Australian Government

Bureau of Meteorology

SPACE WEATHER SERVICES

SOLAR

AND

GEOPHYSICAL

SUMMARY

April 2021

Solar Activity

Solar activity was very low to low with moderate activity on 19 April, when active region 2816 (Dai/beta) at S25E22, produced an M1.1/SN flare at 2342 UT with associated type II, III and IV radio sweeps. There were numerous C-class flares between 20 to 23 April from AR 2816 and 2817, the largest being a C8.5/SF at 2011 UT on 22 April from AR 2817 (Bso/beta) which was located on the northwest limb at the time. A weak CME from a prominence eruption on the northwest limb on 10/0158 UT may have caused an elevation in solar wind parameters on 14-15 April. There was a non-Earth directed CME associated with the 19 April M1.1 flare. An Earth directed CME occurred with a C3.8/1F flare and type II and IV sweeps, from AR2816 on 22/0435 UT, and arrived at Earth on 24/2220 UT, mildly elevating solar wind parameters in the first half of 25 April. Coronal hole wind streams resulted in mild to moderate elevations in solar wind parameters on 05, 07-08, 16-20 and 23 April.

DATE	FLARES		FLARE MAX	FADEOUT POSSIBLE ON DAYLIGHT CIRCUIT
	CLASS M	CLASS X		
19 April 21	M1.1		2342 UT	

FLARE ALERT	SWF ALERT
19 Apr 21	None issued

PROTON ALERT

BEGIN		END		ENERGY THRESHOLD
DATE	TIME	DATE	TIME	

None issued

Ionospheric Activity

No significant region wide depressions in the Maximum Usable Frequencies (MUFs) were observed in April. The Australian region ionosphere was mildly depressed on 04 April. Mild depressions were observed on other days listed below. The development of a number of solar sunspot groups increased background solar flux levels in the second half of the month with higher MUFs being observed then.

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

IONOSPHERIC DISTURBANCES (MUFs for the Australian region)

04 Apr 21: Northern region MUFs Depressed by 15%
Southern region MUFs Depressed by 15%
05 Apr 21: Northern region MUFs Depressed by 15%
07 Apr 21: Northern region MUFs Depressed by 15%
11 Apr 21: Southern region MUFs Depressed by 15%
14 Apr 21: Northern region MUFs Depressed by 15%
17 Apr 21: Southern region MUFs Depressed by 25%

RADIO COMMUNICATIONS WARNINGS

DATE	Nº.	BEGIN	END
16 Apr 21	11	17 Apr 21	18 Apr 21
24 Apr 21	12	25 Apr 21	27 Apr 21

Geomagnetic Activity

Mild geomagnetic activity occurred on 07, 15-16, 19-20 and 23-25 April. The strongest disturbance occurred on 17 April, with an Australian region A index of 18. Coronal hole wind streams caused active periods on 07, 16-20 and 23 April. A weak CME that launched on 10 April, may have caused the active conditions on 15 April. Another CME launched on 22 April, arrived at 24/2220 UT to produce active conditions on 25 April. Weak sudden impulses were observed on 15/0649 UT (8 nT) and 24/0310 UT (6 nT).

DATE	GEOMAGNETIC DISTURBANCES (for the Australian region)
17 Apr 21: Quiet to Active	

	GEOMAGNETIC WARNINGS AND ALERTS			
DATE	Nº.	BEGIN	END	ISSUED
14 Apr 21	13	16 Apr 21	16 Apr 21	Warning
16 Apr 21	14	17 Apr 21	18 Apr 21	Warning
23 Apr 21	15	25 Apr 21	25 Apr 21	Warning
24 Apr 21	16	26 Apr 21	26 Apr 21	Warning

