



Australian Government
Bureau of Meteorology

SPACE WEATHER SERVICES

SOLAR

AND

GEOPHYSICAL

SUMMARY

December 2018

Solar Activity

Solar activity was at very low levels this month, with no significant flares observed. A mildly geoeffective coronal hole high speed solar wind stream was observed on 28 Dec. The 10.7cm solar radio flux was predominately flat this month ranging from 68-72SFU.

DATE	FLARES		FLARE MAX	FADEOUT POSSIBLE ON DAYLIGHT CIRCUIT
	CLASS M	CLASS X		

None observed.

FLARE ALERT	SWF ALERT
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None issued.

PROTON ALERT					
DATE	BEGIN TIME	DATE	END TIME	ENERGY THRESHOLD	

None issued.

Ionospheric Activity

No significant ionospheric depressions were observed this month. However, generally lower than normal maximum usable frequencies (MUFs) were experienced during the month probably in association with low solar flux levels. HF Warnings issued this month were due to this, rather than any associated geomagnetic activity.

IONOSPHERIC DISTURBANCES (MUFs for the Australian region)

02 Dec 18: Southern region MUFs Depressed by 15%
04 Dec 18: Southern region MUFs Depressed by 15%
05 Dec 18: Northern region MUFs Depressed by 15%
08 Dec 18: Southern region MUFs Depressed by 15%
15 Dec 18: Southern region MUFs Depressed by 15%
17 Dec 18: Northern region MUFs Depressed by 15%
26 Dec 18: Northern region MUFs Depressed by 15%
 Southern region MUFs Depressed by 15%
27 Dec 18: Northern region MUFs Depressed by 15%

RADIO COMMUNICATIONS WARNINGS

DATE	Nº.	BEGIN	END
29 Nov 18	19	30 Nov 18	02 Dec 18
03 Dec 18	20	03 Dec 18	04 Dec 18
04 Dec 18	21	05 Dec 18	05 Dec 18
05 Dec 18	22	06 Dec 18	06 Dec 18
07 Dec 18	23	08 Dec 18	09 Dec 18
09 Dec 18	24	10 Dec 18	10 Dec 18
11 Dec 18	25	12 Dec 18	13 Dec 18
13 Dec 18	26	14 Dec 18	15 Dec 18
15 Dec 18	27	16 Dec 18	16 Dec 18
16 Dec 18	28	17 Dec 18	17 Dec 18
17 Dec 18	29	18 Dec 18	20 Dec 18
20 Dec 18	30	21 Dec 18	21 Dec 18
26 Dec 18	31	27 Dec 18	29 Dec 18
29 Dec 18	32	30 Dec 18	31 Dec 18
31 Dec 18	33	01 Jan 19	02 Jan 19

Geomagnetic Activity

No significant geomagnetic disturbances were observed this month, however a mild increase in geomagnetic activity was observed on 28 Dec due to a coronal hole high speed wind stream, with the local A index reaching 14 on this day.

DATE	GEOMAGNETIC DISTURBANCES (for the Australian region)
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No days with A index 16 or more

GEOMAGNETIC WARNINGS AND ALERTS				
DATE	Nº.	BEGIN	END	ISSUED
28 Nov 18	26	01 Dec 18	01 Dec 18	Warning
01 Dec 18	27	02 Dec 18	03 Dec 18	Warning
04 Dec 18	28	05 Dec 18	05 Dec 18	Warning

