1-1	29	2-3-5-6-5-3-2-3	19	3-4-4-5-3-3-2-2
23 December	5	1-2-1-1-1-2-2-1	8	3-1-0-3-2-3-1-1	6	1-2-1-1-1-2-2-2
24 December	2	1-0-0-0-1-1-0-1	3	1-0-0-2-1-2-1-0	4	0-0-0-1-1-2-1-1
25 December	6	2-3-2-1-1-1-1-1	8	2-3-3-3-1-1-1-1	12	3-4-4-2-1-1-2-2
26 December	9	3-2-2-2-1-3-2-2	13	1-3-1-4-4-3-2-2	10	3-3-2-2-2-3-2-2



### *Alerts and Warnings Issued*

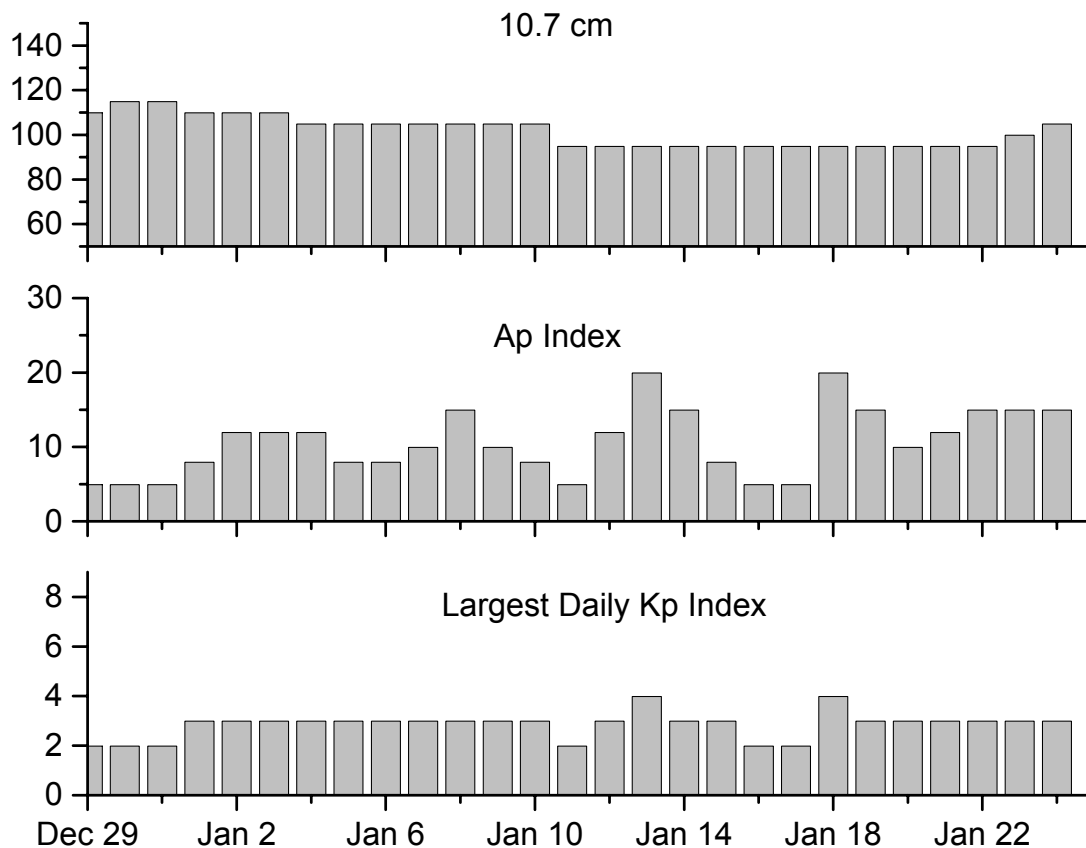
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<u>Date &amp; Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date &amp; Time of Event UT</u>
20 Dec 1157	ALERT: Electron 2MeV Integral Flux exceeded 1000pfu	20 Dec 1135
21 Dec 1031	ALERT: Geomagnetic K= 4	21 Dec 1030
22 Dec 0005	4 – 245 MHz Radio Bursts	21 Dec
22 Dec 0520	WARNING: Geomagnetic K= 4	22 Dec 0520 - 1500
22 Dec 0525	ALERT: Geomagnetic K= 4	22 Dec 0523
22 Dec 1011	ALERT: Geomagnetic K= 5	22 Dec 1010
23 Dec 0012	2 – 245 MHz Radio Bursts	22 Dec
25 Dec 0514	ALERT: Geomagnetic K= 4	25 Dec 0513
25 Dec 0537	ALERT: Geomagnetic K= 5	25 Dec 0537
25 Dec 0655	WARNING: Geomagnetic K= 4	25 Dec 0655 - 1600
25 Dec 0851	ALERT: Geomagnetic K= 4	25 Dec 0845
25 Dec 1554	EXTENDED WARNING: Geomagnetic K= 4	25 Dec 0655 - 2359

