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Comparison of RCM-E Simulations with Observations of Stormtime Ring Current Magnetic Field and Particle Fluxes

Margaret W. Chen[1]

Collaborators: Colby L. Lemon[1], Michael Schulz[2], Timothy B. Guild[1], James L. Roeder[1], Guan Le[3], Amy Keesee[4], Tony Lui[5], Jerry Goldstein[6], Juan Rodriguez[7], and Phil Anderson[8]

[1]The Aerospace Corporation, Los Angeles, CA
[2]Lockheed Martin Retiree
[3]NASA Goddard Space Flight Center
[4]University of West Virginia
[5]Applied Physics Lab, Johns Hopkins University
[6]Southwest Research Institute
[7]University of Colorado, Boulder
[8]University of Texas, Dallas

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Introduction

- We have been assessing how well the magnetically and electrically self-consistent Rice Convection Model-Equilibrium (RCM-E) reproduces simultaneously in-situ ring current magnetic field and particle flux measurements.

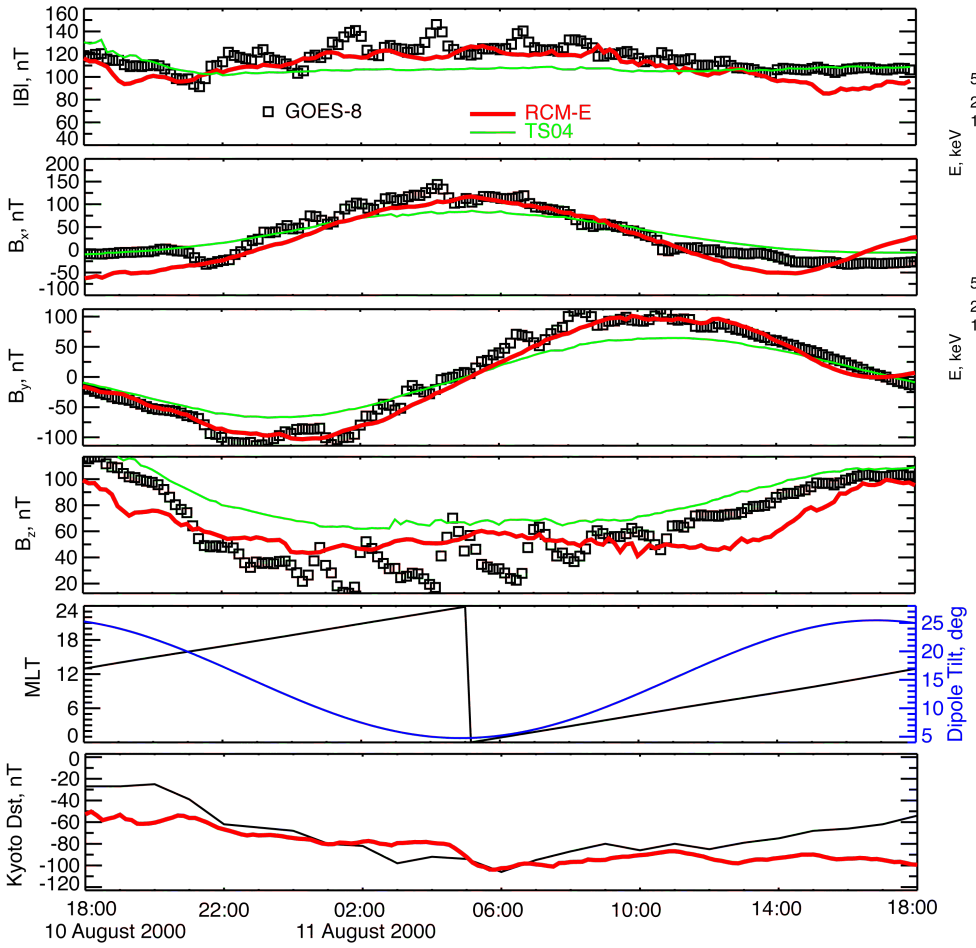
- The RCM-E computes the energy dependent bounce-averaged guiding center drift of isotropic plasma in the inner magnetosphere [*Toffoletto et al*., 2002].

