Solar Bulletin

THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS
SOLAR SECTION

Rodney Howe, Kristine Larsen, Co-Chairs
c/o AAVSO, 185 Alewife Brook Parkway,
Cambridge, MA 02138 USA

Web: https://www.aavso.org/solar-bulletin
Email: solar@aavso.org
ISSN 0271-8480

Volume 81 Number 8 August 2025

The Solar Bulletin of the AAVSO is a summary of each month's solar activity recorded by visual solar observers' counts of group and sunspots, and the very low frequency (VLF) radio recordings of SID Events in the ionosphere. The sudden ionospheric disturbance report is in Section 2. The relative sunspot numbers are in Section 3. Section 4 has endnotes.

1 The McIntosh Classification scheme vs the Zurich Classification scheme

Unipolar				Bipolar													
No penumbra	Penumbra			Sunspot distribution	No penumbra	Penumbra											
Axx				open	Bxo	Penumbra on 1 end			Penumbra on both ends								
				intermediate	Bxi	Length of sunspot group			Length ≤ 10°			10° < Length ≤ 15°			Length > 15°		
North-south diameter main spot	Shape penumbra main spot			Sunspot distribution	North-south diameter main spot	Shape penumbra main spot											
	rudimentary	symmetric	asymmetric			rudim.	symm.	asymm.	rudim.	symm.	asymm.	rudim.	symm.	asymm.	rudim.	symm.	asymm.
≤ 2.5°	Hrx	Hsx	Hax	open	≤ 2.5°	Cro	Cso	Cao	Dro	Dso	Dao	Ero	Eso	Eao	Fro	Fso	Fao
				intermediate		Cri	Csi	Cao	Dri	Dsi	Dai	Eri	Esi	Eai	Fri	Fsi	Fai
				compact						Dsc	Dac		Esc	Eac		Fsc	Fac
> 2.5°		Hhx	Hkx	open	> 2.5°		Cho	Cko		Dho	Dko		Eho	Eko		Fho	Fko
				intermediate			Chi	Cki		Dhi	Dki		Ehi	Eki		Fhi	Fki
				compact						Dhc	Dkc		Ehc	Ekc		Fhc	Fkc

Figure 1: UniPolar and BiPolar classes using the McIntosh classification scheme. (Jan Janssens, 2025)

"Overview of the different types of sunspot groups and the various observational parameters that lead to these 60 classes (white boxes). From a basic distinction between unipolar and bipolar sunspot groups, the unipolar groups can be classified according to the presence (or not) of a penumbra around the main spot, and the shape and North-South diameter of the penumbra. The classification of the bipolar groups is further subdivided by considering the internal sunspot distribution and the length between the two main portions of the group, and which portion has a penumbra (none, one end, or both)" (Jan Janssens, 2025).

1.1 AAVSO adopts the Zurich method for counting sunspots with long–time observer Herbert Luft

The long-time observer Herbert Luft (1908 Breslau, Germany - 1988 New York, USA) was a corresponding contributor to the Zurich series. As a teenager he joined various Amateur Associations and was mentored by the slightly older Wolfgang Gleissberg, who suggested Luft concentrate on Sunspots. Luft's notebooks are archived at AAVSO [aavso@aavso.org] and Leif Svalgaard recently digitized the observational material in them. The nearly 12,000 pages yielded 10,434 usable observations [when image quality was good enough] during 1924-1987. Interesting enough, Luft started using the weighting scheme 24 February 1947, but abandoned the scheme on 5 April of the next year. Figure 2 shows two pages from March 1948. Luft also started to use the Zurich Group Classification System at the same time (and did not later abandon the classification). The spot count for the A-groups was the same with (number to the right of the class letter) and without weighting (number to the left of the class), while the H-I, D, and E class groups had a weighted spot count on average 45 percent higher.

