

Monthly Report (00)
202312 Data Set

Tuesday 16th January, 2024

Prepared for

Statistics for Physical and Engineering Sciences

by

Jamie Riggs, Ph.D.

Principal Statistician
Statistics for Physical and Engineering Sciences Institute

1 Introduction

The process of reporting monthly Sunspot numbers consists of submitting individual observer's daily counts for a specific month to the AAVSO Solar Section. These data are maintained in a SQL database. The monthly data then are extracted for analysis using the R statistics package (<http://www.R-project.org/>). This report is the portion of the analysis concerned with both the raw daily average counts and the data Accuracy, Consistency, and Completeness measures for a particular month. The checks are used to scrub or filter the data to assure only error-free data are used to determine the monthly sunspot number.

This report consists of four sections: the raw daily average counts (Section 2), the known data errors (Section 3), the processed counts using a Generalized Linear Mixed Model to produce the relative sunspot numbers (Section 4), and supporting information on the model construction (Section 5).

The raw daily average of counts consist of submitted counts from all observers who provided data in the particular month. These averaged counts are reported by the day of the month, and are either from data not scrubbed or corrected data. The table captions indicate which. The errors, if any, are reported according to type.

The Error Tables section contains reported errors on missing data, inconsistencies in year and month, inconsistencies in the reported day number (1-31), seeing coding errors, number of annual observations by observer, and inconsistencies between the reported Wolf number and the calculated Wolf number from the group counts and sunspot counts, among other errors that are given in that section.

The relative sunspot numbers R_a section contains the sunspot numbers after the submitted data are scrubbed and modeled by a Generalized Linear Mixed Model (GLMM). The GLMM is a statistical model that accounts for variation due to random effects and fixed effects. For the R_a model random effects include the AAVSO observer as these observers are a selection from all possible observers, and the fixed effects include seeing conditions at one of four possible levels. More details on GLMM are available in a paper (GLMM05) on the sunspot counts research page. The paper title is *A Generalized Linear Mixed Model for Enumerated Sunspots*.

The supporting information for the model is provided for clarification.

2 Raw Daily Average Counts

The reported raw daily average counts have been checked for errors and inconsistencies, and no known errors are present. All observers whose submissions qualify through this month's scrubbing process are represented in Figure 1 and Table 1.

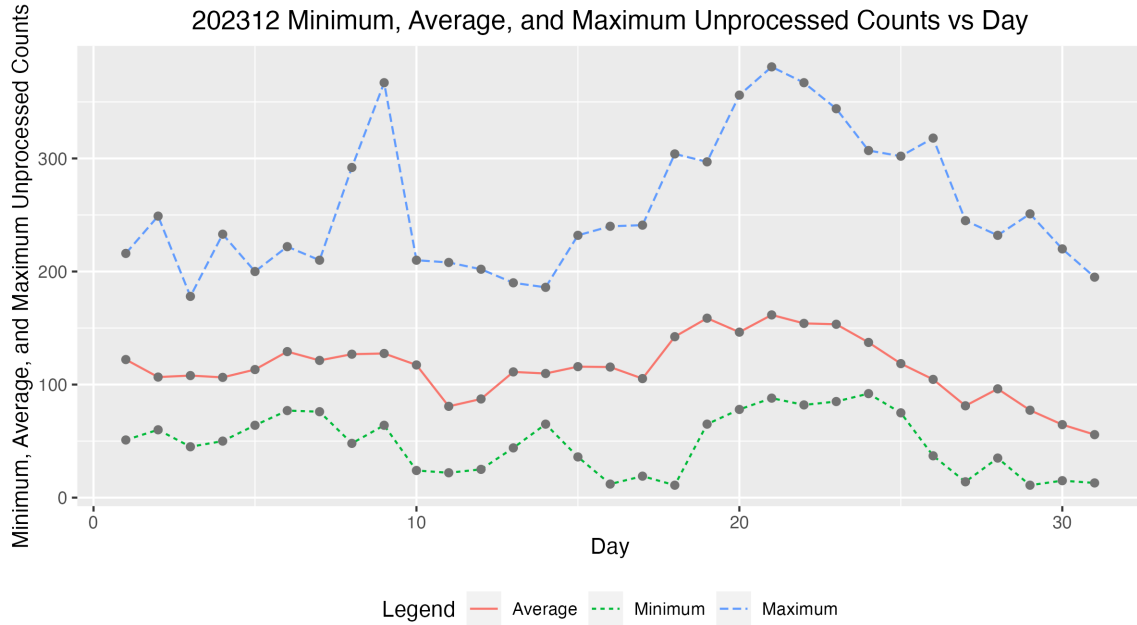


Figure 1: Raw average sunspot count by day of the month.

