



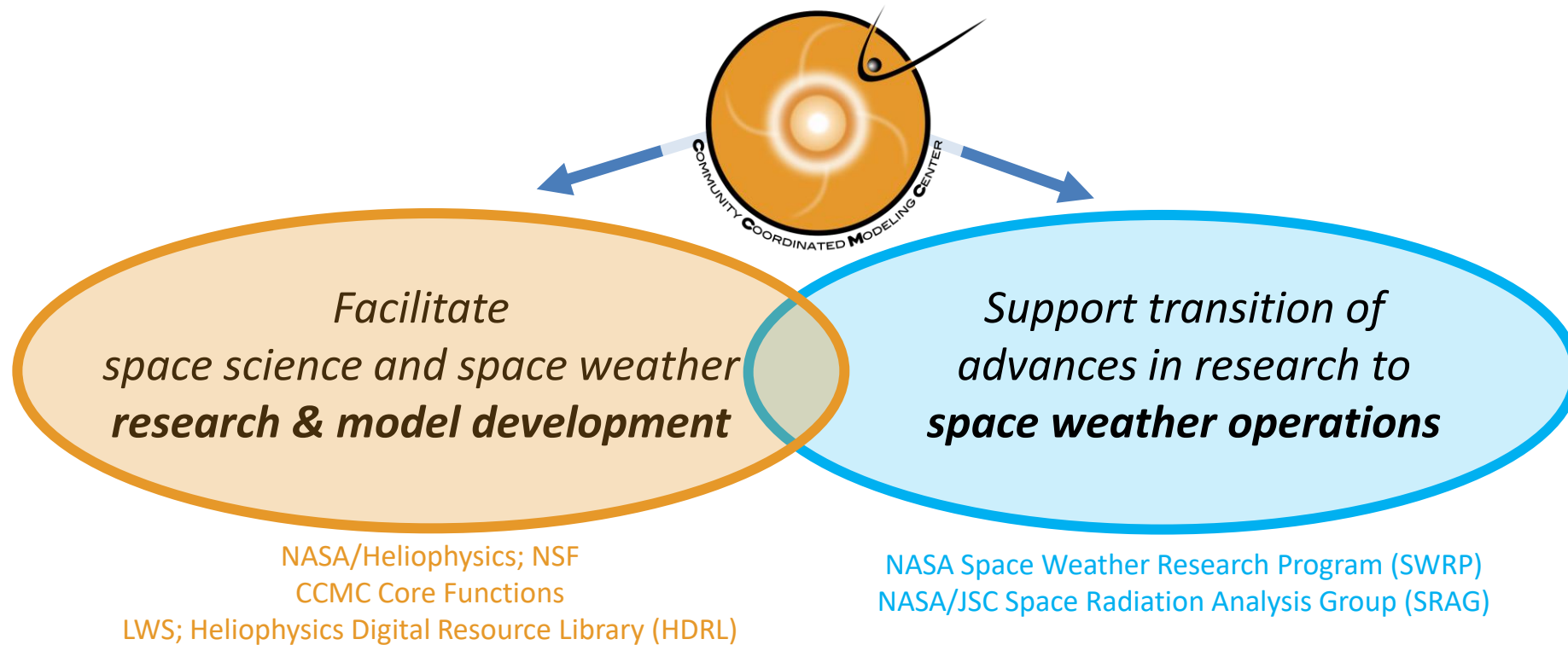
IDHEA 2023: Lessons learned from CCMC implementation of SPASE 2.6.0

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Established in 2000 as multi-agency strategic investment in national SW program



CCMC hosted Models

Access point to state-of-the-art source-to-impact modeling
Portal for R2O Transition

Corona	Heliosphere	Magnetosphere	Local Physics	Inner Magnetosphere	Ionosphere/Thermosphere
SWMF.SC+EEGGL+CME	WSA-ENLIL	GAMERA-RCM-REMIX	GIC	TIEGCM-X	SAMI3
AWSoM EEGGL SRPM	WSA-ENLIL+Cone	OpenGGCM+CTIM		GMAT	SAM
PFSS.Petrie ANMHD	WSA-ENLIL+EPREM	SWMF+RCM+deltaB		SAMI3-TIEGCM	DTM2020
PFSS.Macneice	WSA-ENLIL+SEPMOD	SWMF+RCM		GEODYN	USU-GAIM
PFSS.Luhmann SEPMOD	REleASE	SWMF+RCM+RBE		RCM	SWACI-TEC
MAG4 UMASEP	PREDICCS	SWMF+RCM+CRCM		Fok.CIMI	ABBYNormal
ASAP ASSA AMOS	EMMREM	LFM-MIX-TIEGCM		Li Rad Belt	NRLMSISE
WSA NLFFF REleSE	iPATH	WINDMI LANLstar		UPOS RB	GITM
MAGIC SNB3GEO SEPSTER	CORHEL-CME	IGRF Tsyganenko		AE-8/AP-8	PBMOD
GCR BON NOVICE	CORHEL	PS VP Weigel-deltaB		AE-9/AP-9	CTIPe
	Heltomo SMEI	AACGM Apex		VERB	Weimer IE
	Heltomo IPS	AMPS HYPERS		SEAES-SP	Weimer-deltaB
	MAG4	GUMICS		NAIRAS	IRI-2020 JB2008
	DBM				COSGROVE-PF
	SWMF-AWSoM				Ovation Prime
	DIPS		VPIC		WACCM-X
			PAMHD		
			PIC-Hesse		