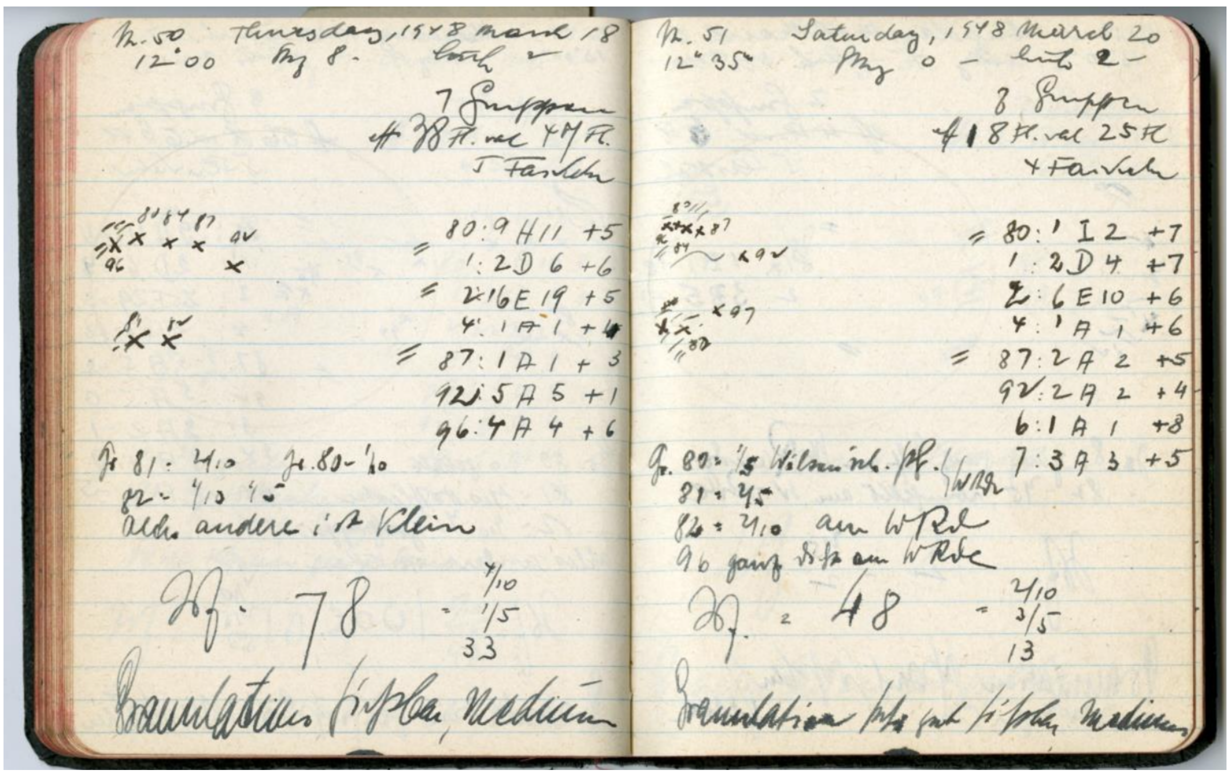

Figure 2: Pages from Herbert Luft's notebook for March 18 and 20, 1948. South is up and West is left. The letters in the columns at the right on each page show the Zurich Group Class for each numbered group, flanked left and right by the raw and the weighted count of spots in each group. The telescope was a superb 54mm aperture Merz used at 96X magnification. In spite of the crude-looking drawings, the counts of groups and spots are of high quality, as can be seen from comparisons with Mount Wilson Observatory. (Svalgaard, 2015)

2 Sudden Ionospheric Disturbance (SID) Report

2.1 SID Records

August 2025 (Figure 3): There were 7 flares on the 7th of August, 5 C-Class, and 2 M-Class flares recorded in Milan, Italy, by Lionel Laudet (A118). (U.S. Dept. of Commerce–NOAA, 2022).

Figure 3: VLF recording from Milan, Italy, for August 7, 2025.

2.2 SID Observers

In August 2025 we had 13 AAVSO SID observers who submitted VLF data as listed in Table 1.

