Monthly Report (00)

202412 Data Set

Monday 13th January, 2025

Prepared for

Statistics for Physical and Engineering Sciences

by

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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.

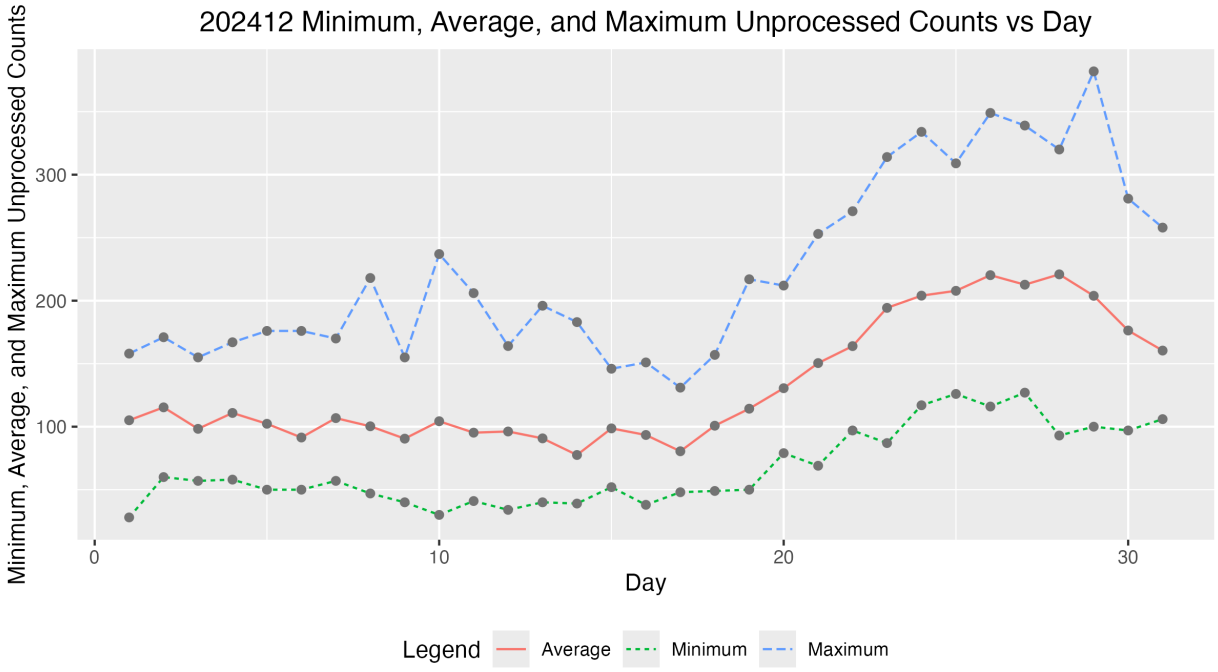

Figure 1: Raw average sunspot count by day of the month.

Table 1: 202412 Daily Raw Counts

Day	Submissions	Minimum	Average	Maximum
1.0000	29.0000	28.0000	105.1034	158.0000
2.0000	26.0000	60.0000	115.3462	171.0000
3.0000	23.0000	57.0000	98.3043	155.0000
4.0000	21.0000	58.0000	110.9048	167.0000
5.0000	26.0000	50.0000	102.3077	176.0000
6.0000	22.0000	50.0000	91.4091	176.0000
7.0000	17.0000	57.0000	106.8235	170.0000
8.0000	19.0000	47.0000	100.3158	218.0000
9.0000	14.0000	40.0000	90.5000	155.0000
10.0000	15.0000	30.0000	104.3333	237.0000
11.0000	16.0000	41.0000	95.2500	206.0000
12.0000	26.0000	34.0000	96.1923	164.0000
13.0000	19.0000	40.0000	90.7368	196.0000
14.0000	22.0000	39.0000	77.5455	183.0000
15.0000	20.0000	52.0000	98.6500	146.0000
16.0000	24.0000	38.0000	93.4167	151.0000
17.0000	24.0000	48.0000	80.5000	131.0000
18.0000	24.0000	49.0000	100.7917	157.0000
19.0000	25.0000	50.0000	114.2800	217.0000
20.0000	22.0000	79.0000	130.5455	212.0000
21.0000	23.0000	69.0000	150.4783	253.0000
22.0000	18.0000	97.0000	163.9444	271.0000
23.0000	20.0000	87.0000	194.3000	314.0000
24.0000	15.0000	117.0000	204.0000	334.0000
25.0000	18.0000	126.0000	207.8333	309.0000
26.0000	19.0000	116.0000	220.2632	349.0000
27.0000	23.0000	127.0000	212.6957	339.0000
28.0000	21.0000	93.0000	220.9048	320.0000
29.0000	24.0000	100.0000	203.8750	382.0000
30.0000	21.0000	97.0000	176.3333	281.0000
31.0000	27.0000	106.0000	160.4074	258.0000