- While adiabatic transport of ions plays a dominant role in the energization of the ring current, our recent results show the importance of electron precipitation for modifying the electric field and influencing the ring current formation.

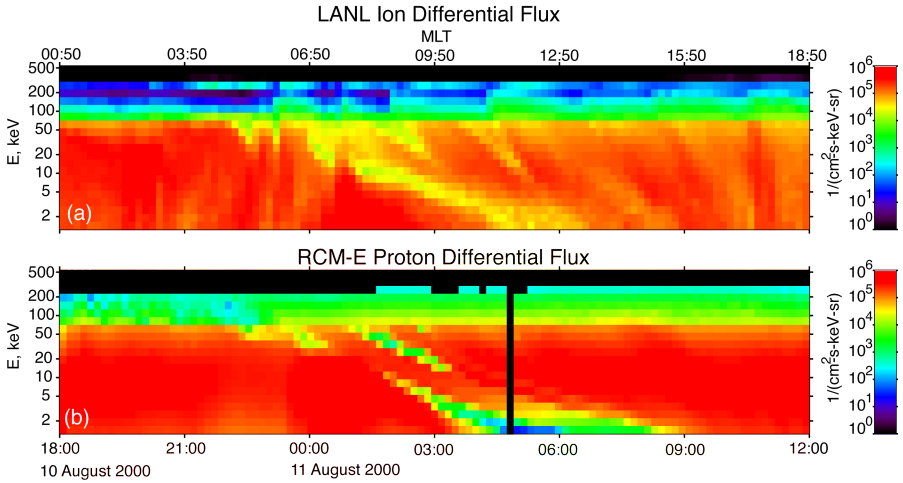
- Improved descriptions of MIT coupling are needed to advance our understanding and characterization of the dynamic ring current.

