

A Short Overview of NASA Data Resources Relevant to Space Weather Research

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Topics

- The Overall Data Policy
- Three categories of data
- Finding and accessing NASA Heliophysics data

NASA's Data Policy

- NASA and specifically the NASA Heliophysics program have and enforce an open data policy
 - All operating science missions are required to make research-usable data publicly available in a timely manner
- And NASA Heliophysics funds both its missions and multiple multi-mission data centers / data services / data archives to ensure such data availability

NASA Heliophysics Operating Missions

Mission	Solar Remote Sensing	In-Situ Solar Wind	Magnetosphere Remote Sensing	In-situ Magnetosphere	ITM	Deep-space (remote sensing)	Deep-space (In-Situ)
SDO	x						
SOHO (with ESA)	x	x (particles only)					
RHESSI	x	x (particles only)					
STEREO	x	x					
ACE		x					
Wind		x					
TWINS			x				
THEMIS/ ARTEMIS				x	x (ground-based program)		
MMS				x			
TIMED	x (solar irradiance)				x		
AIM					x		
IBEX						x	
Voyager							x

Missions Supported in SPDF

ACE
AE
Alouette 1/2
AMPTE
Apollo
Arcad
Ariel
ATS 1-6
~40 BARREL Balloons
Cassini
Cluster
CNOFS
CRRES
Cubesats
DE 1/2
DMSP
DSCOVR
Explorer 4-35
FAST
Genesis

Geotail
GOES 6-15
GPS
~170 Ground-Based Obs
Hawkeye
Helios 1/2
IBEX
IMAGE
IMP 1-8
INJUN
Interball
ISEE 1/2/3/ICE
ISIS1/2
LANL 1989-2002
MAGSAT
Mariner 4-9
Messenger
MMS
New Horizons

NOAA 5-19
OGO 1-6
Pioneer 6-11
Polar
ROCSAT
S-Cubed
SAMPEX
San Marco
Skylab
SNOE
STEREO
THEMIS/ARTEMIS
TIMED
TWINS
Ulysses
Van Allen Probes
(RBSP)
Voyager 1/2
Wind

Coming missions include ICON, GOLD, PSP and part of SO


Three Categories of Data

- For purposes of this presentation, probably useful to distinguish data based on the time between data being taken on a spacecraft and the time data are available for use on the ground
- Long-term research data products
 - Primary science outputs of the spacecraft and instruments
 - Calibrated and converted to physical units; often reprocessed as better calibrations and data reduction algorithms are perfected
 - Days to months between taking data and producing products, sometimes with very long delays for spacecraft using on-board storage to capture most-interesting and highest-resolution data and then gradually download to the ground as telemetry allows
- Near real-time data
 - Data downloaded and available within minutes to hours of time taken on spacecraft
 - Sometimes secondary (lower time and parameter resolution) data stream
 - Sometimes captured at cooperating partner sites worldwide
- “Quicklook” data
 - Preliminary science data for browse and science planning purposes but not intended as the basis for published research
 - Approximate calibrations, often not full time and parameter resolution
 - Fraction of a day to a few days between taking data and producing products

Research Data

- Most active NASA missions operate their own mission and instrument specific websites, including use information and direct data access
- Almost all important NASA Heliophysics mission research data resources can be found using the Heliophysics Data Portal/HDP (<https://heliophysicsdata.gsfc.nasa.gov>)
 - HDP allows e.g. searches by observatory (mission) group and observatory, by instrument, by time span and by measurement type
 - Includes mission, instrument and data product descriptions
 - Returns direct links to data sources and can invoke external data services for plots/listings
- The best source to identify and retrieve current and past solar data is the Virtual Solar Observatory/VSO (<https://www.virtualsolar.org>)
 - VSO supports searches by time, physical observable, instrument/source/provider, and spectral range
 - VSO supports finding and retrieving data via browsers or directly in SolarSoft.
- The Space Physics Data Facility/SPDF (<https://spdf.gsfc.nasa.gov>) holds and serves a wide range of non-solar NASA Heliophysics data
 - Including very recent research data, with online plot/listings/super-subset services
 - Includes s/c position database and Java-based 4D Orbit Viewer

