

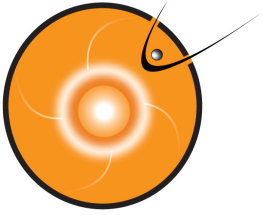
# Director's Report

*Michael Hesse*

<http://ccmc.gsfc.nasa.gov>

NASA Goddard Space Flight Center





# Workshop purpose

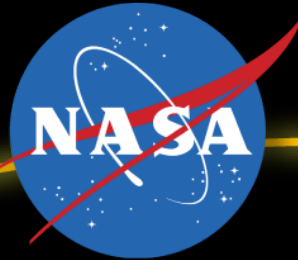
---

- Assess (evolution to) CCMC state-of-affairs
  - What went well
  - What could have gone better
- Provide input for future directions
  - Science service
  - Operations service
  - Collaborations with modelers
- Discuss other topics of interest

Our job is to listen to you...

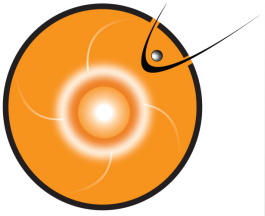
... begin by summary of current status





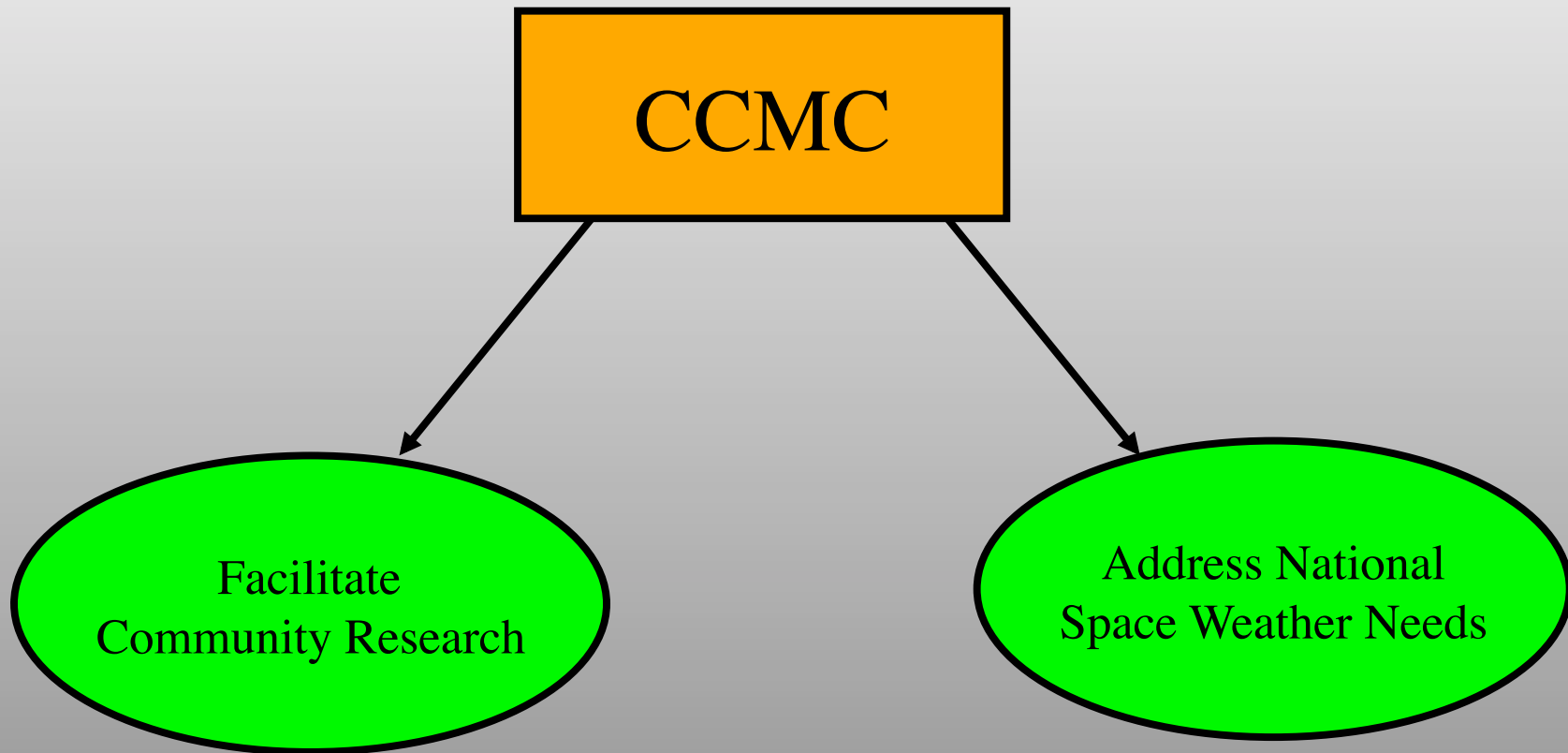
**“A US multi-agency partnership to enable, support, and perform the research and development for next generation space science and space weather models”**





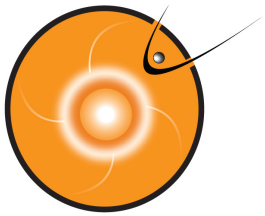
# CCMC goals

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International Research Community

NASA, DoD, and NOAA, other Space Weather needs



## CCMC Staff at NASA GSFC



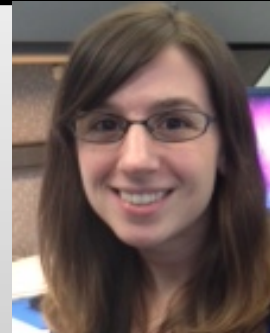
S. Bakshi



D. Berrios



A. Chulaki



R. Frolov



M. Hesse



M. Kuznetsova



P. MacNeice



M. Maddox



M. Mendoza



K. Patel



A. Pulkkinen



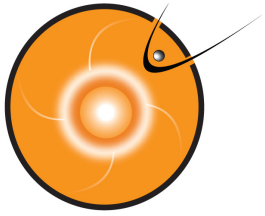
L. Rastaetter



A. Taktakishvili



J-S. Shim



# NASA Space Weather Center Staff

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H. Lee



L. Mays

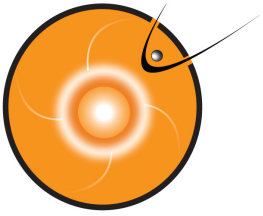


R. Mullinix

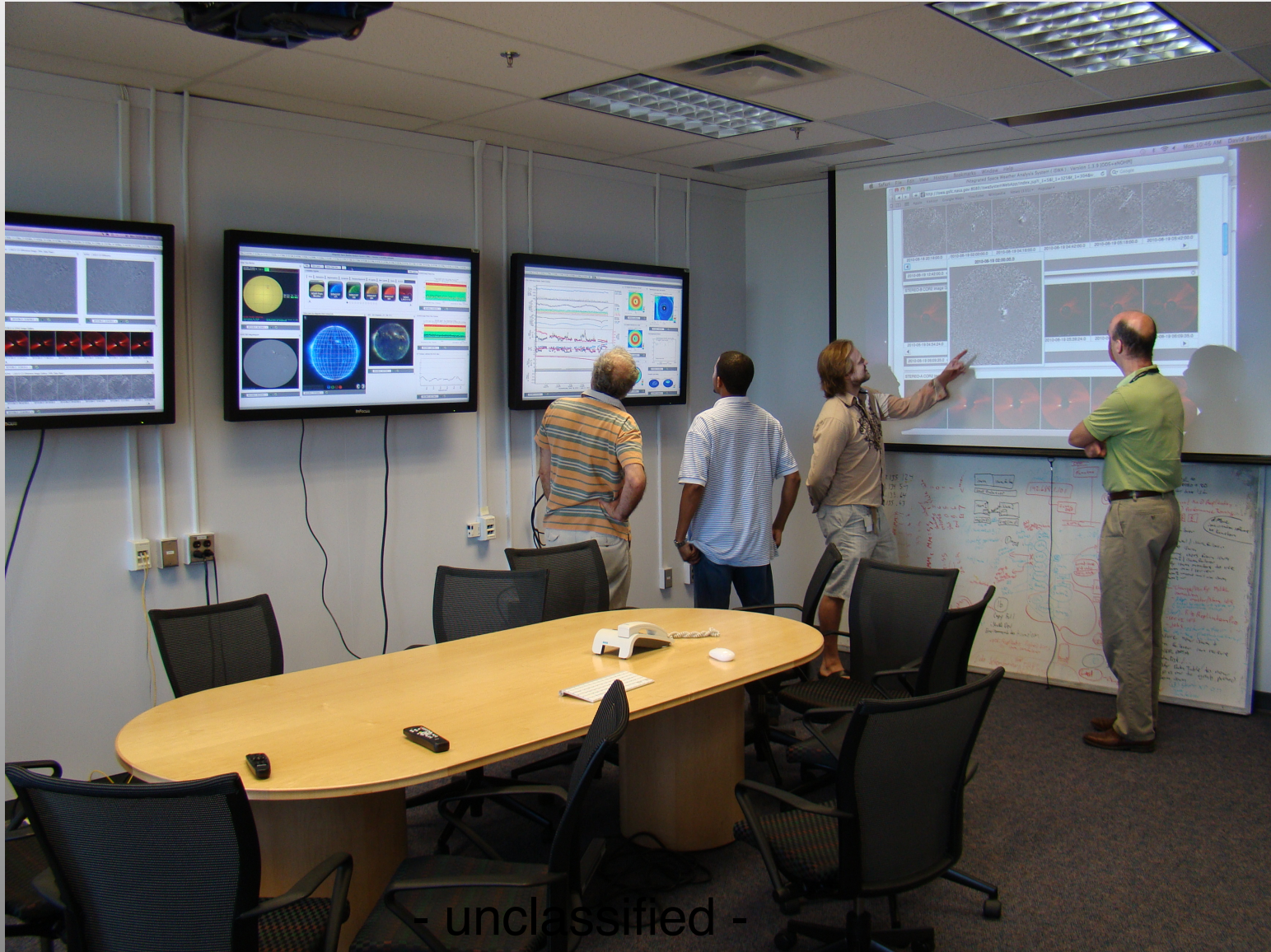


Y. Zheng

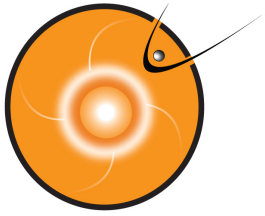




# Facility



- unclassified -

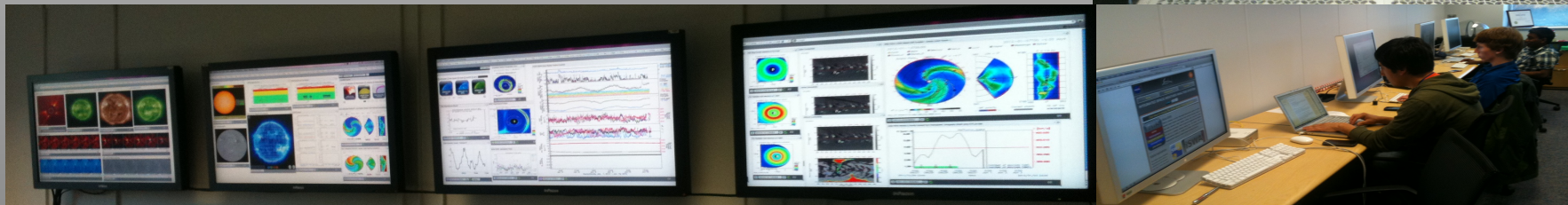


# Computational Resources

- **Dedicated Infrastructure**
  - 19 Rack Footprint
  - 5 Beowulf Clusters
  - 27 Enterprise Class Workstations
  - 1100 CPU Cores
  - .5 Petabyte of Storage
  - dedicated network
  - web, ftp, wiki, cvs, svn, file servers
- **Multi-Building Setup for High Availability and Failover**



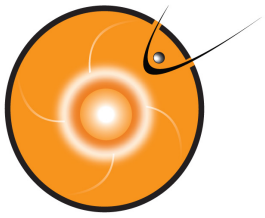
S.Bakshi, K. Patel



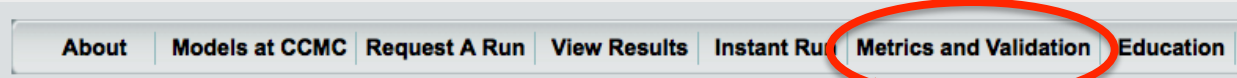


What is new?

An (incomplete) synopsis  
of changes and events 2010-2012



# New on the CCMC website



## Metrics and Validation at the CCMC

- GEM Metrics Challenge
- CEDAR ETI Challenge
- GEM-CEDAR Challenge
- SHINE Challenge

### Simulation Results Submission Interface

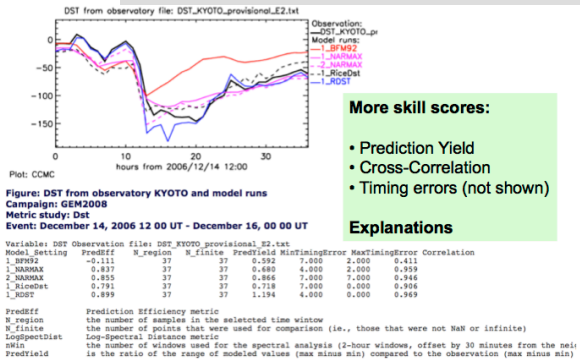
- Register a new model setting
- Submit your simulation results

### Simulation Results Analysis Tools

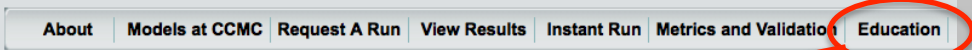
- Time series plotting tool (ionosphere/thermosphere)
- Time series plotting tool (magnetosphere)
- Runs for metric studies performed at the CCMC (ionosphere)
- Runs for metric studies performed at the CCMC (magnetosphere)

### Climatology Project

- The year of ISR observations (March 2007 - March 2008)



- More skill scores:**
- Prediction Yield
  - Cross-Correlation
  - Timing errors (not shown)
- Explanations**



## Educational materials

### CCMC Student Research Contest

### Illustrating space science using CCMC runs

Educational materials created by G.Siscoe on the basis of CCMC runs.