Table 1: 202312 Daily Raw Counts

Day	Submissions	Minimum	Average	Maximum
1.0000	22.0000	51.0000	122.1364	216.0000
2.0000	19.0000	60.0000	106.6316	249.0000
3.0000	29.0000	45.0000	107.9655	178.0000
4.0000	25.0000	50.0000	106.3600	233.0000
5.0000	21.0000	64.0000	113.2857	200.0000
6.0000	31.0000	77.0000	129.1613	222.0000
7.0000	28.0000	76.0000	121.3571	210.0000
8.0000	23.0000	48.0000	126.8696	292.0000
9.0000	22.0000	64.0000	127.5000	367.0000
10.0000	26.0000	24.0000	117.3462	210.0000
11.0000	31.0000	22.0000	80.7419	208.0000
12.0000	30.0000	25.0000	87.2667	202.0000
13.0000	25.0000	44.0000	111.2000	190.0000
14.0000	29.0000	65.0000	109.7931	186.0000
15.0000	34.0000	36.0000	115.8529	232.0000
16.0000	36.0000	12.0000	115.5000	240.0000
17.0000	33.0000	19.0000	105.3030	241.0000
18.0000	29.0000	11.0000	142.3448	304.0000
19.0000	28.0000	65.0000	158.7143	297.0000
20.0000	28.0000	78.0000	146.3571	356.0000
21.0000	23.0000	88.0000	161.6087	381.0000
22.0000	26.0000	82.0000	154.1154	367.0000
23.0000	26.0000	85.0000	153.3462	344.0000
24.0000	26.0000	92.0000	137.2692	307.0000
25.0000	34.0000	75.0000	118.5294	302.0000
26.0000	28.0000	37.0000	104.5714	318.0000
27.0000	30.0000	14.0000	81.2333	245.0000
28.0000	27.0000	35.0000	96.2222	232.0000
29.0000	29.0000	11.0000	77.3103	251.0000
30.0000	30.0000	15.0000	64.5667	220.0000
31.0000	25.0000	13.0000	55.7200	195.0000

3 Error Tables

Data are for the month of December 2023. No errors were found, and hence no errors are reported.

4 Relative Sunspot Numbers

All data errors, if any, have been corrected prior to determining the following relative sunspot numbers. A Generalized Linear Mixed Model (GLMM) was constructed to provide monthly sunspot numbers (see Table 2). The GLMM treats observer as a random effect, with year, month, seeing conditions, observer rank, and dual submission to both AAVSO and SILSO as fixed effects.

Figure 2 shows the monthly R_a numbers for the years and months (ym) in Table 2. The solid cyan curve that connects the cyan X's are the GLMM model estimates given in 2. The dotted black curves on either side of the cyan curve depict a 99% confidence band about the GLMM estimates. The confidence band uses the large sample approximation based on the Gaussian distribution. The dashed red curve connecting the red O's are the SILSO values for the monthly sequence.

The tan box plots for each month are the actual observations submitted by the AAVSO observers. The heavy solid lines approximately midway in the boxes represent the count medians. The box of the box plot represents the InterQuartile Range (IQR), which depicts from the 25th through the 75th quartiles. The lower and upper whiskers extend 1.5 times the IQR below the 25th quartile, and 1.5 times the IQR above the 75th quartile. The black circles below and above the whiskers traditionally are considered outliers, but with GLMM modeling, they are observations that comprise overdispersion. Overdispersion skews the counts data from a true Poisson distribution. The GLMM adjusts for this overdispersion.

Table 2: Year Month (ym) Relative Sunspot Numbers with 99% CI

ym	Ra	lci99	uci99	aavso	sidc
2008.12	2.7705	2.4243	3.1167	0.5000	1.0000
2009.01	5.3380	4.7856	5.8903	1.3000	1.3000
2009.02	4.7792	4.2692	5.2892	0.7000	1.2000
2009.03	6.1818	5.9540	6.4097	0.3000	0.6000
2009.04	6.6964	6.4747	6.9180	0.4000	1.2000
2009.05	7.1123	6.8469	7.3777	1.6000	2.9000
2009.06	7.1213	6.7849	7.4577	3.2000	6.3000
2009.07	6.6813	6.4204	6.9421	3.6000	5.5000
2009.08	6.6524	6.4157	6.8891	0.0000	0.0000
2009.09	7.3906	7.1450	7.6362	4.5000	7.1000
2009.10	6.6700	6.3301	7.0099	4.5000	7.7000
2009.11	6.7204	6.5265	6.9142	3.3000	6.9000
2009.12	7.2740	7.0521	7.4958	10.4000	16.3000
2010.01	19.9820	17.8182	22.1458	13.3000	19.5000
2010.02	16.1510	14.0673	18.2346	19.4000	28.5000

