

# Annual Report on Sunspot Counting Program

2013

Vol. 1

Universidad de Extremadura, Spain



This *Annual Report on Sunspot Counting Program 2013* was compiled by A.J.P. Aparicio, V.M.S. Carrasco, M.C. Gallego and J.M. Vaquero.

## Introduction

This program was born in late 2012 at the University of Extremadura in order to further extend our research in the reconstruction of past solar activity. Since 1st January 2013, our sunspot counts have been submitted to the Royal Observatory of Belgium (ROB) as a contribution to the international effort of maintaining and updating the International Sunspot Number. For this purpose, we have used a small apochromatic refractor –80mm of objective diameter and 550mm of focal length– to project a 150mm diameter image onto a template.

In this report, we provide a complete set of data obtained throughout the year 2013, with four Tables showing our data. Moreover, the reference sunspot index is compared with our results.

We hope that this publication be useful to the scientific community studying the sunspot number: the longest solar index series derived from direct observation of the Sun.

## Data

Table 1 lists all the observations made along this year. A few days reflect two observations. In those cases, we follow the ROB criteria for the chosen drawing of each day. Here are the criteria:

- Highest number of groups
- Highest Wolf number
- Highest Quality
- Smallest time-difference with respect to 12:00 UT (solar culmination)
- Early-in-the-morning counts are best

Note that the drawing quality is represented as an integer number between 1 and 5, according to the following the rule (USSPS code):

- 1 = very poor
- 2 = poor
- 3 = fair
- 4 = good
- 5 = exceptional

Tables 2 and 3 list daily, monthly and yearly values of the number of groups and spots along 2013. From group count  $G$  and sunspot count  $S$ , we define UEx sunspot number (or UEx Wolf number) as follows:  $SN_{UEx} = 10G + S$ . Additionally, we define UEx group sunspot number as:  $GSN_{UEx} = 12.08G$ . These definitions are in agreement with the classical ones (Cliver, Clette, and Svalgaard, 2013).

Table 4 lists daily, monthly and yearly values of  $SN_{UEX}$ , while Figure 1 shows the temporal evolution of these indexes.

Table 1. Data on sunspot counting along 2013, including day, month, time (U.T.), observer, quality, number of groups (G), number of spots (S) and Wolf number ( $SN_{UEX}$ ).

Day	Month	Time (U.T.)	Observer	Quality	G	S	$SN_{UEX}$
1	1	13:15	JM Vaquero	2	5	13	63
5	1	12:30	JM Vaquero	3	13	26	156
7	1	12:40	JM Vaquero	2	12	32	152
8	1	11:30	AJP Aparicio	4	10	38	138
12	1	13:30	JM Vaquero	2	8	61	141
14	1	11:35	JM Vaquero	3	8	40	120
15	1	10:00	A Szelecka	2	6	22	82
17	1	10:00	A Szelecka	2	2	16	36
21	1	10:10	A Szelecka	3	2	6	26
23	1	10:15	A Szelecka	2	5	12	62
28	1	13:30	A Szelecka	3	4	4	44
29	1	11:00	A Szelecka	3	3	3	33
30	1	11:20	A Szelecka	2	4	4	44
31	1	10:15	A Szelecka	4	3	3	33
1	2	13:35	A Szelecka	4	4	4	44
2	2	16:55	JM Vaquero	2	5	12	62
3	2	16:30	JM Vaquero	2	5	13	63
4	2	11:25	A Szelecka	4	2	4	24
5	2	12:05	A Szelecka	2	3	4	34
6	2	12:00	A Szelecka	2	3	5	35
7	2	9:00	A Szelecka	4	5	8	58
8	2	10:25	A Szelecka	4	3	10	40
9	2	13:05	JM Vaquero	3	3	11	41
11	2	12:50	A Szelecka	2	3	6	36
12	2	10:00	A Szelecka	4	4	5	45
13	2	12:05	A Szelecka	3	2	3	23
14	2	10:00	A Szelecka	3	2	4	24
15	2	13:00	A Szelecka	2	2	2	22
16	2	16:15	JM Vaquero	2	4	6	46
23	2	14:15	JM Vaquero	1	2	2	22
23	2	13:05	A Szelecka	3	2	2	22
24	2	13:50	JM Vaquero	3	4	5	45
25	2	9:45	A Szelecka	4	3	6	36
26	2	9:30	A Szelecka	4	3	11	41
27	2	12:35	A Szelecka	3	3	11	41
1	3	10:35	A Szelecka	2	3	7	37
5	3	12:00	VMS Carrasco	1	2	7	27

