



# The Virtual Model Repository (VMR)

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### Introduction



The Heliophysics Data Environment provides essential infrastructure supporting NASA's Vision to understand "the Sun, the Heliosphere, and planetary environments as elements of a single interconnected system, one that contains dynamic space weather and evolves in response to solar, planetary, and interstellar conditions"

NASA Sun-Solar System Connection Science and Technology Roadmap 2005-2035.







Yes, we have a rich set of data, but it is in a wide variety of places and formats, and available through a varied collection of interfaces.

Enter the Heliophysics Data and Model Consortium (HDMC), whose mission is to facilitate Heliophysics research by providing open, easy, uniform, scientifically meaningful access to relevant resources (data, models, tools, and documentation) as quickly and easily as possible.







Some of the HDMC requirements include

- Maintain a comprehensive inventory of data and related resources.
- Provide discipline specific portals to Heliophysics resources (VxOs) that add value by providing easy-touse interfaces and search tools based on events, positions, etc.

Maintain SPASE descriptions of the inventoried resources (SPASE - Space Physics Archive Search and Extract - is a data model that provides a robust description of data, facilitating discovery). The current estimate is that 25% of space-based data products have SPASE descriptions.



### Virtual Observatories (VxOs)



Discipline specific VxOs were formed by individual research proposals in response to a standard NASA Research Announcement.

### These include

VHO
VMO
ViRBO
ViTMO
VEPO
VWO
VMR

Virtual Heliospheric Observatory Virtual Magnetospheric Observatory Virtual Radiation Belt Observatory Virtual Ionosphere, Thermosphere, Mesosphere Observatory Virtual Energetic Particle Observatory Virtual Wave Observatory Virtual Modeling Repository





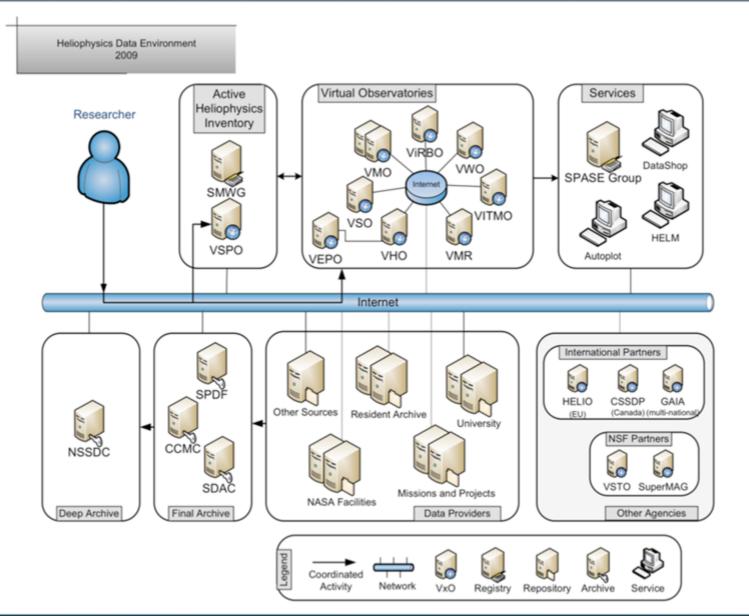
The VxOs all provide a number of functions, most importantly discipline-specific expertise.

The VxOs provide a means of assuring that data descriptions are complete, accurate, and useful.
 All the VxOs are committed to providing a comprehensive set of SPASE descriptions of their relevant data.

# Heliophysics Data Environment

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Observatory ()		4	ACE Daily Survey Plots	Polar-Wind-Geotail 'gif-walk' site	get data							
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VSO

Virtual Solar Observatory

Go





+ Ohttp://sdac.virtualsolar.org/cgi-bin/search

C Q. Google

#### Search VSO Help or enter Cart Id:

AA

### **Search for Solar Physics Data Products:**

### If you're new to the VSO, see How To Search, the FAQ or click the <sup>(1)</sup> icons for online help.

Please select which values you wish to use to search for data products:

#### ✓ Time

Search by time interval.