- Properties of Magnetic Dipoles
- Modules on Magnetospheric Physics
- Database of general purpose runs for education and research

### Heliophysics Summer Schools

- Heliophysics Summer School 2010
- Heliophysics Summer School 2011
- CCMC user help

### Introduction to CCMC tools and services

#### How to request a model run

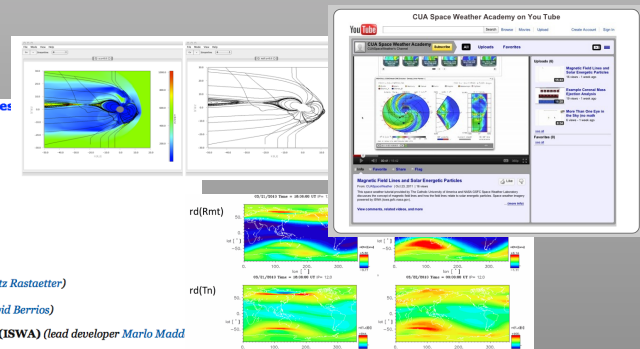
- How CCMC Runs on Requests work
- Request procedure
  - heliosphere runs
  - magnetosphere runs
  - ionosphere/thermosphere runs
- Instant runs

#### How to analyze simulation results

- On-line visualization tool (lead developer Lutz Rastaetter)
- Request run output in CDF format
- Space Weather Explorer (lead developer David Berrios)

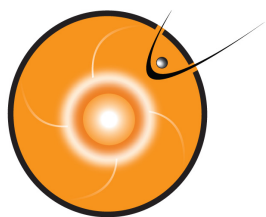
#### Integrated Space Weather Analysis System (ISWA) (lead developer Marlo Madd)

- ISWA home
- ISWA Tutorials



A. Chulaki, M. Mendoza





# New on the CCMC website

## Runs On Request interface improvements:

- Significantly expanded selection of options for run results analysis

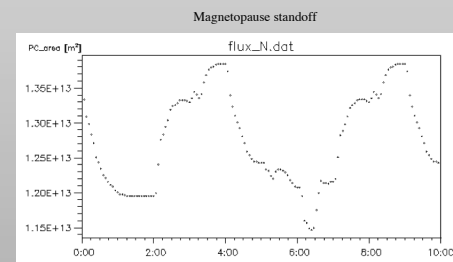
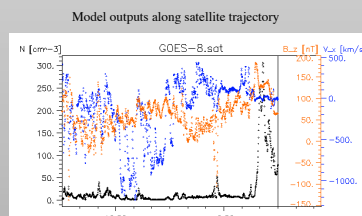
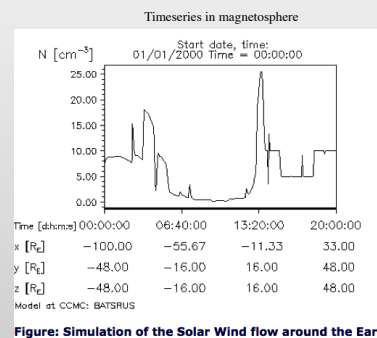
- View [Magnetosphere](#)
- Create [Timeseries in Magnetosphere](#)
- View [Ionosphere](#)

### View pre-computed timeseries data:

- Northern hemisphere polar cap flux and area
- Southern hemisphere polar cap flux and area
- Magnetopause standoff and closest approach
- Polar cap boundary at 24 magnetic local times
- Ionospheric dissipation

### View model outputs along satellite trajectories:

- GOES-10
- GOES-8
- GOES-9
- Geotail
- IMP-8
- Interball-Tail
- LANL-89



- Automatic Solar Wind input generation during run submission (for magnetospheric models)

### Solar wind input

**New:** Have CCMC generate the input automatically:

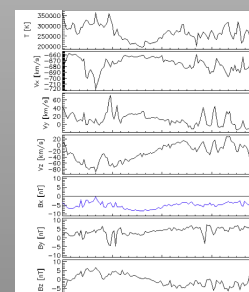
Occasionally, periods of missing data may be seen as linear sections within the solar wind plot at 1-minute cadence.

ACE real time data not available. The selected time interval starts before March 18, 2005.

ACE Level 2

WIND

Note that WIND data are not always available and WIND was not in the solar wind at all times. Refer to the [table of time intervals without valid solar wind data](#) before proceeding.



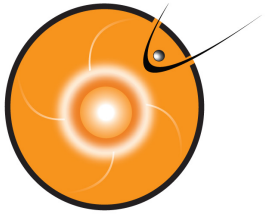
A. Chulaki, M. Mendoza

# Science user support

An abstract visualization of data paths or trajectories. It features a central cluster of red and grey lines, with yellow and grey lines extending outwards in various directions, creating a complex, interconnected network of paths. The background is black, making the colored lines stand out.

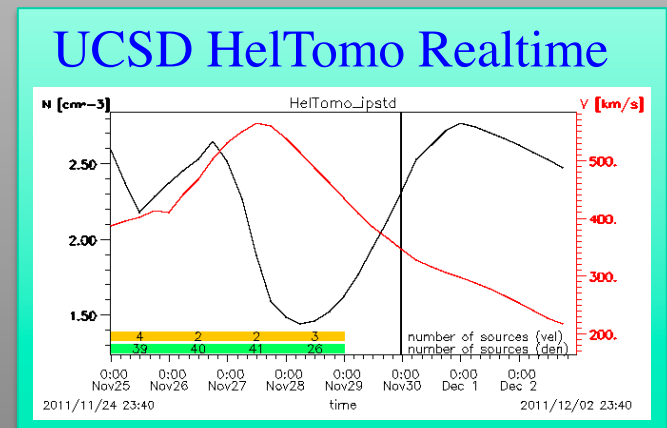
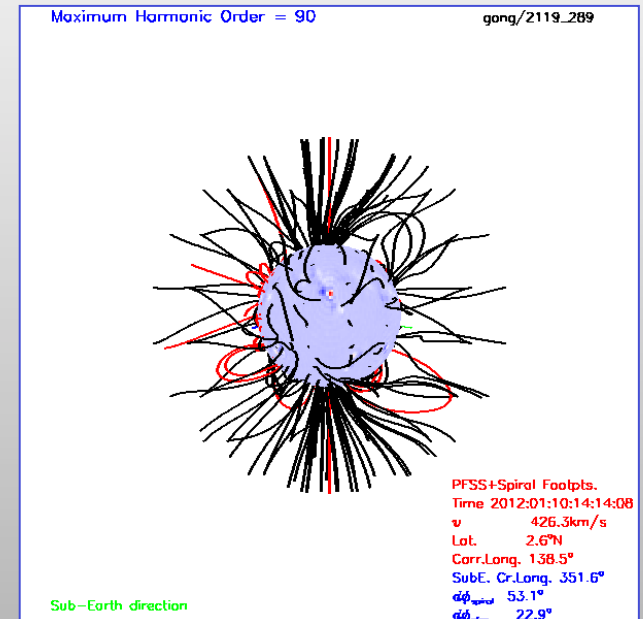
## Goals:

- One stop shopping for modern space science models
- Easy access to modern models for non-experts
- Simple-to-use, unified interfaces
- Advanced, tailored visualization tools
- Continuous improvements through user feedback

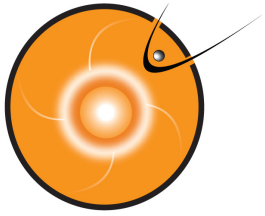


# Solar and Helio Model Inventory

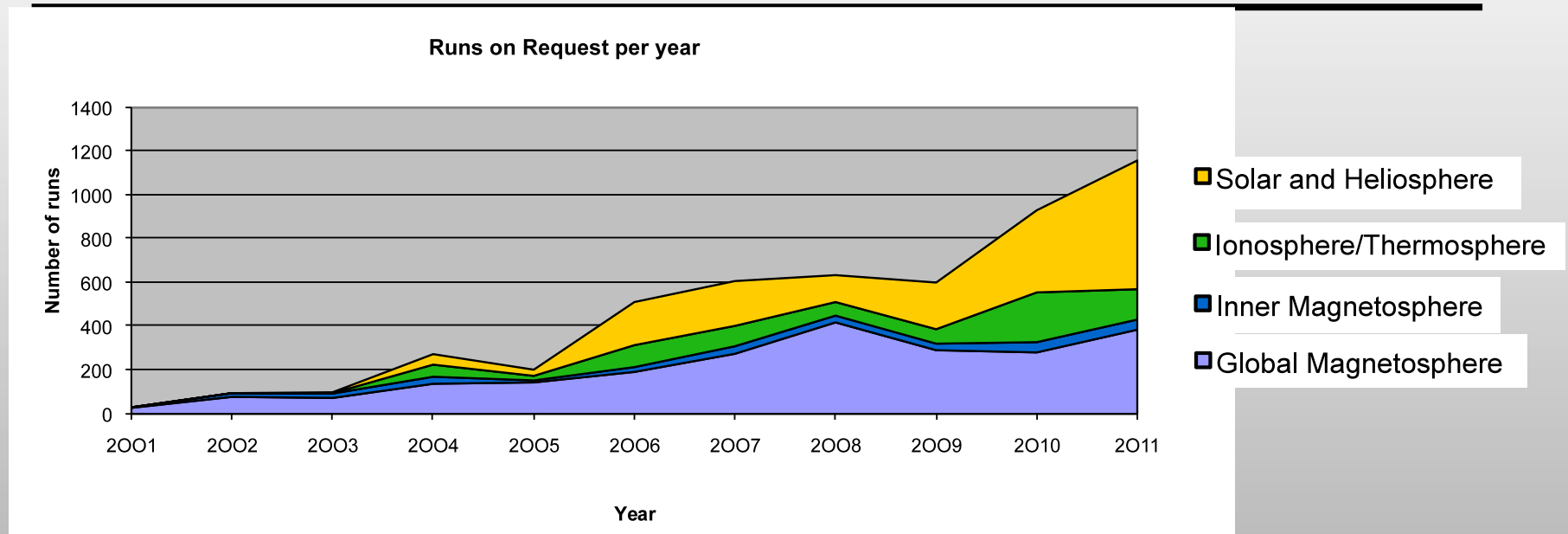
- WSA**                      Upgraded from v1.4.2 to v2.2
- ENLIL**                    Upgraded from v2.6 to v2.7  
v2.7d upgrade in progress
- CORHEL**                  Upgraded from v3.4.1 to v4.2  
v4.7 upgrade in progress
- SWMF**                    Upgrade in progress
- PFSS**
- HEL-TOMO**              Upgraded in June 2011  
Running in realtime since July 2011
- EMMREM**
- ANMHD**
- EXOSPHERIC SOLAR WIND**



P. MacNeice, A. Taktakishvili



# Solar and Helio Model ROR Statistics



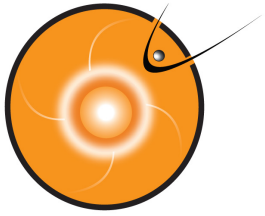
Runs before 2010 - 798

Runs since 2010 - 963 !!!

Runs to date - Total 1761

WSA	8
ENLIL/WSA	1383
SWMF	44
CORHEL	104
Hel-Tomo	61
PFSS	155
ANMHD	6

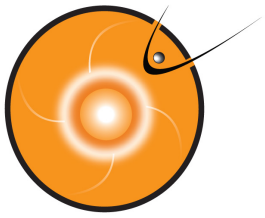
P. MacNeice, A. Taktakishvili



# Solar and Helio Model Validation

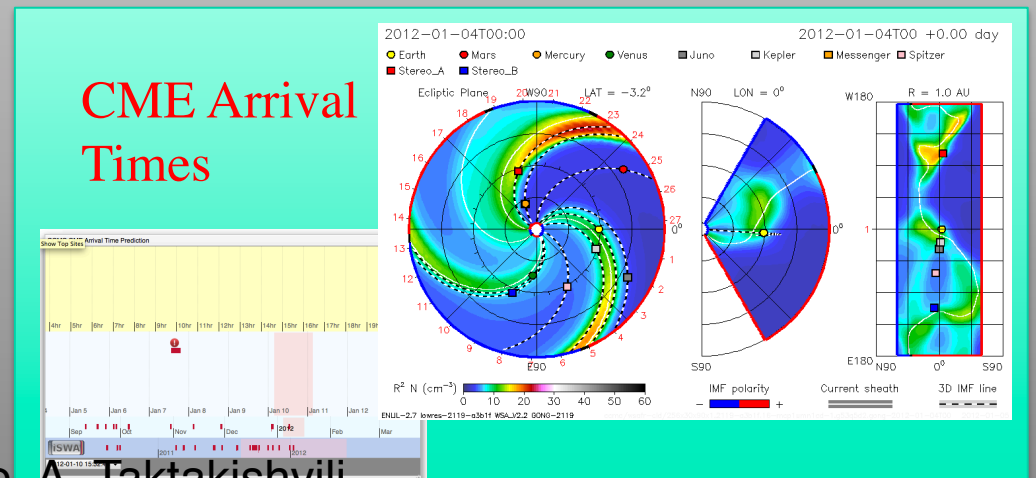
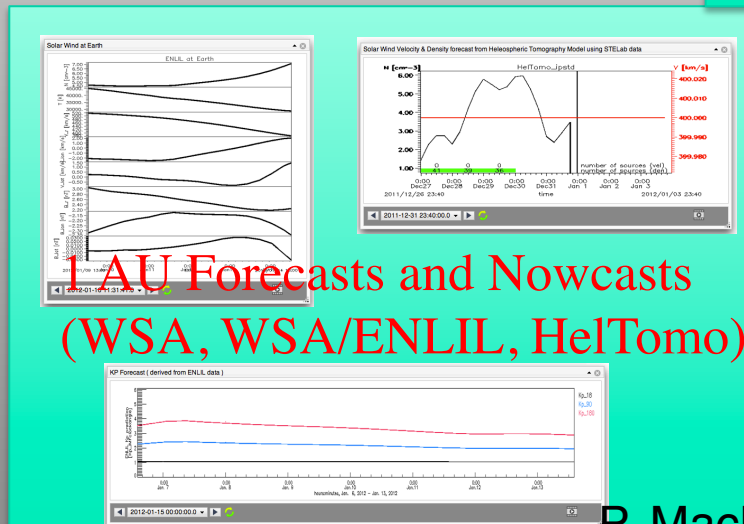
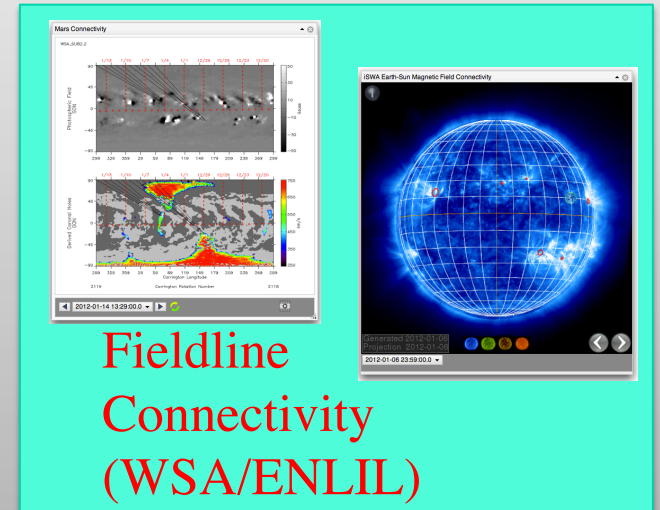
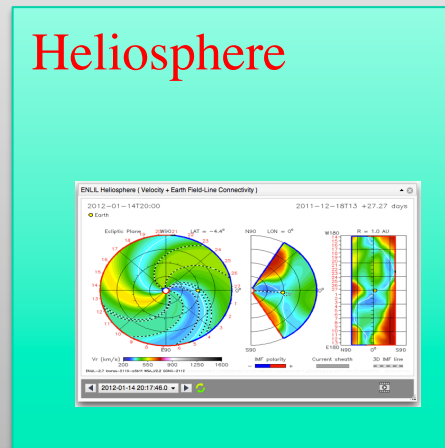
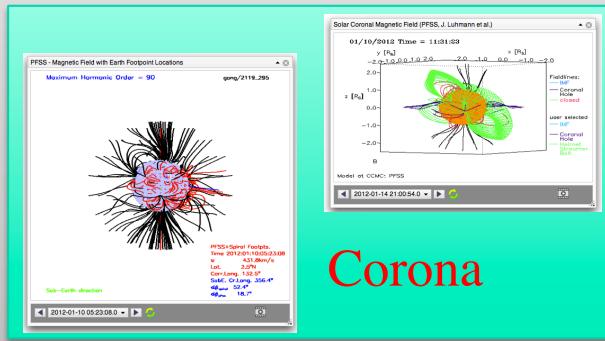
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- Published
  - Falkenberg et al – ‘Investigations of the sensitivity of a coronal mass ejection model (ENLIL) to solar input parameters’, June 2010.
  - Taktakishvili et al – ‘Model Uncertainties in predictions of arrival of CMEs at earth orbit’, June 2010.
  - Taktakishvili et al – ‘Modeling of CMEs that caused particularly large geomagnetic storms using ENLIL heliospheric cone model’, June 2011.
  - Falkenberg et al – ‘Evaluating Predictions of ICME arrival at Earth and Mars’, Sept 2011.
  - MacNeice et al – ‘Tracing Field lines in Heliospheric models’, Oct 2011
- Studies in Progress
  - UCSD Heliospheric Tomography – data collection phase
  - SHINE Challenge – definition phase
  - ENLIL ambient model validation – data collection phase
  - Realtime Cone Model – ‘manual’ and ‘ensemble’ modes

