

Solar activity was at moderate levels. Region 226 (S28, L=127, class/area Fkc/720 on 20 December) was the largest, most complex, and most active region on the visible disk during the period. Region 226 produced 4 M-class flares during the period, the largest of which was an impulsive M6 with an associated Type II (868 km/s) radio sweep and tenflare. For flare times and magnitudes please refer to the energetic and optical flare lists. On 17 December, Region 226 developed a beta-gamma-delta magnetic configuration in the intermediate spots and the region grew steadily until 21 December when it entered a gradual decay phase. Other M-class activity was associated with Region 229 (N19, L=102, class/area Eki/440 on 18 December) and Region 225 (N17, L=115, class/area Dai/110 on 17 December). Region 229 produced an M2.7 with an associated halo CME, Type II (668 km/s) and Type IV radio sweep on 19 December. Region 229 entered a decay phase on 19 December. Region 225 produced an M2.5 on 16 December with an associated Type II (428 km/s) and Type IV radio sweep.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft for most of the summary period. Solar wind velocity increased on 19-20 December due to a recurring coronal hole. Peak wind velocities were near 550 km/s and the Bz component of the interplanetary magnetic field was predominantly southward. A weak transient was observed on 22 December with an increase in solar wind velocity from 400 km/s to 500 km/s.

There were no greater than 10 MeV proton events at geo-synchronous orbit during the summary period. A slight proton enhancement occurred late on 19 December in association the M2.7 flare mentioned above. Peak flux values reached 4.2 pfu.

The greater than 2 MeV electron flux at geo-synchronous orbit reached moderate levels on 18, 20 and 22 December.

The geomagnetic field was at quiet to minor storm levels. An isolated period of minor storm levels was observed on 19 December due to a recurring positive polarity coronal hole. On 21 December, the weak transient CME shock mentioned above resulted in isolated minor storm conditions.

## **Space Weather Outlook**

### **25 December - 20 January 2003**

Solar activity is expected to be at low to moderate levels. Regions 224, 226, and 230 have the potential to produce M-class activity. Region 224, 226, and 230 are due to rotate beyond the west limb on 25, 25, and 30 December respectively. Low-level activity is then expected until these regions return to the visible disk around 08 January.

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 reach event threshold on 30-31 December due to recurring coronal holes.

The geomagnetic field is expected to be at quiet to active levels during the forecast period. A weaker recurring coronal hole is expected to return on 27-29 December resulting in unsettled to isolated active 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
16 December	203	194	1200	C1.4	10	3	0	11	3	0	0	0
17 December	213	252	1550	C1.3	10	1	0	15	1	0	0	0
18 December	197	261	1820	C1.1	11	1	0	7	1	0	0	0
19 December	193	225	1360	B9.2	12	1	0	12	0	2	0	0
20 December	197	203	1650	C1.0	11	1	0	10	1	0	0	0
21 December	184	199	1180	B6.9	8	0	0	7	1	0	0	0
22 December	172	168	930	B8.6	4	1	0	1	0	1	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
	16 December	3.8E+5	1.2E+4	2.3E+3		1.2E+6
17 December	2.8E+5	1.2E+4	2.5E+3		1.6E+6	
18 December	9.7E+5	1.1E+4	2.4E+3		4.8E+6	
19 December	5.5E+5	1.2E+4	2.3E+3		1.9E+5	
20 December	2.5E+6	1.2E+5	2.2E+3		1.2E+6	
21 December	1.1E+6	1.5E+4	2.3E+3		9.3E+5	
22 December	1.4E+6	1.7E+4	2.6E+3		3.4E+6	

### *Daily Geomagnetic Data*

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	16 December	3	0-1-2-1-1-1-1-1	2	0-1-2-1-1-0-0-0	8
17 December	2	1-0-0-0-0-1-1-1	2	3-1-0-0-0-0-0-0	6	2-2-1-2-2-3-2-2
18 December	2	1-1-0-0-1-1-1-1	0	0-0-0-0-0-0-0-0	6	2-2-0-1-2-3-2-1
19 December	15	2-3-3-3-4-3-3-2	39	1-2-4-6-5-6-5-3	21	3-3-4-5-4-4-4-2
20 December	12	3-4-1-1-2-2-3-3	18	2-4-2-3-4-3-4-3	16	3-4-2-3-3-3-3-4
21 December	12	3-5-2-1-2-2-1-1	14	3-4-3-3-3-3-1-1	18	4-5-3-2-3-3-2-2
22 December	9	1-1-0-2-3-2-4-2	9	2-1-2-3-4-1-2-1	12	2-2-2-3-3-3-4-2

