Simulation Study on Energization in the Ring Current and Radiation Belt

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Outline

- Brief Description of Models
- Ring Current Study using Simulated Solar Wind Data
- Radiation Belt Study on May 2-6, 1998

Input into the Fok Model

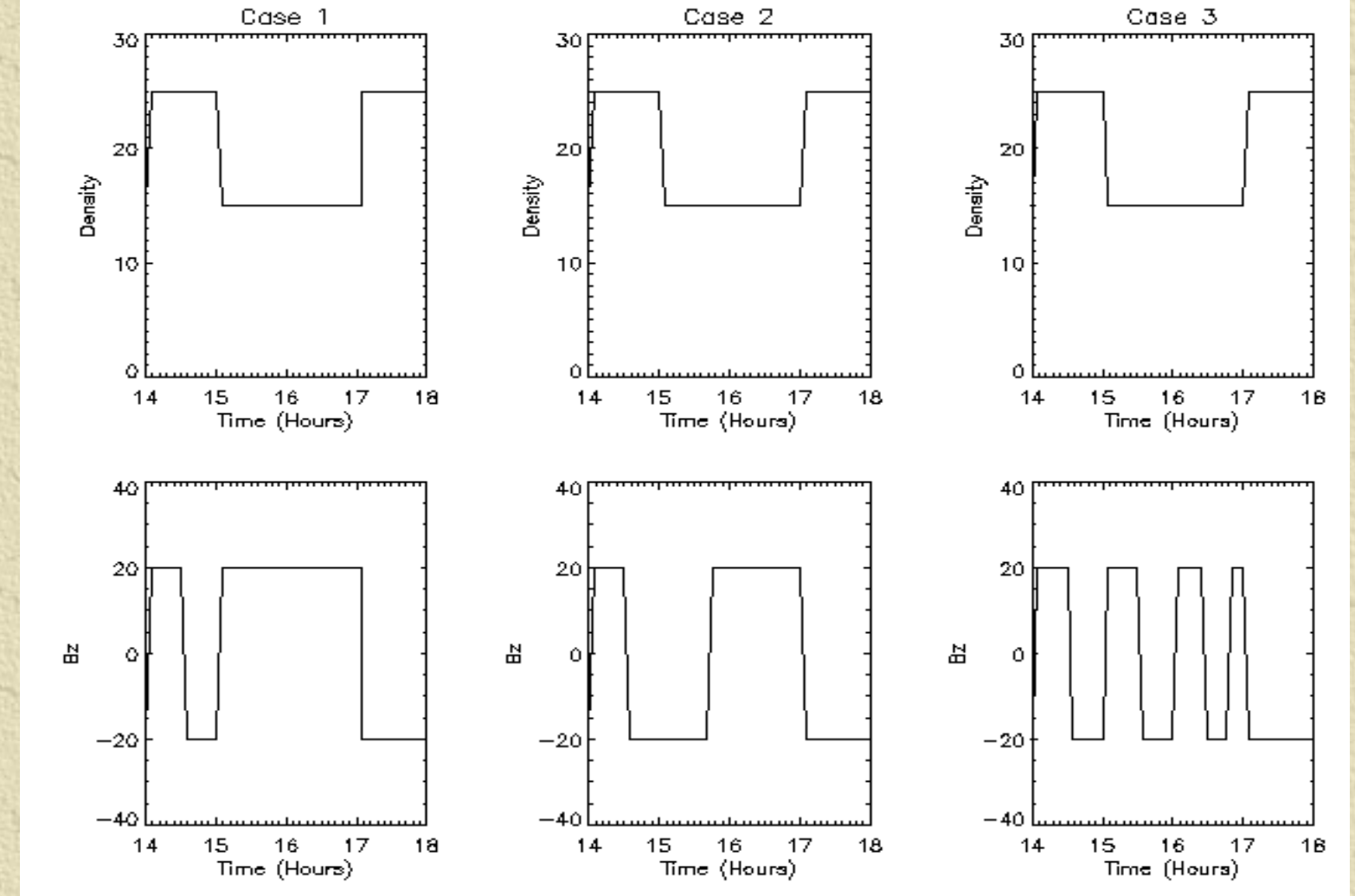
- The Fok Radiation Belt and Ring Current Models use the ionospheric potential and magnetic field from the BATSRUS model.
- The Fok Ring Current Model uses the density and temperature from the BATSRUS model at the Ring Current Model's outer boundary.
- The Fok Radiation Belt Model uses an empirical formula to calculate a uniform density and temperature for the boundary (*Zheng et al.*, 2003).

