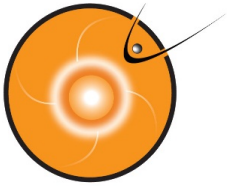


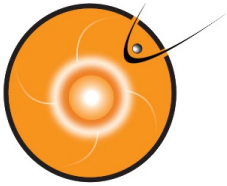
CCMC Overview, tools & databases, SPASE implementation

Darren De Zeeuw and Chiu Wiegand



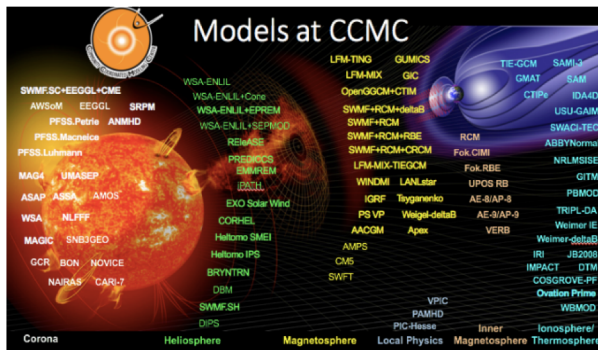
Topics

- CCMC Overview
- CCMC Metadata Registry
- CAMEL (Validation Framework)
- iSWA HAPI implementation
- Kamodo
- ISWAT – International Space Weather Action Teams

