

**Space Weather Highlights  
08-14 December 1997**

Solar activity was very low to low. Isolated C-class subflares occurred on 12 and 14 December.

Solar wind data were received from the WIND spacecraft a few hours per day (no data available for 13 December). Velocities decreased from 350 - 300 km/sec during 08 - 09 December, then increased to 400 km/sec during 10 December. Velocities gradually decreased to 300 km/sec during the rest of the period. Densities were in the 03 - 10 p/cc range during most of the period, but increased to around 35 p/c on 10 December. Another increase occurred on 14 December, peaking near 25 p/cc. Bz ranged from minus 04 to plus 06 nT (GSM) during most days, but was southward during part of 10 December with a maximum southerly deflection near minus 15 nT. Solar sector orientation was predominantly toward, but shifted to an away orientation during 10 December.

There were no significant proton enhancements observed at geosynchronous altitude.

The greater than 2 MeV electron flux at geosynchronous altitude reached high levels during 11 - 12 and 14 December.

The geomagnetic field was quiet during 08 - 09 December. A disturbance occurred during 10 December following a sudden impulse of 27 nT at 10/0530UT (as recorded by the Boulder USGS magnetometer). Active to minor storm levels occurred during the disturbance. Activity declined to mostly quiet levels for the rest of the period.

**Space Weather Forecast  
17 December 1997 -12 January 1998**

Solar activity is expected to range from low to moderate. C-class flares are expected to occur throughout the period. M-class flare activity may occur during 23 December - 04 January due to the return of old Region 8113 (N20, L = 309, class/area Fsc/0940 on 30 November).

No significant proton enhancements are expected at geosynchronous altitude.

The greater than 2 MeV electron flux at geosynchronous altitude is expected to be at normal to moderate levels during most of the period. However, high levels may occur during 23 - 24 December.

The geomagnetic field is expected to be quiet to unsettled during most of the period. However, active periods may occur during 21 - 22 December due to coronal hole effects.



### Daily Solar Data

Date	Radio	Sun	Sunspot	X-ray	X-ray Flux			Flares				
	Flux 10.7 cm	spot No. ( $10^6$ hemi.)	Area	Background	C	M	X	S	Optical			
									1	2	3	4
08 December	98	97	270	B1.5	0	0	0	0	0	0	0	0
09 December	97	94	270	B2.0	0	0	0	0	0	0	0	0
10 December	95	72	280	B1.8	0	0	0	0	0	0	0	0
11 December	96	99	230	B1.8	0	0	0	0	0	0	0	0
12 December	93	64	250	B2.1	4	0	0	4	0	0	0	0
13 December	89	70	260	B1.3	0	0	0	0	0	0	0	0
14 December	90	66	230	B1.9	1	0	0	3	0	0	0	0

### Daily Particle Data

Date	Proton Fluence (protons/cm <sup>2</sup> -day-sr)			Electron Fluence (electrons/cm <sup>2</sup> -day-sr)		
	>1MeV	>10MeV	>100MeV	>.6MeV	>2MeV	>4MeV
08 December	8.9E+5	1.8E+4	4.2E+3		1.3E+7	
09 December	1.0E+6	1.8E+4	4.4E+3		1.5E+7	
10 December	4.1E+5	1.7E+4	4.0E+3		4.5E+6	
11 December	4.1E+5	1.6E+4	3.6E+3		3.7E+7	
12 December	2.5E+5	1.7E+4	4.0E+3		4.8E+7	
13 December	1.4E+5	1.8E+4	4.3E+3		4.6E+7	
14 December	2.3E+5	1.8E+4	4.5E+3		7.6E+7	