3 Error Tables

Data are for the month of December 2024. 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	2.4301	3.1109	0.5000	1.0000
2009.01	5.2910	4.7524	5.8297	1.3000	1.3000
2009.02	4.7571	4.2567	5.2576	0.7000	1.2000
2009.03	6.0024	5.7822	6.2226	0.3000	0.6000
2009.04	6.6534	6.4345	6.8723	0.4000	1.2000
2009.05	7.1350	6.8737	7.3963	1.6000	2.9000
2009.06	7.1948	6.8626	7.5271	3.2000	6.3000
2009.07	6.9743	6.7038	7.2448	3.6000	5.5000
2009.08	7.0795	6.8353	7.3237	0.0000	0.0000
2009.09	7.2759	7.0357	7.5161	4.5000	7.1000
2009.10	6.7362	6.3954	7.0771	4.5000	7.7000
2009.11	6.6805	6.4851	6.8758	3.3000	6.9000
2009.12	7.2378	7.0132	7.4623	10.4000	16.3000
2010.01	19.5556	17.4715	21.6397	13.3000	19.5000
2010.02	15.8915	13.8763	17.9066	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	17.2068	15.2042	19.2095	15.4000	24.0000
2010.04	18.7123	16.6443	20.7804	7.0000	10.4000
2010.05	22.9565	22.5112	23.4017	8.4000	8.7000
2010.06	21.9243	21.5062	22.3423	11.0000	13.6000
2010.07	23.1342	22.7353	23.5330	15.2000	16.1000
2010.08	22.5893	22.1467	23.0319	18.3000	19.6000
2010.09	24.3167	23.8387	24.7948	22.8000	25.2000
2010.10	22.9055	22.4223	23.3886	21.0000	23.5000
2010.11	23.0105	22.5388	23.4823	20.9000	21.6000
2010.12	24.1231	23.5767	24.6695	13.9000	14.5000
2011.01	70.1655	68.5665	71.7645	17.7000	18.7000
2011.02	62.0507	60.5736	63.5278	29.1000	29.6000
2011.03	64.7874	63.3967	66.1781	48.0000	55.8000
2011.04	71.9527	70.3939	73.5115	47.3000	54.4000
2011.05	76.7752	75.2670	78.2833	37.3000	41.5000
2011.06	72.7033	71.2522	74.1544	35.2000	37.0000
2011.07	75.6684	74.2387	77.0981	41.5000	43.8000
2011.08	74.5843	73.2344	75.9343	42.4000	50.5000
2011.09	79.5317	77.9574	81.1061	73.8000	78.0000
2011.10	74.5518	73.1272	75.9764	78.9000	88.0000
2011.11	75.0441	73.3846	76.7037	84.6000	96.7000
2011.12	76.8130	75.1400	78.4859	65.8000	73.0000
2012.01	75.3971	73.7985	76.9957	55.8000	58.2000
2012.02	65.6883	64.2310	67.1456	29.2000	33.1000
2012.03	69.0456	67.7329	70.3583	53.1000	64.1000
2012.04	75.0522	73.5743	76.5302	51.4000	55.2000
2012.05	82.0574	80.5335	83.5814	61.8000	69.0000
2012.06	77.4041	75.9455	78.8627	59.7000	64.5000
2012.07	81.2639	79.7719	82.7559	64.2000	51.3000
2012.08	77.0552	75.6660	78.4444	57.7000	63.1000
2012.09	82.2775	80.7311	83.8239	57.7000	61.5000
2012.10	78.1908	76.6363	79.7452	48.3000	53.3000
2012.11	78.9964	77.3057	80.6872	56.7000	61.4000
2012.12	80.7322	78.8990	82.5653	37.4000	40.8000
2013.01	83.3826	81.6849	85.0802	63.8000	62.9000
2013.02	72.8165	71.2302	74.4028	37.8000	38.0000
2013.03	74.2742	72.6670	75.8815	50.6000	57.9000
2013.04	81.7144	80.1517	83.2772	70.6000	72.4000
2013.05	87.2538	85.5327	88.9749	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	84.0195	82.3596	85.6795	51.0000	52.5000
2013.07	87.2722	85.6976	88.8469	57.0000	57.0000
2013.08	84.5646	83.0541	86.0750	60.0000	66.0000
2013.09	88.7854	87.0671	90.5037	34.6000	36.9000
2013.10	83.1874	81.5173	84.8575	74.5000	85.6000
2013.11	82.8927	80.8737	84.9117	73.9000	77.6000
2013.12	87.0127	85.0714	88.9541	77.8000	90.3000
2014.01	97.5791	95.4156	99.7427	77.4000	82.0000
2014.02	87.0100	85.1247	88.8954	93.9000	102.8000
