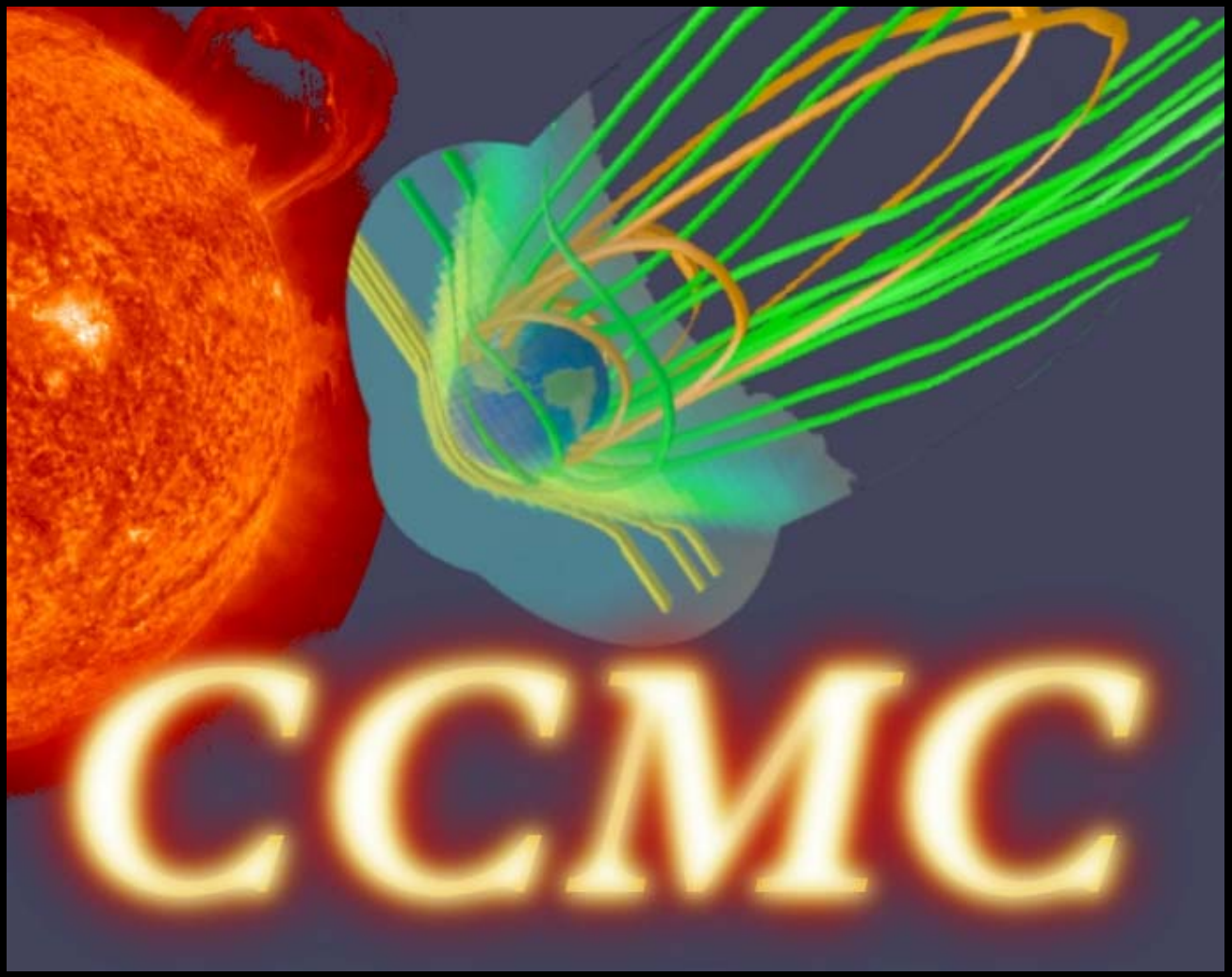
The Community Coordinated Modeling Center Report



M Kuznetsova
(for M. Hesse)

GEM 2002

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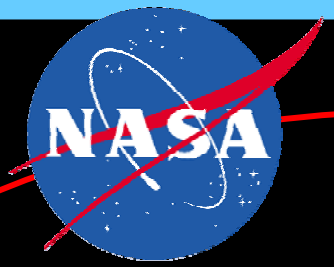


"A multi-agency partnership to enable, support, and perform the research and development for next generation space science and space weather models"

Background: Charter

- Employ scientific research models to accomplish Space Weather objectives
- Work with the research community to generate a flexible model chain, which addresses solar atmosphere to Earth's upper atmosphere
- Serve the research community through access to scientific model results ("open model policy")
- Perform broad-based testing and metrics-based evaluation of research models
- Improve model performance through coupling
- Deliver science- and metrics-tested models to Rapid Prototyping Centers for Space Weather Applications

Background: Recent Accomplishments

2001

- NSF/AFOSR "startup" Beowulf on-line
- Runs-on-request available, supported summer school and thesis work
- Magnetospheric metrics study evaluation
- BATSRUS delivered to SMC
- 3 models added to CCMC
- CCMC workshop at the MHPCC (ops and research input)