Derive time intervals from event catalogs

#### Observable

Search based on physical observables<sup>(1)</sup>

#### Instrument / Source / Provider

Search based on instruments<sup>1</sup> or data archives<sup>1</sup>

- Compact listing
- Instrument / Source (not provider dependent)
- Instrument Only (not source or provider dependent)

#### Spectral Range

Search based on a spectral range

#### Nicknames

Search based on common terms used to describe data products **Note**: Nicknames generate an intersection with other search terms, so searching for a nickname, and a physical observable (or other parameter) when a nickname defines other

Virtual Solar Observatory



Safer For SPAC

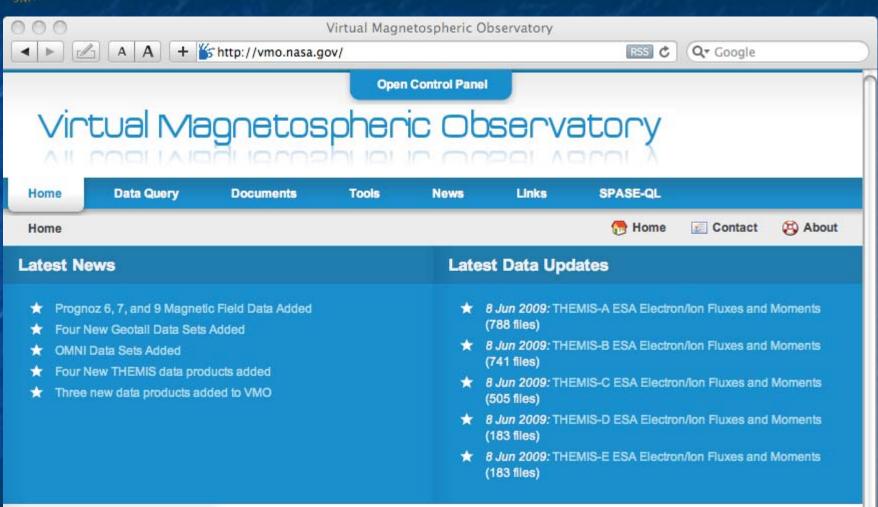
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#### Other

CSE

#### Site Map

Search

### Prognoz 6, 7, and 9 Magnetic Field Data Added

#### Latest News

Written by Tom Narock

💓 Monday, 20 April 2009

### Virbo

view source



Q. Google

Log in / create account

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#### Main Page - ViRBO AA + mahttp://virbo.org/ article discussion Contents 1. Introduction 2. News 3. Data 4. Resources 5. General VO Resources 6. Active Projects 7. FAQ navigation Main Page Recent changes ViRBO Status search Go Search toolbox What links here Related changes Upload file Special pages

- Printable version
- Permanent link

CSE

### 1 Introduction

The Data section below has a complete list of available data. Many previously inaccessible data sets are now available and we plan to continuously add new tools, data sets, and services of interest to radiation belt scientists. If you have any suggestions, requests, or questions, email to virbo@virbo.org or look for us at GEM 2009.

history

This is the version 1.0 alpha release of VIRBO. The "alpha" designation means that the infrastructure of the VxO is nearly complete.

In general, many ViRBO web pages are functional. Some features are not available for all data sets. To see an example of a data set with all of the possible features enabled (except the fully enabled data subsetting and filtering server), please see the Augsburg/ULF page. The features that are not available are listed in the Development Notes section on the page associated with each data product. A more complete list of pending projects is listed in the Active Projects section.

#### About ViRBO

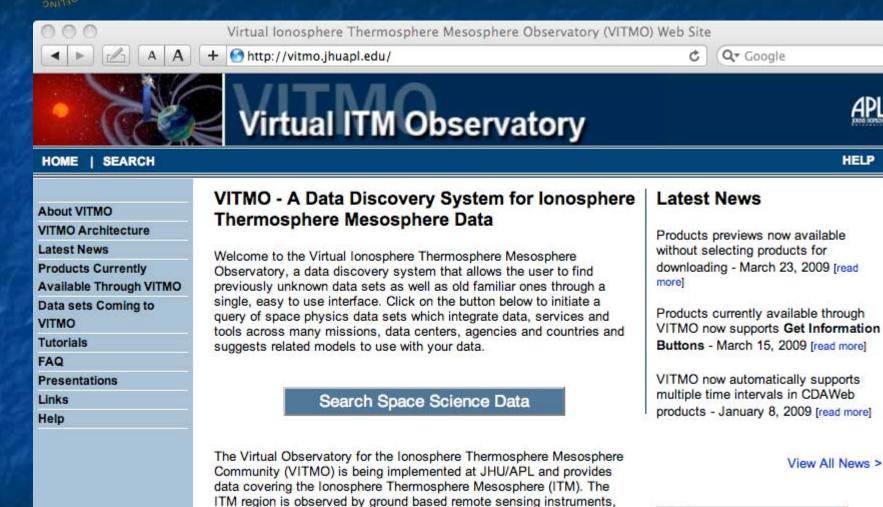
ViRBO (Virtual Radiation Belt Observatory) is one of the domain-specific virtual observatories that began operations in Fall, 2006 and is funded under the NASA Heliophysics Data Environment @ program. As part of this project, we have developed or extended a number of existing software codebases. These codebases have cross-VxO uses, and we are developing them to be re-usable by other virtual observatories.

