

Space Weather Highlights
02 - 08 December 2002

SWO PRF 1423
10 December 2002

Solar activity has been low to moderate. On 04 December, Region 213 (N14, L=235, class/area Cao/110 on 05 December) produced an M2.5/2n flare with an associated Type II (900 km/s) and Type IV radio sweep. A CME was also associated with this event but no Earth directed component was observed. Solar activity during the rest of the summary period was at low levels. Region 208 (N10, L=290, class/area Eai/140 on 04 December) grew rapidly for the first few days it was on the visible disk and produced a number of minor C-class flares and sub-flares. For flare times and magnitudes please refer to the Energetic and Optical flare lists. Region 208 developed moderate magnetic complexity early in the period as a beta-gamma classification then simplified to a beta class on 07 December. Region 214 (N13, L=315, class/area Eso/120 on 08 December) appeared later in the period and developed moderate beta-gamma magnetic complexity. A couple of minor C-class events were also observed from Region 214.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft for most of the summary period. A coronal hole rotated into a geo-effective position on 06 - 08 December with solar wind speed increasing to near 600 km/s and the Bz component of the interplanetary magnetic field remaining, on average, positive.

The greater than 10 MeV protons at geo-synchronous orbit were at background levels during the summary period.

The greater than 2 MeV electron flux at geo-synchronous orbit reached high levels on 02 - 06 December. The highest value of GOES-8 electron flux occurred on 06 December, reaching 8230 pfu. The geomagnetic field was at quiet to active levels during the summary period. Quiet to unsettled conditions were observed on 02 - 07 December with isolated active conditions on 04 and 07 December. Quiet to active levels were observed on 08 December due to a recurring coronal hole.

Space Weather Outlook
11 December - 06 January 2003

Solar activity is expected to be low to moderate. Isolated low-level M-class activity is possible during the period.

There is a slight chance of a greater than 10 MeV proton event during the forecast period.

The greater than 2 MeV electron flux at geo-synchronous orbit is expected to exceed event threshold on 21-22 and 25-26 December due to recurring coronal holes.

The geomagnetic field is expected to be at quiet to active levels during the forecast period.

A coronal hole is due to return on 18-19 December and is expected to result in active to isolated minor storm conditions. Weaker recurring coronal holes are expected to return on 26-28 December and again on 03-04 January resulting in unsettled to isolated active conditions.



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
02 December	146	155	850	B3.6	3	0	0	2	1	0	0	0
03 December	146	135	740	B4.1	2	0	0	5	0	0	0	0
04 December	149	144	770	B4.2	0	1	0	3	0	1	0	0
05 December	149	153	860	B3.8	2	0	0	0	0	0	0	0
06 December	148	112	700	B3.8	2	0	0	2	0	0	0	0
07 December	151	106	490	B4.0	2	0	0	0	0	0	0	0
08 December	154	150	660	B5.0	3	0	0	5	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
	02 December	2.4E+5	1.2E+4	2.7E+3		6.7E+7
03 December	2.4E+5	1.3E+4	2.9E+3		7.0E+7	
04 December	2.2E+5	1.3E+4	2.8E+3		6.8E+7	
05 December	1.1E+5	1.2E+4	3.0E+3		4.4E+7	
06 December	8.6E+5	1.2E+4	2.7E+3		8.9E+7	
07 December	5.4E+5	1.2E+4	2.5E+3		2.7E+6	
08 December	7.8E+4	1.1E+4	2.2E+3		1.6E+6	

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	02 December	9	2-3-2-2-2-3-2-2	*	*-*-*-*-*-*-*	11
03 December	7	3-2-1-2-2-1-2-1	17	2-3-2-4-5-3-2-2	11	3-3-2-3-3-3-3-2
04 December	7	1-1-2-1-2-3-3-1	16	1-1-3-3-4-4-4-2	12	2-2-3-3-3-4-3-2
05 December	5	2-1-2-1-2-1-1-1	7	1-1-3-3-2-2-1-0	9	3-3-2-3-2-3-2-2
06 December	6	0-2-2-2-1-2-2-2	4	0-0-2-2-2-2-1-1	10	2-2-2-2-3-3-3-3
07 December	8	2-2-2-2-3-2-2-2	27	3-3-3-5-6-3-3-3	16	3-3-3-4-3-3-3-3
08 December	8	1-3-1-1-3-3-2-1	15	2-4-1-1-3-5-3-1	12	2-4-2-2-3-4-3-2