RCM-E-Data Comparisons at GEO for 10-11 August 2000 Storm

Magnetic Field

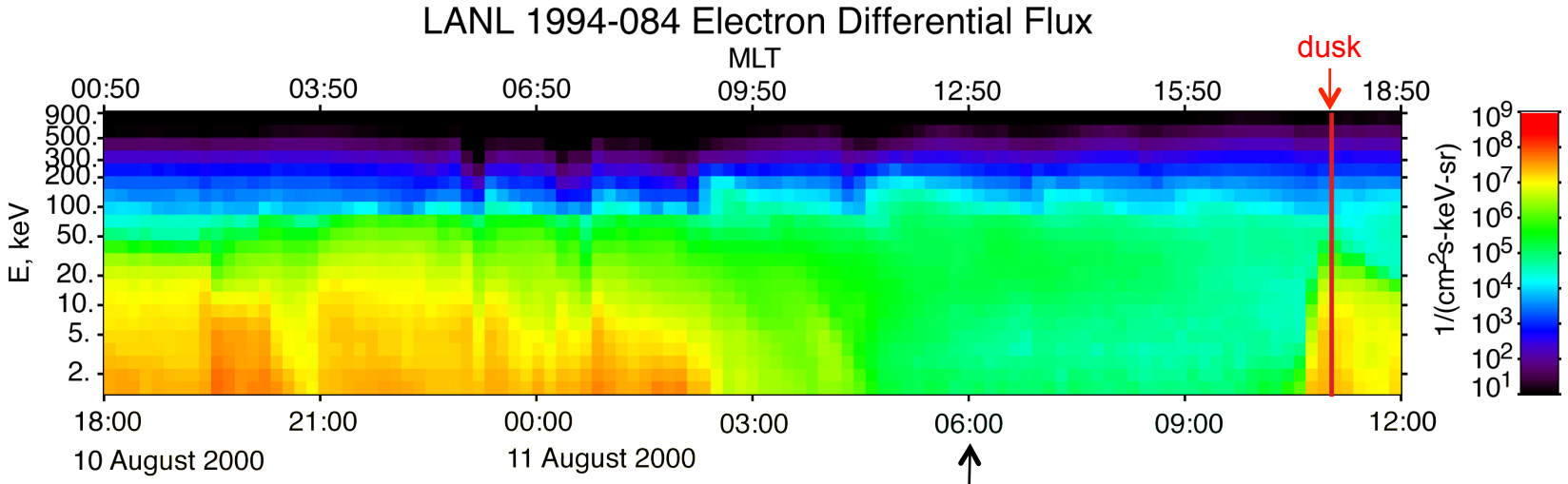


Proton Fluxes



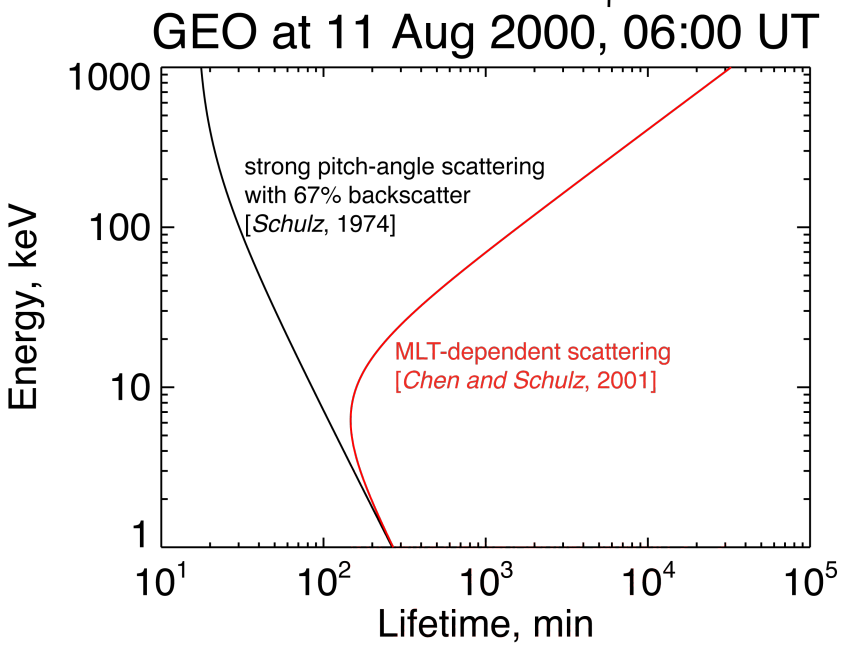
- Found reasonably good agreement between model and observed **B** field **and** proton fluxes at GEO.
- Charge exchange lifetime (~2 days) > duration of storm main phase; features in flux spectrogram can be explained well by drift physics.

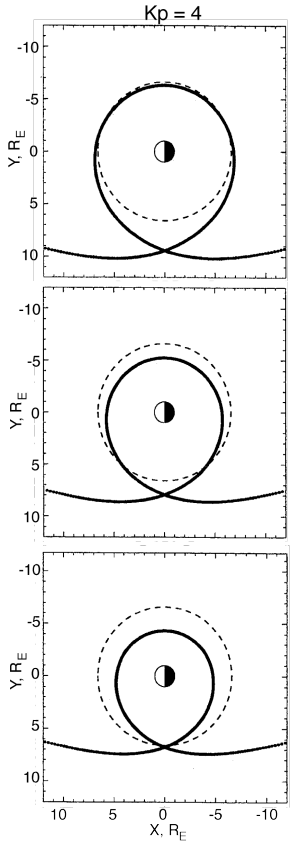
[*Chen et al.*, *JGR*, 2012]