2002

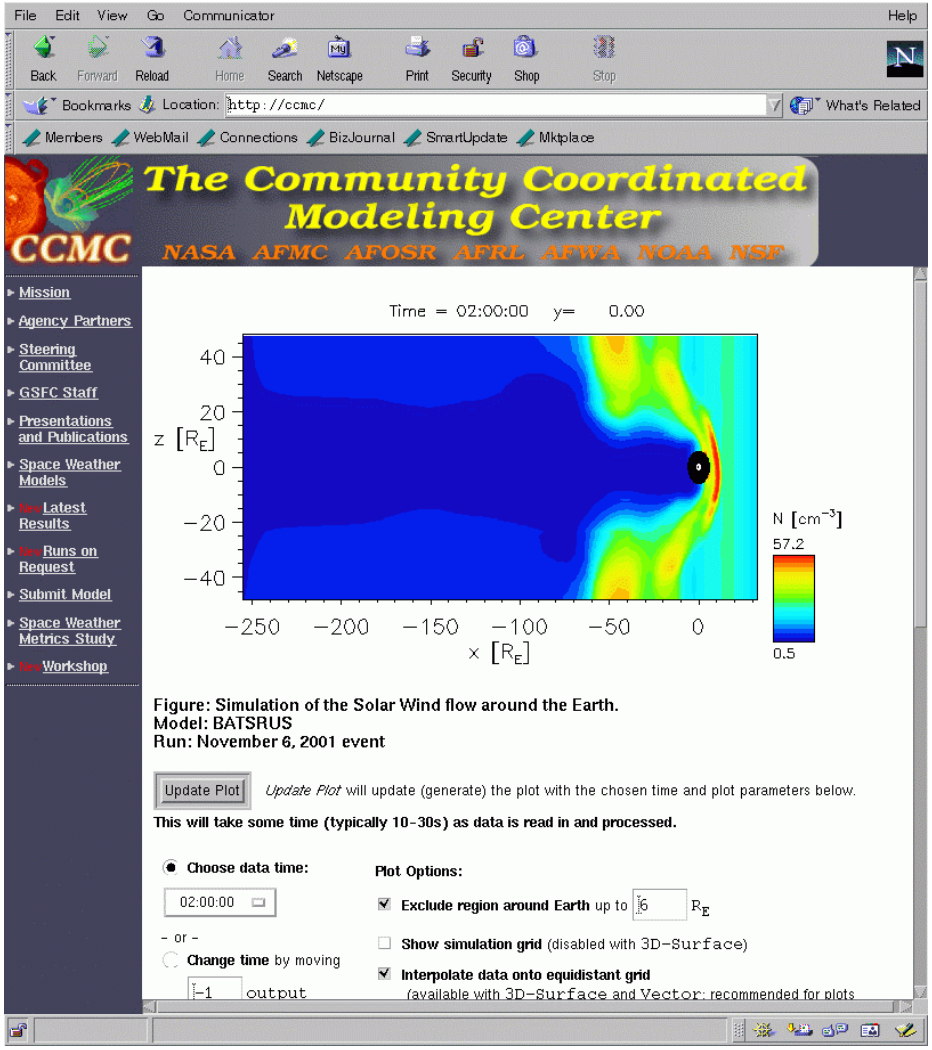
- Polar cap current/electric field model (SEC request, endorsed by SMC)
- Initiated routine metrics study
- 64 node NSF/AFOSR Beowulf in use
- 128 node AF/XOW Beowulf on order
- Hosted Space Environment Modeling Workshop
- Real-time pages for global MHD and polar cap potential (experimental)
- New features for RoR, and for user interface

CCMC Functions: Research Support

- Through www-accessible run results, and runs on request
- Purpose:
  - Enable broader model usage
  - Enable broad-based model testing
- Runs on request

Now available for

- BATSRUS
- UCLA MHD
- SAMI2 ionospheric model
- Fok ring current model
- Weimer Polar Cap model
- CTIP ionos. model (soon)



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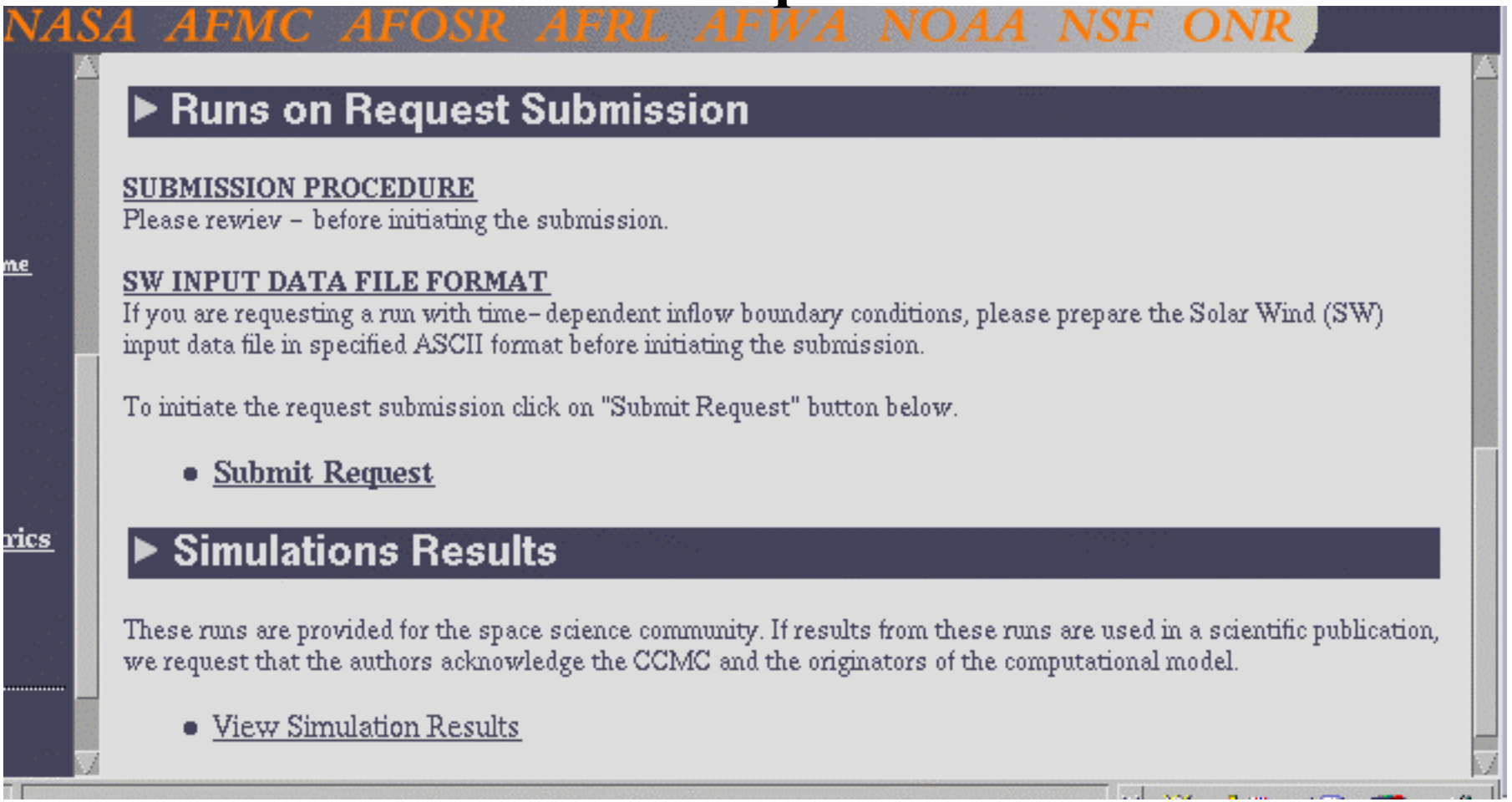
Runs on Request



Runs On Request: New Features.