Table 1: 202508 VLF Observers

Observer	Code	Stations
R Battaiola	A96	HWU
J Wallace	A97	NAA
L Loudet	A118	DHO
J Godet	A119	DHO GBZ GQD
J Karlovsky	A131	DHO
R Mrllak	A136	NSY
S Aguirre	A138	NLK
G Silvis	A141	NAA NPM NLK
L Pina	A148	NAA NML
J Wendler	A150	NAA
H Krumnow	A152	DHO GBZ
J DeVries	A153	NLK
M Cervoni	A154	DHO ICV

Figure 4 depicts the importance rating of the solar events. The duration in minutes are -1: LT 19, 1: 19-25, 1+: 26-32, 2: 33-45, 2+: 46-85, 3: 86-125, and 3+: GT 125.

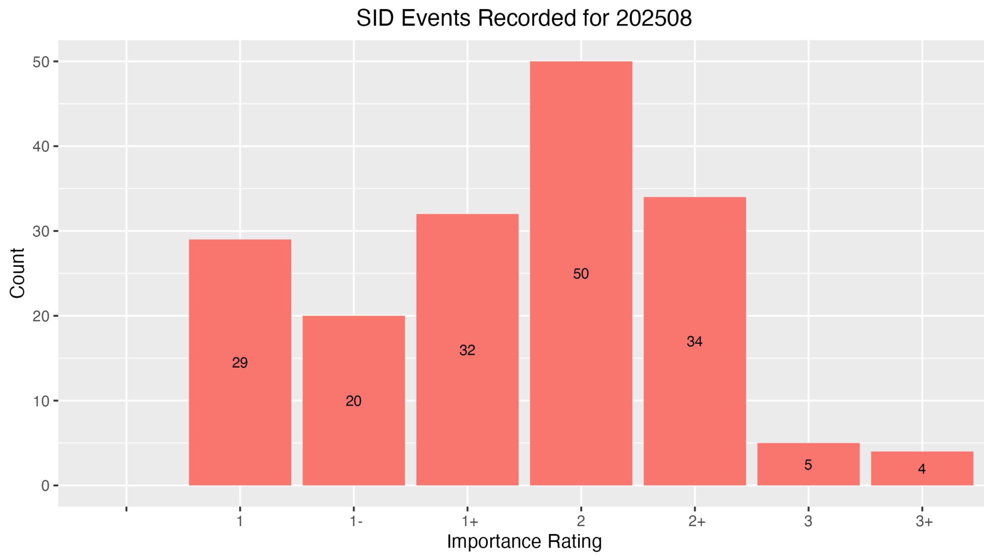

Figure 4: VLF SID Events.

2.3 Solar Flare Summary from GOES-16 Data

In August 2025, there were 306 GOES-16 XRA flares: 42 M-class, 257 C-class, and 7 B-class. There was far more flaring this month compared to last month. (U.S. Dept. of Commerce–NOAA, 2022). (see Figure 5).

