

SWx TREC's Space Weather Data Portal: a launch pad for space weather research

Jenny Knuth¹, Greg Lucas¹, CHRISTOPHER PANKRATZ², Thomas Berger³, Richard Clark⁴, and Tamitha Skov⁴

¹Laboratory for Atmospheric and Space Physics

²University of Colorado Boulder

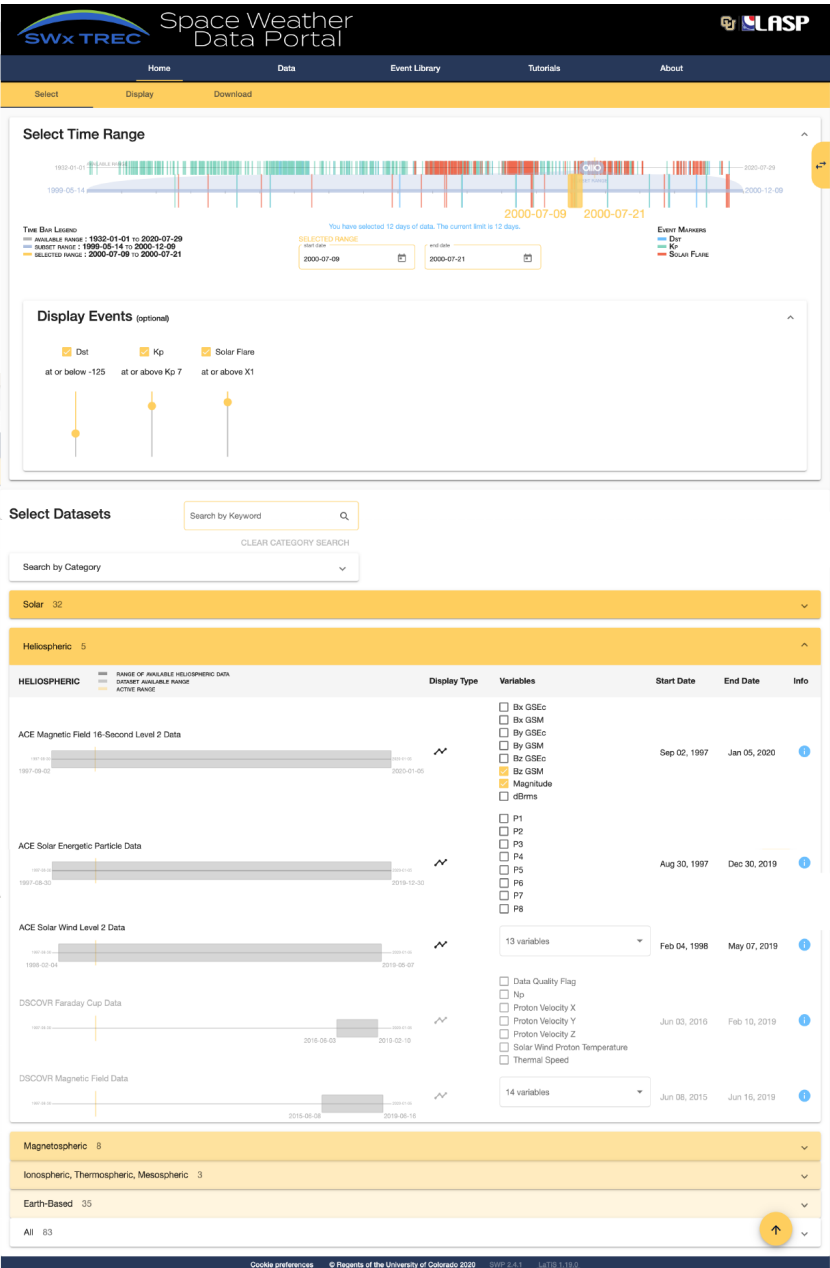
³CU Boulder

⁴Millersville University

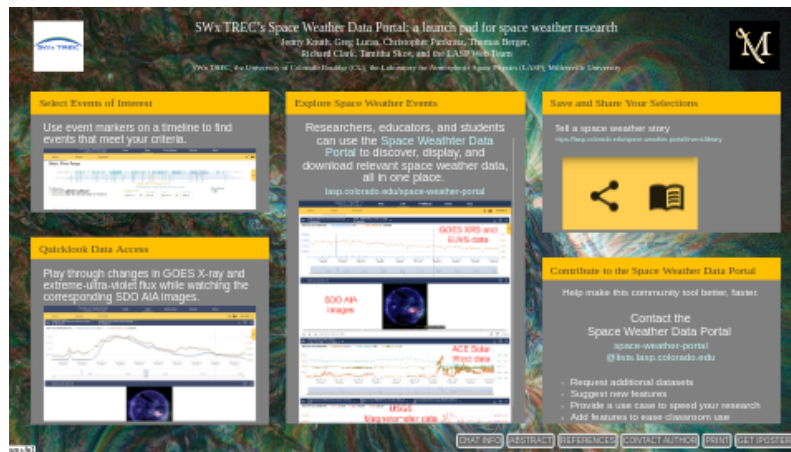
November 24, 2022

Abstract

One obstacle to space weather research is the practical challenge of accessing relevant data. Space weather data are housed in disparate repositories, each with its own unique focus, be it solar, magnetospheric, atmospheric, or earth-based. Much of the effort spent acquiring data could instead be spent on space weather research and education. To address this problem, the Space Weather Technology, Research, and Education Center (SWx TREC), at the University of Colorado, Boulder, in collaboration with the Laboratory for Atmospheric and Space Physics (LASP), has developed the Space Weather Data Portal (<https://lasp.colorado.edu/space-weather-portal>), a tool built by and for the space weather community. Through the Data Portal, previously dispersed space weather data are in one unified place, accessible to scientists, students, and curious individuals. The focus is on the users and their ability to discover, display, compare, overplot, and download relevant data. A user can filter for past