Finding Heliophysics Data

 **GODDARD SPACE FLIGHT CENTER**
Space Physics Data Facility

+ Goddard Home
+ Visit NASA.gov

Heliophysics Data Portal

 "Find it. Browse it. Get it." **SPASE** inside

Help Geo Orbits Helio Orbits SPASE Registry ADS Abstracts Weather Feedback

Text Restriction
[] Add

Time Span Restriction
YYYY-MM-dd or YYYY-DDD
from: []
to: [] Add

Element Restriction
Resource type
Measurement type
Observatory Group
Observatory
Instrument
Observed region
Spectral range
Cadence
Repository Name
Access rights
Format

Current Product Restrictions Remove All
Observatory equals 'VAP-A (formerly RBSP-A)' Remove
Measurement type contains 'Energetic Particles' Remove


Showing 1 - 20 of 36 Results View Current List Sort by Observatory

#	Products (& SPASE descriptions)	Access Links
1	Van Allen Probe A ECT HOPE Pitch angle resolved Level 3 Science Data	<ul style="list-style-type: none"> FTP access to files at SPDF HTTP access to files at SPDF CDWeb ECT home page ECT SOC and data services The Van Allen Probes Home Page Get Data/Plots
2	Van Allen Probe A ECT HOPE Science Release #3 Spin Averaged Level 2 Data	<ul style="list-style-type: none"> FTP access to files at SPDF HTTP access to files at SPDF CDWeb The MMS FIELDS Team home page at UNH at LANL Science Gateway (including Mission Rules of the Road for Data Usage) Get Data/Plots
3	Van Allen Probe A ECT HOPE Spin Resolved Level 2 Science Data	<ul style="list-style-type: none"> FTP access to files at SPDF HTTP access to files at SPDF CDWeb ECT home page ECT SOC and data services The Van Allen Probes Home Page Get Data/Plots
4	Van Allen Probe A ECT HOPE Spin resolved Level 3 Science Data	<ul style="list-style-type: none"> FTP access to files at SPDF HTTP access to files at SPDF CDWeb ECT home page ECT SOC and data services The Van Allen Probes Home Page Get Data/Plots
5	Van Allen Probe A ECT MagEIS Release #3 Level 3 Data	<ul style="list-style-type: none"> FTP access to files at SPDF HTTP access to files at SPDF CDWeb ECT SOC and data services The Van Allen Probes Home Page Get Data/Plots

Heliophysics Data
Portal / HDP

Search VSO Help or enter Cart Id: [] Go

Search for Solar Physics Data Products:

If you're new to the VSO, see [How To Search](#), the [FAQ](#) or click the  icons for online help.

Please select which values you wish to use to search for data products:

- Time**
Search by time interval.
[Derive time intervals from event catalogs](#)
- Observable**
Search based on physical observables
- Instrument / Source / Provider**
Search based on instruments or data archives
 - Compact listing
 - Instrument / Source (not provider dependent)
 - Instrument Only (not source or provider dependent)
- Spectral Range**
Search based on a spectral range
- Nicknames**
Search based on common terms used to describe data products
Note: Nicknames generate an intersection with other search terms, so searching for a nickname, and a physical observable (or other parameter) when a nickname defines other physical observables will result in no matches.
 Show Nickname Definitions


Searching against current VSO instances
Generate VSO Search Form

VSO Documentation

Documentation for Scientists, Programmers and Data Providers, including Changes, [FAQs](#), and [contact info](#).

