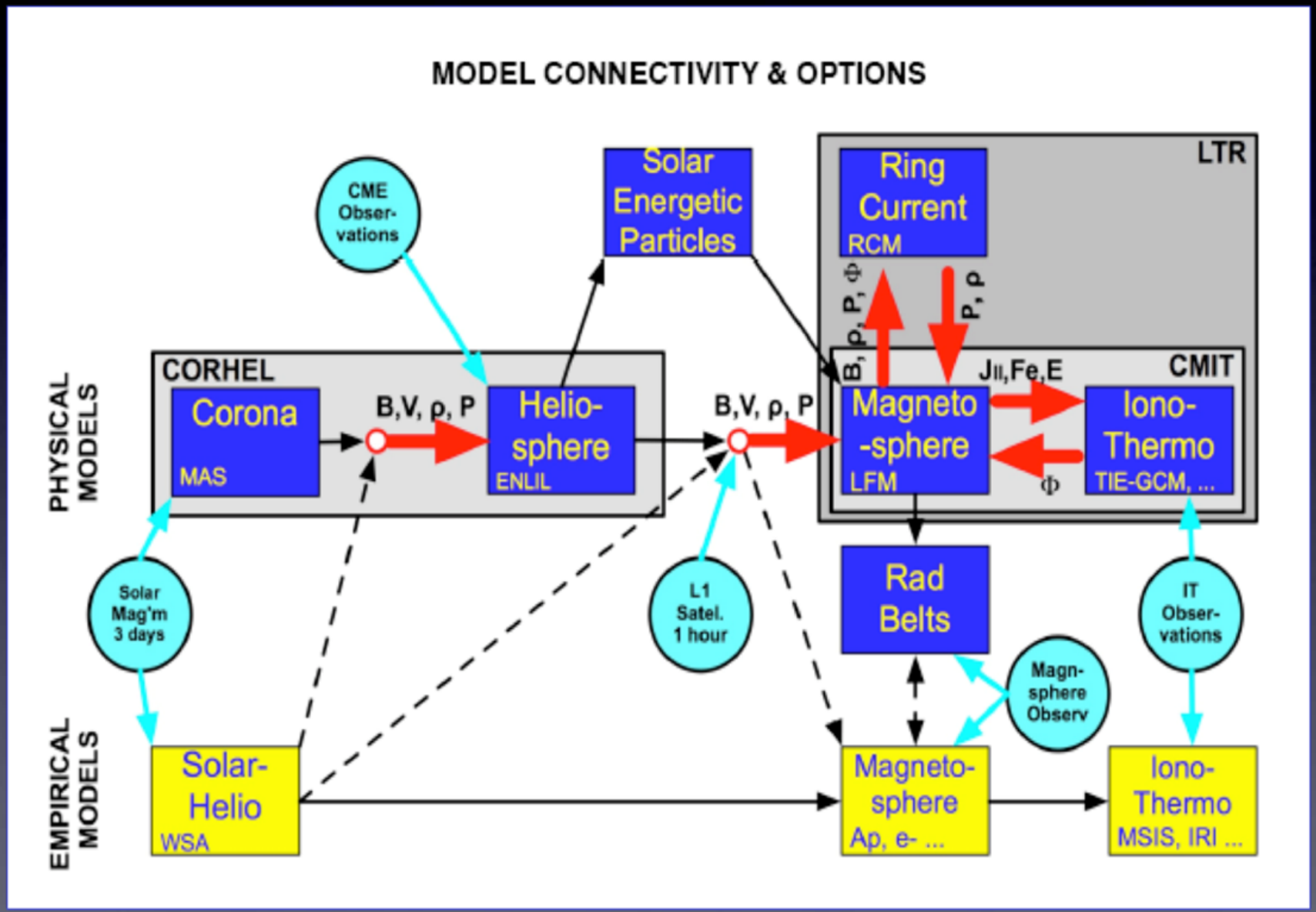
CISM-CCMC Collaboration

CISM Coupled Model System

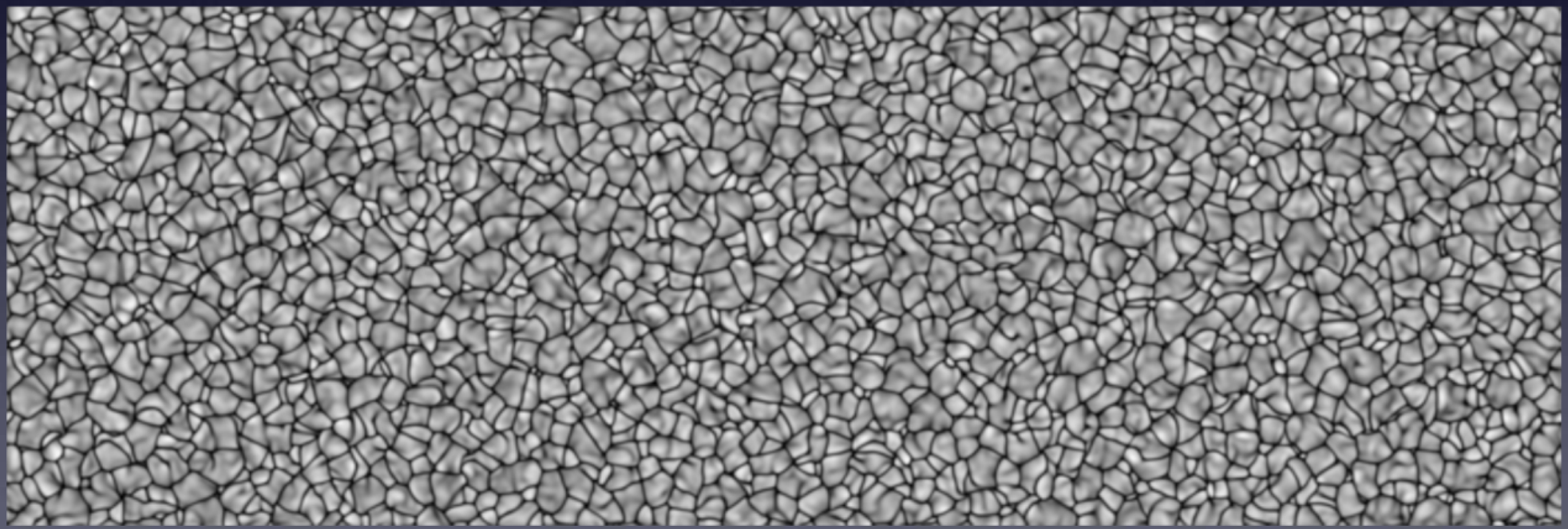


CISM models at CCMC

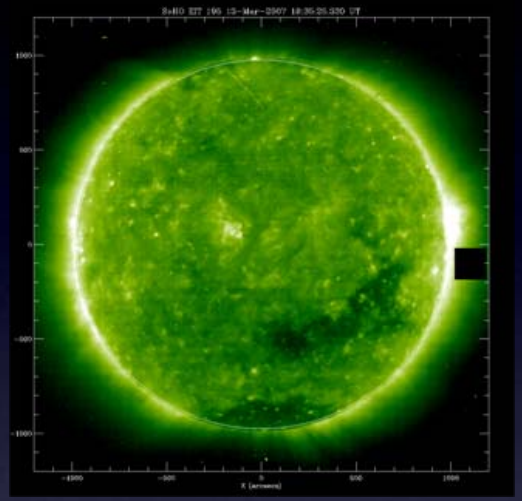
Model	First Run	# of Runs	Talk
MAS	10/03	62	
CORHEL	6/07	7	Z. Mikic
PFSS	3/04	115	
WSA	4/07	8	N. Arge
ANMHD	2/09	1	
ENLIL	4/05	552	D. Odstrcil
LFM-MIX	?	12	
TIEGCM			S. Solomon
RCM			S. Sazykin

