

# Parker Solar Probe In-Situ Data at the SPDF Archives

AGU Fall Meeting 2019

## Poster: SH21C-3330

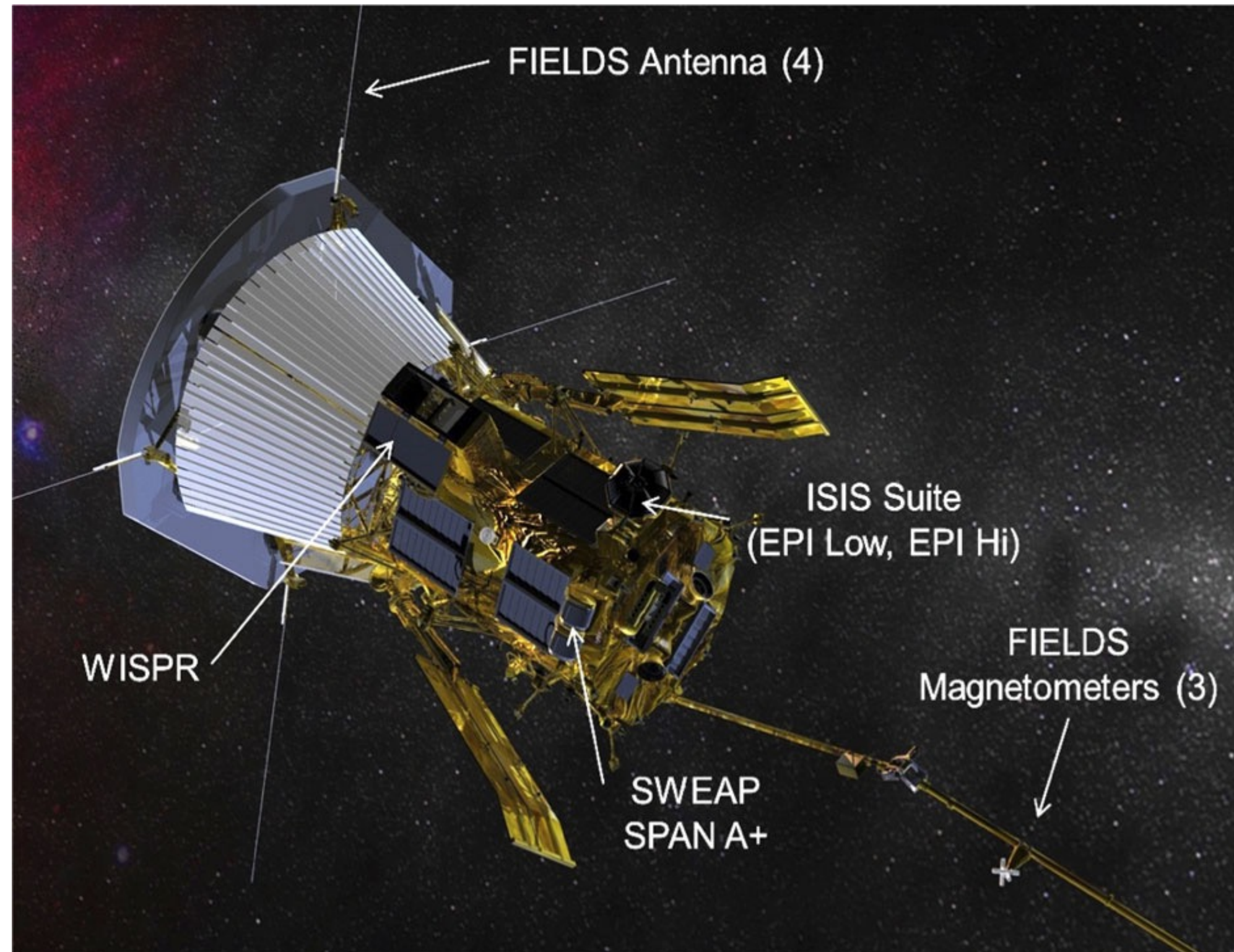
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## Space Physics Data Facility (SPDF)

