

Space Weather Highlights
22 - 28 December 2003

SWO PRF 1478
30 December 2003

Solar activity was at very low to moderate levels during the period. The largest, and most active region was Region 528 (N10, L=261, class/area Fkc/740 on 25 December). This region exhibited steady areal growth early in the period and a slow steady decay after 26 December. Activity from Region 528 consisted of nineteen C-class flares including two long duration events, a C5/Sf at 0825 UTC on 25 December and a C7/1f at 1038 UTC on 26 December. A weak partial halo CME was associated with the long duration C5 on the 25th. This region also produced the largest event of the period, an M1/1n at 1928 UTC on 26 December. The other region of interest during the period was Region 525 (N10, L=291, class/area Dsi/130 on 21 December). This region produced six C-class flares before it dissipated on the disk on 26 December.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft during most of the summary period. The period began with elevated solar wind speeds near 625 km/s due to residual effects from a small coronal hole high speed stream. On 23 December, solar wind speed began a steady decline that reached 375 km/s by 25 December. A weak transient passed the ACE spacecraft at 0900 UTC on 27 December and was likely the effects of a weak CME from the long duration C5 on 25 December. Wind speeds finished the period near 525 km/s.

There were no greater than 10 MeV proton events at geosynchronous orbit during the summary period.

The greater than 2 MeV electron flux at geosynchronous orbit reached high levels on 22 - 25 December.

The geomagnetic field ranged from quiet to active levels. Isolated active periods were observed on 22 December and again on 27 December.

Space Weather Outlook
31 December 2003 - 26 January 2004

Solar activity is expected to be at very low to low levels. A slight chance of moderate level activity is possible from Region 528 for the first two days of the period. Expect mostly very low to low activity levels for the remainder of the period.

No greater than 10 MeV proton events at geosynchronous orbit are expected during the period.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to reach high levels on 02 - 03 January and again on 06 - 14 January due to recurrent coronal holes.

Geomagnetic activity is expected to range from quiet major storm levels. Unsettled to minor storm periods are expected on 01 - 02 January due to a small coronal hole high speed stream. A large transequatorial coronal hole is expected to return 04 - 10 January and major storm periods are expected.



Daily Solar Data

Date	Radio Flux 10.7 cm	Sun spot No.	Sunspot Area (10 ⁻⁶ hemi.)	X-ray Background	Flares							
					X-ray Flux			Optical				
					C	M	X	S	1	2	3	4
22 December	138	152	630	B3.8	9	0	0	4	0	0	0	0
23 December	142	144	710	B4.6	6	0	0	4	0	0	0	0
24 December	139	100	730	B3.8	4	0	0	2	0	0	0	0
25 December	139	58	780	B4.5	6	0	0	9	0	0	0	0
26 December	137	65	740	B3.5	4	1	0	1	2	0	0	0
27 December	127	47	680	B2.8	0	0	0	0	0	0	0	0
28 December	119	47	560	B2.5	0	0	0	0	0	0	0	0

Daily Particle Data

Date	Proton Fluence (protons/cm ² -day-sr)			Electron Fluence (electrons/cm ² -day-sr)		
	>1MeV	>10MeV	>100MeV	>.6MeV	>2MeV	>4MeV
	22 December	1.2E+6	1.2E+6	1.2E+4	2.7E+3	2.9E+7
23 December	8.1E+5	8.1E+5	1.1E+4	2.8E+3	4.4E+7	
24 December	5.2E+5	5.2E+5	1.2E+4	2.7E+3	7.8E+7	
25 December	5.7E+5	5.7E+5	1.2E+4	2.8E+3	6.5E+7	
26 December	4.7E+5	4.7E+5	1.1E+4	2.6E+3	2.8E+7	
27 December	5.7E+5	5.7E+5	1.1E+4	2.6E+3	1.7E+7	
28 December	3.4E+5	3.4E+5	1.1E+4	2.5E+3	1.1E+7	

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	22 December	18	4-3-3-3-3-4-3-3	34	2-2-5-6-5-5-3-3	15
23 December	6	1-1-1-2-2-3-2-1	14	2-1-2-4-4-4-2-2	9	2-2-1-3-3-3-3-2
24 December	6	1-1-1-1-1-3-2-2	5	1-0-1-0-2-3-2-1	8	1-2-2-2-3-3-3-2
25 December	8	2-1-1-2-3-3-2-2	6	1-0-0-3-3-3-0-1	6	2-1-1-2-2-3-2-2
26 December	11	2-2-2-3-2-3-3-3	6	1-2-0-3-3-1-1-1	9	2-2-2-3-3-3-2-3
27 December	12	2-3-2-3-2-3-3-3	8	1-2-0-3-2-3-1-3	12	3-3-2-3-3-3-3-4
28 December	13	3-3-2-3-2-3-3-3	14	2-3-2-4-3-3-3-2	12	3-3-2-3-3-3-3-2

