

Solar activity ranged from low to high levels. Moderate conditions occurred during 24 – 25 December with isolated low-level M-class flares from Region 9754 (S08, L = 121, class/area Eai/270 on 25 December), which was moderate in size and magnetic complexity (for flare specifics, please refer to the Energetic Events or Optical Flares lists). Activity increased to high levels on 26 December due to an M7/1b flare at 26/0540 UTC from Region 9742 (N10, L = 214, class/area Fkc/1070 on 25 December). This flare was associated with a 2600 SFU Tenflare, Type II and IV radio sweeps, and a partial-halo CME. Region 9742 was the largest and most complex sunspot group on the disk until it rotated out of view on 28 December. Activity decreased to moderate levels on 27 December with isolated low-level M-class flares from Regions 9742, 9748 (S10, L = 191, class/area Eao/330 on 27 December), and 9752 (S14, L = 217, class/area Dso/020 on 23 December). Region 9748 was moderate in size and complexity and remained so until it crossed the west limb on 29 December. Region 9752 was a spotless plage area during most of the period. Activity returned to high levels on 28 December by virtue of an X3 X-ray flare at 28/2045 UTC from a source just beyond the southeast limb. The X3 flare was associated with a 1600 SFU Tenflare, a loop-prominence system, a proton event, a coronal mass ejection (CME), and a ground-level event (GLE – the fourth such event of Cycle 23). Region 9742 produced an impulsive M4/Sf flare at 28/0351 UTC as it crossed the west limb. Activity remained high on 29 December due to an M9 X-ray flare at 29/0945 UTC from a source beyond the west limb, probably from (old) Region 9742. This flare was associated with Type II and IV radio sweeps and a non-Earth-directed CME. There were several low-level M-class flares on 29 December as well, including an M1/1f at 29/0546 UTC from Region 9751 (N04, L = 141, class/area Eki/500 on 26 December) and a long-duration M1 X-ray flare at 29/2127 UTC from a source beyond the west limb. Region 9767 (S23, L = 018, class/area Eki/210 on 30 December) rotated into view on the last day of the period. This region, which may have been the source of the X3 flare on 28 December, appeared to be the return of old Region 9727, which had a history of major flare production. At present, it is large with a moderate degree of magnetic complexity.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft for most of the period. However, ACE SWEPAM data was unreliable during approximately 26/0630 – 1400 UTC due to solar proton contamination. A high-speed stream was observed during 24 – 25 December, associated with a negative-polarity coronal hole. Solar wind velocities increased to as high as 600 km/sec during this time. A coronal mass ejection passed the spacecraft at approximately 29/0440 UTC accompanied by abrupt increases in total IMF field intensity, temperature, density, and velocity; and (initially) a fairly strong northward turn of IMF Bz with peak deflections to plus 15 nT (GSM). The source for this CME passage may have been the long-duration M7/1b flare on 26 December. Another CME passage began at approximately 30/1932 UTC accompanied by increased proton temperatures and densities, as well as increased IMF total field intensity. IMF Bz became highly variable following the passage with a range of plus 26 to minus 20 nT (GSM)



Three proton events occurred at geosynchronous orbit during the period. Proton events at greater than 100 MeV and 10 MeV occurred in the wake of the M7/1b flare on 26 December. The greater than 100 MeV event began at 26/0555 UTC, reached a peak of 50 PFU at 26/0720 UTC, then ended at 26/1940 UTC. The greater than 10 MeV event began at 26/0605 UTC, reached a peak of 779 PFU at 26/1115 UTC, then ended at 28/1040 UTC. Another greater than 10 MeV proton event began at 29/0510 UTC, reached a peak of 76 PFU at 29/0815 UTC, then ended at 29/2205 UTC. This event may have been due to the east limb X3 flare on 28 December. Another greater than 10 MeV proton event began at 30/0240 UTC and was in progress as the period ended (the preliminary peak for this event was 108 PFU at 31/1620 UTC).

The greater than 2 MeV electron flux at geosynchronous orbit was at normal to moderate levels during most of the period.

Geomagnetic field activity ranged from quiet to major storm levels on 24 December due to coronal hole effects (the major storm periods were limited to high latitudes). Activity decreased to quiet to unsettled levels during 25 – 28 December. Quiet to active conditions occurred during 29 – 30 December due to the CME passages described above. The Boulder USGS magnetometer detected a sudden impulse (SI) of 44 nT at 29/0538 UTC. Another SI (27 nT) occurred at 30/2010 UTC.

### **Space Weather Outlook**

**02 January 2002      28 January 2002**

Solar activity is expected to range from low to high levels. Isolated low-level M-class flares are likely. There will be a chance for isolated major flare activity as well, due to the return of previously active heliolongitudes.

The greater than 10 MeV proton event that began on 30 December is expected to end late on 04 January. There will be a chance for a proton flare during the period.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at normal to moderate levels during most of the period.

The geomagnetic field is expected to be at quiet to unsettled levels during most of the period. However, active periods will be possible on 13 and 20 January due to coronal hole effects.



### 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
24 December	275	176	1820	C2.2	3	3	0	6	2	0	0	0
25 December	259	246	2410	C2.4	4	1	0	18	3	0	0	0
26 December	268	290	1980	C2.9	3	5	0	33	3	0	0	0
27 December	275	268	2070	C3.6	8	3	0	26	0	2	0	0
28 December	263	263	1830	C2.6	3	3	1	13	2	0	0	0
29 December	264	222	1360	M1.6	0	8	0	6	2	0	0	0
30 December	247	218	1200	C8.4	4	0	0	6	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)		
	>1MeV	>10MeV	>100MeV	>.6MeV	>2MeV	>4MeV
24 December	3.8E+5	1.2E+4	2.8E+3		3.6E+5	
25 December	6.7E+4	1.3E+4	3.0E+3		1.5E+6	
26 December	5.8E+7	2.4E+7	6.2E+5		9.5E+6	
27 December	6.8E+7	3.8E+6	1.9E+4		9.9E+6	
28 December	4.0E+7	7.7E+5	5.8E+3		7.2E+6	
29 December	3.0E+7	1.6E+6	5.6E+3		5.3E+6	
30 December	1.2E+7	8.6E+5	4.3E+3		2.1E+6	

### Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
24 December	13	1-3-4-3-3-3-2-2	36	0-3-6-4-6-5-4-2	19	3-3-5-4-4-4-3-2
25 December	11	2-2-2-3-3-3-2-3	*	*_*_*_*_*_*_*_*_*_*	8	3-2-1-3-2-2-1-3
26 December	10	2-1-1-1-3-4-3-2	*	*_*_*_*_*_*_*_*_*_*	7	2-0-0-1-2-3-3-2
27 December	10	2-1-2-2-3-3-3-2	*	*_*_*_*_*_*_*_*_*_*	6	2-1-1-2-2-3-3-1
28 December	9	1-0-2-2-3-3-3-3	*	*_*_*_*_*_*_*_*_*_*	5	1-0-1-2-2-2-2-2
29 December	13	2-4-2-2-2-4-2-3	*	*_*_*_*_*_*_*_*_*_*	10	2-4-2-2-2-3-3-2
30 December	15	3-3-3-2-2-2-4-4	*	*_*_*_*_*_*_*_*_*_*	17	3-4-4-2-3-2-4-4



### *Alerts and Warnings Issued*

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UT
24 Dec 0008	2 – 245 MHz Radio Bursts	23 Dec
24 Dec 0008	245 MHz Noise Storm	23 Dec
24 Dec 0842	K= 5 Warning	24 Dec 0845 – 1500
24 Dec 0900	K= 5 Observed	24 Dec 0600 – 0900
24 Dec 1502	A $\geq$ 20 Observed	24 Dec 1500
24 Dec 1505	K= 4 Warning	24/1505 - 26/1500
25 Dec 0020	245 MHz Radio Burst	24 Dec
25 Dec 0020	245 MHz Noise Storm	24 Dec
25 Dec 0021	ENDED A $\geq$ 20 Observed	25 Dec 0001
25 Dec 0300	A $\geq$ 20 Observed	25 Dec 0300
25 Dec 0601	ENDED A $\geq$ 20 Observed	25 Dec 0300
25 Dec 1313	Stratwarm Alert EXISTS Tuesday	
25 Dec 1504	CANCELLED K= 4 Warning	24/1505 – 26 Dec 1500
26 Dec 0008	245 MHz Noise Storm	25 Dec
26 Dec 0515	Type II Radio Emission	26 Dec 0502
26 Dec 0530	Type IV Radio Emission	26 Dec 0520
26 Dec 0602	Proton event >100 MeV >1pfu Warning	26 Dec 0602 – 1500
26 Dec 0614	Proton event >100 MeV >1pfu	26 Dec 0613
26 Dec 0616	Proton event >10MeV $\geq$ 10pfu Warning	26 Dec 0615 – 1500
26 Dec 0624	Protons event >10 MeV $\geq$ 10pfu	26 Dec 0623
26 Dec 0649	X-Ray event M7/1B/N08W54	26 Dec 0548
26 Dec 0720	10cm Radio Burst 2600 F.U.	26 Dec 0438
26 Dec 1333	Stratwarm Alert EXISTS Wednesday	
26 Dec 1414	Type IV Radio Emission	26 Dec 0634
26 Dec 1458	CONTINUED Proton event >100 MeV >1pfu Warning	26/0602 – 27 Dec 1500
26 Dec 1500	CONTINUED Proton event >10MeV $\geq$ 10pfu Warning	26/0615 – 29 Dec 1500
26 Dec 1802	K= 4 Observed	26 Dec 1500 - 1800
26 Dec 2051	A $\geq$ 30 Watch	28 Dec
26 Dec 2351	ENDED Proton event >100 MeV >1pfu	26 Dec 0613
26 Dec 2357	CANCELLED Proton event >100 MeV >1pfu Warning	26/0602 – 27 Dec 1500
27 Dec 0016	5 – 245 MHz Radio Bursts	26 Dec
27 Dec 0016	245 MHz Noise Storm	26 Dec
27 Dec 0034	CONTINUED Protons event >10 MeV $\geq$ 10pfu	26 Dec 0623
27 Dec 1332	Stratwarm Alert Exists Thursday	
28 Dec 0011	CONTINUED Protons event >10 MeV $\geq$ 10pfu	26 Dec 0623
28 Dec 1458	ENDED Protons event >10 MeV $\geq$ 10pfu	26 Dec 0623
28 Dec 2022	Type II Radio Emission	28 Dec 2003
28 Dec 2120	A $\geq$ 20 Watch	29 Dec
28 Dec 2131	10cm Radio Burst 1600 F.U.	28 Dec 1946
28 Dec 2141	X-Ray event X3.4	28 Dec 2045
29 Dec 0033	4 – 245 MHz Radio Bursts	28 Dec
29 Dec 0526	Protons event >10 MeV $\geq$ 10pfu	29 Dec 0510
29 Dec 0544	K = 4 Warning	29 Dec 0545 – 1500
29 Dec 0546	Sudden Impulse observed at Boulder	29 Dec 0538