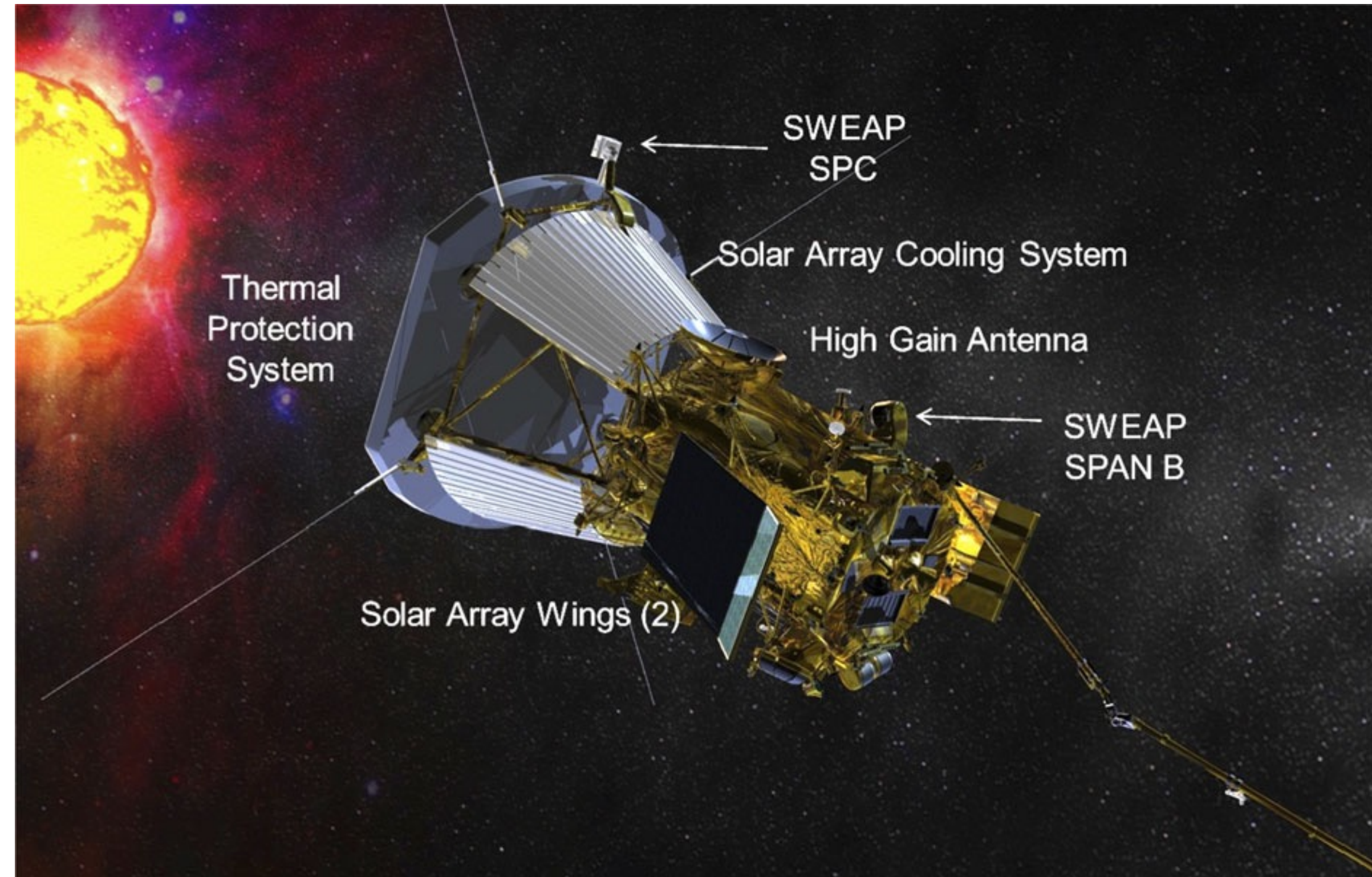
## NASA Heliophysics Active Final Archive for non-solar data

- SPDF is the active and final archive of **in-situ data** from NASA heliophysics missions, including collaboration missions with other US and foreign agencies
- We also archive other data **relevant to NASA heliophysics science objectives**
  - Related data from planetary missions (e.g., MESSENGER, MAVEN, New Horizons)
  - Heliophysics data from some NOAA and DoD satellites (e.g., GOES, DISCOVER)
  - Ground-based magnetometers, aurora cameras, radars, etc., which are funded by NSF or other agencies/programs
- The data covers the space from the Sun to the local interstellar medium, including magnetosphere, ionosphere, thermosphere, and mesosphere (M-ITM) of the Earth and other applicable planets
- SPDF provides three main science-enabling services besides archiving data
  - CDAWeb (Coordinated Data Analysis Web): browse, correlate, and display
  - SSCWeb (Satellite Situation Center): orbit/ground track displays and queries
  - OMNIWeb Plus: solar wind conditions, especially at bowshock nose
- SPDF enables multi-instrument, multi-mission heliophysics science
  - Specific mission/instrument data in context of other missions/data
  - Specific mission/instrument data as enriching context for other data
  - Ancillary services & software (orbits, data standards, special products)
- SPDF also builds critical infrastructures for the **heliophysics data environment**:
  - Common Data Format (CDF) <https://cdf.gsfc.nasa.gov>
  - Heliophysics Data Portal <https://heliophysicsdata.gsfc.nasa.gov>



