Monthly Report (00)

202310 Data Set

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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.

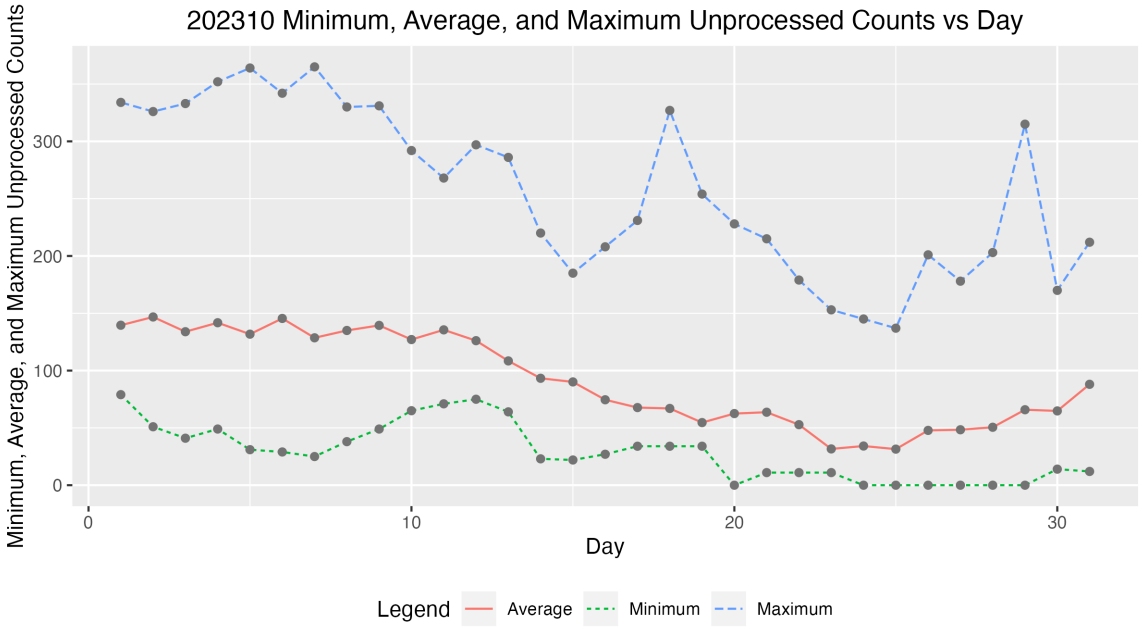

Figure 1: Raw average sunspot count by day of the month.

Table 1: 202310 Daily Raw Counts

Day	Submissions	Minimum	Average	Maximum
1.0000	43.0000	79.0000	139.5814	334.0000
2.0000	40.0000	51.0000	146.7750	326.0000
3.0000	38.0000	41.0000	133.9211	333.0000
4.0000	33.0000	49.0000	141.7576	352.0000
5.0000	36.0000	31.0000	131.7778	364.0000
6.0000	38.0000	29.0000	145.5000	342.0000
7.0000	38.0000	25.0000	128.6053	365.0000
8.0000	35.0000	38.0000	135.0000	330.0000
9.0000	37.0000	49.0000	139.4324	331.0000
10.0000	38.0000	65.0000	127.0789	292.0000
11.0000	32.0000	71.0000	135.5312	268.0000
12.0000	29.0000	75.0000	126.1034	297.0000
13.0000	32.0000	64.0000	108.4375	286.0000
14.0000	35.0000	23.0000	93.2857	220.0000
15.0000	38.0000	22.0000	90.1053	185.0000
16.0000	33.0000	27.0000	74.5455	208.0000
17.0000	30.0000	34.0000	67.7333	231.0000
18.0000	31.0000	34.0000	66.9677	327.0000
19.0000	30.0000	34.0000	54.6333	254.0000
20.0000	30.0000	0.0000	62.5000	228.0000
21.0000	31.0000	11.0000	63.6774	215.0000
22.0000	29.0000	11.0000	52.8276	179.0000
23.0000	31.0000	11.0000	31.6452	153.0000
24.0000	34.0000	0.0000	34.1765	145.0000
25.0000	36.0000	0.0000	31.4722	137.0000
26.0000	28.0000	0.0000	47.8214	201.0000
27.0000	34.0000	0.0000	48.3824	178.0000
28.0000	38.0000	0.0000	50.5526	203.0000
29.0000	25.0000	0.0000	65.8400	315.0000
30.0000	27.0000	14.0000	64.8148	170.0000
31.0000	31.0000	12.0000	88.0323	212.0000