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### 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
29 Dec	110	5	2	12 Jan	95	12	3
30	115	5	2	13	95	20	4
31	115	5	2	14	95	15	3
01 Jan	110	8	3	15	95	8	3
02	110	12	3	16	95	5	2
03	110	12	3	17	95	5	2
04	105	12	3	18	95	20	4
05	105	8	3	19	95	15	3
06	105	8	3	20	95	10	3
07	105	10	3	21	95	12	3
08	105	15	3	22	95	15	3
09	105	10	3	23	100	15	3
10	105	8	3	24	105	15	3
11	95	5	2				



### *Energetic Events*

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

*No Events Observed*

### *Flare List*

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
20 December	0630	0634	0637	B1.8			713
	0850	1006	1034	B3.9			
	2048	2054	2103	B1.9			713
	2115	2211	2227	B3.9			713
	2249	2254	2257	B3.9			713
21 December	0103	0201	0213	B4.7			
	0752	0756	0758	B2.6			713
	0920	0925	0928	B4.0			713
	1018	1022	1025	B3.4			713
	1219	1224	1243	B3.7			
	1312	1315	1317	B3.2			713
	1906	1910	1912	B9.1			713
	2009	2011	2013	B3.5			
22 December	2229	2232	2235	B2.2			
	0201	0206	0210	B4.7			
	0227	0234	0236	B8.8			713
	0600	0605	0611	B6.0			
	0845	0852	0857	B5.2			
	1705	1710	1720	B2.8			
	1729	1737	1747	B5.6			
	2016	2018	2037	C2.3	Sf	S08E13	713
2333	2333	2343	C1.8	Sf	S13E04	713	
23 December	0426	0439	0451	B8.2			713
	0541	0545	0552	B5.1			713
	0617	0629	0636	C1.1			713
	0709	0713	0717	B3.5			713
	0957	1008	1016	C5.1			713
24 December	B0349	0358	0408	C1.8	Sf	S23E45	
	B0428	0428	0521		Sf	S22E44	
25 December	No Flares Observed						
26 December	0509	0513	0515	B1.6			
	0705	0709	0719	B1.6			
	1232	1240	1244	B9.9			713
	1820	1929	2017	B4.3			



### *Region Summary*

Date	Location		Sunspot Characteristics				Flares							
	( ° Lat ° CMD)	Helio Lon	Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical			
								C	M	X	S	1	2	3

*Region 712*

17 Dec S10E50	148	0020	06	Dso	004	B											
18 Dec S10E37	148	0030	05	Cso	005	B											
19 Dec S11E24	147	0010	04	Bxo	002	B											
20 Dec S11E11	147																
21 Dec S11W02	147																
22 Dec S11W15	147																
23 Dec S11W28	147																
24 Dec S11W41	147																
25 Dec S11W54	147																
26 Dec S11W67	147																

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude:147

*Region 713*

17 Dec S10E70	128	0070	03	Hax	001	A											
18 Dec S10E59	126	0100	07	Dao	004	B											
19 Dec S10E46	125	0120	10	Cso	007	B	1										
20 Dec S09E34	124	0210	11	Eai	020	Bg											
21 Dec S08E22	123	0210	11	Eai	015	Bg											
22 Dec S10E07	125	0190	16	Fai	025	Bg	2			2							
23 Dec S08W06	125	0210	10	Dao	021	Bg	2										
24 Dec S08W21	126	0190	12	Eai	020	B											
25 Dec S09W36	128	0100	07	Dsi	005	B											
26 Dec S08W47	126	0090	04	Cso	006	B											

5 0 0 2 0 0 0 0

Still on Disk.

