

# **Activities and Status of the Space Physics Data Facility (SPDF) for the Past Year**

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NASA Goddard Space Flight Center

IHDEA Meeting  
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[SPDF.gsfc.nasa.gov](https://spdf.gsfc.nasa.gov)

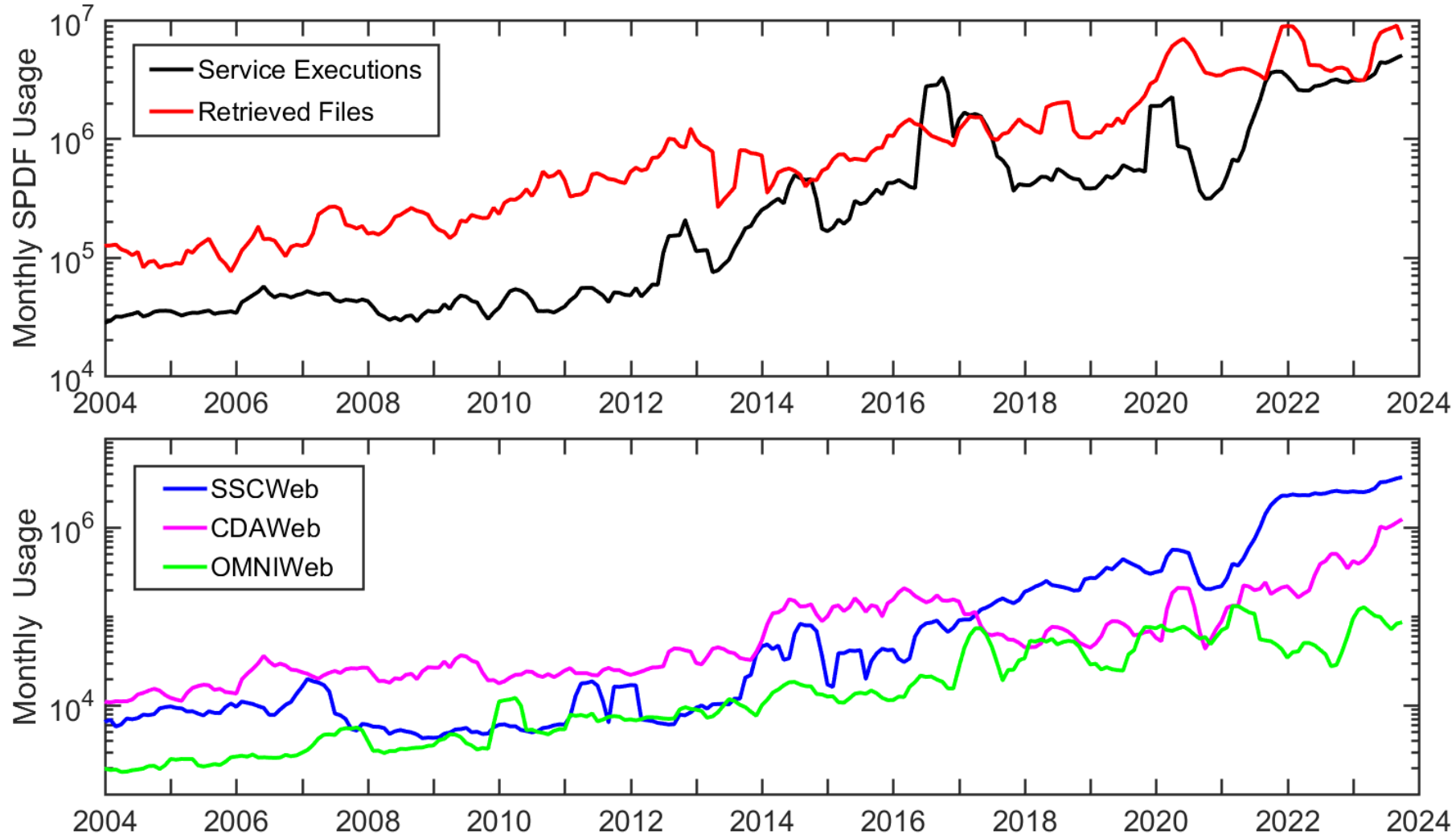
# SPDF Activities in the Past Year

- Added many new datasets from ICON, GOLD, Parker Solar Probe, IBEX, Solar Orbiter, MMS, and many other spacecraft, rocket, balloon, and ground instruments
- Continued ingesting CDFs from the Cluster archive, starting with the datasets identified as most important by Harri Laakso and Perri Makela (288 out of 1960 datasets, and 349 later)
- Automated ingest pipeline for > 75 missions out of over 200 missions for a total of ~4,000 datasets using ~550 TB (ingest and usage logs: <https://cdaweb.gsfc.nasa.gov/publiclogs/> )
- Recent average monthly data ingestion rate: ~0.7 million files, ~14 TB data
- Continuing the population of OMNI, COHO, SSC databases
- CDAWeb plot and display improvements, waveforms, inventory plots, time slices, audification
- Added SPASE Resource IDs and DOIs to CDAWeb metadata and displays
- Working towards a grand vision as part of NASA's Heliophysics Digital Resource Library



# SPDF Statistics

See reports at <<https://cdaweb.gsfc.nasa.gov/publiclogs/>>



40% of heliophysics papers in 2022 AGU journals acknowledged SPDF services and data

# Planned SPDF Activities

- We are starting to copy all Level 2+ data into HelioCloud for use with cloud-based analysis tools
- About to release revised SPDF web site, based on US Government web design system (USWDS)
- Standardize ISTP/IACG Metadata Guidelines with version control, etc.
- Developing new SKTeditor in JavaScript, including defining SPASE metadata at the same time as defining the internal metadata and structure of the CDF/netCDF dataset
- Working on web services for event lists for burst mode data and science events (CMEs, bow shock crossings, etc.) and use by SSCweb and CDAWeb to better serve intermittent/burst data (find next/previous burst or event)
- Developing JavaScript alternative to the Java-based 4D Orbit Viewer
- HTML5/JavaScript-based browser interface for CDAWeb/SSCweb, building on the above prototype 4D orbit viewer, expanded to add interactive data plotting and sonification tied to the orbit display, perhaps with data glyphs along the orbits as well (uses JSON output from SSCweb and CDAWeb web services)
- Quick start guides, tutorials, improved documentation, web redesign

# SPDF Action Items from Previous IHDEA Meetings

1. Action on SPDF: to circulate on a regular basis, at least yearly, to IHDEA members the roadmap of CDF development
  - See next page for CDF status
2. Action on NASA and ESA/ESDC: to coordinate/facilitate the transfer of all science datasets of the Cluster mission from ESDC to SPDF
  - Nearly done with 288 datasets identified as most important, second tier next