3 Error Tables

Data are for the month of October 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 25^{th} through the 75^{th} quartiles. The lower and upper whiskers extend 1.5 times the IQR below the 25^{th} quartile, and 1.5 times the IQR above the 75^{th} 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	2.4255	3.1155	0.5000	1.0000
2009.01	5.2323	4.6930	5.7716	1.3000	1.3000
2009.02	4.6830	4.1853	5.1806	0.7000	1.2000
2009.03	6.0586	5.8364	6.2808	0.3000	0.6000
2009.04	6.5635	6.3468	6.7801	0.4000	1.2000
2009.05	6.9677	6.7083	7.2270	1.6000	2.9000
2009.06	6.9454	6.6173	7.2735	3.2000	6.3000
2009.07	6.5475	6.2927	6.8024	3.6000	5.5000
2009.08	6.5165	6.2844	6.7485	0.0000	0.0000
2009.09	7.2411	7.0011	7.4811	4.5000	7.1000
2009.10	6.5351	6.2032	6.8670	4.5000	7.7000
2009.11	6.8610	6.6641	7.0580	3.3000	6.9000
2009.12	7.3203	7.0980	7.5425	10.4000	16.3000
2010.01	19.8534	17.7112	21.9957	13.3000	19.5000
2010.02	16.0498	13.9872	18.1124	19.4000	28.5000

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

ym	Ra	lci99	uci99	aavso	sidc
2010.03	17.7516	15.6544	19.8488	15.4000	24.0000
2010.04	18.8529	16.7384	20.9674	7.0000	10.4000
2010.05	23.0880	22.6484	23.5275	8.4000	8.7000
2010.06	21.6856	21.2819	22.0894	11.0000	13.6000
2010.07	22.3717	21.9956	22.7478	15.2000	16.1000
2010.08	21.4081	21.0016	21.8147	18.3000	19.6000
2010.09	24.8991	24.4238	25.3743	22.8000	25.2000
2010.10	22.8586	22.3930	23.3242	21.0000	23.5000
2010.11	24.2940	23.8113	24.7766	20.9000	21.6000
2010.12	25.0354	24.4852	25.5856	13.9000	14.5000
2011.01	71.1468	69.5720	72.7216	17.7000	18.7000
2011.02	62.6246	61.1729	64.0762	29.1000	29.6000
2011.03	66.8275	65.4284	68.2266	48.0000	55.8000
2011.04	72.5013	70.9713	74.0313	47.3000	54.4000
2011.05	76.7208	75.2530	78.1886	37.3000	41.5000
2011.06	71.6196	70.2283	73.0108	35.2000	37.0000
2011.07	72.7990	71.4577	74.1403	41.5000	43.8000
2011.08	70.3841	69.1430	71.6251	42.4000	50.5000
2011.09	80.9643	79.4024	82.5262	73.8000	78.0000
2011.10	74.0530	72.6758	75.4302	78.9000	88.0000
2011.11	78.8449	77.1380	80.5518	84.6000	96.7000
2011.12	79.5254	77.8284	81.2224	65.8000	73.0000
2012.01	76.5042	74.9175	78.0908	55.8000	58.2000
2012.02	66.3364	64.8986	67.7743	29.2000	33.1000
2012.03	71.2561	69.9265	72.5857	53.1000	64.1000
2012.04	75.6271	74.1684	77.0857	51.4000	55.2000
2012.05	81.9888	80.5018	83.4757	61.8000	69.0000
2012.06	76.1040	74.7050	77.5030	59.7000	64.5000
2012.07	78.0649	76.6679	79.4619	64.2000	51.3000
2012.08	72.6099	71.3285	73.8913	57.7000	63.1000
2012.09	83.7138	82.1731	85.2545	57.7000	61.5000
2012.10	77.5433	76.0323	79.0543	48.3000	53.3000
2012.11	82.8879	81.1475	84.6282	56.7000	61.4000
2012.12	83.4240	81.5603	85.2876	37.4000	40.8000
2013.01	84.7521	83.0590	86.4452	63.8000	62.9000
2013.02	73.5907	72.0245	75.1569	37.8000	38.0000
2013.03	76.6817	75.0481	78.3153	50.6000	57.9000
2013.04	82.4280	80.8754	83.9805	70.6000	72.4000
2013.05	87.2540	85.5658	88.9422	77.4000	78.7000