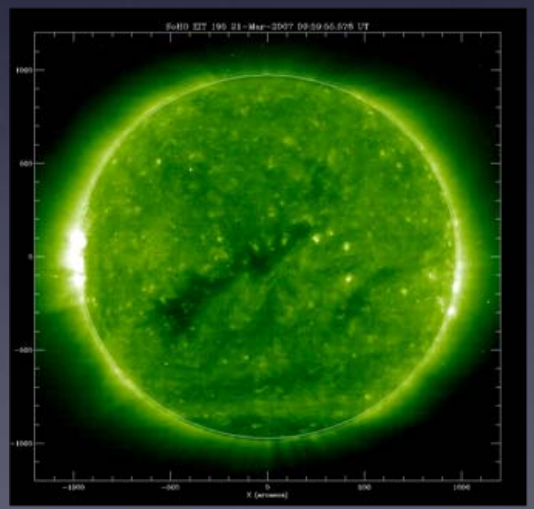
ANMHD

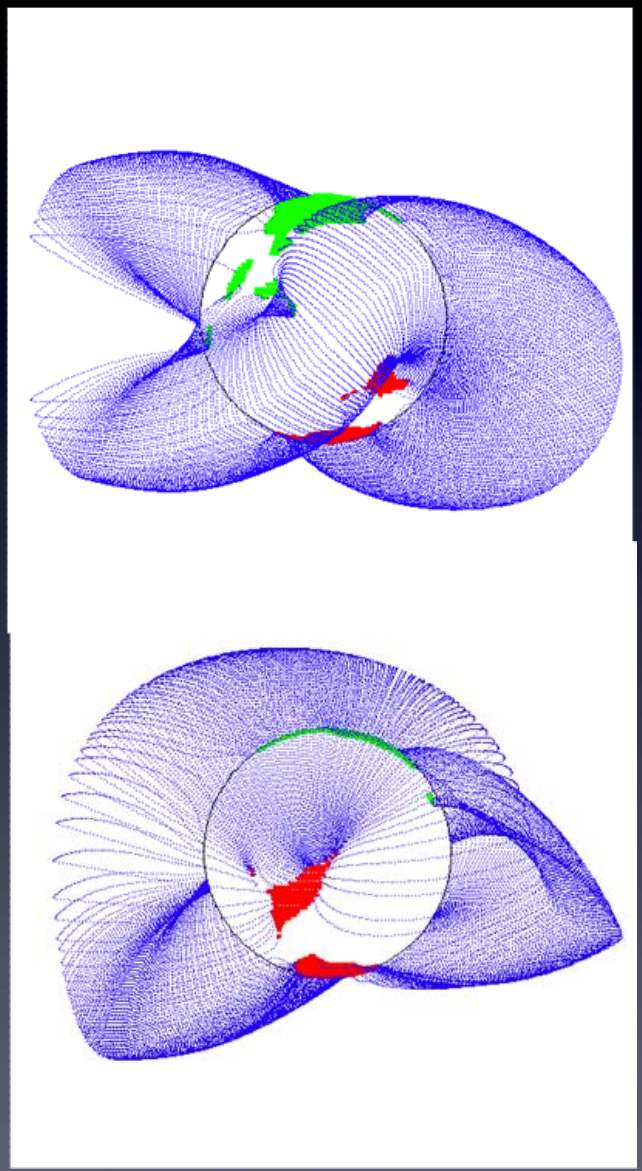
- Anelastic MHD tailored to solar convection
  - can be used to study flux emergence
  - plot of simulated solar granulation



PFSS -source surface model

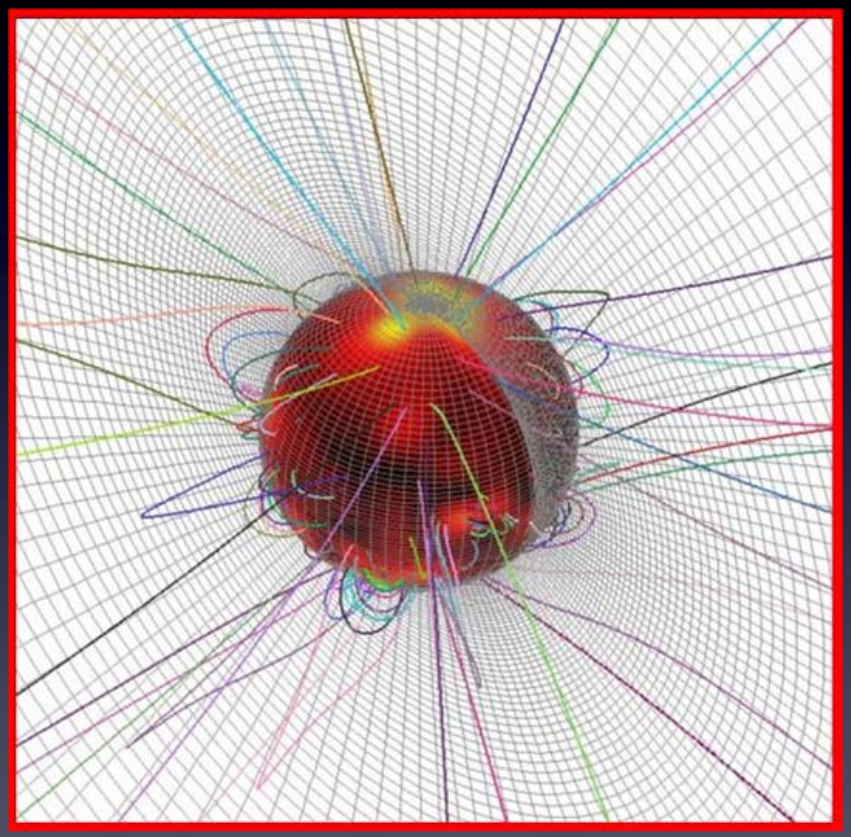






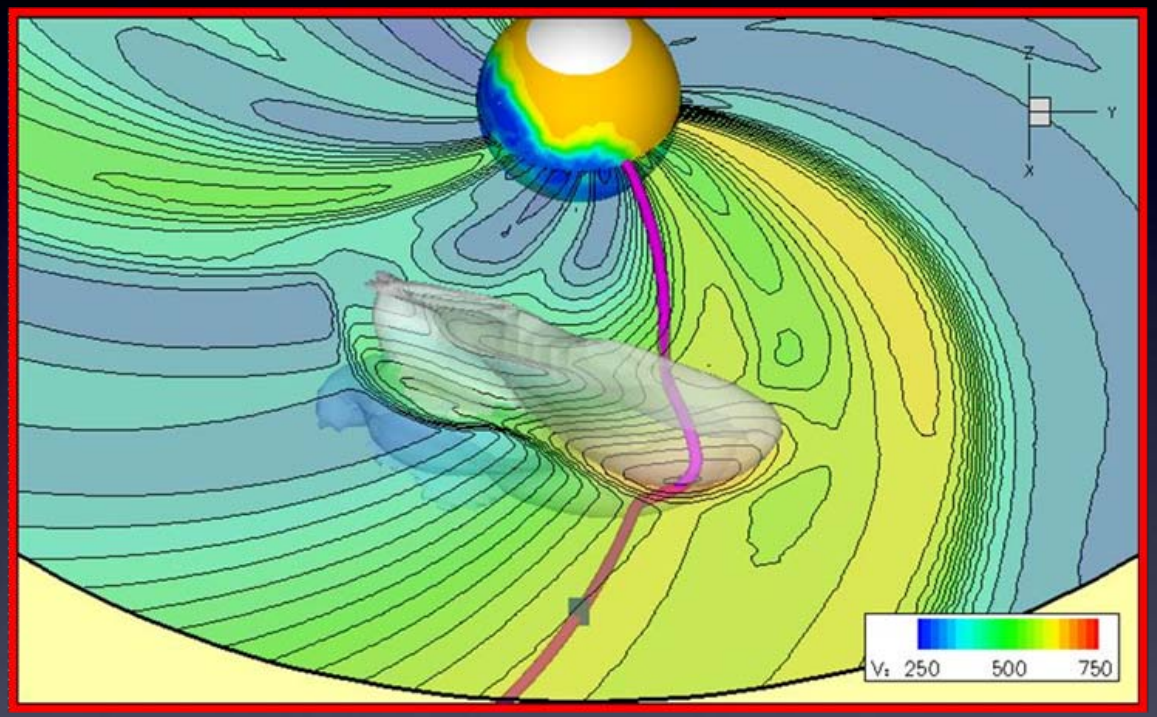
SOHO EIT images (left) ; (right) PFSS models from the GONG website (G. Petrie)