5	3	14:10	A Szelecka	2	4	16	56
6	3	10:55	VMS Carrasco	2	3	11	41
6	3	12:45	A Szelecka	2	7	19	89
7	3	15:35	A Szelecka	1	4	15	55
7	3	10:15	VMS Carrasco	3	2	10	30
11	3	9:00	VMS Carrasco	3	6	13	73
13	3	9:00	VMS Carrasco	4	7	23	93
14	3	9:30	VMS Carrasco	4	8	26	106
15	3	9:00	VMS Carrasco	4	8	22	102
15	3	14:50	A Szelecka	3	7	16	86
18	3	8:45	VMS Carrasco	4	7	22	92
18	3	11:30	A Szelecka	3	5	18	68
20	3	9:30	VMS Carrasco	3	3	6	36
20	3	9:50	A Szelecka	4	3	9	39
21	3	9:00	VMS Carrasco	3	3	8	38
22	3	10:00	VMS Carrasco	3	3	9	39
22	3	11:05	A Szelecka	4	3	11	41
23	3	11:15	VMS Carrasco	2	2	8	28
2	4	9:40	A Szelecka	3	7	22	92
2	4	9:00	VMS Carrasco	4	7	19	89
4	4	8:30	VMS Carrasco	4	6	18	78
4	4	9:15	A Szelecka	4	6	23	83
5	4	9:00	VMS Carrasco	3	6	22	82
5	4	9:50	A Szelecka	4	6	20	80
6	4	9:30	VMS Carrasco	4	8	20	100
7	4	9:30	VMS Carrasco	3	7	27	97
7	4	15:40	A Szelecka	5	7	23	93
8	4	7:45	VMS Carrasco	3	5	24	74
8	4	14:55	A Szelecka	1	5	19	69
11	4	17:00	VMS Carrasco	3	5	41	91
11	4	17:35	A Szelecka	4	5	40	90
12	4	8:45	VMS Carrasco	3	6	30	90
12	4	11:30	A Szelecka	3	4	31	71
15	4	7:30	VMS Carrasco	3	5	15	65
15	4	9:15	A Szelecka	2	5	19	69
16	4	12:25	A Szelecka	2	4	22	62
16	4	9:00	VMS Carrasco	3	5	20	70
17	4	11:00	A Szelecka	3	5	18	68
17	4	10:30	VMS Carrasco	2	5	18	68
18	4	11:20	A Szelecka	2	4	14	54
18	4	8:00	VMS Carrasco	4	4	20	60
19	4	8:00	A Szelecka	2	4	13	53
19	4	8:15	VMS Carrasco	4	6	11	71
20	4	9:00	VMS Carrasco	4	3	21	51
21	4	12:30	A Szelecka	3	3	23	53