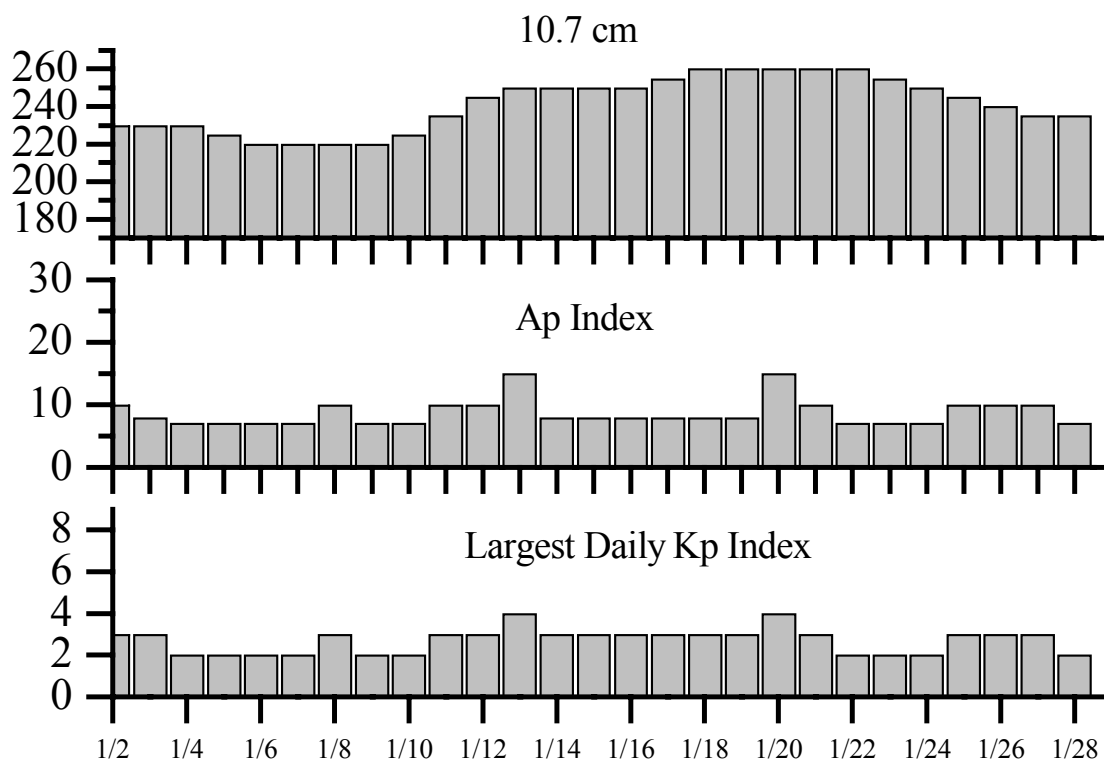


*Alerts and Warnings Issued- continued*

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UT
29 Dec 0557	K= 4 Observed	29 Dec 0300 – 0600
29 Dec 1003	Type II Radio Emission	29 Dec 0943
29 Dec 1004	Type IV Radio Emission	29 Dec 0956
29 Dec 1013	X-Ray event M9.3/0F/S07W85	29 Dec 0945
29 Dec 1322	Stratwarm Alert Exists Saturday	
29 Dec 1454	CONTINUED Proton event >10MeV $\geq$ 10pfu Warning	26/0615 – 29 Dec 2400
29 Dec 1749	K= 4 Warning	29 Dec 1755 – 2359
29 Dec 1800	K= 4 Observed	29 Dec 1500 – 1800
29 Dec 2059	A $\geq$ 20 Watch	01 Jan 2002
30 Dec 0043	2 – 245 MHz Radio Bursts	29 Dec
30 Dec 0003	ENDED Protons event >10 MeV $\geq$ 10pfu	29 Dec 0510
30 Dec 0256	Proton event >10MeV $\geq$ 10pfu Warning	30 Dec 0300 – 1500
30 Dec 0257	Protons event >10 MeV $\geq$ 10pfu	30 Dec 0245
30 Dec 0600	K= 4 Observed	30 Dec 0300 – 0600
30 Dec 1304	Stratwarm Alert Exists Sunday	
30 Dec 2039	Sudden Impulse observed at Boulder	30 Dec 2010
30 Dec 2040	A $\geq$ 20 Watch	31 Dec
30 Dec 2041	K= 5 Warning	30/2045 – 31 Dec 1500
30 Dec 2100	K= 4 Observed	30 Dec 1800 – 2100



## 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
02 Jan	230	10	3	16 Jan	250	8	3
03	230	8	3	17	255	8	3
04	230	7	2	18	260	8	3
05	225	7	2	19	260	8	3
06	220	7	2	20	260	15	4
07	220	7	2	21	260	10	3
08	220	10	8	22	260	7	2
09	220	7	2	23	255	7	2
10	225	7	2	24	250	7	2
11	225	10	3	25	245	10	3
12	235	10	3	26	240	10	3
13	245	15	4	27	235	10	3
14	250	8	3	28	235	7	2
15	250	8	3				



### *Energetic Events*

Date	Time		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½ Max	Class	Integ Flux	Imp/Location		Rgn #	Radio Flux		Intensity	
						Brtns	Lat CMD		245	2695	II	IV
24 Dec	0026	0032	0037	M1.7	.007	1n	S07E59	9754	62	71		
24 Dec	1350	1400	1410	M3.5	.024				98	100		
24 Dec	2234	2241	2247	M1.4	.007	1f	S10E46	9754		32		
25 Dec	0700	0708	0712	M1.2	.005	1f	S11E50	9754	44	30		
26 Dec	0432	0540	0647	M7.1	.340	1b	N08W54	9742		2600	3	3
26 Dec	1222	1226	1229	M1.8	.005	1f	N10W68	9742		71		
26 Dec	1713	1718	1731	M1.3	.012	Sf	N10W72	9742				
26 Dec	2111	2115	2119	M1.2	.004	Sf	S10W56	9748				
26 Dec	2238	2242	2245	M1.0	.003							
27 Dec	0526	0613	0619	M1.4	.022	2n	S15W86	9752		26		
27 Dec	1127	1133	1141	M1.0	.007	Sf	N08W80	9742		44		
27 Dec	1643	1658	1720	M2.3	.038	2n	S10W66	9748		110		
28 Dec	0342	0351	0356	M4.7	.024	Sf	N04W90	9742		270		
28 Dec	0647	0655	0706	M1.0	.008	1f	S07E10	9754				
28 Dec	1210	1230	1259	M1.3	.028	Sf	S12W77	9748				
28 Dec	2002	2045	2132	X3.4	1.30				700	1600	1	
29 Dec	0404	0411	0423	M2.1	.023							
29 Dec	0540	0545	0550	M1.1	.007	1f	N02W32	9751				
29 Dec	0905	0916	0928	M1.8	.021							
29 Dec	0938	0945	1006	M9.3	.110	Sf	S07W85	9748	8000	100	2	2
29 Dec	1152	1157	1204	M1.4	.009	Sf	S26E87					
29 Dec	1633	1647	1702	M3.3	.043							
29 Dec	1950	2127	2355	M1.8	.190							
29 Dec	2251	2256	2308	M2.8	.026	1f	S24E88	9767				

