



Past solar data

Status, recovery and future preservation

Frédéric Clette

WDC – SILSO, Royal Observatory of Belgium

Outline

- Types of solar data + examples
- Specific weaknesses and risks
- Broader data problems and challenges:
international science data organizations
- Business models for solar repositories
- Key questions

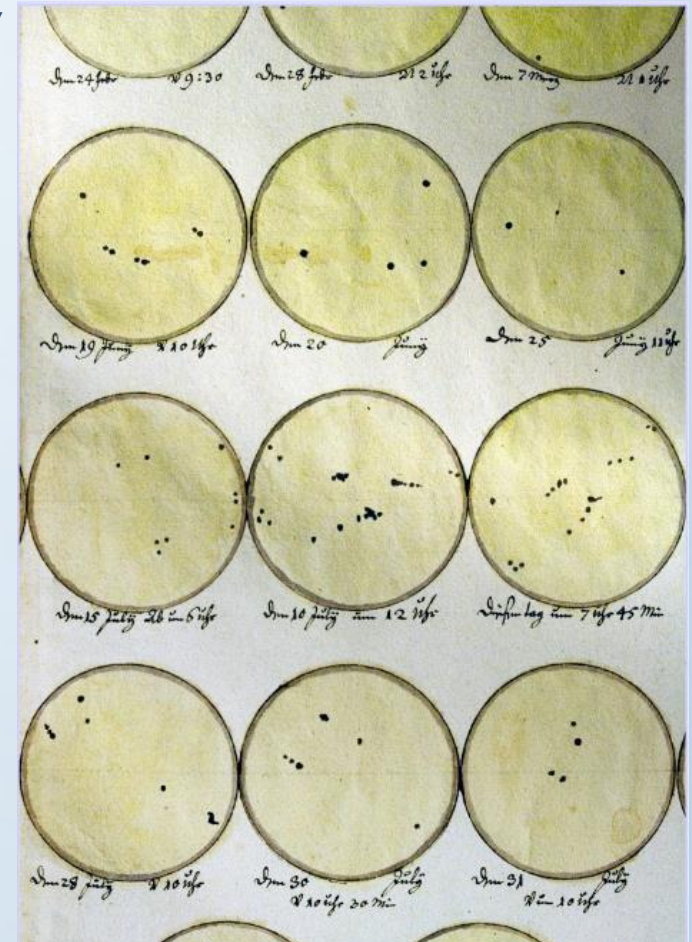
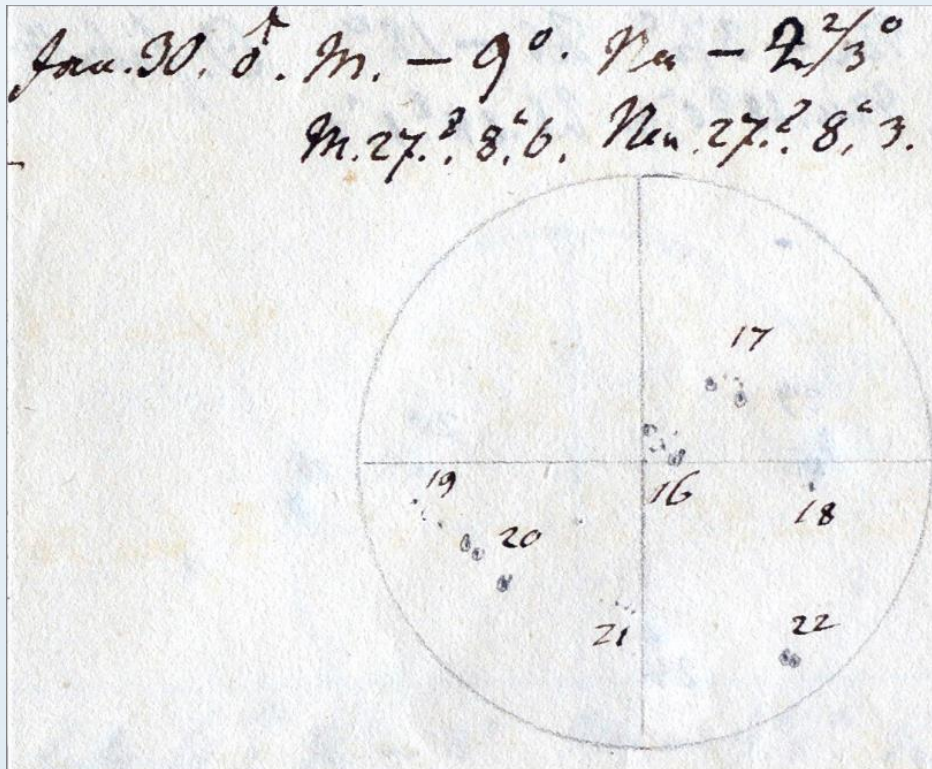
What kind of data ?

- Paper documents (printed or handwritten):
 - Drawings: sunspots, corona (eclipses)
 - Tables: sunspot counts, catalogues
 - Logbooks and reports
- Photographic images (1874 to ~2010):
 - White-light photosphere (sunspots, photometric)
 - Filtergrams/spectroscopic rasters: H-alpha (flare patrol) , CaII-K
 - Magnetograms (Mount Wilson)
 - Spectra
 - Solar eclipses (corona)
- Electronic images (electron tube to CCD, after ~1970)
- Radio (paper-roll recordings, magnetic tapes):
 - Total flux (e.g. F10.7cm)
 - 1D-disc scans or 2D images
 - Spectrograms

Historical drawings

- Staudacher, Schwabe: digitization by R. Arlt (AI Postdam)
- Data not accessible: "ask the author"