21	4	9:00	VMS Carrasco	3	4	28	68
22	4	7:30	VMS Carrasco	3	4	25	65
23	4	11:20	A Szelecka	3	3	18	48
23	4	9:00	VMS Carrasco	4	4	18	58
24	4	8:45	VMS Carrasco	4	4	18	58
24	4	9:15	A Szelecka	4	5	21	71
25	4	8:30	VMS Carrasco	4	6	20	80
26	4	6:45	VMS Carrasco	5	6	15	75
26	4	8:45	A Szelecka	3	7	17	87
27	4	9:30	VMS Carrasco	3	5	24	74
28	4	9:00	VMS Carrasco	4	5	32	82
28	4	16:15	A Szelecka	4	5	23	73
2	5	8:45	VMS Carrasco	3	4	28	68
3	5	9:45	VMS Carrasco	3	4	22	62
3	5	12:15	NB Paredes	3	4	18	58
4	5	18:30	JM Vaquero	2	6	34	94
5	5	12:05	JM Vaquero	2	6	23	83
6	5	8:00	VMS Carrasco	4	5	23	73
7	5	8:30	VMS Carrasco	1	4	9	49
9	5	8:15	VMS Carrasco	2	5	13	63
10	5	8:15	VMS Carrasco	3	7	17	87
10	5	7:15	MJ Trinidad/N Bravo	2	7	21	91
11	5	11:30	JM Vaquero	2	9	24	114
12	5	12:35	JM Vaquero	1	7	31	101
13	5	7:15	VMS Carrasco	4	7	49	119
14	5	8:15	VMS Carrasco	4	7	42	112
14	5	7:45	A Galán/S Rubí	4	7	34	104
15	5	15:30	VMS Carrasco	4	12	49	169
16	5	9:00	VMS Carrasco	4	13	51	181
17	5	9:15	NB Paredes	4	9	44	134
17	5	9:00	VMS Carrasco	4	10	44	144
18	5	8:15	VMS Carrasco	5	8	29	109
19	5	8:30	VMS Carrasco	3	8	35	115
20	5	7:30	VMS Carrasco	3	6	24	84
21	5	11:45	A Galán/S Rubí	2	7	16	86
21	5	8:45	VMS Carrasco	4	6	15	75
22	5	8:15	VMS Carrasco	4	7	26	96
23	5	8:30	VMS Carrasco	3	5	23	73
23	5	9:45	P Méndez/M Moreno	4	5	19	69
24	5	9:30	NB Paredes	3	6	30	90
24	5	8:30	VMS Carrasco	3	6	28	88
25	5	9:00	VMS Carrasco	3	5	32	82
26	5	9:45	VMS Carrasco	3	4	18	58
27	5	8:30	VMS Carrasco	4	4	19	59
28	5	10:00	VMS Carrasco	2	4	13	53

29	5	8:00	VMS Carrasco	4	4	13	53
30	5	7:30	VMS Carrasco	4	4	6	46
31	5	8:15	VMS Carrasco	4	4	7	47
31	5	10:00	MJ Trinidad/N Bravo	4	4	6	46
1	6	8:15	VMS Carrasco	4	5	14	64
2	6	9:15	VMS Carrasco	4	4	18	58
3	6	8:00	VMS Carrasco	5	4	16	56
4	6	8:15	VMS Carrasco	4	3	11	41
5	6	9:00	VMS Carrasco	3	4	17	57
7	6	8:15	VMS Carrasco	4	2	14	34
10	6	17:45	VMS Carrasco	3	1	6	16
11	6	7:45	VMS Carrasco	3	1	4	14
12	6	8:30	VMS Carrasco	4	2	6	26
13	6	8:30	VMS Carrasco	3	2	11	31
14	6	7:30	VMS Carrasco	3	3	15	45
16	6	11:30	VMS Carrasco	3	6	17	77
17	6	8:15	VMS Carrasco	4	6	25	85
19	6	9:10	MJ Trinidad/N Bravo	3	8	34	114
20	6	9:10	MJ Trinidad/N Bravo	4	8	39	119
21	6	9:10	MJ Trinidad/N Bravo	3	7	34	104
22	6	17:35	JM Vaquero	3	9	28	118
23	6	12:00	JM Vaquero	2	7	20	90
24	6	10:05	JM Vaquero	4	7	30	100
25	6	9:15	VMS Carrasco	4	5	11	61
26	6	8:30	VMS Carrasco	3	3	7	37
27	6	8:45	VMS Carrasco	4	4	11	51
28	6	8:30	VMS Carrasco	4	5	14	64
29	6	8:40	VMS Carrasco	4	4	19	59
30	6	8:40	VMS Carrasco	4	3	16	46
1	7	9:00	AJP Aparicio	4	4	9	49
2	7	10:46	MJ Trinidad/N Bravo	3	5	22	72
3	7	8:00	JM Vaquero	2	4	19	59
3	7	9:00	MJ Trinidad/N Bravo	2	3	34	64
4	7	10:00	MJ Trinidad/N Bravo	5	4	63	103
5	7	9:47	MJ Trinidad/N Bravo	4	5	77	127
8	7	11:00	MJ Trinidad/N Bravo	3	5	68	118
9	7	9:30	MJ Trinidad/N Bravo	3	4	54	94
10	7	9:30	MJ Trinidad/N Bravo	4	3	50	80
11	7	9:15	MJ Trinidad/N Bravo	3	3	28	58
16	7	9:30	AJP Aparicio	4	3	11	41
17	7	9:30	AJP Aparicio	4	2	7	27
18	7	8:00	AJP Aparicio	4	3	15	45
19	7	7:45	AJP Aparicio	4	3	19	49
22	7	10:30	AJP Aparicio	4	3	8	38
23	7	8:15	AJP Aparicio	2	3	7	37