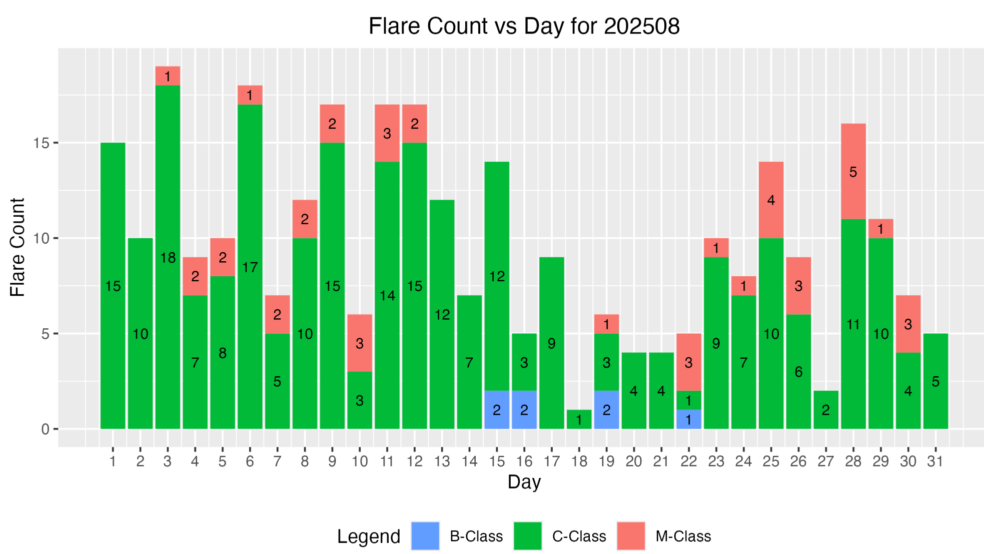

Figure 5: GOES-16 XRA flares (U.S. Dept. of Commerce–NOAA, 2022).

3 Relative Sunspot Numbers (R_a)

Reporting monthly sunspot numbers consists of submitting an individual observer's daily counts for a specific month to the AAVSO Solar Section. These data are maintained in a Structured Query Language (SQL) database. The monthly data then are extracted for analysis. This section is the portion of the analysis concerned with both the raw and daily average counts for a particular month. Scrubbing and filtering the data assure error-free data are used to determine the monthly sunspot numbers.

3.1 Raw Sunspot Counts

The raw daily sunspot counts consist of submitted counts from all observers who provided data in August 2025. These counts are reported by the day of the month. 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 6.

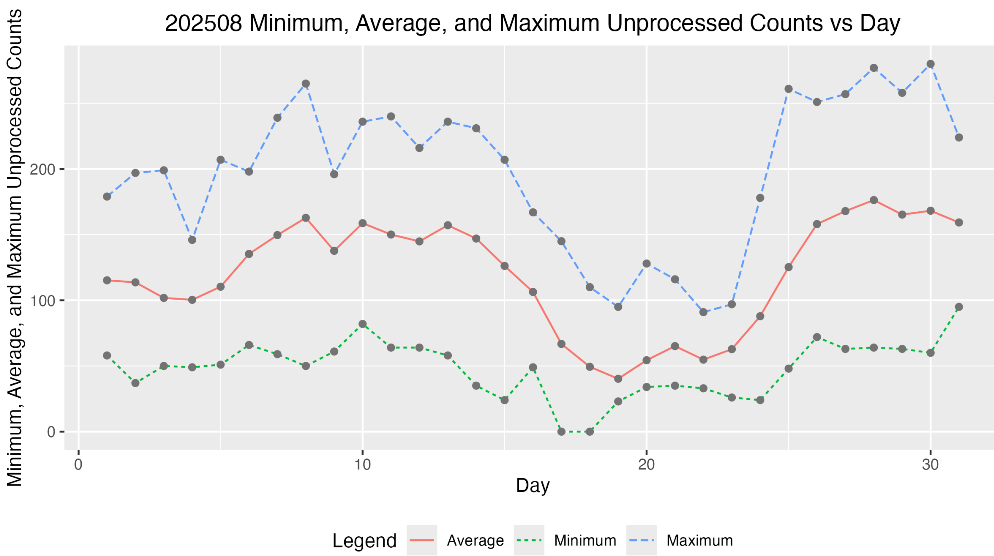

Figure 6: Raw Wolf number average, minimum and maximum by day of the month for all observers.