events then easily display and download data related to that event, from the moment it occurs on the Sun, as it travels through space and the atmosphere, to the impacts it has on the Earth. Analysis of space weather events via the Data Portal has proved useful for forecaster training and online learning. The community-created Event Library is a short-cut to curated data collections that provide narratives for context and serve as launch pads for further space weather exploration. This presentation will highlight contributions to the Data Portal from the community: datasets, event markers, timelines, and narrated data collections. Your contributions are encouraged as new resources and improvements are deployed every few weeks. Through this iterative, collaborative process, the Data Portal aims to increase awareness of space weather and its impacts and decrease the time between research and real-world applications.



SWx TREC's Space Weather Data Portal: a launch pad for space weather research



Jenny Knuth, Greg Lucas, Christopher Pankratz, Thomas Berger,
Richard Clark, Tamitha Skov, and the LASP Web Team

SWx TREC, the University of Colorado Boulder (CU), the Laboratory for Atmospheric Space Physics
(LASP), Millersville University

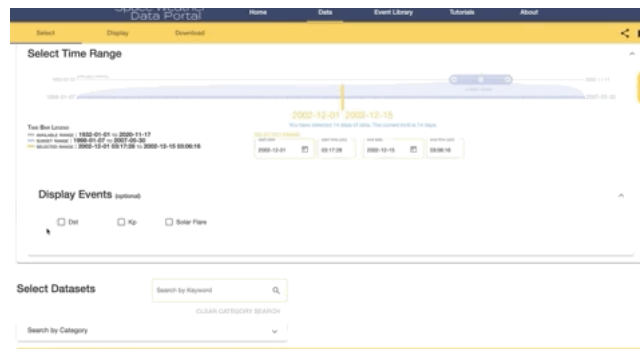


PRESENTED AT:



SELECT EVENTS OF INTEREST

Use event markers on a timeline to find events that meet your criteria.