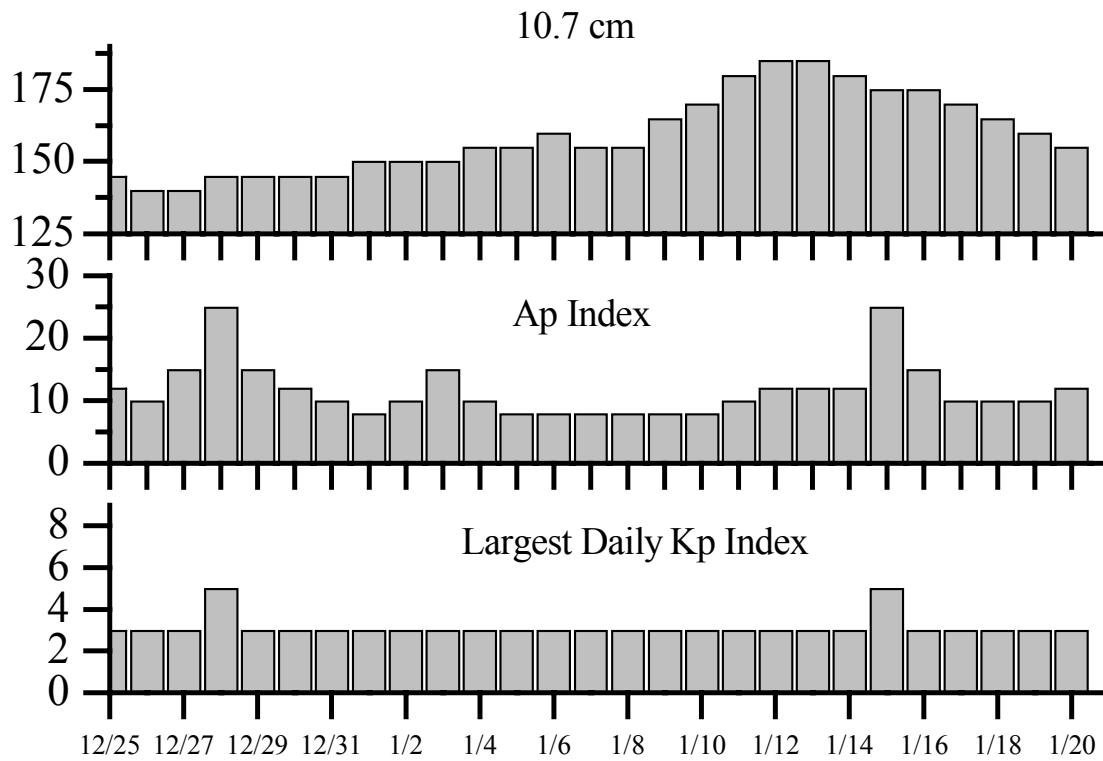


### *Alerts and Warnings Issued*

<u>Date &amp; Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date &amp; Time of Event UT</u>
16 Dec 0032	6 - 245 MHz Radio Bursts	15 Dec
16 Dec 1214	ALERT: Type II Radio Emission	16 Dec 1134
16 Dec 1215	ALERT: Type IV Radio Emission	16 Dec 1146
16 Dec 2115	WATCH: Geomagnetic $A \geq 20$	19 Dec
17 Dec 0042	3 - 245 MHz Radio Bursts	16 Dec
17 Dec 0042	1 - 245 MHz Radio Noise Storm	16 Dec
18 Dec 0043	2 - 245 MHz Radio Bursts	17 Dec
19 Dec 0024	1 - 245 MHz Radio Burst	18 Dec
19 Dec 0024	1 - 245 MHz Radio Noise Storm	18 Dec
19 Dec 1657	ALERT: Geomagnetic $K=4$	19 Dec 1650
19 Dec 1711	WARNING: Geomagnetic $K=4$	19 Dec 1711 - 20 Dec 2359
19 Dec 2205	ALERT: Type II Radio Emission	19 Dec 2144
19 Dec 2215	ALERT: Type IV Radio Emission	19 Dec 2154
19 Dec 2218	SUMMARY: 10cm Radio Burst	19 Dec 2138
20 Dec 0007	WARNING: Proton 10MeV Integral Flux > 10pfu	20 Dec 0030 - 2359
20 Dec 0057	6 - 245 MHz Radio Bursts	19 Dec
20 Dec 0057	1 - 245 MHz Radio Noise Storm	19 Dec
20 Dec 0441	ALERT: Geomagnetic $K=4$	20 Dec 0440
20 Dec 1319	ALERT: X-Ray Flux exceeded M5	20 Dec 1318
20 Dec 1334	SUMMARY: X-ray Event exceeded M5	20 Dec 1318
20 Dec 1339	SUMMARY: 10cm Radio Burst	20 Dec 1315
20 Dec 1346	ALERT: Type II Radio Emission	20 Dec 1318
20 Dec 1505	CANCEL WARNING: Proton 10MeV Integral Flux > 10pfu	20 Dec 0007
20 Dec 2155	WATCH: Geomagnetic $A \geq 20$	22 Dec
20 Dec 2354	EXTENDED WARNING: Geomagnetic $K=4$ expected	19 Dec 1711 - 21 Dec 1500
21 Dec 0007	2 - 245 MHz Radio Bursts	20 Dec
21 Dec 0007	1 - 245 MHz Radio Noise Storm	20 Dec
21 Dec 0336	WARNING: Geomagnetic $K=5$ expected	21 Dec 0335 - 1500
21 Dec 0347	ALERT: Geomagnetic $K=5$	21 Dec 0344
21 Dec 0429	ALERT: Geomagnetic $K=6$	21 Dec 0426
22 Dec 0038	1 - 245 MHz Burst	20 Dec
22 Dec 0301	ALERT: Type II Radio Emission	22 Dec 0248
22 Dec 0304	SUMMARY: 10cm Radio Burst	22 Dec 0234
22 Dec 0318	ALERT: Type IV Radio Emission	22 Dec 0305
22 Dec 2021	ALERT: Geomagnetic $K=4$	22 Dec 2016