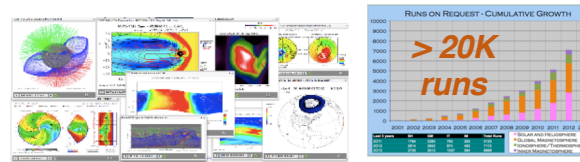


CCMC Overview

Models



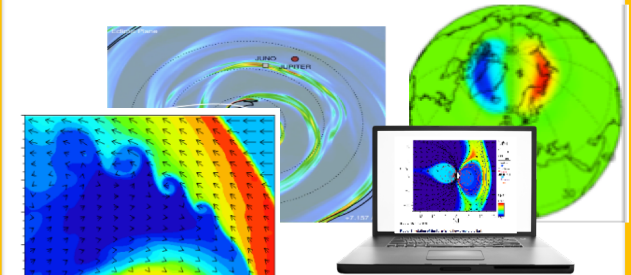
Simulation Services



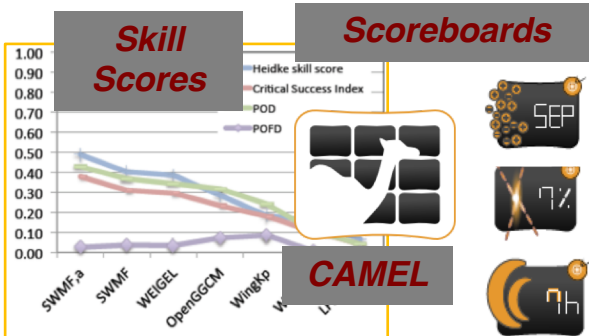
Runs-on-Request

Real-time Runs

Visualization, Dissemination



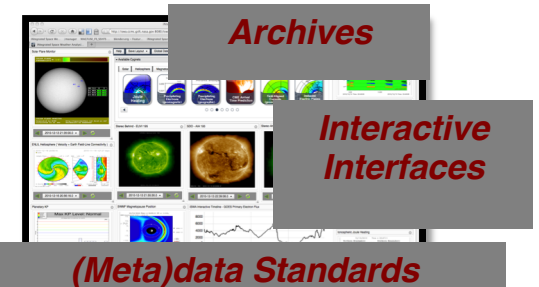
Validation

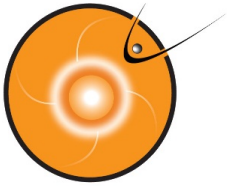


NASA Missions & Community Support

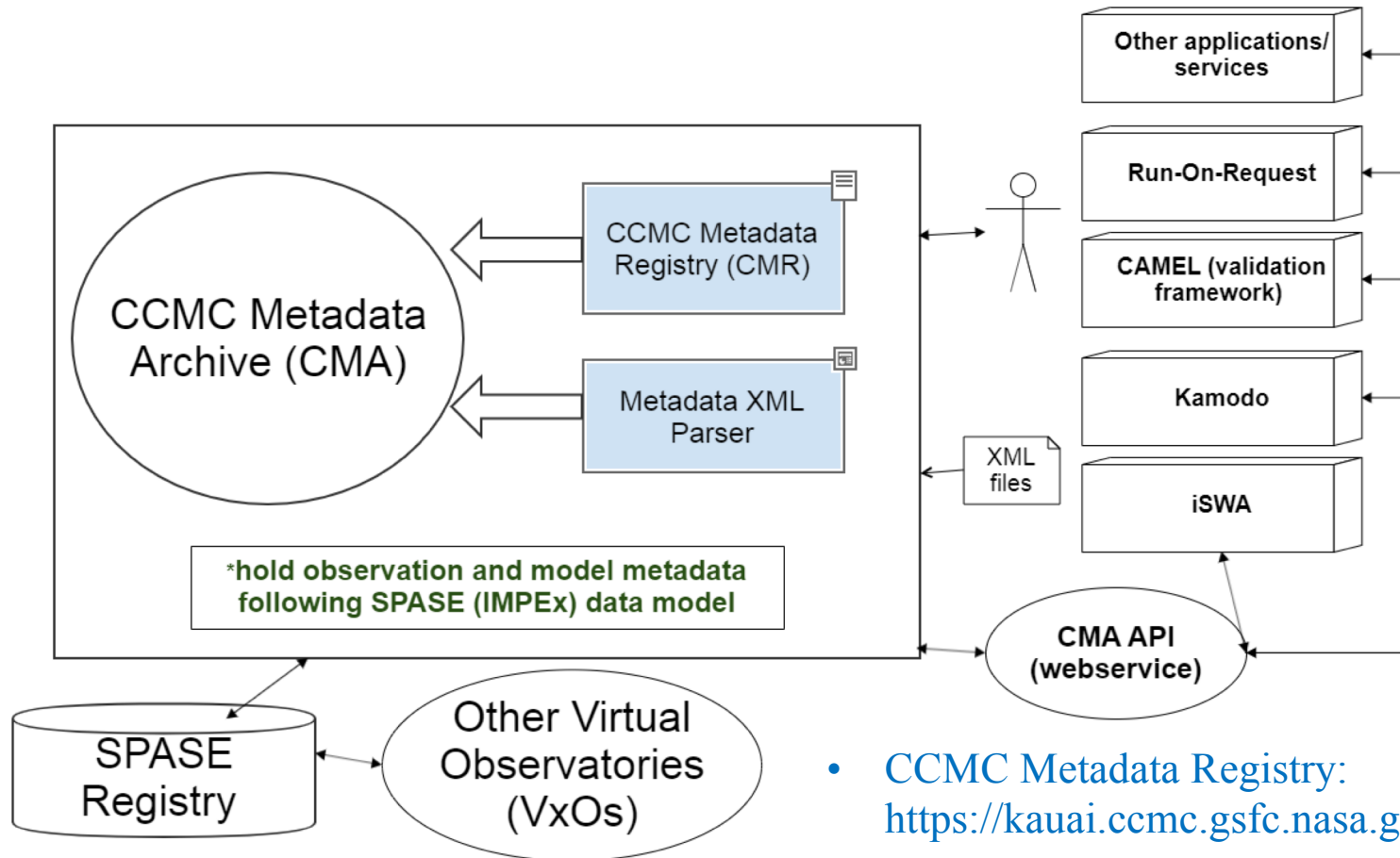


Information Architecture:





CCMC Metadata Registry



- **CCMC Metadata Registry:**
<https://kauai.ccmc.gsfc.nasa.gov/CMR>
- [Enter/View](#) metadata stored in our database

Comprehensive Assessment of Models and Events based on Library tools

Events

- ☒ Event 1 : October 29th, 2003 06:00 UT - October 30th, 06:00 UT
- ☒ Event 2 : December 14, 2006 12:00 UT - December 16, 00:00 UT
- ☒ Event 3 : August 31, 2001 00:00 UT - September 1, 00:00 UT
- ☒ Event 4 : August 31, 2005 10:00 UT - September 1, 12:00 UT
- ☒ Event 5 : May 15, 2005 00:00 UT - May 16, 00:00 UT
- ☒ Event 6 : July 09, 2005 00:00 UT - July 12, 00:00 UT
- ☒ Event 7 : April 05, 2010 00:00 UT - April 6, 00:00 UT
- ☒ Event 8 : August 05, 2011 09:00 UT - August 6, 09:00 UT

Models

- ☒ Run 9_SWMF
- ☒ Run 2_LFM-MIX
- ☐ Run 4_OPENGGCM
- ☐ Run 6_WEIMER
- ☐ Run 3_WEIGEL
- ☐ Run 2_WEIGEL



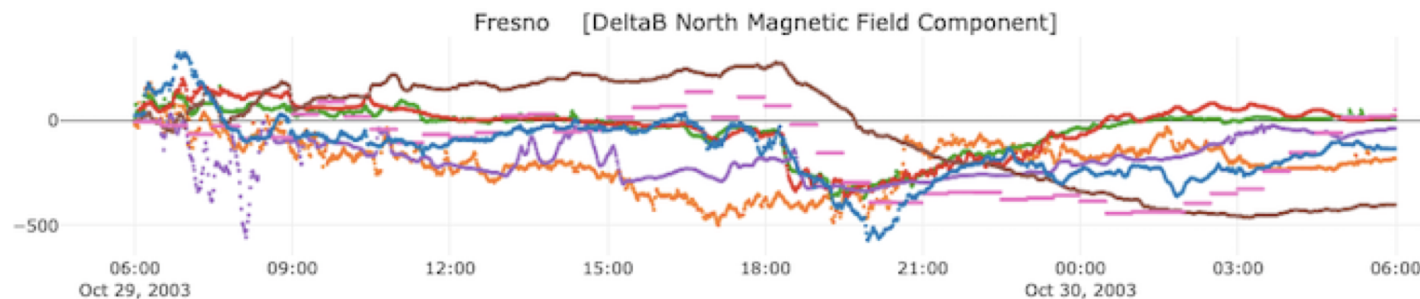
CAMEL

Locations

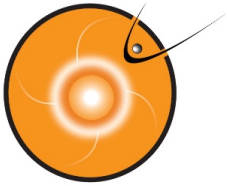
- ☒ Polar Latitudes: iqa - Iqaluit
- ☒ Polar Latitudes: hrm - Hornsund
- ☒ Polar Latitudes: ykc - Yellowknife
- ☒ Auroral Latitudes: abk - Abisko
- ☒ Auroral Latitudes: pbq - Poste de la Baleine
- ☒ Auroral Latitudes: mea - Meanook
- ☒ Auroral Latitudes: snk - Sanikiluaq
- ☒ Sub-auroral Latitudes: ott - Ottawa
- ☒ Sub-auroral Latitudes: new - Newport
- ☒ Sub-auroral Latitudes: wng - Wingst
- ☒ Mid Latitudes: frd - Fredericksburg
- ☒ Mid Latitudes: fur - Furstenfeldbruck
- ☒ Mid Latitudes: frm - Fresno

Interactive front-end web interface for display and analysis of evaluation results:

<https://ccmc.gsfc.nasa.gov/camel/>

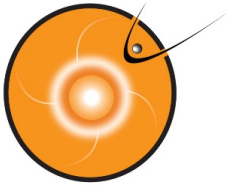


Database (with API access) of time series, derived from model output and observational data, for all validation studies.