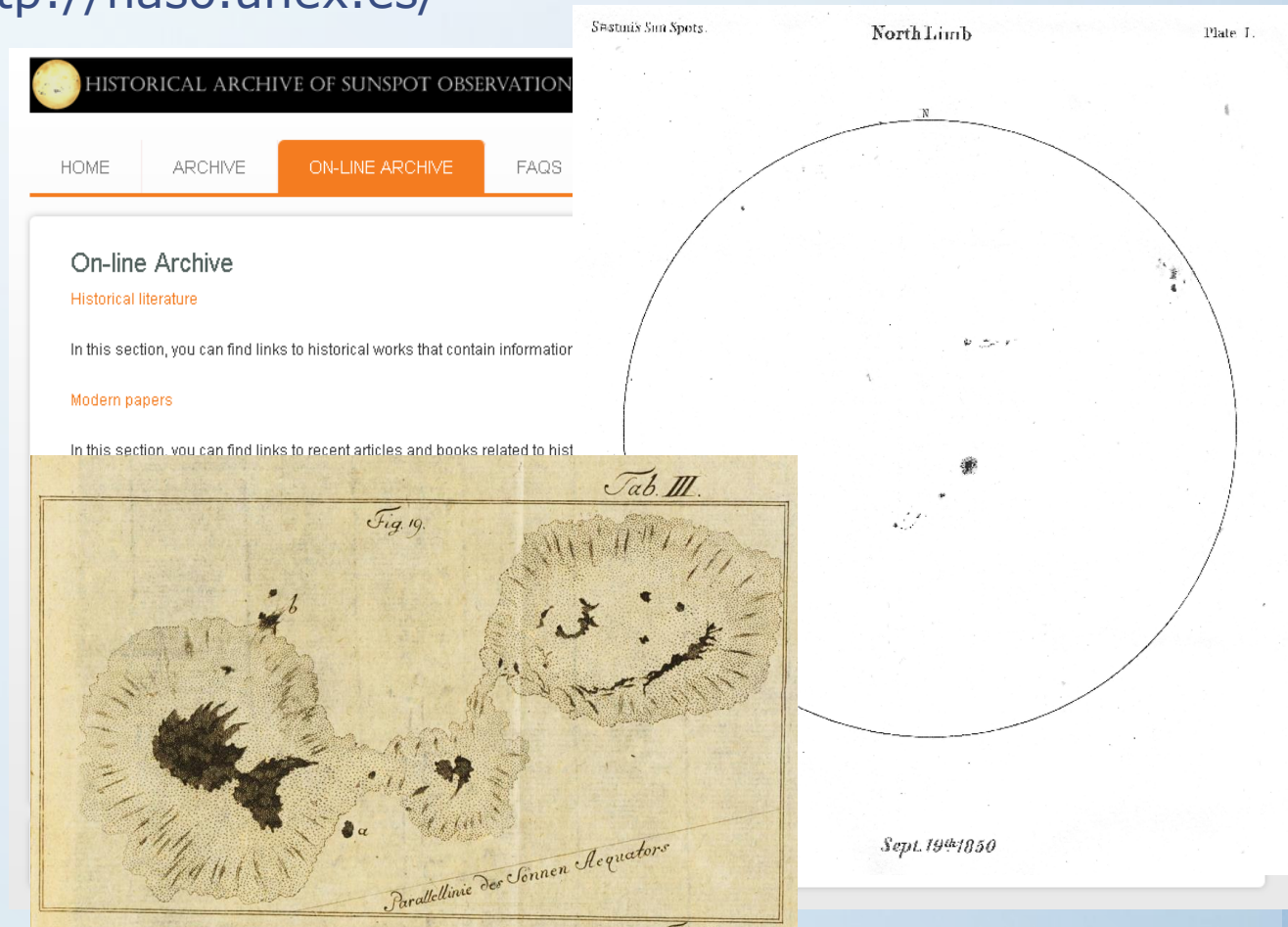
(Historical drawings resource page
<http://obs.astro.ucla.edu/resource2.html>)



The Historical Archive of Solar Observations (HASO)

- Digital archive for sunspot drawings and related historical documents in digital form (University of Extremadura, J. Vaquero): <http://haso.unex.es/>

- Revised group number database (Vaquero et al. 2016): catalog of raw sunspot counts by historical observers (1610-2015)



Zurich sunspot drawing collection

- Drawing collection (1882-1980):
 - Digitization started in 2016, ETH Library (Swiss federal program)



Digitization of sunspot drawings

Aim of the project

Internationally and in scientific circles, there is strong interest in the sunspot drawings stored in the [ETH Zurich University Archives](#). By presenting detailed archive metadata and high-quality digital reproductions of original drawings online in the [e-manuscripta.ch](#) portal, access to this unique observation series will be optimized and simplified for solar research.

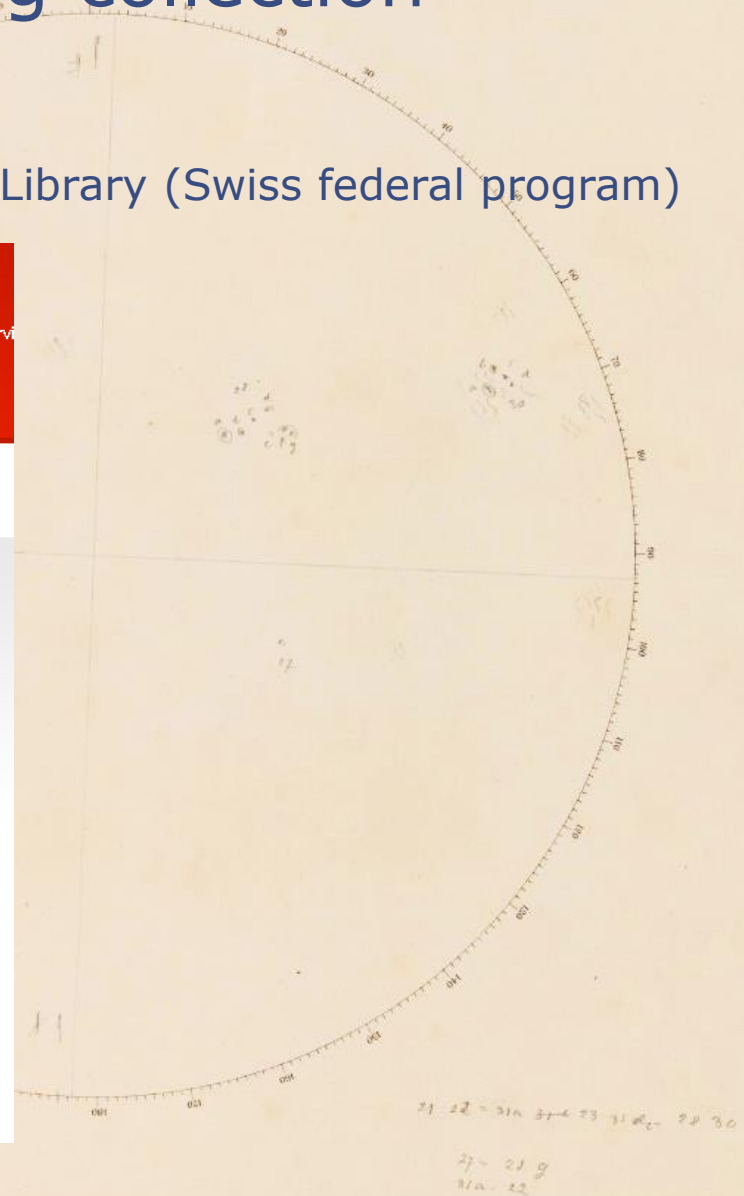
Description of the project

Observation of sunspots began in 1884 using projection image drawings at the Zurich observatory, and was passed on as an ongoing series from 1887 to 1995. In an initial phase, around 23,000 drawings of the observation staff under the respective direction of Rudolf Wolf, Alfred Wolfer and William Brunner will be indexed and digitized by the end of 2016.

From 1947, Helmut Müller assumed responsibility for recording sunspots. A subsequent project will see the indexing and digitization of the later 27,000 or so drawings from the series made at the main Zurich observatory - with additions particularly from Locarno-Monti.