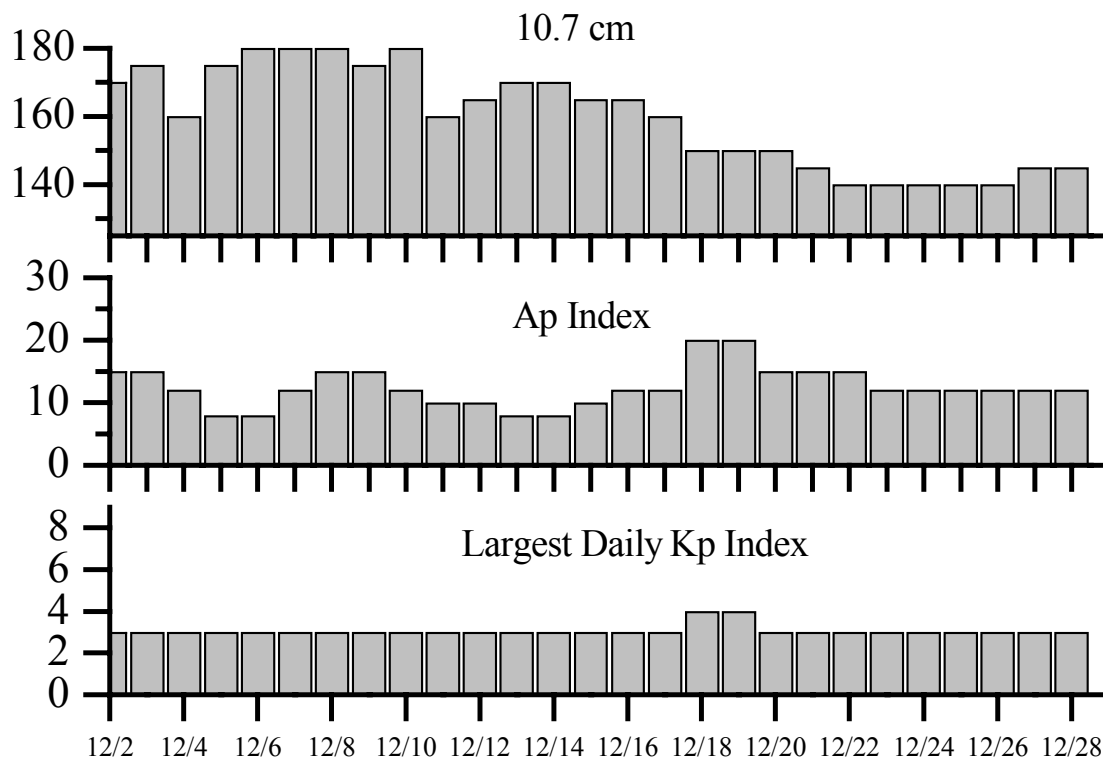


Alerts and Warnings Issued

<u>Date & Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date & Time of Event UT</u>
03 Dec 0042	3 - 245 MHz Radio Bursts	02 Dec
02 Dec 1230	ALERT: Electron 2MeV Integral Flux > 1000pfu	02 Dec 1220
03 Dec 1158	ALERT: Electron 2MeV Integral Flux > 1000pfu	03 Dec 1155
04 Dec 1108	ALERT: Electron 2MeV Integral Flux > 1000pfu	04 Dec 1045
04 Dec 2255	SUMMARY: 10cm Radio Burst	04 Dec 2244
04 Dec 2309	ALERT: Type II Radio Emission	04 Dec 2249
04 Dec 2336	ALERT: Type IV Radio Emission	04 Dec 2244
05 Dec 0021	1 - 245 MHz Radio Burst	04 Dec
05 Dec 0021	1 - 245 MHz Radio Noise Storm	04 Dec
05 Dec 1444	ALERT: Electron 2MeV Integral Flux > 1000pfu	05 Dec 1425
06 Dec 0038	3 - 245 MHz Radio Bursts	05 Dec
06 Dec 1313	ALERT: Electron 2MeV Integral Flux > 1000pfu	06 Dec 1250
07 Dec 0143	ALERT: Geomagnetic K=4	07 Dec 0143
07 Dec 0312	WARNING: Geomagnetic Sudden Impulse	07 Dec 0350 - 0415



