

The BAA Solar Section observation databases

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A report of the Solar Section. Director: Lyn Smith

This paper describes an easy-to-use online form and database for the submission of white light and hydrogen alpha observations to the BAA Solar Section. The graphical output enables an observer to track variations in solar activity over long periods of time based on their own observations – an advantage over the previous *Microsoft Excel*-based approach.

Introduction

Each month over 50 BAA solar observers submit their daily observations to the Solar Section, which need to be collated to form the summary tables published in the Section's monthly *Newsletter* and in the 'Notes and News' section of the *Journal*. These observations are also used for monitoring the longer-term activity of the solar cycle. The collation has been quite time consuming due to it being a manual process, even though the majority of observers submitted their observations using a standard *Excel* spreadsheet template.

During a conversation between the Section Director Lyn Smith and the author, the idea of developing a web-based online form and database for the submission and collation of solar observations was suggested. In fact, two online forms and databases were developed: one for white light observations and the other for hydrogen alpha observations.

After extensive testing, the online forms have been successfully used by the majority of BAA solar observers since 2018 April. This has considerably eased the Director's data collation task each month. In addition, the databases enable the individual observer to easily retrieve their previous observations and view these *via* a graphical plot.

Development

Both online forms were initially based on that used by the Solar Influences Data Analysis Center (SIDC),¹ for the submission of white light observations that are used for determining the International Sunspot Number from solar observers around the globe,² including BAA observers. The SIDC form has been extensively altered to be compatible with the layout of the previously-used *Excel* form, together with additional outputs for both the observer and the Director.

The project used XAMPP,³ a popular PHP development environment. PHP is a widely-used open-source, general-purpose scripting language that is especially suited for web development and can be embedded into HTML web pages. This includes an offline web server and a *MySQL* database, enabling the two forms and databases to be developed and tested. The *Sublime Text* editor environment was used to easily edit a number of PHP web pages that form the new database system.⁴ Graphical output was created using *Highcharts*.⁵

The main pages created are listed as follows.

registration.php – for initial registration using a username, e-mail address and password (encrypted). Includes HTML and PHP.

login.php – to enable access to the observation forms. Includes HTML and PHP.

index.php – the main form page, where observations are entered for a user-selected month (defaults to the current month). Includes HTML, PHP, JavaScript (for checking of input errors) and SQL (for database submission and retrieval).

actions.php – used following the submission of observations, to display graphical output. Includes HTML, PHP and SQL.

summary.php – a summary page for the Director, giving all the required tables for the *Newsletter* and *Journal*. Includes HTML, PHP, SQL and *Highcharts*.

logout.php – for logging out of the databases. Includes PHP.

Linked with the PHP web pages are a number of *MySQL* database tables, given below.

users – username, password, e-mail address, name, white light telescope, hydrogen alpha telescope and brief location.

WLDaily – username, year, month, day and daily white light data.

WLMDF – username, year, month and monthly white light data.

WLDailySummary – year, month, day and observer; averaged daily white light data.

WLMDFSummary – year, month and observer; averaged monthly white light data.

HaDaily – username, year, month, day and daily hydrogen alpha data.

HaMDF – username, year, month and monthly hydrogen alpha data.

Note that the two white light summary tables are only used to generate a long-term activity graph based on all submitted observations (a similar graph is not produced for hydrogen alpha).

Following the initial development, the web pages were transferred to a sub-domain of the author's own website for testing by a few BAA observers. This proved very useful, as a few problems were identified and improvements made based on feedback. The final step was to transfer the web pages to the BAA website, so that all the Association's solar observers could switch from using the *Excel* spreadsheets to the new online databases *via* a link from the Solar Section website and the *Newsletter*. A presentation was prepared and provided to observers on how to use the online forms and databases.

White Light Database

When using the database for the first time, the observer needs to register by creating a username – usually of the form 'firstnamelastname' (e.g. 'petermeadows') – a password, and by adding an e-mail address. The password is encrypted when stored in the database. The e-mail address is used to send a registration confirmation. Registration is only required to be performed once, even if both the white light and hydrogen alpha databases are used.

Subsequently, only the username and password are required to log in.

Once the observer has logged into the white light database,⁶ the web form is displayed as shown in Figure 1. The default month is that which is current, up to and including the current day. Other months can be selected, by altering values in the month and year boxes and pressing the ‘Select’ button.