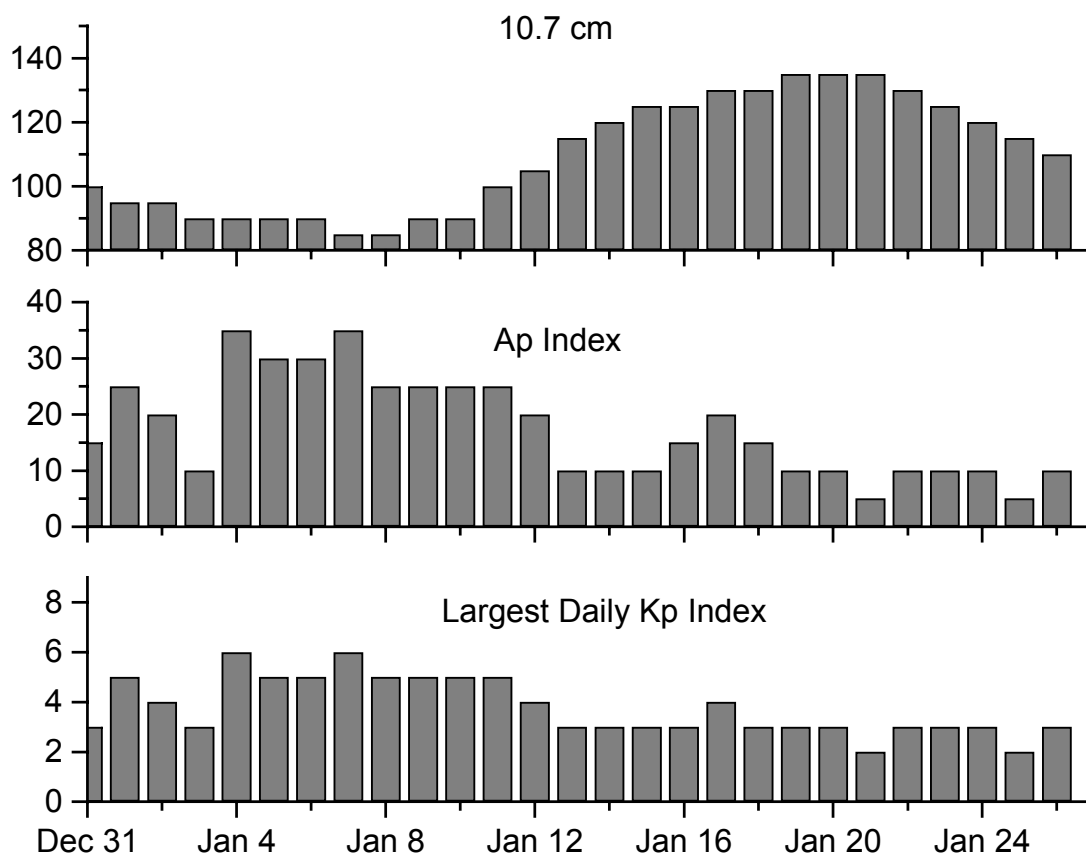


Alerts and Warnings Issued

<u>Date & Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date & Time of Event UT</u>
22 Dec 1208	ALERT: STRATWARM	22 Dec
22 Dec 1707	EXTENDED WARNING: Geomagnetic K= 4	20 Dec 1043 - 22 Dec 2359
22 Dec 1714	ALERT: Electron 2MeV Integral Flux > 1000pfu	22 Dec 1650
22 Dec 2339	EXTENDED WARNING: Geomagnetic K= 4	20 Dec 1043 - 23 Dec 1600
23 Dec 1432	ALERT: STRATWARM	23 Dec
23 Dec 2136	ALERT: Electron 2MeV Integral Flux > 1000pfu	23 Dec 2115
24 Dec 0006	1 - 245 MHz Burst	23 Dec
24 Dec 0006	1 - 245 MHz Radio Noise Storm	23 Dec
24 Dec 1024	ALERT: Electron 2MeV Integral Flux > 1000pfu	24 Dec 1005
24 Dec 1148	ALERT: STRATWARM	24 Dec
25 Dec 0009	1 - 245 MHz Burst	24 Dec
25 Dec 1230	ALERT: Electron 2MeV Integral Flux > 1000pfu	25 Dec 1210
26 Dec 1256	ALERT: STRATWARM	26 Dec
27 Dec 1207	ALERT: STRATWARM	27 Dec
28 Dec 1101	ALERT: STRATWARM	28 Dec



