

**Space Weather Highlights**  
**16 December - 22 December 2019**

**SWPC PRF 2312**  
**23 December 2019**

Solar activity was very low. No Earth-directed CMEs were observed.

No proton events were observed at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit was at normal levels on 16-18 Dec and reached moderate levels on 19-22 Dec. The largest flux of the period was 737 pfu observed at 22/1825 UTC.

Geomagnetic field activity ranged from quiet to active levels. Solar wind parameters were at nominal levels on 16-17 Dec with solar wind speeds between 330-425 km/s. By early on 18 Dec, total field increased to a maximum of 12 nT at 18/1015 UTC while solar wind speed increased to near 550 km/s by midday on 18 Dec as a positive polarity coronal hole high speed stream (CH HSS) moved into geoeffective position. By late on 19 Dec, solar wind speed was in decline and finished the period near 360 km/s. The geomagnetic field responded with quiet levels on 16-17 Dec and 20-22 Dec and quiet to active conditions on 18-19 Dec.

**Space Weather Outlook**  
**23 December - 18 January 2020**

Solar activity is expected to be at very low levels for the forecast period.

No proton events are expected at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at moderate levels on 23 Dec-05 Jan and 15-18 Jan. Normal levels are expected on 06-14 Jan.

Geomagnetic field activity is expected to reach unsettled levels on 25-27 Dec and unsettled to active levels on 14-15 Jan due to CH HSS activity.



### ***Daily Solar Data***

Date	Radio	Sun	Sunspot	X-ray	Flares							
	Flux	spot	Area	Background	X-ray			Optical				
	10.7cm	No.	(10 <sup>-6</sup> hemi.)	Flux	C	M	X	S	1	2	3	4
16 December	70	0	0	A7.9	0	0	0	0	0	0	0	0
17 December	71	0	0	A8.0	0	0	0	0	0	0	0	0
18 December	70	0	0	A8.3	0	0	0	0	0	0	0	0
19 December	70	0	0	A8.5	0	0	0	0	0	0	0	0
20 December	70	0	0	A8.5	0	0	0	0	0	0	0	0
21 December	71	0	0	A8.4	0	0	0	0	0	0	0	0
22 December	71	0	0	A8.4	0	0	0	0	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)		
	>1 MeV	>10 MeV	>100 MeV	>0.6 MeV	>2MeV	>4 MeV
16 December		4.9e+05	2.2e+04	3.8e+03		2.0e+06
17 December		8.1e+05	2.2e+04	4.4e+03		2.5e+06
18 December		1.3e+06	2.2e+04	3.7e+03		1.0e+06
19 December		5.2e+05	2.1e+04	3.5e+03		8.0e+06
20 December		3.5e+05	2.1e+04	3.9e+03		2.1e+07
21 December		4.1e+05	2.1e+04	3.8e+03		2.6e+07
22 December		4.2e+05	2.1e+04	3.8e+03		2.7e+07

### ***Daily Geomagnetic Data***

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
16 December	1	0-0-0-1-1-1-0-0	2	1-0-0-0-2-1-0-0	1	0-0-0-0-1-1-0-0
17 December	2	1-1-1-0-1-1-1-0	1	0-0-1-1-0-0-0-0	2	0-0-1-1-0-0-0-0
18 December	12	1-1-1-3-4-4-3-1	34	0-0-1-7-6-4-3-1	13	1-2-1-3-4-4-3-2
19 December	12	3-3-4-3-2-2-2-1	21	1-3-4-6-4-2-2-0	13	3-4-4-3-2-2-2-1
20 December	4	2-1-1-0-1-2-1-1	4	0-1-1-2-3-2-0-0	5	2-1-1-0-2-2-1-2
21 December	4	2-0-2-2-1-1-1-1	8	0-0-3-3-4-0-0-1	5	2-0-2-1-1-0-1-1
22 December	2	1-0-2-0-1-1-0-1	2	1-0-2-1-1-0-0-0	5	1-0-2-0-0-0-1-1