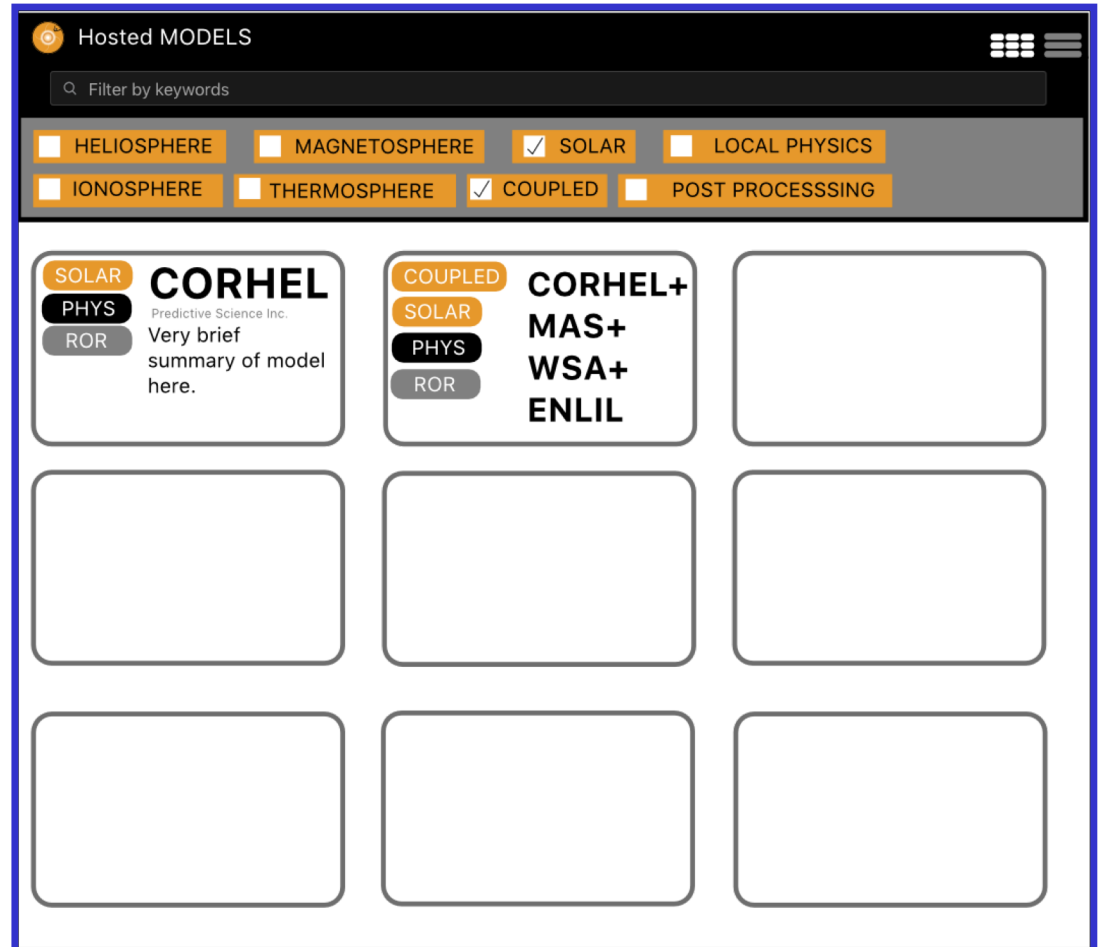
iSWA HAPI Implementation

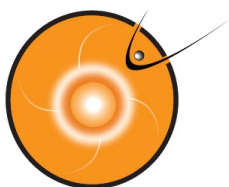
- iSWA supports the HAPI Data Access Specification (version 2.0) for delivery of time series data
 - Includes all data resources/parameters that are shown in iSWA super timeline cygnet
 - <https://iswa.gsfc.nasa.gov/IswaSystemWebApp/hapi/>