# CDF Status and Recent Development

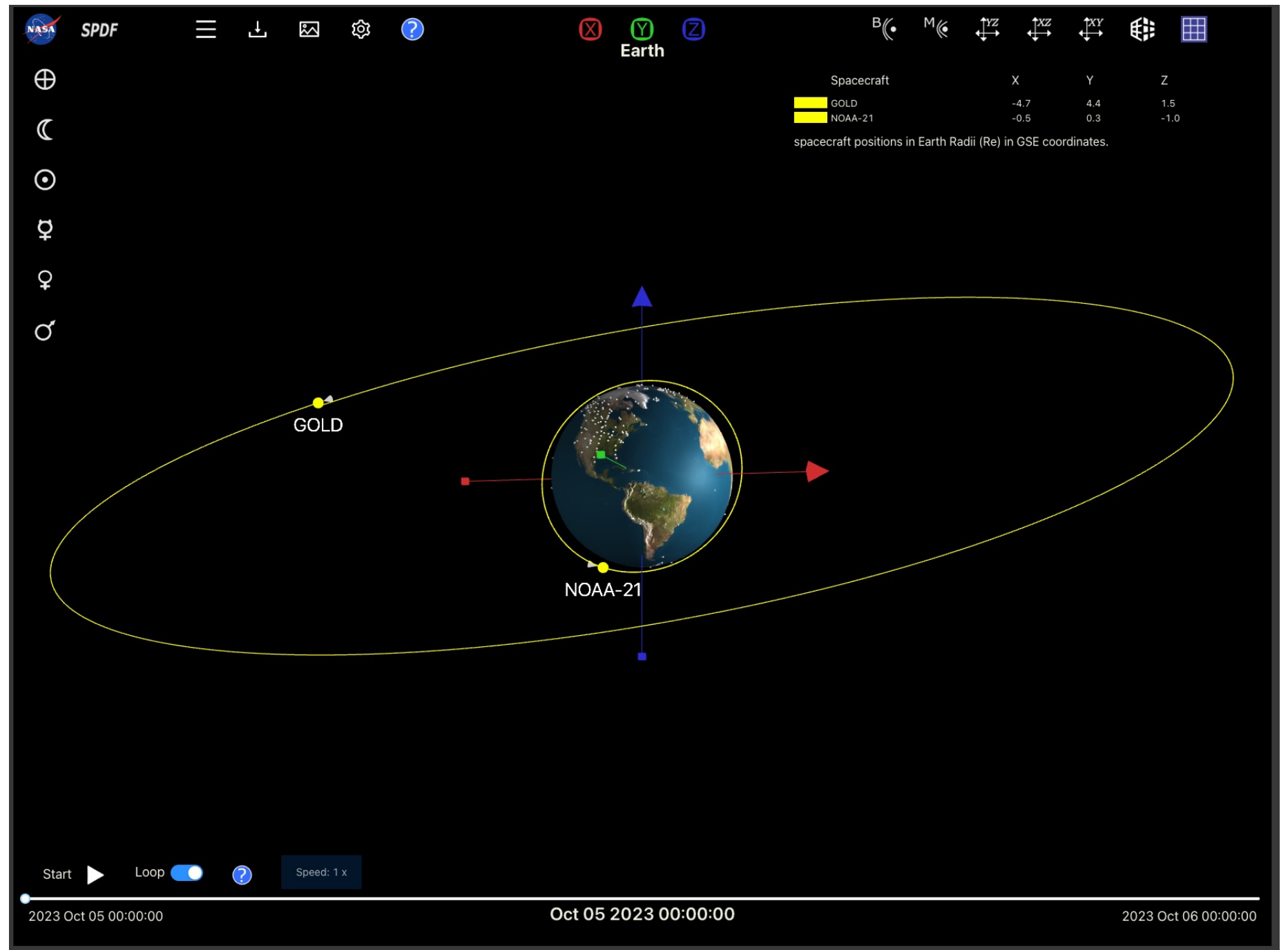
- CDF 3.9 C-library released with improved dynamic space management in core library, and improved compression logic to avoid using temporary files as much as possible
- Continued CDF support and general development, plus added features
- Improving documentation, beginner's guides, adding to Wikipedia CDF entry
- Standardizing ISTP/IACG Metadata Guidelines with version control, etc.  
[https://github.com/IHDE-Alliance/ISTP\\_metadata](https://github.com/IHDE-Alliance/ISTP_metadata)
- We are looking for feedback on whether this is a suitable path forward, and for feedback on its layout and content
- Future governance might fold into the SPASE effort or be overseen by an international committee similar to the Earth science CF Conventions <https://cfconventions.org/>

# CDF Plans

- Adding thread-safe support to C library
- New SKTeditor in Javascript, adding SPASE metadata creation
- Supporting CDFs in cloud object storage
- Defining CDF MIME type and international standard
- Apache 2 license in place of current custom license
- Updating CDFML and its corresponding JSON representation with cdf.xsd to use more specific datatypes (e.g., xs:dataTime, xs:integer, xs:float, etc.) instead of just xs:string
- Adding support for CDF to command line netCDF tools, such as NCO, NCAR, ANTS, NCtools
- CDF gap checker to write filename, variable name, begin and end time, number of records, and any gaps greater than a certain amount (G-good, M-missing, F-fill, R-outside range, B-backward time)