Dipole Tilt Effects Studies Support:

- Simulations of Real Events: Dipole Tilt Consistent With Real Time.
- Simulations With Modeled Conditions:

Support For Studies of Ionospheric Conductance Effects:

- Choice of Conductance Model: Uniform, Auroral, CTIM (UCLA-GGCM)

Magnetopause, Shock, Cusp Studies Support:

- Simulations with high resolution grid (0.25 Re) in magnetopause/shock/cusp area available on special request.

Event Studies Support:

- Simulations of real events with time varying SW conditions up to 12 hours of real time.

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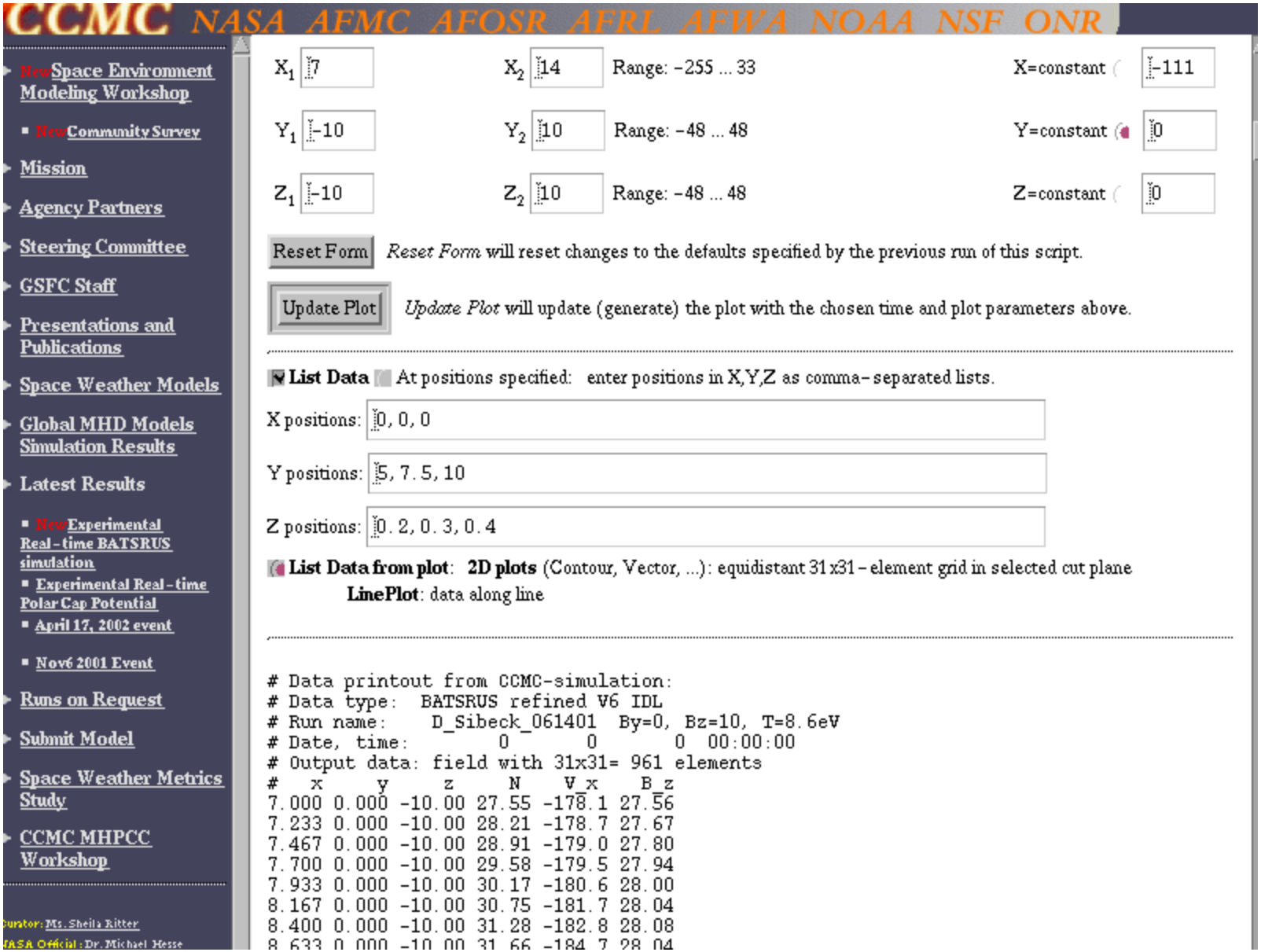
New User Interface Features



