EUHFORIA in the ESA Virtual Space Weather Modelling Centre


Objective and scope

- The further development of the VSWMC building on the Phase 1 prototype system and focusing on the interaction with the SSA SWE system.
- Models are geographically distributed (Leuven, Brussels, Cambridge, Paris, …)
- Efficient integration of new models and new model couplings, including a first demonstration of an end-to-end simulation capability.
- Further development and wider use of the coupling toolkit and the front-end GUI which will be designed to be accessible via the SWE Portal.
- Availability of more accessible input and output data on the system and development of integrated visualization tools.

Work breakdown

Part 2A: Updated architectural design of the full VSWMC system of the future and the detailed design of the P2 prototype based on the requirements analysis

Part 2B: Prototype of the VSWMC, developed based on the outcomes of the Part 2a

Part 2C: Utilities federates (for visualization, validation, demonstration, etc.) in order to showcase the functionality of the system, to verify and to validate the Part 2 Prototype

VSWMC aims to combine three roles:
- Repository for models and data
- A facility offering a model coupling infrastructure
- A facility that executes coupled model simulations

Typical prototype setup

The VSWMC prototype uses high-level architecture (HLA), a general purpose architecture for distributed computer simulation systems (across heterogeneous hardware and software platforms). HLA enables computer simulations to interact (to communicate data and to synchronize actions) with other computer simulations regardless of the computing platforms: reuse without significant code change or development cost.

‘Federates’ (models) included

ODI (Open Data Interface): MySQL database system (used for input data and validation)
- XTRAPOL*: NLFF Magnetic Field Reconstruction
- EUHFORIA*: 2.5D solar wind model + CMEs
- AMRVAC*: 2.5D kinetic PIC magnetosphere
- COOLFluid*: 3D kinetic PIC magnetosphere
- CTIP/Camat2*: ionosphere
- GUMICS-4*: 3D MHD magneto-ionosphere
- BAS-RBM*: Radiation Belt Model (Cambridge)
- EUHFORIA*: 3D solar wind model + CMEs

Effects models: Det and Kp indices, bow shock stand-off distance

More info on https://esa-vswmc.eu/ and this JSWSC PAPER

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