2014.03	90.7203	88.9414	92.4991	80.9000	92.2000
2014.04	99.9174	97.9963	101.8386	76.9000	84.7000
2014.05	107.3180	105.3328	109.3031	72.3000	75.2000
2014.06	103.1577	101.2163	105.0991	67.2000	71.0000
2014.07	106.6853	104.7071	108.6636	72.5000	72.5000
2014.08	103.3930	101.6174	105.1686	71.2000	74.7000
2014.09	109.8096	107.6783	111.9410	83.2000	87.6000
2014.10	102.3508	100.3311	104.3706	59.5000	60.6000
2014.11	102.9221	100.6107	105.2335	65.8000	71.1000
2014.12	105.4022	102.8988	107.9057	75.8000	78.0000
2015.01	60.4030	59.1456	61.6604	65.9000	67.0000
2015.02	52.7655	51.4905	54.0405	42.4000	44.8000
2015.03	55.7968	54.6977	56.8959	38.0000	38.4000
2015.04	61.1267	59.9205	62.3328	49.0000	54.4000
2015.05	65.5652	64.3871	66.7432	56.3000	58.8000
2015.06	62.4892	61.3256	63.6529	50.2000	68.3000
2015.07	63.9492	62.8480	65.0503	47.9000	65.8000
2015.08	63.2237	62.1480	64.2995	39.5000	57.2000
2015.09	66.5424	65.3165	67.7684	49.2000	72.1000
2015.10	62.4881	61.2661	63.7102	39.3000	48.3000
2015.11	63.2905	61.8822	64.6989	39.6000	55.9000
2015.12	65.6080	64.1246	67.0915	36.4000	44.8000
2016.01	33.0354	32.3304	33.7404	33.7000	43.3000
2016.02	28.8043	28.1902	29.4185	38.3000	46.8000
2016.03	30.0477	29.4342	30.6612	30.5000	38.9000
2016.04	32.6562	32.0204	33.2921	26.6000	30.9000
2016.05	35.2057	34.5541	35.8573	33.7000	48.4000
2016.06	33.3656	32.7875	33.9436	13.1000	19.5000
2016.07	34.9032	34.3336	35.4728	21.2000	27.5000
2016.08	34.0511	33.4418	34.6605	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	36.6187	35.9383	37.2991	27.7000	37.1000
2016.10	34.1196	33.4506	34.7887	22.7000	31.7000
2016.11	34.1991	33.4726	34.9256	14.0000	22.2000
2016.12	35.8521	35.0693	36.6350	11.1000	20.0000
2017.01	17.8308	17.4479	18.2137	18.4000	26.2000
2017.02	15.6232	15.2716	15.9749	14.4000	20.6000
2017.03	16.3858	16.0662	16.7055	11.3000	15.5000
2017.04	17.9969	17.6730	18.3207	21.6000	33.2000
2017.05	19.1787	18.8409	19.5166	12.5000	18.1000
2017.06	18.1291	17.8250	18.4333	15.5000	19.3000
2017.07	19.0329	18.7243	19.3416	11.5000	16.3000
2017.08	18.5677	18.2403	18.8951	22.8000	35.7000
2017.09	20.2465	19.8179	20.6750	34.6000	42.9000
2017.10	18.3479	17.9687	18.7270	10.5000	11.0000
2017.11	18.3202	17.9284	18.7120	4.2000	5.6000
2017.12	19.1128	18.8187	19.4070	4.0000	4.6000
2018.01	4.9287	4.8215	5.0359	3.1000	6.3000
2018.02	4.2734	4.1691	4.3776	6.8000	11.8000
2018.03	4.4266	4.3365	4.5168	1.1000	1.2000
2018.04	4.8037	4.7062	4.9013	4.7000	7.5000
2018.05	5.1909	5.0936	5.2881	8.4000	14.0000
2018.06	4.9289	4.8412	5.0166	10.2000	13.6000
2018.07	5.1894	5.1314	5.2475	0.5000	1.7000
2018.08	4.9964	4.9109	5.0819	5.9000	9.5000
2018.09	5.2613	5.1631	5.3596	1.6000	2.9000
2018.10	5.0157	4.9180	5.1134	2.5000	5.6000
2018.11	5.0110	4.9056	5.1164	3.1000	4.2000
2018.12	5.3194	5.2152	5.4236	1.6000	2.3000
2019.01	3.2923	3.2290	3.3555	5.4000	2.3000
2019.02	2.9081	2.8502	2.9661	0.1000	1.2000
2019.03	2.9804	2.9294	3.0313	6.1000	12.1000
2019.04	3.2764	3.2149	3.3380	6.2000	9.3000
2019.05	3.4292	3.3695	3.4889	7.0000	11.9000
2019.06	3.2745	3.2193	3.3298	0.7000	1.5000
2019.07	3.4358	3.3847	3.4868	0.4000	2.2000
2019.08	3.3579	3.3082	3.4076	0.3000	0.8000
2019.09	3.6071	3.5506	3.6637	0.5000	1.0000