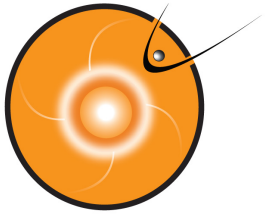


# Solar and Helio – New ISWA Products

ISWA has more than 65 widgets based on ‘realtime’ CCMC solar and helio model output!



P. MacNeice, A. Taktakishvili



# Solar and Helio Model Outlook

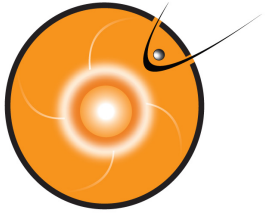
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- **New Models**

- SRPM Model - Irradiance LWS Strategic Capability, Fontenla *et al*
- Next Generation of SWMF and CORHEL
- ENLIL
  - cone model with internal structure
  - coupled with Luhmann shock front SEP model
- ADAPT3D + MAGIC – MacNeice *et al*
  - includes Wiegelmann Non-Linear Force Free Field Model
- Coronal Tomography – Frazin

- **Collaborations**

- Owens and Davis – using STEREO observations to set ENLIL inner boundary conditions



## Progress: magnetosphere

---

- CMIT

  - LFM-MIX now available for Runs-on-Request (RoR)

  - LFM-MIX-TIEGCM operational, available for RoR soon

  - LFM-MIX included in model validations.

- OpenGGCM

  - Version 4.0 operational

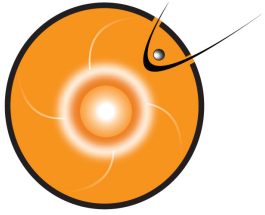
  - Included in model validations

  - Available for RoR soon

- Fok Radiation Belt

  - Running in real-time

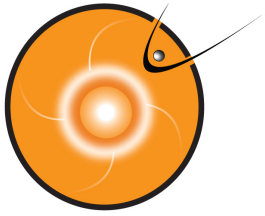




## Progress: magnetosphere

---

- SWMF 2011 version
  - Daily copy from SVN can be downloaded and tested against CCMC parameter configurations.
  - Operational
  - Available for RoR soon
- Plasmasphere model
  - Operational, Available for RoR



## Progress: magnetosphere

---

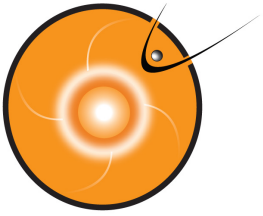
- Magnetosphere RoR submission interface reworked:

User selects solar wind monitor based on available data:  
ACE (K or L2 data), WIND (event runs)  
or uploads/defines solar wind input (modeled runs).

Low Mach numbers are detected and solar wind input boundary is adjusted.

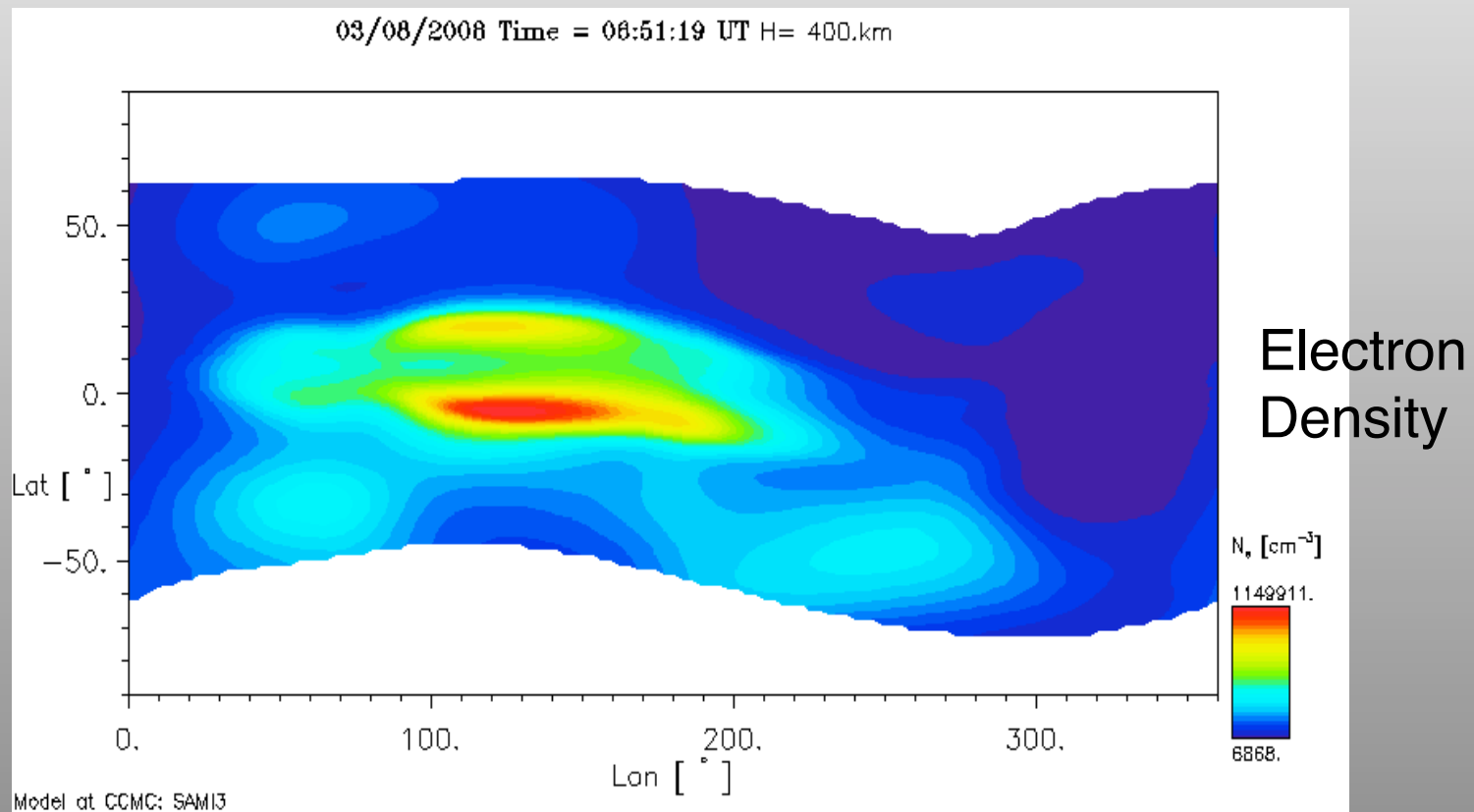
Value for  $B_x$  can be set to a pre-set constant or to the average value of the solar wind input.

Minimum-variance parameters ( $b_0$ ,  $a$ ,  $b$ ) for  
 $B_x = B_{x0} + a * B_y + b * B_z$  to be computed and offered soon.

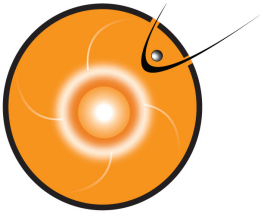


# Progress in ITM Modeling

- SAMI3 upgrade from SAMI2

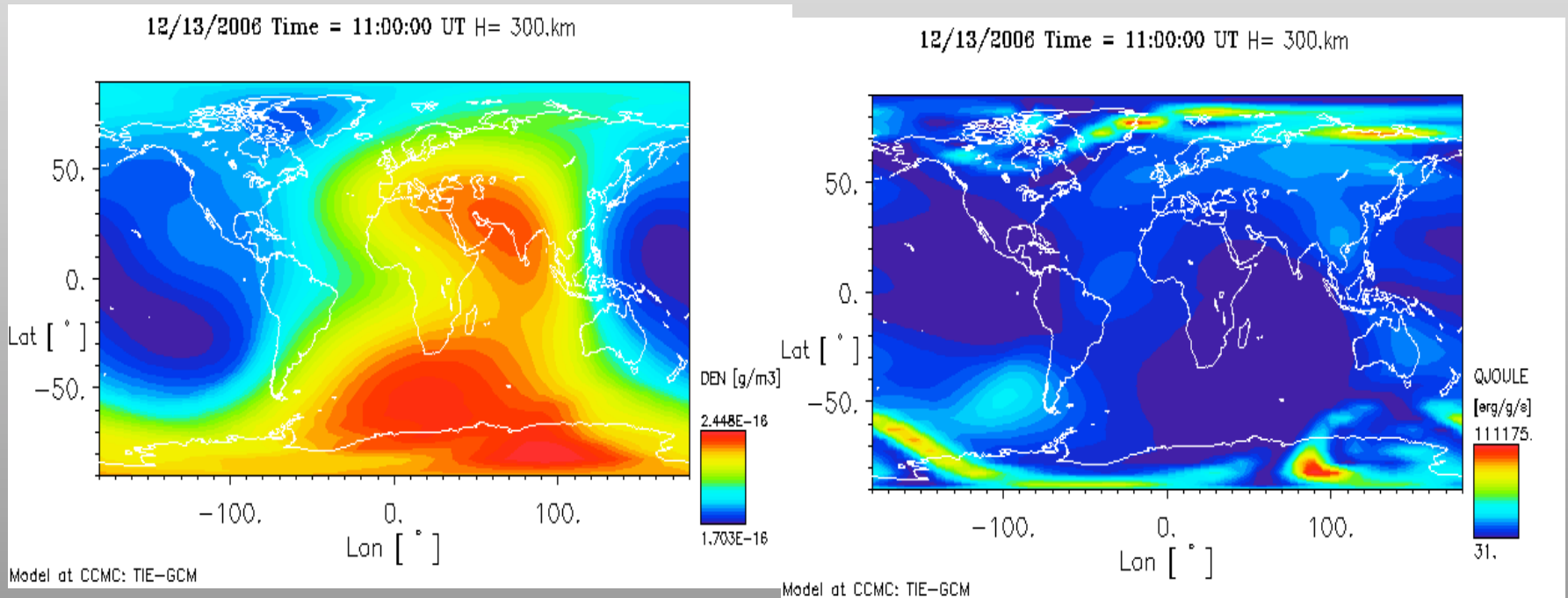


J.-S. Shim, M. Kuznetsova, L. Rastaetter



# Progress in ITM Modeling

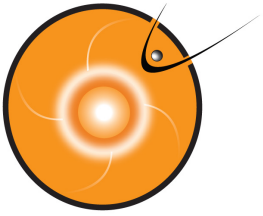
- TIE-GCM upgrade from 1.93 to 1.94
- TIE-GCM1.94 driven by Weimer 2005 was added