### Daily Geomagnetic Data

Date	Middle Latitude		High Latitude		Estimated	
	Fredericksburg		College		Planetary	
	A	K-indices	A	K-indices	A	K-indices
08 December	1	0-1-1-0-0-0-0-0	*	0-0-0-0-*-0-0	2	0-0-0-0-1-2-1-0
09 December	1	0-0-0-0-0-1-1-0	0	0-0-0-1-0-0-0-0	2	0-0-0-0-0-1-1-0
10 December	15	0-3-2-4-4-3-3-3	23	0-3-4-6-4-3-2-3	15	0-3-3-4-4-4-2-3
11 December	11	4-3-2-3-2-2-2-1	12	3-3-2-5-2-1-1-0	13	4-4-3-4-3-2-1-1
12 December	2	1-1-1-0-0-1-0-0	0	0-0-0-0-0-0-0-0	2	1-1-0-0-0-1-1-0
13 December	1	0-0-1-0-0-0-1-0	*	0-0-1-*-0-0-0-0	2	0-0-0-0-1-1-1-0
14 December	3	0-1-1-1-1-2-1-1	0	0-0-0-0-0-0-0-0	2	0-0-0-0-0-1-1-1

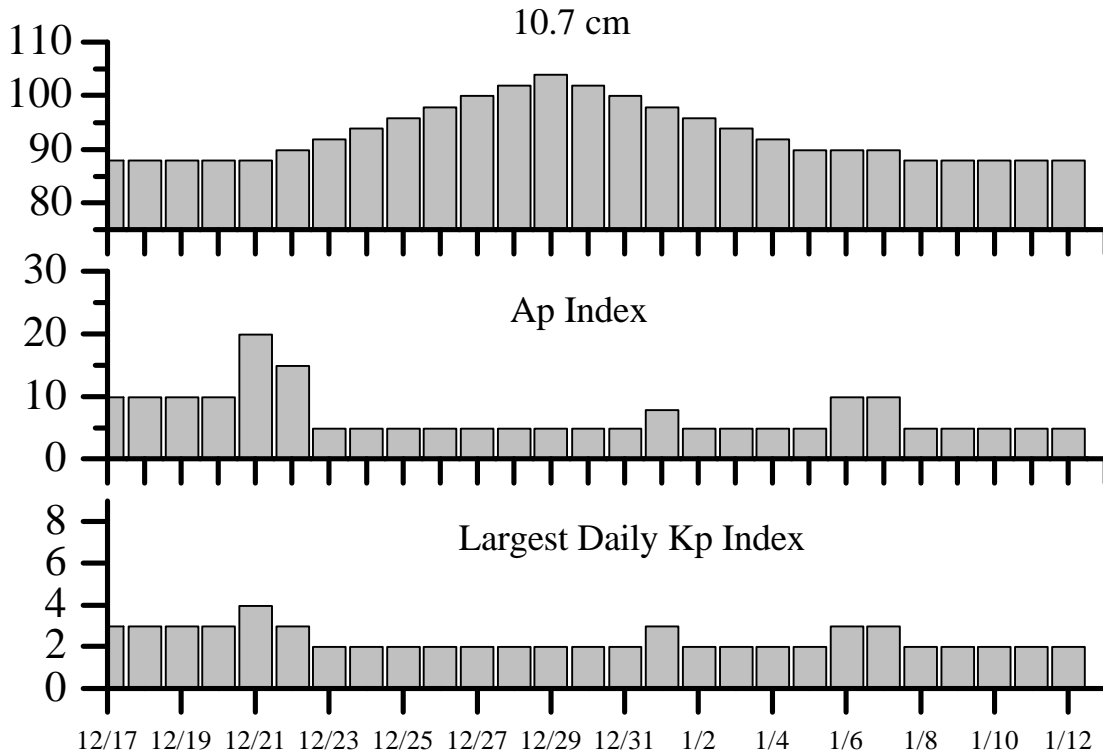


***Alerts and Warnings Issued***

Date and Time of Issue (UT)	Type of Alert or Warning	Date and Time of Event (UT)
08 Dec 0010	1-245 MHz Burst	07 Dec
08 Dec 2201	A $\geq$ 20 Watch	10 Dec
09 Dec 1543	Stratwarm Alert exists Tuesday	
09 Dec 1904	A $\geq$ 20 Watch	11 Dec
10 Dec 1223	K= 4 Observed	10 Dec 09-12
10 Dec 1340	Stratwarm Alert exists Wednesday	
10 Dec 1349	Sudden Impulse observed at Boulder	10 Dec 0530
10 Dec 1810	K= 4 Observed	10 Dec 15-18
11 Dec 0010	1-245 MHz Burst	10 Dec
11 Dec 1111	Stratwarm Alert exists Thursday	
11 Dec 1815	>2MeV Electron Event $\geq$ 1000pfu	11 Dec 1800
12 Dec 0010	1-245 MHz Burst	11 Dec
12 Dec 1319	Stratwarm Alert exists Friday	
13 Dec 029	>2MeV Electron Event in Progress $\geq$ 1000pfu	12 Dec
14 Dec 1442	>2MeV Electron Event $\geq$ 1000pfu	14 Dec 1435



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
17 Dec	88	10	3	31 Dec	100	5	2
18	88	10	3	01 Jan	98	8	3
19	88	10	3	02	96	5	2
20	88	10	3	03	94	5	2
21	88	20	4	04	92	5	2
22	90	15	3	05	90	5	2
23	92	5	2	06	90	10	3
24	94	5	2	07	90	10	3
25	96	5	2	08	88	5	2
26	98	5	2	09	88	5	2
27	100	5	2	10	88	5	2
28	102	5	2	11	88	5	2
29	104	5	2	12	88	5	2
30	102	5	2				



***Energetic Events***

Date	Time (UT)		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½ Max	Class	Integ Flux	Imp Brtns	Location		Radio Flux		Intensity	
