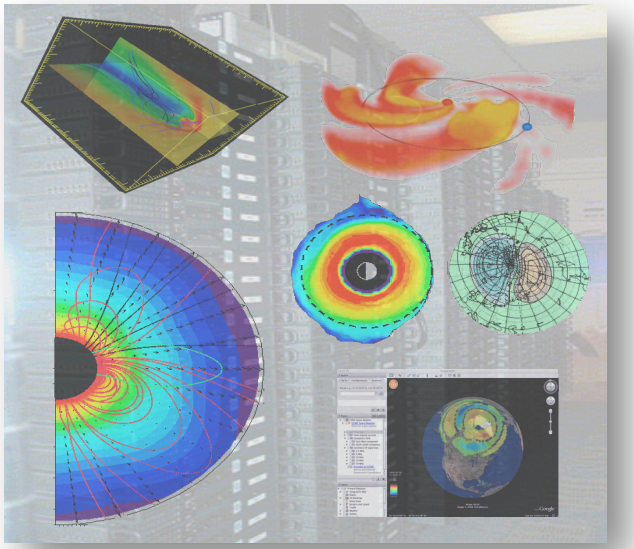
COMMUNITY COORDINATED MODELING CENTER

Model Delivery to CCMC



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Outline

- Model delivery, installation, testing. Review of actions. Status.
- Lessons learned.
- Outlook

Action Plan: Jan 31, 2011 - SWW

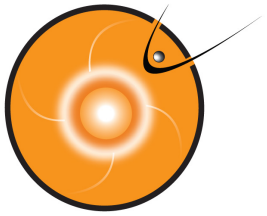
- Delivery
- Installation: compiling, running test cases provided by modelers
- Speed evaluation
- Robustness/Stability tests (long runs)
- Sanity checks (3D output inspection). Consistency checks (modelers compare CCMC outputs with run results obtained at their computers)
- Selection of up to two model settings.
- No model-data comparison yet. Need to agree on what time series to compare and metrics format.

Delivery, Installation

- Global MHD models delivered prior to Jan 31, 2011
  - LFM
  - SWMF
  - OpenGGCM
- Successful installation of all global MHD models (~ Feb, 2011). A lot of improvements in comparison with previous versions. For example,
  - OpenGGCM: include coupling with RCM as an option
  - LFM: much more stable and easy to manage version
  - SWMF: coupling with RCM as a default
- Empirical models:
  - Weimer Delta-B prediction model, idl latest update, April 19, 2011
  - Weigel model.

Model Settings Details

- LFM
  - 1 setting only, grid: 53 x 48 x 64. Needs 24 procs
  - No RCM, SM coordinates.
  - Restart capability. PVM control of several executables add some complexity.
- SWMF
  - 2 settings (both with RCM). Differences are in the details of RCM-BATSRUS coupling. Same grid (~ 1mln cells) for both settings
  - GSM coordinates, dipole updates with time
  - Calculates Kp and ground perturbations at selected locations.
  - Restart capability
- OpenGGCM:
  - 2 settings with different grids. Coupled with CTIM. No RCM.
  - GSE coordinates, dipole is not updating.
  - No restart capability

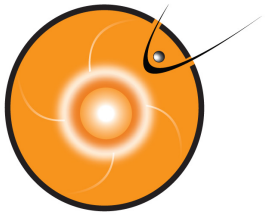


Speed Evaluation

- CCMC dedicated eight 8-core nodes for speed and robustness tests:
  - Dell Beowulf Cluster (less than 3 years old)
  - 64 processors (2.66GHz Intel)
  - Infiniband network
- PG compiler (pgf90, pf77), mvapich mpi libraries (default)
  - SWMF: 2 – 4.5 x RT (2-4 times slower than realtime)
  - OpenGGCM: settiing1 (preferred): 2 x RT, setting2: 6 x RT
  - LFM (24 procs): 4 x RT
- Intel compiler (ifort), openmpi libraries (newly installed):
  - SWMF: < 1-2 RT
  - OpenGGCM: setting1: 2 x RT
  - LFM – ???

Robustness/Stability/Consistency Tests

- Halloween storm (GEM Event 1):
  - **October 29th, 2003 06:00 UT - October 30th, 06:00 UT**
  - Runs initiated 5 hours prior to intended model-data comparison (29 hours entire run including startup)
  - Solar wind input file provided by A.Ridley: http://ccmc.gsfc.nasa.gov/support/GEM_metrics_08/sample_formats/imf2003102.txt
- Procedure
  - Use the same set of nodes. Take turns to run models.
  - Test run at CCMC – feedback to modelers – update/bug fix - new test at CCMC. Approximately 3 rounds per model.
- Results of robustness tests:
  - SWMF: passed
  - LFM: passed
  - OpenGGCM: failed (setting1: 3 h, setting2: 12 h). More work is needed.



Lessons learned

- Compiler/ MPI Library can change the speed on factor of 2-3.
- Model stable for one compiler may require bug fixes to make it work on another compiler. May be time consuming.
- Restart capabilities are very helpful (SWMF, LFM).
- Real-time tags in model output file names are very helpful (LFM).

- The following issues have to be addressed prior to selection of time intervals for model validation:
  - Inflow boundary is typically set at 30 Re. For low Mach numbers the bow shock can cross the inflow boundary
  - How to handle large Bx? Keeping large Bx constant contributes to low Mach number after the shock
  - Example: GEM Event 5: May 15-16 2005

Outlook

- Great Progress!
- Significant improvement in all models.
- SWMF, LFM are ready for metrics evaluations. More work is needed with OpenGGCM.
- Results of metrics studies will be used in the second round of GEM GGCM Modeling Challenge.

- On-going activity supporting NOAA SWPC is also extremely beneficial to
  - CCMC Runs-on-Request users
  - NASA/GSFC Space Weather Desk supporting NASA Robotic Missions
  - GEM Community