Collaboration with Code Developers – AKA What's New in Magnetosphere and Ionosphere Models

What's New – SWMF (Magnetospheres)

- Gabor Toth

- Added two-fluid (electron + ion) and anisotropic MHD to BATS-R-US.

  – Initial verification tests pass

  – Preliminary magnetosphere runs look interesting – significant changes in tail from isotropic MHD

  – Will be coupled with HEIDI, RAM, PWOM

  – Will be applied to reconnection, solar wind

- Multi-fluid MHD is fairly well tested and working

  – Coupled with RCM and PWOM

  – Mars ionosphere-solarwind interaction, in progress

  – Earth magnetosphere (Glocer et al, 2009, JGR)

  – Outer heliosphere (Opher et al, 2009, Nature)

- New features are transferred to CCMC once they become robust

What's New – SWMF (Ionospheres)

- Aaron Ridley
- The Global Ionosphere Thermosphere Model is new
  - Nonhydrostatic, altitude coordinates
  - Navier-Stokes with lots of source terms
  - Can be run for different bodies
  - 1D and 3D with extremely flexible grid
  - Can use many different E-field and auroral models
  - Equatorial electrodynamics is working now, but with small issues
- The Ridley Ionosphere Model is also new
  - Folded potential solver, forces north and south potentials to be identical
  - Multiple auroral models
  - Multiple FAC sources
- BATSRUS in spherical coordinates

What's New – CRCM/RBE

- Alex Glocer
  - Discussed stand alone CRCM (Comprehensive Ring Current Model)
  - Fok ring current plus RCM electrodynamics
  - TWINS image – comparison with ENA image
  - Radiation Belt Environment Model
    - Includes Horne diffusion model
    - Real time radiation belt simulations

What's New - OpenGGCM

- Alex Vapirev
- Coupled OpenGGCM (global MHD model) with CRCM (ring current kinetic model) via pressure and density feedback.
  - CRCM uses inputs from the global MHD model to calculate the plasma pressure and density close to Earth. Then the CRCM pressure and density are mapped back on the OpenGGCM MHD grid.
- The MHD model self-consistently computes the field aligned currents, but does not fully reproduce the contribution of the ring current model to the inner magnetosphere current system in the case of CRCM feedback (need better conductance and may be better method of MHD FAC mapping).
- Modeled THEMIS substorms

What's New - RCM

- Stan Sazykin
  - Reviewed stand alone RCM
  - Synthetic HENA images
  - Suggested stand alone RCM be included in CCMC.
  - Getting it ready.
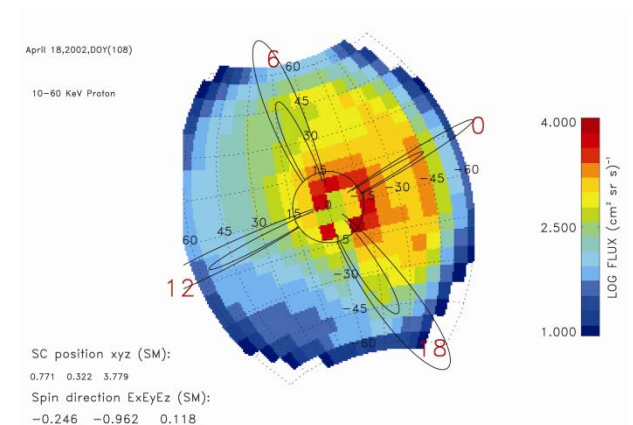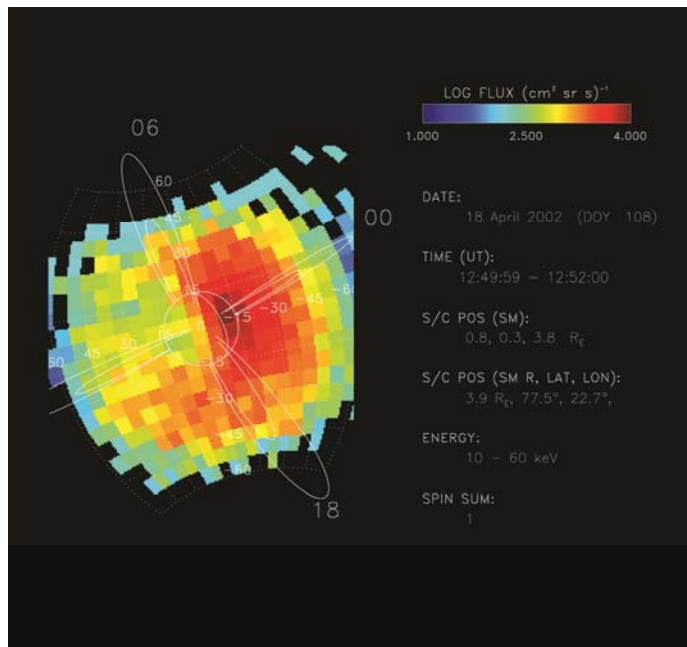
What's New - WINDME

- Wendell Horton

- WINDMI = low dimensional, ODE physics model that couples the solar wind to the magnetosphere-ionosphere system. Derived from projections on basic volumes of magnetospheric plasma. A basic physics model ~20 physical parameters.

- The rectified driver was found to be the best in overall performance during both training as well as prediction phases. Often gives the best prediction of Dst.

- The Siscoe formula performed best during the training phase in re-producing the AL faithfully, and capturing multiple substorms within storms were predicted.

- Newell coupling function performed as best driver for strong – high level- AL events: was poorer for weak events.