New User Interface Features

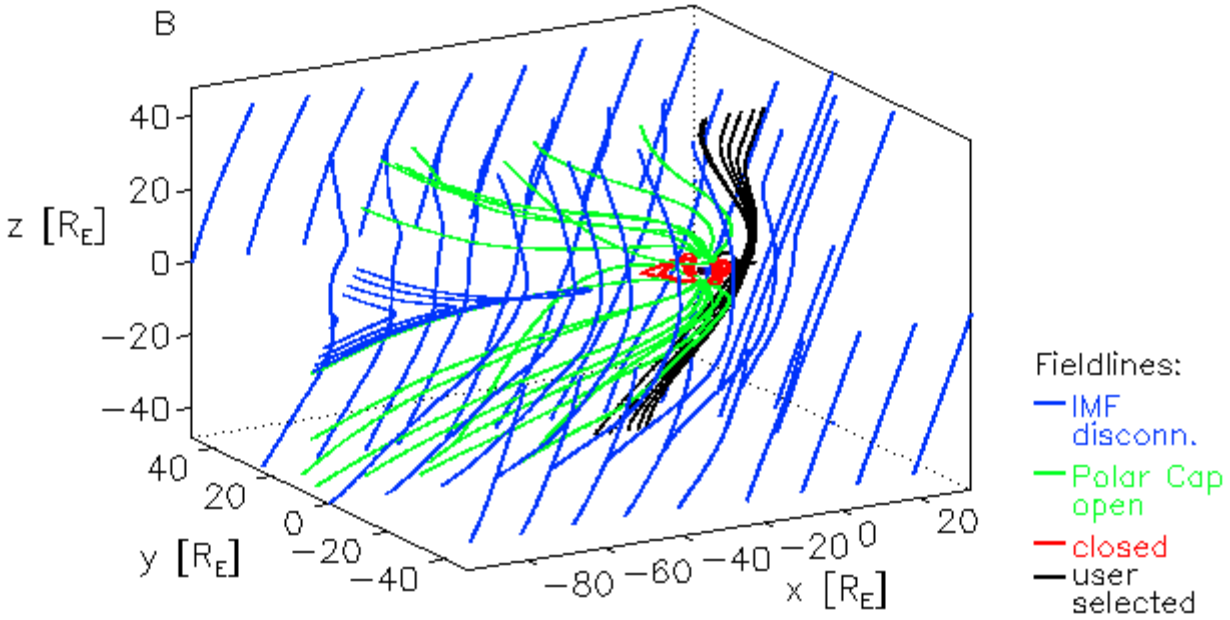


Figure: Simulation of the Solar Wind flow around the Earth.
Model: BATSRUS
Run: Brian_Anderson_041102_3

Update Plot *Update Plot* will update (generate) the plot with the chosen time and plot parameters below.

This will take some time (typically 10-30s) as data is read in and processed.

Choose data time:

02:30:00

Plot Options:

Exclude region around Earth up to 6 R_E

▶Simulations With Modeled Conditions

Number of Runs Listed: 39

Sort The List by [**Key Word**] [**Run Date**] [**Model**] [**IMF Clock Angle**] [**IMF Magnitude**] [**IMF Bz**] [**IMF By**] [**SW Density**] [**Dipole Tilt**] [**Name of Run Originator**]

Run Number	Key Words	|B|	IMF Clock Angle	B_x	B_y	B_z	V_x	V_y	V_z	N	Temp.	Dipole Tilt (in X-Z Plane)	Dipole Tilt (in Y-Z GSE Plane)	Model
		[nT]	deg	[nT]	[nT]	[nT]	[km/s]	[km/s]	[km/s]	[cm^{-3}]	[K] ([eV])	deg	deg	
QG_Zong_041302_2	By < Bz	6.16	31	2	3	5	-400	0	0	40	182000(15.7)	0	0	BATSRUS
CISM_SummerSchool_070601_4	CISM Project2	1	0	0	0	1	-1000	0	0	30	232100(20)	0	0	BATSRUS
QG_Zong_041302_1	By > Bz	11.87	296.6	4	-10	-5	-400	0	0	30	182000(15.7)	0	0	BATSRUS
Brian_Anderson_050702_1	Stable IMF	6.54	304.6	-2.71	-4.9	-3.38	-386	0	0	11.7	182000(15.7)	0	0	BATSRUS
CISM_SummerSchool_070501_2	CISM												0	BATSRUS

Global MHD Simulation Results

- **List Simulations of Real Events**
- **List Simulations With Modeled Conditions**
- **List Runs on Request**