Continued on next page

Table 2: Year Month (ym) Relative Sunspot Numbers with 99% CI

ym	Ra	lci99	uci99	aavso	sidc
2010.03	17.8604	15.7431	19.9776	15.4000	24.0000
2010.04	18.9668	16.8322	21.1015	7.0000	10.4000
2010.05	23.2256	22.7812	23.6700	8.4000	8.7000
2010.06	21.9345	21.5242	22.3447	11.0000	13.6000
2010.07	22.5004	22.1201	22.8807	15.2000	16.1000
2010.08	21.5436	21.1321	21.9550	18.3000	19.6000
2010.09	25.0600	24.5788	25.5412	22.8000	25.2000
2010.10	23.0051	22.5336	23.4765	21.0000	23.5000
2010.11	23.4570	22.9886	23.9254	20.9000	21.6000
2010.12	24.5269	23.9847	25.0690	13.9000	14.5000
2011.01	71.4909	69.8988	73.0830	17.7000	18.7000
2011.02	62.9129	61.4446	64.3813	29.1000	29.6000
2011.03	67.1303	65.7186	68.5421	48.0000	55.8000
2011.04	72.8309	71.2872	74.3746	47.3000	54.4000
2011.05	77.0751	75.5938	78.5565	37.3000	41.5000
2011.06	72.2967	70.8855	73.7079	35.2000	37.0000
2011.07	73.0972	71.7443	74.4501	41.5000	43.8000
2011.08	70.6795	69.4279	71.9312	42.4000	50.5000
2011.09	81.3408	79.7661	82.9154	73.8000	78.0000
2011.10	74.3863	72.9972	75.7754	78.9000	88.0000
2011.11	75.9945	74.3458	77.6432	84.6000	96.7000
2011.12	77.7596	76.0956	79.4236	65.8000	73.0000
2012.01	76.8611	75.2605	78.4617	55.8000	58.2000
2012.02	66.6637	65.2128	68.1147	29.2000	33.1000
2012.03	71.5640	70.2247	72.9032	53.1000	64.1000
2012.04	75.9539	74.4831	77.4247	51.4000	55.2000
2012.05	82.3583	80.8587	83.8580	61.8000	69.0000
2012.06	76.8352	75.4168	78.2537	59.7000	64.5000
2012.07	78.3974	76.9885	79.8063	64.2000	51.3000
2012.08	72.9280	71.6361	74.2200	57.7000	63.1000
2012.09	84.1032	82.5502	85.6563	57.7000	61.5000
2012.10	77.9073	76.3844	79.4303	48.3000	53.3000
2012.11	79.9051	78.2228	81.5875	56.7000	61.4000
2012.12	81.5781	79.7514	83.4047	37.4000	40.8000
2013.01	85.1417	83.4362	86.8473	63.8000	62.9000
2013.02	73.9565	72.3768	75.5362	37.8000	38.0000
2013.03	77.0131	75.3688	78.6575	50.6000	57.9000
2013.04	82.7712	81.2080	84.3345	70.6000	72.4000
2013.05	87.6279	85.9269	89.3288	77.4000	78.7000

Continued on next page

Table 2: Year Month (ym) Relative Sunspot Numbers with 99% CI

ym	Ra	lci99	uci99	aavso	sidc
2013.06	83.4523	81.8320	85.0726	51.0000	52.5000
2013.07	84.1799	82.6875	85.6723	57.0000	57.0000
2013.08	80.0127	78.6080	81.4174	60.0000	66.0000
2013.09	90.7218	88.9945	92.4490	34.6000	36.9000
2013.10	82.8897	81.2540	84.5254	74.5000	85.6000
2013.11	83.8416	81.8330	85.8503	73.9000	77.6000
2013.12	87.9691	86.0314	89.9068	77.8000	90.3000
2014.01	99.5453	97.3679	101.7226	77.4000	82.0000
2014.02	88.3548	86.4771	90.2326	93.9000	102.8000
2014.03	94.0333	92.2144	95.8522	80.9000	92.2000
2014.04	101.1796	99.2650	103.0943	76.9000	84.7000
2014.05	107.7120	105.7487	109.6753	72.3000	75.2000
2014.06	102.4360	100.5450	104.3270	67.2000	71.0000
2014.07	102.8887	101.0142	104.7632	72.5000	72.5000
2014.08	97.8207	96.1696	99.4719	71.2000	74.7000
2014.09	112.2309	110.0917	114.3700	83.2000	87.6000
2014.10	102.0027	100.0223	103.9832	59.5000	60.6000
2014.11	104.1118	101.8135	106.4102	65.8000	71.1000
2014.12	106.5639	104.0635	109.0643	75.8000	78.0000
2015.01	61.5258	60.2618	62.7898	65.9000	67.0000
2015.02	53.4857	52.2181	54.7533	42.4000	44.8000
2015.03	57.7463	56.6277	58.8649	38.0000	38.4000
2015.04	61.8131	60.6154	63.0108	49.0000	54.4000
2015.05	65.7633	64.6030	66.9235	56.3000	58.8000
2015.06	62.0283	60.8890	63.1676	50.2000	68.3000
2015.07	61.6447	60.5957	62.6937	47.9000	65.8000
2015.08	59.8051	58.7992	60.8109	39.5000	57.2000
2015.09	67.9676	66.7283	69.2069	49.2000	72.1000
2015.10	62.2134	61.0096	63.4172	39.3000	48.3000
2015.11	64.0281	62.6193	65.4370	39.6000	55.9000
2015.12	66.2862	64.8021	67.7702	36.4000	44.8000
2016.01	33.6773	32.9682	34.3865	33.7000	43.3000
2016.02	29.2331	28.6176	29.8485	38.3000	46.8000
2016.03	31.1124	30.4845	31.7404	30.5000	38.9000
2016.04	33.0605	32.4242	33.6968	26.6000	30.9000
2016.05	35.3457	34.6978	35.9937	33.7000	48.4000
2016.06	33.1294	32.5604	33.6983	13.1000	19.5000
2016.07	33.6493	33.1057	34.1929	21.2000	27.5000
2016.08	32.2203	31.6497	32.7908	33.0000	47.9000