Solar And Geophysical Indices

DATE	10cm FLUX	AUSTRALIAN A-INDEX	AUSTRALIAN T-INDEX	DATE	10 cm FLUX	AUSTRALIAN A-INDEX	AUSTRALIAN T-INDEX
1-Dec	69	5	-34	16-Dec	70	2	-40
2-Dec	69	7	-35	17-Dec	70	6	-32
3-Dec	68	6	-35	18-Dec	70	6	-32
4-Dec	69	7	-38	19-Dec	70	6	-15
5-Dec	71	3	-31	20-Dec	70	7	-29
6-Dec	70	3	-36	21-Dec	71	2	-11
7-Dec	70	8	-24	22-Dec	71	1	-14
8-Dec	71	9	-35	23-Dec	70	1	-17
9-Dec	72	6	-46	24-Dec	70	3	-16
10-Dec	71	8	-28	25-Dec	70	2	-20
11-Dec	71	6	-37	26-Dec	69	3	-48
12-Dec	71	2	-41	27-Dec	69	3	-39
13-Dec	70	1	-49	28-Dec	69	14	-28
14-Dec	71	2	-50	29-Dec	69	6	-35
15-Dec	71	1	-50	30-Dec	69	5	-6
				31-Dec	69	4	-37

DATE	10cm FLUX	AUSTRALIAN A-INDEX	AUSTRALIAN T-INDEX	SUNSPOT NUMBER	FLARES	
	Monthly Average	Monthly Average	Monthly Average	Monthly Average	13-month smoothed	>M1.0
Jan 18	70	4.8	-6.5	6.7	14.3	0
Feb 18	72.1	5	-0.9	10.6	12.6	0
Mar 18	68.4	5.4	2.4	2.5	9.9	0
Apr 18	70.1	4.4	6.5	8.9	7.9	0
May 18	70.9	4.3	4.4	13.2	7.5	0
Jun 18	72.5	4.4	6.5	15.9	7.3	0
Jul 18	69.7	3.2	5.8	1.6	7.0	0
Aug 18	69.1	6.4	1	8.8	6.7	0
Sep 18	68.3	5.8	-0.9	3.3	6.4	0
Oct 18	69.6	4.8	-17.8	4.9	6.2	0
Nov 18	69	4.4	-32.8	5.9	5.6	0
Dec 18	70	4.7	-31.9	3.1	4.6	0

Predicted sunspot numbers

SPECIAL NOTE

In June 2015, WDC-SILSO, Royal Observatory of Belgium, Brussels, adjusted their original observed sunspot numbers (Version 1.0) to a Version 2.0 series in which the sunspot numbers are higher. In the Version 1.0 data series, some of the sunspot numbers were weighted. The new (Version 2.0) sunspot numbers are unweighted sunspot number counts (for more information see: www.sidc.be/silso/home). The Bureau of Meteorology SWS solar cycle prediction is now based on the Version 2.0 values. As a result of this recalibration, the observed monthly and observed and predicted smoothed sunspot numbers are higher in the monthly table and solar cycle graph.