## SWEAP Data sets

SPC (Solar Probe Cup)		psp_swp_spc_l2i	ion charge flux distribution as a function of the energy-per-charge carrier with <b>mode flag</b> , and its quick look plots
		psp_swp_spc_l3i	ion properties derived from <b>moments</b> and <b>fits</b> with <b>quality flag</b>
SPI (Solar Probe Analyzer <b>ion</b> instrument)	spi_sf00	psp_swp_spi_sf00_L2_8Dx32Ex8A	differential proton energy flux at each measured deflector step, energy, and anode for SPAN-Ion
	spi_sf00	psp_swp_spi_sf00_L3_mom_INST	partial moments of the proton (0a for alpha) distribution function in the instrument frame of reference
	spi_sf0a	psp_swp_spi_sf0a_L3_mom_INST	
SPE (Solar Probe Analyzer <b>Electron</b> instrument)	spa_sf0	psp_swp_spa_sf0_L2_16Ax8Dx32E	differential electron energy flux from SPAN-A
	spa_sf1	psp_swp_spa_sf1_L2_32E	
	spb_sf0	psp_swp_spb_sf0_L2_16Ax8Dx32E	differential electron energy flux from SPAN-B
	spb_sf1	psp_swp_spb_sf1_L2_32E	



**SPDF fully supports the Parker Solar Probe mission with multiple services and access methods**

- Direct file downloads via FTPS and HTTPS <https://spdf.gsfc.nasa.gov/pub/data/psp/>
- Orbit and ground track displays/queries via SSCWeb and 4D Orbit Viewer, along with all other supported heliophysics missions
- CDAWeb services:
  - Plots and listings (ASCII, CSV, JSON)
  - Supersets or subsets by time & selected variables
  - Time-binning of data where appropriate
  - Web service interfaces (REST, SOAP, IDL, Matlab, Java, Python)  
<https://cdaweb.gsfc.nasa.gov/WebServices/>
  - New HAPI (Heliophysics API) <https://cdaweb.gsfc.nasa.gov/hapi>
  - Autoplot [autoplot.org/help#CDAWeb](http://autoplot.org/help#CDAWeb)
- CDAWeb REST example (CDF fastest but other formats also: text, csv, json, png, gif, ps, pdf, nc, audio)

For instance, to get a CDF file containing the psp\_fld\_l2\_mag\_RTN data from the PSP\_FLD\_L2\_MAG\_RTN dataset for a time range:

[https://cdaweb.gsfc.nasa.gov/WS/cdasr/1/dataviews/sp\\_phys/datasets/PSP\\_FLD\\_L2\\_MAG\\_RTN/data/20190307T100000Z,20190317T230000Z/psp\\_fld\\_l2\\_mag\\_RTN?format=cdf](https://cdaweb.gsfc.nasa.gov/WS/cdasr/1/dataviews/sp_phys/datasets/PSP_FLD_L2_MAG_RTN/data/20190307T100000Z,20190317T230000Z/psp_fld_l2_mag_RTN?format=cdf)