Continued on next page

Table 2: Year Month (ym) Relative Sunspot Numbers with 99% CI

ym	Ra	lci99	uci99	aavso	sidc
2016.09	37.4328	36.7453	38.1202	27.7000	37.1000
2016.10	33.9855	33.3279	34.6432	22.7000	31.7000
2016.11	34.6058	33.8805	35.3310	14.0000	22.2000
2016.12	36.2470	35.4653	37.0286	11.1000	20.0000
2017.01	18.1760	17.7902	18.5618	18.4000	26.2000
2017.02	15.8399	15.4885	16.1912	14.4000	20.6000
2017.03	16.9645	16.6376	17.2915	11.3000	15.5000
2017.04	18.2101	17.8862	18.5341	21.6000	33.2000
2017.05	19.2263	18.8915	19.5611	12.5000	18.1000
2017.06	17.9768	17.6775	18.2761	15.5000	19.3000
2017.07	18.3317	18.0373	18.6261	11.5000	16.3000
2017.08	17.5358	17.2291	17.8424	22.8000	35.7000
2017.09	20.6769	20.2426	21.1111	34.6000	42.9000
2017.10	18.2562	17.8816	18.6309	10.5000	11.0000
2017.11	18.5075	18.1155	18.8996	4.2000	5.6000
2017.12	19.2905	18.9963	19.5847	4.0000	4.6000
2018.01	5.0506	4.9421	5.1591	3.1000	6.3000
2018.02	4.3586	4.2531	4.4642	6.8000	11.8000
2018.03	4.6004	4.5076	4.6932	1.1000	1.2000
2018.04	4.8815	4.7834	4.9796	4.7000	7.5000
2018.05	5.2280	5.1308	5.3252	8.4000	14.0000
2018.06	4.9111	4.8247	4.9976	10.2000	13.6000
2018.07	5.0202	4.9643	5.0762	0.5000	1.7000
2018.08	4.7437	4.6628	4.8247	5.9000	9.5000
2018.09	5.3963	5.2957	5.4968	1.6000	2.9000
2018.10	5.0196	4.9221	5.1171	2.5000	5.6000
2018.11	5.0926	4.9864	5.1989	3.1000	4.2000
2018.12	5.3991	5.2941	5.5040	1.6000	2.3000
2019.01	3.3581	3.2943	3.4219	5.4000	2.3000
2019.02	2.9538	2.8955	3.0121	0.1000	1.2000
2019.03	3.0873	3.0348	3.1397	6.1000	12.1000
2019.04	3.3159	3.2538	3.3781	6.2000	9.3000
2019.05	3.4400	3.3803	3.4997	7.0000	11.9000
2019.06	3.2479	3.1933	3.3024	0.7000	1.5000
2019.07	3.3088	3.2599	3.3576	0.4000	2.2000
2019.08	3.1755	3.1287	3.2224	0.3000	0.8000
2019.09	3.6862	3.6286	3.7438	0.5000	1.0000
2019.10	3.3308	3.2746	3.3870	0.2000	0.5000
2019.11	3.4584	3.3922	3.5247	0.3000	0.6000

Continued on next page

Table 2: Year Month (ym) Relative Sunspot Numbers with 99% CI

ym	Ra	lci99	uci99	aavso	sidc
2019.12	3.5757	3.5043	3.6472	0.8000	1.0000
2020.01	7.4333	7.2883	7.5782	4.0000	5.3000
2020.02	6.4798	6.3501	6.6094	0.1000	0.0000
2020.03	6.8280	6.7007	6.9552	1.2000	1.5000
2020.04	7.3834	7.2633	7.5034	3.0000	5.1000
2020.05	7.7184	7.5993	7.8376	0.1000	0.4000
2020.06	7.3320	7.2198	7.4441	3.9000	6.4000
2020.07	7.3665	7.2583	7.4748	4.2000	7.7000
2020.08	6.9716	6.8753	7.0678	5.3000	7.8000
2020.09	8.0593	7.9301	8.1886	0.4000	0.9000
2020.10	7.4531	7.3304	7.5757	9.9000	13.6000
2020.11	7.6435	7.5183	7.7687	21.2000	33.1000
2020.12	7.9280	7.7843	8.0716	15.4000	19.8000
2021.01	25.8787	25.4147	26.3428	7.0000	15.8000
2021.02	23.0010	22.5939	23.4081	5.8000	10.7000
2021.03	24.3951	24.0107	24.7796	11.0000	17.2000
2021.04	26.5512	26.0784	27.0240	18.5000	28.8000
2021.05	28.0768	27.6214	28.5322	15.9000	22.9000
2021.06	26.4972	26.0596	26.9348	19.9000	24.1000
2021.07	26.5364	26.0833	26.9896	23.8000	35.6000
2021.08	25.9233	25.4852	26.3613	15.7000	19.5000
2021.09	29.6620	29.1398	30.1842	39.1000	52.5000
2021.10	27.7576	27.2567	28.2584	27.1000	37.0000
2021.11	28.0563	27.5294	28.5832	27.2000	35.1000
2021.12	29.9477	29.3261	30.5692	50.6000	69.0000
2022.01	73.9699	72.5858	75.3539	43.9000	62.0000
2022.02	65.3127	64.0486	66.5768	48.8000	60.5000
2022.03	70.0448	68.7049	71.3848	58.4000	80.6000
2022.04	72.6685	71.4324	73.9047	59.1000	83.9000
2022.05	79.4410	78.1064	80.7755	72.5000	0.4000
2022.06	72.8428	71.6470	74.0386	58.9000	0.4000
2022.07	74.9511	73.6674	76.2349	76.7000	102.5000
2022.08	71.8399	70.6441	73.0357	63.3000	86.0000
2022.09	82.1444	80.5547	83.7342	72.6000	94.5000
2022.10	75.4826	74.0912	76.8740	66.4000	112.1000
2022.11	76.7610	75.2186	78.3034	54.3000	82.1000
2022.12	80.3570	78.5339	82.1801	93.7000	165.0000
2023.01	122.7307	119.9631	125.4983	112.9000	173.8000
2023.02	105.6938	103.3807	108.0070	89.6000	152.3000