Neutral Mass Density

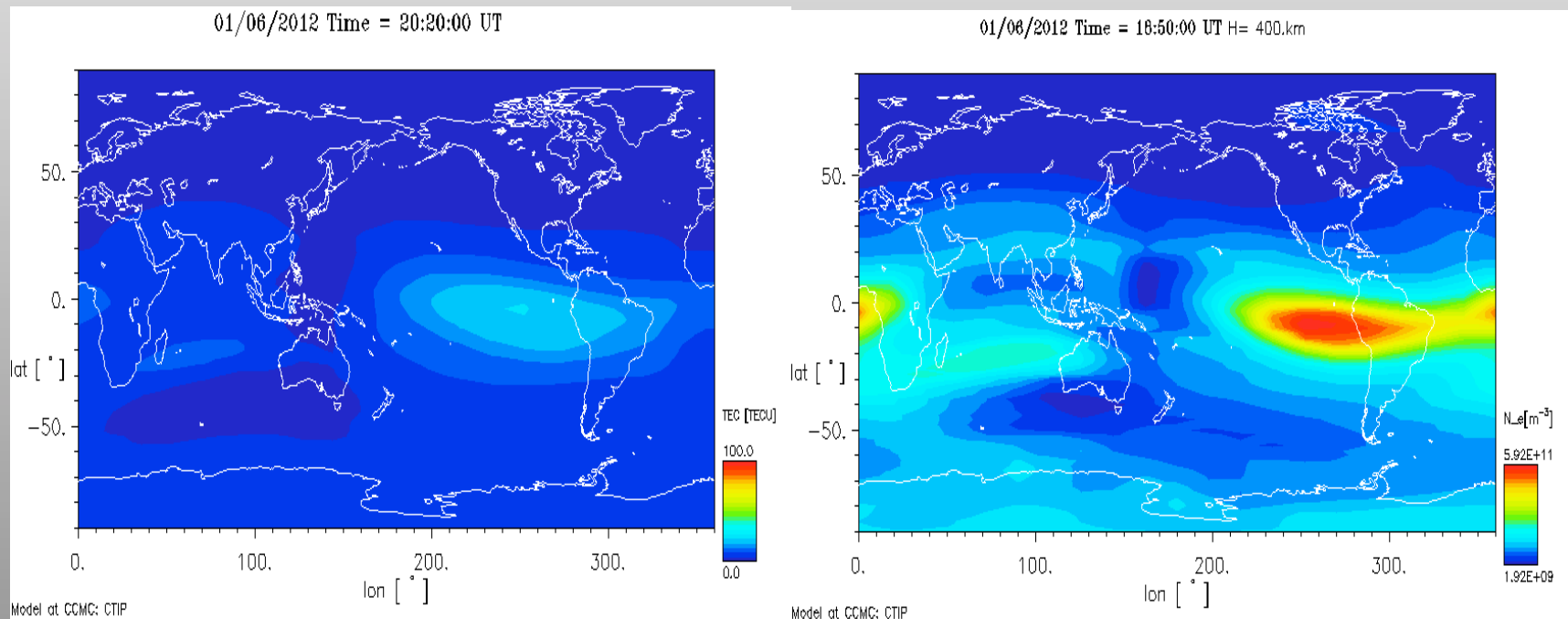
Joule Heating

J.-S. Shim, M. Kuznetsova, L. Rastaetter



# Progress in ITM Modeling

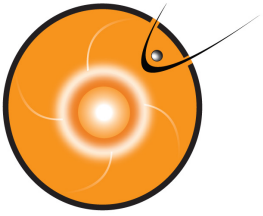
- CTIPe has replaced CTIP for RoR
- Real Time Run of CTIPe for space weather applications



TEC

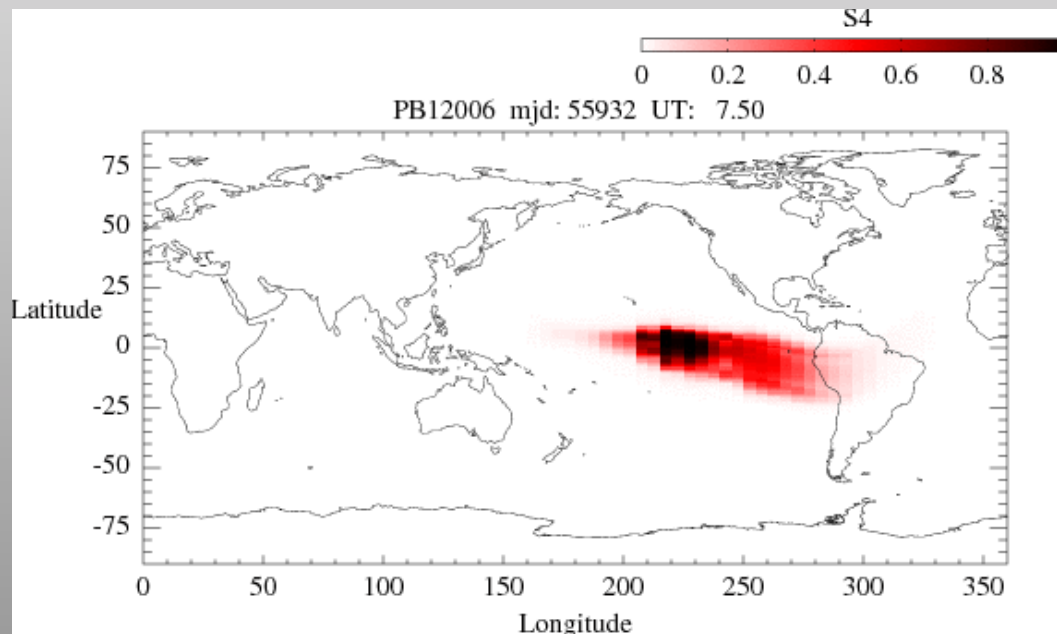
Electron Density

J.-S. Shim, M. Kuznetsova, L. Rastaetter



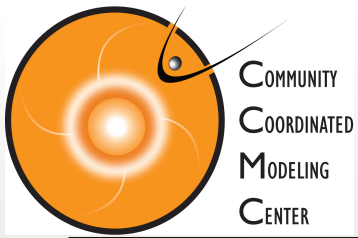
# Progress in ITM Modeling

- PBMOD is running in real time in test mode
- PBMOD for both RoR and real time run will be available soon

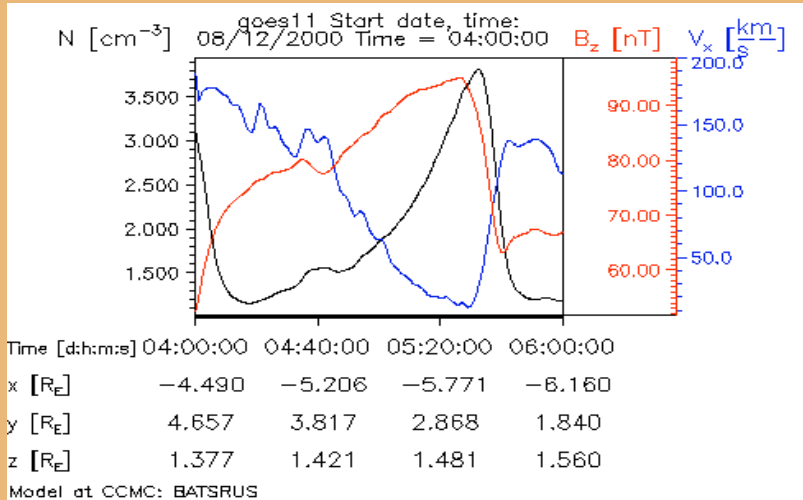


S4 for UHF (250 MHz)

J.-S. Shim, M. Kuznetsova, L. Rastaetter



# Progress: visualization



Exclude region around the Earth up to 6 R<sub>E</sub>

Use satellite track

Use satellite name at SSCWeb:

**Note:** Satellites may not always model data may be unavailable

Image magnification  (all images; use >=1.25 for 3D)

quantity to be displayed (some P...):

des:

- Geotail
- GOES-10
- GOES-11
- GOES-8
- GOES-9
- IMAGE
- IMP-8
- Interball-Tail
- LANL-89
- LANL-90
- LANL-91
- LANL-94
- LANL-97
- Moon
- Polar

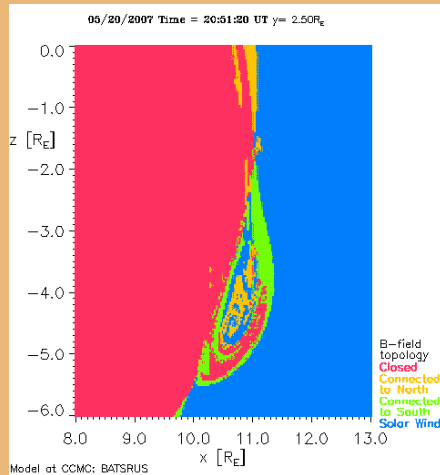
“Use Satellite Track” option with list of applicable satellites

## Time-series generation and plots

- Track satellites through 3D magnetosphere or follow single position (or line in space) in time.
- Over-sampling possible in time.

L. Rastaetter

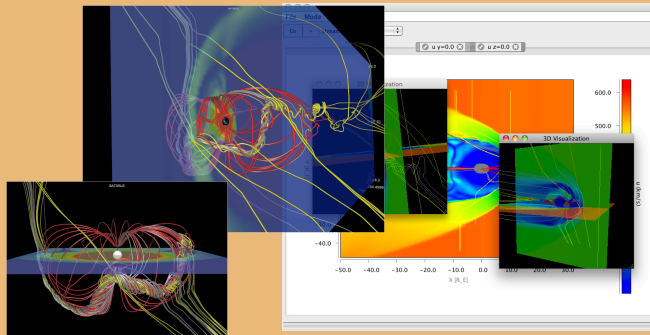
# Progress: visualization



## Magnetic topology for magnetosphere models

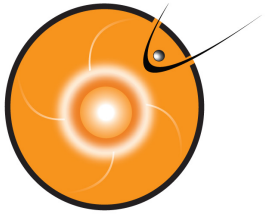
- Field lines started on adaptive grid in cut plane.
- Available as single plot or in Movie-on-Request

## Space Weather Explorer 2



- Completely rewritten using Java OpenGL 2
- Java webstart application

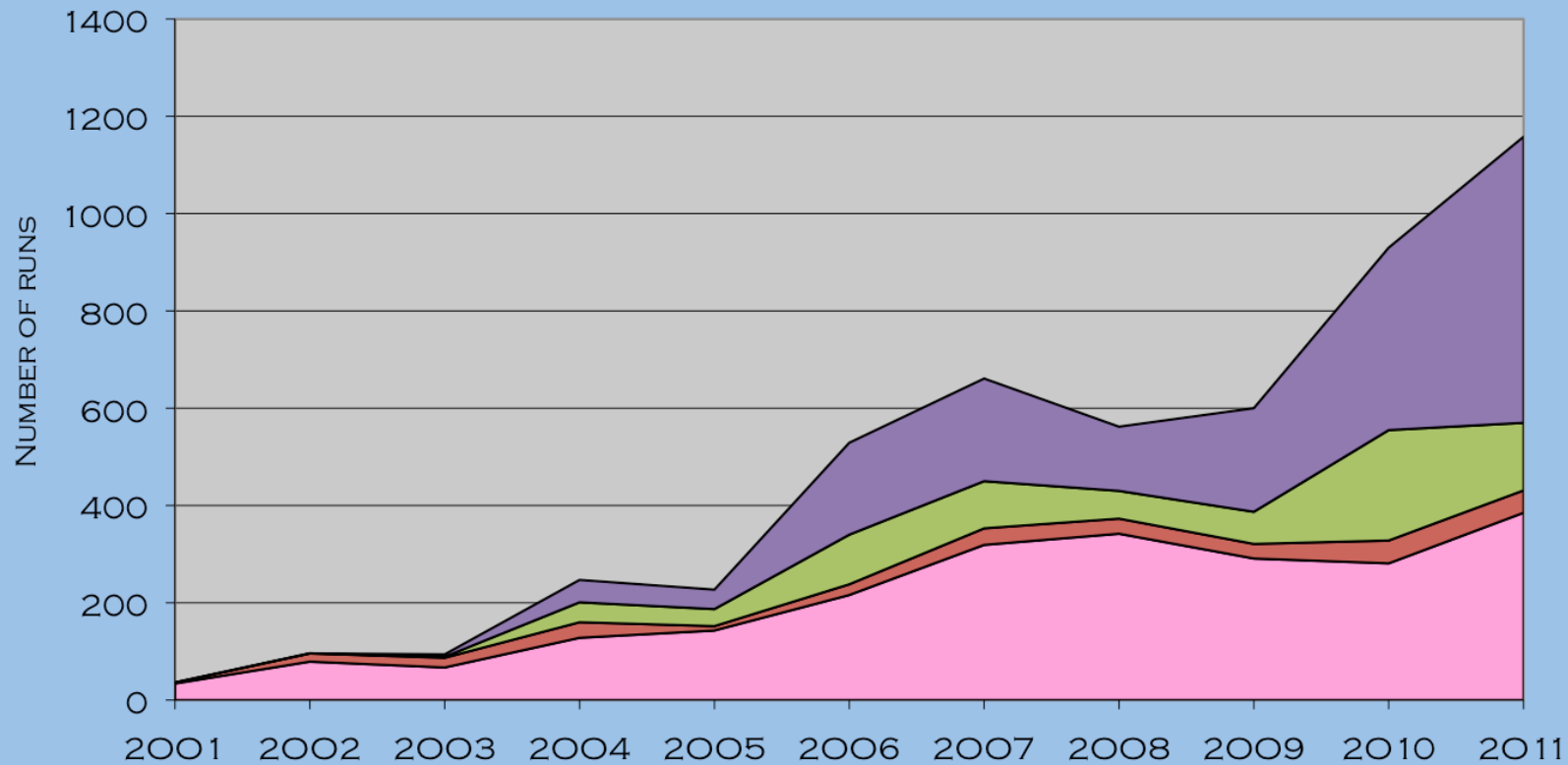




# Runs-On-Request Usage Summary

## Total ROR Runs by Domain

RUNS ON REQUEST - EXECUTED PER YEAR

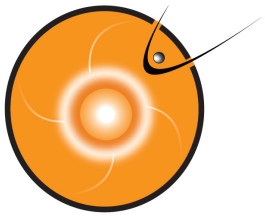


Year (last 3 yrs)	GM	IM	IT	SH
2009	291	30	66	213
2010	281	47	227	375
2011	385	46	139	588
<b>TOTAL (2001-2011)</b>	<b>2303</b>	<b>290</b>	<b>765</b>	<b>1782</b>