### 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
25 Dec	145	12	3	08 Jan	155	8	3
26	140	10	3	09	165	8	3
27	140	15	3	10	170	8	3
28	145	25	5	11	180	10	3
29	145	15	3	12	185	12	3
30	145	12	3	13	185	12	3
31	145	10	3	14	180	12	3
01 Jan	150	8	3	15	175	25	5
02	150	10	3	16	175	15	3
03	150	15	3	17	170	10	3
04	155	10	3	18	165	10	3
05	155	8	3	19	160	10	3
06	160	8	3	20	155	12	3
07	155	8	3				



### Energetic Events

Date	Time			X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½	Class	Flux	Imp/ Brtns	Location		Rgn #	Radio Flux		Intensity	
			Max				Lat	CMD		245	2695	II	IV
16 Dec	1107	1115	1126	M2.5	.020	1n	N17E32		225	64		1	
16 Dec	2245	2255	2320	M1.9	.029	1n	S27E10		226				
16 Dec	2333	2336	2340	M1.3	.005	Sf	N06W08		227				
17 Dec	2257	2335	2345	M1.6	.021	Sf	S27E00		226				
18 Dec	0631	0642	0656	M2.4	.024	1n	S28W03		226	68			
19 Dec	2134	2153	2217	M2.7	.048	2n	N15W09		229	640	210	1	2
20 Dec	1313	1318	1320	M6.8	.009	Sf	S25W34		226	2300	750	1	
22 Dec	0214	0252	0312	M1.1	.023	2f	N23W42		223	160	230	1	1

### Flare List

Date	Time			X-ray Class.	Imp / Brtns	Optical Location Lat CMD	Rgn
	Begin	Max	End				
16 December	0142	0145	0150	C2.3			
	0215	0226	0242	C4.3			
	0245	0246	0248		Sf	N07E04	227
	0333	0333	0337		Sf	N17E47	229
	0421	0425	0429	C2.1			
	0446	0449	0454		Sf	S26E22	226
	B0624	0637	0653	C2.9	Sf	S27E22	226
	0654	0656	0700		Sf	S29E24	226
	0704	0725	0823	C4.1	Sf	S29E24	226
	0837	0844	0855		Sf	N21E47	229
	0926	0926	0956	C4.8	1f	N18E45	229
	0928	0928	0934		Sf	S27E19	226
	B1111	U1119	A1137	M2.5	1n	N17E32	225
	1718	1719	1726		Sf	S26E17	226
	1906	1910	1919	C2.9			
	1933	1934	1950	C3.5	Sf	S28E16	226
	2026	2030	2038	C2.7			
	2102	2109	2119	C7.9			
	2248	2251	2326	M1.9	1n	S27E10	226
2330	2338	0007	M1.3	Sf	N06W08	227	
17 December	0056	0100	0113	C6.0	Sf	S26E07	226
	0107	0108	0111		Sf	N16E19	225
	0158	0203	0226	C1.8	Sf	S27E09	226
	0247	0250	0259	C2.8	Sf	S26E09	226
	0328	0336	0339		Sf	S26E05	226
	0445	0445	0451		Sf	N06W10	227
	0454	0505	0530	C5.3	Sf	N06W10	227
	0552	0554	0621	C3.5	Sf	N19E25	229
	0635	0636	0646	C2.2	Sf	S27E07	226
	0719	0723	0728		Sf	N05W12	227
	0755	0819	0859	C4.1	Sf	N06W13	227
1001	1007	A1020	C5.9	1f	N05W14	227	
B1351	U1419	A1430		Sf	N05W15	227	



