Space Weather Modeling and Open Science

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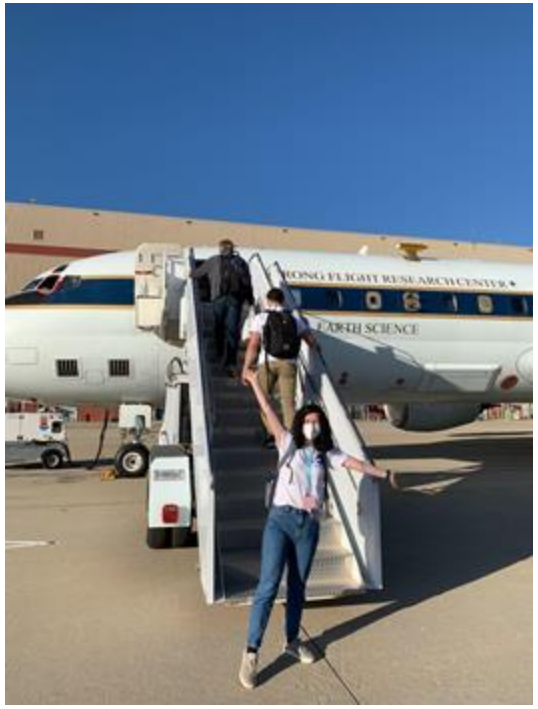
CONNECTING SMES AND SCIACT

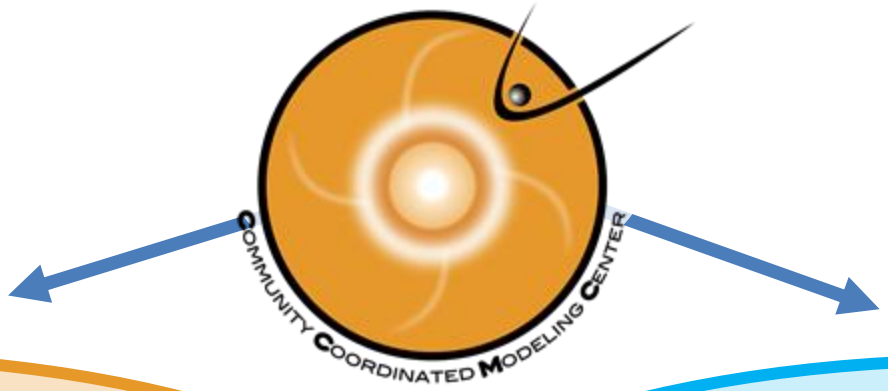
About Me

Brandeis UNIVERSITY



Community Coordinated Modeling Center

CCMC was established in 2000 as multi-agency strategic investment in national space weather program



Facilitate
space weather ***research and model development***

Support transition of advances in research to ***space weather operations***

CCMC Project Overview

Observational Data Archives

Model Repository

Model Input Generation Tools

Runs-on-Request

Continuous Runs

CCMC Archives

ISWA

Visualization, Analysis, Validation Tools

CCMC-Vis

Kamodo

Science Community

Key Terms at the CCMC

MODEL

A model is a computer simulation.

"The ultimate goal in **modeling any physical system** is, given appropriate spatiotemporal boundary conditions, to accurately **predict the course of the past and the future events** within the system."[1]

VALIDATION

Validation is the comparison of model outputs with observed data.