YEAR

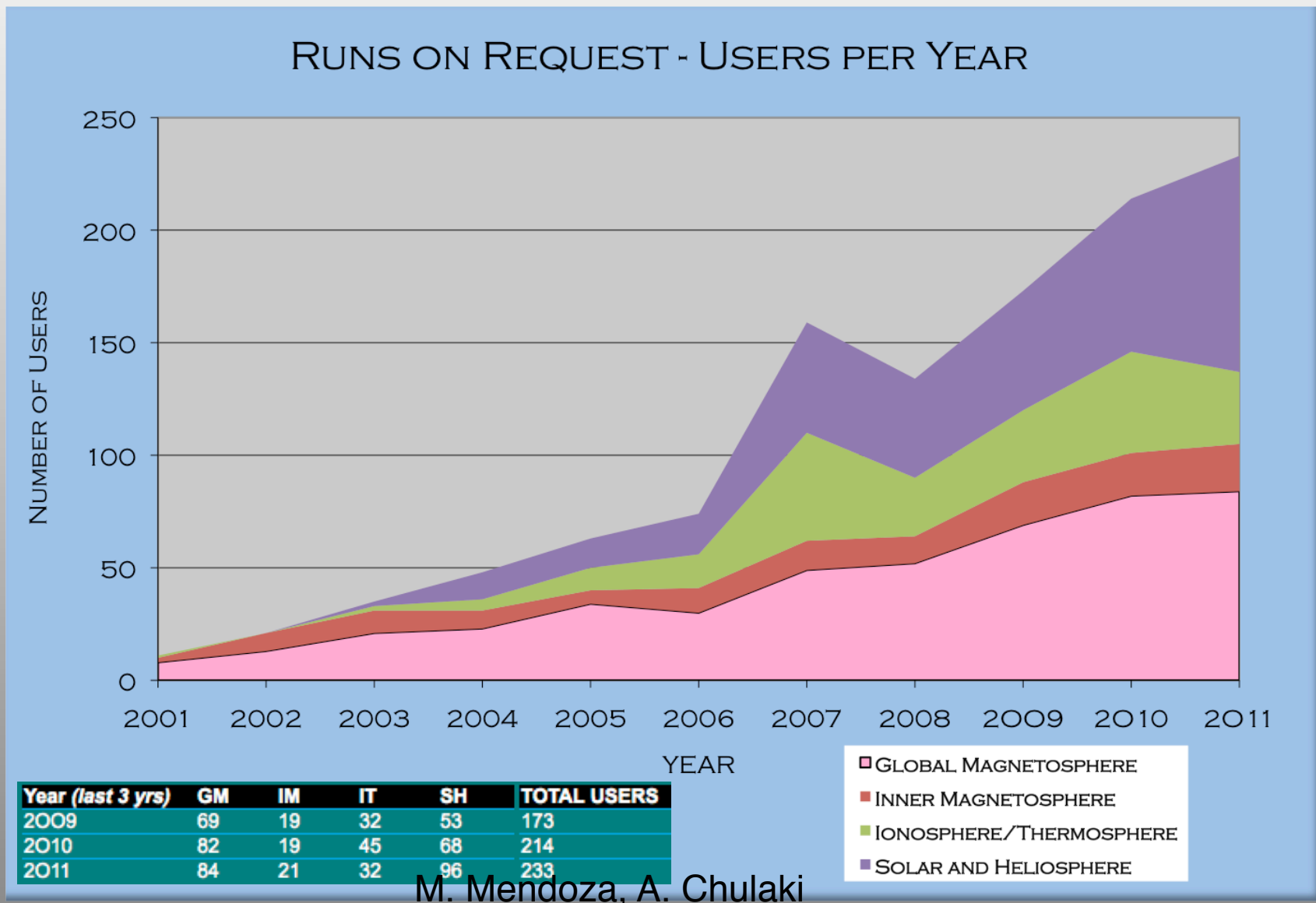
- GLOBAL MAGNETOSPHERE
- INNER MAGNETOSPHERE
- IONOSPHERE/THERMOSPHERE
- SOLAR AND HELIOSPHERE

M. Mendoza, A. Chulaki

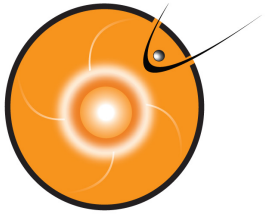


# Runs-On-Request Usage Summary

## Total ROR Users per Year



M. Mendoza, A. Chulaki



# Runs-On-Request Model Additions

New Model Additions to Runs-On-Request and Instant Runs:

▪ Magnetosphere

<b>CMIT/LFM-MIX</b>	John Lyon, Wenbin Wang, Slava Merkin, Mike Wiltberger, Pete Schmitt, and Ben Foster	Dartmouth College/NCAR-HAO/JHU-APL/CISM
<b>WINDMI</b>	W. Horton, M. L. Mays, E. Spencer and I. Doxas	Univ. of Texas at Austin
<b>plasmisphere model</b>	Viviane Pierrard	IASB-BIRA

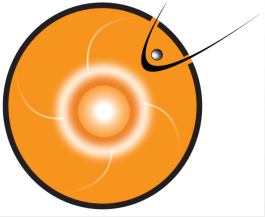
▪ Ionosphere/Thermosphere

<b>SAMI3</b>	Joseph Huba, Glenn Joyce, Marc Swisdak	NRL and Icarus Research, Inc.
<b>CTIPe</b>	Timothy Fuller-Rowell et al	NOAA SEC
<b>TIE-GCM</b>	R. G. Roble et al.	HAO NCAR

▪ Solar/Heliosphere (*almost complete*)

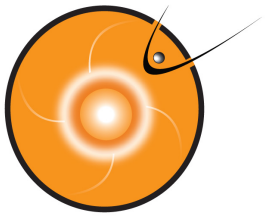
<b>CORHEL MAS/WSA ENLIL/MAS</b>	J. Linker, Z. Mikic, R. Lionello, P. Riley, N. Arge, D. Odstrcil	PSI, AFRL, U.Colorado
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M. Mendoza, A. Chulaki, Team



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# Space Weather Support



# NASA/GSFC Space Weather Center

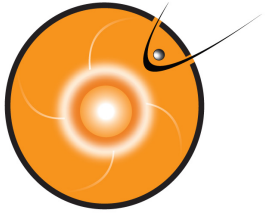
A sibling organization to CCMC



**Objectives: provide the latest space weather information/forecast to NASA's robotic mission operators, as well as other (national/international) partners.**

Dryden Flight Research Center



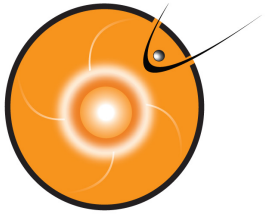


## CCMC Support for NASA/GSFC Space Weather Center

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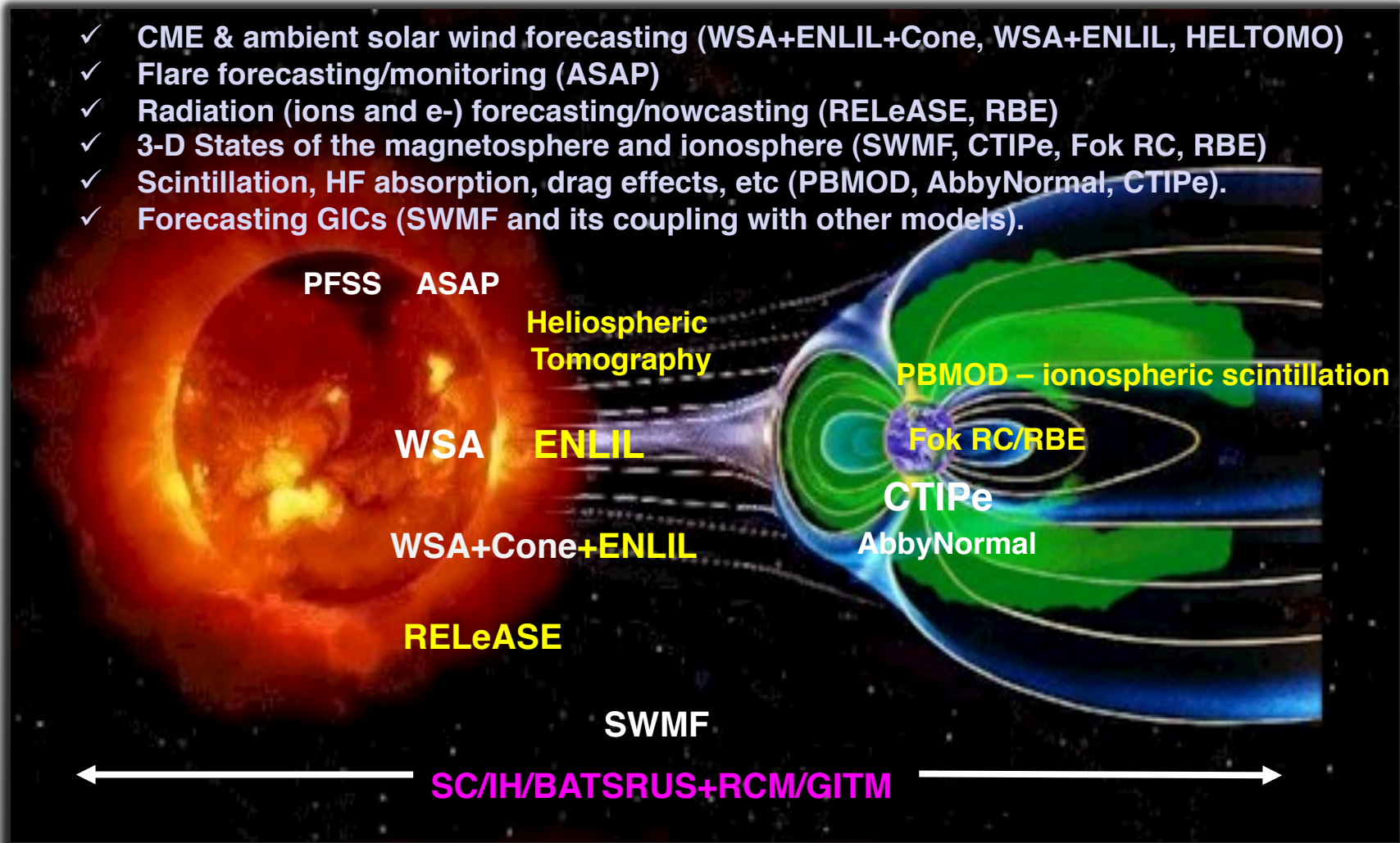
- Real-time run of major models throughout the space weather domain for forecasting and nowcasting purposes
- Automated procedures/tools for ingesting/displaying (near) real-time data to support space weather services
- Tailored products along specific orbits/spacecraft (e.g., ISS, RAX, CALIPSO).
- Model validation (e.g. interplanetary field-line connectivity, cone model and CME simulations).



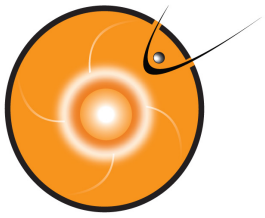


# Models Running in Real-Time

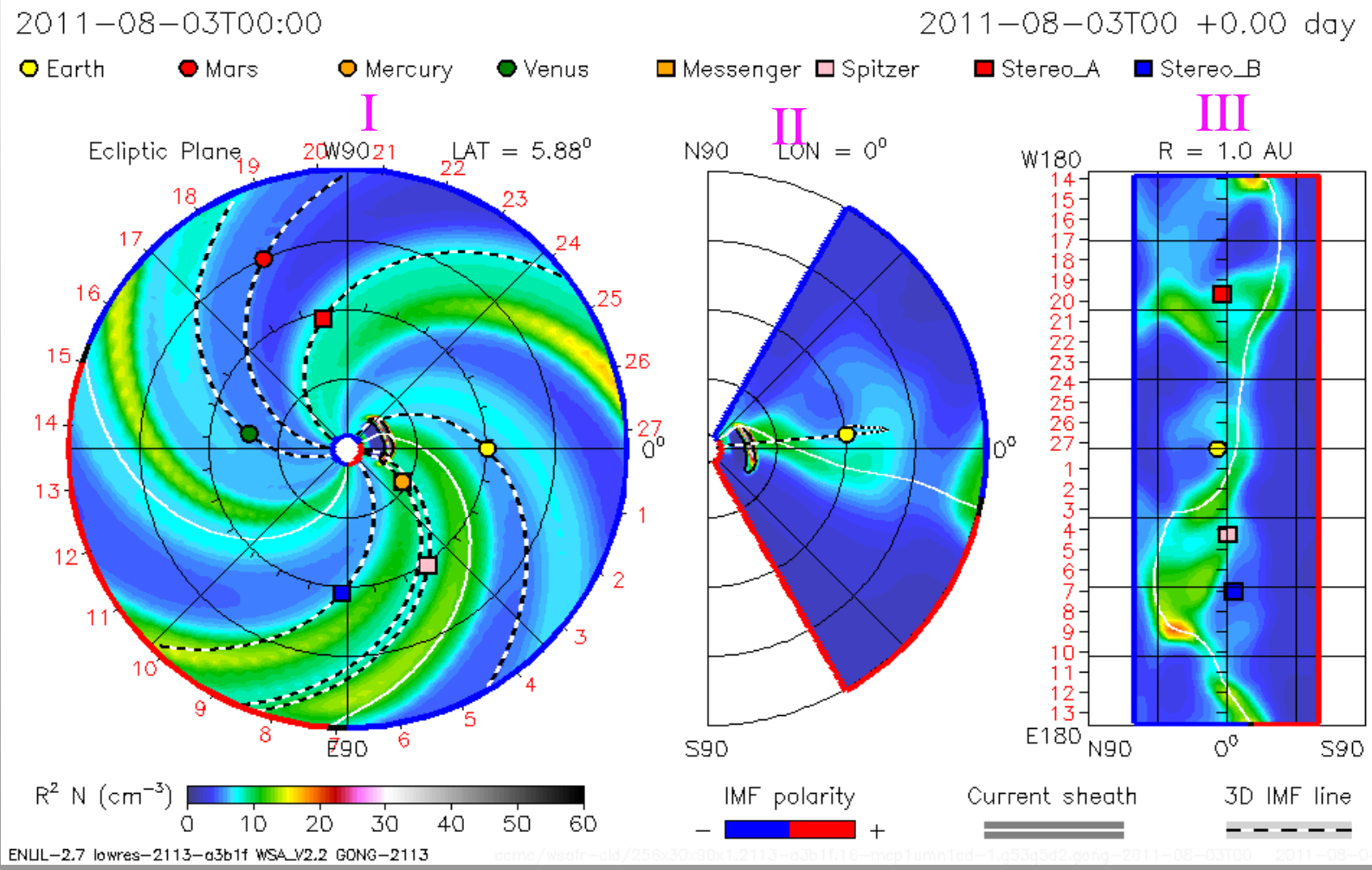
- ✓ CME & ambient solar wind forecasting (WSA+ENLIL+Cone, WSA+ENLIL, HELTOMO)
- ✓ Flare forecasting/monitoring (ASAP)
- ✓ Radiation (ions and e-) forecasting/nowcasting (RELeASE, RBE)
- ✓ 3-D States of the magnetosphere and ionosphere (SWMF, CTIPe, Fok RC, RBE)
- ✓ Scintillation, HF absorption, drag effects, etc (PBMOD, AbbyNormal, CTIPe).
- ✓ Forecasting GICs (SWMF and its coupling with other models).