Ring Current Study

Simulated Solar Wind

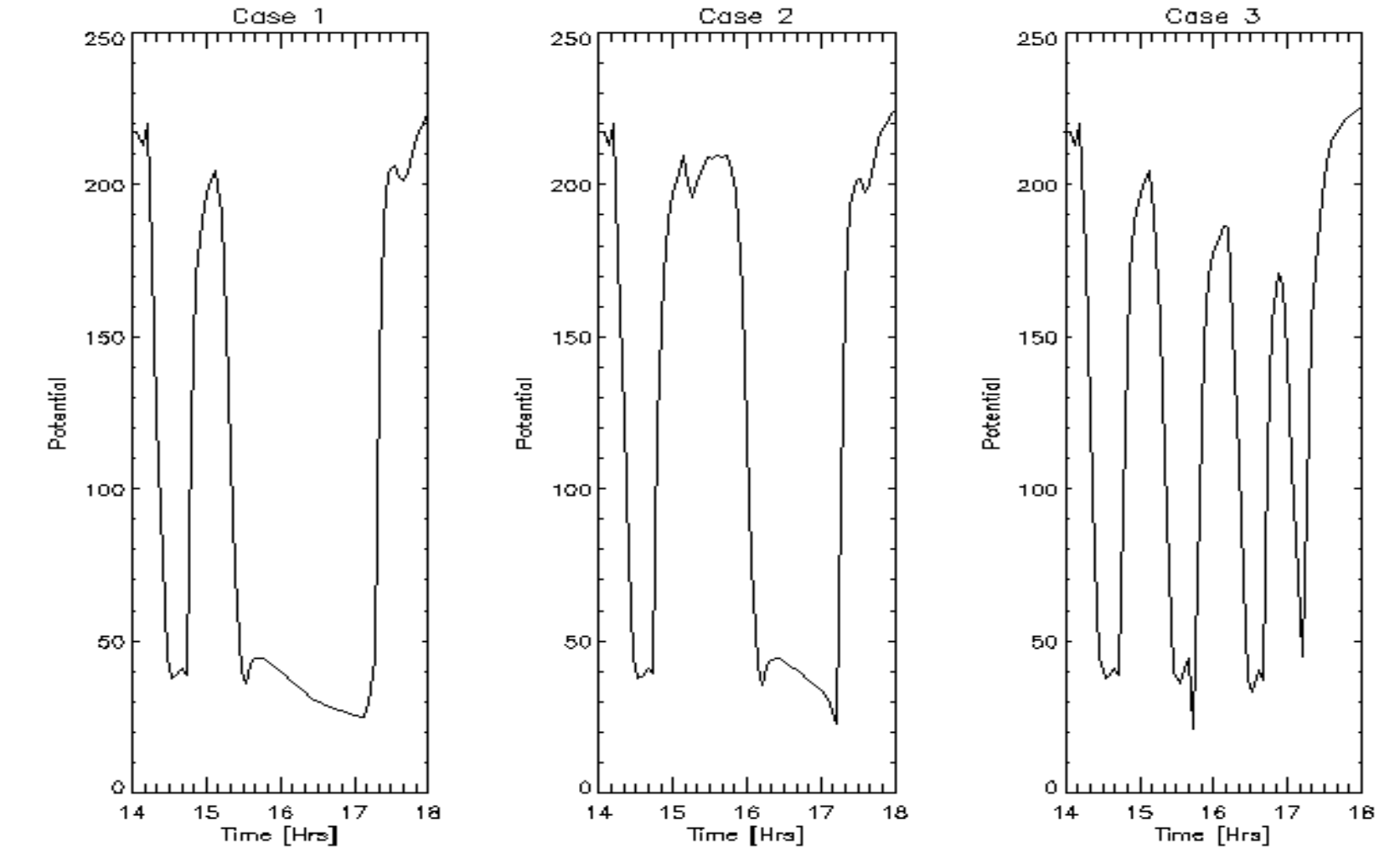
Solar Wind Input

Input into BATSRUS



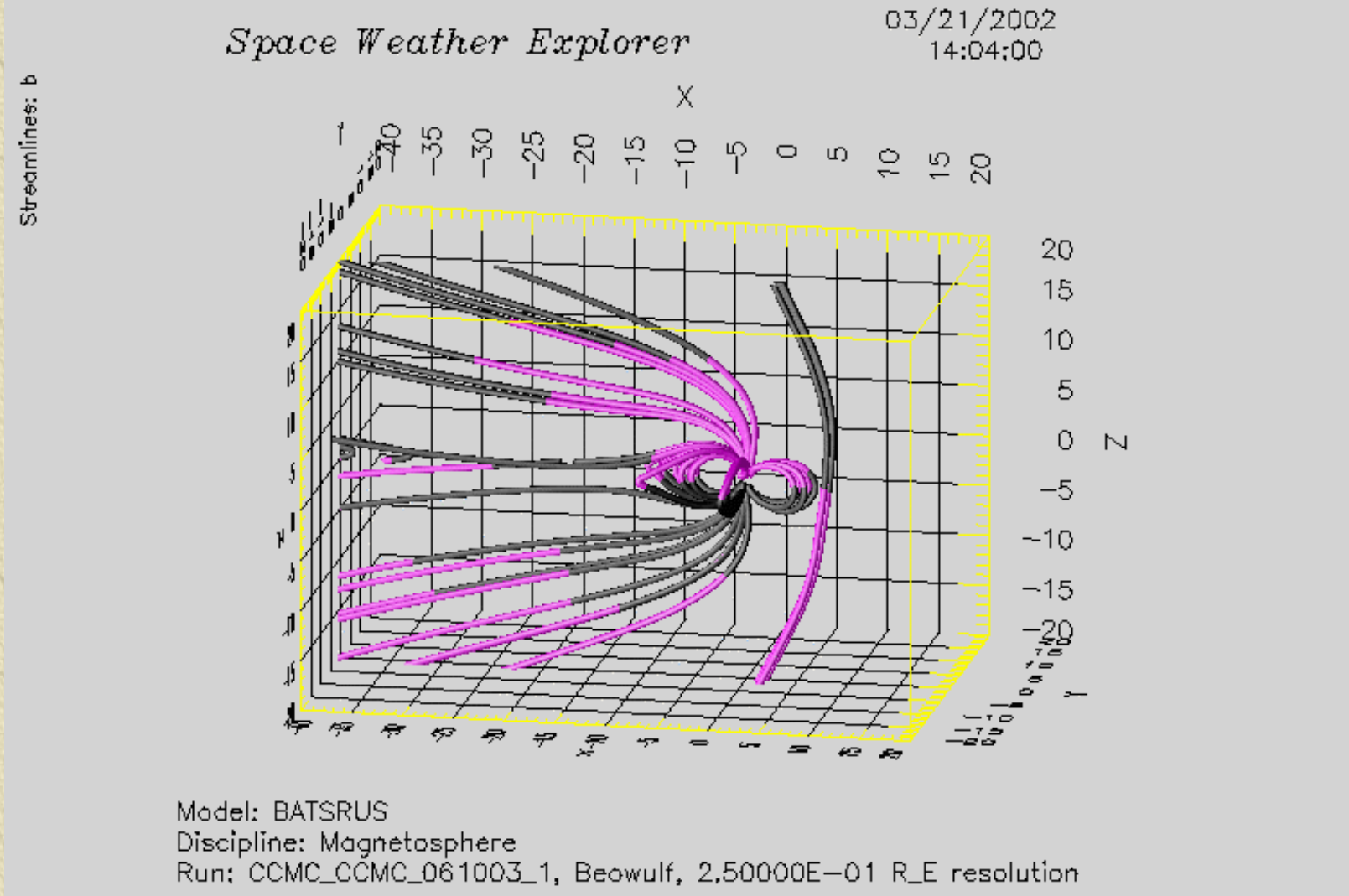
Cross Polar Cap Potential

Output from BATSRUS

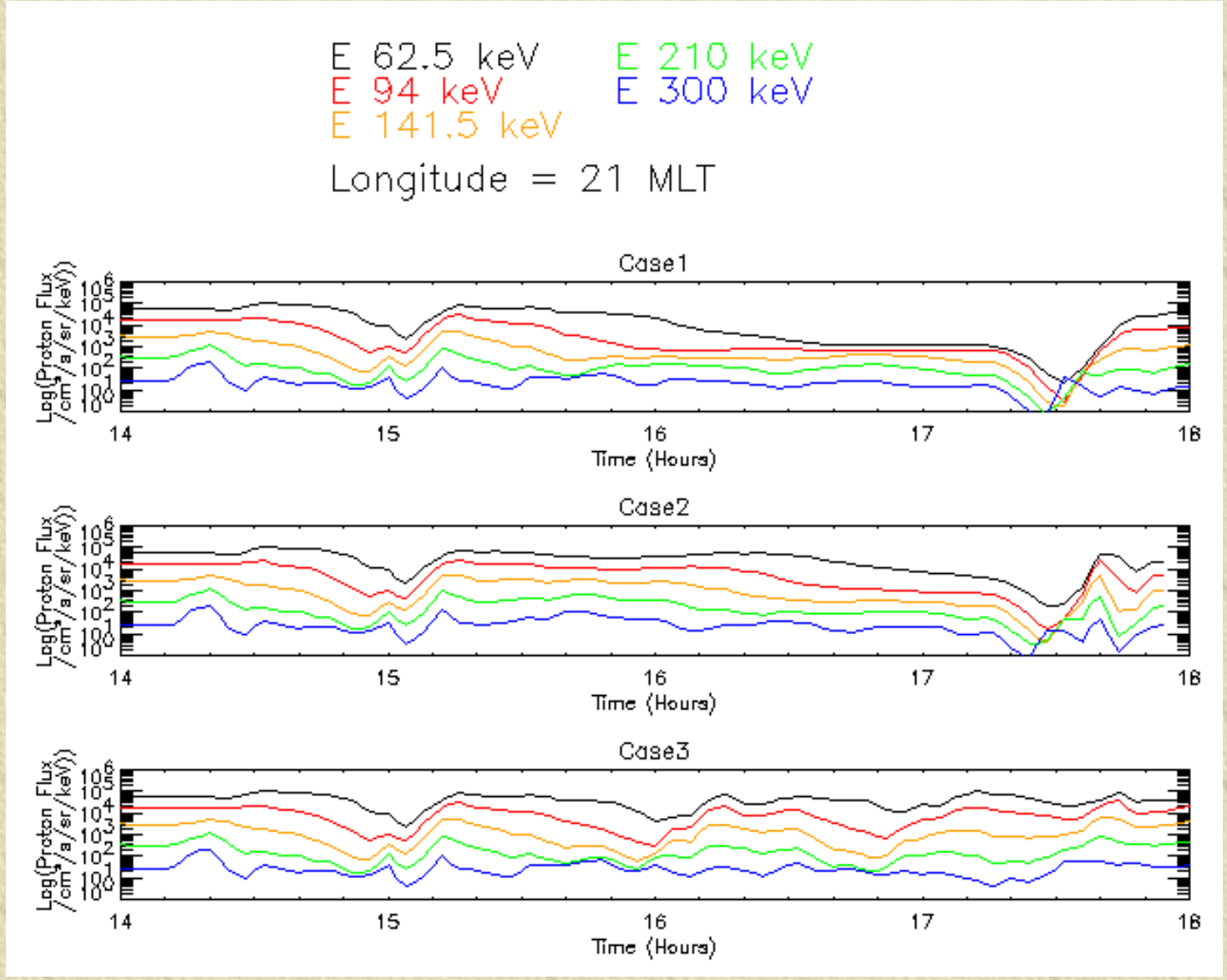