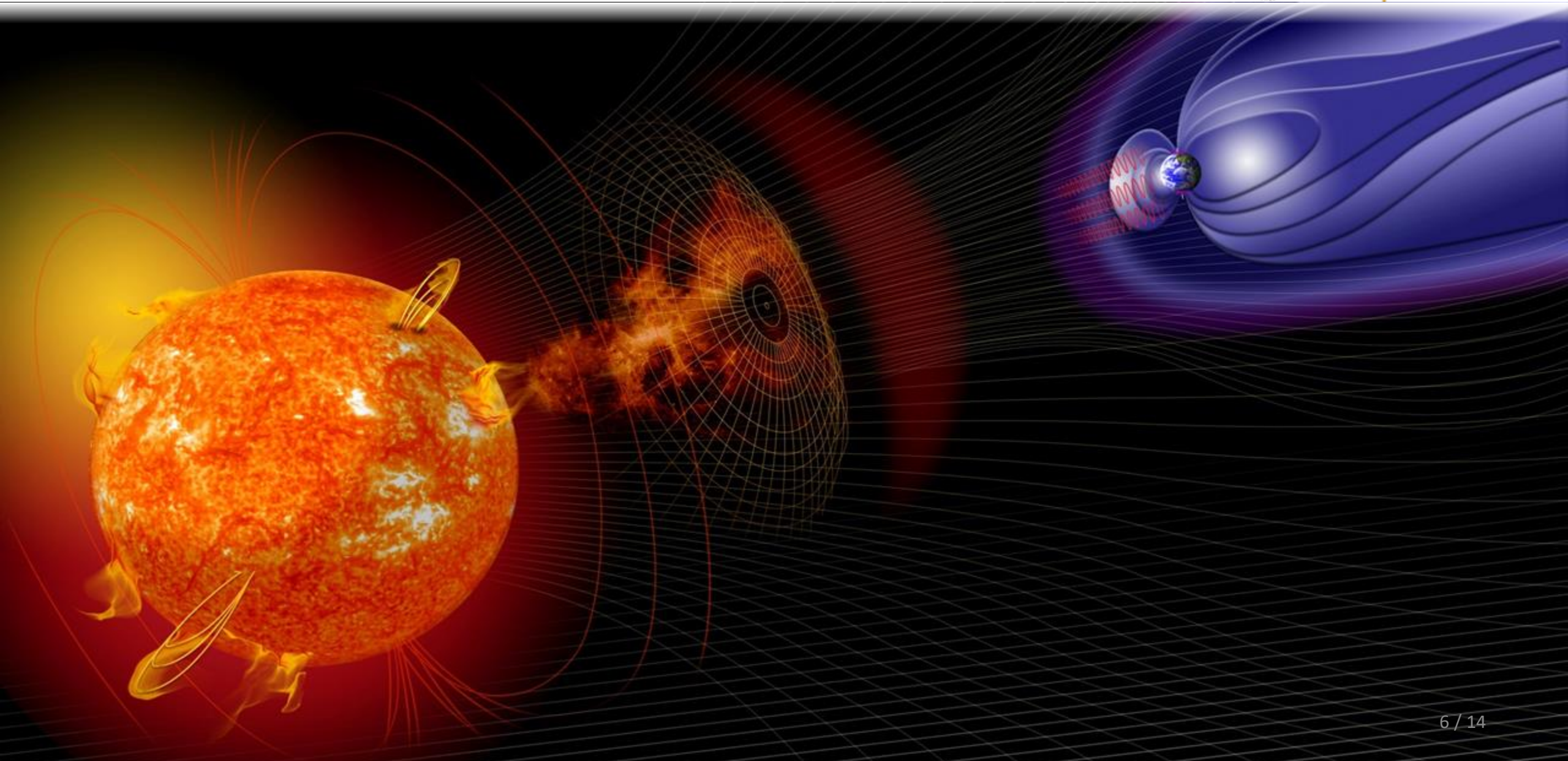
"Validation efforts have helped to **better understand the limitations and the capabilities of various models** and model setups and have been used to address the key model features in need of improvement for better predictive capability."[1]

VISUALIZATION

Visualization is the representation of data as an image or video.

"Providing accurate and illuminating model output visualization is an extremely important function… because it can **aid researchers, model developers, operational staff, and educators**."[2]

Space Weather



CCMC Models

Corona

- SWMF.SC+EEGGL+CME
- AWSoM
- EEGGL
- SRPM
- PFSS.Petrie
- ANMHD
- PFSS.Macneice
- SEPMOD
- PFSS.Luhmann
- SEPTSTER
- MAG4 UMASEP
- ASAP
- ASSA
- AMOS
- WSA
- NLFFF
- RELeSE
- MAGIC
- SNB3GEO
- GCR
- BON
- NOVICE

Heliosphere

- WSA-ENLIL
- WSA-ENLIL+Cone
- WSA-ENLIL+EPREM
- WSA-ENLIL+SEPMOD
- REleASE
- PREDDICS EMMREM
- CORHEL-CME
- CORHEL
- iPATH
- Heltomo SMEI
- Heltome IPS
- MAG4
- DBM
- SWMF-AWSoM
- DIPS

Magnetosphere

- GAMERA-RCM-REMIX
- OpenGGCM+CTIM
- SWMF+RCM
- SWMF+RCM+RBE
- SWMF+RCM+CRCM
- WINDMI
- LANLstar
- LFM-MIX-TIEGCM
- GRF
- Tsyganenko
- PS VP
- AACGM
- GUMICS
- Apex
- Weigel-deltaB
- GIC