*Flare List - continued.*

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
17 December	1817	1821	1824	C3.1			
	1926	1927	1938	C6.4	Sf	S27E05	226
	1929	1933	1938		Sf	N20E17	223
	2257	2339	0015	M1.6	Sf	S27E00	226
18 December	0015	0022	0025		Sf	S29E01	226
	0025	0033	0045		Sf	S28E02	226
	0224	0224	0230	C3.5	Sf	S17E01	224
	0231	0232	0241	C6.9	Sf	S27E00	226
	0538	0538	0544	C1.6	Sf	S17E00	224
	0635	0639	0713	M2.4	1n	S28W03	226
	1141	1147	1151	C7.1			
	1437	1441	1450	C1.8			
	1727	1731	1740	C2.7			
	1932	1937	1941	C1.4			
	2023	2028	2032	C1.9			
	2125	2128	2133	C1.6			
	2209	2212	2214	C2.0			
	2224	2224	2231		Sf	S28W15	226
	2355	2358	0005	C1.2	Sf	S10E45	230
19 December	0032	0035	0046	C2.7	Sf	S27W17	226
	0128	0144	0146	C1.6	Sf	S23W16	226
	0308	0308	0313	C1.7	Sf	S28W14	226
	0344	0348	0350		Sf	S28W17	226
	0437	0446	0456	C1.3	Sf	S09E44	230
	0515	0602	0622	C3.7			
	0531	0532	0537		Sf	S27W18	226
	0649	0652	0657	C2.1			
	0730	0730	0740	C2.9	Sf	S27W23	226
	0815	0821	0823	C2.3			
	0935	0940	0946	C2.3	Sf	S29W16	226
	1115	1118	1122	C1.4			
	1301	1310	1330	C2.2			
	2005	2007	2017	C2.3	Sf	S28W27	226
	2138	2147	2207		Sf	N23W21	223
2138	2143	2303	M2.7	2n	N15W09	229	
B2219	U2254	2328		2f	N18W01	229	
2322	2323	2327		Sf	N15W09	229	
2354	2355	0001		Sf	S09E37	230	
20 December	0034	0036	0057	C4.5	Sf	S25W27	226
	0144	0145	0147	C1.4	Sf	S09E35	230
	0225	0227	0232		Sf	S27W32	226



*Flare List - continued.*

Date	Time			X-ray Class.	Optical		Rgn	
	Begin	Max	End		Imp / Brtns	Location Lat CMD		
20 December	0539	0541	0554	C1.6	Sf	S09E33	230	
	0759	0801	0818	C1.9	Sf	S23W30	226	
	0823	0824	0834	C8.5	Sf	S24W31	226	
	0827	0832	0845		Sf	S07E31	230	
	1125	1128	1130	C2.7				
	1247	1253	1257	C4.2				
	1316	1319	1326	M6.8	Sf	S25W34	226	
	1857	1904	1906	C3.5				
	2014	2014	A2024	C7.2	1f	S29W35	226	
	2304	2308	2311	C1.7	Sf	S24W37	226	
	2319	2321	2326	C2.0	Sf	S25W37	226	
	21 December	0002	0002	0004	C1.7	Sf	S28W38	226
		0023	0024	0142		Sf	N21W15	229
0028		0032	0035		Sf	S26W37	226	
0249		0250	0253	C2.4	Sf	S27W45	226	
0342		0342	0354	C2.9	Sf	N19W19	229	
0438		0441	0445	C2.2				
0440		0453	0505	C4.6	1f	S25W41	226	
0950		0951	0958	C1.6	Sf	S25W44	226	
1905		1905	1917	C1.0	Sf	S25W49	226	
2144		2147	2151	C1.2				
22 December	0232	0246	0323	M1.1	2f	N23W42	223	
	0732	0736	0740	C2.3				
	1403	1408	1416	C2.2				
	1535	1539	1541	C1.5				
	2141	2149	2154	C1.9				
	2312	2315	2320		Sf	S13W56	224	



### 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 213</i>																	
03 Dec	N15E79	232	0070	07	Cso	003	B						1				
04 Dec	N14E64	234	0090	07	Cao	005	B	1							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										
09 Dec	N14E01	231	0020	07	Cso	006	B										
10 Dec	N15W12	231	0010	01	Axx	001	A						1				
11 Dec	N16W28	234	0020	05	Cso	007	B										
12 Dec	N17W41	233	0010	03	Cso	004	B										
13 Dec	N18W53	232	0020	03	Cso	003	B										
14 Dec	N18W66	232															
15 Dec	N18W79	232															
16 Dec	N18W92	232															
								0	1	0	2	0	1	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 231