							Lat	CMD	Rgn #	245	2695	II

*No Events Observed*

***Flare List***

Date	Time			X-ray Class.	Optical		Rgn #
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
08 December	0518	0521	0527	B3.1			
	0727	0733	0745	B3.8			
09 December	0042	0046	0048	B7.9			
	1605	1608	1612	B2.3			
	2036	2039	2041	B4.7			
	2248	2251	2253	B3.0			
10 December	1010	1014	1026	B4.1			8115
11 December	0409	0414	0418	B4.5			
	1301	1312	1323	B4.4			
	1445	1452	1459	B4.3			
12 December	0044	0054	0100	B5.2			
	0301	0305	0308	B8.0			
	0607	0609	0613	B4.3	SF	N32W05	8122
	0630	0633	0635	B2.3			
	0717	0718	0733	C1.4	SF	N36W39	8119
	0747	0755	0800	B6.2			
	0857	0858	0905	B3.8	SF	N30W08	8122
	1003	1028	1033	B8.8			
	1046	1052	1056	C1.8			
	1110	1114	1119	B6.8			
	1145	1154	1159	C2.3			
	1208	1212	1215	B8.0			
	1218	1225	1229	C1.3			
	1415	1419	1422	B3.0			
	1539	1545	1602	B2.6			
	1634	1638	1641	B3.3			
2224	2230	2242	B9.4	SF	N25W52	8116	
13 December	0220	0230	0245	B4.0			
	0909	0914	0919	B2.3			
	1338	1342	1346	B1.8			
14 December	0056	0056	0101		SF	N29W65	8116
	0553	0559	0609	B1.8			
	0916	0925	0935	B4.2			
	1537	1551	1710	C1.2	SF	N29W41	8122
	2125	2144	2235	B4.4			



## 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

### Region 8113

25 Nov	N19E87	307	0100	02	HAX	001	A												
26 Nov	N20E77	307	0330	13	EKO	010	B	2	1		7								
27 Nov	N20E60	311	0610	14	EKO	012	B	1		1	4		1						
28 Nov	N20E48	310	0680	14	EKO	019	BGD	5	1		7	1	1						
29 Nov	N20E36	309	0710	14	EHO	027	BG	3	1		5		1						
30 Nov	N22E21	310	0940	17	FSC	046	BGD	2			6	1							
01 Dec	N21E09	309	0550	17	FHI	050	BG	5	1		9	2							
02 Dec	N20W04	309	0610	15	EKI	044	BG				2								
03 Dec	N21W16	308	0600	15	EKI	032	BG	5			8								
04 Dec	N21W28	307	0420	14	EHI	026	B	1			3								
05 Dec	N20W42	307	0330	14	EHO	013	B												
06 Dec	N21W55	307	0280	13	CAO	007	B												
07 Dec	N20W70	309	0190	12	CAO	005	B												
08 Dec	N19W87	313	0110	02	HAX	001	A												
								24	4	1	51	4	3	0	0				

Crossed West Limb.