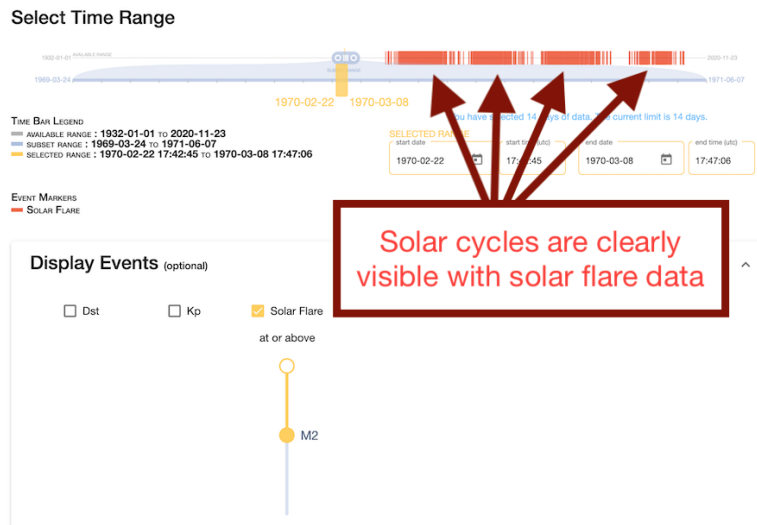


The Space Weather Data Portal provides graphical event selectors to help the user visualize events on a timeline and select a time range of interest.

Filtering on event indices can speed investigation of space weather phenomena. Some common barriers to entry for space weather data include:

- How do I know where to look?
- What is my time range of interest?
- What kinds of data were available at that time?
- What are key space weather phenomena?
- What are relevant indicators of space weather events?
- How do the indices relate to each other?

The Space Weather Data Portal smooths out the discovery process. The time range selector interactively displays events so users can quickly see solar cycles and patterns.



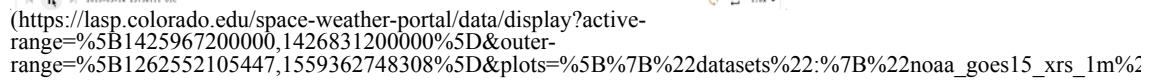
Selecting solar flares of class M2 and above clearly delineates solar cycles since data became available in 1975.

Some potential areas for further exploration:

- When are there solar flares but not geomagnetic storms?
- What were the largest geomagnetic storms in Solar Cycle 23?
- Does solar flare magnitude correlate with geomagnetic storm intensity?