24	7	8:30	AJP Aparicio	4	4	14	54
25	7	8:30	AJP Aparicio	4	6	15	75
26	7	8:30	AJP Aparicio	4	5	17	67
27	7	12:00	AJP Aparicio	1	4	6	46
28	7	10:30	AJP Aparicio	2	4	12	52
29	7	9:00	AJP Aparicio	4	6	22	82
30	7	8:30	AJP Aparicio	4	5	15	65
31	7	8:45	AJP Aparicio	4	6	17	77
1	8	8:00	AJP Aparicio	4	7	11	81
5	8	9:00	AJP Aparicio	3	4	6	46
6	8	9:30	AJP Aparicio	3	5	7	57
7	8	9:00	AJP Aparicio	3	3	6	36
8	8	9:00	AJP Aparicio	3	5	9	59
9	8	8:45	AJP Aparicio	4	5	11	61
12	8	10:30	AJP Aparicio	3	4	20	60
13	8	9:45	AJP Aparicio	3	3	29	59
14	8	9:30	AJP Aparicio	4	6	34	94
15	8	9:15	AJP Aparicio	3	4	22	62
16	8	8:45	AJP Aparicio	3	5	13	63
19	8	10:45	AJP Aparicio	3	6	14	74
20	8	9:00	AJP Aparicio	4	7	26	96
21	8	9:00	AJP Aparicio	5	8	25	105
23	8	9:15	AJP Aparicio	3	8	16	96
24	8	10:45	AJP Aparicio	3	5	6	56
25	8	10:15	AJP Aparicio	3	3	3	33
26	8	9:15	AJP Aparicio	4	3	3	33
27	8	9:30	AJP Aparicio	3	3	5	35
29	8	9:30	AJP Aparicio	3	3	17	47
2	9	10:30	AJP Aparicio	3	5	18	68
3	9	8:30	AJP Aparicio	4	4	20	60
4	9	8:45	AJP Aparicio	4	4	25	65
5	9	9:15	AJP Aparicio	4	4	16	56
6	9	9:15	AJP Aparicio	3	3	6	36
10	9	8:30	AJP Aparicio	4	1	2	12
11	9	8:30	AJP Aparicio	3	2	6	26
12	9	8:30	AJP Aparicio	3	3	3	33
13	9	8:30	AJP Aparicio	4	2	2	22
14	9	11:00	AJP Aparicio	4	1	1	11
15	9	10:50	AJP Aparicio	4	1	1	11
16	9	8:30	AJP Aparicio	2	1	1	11
17	9	10:40	AJP Aparicio	3	2	2	22
18	9	9:20	AJP Aparicio	3	4	6	46
19	9	9:15	AJP Aparicio	4	5	9	59
20	9	9:15	AJP Aparicio	5	7	14	84
23	9	8:45	AJP Aparicio	4	4	10	50