Absolute heliographic longitude: 309

### Region 8114

03 Dec	S30E04	288	0010	03	BXO	002	B											
04 Dec	S30W08	287	0000	00	AXX	001	A											
05 Dec	S30W21	286	0000	01	AXX	001	A											
06 Dec	S30W34	286	0000	00		000												
07 Dec	S28W51	290	0000	00	AXX	001	A											
08 Dec	S28W64	290																
09 Dec	S28W77	290																
10 Dec	S28W90	290																
								0	0	0	0	0	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude: 288

### Region 8115

05 Dec	N32W19	284	0020	05	BXO	003	B											
06 Dec	N33W34	286	0010	06	BXO	003	B											
07 Dec	N33W46	285	0010	06	BXO	003	B											
08 Dec	N34W59	285	0020	11	BXO	003	B											
09 Dec	N33W72	285	0020	07	BXO	002	B											
10 Dec	N34W85	285																
								0	0	0	0	0	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude: 284



*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 8116*

05 Dec	N25E40	225	0000	00	AXX	001	A											
06 Dec	N26E27	225	0030	05	CRO	004	B											
07 Dec	N25E13	226	0080	06	CSO	008	B											
08 Dec	N25W03	229	0050	05	CSO	004	B											
09 Dec	N25W15	228	0070	05	CSO	005	B											
10 Dec	N26W28	228	0040	05	CSO	003	B											
11 Dec	N26W41	227	0020	01	HSX	001	A											
12 Dec	N26W53	226	0000	00	AXX	001	A					1						
13 Dec	N24W68	228	0000	00	AXX	001	A											
14 Dec	N25W82	229	0000	00	AXX	001	A					1						
								0	0	0	0	2	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 229

*Region 8117*

07 Dec	N23E37	202	0010	04	BXO	003	B											
08 Dec	N22E23	203	0020	05	BXO	003	B											
09 Dec	N22E10	203	0010	05	BXO	003	B											
10 Dec	N22W03	203																
11 Dec	N22W16	203																
12 Dec	N22W16	203																
								0	0	0	0	0	0	0	0	0	0	0

Died on Disk.

Absolute heliographic longitude: 203

*Region 8118*

08 Dec	S38E37	189	0020	06	BXO	005	B											
09 Dec	S39E25	188	0070	07	CAO	007	B											
10 Dec	S39E09	191	0070	02	HSX	001	A											
11 Dec	S39W03	189	0040	02	HSX	001	A											
12 Dec	S38W14	187	0050	02	HSX	001	A											
13 Dec	S40W27	187	0050	02	HSX	001	A											
14 Dec	S41W39	186	0040	01	HSX	001	A											
								0	0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 189



*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 8119*

08 Dec	N32E00	226	0020	03	BXO	006	B											
09 Dec	N32W13	226	0050	05	CRO	008	B											
10 Dec	N33W25	225	0110	08	DAO	008	B											
11 Dec	N32W38	224	0100	08	DSO	015	B											
12 Dec	N33W49	222	0080	08	DAO	008	B	1				1						
13 Dec	N31W63	223	0090	08	CAO	006	B											
14 Dec	N31W81	228	0070	02	CAO	002	B											

Still on Disk.

Absolute heliographic longitude: 226

*Region 8120*

08 Dec	S22E35	191	0030	03	BXO	005	B											
09 Dec	S22E22	191	0050	04	CRO	009	B											
10 Dec	S22E10	190	0040	06	CAO	007	B											
11 Dec	S21W06	192	0000	00	AXX	001	A											
12 Dec	S21W19	192																
13 Dec	S20W31	191	0000	01	AXX	001	A											
14 Dec	S20W44	191																

Still on Disk.