Solar And Geophysical Indices

DATE	10cm FLUX	AUSTRALIAN A-INDEX	AUSTRALIAN T-INDEX	DATE	10 cm FLUX	AUSTRALIAN A-INDEX	AUSTRALIAN T-INDEX
01 Apr	78	5	7	16 Apr	77	13	14
02 Apr	72	5	3	17 Apr	75	18	23
03 Apr	73	2	6	18 Apr	78	15	24
04 Apr	70	1	0	19 Apr	86	12	25
05 Apr	72	4	1	20 Apr	80	10	22
06 Apr	74	2	5	21 Apr	78	5	15
07 Apr	76	13	6	22 Apr	84	3	15
08 Apr	74	1	4	23 Apr	77	9	14
09 Apr	78	2	5	24 Apr	79	8	24
10 Apr	70	2	5	25 Apr	79	13	24
11 Apr	73	3	9	26 Apr	80	4	20
12 Apr	83	4	11	27 Apr	79	5	22
13 Apr	73	4	12	28 Apr	78	1	9
14 Apr	74	5	9	29 Apr	77	1	8
15 Apr	72	9	17	30 Apr	73	2	11

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
May 20	69.2	2.0	1.6	0.2	5.6	1
Jun 20	69.7	1.5	-0.5	5.8	7.9	0
Jul 20	69.5	2.2	-0.9	6.1	9.0	0
Aug 20	71.7	3.4	5.6	7.5	9.5	0
Sep 20	70.6	5.2	-2.6	0.6	10.5	0
Oct 20	74.6	4.7	-13.7	14.6	11.9	0
Nov 20	90.1	3.4	-6.3	34.5	14.3	1
Dec 20	87.3	4.2	11.1	23.1	17.3	0