Continued on next page

Table 2: Year Month (ym) Relative Sunspot Numbers with 99% CI

ym	Ra	lci99	uci99	aavso	sidc
2023.03	109.6946	107.3424	112.0468	85.0000	126.8000
2023.04	117.7651	115.4331	120.0972	72.1000	114.3000
2023.05	125.3243	122.8210	127.8277	105.0000	140.0000
2023.06	119.7693	118.4074	121.1311	118.5000	173.0000
2023.07	117.6966	115.5006	119.8926	124.7000	161.2000
2023.08	112.5613	110.4110	114.7115	90.6000	132.5000
2023.09	130.4753	127.8696	133.0810	110.4000	156.8000
2023.10	119.8351	117.1772	122.4930	78.4000	119.6000
2023.11	118.8878	116.0664	121.7091	88.6000	105.1000
2023.12	128.2465	125.0800	131.4130	98.2000	115.0000

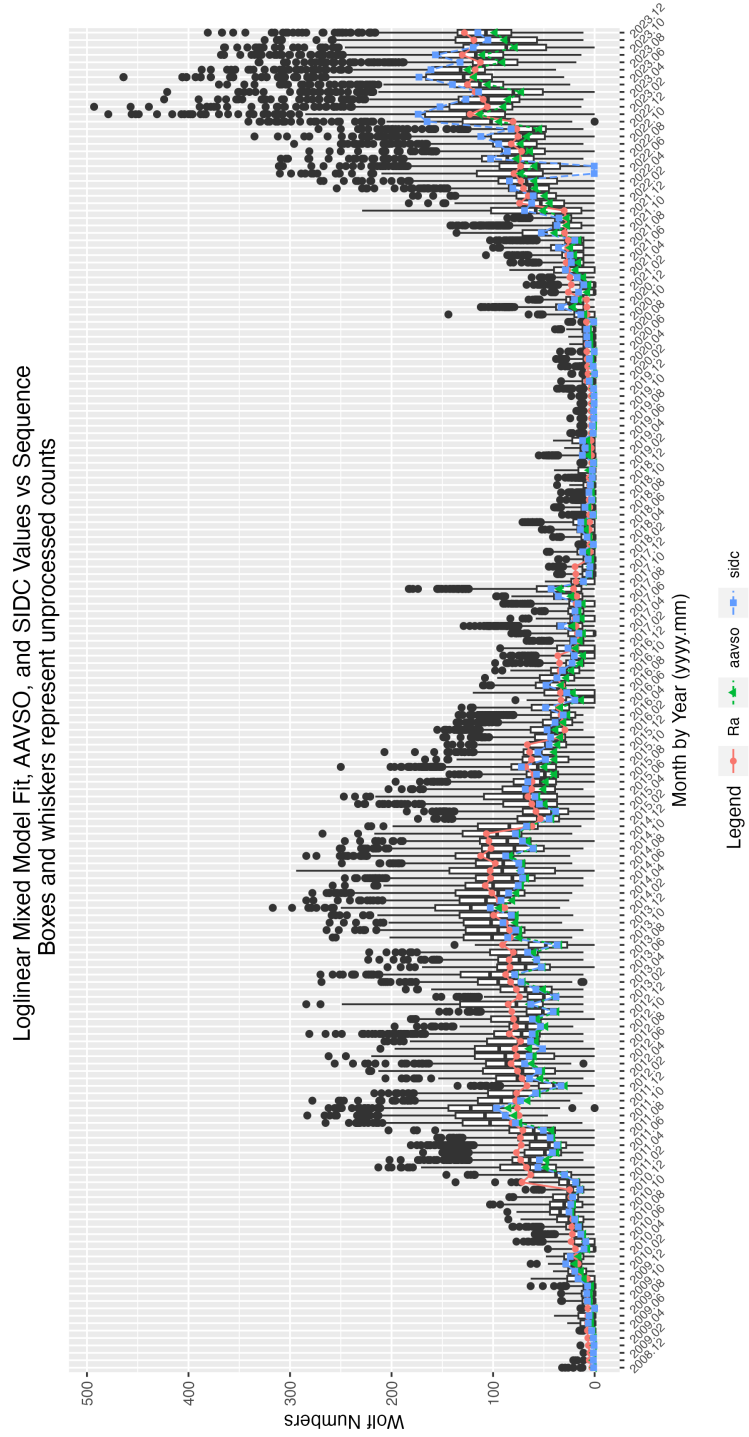


Figure 2: GLMM fitted data for R_a . AAVSO data: <https://www.aavso.org/category/tags/solar-bulletin>. SILSO data: WDC-SILSO, Royal Observatory of Belgium, Brussels

The GLMM parameter estimates and measures of importance in the determining the monthly R_a values are given in Table 3. The parameter estimates and levels of statistical significance are determined for the residual error size combined with the observer random effect error size. Thus, the parameter estimates are adjusted for the random effect of observer. The significance level is set at 0.05. Any $\Pr(>|z|)$ values equal to or less than 0.05 are considered statistically significant.

The year effect levels are given as year2011, year2012, and year2013. The yearly effect is significant as $\Pr(>|z|) < 0.05$. So the year in which the observations are made is commensurate with the expected rise toward and anticipated sunspot number maximum. Similarly, the monthly effect, denoted as mon2 through mon12, is significant at the 0.05 level.

The seeing conditions account for a significant amount of deviation in sunspot numbers. The seeing conditions are denoted as seeF (Fair), seeG (Good), and seeP (Poor), and are significant at the 0.05 level. Therefore, seeing conditions influence the reported sunspot numbers, as intuition anticipates.