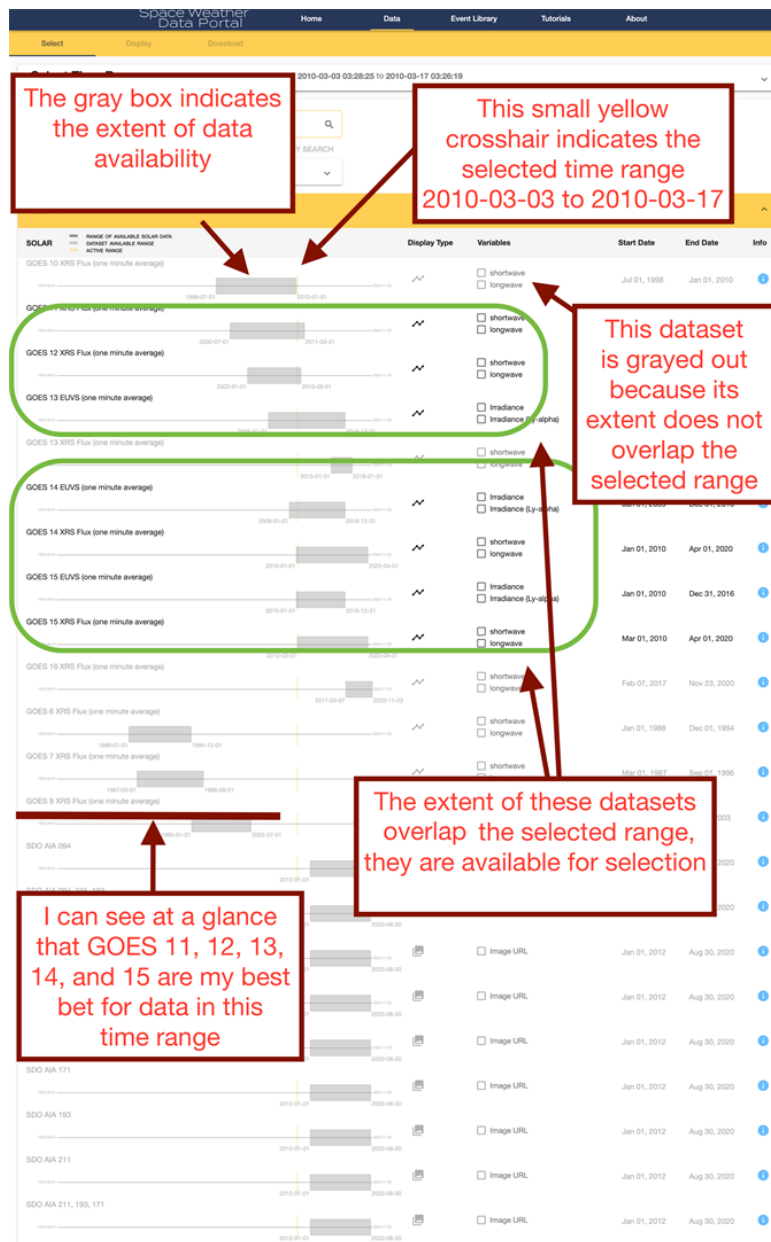
Event filters are optional for discovering data, but they can help the user focus in on an area of interest and spark new research directions.

Play through changes in GOES X-ray and extreme-ultra-violet flux while watching the corresponding SDO AIA images.



See at a glance what data is likely to be available in which time ranges.

- What data was available in 1972?
- What GOES data might be available for my 2010 event?



A view of some of the datasets available on the data selection page. (<https://lasp.colorado.edu/space-weather-portal/data?active-range=%5B1267586905033,1268796379794%5D&outer-range=%5B1215823627360,1278103481143%5D&plots=%5B%5D>) (<https://lasp.colorado.edu/space-weather-portal/data?active-range=%5B1267586905033,1268796379794%5D&outer-range=%5B1215823627360,1278103481143%5D&plots=%5B%5D>)

Display all the SDO suns together and watch an event.

Researchers, educators, and students can use the Space Weather Data Portal (<https://lasp.colorado.edu/space-weather-portal>) to discover, display, and download relevant space weather data, all in one place.

The screenshot displays the Space Weather Data Portal interface with several data visualization panels:

- GOES XRS and EUVS data:** A line plot showing GOES 15 XRS Flux (one minute average) and GOES 15 EUVS (one minute average) irradiance from 2015-03-11 to 2015-03-20. The XRS flux is on the left y-axis (0.00002 to 0.00008), and EUVS irradiance is on the right y-axis (0.000 to 0.010). A red text label "GOES XRS and EUVS data" is overlaid.
- SDO AIA images:** A panel showing SDO AIA 034, 035, 193 images. It includes a thumbnail of a solar image and a red text label "SDO AIA images".
- ACE Solar Wind Level 2 Data:** A line plot showing ACE Solar Wind Level 2 Data from 2015-03-11 to 2015-03-20. The plot includes parameters like Tpr, V_GSE_1, V_GSE_3, V_GSE_1km/s, and V_GSE_3km/s. A red text label "ACE Solar Wind data" is overlaid.
- USGS Magnetometer data:** A line plot showing Magnetometer (USGS) data from three stations: Barrow Station, Fresno Station, and College Station. The plot shows magnetic field components (Z, X, Y) from 2015-03-11 to 2015-03-20. A red text label "USGS Magnetometer data" is overlaid.
- Geomagnetically induced currents:** A map of the United States showing maps of Electric Line Voltage (ELV) from 2015-03-17 to 2015-03-18. A red text label "Geomagnetically induced currents" is overlaid.