25	9	10:15	AJP Aparicio	2	2	11	31
26	9	16:20	AJP Aparicio	2	3	9	39
3	10	12:20	AJP Aparicio	4	5	17	67
4	10	10:50	AJP Aparicio	1	4	12	52
6	10	12:15	JM Vaquero	3	3	4	34
7	10	10:00	AJP Aparicio	4	5	10	60
8	10	8:45	AJP Aparicio	3	5	8	58
9	10	9:46	N Bravo	3	4	19	59
10	10	9:40	AJP Aparicio	3	5	18	68
11	10	8:10	MJ Trinidad	2	4	33	73
12	10	12:55	JM Vaquero	2	5	26	76
13	10	15:30	JM Vaquero	2	7	22	92
15	10	12:30	AJP Aparicio	2	5	16	66
16	10	10:14	N Bravo	2	5	22	72
20	10	10:40	AJP Aparicio	3	6	23	83
21	10	13:25	AJP Aparicio	2	6	37	97
22	10	13:35	AJP Aparicio	3	4	33	73
29	10	9:40	AJP Aparicio	5	7	28	98
30	10	10:12	MJ Trinidad	4	5	36	86
31	10	9:45	AJP Aparicio	5	7	29	99
3	11	16:20	AJP Aparicio	2	6	42	102
5	11	13:10	AJP Aparicio	3	5	54	104
8	11	14:15	JM Vaquero	2	4	23	63
9	11	16:30	JM Vaquero	2	4	18	58
11	11	10:05	AJP Aparicio	4	6	29	89
12	11	9:50	AJP Aparicio	5	7	43	113
12	11	12:45	L Bautista	4	7	33	103
13	11	11:30	AJP Aparicio	4	9	45	135
14	11	9:40	AJP Aparicio	4	10	47	147
18	11	10:00	AJP Aparicio	4	8	38	118
19	11	9:00	AJP Aparicio	4	8	30	110
19	11	13:15	L Bautista	4	5	10	60
20	11	11:10	AJP Aparicio	4	6	9	69
23	11	12:20	AJP Aparicio	3	2	4	24
24	11	12:25	AJP Aparicio	4	3	9	39
25	11	8:50	AJP Aparicio	4	2	6	26
26	11	9:00	AJP Aparicio	3	1	1	11
27	11	10:50	AJP Aparicio	4	5	22	72
28	11	11:50	AJP Aparicio	3	7	34	104
29	11	10:40	AJP Aparicio	5	7	33	103
30	11	12:00	AJP Aparicio	4	6	27	87
1	12	12:45	AJP Aparicio	4	5	43	93
2	12	10:30	AJP Aparicio	5	8	41	121
3	12	9:25	AJP Aparicio	4	5	18	68
3	12	12:45	L Bautista	4	4	13	53

4	12	11:25	AJP Aparicio	4	8	26	106
5	12	9:40	AJP Aparicio	3	5	16	66
6	12	13:15	JM Vaquero	2	5	17	67
7	12	16:10	JM Vaquero	3	5	23	73
8	12	12:45	JM Vaquero	2	4	16	56
9	12	8:25	VMS Carrasco	3	6	20	80
10	12	12:45	L Bautista	3	5	14	64
10	12	13:35	AJP Aparicio	3	11	54	164
11	12	9:40	MJ Trinidad	3	8	22	102
14	12	16:10	JM Vaquero	3	7	27	97
15	12	13:45	JM Vaquero	3	7	31	101
16	12	11:15	AJP Aparicio	4	6	27	87
18	12	13:30	AJP Aparicio	2	8	40	120
20	12	15:55	JM Vaquero	2	8	42	122
21	12	15:40	JM Vaquero	2	6	27	87
22	12	13:55	JM Vaquero	3	5	30	80
23	12	10:15	JM Vaquero	4	7	24	94

Total number of observations: 279

Total number of days with a record: 241

Table 2. Daily, monthly and yearly values of number of groups ( $G$ ) in 2013.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	5	4	3			5	4	7				5
2		5		7	4	4	5		5			8
3		5			4	4	4		4	5	6	5
4		2		6	6	3	4		4	4		8
5	13	3	4	6	6	4	5	4	4		5	5
6		3	7	8	5			5	3	3		5
7	12	5	4	7	4	2		3		5		5
8	10	3		5			5	5		5	4	4
9		3			5		4	5		4	4	6
10					7	1	3		1	5		11
11		3	6	5	9	1	3		2	4	6	8
12	8	4		6	7	2		4	3	5	7	
13		2	7		7	2		3	2	7	9	
14	8	2	8		7	3		6	1		10	7
15	6	2	8	5	12			4	1	5		7
16		4		5	13	6	3	5	1	5		6
17	2			5	10	6	2		2			
18			7	4	8		3		4		8	8
19				6	8	8	3	6	5		8	
20			3	3	6	8		7	7	6	6	8
21	2		3	4	7	7		8		6		6
22			3	4	7	9	3			4		5
23	5	2	2	4	5	7	3	8	4		2	7
24		4		5	6	7	4	5			3	
25		3		6	5	5	6	3	2		2	
26		3		7	4	3	5	3	3		1	
27		3		5	4	4	4	3			5	
28	4			5	4	5	4				7	
29	3				4	4	6	3		7	7	
30	4				4	3	5			5	6	
31	3				4		6			7		
Monthly mean	6.1	3.3	5.0	5.4	6.3	4.5	4.1	4.9	3.1	5.1	5.6	6.5
Yearly mean	5.0											

