



New Run Discovery Features in ROR

We will also present our recent work on making heliophysical models more accessible and open to the community, particularly through simplified user experience and expert domain support. We will report on our progress in establishing an inter-center infrastructure with the ESA Virtual Space Weather Modelling Centre (VSWMC), designed to cross organizational boundaries and provide streamlined access to a joint palette of the models.

- Services freely available at CCMC for the hosted models:
 - Most models can be requested to **Run on Request (ROR)** with model input parameters specified through a simple Web-based interface and results staged on a public Web-page. **Interactive value-added visualization** and file conversion of the results is available for most models. This enables scientists who are not modelers themselves to utilize state-of-the-art models in their research.
 - A limited set of fast and simple models is available for **Instant Run**, where a model can be executed and visualized while-you-wait.
 - Certain models **continuously run** to generate simulation results over long time periods testing model robustness and long-term performance, while also feeding the perpetual archive and portal of space weather information at CCMC. The results are available to researchers and decision makers in real time, through our signature interactive tools such as **ISWA**, **SF**, **ScoreBoard**, and others.

The figure displays a collection of 12 panels, each representing a different solar wind or coronal data visualization. The panels are arranged in a 4x3 grid. The first row contains three panels: OSPREI (three panels showing different parameters), SAMI3-WACCMX (one panel showing a 2D map), and IMP/TAM (one panel showing a 2D map). The second row contains three panels: HWM14 (one panel showing a 2D map), EUHFORIA (one panel showing a 2D map), and MAGE (one panel showing a 2D map). The third row contains three panels: WAM-IPE (one panel showing a 2D map), CORHEL CME (one panel showing a 2D map), and GAMERA Helio (one panel showing a 2D map). The fourth row is empty.

Database Of Notifications, Knowledge, Information

- Catalog of space weather phenomena
- Knowledgebase of interpretations, simulation results, and forecasting analysis
- Online tool for dissemination of forecasts, notifications, & archiving event-focused information

**Comprehensive Assessment of Models and Events
using Library Tools Framework**



- The CAMEL framework is an integrated and flexible framework allowing users to seamlessly compare space weather and space science model outputs with observational data sets.
- The backend of the CAMEL framework takes advantage of Community Coordinated Modeling Center (CCMC) existing services.

EEGGL Eruption Event Generator (Gibson & Low)



- Use observations defining the CME source region (location and flux rope orientation).
- Generate Gibson-Low flux rope parameters for the flux rope emergence models.



Stereocat CME Analysis Tool

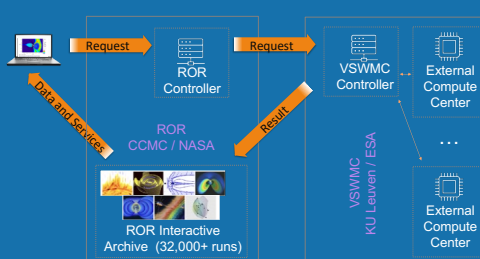
- Determine CME kinematic parameters
- Create CME height-time measurements
- Create an ensemble of CME measurements
- Save and share measurement sessions

... Automatic search in ROR metadata for the runs in the overlapping date range yields a more complete set of 170 runs providing an extensive coverage of the event

Exploring runs with similar parameters may reveal runs studying similar extreme events in the past

- Containerized ENJIL+SEPMOD – a complex model chain that is now trivially portable!
- Implemented real-time log collection, monitoring, and analysis of models (Kafka+Fluentd), improving observability and reliability of the system
- Implemented multi-modal deployment pipeline that enables multiple installations of a model tailored to specific client needs

- EUHFORIA model is now available in ROR through collaboration between NASA CCMC and ESA VSWMC
- Requests placed through ROR are executed at European compute centers using VSWMC infrastructure
- Results are stored in CCMC's ROR archive and can be explored using ROR visualization and data analysis tools



CCMC Space Weather Research Portals and Forecasting Tools at CCMC

Library of Curated Runs: Time Periods

- Curated library of 1550+ custom simulations covering 200+ time periods of interests including all major solar storms since the year 2000
- Each custom simulation is crafted and checked by CCMC scientists
- Ready-to-use collection of runs eliminates the need to prepare and wait for long-running simulations
- All simulations are open for anyone to use for the purpose of research and validation
- A growing list of time periods is available at https://www.ccmc.gsfc.nasa.gov/science/data/solar_data/VII/ and is continuously expanded in response to new CSM events, and validation campaigns

Satish P. Deyda, Dayana Desrosiers modeling and analysis techniques at the CCMC by L. Ballester et al in SW313A-2587 for more details

Future Work

- We are looking into making the system more open and transparent, including being able to ‘reload’ runs, a better access to run input and configuration parameters, ability to order ROR runs remotely through an API, etc
- We are exploring ways to support interconnectivity with other services and applications
- We work on reducing pain points, including run status tracking, diagnostic information during the run, and others