TerraVirtualE

A Data Management Plan created using DMPonline.be

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Project abstract:

The question about how solar storms impact a planet has both fundamental scientific importance and great social impacts for protecting our infrastructure from the most powerful solar storms. At present, models rely on a fluid description of the electrons due to algorithmic and computational challenges. Our goal is to develop a model of the space environment around a planet based on a particle description of both ions and electrons. We plan to use the particle in cell (PIC) model where both ions and electrons retain their nature as particles. This PIC model will allow us to investigate the critical role of energetic electrons participating in the energy and matter transfer from the solar wind to the planet inner space. What makes this goal now possible is the Energy Conserving semi implicit method (ECsim), developed by the PI. The ECsim conserves energy exactly, a critical element in the investigation of energy flow from the solar wind. In addition, the energy conservation leads to enhanced numerical stability, which in turn greatly augment ECsim's capability to simulate very large systems such as planet atmospheres while treating electrons as particles rather than fluid. We will start from this new development and introduce two critical innovations. First, we will implement adaptive spatial and temporal resolution for finer resolution closer to the planet and in selected areas of interest. Second, we will implement CPU-GPU algorithms for the new heterogeneous supercomputers developed by EuroHPC. These innovations will increase the capability of ECsim by more than an order of magnitude making it possible to model a region as big as the Earth space environment with the computers available within the next 3-5 years. If successful, we will have the first PIC model to describe a planetary space environment where the correct particle nature of the electrons is considered with all its implication for the energy and matter transport.

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TerraVirtualE
GDPR Record

GDPR record

Have you registered personal data processing activities for this project?

- Not applicable

TerraVirtualE
DPIA

DPIA

Have you performed a DPIA for the personal data processing activities for this project?

- Not applicable

TerraVirtualE
ERC DMP +

Project information

Project Acronym

TerraVirtualE

Project Number

101095310

Data summary

Summary

There will be two types of data:

- FIELDS: Fields (electric and magnetic) and moments (density, current, pressure tensor and energy flux) for each species (at least 2: protons and electrons). The data is generated by the code ECsim and is in hdf5 format. Each file is typically less than 5GB. A single file is generated by all processors in parallel and includes each quantity as a separate field within the hierarchical hd5 file. One file is generated for each saved time step, typically one every 500-1000.
- PARTICLES: Particle data (position, velocity, color and id) for each species. The data is generated by the code ECsim and is in hdf5 format. Each file is typically less than 5TB. A single file is generated by all processors in parallel and includes each quantity as a separate field within the hierarchical hd5 file. One file is generated for each saved time step, typically one every 1000-2000.

FAIR data

1. Making data findable

Data is discoverable via search engines and catalogues, have machine-readable metadata and a unique persistent identifier such as a Digital Object Identifier (DOI).
We will ensure data fundability by

- Depositing and publishing your data in a trusted data repository such as KU Leuven RDR or one of many other suitable data repositories makes data findable.
- Repositories will apply metadata for discovery.
- Repositories will apply a unique persistent identifier. E.g. a field data can have the unique identifier ECSIMFIELD_JAX:006852 in the Resource Identification Portal.
- Repositories exchange metadata with aggregation discovery portals such as Google Dataset Search, OpenAIRE Explore or DataCite.

2. Making data openly accessible

Users will be informed that they can access our data. Data will be available as open data (public access).
All our codes and data will be openly accessible

- Data repositories will make our data accessible.
- We use no restricted data
- Metadata are always openly accessible
- Metadata explain the procedures for accessing the data.

3. Making data interoperable

We will use standardisation of data, metadata and using open file formats to make data combinable and exchangable with other data.
We will use:

- Open and standard (hdf5) file formats to make data interoperable.
- The provided metadata follows relevant standards in the field as set in the planetary database.
- Controlled vocabularies, community standards, thesauri, or ontologies are used where possible.

4. Increase data re-use

Documentation and metadata wil support data interpretation and reuse.

- The data are accurate and well described with many relevant attributes (documentation & metadata).
- The data have a clear and accessible data usage license (see licenses in RDR).
- The data have a clear and detailed provenance: how, why, and by whom is the data created and/or processed.
- The data and metadata meet relevant domain standards.

5. Allocation of resources and data security

Sufficient resources are already available to store the data at the Flemish Supercomputing Center, VSC, using the Tier-1 data system.
Data security will be ensured by the practices of the Flemish Supercomputing Center, VSC.