



# Sunspot Index and Long-term Solar Observations

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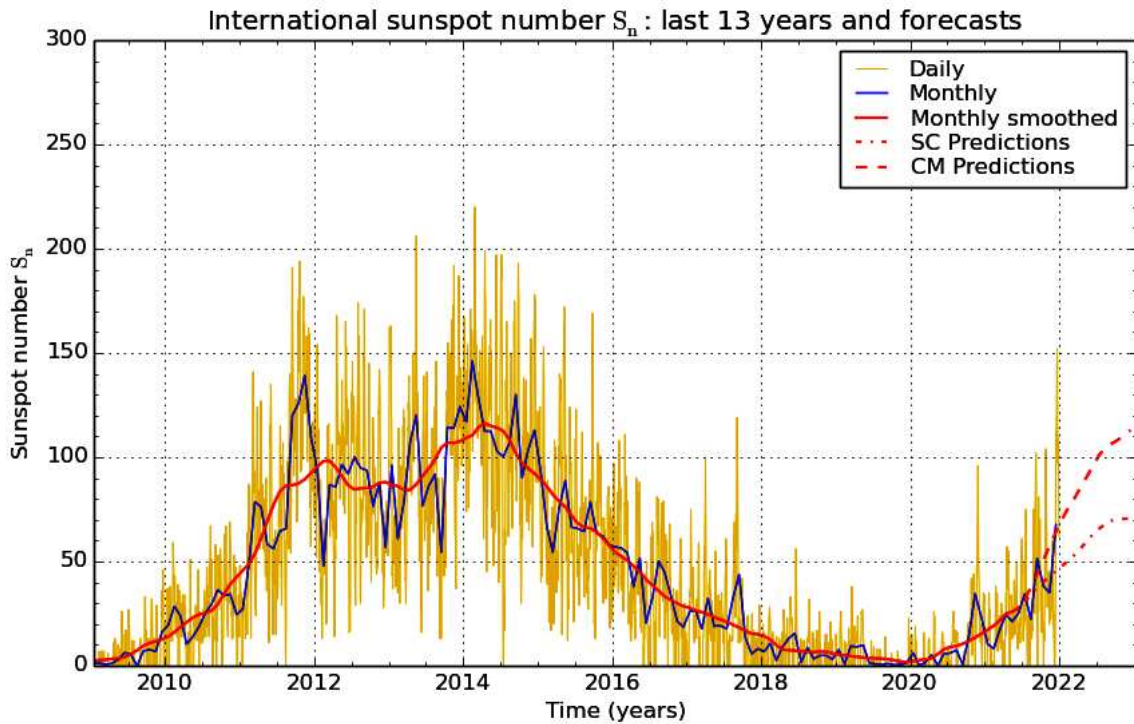
## ***SUNSPOT BULLETIN***

2021 n° 12

Provisional international and normalized hemispheric daily sunspot numbers for December 2021

Computed at the *Royal Observatory of Belgium* using observations from an international network with the *Specola Solare Ticinese Locarno* as reference station.

Date	$S_n$	$S_n(N)$	$S_n(S)$
1	43	17	26
2	37	19	18
3	30	14	16
4	19	13	6
5	25	7	18
6	13	0	13
7	12	0	12
8	6	0	6
9	0	0	0
10	0	0	0
11	0	0	0
12	13	0	13
13	25	8	17
14	44	0	44
15	78	7	71
16	107	18	89
17	111	27	84
18	110	27	83
19	120	24	96
20	120	28	92
21	133	34	99
22	152	47	105
23	145	39	106
24	114	31	83
25	112	35	77
26	97	31	66
27	109	47	62
28	102	47	55
29	87	38	49
30	70	26	44
31	62	9	53
Monthly mean	67.6	19.1	48.5
Cooperating stations	70	56	56



SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium 2022 January 1

**Predictions of the monthly smoothed Sunspot Number**  
 using the last provisional value, calculated for June 2021: 27.8 ( $\pm 5\%$ )

	SM	CM		SM	CM		SM	CM
2021 Jul	31	32	2022 Jan	48	70	2022 Jul	66	101
Aug	34	38	Feb	50	76	Aug	68	104
Sep	38	44	Mar	53	80	Sep	70	107
Oct	40	51	Apr	56	86	Oct	70	108
Nov	43	58	May	60	91	Nov	71	111
Dec	46	64	Jun	63	96	Dec	71	113

**SM : SIDC classical method** : based on an interpolation of Waldmeier's standard curves. The estimated error ranges from 7% (first month) to 35% (last month)

**CM : Combined method** : the combined method is a regression technique coupling a dynamo-based estimator with Waldmeier's method of standard curves, designed by K. Denkmayr.