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 Dec	100	15	3	14 Jan	120	10	3
01 Jan	95	25	5	15	125	10	3
02	95	20	4	16	125	15	3
03	90	10	3	17	130	20	4
04	90	35	6	18	130	15	3
05	90	30	5	19	135	10	3
06	90	30	5	20	135	10	3
07	90	35	6	21	135	5	2
08	90	25	5	22	130	10	3
09	90	25	5	23	125	10	3
10	90	25	5	24	120	10	3
11	100	25	5	25	115	5	2
12	105	20	4	26	110	10	3
13	115	10	3				



Energetic Events

Date	Time		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½ Max	Class	Integ Flux	Imp/ Brtns	Location Lat CMD	Rgn #	Radio Flux		Intensity	
									245	2695	II	IV
26 Dec	1913	1928	1933	M1.5	.008	1n	N09W30	528				

Flare List

Date	Time			X-ray Class.	Imp / Brtns	Optical Location Lat CMD	Rgn
	Begin	Max	End				
22 December	0042	0045	0052	C5.5	Sf	N08E41	528
	0636	0654	0711	C2.2			530
	0653	0654	0705		Sf	N07E28	528
	0926	0930	0933	B7.0			
	1102	1109	1117	C1.7			528
	1346	1356	1406	C2.3			528
	1438	1441	1443	C1.6			528
	1541	1545	1549	C1.2			528
	1943	1949	2013	C3.7	Sf	N09E23	528
	2036	2042	2046	C1.6	Sf	S18E51	530
23 December	2133	2139	2143	C1.8			528
	0232	0238	0248	C2.1	Sf	N11E25	528
	0452	0457	0502	C1.1			528
	0535	0543	0551	B8.7			528
	0650	0650	0654	B9.5	Sf	N11E23	528
	0731	0733	0746	C1.6	Sf	N11W10	525
	0808	0810	0817	C1.3	Sf	N09E16	528
	1014	1024	1035	C6.9			525
	1513	1532	1600	C1.0			
	1756	1801	1806	B9.5			525
24 December	0602	0627	0639	C1.2			525
	0801	0806	0812	B9.5			528
	0959	1006	1014	C1.2			531
	1029	1033	1036	B6.1			528
	1816	1822	1829	B7.9			525
	2130	2133	2136	B8.4			528
	2316	2316	2329	C1.5	Sf	N09E00	528
	2350	0002	0008	C1.8	Sf	N09W05	528
25 December	0216	0216	0223		Sf	N09W36	525
	0226	0230	0252	C5.3	Sf	N09W01	528
	B0229	0231	0237		Sf	N10W02	525
	0232	0235	0239		Sf	N09W36	525
	0256	0302	0318	C3.6	Sf	N09W37	525
	0347	0347	0352		Sf	N09W02	528
	0400	0401	0410	C1.9	Sf	N09W38	525
	0522	0527	0544	C1.2	Sf	N11W39	525
	0754	0823	0901	C5.3	Sf	N09W04	528



Flare List - continued.

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
25 December	1147	1150	1155	C1.5			528
26 December	0114	0118	0121	B8.6			532
	1027	1038	1114	C7.1	1f	N08W22	528
	1137	1143	1150	C1.2			528
	1204	1209	1215	C1.0			528
	1258	1302	1309	B7.2			528
	1619	1621	1630	C1.8	Sf	N09W29	528
	1921	1928	1945	M1.5	1n	N09W30	528
27 December	No Flares Observed						
28 December	0354	0359	0405	B6.6			528

Region Summary

Date	Location		Sunspot Characteristics				Flares								
	Helio		Area (10 ⁻⁶ hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical				
	(° Lat ° CMD)	Lon						C	M	X	S	1	2	3	4