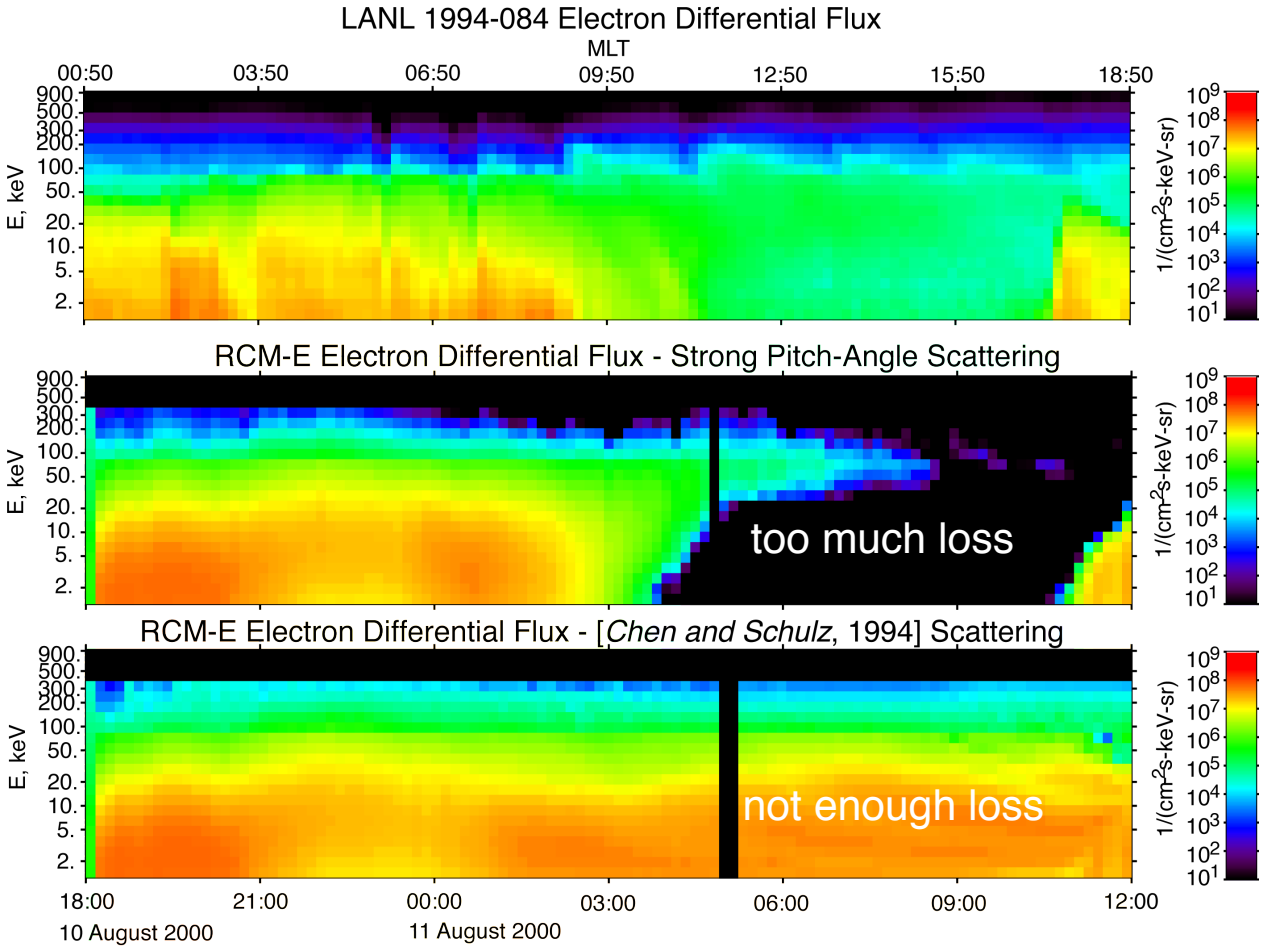
- Lifetime of electrons with E < 50 keV ~ 10's min to 5 hr

- Electron energy dispersion features at GEO need to be explained by both transport and loss.