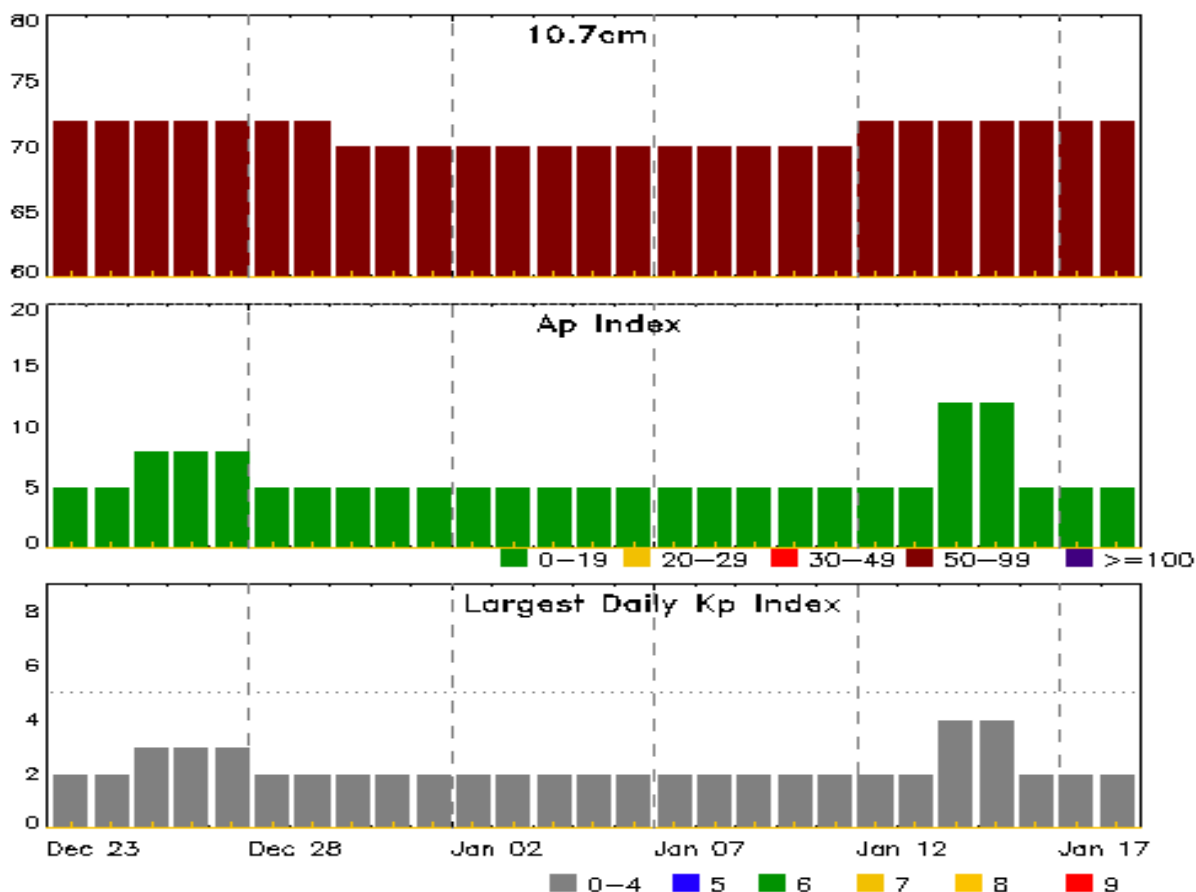


### *Alerts and Warnings Issued*

<b>Date &amp; Time of Issue UTC</b>	<b>Type of Alert or Warning</b>	<b>Date &amp; Time of Event UTC</b>
18 Dec 1153	WARNING: Geomagnetic K = 4	18/1153 - 1500
18 Dec 1432	EXTENDED WARNING: Geomagnetic K = 4	18/1153 - 19/1200
18 Dec 1435	ALERT: Geomagnetic K = 4	18/1426



## Twenty-seven Day Outlook



Date	Radio Flux 10.7cm	Planetary A Index	Largest Kp Index	Date	Radio Flux 10.7cm	Planetary A Index	Largest Kp Index
23 Dec	72	5	2	06 Jan	70	5	2
24	72	5	2	07	70	5	2
25	72	8	3	08	70	5	2
26	72	8	3	09	70	5	2
27	72	8	3	10	70	5	2
28	72	5	2	11	70	5	2
29	72	5	2	12	72	5	2
30	70	5	2	13	72	5	2
31	70	5	2	14	72	12	4
01 Jan	70	5	2	15	72	12	4
02	70	5	2	16	72	5	2
03	70	5	2	17	72	5	2
04	70	5	2	18	72	5	2
05	70	5	2				

