

WG-1/2/3: End-to-end Modeling

- Janet Luhmann
 - Presented an overview of CISM efforts toward modeling the coupled Sun-to-L1 system
 - Detailed recent progress by team members toward the development of a realistic model corona and resulting solar wind structure, a realistic CME initiation and propagation capability, a SEP injection and transport scheme that utilizes MHD model results, and a solar wind and SEP coupling to geospace
 - Developed CORHEL, a coupled MAS corona/ENLIL solar wind MHD simulation with a user-friendly interface; carried out an initial, coupled, modular, end-to-end proof-of-concept simulation of an ad-hoc CME event; characterized details of realistic CME initiation for e.g., the May 12, 1997 event; and adopted a “Cone” Model of CME events for developing a generalized first-order scheme for interplanetary propagation and SEP code development

- Described Near-term CISM Goals: Archive Codes capable of providing regular MHD simulations of the quiet corona and solar wind, the Cone Model code for CME events (including an integrated SEP code module), as well as codes for coronal/solar wind/SEP event simulations for examples of realistic CME initiation. Also, introduce a geospace coupler scheme for solar wind, shocks, and SEPs

- Chuck Goodrich
 - Presented an overview of CISM efforts toward development of a framework for coupled solar/heliospheric/magnetospheric models
 - Described two philosophies of framework design: The loosely coupled framework, and the tightly coupled framework. The relative advantages and disadvantages of each approach were discussed
 - Emphasized the importance of “minimal changes” when incorporating models into a loosely coupled framework

Space Physics Frameworks

	ESMF	SWMF	CISM
Approach	Tightly coupled, single executable , high-performance portable, highly structured modeling environment.		Loosely coupled, multiple executable , rapidly prototyped, not necessarily high-performance.
Infrastructure	Provides data structures and common utilities that components use <ol style="list-style-type: none"> 1. to organize codes 2. to improve performance & portability 3. for common services. 		Minimal infrastructure and minimal science code modification. Data channels provide component initialization and control
Coupling	Grid mapping is presently limited to regular grids.	Focuses on 3D overlapping interfaces and can handle 3D AMR grids.	Coupling can support arbitrary grids
Implementation	Adheres to high software engineering standards with separate framework and applications teams. Provides a high level of flexibility.	Uses minimal software engineering tools and has an integrated framework and application development team.	Uses of InterComm package for data transfer, and component control.. Overture is used for data translation and grid interpolation.
Status	Framework is operational.	Framework with 9 science models is operational and transitioned to CCMC.	Being implemented in stages for CISM codes for testing and validation.. Transition to CCMC and NCAR in near future.

- Discussion:

- Can we test the two approaches to determine their relative strengths and weaknesses by performing an identical Sun-to-Earth coupled simulation?
- Many suggestions were put forward --- the May 1997 event was mentioned by several attendees as a reasonable demonstration because of its relative simplicity
- An important cautionary note (MacNeice): The extent to which a framework succeeds or fails is ultimately related to the amount of effort that the individual modelers (those providing the components of the framework) are willing to contribute to the project. “A great framework with sub-standard modules likely will give a worse result than a sub-standard framework with great modules”; e.g., How do you test the framework separately from the modules?
- How best can we include the broader community in these demonstrations?