Inner Magnetosphere

- RCM
- Fok.CIMI
- Li Rad Belt
- UPOS RB
- VERB
- AE-8/AP-8
- AE-9/AP-9
- SEAES-SP
- NAIRAS

Local Physics

- VPIC
- PAMHD
- PIC-Hesse

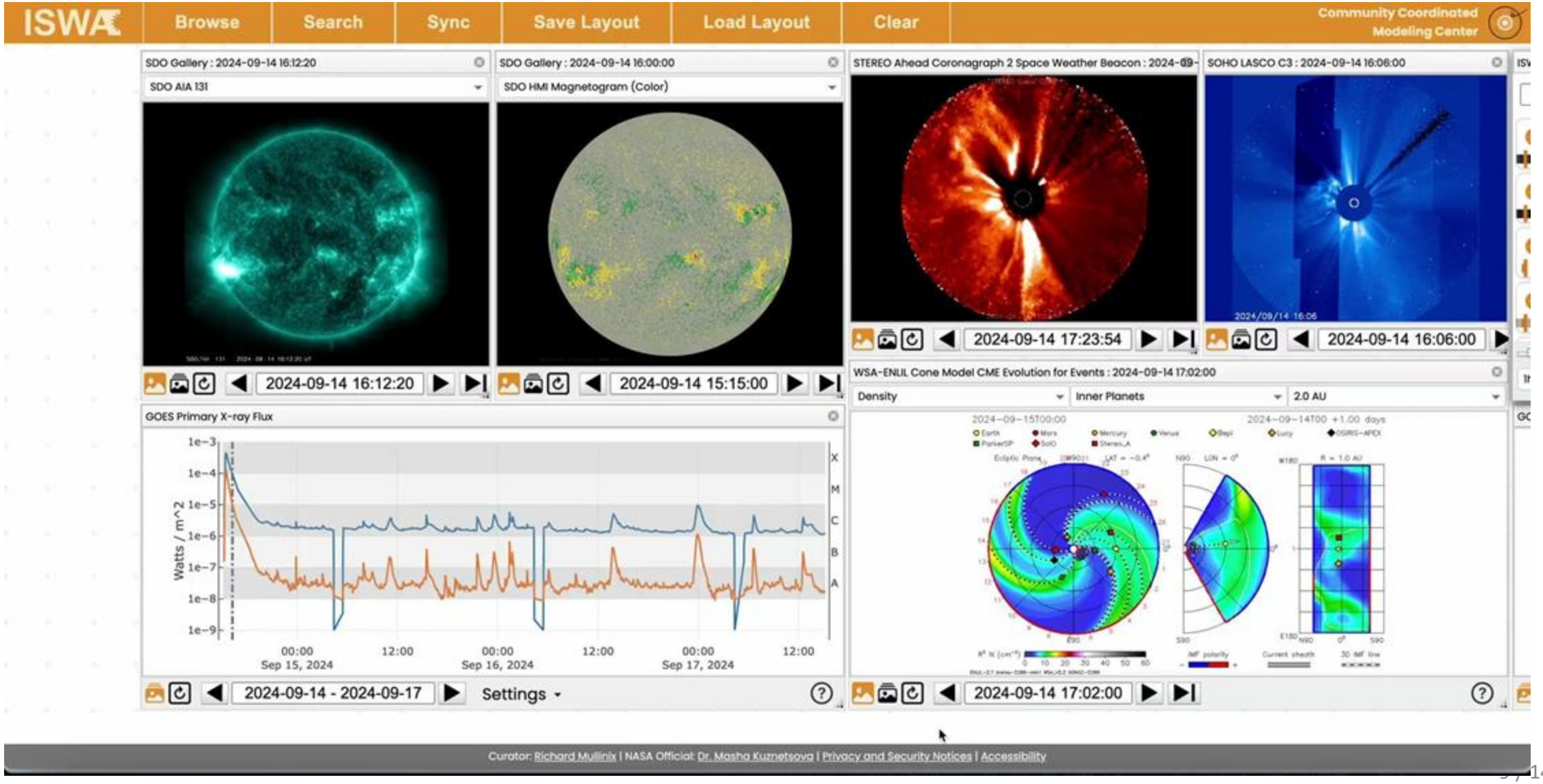
Ionosphere/ Thermosphere

- TIEGCM-X
- SAMI3
- SAMI3-TIEGCM
- GMAT
- GEODYN
- USA-GAIM
- SAM
- SWACI-TEC
- NRLMSISE
- Weimer IE
- Weimer-deltaB
- CTIPe
- GITM
- ABBYNormal
- PBMOD
- JB2008
- IRI-2020
- WACCM-X
- COSGROVE-PF
- Ovation Prime