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

ym	Ra	lci99	uci99	aavso	sidc
2013.06	82.6670	81.0679	84.2661	51.0000	52.5000
2013.07	83.8287	82.3481	85.3092	57.0000	57.0000
2013.08	79.6591	78.2650	81.0531	60.0000	66.0000
2013.09	90.2973	88.5830	92.0115	34.6000	36.9000
2013.10	82.5111	80.8878	84.1345	74.5000	85.6000
2013.11	86.9607	84.8834	89.0380	73.9000	77.6000
2013.12	89.9455	87.9673	91.9238	77.8000	90.3000
2014.01	99.1029	96.9391	101.2666	77.4000	82.0000
2014.02	87.9496	86.0864	89.8129	93.9000	102.8000
2014.03	93.6600	91.8524	95.4676	80.9000	92.2000
2014.04	100.7904	98.8888	102.6921	76.9000	84.7000
2014.05	107.2633	105.3131	109.2135	72.3000	75.2000
2014.06	101.4870	99.6201	103.3539	67.2000	71.0000
2014.07	102.4754	100.6143	104.3365	72.5000	72.5000
2014.08	97.4253	95.7857	99.0649	71.2000	74.7000
2014.09	111.7397	109.6162	113.8632	83.2000	87.6000
2014.10	101.5660	99.5993	103.5326	59.5000	60.6000
2014.11	108.0250	105.6473	110.4027	65.8000	71.1000
2014.12	109.0119	106.4582	111.5656	75.8000	78.0000
2015.01	61.2466	59.9910	62.5022	65.9000	67.0000
2015.02	53.2130	51.9563	54.4697	42.4000	44.8000
2015.03	57.4778	56.3670	58.5886	38.0000	38.4000
2015.04	61.5304	60.3415	62.7192	49.0000	54.4000
2015.05	65.4537	64.3016	66.6058	56.3000	58.8000
2015.06	61.4369	60.3098	62.5641	50.2000	68.3000
2015.07	61.3822	60.3387	62.4258	47.9000	65.8000
2015.08	59.5474	58.5467	60.5482	39.5000	57.2000
2015.09	67.6487	66.4161	68.8812	49.2000	72.1000
2015.10	61.9222	60.7247	63.1197	39.3000	48.3000
2015.11	66.4169	64.9552	67.8786	39.6000	55.9000
2015.12	67.7652	66.2460	69.2843	36.4000	44.8000
2016.01	33.5125	32.8080	34.2170	33.7000	43.3000
2016.02	29.0811	28.4701	29.6922	38.3000	46.8000
2016.03	30.9611	30.3366	31.5857	30.5000	38.9000
2016.04	32.9060	32.2731	33.5390	26.6000	30.9000
2016.05	35.1742	34.5294	35.8190	33.7000	48.4000
2016.06	32.8055	32.2421	33.3688	13.1000	19.5000
2016.07	33.4942	32.9532	34.0353	21.2000	27.5000
2016.08	32.0730	31.5049	32.6411	33.0000	47.9000

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

ym	Ra	lci99	uci99	aavso	sidc
2016.09	37.2572	36.5732	37.9412	27.7000	37.1000
2016.10	33.8245	33.1701	34.4790	22.7000	31.7000
2016.11	35.8926	35.1401	36.6450	14.0000	22.2000
2016.12	37.0627	36.2634	37.8619	11.1000	20.0000
2017.01	18.0562	17.6729	18.4394	18.4000	26.2000
2017.02	15.7305	15.3819	16.0792	14.4000	20.6000
2017.03	16.8576	16.5329	17.1823	11.3000	15.5000
2017.04	18.0997	17.7778	18.4216	21.6000	33.2000
2017.05	19.1034	18.7708	19.4360	12.5000	18.1000
2017.06	17.7725	17.4766	18.0685	15.5000	19.3000
2017.07	18.2163	17.9237	18.5089	11.5000	16.3000
2017.08	17.4239	17.1193	17.7286	22.8000	35.7000
2017.09	20.5463	20.1142	20.9785	34.6000	42.9000
2017.10	18.1443	17.7719	18.5167	10.5000	11.0000
2017.11	19.1634	18.7573	19.5694	4.2000	5.6000
2017.12	19.6854	19.3850	19.9857	4.0000	4.6000
2018.01	5.0289	4.9209	5.1369	3.1000	6.3000
2018.02	4.3399	4.2348	4.4450	6.8000	11.8000
2018.03	4.5817	4.4893	4.6740	1.1000	1.2000
2018.04	4.8618	4.7642	4.9595	4.7000	7.5000
2018.05	5.2053	5.1085	5.3021	8.4000	14.0000
2018.06	4.8642	4.7786	4.9498	10.2000	13.6000
2018.07	4.9990	4.9432	5.0547	0.5000	1.7000
2018.08	4.7229	4.6422	4.8036	5.9000	9.5000
2018.09	5.3710	5.2708	5.4711	1.6000	2.9000
2018.10	4.9984	4.9013	5.0954	2.5000	5.6000
2018.11	5.2851	5.1750	5.3952	3.1000	4.2000
2018.12	5.5233	5.4160	5.6306	1.6000	2.3000
2019.01	3.3430	3.2795	3.4064	5.4000	2.3000
2019.02	2.9398	2.8818	2.9978	0.1000	1.2000
2019.03	3.0734	3.0212	3.1256	6.1000	12.1000
2019.04	3.3016	3.2397	3.3636	6.2000	9.3000
2019.05	3.4241	3.3647	3.4835	7.0000	11.9000
2019.06	3.2158	3.1617	3.2698	0.7000	1.5000
2019.07	3.2937	3.2451	3.3423	0.4000	2.2000
2019.08	3.1613	3.1147	3.2080	0.3000	0.8000
2019.09	3.6692	3.6118	3.7265	0.5000	1.0000
2019.10	3.3155	3.2595	3.3714	0.2000	0.5000
2019.11	3.5884	3.5197	3.6571	0.3000	0.6000