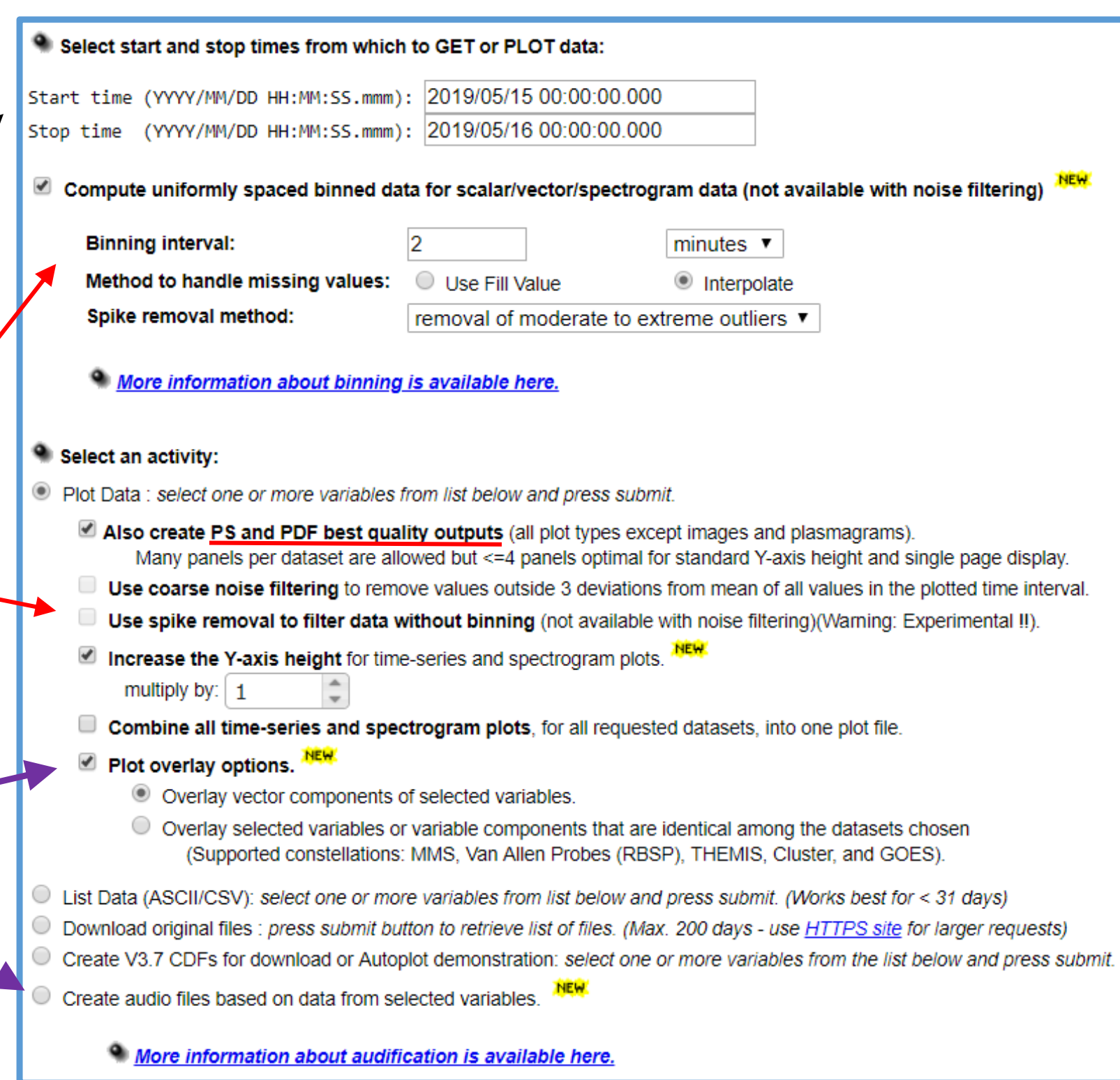
- SPDF complement the services of the PSP Science Gateway and instrument teams
- SPDF auto-ingest scripts check PSP on all supported mission data sites daily to retrieve new data files, and CDF files are validated and ingested
- Master CDFs add or improve metadata for use in CDAWeb
- The **SPASE** (Space Physics Archive Search and Extract, <http://www.spase-group.org/>) team use the master CDFs to generate SPASE IDs and descriptions for all PSP datasets, to add entries to the **Heliophysics Data Portal**, <https://heliophysicsdata.gsfc.nasa.gov>

**CDAWeb  
Data Explorer**

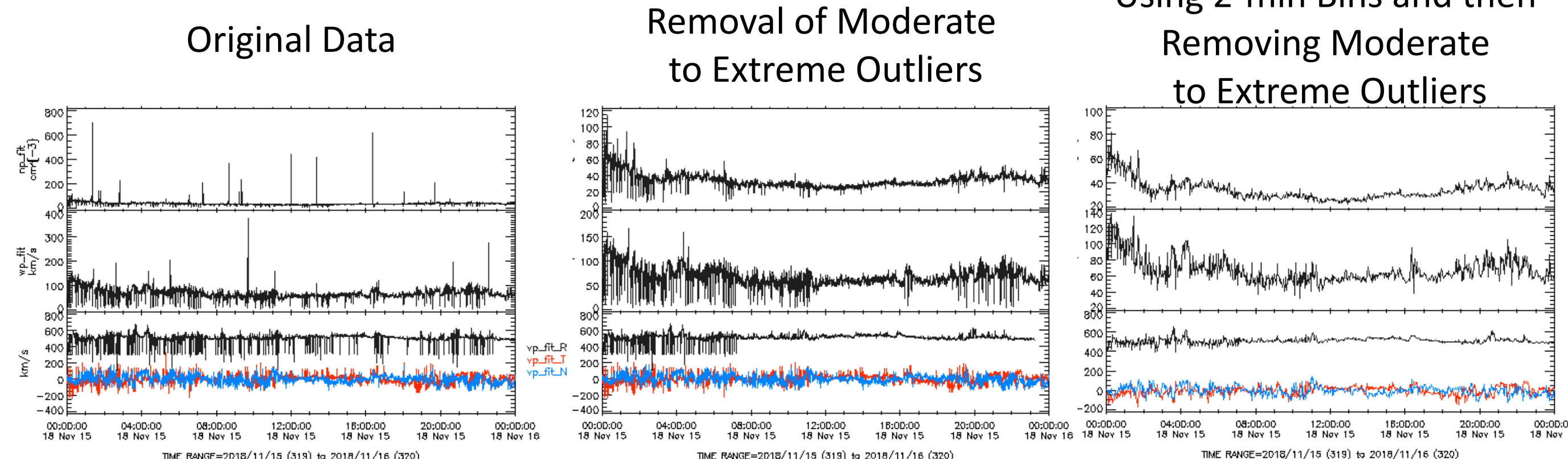
Defaults to the last available day of the selected data