Absolute heliographic longitude: 192

*Region 8121*

10 Dec	N25W55	255	0020	04	BXO	003	B											
11 Dec	N25W68	254	0020	06	BXO	003	B											
12 Dec	N26W77	250																

Died on Disk.

Absolute heliographic longitude: 253

*Region 8122*

11 Dec	N31W06	192	0050	05	DRO	018	B											
12 Dec	N31W18	191	0120	08	DSO	014	B					2						
13 Dec	N30W33	193	0120	10	DAO	011	B											
14 Dec	N29W48	195	0110	09	DAO	009	B	1				2						

Still on Disk.

Absolute heliographic longitude: 192





***Region Summary- continued.***

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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

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*Region 8123*

14 Dec N19E61 086 0010 04 BXO 003 B  
 0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 086

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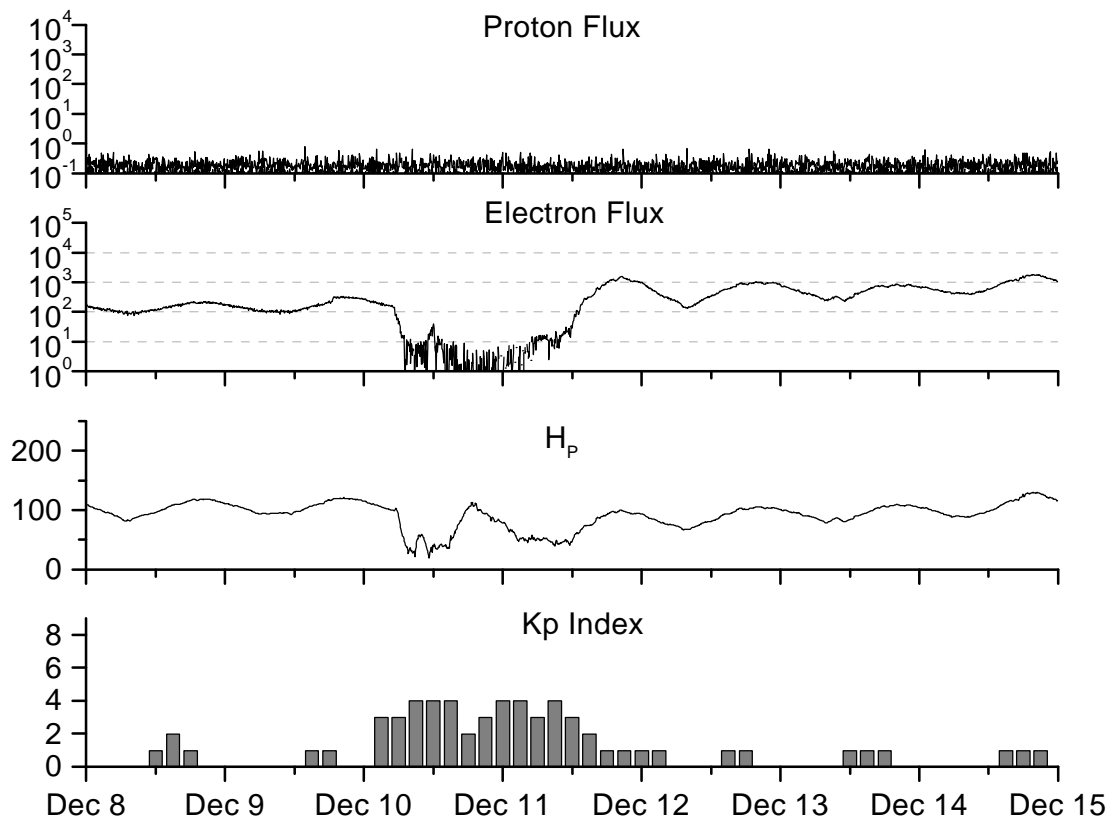
**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