Absolute heliographic longitude:125

*Region 714*

22 Dec S04W01	133	0010	03	Cao	002	B											
23 Dec S03W16	135	0020	04	Bxo	006	B											
24 Dec S03W30	135	0020	05	Cro	002	B											
25 Dec S03W40	132	0000	01	Axx	001	A											
26 Dec S03W53	132	0000	00		000												

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude:133

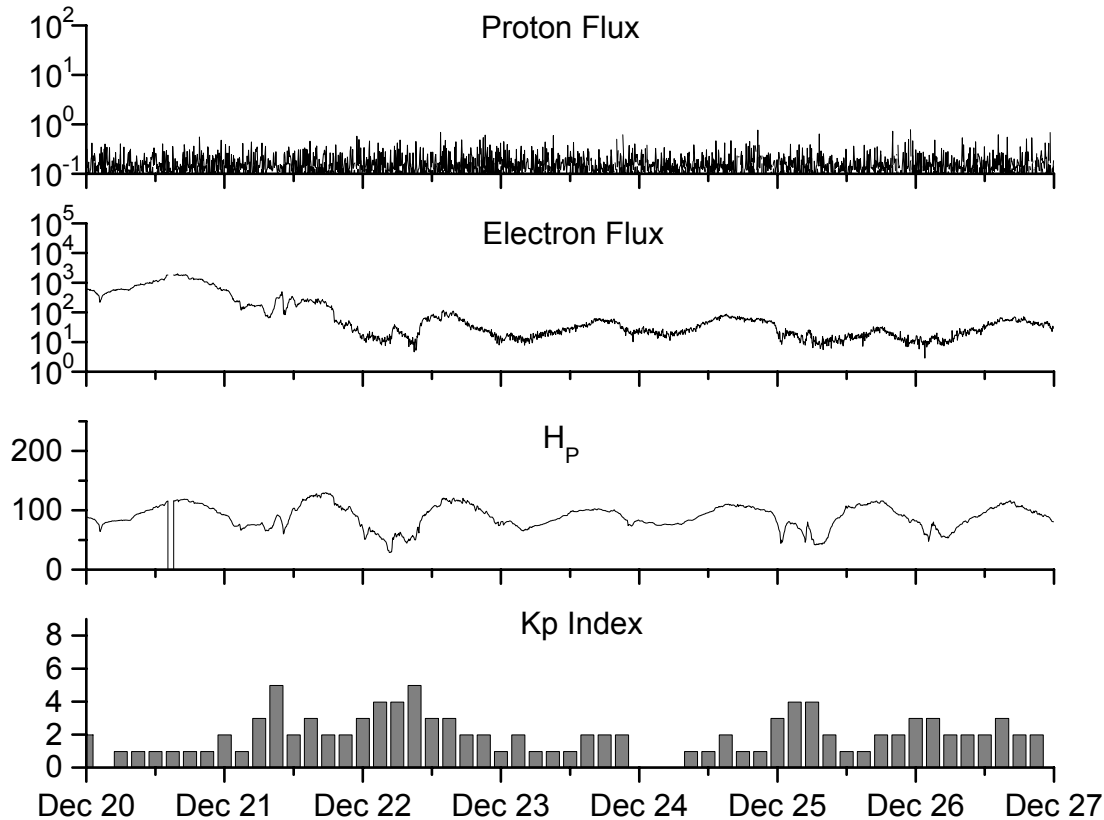


**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

Month	Sunspot Numbers			Radio Flux		Geomagnetic			
	Observed values SWO	Ratio RI	Ratio RI/SWO	Smooth values SWO	Smooth values RI	*Penticton 10.7 cm	Smooth Value	Planetary Ap	Smooth Value
<b>2002</b>									
December	147.9	80.8	0.55	144.6	82.1	158.6	150.9	13	17.0
<b>2003</b>									
January	149.3	79.7	0.53	141.7	81.0	144.0	149.2	13	18.2
February	87.0	46.0	0.53	136.4	78.5	124.5	144.7	17	18.9
March	119.7	61.1	0.51	128.1	74.2	132.2	139.5	21	19.4
April	119.7	60.0	0.50	121.5	70.3	126.3	135.0	20	20.1
May	89.6	55.2	0.62	118.3	67.8	129.3	133.1	26	21.0
June	118.4	77.4	0.65	113.6	65.2	129.4	130.2	24	21.5
July	132.8	85.0	0.64	106.9	62.0	127.8	127.2	19	22.0
August	114.3	72.7	0.64	102.8	60.3	122.1	125.2	23	22.2
September	82.6	48.8	0.59	100.7	59.8	112.3	123.7	18	21.8
October	118.9	65.5	0.55	96.6	58.4	153.1	121.8	35	21.1