Region 520

10 Dec	N03E75	006	0120	02	Hax	002	A												
11 Dec	N02E62	005	0100	03	Hax	001	A												
12 Dec	N02E47	007	0100	02	Hsx	001	A												
13 Dec	N02E33	008	0110	02	Hsx	001	A												
14 Dec	N02E19	009	0140	06	Dso	010	B												
15 Dec	N02E06	009	0080	06	Dso	005	B												
16 Dec	N01W07	008	0170	07	Dso	009	Bg												
17 Dec	N03W22	010	0110	07	Dso	004	B												
18 Dec	N03W35	010	0120	07	Dao	003	B												
19 Dec	N03W48	010	0100	07	Cso	003	B												
20 Dec	N03W61	010	0120	07	Cso	002	B												
21 Dec	N02W71	007	0080	02	Hsx	001	A												
22 Dec	N03W84	006	0090	03	Hhx	001	A												
23 Dec	N04W99	008	0020	01	Hrx	001	A												

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 009



Region Summary - continued.

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

Region 521

10 Dec S11E82	359	0060	04	Dao	002	B													
11 Dec S11E63	004	0110	08	Dso	003	B													
12 Dec S12E48	004	0090	06	Cso	004	B													
13 Dec S12E34	007	0080	06	Dso	004	B													
14 Dec S12E21	007	0050	06	Dso	004	B													
15 Dec S12E09	006	0040	06	Dso	003	B													
16 Dec S11W05	006	0050	06	Dso	006	Bg													
17 Dec S11W20	008	0020	07	Cro	005	B	1												
18 Dec S12W34	009	0020	01	Hsx	003	A													
19 Dec S12W47	009	0010	04	Bxo	002	B													
20 Dec S12W60	009																		
21 Dec S12W73	009																		
22 Dec S12W86	009																		

Crossed West Limb.

Absolute heliographic longitude: 006

Region 523

16 Dec S15E72	289	0060	01	Hsx	002	A													
17 Dec S15E58	290	0020	00	Axx	002	A													
18 Dec S13E45	290	0040	03	Hax	002	A													
19 Dec S17E34	288	0040	03	Cso	004	B													
20 Dec S17E23	286	0020	03	Cso	002	B													
21 Dec S17E09	287	0000	00	Axx	002	A													
22 Dec S18W01	283	0020	04	Bxo	012	B													
23 Dec S19W13	282	0010	05	Bxo	005	B													
24 Dec S19W26	282	0010	01	Axx	001	A													
25 Dec S19W39	282	0000	00		000														
26 Dec S19W52	282	0000	00		000														

Still on Disk.

Absolute heliographic longitude: 283



Region Summary - continued.

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

Region 524

16 Dec	S08E67	294	0030	01	Axx	002	A												
17 Dec	S08E54	294	0050	02	Hsx	001	A												
18 Dec	S07E39	296	0030	02	Hsx	002	A												
19 Dec	S08E25	297	0020	03	Cso	004	B												
20 Dec	S08E13	296	0010	03	Cso	002	B												
21 Dec	S08W03	299	0000	01	Bxo	002	B												
22 Dec	S08W16	298																	
23 Dec	S08W29	298																	
24 Dec	S08W42	298																	
25 Dec	S08W55	298																	
26 Dec	S08W68	298																	

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 299

Region 525

16 Dec	N10E68	293	0030	01	Axx	002	B												
17 Dec	N09E56	292	0070	04	Cso	005	B	2			1								
18 Dec	N09E44	291	0090	07	Dao	014	B	4			4								
19 Dec	N10E31	291	0180	10	Dki	014	B	7			7								
20 Dec	N09E17	292	0120	09	Dai	017	B	4			2								
21 Dec	N09E05	291	0130	09	Dsi	020	Bg	1			1								
22 Dec	N08W10	292	0080	09	Dao	028	B												
23 Dec	N08W22	291	0080	07	Dao	011	B	2			1								
24 Dec	N09W36	292	0050	09	Cao	011	B	1											
25 Dec	N09W49	292	0010	02	Axx	002	A	3			6								
26 Dec	N09W62	292																	
27 Dec	N09W75	292																	
28 Dec	N09W88	292																	

24 0 0 22 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 291



Region Summary - continued.