MAS



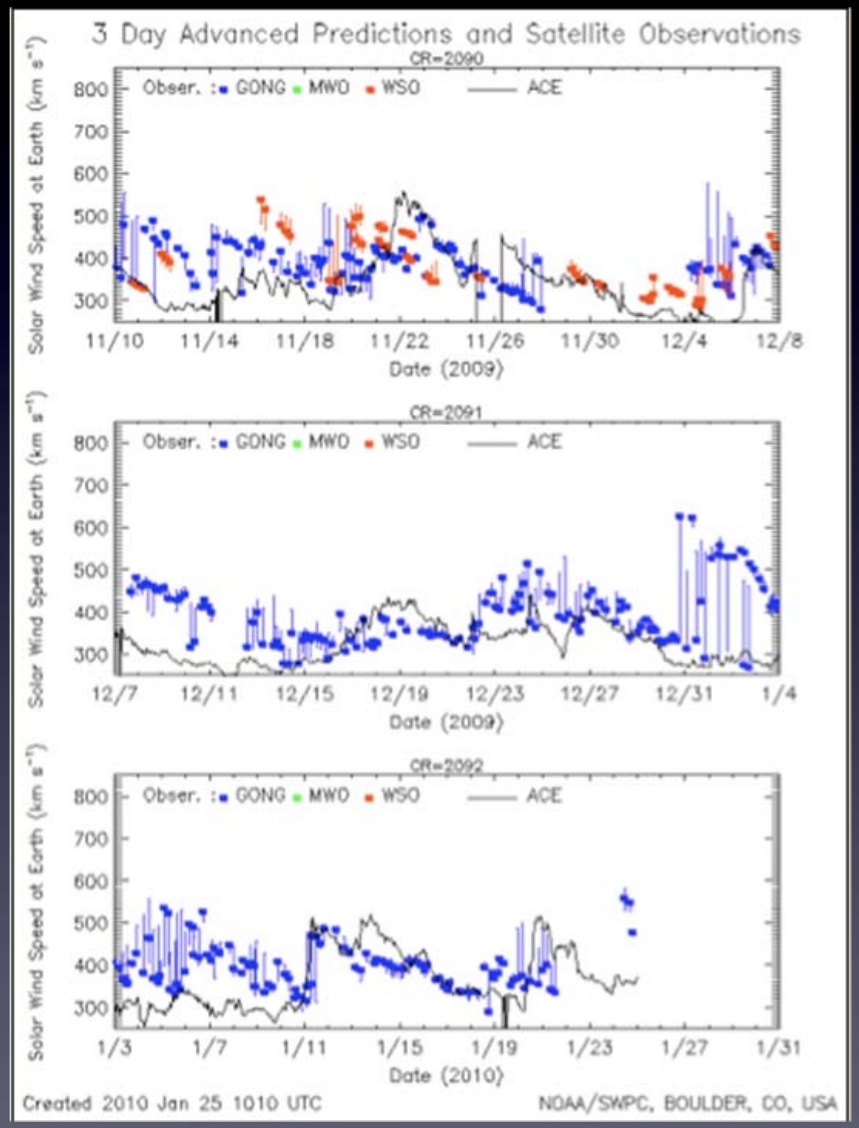
- MHD on A SPHERE
- solves MHD equations for the corona
- starting point for CORHEL

ENLIL



- MHD in the heliosphere
- Dusan Odstrcil !!
- outer part of CORHEL

WSA

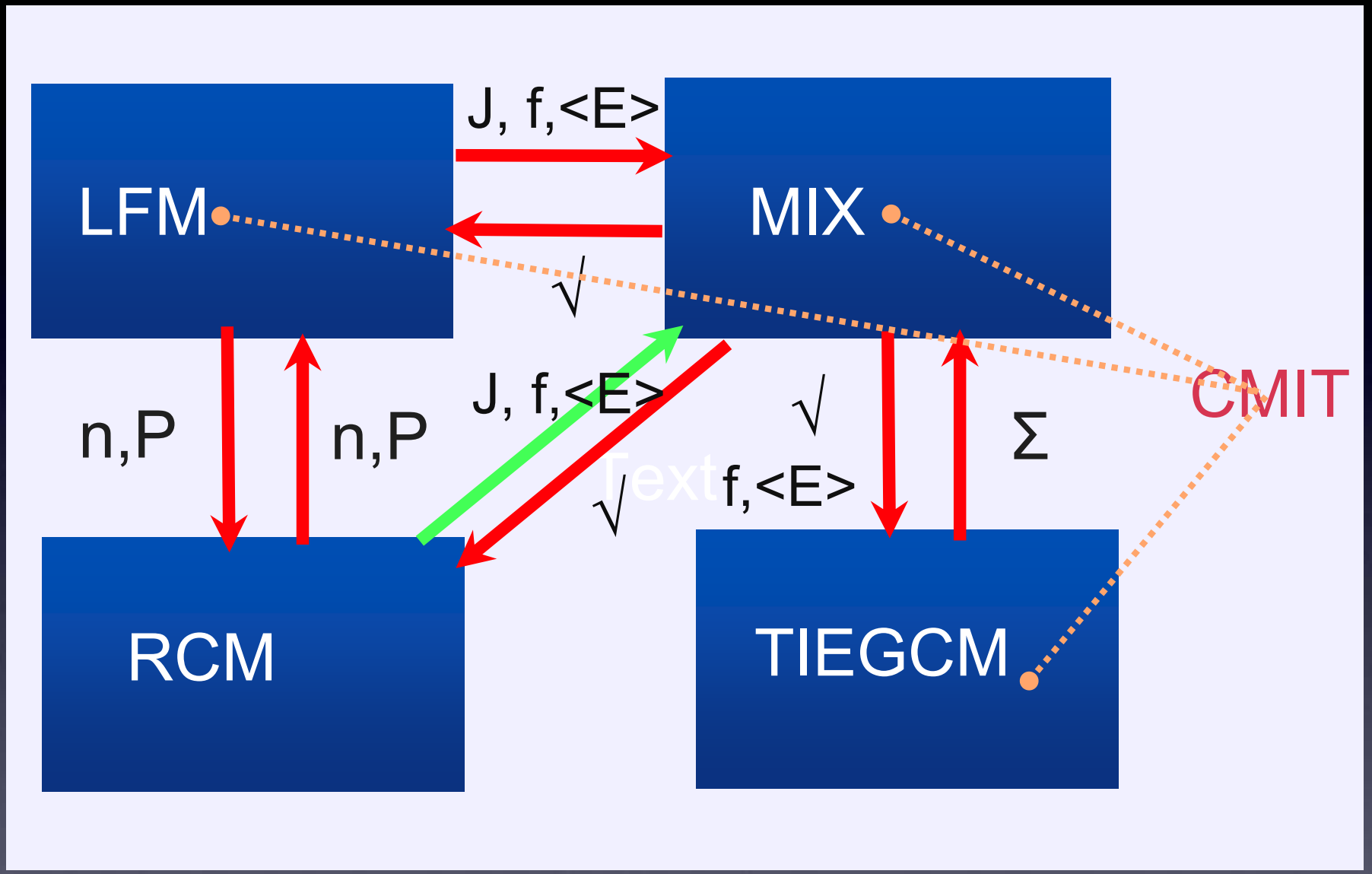


- Wang Sheeley Arge model
  - takes magnetograms and predicts solar wind velocity and field direction
- used to initialize versions of CORHEL