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
11 Dec	160	10	3	25 Dec	140	12	3
12	165	10	3	26	140	12	3
13	170	8	3	27	145	12	3
14	170	8	3	28	145	12	3
15	165	10	3	29	145	10	3
16	165	12	3	30	150	10	3
17	160	12	3	31	150	12	3
18	150	20	4	01 Jan	150	8	3
19	150	20	4	02	150	10	3
20	150	15	3	03	150	15	3
21	145	15	3	04	155	10	3
22	140	15	3	05	155	12	3
23	140	12	3	06	160	12	3
24	140	12	3				



Energetic Events

Date	Time		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½	Integ	Imp/ Brtns	Location Lat CMD	Rgn #	Radio Flux		Intensity		
			Max	Flux				245	2695	II	IV	
04 Dec	2241	2249	2257	M2.5	.014	2n	N16E61	213	3300	170	3	1

Flare List

Date	Time			X-ray Class.	Imp / Brtns	Optical Location Lat CMD	Rgn
	Begin	Max	End				
02 December	0155	0157	0219	C2.4	1n	N10E44	208
	0930	0933	0936	B9.4			
	1642	1647	1652	B7.7			
	B1927	U1929	1958	C9.5	Sf	N09E32	208
	B2041	U2041	A2104	C1.8	Sf	S19E09	207
03 December	0814	0817	0842	C8.3	Sn	N09E25	208
	1259	1306	1313	C1.2			
	1317	1319	1323		Sf	N16E83	213
	1334	1336	1350		Sf	S18W06	207
	1741	1741	1751		Sf	N10E19	208
04 December	2013	2019	2030		Sf	S21W04	207
	0334	0334	0342	B6.1	Sf	S18W13	207
	0555	0557	0614	B7.8	Sf	N09E12	208
	0639	0654	0709	B9.1			
	1631	1631	1637	B8.4	Sf	N16E54	212
05 December	2240	2253	A2257	M2.5	2n	N16E61	213
	0439	0450	0502	C1.1			
	1108	1112	1116	B7.3			
06 December	2201	2206	2212	C1.0			
	0546	0547	0549		Sf	N12E33	212
	0854	0855	0903	C2.1	Sf	N12W34	214
	1035	1046	1059	C1.7			
	2230	2237	2246	B8.6			
07 December	2356	0000	0005	B8.4			
	0708	0712	0717	B9.1			
	0955	1000	1005	C2.1			
	1106	1116	1129	B7.4			
	1752	1757	1810	B7.1			
08 December	1846	1851	1856	C1.0			
	0040	0041	0050		Sf	S13E76	220
	0240	0240	0247		Sf	S13E75	220
	0357	0401	0404	C1.0			
	0824	0825	0838	C2.5	Sf	N11W59	214
	0915	0916	0922		Sf	S12E70	220
	1639	1643	1645	B8.4			
2321	2331	2335	C2.5	Sf	S19E70	220	



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 204</i>																		
27 Nov	N16E40	350	0040	06	Dso	008	B						2					
28 Nov	N17E28	349	0030	06	Cso	007	B											
29 Nov	N18E14	350	0010	03	Bxo	004	B											
30 Nov	N20W02	353	0010	04	Bxo	007	B											
01 Dec	N20W15	353																
02 Dec	N16W26	350	0020	08	Bxo	010	B											
03 Dec	N16W38	349																
04 Dec	N16W51	349																
05 Dec	N16W64	349																
06 Dec	N16W77	349																

0 0 0 2 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 353

<i>Region 205</i>																		
27 Nov	N19E63	327	0050	01	Hsx	001	A											
28 Nov	N19E49	328	0040	01	Hsx	001	A											
29 Nov	N19E36	328	0050	02	Hsx	001	A											
30 Nov	N19E23	328	0020	01	Hsx	001	A											
01 Dec	N19E10	328	0020	01	Hsx	001	A											
02 Dec	N19W03	327	0000	01	Axx	001	A											
03 Dec	N20W16	327	0020	03	Cso	005	B											
04 Dec	N20W29	327	0020	04	Cro	005	B											
05 Dec	N20W41	326	0010	03	Cro	004	B											
06 Dec	N20W54	326																
07 Dec	N20W67	326																
08 Dec	N18W78	323	0070	06	Hsx	002	A											