Date	Location		Sunspot Characteristics				Flares											
	(° Lat ° CMD)	Helio	Area (10 ⁻⁶ hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical							
		Lon						C	M	X	S	1	2	3	4			
<i>Region 528</i>																		
18 Dec	N08E71	264	0170	03	Hax	006	A											
19 Dec	N09E62	260	0290	16	Fac	015	B	1										
20 Dec	N09E49	260	0360	18	Fsi	020	B											
21 Dec	N09E37	259	0390	18	Fho	019	Bg	2				1						
22 Dec	N09E23	259	0410	18	Fko	045	Bg	7				3						
23 Dec	N09E09	260	0520	18	Fkc	043	Bg	3				3						
24 Dec	N10W05	261	0650	17	Fkc	029	Bg	2				2						
25 Dec	N10W18	261	0740	17	Fkc	022	Bg	3				3						
26 Dec	N10W31	261	0690	18	Fkc	036	Bg	4	1			1	2					
27 Dec	N10W44	261	0640	18	Fkc	019	Bg											
28 Dec	N10W57	261	0500	17	Fkc	012	Bg											
								22	1	0	13	2	0	0	0	0		

Still on Disk.

Absolute heliographic longitude: 261

<i>Region 529</i>																		
20 Dec	N09W18	327	0000	01	Axx	001	A											
21 Dec	N09W31	327	0000	00		000												
22 Dec	N09W44	327	0000	00		000												
23 Dec	N09W60	329	0010	01	Axx	001	A											
24 Dec	N09W73	329	0000	00		000												
25 Dec	N09W86	329	0000	00		000												
								0	0	0	0	0	0	0	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 327

<i>Region 530</i>																		
21 Dec	S20E64	232	0030	02	Hax	001	A											
22 Dec	S21E50	232	0020	01	Hax	001	A	2				1						
23 Dec	S22E37	232	0040	04	Dso	005	B											
24 Dec	S22E24	232	0010	05	Bxo	005	B											
25 Dec	S22E11	232	0000	00		000												
								2	0	0	1	0	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 232



Region Summary - continued.

Date	Location		Sunspot Characteristics				Flares																	
	(° Lat ° CMD)	Helio	Area (10 ⁻⁶ hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical													
		Lon						C	M	X	S	1	2	3	4									
<i>Region 531</i>																								
22 Dec	N01W21	303	0010	07	Bxo	005	B																	
23 Dec	N02W37	306	0030	04	Cso	008	B																	
24 Dec	N03W50	306	0010	03	Bxo	004	B	1																
25 Dec	N03W63	306	0000	00		000																		
26 Dec	N03W76	306	0000	00		000																		
27 Dec	N03W89	306	0000	00		000																		
								1	0	0	0	0	0	0	0	0	0	0						
Crossed West Limb.																								
Absolute heliographic longitude: 303																								
<i>Region 532</i>																								
25 Dec	S11E02	241	0030	04	Cso	004	B																	
26 Dec	S11W11	241	0050	04	Dao	009	B																	
27 Dec	S11W25	241	0040	04	Dao	008	B																	
28 Dec	S11W38	241	0020	04	Cso	003	B																	
								0	0	0	0	0	0	0	0	0	0	0						
Still on Disk.																								
Absolute heliographic longitude: 241																								
<i>Region 533</i>																								
28 Dec	N16E54	149	0040	03	Dso	002	B																	
								0	0	0	0	0	0	0	0	0	0	0						
Still on Disk.																								
Absolute heliographic longitude: 149																								