- Adding CDF support to Octave, Gnu Data Language (GDL), Excel, Ruby, C++, WebWinds, LinkWinds, Opendap, SWIG.org



# 4D Orbit Viewer (TIPSOD) rewritten in JavaScript (released soon)



# Rewrite of SKTeditor in JavaScript for laying out datasets and adding ISTP and SPASE metadata

The screenshot shows the SKTeditor+ web interface with the following metadata fields:

- Required:**
  - Project: STP>Solar-Terrestrial Physics
  - Source / Spacecraft Name: MMS3>MMS Satellite Number 3
  - Descriptor / Instrument Name: DIS>Dual Ion Spectrometers
  - Data Type: fast\_I2\_dis-moms
  - File Naming Convention: source\_descriptor\_dataty | yyyyMMdd | HHmmss
  - PI Name: J. Burch, B. Giles
  - PI Affiliation: SwRI, GSFC
  - Discipline: Space Physics>Magnetospheric Science
  - Mission Group: MMS
  - Instrument Types: Plasma and Solar Wind
  - Data Version: 3.3.0
  - Logical File ID: mms3\_fpi\_fast\_I2\_dis-moms\_20200902060000\_v3.3.0
  - Logical Source: mms3\_fpi\_fast\_I2\_dis-moms
- Recommended:**
  - Acknowledgement: [Empty]
  - Rules of Use: See FPI Version Release Notes (<https://lasp.colorado.edu/mms/sdc/public/datasets/fpi/>) for
  - DOI: [Empty]
  - SPASE ID: [Empty]
  - Time Resolution: 4.5 seconds
  - Generated By: FPI ITF, NASA/GSFC Code 673
  - Generation Date: Fri Oct 2 10:56:03 2020
  - Link Text (describing on-line data):
    - MMS home page
    - SMART package home page
    - Science Data Center
  - Link Title:
    - at GSFC
    - at SWRI
    - at LASP
  - HTTP Link:
    - <http://mms.gsfc.nasa.gov>
    - <http://mms.space.swri.edu>
    - <http://lasp.colorado.edu/mms/sdc>