View sun-to-mud data for the 2015 St. Patrick's Day solar storm (https://lasp.colorado.edu/space-weather-portal/data/display?active-range=%5B1425967200000,1426831200000%5D&outer-range=%5B1262552105447,1559362748308%5D&plots=%5B7B%22datasets%22:%7B7B%22noaa_goes15_xrs_1m%22:%5B%22shortwave%22%5D,%22noaa_gc_all%22%5D%7D%7D). Click image to link to live site.



The Space Weather Data Portal uses the LaTiS API (<https://github.com/latiis-data/latiis>) to access data at its source (see Lindholm and Lindholm). The Data Portal is not a repository that stores data. Instead, it is an entry point to multiple, dispersed, established

repositories that house data relevant to space weather research. This "portal" model—enabled by the LaTiS access layer—decreases duplication and reduces confusion about the definitive source of a dataset.

SAVE AND SHARE YOUR SELECTIONS

Tell a space weather story.

<https://lasp.colorado.edu/space-weather-portal/event-library> (<https://lasp.colorado.edu/space-weather-portal/event-library>)



Save your selections with a copy of the URL. This will serve as a shortcut or bookmark to return to that selection of data.

Share your selections with colleagues and students by sending them your link.

See something cool? Add your observations to the Event Library (<https://lasp.colorado.edu/space-weather-portal/event-library>).

A screenshot of the 'Space Weather Data Portal' website. The header includes the 'SWx TREC' logo, the site title 'Space Weather Data Portal', and the 'LASP' logo. A navigation bar contains links for 'Home', 'Data', 'Event Library', 'Tutorials', and 'About'. The main content area is titled 'Event Library' with a subtitle 'Quick links to community-curated SWx events: expand the card and click the button.' Below this, there are several event cards arranged in a grid. Each card has a date header (e.g., 'Aug 2020', 'Jul 2020', 'Sep 2019'), a title, a description, a date range, and the contributor's name. The events listed include 'The Perfect Storm: Hurricane Irma and the Radio Blackouts of September 2017', 'August 1972: Super Storm of the Apollo Era', 'Moreton Wave Event of 6 December 2006', 'Dual Flare Event of 6 September 2017', 'Radio Blackout Solar Event in Sweden, 3-4 November 2015', '10-September-2017 Ground-Level-Event Radiation Storm', and '2015 Saint Patrick's Day Storm "Sun to Mud"'. At the bottom of the event grid is a 'Share Events' section with a form for submitting new events, including fields for title, link, name, email, and description.

(<https://lasp.colorado.edu/space-weather-portal/event-library>)

To contribute to the Event Library (<https://lasp.colorado.edu/space-weather-portal/event-library>), send your link from the Space Weather Data Portal to:

space-weather-portal@lists.lasp.colorado.edu

Include a title, the link, your name, optional email, and a brief description.

Recent contributions to the Event Library (<https://lasp.colorado.edu/space-weather-portal/event-library>) were made as part of an undergraduate 2020 summer internship program at Millersville University supervised by Dr. Richard Clark and Dr. Tamitha Skov. Each student was assigned a paper about a space-weather event with clear societal impacts. After reading the paper, each student created an entry for the Event Library (<https://lasp.colorado.edu/space-weather-portal/event-library>) describing the event and linking to data to illustrate the event's impact.

CONTRIBUTE TO THE SPACE WEATHER DATA PORTAL

Help make this community tool better, faster.