Magnetic Field

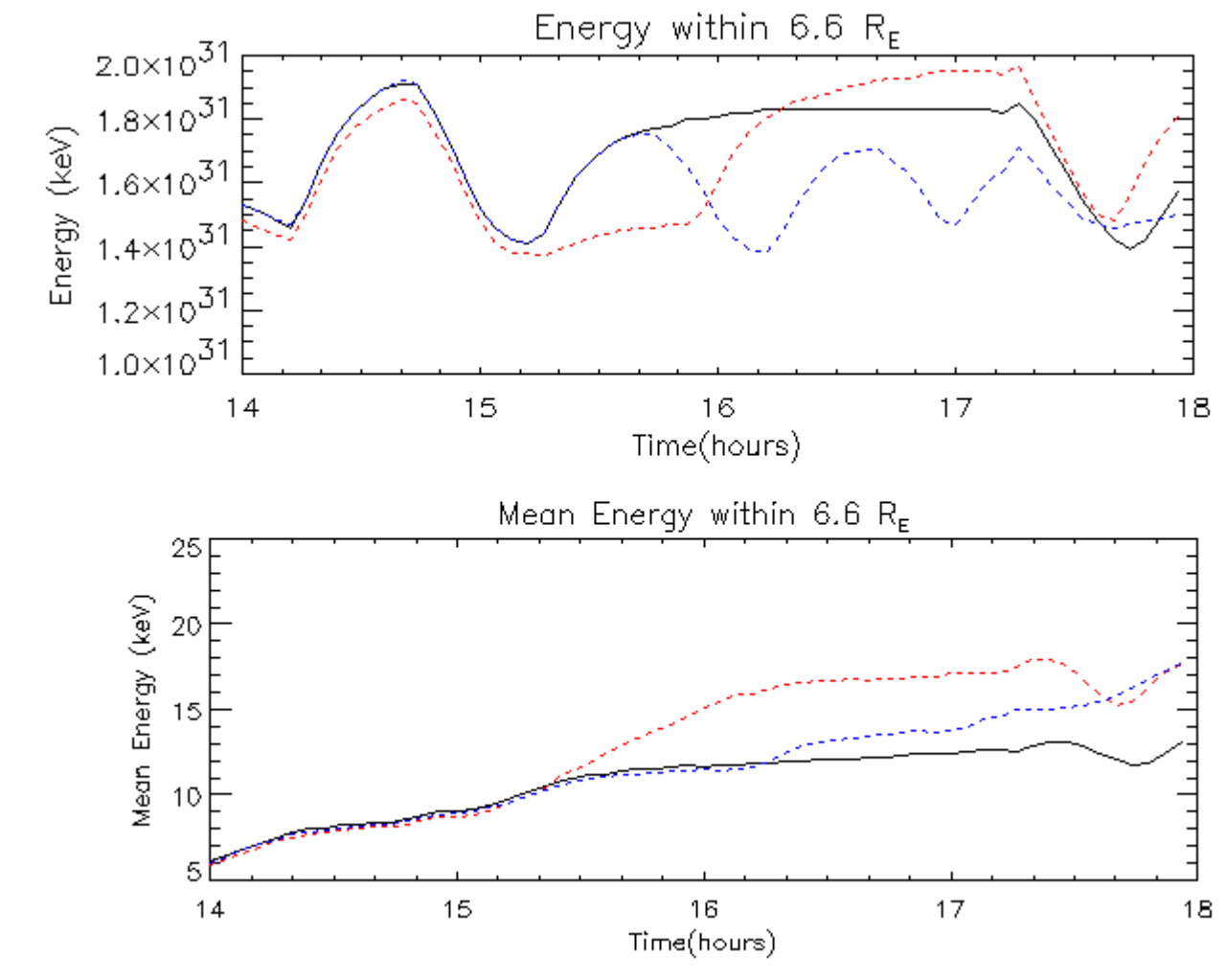
Output from BATSRUS



Flux at 6.6 R_E at 21 MLT



Changes in Energy

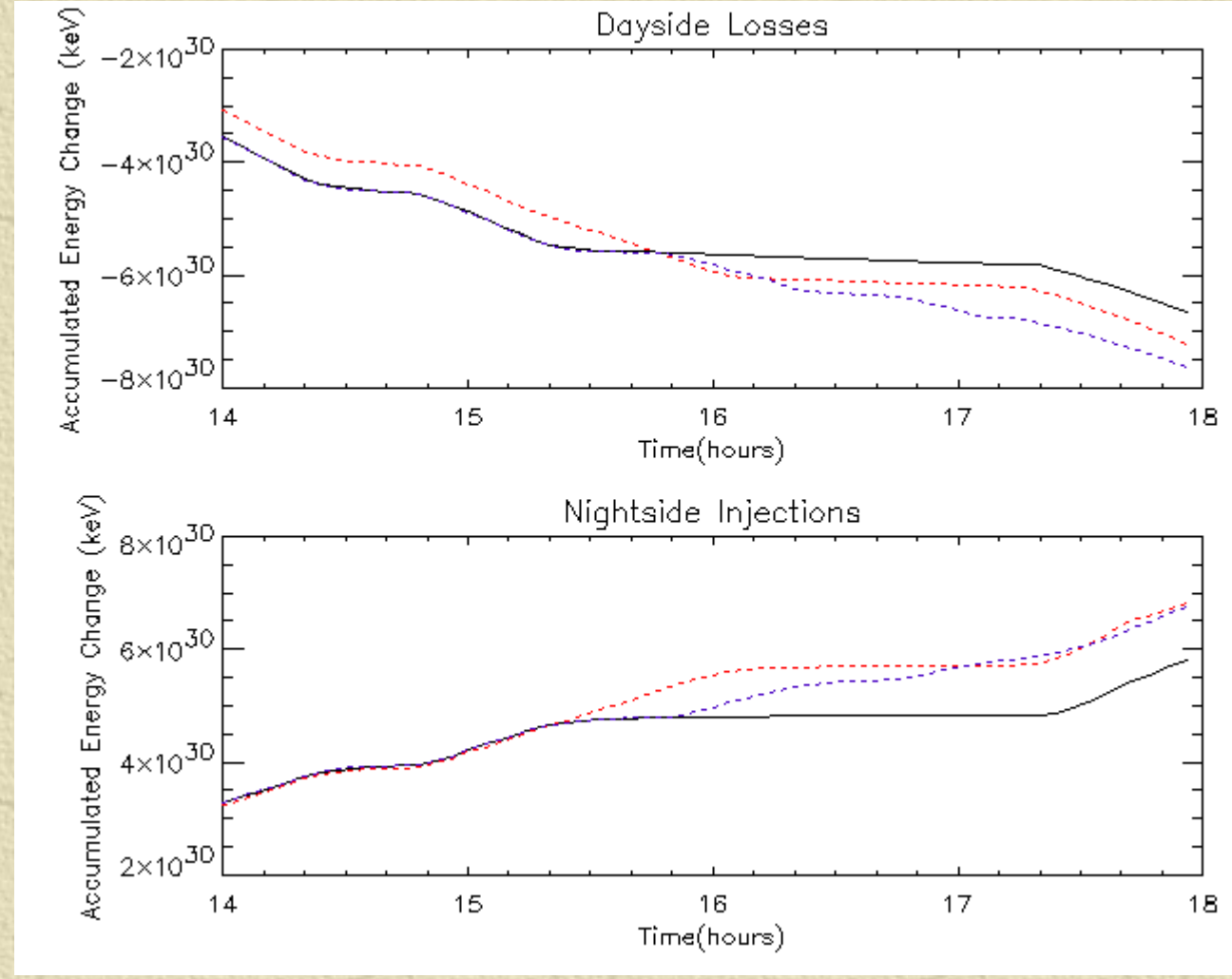


Case 1: Black

Case 2: Red

Case 3: Blue

Changes in Energy

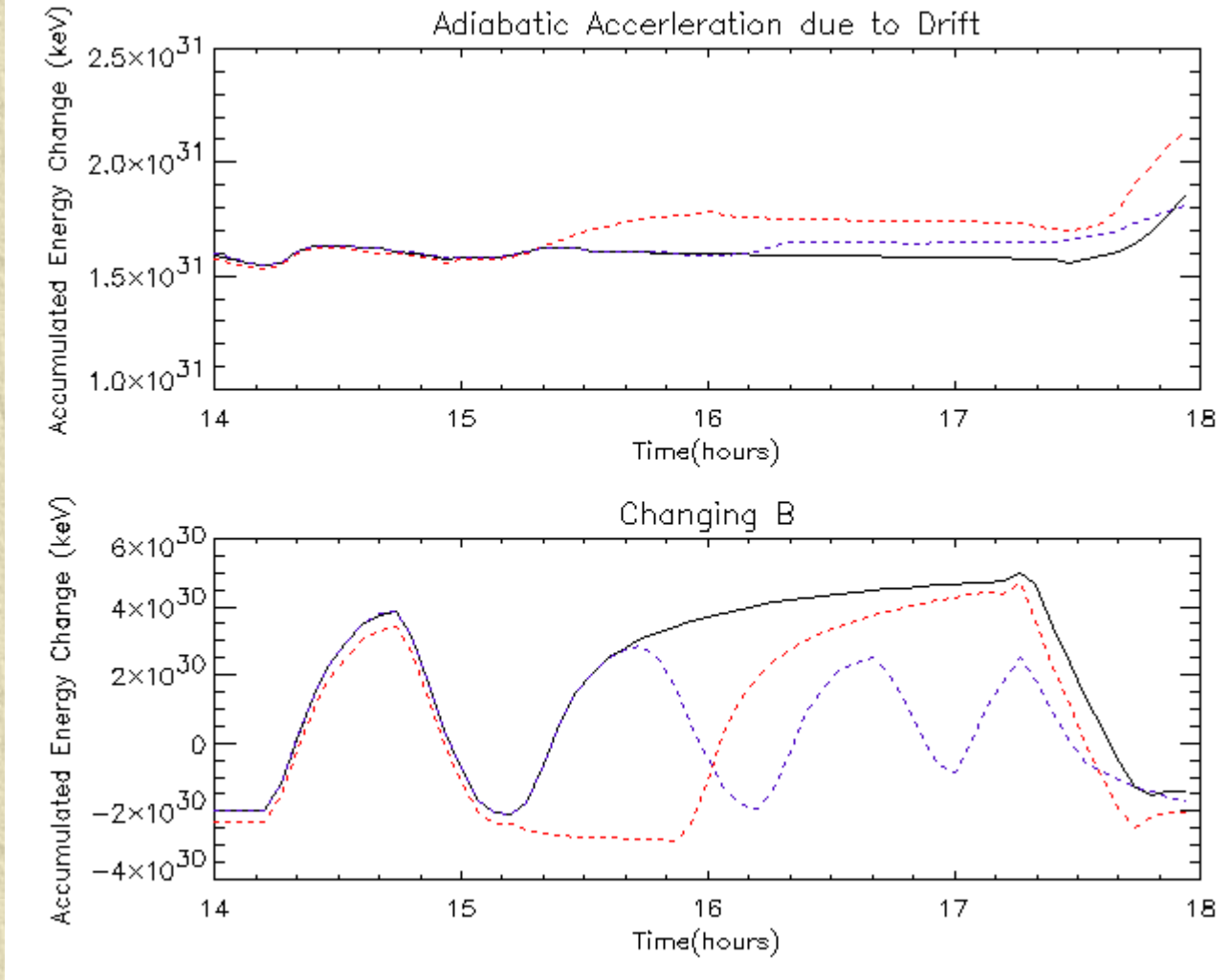