2019.10	3.3442	3.2876	3.4008	0.2000	0.5000
2019.11	3.4166	3.3506	3.4825	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	3.5364	3.4648	3.6080	0.8000	1.0000
2020.01	7.2836	7.1404	7.4267	4.0000	5.3000
2020.02	6.3798	6.2516	6.5079	0.1000	0.0000
2020.03	6.5892	6.4658	6.7127	1.2000	1.5000
2020.04	7.2962	7.1776	7.4148	3.0000	5.1000
2020.05	7.6907	7.5715	7.8099	0.1000	0.4000
2020.06	7.3898	7.2761	7.5035	3.9000	6.4000
2020.07	7.6499	7.5368	7.7631	4.2000	7.7000
2020.08	7.3797	7.2775	7.4820	5.3000	7.8000
2020.09	7.8928	7.7657	8.0200	0.4000	0.9000
2020.10	7.4846	7.3605	7.6086	9.9000	13.6000
2020.11	7.5471	7.4220	7.6722	21.2000	33.1000
2020.12	7.8398	7.6969	7.9827	15.4000	19.8000
2021.01	25.3532	24.8946	25.8118	7.0000	15.8000
2021.02	22.6619	22.2585	23.0654	5.8000	10.7000
2021.03	23.5474	23.1742	23.9206	11.0000	17.2000
2021.04	26.2469	25.7712	26.7225	18.5000	28.8000
2021.05	27.9939	27.5309	28.4570	15.9000	22.9000
2021.06	26.7220	26.2712	27.1728	19.9000	24.1000
2021.07	27.5723	27.0927	28.0519	23.8000	35.6000
2021.08	27.4571	26.9838	27.9303	15.7000	19.5000
2021.09	29.0596	28.5371	29.5821	39.1000	52.5000
2021.10	27.8986	27.3857	28.4115	27.1000	37.0000
2021.11	27.7356	27.2010	28.2702	27.2000	35.1000
2021.12	29.6842	29.0529	30.3154	50.6000	69.0000
2022.01	72.4880	71.1017	73.8743	43.9000	62.0000
2022.02	64.3225	63.0516	65.5933	48.8000	60.5000
2022.03	67.6152	66.2931	68.9373	58.4000	80.6000
2022.04	71.7827	70.5320	73.0334	59.1000	83.9000
2022.05	79.1279	77.7643	80.4915	72.5000	0.4000
2022.06	73.3538	72.1233	74.5842	58.9000	0.4000
2022.07	77.7752	76.4142	79.1363	76.7000	102.5000
2022.08	76.0220	74.7319	77.3122	63.3000	86.0000
2022.09	80.4560	78.8662	82.0459	72.6000	94.5000
2022.10	75.7874	74.3610	77.2137	66.4000	112.1000
2022.11	75.8704	74.3118	77.4290	54.3000	82.1000
2022.12	79.5416	77.6853	81.3979	93.7000	165.0000
2023.01	119.3569	116.5871	122.1267	112.9000	173.8000
2023.02	103.4845	101.1684	105.8006	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	105.2871	102.9832	107.5910	85.0000	126.8000
2023.04	115.9404	113.6200	118.2608	72.1000	114.3000
2023.05	124.4637	121.9589	126.9684	105.0000	140.0000
2023.06	120.4000	119.0287	121.7713	118.5000	173.0000
2023.07	121.6859	119.4103	123.9615	124.7000	161.2000
2023.08	119.5184	117.2849	121.7519	90.6000	132.5000
2023.09	128.5434	126.0257	131.0610	110.4000	156.8000
2023.10	120.6577	118.0215	123.2938	78.4000	119.6000
2023.11	117.9798	115.2577	120.7019	88.6000	105.1000
2023.12	126.7376	123.7042	129.7709	98.2000	115.0000
2024.01	137.3669	133.8249	140.9089	102.8000	120.0000
2024.02	117.1410	114.4394	119.8427	94.8000	124.6000
2024.03	123.3708	120.6631	126.0786	84.8000	119.4000
2024.04	133.8432	130.9331	136.7532	107.1000	136.5000
2024.05	143.1011	140.2006	146.0017	120.5000	171.7000
2024.06	134.6169	132.0375	137.1964	124.8000	164.2000
2024.07	140.1567	137.3590	142.9544	146.7000	196.5000
2024.08	139.5619	136.8141	142.3098	158.4000	215.5000
2024.09	148.3408	145.0986	151.5830	109.9000	141.4000
2024.10	139.2323	136.2300	142.2347	124.2000	166.3000
2024.11	142.5439	138.8779	146.2099	113.9000	152.5000
2024.12	142.5264	139.5397	145.5130	120.5000	154.5000

