

CEDAR ETI Challenge

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

<http://cedarweb.hao.ucar.edu>



Agenda

- Introduction (M. Kuznetsova)
- CCMC tools in support of the Challenge (M. Kuznetsova)
- Preliminary results of the first round of the Challenge for the 9 selected events (Ja Soon Shim)
- Climatology analysis of TIEGCM model results for the 13-month interval from March 2007 to March 2008 Dst index metrics study (Barbara Emery)
- Discussion (all)
- Formulate projects for a possible joint CEDAR-GEM Challenge

CEDAR ETI Challenge: Motivation

- Help evaluate the current state of the IT models
 - storms and moderate activity periods
 - climatology studies
- Track model improvements over time
- Encourage collaborations (modeler-data provider, modeler-modeler, GEM-CEDAR, ...)
 - output in the same format, timelines on the same plot
- Demonstrate effects of model coupling, new physics, grid resolution, etc. Facilitate further model improvement.
- Facilitate interaction between research and operation communities
 - physical parameters of interest to SW operation
 - ensemble modeling evaluation

<http://ccmc.gsfc.nasa.gov/support/CETI2010/>



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CEDAR ETI Challenge



[Challenge home](#) | [Events/Parameters](#) | [Available measurements/Locations/Trajectories](#) | [Model output file](#)

About CEDAR ETI Challenge

CEDAR Electrodynamics Thermosphere Ionosphere (CETI) Challenge was initiated at the 2009 CEDAR workshop. The goal of the CEDAR Challenge is to help to evaluate the current state of the ionosphere/thermosphere models, to track model improvements over time, and to facilitate interaction between research and operation communities in developing metrics for space weather model evaluations.

CCMC Metrics Suite:

- [Simulation results submission interface](#)
 - [Available measurements](#)
 - [Model output file format](#)
- [Time series plotting tool](#)
- [Runs for metric studies performed at the CCMC](#)

Runs for CETI challenge performed at CCMC: Full 3D model output archive. On-line analysis.

Run Number	Key Words	Model	Model Version	Year	DoY at Start	Start Time	Run Duration [days]	E-field Model
CCMC_CETIC_060210_IT_1	CETIC metrics	USU-GAIM	2.4.3	2007	79	00:00:00	3	--
CCMC_CETIC_052510_IT_3	CETIC metrics	USU-GAIM	2.4.3	2008	59	00:00:00	5	--
CCMC_CETIC_052510_IT_2	CETIC metrics	USU-GAIM	2.4.3	2007	142	00:00:00	5	--
CCMC_CETIC_052510_IT_1	CETIC metrics	USU-GAIM	2.4.3	2007	91	00:00:00	3	--
CCMC_CETIC_052010_IT_1	CETIC metrics	USU-GAIM	2.4.3	2006	348	00:00:00	3	--
CCMC_CETIC_051710_IT_1	CETIC metrics	USU-GAIM	2.4.3	2005	241	00:00:00	4	--
CCMC_CETIC_E.2008.059	CETIC metrics	TIE-GCM	1.92	2008	59	00:00:00	3	Heelis
CCMC_CETIC_E.2007.341	CETIC metrics	TIE-GCM	1.92	2007	341	00:00:00	2	Heelis
CCMC_CETIC_E.2007.190	CETIC metrics	TIE-GCM	1.92	2007	190	00:00:00	1	Heelis
CCMC_CETIC_E.2007.142	CETIC metrics	TIE-GCM	1.92	2007	142	00:00:00	3	Heelis
CCMC_CETIC_E.2007.091	CETIC metrics	TIE-GCM	1.92	2007	91	00:20:00	2	Heelis
CCMC_CETIC_E.2007.079	CETIC metrics	TIE-GCM	1.92	2007	79	00:20:00	1	Heelis
CCMC_CETIC_E.2006.348	CETIC metrics	TIE-GCM	1.92	2006	348	00:20:00	3	Heelis
CCMC_CETIC_E.2005.243	CETIC metrics	TIE-GCM	1.92	2005	243	00:20:00	2	Heelis
CCMC_CETIC_E.2001.243	CETIC metrics	TIE-GCM	1.92	2001	243	00:20:00	1	Heelis
CCMC_CETIC_053110	CETIC metrics	CTIP	CTIPe	2007	79	00:10:00	3	Weimer
CCMC_CETIC_053010	CETIC metrics	CTIP	CTIPe	2008	59	00:10:00	3	Weimer
CCMC_CETIC_052910	CETIC metrics	CTIP	CTIPe	2007	142	00:10:00	4	Weimer
CCMC_CETIC_052710	CETIC metrics	CTIP	CTIPe	2007	91	00:10:00	2	Weimer
CCMC_CETIC_052610	CETIC metrics	CTIP	CTIPe	2006	348	00:20:00	3	Weimer
CCMC_CETIC_052510	CETIC metrics	CTIP	CTIPe	2005	243	00:10:00	2	Weimer
CCMC_CETIC_052410	CETIC metrics	CTIP	CTIPe	2001	243	00:10:00	2	Weimer