The level of observer experience (denoted r1000B through r5000H, which is least to most experience) is not significant at the 0.05 significance level. It therefore does not contribute to changes in the monthly sunspot numbers.

Whether an observer contributes counts to the SILSO as well as the AAVSO (silsoy) is not significant at the 0.05 level, and hence we conclude that those observers who contribute to both institutions tend to differ from those observers contributing only to the AAVSO.

5 Supporting Information

Table 3: 202312 Parameter Estimates

	Estimate	Std. Error	t-value	Pr(> t)
(Intercept)	1.2113	0.3156	3.8385	0.0001
seeG	-0.1097	0.0042	-26.1708	0.0000
seeF	-0.2261	0.0048	-47.0437	0.0000
seeP	-0.3210	0.0069	-46.3106	0.0000
seeM	-0.1860	0.0243	-7.6483	0.0000
sidc1	0.0511	0.0107	4.7856	0.0000
year2009	0.7569	0.3171	2.3869	0.0170
year2010	1.9807	0.3149	6.2900	0.0000
year2011	3.1280	0.3148	9.9364	0.0000
year2012	3.1713	0.3148	10.0743	0.0000
year2013	3.2659	0.3148	10.3748	0.0000
year2014	3.4651	0.3148	11.0076	0.0000
year2015	2.9859	0.3148	9.4851	0.0000
year2016	2.3704	0.3148	7.5291	0.0000
year2017	1.7588	0.3149	5.5857	0.0000
year2018	0.4725	0.3152	1.4993	0.1338
year2019	0.0630	0.3154	0.1998	0.8416
year2020	0.8694	0.3150	2.7597	0.0058
year2021	2.1490	0.3148	6.8257	0.0000
year2022	3.1433	0.3148	9.9848	0.0000
year2023	3.6235	0.3148	11.5104	0.0000
mon2	-0.1333	0.0077	-17.2924	0.0000
mon3	-0.0760	0.0073	-10.4320	0.0000
mon4	-0.0167	0.0071	-2.3635	0.0181
mon5	0.0393	0.0069	5.7161	0.0000
mon6	-0.0210	0.0067	-3.1521	0.0016
mon7	-0.0158	0.0069	-2.2897	0.0220
mon8	-0.0581	0.0069	-8.4285	0.0000
mon9	0.0892	0.0069	12.9878	0.0000
mon10	0.0022	0.0071	0.3117	0.7552
mon11	0.0361	0.0073	4.9388	0.0000
mon12	0.0785	0.0073	10.7919	0.0000

Table 4: 202312 Summary of Sunspot Numbers

year	mon	day	obs	side
Min. :2008	Min. : 1.00	Min. : 0.0	Length:178290	Min. :0.0000
1st Qu.:2014	1st Qu.: 4.00	1st Qu.: 8.0	Class :character	1st Qu.:0.0000
Median :2017	Median : 7.00	Median :16.0	Mode :character	Median :0.0000
Mean :2017	Mean : 6.63	Mean :15.7		Mean :0.2385
3rd Qu.:2020	3rd Qu.: 9.00	3rd Qu.:23.0		3rd Qu.:0.0000
Max. :2023	Max. :12.00	Max. :31.0		Max. :1.0000

Table 5: 202312 Summary of Sunspot Numbers

g	s	w	see	method
Min. : 0.000	Min. : 0.00	Min. : 0.00	E:37476	Length:178290
1st Qu.: 1.000	1st Qu.: 1.00	1st Qu.: 11.00	G:73228	Class :character
Median : 2.000	Median : 10.00	Median : 37.00	F:52004	Mode :character
Mean : 3.208	Mean : 18.53	Mean : 50.61	P:14797	
3rd Qu.: 5.000	3rd Qu.: 28.00	3rd Qu.: 80.00	M: 785	
Max. :30.000	Max. :295.00	Max. :493.00		

Table 6: 202312 Summary of Sunspot Numbers

inst	filter	unit
Length:178290	Length:178290	Length:178290
Class :character	Class :character	Class :character
Mode :character	Mode :character	Mode :character

Table 7: 202312 Summary of Sunspot Numbers

aperture	eyep	foclen	mag
Min. : 0.00	Min. : 0.00	Min. : 0	Min. : 0.0
1st Qu.: 60.00	1st Qu.: 4.00	1st Qu.: 150	1st Qu.: 40.0
Median : 80.00	Median : 14.00	Median : 900	Median : 57.0
Mean : 93.52	Mean : 39.67	Mean : 890	Mean : 180.5
3rd Qu.: 104.00	3rd Qu.: 23.00	3rd Qu.:1200	3rd Qu.: 72.0
Max. :1524.00	Max. :2010.00	Max. :9990	Max. :4591.0