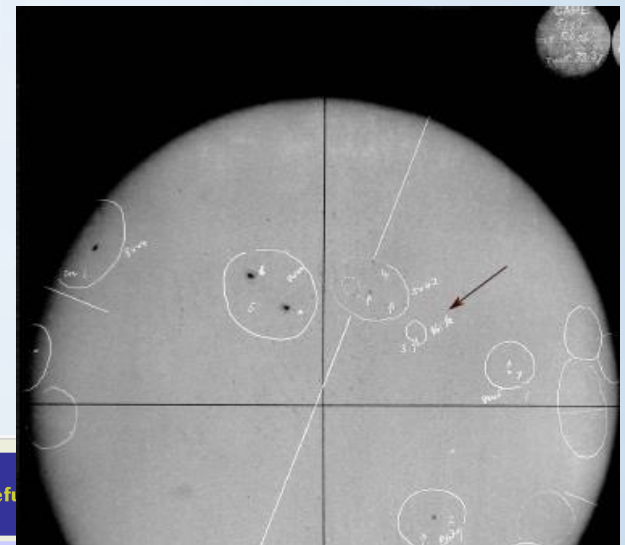
Synergies and context

International solar research



Greenwich photographic collection

- Cambridge Library (D.Willis et al. 2016) :
 - discovery.nationalarchives.gov.uk/details/r/C15306
 - <https://janus.lib.cam.ac.uk/db>
 - After 1976: Debrecen (A.Ludmany, T.Baranyi)
- Loss: all plates before 1918 damaged beyond use during WWII (only contact prints remaining).



About Janus
Participating Institutions
Browse and Search
What's New
Feedback
Useful

[Home](#) > [Janus](#) > [Repositories](#) > [RGO Archives](#)

RO and RGO Solar Plates

Title RO and RGO Solar Plates
Reference GBR/0180/RGO 50
Creator Royal Observatory, Greenwich; Royal Greenwich Observatory
Covering Dates 1918–1979
Extent and Medium 20374 glass plates; 54 contact prints, prints or photoheliographs; 33 positive films; 7 cellulose acetate sheets; glass plate/photograph/paper; The plates in India are in poor condition. Many show mould damage.
Repository Royal Greenwich Observatory Archives

Content and context

Regular observations of the sun were begun at Greenwich because of the fluctuation of the Earth's magnetic field with sunspots and other phenomena. The frequency of magnetic disturbance was due to changes taking place in the sun's activity. Two observers, one working on spots on the sun and the other on the magnetic needle, independently found that the phenomena they observed were cyclical and that when the cycles were compared they proved to be the same. As the spots on the sun became more numerous the daily swing of the magnetic needle became stronger and as they diminish the needle moves more feebly. It was decided to supplement the Magnetic Observatory by one devoted to the direct photography of the sun.

Observations of the sun had been made during the 1860s on a photographic heliograph. Warren De La Rue operated from the Kew Observatory. Early in the

RGO Archives contains:

[<-- See earlier](#)

[RGO 45](#) Papers of John Guy Porter

[RGO 46](#) Papers of Leslie John Cornie

[RGO 47](#) Anglo-Australian Telescope papers

[RGO 48](#) Papers of the Radcliffe Observatory

[RGO 5](#) Papers of John Pond

[RGO 50](#) RO and RGO Solar Plates

[RGO 51](#) RO and RGO Solar Plates Contact Prints

[RGO 52](#) The Astronomical Almanac

[RGO 54](#) Papers of William Ellis

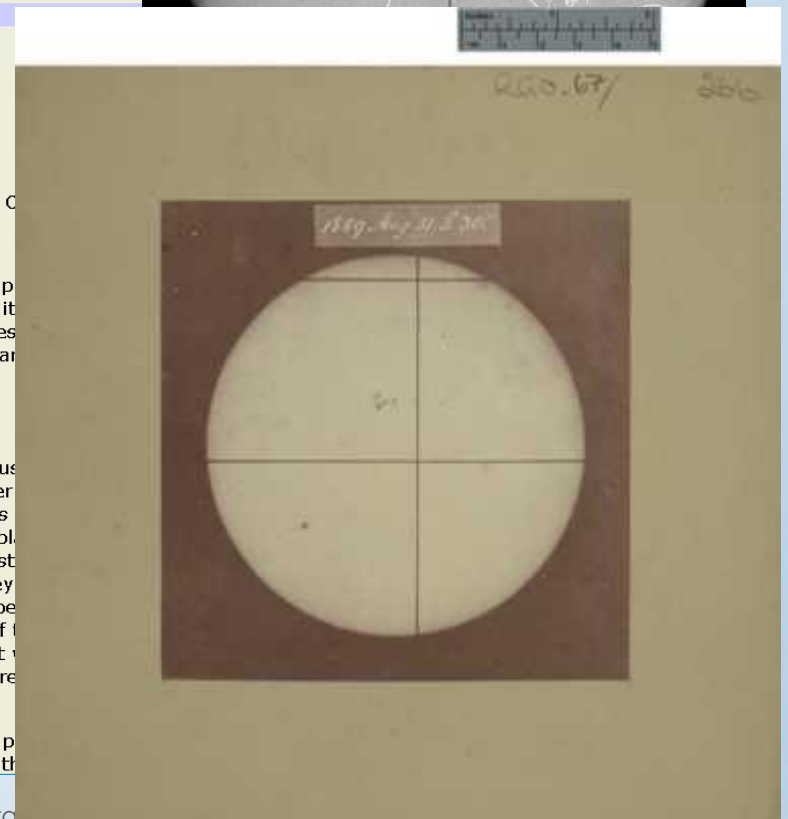
[RGO 55](#) Papers of the Board of Visitors

[RGO 56](#) Papers of Herstmonceux Conferences

[See later -->](#)

Search Janus

[Advanced search](#)



Mount Wilson photographic archive (CaII-K)

- www.astro.ucla.edu/~ulrich/MW_SPADP/ (*site inaccessible!*) re-digitization (L. Bertello et al. 2010):
 - Escaped full loss (single copy of raw data recovered after hard-disk crash)



Mt. Wilson Solar Photographic Archive Digitization Project

The Mount Wilson Archive

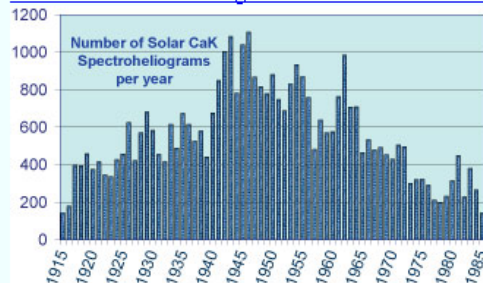
This material is based upon work supported by the National Science Foundation under Grant No. 0236682

Any opinions, findings, and conclusions expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

This archive contains over 150,000 images of the sun which were acquired over a time span in excess of 100 years stored and maintained at the Pasadena California offices of the Observatories of the Carnegie Institution of Washington. Images called White Light Directs, ionized Ca K line spectroheliograms and Hydrogen Balmer alpha spectroheliograms.

This project has digitized essentially all of the CaK. Solar images and step wedge images (available after 1962) original logbook parameters of observation time and scan format.