Integrated Space Weather Analysis (ISWA)

- Provides access to **continuous/real-time model output**
- Combines forecasts based on the most advanced space weather models with **concurrent space environment information**
- Dashboard layout: configurable and adaptable
- 25+ models

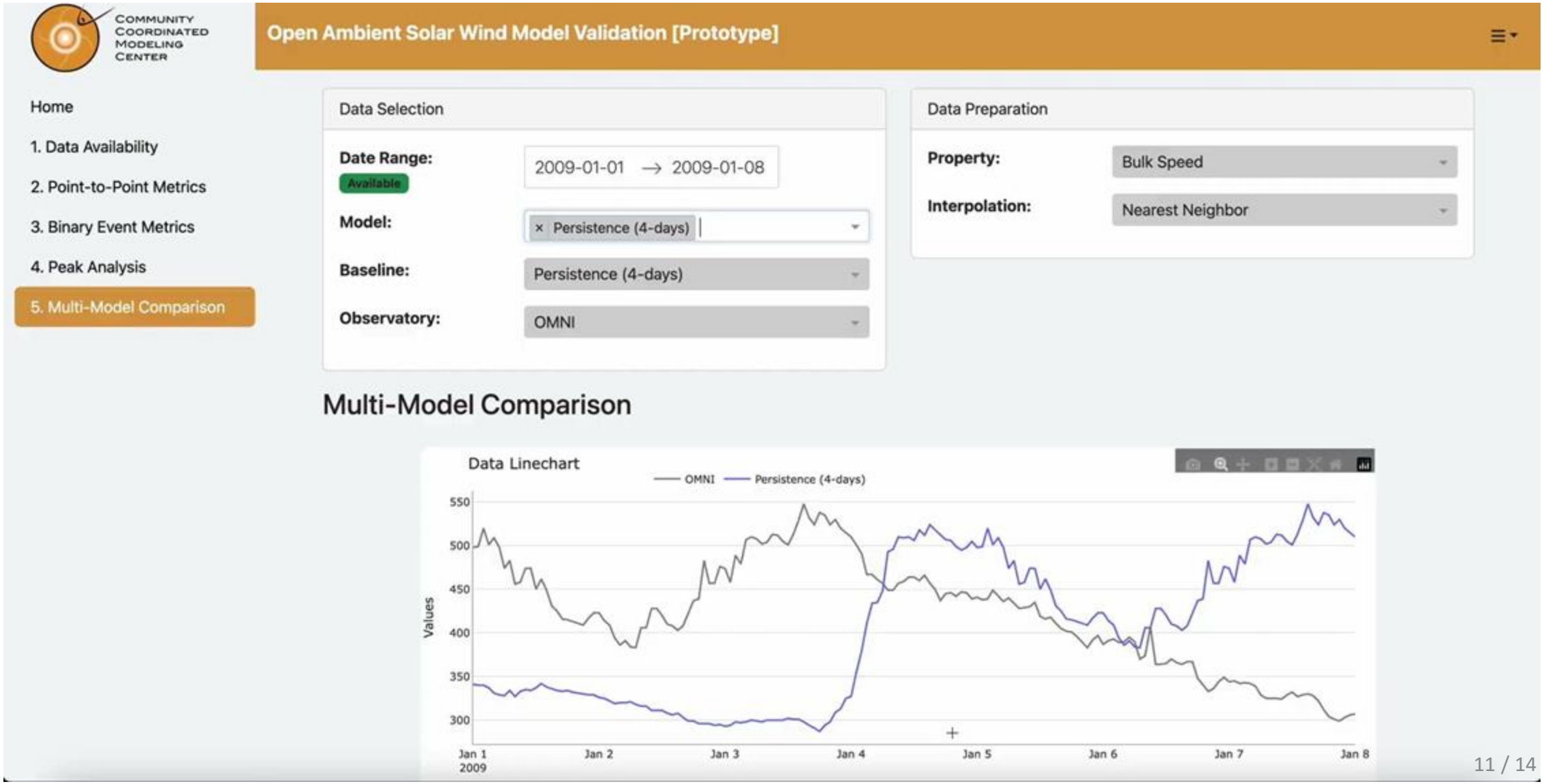
ISWA Demo (Live)