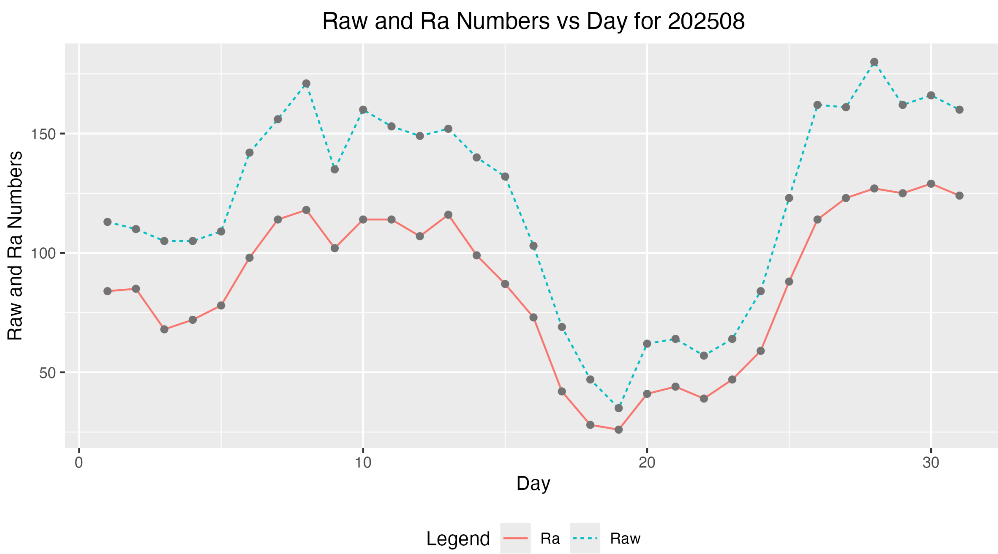

Figure 7: Raw Wolf average and R_a numbers by day of the month for all observers.

3.2 American Relative Sunspot Numbers

The relative sunspot numbers, R_a, contain the sunspot numbers after the submitted data are scrubbed and modeled by Shapley's method with k-factors (`http://iopscience.iop.org/article/10.1086/126109/pdf`). The Shapley method is a statistical model that agglomerates variation due to random effects, such as observer group selection, and fixed effects, such as seeing condition. The raw Wolf averages and calculated R_a are seen in Figure 7, and Table 2 shows the Day of the observation (column 1), the Number of Observers recording that day (column 2), the raw Wolf number (column 3), and the Shapley Correction (R_a) (column 4).

Table 2: 202508 American Relative Sunspot Numbers (R_a).

Day	Number of Observers	Raw	R_a
1	32	113	84
2	34	110	85
3	35	105	68
4	28	105	72
5	33	109	78
6	29	142	98
7	35	156	114
8	38	171	118
9	41	135	102
10	44	160	114
11	43	153	114
12	36	149	107
13	30	152	116
14	29	140	99
15	34	132	87

Continued

Table 2: 202508 American Relative Sunspot Numbers (R_a).

Day	Number of Observers	Raw	R_a
16	31	103	73
17	35	69	42
18	29	47	28
19	23	35	26
20	24	62	41
21	29	64	44
22	31	57	39
23	34	64	47
24	34	84	59
25	37	123	88
26	37	162	114
27	31	161	123
28	31	180	127
29	27	162	125
30	34	166	129
31	34	160	124
Averages	33	120.4	86.6

3.3 Sunspot Observers

Table 3 lists the Observer Code (column 1), the Number of Observations (column 2) submitted for August 2025, and the Observer Name (column 3). The final row gives the total number of observers who submitted sunspot counts (58), and total number of observations submitted (1022).

Table 3: 202508 Number of observations by observer.

Observer Code	Number of Observations	Observer Name
AAX	19	Alexandre Amorim
AJV	15	J. Alonso
ARAG	31	Gema Araujo
ASA	3	Salvador Aguirre
BATR	6	Roberto Battaiola
BKL	19	John A. Blackwell
BMIG	27	Michel Besson
BTB	19	Thomas Bretl
BVZ	27	Jesus E. Blanco
BXZ	27	Jose Alberto Berdejo
CKB	29	Brian Cudnik
CMAB	18	Maurizio Cervoni
CNT	26	Dean Chantiles
CWD	15	David Cowall

Continued

Table 3: 202508 Number of observations by observer.