## Ways to remove spikes

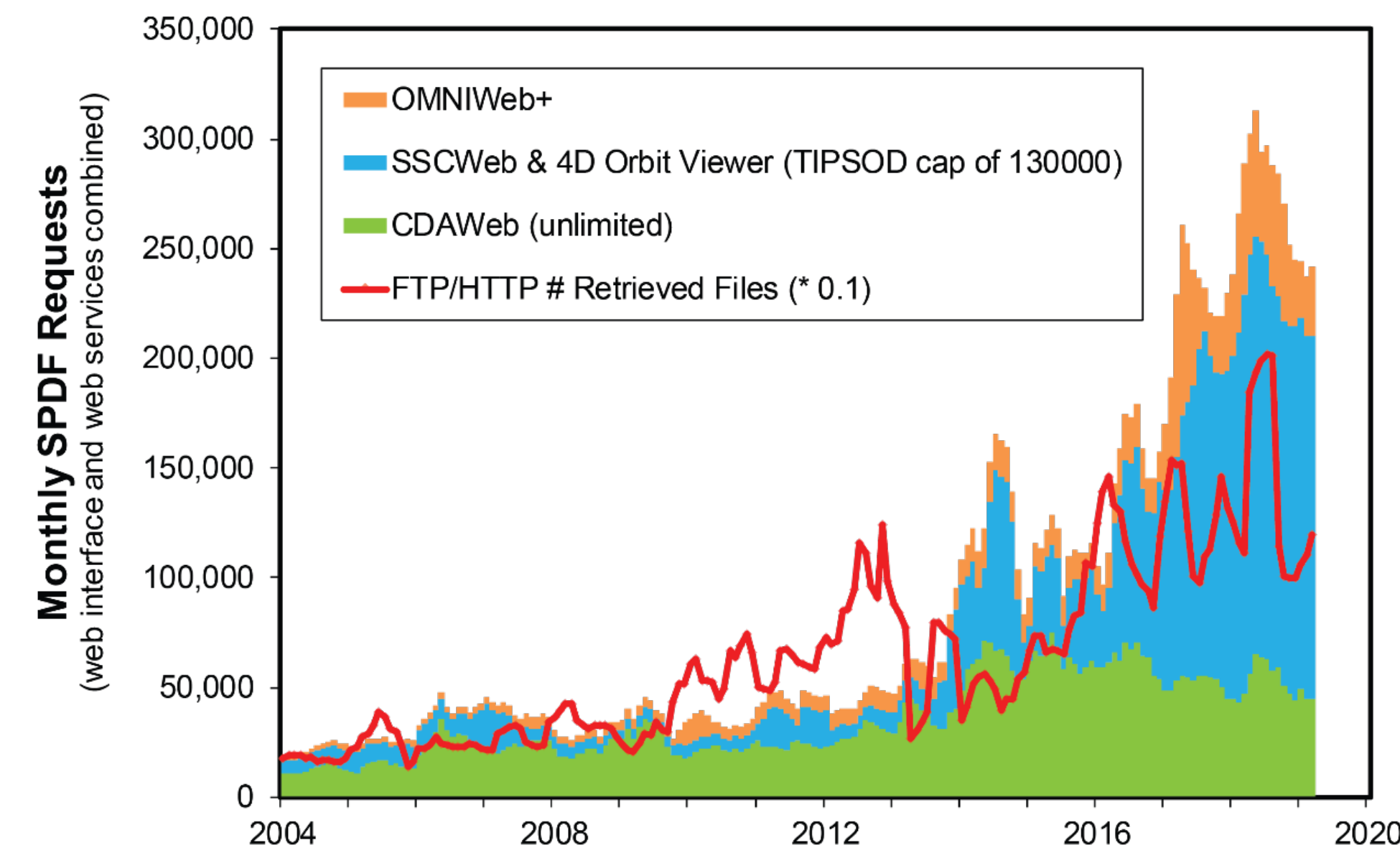
Other Options:  
overlay plotting,  
audification,  
making animations