A. Pulkkinen, Y. Zheng, A. Taktakishvili, H. Lee, L. Mays, A. Chulaki, M. Kuznetsova  
Team



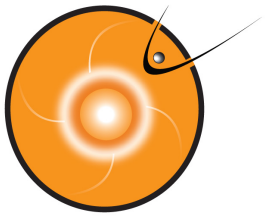
# Modeling Highlight CME Forecasting



1-2 day lead-time forecasting

A. Pulkkinen, Y. Zheng, A. Taktakishvili, H. Lee, L. Mays, A. Chulaki, M. Kuznetsova



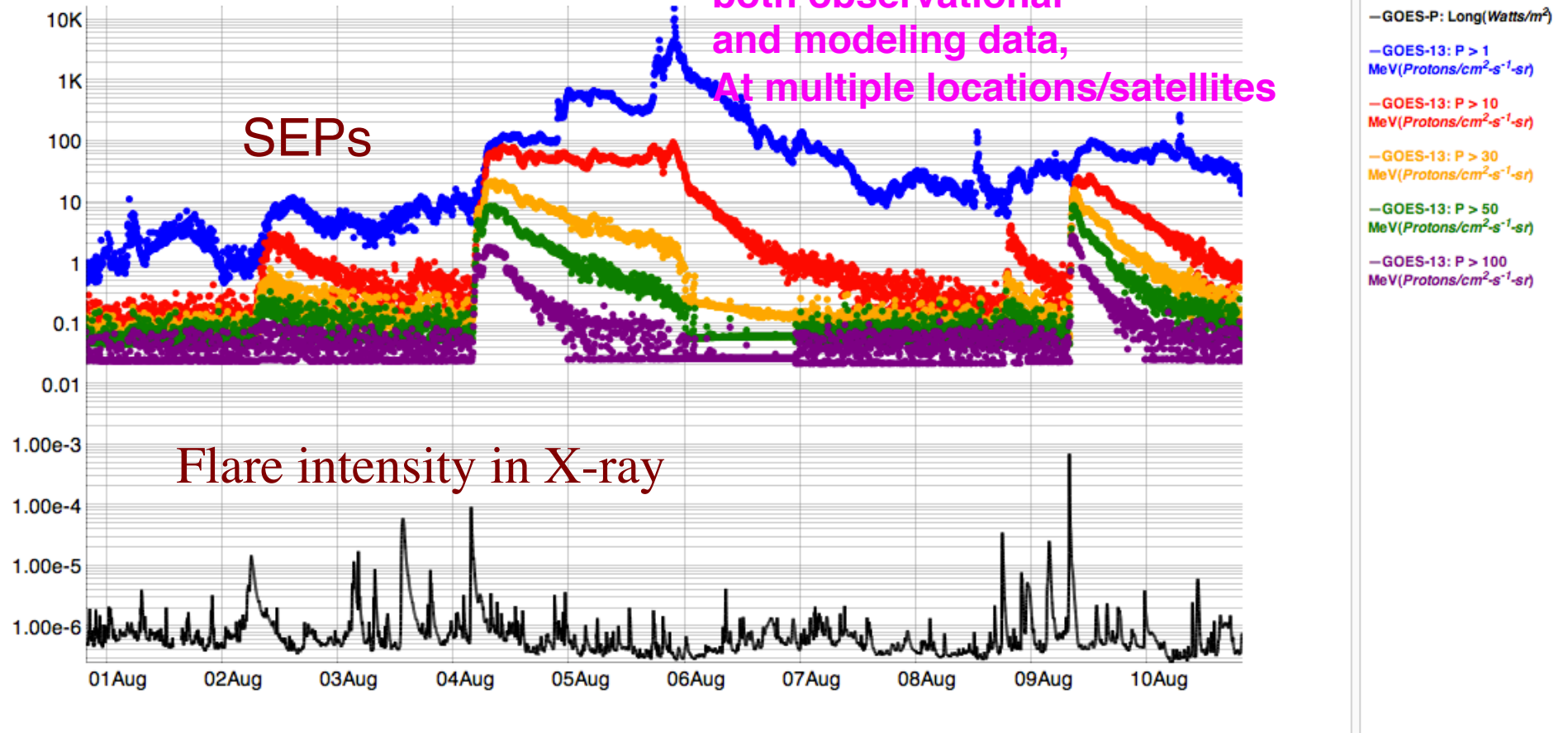


# Tools/Vis. Highlight

Super timeline showing the SEP events in early Aug, 2011

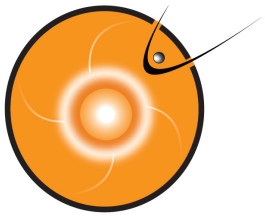
SWA Custom Timeline Cygnet

Interactive, dynamic  
both observational  
and modeling data,  
At multiple locations/satellites



2011-08-10 20:00:00.0 Settings Select Data

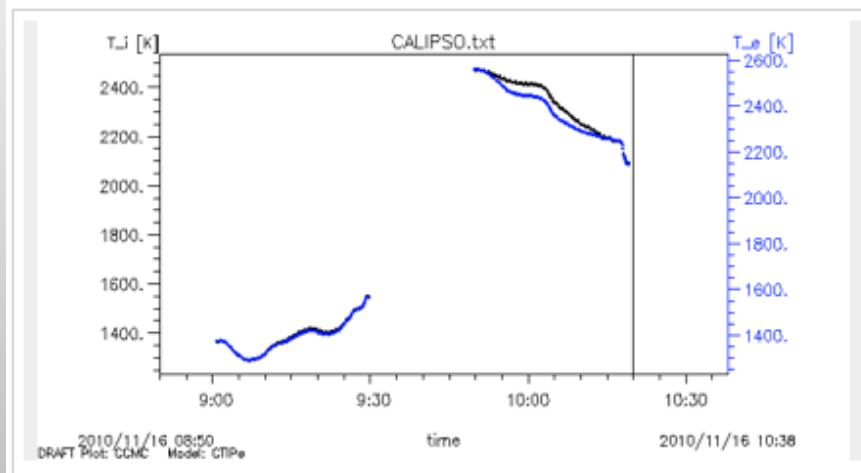
A. Pulkkinen, Y. Zheng, A. Taktakishvili, H. Lee, L. Mays, A. Chulaki, M. Kuznetsova



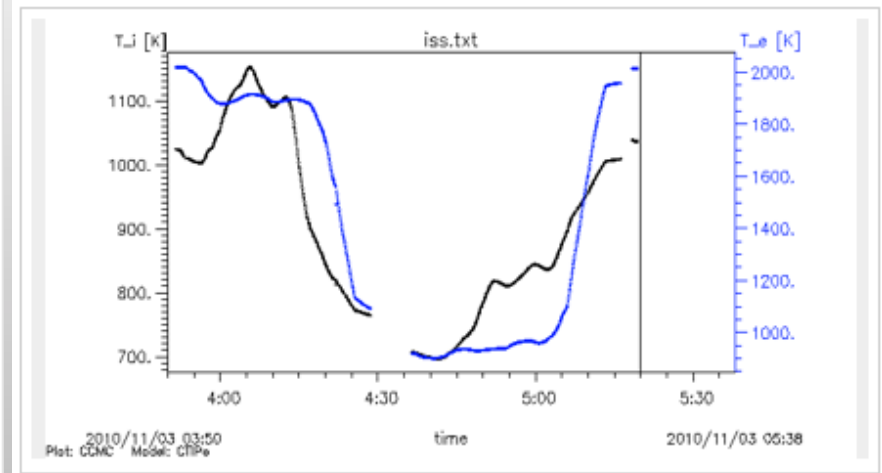
# Tailored Product Highlight

## CTIPe at CALIPSO and ISS

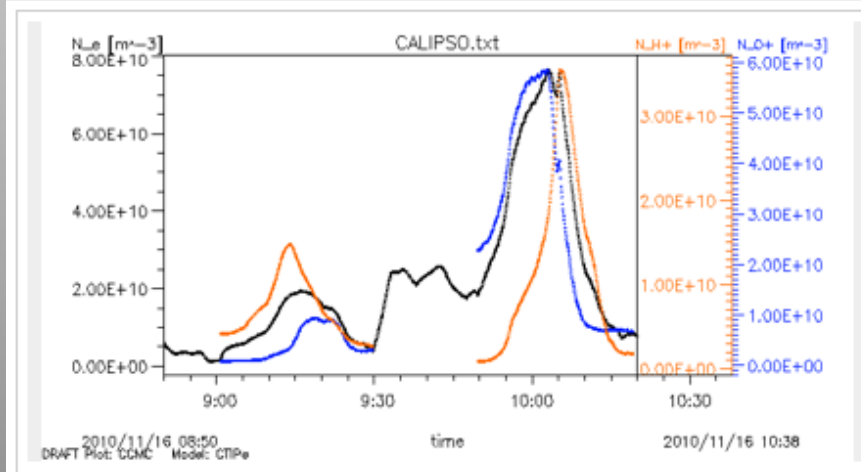
CTIPe - T at CALIPSO Satellite



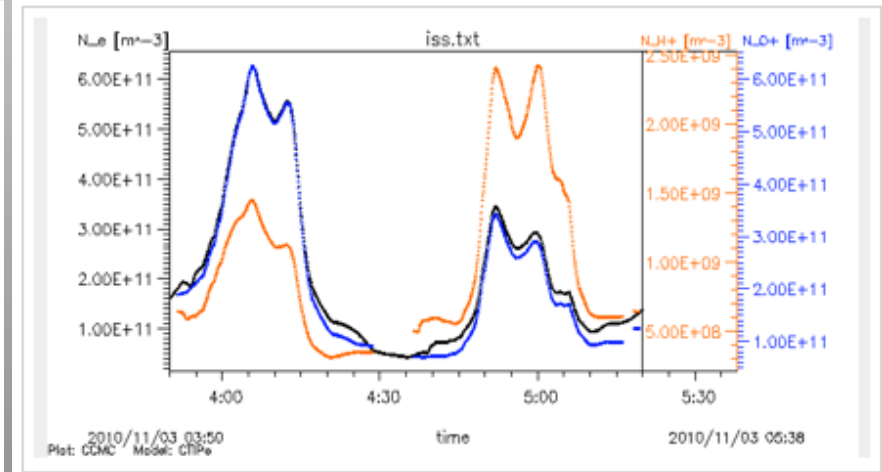
CTIPe - T at International Space Station



CTIPe - N at CALIPSO Satellite

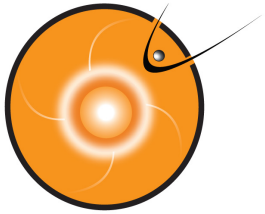


CTIPe - N at International Space Station



2010-11-16 10:20:00.0

2010-11-03 05:20:00.0



## Model evaluations: V&V and metrics

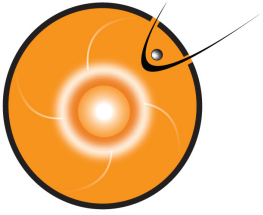
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Decision makers and operational agencies need model evaluations

- 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**

*Specifically, CCMC does not own candidate models*

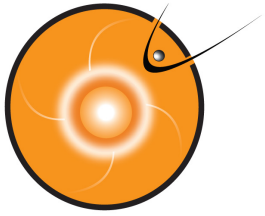


# GEM GGCM Focus Group Support

---

- Leadership in community-wide model validation efforts
- Facilitate a dialog between research and operational communities to define metrics formats relevant to SWx applications.
- Address uncertainties and challenges in model-data comparisons.
- CCMC developed a set of on-line tools for simulation results submission, archiving, on-line interactive model-model model-data comparison and metrics study.
- The first GEM Metrics Challenge was initiated in 2008-2009 (4 events)
  - Magnetic perturbations at ground stations and geosynch orbits
  - 3 publications (JGR and SWJ). Models: SWMF, OpenGGCM, Weimer
- In 2010-2011 added Dst Index and Joule Heating/Poynting Flux studies
  - > 10 participating models
  - 2 papers in preparation
- Collaboration with CEDAR community
  - 2 joint sessions at GEM-CEDAR Summer workshop
  - Joint session at GEM mini-workshop
  - GEM-CEDAR Challenges (common time intervals and phys. parameters)

/ M. Kuznetsova, A. Pulkkinen, L. Rastaetter, A. Chulaki, Y. Zheng



# CEDAR Modeling Challenges

---

- **CEDAR Electrodynamics Thermosphere Ionosphere (CETI) Challenge**

**Events** : total of 9 event during different geomagnetic condition

**Physical Parameters** : • Vertical and horizontal drifts at Jicamarca,  
• Electron density and Neutral density at CHAMP orbit,  
• NmF2 and hmF2 from LEO satellites and ISRs

- **Global Electron Density Challenge (ongoing)**

Eight 5°geographic longitude sectors (36 latitude bins each)

**Time interval (one of GEM Challenge events)** : 2006/12/13 - 2006/12/16

**Physical parameters** : global • TEC from ground-based GPS,  
• NmF2 and hmF2 from COSMIC  
+ parameters for CETI Challenge

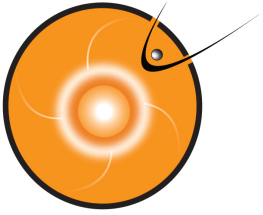
- **Publication:**

Shim, J. S., et al. (2011), CEDAR Electrodynamics Thermosphere Ionosphere (ETI) Challenge for systematic assessment of ionosphere/thermosphere models: NmF2, hmF2, and vertical drift using ground-based observations, *Space Weather*, 9, S12003, doi10.1029/2011SW000727.