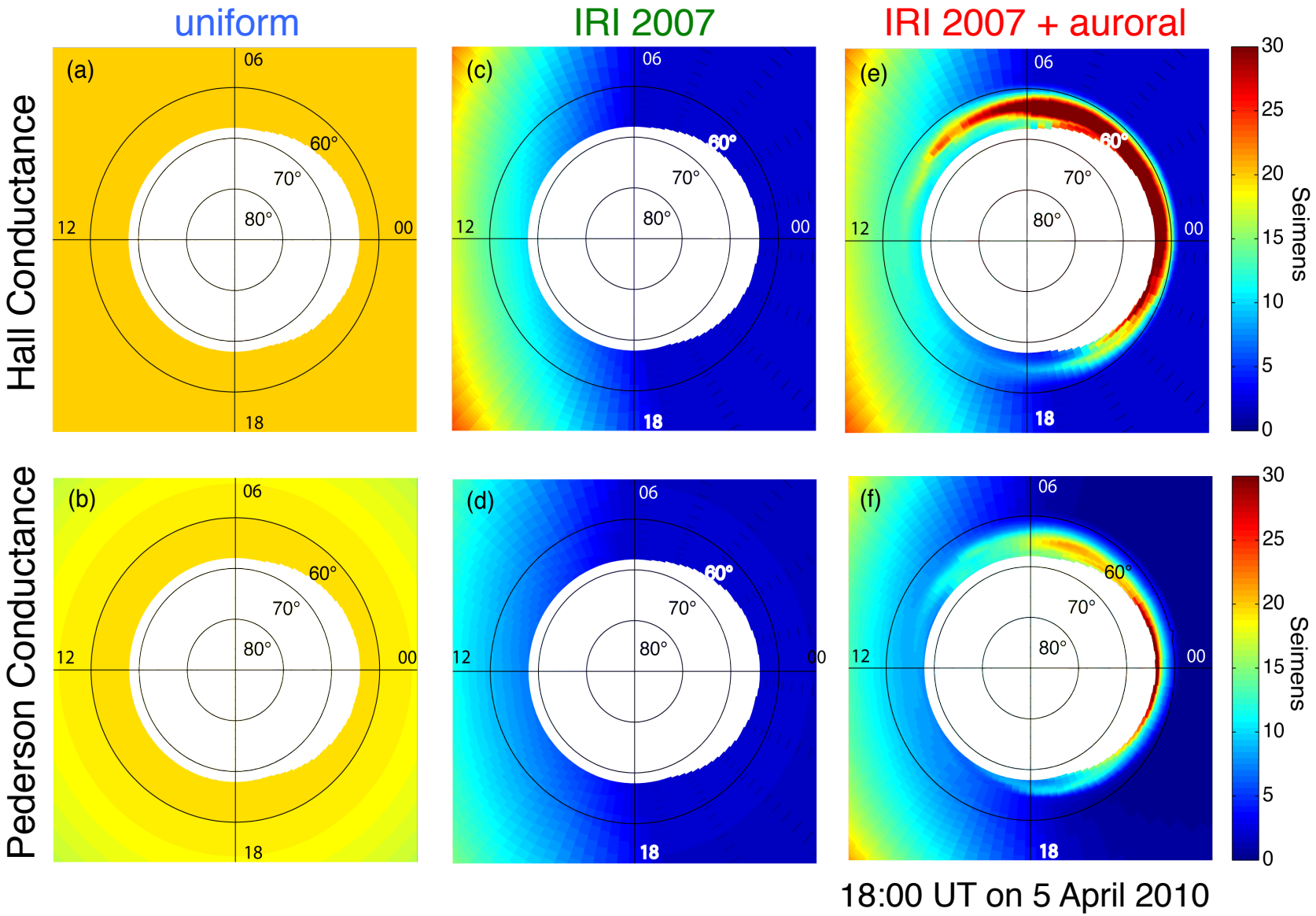
From Korth *et al.*, *JGR* [1999]