### Comparison Plots of PSP\_SWP\_SPC\_L3I

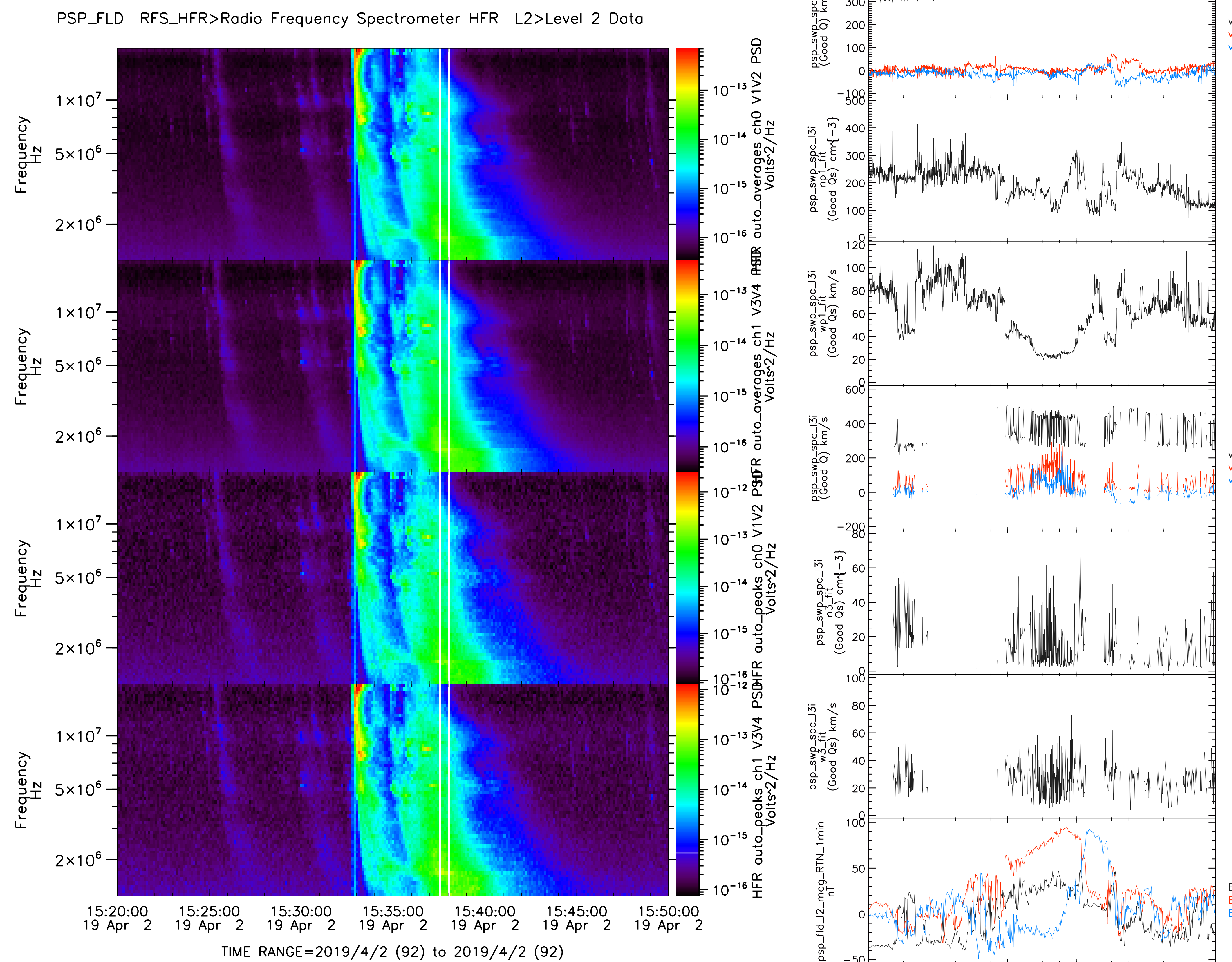


## Extensive Use of SPDF Data & Services



- ✓ SPDF data and services enable global-scale, multi-mission heliophysics science