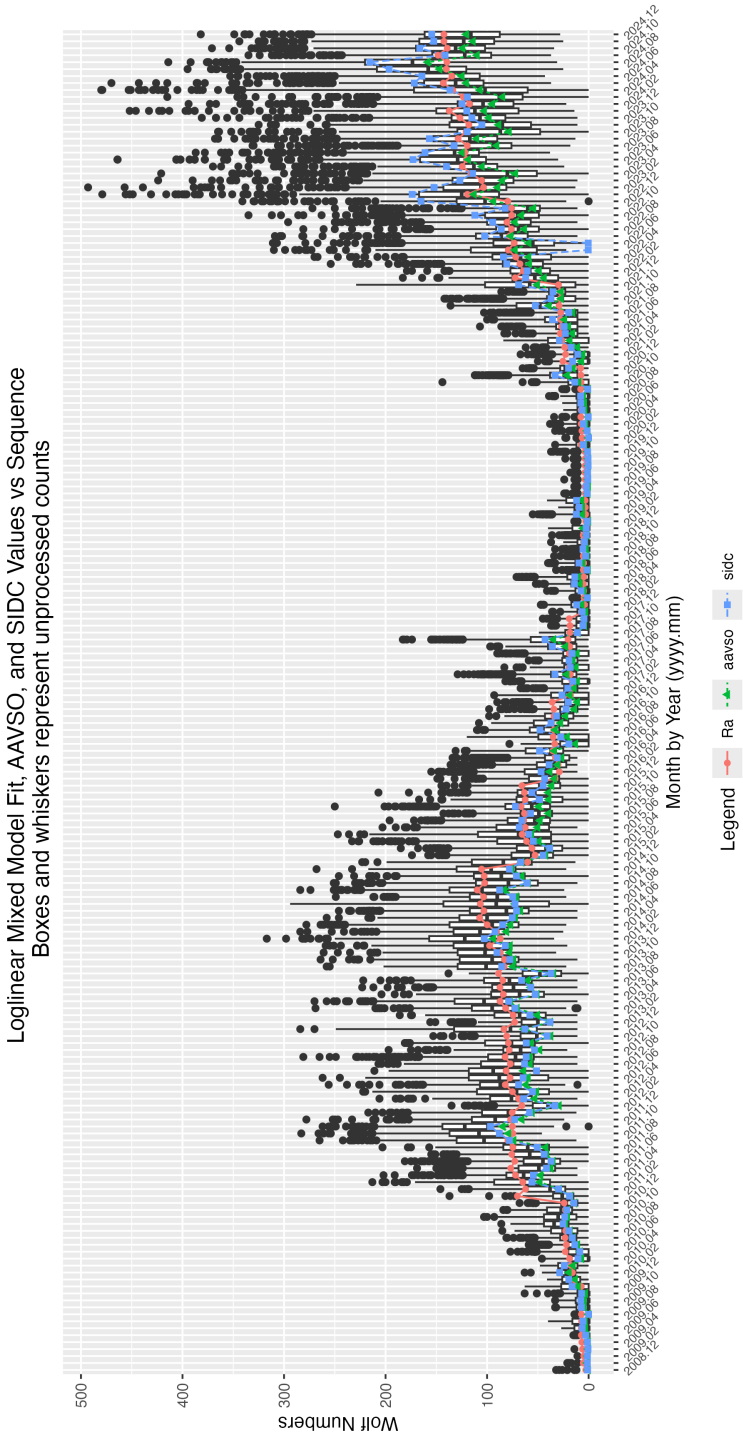

Figure 2: GLMM fitted data for R_a. AAVSO data: https://www.aavso.org/category/tags/solar-bulletin. SILSO data: WDC-SILSO, Royal Observatory of Belgium, Brussels

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: 202412 Parameter Estimates

	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	1.1852	0.3166	3.7439	0.0002
seeG	-0.1065	0.0039	-27.3729	0.0000
seeF	-0.2160	0.0045	-48.2407	0.0000
seeP	-0.3132	0.0065	-48.3833	0.0000
seeM	-0.1731	0.0244	-7.1066	0.0000
sidc1	0.0577	0.0092	6.2900	0.0000
year2009	0.7573	0.3182	2.3801	0.0173
year2010	1.9686	0.3160	6.2305	0.0000
year2011	3.1246	0.3159	9.8927	0.0000
year2012	3.1707	0.3158	10.0387	0.0000
year2013	3.2645	0.3158	10.3359	0.0000
year2014	3.4643	0.3158	10.9685	0.0000
year2015	2.9864	0.3159	9.4551	0.0000
year2016	2.3708	0.3159	7.5052	0.0000
year2017	1.7599	0.3159	5.5708	0.0000
year2018	0.4676	0.3162	1.4788	0.1392
year2019	0.0622	0.3164	0.1967	0.8441
year2020	0.8683	0.3161	2.7472	0.0060
year2021	2.1482	0.3159	6.8004	0.0000
year2022	3.1399	0.3159	9.9410	0.0000
year2023	3.6125	0.3158	11.4375	0.0000
year2024	3.7675	0.3159	11.9280	0.0000
mon2	-0.1285	0.0072	-17.9385	0.0000
mon3	-0.0912	0.0068	-13.3328	0.0000
mon4	-0.0083	0.0066	-1.2571	0.2087
mon5	0.0566	0.0064	8.8335	0.0000
mon6	0.0077	0.0062	1.2308	0.2184
mon7	0.0422	0.0064	6.6244	0.0000
mon8	0.0190	0.0064	2.9902	0.0028
mon9	0.0887	0.0064	13.7828	0.0000
mon10	0.0266	0.0066	4.0416	0.0001
mon11	0.0446	0.0068	6.5174	0.0000
mon12	0.0877	0.0068	12.8177	0.0000