### ***Energetic Events***

Date	Time			X-ray		Optical Information			Peak		Sweep Freq	
	Begin	Max	Half	Class	Integ Flux	Imp/	Location Lat CMD	Rgn #	Radio Flux		Intensity	
			Max			Brtns			245	2695	II	IV

**No Events Observed**

### ***Flare List***

Date	Time			X-ray Class	Optical		
	Begin	Max	End		Imp/ Brtns	Location Lat CMD	Rgn #
20 Dec	1054	1103	1104	A8.7			



### ***Region Summary***

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

No Active Regions

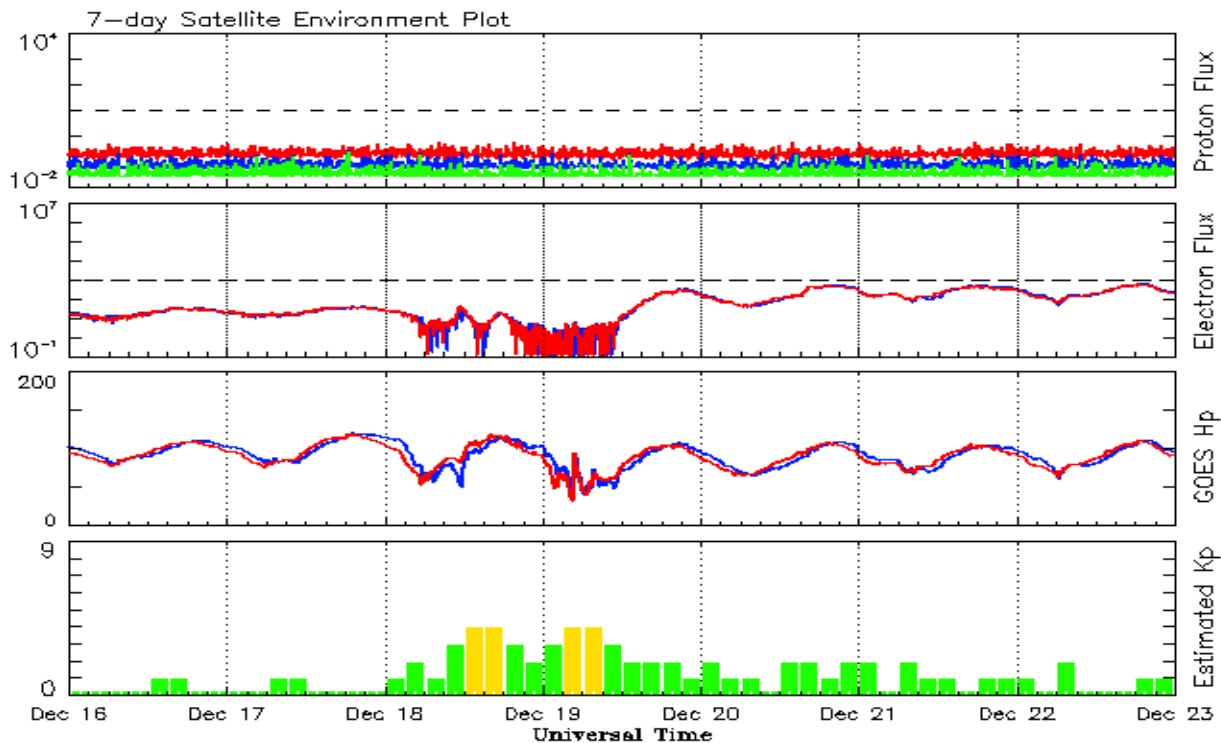


**Recent Solar Indices (preliminary)**  
**Observed monthly mean values**

Month	Sunspot Numbers					Radio Flux		Geomagnetic	
	Observed values		Ratio	Smooth values		Penticton	Smooth	Planetary	Smooth
	SEC	RI	RI/SEC	SEC	RI	10.7 cm	Value	Ap	Value
<b>2017</b>									
December		7.6	4.9	0.64	15.7	9.1	71.5	74.4	8 9.4
<b>2018</b>									
January		7.8	4.1	0.51	15.0	8.5	70.0	74.0	6 9.3
February		16.0	6.4	0.40	13.7	7.6	72.0	73.3	7 9.1
March		6.0	1.5	0.25	11.5	5.9	68.4	71.9	8 8.6
April		7.0	5.3	0.76	9.6	4.7	70.0	70.6	7 8.0
May		15.0	7.9	0.53	9.2	4.5	70.9	70.2	8 7.6
June		19.7	9.4	0.48	9.1	4.3	72.5	70.0	7 7.4
July		1.3	1.0	0.77	9.4	4.2	69.7	70.0	6 7.3
August		10.0	5.2	0.53	9.0	4.0	69.1	70.0	10 7.3
September		5.7	2.0	0.35	8.7	3.9	68.3	70.1	9 7.3