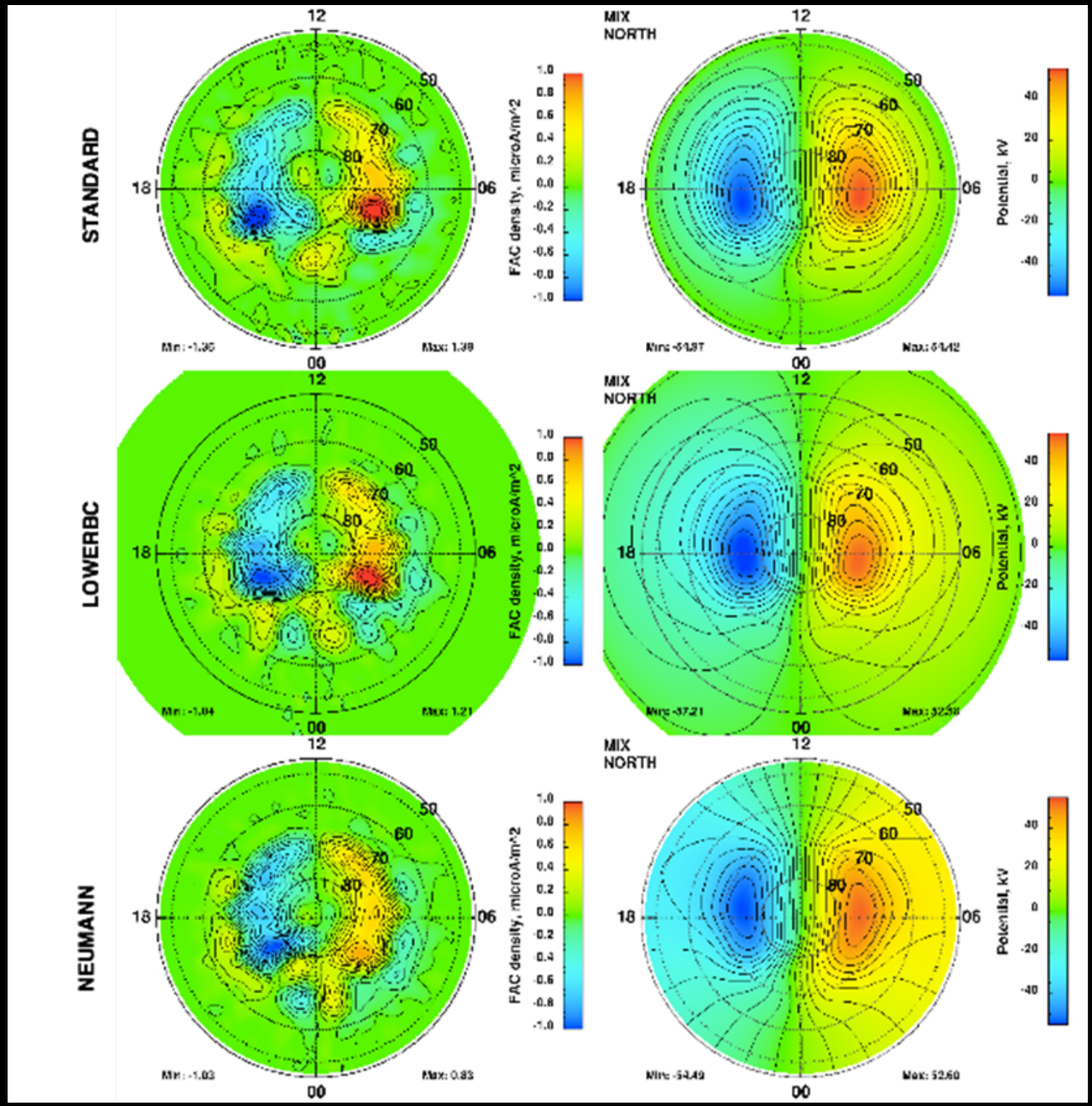
LFM-MIX

- Now ready for runs on demand at CCMC
  - tip of hat to Lutz Rastaetter
- Basically a version of the parallel standalone LFM code with the MIX ionospheric solver
- MIX (written by Slava Merkin)
  - contains hooks for coupling to RCM and TIEGCM
  - adaptable to any magnetospheric grid
  - allows input of parallel currents from multiple sources
  - very fexible boundary conditions