Help us improve VSO

- Tell us what features you would like to see.
- Other suggestions / comments / criticism
- Contact information for VSO team members



Virtual Solar Observatory

Virtual Solar
Observatory / VSO

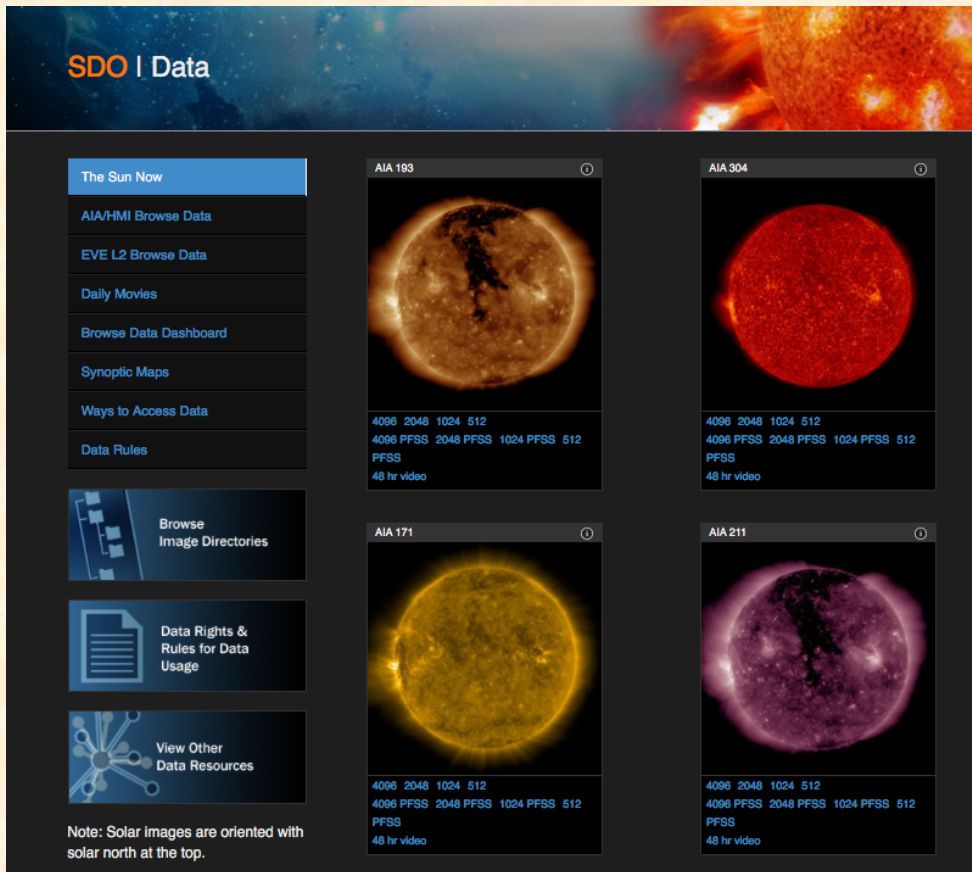
Select NASA Near Real-Time Solar and Solar Wind Data

- SDO (reduced resolution solar images)
 - AIA solar images: Fe XVIII 94Å, Fe XX 131Å, Fe IX/X 171Å, FeXII 193Å, Fe XIV 211Å, He II 304Å, Fe XVI 335Å, Continuum+C IV 1600Å, Cont'm 1700Å, Cont'm 4500Å
 - EVE: Solar irradiances
 - HMI: Magnetogram and Intensitygram
- SOHO (coronagraph images)
 - LASCO C2: Coronagraph white light images
- ACE (solar wind at L1)
 - In-situ solar wind density, speed, temperature and vector magnetic field
- STEREO (Ahead) Beacon Data
 - SECCHI EUVI solar images in: 195A, 304A
 - SECCHI COR1 (inner) and COR2 (outer) coronagraphs
 - IMPACT: Solar wind plasma, magnetic field and energetic particles
 - WAVES: Solar radio waves and bursts
- Wind (solar wind at L1/backup source)
 - Depends on Wind tracking; ground processing presently under repair