Case 1: Black

Case 2: Red

Case 3: Blue

Changes in Energy



Case 1: Black

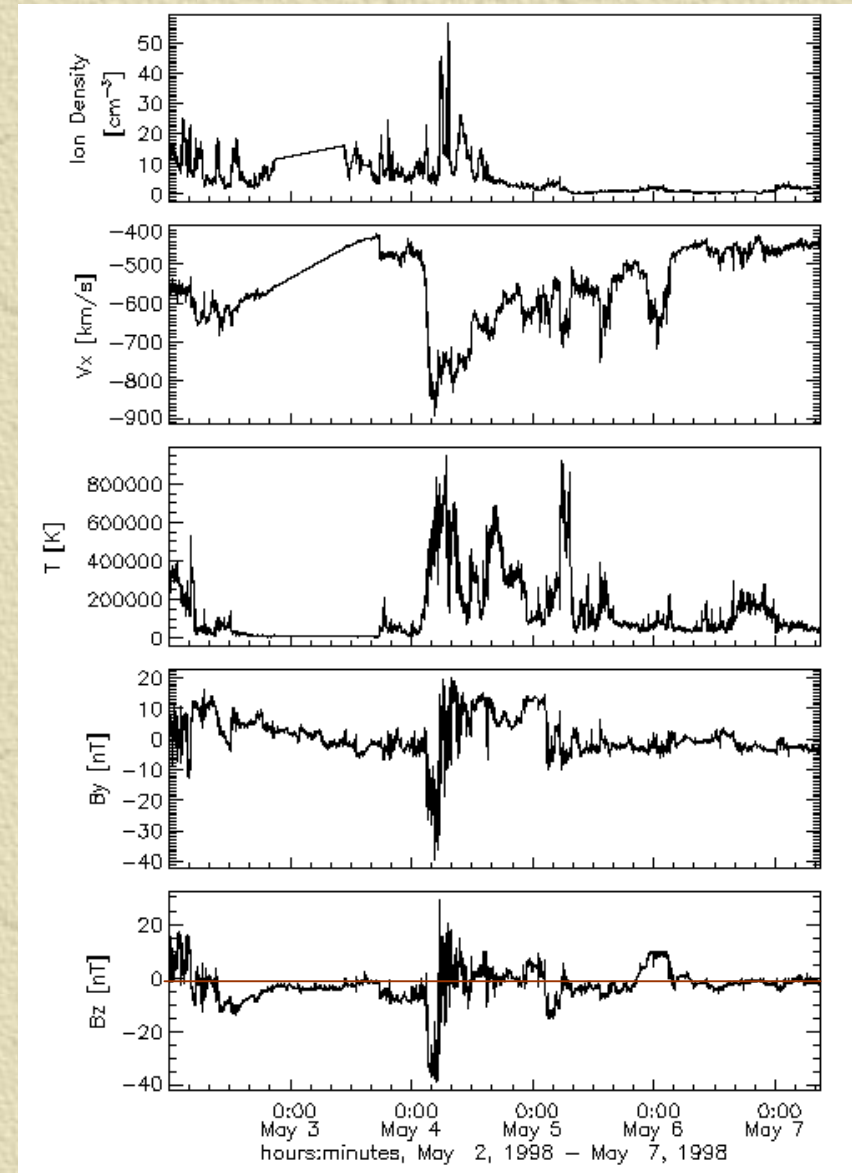
Case 2: Red

Case 3: Blue

Radiation Belt Study

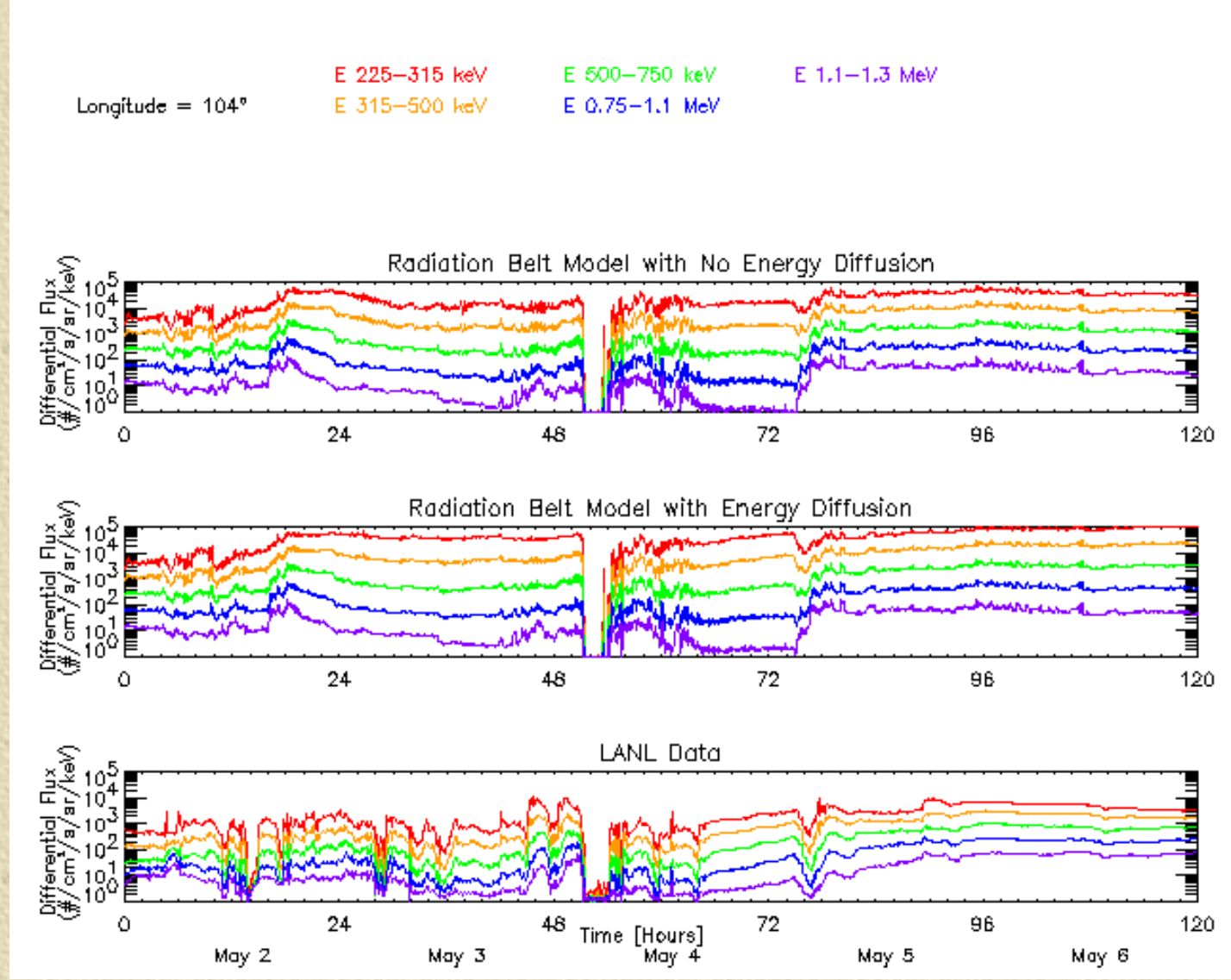
May 2-6, 1998

Solar Wind Input