[Browseable CaK images are available from 1915 to 1985.](#)



16/10/2017

Synoptic Data, MPS, Goettingen

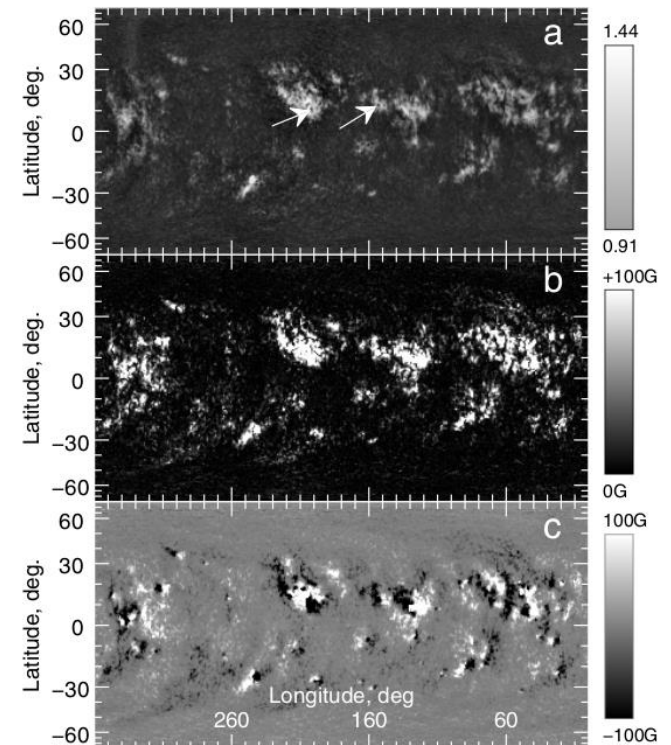
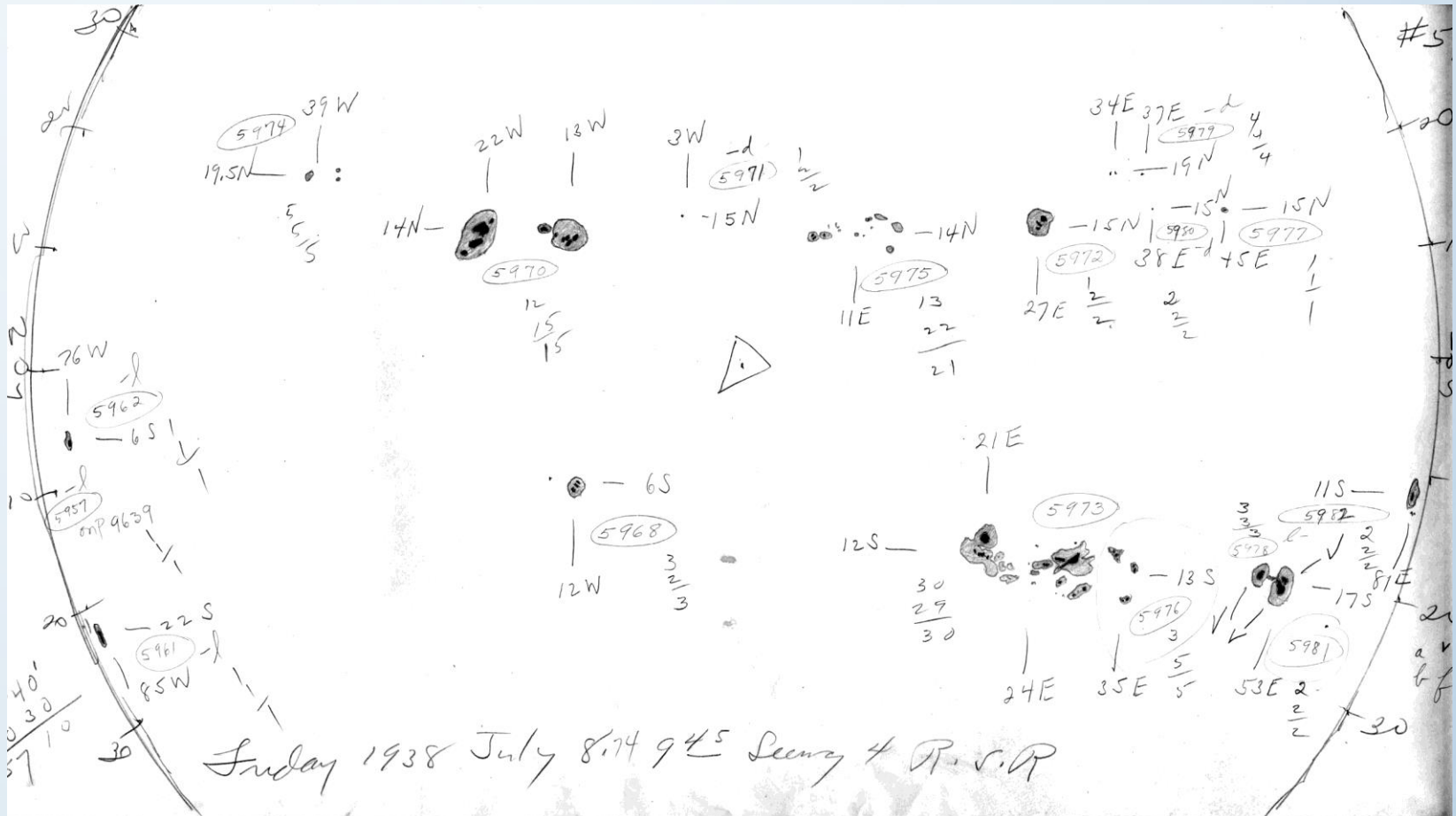


Fig. 1. Synoptic maps of the Ca K-line intensity (*upper panel*), unsigned (*middle*), and signed (*lower panel*) magnetic flux for CR1708. In the magnetogram (*lower panel*) the black and white halftones correspond to magnetic fields with negative and positive polarity. The Ca K-line observations are taken from the MWO, the magnetic field data from the NSO/KP. Two arrows point to dark circular voids (corresponding to sunspot umbrae) in the middle of bright plages. Panel (c) is scaled between ± 100 G (see scale on the right side of the panel).