Table 4: 202412 Summary of Sunspot Numbers

year	mon	day	obs	sidc
Min. :2008	Min. : 1.000	Min. : 0.0	Length:189603	Min. :0.0000
1st Qu.:2014	1st Qu.: 4.000	1st Qu.: 8.0	Class :character	1st Qu.:0.0000
Median :2018	Median : 7.000	Median :16.0	Mode :character	Median :0.0000
Mean :2017	Mean : 6.618	Mean :15.7		Mean :0.2338
3rd Qu.:2021	3rd Qu.: 9.000	3rd Qu.:23.0		3rd Qu.:0.0000
Max. :2024	Max. :12.000	Max. :31.0		Max. :1.0000

Table 5: 202412 Summary of Sunspot Numbers

g	s	w	see	method
Min. : 0.000	Min. : 0.00	Min. : 0.00	E:40246	Length:189603
1st Qu.: 1.000	1st Qu.: 1.00	1st Qu.: 11.00	G:78043	Class :character
Median : 3.000	Median : 12.00	Median : 41.00	F:54852	Mode :character
Mean : 3.509	Mean : 20.67	Mean : 55.76	P:15677	
3rd Qu.: 6.000	3rd Qu.: 31.00	3rd Qu.: 88.00	M: 785	
Max. :31.000	Max. :295.00	Max. :493.00		

Table 6: 202412 Summary of Sunspot Numbers

inst	filter	unit
Length:189603	Length:189603	Length:189603
Class :character	Class :character	Class :character
Mode :character	Mode :character	Mode :character

Table 7: 202412 Summary of Sunspot Numbers

aperture	eyep	foclen	mag
Min. : 0.00	Min. : 0.00	Min. : 0.0	Min. : 0.0
1st Qu.: 60.00	1st Qu.: 4.00	1st Qu.: 400.0	1st Qu.: 40.0
Median : 80.00	Median : 14.00	Median : 900.0	Median : 55.0
Mean : 94.34	Mean : 41.72	Mean : 889.3	Mean : 181.1
3rd Qu.: 104.00	3rd Qu.: 23.00	3rd Qu.:1200.0	3rd Qu.: 72.0
Max. :1524.00	Max. :2010.00	Max. :9990.0	Max. :4591.0

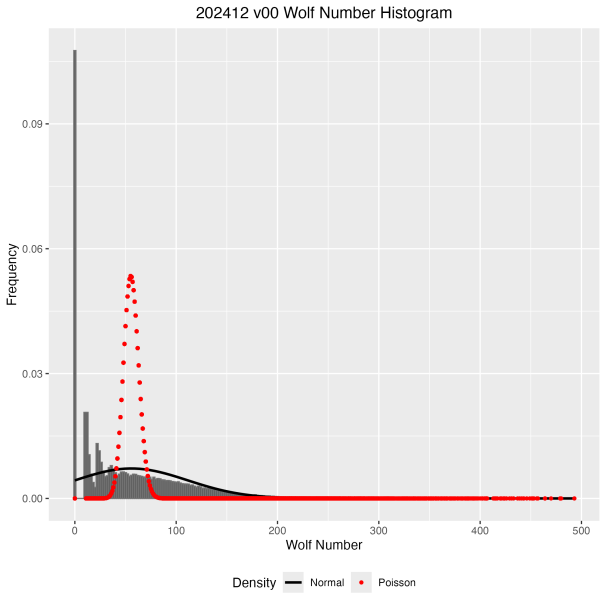

Figure 3: Box plots of raw Wolf number (w) by observer rank.

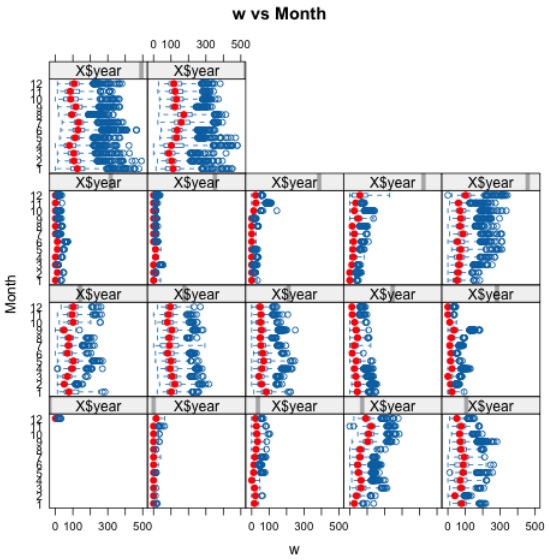

Figure 4: Box plots of raw Wolf number (w) by month and year.