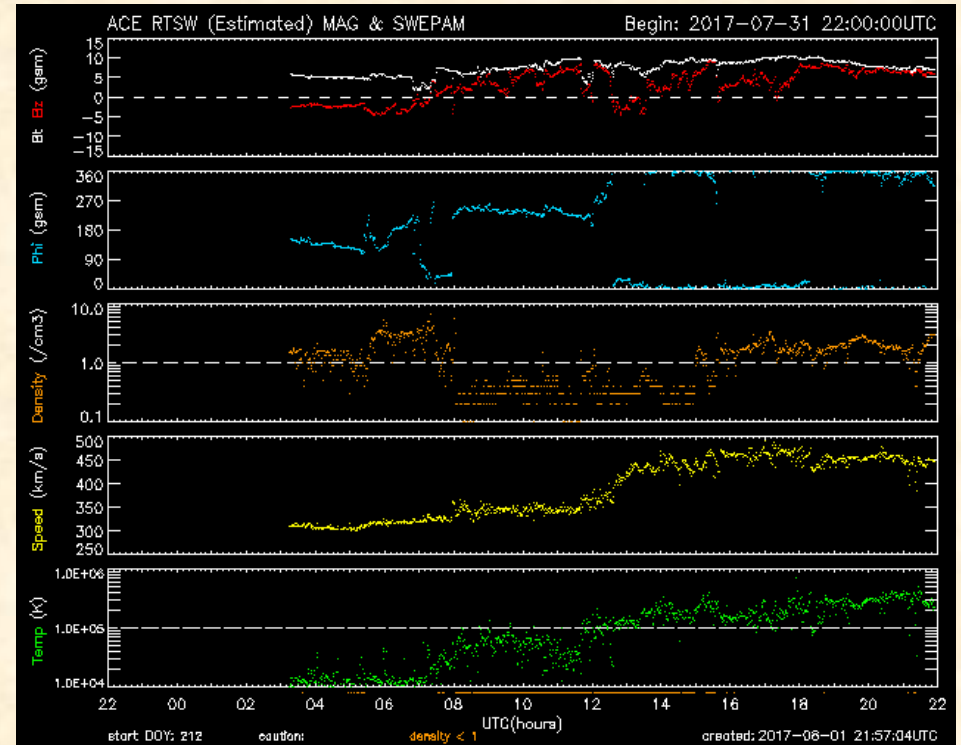
Other NASA Near Real-Time and Quicklook Data

- **Van Allen Probes**
 - Wide range of field and radiation belt sample measurements
 - Electric and magnetic fields, waves, plasma and energetic particles
 - Few hours delays but not continuous; depends on partner groups for data capture
- **MMS**
 - Wide range of displays showing in turn a wide range of field and particle measurements
 - “Quicklook” in nature; typical time lag from real-time of 1-2 days
- **THEMIS**
 - Displays showing a wide range of field and particle measurements
 - “Quicklook” in nature; typical time lag from real-time of 1-2 days
- **AIM, RHESSI, TIMED, TWINS and VOYAGER**
 - Preliminary and definitive data are made public as they become available but time from data collection to first public data is typically at least weeks