### *Flare List*

Date	Time			X-ray Class.	Optical Imp / Brtns	Location Lat CMD	Rgn
	Begin	Max	End				
24 December	0030	0032	0045	M1.7	1n	S07E59	9754
	0124	0129	0142		Sf	N10W30	9742
	0302	0304	0320	C3.3	Sf	N11W30	9742
	0749	0805	0840	C4.4			9748
	0900	0903	0912		Sf	N11W30	9742
	1350	1400	1410	M3.5			
	1551	1607	1615		Sf	N10W39	9742
	1626	1637	1656		Sf	N10W39	9742
	1957	1958	2001		Sf	N10W41	9742
	2203	2208	2222	C4.8			
25 December	B2238	2239	2258	M1.4	1f	S10E46	9754
	0031	0036	0050	C8.0	Sf	S11W20	9748
	0259	0301	0303		Sf	N06W47	9742
	0407	0418	0447		Sf	S13W29	9748
	0435	0436	0441		Sf	N05W48	9742
	0508	0508	0515		Sf	N10W41	9742
	0703	0708	0717	M1.2	1f	S11E50	9754



*Flare List- continued*

Date	Time			X-ray Class.	Optical		Rgn	
	Begin	Max	End		Imp / Brtns	Location Lat CMD		
25 December	0706	0713	0719		Sf	N09W45	9742	
	0835	0843	0857		Sf	N09W46	9742	
	0936	0941	1013		Sf	N04E28	9751	
	1148	1152	1208	C5.4	Sf	N11W48	9742	
	1646	1647	1651		Sf	N08W56	9742	
	1742	1745	1749		Sf	N10W52	9742	
	1825	1840	1851		Sf	S11E36	9754	
	1952	1953	1955		Sf	N10W58	9742	
	2025	2034	2113	C9.8	1f	S11W40	9748	
	2047	2047	2050		Sf	N09W60	9742	
	2116	2124	2132		Sf	S11E42	9754	
	2116	2118	2121		Sf	N07W57	9742	
	2131	2131	2208		Sf	N06E18	9751	
	2303	2305	2316		Sf	N08W58	9742	
	2305	2319	2336		Sf	N07E17	9751	
	2311	2313	2325	C7.5	1f	S11E41	9754	
	26 December	0008	0032	0055	C6.2	Sf	N06E17	9751
		0122	0122	0126		Sf	S10W36	9748
		0123	0131	0149		Sf	N06E16	9751
		0231	0235	0243		Sf	S10W38	9748
0231		0247	0314		Sf	N06E15	9751	
0234		0234	0240		Sf	N10W61	9742	
0330		0331	0431	C8.2	Sf	N01E09	9751	
0401		0403	0406		Sf	N10W59	9742	
0432		0514	0823	M7.14	1b	N08W54	9742	
0443		0444	0453		Sf	N07E15	9751	
0526		0531	0542		Sf	S10W40	9748	
0541		0548	0553		Sf	S10E29	9754	
0713		0724	0726		Sf	S08E35	9754	
0825		0841	0857		Sf	N05W58	9742	
0833		0838	0841		Sf	S10W42	9748	
0834		0838	0911		1f	S09E32	9754	
0913		0920	0931		Sf	S11W42	9748	
0914		0915	0924		Sf	S07E34	9754	
0936		0939	0941		Sf	N07E13	9751	
0948		0949	0955		Sf	N09W65	9742	
1224	1226	1235	M1.8	1f	N10W68	9742		
1251	1252	1256		Sf	N14W60	9742		
1411	1411	1418	C7.4	Sf	N12W70	9742		
1614	1616	1623		Sf	N14W63	9742		
1630	1632	1641		Sf	S11W50	9748		
1640	1705	1722		Sf	S09E23	9754		





*Flare List- continued*

Date	Time			X-ray Class.	Optical		Rgn		
	Begin	Max	End		Imp / Brtns	Location Lat CMD			
26 December	1716	1718	1740	M1.3	Sf	N10W72	9742		
	1752	1755	1800		Sf	N04E06	9751		
	1752	1752	1756		Sf	S10W56	9743		
	1803	1812	1816		Sf	N07E07	9751		
	1854	1857	1904		Sf	N06E07	9751		
	1930	1932	1936		Sf	N09W73	9742		
	1932	1932	1936		Sf	N04E06	9751		
	2041	2059	2118		M1.2	Sf	S10W56	9748	
	2141	2142	2151			Sf	S10W46	9748	
	2226	2226	2235			Sf	N02W01	9751	
	27 December	2238	2242		2245	M1.0			
		0040	0040		0048		Sf	N07E06	9751
		0137	U0137		A0149		Sf	N06W73	9742
0252		U0252	A0259	Sf	S12W54		9752		
0314		0314	0318	Sf	S11W57		9752		
B0349		U0349	A0404	Sf	N07W04		9751		
B0350		U0417	A0430	C5.7	Sf		S11W58	9752	
B0354		U0355	A0400		Sf		N10W72	9742	
B0431		U0436	A0446		Sf		S11W54	9752	
0447		U0610	0645	M1.4	2n		S15W86	9752	
B0536		U0537	A0557		Sf		N06E03	9751	
0647		0649	0656		Sf		S11W55	9752	
0717		0721	0724	Sf	S10W56		9752		
0724		0725	0727	Sf	S11W57		9752		
0728		0735	0741	Sf	S15W86		9752		
0755		0759	0804	C4.5	Sf		S15W87	9752	
0755		0801	0810		Sf		N10W79	9742	
0855		0856	0900		Sf		S11W57	9752	
0936		0939	0945	C4.2					
1130		1130	1143	M1.0	Sf		N08W80	9742	
1218		1218	1226		Sf		N09W82	9742	
1235		1238	1244		Sf		S12E12	9754	
1417		1422	1429	C7.8					
1524		1529	1551	C9.0	Sf		S11E10	9754	
1644		1651	1920	M2.3	2n		S10W66	9748	
1704		1705	1707		Sf		N11W89	9742	
1824		1828	1838		Sf		S07W71	9743	
1943	1948	1954	C7.6						
2020	2025	2041	C6.5	Sf	S09E15	9754			
2103	2107	2116		Sf	S09W65	9748			
2134	2144	2155		C4.7	Sf	S12W70	9743		
2318	2318	2322		Sf	S11W64	9748			
28 December	0123	0127	0132	C6.5					