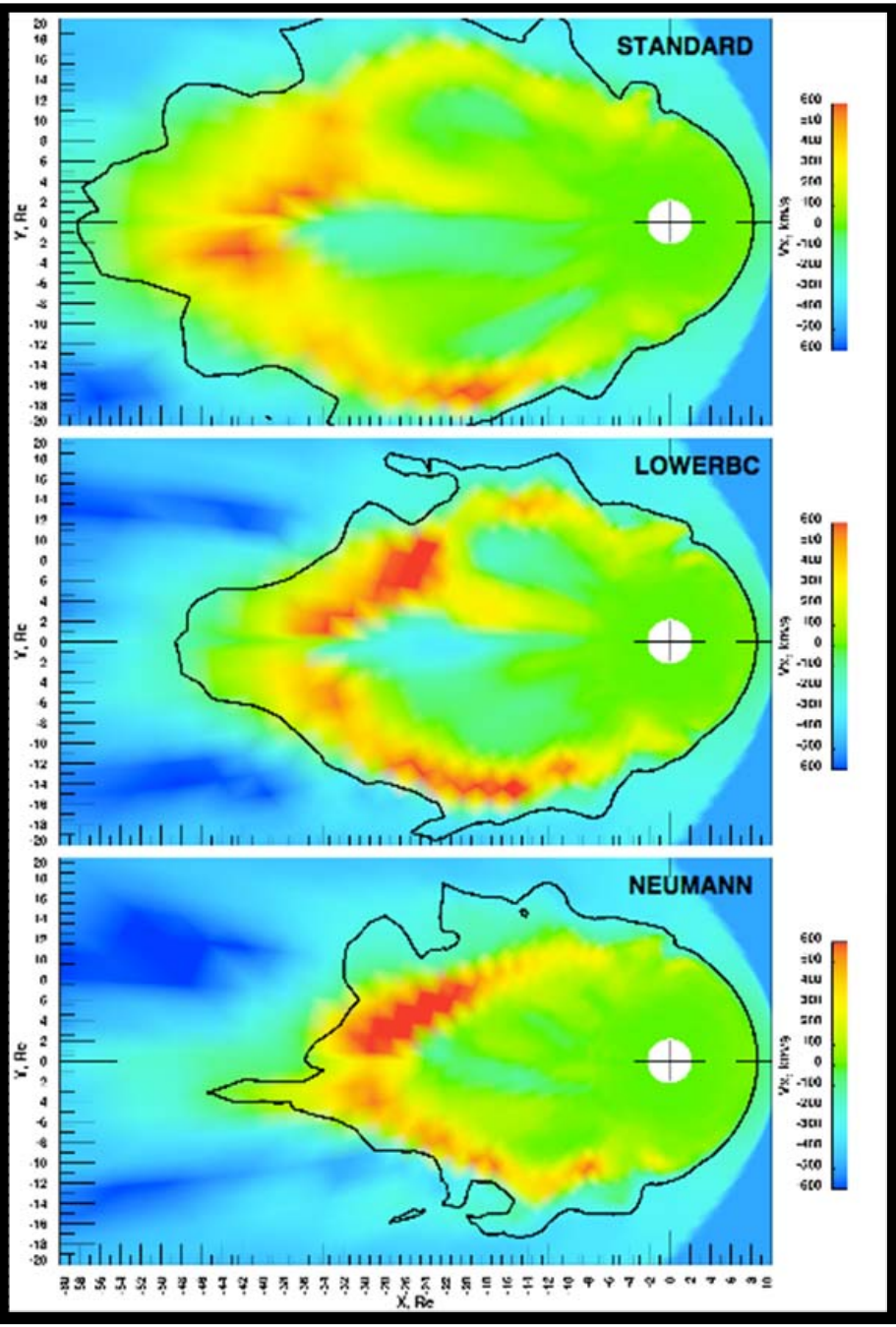
LTR

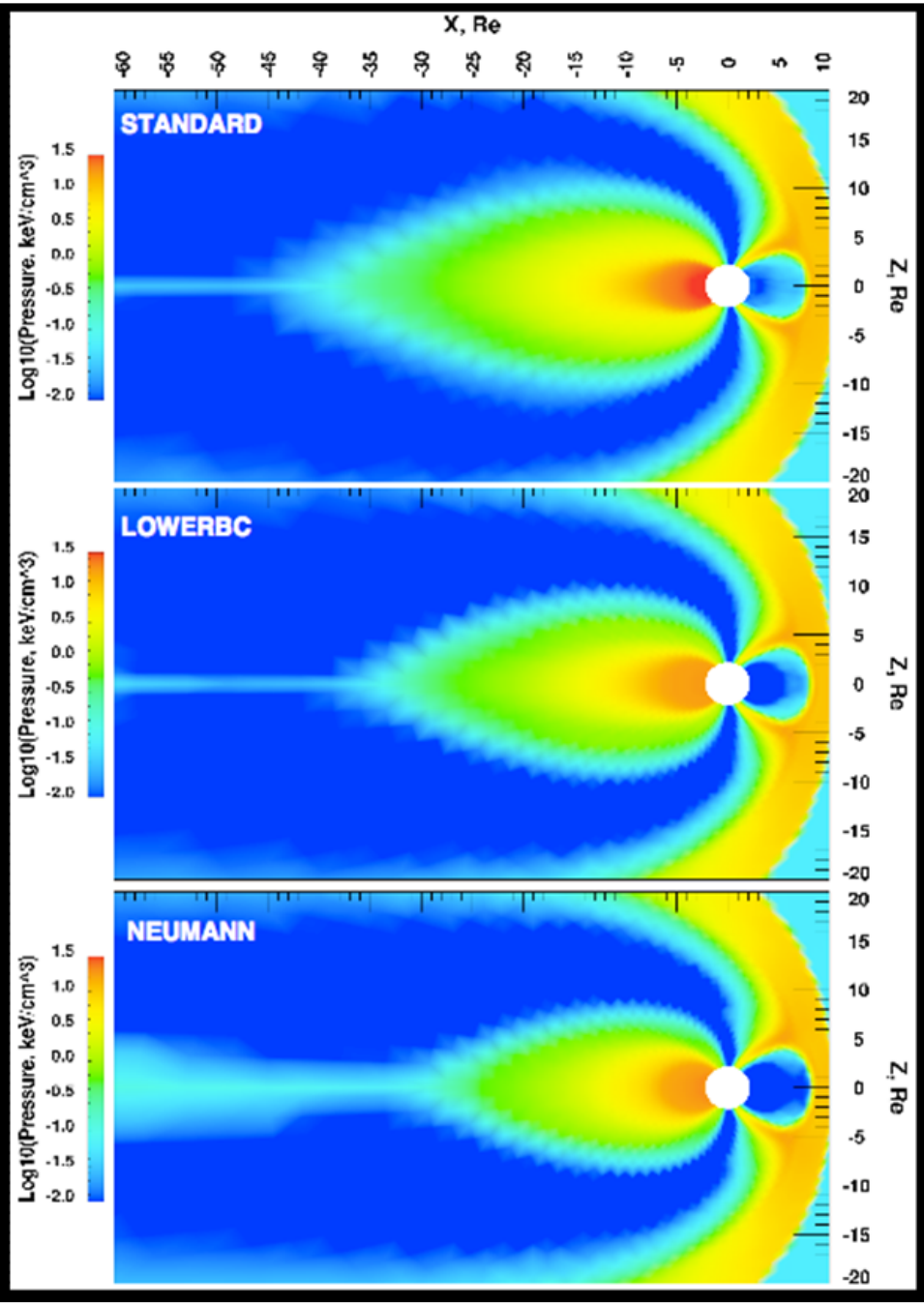


MIX highlights



MIX highlights



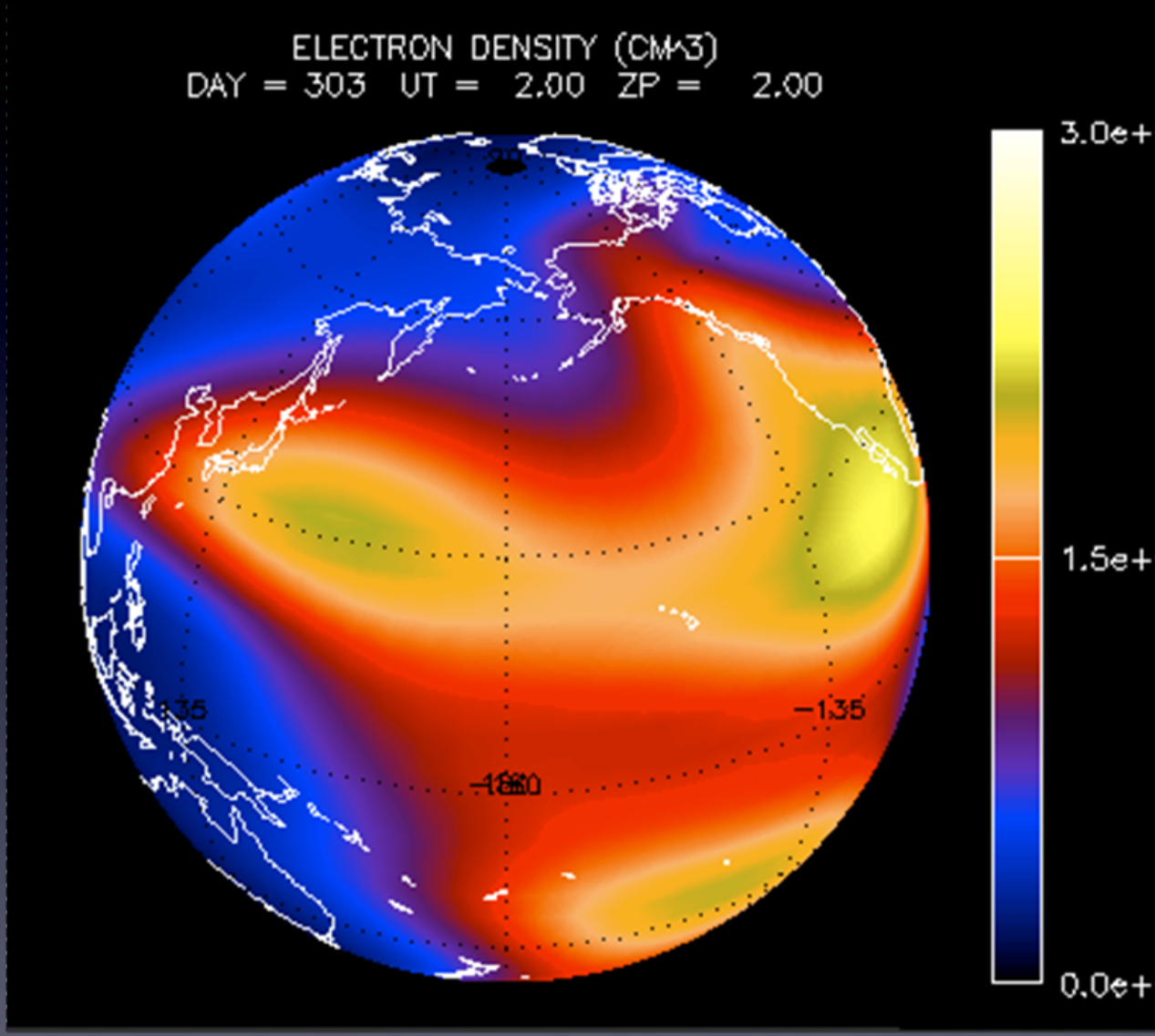


Future Plans

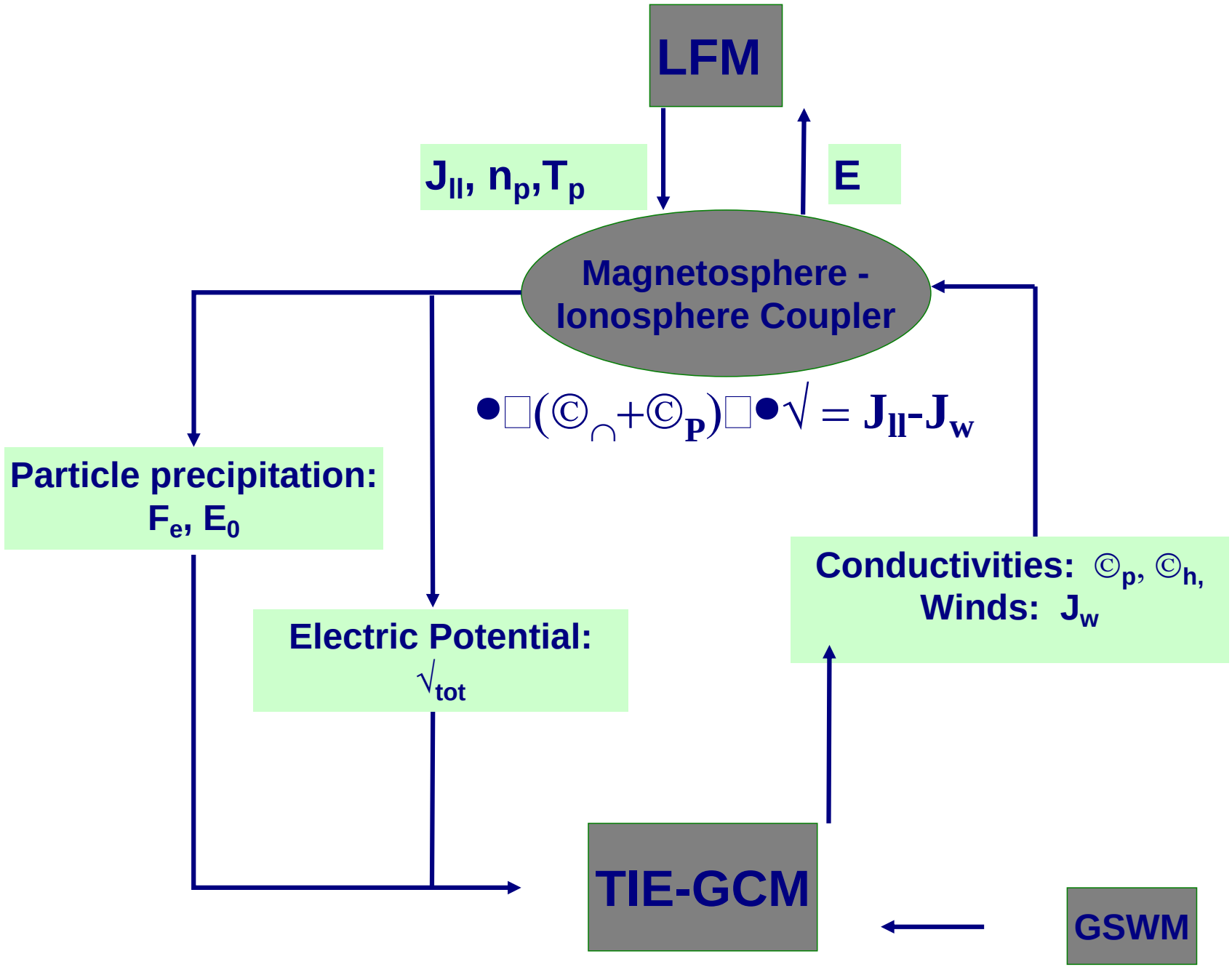
- TIEGCM
  - in process of being implemented
- CMIT
  - after TIEGCM (already couped as CISM research code)
- LTR
  - Dependent on RCM being judged robust enough for runs on demand
- Multi-fluid LFM
- ???
  - LFM-helio (Slava Merkin)