The various columns in the form, with their formats, are:

- *UT* (time of observation), HHMM only
- *Seeing*: any format, but that of the BAA preferred (1= excellent; 2= good; 3= fair; 4= poor; 5= bad)
- *g north* (number of groups/active areas in the northern hemisphere), integer
- *f north* (number of sunspots in the northern hemisphere), integer
- *g south*, *f south* (as for *g north* and *f north*, but for the southern hemisphere)
- *g total*, *f total* (as for *g north* and *f north*, but for the whole disk)
- *R* (sunspot number= $10(g \text{ total}) + f \text{ total}$), integer
- *Q* (Quality number), integer
- *Notes*: any format.

The ‘Clear’ button on the extreme right removes all entries for that day (an easy way to correct any input errors). Values are assigned to a cell by clicking on it. ‘Tab’ can be used to move to successive cells on a particular day. If *gn*, *fs*, *gs* and *fs* are input then *g*, *f* and *R* are automatically calculated when these cells are selected, by using ‘tab’ to move between cells. Similarly, if only *g* and *f* are input then *R* is automatically calculated. *Q* is the BAA Quality number, which is based on the sunspot group’s type.⁷ The Notes column can be used for any additional white light information, such as observations of naked-eye sunspots, spots showing light bridges and notable or polar faculae.

Note that a cell should be left blank if an associated quantity is not determined. For example, if the groups are not separated between the hemispheres, then *gn*, *fs*, *gs* and *fs* should be left blank. Similarly, if *Q* is not calculated from the different group types on the solar disk, the *Q* cell should be blank. All observations must include a time in UT.

After the daily observations part of the form, there are the ‘totals’, mean daily frequency (MDF) and ‘days observed’ rows as shown in Figure 2. These values are also automatically calculated by selecting the first ‘totals’ cell and successively pressing the tab key to complete all entries. Here any errors can be picked up (such as different observing days for *g north* and *g south*, for example) and corrected before pressing ‘Submit’ to add the contents of the form to the database. Also included at the bottom of the form are the ob-

BAA Solar Section Database
Active Area, Relative Sunspot Number and Quality Number Report Form

Month Year

Day	UT	Seeing	g north	f north	g south	f south	g	f	R	Q	Notes	
01	0715	1	0	0	1	2	1	2	12	1		Clear
02	0715	1	0	0	1	1	1	1	11	1		Clear
03	0710	1	0	0	1	2	1	2	12	1		Clear
04	0830	2	0	0	0	0	0	0	0	0	Faculae NW limb	Clear
05	0840	1	0	0	0	0	0	0	0	0	Extensive faculae SE limb	Clear
06	0710	1	0	0	0	0	0	0	0	0	Faculae SE limb	Clear
07	0710	2	0	0	0	0	0	0	0	0	Faculae SE limb	Clear
08	1710	2	0	0	0	0	0	0	0	0		Clear
09												Clear
10	0715	1	0	0	0	0	0	0	0	0		Clear
11	0845	1	0	0	0	0	0	0	0	0		Clear

Figure 1. White light web form, with example entries.

Totals	3	13	10	23	13	36	166	28	Clear
	g north	f north	g south	f south	g	f	R	Q	
M.D.F.	0.14		0.48		0.62		7.90	1.33	Clear
Days Observed	21		21		21		21	21	Clear

server
 telescope
 location

Figure 2. White light web form totals, MDF and days observed.

server’s name, telescope and brief location (these only need to be included once, unless they require alteration).

After the form has been submitted, a new page is shown confirming successful submission, together with a graph plotting all the observer’s daily and monthly sunspot number (*R*) values; an example is shown in Figure 3. If an observer does not submit *R* values then the number of groups is shown instead. Any portion of the timeline can be selected to zoom in on a particular time period. The cursor can also be used to obtain the data values for a particular day or monthly MDF. The MDF values are displayed on the middle day of the month. The graph not only adds interest for the observer by showing longer-term variations in solar activity, but is also a visual

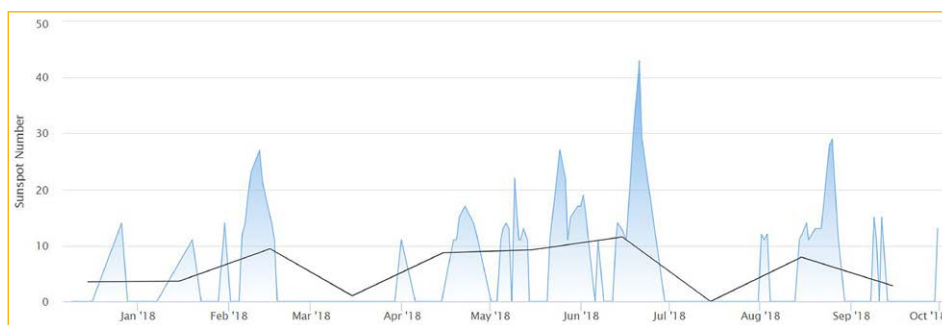


Figure 3. Example of a graph displaying the daily and monthly sunspot numbers.