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

ym	Ra	lci99	uci99	aavso	sidc
2019.12	3.6570	3.5840	3.7299	0.8000	1.0000
2020.01	7.3962	7.2520	7.5404	4.0000	5.3000
2020.02	6.4455	6.3167	6.5743	0.1000	0.0000
2020.03	6.7956	6.6692	6.9221	1.2000	1.5000
2020.04	7.3493	7.2299	7.4687	3.0000	5.1000
2020.05	7.6811	7.5626	7.7996	0.1000	0.4000
2020.06	7.2573	7.1464	7.3683	3.9000	6.4000
2020.07	7.3286	7.2210	7.4363	4.2000	7.7000
2020.08	6.9343	6.8385	7.0301	5.3000	7.8000
2020.09	8.0156	7.8870	8.1441	0.4000	0.9000
2020.10	7.4132	7.2912	7.5352	9.9000	13.6000
2020.11	7.9271	7.7975	8.0568	21.2000	33.1000
2020.12	8.1090	7.9627	8.2552	15.4000	19.8000
2021.01	25.7795	25.3191	26.2399	7.0000	15.8000
2021.02	22.8968	22.4929	23.3007	5.8000	10.7000
2021.03	24.2940	23.9124	24.6756	11.0000	17.2000
2021.04	26.4340	25.9649	26.9031	18.5000	28.8000
2021.05	27.9409	27.4891	28.3926	15.9000	22.9000
2021.06	26.2257	25.7935	26.6580	19.9000	24.1000
2021.07	26.3949	25.9454	26.8444	23.8000	35.6000
2021.08	25.7891	25.3549	26.2234	15.7000	19.5000
2021.09	29.4935	28.9764	30.0105	39.1000	52.5000
2021.10	27.6053	27.1091	28.1015	27.1000	37.0000
2021.11	29.0840	28.5403	29.6278	27.2000	35.1000
2021.12	30.6049	29.9719	31.2380	50.6000	69.0000
2022.01	73.6440	72.2721	75.0159	43.9000	62.0000
2022.02	65.0217	63.7690	66.2743	48.8000	60.5000
2022.03	69.7405	68.4112	71.0698	58.4000	80.6000
2022.04	72.3566	71.1302	73.5830	59.1000	83.9000
2022.05	79.1023	77.7826	80.4220	72.5000	0.4000
2022.06	72.1466	70.9691	73.3241	58.9000	0.4000
2022.07	74.6252	73.3550	75.8955	76.7000	102.5000
2022.08	71.5050	70.3219	72.6881	63.3000	86.0000
2022.09	81.7937	80.2212	83.3663	72.6000	94.5000
2022.10	75.1419	73.7615	76.5222	66.4000	112.1000
2022.11	79.5992	78.0011	81.1973	54.3000	82.1000
2022.12	82.1769	80.3218	84.0320	93.7000	165.0000
2023.01	125.4992	122.6767	128.3218	112.9000	173.8000
2023.02	108.0464	105.6916	110.4013	89.6000	152.3000

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

ym	Ra	lci99	uci99	aavso	sidc
2023.03	112.1730	109.7735	114.5724	85.0000	126.8000
2023.04	120.4541	118.0773	122.8310	72.1000	114.3000
2023.05	128.0908	125.5372	130.6445	105.0000	140.0000
2023.06	121.7752	120.3967	123.1537	118.5000	173.0000
2023.07	120.3143	118.0773	122.5514	124.7000	161.2000
2023.08	115.1295	112.9364	117.3226	90.6000	132.5000
2023.09	133.3777	130.7228	136.0325	110.4000	156.8000
2023.10	122.6267	119.9150	125.3383	78.4000	119.6000