  - SEP Penetration
  - other rad belt (e.g. Fokker-Planck diffusion)

Thermosphere-Ionosphere-Electrodynamics General Circulation Model (TIE-GCM)

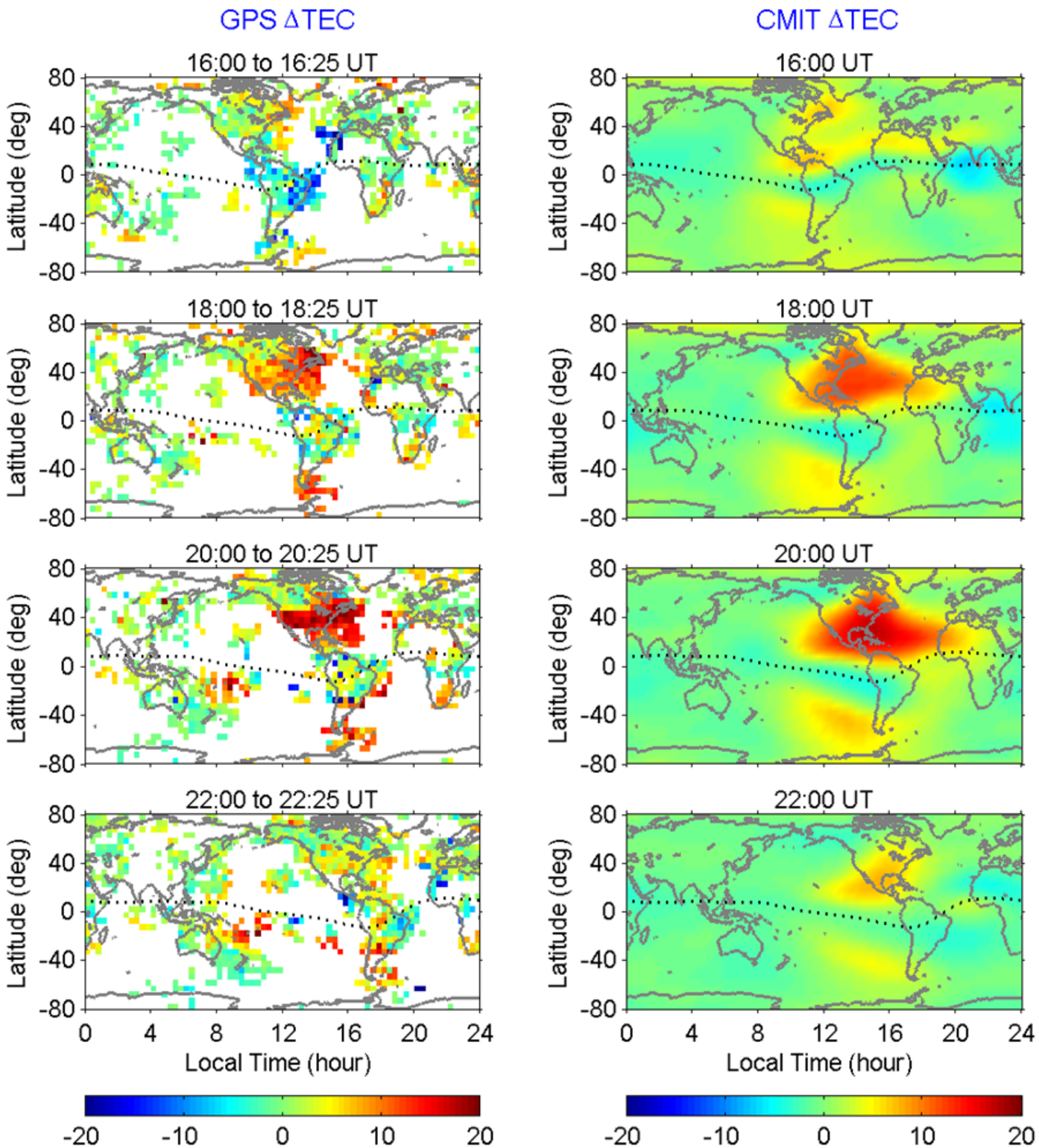
- Developed by Ray Roble, Bob Dickinson, Art Richmond, et al.
- Small group of in-house developers and visitors
- Cross-platform release (version 1.9), June 2008
- User manual complete
- Documentation mostly complete
- Open-source academic research license
- Now running at CCMC