*Flare List- continued*

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
28 December	0236	0239	0301	C4.2	Sf	S11E03	9754
	0301	0305	0309		Sf	S11W66	9748
	0312	0313	0315		Sf	S11W66	9748
	0346	0347	0353	M4.7	Sf	N04W90	9742
	0406	0408	0429		Sf	S11W66	9748
	0422	0424	0431		Sf	S08E07	9754
	0649	0656	0707	M1.0	1f	S07E10	9754
	0833	0838	0846		Sf	S09E06	9754
	1225	1229	1234	M1.3	Sf	S12W77	9748
	1335	1336	1339		Sf	S10W90	9743
	1435	1435	1439		Sf	S03E28	9755
	1616	1618	1633		Sf	N01W23	9751
	1703	1707	1718		Sf	N01W24	9751
	1848	1853	1916	C8.2	1f	N03W26	9751
	2002	2045	2132	X3.4			
	2048	2052	2056		Sf	S11E01	9754
	29 December	0404	0411	0423	M2.1		
0513		0513	0521	Sf		N00W30	9751
0529		0546	0559	M1.1	1f	N02W32	9751
0608		0611	0614		Sf	N08E65	9763
0705		0706	0711		Sf	S01E17	9755
0905		0916	0928	M1.8			
0941		0942	0950	M9.3	Sf	S07W85	9748
B1154		U1156	1205	M1.4	Sf	S26E87	
1633		1647	1702	M3.3			
1950		2127	2355	M1.8			
2242		2246	2250		Sf	S09W15	9754
2249	U2301	A2308	M2.8	1f	S24E88	9767	
30 December	0656	0659	0710	C6.1	Sf	N02W49	9751
	1216	1227	1235		Sf	N04W45	9751
	1216	1220	1236		Sf	S07W23	9754
	1343	1343	1359	C3.2	Sf	N03W43	9751
	1506	1506	1512	C5.0	Sf	S23E82	9767
	2155	2158	2203	C4.2	1f	S24E77	9767
	2349	2349	2352		Sf	S11E55	



### 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								
<i>Region 9742</i>																							
15 Dec	N09E73	217	0150	11	Eao	005	B																
16 Dec	N08E64	213	0470	10	Dki	011	B						4										
17 Dec	N08E51	213	0340	10	Dki	017	B						1										
18 Dec	N09E37	214	0350	11	Eki	022	Bg	1					5										
19 Dec	N12E27	211	0320	13	Eai	024	Bg	2					2										
20 Dec	N10E13	211	0530	15	Eki	045	Bg	4					7										
21 Dec	N10W03	214	0720	17	Fkc	060	Bg	6					10										
22 Dec	N10W16	214	0680	17	Fkc	055	Bg																
23 Dec	N10W29	214	0900	18	Fkc	055	Bg						3										
24 Dec	N11W44	216	0960	17	Fkc	040	Bg	1					6										
25 Dec	N12W57	215	1070	20	Fkc	049	Bg	1					12										
26 Dec	N12W68	213	0470	15	Eki	025	Bg	1	3				9	2									
27 Dec	N12W81	213	0690	15	Eki	014	Bg		1				6										
28 Dec	N12W94	213	0350	15	Eki	007	Bg		1				1										
								16	5	0	65	2	0	0	0								

Crossed West Limb.

Absolute heliographic longitude: 214

#### *Region 9743*

16 Dec	S11E73	204	0240	03	Hax	002	A	1					1								
17 Dec	S12E59	205	0160	02	Hax	004	A														
18 Dec	S10E45	206	0150	04	Cao	006	B														
19 Dec	S10E34	204	0120	02	Hax	002	A														
20 Dec	S11E19	205	0120	05	Cao	005	B														
21 Dec	S10E04	207	0130	06	Cao	005	B														
22 Dec	S09W07	205	0130	07	Cso	006	B														
23 Dec	S11W20	205	0120	03	Cso	002	B														
24 Dec	S10W34	206	0090	03	Cao	002	B														
25 Dec	S09W46	204	0100	04	Cao	004	B														
26 Dec	S09W60	205	0070	03	Cso	002	B						1								
27 Dec	S09W74	206	0050	02	Hsx	001	A	1	1				2								
28 Dec	S10W89	208	0060	03	Hsx	001	A						1								
								2	1	0	5	0	0	0	0						

Crossed West Limb.

Absolute heliographic longitude: 207



**Region Summary - continued.**

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 9745*

18 Dec	N18E60	191	0030	05	Bxo	005	B												2
19 Dec	N18E48	190	0030	05	Bxo	004	B												
20 Dec	N17E33	191	0030	06	Bxo	008	B												
21 Dec	N17E19	192	0020	05	Cro	006	B												
22 Dec	N17E06	192	0060	06	Dao	009	B												1
23 Dec	N17W07	192	0070	08	Dao	010	B												
24 Dec	N17W22	194	0030	06	Dao	009	B												
25 Dec	N19W38	196	0010	06	Cso	004	B												
26 Dec	N18W50	195	0010	05	Dro	003	B												
27 Dec	N18W62	194	0010	02	Bxo	002	B												
28 Dec	N18W75	194																	
29 Dec	N18W88	194																	
																			0 0 0 3 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 192

*Region 9746*

19 Dec	S18E08	230	0020	04	Bxo	002	B												
20 Dec	S18W05	230																	
21 Dec	S17W20	231	0010	03	Bxo	003	B												
22 Dec	S17W32	230	0010	04	Bxo	002	B												
23 Dec	S17W45	230																	
24 Dec	S17W58	230																	
																			0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 230