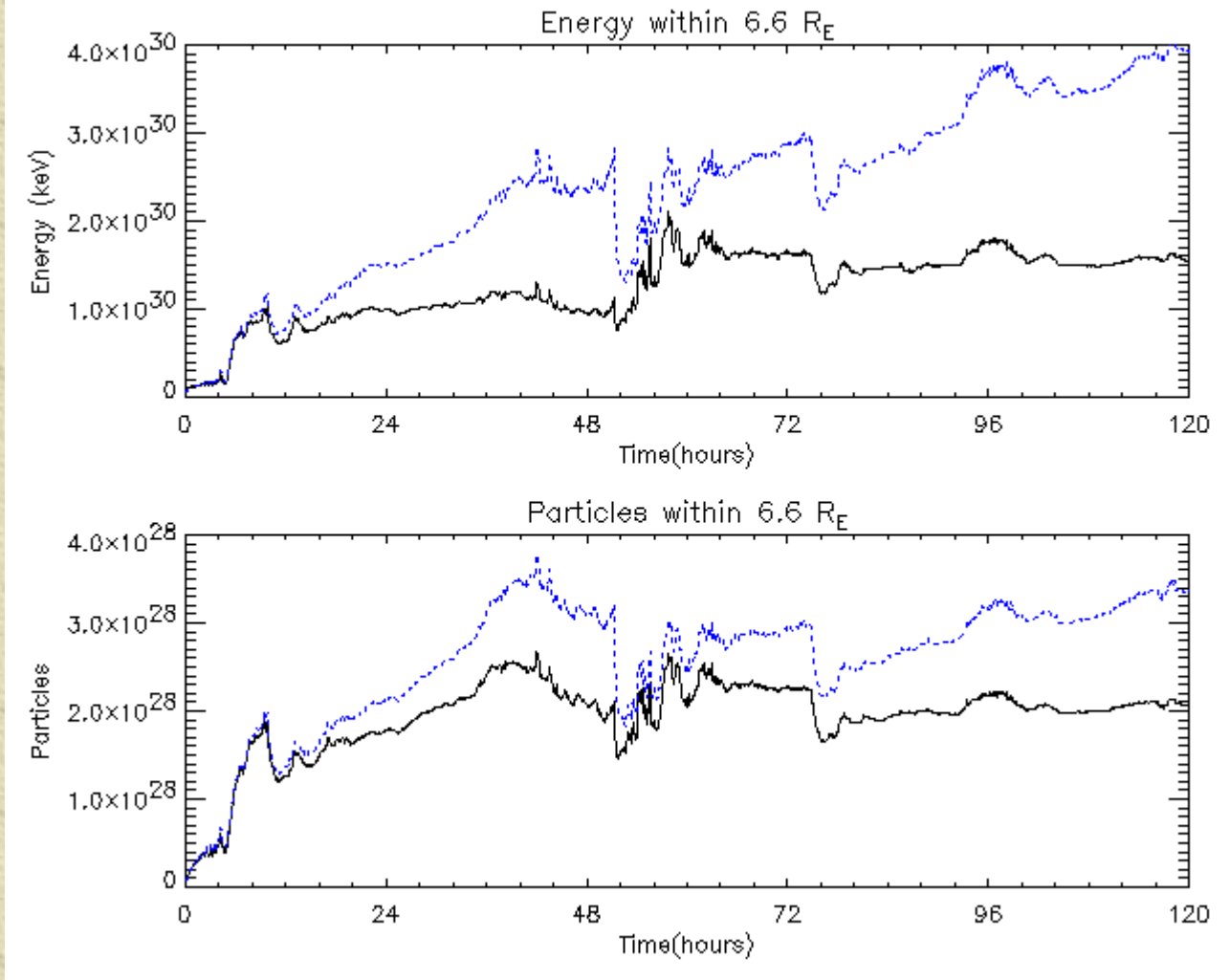
We thank the ACE SWEPAM and ACE MAG instrument teams and the ACE Science Center for providing the ACE data.

Flux at 6.6 R_E



Geosynchronous electron flux data was provided by the Energetic Particle team at Los Alamos National Laboratory, Richard Belian (PI).

Energy



Black: With Energy Diffusion

Blue: With Energy Diffusion

Summary

- Ring Current
  - The major energization mechanism is acceleration due to drift.
  - In these cases, more reconnection events cause more injections into the ring current but do not impact the overall energy.
  - There is limited field line stretching within 10 R_E in the MHD code and this reduces energy gains and losses due to changing magnetic field topology.
- Radiation Belt
  - The addition of energy diffusion makes the model agree with the data better on days 4 and 5.
  - The model misses many transients.
  - The model matches the magnetopause crossing seen in the data.
  - The flux levels tend to be higher in the model than in the data.