<i>Region 215</i>																	
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										
09 Dec	S18E19	213	0040	05	Dao	011	B										
10 Dec	S18E04	215	0060	03	Dao	010	B										
11 Dec	S18W07	213	0030	04	Dso	009	B										
12 Dec	S17W21	213	0030	01	Hrx	001	A										
13 Dec	S17W35	214															
14 Dec	S18W48	213	0000	00	Axx	001	A										
15 Dec	S18W61	213															
16 Dec	S18W74	213															
17 Dec	S18W87	213															
								0	0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 215





**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

*Region 217*

08 Dec	N12E56	189	0020	01	Axx	002	A												
09 Dec	N12E43	189	0020	02	Hsx	004	A												
10 Dec	N12E29	190	0010	01	Axx	001	A												
11 Dec	N12E17	189	0010	04	Bxo	003	B												
12 Dec	N14E04	188	0000	01	Axx	002	A												
13 Dec	N13W09	188																	
14 Dec	N13W22	188																	
15 Dec	N13W35	188																	
16 Dec	N13W48	188																	

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 188

*Region 218*

08 Dec	S20E68	177	0050	01	Hax	001	A													1	
09 Dec	S20E55	177	0070	02	Hax	002	A														
10 Dec	S18E42	177	0060	03	Cso	003	B														1
11 Dec	S19E30	176	0040	03	Cao	007	B														
12 Dec	S19E17	175	0020	02	Hsx	002	B														
13 Dec	S18E03	176	0080	06	Dao	012	B														
14 Dec	S18W11	176	0090	06	Dao	016	B														
15 Dec	S18W25	177	0070	08	Dao	012	B														
16 Dec	S17W39	178	0020	01	Hsx	001	A														
17 Dec	S18W49	175	0020	06	Cso	004	B														
18 Dec	S18W63	177	0020	01	Axx	001	A														
19 Dec	S18W79	178	0000	00	Axx	001	A														
20 Dec	S18W92	178																			

0 0 0 2 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 176



**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 220</i>																	
09 Dec	S12E47	185	0150	06	Dao	012	B										
10 Dec	S12E33	186	0310	07	Dai	016	Bg	3				3					
11 Dec	S12E21	185	0270	09	Dai	025	Bg										
12 Dec	S12E07	185	0190	10	Dai	017	B										
13 Dec	S12W06	185	0140	10	Dao	015	B	1				1					
14 Dec	S13W18	183	0120	11	Eao	016	B	1				1					
15 Dec	S12W33	185	0080	10	Dao	012	B										
16 Dec	S12W50	189	0040	02	Hsx	001	A										
17 Dec	S13W64	190	0080	04	Hsx	003	A										
18 Dec	S13W78	190	0040	02	Hax	001	A										
19 Dec	S13W91	190	0000	00	Axx	001	A										
								5	0	0	5	0	0	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 185

<i>Region 221</i>																	
09 Dec	N22E61	171	0020	02	Hsx	002	A										
10 Dec	N23E48	171	0020	02	Hsx	001	A										
11 Dec	N23E35	171	0020	03	Cso	004	B										
12 Dec	N23E22	171	0010	03	Bxo	002	B										
13 Dec	N20E12	167	0010	02	Axx	002	A										
14 Dec	N20W01	166	0020	02	Cro	004	B										
15 Dec	N20W14	166															
16 Dec	N20W27	166															
17 Dec	N20W40	166															
18 Dec	N20W53	166															
								0	0	0	0	0	0	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 166

<i>Region 222</i>																	
11 Dec	S06W03	209	0020	05	Cso	008	B										
12 Dec	S12W16	208	0010	04	Bxo	007	B										
13 Dec	S13W28	207	0010	03	Bxo	007	B										
14 Dec	S13W41	207															
15 Dec	S13W54	207															
16 Dec	S13W67	207															
								0	0	0	0	0	0	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 209



**Region Summary - continued.**

Date	Location		Sunspot Characteristics				Flares										
	Helio		Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical						
	( ° Lat ° CMD)	Lon						C	M	X	S	1	2	3	4		
<i>Region 223</i>																	
12 Dec	N23E71	121	0070	02	Hsx	001	A					1					
13 Dec	N24E60	119	0130	06	Cso	006	B	1				2					
14 Dec	N23E46	119	0140	04	Dso	005	B					2					
15 Dec	N24E34	118	0140	04	Cai	007	B										
16 Dec	N24E21	118	0110	05	Dso	008	B										
17 Dec	N25E08	118	0140	05	Dso	011	B	1				1					
18 Dec	N25W06	118	0140	04	Cso	007	B										
19 Dec	N25W19	118	0080	03	Cao	004	B					1					
20 Dec	N25W32	118	0280	04	Dao	004	B										
21 Dec	N25W45	118	0050	04	Cso	005	B										
22 Dec	N25W58	118	0050	04	Cao	004	B		1						1		
								2	1	0	7	0	1	0	0	0	

Still on Disk.