***Region Summary - continued.***

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	4		
<i>Region 9747</i>																	
19 Dec	N12E71	167	0030	03	Bxo	002	B					1					
20 Dec	N12E58	166	0090	06	Cao	005	B										3
21 Dec	N12E44	167	0060	08	Cao	011	B										
22 Dec	N11E30	168	0070	07	Dao	008	B										
23 Dec	N11E17	168	0050	06	Dso	005	B										
24 Dec	N12E02	170	0020	06	Dso	005	B										
25 Dec	N12W10	168	0030	08	Dso	004	B										
26 Dec	N12W26	171	0010	01	Hrx	001	A										
27 Dec	N12W39	171															
28 Dec	N12W52	171															
29 Dec	N12W65	171															
																	0 0 0 4 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 170

<i>Region 9748</i>																	
20 Dec	S11E36	188	0030	03	Cso	004	B										
21 Dec	S12E21	190	0050	06	Dao	008	B										
22 Dec	S11E07	191	0080	09	Dao	018	B										3
23 Dec	S10W07	192	0200	09	Dao	019	B	2	1								5
24 Dec	S10W21	193	0180	11	Eao	013	B	1									1
25 Dec	S10W36	194	0320	12	Eao	023	Bg	2									2 1
26 Dec	S10W48	193	0300	10	Dao	018	B										1 8
27 Dec	S11W64	196	0330	12	Eao	016	B										1 2 1
28 Dec	S11W77	196	0250	15	Eao	012	B	1	1								4
29 Dec	S10W91	197	0180	05	Dao	004	B										1 1
																	6 5 0 26 1 1 0 0

Crossed West Limb.

Absolute heliographic longitude: 191

<i>Region 9749</i>																	
20 Dec	S08E72	152	0080	08	Cso	003	B										
21 Dec	S08E56	155	0060	07	Cso	005	B	1									4
22 Dec	S08E43	155	0040	07	Dso	003	B										1
23 Dec	S07E29	156															1
24 Dec	S07E16	156															
25 Dec	S07E03	156															
26 Dec	S07W10	156															
																	1 0 0 6 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 156



**Region Summary - continued.**

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 9751*

21 Dec	N04E68	143	0220	05	Hax	001	A												
22 Dec	N04E55	143	0330	09	Cho	003	B												
23 Dec	N04E44	141	0320	13	Eko	014	B												
24 Dec	N05E30	142	0380	13	Eko	013	B												
25 Dec	N04E18	140	0380	13	Eki	025	Bg						3						
26 Dec	N04E04	141	0500	14	Eki	033	Bg	2				11							
27 Dec	N04W10	142	0410	14	Eai	038	Bg					3							
28 Dec	N04W24	143	0380	14	Eai	034	Bg	1				2	1						
29 Dec	N04W38	144	0300	14	Eai	031	Bg		1			1	1						
30 Dec	N05W51	142	0230	13	Eai	018	Bg	2				3							
												5	1	0	23	2	0	0	0

Still on Disk.

Absolute heliographic longitude: 141

*Region 9752*

22 Dec	S14W19	217	0010	01	Axx	001	A												
23 Dec	S14W31	216	0020	04	Dso	004	B												
24 Dec	S14W44	216																	
25 Dec	S13W59	217	0010	03	Bxo	002	B												
27 Dec	S13W85	217						2	1			10		1					
28 Dec	S13W98	217																	
												2	1	0	10	0	1	0	0

Crossed West Limb.

Absolute heliographic longitude: 217

*Region 9753*

22 Dec	S20E67	131	0030	02	Hax	001	A												
23 Dec	S20E53	132	0060	08	Cao	003	B					1							
24 Dec	S18E37	135	0080	08	Cao	008	B												
25 Dec	S18E12	146	0040	09	Dso	007	B												
26 Dec	S19E09	136	0050	10	Dso	015	B												
27 Dec	S18W06	138	0050	08	Dso	012	B												
28 Dec	S19W19	138	0060	11	Eso	013	B												
29 Dec	S19W33	139	0050	09	Dao	010	B												
30 Dec	S18W48	139	0090	09	Dao	015	B												
												0	0	0	1	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 138



**Region Summary - continued.**

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								
<i>Region 9754</i>																							
23 Dec	S09E61	124	0090	11	Eao	006	B					1											
24 Dec	S08E48	124	0080	11	Eao	006	B		2				2										
25 Dec	S09E38	120	0270	14	Eai	025	Bg	1	1			2	2										
26 Dec	S09E24	121	0250	15	Eai	026	Bg					4	1										
27 Dec	S08E11	121	0140	15	Eai	023	Bg	2				3											
28 Dec	S08W02	121	0200	17	Fai	028	Bg	1	1			4	1										
29 Dec	S08W17	123	0250	17	Fai	033	Bg					1											
30 Dec	S08W30	121	0160	16	Fai	028	Bg					1											
								4	4	0		16	6	0	0	0	0						

Still on Disk.

Absolute heliographic longitude: 121

<i>Region 9755</i>																							
25 Dec	S05E64	094	0180	06	Cao	003	B																
26 Dec	S04E50	095	0200	05	Cao	006	B																
27 Dec	S04E37	095	0150	05	Cao	008	B																
28 Dec	S04E23	096	0170	04	Cso	006	B					1											
29 Dec	S04E10	096	0180	06	Dso	012	B					1											
30 Dec	S04W03	094	0150	05	Dso	010	B																
								0	0	0		2	0	0	0	0	0						

Still on Disk.

Absolute heliographic longitude: 094

<i>Region 9756</i>																							
26 Dec	S28E72	073	0040	02	Hsx	001	A																
27 Dec	S29E60	072	0070	02	Hsx	001	A																
28 Dec	S29E47	072	0120	03	Cao	005	B																
29 Dec	S28E34	072	0080	03	Cao	004	B																
30 Dec	S29E20	071	0060	03	Cao	003	B																
								0	0	0	0	0	0	0	0	0	0						

Still on Disk.