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 327



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 208

29 Nov	N09E75	289	0100	10	Dso	006	B												
30 Nov	N10E63	288	0210	07	Dao	012	B												
01 Dec	N10E49	289	0140	09	Dso	016	B	2			2								
02 Dec	N10E35	289	0170	10	Dai	022	Bg	2			1	1							
03 Dec	N11E22	289	0120	11	Eai	024	Bg	1			2								
04 Dec	N10E08	290	0140	11	Eai	026	Bg				1								
05 Dec	N10W06	291	0130	11	Eao	027	Bg												
06 Dec	N09W24	296	0090	03	Dao	008	Bg												
07 Dec	N09W38	296	0060	03	Dao	004	B												
08 Dec	N11W51	296	0040	03	Dao	005	B												
										5	0	0	6	1	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 291

Region 209

30 Nov	S20E62	289	0140	09	Dao	008	B	1			1								
01 Dec	S21E48	290	0170	12	Eao	007	B	1			1								
02 Dec	S20E35	289	0170	13	Eso	010	B												
03 Dec	S19E20	291	0110	11	Eso	006	B												
04 Dec	S19E07	291	0120	12	Cso	011	B												
05 Dec	S20W07	292	0110	14	Cso	006	B												
06 Dec	S19W26	298	0090	02	Hax	001	A												
07 Dec	S20W39	297	0050	16	Fao	006	B												
08 Dec	S18W52	297	0060	02	Hsx	001	A												
										2	0	0	2	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 291

Region 211

02 Dec	S08E04	320	0020	03	Bxo	004	B												
03 Dec	S08W09	320																	
04 Dec	S08W22	320																	
05 Dec	S08W35	320																	
06 Dec	S08W48	320																	
07 Dec	S08W61	320																	
08 Dec	S08W74	320																	
										0	0	0	0	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 320



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 212

02 Dec	N13E75	249	0160	05	Cao	004	B												
03 Dec	N14E62	249	0180	05	Dao	008	B												
04 Dec	N13E49	249	0180	07	Dao	009	B					1							
05 Dec	N12E35	250	0170	06	Cao	012	B												
06 Dec	N12E21	251	0170	07	Dao	013	B					1							
07 Dec	N13E08	250	0090	07	Dao	012	B												
08 Dec	N14W05	250	0080	06	Dao	009	Bg												
												0	0	0	2	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 250

Region 213

03 Dec	N15E79	232	0070	07	Cso	003	B					1							
04 Dec	N14E64	234	0090	07	Cao	005	B			1									
05 Dec	N14E50	235	0110	08	Cao	006	B												
06 Dec	N14E38	234	0040	05	Cao	004	B												
07 Dec	N14E24	234	0040	07	Cao	002	B												
08 Dec	N14E14	231	0020	02	Cso	002	B												
												0	1	0	1	0	1	0	0

Still on Disk.

Absolute heliographic longitude: 231

Region 214

05 Dec	N12W27	312	0060	05	Dro	007	B												
06 Dec	N12W41	313	0090	06	Dao	009	B			1									
07 Dec	N13W55	313	0110	08	Dao	009	Bg												
08 Dec	N13W70	315	0120	11	Eso	009	Bg			1									
												2	0	0	2	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 312

Region 215

05 Dec	S18E74	211	0100	03	Hax	001	A												
06 Dec	S19E59	213	0080	02	Hsx	002	A												
07 Dec	S18E46	213	0080	02	Hsx	002	A												
08 Dec	S18E32	213	0070	03	Hax	002	A												
												0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 213