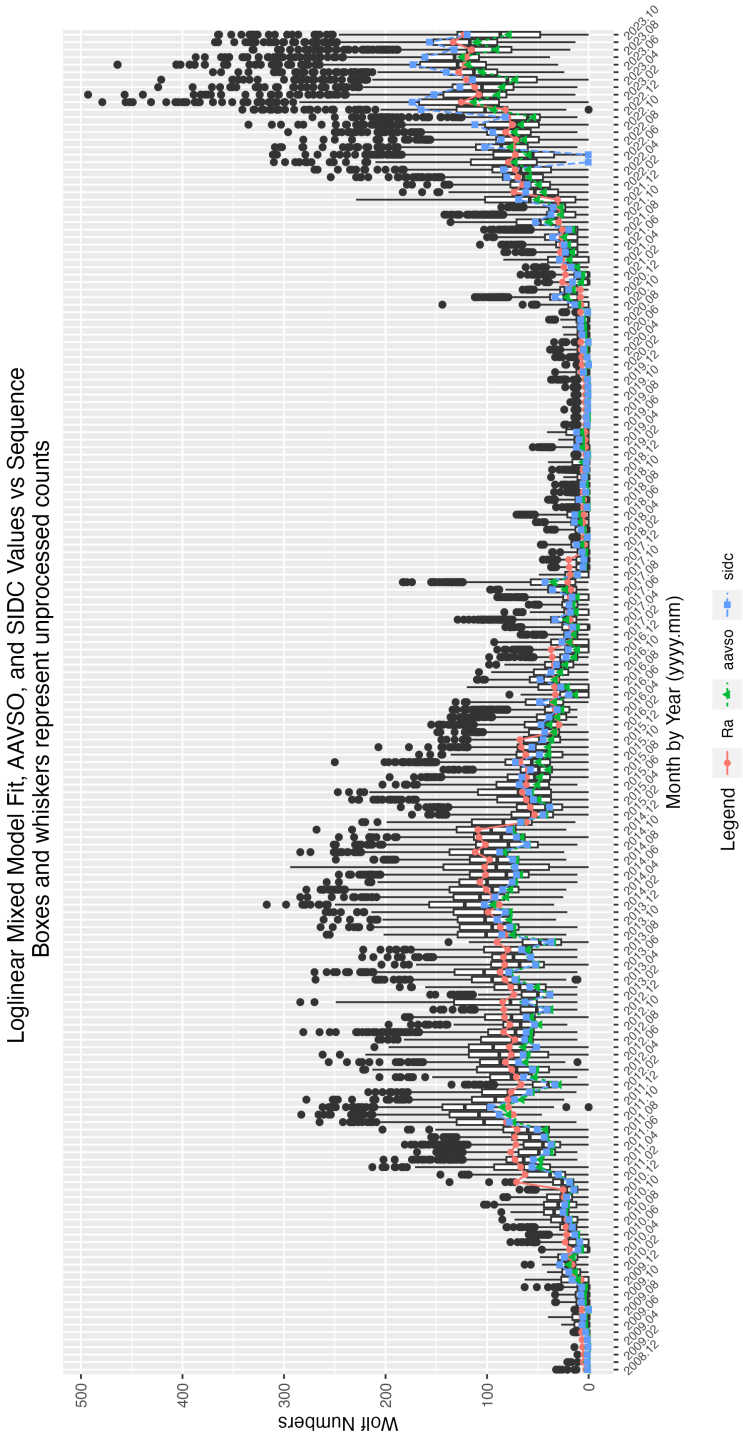

Figure 2: GLMM fitted data for R_a. AAVSO data: https://www.aavso.org/category/tags/solar-bulletin. SILSO data: WDC-SILSO, Royal Observatory of Belgium, Brussels

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 contribution to both institutions tend to differ from those observers contributing only to the AAVSO.

5 Supporting Information

Table 3: 202310 Parameter Estimates

	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	1.1826	0.3151	3.7534	0.0002
seeG	-0.1109	0.0042	-26.2387	0.0000
seeF	-0.2279	0.0048	-46.9897	0.0000
seeP	-0.3203	0.0070	-45.7359	0.0000
seeM	-0.1872	0.0243	-7.7102	0.0000
sidc1	0.0502	0.0108	4.6334	0.0000
year2009	0.7637	0.3166	2.4124	0.0159
year2010	2.0016	0.3144	6.3665	0.0000
year2011	3.1504	0.3143	10.0236	0.0000
year2012	3.1935	0.3143	10.1609	0.0000
year2013	3.2882	0.3143	10.4624	0.0000
year2014	3.4876	0.3143	11.0970	0.0000
year2015	3.0081	0.3143	9.5708	0.0000
year2016	2.3924	0.3143	7.6111	0.0000
year2017	1.7791	0.3144	5.6593	0.0000
year2018	0.4951	0.3147	1.5734	0.1156
year2019	0.0853	0.3149	0.2709	0.7865
year2020	0.8912	0.3145	2.8336	0.0046
year2021	2.1714	0.3143	6.9078	0.0000
year2022	3.1665	0.3143	10.0748	0.0000
year2023	3.6740	0.3143	11.6893	0.0000
mon2	-0.1335	0.0077	-17.3491	0.0000
mon3	-0.0758	0.0073	-10.4247	0.0000
mon4	-0.0164	0.0071	-2.3237	0.0201
mon5	0.0393	0.0069	5.7305	0.0000
mon6	-0.0262	0.0067	-3.9291	0.0001
mon7	-0.0156	0.0069	-2.2755	0.0229
mon8	-0.0581	0.0069	-8.4359	0.0000
mon9	0.0890	0.0069	12.9774	0.0000
mon10	0.0022	0.0071	0.3151	0.7527
mon11	0.0776	0.0076	10.1799	0.0000
mon12	0.1056	0.0076	13.9109	0.0000