Absolute heliographic longitude: 071



**Region Summary - continued.**

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 9757*

26 Dec	S09E02	143	0010	03	Cso	003	B										
27 Dec	S08W12	144	0020	03	Cro	006	B										
28 Dec	S10W26	145	0010	02	Bxo	003	B										
29 Dec	S09W39	145	0000	01	Axx	003	A										
30 Dec	S10W51	142	0000	00	Axx	001	A										
																	0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 143

*Region 9758*

26 Dec	N13E20	125	0000	01	Axx	001	A										
27 Dec	N13E07	125															
28 Dec	N13W06	125															
29 Dec	N13W19	125															
																	0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 125

*Region 9759*

26 Dec	N17E28	117	0010	03	Bxo	002	B										
27 Dec	N17E15	117															
28 Dec	N17E09	110															
29 Dec	N18W04	110															
																	0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 110

*Region 9760*

26 Dec	N06E35	110	0010	03	Cro	003	B										
27 Dec	N07E21	111	0020	03	Cro	004	B										
28 Dec	N06E13	106															
29 Dec	N06E00	106															
30 Dec	N06W13	106															
																	0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 106





**Region Summary - continued.**

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 9761*

26 Dec	N09E75	070	0050	02	Hsx	001	A											
27 Dec	N10E61	071	0050	02	Hsx	001	A											
28 Dec	N10E47	072	0070	02	Hsx	001	A											
29 Dec	N10E34	072	0070	02	Hsx	001	A											
30 Dec	N10E21	070	0070	02	Hsx	001	A											
																		0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 070

*Region 9762*

27 Dec	N03E07	125	0020	01	Hsx	001	A											
28 Dec	N02W07	126	0000	01	Axx	001	A											
29 Dec	N02W16	122																
30 Dec	N02W29	122																
																		0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 125

*Region 9763*

27 Dec	N06E76	056	0060	03	Hsx	001	A											
28 Dec	N06E61	058	0080	07	Cso	004	B											
29 Dec	N06E49	057	0090	08	Cao	006	B					1						
30 Dec	N06E35	056	0060	06	Cso	004	B											
																		0 0 0 1 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 056

*Region 9764*

28 Dec	N12E15	104	0010	04	Bxo	005	B											
29 Dec	N13E02	104	0010	04	Bxo	004	B											
30 Dec	N13W11	102	0020	05	Dso	006	B											
																		0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 104



**Region Summary - continued.**

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		
<i>Region 9765</i>																	
28 Dec	N05E78	041	0070	07	Dso	003	B										
29 Dec	N06E63	043	0150	06	Dao	004	B										
30 Dec	N06E50	041	0110	06	Dao	005	B										
								0	0	0	0	0	0	0	0	0	0
Still on Disk.																	
Absolute heliographic longitude: 041																	
<i>Region 9766</i>																	
30 Dec	N05E62	029	0040	03	Cso	003	B										
								0	0	0	0	0	0	0	0	0	0
Still on Disk.																	
Absolute heliographic longitude: 029																	
<i>Region 9767</i>																	
30 Dec	S23E73	018	0210	09	Eki	004	Bg	2			1	1					
								2	0	0	1	1	0	0	0	0	0
Still on Disk.																	
Absolute heliographic longitude: 018																	