- **Papers to be submitted soon:**

1. Invited article on the 'CCMC IT Challenge' for the AGU monograph on 'Modeling the Ionosphere/Thermosphere System.'
2. CEDAR ETI Challenge for systematic assessment of IT models: Electron density, Neutral density, NmF2, and hmF2 Using Space Based Observations

J.-S. Shim, M. Kuznetsova, L. Rastaetter, A. Chulaki *ning*

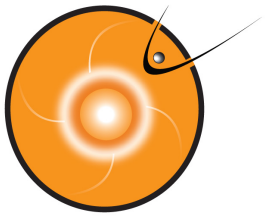


# SHINE Model Validation Study

---

- Engaged the SHINE community in a ‘science oriented validation’
- Very well attended kick-off meeting at SHINE in July 2011.
- Focus on ambient corona and inner heliosphere
- Agreed on set of model diagnostics that include comprehensive post-processing synthetic image tools by D. Odstrcil and S. Gibson.
- Currently refining the CR selection (for solar min and solar max)
- Potential model participants
  - Corona
    - MHD
      - ✓ CORHEL (PredSci)
      - ✓ SWMF
      - ✓ Wu et al
    - NLFFF
      - ✓ Wiegelmann et al
      - ✓ McKay, Yeates, Van Ballegooijen
    - Potential
      - ✓ WSA(Arge et al)
  - Inner Heliosphere
    - ✓ CORHEL (PredSci)
    - ✓ SWMF
    - ✓ ENLIL
    - ✓ Wu et al
    - ✓ WSA (Arge et al)
    - ✓ HelTomo (Jackson et al)
    - ✓ Merkin et al

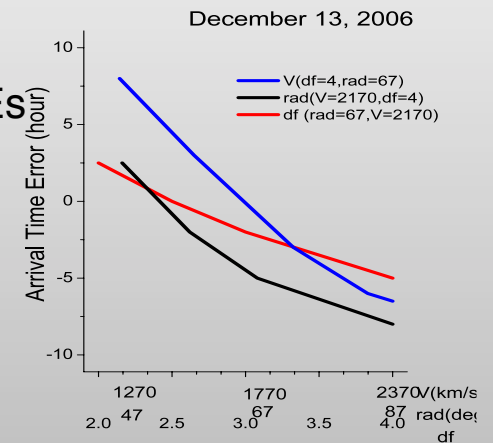




# Internal Model Validation:

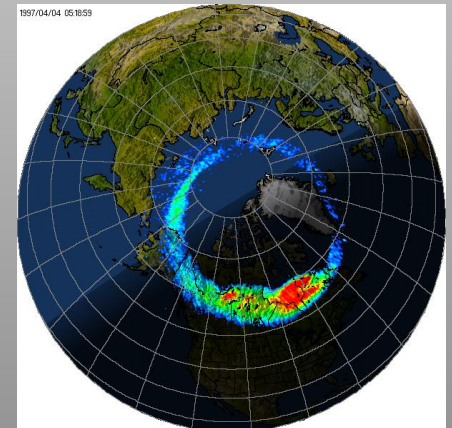
## Published

- Falkenberg et al – ‘Investigations of the sensitivity of a coronal mass ejection model(ENLIL) to solar input parameters’, June 2010.
- Taktakishvili et al – ‘Model Uncertainties in predictions of arrival of CMEs at earth orbit’, June 2010
- Taktakishvili et al – ‘Modeling of CMEs that caused particularly large geomagnetic storms using ENLIL heliospheric cone model’, June 2011.
- Falkenberg et al – ‘Evaluating Predictions of ICME arrival at Earth and Mars’, Sept 2011.
- MacNeice et al – ‘Tracing Field lines in Heliospheric models’, Oct 2011

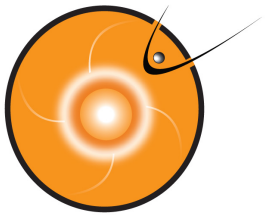


## Ongoing Studies

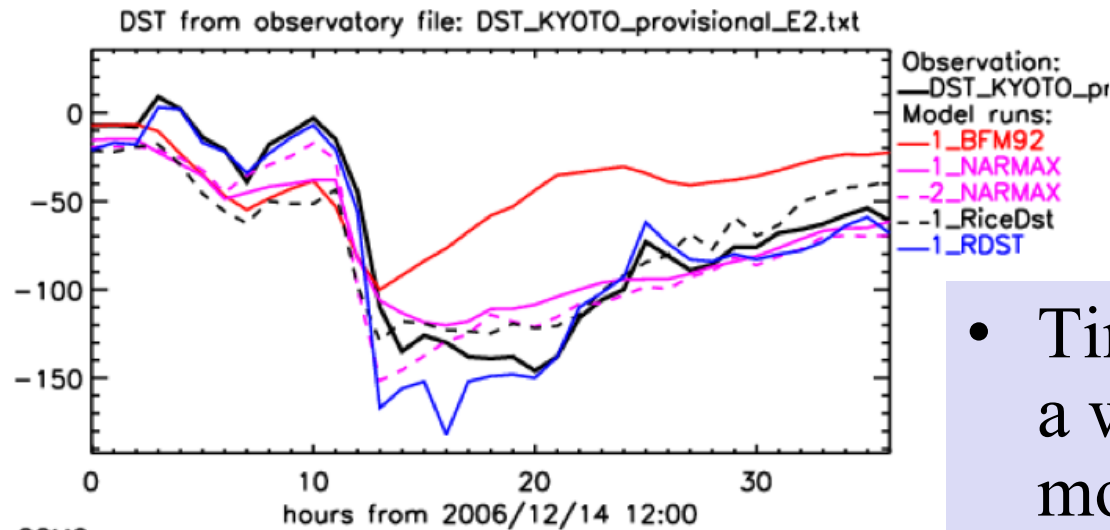
- UCSD Heliospheric Tomography – data collection phase
- ENLIL ambient model validation – data collection phase
- Realtime Cone Model – ‘manual’ and ‘ensemble’ modes
- Rad. Belt models validation (historic events and realtime)
  - RBE standalone, SWMF (with RBE-RCM)
- Auroral models validation (collaboration with AFIT)
  - Ovation Prime, New and Old Hardy, SWMF –Fok-RC, AMIE



Team *in Peter Macneice talk on Thursday morning*



# Web interface for model validation



Observed Dst (black)  
and models (colors)

- Time series data from a wide variety of models and quantities.
- Skill scores computed with plots.

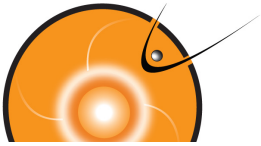
**Figure: DST from observatory KYOTO and model runs**  
**Campaign: GEM2008**  
**Metric study: Dst**  
**Event: December 14, 2006 12 00 UT - December 16, 00 00 UT**

Variable: DST Observation file: DST\_KYOTO\_provisional\_E2.txt

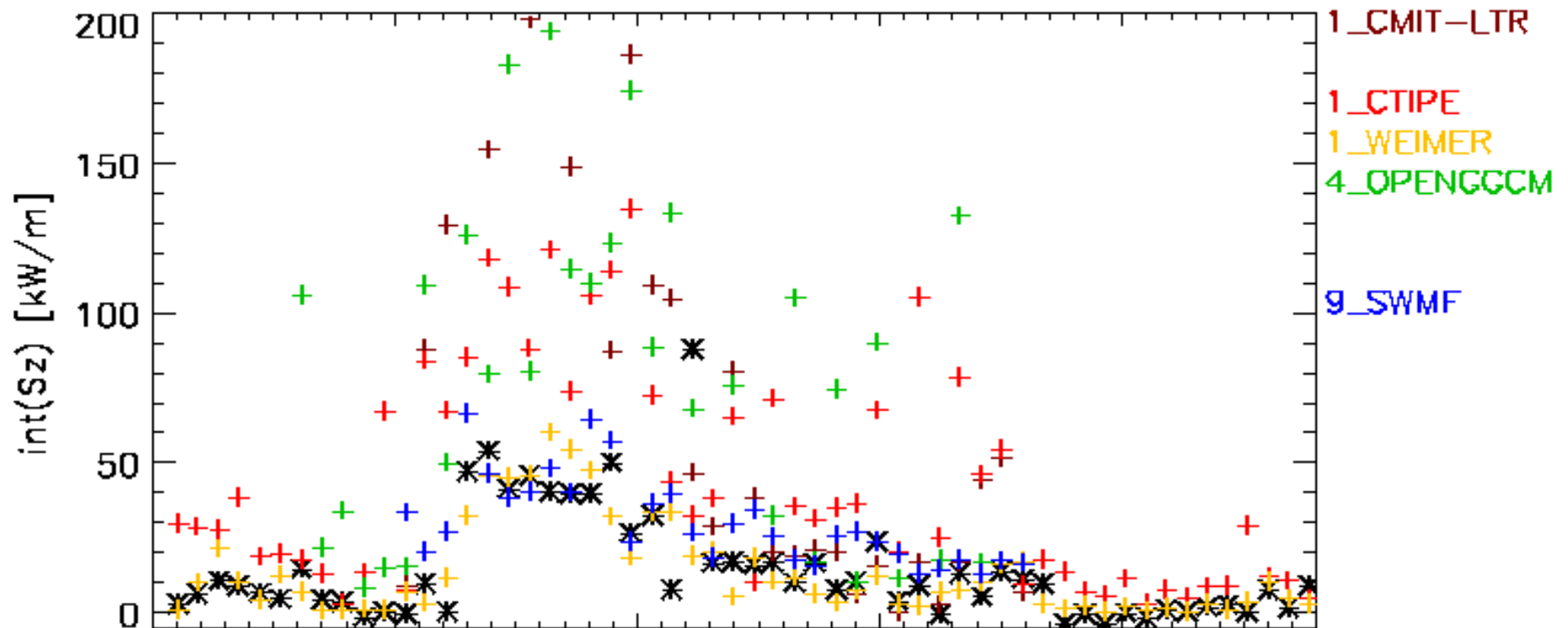
Model_Setting	PredEff	N_region	N_finite	PredYield	MinTimingError	MaxTimingError	Correlation
1_BFM92	-0.111	37	37	0.592	7.000	2.000	0.411
1_NARMAX	0.837	37	37	0.680	4.000	2.000	0.959
2_NARMAX	0.855	37	37	0.866	7.000	7.000	0.946
1_RiceDst	0.791	37	37	0.718	7.000	0.000	0.906
1_RDST	0.899	37	37	1.194	4.000	0.000	0.969

PredEff Prediction Efficiency metric  
 N\_region the number of samples in the selected time window  
 N\_finite the number of points that were used for comparison (ie., those that were not NaN or infinite)  
 LogSpectDist Log-Spectral Distance metric  
 nWin the number of windows used for the spectral analysis (2-hour windows, offset by 30 minutes from the nearest observation)  
 PredYield compared to the observation (max minus min)

A. Chulaki, M. Kuznetsova, L. Rastaetter

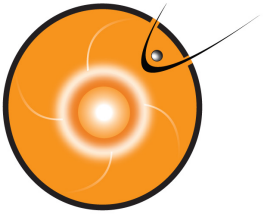


# Integrated Joule Heating vs. Poynting Flux

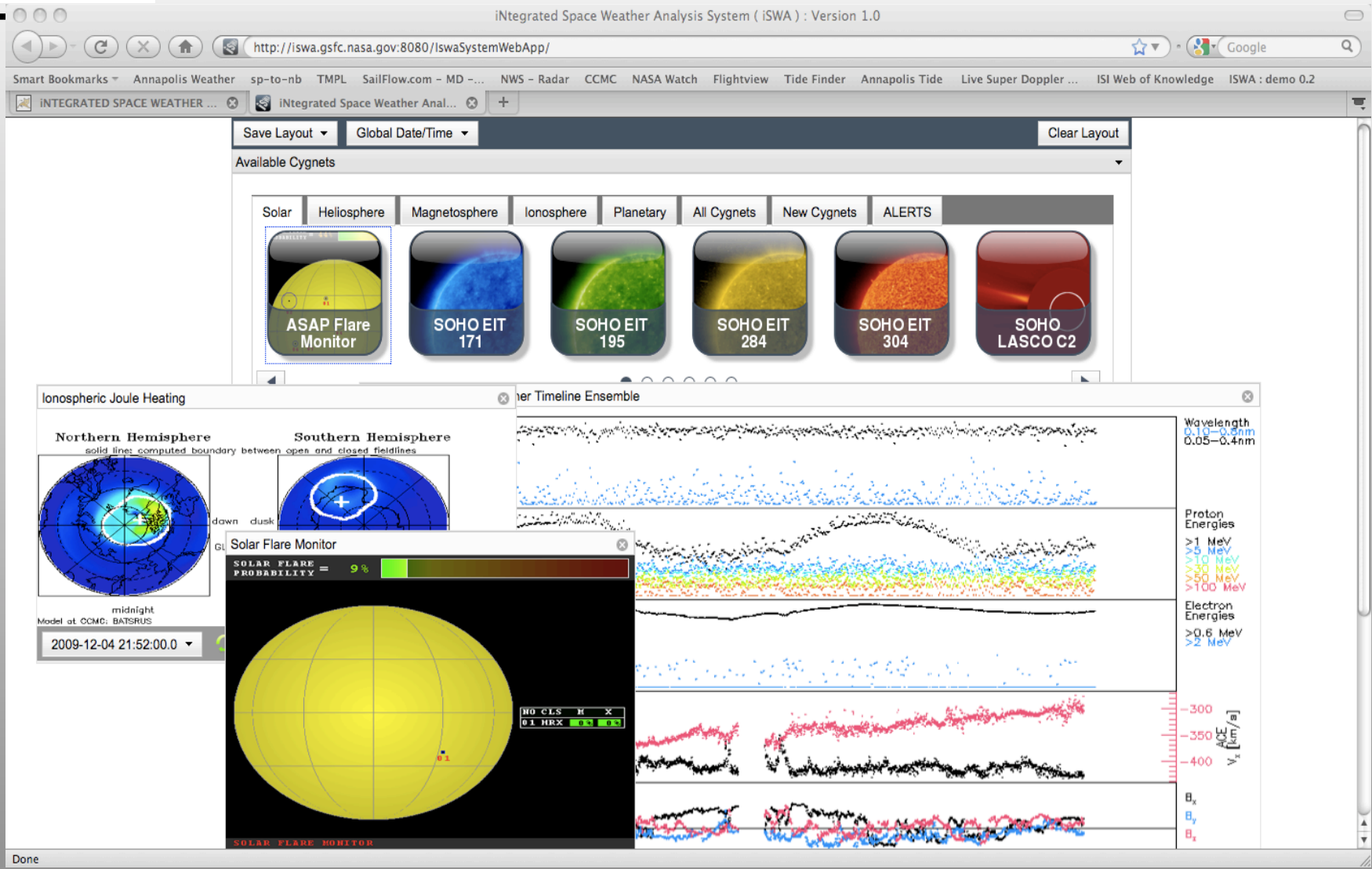


Analysis includes:

Integrated values in each pass over auroral zone,  
local features within each pass (inbound and outbound).