Time series archive and plotting tool

	VperpN/VperpE	Nden	Eden	NmF2	HmF2
E.2006.348	Jicamarca	CHAMP	CHAMP	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC4 COSMIC5 Millstone_Hill	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC4 COSMIC5 Millstone_Hill
E.2001.243	Jicamarca	CHAMP	CHAMP	no data available	no data available
E.2005.243	Jicamarca	CHAMP	CHAMP	CHAMP Millstone_Hill	CHAMP Millstone_Hill
E.2007.091	no data available	CHAMP	CHAMP	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC4 COSMIC5 COSMIC6 EISCAT_Svalbard Poker_Flat	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC4 COSMIC5 COSMIC6 EISCAT_Svalbard Poker_Flat
E.2007.142	Jicamarca	CHAMP	CHAMP	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC4 COSMIC5 COSMIC6 Millstone_Hill EISCAT_Svalbard Poker_Flat Sondrestrom	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC4 COSMIC5 COSMIC6 Millstone_Hill EISCAT_Svalbard Poker_Flat Sondrestrom
E.2008.059	Jicamarca	CHAMP	CHAMP	CHAMP COSMIC2 COSMIC3 COSMIC4 COSMIC6 Millstone_Hill Sondrestrom	CHAMP COSMIC2 COSMIC3 COSMIC4 COSMIC6 Millstone_Hill Sondrestrom
E.2007.079	Jicamarca	CHAMP	CHAMP	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC5 COSMIC6 EISCAT_Svalbard Poker_Flat Sondrestrom	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC5 COSMIC6 EISCAT_Svalbard Poker_Flat Sondrestrom
E.2007.190	Jicamarca	CHAMP	CHAMP	CHAMP COSMIC1 COSMIC2 COSMIC4 COSMIC6 EISCAT_Svalbard	CHAMP COSMIC1 COSMIC2 COSMIC4 COSMIC6 EISCAT_Svalbard
E.2007.341	Jicamarca	CHAMP	CHAMP	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC4 COSMIC6 Millstone_Hill Poker_Flat Sondrestrom	CHAMP COSMIC1 COSMIC2 COSMIC3 COSMIC4 COSMIC6 Millstone_Hill Poker_Flat Sondrestrom

Plot Options:Image magnification Line thickness Character thickness (all annotations) Lock plot range:Min.: Max.: Show scores**Select model settings**

- 1_CTIPE: 1_CTIPE
 1_TIE-GCM: TIE-GCM v. 1.92
 2_TIE-GCM: CCMC_CETIC_IT (2010/04/07), TIE-GCM v. 1.92
 3_TIE-GCM: 2_TIE-GCM v. 1.93
 1_USU-GAIM: 1_USU-GAIM
 1_USU-IFM: 1_USU-IFM
 1_IRI: 1_IRI
 1_GITM: 1_GITM

Figure: HmF2 from observatory Millstone_Hill and model runs**Campaign: CETI2010****Metric study: HmF2 - height at maximum electron density in F2 layer****Event: December 14, 2006 12 00 UT - Dec. 16, 2006 00 00 UT**

To track usage for our government sponsors, we ask that you notify [CCMC staff](#) whenever you use CCMC results in a scientific publication or presentation. Thank you.

[Go back to metrics challenge table](#)

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.