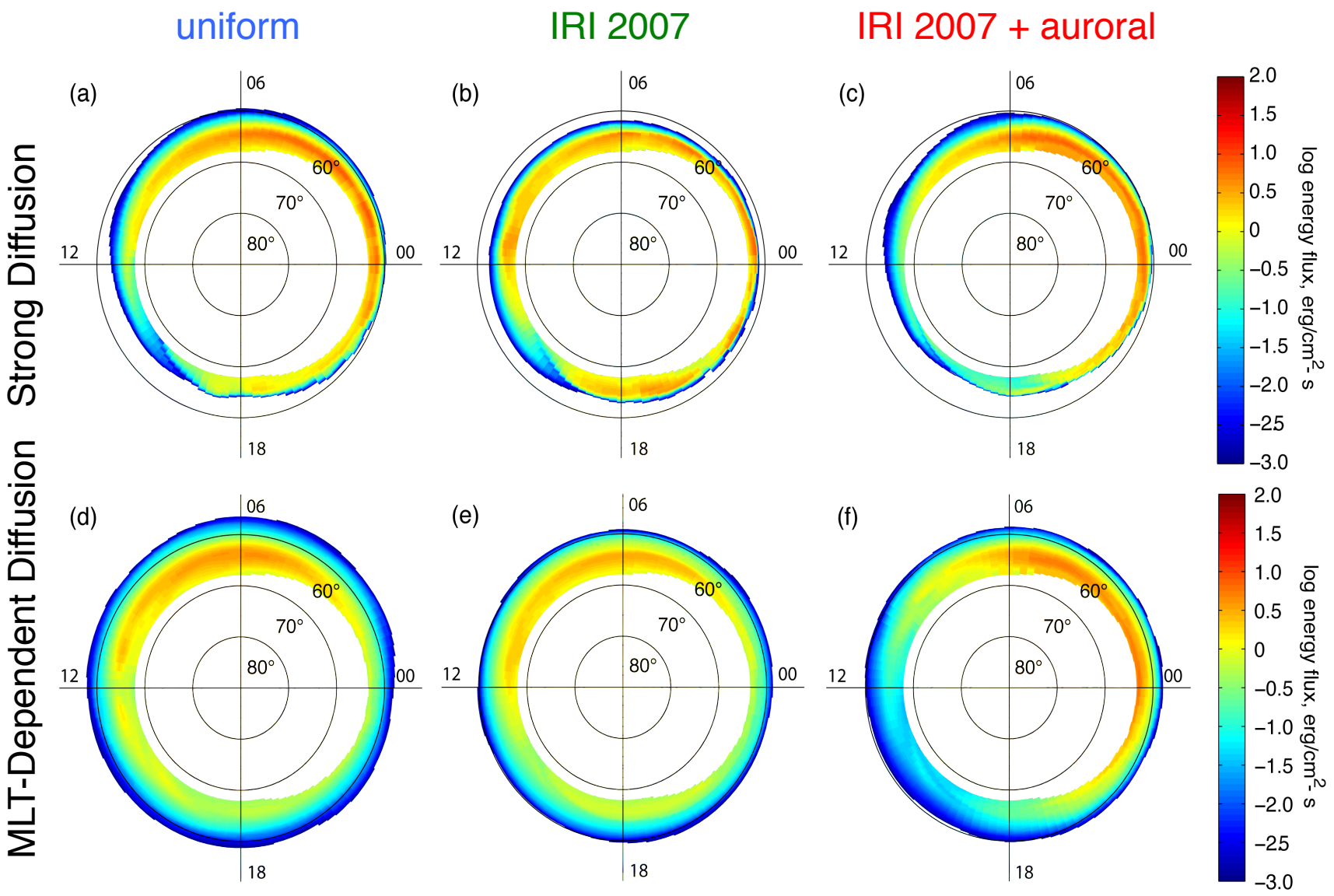
- Need to improve modeling of electron loss rates
- Currently collaborating with Binbin Ni & R. Thorne who are calculating rates of electron pitch-angle diffusion with whistler chorus for this event.

- Electrons contribute ~ 15% of the total energy content during the main phase. Thus, electrons do not significantly affect the ring current magnetic field. However, precipitating electrons affect the ionospheric conductivity and hence the inner magnetospheric electric field.