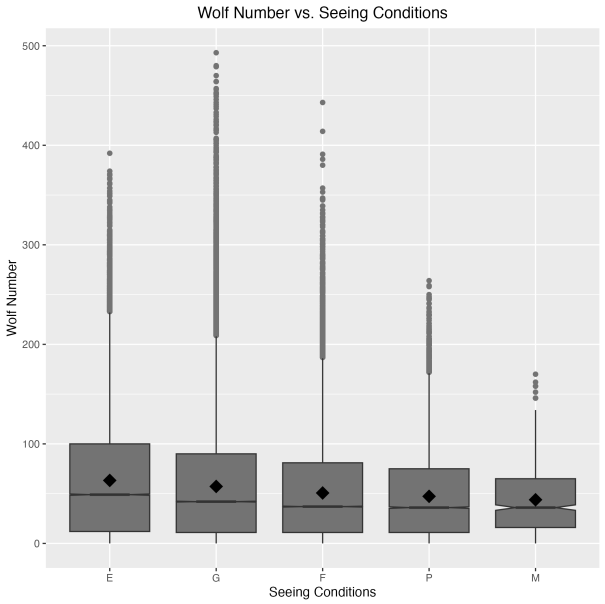

Figure 5: Box plots of raw Wolf number (w) by seeing condition.

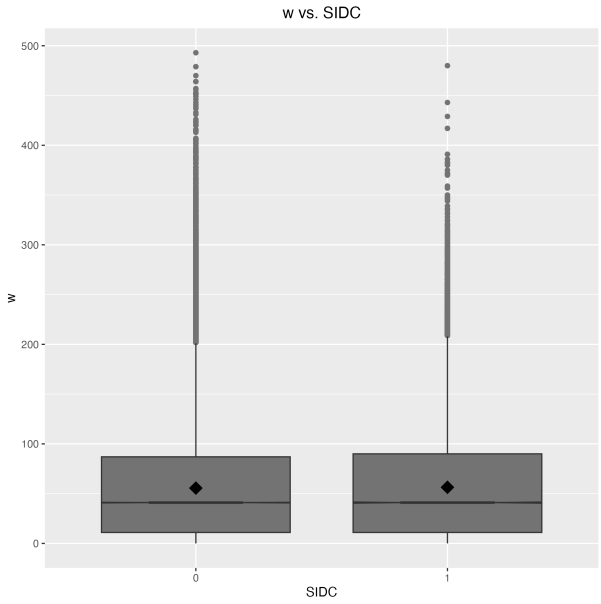

Figure 6: Box plots of raw Wolf number (w) by organization.

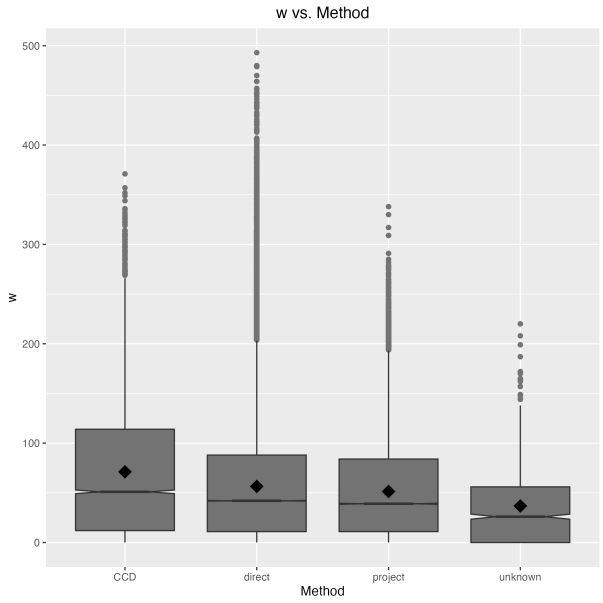

Figure 7: Box plots of raw Wolf number (w) by observer rank.

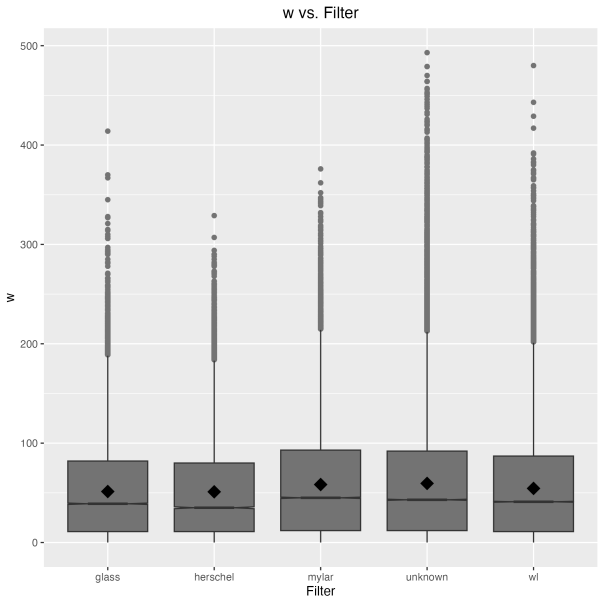

Figure 8: Box plots of raw Wolf number (w) by month and year.