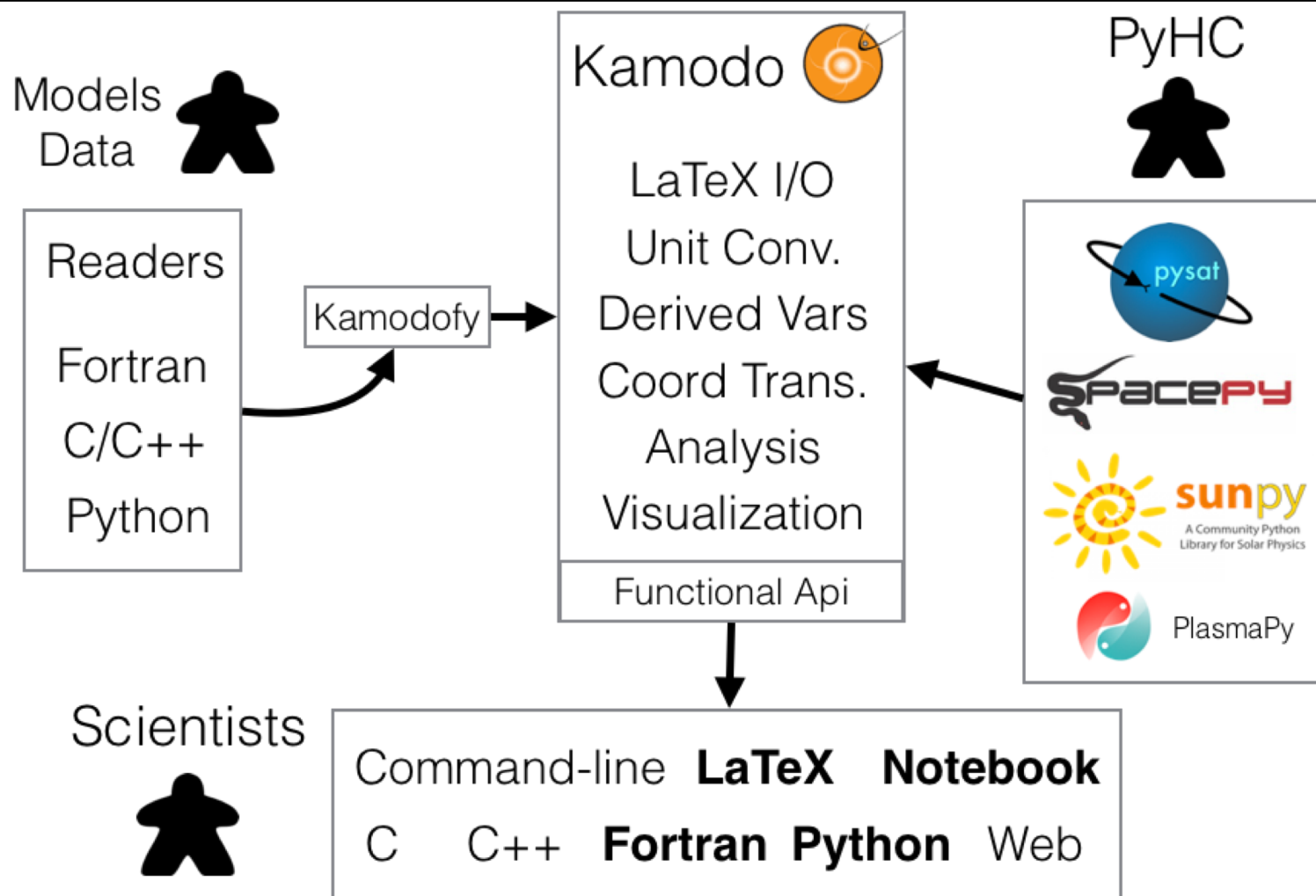
Models Display System

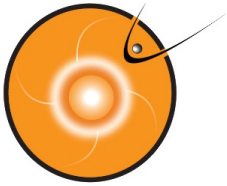
- Models Display System:
 - Backend:
 - Metadata about our hosted models stored in CMR (SPASE format)
 - Frontend:
 - Calls API from CMR to get details about the model