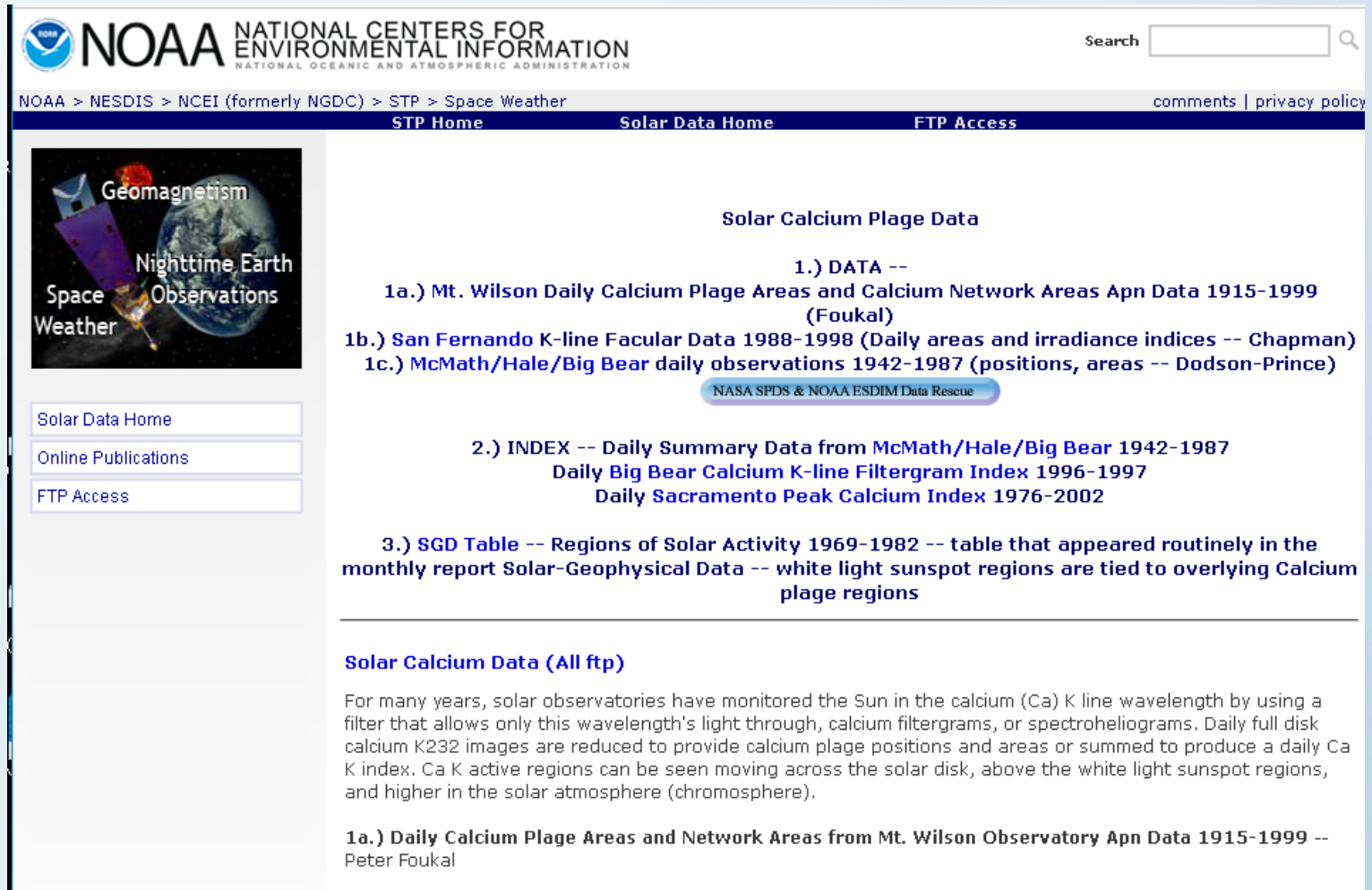
Mount Wilson sunspot Drawings

- Simple FTP: <ftp://howard.astro.ucla.edu/pub/obs/drawings/>



Mount Wilson catalogs and indices

- Distribution through a central platform: NOAA-NCEI



The screenshot shows the NOAA National Centers for Environmental Information website. The header includes the NOAA logo and the text "NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION". A search bar is located in the top right. The navigation bar contains "NOAA > NESDIS > NCEI (formerly NGDC) > STP > Space Weather" and links for "comments | privacy policy". Below the navigation bar are three tabs: "STP Home", "Solar Data Home", and "FTP Access".

On the left side, there is a vertical menu with the following items: "Geomagnetism", "Nighttime Earth Observations", "Space Weather", "Solar Data Home", "Online Publications", and "FTP Access".

The main content area is titled "Solar Calcium Page Data" and contains the following sections:

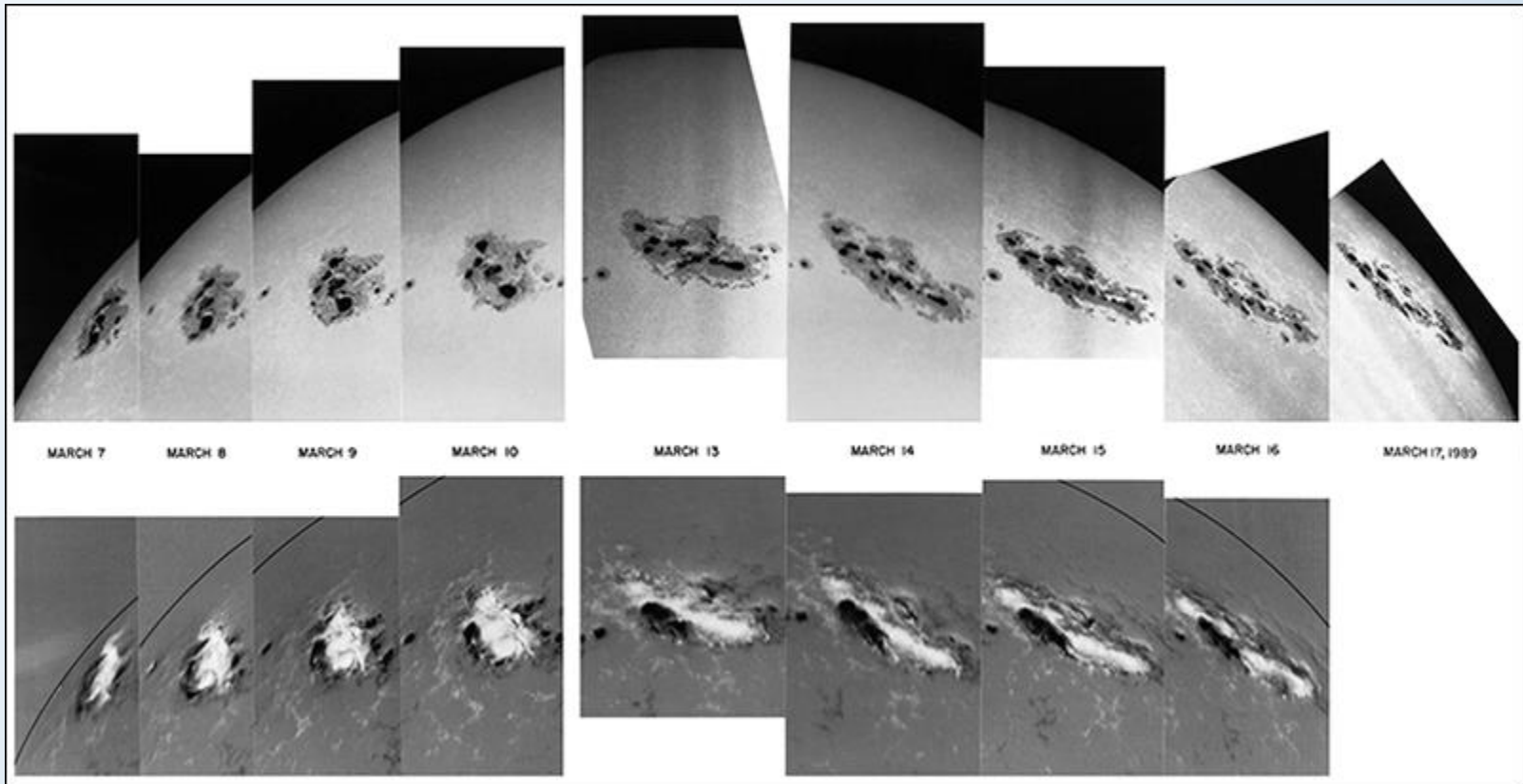
- 1.) DATA --**
 - 1a.) Mt. Wilson Daily Calcium Plage Areas and Calcium Network Areas Apn Data 1915-1999 (Foukal)**
 - 1b.) San Fernando K-line Facular Data 1988-1998 (Daily areas and irradiance indices -- Chapman)**
 - 1c.) McMath/Hale/Big Bear daily observations 1942-1987 (positions, areas -- Dodson-Prince)**
- 2.) INDEX -- Daily Summary Data from McMath/Hale/Big Bear 1942-1987**
 - Daily Big Bear Calcium K-line Filtergram Index 1996-1997**
 - Daily Sacramento Peak Calcium Index 1976-2002**
- 3.) SGD Table -- Regions of Solar Activity 1969-1982 -- table that appeared routinely in the monthly report Solar-Geophysical Data -- white light sunspot regions are tied to overlying Calcium plage regions**