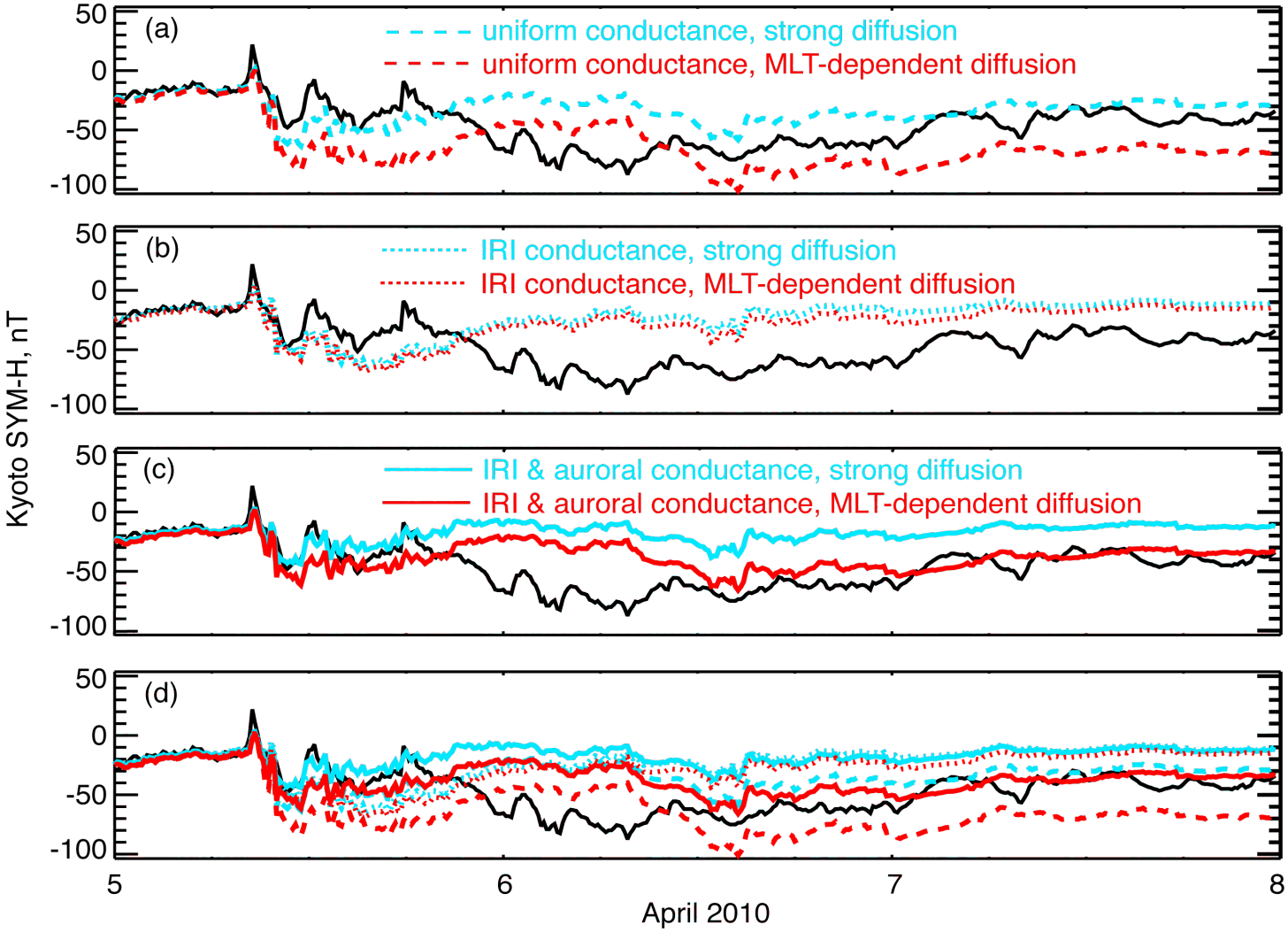
Model Ionospheric Conductance



5-6 April 2010: Simulated Precipitating Electron Energy Flux



Comparison of Simulated DPS *Dst* to SYM-H



Of the 6 cases shown, the simulated DPS *Dst* with IRI 2007 and auroral conductance agrees best with data.

Improved descriptions of MIT coupling are needed in models to advance our understanding and characterization of the dynamic ring current.

Our model can provide

- *simulated precipitating electron flux distributions that result from wave-particle interactions in the inner magnetosphere*
- *simulated distributions of field-aligned currents*

Our model needs

- *improved calculations of the energy deposition and ionization caused by the precipitating electrons*
- *neutral wind induced field-aligned currents*