Contact the Space Weather Data Portal

space-weather-portal
@lists.lasp.colorado.edu

- Request additional datasets
- Suggest new features
- Provide a use case to speed your research
- Add features to ease classroom use
- Contribute a narrated event to the Event Library
(<https://lasp.colorado.edu/space-weather-portal/event-library>)
- Report a problem
- Suggest an improvement

Let us know what you think. We look forward to hearing from you.

ACKNOWLEDGMENTS

Thanks to the CU Boulder Chancellor's Office for providing the seed funding for SWx TREC and the Space Weather Data Portal.

Thanks to LASP for hosting the site and providing critical infrastructure.

Thanks to the LASP Web Team for contributing libraries on the front end, LaTiS on the backend, and the infrastructure that ties it all together and keeps deployments updating and running smoothly.

Special thanks to Richard Clark, Tamitha Skov, and the dedicated students from Millersville University who contributed events to the Event Library: Cameron Gonetski, Rhiannon Flemming, Lauren Coca, Kerstin Gillespie, and Samuel Reams.

ABSTRACT

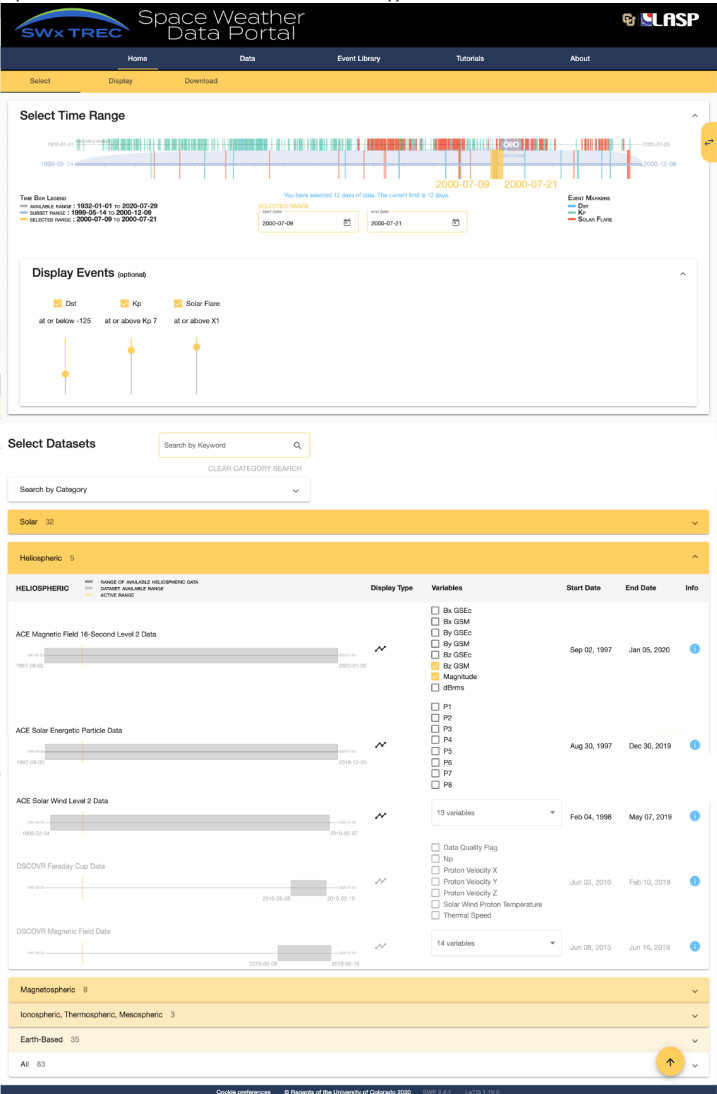
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(https://agu.confex.com/data/abstract/agu/fm20/3/2/Paper_747723_abstract_718468_0.png)

REFERENCES

Lindholm, D., & Lindholm, C. (n.d.). LaTiS. Retrieved November 23, 2020, from <https://lasp.colorado.edu/home/mission-ops-data/tools-and-technologies/latiis/>

