



UK Solar System Data Centre

Digitising Royal Greenwich Observatory Photo-Heliographic Reports (1887-1976)

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Project Overview

- Books of Royal Observatory, Greenwich (RGO) Photo-Heliographic reports from 1874 – 1976 stored in the WDC archive.
- Some books contain more than one year of data.
- The reports are results calculated from images of the sun, taken at observatories all around the world (mainly in Greenwich).
- Contain sunspot and faculae data for each day of each year.
- The earlier books (pre 1925) are very delicate.

Project Overview

- Aim was to assess which reports are not available as digital copies elsewhere and digitise the samples.
- This involved quantifying the effort and resources needed to preserve the digital images and the best methods for doing this.
- In the past, the numbers in the reports have been digitised but ongoing work has found errors in the digital data set which have a knock on effect on other, derived data sets.
- The long term record of solar activity is scientifically important and so these errors in the currently available data sets are of concern.
- There is ongoing work to identify and correct the errors in the dataset.

Method

- 97 books to be digitised – 48 previously done by the National Geophysical Data Center (NGDC) in the USA
- Books photographed page by page using a camera rig set-up and *Entangle* software.
- Photos batch edited using *GIMP* – rotated and cropped
- The JPEGs are combined and converted to PDFs using *PDFJam*

Method

- Directory created to store the final PDFs, to be used by the web server
- The directory is populated with soft links to the PDFs from NGDC and the UKKSDC
- Quality of some PDFs reduced in order to reduce the file sizes
- Files all renamed to a general naming scheme, generally "*YYYY Greenwich Photo-Heliographic Results.pdf*"

Availability on UKSSDC Website

- Both NGDC and UKSSDC copies are available on the UKSSDC website at

<http://www.ukssdc.ac.uk/wdcc1/RGOPHR/>

- Can be viewed and downloaded after registering to the UKSSDC website
- Available as original copies or annotated (covered later)



UK Solar System Data Centre

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Royal Observatory Greenwich - Photo-Heliographic Results

The digitising of the Royal Observatory Greenwich Photo-Heliographic Results is a joint project between the National Geographical Data Center (NGDC) and the UK Solar System Data Centre (UKSSDC), in order to preserve the physical copies as well as to easily distribute the copies. The originals are held at NGDC and UKSSDC if required.

The difference in the quality of copies comes from the different methods used to digitise the Photo-Heliographic Results.

Publications containing errors have been annotated to link errors to the relevant errata. Annotated PDFs are marked with the suffix "(Annotated)".

The data in the 1874 and 1875 books are presented in a format that was changed after a few years. The data is repeated in the '1877 Greenwich Astronomical Results' book with angles given in degrees and minutes, and is repeated again in the '1874-1885 Greenwich Photo-Heliographic Results' book in decimal degrees (the format used from 1881 December 22).

Name	Last modified	Size	Description
1874-1885 Greenwich Photo-Heliographic Results (Annotated).pdf	17-Aug-2012 14:57	27M	
1874-1885 Greenwich Photo-Heliographic Results.pdf	17-Aug-2012 14:58	27M	
1874-1954 Greenwich Sunspot and Geomagnetic-Storm Data.pdf	17-Aug-2012 15:00	7.7M	
1874 Greenwich Astronomical Results (Annotated).pdf	17-Aug-2012 14:54	104M	
1874 Greenwich Astronomical Results.pdf	17-Aug-2012 14:55	104M	
1875 Greenwich Astronomical Results.pdf	17-Aug-2012 15:01	128M	
1877 Greenwich Astronomical Results (Annotated).pdf	17-Aug-2012 15:03	150M	
1877 Greenwich Astronomical Results.pdf	17-Aug-2012 15:04	151M	
1878-1881 Measures of Positions and Areas of Sun Spots and Faculae with the deduced Heliographic Longitudes and Latitudes (Annotated).pdf	17-Aug-2012 15:14	85M	
1878-1881 Measures of Positions and Areas of Sun Spots and Faculae with the deduced Heliographic Longitudes and Latitudes.pdf	17-Aug-2012 15:12	85M	
1878 Greenwich Spectroscopic and Photographic Results (Annotated).pdf	17-Aug-2012 15:07	34M	
1878 Greenwich Spectroscopic and Photographic Results.pdf	17-Aug-2012 15:10	34M	
1879 Greenwich Spectroscopic and Photographic Results (Annotated).pdf	17-Aug-2012 15:16	24M	
1879 Greenwich Spectroscopic and Photographic Results.pdf	17-Aug-2012 15:16	24M	
1880 Greenwich Spectroscopic and Photographic Results (Annotated).pdf	17-Aug-2012 15:17	89M	
1880 Greenwich Spectroscopic and Photographic Results.pdf	17-Aug-2012 15:19	89M	
1881 Greenwich Spectroscopic and Photographic Results (Annotated).pdf	17-Aug-2012 15:21	101M	

Errata Annotations

- Some of the books contain errata.
- Errata are often for the same book, but sometimes for other books.
- Links are placed at the location of errors, linking to the location of the relevant errata.
- In the NGDC copies, OCR has been used, and so text corrections have been made in addition to the links.

Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULE.	Greenwich Civil Time.	Measurers.	No. of Group, and Letter for Spot.	Distance from Centre in terms of Sun's Radius.	Position Angle from Sun's Axis.	HELIOGRAPHIC		SPOTS.		FACULE.
					Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	Area of WHOLE for each Spot (and for Day).							Area for each Group (and for Day).	Longitude.	Latitude.	Area of UMBRA for each Spot (and for Day).	
1899. 4.251	CL, M	4826c	0.336	105.1	103.1	- 8.5	12	52		1899. 7.484	CL, M	4829	0.688	108.4	37.1	- 15.5	0	4	
I.		4826	0.372	100.9	100.7	- 7.5	0	4				4829	0.710	107.3	35.2	- 15.0	0	3	
Jan. 5		4829a	0.992	103.0	39.0	- 13.4	0	182	117p	Jan. 8		4829c	0.713	105.1	34.7	- 13.6	18	99	
		Centre	0.941	77.7	63.3	+ 10.3	(43)	(428)	104 (568)		Centre			(79.6)	(- 4.0)	(58)	(383)	(262)	
5.236	CL, M		0.894	258.7	172.7	- 11.8			266	8.471	CL, M	4827a	0.770	267.2	117.4	- 4.8	5	20	183c
		4827a	0.148	260.7	117.7	- 5.2	17	86				4826	0.555	260.7	100.6	- 8.6	0	9	
M.		4827	0.133	263.5	116.9	- 4.7	0	10				4826	0.549	257.9	100.0	- 10.0	0	2	
		4827	0.082	251.9	113.8	- 5.2	0	1				4829a	0.486	112.0	39.5	- 14.1	33	209	
		4827	0.053	235.4	111.8	- 5.5	7	21				4829b	0.510	113.1	38.2	- 15.1	0	30	
		4826b	0.125	135.4	104.2	- 8.9	3	13				4829	0.512	110.8	37.7	- 14.1	0	24	
		4826c	0.139	127.2	102.9	- 8.6	8	41				4829	0.547	111.1	35.4	- 14.9	0	2	
		4826	0.181	117.8	100.0	- 8.6	0	3				4829c	0.549	108.3	34.8	- 13.4	20	125	
		4826	0.205	118.4	98.8	- 9.3	0	3				4831a	0.516	54.1	41.7	+ 13.9	2	13	
		4829a	0.942	103.9	38.8	- 14.4	34	236		Jan. 9	Centre	4831b	0.534	56.6	39.9	+ 13.4	0	7	
		4829b	0.952	105.0	37.0	- 15.5	7	78				Centre			(67.1)	(- 4.1)	(60)	(441)	(183)
		4829c	0.965	103.8	34.2	- 14.3	14	159	768c	9.262	CL, M	4827a	0.883	266.1	118.2	- 5.5	5	16	132f
Jan. 6		Centre			(109.3)	(- 3.8)	(90)	(651)	(1034)			4826c	0.733	262.3	103.3	- 8.5	0	3	412p
6.450	CL, M		0.879	258.7	154.7	- 11.8			170			4829a	0.335	121.9	39.2	- 14.2	32	161	
		4827a	0.408	266.1	117.2	- 5.2	5	40				4829	0.354	125.8	38.9	- 16.0	0	1	
		4827	0.397	266.3	116.5	- 5.0	0	5				4829b	0.359	124.4	38.4	- 15.6	0	4	
		4827	0.319	264.8	111.7	- 5.3	0	10				4829	0.358	121.8	37.9	- 14.8	3	21	
		4826b	0.208	244.6	104.1	- 9.0	0	3			I.	4829	0.358	119.3	37.5	- 14.0	1	12	
		4826c	0.183	244.8	102.8	- 8.3	2	26				4829c	0.398	114.5	34.4	- 13.4	21	101	
		4830	0.615	69.2	57.7	+ 9.4	2	9				4831a	0.388	36.2	42.6	+ 14.1	1	3	
		4830	0.683	71.6	52.3	+ 9.5	0	5				4832	0.718	105.5	10.9	- 14.0	5	17	
		4829a	0.806	104.9	39.9	- 14.3	31	175				4832	0.745	105.1	8.6	- 14.0	0	3	
		4829b	0.823	105.7	38.3	- 15.1	0	72				4832	0.753	107.3	8.1	- 15.7	0	7	
		4829c	0.851	103.9	35.1	- 13.8	15	113	408c	Jan. 10	Centre		0.885	99.3	353.9	- 10.2	(68)	(349)	153 (697)
		4829	0.852	105.3	35.1	- 15.1	0	7	(578)	10.427	CL, M		0.885	262.8	103.3	- 8.4		180	
Jan. 7		Centre			(93.2)	(- 3.9)	(55)	(465)				4829a	0.174	173.8	39.8	- 14.4	22	139	
												4829	0.100	167.3	38.4	- 15.0	7	45	

ERRATA.

SPECTROSCOPIC AND PHOTOGRAPHIC RESULTS, 1899.

MEASURES OF POSITIONS AND AREAS OF SUN SPOTS AND FACULÆ, 1899.

Page.	Column.	Line.	
3	1	10	Longitude, <i>for</i> 111°·8, <i>read</i> 111°·7.
3	1	10	Latitude, <i>for</i> -5°·5, <i>read</i> -5°·4.
10	2	18	Area for Umbra, <i>for</i> 5, <i>read</i> 51.
10	2	21	Total Area for Umbra, <i>for</i> 5, <i>read</i> 51.
15	1	8	Position Angle, <i>for</i> 238°·7, <i>read</i> 245°·6.
15	1	8	Longitude, <i>for</i> 59°·3, <i>read</i> 60°·8.
15	1	8	Latitude, <i>for</i> -15°·9, <i>read</i> -12°·7.
17	2	1	Latitude, <i>for</i> -6°·0, <i>read</i> +6°·0.
17	2	2	Latitude, <i>for</i> -5°·9, <i>read</i> +5°·9.
23	2	1	Measurers, <i>insert</i> CL, M.

Why?

- Preserve the condition of the books.
- Allow for easy access to the data across the globe.
- Allow easier identification of errors
- Once the errors have been found and corrected, further solar research can take place.