Observer Code	Number of Observations	Observer Name
DARB	17	Aritra Das
DELS	7	Susan Delaney
DFR	13	Frank Dempsey
DJOB	10	Jorge del Rosario
DJSA	4	Jeff DeVries
DJVA	30	Jacques van Delft
DTLB	7	Terry Dixon
DUBF	30	Franky Dubois
EHOA	7	Howard Eskildsen
FALB	27	Allen Frohardt
FERA	23	Eric Fabrigat
FJOF	2	Joe Fazio
GCNA	6	Cndido Gmez
GIGA	29	Igor Grageda Mendez
HKY	21	Kim Hay
HOWR	17	Rodney Howe
ILUB	7	Luigi Iapichino
JGE	10	Gerardo Jimenez Lopez
JSI	7	Simon Jenner
KAND	30	Kandilli Observatory
KAPJ	24	John Kaplan
KNJS	26	James & Shirley Knight
KTOC	18	Tom Karnuta
LKR	11	Kristine Larsen
LRRA	19	Robert Little
MARC	3	Arnaud Mengus
MARE	16	Enrico Mariani
MJHA	30	John McCammon
MMI	31	Michael Moeller
MUDG	20	George Mudry
MWU	28	Walter Maluf
NMID	3	Milena Niemczyk
NPAB	1	Panagiotis Ntais
PLUD	19	Ludovic Perbet
RJV	22	Javier Ruiz Fernandez
SDOH	31	Solar Dynamics Obs - HMI
SNE	14	Neil Simmons
SRIE	19	Rick St. Hilaire
TDE	17	David Teske
TPJB	2	Patrick Thibault
TST	27	Steven Toothman
URBP	31	Piotr Urbanski
WGI	4	Guido Wollenhaupt

Continued

Table 3: 202508 Number of observations by observer.

Observer Code	Number of Observations	Observer Name
WND	21	Denis Wallian
Totals	1022	58

3.4 Generalized Linear Model of Sunspot Numbers

Dr. Jamie Riggs, Solar System Science Section Head, International Astrostatistics Association, maintains a relative sunspot number (R_a) model containing the sunspot numbers after the submitted data are scrubbed and modeled by a Generalized Linear Mixed Model (GLMM), which is a different model method from the Shapley method of calculating R_a in Section 3 above. The GLMM is a statistical model that accounts for variation due to random effects and fixed effects. For the GLMM 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 the paper, *A Generalized Linear Mixed Model for Enumerated Sunspots* (see 'GLMM06' in the sunspot counts research page at http://www.spesi.org/?page_id=65).

Figure 8 shows the monthly GLMM R_a numbers for a rolling eleven-year (132-month) window beginning within the 24th solar cycle and ending with last month's sunspot numbers. The solid cyan curve that connects the red *X's* is the GLMM model R_a estimates of excellent seeing conditions, which in part explains why these R_a estimates often are higher than the Shapley R_a values. The dotted black curves on either side of the cyan curve depict a 99% confidence band about the GLMM estimates. The green dotted curve connecting the green triangles is the Shapley method R_a numbers. The dashed blue curve connecting the blue *O's* is the SILSO values for the monthly sunspot numbers.

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 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 dots below and above the whiskers traditionally are considered outliers, but with GLMM modeling, they are observations that are accounted for by the GLMM model.