November	118.9	67.3	0.57	93.6	57.0	153.1	120.1	28	20.0
December	75.4	46.5	0.62	91.4	55.0	115.1	118.0	16	18.6
<b>2004</b>									
January	62.3	37.7	0.61	87.9	52.0	114.1	116.3	22	18.1
February	75.6	45.8	0.61	84.2	49.4	107.0	115.5	13	17.7
March	81.0	49.1	0.61	80.9	47.2	112.2	114.6	14	16.9
April	59.3	39.3	0.66	77.9	45.6	101.2	112.3	11	15.5
May	77.3	41.5	0.54			99.8		8	
June	78.9	43.2	0.55			97.4		8	
July	87.8	51.0	0.58			118.5		23	
August	69.5	40.9	0.59			110.1		11	
September	50.0	27.7	0.55			103.1		10	
October	77.9	48.4	0.62			167.0		9	
November	70.5	43.7	0.62			113.2		26	

**NOTE:** All smoothed values after September 2002 and monthly values after March 2003 are preliminary estimates. The lowest smoothed sunspot index number for Cycle 22, RI = 8.0, occurred in May 1996. The highest smoothed sunspot number for Cycle 23, RI= 120.8, occurred April 2000. \*After June 1991, the 10.7 cm radio flux data source is Penticton, B.C. Canada. Prior to that, it was Ottawa.





*Weekly Geosynchronous Satellite Environment Summary  
Week Beginning 20 December 2004*

*Protons* plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>-sec -sr) as measured by GOES-11 (W103) 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-12 (W75).