SPASE-like Metadata at the CCMC



- Metadata on models:
 - Collecting SPASE-like metadata on models is part of the [CCMC model onboarding procedures](#).
 - The [CCMC model catalog](#) online is based on such metadata
- Metadata on model runs:
 - Starting around 2020, the CCMC has defined a pipeline to generate and store SPASE-like metadata on each Run-On-Request (ROR) run.
 - As of 2023, we have collected more than 5K ROR runs metadata
 - Such info would be very helpful to design and build the next ROR system with increased transparency and redundancy checking
 - The more info we have and know about each run, the easier it is for us to build and improve our simulation services which can extend to the visualization services as well

SPASE 2.6.0



- SPASE Metadata model version 2.6.0 was released on 08/03/2023
 - The ‘Simulation’ extension is officially adopted into the base model starting with version 2.6.0
 - Suggested changes that have been incorporated by the SPASE group from the CCMC:
 - Add ‘Empirical’ as a ModelType
 - Renamed ‘SimulationModel’ to just ‘Model’, ‘SimuationRun’ to ‘ModelRun’, etc.
 - Add ‘AccessInformationOptional’ under ‘Model’

Adding SPASE descriptions into the official registry



- Using the [SPASE Metadata Editor](#), we generated a sets of SPASE descriptions in a few category:
 - Model:
 - <spase://CCMC/Model/InternationalReferenceIonosphere/2016>
 - Service:
 - <spase://CCMC/Service/RunsOnRequest>
 - <spase://CCMC/Service/InstantRun>
 - Software:
 - <spase://CCMC/Software/Kamodo>
- They are all incorporated into the official SPASE registry under the CCMC naming authority: <https://hpde.io/CCMC/index.html>

What's next?

- Added all CCMC developed software with a description in SPASE
 - Open Question to the SPASE group: Should it be under 'Software' or 'service' for web applications

Validation & Scoreboards

CAMEL

CAMEL is an integrated and flexible framework for comparing space weather and space science model outputs with observational data sets.

Flare Scoreboard

Real-time Forecasting Methods
Validation for predicting Solar Flare events.

CME Arrival Time Scoreboard

Real-time Forecasting Methods
Validation for Coronal Mass Ejections arrival time at Earth.

SEP Scoreboard

Real-time Forecasting Methods
Validation for predicting Solar Energetic Particle (SEP) events.

IMF Bz Scoreboard

Real-time Forecasting Methods
Validation for interplanetary magnetic field forecasts at L1.

Space Weather Analysis

iSWA

iSWA serves CCMC real-time/continuous model outputs and observational data.

DONKI

DONKI is a comprehensive online database of space weather events for the community.

Flux Rope and CME measurements

StereoCAT

The Stereo CME Analysis Tool is an online tool enabling space weather forecasters and researchers to quickly calculate CME kinematic properties.

SWPC CAT Web

The web version of SWPC CME Analysis Tool enables users to calculate CME kinematic properties.

EEGGL

EEGGL is a tool which uses observational data to specify input parameters for the Gibson-Low flux rope model so that it may approximately reproduce observed CME events.



What's next?

- Add SPASE description on other CCMC services
 - Online visualization
 - iSWA HAPI server
 - If every group that has implemented their own HAPI server would provide a SPASE description as part of the step, potentially users can use SPASE to easily search and see what they can access via the HAPI standard
 - Questions:
 - How do users know what they can obtain via HAPI standards now other than 'word of mouth'?
 - Should the HAPI standard be described in SPASE or any API/data access standards be described in SPASE? Would that be useful? If so, what category should it be under?
- Add SPASE descriptions on CCMC hosted models

Open Questions on 'Model' Metadata



- How to description run output?
 - Current SPASE model provides NumericalOutput and DisplayOutput as two options for describing run output files. For a given model run, there could be hundreds of files and having a SPASE description for each of the file will not be useful and hard to implement/maintain
 - Smaller sub-group to think about the purpose of describing run output and what would be most useful to users. What do users want to see as metadata for a given run? How would they use such metadata?
- DOI generation:
 - When and what should DOI be generated? For all 'model', 'software', 'modelrun', and 'service'?
 - How to handle version changes? What is some use cases that make sense?

Our observations/Suggestions



- There is a steep learning curve on the SPASE metadata model for new users
 - Should brainstorm on how to help users to generate SPASE descriptions
 - Improve website with how-to? Provide complete example on each category in SPASE?
 - Add web form and contacts for people to ask questions? Offer 1 on 1 help if needed?
 - Organized hackathon with target user groups to generate SPASE descriptions for that group?
- It does take time to make meaning descriptions instead of bare bone descriptions. The bare bone descriptions are not useful.
 - Open question: should the data model mark more fields as 'required' instead of making them optional?
- For naming authorities (NA), set up a way for groups in charge of their NA to push and request merge of SPASE descriptions in their repository
- In general, add automation as much as possible in the process of submitting and accepting SPASE descriptions from folks

Our Observations/Suggestions



- From the end user perspective, folks need to see that providing SPASE descriptions are useful for the community
 - Easy to use online search interface should be build to harvest the SPASE metadata that would let any user to find and locate data, software, services, catalogs, etc. with URL(s)/access method(s) to get to them
 - Provide 'how-to' with examples on searching and using the SPASE metadata
 - Different user groups might have different use cases but an end-to-end example/workflow for each user group would be valuable
 - Set up ways to collect feedback from users periodically to see what can be done and build to make the SPASE metadata registry more useful
 - Follow the KISS (Keep it Simple, Stupid) principle