Implementation of IMPEx at CCMC

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CCMC
Outline

- Objective
- SPASE Overview
- IMPEX Overview
- Progress
Objective

• Re-architecture of the CCMC run-on-request database
  – Provide a hub for the community to easily search and obtain simulations data for their own research
  – Interconnect the compare simulations from scientific models with observation data
The Space Physics Archive Search and Extract (SPASE)

• The SPASE effort is a Heliophysics community-based project with the goals of:
  – **Facilitating data search and retrieval** across the Space and Solar Physics data environment with a common metadata language
  – Defining and maintaining a **standard Data Model** for Space and Solar Physics **interoperability**, especially within the Heliophysics Data Environment
  – Using the Data Model to create data set descriptions for all important Heliophysics data sets
  – Providing **tools and services** to assist SPASE data set description creators as well as the researchers/users
  – Working with other groups for other Heliophysics data management and services coordination as needed

• Three products:
  – SPASE Metadata Model
  – Set of Services and protocols to enable the exchange of information
  – Tools for developing and validating resource descriptions

• [http://www.spase-group.org/](http://www.spase-group.org/)
Problem?

- SPASE data model is used to describe data coming from observations of space physics domain
- What about simulations?
The SPASE Simulation Extensions developed by the IMPEx project, a European Union (EU) Seventh Framework Programme sponsored project
Describing simulations and related generated data
http://impex-fp7.oeaw.ac.at/home.html
• Metadata for simulation run and output dataset
• 4 level of metadata related to simulation results:
  – File: basic information about a data file that is part of a dataset
  – Dataset: what do the data represent? Under which form?
  – Simulation Run: Description of the run including the inputs
  – Simulation Model: description of the model
• Simulation data maybe searched in 2 ways:
  – From the simulation inputs
  – By the simulation outputs
IMPEX Simulation Data Model (v.1.0.3)

• XML Schema:
  – http://impex-fp7.oeaw.ac.at/xsd/doc/1_0_3/impex-1_0_3.pdf
    (300+pages)

• Challenge:
  – No easy task to translate the schema to an actual database design
  – Very comprehensive schema but will it work for us?
Simulation Model: Description of the model
User Interface to Enter Simulation Model

- UI to enter simulation model info into the database
- Unique resource ID generated using model name and version (ex: ccmc://Model/AMOS/v1/Info)
User Interface to View Simulation Model

Model Description

The User Interface to View Simulation Model (UIVM) tool provides an interactive environment for users to explore the simulation model and its various components. The UIVM allows users to manipulate parameters, view simulation results, and analyze data in a user-friendly manner.

Model Inputs

- **Model Name:** User Interface to View Simulation Model
- **Model Description:** Tools for visualizing and analyzing simulation data
- **Model Inputs:**
  - **Input Type:** Text, Number, Boolean
  - **Input Range:** Various ranges depending on the specific input (e.g., 0 to 100)

Model Outputs

- **Output Type:** Graphs, Tables, Reports
- **Output Range:** Various outputs depending on the specific output (e.g., plot of simulation data)

Model Features

- **Interactive Controls:** User can manipulate model parameters in real-time
- **Visualization Tools:** 2D and 3D visualizations of simulation results
- **Analysis Tools:** Tools for data analysis and statistical calculations

Model Development

The model was developed using a combination of programming languages and software tools, such as Python and MATLAB, to ensure accuracy and efficiency. The model was tested extensively to ensure its reliability and usability.

Model Deployment

The model is accessible to users through a web interface, allowing for easy access and integration into existing workflows.

Model Documentation

Documentation is available for users, providing detailed information on how to use the model, understand its inputs and outputs, and interpret results.
# User Interface to View Simulation Model

## Acknowledgement

[Add Acknowledgment]

## List of Model Inputs

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Current</th>
<th>Units</th>
<th>Property</th>
<th>Units/URL</th>
<th>Valid Min</th>
<th>Valid Max</th>
<th>Default Value</th>
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<td>CME's longitude of central position distance, phi (°). Valid between 180° to 180° degrees (°).</td>
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<td>CME take-off date and time</td>
<td>CME's take-off date. Allowed format: YYYY-DD-MM-HH:MM:SS (days from 01 to 31, months from 01 to 12, YYYY - years from 1900 to 2049).</td>
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## Relevant Links

- Development Site: [http://www.geomag.bgs.ac.uk/pipe/bmu.html](http://www.geomag.bgs.ac.uk/pipe/bmu.html) (Edit)
- Detailed Description of Model: [http://www.geomag.bgs.ac.uk/predictions/CDM/pipe.pdf](http://www.geomag.bgs.ac.uk/predictions/CDM/pipe.pdf) (Edit)
- Publications (Add Publications) (Edit)

## CCMC Service Available

[Add Access]
Web Service Interface

- **Web service** call to get a **SimulationModel** Object with all the info about a simulation model:
  
  ```
  http://kauai.ccmc.gsfc.nasa.gov/ROR2/WS/get/ModelInfo?SpaseResourceID=(the unique SpaseResourceID for the model info)
  ```
  
  *note: the parameter 'SpaseResourceID' is required. All simulation models have a unique ID assigned to them, and this ID is needed to get info about it.*
  

- **JSON object** returned by the call:
  
  ```
  ```
What’s Next?

• Continue testing and modifying our current database design based on user feedback and needs
• New Instant-Run interface utilizing the simulation model info (list of all inputs) and the web service API
• Continue adding to the database model to support simulation runs and simulation results
• Expending web service API depending on user feedback and needs