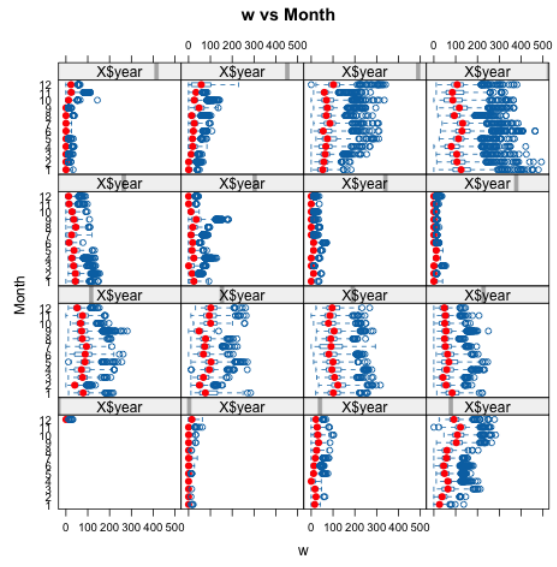
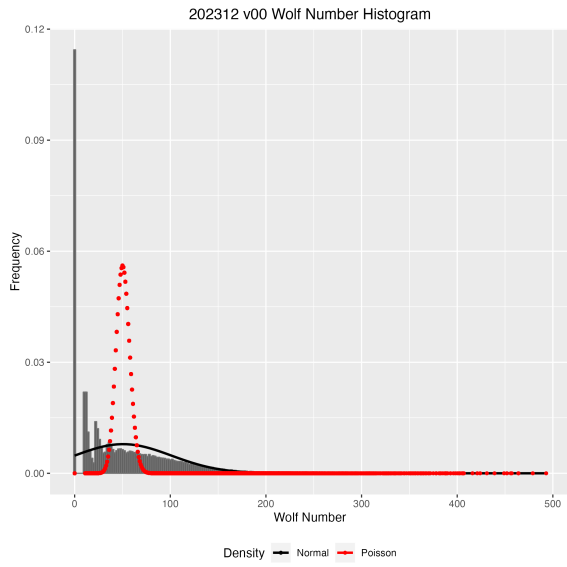


Figure 3: Box plots of raw Wolf number (w) by observer rank.

Figure 4: Box plots of raw Wolf number (w) by month and year.

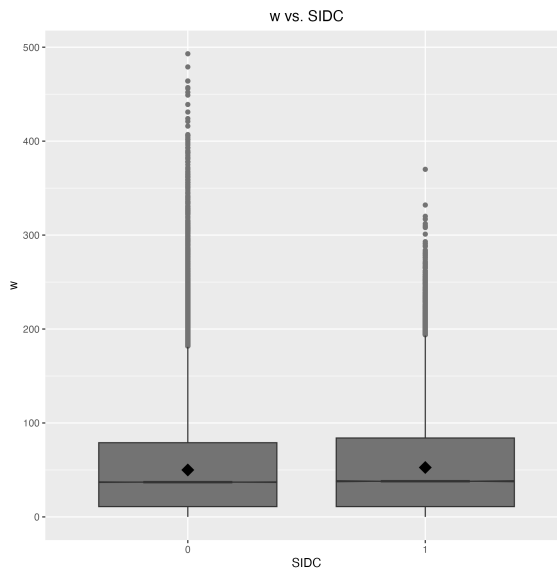
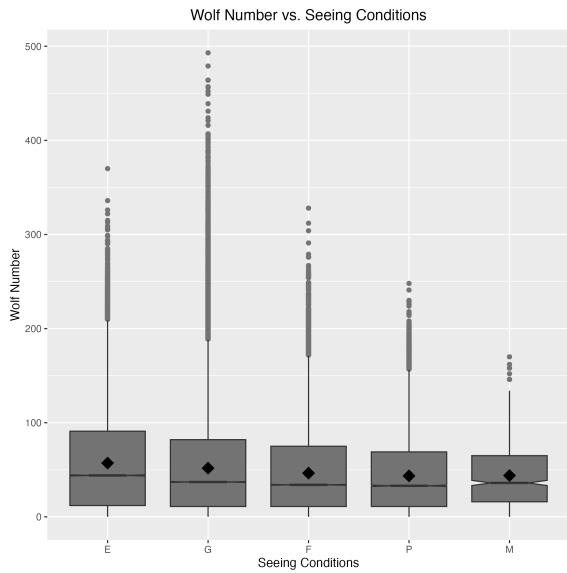


Figure 5: Box plots of raw Wolf number (w) by seeing condition.

Figure 6: Box plots of raw Wolf number (w) by organization.

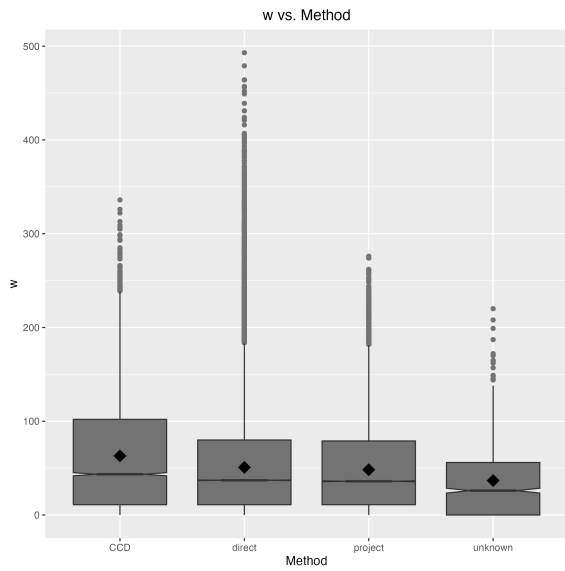


Figure 7: Box plots of raw Wolf number (w) by observer rank.

