Australian Government

Bureau of Meteorology

SPACE WEATHER SERVICES

SOLAR

AND

GEOPHYSICAL

SUMMARY

July 2017

Solar Activity

Solar activity was predominately at very low to low levels this month, with 3 M class flares observed. The largest flare for the month was an M2.4 flare on July 14. This flare was associated with a coronal mass ejection,and a weak solar proton event which fluctuated over the 10MeV threshold level. This solar event was produced by solar region 2665. This solar region is also thought to be a possible origin for a strong solar far/back side full halo coronal mass ejection on 23 July 2017. The location of these events means they are not geo-effective, as they are projected away from the Earth. However, this activity does show us that the Sun can still surprise us with activity, even in the declining phase of a solar cycle.

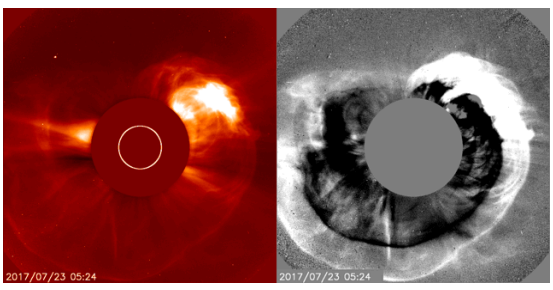
DATE	CLASS M FLARES	CLASS X FLARES	FLARE MAX	FADEOUT POSSIBLE ON DAYLIGHT HF CIRCUIT
03 Jul 17	M1.3		1615UT	
09 Jul 17	M1.3/2N		0318UT	
14 Jul 17	M2.4/1N		0209UT	

Total Number of M-flares 3, X-flares 0
Total Number of flares for May was 3

FLARE ALERT	SWF ALERT
03 Jul 17 09 Jul 17 14 Jul 17	None issued

PROTON ALERT

BEGIN DATE	BEGIN TIME	END DATE	END TIME	ENERGY THRESHOLD
14 07 2017	0855UT	15 07 2017	1105UT	10MeV



23 July 2017 04UT Far/back-side CME Courtesy ESA/NASA SOHO/LASCO

Ionospheric Activity

No significant ionospheric depressions were observed this month. A minor short wave fadeout was observed only for lower frequencies Northern Australian region in association with the M2.4 flare at 0209UT on 14 July. The Australian regional ionosphere during the local day 16-17 July was not significantly depressed following the onset of the geomagnetic activity following the M2.4 event. However, degraded HF communications conditions may have been experienced during local night hours for southern Australian region during this period.

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

IONOSPHERIC DISTURBANCES (MUFs for the Australian Region)

04 Jul 17	Northern region MUFs Depressed by 15%
21 Jul 17	Northern region MUFs Depressed by 15%
24 Jul 17	Northern region MUFs Depressed by 15%
29 Jul 17	Northern region MUFs Depressed by 15%
30 Jul 17	Northern region MUFs Depressed by 15%
31 Jul 17	Northern region MUFs Depressed by 15%

RADIO COMMUNICATIONS WARNINGS

DATE	N°.	BEGIN	END
02 Jul 17	31	02 Jul 17	03 Jul 17
09 Jul 17	32	10 Jul 17	12 Jul 17

Geomagnetic Activity

The strongest disturbance for the month was observed on 16 and 17 July with a local A indices of 27 and 22 respectively. A sudden impulse of 34nT was observed at 0515UT on 16 July. The sudden impulse was followed by geomagnetic activity that peaked at minor storm levels. This geomagnetic activity is thought to be associated with the M2.4 flare and coronal mass ejection on 14 July.

DATE	GEOMAGNETIC DISTURBANCES (for the Australian region)
16 Jul 17:	Quiet to Minor Storm
17 Jul 17:	Quiet to Minor Storm

GEOMAGNETIC WARNINGS AND ALERTS

DATE	N^{o}.	BEGIN	END	ISSUED
02 Jul 17	32	02 Jul 17	03 Jul 17	Warning
07 Jul 17	33	08 Jul 17	09 Jul 17	Warning
15 Jul 17	34	16 Jul 17	17 Jul 17	Warning
30 Jul 17	35	31 Jul 17	01 Aug 17	Warning
16 Jul 17				Alert
17 Jul 17				Alert

Solar And Geophysical Indices

DATE	10cm FLUX	AUSTRALIAN A-INDEX	AUSTRALIAN T-INDEX	DATE	10 cm FLUX	AUSTRALIAN A-INDEX	AUSTRALIAN T-INDEX
01 Jul	71	5	10	16 Jul	87	27	18
02 Jul	71	14	19	17 Jul	86	22	16
03 Jul	72	3	15	18 Jul	78	3	8
04 Jul	72	1	3	19 Jul	73	1	-2
05 Jul	73	0	6	20 Jul	70	3	0
06 Jul	76	3	5	21 Jul	69	8	11
07 Jul	80	2	15	22 Jul	70	12	13
08 Jul	87	1	14	23 Jul	71	9	8
09 Jul	91	13	16	24 Jul	70	8	4
10 Jul	95	6	19	25 Jul	70	7	6
11 Jul	91	6	19	26 Jul	69	7	11
12 Jul	90	2	12	27 Jul	68	3	4
13 Jul	92	1	13	28 Jul	70	6	8
14 Jul	94	0	12	29 Jul	70	1	8
15 Jul	92	1	13	30 Jul	70	0	8
				31 Jul	72	1	2