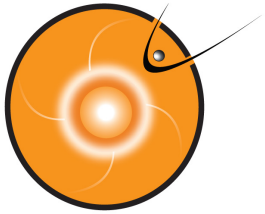


# Innovative dissemination: iSWA



[iswa.gsfc.nasa.gov](http://iswa.gsfc.nasa.gov)

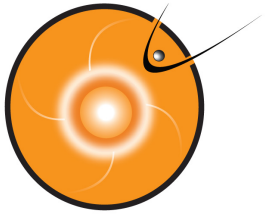
M. Maddox, D. Berrios, R. Mullinix



# Integrated Space Weather Analysis System ( iSWA )



January 2010	January 2012
iSWA Version <b>1.0</b>	iSWA Version <b>1.9.8</b>
<b>171</b> Data Feeds	<b>370</b> Data Feeds
<b>6</b> Million Data Files	<b>27</b> Million Data Files
<b>135</b> SWx Products/Cygnets	<b>275</b> SWx Products/Cygnets
<b>3.3K</b> Visits (2008, 2009)	<b>170K</b> Visits (2010, 2011)
<b>728</b> NASA Visits (2008,2009)	<b>10K</b> NASA Visits (2010, 2011)
<b>671</b> Unique Visitors (2008, 2009)	<b>70K</b> Unique Visitors (2010, 2011)
<b>0</b> twitter followers <b>@NASAiSWA</b>	<b>132</b> twitter followers <b>@NASAiSWA</b>

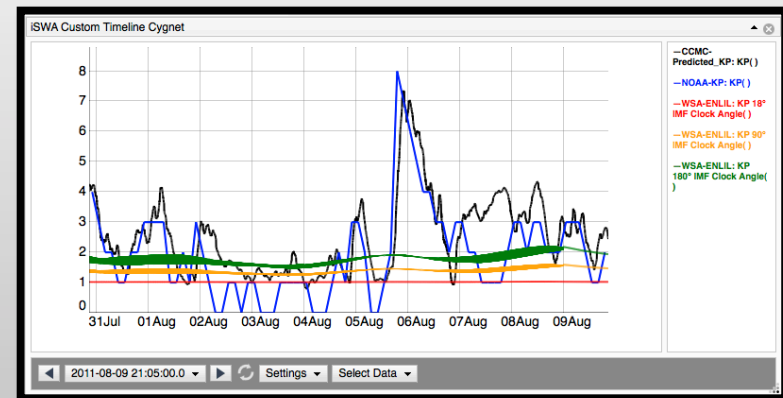


# Integrated Space Weather Analysis System ( iSWA )

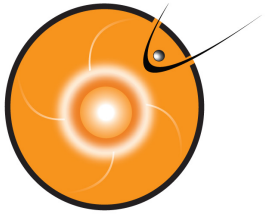


## Status/Feature Update

- Improved Feature Set
  - interactive super timeline
  - movie/animation modes
  - smart bookmarking/save layout feature
- New High Availability Architecture
  - multi node system with load balancing/failover
- Raw Data Database & Streaming Service
  - infrastructure to stream both data and products
- Mobile Interfaces – iOS & Android



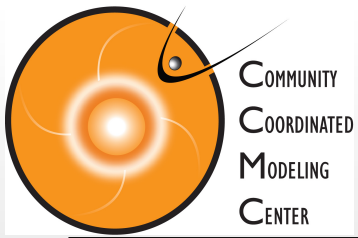




## iSWA 2.0 – Future



- Improved Help & Learning Features
- Redesigned Cygnet Catalog
  - revised display options
  - cygnet search capabilities
  - customizable lists ( favorites, history )
  - rankings, reviews, top n lists, related products
- Event & Related Cygnet Catalog
  - lists related products & associate products with specific events
- Cygnet Specific Improvements
  - stackable timelines, data export, movie stride



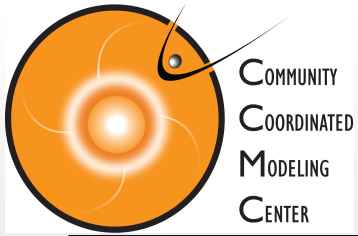
# NASA Space Weather iPhone App



iPhone interface for iSWA  
Available on iTunes App Store  
Search for “NASA Space Weather”



R. Mullinix, D. Berrios, M. Maddox



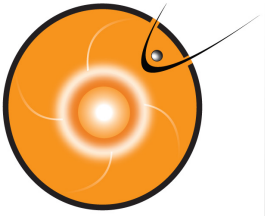
# NASA Space Weather Android App



Android interface for iSWA  
Coming soon to Android Market  
See David Berrios to obtain beta.

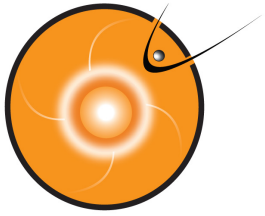


D. Berrios, J. Bobblitt, R. Mullinix, M. Maddox



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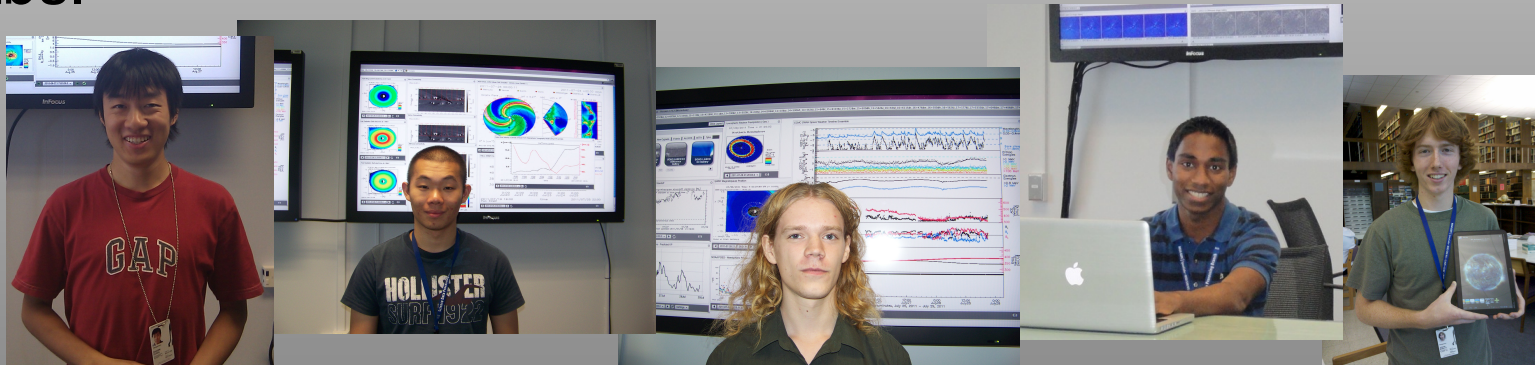
# Education

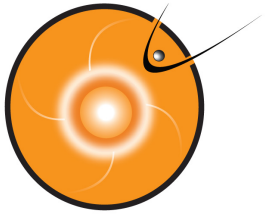


## CCMC Educational Activities

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- Following the well-established tradition, CCMC hosted a number of summer interns 2010 and 2011. Also winter interns 2011.
- CCMC scientists co-supervised three Air Force Institute of Technology graduate students 2010-2011. Models hosted at CCMC utilized extensively.
- CCMC supported CISM and Heliophysics Summer Schools. Development of classroom materials and school labs.



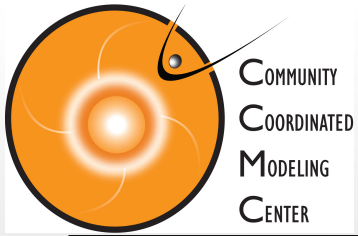


## CCMC Educational Activities

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- CCMC has generated an initial library of online tutorials on the usage of CCMC tools. Development of space weather tutorials underway in collaboration with Air Force Weather Agency and The Catholic University of America.
- CCMC arranged NSF-supported student research contest. CCMC tools and services will be used.
- General support of usage of models at CCMC in a classroom setting (e.g., University of Colorado, Embry-Riddle Aeronautical University, George Mason University).





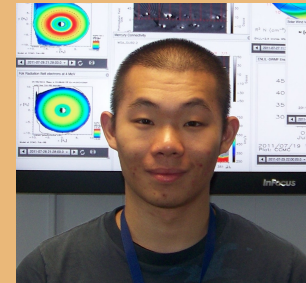
# Summer Interns - 2010

**Sangman Lee**



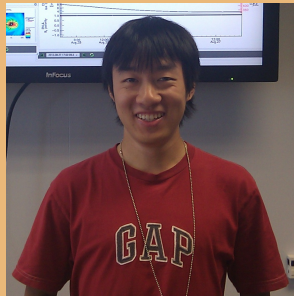
*University of Maryland*  
Kameleon Tester

**Patrick Zhou**



*University of Maryland*  
STEREO Archive data processing

**Shawn Doria**

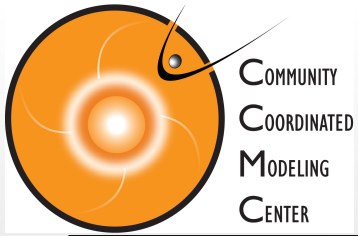


*University of Pennsylvania*  
Time-series visualizations

**Freddie Romano**



*Catholic University*  
Kameleon IDL Wrappers



# Summer Interns - 2011

## Justin Boblitt



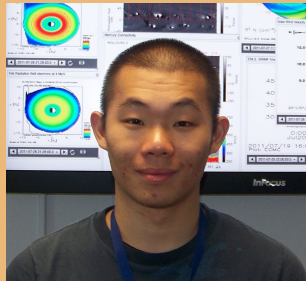
*Virginia Tech*  
Android App Development

## Nitesh Donti



*Cornell University*  
Java Kameleon Converter

## Patrick Zhou

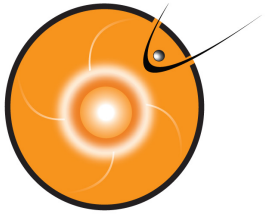


*University of Maryland*  
Super Timeline Tool

## Jack LaSota



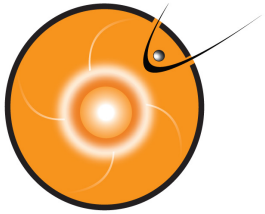
*University of Alaska Fairbanks*  
Events Timeline and WebGL



# Challenges

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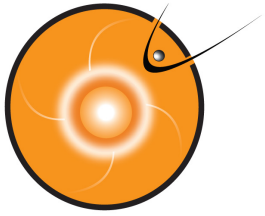
- Manage the RoR load
- Manage the data load, incl. archiving
- RT run maintenance
- Manage IT security needs and requirements
- Small staff - large workload



# Future of CCMC Research Support

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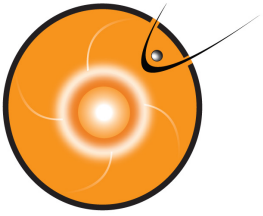
- Expand strong service to (international) research community
  - Maintain close contact with research community
  - Customer feedback forms guidance
- Expand close collaborations with model owners
- Make new models rapidly available to science customers
  - CCMC is designated repository for LWS/TR&T-produced models
- CCMC education support
  - AFIT graduate students
  - USAF Academy
  - NASA summer student program
  - Supporting courses at various institutions of higher education...
- **Always looking for feedback/suggestions to develop services**



# Future of CCMC SWx Support

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- Serve as a tool by which science progress at NASA, NSF, AFOSR, ONR feeds into Space Weather operations
- Lead and support community-wide model evaluation programs
- Transition RoR experience into RT ops for NASA and elsewhere
- Expose the value of model development
- Partner with AFWA, evaluation support for SWPC
- Support NASA's Space Weather Center
  - Model output tailored to operator needs -> ISWA project
  - Operational model results/forecasts derived from science ops
- Much more is possible – suggestions and help are invited!



# Future of CCMC Management

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- A num

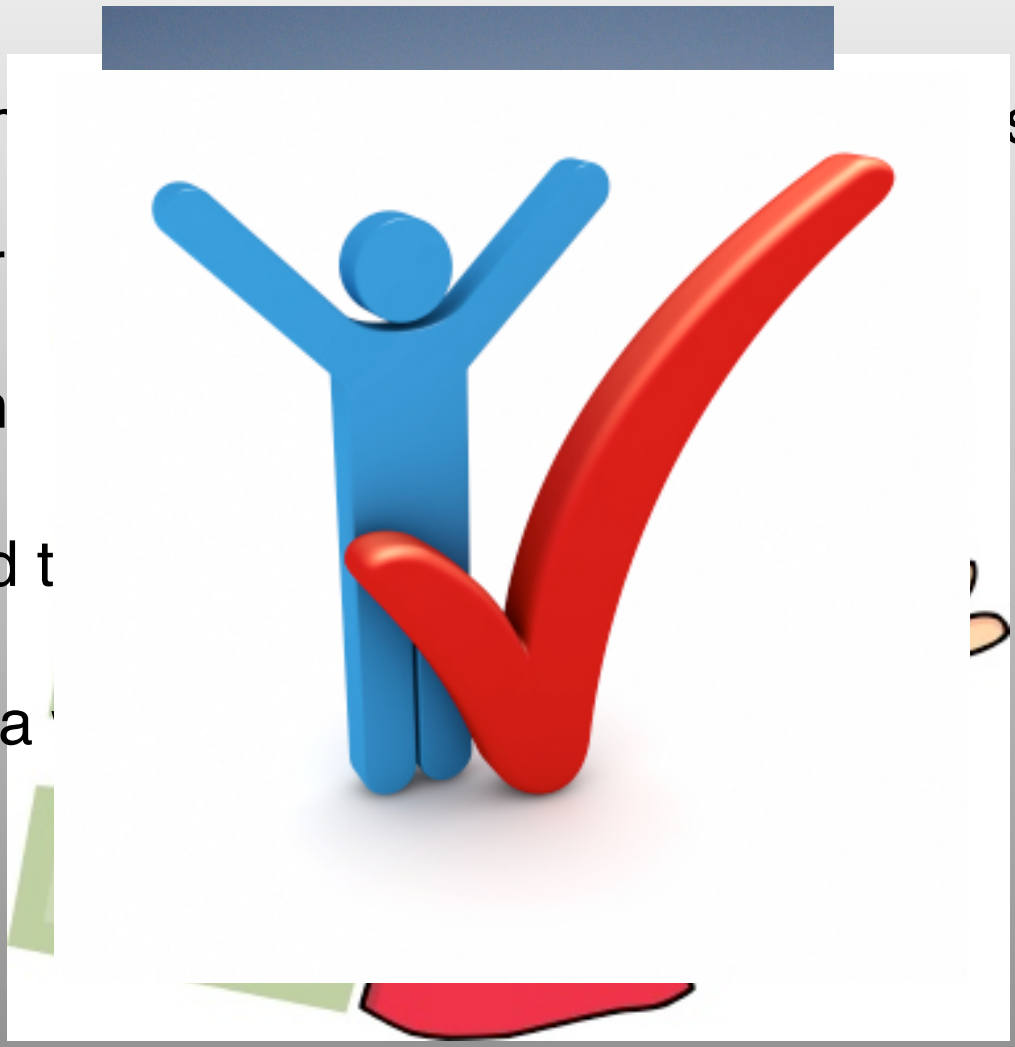
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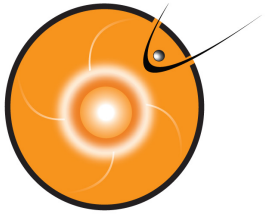
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# Thank you!!

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- Our Sponsors: NASA and NSF
- Our modeling partners
- Our users
- The CCMC staff