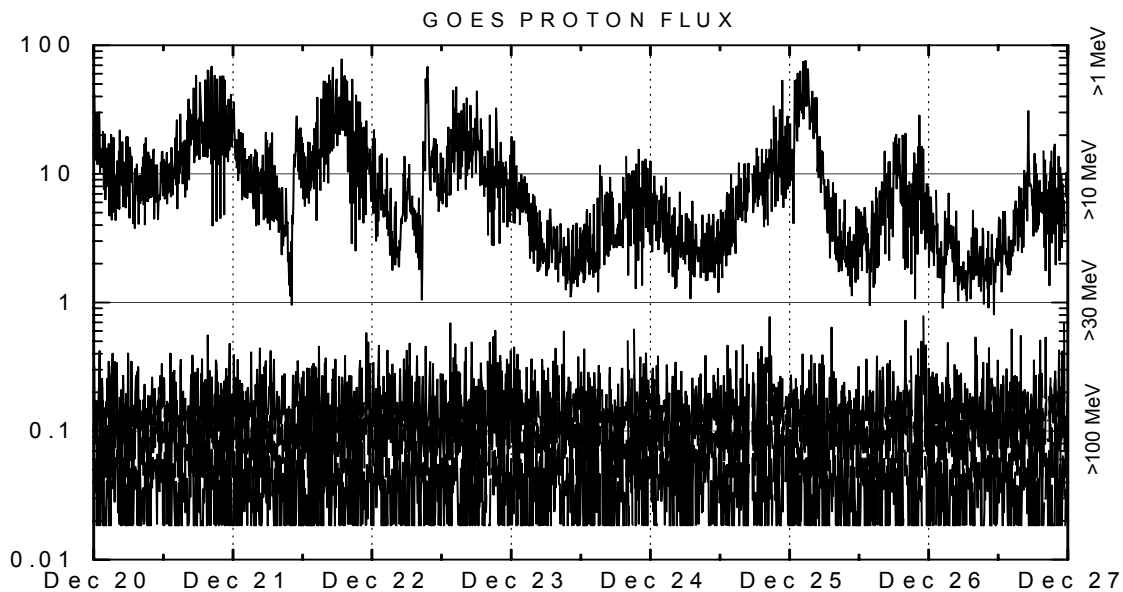
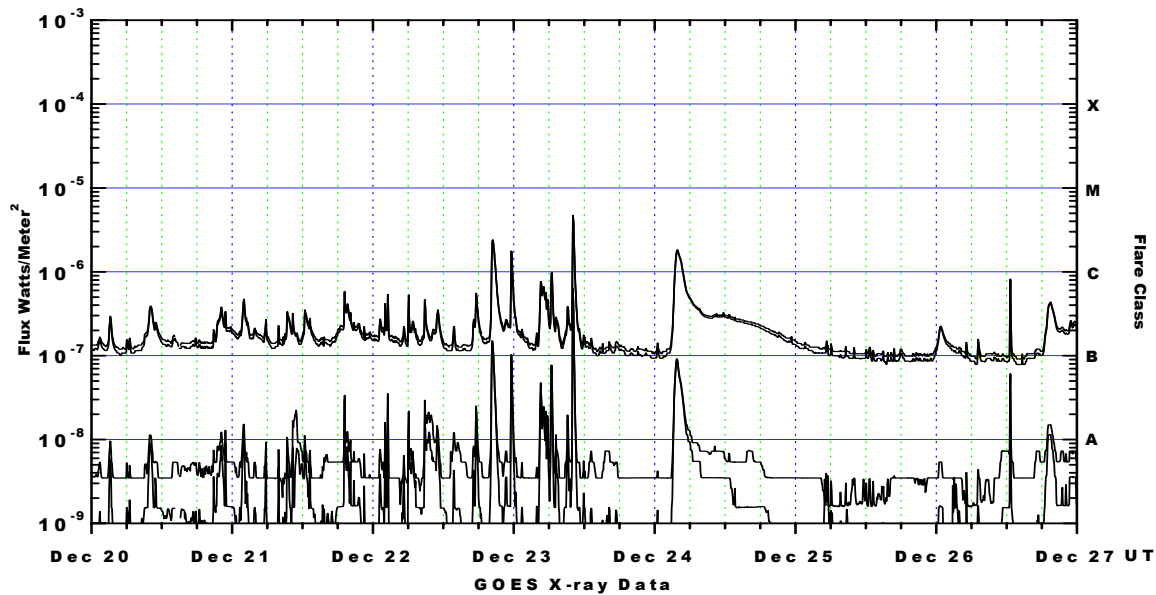
*H<sub>p</sub>* plot contains the five minute averaged magnetic field H - component in nanoteslas (nT) as measured by GOES-12. The H component is parallel to the spin axis of the satellite, which is nearly parallel to the Earth's rotation axis.

*K<sub>p</sub>* 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 K<sub>p</sub> values derived from a more extensive network of magnetometers.

The data included here are those now available in real time at the SWO 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 K<sub>p</sub> are "global" parameters that are applicable to a first order approximation over large areas. H<sub>p</sub> 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 12 (W75) and GOES 10 (W135) in two wavelength bands, .05 - .4 and .1 - .8 nm. The letters A, B, C, M and X refer to x-ray event levels for the .1 - .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 (W103) 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.