Absolute heliographic longitude: 118

<i>Region 224</i>																	
12 Dec	S16E70	122	0090	05	Dao	003	B										
13 Dec	S17E61	118	0220	15	Eao	011	B	1				2					
14 Dec	S18E49	116	0290	13	Eai	022	Bg					1					
15 Dec	S18E36	116	0200	15	Eai	025	Bg										
16 Dec	S15E22	117	0120	11	Eao	013	B										
17 Dec	S14E06	120	0160	13	Eao	026	B										
18 Dec	S14W08	120	0140	15	Eao	033	B	2				2					
19 Dec	S14W21	120	0050	16	Fro	017	B										
20 Dec	S14W32	118	0070	10	Dao	018	B										
21 Dec	S14W45	118	0070	10	Dso	013	B										
22 Dec	S14W58	118	0150	10	Dao	022	B					1					
								3	0	0	6	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 120



**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 225*

13 Dec	N17E66	113	0120	10	Dao	009	B												
14 Dec	N17E51	114	0140	09	Dai	009	B							3					
15 Dec	N16E38	114	0100	07	Dai	014	B							1					
16 Dec	N17E23	116	0100	08	Dai	015	Bg	1						1					
17 Dec	N17E11	115	0110	08	Dai	014	Bg							1					
18 Dec	N17W03	115	0090	09	Dao	014	Bg												
19 Dec	N17W18	117	0040	05	Cao	006	B												
20 Dec	N17W33	119	0030	01	Hsx	001	A												
21 Dec	N17W46	119	0020	01	Axx	002	A												
22 Dec	N17W59	119																	
										0	1	0	5	1	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 115

*Region 226*

13 Dec	S28E51	128	0070	06	Dso	008	B							8					
14 Dec	S28E39	126	0170	08	Dai	019	B	4						9	1				
15 Dec	S28E25	127	0290	12	Eki	020	B	3						5					
16 Dec	S28E12	127	0320	14	Eki	028	Bg	3	1					7	1				
17 Dec	S28W01	127	0560	16	Fki	042	Bgd	5	1					7					
18 Dec	S28W15	127	0720	17	Fki	047	Bgd	1	1					4	1				
19 Dec	S28W28	127	0690	20	Fkc	045	Bgd	6						8					
20 Dec	S28W41	127	0720	21	Fkc	041	Bgd	7	1					7	1				
21 Dec	S28W54	127	0510	21	Fkc	029	Bgd	4						5	1				
22 Dec	S28W67	127	0360	21	Fki	026	Bgd												
										33	4	0	60	5	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 127



**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

*Region 227*

13 Dec	N05E34	145	0010	03	Bxo	003	B												
14 Dec	N06E21	144	0030	04	Cso	004	B												
15 Dec	N06E08	144	0050	06	Dsi	008	B												
16 Dec	N07W07	146	0070	07	Dri	009	Bg		1		2								
17 Dec	N07W20	146	0090	08	Dao	019	Bg	3			5	1							
18 Dec	N07W34	146	0070	07	Cao	007	B												
19 Dec	N07W47	146	0030	05	Cao	004	B												
20 Dec	N07W63	149	0010	01	Axx	001	A												
21 Dec	N07W76	149	0040	01	Hsx	001	A												
22 Dec	N07W89	149																	
										3	1	0	7	1	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 146

*Region 228*

14 Dec	S14E65	100	0040	01	Hsx	001	A					1							
15 Dec	S15E52	100	0020	01	Hrx	001	A												
16 Dec	S17E37	102	0010	01	Axx	001	A												
17 Dec	S17E24	102	0000	00		000													
18 Dec	S17E10	102	0010	04	Bxo	004	B												
19 Dec	S17W03	102	0010	03	Bxo	002	B												
20 Dec	S17W16	102	0010	03	Bxo	002	B												
21 Dec	S14W26	099																	
22 Dec	S14W39	099																	
										0	0	0	1	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 102