Search Database For The String Storm

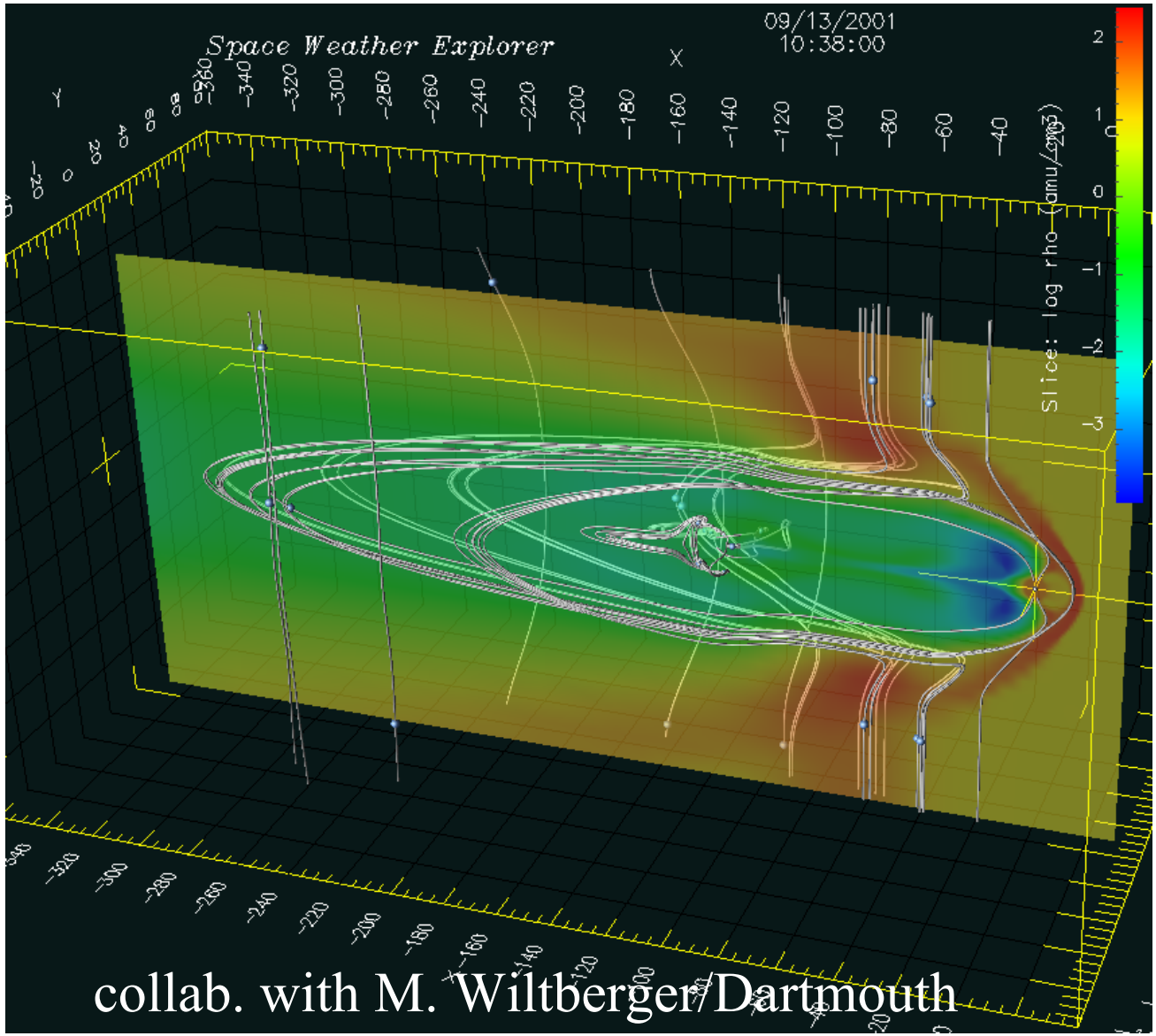
▶Simulations of Real Events

Number of Runs Listed: 21

Sort The List by [**Key Word**] [**Event Date**] [**Model**] [**Dipole Tilt at Start**]

Event Date	Start Time (YYYY/MM/DD)	End Time (YYYY/MM/DD)	Key Words	Model	Model Version	Run Validation Level	Coordinate System for Input	Coordinate System for Output	Dipole Tilt (in X-Z Plane) at Start
	UT	UT						deg	deg
April 17 2002	2002/04/17 10:45	2002/04/17 22:45	Storm	BATSRUS	v7.42	0	GSM	GSM	10.49
November 6 2001	2001/11/06 01:00	2001/11/06 02:30	Storm	BATSRUS	v6.07	0	GSM	GSM	-22.73
October 22 2001	2001/10/22 12:00	2001/10/22 17:00		UCLA-GGCM	2.1-1	0	GSM	GSE	-7.84
March 31 2001	2001/03/31 04:30	2001/03/31 08:00	Storm	BATSRUS	v6.07	2	GSM	GSM	-7.5

Visualization tools: IDL-based, OpenDx-based



collab. with M. Wiltberger/Dartmouth

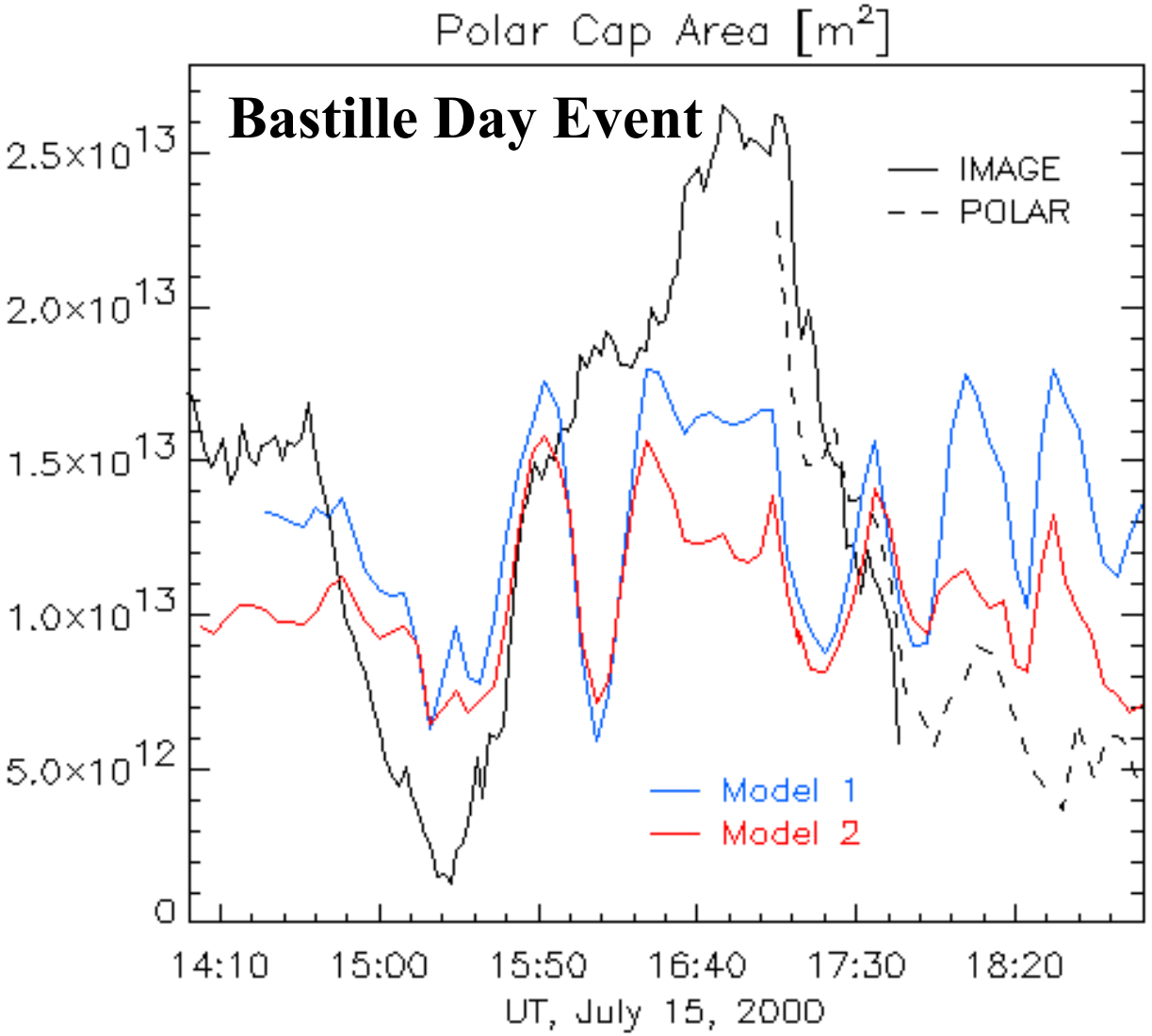
Operational agencies (RPCs) need model evaluations