Coupled Magnetosphere-Ionosphere-Thermosphere Model



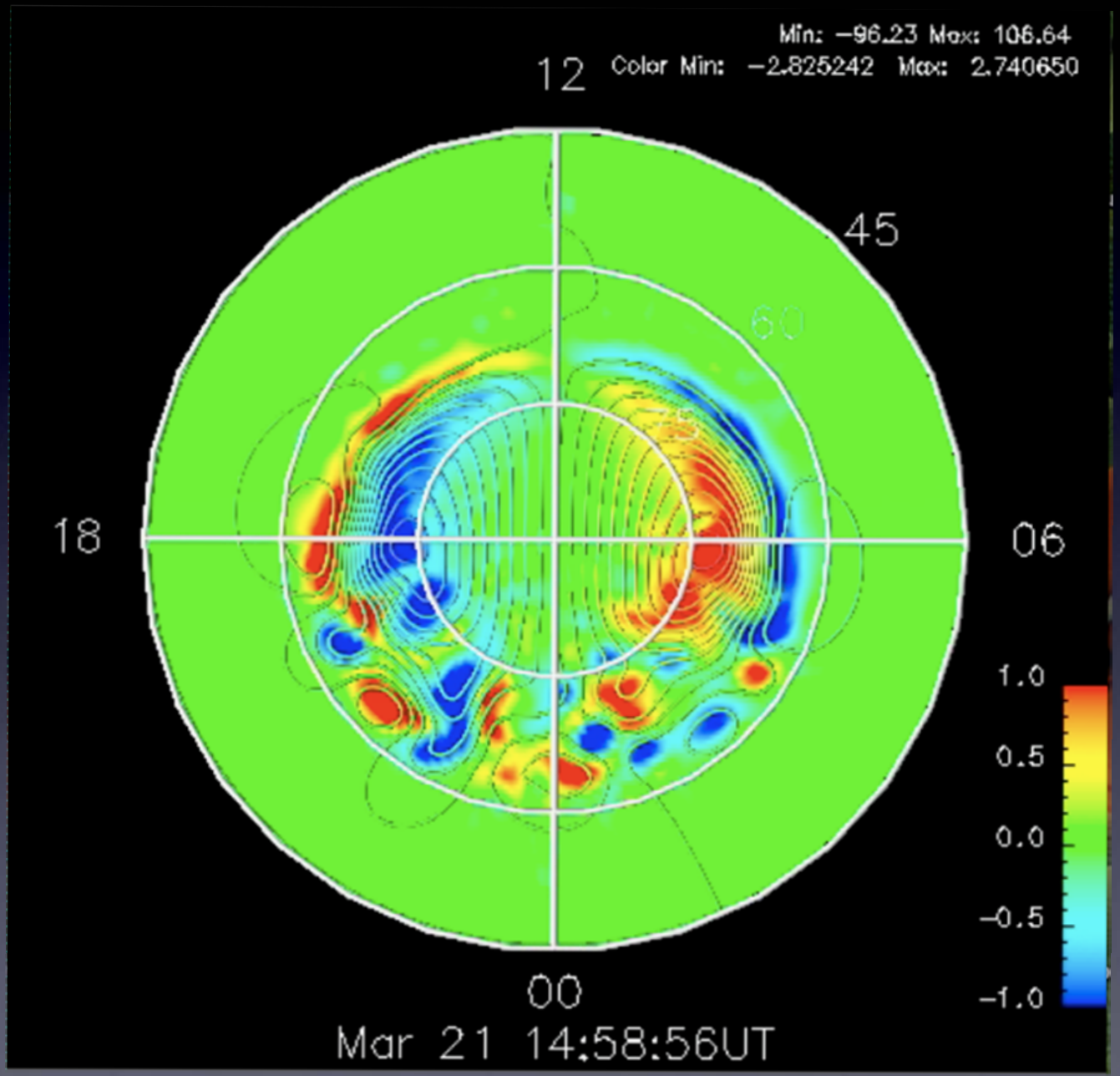
December, 2006
"AGU Storm"



LFM-RCM progress

- RCM coupling has been trickier (for everybody) than originally thought
- Dogged work by Frank Toffoletto has gotten CISM model to stably couple for long term driving
- Strong shielding of inner magnetosphere
- Interesting phenomena (bubble/BBF driven), but is it real?

Magnetospheric Shielding

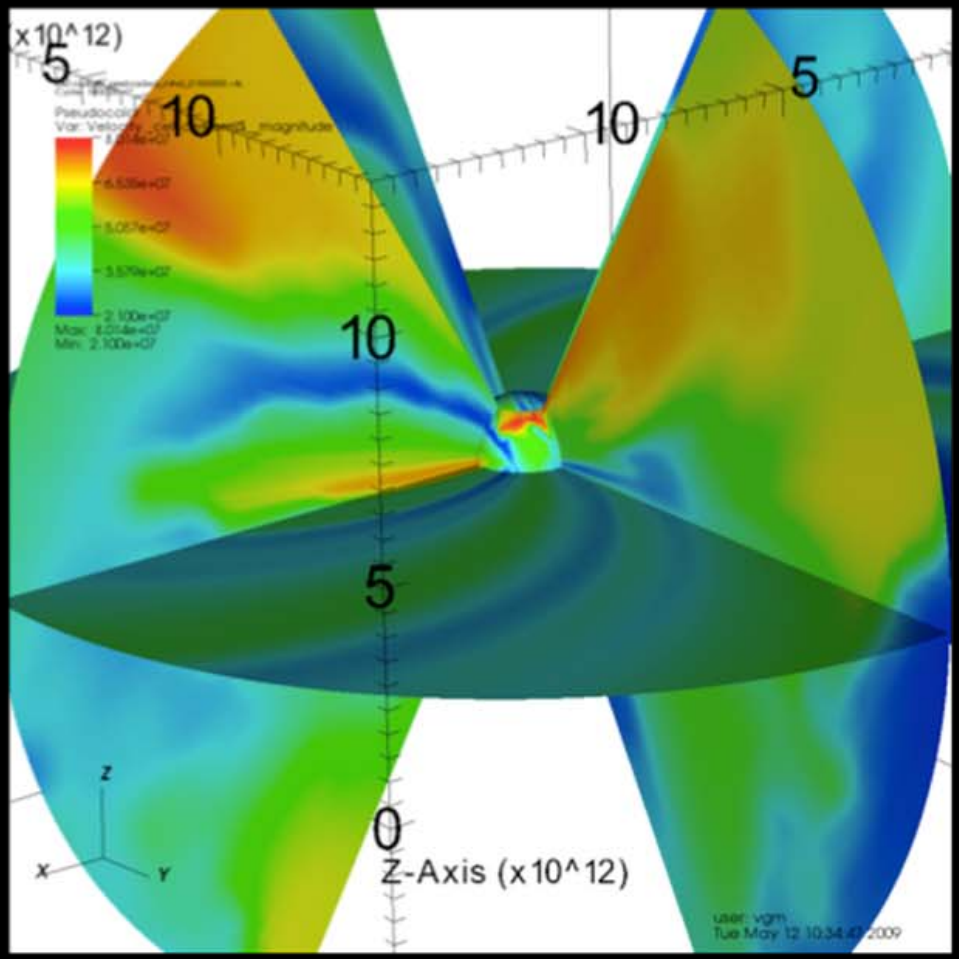



QuickTime™ and a
YUV420 codec decompressor
are needed to see this picture.