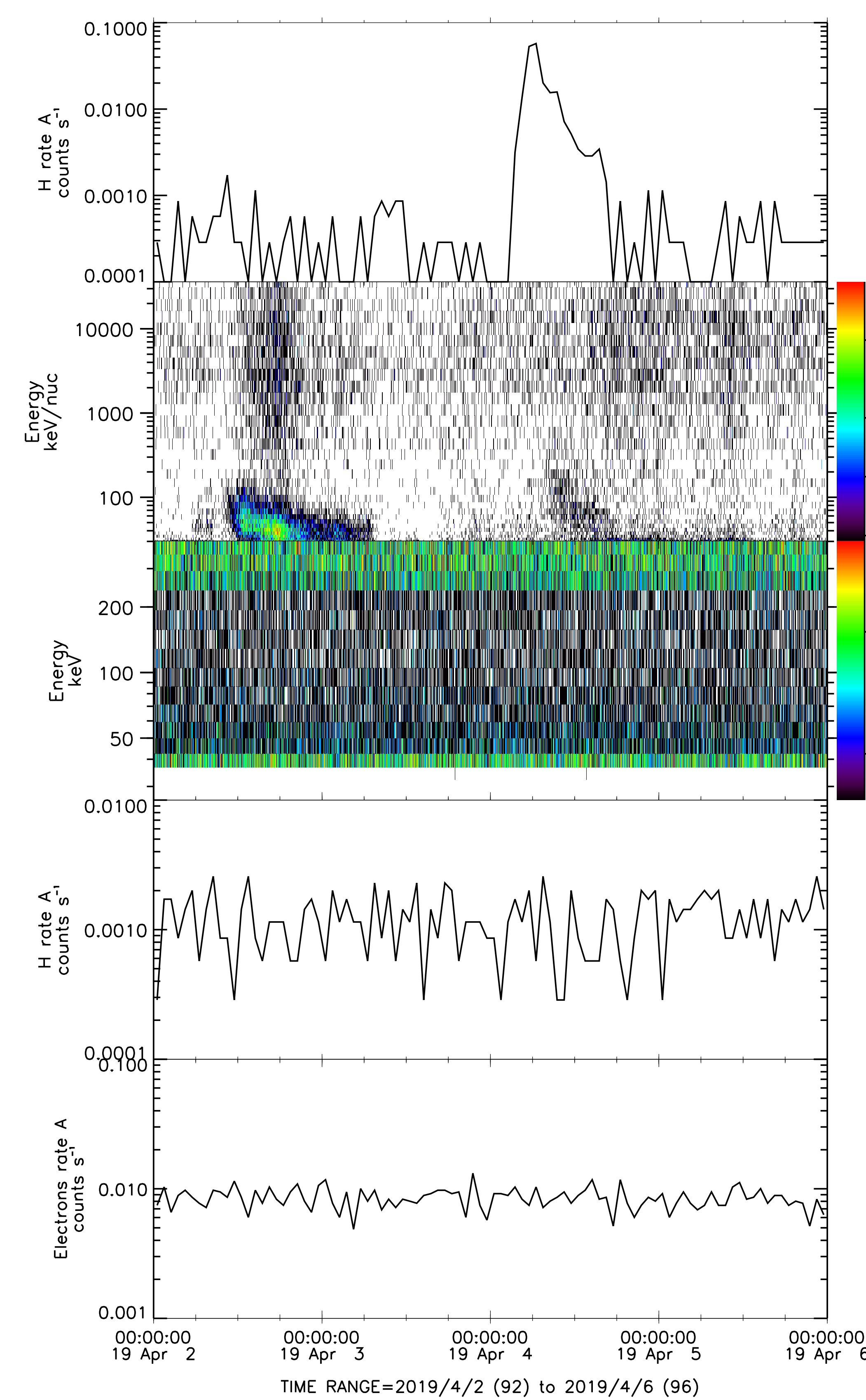
- ✓ ~30% of papers in AGU's JGR Space Physics acknowledged SPDF services and/or data in recent years



## IS@IS Data sets

EPI-Hi	HET	psp_isois-epihi_i2-het-rates10, rates60, rates300, rates3600	Rates10 is 10-s cadence. Only <b>rates3600</b> data are the main <b>cruise</b> phase product and they have the largest number of variables. Other data are <b>encounter-only</b> products
	LET1	psp_isois-epihi_i2-let1-rates10, rates60, rates300, rates3600	
	LET2	psp_isois-epihi_i2-let2-rates10, rates60, rates300, rates3600	
	Selected Summary	<b>psp_isois-epihi_i2-second-rates</b>	count rates of energetic protons and electrons, 10 "data" variables
EPI-Lo		psp_isois-epilo_i2-ic	ion composition
		psp_isois-epilo_i2-pe	particle energy
Merged		<b>psp_isois_i2-summary</b>	count rates of energetic protons and electrons, 5 "data" variables

PSP ISOIS&gt;Integrated Science Investigation of the Sun L2-Summary&gt;level 2 summary



## Additional Public Access to PSP Data

- PSP Science Gateway <https://spgway.jhuapl.edu/>
- Homepages of instrument teams, with links to public data and user's guides
  - Solar Wind Electrons Alphas and Protons (SWEAP) <http://sweap.cfa.harvard.edu>
  - Electromagnetic Fields Investigation (FIELDS) <http://fields.ssl.berkeley.edu>
  - Integrated Science Investigation of the Sun (IS<sup>2</sup>IS) <https://spacephysics.princeton.edu/missions-instruments/isois>
  - Wide-field Imager for Solar Probe (WISPR) <https://wispr.nrl.navy.mil>
- The in-situ data at Levels 2-3 and ephemeris data are archived at SPDF <https://spdf.gsfc.nasa.gov/pub/data/psp/> (63 GB, 53 datasets)
- WISPR data at Solar Data Analysis Center (SDAC) are searchable and retrievable via Virtual Solar Observatory (VSO, [virtualsolar.org](https://virtualsolar.org)) clients: SunPy: Fido, Solarsoft/IDL: [vso\\_search.pro](https://vso.nrl.navy.mil/vso_search.pro), [vso\\_get.pro](https://vso.nrl.navy.mil/vso_get.pro)