Kamodo Architecture





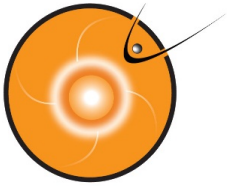
Kamodofication

- the process of exposing models and data to Kamodo

A model or data source is considered “kamodofied” when all scientifically relevant variables are exposed as Kamodo objects.

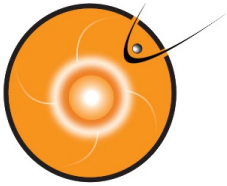
Prioritized Kamodofication requirements:

- 1. Model must be accessible from python**
- 2. Model must provide an interpolating function for each variable**
3. Interpolating functions should supply default values as arguments, indicating the valid domain for their inputs.
4. Variable names should follow Kamodo’s naming specification for LaTeX legibility.
5. Interpolating functions should contain the following metadata as attributes:
 1. meta - dictionary of {'units': 'kg', 'citation' : 'Doe, J. et. al'}
 2. data – array
6. Class Methods should use “self” as the first argument.



Kamodo recent improvements

- Project page: <https://ccmc.gsfc.nasa.gov/Kamodo>
- Open source: <https://github.com/nasa/Kamodo>
- Field line integration (IVP solver)
- Kamodofied Kameleon readers
- Kamodofied MMS analysis
- Collaboration with PySat



ISWAT – International Space Weather Action Teams

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ISWAT - International Space Weather Action Teams

Join forces to advance space weather understanding and capabilities to alert and shield society!

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Collaboration and exchange of ideas:

The COSPAR International Space Weather Action Teams (ISWAT) initiative is a global hub addressing challenges across the field of space weather.

The sum is worth more than its parts:

Space weather is a multi-disciplinary research area connecting scientists from across all domains requiring the whole global community to work together.

S: Space weather origins at the Sun	H: Heliosphere variability	G: Coupled geospace system	Impacts
S1: Long-term solar variability	H1: Heliospheric magnetic field and solar wind	G1: Geomagnetic environment	Climate
S2: Ambient solar magnetic field, heating and spectral irradiance	H2: CME structure, evolution and propagation through heliosphere	G2a: Atmosphere variability	Electric power systems/GICs
S3: Solar eruptions	H3: Radiation environment in heliosphere	G2b: Ionosphere variability	Satellite/debris drag
	H4: Space weather at other planets/planetary bodies	G3: Near-Earth radiation and plasma environment	Navigation/Communications
			(Aero)space assets functions
			Human Exploration

Overarching Activities:

Assessment Information Architecture Data Utilization Education/Outreach

- The ISWAT initiative provides a portal for state-of-the-art in space-weather science and modeling.
- Action Teams work via self-guided topical collaborations on different aspects of space weather organized into *ISWAT Clusters*.
- The ISWAT initiative provides an ideal opportunity for the next generations to take the lead and shine in the community.
- ISWAT Clusters are enhancing our capabilities through shared resources forming partnerships to maximize return on investments to national and international space weather programs.
- The COSPAR ISWAT initiative is a channel for community inputs to our *Living Global Space Weather Roadmap*.

- <https://iswat-cospar.org>
- Overarching Activities:
 - Information Architecture
 - Data Utilization
 - Responds to Recommendations of the COSPAR Panel on Space Weather (PSW):
 - PSW 2018 Metadata Resolution
 - PSW 2018 Data Access Resolution