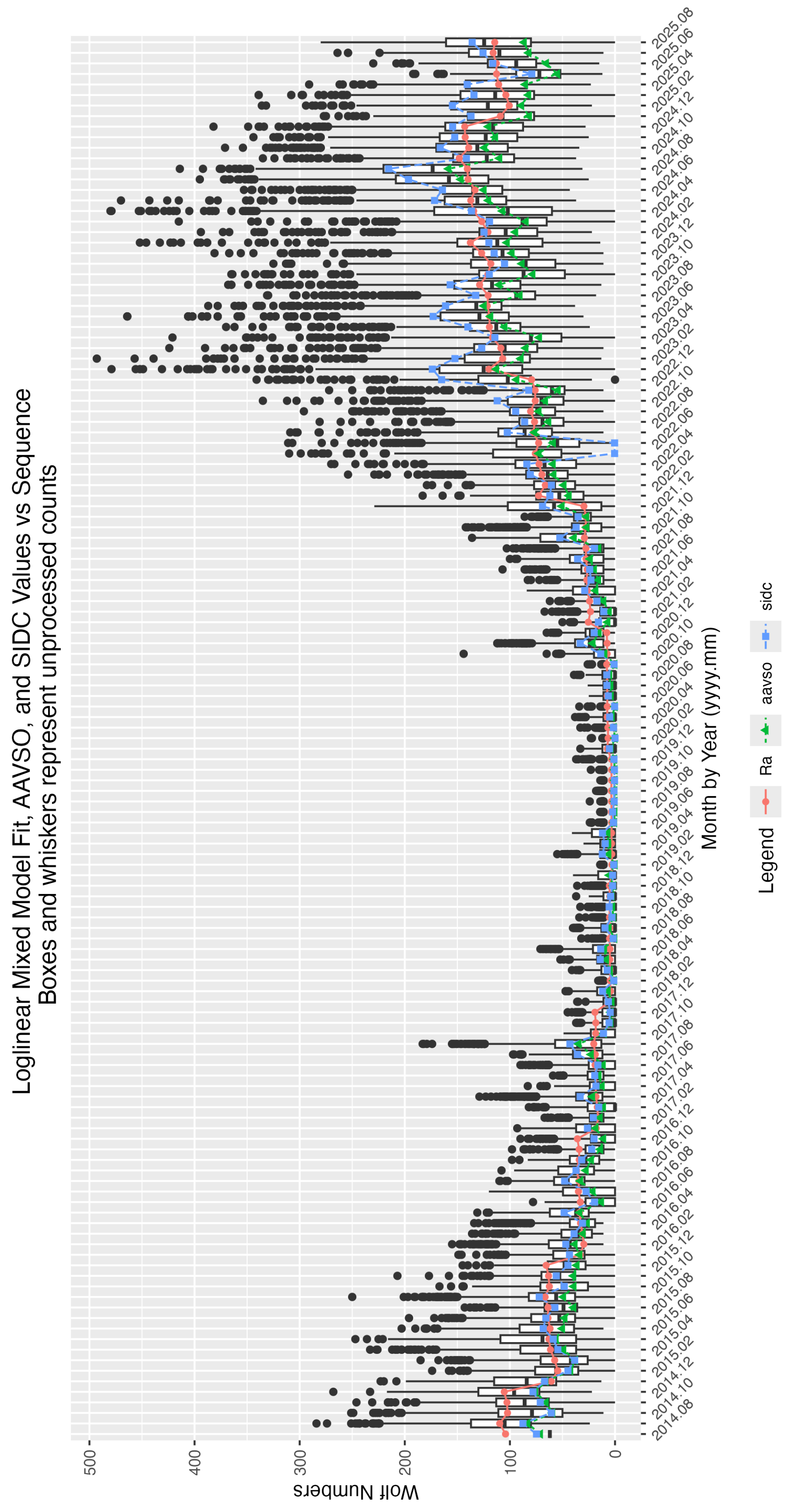

Figure 8: GLMM fitted data for R_a. AAVSO data: https://www.aavso.org/category/tags/solar-bulletin. SIDC data: WDC-SILSO, Royal Observatory of Belgium, Brussels

4 Endnotes

- Sunspot Reports: Kim Hay solar@aavso.org
- SID Solar Flare Reports: Rodney Howe rhowe137@icloud.com