Table 3. Daily, monthly and yearly values of number of spots (*S*) in 2013.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	13	4	7			14	9	11				43
2		12		22	28	18	22		18			41
3		13			22	16	19		20	17	42	18
4		4		23	34	11	63		25	12		26
5	26	4	16	22	23	17	77	6	16		54	16
6		5	19	20	23			7	6	4		17
7	32	8	15	27	9	14		6		10		23
8	38	10		24			68	9		8	23	16
9		11			13		54	11		19	18	20
10					21	6	50		2	18		54
11		6	13	41	24	4	28		6	33	29	22
12	61	5		30	31	6		20	3	26	43	
13		3	23		49	11		29	2	22	45	
14	40	4	26		42	15		34	1		47	27
15	22	2	22	19	49			22	1	16		31
16		6		20	51	17	11	13	1	22		27
17	16			18	44	25	7		2			
18			22	20	29		15		6		38	40
19				11	35	34	19	14	9		30	
20			9	21	24	39		26	14	23	9	42
21	6		8	28	16	34		25		37		27
22			11	25	26	28	8			33		30
23	12	2	8	18	23	20	7	16	10		4	24
24		5		21	30	30	14	6			9	
25		6		20	32	11	15	3	11		6	
26		11		17	18	7	17	3	9		1	
27		11		24	19	11	6	5			22	
28	4			32	13	14	12				34	
29	3				13	19	22	17		28	33	
30	4				6	16	15			36	27	
31	3				7		17			29		
Monthly mean	20.0	6.6	15.3	22.9	26.0	17.5	25.0	14.2	8.5	21.8	27.1	28.6
Yearly mean	19.8											

Table 4. Daily, monthly and yearly values of Wolf number ( $SN_{UEX}$ ) in 2013.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	63	44	37			64	49	81				93
2		62		92	68	58	72		68			121
3		63			62	56	59		60	67	102	68
4		24		83	94	41	103		65	52		106
5	156	34	56	82	83	57	127	46	56		104	66
6		35	89	100	73			57	36	34		67
7	152	58	55	97	49	34		36		60		73
8	138	40		74			118	59		58	63	56
9		41			63		94	61		59	58	80
10					91	16	80		12	68		164
11		36	73	91	114	14	58		26	73	89	102
12	141	45		90	101	26		60	33	76	113	
13		23	93		119	31		59	22	92	135	
14	120	24	106		112	45		94	11		147	97
15	82	22	102	69	169			62	11	66		101
16		46		70	181	77	41	63	11	72		87
17	36			68	144	85	27		22			
18			92	60	109		45		46		118	120
19				71	115	114	49	74	59		110	
20			39	51	84	119		96	84	83	69	122
21	26		38	68	86	104		105		97		87
22			41	65	96	118	38			73		80
23	62	22	28	58	73	90	37	96	50		24	94
24		45		71	90	100	54	56			39	
25		36		80	82	61	75	33	31		26	
26		41		87	58	37	67	33	39		11	
27		41		74	59	51	46	35			72	
28	44			82	53	64	52				104	
29	33				53	59	82	47		98	103	
30	44				46	46	65			86	87	
31	33				47		77			99		
Monthly mean	80.7	39.1	65.3	76.5	88.8	62.7	65.9	62.7	39.1	72.9	82.8	93.9
Yearly mean	69.6											
Observed days	14	20	13	22	29	25	23	20	19	18	19	19
Total observed days	241											