Below the main content, there is a section titled "Solar Calcium Data (All ftp)" with a paragraph of text: "For many years, solar observatories have monitored the Sun in the calcium (Ca) K line wavelength by using a filter that allows only this wavelength's light through, calcium filtergrams, or spectroheliograms. Daily full disk calcium K232 images are reduced to provide calcium plage positions and areas or summed to produce a daily Ca K index. Ca K active regions can be seen moving across the solar disk, above the white light sunspot regions, and higher in the solar atmosphere (chromosphere)."

At the bottom of the page, there is a link: "1a.) Daily Calcium Plage Areas and Network Areas from Mt. Wilson Observatory Apn Data 1915-1999 -- Peter Foukal"

NOAO photographic archive

- <http://archive.noao.edu/home/main>:
filtergrams, magnetograms



7-17 march 1989 (NOAO/AURO/NSF)

PSPT CaII K and photospheric archive

- www.mporzio.astro.it/solare/

INAF - OSSERVATORIO ASTRONOMIC DI ROMA
SOLAR PHYSICS

MAIN

RESEARCH
DATA
PUBLICATIONS
NEWS
STAFF

Latest Images

Updated:
11-Oct-2017

Transit of Mercury

Data Archive

PSPT Images
Arcetri Plates
Equatorial Bar

Latest images of the Sun
observed by Rome PSPT


K B R C

K (393.3 nm)


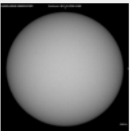
RISE/PSPT (OAR) K (393.3 nm) 11 Oct 2017 UT 07:20:53

Kanzelhöhe CESAR

- cesar.kso.ac.at/: drawings, H α images

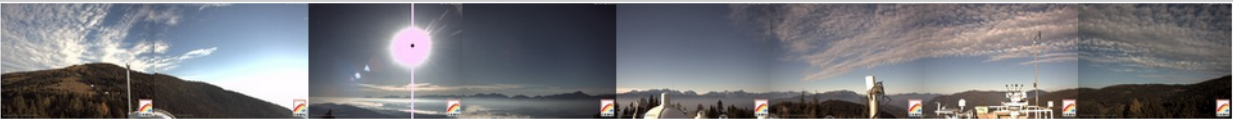


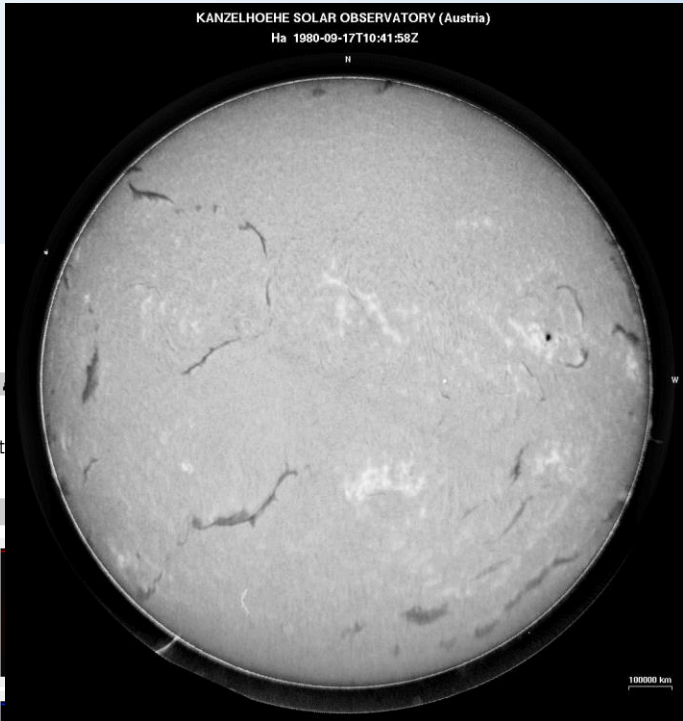
Kanzelhöhe Observatory
Synoptic Archives

Navigation	Archives	Docs & Info	
» Data Policy	October 12, 2017	Julian Date: 2458038.8012	
Browse Data	07:13 UT	Dist. = 0.998 AU App. Diam. = 1923.9" Elevat	
» Latest Images	Sun - Photosphere for Today		
» Latest H α (ESA SSA)		Kanzelhöhe Sunspot Drawing	i
» H α Wing Test		<i>Side reversed!</i>	» Syn. Archive
» Two Weeks Photosphere		Kanzelhöhe Continuum	i
» Two Weeks Chromosphere		06:15 UT	
» Daily Overview		Synoptic * .jpg * .fits.gz	» Syn. Archive
» Sunspot Numbers		Normalized * .jpg * .fits.gz	» Complete Data Archive
» Sunspot Drawings			
» H α	$R_i = 0$	Monthly Summary	
» Whitelight	$g = 0$	H α /GOES Intensity Plot	
» CallK	$f = 0$		
» Flare Detection			
» Filaments			
Download Data			
» Archive / Ftp-Server / Local			
» Fast Mirror Archive / Graz			
Database Search			
» Observation Database			
» Sunspot Numbers			
» Observed Flares			
» KSO observing logs			
Misc.			
» Solar Ephemeris			
» Debrecen Photohel. Data			

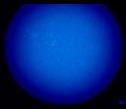
2017-10-11 **« 1 Month** **2017-10-12**

Panorama: 2017-10-12 07:03 (UT)





KANZELHOEHE SOLAR OBSERVATORY (Austria)
Ha 1980-09-17T10:41:58Z



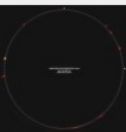
06:32 UT

Synoptic * .jpg * .fits.gz

Normalized * .jpg * .fits.gz

[» Syn. Archive](#)

[» Complete Data Archive](#)



Kanzelhöhe H α Prominence Images

06:17 UT

[» Syn. Archive](#)

» Data Policy
» KSO Homepage
» Institute of Geophysics, Astrophysics and Meteorology (IGAM)
» University of Graz
» Contact

Kislovodsk Mountain Astronomical Station

- solarstation.ru: sunspot, H α -Ca feature catalogues and maps

The image displays two side-by-side panels. The left panel is a screenshot of the website for the Kislovodsk Mountain Astronomical Station, part of the Pulkovo observatory. The website header includes the station's logo and name. A navigation menu lists 'Main', 'About station', 'Staff', 'News', and 'Gallery'. A sidebar on the left contains a list of links for solar activity, data archive, sun service, and various solar layers like the photosphere, chromosphere, and corona. The main content area is titled 'Sun activity' and features a 3D visualization of the Sun's atmosphere with labels for 'Chromosphere 656.3nm' and 'Chromosphere 393.4nm'. Below this, a satellite is shown orbiting Earth, with a label for 'Geomagnetic field'. The right panel is a historical sunspot map from July 7, 1979. It shows a globe with a grid of latitude and longitude lines. Sunspot groups are marked with numbers and letters, such as 19N, 21N, 24N, 26N, 27N, 17S, 21S, 15N, 17S, 26S, and 18N. The map includes coordinates: $W = 231$, $S = 2738$, $D = +3^\circ$, $L_0 = 130^\circ$, and the date $7 VII 1979$. At the bottom of the map, there is a Russian caption: 'Наблюдений флюккул, протуберанцев и короны не было'.