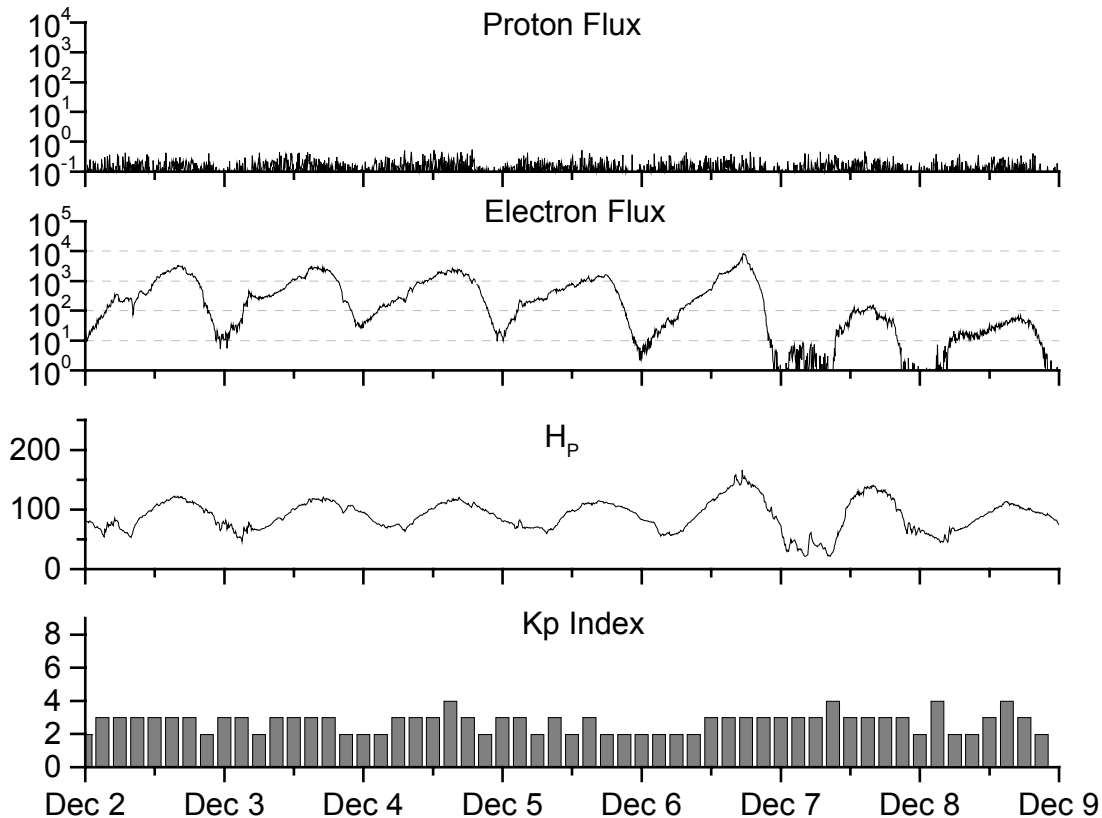


**Recent Solar Indices (preliminary)
of the observed monthly mean values**

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
2000									
December	146.4	104.5	0.71	160.8	112.1	173.6	172.1	08	14.4
2001									
January	142.7	95.1	0.67	156.3	108.8	166.7	168.8	08	13.8
February	131.0	80.1	0.61	151.4	104.2	147.3	165.8	06	13.3
March	166.7	114.2	0.69	154.0	104.9	177.7	167.9	17	12.9
April	163.6	108.2	0.66	159.4	107.7	178.3	171.7	18	12.7
May	135.1	97.3	0.72	163.1	108.8	148.7	174.8	12	12.5
June	196.7	134.0	0.68	167.2	109.9	173.7	178.8	12	12.4
July	124.6	82.2	0.66	172.1	111.8	131.3	183.9	11	12.4
August	159.4	106.8	0.67	176.7	113.8	163.2	188.8	13	12.5
September	229.1	150.7	0.66	178.8	114.3	233.8	191.3	13	12.8
October	197.4	125.6	0.64	179.5	114.1	208.1	191.9	20	12.0
November	178.6	106.5	0.60	183.7	115.6	212.7	193.7	16	12.0
December	217.5	131.8	0.61	184.5	114.7	235.6	193.9	09	12.2
2002									
January	189.0	113.9	0.60	184.8	113.5	227.3	194.6	08	12.4
February	194.5	108.0	0.56	188.6	114.7	205.0	197.2	10	12.8
March	153.1	98.1	0.64	188.9	113.3	180.3	195.7	10	13.0
April	194.9	120.4	0.62	186.2	110.4	189.8	191.5	15	13.2
May	204.1	120.8	0.59	183.6	108.8	178.4	188.0	15	13.3
June	146.0	88.5	0.61			148.7		11	
July	183.5	99.9	0.54			173.5		13	
August	191.0	116.4	0.61			183.9		16	
September	206.4	109.3	0.53			175.8		14	
October	153.9	97.5	0.63			167.0		23	
November	159.8	95.0	0.59			168.7		16	

NOTE: All smoothed values after June 1999 and monthly values after December 2000 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 22, RI= 158.5, occurred July 1989. *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 02 December 2002

