Australian Government

Bureau of Meteorology

SPACE WEATHER SERVICES

SOLAR

AND

GEOPHYSICAL

SUMMARY

December 2017

Solar Activity

Solar activity was at very low levels this month with no C, M or X class flares observed. There were few sunspot groups and 16 days with no sunspots (SIDC, Belgium provisional count). A solar filament erupted from the Sun's south-east quadrant on 15 Dec but the associated coronal mass ejection missed Earth. No Earth directed CMEs observed during the month. Moderate solar wind speeds associated with coronal hole high speed streams were observed on 01, 05-08, 11-13, 15, 17-20 and 24-26 Dec.

No M or X class flares observed during the month.

DATE	FLARES		FLARE MAX	FADEOUT POSSIBLE ON DAYLIGHT CIRCUIT
	CLASS M	CLASS X		
None.				

FLARE ALERT	SWF ALERT
None issued.	

PROTON ALERT

BEGIN		END		ENERGY THRESHOLD
DATE	TIME	DATE	TIME	
None issued.				

Ionospheric Activity

MUFs were mostly near predicted monthly values to slightly depressed throughout the month. Occasional deeper depressions (to 35% at times) were observed on 03-06, 12-13, 16, 18, 21 and 25 Dec and were likely the result of coronal hole related geomagnetic activity.

Ionospheric depressions listed below are calculated using foF2 data from the SWS ionosonde network.

IONOSPHERIC DISTURBANCES (MUFs for the Australian region)

03 Dec 17	Northern region MUFs	Depressed by 15%
05 Dec 17	Southern region MUFs	Depressed by 25%
06 Dec 17	Northern region MUFs	Depressed by 20%
	Southern region MUFs	Depressed by 15%
13 Dec 17	Northern region MUFs	Depressed by 15%
	Southern region MUFs	Depressed by 20%
18 Dec 17	Southern region MUFs	Depressed by 15%
25 Dec 17	Southern region MUFs	Depressed by 25%
28 Dec 17	Southern region MUFs	Depressed by 15%

RADIO COMMUNICATIONS WARNINGS

DATE	N^{o}.	BEGIN	END
05 Dec 17	52	05 Dec 17	07 Dec 17
12 Dec 17	53	13 Dec 17	14 Dec 17
18 Dec 17	54	18 Dec 17	19 Dec 17
24 Dec 17	55	25 Dec 17	26 Dec 17
31 Dec 17	56	01 Jan 18	03 Jan 18

Geomagnetic Activity

The moderately disturbed conditions observed on 05 Dec were probably related to a coronal hole high speed stream. This was the most disturbed day of the month with a local A-index of 20 and one period of minor storm (local K index reached 5) observed at most locations in the middle of the UT day. Mildly disturbed conditions were also observed on 04, 17-18 and 24 Dec, again likely due to the influence of coronal hole high speed streams.

Disturbances with Australian A-indices greater than or equal to 16 are reported below.

DATE	GEOMAGNETIC DISTURBANCES (for the Australian region)
05 Dec 17	Unsettled to Minor Storm

	GEOMAGNETIC WARNINGS AND ALERTS			
DATE	N^{o}.	BEGIN	END	ISSUED
02 Dec 17	59	04 Dec 17	05 Dec 17	
05 Dec 17	60	06 Dec 17	07 Dec 17	
05 Dec 17				Alert
15 Dec 17	61	17 Dec 17	18 Dec 17	
24 Dec 17	62	25 Dec 17	25 Dec 17	
31 Dec 17	63	01 Jan 18	02 Jan 18	

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	70	5	-1	16-Dec	71	3	-12
2-Dec	72	4	-8	17-Dec	71	13	6
3-Dec	70	0	-20	18-Dec	72	11	-23
4-Dec	68	9	-21	19-Dec	69	5	-15
5-Dec	68	20	-21	20-Dec	74	3	-10
6-Dec	68	8	-17	21-Dec	76	2	-19
7-Dec	68	6	-9	22-Dec	75	1	-11
8-Dec	70	4	-7	23-Dec	76	4	1
9-Dec	71	4	-6	24-Dec	76	12	12
10-Dec	72	1	-12	25-Dec	76	5	-16
11-Dec	72	8	-7	26-Dec	72	6	-3
12-Dec	71	7	-29	27-Dec	71	8	1
13-Dec	72	5	-28	28-Dec	71	4	-6
14-Dec	72	3	-5	29-Dec	72	3	4
15-Dec	72	5	-6	30-Dec	70	3	-1
				31-Dec	71	4	8