*Region 229*

14 Dec	N15E63	102	0220	07	Dai	007	B					4							
15 Dec	N17E51	101	0400	10	Dki	028	B	2			3								
16 Dec	N18E37	102	0410	12	Ehi	028	Bg	1			2	1							
17 Dec	N19E24	102	0320	13	Eki	038	Bg	1			1								
18 Dec	N19E12	102	0440	14	Eki	037	Bg												
19 Dec	N19W03	102	0230	14	Eai	021	Bg		1		1		2						
20 Dec	N19W16	102	0200	16	Fao	023	Bg												
21 Dec	N19W29	102	0140	15	Eao	023	Bg	1			2								
22 Dec	N19W42	102	0080	10	Dao	011	Bg												
										5	1	0	13	1	2	0	0	0	

Still on Disk.

Absolute heliographic longitude: 102



**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

*Region 230*

17 Dec	S08E59	067	0070	07	Dao	005	B								
18 Dec	S08E45	067	0150	07	Dao	010	B	1			1				
19 Dec	S08E32	067	0210	13	Eai	012	Bg	1			2				
20 Dec	S08E19	067	0310	12	Eki	018	Bg	2			3				
21 Dec	S08E06	067	0300	13	Eai	027	Bg								
22 Dec	S08W07	067	0220	10	Dho	022	Bg								
								4	0	0	6	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 067

*Region 231*

19 Dec	S25E13	086	0020	04	Cso	002	B								
20 Dec	S25E00	086	0020	06	Dso	005	B								
21 Dec	S25W13	086	0030	07	Cao	006	B								
22 Dec	S25W26	086	0050	08	Dao	010	B								
								0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 086

*Region 232*

21 Dec	N13W08	081	0020	00	Dao	003	B								
22 Dec	N13W21	081	0020	05	Dao	003	B								
								0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 081

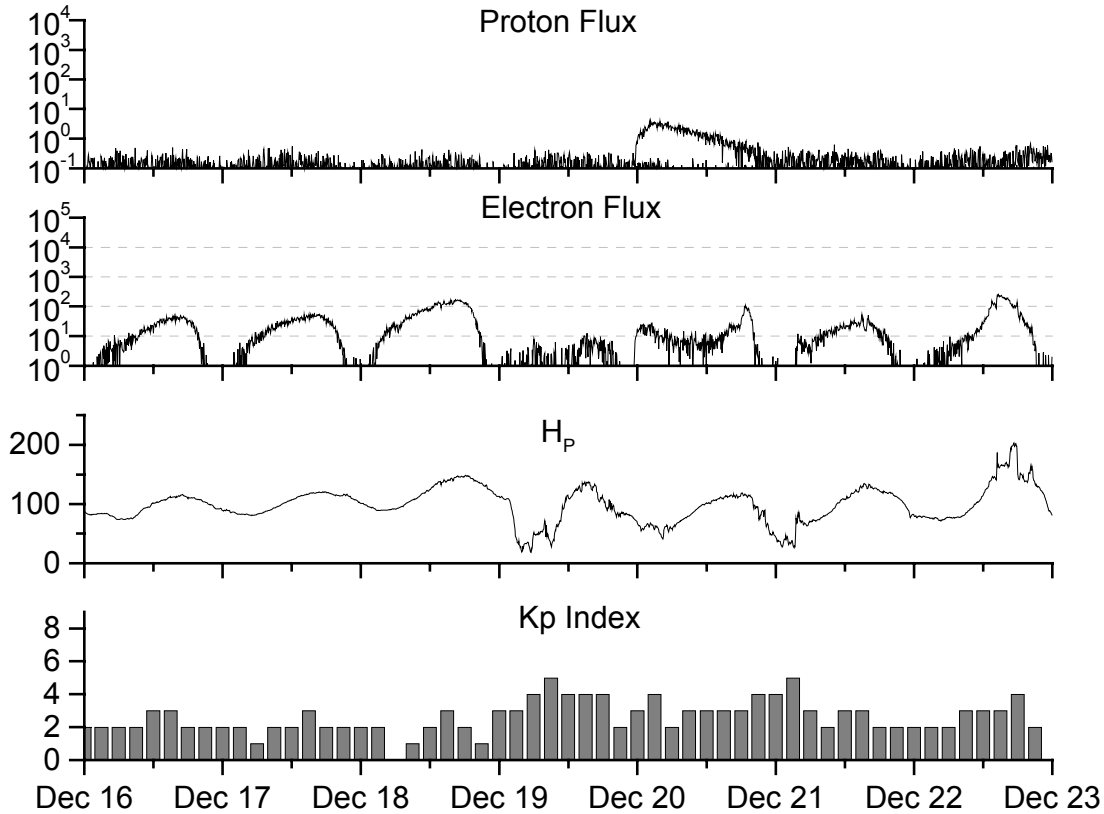


**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

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>2000</b>									
December	146.4	104.5	0.71	160.8	112.1	173.6	172.1	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	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
<b>2002</b>									
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 16 December 2002*

*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.