Ref.: K. Denkmayr, P. Cugnon, 1997 : "About Sunspot Number Medium-Term Predictions", in "Solar-Terrestrial Prediction Workshop V", eds. G.Heckman et al., Hiraiso Solar Terrestrial Research Center, Japan, 103.

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*With our best wishes for a fruitful and sunny new year in 2022 !*

**Summary of the URSIGRAMs from S.I.D.C.**

Date	S <sub>n</sub>	PPSI	600	2800	COS	SFI	XI	Ak
30	60	19	-	90	////	0	0/0	14
1	43	13	-	86	////	0	0/0	19
2	37	12	-	87	////	0	0/0	10
3	30	3	-	85	////	2	0/0	13
4	19	2	-	88	////	0	0/0	8
5	25	4	-	83	////	0	0/0	10
6	13	2	-	80	////	1	0/0	8
7	12	1	-	79	////	0	0/0	4
8	6	0	-	77	////	0	0/0	4
9	0	0	-	77	////	0	0/0	1
10	0	0	-	76	////	0	0/0	3
11	0	0	-	76	////	0	0/0	4
12	13	2	-	80	////	0	0/0	3
13	25	3	-	81	////	0	0/0	5
14	44	7	-	89	////	5	0/0	5
15	78	21	-	103	////	5	0/0	10
16	107	43	-	118	////	3	0/0	8
17	111	61	-	121	////	18	1/0	3
18	110	61	-	121	////	0	0/0	4
19	120	55	-	115	////	12	0/0	18
20	120	32	-	123	////	19	1/0	16
21	133	34	-	137	////	13	2/0	11
22	152	54	-	140	////	27	1/0	13
23	145	47	-	130	////	12	0/0	4
24	114	51	-	126	////	28	0/0	6
25	112	60	-	131	////	5	0/0	8
26	97	47	-	125	////	1	0/0	3
27	109	103	-	124	////	0	0/0	12
28	102	72	-	121	////	8	2/0	9
29	87	63	-	111	////	0	0/0	8
30	70	56	-	102	////	3	0/0	10
31	62	18	-	102	////	2	0/0	4

**S<sub>n</sub>** : provisional international sunspot numbers from the S.I.D.C.

**PPSI** : prompt photometric sunspot index from the S.I.D.C. in  $10^{-5} \text{ w/m}^2$  : the quantity to be subtracted from the mean solar constant to account for the sunspot contribution.

**600** : 600 Mhz solar flux from the station at Humain (Belgium).

**2800** : 2800 Mhz solar flux from Ottawa (origin : Ursigrams - UGEOI). The 10.7cm Flux data are a service of the National Research Council of Canada.

**COS** : thousands of the cosmic ray counts (origin : Ursigrams - UCOSE Terre Adélie).

**SFI** : Solar Flare Index from the S.I.D.C. (origin: Ursigrams - UGEOI, evaluation :  $1 \times S_n + 10 \times ">1" + 100 \times ">1"$ ).

**XI** : X-flares index from the Ursigrams (M-flares/X-flares) (origin: Ursigrams - UGEOI, UGEOI).

**Ak** : geomagnetic index from Wingst, Germany (origin: Ursigrams).

SOLAR PHYSICS DEPARTMENT

UCCLE DAILY PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR DECEMBER 2021

DATE	UT	NUMBER		RELATIVE SUNSPOT NUMBERS			PPSI 10-5	QUAL	OBS	
		OF GROUPS	OF SPOTS	TOTAL	NORTH	SOUTH				CENTRAL
2	1240	2	10	30	19	11	19	19.1	2	OB
6	930	1	2	12	0	12	0	0.2	2	SB
7	910	1	3	13	0	13	0	0.3	2	SB
8	920	1	1	11	0	11	11	0.3	2	SB
11	930	0	0	0	0	0	0	0.0	2	SB
16	1355	7	60	130	24	106	46	60.1	2	FC
21	940	9	55	145	35	110	65	35.8	3	SB
22	1000	11	55	165	58	107	23	60.1	2	SB
31	1050	4	16	56	0	56	11	16.9	2	OL

The relative mean sunspot number is 62.4.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS  $U'=K'U$  FOR DECEMBER 2021

$$K' = 1.108 (*)$$

1	***	7	14	13	***	19	***	25	***
2	33	8	12	14	***	20	***	26	***
3	***	9	***	15	***	21	161	27	***
4	***	10	***	16	144	22	183	28	***
5	***	11	0	17	***	23	***	29	***
6	13	12	***	18	***	24	***	30	***
								31	62

The normalised relative monthly mean sunspot number is 69.

(\*)  $K'$  is the mean of the monthly  $K'$  for the last five years.

The Sun has been observed 9 days on 31 possible.