

RELATIVE SUNSPOT NUMBERS AND SOLAR ACTIVITY 2002-2003

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July 2004

1. Mean and characteristic figures of solar activity

(numbers in parentheses refer to 2001 for comparison)

	2002	2003	(2001)
- Mean daily Sunspot Number (SIDC data)	104.0	63.7	(111.0)
- Lowest daily Sunspot Number (SIDC data)	27	9	(28)
- Highest Sunspot Number (SIDC data)	192	167	(241)
- Mean daily number of sunspot-groups*	9.3	5.6	(9.7)
- Total number of groups in the northern hemisphere*	230	130	(279)
- Total number of groups in the southern hemisphere*	293	189	(284)
- Mean latitude of the northern groups (cycle 25)*	+13.4	+11.5	(+14.3)
- Mean latitude of the southern groups (cycle 25)*	-15.7	-13.4	(-14.9)

* observations at Locarno Station.

2. Relative Sunspot Numbers

The very simple definition of the Relative Sunspot Number R, given by Rudolf Wolf (1851 and 1858) :

$$R = k(10g + f) ,$$

were g is the number of observed sunspot-groups, f the total number of observed sunspots and k the reduction coefficient, contrasts with the relative complexity of their determination. The contrast is due to the precaution needed to preserve the calibration defined by Rudolf Wolf. Several criteria for the control of this calibration have been enounced by Max Waldmeier (1968, 1971).

At the level of the basic visual observation, a thorough experience is required to determine correctly the number of groups (g), which is not necessarily concordant with the physical grouping based on magnetic field polarities, and in wich, moreover, the limits set between A1 groups and pores may depend upon seeing quality and instrumental parameters. As to f, the weighting of large umbrae (e.g. M. Waldmeier, 1961), must be applied self consistently, even after minimum periods, in order to keep the link to the sunspot areas unchanged.

Table 1 : Definitive Relative Sunspot Numbers for 2002 (Yearly mean = 104.0)

Day	Month											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1	136	113	109	116	102	124	58	137	120	58	124	72
2	135	135	78	130	114	129	61	132	136	70	115	66
3	136	159	112	126	149	133	80	121	147	67	123	64
4	142	153	114	127	166	150	82	95	144	60	107	80
5	118	151	106	127	172	126	88	84	132	76	122	82
6	98	125	112	136	149	135	75	87	118	81	137	82
7	90	104	93	138	157	135	66	88	120	79	145	79
8	100	104	79	134	142	127	63	76	124	101	122	98
9	121	110	74	148	126	113	64	73	116	106	129	107
10	115	105	78	142	133	88	58	73	118	129	126	94
11	129	109	103	152	138	68	61	99	109	121	114	74
12	129	110	90	162	130	75	52	117	109	122	100	65
13	124	104	92	144	104	55	72	134	109	119	94	75
14	122	92	87	150	76	73	78	177	87	114	104	124
15	104	103	100	138	74	70	96	185	97	116	102	119
16	87	79	94	113	84	80	99	174	99	128	89	129
17	74	91	88	94	86	60	91	186	116	110	91	140
18	86	80	92	106	93	87	92	179	121	118	83	134
19	99	78	76	104	93	79	83	164	112	120	74	134
20	109	95	85	102	107	74	77	140	114	122	94	124
21	118	81	95	95	121	57	77	127	106	93	82	112
22	120	84	93	93	137	57	91	114	108	88	79	104
23	140	94	106	114	136	65	121	123	112	77	77	75
24	115	99	111	150	128	74	129	99	103	73	67	57
25	97	121	109	147	127	76	133	98	111	77	56	35
26	106	123	101	101	121	74	164	79	90	81	49	32
27	118	107	115	88	123	66	182	80	90	84	68	29
28	121	97	107	71	119	60	192	81	80	87	70	27
29	116	--	114	87	114	66	181	82	76	114	61	31
30	119	--	111	85	103	72	174	97	64	120	61	29
31	112	--	125	--	120	--	148	106	--	110	--	33
Mean	114.1	107.4	98.4	120.7	120.8	88.3	99.6	116.4	109.6	97.5	95.5	80.8

From January 1, 1981, the relative numbers are being calculated at the Royal Belgian Observatory and edited by the Sunspot Index Data Center, (now Solar Influences Data analysis Center), SIDC, according to a method which hardly differs from that used in Zürich, in order to preserve the homogeneity of the series. For the years 2002 and 2003 the daily definitive data are reported in Tables 1 and 2.