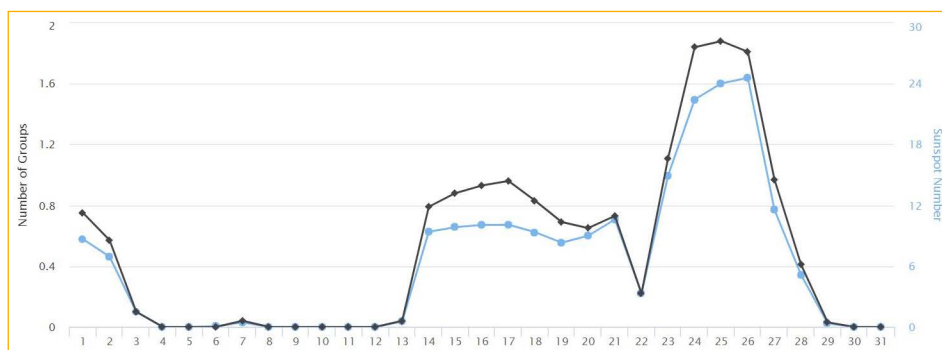


Figure 4. Averaged daily number of groups and sunspot number (2018 August).

	gn	gs	g	R	Q
M.D.F.	0.15	0.39	0.51	6.89	1.15
Days Observed	735	735	874	809	288
Num of Observers	41	41	50	46	19

Figure 5. Averaged white light MDF, days observed and number of observers (2018 August).

way of picking up any spuriously inputted values. Before logging out, a button can be used to receive the submitted observations in an e-mail.

There is also a special Director's web page which gives, for a particular month, the following:

- Table giving the average daily *g* and *R* values (defaults to the previous month)
- Combined *g* and *R* graph, as shown in Figure 4
- Table giving summary MDF, days observed and number of observers as shown in Figure 5 (the bold values are used for the *Newsletter* and *Journal*)
- Lists of all observers, telescopes and brief locations
- List of all observers' daily observations
- List for each observer of their MDF values
- Long-term graph similar to Figure 3, but for all observers

An e-mail containing the above tables and lists can be sent to the Director.

Hydrogen Alpha Database

The hydrogen alpha web form,⁸ as shown in Figure 6, is very similar to that used for submitting white light observations. The columns in the form and their formats are:

- *UT* (time of observation), HHMM only
- *Seeing*, any format, but that of the BAA preferred (1= excellent; 2= good; 3= fair; 4= poor; 5= bad)
- *Prominences* (numbers of active and quiet prominences, as well as a total), integer
- *Plage* (number of plage on disk), integer
- *Filaments* (number of filaments on disk), integer
- *Flares* (number of flares on disk), integer
- *Notes*: any format

The 'totals' and MDF parts of the form are also very similar to those of the white light equivalent, as shown in Figure 7. The telescope details are likely to be different from white light observation – again this information only needs to be entered once, unless it changes. Prominences are categorised as active or quiet, the former relating to movement having been detected during observation. In many instances, such as during a short observing session, it may not be possible to determine whether there has been movement or not. In such cases, just the total number of prominences should be recorded (with the active and quiet cells left blank).

The Director's summary web page is also similar to that for white light observations (see Figure 8), but excludes any graphs. An e-mail of all the tables and lists can also be sent to the Director.

Figure 6. Hydrogen alpha web form, with example entries.

Figure 7. Hydrogen alpha web form totals, MDF and days observed.

	Prominences			Plages	Filaments	Flares
	Active	Quiet	Total			
M.D.F.	0.25	1.42	1.30	0.77	1.46	0.01
Days Observed	123	181	275	177	227	143
Num of Observers	10	14	23	16	19	12

Figure 8. Averaged hydrogen alpha MDF, days observed and number of observers (2018 August).

Summary

The aim of enabling BAA solar observers to easily submit their observations online has been described in this paper. It is encouraging to note that the majority of observers quickly

switched to the new system. Any observations submitted *via* the *Excel* form are added to the database by the Director or Assistant Director, to ensure that all observers' records are included in the results that appear in the *Solar Section Newsletter* and *Journal*.

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References

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