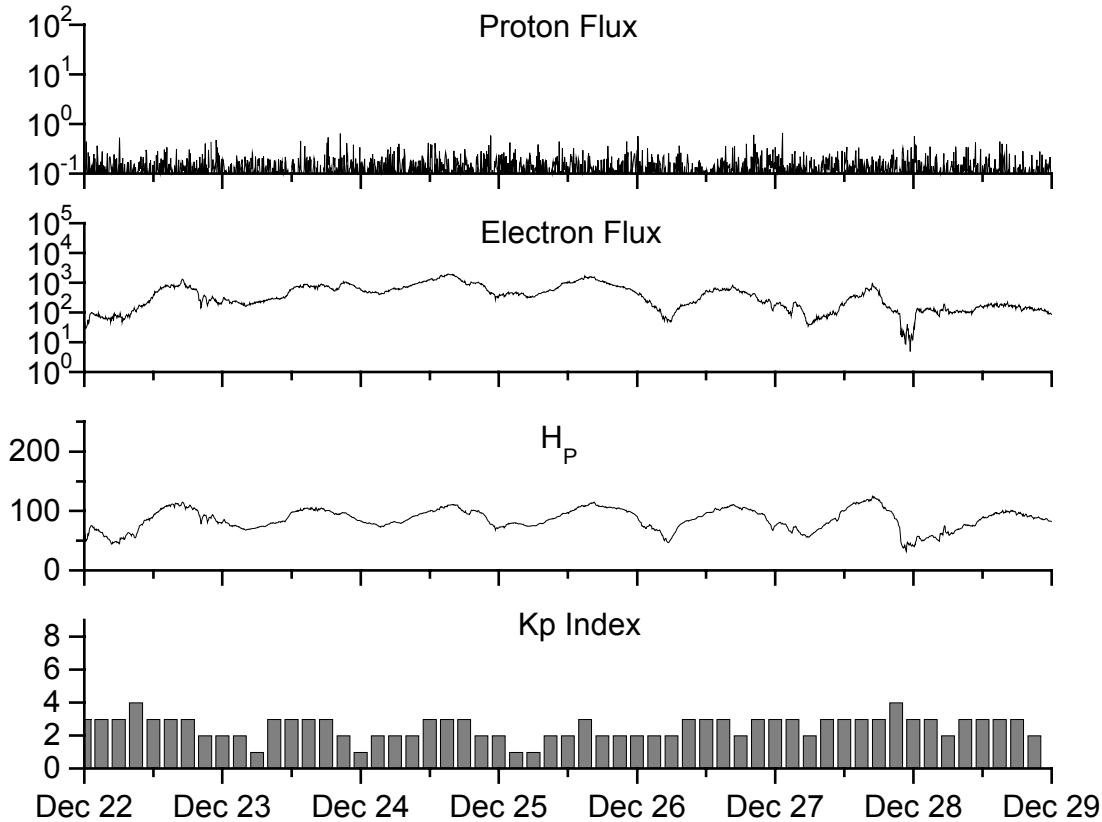


**Recent Solar Indices (preliminary)
of the observed monthly mean values**

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
2001									
December	217.5	132.2	0.61	184.5	114.6	235.6	193.9	09	12.2
2002									
January	189.0	114.1	0.60	184.8	113.5	227.3	194.6	08	12.3
February	194.5	107.4	0.55	188.6	114.7	205.0	197.2	10	12.8
March	153.1	98.4	0.64	188.9	113.3	180.3	195.7	10	12.9
April	194.9	120.7	0.62	186.2	110.5	189.8	191.5	15	13.2
May	204.1	120.8	0.59	183.6	108.9	178.4	188.0	15	13.3
June	146.0	88.3	0.60	179.9	106.3	148.7	183.0	11	13.5
July	183.5	99.6	0.54	175.4	102.7	173.5	176.3	11	13.7
August	191.0	116.4	0.61	169.2	98.7	183.9	169.5	16	14.2
September	206.4	109.6	0.53	163.4	94.6	175.8	164.1	14	15.0
October	153.9	97.5	0.63	158.8	90.5	167.0	159.4	23	15.6
November	159.8	95.5	0.60	150.9	85.2	168.7	154.8	16	16.3
December	147.9	80.8	0.55	144.6	82.1	158.6	150.9	13	17.0
2003									
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	136.3	20	20.0
May	89.6	55.2	0.62	118.3	67.8	129.3	135.0	26	21.0
June	118.4	77.4	0.65			129.4		24	
July	132.8	85.0	0.64			127.8		20	
August	114.3	72.7	0.64			122.1		23	
September	82.6	48.8	0.59			112.3		19	
October	118.9	65.6	0.55			153.1		32	
November	118.9	67.2	0.57			153.1		31	