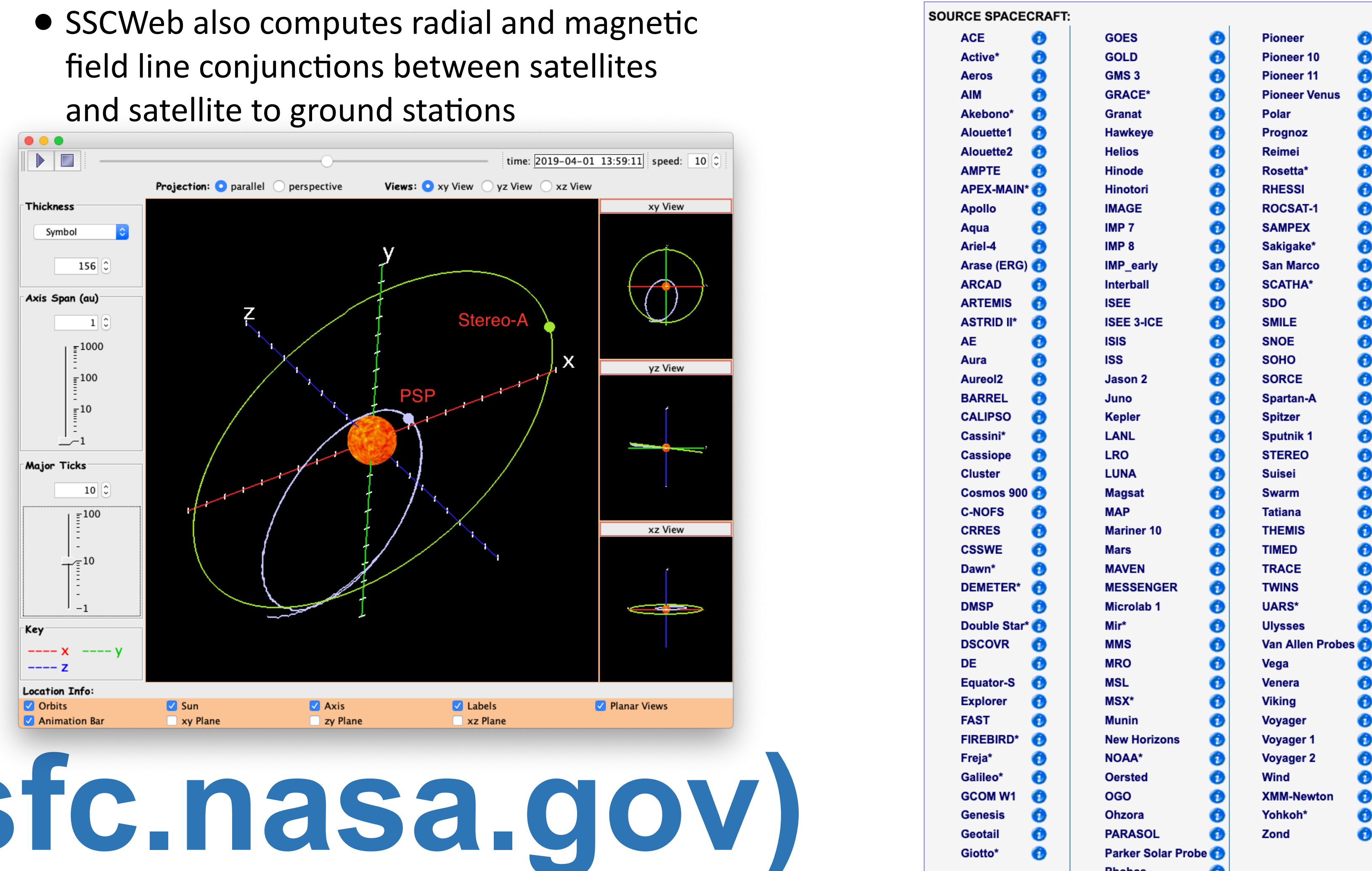
## SSCWeb and the 4-D Orbit Viewer

- 4D Orbit Viewer uses SSCWeb webservices API to access the spacecraft database
- SSCWeb also computes radial and magnetic field line conjunctions between satellites and satellite to ground stations

## 132 Missions Supported by SPDF

[https://spdf.gsfc.nasa.gov/data\\_orbits.htm](https://spdf.gsfc.nasa.gov/data_orbits.htm)

Monthly data ingestion rate: ~0.6 million data files, ~13.7 TB data



# Space Physics Data Facility (<https://spdf.gsfc.nasa.gov>)