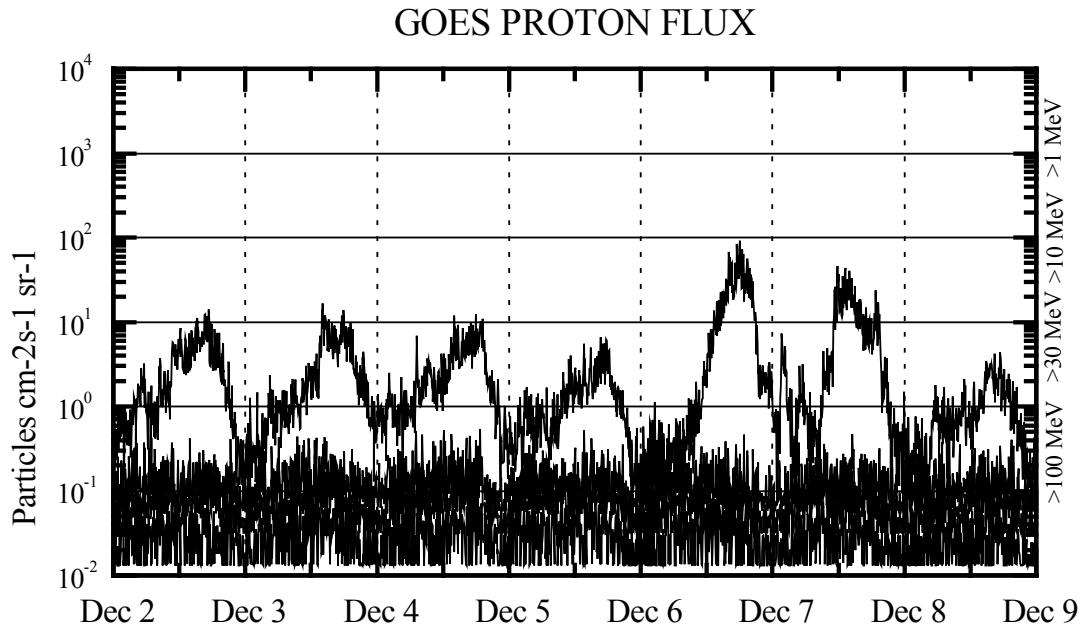
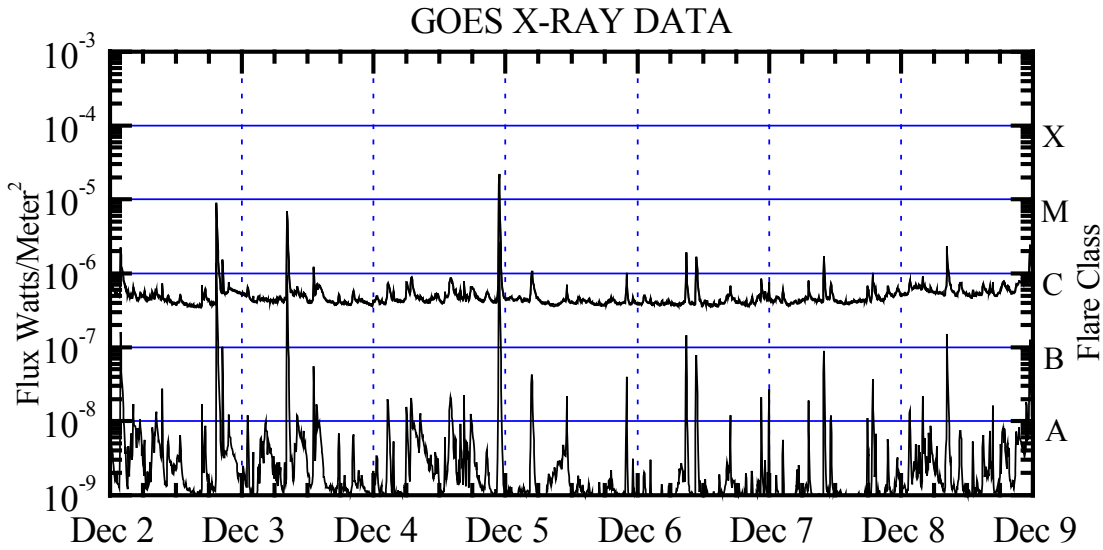
Protons plot contains the five-minute averaged integral proton flux (protons/cm²-sec-sr) as measured by GOES-8 (W75) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

Electrons plot contains the five-minute averaged integral electron flux (electrons/cm²-sec-sr) with energies greater than 2 MeV at GOES-8.

H_p plot contains the five minute averaged magnetic field H - component in nanoteslas (nT) as measured by GOES-8. 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 Meenook, 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_p 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 8 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-8 (W75) 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.