5 Antique telescope project

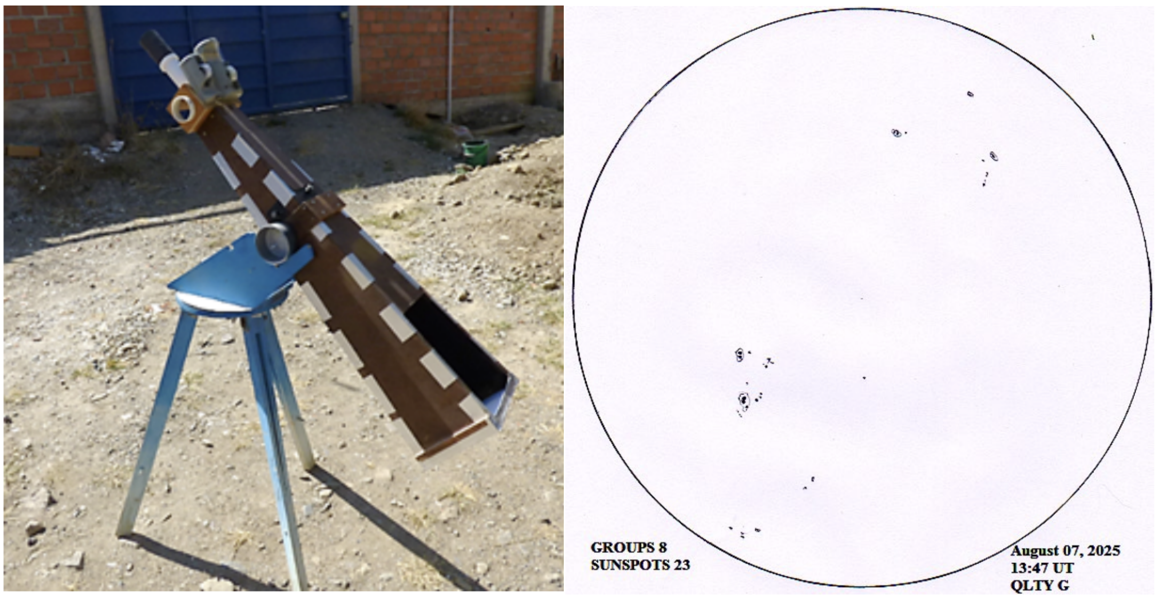

Figure 9: A recent replica of an antique telescope built by Gonzalo Vargas (BZX) in Cochabamba, Bolivia (left), and a drawing for August 7 (right).

Gonzalo gives a short comment on the differences between the original Zurich classification and the modified Zurich classification, where the latter eliminates the group of J and G spots that are in the original Zurich classification: "In my experience however, sometimes a unipolar group with penumbra is observed next to several spots, even some with penumbras, but they are not similar to those classified as type H, which in the modified Zurich classification appear as a large, almost circular spot with penumbra without having other small spots around it ... On the other hand, I have repeatedly observed smaller spots with penumbra that in the original Zurich classification (Waldmeier) are registered as type J and that do not exist in the modified Zurich version ... The most similar would be those of type A, but what do we do with the penumbra that surrounds the nucleus? As a visual observer of the Sun, my preference is for the original Zurich classification. Image quality conditions due to atmospheric instability do not allow for clear details around K-type sunspots, and they can be interpreted as type H. On the other hand, the bipolar type B sunspots that are frequently observed could be interpreted as two groups one of type A and one of type J in the original Zurich classification. Personally, and as a visual solar observer, I believe that the original Zurich or Waldmeier classification for visual observation in white light is the one that best fits the study of sunspots."

6 References

Janssens, Jan, et.al, 2025, Solar flare rates and probabilities based on the McIntosh classification: Impacts of GOES/XRS rescaling and revisited sunspot classifications. (https://www.swsc-journal.org/articles/swsc/full_html/2025/01/swsc240043/swsc240043.html)

Svalgaard, L., 2015, Biases in the Zurich era: causes and diagnostics. https://www.researchgate.net/publication/316736457_Sunspot_Group_Numbers_Since_1900_and_Implications_for_the_Long-term_Record_of_Solar_Activity

U.S. Dept. of Commerce–NOAA, Space Weather Prediction Center ,2022. *GOES-16 XRA data.* ftp://ftp.swpc.noaa.gov/pub/indices/events/