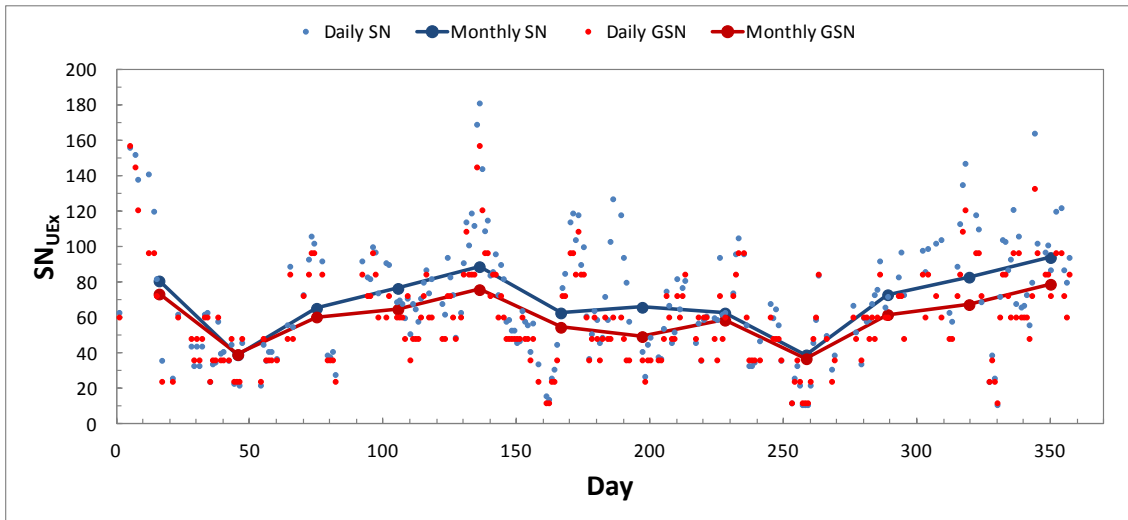


Figure 1. Daily and monthly  $SN_{UEX}$  and  $GSN_{UEX}$  values in 2013.

### Relationship with the reference sunspot index

We have compared  $SN_{UEX}$  with the international sunspot number (ISN), provided by World Data Center SILSO, Royal Observatory of Belgium, Brussels (see Figure 2).



Figure 2. Monthly  $SN_{UEX}$  and ISN values in 2013.

Figure 3 shows a scatter plot of daily  $SN_{UEX}$  versus ISN values for those values corresponding to 2013. Here is the linear fit equation:

$$SN_{UEX} = (1.11 \pm 0.04) ISN + (-1.4 \pm 2.7) \quad (r = 0.877; p\text{-value} < 0.001)$$

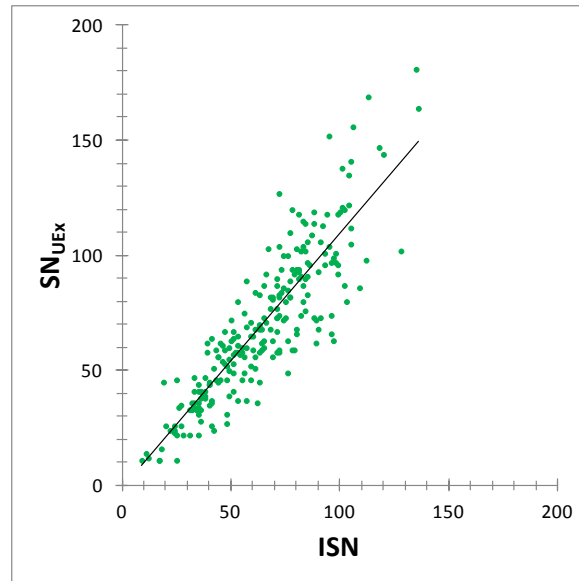


Figure 3. Scatter plot of daily  $SN_{UEx}$  versus ISN values in 2013.

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SILSO, World Data Center - Sunspot Number and Long-term Solar Observations, Royal Observatory of Belgium, on-line Sunspot Number catalogue: <http://www.sidc.be/SILSO/>, '1996-2013'.