Table 4: 202310 Summary of Sunspot Numbers

year	mon	day	obs	sidc
Min. :2008	Min. : 1.00	Min. : 0.0	Length:176497	Min. :0.0000
1st Qu.:2013	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 : 6.58	Mean :15.7		Mean :0.2394
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: 202310 Summary of Sunspot Numbers

g	s	w	see	method
Min. : 0.000	Min. : 0.00	Min. : 0.00	E:37138	Length:176497
1st Qu.: 1.000	1st Qu.: 1.00	1st Qu.: 11.00	G:72496	Class :character
Median : 2.000	Median : 10.00	Median : 37.00	F:51515	Mode :character
Mean : 3.169	Mean : 18.36	Mean : 50.05	P:14563	
3rd Qu.: 5.000	3rd Qu.: 27.00	3rd Qu.: 80.00	M: 785	
Max. :30.000	Max. :295.00	Max. :493.00		

Table 6: 202310 Summary of Sunspot Numbers

inst	filter	unit
Length:176497	Length:176497	Length:176497
Class :character	Class :character	Class :character
Mode :character	Mode :character	Mode :character

Table 7: 202310 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 : 93.31	Mean : 39.29	Mean : 890	Mean : 180.3
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

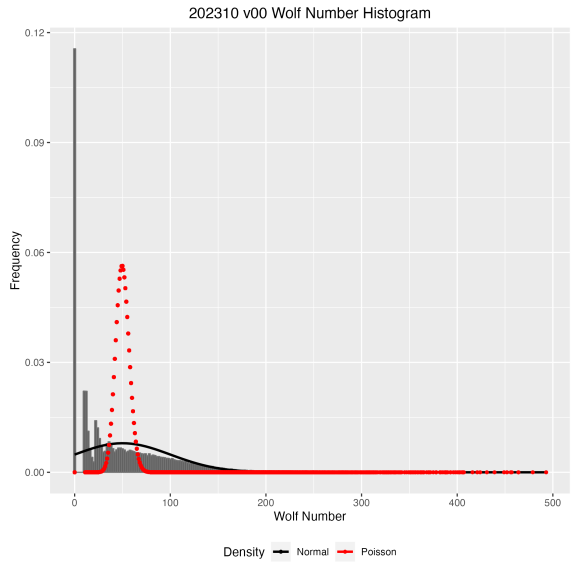

Figure 3: Box plots of raw Wolf number (w) by observer rank.

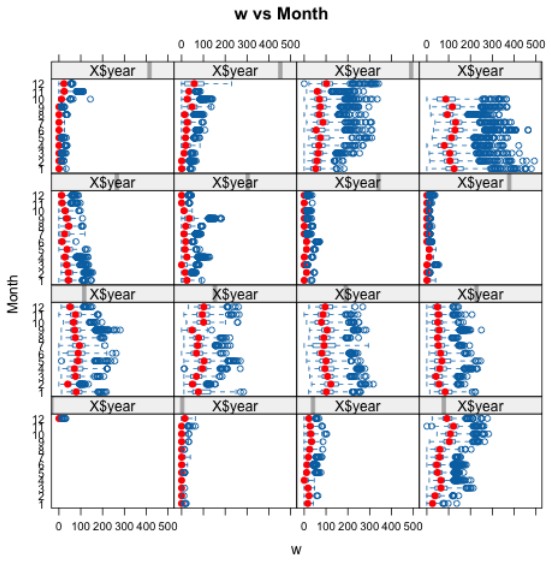

Figure 4: Box plots of raw Wolf number (w) by month and year.

