The NASA Heliophysics Digital Resource Library

( generalized HPDE)

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Needed: A Virtual Heliophysics System Observatory (hpde.gsfc.nasa.gov)

All these (and more) should be (machine) accessible and “the same.” A basis for analysis, modeling, and understanding.
HDRL Vision

The purpose of the Heliophysics (HP) Digital Resource Library (HDRL) is to facilitate scientific research as a comprehensive repository and source for much of what underlies HP research, namely the data, models, software, tools, and services that encompass what we have measured, modeled, and simulated of the Heliophysical plasma environment.
HDRL Vision (continued)

The HDRL:

- *provides* and helps users understand *data and metadata standards*;
- *archives and serves for the long term* all the mission-produced data products from the NASA Heliophysics System Observatory (HSO);
- *provides tools for data access and analysis* and *allows users to run and use models* to understand and predict processes in the Solar and Space environment;
- works with *national and international partners* to *make data and services uniformly FAIRUST* (Findable, Accessible, Interoperable, Reusable, Understandable, Safe, and Trustworthy)
**HDRL**: Who we are. What we do.

### HP Data and Model Consortium
- **D. Aaron Roberts (PS), Brian Thomas (DPS)**
  - Overall management of the HDRL.
  - Registries and DOIs for all digital resources; SPASE Data Model.
  - Python and other software integration.
  - Analysis and visualization services ((Py)SPEDAS, Autoplot).
  - Data upgrades and services.
  - HP Cloud initiative with data and software from all groups.

### Space Physics Data Facility
- **Robert Candeys (PS), Lan Jian (DPS)**
  - Non-solar Data Final Active Archive for NASA (and other) missions.
  - CDAWeb data browsing and access; Web Service access.
  - OMNIWeb data (1 AU and indices) production and serving.
  - SSCWeb and 4-D spacecraft orbit facility. Common Data Format.
  - Heliophysics Data Portal (including solar).

### Solar Data Analysis Center
- **Jack Ireland (PS)**
  - Solar Data Final Active Archive for Solar Dynamics Observatory and other NASA missions.
  - Virtual Solar Observatory data access.
  - High Performance Computing for NASA HP.

### Community Coordinated Modeling Center
- **Masha Kuznetsova (PS), Leila Mays (DPS)**
  - Runs on request (use); data—model comparisons.
  - Model Output.
  - Registry of models and output.
  - “Kamodo” enabled visualization.
  - Integrated Space Weather Analysis system.

* Heliophysics Digital Resource Library
HDRL: Relationships

HDRL is part of CCMC with its own Registry and Tools/Software and Services.

HDRL interacts with:
- External cloud accounts
- Science Community
- ADS publication search
- Relationship (dashed if ‘to be’)

HDRL has relationships with:
- CDF, CDAMe, OMNI, SSC
- VSO, SolarSoft, SunPy, Heliocviewer
- Curation scientists
- Future mirror to Ames
- Active Archive Storage
- On Premises HEC (NCCS)
- SPDF, Archives, SDAC

HDRL is connected to:
- Mission Science Operations Centers
- Heliophysic Spacecraft
- Partner CubeSats & Sounding Rockets
- CCMC Products
- ROSES/Research Data

ADS:
- Funded external projects: Autoplot, PyHC, SPEDAS, etc.
**HDRL**  
Heliophysics Digital Resource Library

Complete (content per entry and entry coverage), easily discoverable and accessible REGISTRIES for data, documents, software, people, missions, etc., based on standard metadata (SPASE Data Model).

Robust, secure (multiple levels of backup), fast, uniform, CURATED, ACTIVE ARCHIVAL STORAGE

Registered, uniform, well-used, Permanent IDs (PIDs) for Data, Model Output, Software, Documents, People, etc.

Uniformly formatted, well calibrated, fully documented, registered, web and web service accessible, easily discoverable, curated DATA SETS; includes OMNI and Research Data

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Standard data FORMATS including details on time and other quantities

Standard ACCESS METHODS including general web browser and web service tools

Clear, capable MANAGEMENT at various levels—HQ, HDRL, Archives, CCMC, Software teams, Registries, HPCloud, etc.

DATA-MODEL COMPARISONS, with Kamodo-based 4-D graphics

OUTREACH: PUBLICIST for services, tools, new data, etc.; related SCIENCE WRITER

GLOBAL WEB SITE; browse and access all, and general info

HIGH-END COMPUTE PLATFORM NEAR (“BIG”) DATA with required hardware, archives, and people/software infrastructure.

OPEN RESEARCH: Data, software; reproducible results.

Fast, reliable, extensible, open, easy-to-use CLOUD PROCESSING including DATA NEAR the COMPUTATION.

General, fast, flexible DISCOVERY TOOLS (e.g., Knowledge Graphs) to enhance (especially) early stages of research.
Three Ways to Analyze Heliophysics Data! Size of lines show service throughput and indicates the size of dataset which may be analyzed with ease. Color indicates the location of the capabilities. Dashed lines indicate ‘to be’ state.