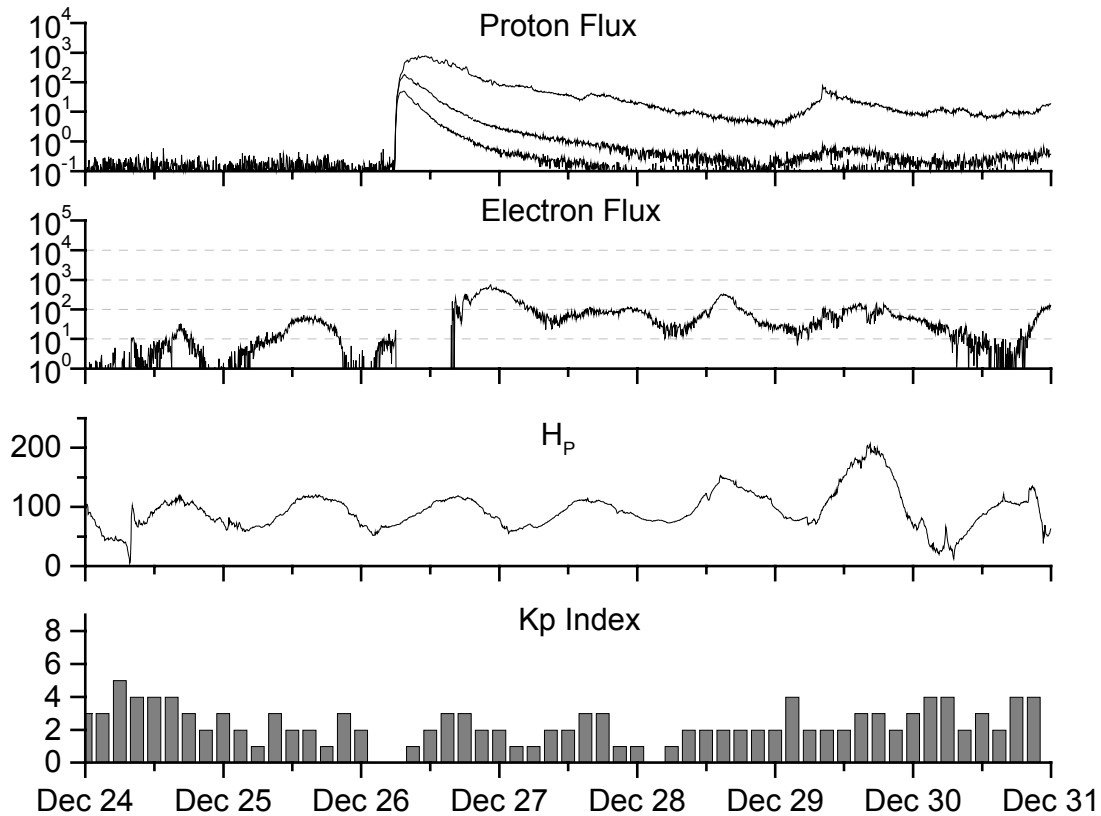


**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

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>1999</b>									
December	123.5	86.4	0.69	165.9	111.1	169.8	173.4	10	13.8
<b>2000</b>									
January	140.8	90.1	0.64	168.0	112.9	158.1	175.5	13	14.5
February	161.9	112.9	0.70	172.1	116.7	173.2	176.8	15	15.0
March	203.6	138.5	0.68	175.4	119.9	208.2	178.4	09	15.0
April	193.4	125.5	0.65	176.3	120.8	184.2	180.5	15	15.0
May	188.8	121.6	0.64	173.1	119.0	184.5	180.0	15	15.0
June	190.3	124.9	0.66	172.0	118.7	179.8	179.7	15	15.1
July	236.7	169.1	0.71	173.0	119.7	204.7	180.2	21	14.8
August	166.6	130.5	0.78	171.8	118.6	163.1	179.5	16	14.2
September	157.9	109.9	0.70	169.0	116.2	182.1	177.1	18	14.2
October	138.9	100.1	0.72	166.2	114.4	167.7	175.6	18	14.6
November	149.9	106.5	0.71	162.7	112.7	178.8	173.6	17	14.6
December	146.4	104.5	0.71	160.8	112.1	173.6	172.0	08	14.4
<b>2001</b>									
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			173.7		12	
July	124.6	82.2	0.66			131.3		11	
August	159.4	106.8	0.67			163.2		13	
September	229.1	150.7	0.66			233.3		12	
October	197.4	125.6	0.64			208.2		18	
November	178.6	106.5	0.60			212.5		14	

**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 24 December 2001*

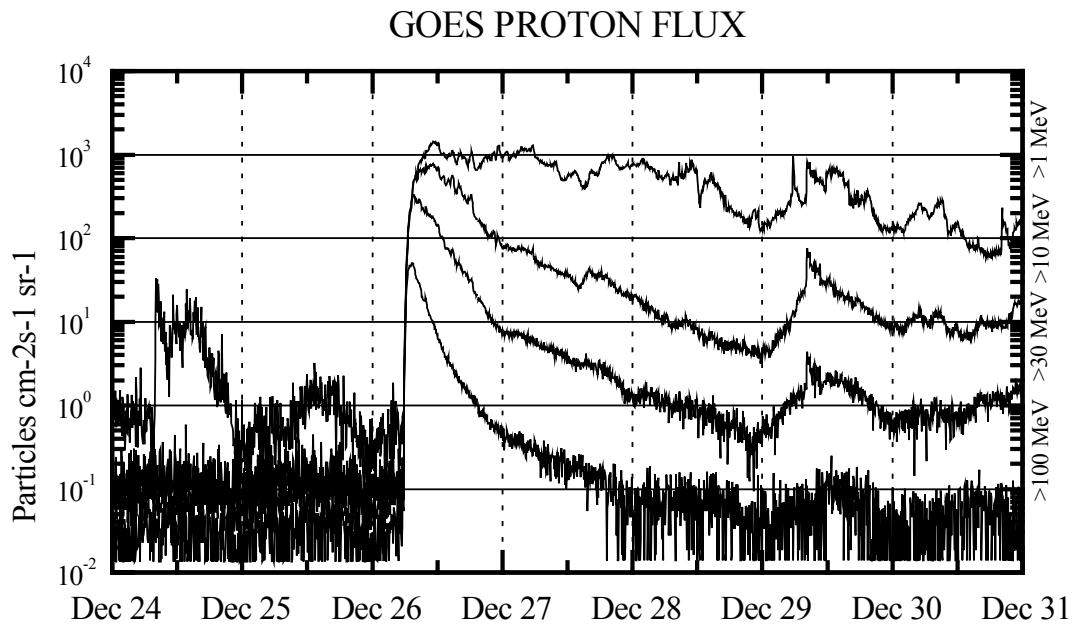
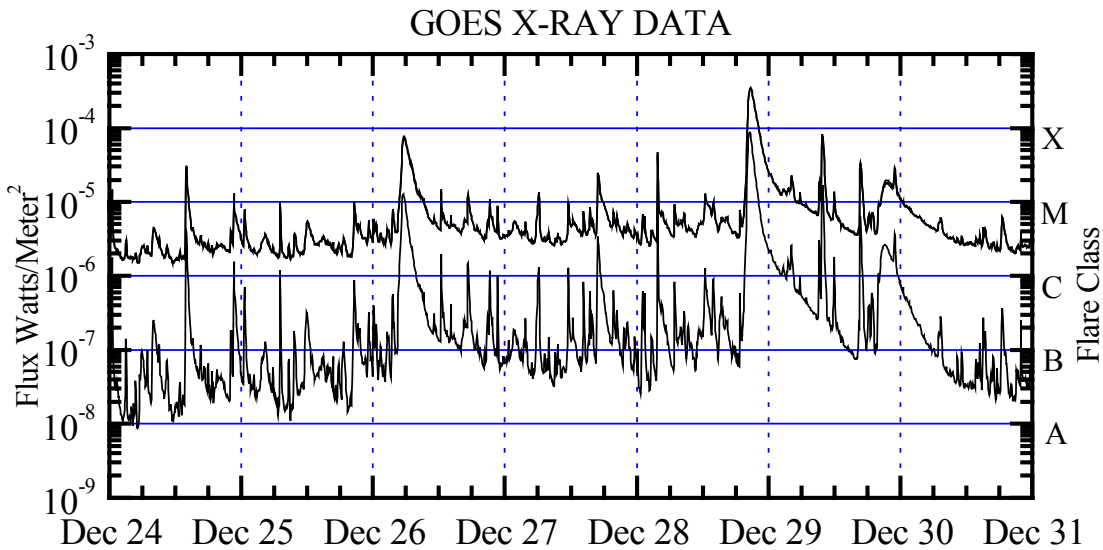
*Protons* plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>-sec-sr) as measured by GOES-8 (W75) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

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

*H<sub>p</sub>* 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<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 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<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 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/cm<sup>2</sup>-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/cm<sup>2</sup>-sec-sr) at greater than 10 MeV.