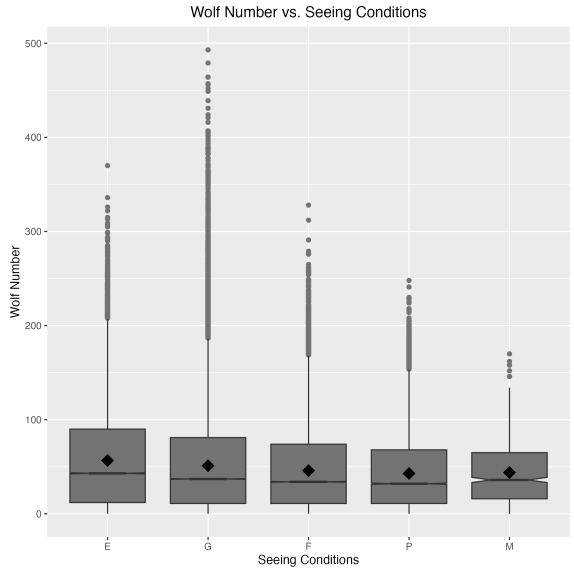

Figure 5: Box plots of raw Wolf number (w) by seeing condition.

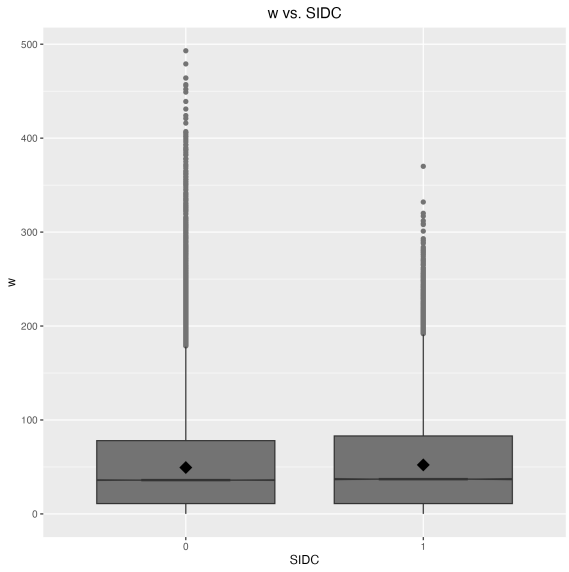

Figure 6: Box plots of raw Wolf number (w) by organization.

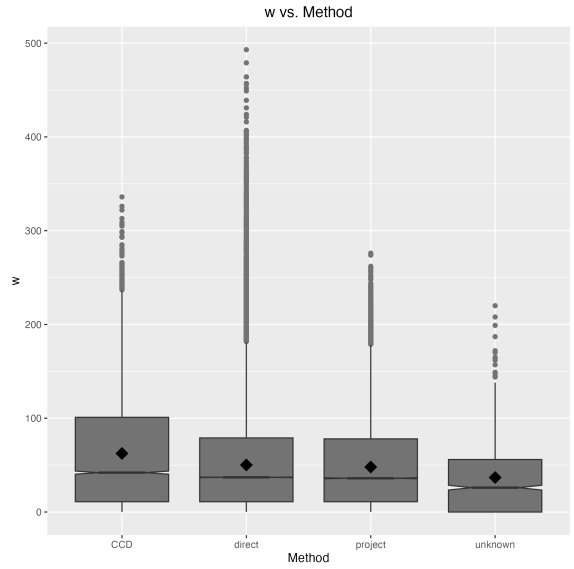

Figure 7: Box plots of raw Wolf number (w) by observer rank.

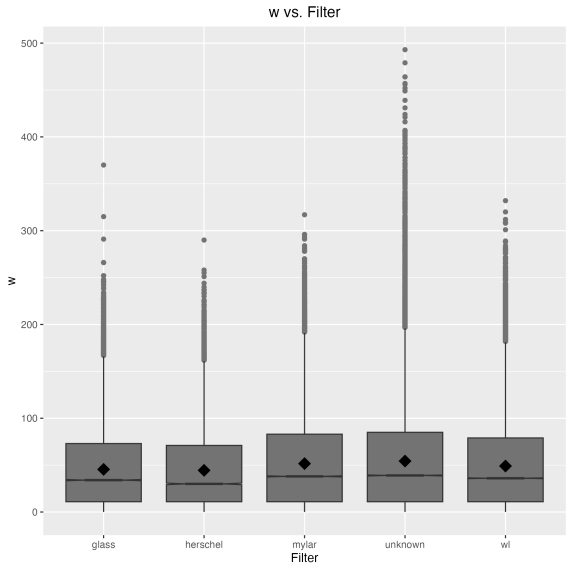

Figure 8: Box plots of raw Wolf number (w) by month and year.