NAOJ drawing and CCD image archive

- <http://solarwww.mtk.nao.ac.jp/en/database.html>



English / Japanese

Home

Overview

Instruments

Research

Database

Gallery

Solar Activity Database

Overview

National Astronomical Observatory of Japan and its (Tokyo) have been conducting observations of various numerous sunspots and frequent flare explosions, for example in the 17-th century there was a period of investigate such a long time scale variation of the sunspot data are crucial.

We have made the following data available to the public. If you publish an article based on these data, you are requested to cite the following URL.

Database Calendar

Database

	Solar Flare Observing
White-Light Full-Disk	White-Light, G-band Full-Disk Images, 1992--2007
Ca-K Full-Disk	Ca-K Full-Disk Images, 1992--2007
H α Full-Disk	H α Full-Disk Images, 1992--2007
He 10830Å Full-Disk Magnetograms	Infrared Stokes-Polarization Magnetograms, 2010--
Full-Disk Magnetograms	Infrared Stokes-Polarization Magnetograms, 2010--
Active Region Vector Magnetograms	Vector Magnetogram Images, 1992--2007
H α Active Region	H α Active Region Images, 1992--2007

NAOJ News 2016,3 Special Poster (PDF, 21MB, 3.6MB)

The biggest sunspot in solar cycle 23 (2003)

Mar. 18, 1959
11 h 00 m

Weather Fine with some clouds

Tra. 3~4

Sci. 4

Dis. 2~3

Image 2~3

P = -24.86
B_z = -9.10
L_z = 99.00

R = 17.132
g = 9.72
C.N.

196

1958~1959
J 198
q +8.2
a2 7.6

Multi-station data portals: BASS2000

- bass2000.obspm.fr: Paris-Meudon, Pic-du-Midi, Coimbra, USET-Brussels

The screenshot displays the BASS2000 web portal. At the top, the header includes the logo 'BASS2000 Observations systématiques du Soleil' and the date '12 Oct 2017 11:35 UT'. Below the header, there are navigation buttons for 'Jour précédent', 'OK', and 'Jour suivant', along with a date input field and language selection options for 'en' and 'fr'. A sidebar on the left contains a menu with categories: ACCUEIL (Dernières observations, Derniers films, Archive long terme, Actualité), RECHERCHER (Des observations, Des fichiers, Des structures solaires, Des cartes synoptiques, HELIO features cat.), OUTILS (Ephémérides, Spectre solaire, Externes, Soleil live & webcams, Logiciels), and GUIDES (Instruments, Données, Logiciels, Ressources éducatives). The main content area is titled 'RECHERCHER DES OBSERVATIONS' and contains a search form. The form has three sections: 'Date selection' with options for '1 derniers jours OU', 'du: 01 Jan 2017 à 0 jours après OU', and 'Toutes les dates où la région NOAA numéro [] est observée'; 'Longueur d'onde ou fréquence, instrument' with dropdown menus for 'chromosphère', 'photosphère', 'H_Alpha', 'K1v', and 'Spectrohéliographe de Meudon', 'Héliographe de Meudon'; and 'Options de sortie' with 'Imagettes: Oui/Non', 'Résultats/page: Un jour', and 'Trier les résultats par: date ->'. A large blue callout box contains the text: 'Ce formulaire permet d'interroger la base des Observations. Spécifier une ou un intervalle de dates. La recherche peut être limitée en choisissant un domaine de longueurs d'onde ou un ou plusieurs instruments. En changeant les Options de sortie, vous pouvez changer l'aspect de la page de résultats.' A smaller blue callout box at the bottom says: 'Ou obtenir les observations du mois en cours pour l'instrument sélectionné'.

Issues and risks



Weaknesses

- Isolated initiatives:
 - by individuals or single institute
 - No coordination or common standards
 - ➔ Long-term storage depends only on local resources of a single hosting institute.
- Low accessibility and discoverability:
 - Data not accessible in-digital form
 - Basic or no on-line browsing tools (FTP)
 - ➔ Users reluctant to spend efforts on the time-consuming and “invisible” data recovery
- Data at risk!
 - Improper document storage conditions
 - Important data falling into oblivion:
 - Disappearance of know-how as dedicated staff is not renewed
- ➔ Most problems resulting from:
 - Minimal or no funding for data curation work (one-person teams)
 - Disappearance of long-term structural funding schemes

Issues for **paper documents**


- **Assets:**
 - Information accessible without equipment (visual reading)
 - Permanently decodable (no compression or coding layer)
- **Risks:**
 - **Slow paper and ink degradation (acid paper)**
 - **Accidental destruction (single copy): fire, floods**
 - Archives maintained by individual scientists in local institution:
 - loss of know-how after retirements, etc.
 - Data loss (trashing of archives considered as obsolete)
- **Inaccessible to direct scientific exploitation:**
 - Digitization required:
 - **Scanning:** fast step, ensure protection against risks
 - **Encoding (tables) or measuring (drawings)**
 - **Dispersed and non-discoverable:**
 - Original historical documents scattered in their home institutions, libraries
 - Deep storage and lack of metadata
 - **Restricted or paying access policy in academic libraries (property)**

Issues for **photographic documents**

- Assets:
 - Information accessible without equipment
 - Permanently decodable/measurable (no compression or coding layer)
- Risks:
 - **Slow degradation (humidity, mold, delamination): improper storage**
 - Accidental destruction (single copy): fire, floods
 - Archives maintained locally in the host institution: loss of know-how, changes in institution priorities
 - Loss: trashing of collections or isolated plates considered as obsolete
- Inaccessible to direct scientific exploitation:
 - Digitization required:
 - **Scanning (photometric quality)**: ensure protection against risks
 - **Calibration: missing metadata** (e.g. emulsion type and properties)
 - (Exploitation similar to other digital images)
 - Dispersed and non-discoverable:
 - Original historical documents scattered in their home institutions

Issues for old **digital-born data**

- Assets:
 - Data already in digital form (ready for computer processing)
 - Data sets often documented (readme files) and discoverable
- Risks:
 - Slow media degradation (magnetic tapes, CDs, DVDs, hard disks)
 - Accidental destruction: media erased, fire, floods
 - Archives maintained locally in the host institution: loss of know-how, changes in institution priorities
 - Loss (uncatalogued media considered as obsolete)
- **Long-term readability of the archived data:**
 - Data in old compressed form
 - **Obsolete file formats (sometimes proprietary): unsupported by newer software**
 - **Obsolete media (no more readers)**