Start: Year: Month: Day: Hour: Minute: Second: to End: Year: Month: Day: Hour: Minute: Second: Choose **Quantity** to be displayed:

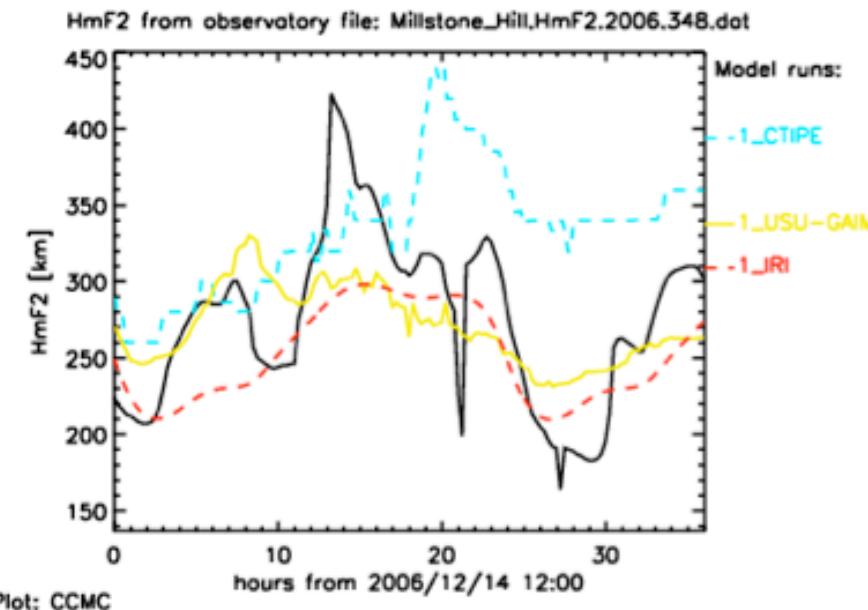


Figure: HmF2 from observatory Millstone_Hill and model runs

Campaign: CETI2010

Metric study: HmF2 - height at maximum electron density in F2 layer

Event: December 14, 2006 12 00 UT - Dec. 16, 2006 00 00 UT

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Start: Year: Month: Day: Hour: Minute: Second:

to End: Year: Month: Day: Hour: Minute: Second:

Choose **Quantity** to be displayed:

Topics for Discussion

- What metric(s) should be used for model comparisons?
 - What formula(e) should be used for skill score calculations? Should there be any type of threshold-based/utility metrics especially for storm modeling?
- How do we utilize global TEC data?
 - Should we pick a few representative stations/points or utilize the entire 2D grid? Should we accept submission of 2D timelines? How do we visualize the comparison for 2D timelines? Should we pick a few representative stations/points or utilize the entire 2D grid?
- Should we accept submission of 2D timelines?
 - How do we visualize the comparison for 2D timelines? How do we utilize 2D electron density profiles in height from COSMIC or selected ISR stations that cover various parts of the globe, and so are nearly 3D in nature?

Ideas for Joint CEDAR-GEM Challenge

- Ideas for Joint GEM-CEDAR project (message from GEM Workshop in Snowmass):
 - Ionosphere Joule heating (Delores Knipp)
 - Hemisphere power (Aaron Ridley).
 - Coupled magnetosphere/ionosphere runs. Compare with stand-alone models (Aaron Ridley)
- Comparison of different approaches to introducing geomagnetic activity effects into ionosphere models.
 - Role of models for ionosphere potential patterns.
 - Role of heat flux into the ionosphere.
 - Role of ion outflows from the ionosphere to the magnetosphere.
- Time periods/events update

GEM: Ideas for events

GEM Challenge 2008-2009 events:

- Event 1: Oct 29, 2003 06:00 UT - Oct 30, 06:00 UT
- Event 2: Dec 14, 2006 12:00 UT - Dec 16, 00:00 UT
- Event 3: Aug 31, 2001 00:00 UT - Sep 01, 00:00 UT
- Event 4: Aug 31, 2005 10:00 UT - Sep 01, 12:00 UT

Additional events recommended for ionosphere Joule heating metrics study (Delores Knipp)

May 15, 2005

July 9 -11, 2005

Moderate storms from CEDAR Challenge list
(for possible joint CEDAR-GEM projects)

2007/04/01 00:00 UT - 04/02 12:00 UT (Kp_max = 5)

2007/05/22 12:00 UT - 05/25 00:00 UT (Kp_max = 5.7)

2008/02/28 12:00 UT - 03/01 12:00 UT (Kp_max = 5.3)

Supplementary Slides

CEDAR Challenge : Physical Parameters

- Vertical and horizontal drifts at Jicamarca (V_{perpN} and V_{perpE})
- Neutral density at CHAMP orbit (N_{den})
- Electron density at CHAMP orbit (E_{den})
- $NmF2$ from LEO satellites (CHAMP and COSMIC) and ISRs
- $HmF2$ from LEO satellites (CHAMP and COSMIC) and ISRs
- Global TEC

CEDAR Challenge : Events

GEM storms

E.2006.348: 2006/12/14 (doy 348) 12:00 UT - 12/16 (doy 350) 00:00 UT (Kp_max = 8)