October		6.9	2.9	0.42	9.2	4.1	69.5	70.3	7 7.1
November		7.3	2.9	0.48	9.5	4.0	68.9	70.4	6 7.0
December		5.6	1.9	0.34	9.3	3.6	70.0	70.3	7 6.9
<b>2019</b>									
January		16.0	4.6	0.29	9.0	3.2	71.6	70.0	6 6.8
February			0.5		8.7	3.0	70.6	69.8	7 6.7
March		14.8	5.6	0.39	8.3	2.8	71.5	69.7	6 6.6
April		11.5	5.5	0.48	7.9	2.6	72.4	69.6	6 6.7
May		18.1	5.9	0.34	7.4	2.3	71.3	69.6	7 6.7
June		11.6	0.7	0.06			68.1		5
July		1.6	0.5	0.31			67.1		6
August		2.5	0.4	0.16			67.0		7
September		2.6	0.7	0.27			68.1		10
October		1.8	0.2	0.11			67.4		8
November		1.1	0.3	0.27			70.2		4

**Note:** Values are final except for the most recent 6 months which are considered preliminary.  
Cycle 24 started in Dec 2008 with an RI=1.7.





*Weekly Geosynchronous Satellite Environment Summary  
Week Beginning 16 December 2019*

The proton flux plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>-sec -sr) as measured by the SWPC Primary GOES satellite, near West 75, for each of three energy thresholds: greater than 10, 50, and 100 MeV.

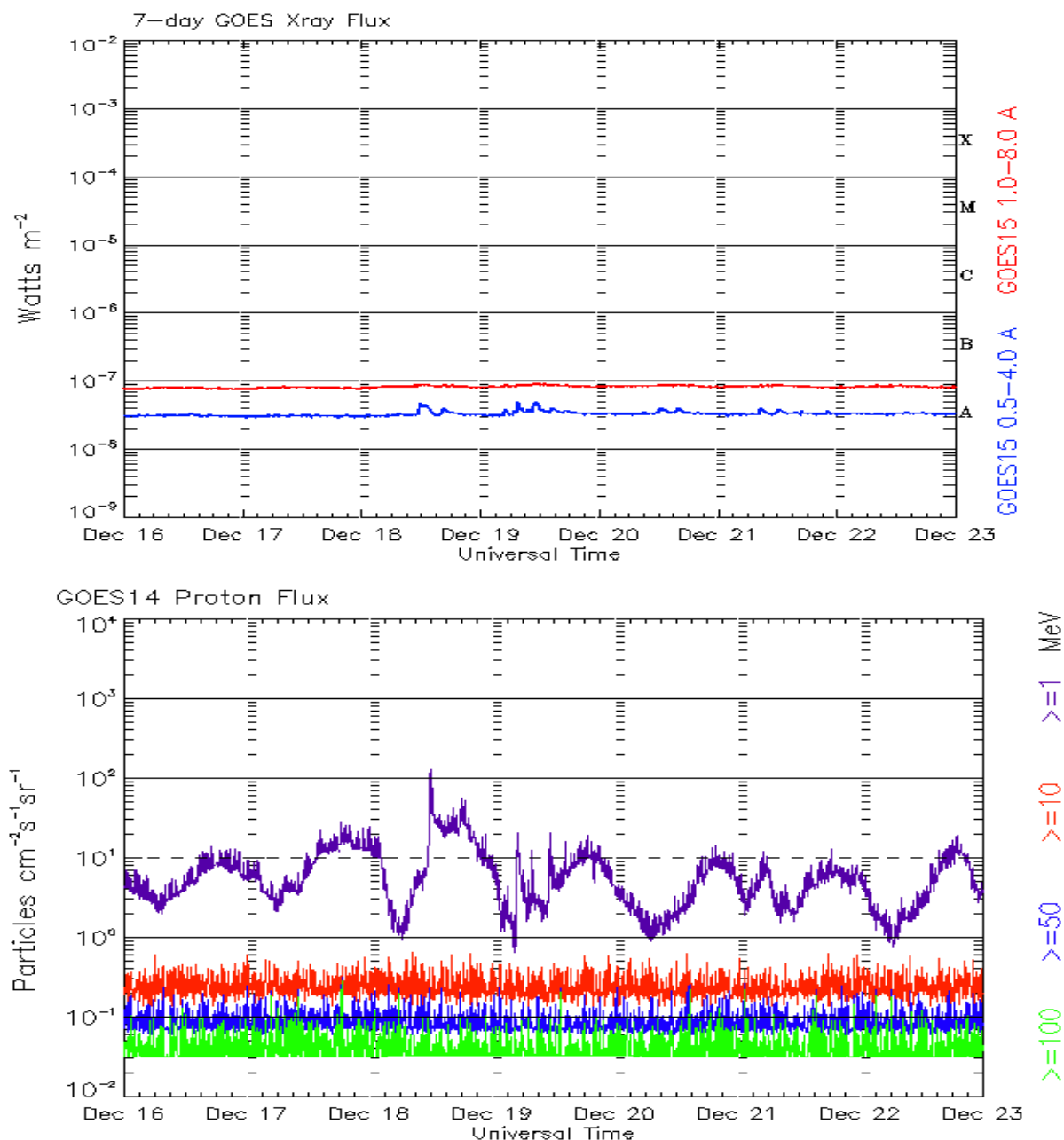
The electron flux plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>-sec -sr) with energies greater than 2 MeV by the SWPC Primary GOES satellite.