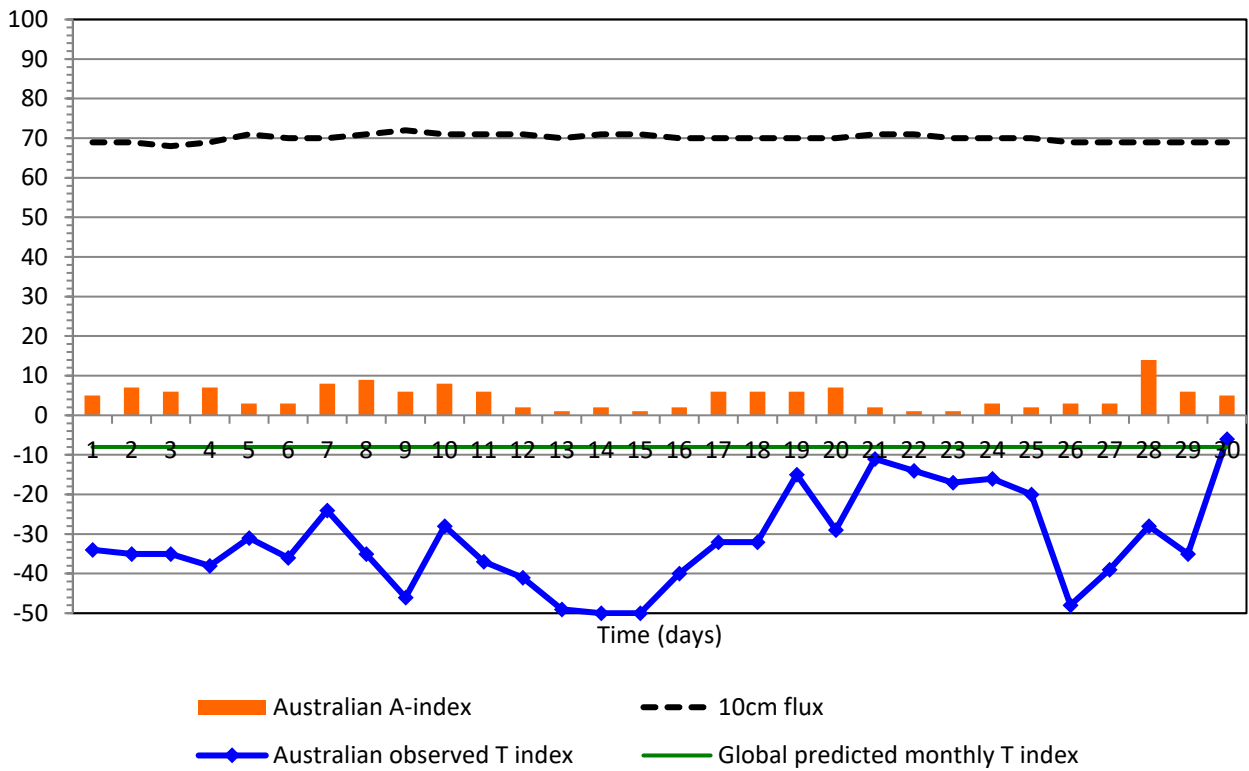
SWS WORLD T-INDICES

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	91	108	130	114	96	84	86	81	90	94	98	103
2015	92	101	91	97	85	79	71	48	40	43	53	50
2016	52	57	46	30	34	28	26	25	28	17	12	10
2017	14	19	11	8	2	2	0	3	16	13	5	6
2018	8	2	3	-2	-6	-3	-3	-8	-6	-10	-15	-9*
2019	-12	-13	-13	-14	-15	-15	-16	-17	-17	-18	-19	-19
2020	-20	-20	-20	-19	-19	-19	-18	-17	-16	-15	-14	-13
2021	-11	-8	-6	-3	-1	2	6	10	14	17	20	24