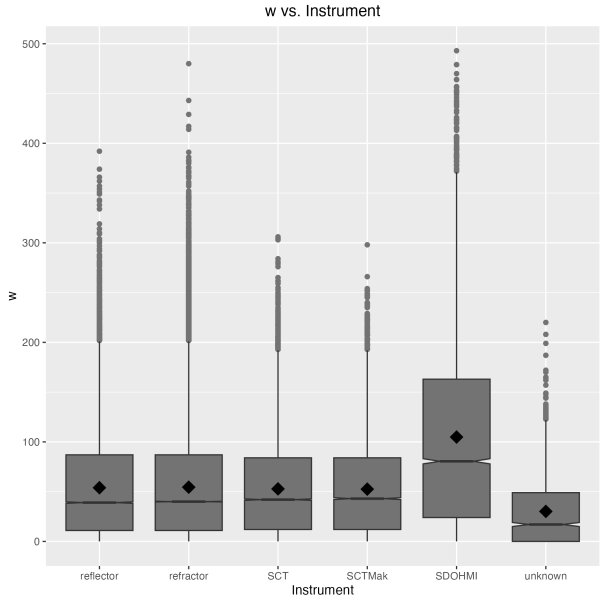

Figure 9: Box plots of raw Wolf number (w) by seeing condition.

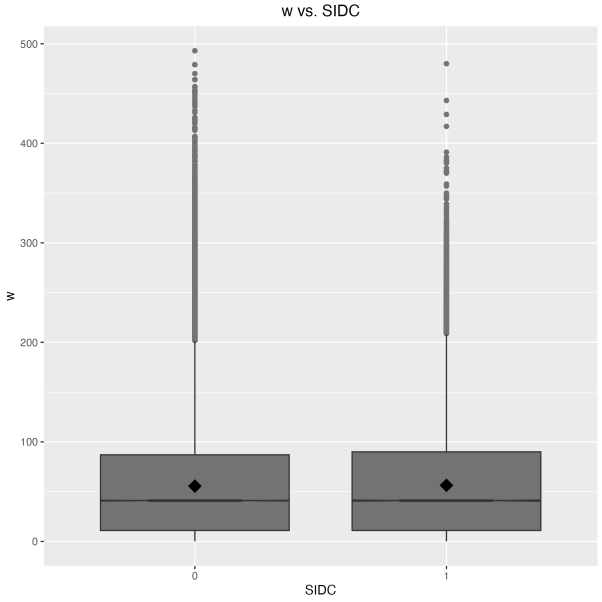

Figure 10: Box plots of raw Wolf number (w) by organization.

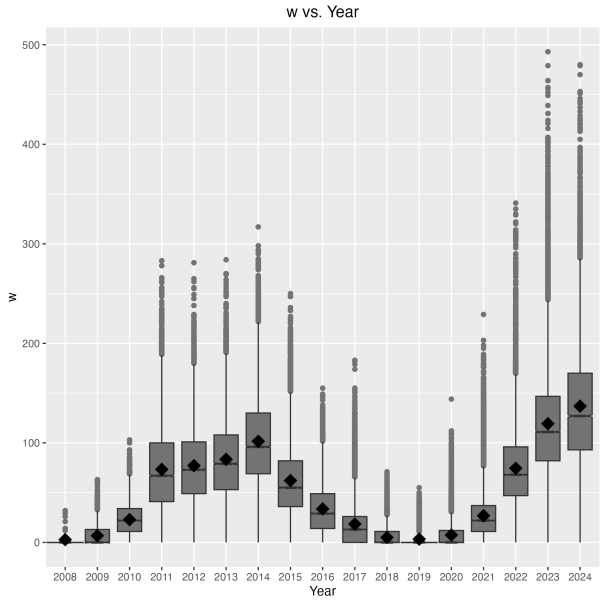

Figure 11: Box plots of raw Wolf number (w) by year.

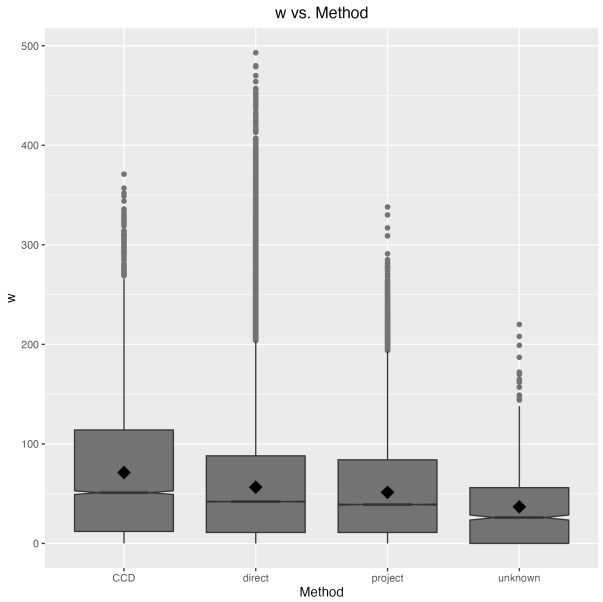

Figure 12: Box plots of raw Wolf number (w) by observing method.