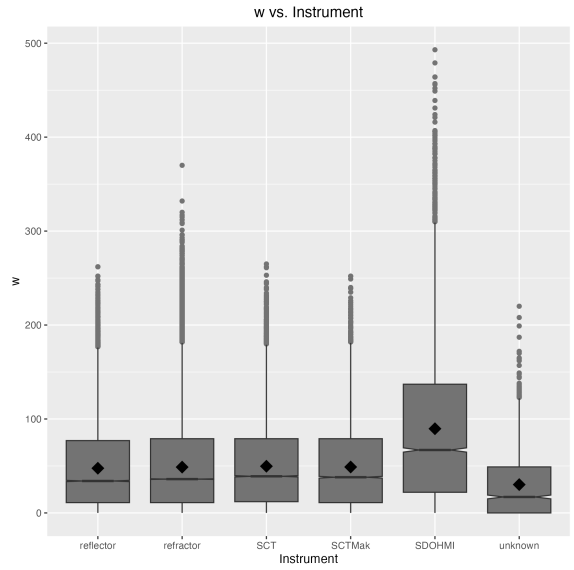

Figure 9: Box plots of raw Wolf number (w) by seeing condition.

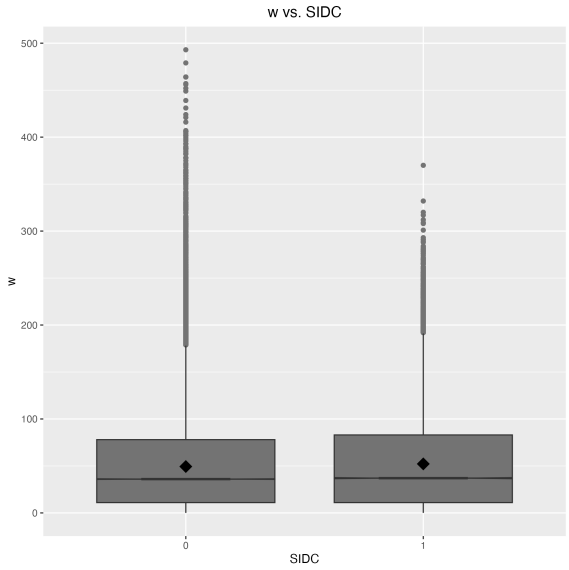

Figure 10: Box plots of raw Wolf number (w) by organization.

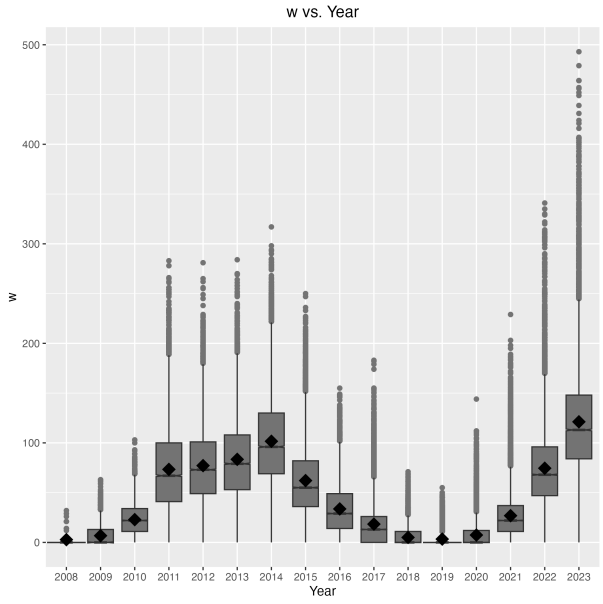

Figure 11: Box plots of raw Wolf number (w) by year.

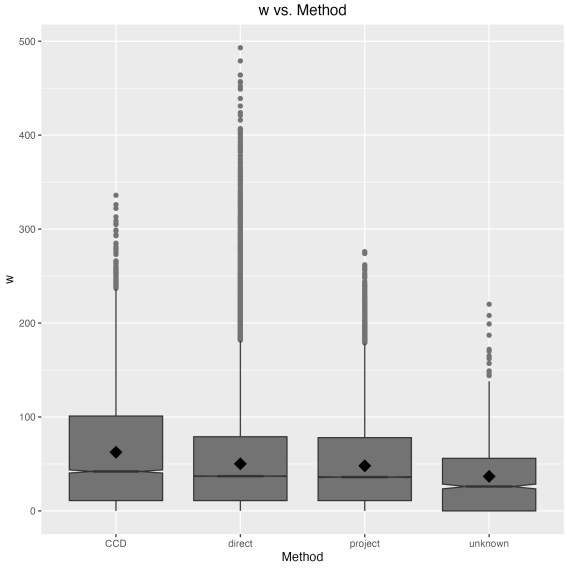

Figure 12: Box plots of raw Wolf number (w) by observing method.