Month	Sunspot Numbers					Radio Flux		Geomagnetic	
	Observed values		Ratio	Smooth values		Penticton	Smooth	Planetary	Smooth
	SWO	RI	RI/SWO	SWO	RI	10.7 cm	Value	Ap	Value
<b>1995</b>									
December	16.2	10.0	0.62	17.6	10.8	72.6	72.8	09	10.0
<b>1996</b>									
January	17.6	11.5	0.65	16.8	10.4	74.5	72.4	09	09.8
February	09.1	04.4	0.48	16.2	10.1	71.5	72.2	10	09.8
March	12.1	09.2	0.76	15.4	09.7	72.7	72.1	11	09.9
April	08.5	04.8	0.56	13.6	08.5	69.3	71.6	11	09.7
May	11.8	05.5	0.47	12.9	08.0	72.1	71.4	07	09.5
June	18.8	11.8	0.63	13.5	08.5	69.6	71.8	05	09.4
July	13.2	08.2	0.62	13.4	08.4	71.2	72.0	07	09.3
August	20.5	14.4	0.70	13.1	08.3	72.4	72.1	09	09.4
September	02.9	01.6	0.55	13.3	08.4	69.4	72.3	15	09.3
October	02.3	00.9	0.39	14.0	08.8	69.2	72.6	13	09.1
November	26.7	17.9	0.67	15.4	09.8	78.7	73.0	08	09.1
December	21.1	13.3	0.63	16.2	10.4	77.8	73.3	07	09.3
<b>1997</b>									
January	09.0	05.7	0.63	16.5	10.5*	74.0	73.4	09	09.3*
February	11.3	07.6	0.67	17.4	11.0*	73.8	73.7	11	09.2*
March	14.4	08.7	0.60	20.4	13.5*	73.5	75.1*	08	09.0*
April	24.5	15.5	0.63	24.0	16.5*	74.5	76.8*	10	08.6*
May	28.6	18.5	0.65	26.4	18.4*	74.6	78.4*	08	08.6*
June	22.1	12.7	0.57			71.7		07	
July	17.0	10.5*	0.62*			71.1		06*	
August	36.7	24.7*	0.67*			79.0		08*	
September	52.8	51.3*	0.88*			96.2*		10*	
October	33.6	23.3*	0.69*			85.0*		10*	
November	53.5	39.3*	0.73*			99.5*		10*	

\*Preliminary estimates.

The lowest smoothed sunspot number for Cycle 22, RI = 8.0, occurred May 1996. The highest smoothed sunspot number for Cycle 22, RI=158.5, occurred July 1989. October 1996 has been selected as the start of Solar Cycle 23. \*\* From June 1991 onward, 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 08 December 1997

*Protons* plot contains the five-minute averaged integral proton flux (protons/  $\text{cm}^2\text{-sec-sr}$ ) as measured by GOES-9 (W135) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

*Electrons* plot contains the five-minute averaged integral electron flux (electrons/  $\text{cm}^2\text{-sec-sr}$ ) with energies greater than 2 MeV at GOES-9.