The Hp plot contains the five minute averaged Hp magnetic field component in nanoteslas (nT) as by the SWPC Primary GOES satellite. The Hp component is parallel to the spin axis of the satellite, which is nearly parallel to the Earth's rotation axis.

The Estimated 3-hour Planetary Kp-index is derived at the NOAA Space Weather Prediction Center using data from the following ground-based magnetometers: Boulder, Colorado; Chambon la Foret, France; Fredericksburg, Virginia; Fresno, California; Hartland, UK; Newport, Washington; Sitka, Alaska. These data are made available thanks to the cooperative efforts between SWPC and data providers around the world, which currently includes the U.S. Geological Survey, the British Geological Survey, and the Institut de Physique du Globe de Paris.

The data included here are those now available in real time at the SWPC 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 Kp are 'global' parameters that are applicable to a first order approximation over large areas. H parallel is subject to more localized phenomena and the measurements generally are applicable to within a few degrees of longitude of the measuring satellite.





*Weekly GOES Satellite X-ray and Proton Plots  
Week Beginning 16 December 2019*

The x-ray plots contains five-minute averages x-ray flux ( $\text{Watt/m}^2$ ) as measure by the SWPC primary GOES X-ray satellite, usually at West 105 longitude, in two wavelength bands, 0.05 - 0.4 and 0.1 - 0.8 nm. The letters A, B, C, M and X refer to x-ray event levels for the 0.1 - 0.8 nm band.

The proton plot contains the five-minute averaged integral flux units (pfu = protons/ $\text{cm}^2$  -sec -sr) as measured by the primary SWPC GOES Proton satellite for each of the energy thresholds:  $>1$ ,  $>10$ ,  $>30$ , and  $>100$  MeV. The P10 event threshold is 10 pfu at greater than 10 MeV.



## ***Preliminary Report and Forecast of Solar Geophysical Data (The Weekly)***

Published every Monday by the Space Weather Prediction Center.

U.S. Department of Commerce  
NOAA / National Weather Service  
Space Weather Prediction Center  
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**Notice:** The 27-day Outlook, Satellite Environment, X-ray and Proton plots have been redesigned.  
Comments and suggestions are welcome [SWPC.Webmaster@noaa.gov](mailto:SWPC.Webmaster@noaa.gov)

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