Example NASA Near Real-Time Data



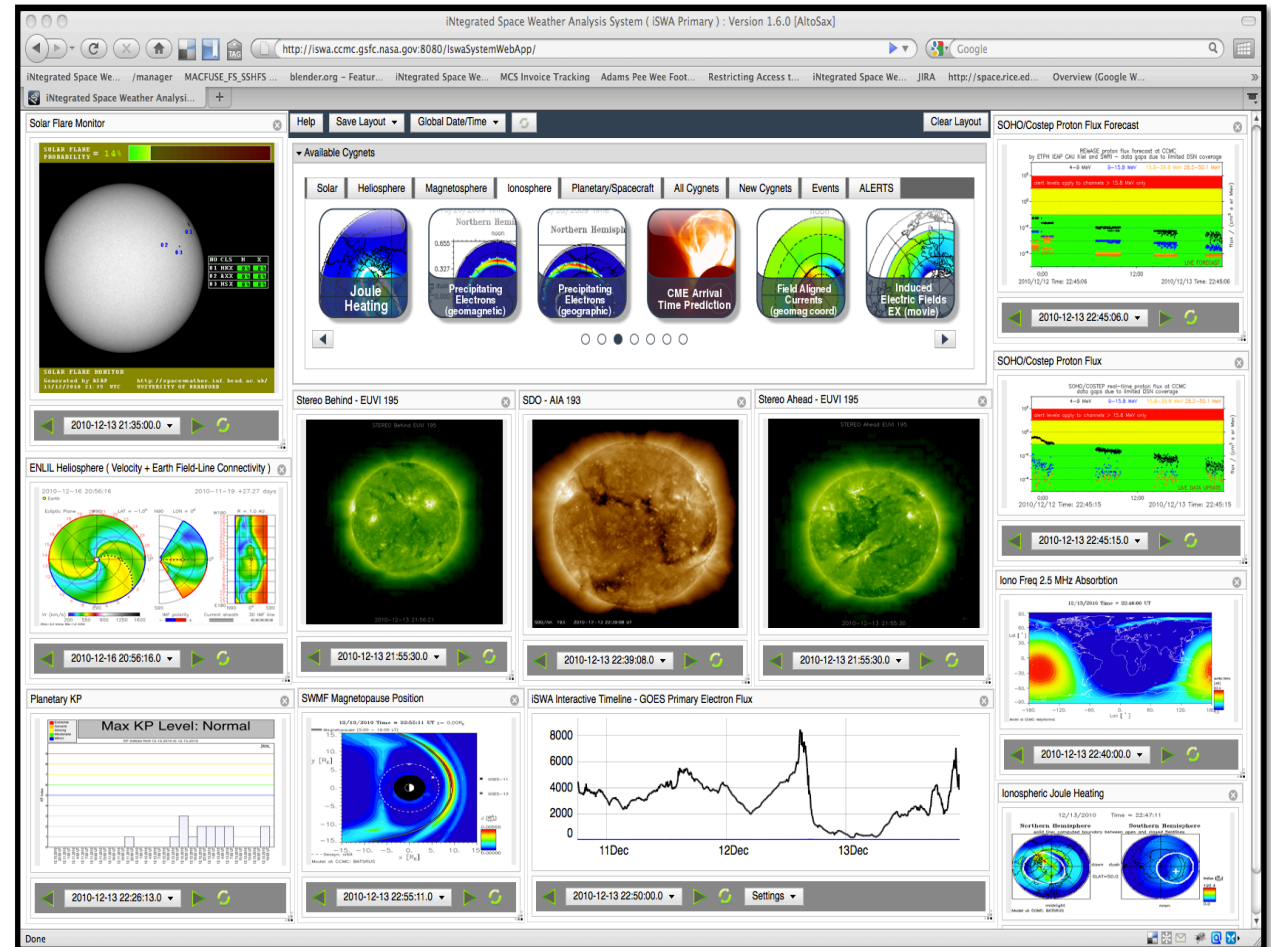
Solar Dynamic
Observatory / SDO)



Advanced Composition
Explorer / ACE
(Also DSCOVR from
NOAA)

CCMC INTEGRATED SPACE WEATHER ANALYSIS (ISWA) SYSTEM

- A number of these NRT data streams are available as iSWA “Cygnets”
 - iSWA combines forecasts based on space weather models with concurrent space environment information (<https://ccmc.gsfc.nasa.gov/iswa/>)
 - Both direct web and mobile app interfaces



<http://iswa.ccmc.gsfc.nasa.gov>

NRT and Quicklook Data URLs

SDO	https://sdo.gsfc.nasa.gov/data/
SOHO	https://soho.nascom.nasa.gov/data/realtime-images.html
ACE	http://www.swpc.noaa.gov/products/ace-real-time-solar-wind
STEREO	https://stereo.gsfc.nasa.gov/spaceweather/spaceweather.shtml
Wind	https://pwg.gsfc.nasa.gov/windnrt
Van Allen Probes	http://rbspgateway.jhuapl.edu/rPlotTime?sw
MMS	https://lasp.colorado.edu/mms/sdc/public/quicklook/
THEMIS	http://themis.ssl.berkeley.edu/summary.php?
CCMC/ISWA	https://ccmc.gsfc.nasa.gov/iswa/
SWPC (NOAA)	http://www.swpc.noaa.gov
SolarSoft	http://www.lmsal.com/solarsoft/last_events/
Solar Monitor (ESA)	https://solarmonitor.org
Heliviewer	https://www.heliviewer.org
LANCE (NRT Earth Data)	https://earthdata.nasa.gov/earth-observation-data/near-real-time/download-nrt-data