Table 2 : Definitive Relative Sunspot Numbers for 2003 (Yearly mean = 63.7)

Day	Month											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1	31	40	48	93	99	42	100	49	46	76	124	92
2	27	43	59	103	86	38	97	56	46	68	112	72
3	66	36	57	90	95	40	80	76	47	62	72	72
4	65	35	80	72	96	47	67	73	50	49	52	66
5	68	50	65	60	93	59	56	87	39	50	12	59
6	86	68	63	52	78	86	63	83	37	41	9	45
7	90	82	79	48	65	98	85	78	30	41	12	32
8	108	87	66	34	33	101	89	69	25	43	21	26
9	109	93	89	42	20	111	90	70	17	47	39	16
10	117	73	71	38	17	111	74	72	25	45	39	25
11	117	73	69	25	36	116	61	72	34	44	30	25
12	104	71	56	37	38	115	68	71	29	25	11	25
13	94	59	45	38	41	96	96	70	30	13	21	28
14	94	45	58	35	43	81	96	63	33	13	23	31
15	84	31	63	29	50	63	105	67	42	13	33	30
16	84	20	62	16	51	57	105	73	46	19	42	39
17	81	10	41	19	39	56	112	74	58	30	34	68
18	77	20	43	27	44	68	121	67	58	41	52	71
19	87	33	39	34	48	76	128	58	52	41	70	71
20	93	44	29	45	61	74	161	62	46	47	90	74
21	68	46	23	58	50	62	146	58	50	59	97	60
22	86	34	8	75	65	61	123	69	57	58	83	74
23	70	28	27	73	57	66	100	76	65	61	109	76
24	76	28	33	73	37	68	78	82	64	75	107	59
25	59	32	52	89	39	76	47	82	67	88	123	44
26	72	30	70	86	52	82	28	89	77	89	119	40
27	85	43	81	103	57	93	33	90	79	133	132	31
28	85	34	91	100	62	93	50	95	71	165	121	34
29	84	--	112	109	56	94	43	85	74	167	113	26
30	62	--	112	98	44	92	38	74	66	167	116	17
31	41	--	102	--	42	--	42	65	--	160	--	12
Mean	79.7	46.0	61.1	60.0	54.6	77.4	83.3	72.7	48.7	65.5	67.3	46.5

The reduction factors (k) effective at Locarno station, resulting from the comparison with the observations of more than 40 collaborating stations of SIDC over the world, are reported at their average monthly values in table 3.

Table 3: Monthly k coefficient of the Locarno Station for 2002-2003 (SIDC values)

Month	Nr. of observation		k	
	2002	2003	2002	2003
Jan.	28	29	0.606	0.605
Feb.	23	26	0.613	0.598
Mar.	27	31	0.588	0.590
Apr.	22	28	0.611	0.613
May	23	29	0.597	0.604
June	29	30	0.616	0.602
July	28	29	0.599	0.602
Aug.	29	31	0.603	0.611
Sep.	25	26	0.598	0.614
Oct.	26	25	0.611	0.607
Nov.	16	17	0.609	0.610
Dec.	20	19	0.611	0.601
Total	296	320	0.605	0.605
Average quadratic error			± 0.008	± 0.007

Our observations are made with the Zeiss coude-refractor (D=150 mm) on projected image. The drawing of the sunspots and the determination of the relative numbers are carried out with the projection of the solar disk of 250 mm in diameter, with the same method utilized in these last 47 years by our observation station.

References

- Wolf, R. : 1851, Mittheilungen der Naturforschenden Ges. in Bern, N°206/207
 1858, Astronomische Mittheilungen Sternwarte Zuerich, N°6.
 Waldmeier, M.:1961, The Sunspot Activity in the Years 1610-1960, Schulthess, Zh. p.7
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 1991, Astronomische Mitt. N°382 (Comunicaz. Specola Solare Ticinese N°6)
 1992, Astronomische Mitt. N°384 (Comunicaz. Specola Solare Ticinese N°8)
 1994, Astronomische Mitt. N°385 (Comunicaz. Specola Solare Ticinese N°9)
 1996, Astronomische Mitt. N°386 (Comunicaz. Specola Solare Ticinese N°10)
 1998, Astronomische Mitt. N°387 (Comunicaz. Specola Solare Ticinese N°11)
 2000, Astronomische Mitt. N°388 (Comunicaz. Specola Solare Ticinese N°12)
 2002, Astronomische Mitt. N°389 (Comunicaz. Specola Solare Ticinese N°13)

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