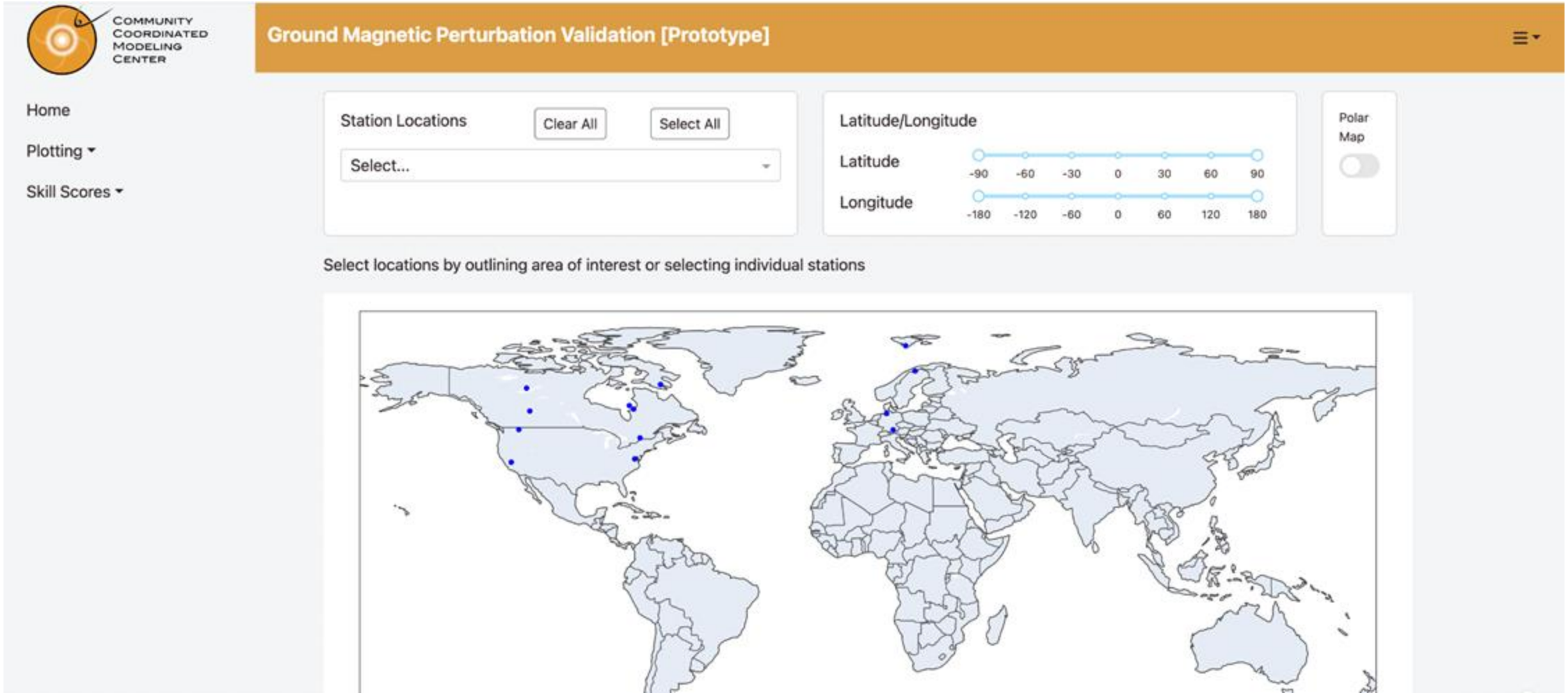
Comprehensive Assessment of Models and Events using Library tools (CAMEL)

- First **open validation** framework
- Validates **space weather and space science models** with observational data sets
- Calculates various **skill scores** in support of different validation efforts and campaigns
- Displays specific webpages for each validation campaign with **unique parameters and time periods**

CAMEL Demo (Live)



Upcoming CAMEL Data Validation Campaign



Open Science

CAMEL is an

Open Validation Framework

community members

CCMC developers

skill score calculation library code

observational data

model output

with permission of data originators

public code
Git repository

public data
Git repository &
CAMEL API

with proper credit to data providers and developers

research, innovation, & community development

Links and Resources:

https://ccmc.gsfc.nasa.gov/

https://iswa.ccmc.gsfc.nasa.gov/IswaSystemWebApp/

https://ccmc.gsfc.nasa.gov/tools/CAMEL/

https://science.nasa.gov/open-science/

Questions?

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