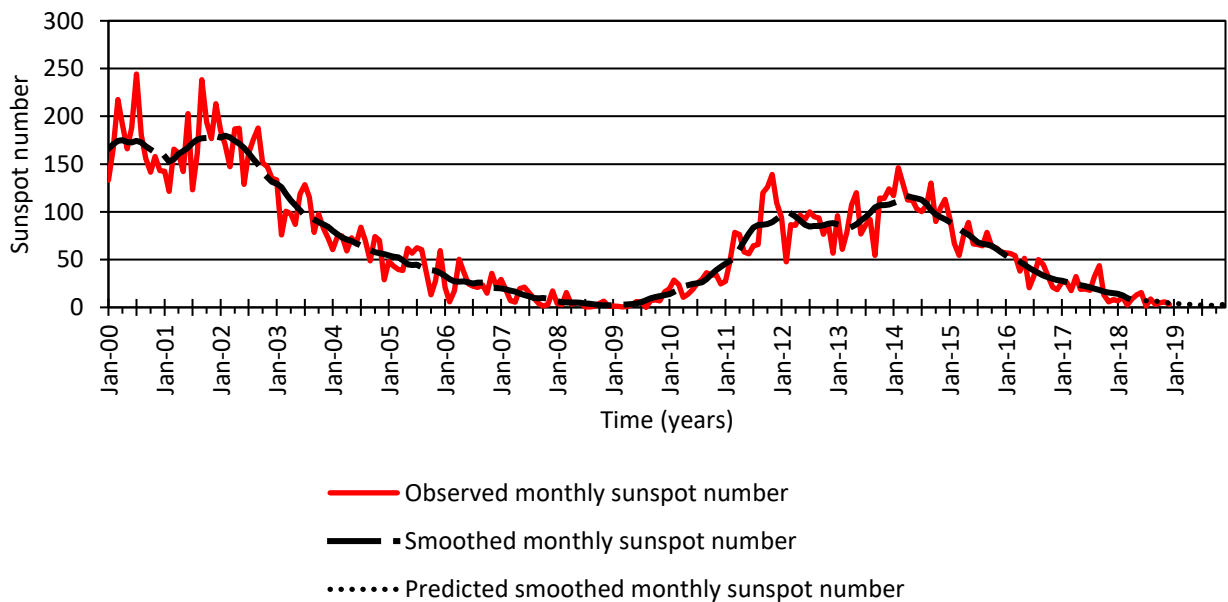
SWS predicted T-index

* New observed data. T-index value may have changed

Solar and Geophysical Indices - December 2018



Solar Cycle



Observed monthly sunspot numbers courtesy of WDC-SILSO, Royal Observatory of Belgium, Brussels (www.sidc.be/silso/home)

NOTES - notes - NOTES - notes - NOTES - notes

- a. Times quoted in this publication are all Universal Time (UT).
- b. The values of all indices are provisional. Final values are not available for several months.
- c. M or X class flares refer to the X-ray classification system for solar flares. In this system, X class flares are more energetic than M class flares.

FLARE CLASS	X-RAY FLUX DENSITY	
	Ergs/cm ² /sec	W/m ²
M	0.01-0.1	10 ⁻⁵ to 10 ⁻⁴
X	>0.1	> 10 ⁻⁴

- d. Class M flares, particularly the less energetic ones, are likely to cause a fadeout on only the lowest frequencies. Class X flares are likely to cause a fadeout over the entire HF spectrum. It should be noted that a fadeout will only occur on those circuits having a reflection point in the daylight hemisphere of the earth. Circuits having only night hemisphere reflection points will not be affected no matter the energy of the solar flares.
- e. The 10cm flux is the radio power of the sun at a frequency of 2800 MHz (wavelength 10.7 cm). This flux is a good indicator of solar activity and is widely used in place of the sunspot number. The values are measured by the Penticton radio observatory, Canada. Unlike the sunspot number, the 10cm flux never drops to zero even during solar minimum. With no sunspots visible on the solar disk, the 10cm flux will still have a value of around 67. The table below gives a (statistical) comparison between 10cm flux and sunspot number. The 10cm flux is measured in solar flux units (10⁻²²W m⁻² Hz⁻¹).

SUNSPOT No.	10 cm FLUX
0	67
20	78
40	93
60	110
100	147
150	195
200	243

- f. Ionospheric disturbances refer to measurements made across Australia, but are generally applicable to mid-latitude Southern Hemisphere conditions. Spread F conditions indicate tilts in the ionosphere,

which may result in multipath fading on some HF circuits.

- g. The magnetic A-indices are for the Australian region. Large values for the A index correspond to disturbed conditions. Levels of magnetic disturbances are described in the following terms.

A INDEX VALUE	DESCRIPTION
0 up to 7	Quiet
8 up to 15	Unsettled
16 up to 24	Active
25 up to 35	Minor Storm
36 and above	Major Storm

- h. The Australian daily T-index is a measure of the average of the ionospheric critical frequencies available on a particular day - the higher the value of the T-index, the higher the ionospheric critical frequencies (and Maximum Usable Frequencies on HF circuits) for that day. The T-index is based on data from Australian ionospheric stations and so is most applicable to HF circuits with reflection points in the Australian region.

- i. The SWS monthly observed T-index is derived from the observed monthly median values of foF2 for each hour from ionospheric stations worldwide.

The predicted smoothed monthly T-indices are computed by using a statistical analysis of the observed monthly T-indices for all solar cycles since 1938.

The SWS T-indices may not be updated each month but only when sufficient new data becomes available.

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