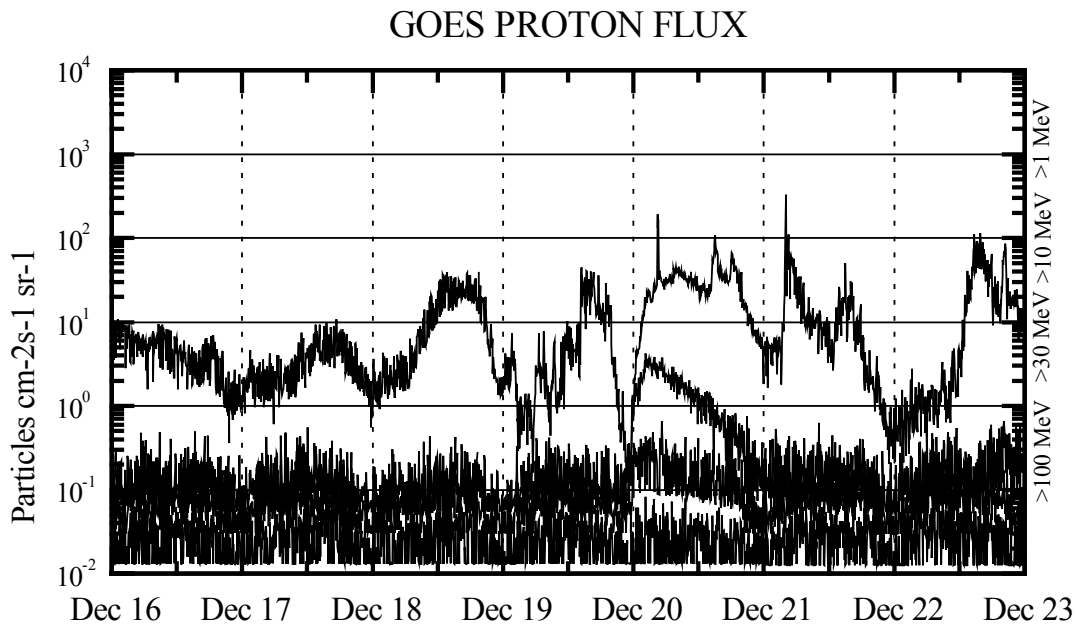
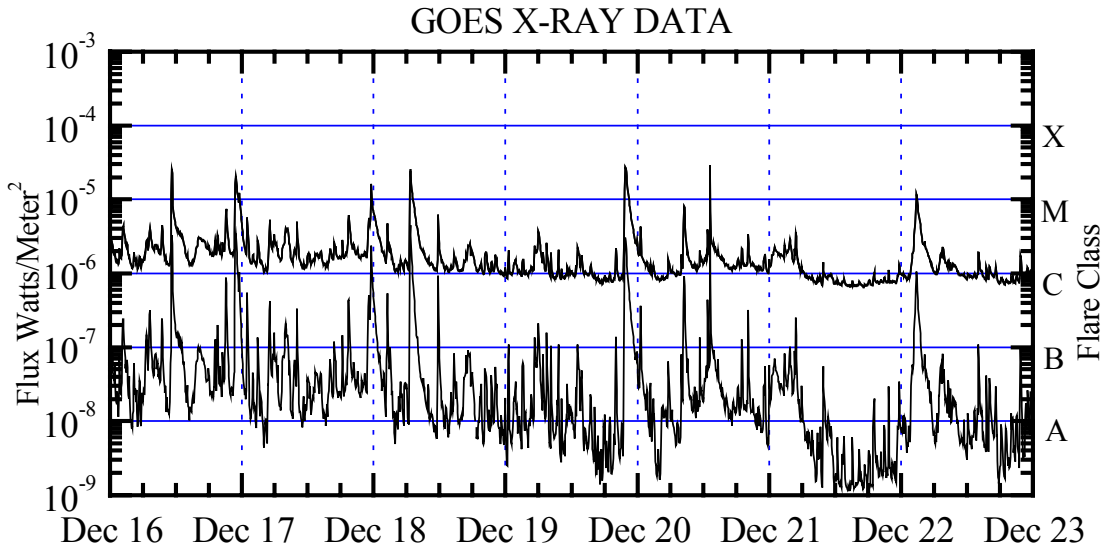
*Electrons* plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>-sec -sr) with energies greater than 2 MeV at GOES-8.

*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.