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 22 December 2003

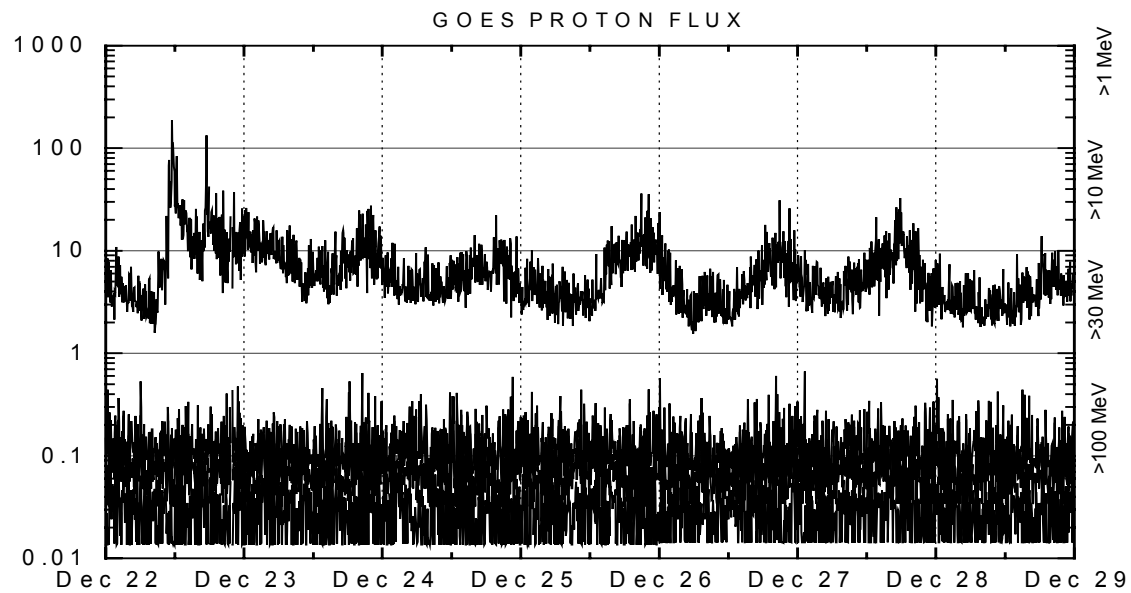
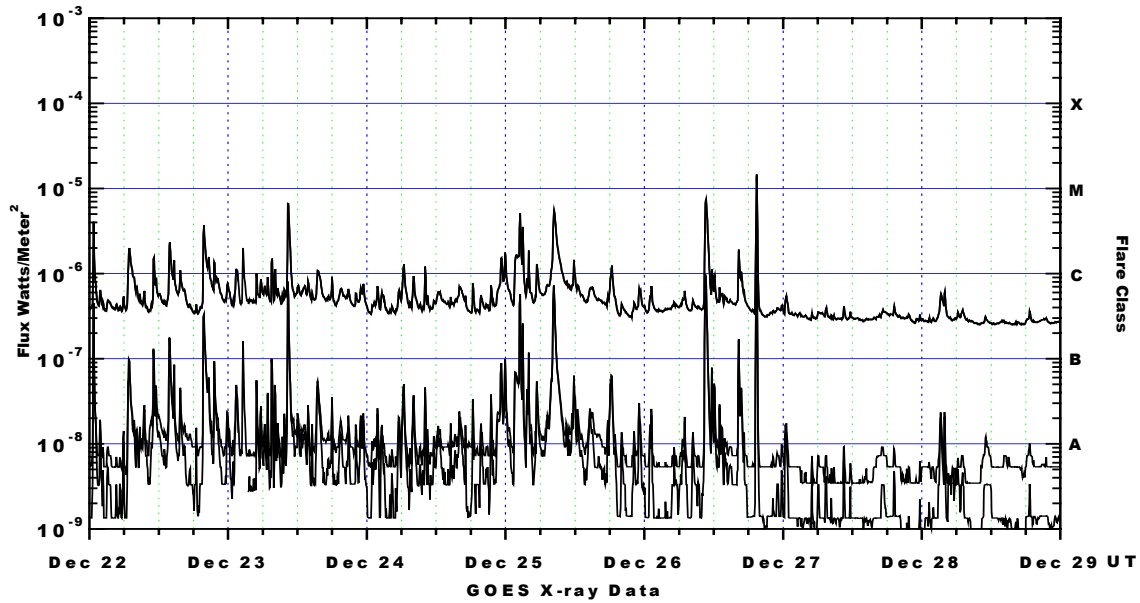
Protons plot contains the five-minute averaged integral proton flux (protons/cm²-sec -sr) as measured by GOES-11 (W113) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

Electrons plot contains the five-minute averaged integral electron flux (electrons/cm²-sec -sr) with energies greater than 2 MeV at GOES-12.

H_p 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_p 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 Heartland, UK. These data are made available through cooperation from the Geological Survey of Canada (GSC) and the US Geological Survey. These may differ from the final K_p 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_p 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/m²) as measured by GOES 12 and 10 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/cm²-sec-sr) as measured by GOES-11 (W113) for each of the energy thresholds: >1, >10, >30 and >100 MeV. P10 event threshold is 10 pfu (protons/cm²-sec-sr) at greater than 10 MeV.