- Science-based validation: Compare model output to measurements for select events, detailed analysis

- Metrics studies: Repeatable comparison between model output and measurements, “one number”

Need to be blind studies, performed by independent agent

CCMC Functions: Model validation - example



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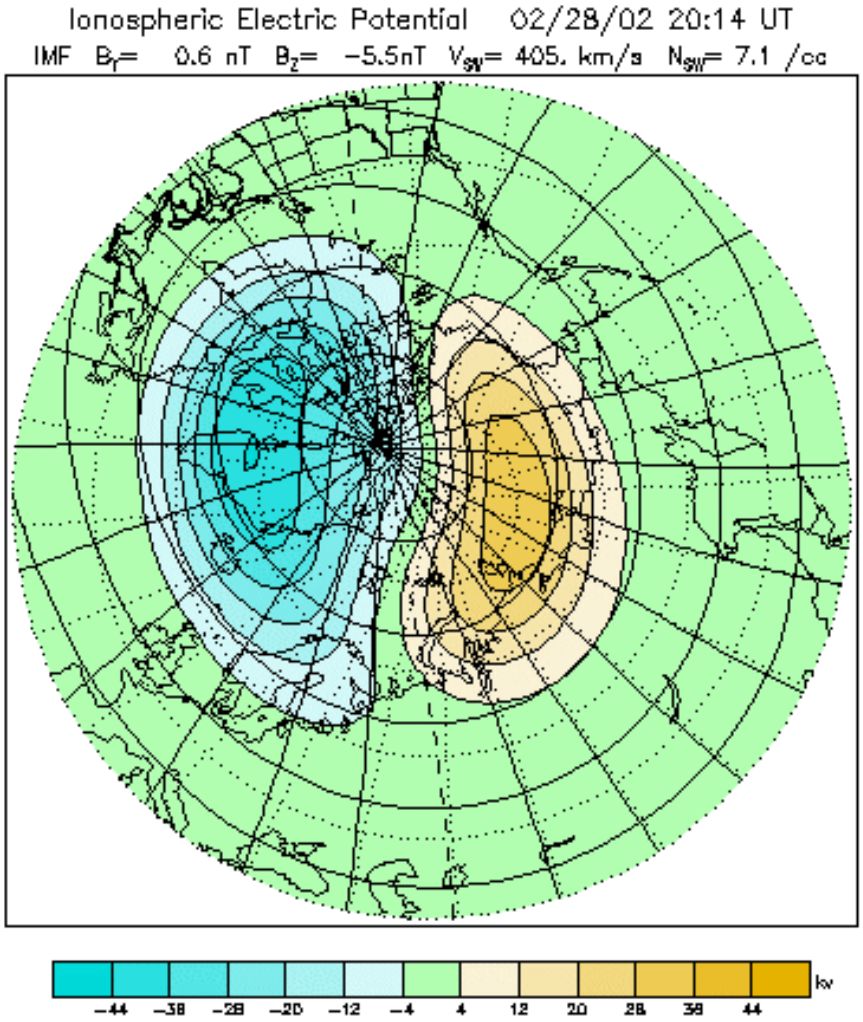
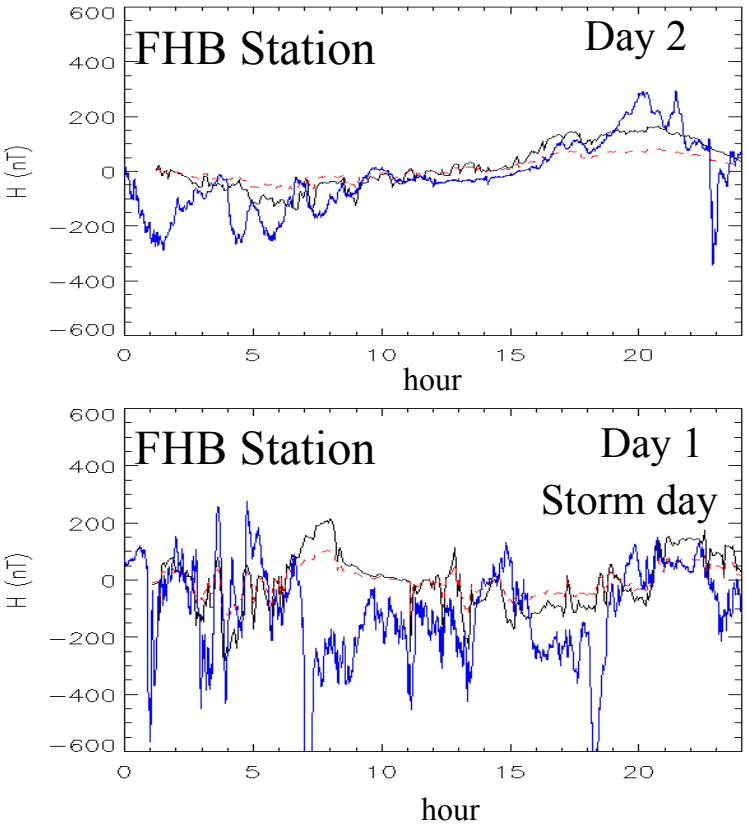
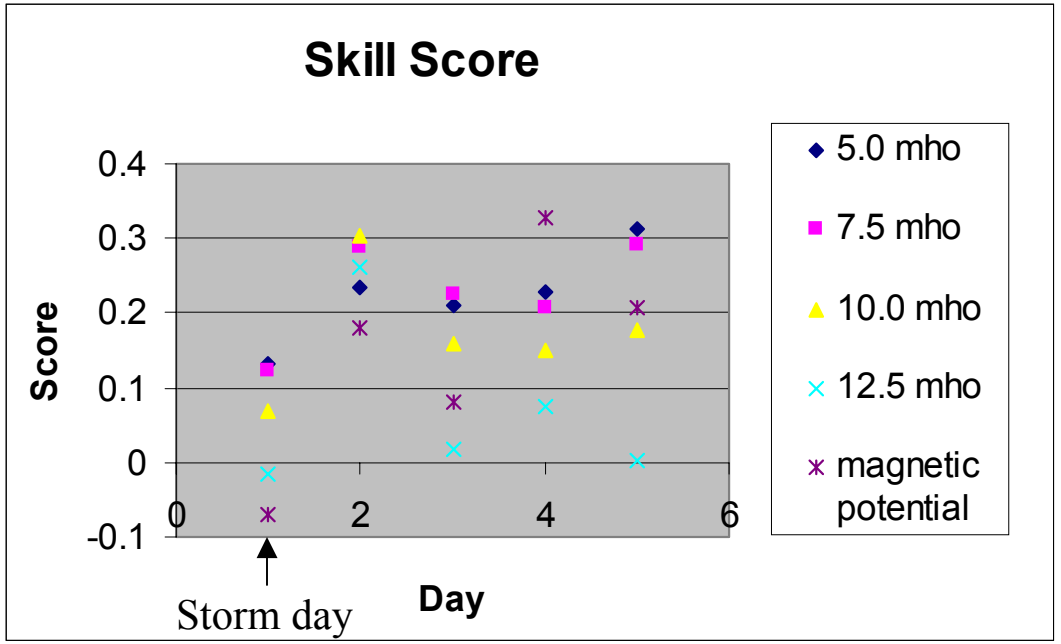