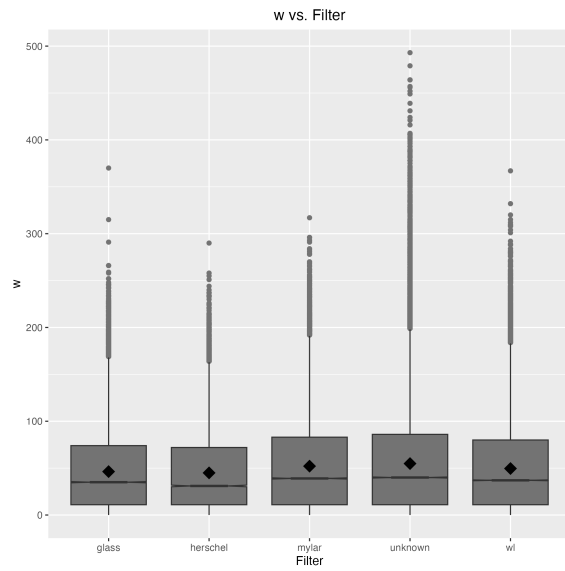


Figure 8: Box plots of raw Wolf number (w) by month and year.

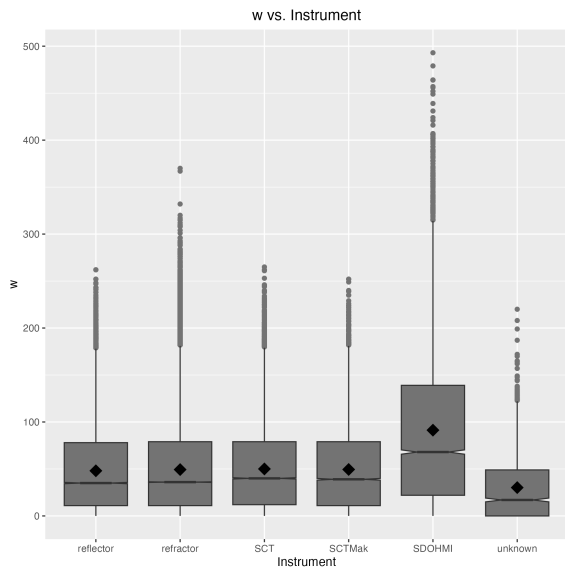


Figure 9: Box plots of raw Wolf number (w) by seeing condition.

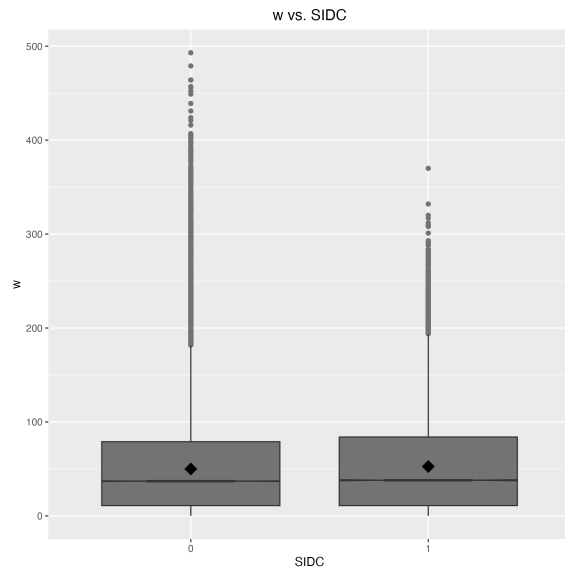


Figure 10: Box plots of raw Wolf number (w) by organization.

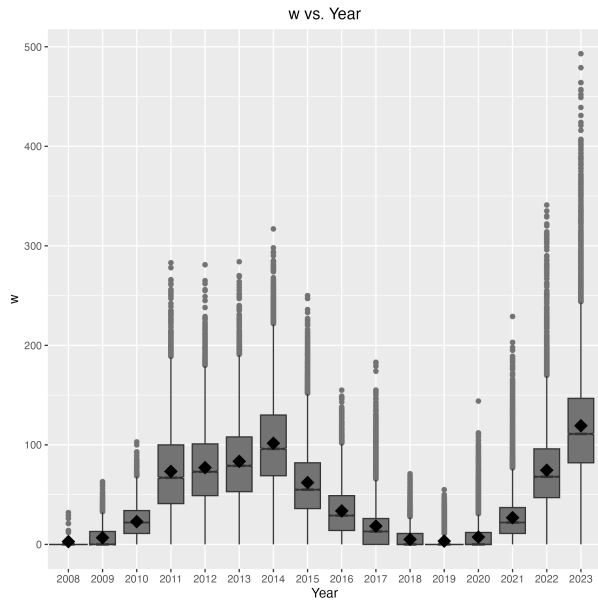


Figure 11: Box plots of raw Wolf number (w) by year.

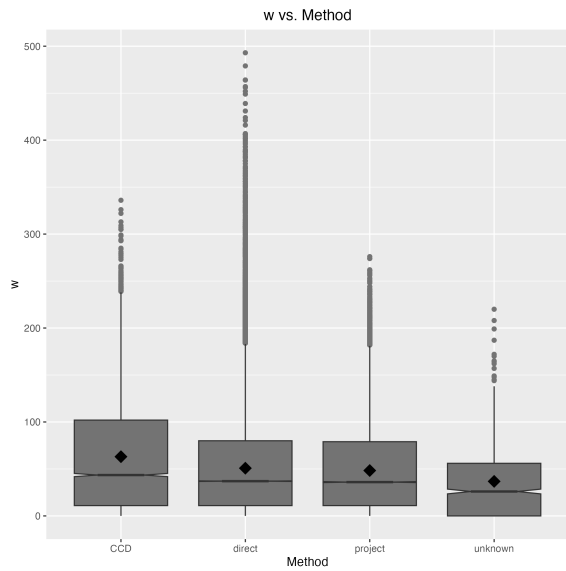


Figure 12: Box plots of raw Wolf number (w) by observing method.