E.2001.243: 2001/08/31 (doy 243) 00:00 UT - 09/01 (doy 244) 00:00 UT (Kp_max = 4)

E.2005.243: 2005/08/31 (doy 243) 10:00 UT - 09/01 (doy 244) 12:00 UT (Kp_max = 7)

Year of incoherent scatter radar (ISR) observations from 2007/03/01 (doy 060) – 2008/03/31 (doy 091)

Moderate storms

E.2007.091: 2007/04/01 (doy 091) 00:00 UT - 04/02 (doy 092) 12:00 UT (Kp_max = 5)

E.2007.142: 2007/05/22 (doy 142) 12:00 UT - 05/25 (doy 145) 00:00 UT (Kp_max = 5.7)

E.2008.059: 2008/02/28 (doy 059) 12:00 UT - 03/01 (doy 061) 12:00 UT (Kp_max = 5.3)

Quiet periods

E.2007.079: 2007/03/20 (doy 079) 00:00 UT - 03/22 (doy 081) 00:00 UT (Kp_max = 0.7)

E.2007.190: 2007/07/09 (doy 190) 00:00 UT - 07/10 (doy 191) 00:00 UT (Kp_max = 0.3)

E.2007.341: 2007/12/07 (doy 341) 00:00 UT - 12/09 (doy 343) 00:00 UT (Kp_max = 1.0)

GEM Challenge Status Summary

- Ground magnetic perturbations
 - First report is submitted to Space Weather J. (Pulkkinen et al)
 - Study of interest for NOAA SWPC geospace model selection for operations
 - Repeat the study next year with updated models to show progress over time
- Magnetic field at geosynchronous orbit
 - Draft of the report is ready (Rastaetter et al).
- Magnetopause crossings by geosynch. satellite
 - Comparison with LANL magnetopause in/out time series.
 - In-depth comparative study of magnetopause position
- Plasma parameters at geosynch. orbit
 - On-line tool for LANL MPA data and model output comparison is ready
 - SOPA ion corrections for MPA are needed for pressure comparison. J. Borovsky and R. Friedel are working on removal of electron contamination from the low- energy ion channels of SOPA
- Dst index study
- CEDAR Electrodynamics Thermosphere Ionosphere (ETI) Challenge.

On-line time series plotting tool

Challenge events:

- Event 1: October 29th, 2003 06:00 UT - October 30th, 06:00 UT
- Event 2: December 14, 2006 12:00 UT - December 16, 00:00 UT
- Event 3: August 31, 2001 00:00 UT - September 1, 00:00 UT
- Event 4: August 31, 2005 10:00 UT - September 1, 12:00 UT

Metrics studies:

- 1: Magnetic field at geosynchronous orbit (GOES)
- 2: Magnetopause crossings by geosynchronous satellite (GOES and LANL)
- 3: Plasma density/temperature at geosynchronous orbit (LANL)
- 4: Ground magnetic perturbations (ground based magnetometers)
- 5: DST (final or provisional DST index from WDC, Kyoto)

	Metrics Study 1	Metrics Study 2	Metrics Study 3	Metrics Study 4	Metrics Study 5
Event 1	GOES12 GOES10	LANL-02A LANL-01A LANL-97A LANL-1994 LANL-1991 LANL-1990 GOES12 GOES10	LANL-02A LANL-01A LANL-97A LANL-1994 LANL-1991 LANL-1990	YKC MEA NEW FRN IQA PBQ OTT FRD HRN ABK WNG FUR	DST
Event 2	GOES12 GOES11	LANL-02A LANL-01A LANL-97A LANL-1994 LANL-1989 GOES12 GOES11	LANL-02A LANL-01A LANL-97A LANL-1994 LANL-1989	YKC MEA NEW FRN IQA PBQ OTT FRD HRN ABK WNG FUR	DST
Event 3	GOES10 GOES08	LANL-01A LANL-97A LANL-1994 LANL-1990 GOES10 GOES08	LANL-01A LANL-97A LANL-1994 LANL-1990	YKC MEA NEW FRN IQA PBQ OTT FRD ABK WNG FUR	DST
Event 4	GOES12 GOES10	LANL-02A LANL-01A LANL-97A LANL-1994 LANL-1990 GOES12 GOES10	LANL-02A LANL-01A LANL-97A LANL-1994 LANL-1990	YKC MEA NEW FRN PBQ OTT FRD HRN ABK WNG FUR	DST