Ionospheric electric potential obtained from the Weimer 2000 polar cap model.
Experimental real time page at http://ccmc.gsfc.nasa.gov/

CCMC Functions: Model evaluations - Metrics



Results Averaged Over 10 Stations
(THL SVS UPN GDH STF GHB FHB NAQ NRD SLO)



ground magnetic measurements

magnetic perturbations from model (10 mho)

magnetic perturbations from model (5 mho)

...establish absolute measure of model performance

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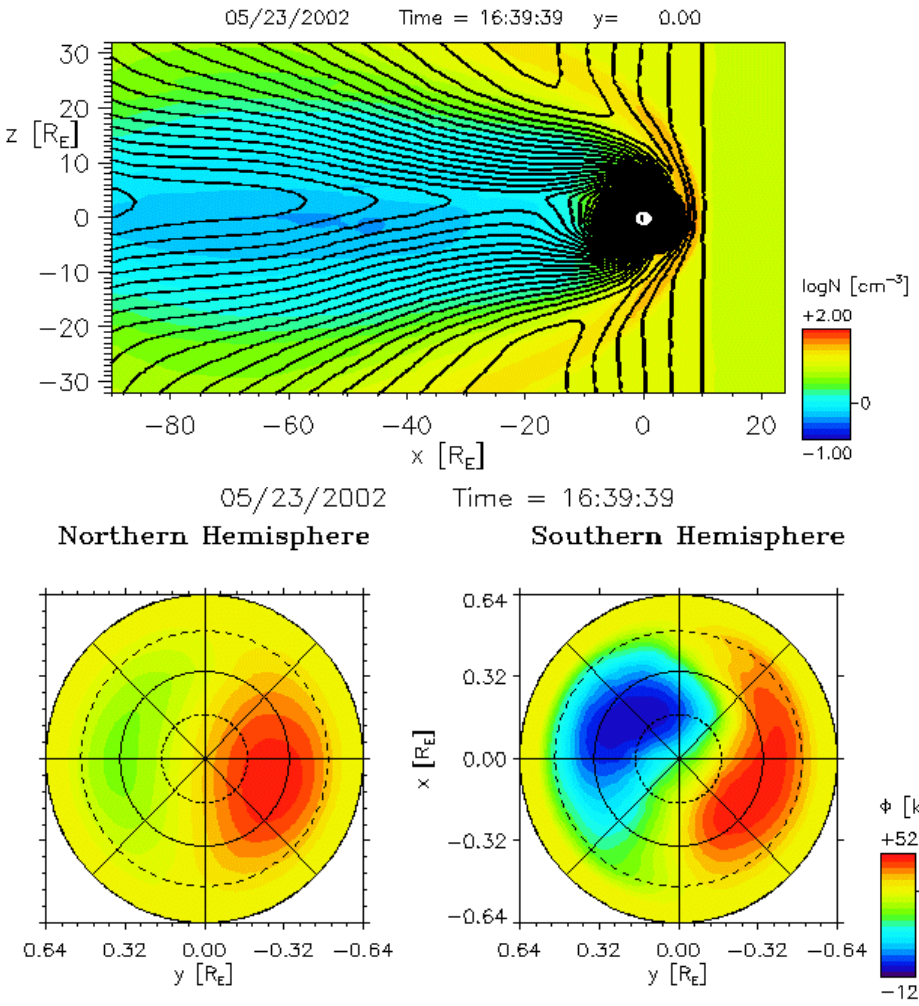
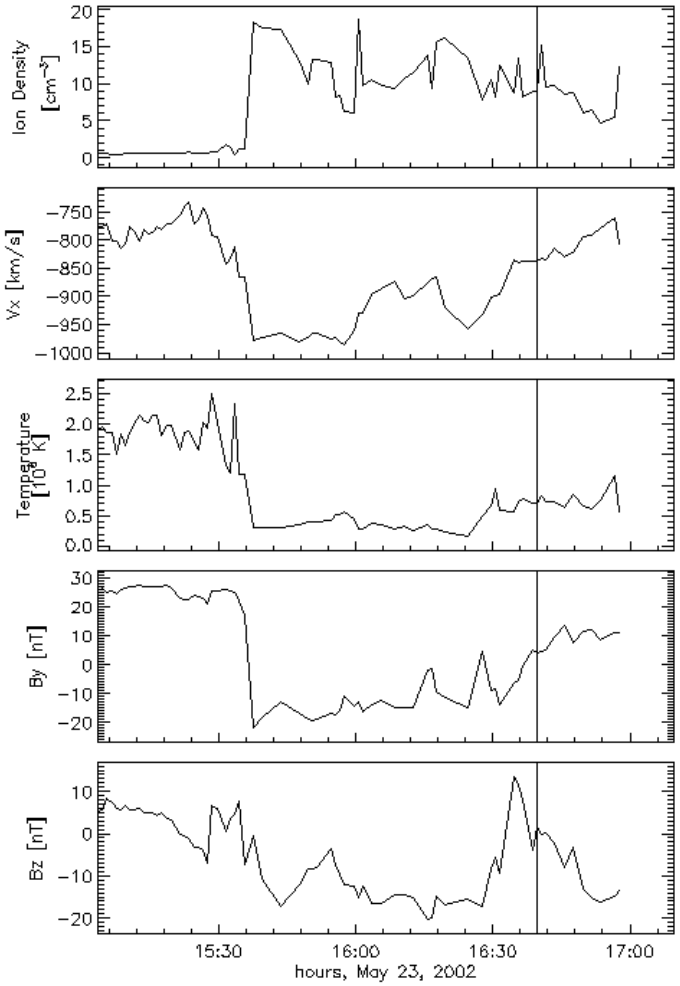