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-17	77.6	6.7	0.5	25.8	27.9	0
Feb-17	76.9	6.3	10	26.1	26.6	0
Mar-17	74.7	8.4	11.1	17.7	25.8	0
Apr-17	81	7.3	14.4	32.6	24.9	7
May-17	73.6	5	9.9	18.8	23.4	0
Jun-17	74.8	3.4	9.2	19.4	22.3	0
Jul-17	78	5.8	10.5	18.3	21.6	3
Aug-17	78	7.3	10.4	33.1	21.0	1
Sep-17	93.4	10.4	19.5	43.6	20.6	31
Oct-17	76.4	6.9	4.6	13.2	20.0	1
Nov-17	72.2	7.1	-5.6	5.7	19.2	0
Dec-17	71.7	5.8	-9.2	8.2	18.9	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.

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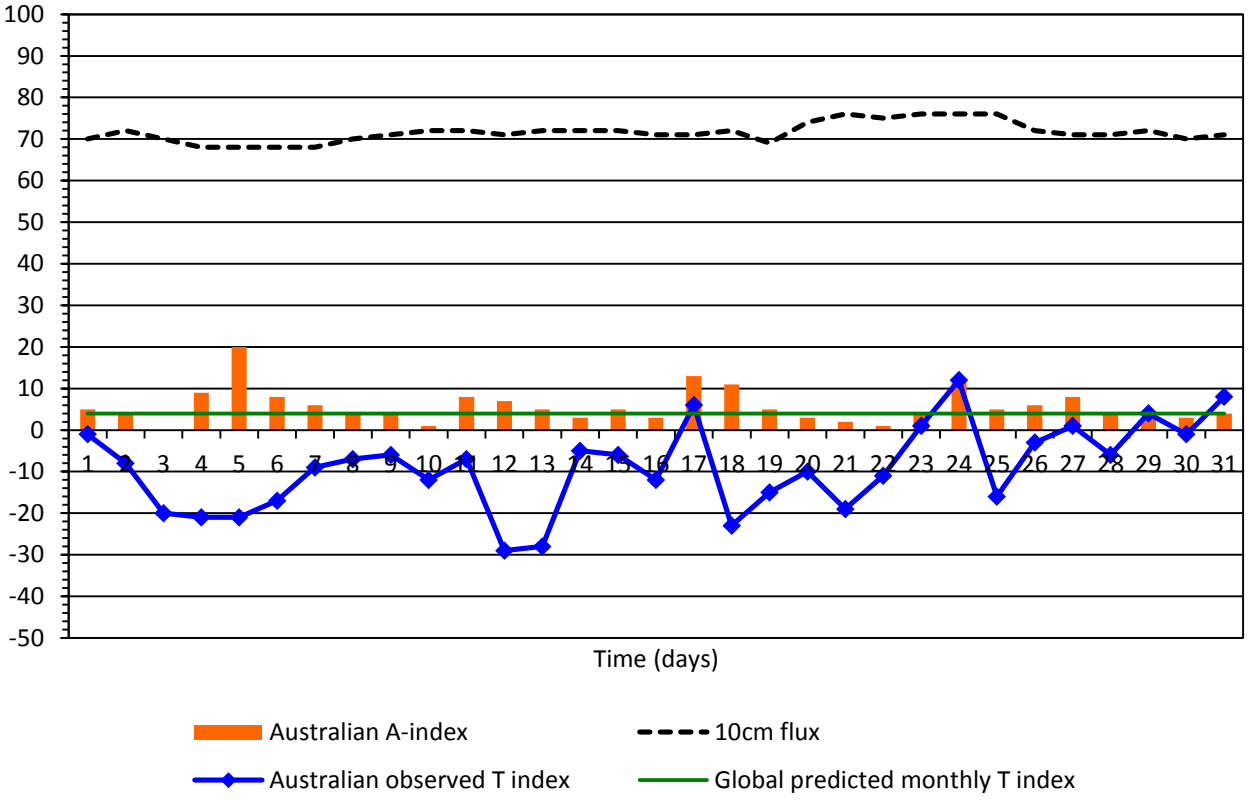
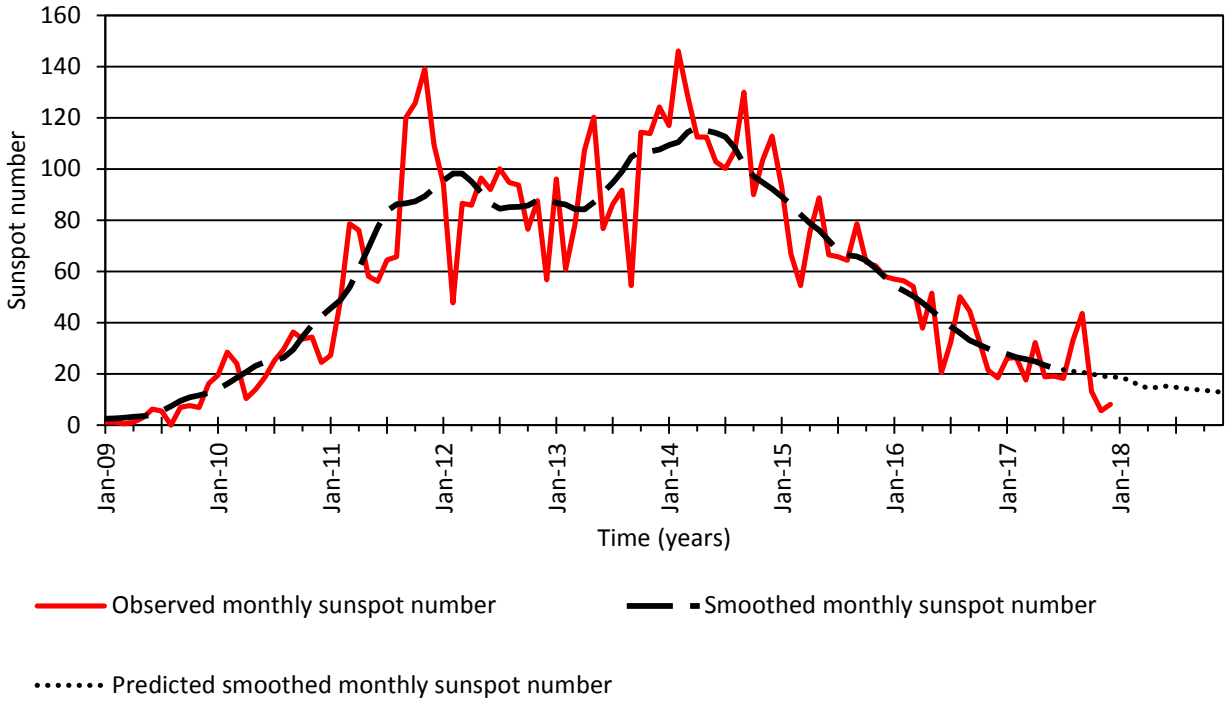
SWS WORLD T-INDICES

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	81	65	64	69	77	74	70	80	86	75	65	65
2013	74	62	69	84	92	82	81	76	68	76	86	90
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	4	4	3	2	1	0	-1	-2	-2	-3	-3	-4
2019	-4	-5	-5	-5	-5	-4	-4	-3	-3	-2	-1	0
2020	1	3	5	7	9	11	14	17	20	23	26	28
2021	32	35	38	40	42	44	46	49	50	51	52	54
	SWS predicted T-index				* New observed data. T-index value may have changed							

Solar and Geophysical Indices - December 2017



Solar Cycle 24



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^{-22} W 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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