DATE	10cm FLUX	AUSTRALIAN A-INDEX	AUSTRALIAN T-INDEX	SUNSPOT NUMBER		FLARES
	Monthly Average	Monthly Average	Monthly Average	Monthly Average	Yearly Average	>M1.0
Aug-16	85.0	6.2	28.7	50.7	36.0	1
Sep-16	87.8	9.1	28.9	44.7	33.2	0
Oct-16	86.1	9.1	9.9	33.6	31.4	0
Nov-16	78.7	6.4	3.8	21.4	29.9	2
Dec-16	75.2	7.3	2.5	19.5	28.5	0
Jan-17	77.6	6.7	0.5	25.8	27.9	0
Feb-17	76.9	6.3	10.0	26.1	26.3	0
Mar-17	74.7	8.4	11.1	17.7	24.5	0
Apr-17	81.0	7.3	14.4	32.6	23.3	7
May-17	73.6	5.0	9.9	18.8	23.0	0
Jun-17	74.8	3.4	9.2	19.4	23.2	0
Jul-17	78.0	5.8	10.5	18.3	23.1	3
					Predicted Sunspot Numbers	

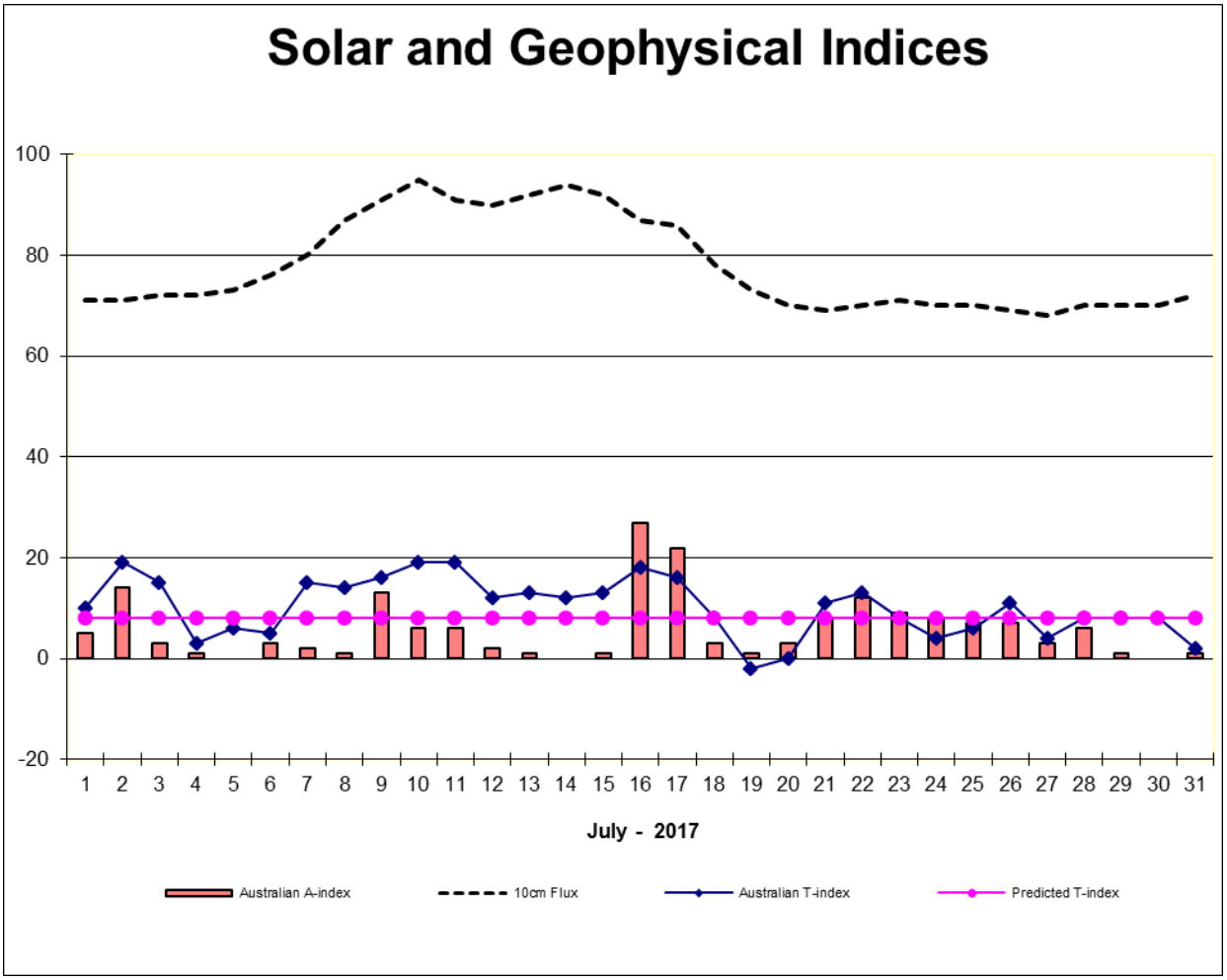
SPECIAL NOTE
In June 2015, WDC-SILSO, Royal Observatory of Belgium, Brussels, adjusted their original observed sunspot numbers (Version 1.0) to a Version 2.0 series in which the sunspot numbers are higher. In the Version 1.0 data series, some of the sunspot numbers were weighted. The new (Version 2.0) 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.