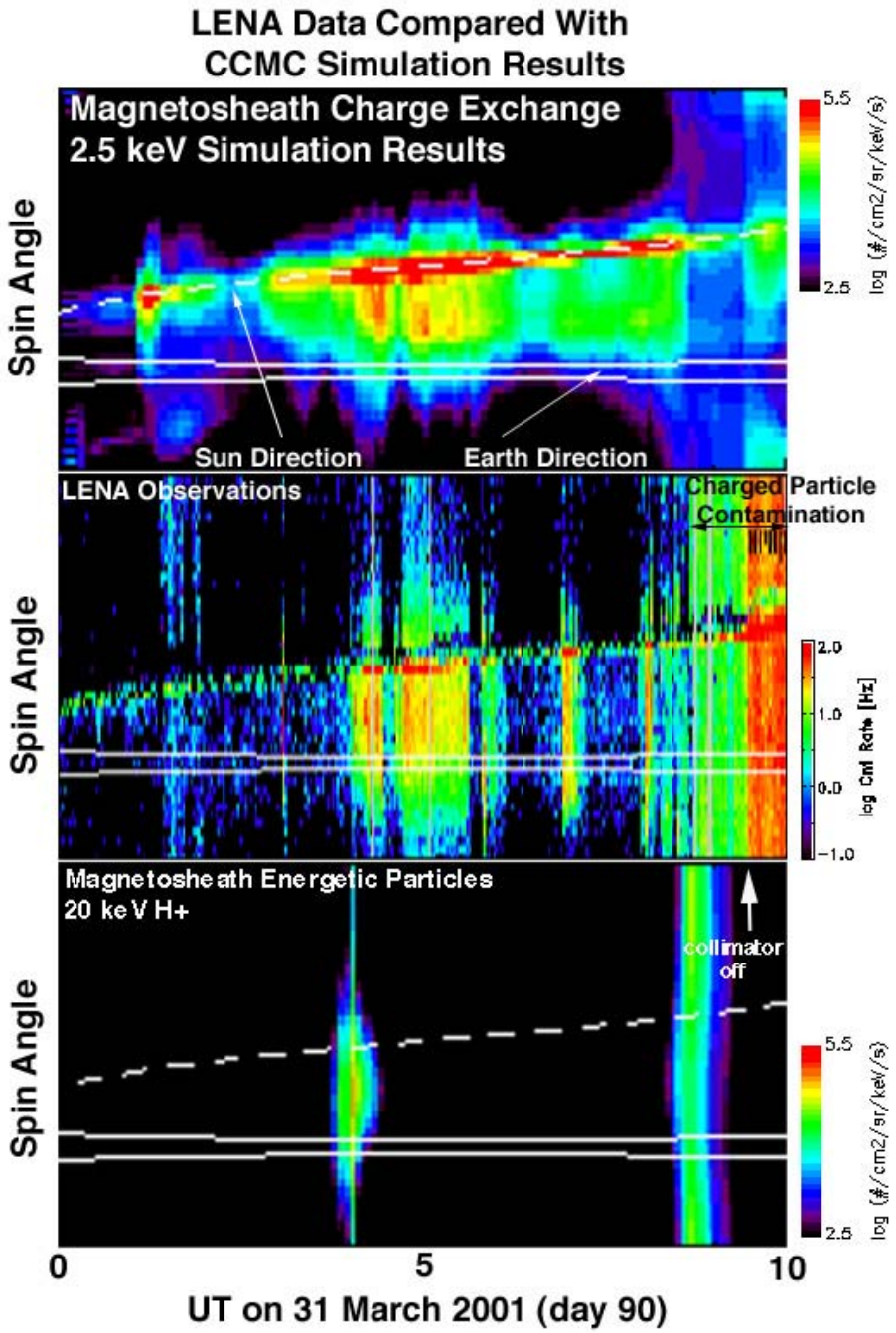
Experimental real time page at:
http://ccmc.gsfc.nasa.gov/cgi-bin/BATSRUSpred.cgi

Future Plans

- Support Living With a Star, NSWP, DoD Space Weather Transition Plan
  - CCMC supports and undertakes the R&D for advanced space weather prediction models
  - CCMC remains a multi-agency partnership
- Provide expanded, independent model evaluations
  - Model evaluations are both science-based, and metrics-based
- Provide strong service to research community
  - Runs-on-request support using modern space environment models
  - Access to model output tailored to researcher needs
- Expand scope and service
  - Cover Sun-to-Mud
  - Runs-on-request for testing and utility w. additional models
  - Expand model evaluations, coordinate with ops and research
  - Continue and expand model delivery to RPCs
- Collaborate with CISM

Community use of CCMC models (example)

- Run requested for March 31, 2001 storm
- Magnetosheath densities and temperatures used for charge exchange calculations
- Results of line-of-sight integrations compared to IMAGE/LENA observations
- Model provided analysis tool to researchers
- Analysis/comparison reveal model quality



plot courtesy M. Collier