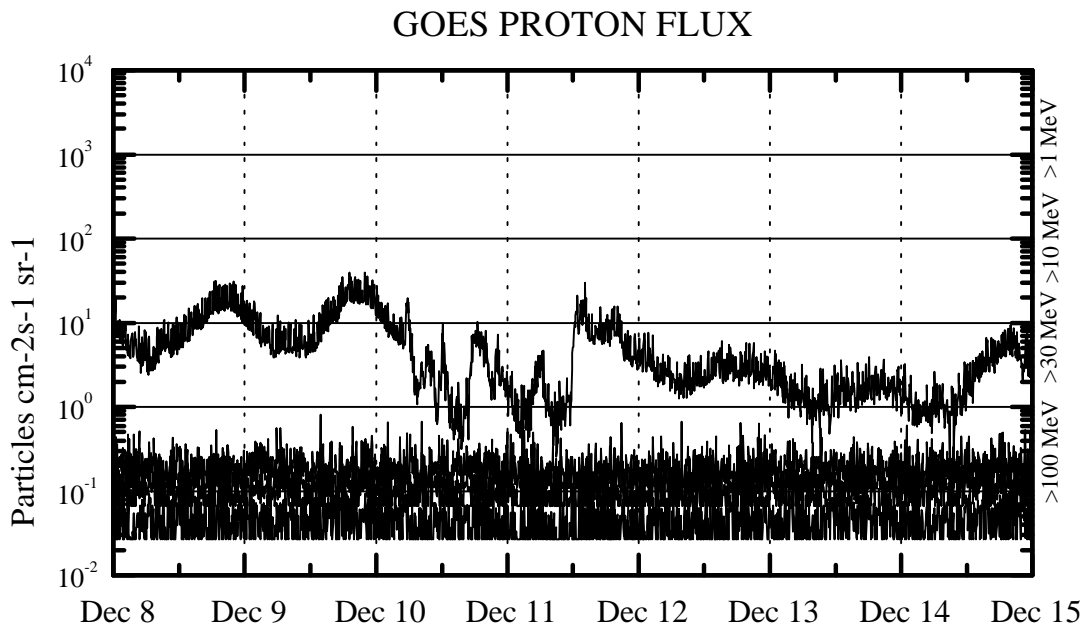
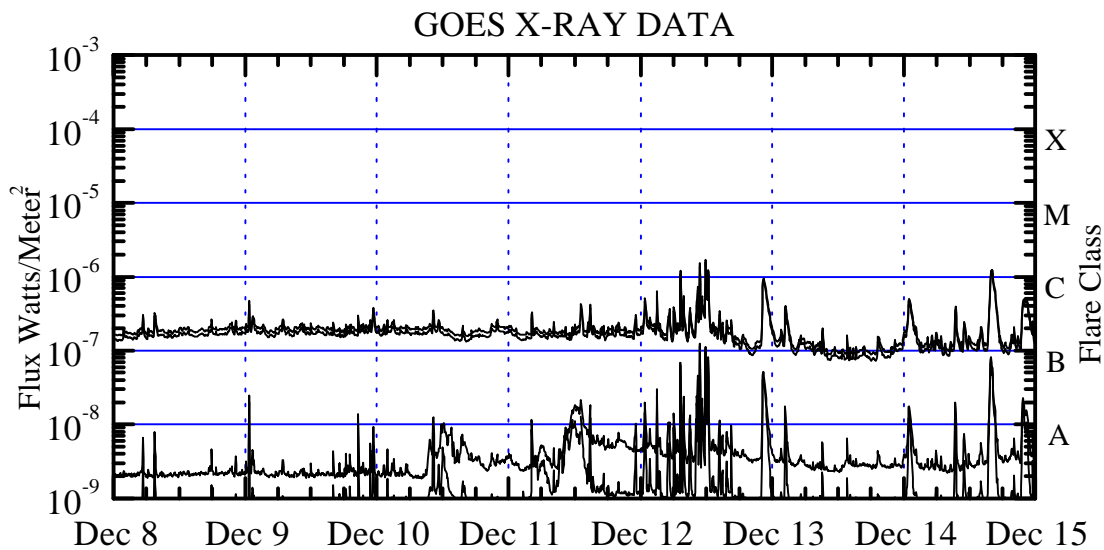
*H<sub>p</sub>* plot contains the five minute averaged magnetic field H component in nanoteslas (nT) as measured by GOES-9. The H component is parallel to the spin axis of the satellite, which is nearly parallel to the Earth's rotation axis.

*K<sub>p</sub>* plot contains the estimated planetary 3-hour K-index (derived by the USAF 55<sup>th</sup> Space Weather Squadron) 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 a 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*

Proton plot contains the five minute averaged integral proton flux (protons/cm<sup>2</sup>-sec-sr) as measured by GOES-9 (W135) 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.

X-ray plot contains five minute averaged x-ray flux (watts/m<sup>2</sup>) as measured by GOES 8 and 9 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.