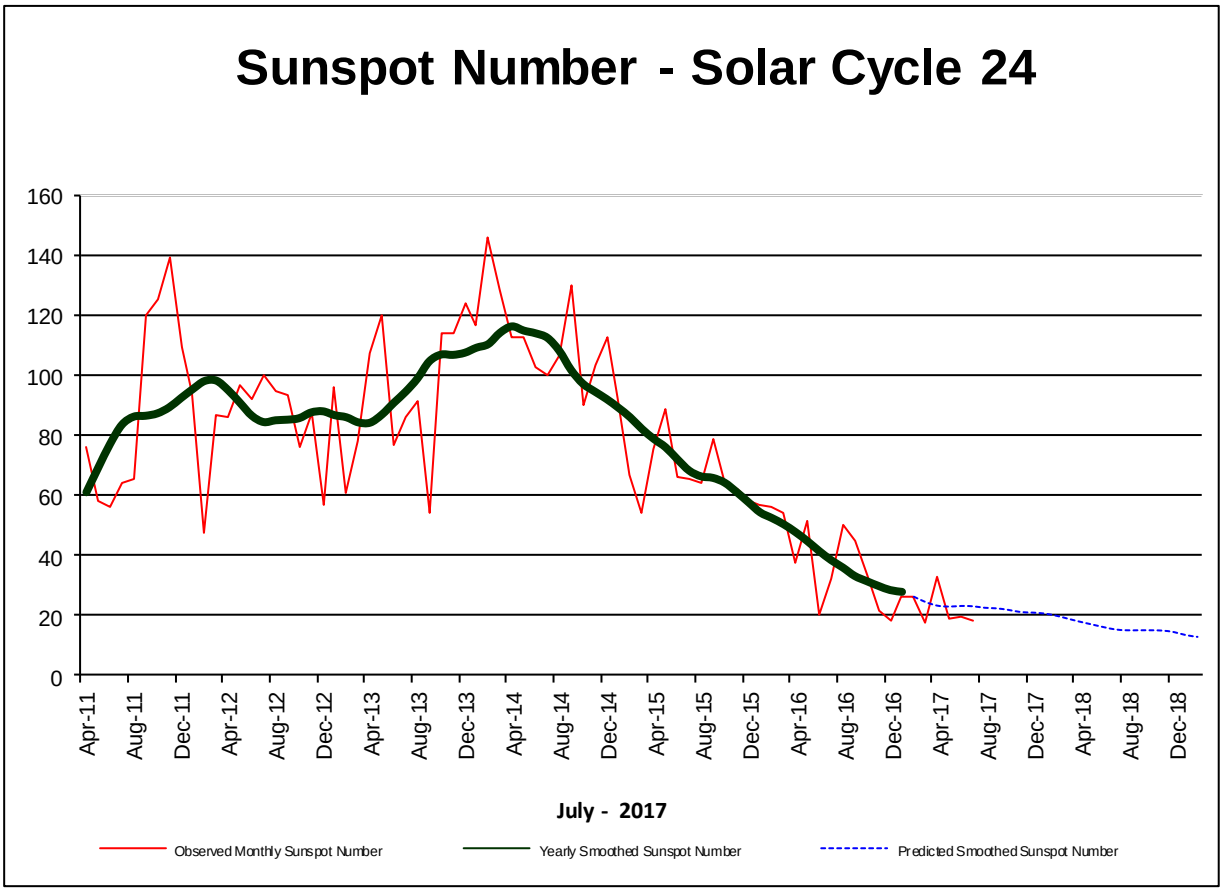
IPS WORLD T-INDICES

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*	6	5	4	4	4
2018	4	3	3	2	1	1	0	-1	-1	-2	-2	-3
2019	-3	-4	-4	-5	-5	-5	-5	-4	-4	-3	-3	-2
2020	-1	0	1	3	5	7	9	11	14	17	20	23
2021	26	28	32	35	38	40	42	44	46	49	50	51

SWS Predicted T-Indices

* T-Indices may have changed





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 T-index is a measure of the average level 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 IPS Monthly T-index for ASAPS is derived from the observed monthly median values of foF2 for each hour at up to 40 ionospheric stations worldwide. These records become available from IPS stations in Australia very soon after each month, but the majority are received up to one year later. This means that the exact observed value of the monthly T-index is not available until some months later.

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 IPS T-indices for ASAPS may not be updated each month but only when sufficient new data becomes available.

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