 **Need for an active periodic transfer to new media/formats.**

Low and shrinking funding: causes

- Funding limited to short-term projects with immediate return
 - Requirement of immediate identifiable science return:
excludes long data recovery projects
 - Political attraction for Big Science (big data):
ignores old small-volume high-significance data sets
- Competition-based science policy
 - Quick return, mainstream topics (e.g. space weather)
 - Deters young scientists (“slow science” kills your career!)
- Unidimensional science productivity criteria:
 - Bibliometry as unique measure
 - Data production not considered as a true scientific activity
 - Science as driver of technology and economy:
 - Past data only require off-the-shelf commercial equipment/software

➡ Long-term data recovery and maintenance is out of the picture

Typical “survival” solutions

- End-of-career project of senior scientists:
 - Small side-budgets (from annual dotation of host institute)
 - One-shot money for small investments from project participations
 - Use of volunteers, part-time colleagues, student summer jobs
 - Part-time side work >>> sloooooow

➡ **Highly precarious** (homogeneity and completion not guaranteed)
- Governmental digitization programs:
 - Often destined to museums and ministries:
 - Paper documents: texts
 - Pieces of art (cf. Europeana)
 - Special quantitative techniques are not foreseen (e.g. densitometers)
 - Focus on commercial return (public-private contracts):
 - On-line access to popular items (paintings, etc.) for a fee
 - Focus on data/artifact preservation:
 - Survival to steady decay
 - No more manipulation of the original

➡ **No budget for measurements or catalog construction**

Broader data problems and challenges

International science data organizations



A much broader problem

- Three worldwide organizations dedicated to science data

- **World Data System, WDS** (ICSU/UNESCO)
since 2008: www.icsu-wds.org

- Coordination and accreditation of World Data Centers (data repositories & services, origins back in 1957)
- Focus on identifying, creating, and sustaining institutions that provide stewardship, long-term preservation, and access to data.



- **Committee on Data for Science and Technology, CODATA** (ICSU) since 1966: www.codata.eu

- Members: academies, science councils, international scientific unions
- Focus on data technologies and standards: framework of standards, agreements and protocols that enable data to be shared and reused.
 - Data citation standards and practices
 - Interoperability standards
 - Citizen science and crowdsourced data



A much broader problem

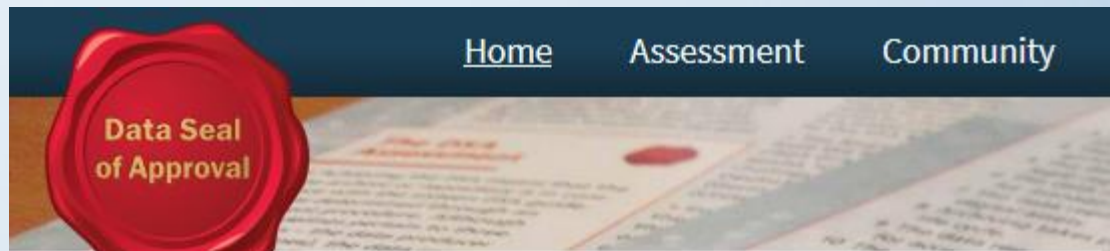


- **Research Data Alliance RDA** since 2013:
www.rd-alliance.org
 - Membership: private & non-profit organizations (publishers), individuals
 - Focus on data curation practices and policies:
 - **Data discoverability** (permanent identifiers)
 - Data security, versioning, interoperability
 - **Data repositories**, metadata standards, disciplinary data registers
 - **Data rescue, data service sustainability**
 - **Long-tail data**
 - Legal and ethical aspects (Health and social sciences)
- Organization of **International Data Weeks** (Sept. 2016, Denver, USA): synergies, common initiatives:
 - Challenge of Big Data
 - Trans-disciplinary data standards and interoperability
 - **Data traceability and permanent identifiers** (CrossRef, DataCite)



Some initiatives under development

- Generalization of **permanent identifiers** (DOI codes):
 - Uniquely identifies an item regardless of its physical status/location
 - Also for identification of data sets
 - Tracking of different versions
- **Data Seal of Approval** (DSA):
<https://www.datasealofapproval.org>
 - Created by the Data Archiving and Networked Services (DANS, Netherlands)
 - Focused on **data curation practices**
 - Now adopted by WDS as base for future accreditation of World Data Centers



Value of data production = peer-review publications

Putting solar data in a broader context

- Advantages:
 - Not reinventing the wheel: adopting standards, practices already in development for other domains
 - Compatibility and interoperability with other types of data
 - Leveraging effect: benefiting from the weight of a large international data community
- Disadvantages:
 - Small solar community:
 - Limited influence on adopted standards (not well adapted to the case of solar physics?)
 - Large bureaucratic organizations:
 - Heavy decisional process
 - Emphasis on advanced data techniques (large repositories) and on service accreditation:
 - Data rescue is secondary.

Putting solar data in a broader context

- Risks for small historical data repositories:
 - Higher requirements on data services (advanced standards):
 - More work for already understaffed services
 - Lack of existing know-how in the latest data technologies (small teams)
 - Organization working only as specifying bodies:
 - No corresponding support or funding for the implementation
- Only data curation standards:
 - Science validation of the data is under responsibility of disciplinary science unions

Business models

- **Classical institutional repository:**
 - Funding, staff and logistic provided by a hosting institution (University, Governmental research)
 - Funding source: running annual budgets of institutions
 - Open-access public data (no revenue)
 - **Dominant (exclusive?) model for solar data**
- **Commercial revenues from paying users:**
 - All data (typically: statistical data, geographically distributed data)
 - Or part of the data: value-added data products (mapping, etc.)
 - **Not applicable to solar data: No market:**
 - Users = small community of (non-paying) scientists
 - Indirectly feeds services to end-users (ionosphere: telecom, GNSS; magnetosphere: energy distribution, space assets)

Business models: other options?

- **Cost-recovery mechanisms:**

- Charging licence fees for any commercial downstream service
- Still open for all non-profit public-service uses:

Creative Commons type of licences



- **Global funding scheme for international data services:**

- International source: Supervising worldwide institution provides the funding to accredited services
- Most logical solution: full superposition

benefiting science community = accreditation body = financial source

- Primary overarching organisations for solar physics:
 - IAU
 - ICSU
 - AGU, EGU, IUGG

Questions as conclusion

- Which is the best way to standardized-browsable-discoverable multi-site archives?
 - Promoting the implementation of standards in existing local archives?
 - Which extra budget?
 - How to acquire the required technical know-how? (training?)
 - Creation/development of central repositories/portals?
 - Where and how ?
 - How to address data property issues ?
 - Will data stored in those centers have a better life expectancy?
- Local institutional solar archives: a financially sustainable business model?
 - Alternative options? Which ones?
 - Working examples?
- Solar-specific advocacy for solar archive services or integration in international data organizations?
 - Role of IAU or other scientific unions?



Thank you for your attention