The screenshot shows the SKTeditor+ web interface with the following variable specifications:

- Epoch:** Epoch\_plus\_var, Epoch\_minus\_var, mms3\_dis\_errorflags\_fast, mms3\_dis\_compressionloss\_fast, mms3\_dis\_startdelphi\_count\_fast, mms3\_dis\_startdelphi\_angle\_fast, mms3\_dis\_energyspectr\_px\_fast, mms3\_dis\_energyspectr\_mx\_fast, mms3\_dis\_energyspectr\_py\_fast, mms3\_dis\_energyspectr\_my\_fast, mms3\_dis\_energyspectr\_pz\_fast, mms3\_dis\_energyspectr\_mz\_fast, mms3\_dis\_energyspectr\_omni\_fast, mms3\_dis\_spectr\_bg\_fast, mms3\_dis\_numberdensity\_bg\_fast, mms3\_dis\_numberdensity\_fast, mms3\_dis\_numberdensity\_err\_fast, mms3\_dis\_densityextrapolation\_low, mms3\_dis\_densityextrapolation\_high, mms3\_dis\_bulkv\_dbcs\_fast, mms3\_dis\_bulkv\_spintone\_dbcs\_fast, mms3\_dis\_bulkv\_gse\_fast, mms3\_dis\_bulkv\_spintone\_gse\_fast, mms3\_dis\_bulkv\_err\_fast, mms3\_dis\_prestensor\_dbcs\_fast, mms3\_dis\_prestensor\_gse\_fast, mms3\_dis\_prestensor\_err\_fast, mms3\_dis\_pres\_bg\_fast, mms3\_dis\_temptensor\_dbcs\_fast
- CDF Specifications:**
  - Name: mms3\_dis\_energyspectr\_omni\_fast
  - Data Type: CDF\_REAL4
  - Time Varying: True
  - Dimensions: 1:[32]
  - Compression: gzip.6
  - Sparse Recd: None
  - Pad Value: -1.00e+30
  - Fill Value: -1.00e+31
- Description:** MMS3 FPI/DIS energySpectr\_omni
- One-Line Description:** MMS3 FPI/DIS omni-directional ion energy spectrum during this survey
- Variable Notes:** Differential energy flux by energy bin, averaged (weighted by solid angle) over all directions (flow or look).
- Value Uncertainty:** Plus, Minus
- Axis Information:**
  - Label 1: DEF\_omni
  - Label 2: [Empty]
  - Label 3: [Empty]
  - Scale Type: log
  - Format: E12.2
  - Units: keV/(cm^2 s sr keV)
- Plot Information:**
  - Variable Type: Data
  - Display Type: Spectrogram
  - Display Arguments: [Empty]
- Depends:**
  - Depend 0: Epoch
  - Depend 1: mms3\_dis\_energy\_fast
  - Depend 2: [Empty]
  - Depend 3: [Empty]
- Values:** [Empty]
- Valid Min:** 0
- Valid Max:** 1.00e+30

Backup

# SPDF Access Protocols

- Files available through HTTPS and FTPS  
<https://spdf.gsfc.nasa.gov/pub/>
- HAPI <https://cdaweb.gsfc.nasa.gov/hapi>
- REST and SOAP web services for
  - CDAWeb <https://cdaweb.gsfc.nasa.gov/WebServices/>
  - SSCweb orbits <https://sscweb.gsfc.nasa.gov/WebServices/>
- Autoplot <http://autoplot.org/help#CDAWeb>
- Other methods such as IDL  
[https://cdaweb.gsfc.nasa.gov/alternative\\_access\\_methods.html](https://cdaweb.gsfc.nasa.gov/alternative_access_methods.html)