Jan 21	76.1	4.0	2.2	10.4	20.6	0
Feb 21	74.3	6.7	-0.5	8.3	24.1	0
Mar 21	77.6	6.1	9.1	17.3	28.4	0
Apr 21	76.4	6.0	12.3	24.5	32.7	1
					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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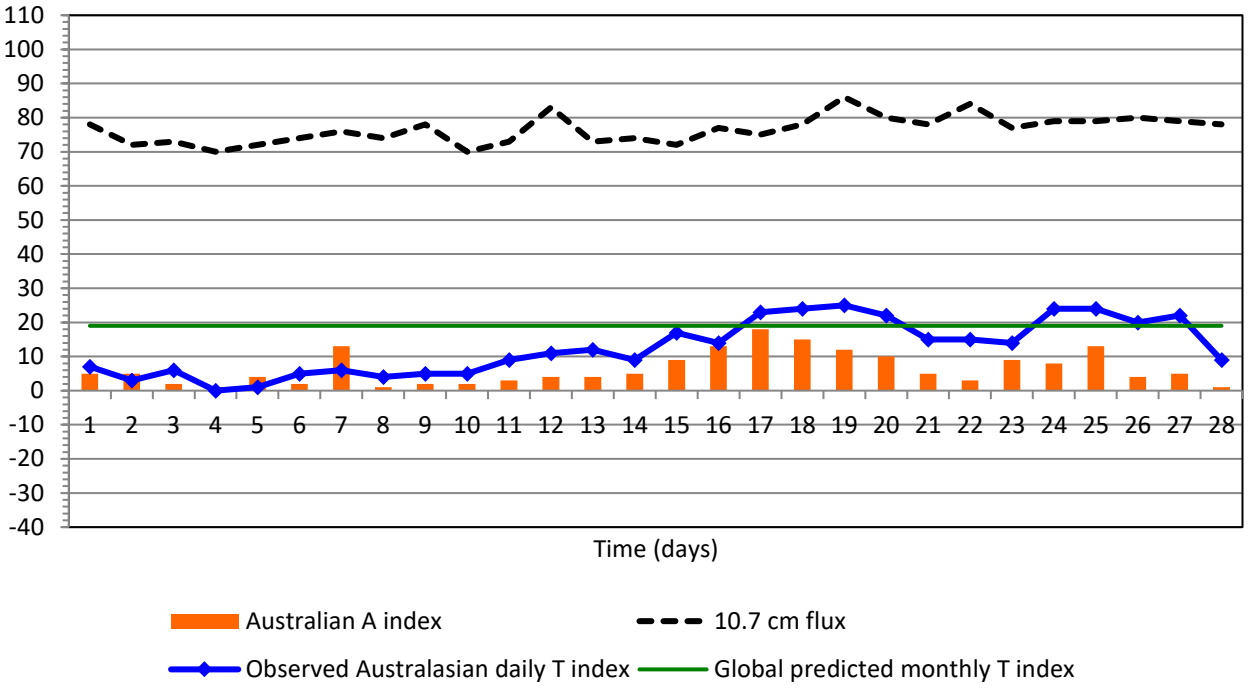
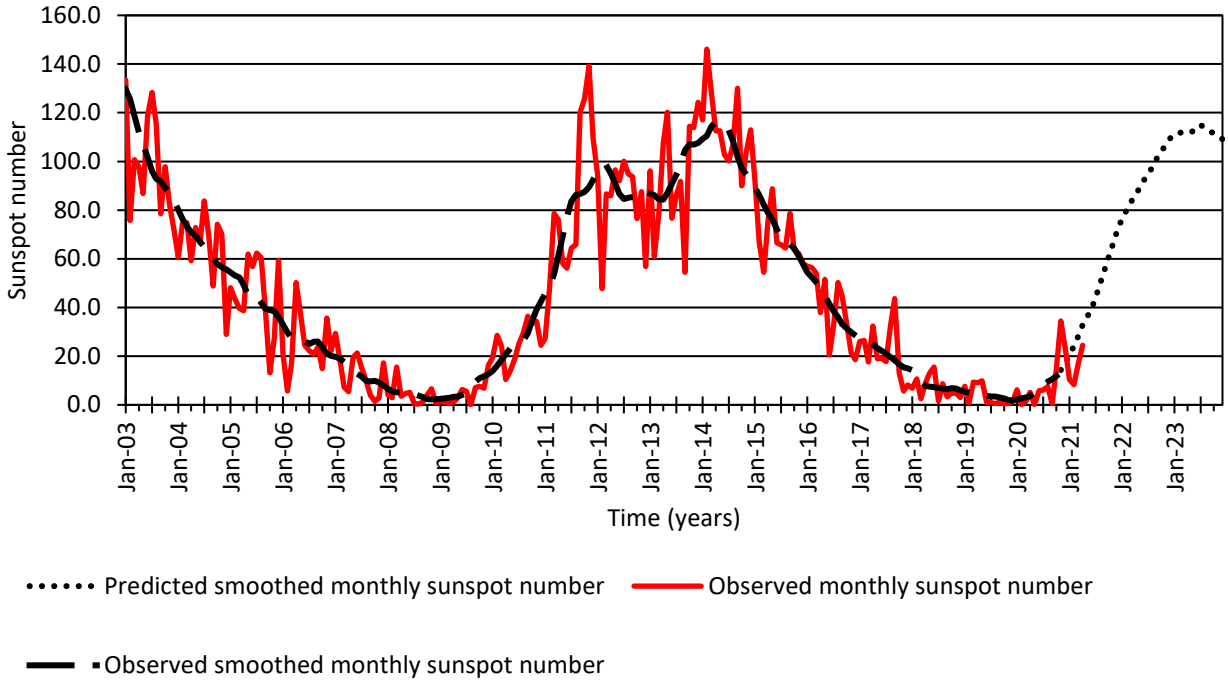
SWS WORLD T-INDICES

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	-5	-3	-4	-4	-9	-14	-12	-14	-11	-13	-15	-11
2020	-4	-4	2	-1	-8	-7	-9	-2	-6	-5	7	13
2021	12	4	10	6*	21	24	27	30	34	38	43	45
2022	47	49	51	52	53	55	56	57	59	60	61	61
2023	62	63	65	66	66	68	69	70	70	70	69	68
	SWS predicted T-index				* New observed data. T-index value may have changed							

Solar and Geophysical Indices - April 2021



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^{-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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