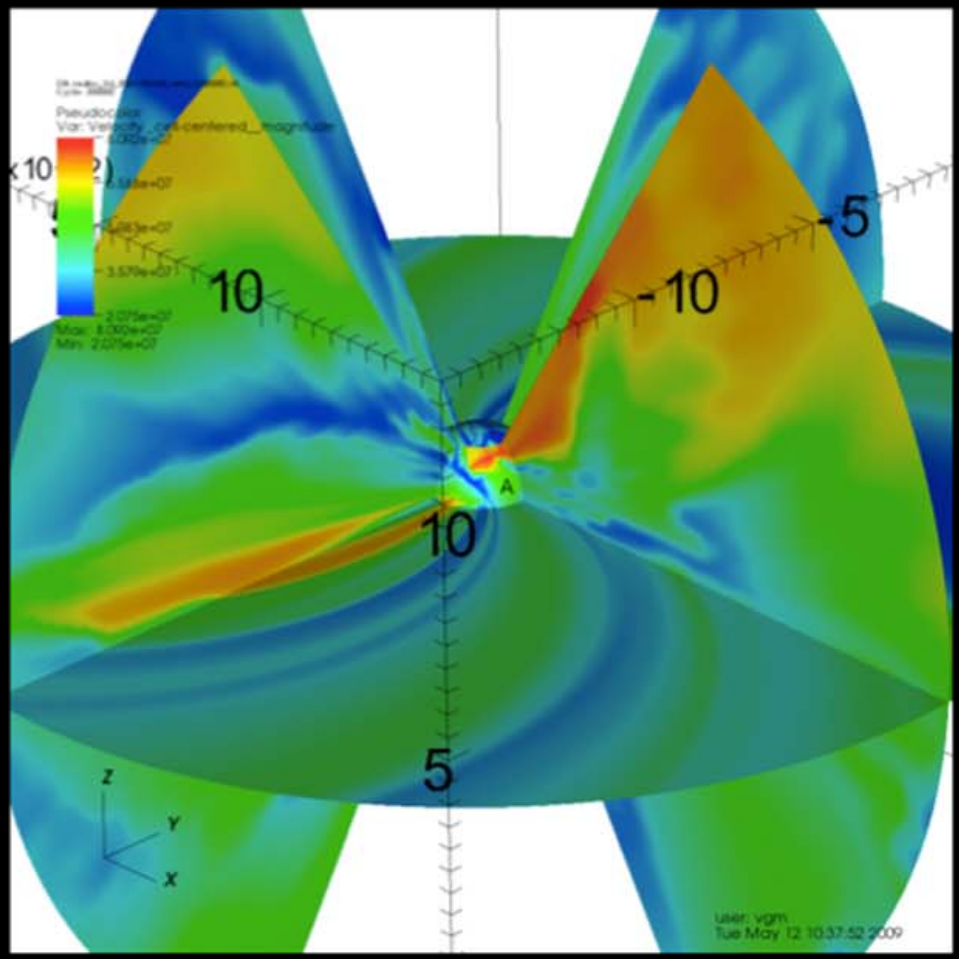
LFM-helio

- developed by Slava Merkin
- modification of LFM code to model the heliosphere
- yet another CORHEL version

Low resolution vs high resolution



$2^{o}x2^{o}x2R_s$



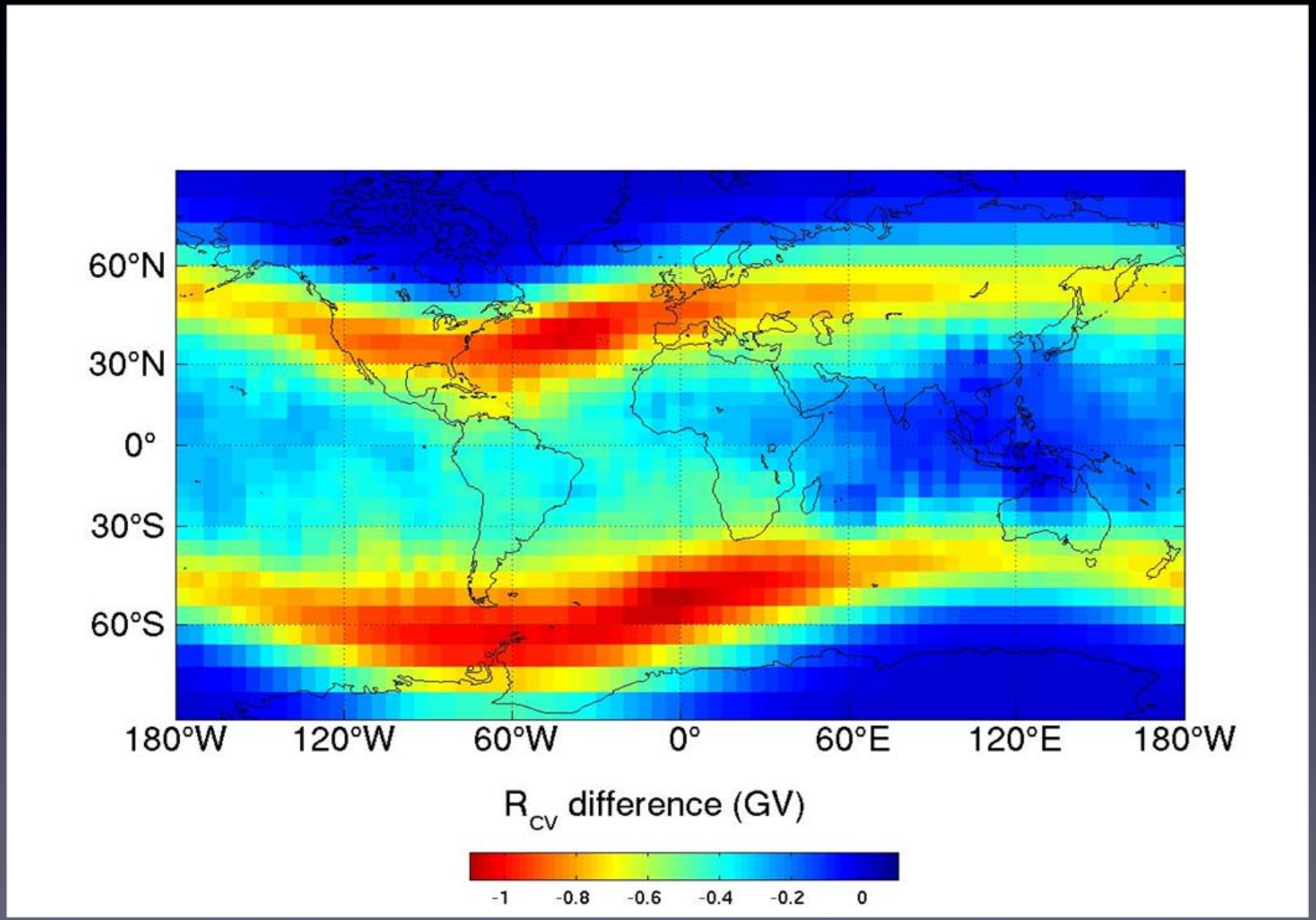
$1^{o}x1^{o}x1R_s$

2,000,000 SU

Geomagnetic Cut-off Code

- Developed by Brian Kress
- Uses global magnetic field model (LFM) to determine where energetic particles can penetrate
- Uses values from MHD code interpolated to 3D Cartesian grid -- easily extended to other MHD results

Difference Between Quiet & Storm Cutoffs



- Active longstanding collaboration with CCMC
- Has been mainly solar-heliospheric
- Magnetospheric models coming on-line
- Very happy to have CCMC to answer the phone