- Autoplot & Visualize many space science data resources.
- VxOware The metadata search and edit engine that ViBBO uses -











Some unique features about VITMO include the following:

types in the study of this region.

satellite based remote sensing instruments, and in-situ satellite

instruments. In addition, there are external drivers in solar radiation and the solar wind and magnetospheric particle inputs. A Virtual Observatory that covers the ITM region needs to deal with the large diversity of data



#### + Home

#### Virtual Energetic Particle Observatory

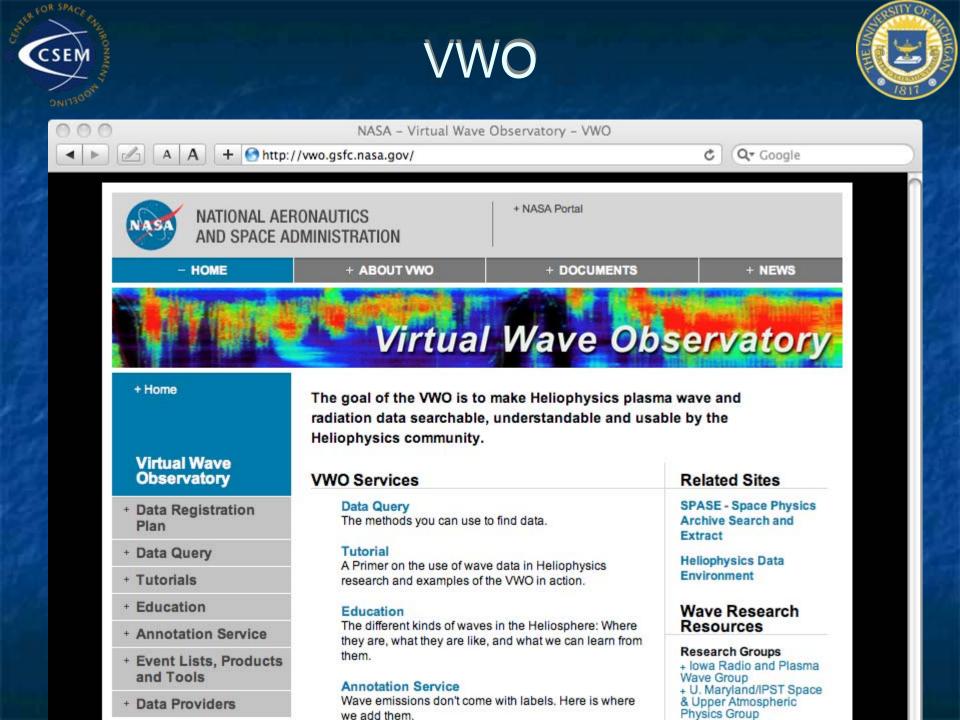
- + Introduction
- Energetic Particle QUERY (via VHO)
- + Data Products
- + Organization

#### INTRODUCTION

The Virtual Energetic Particle Observatory (VEPO) serves the heliophysics data user community as a focus group component operating within the domain of the Virtual Heliospheric Observatory (VHO) for improved discovery, access, understandability, and usability of energetic particle data products from selected spacecraft and sub-orbital instruments within the VEPO Data Source Environment. more...

#### NEW DATA PRODUCTS

- ISEE 3 High Energy Cosmic Ray (HECR) Elemental and Isotopic Abundance Tables
- Ulysses HISCALE count rates (32 ASCII products)
- Helios-1 Energetic Proton and Electron (E8, Keppler) Hourly Count Rates (ASCII)









 Make model results available to the general community in a consistent format

- Allow visualization of any model results
- Allow independent interpretation of published model results
- Seamless data-model comparisons
  - Get data from other VxOs
  - Get model results from Virtual Model Repository and CCMC

Can request a model run if no model results exist



### VMR: ModelWeb Interface

Virtual Modeling Repository



### VMR - VIRTUAL MODELING REPOSITORY

Home Search & Visualize Other VxOs Publications & Presentations Help > IRI/DMSP > CCMC Search

Run IRI

4



Select date for all run types: Year: 2000 : Month: January : Day: 01 :

1st location selected. Latitude = 40.5 Longitude = 239.5 (Clear all values)

Run IRI for single verticle profile

2nd location selected. Latitude = 9 Longitude = 278 (Clear 2nd values)

(Run IRI 2D sweep) with 20 steps.

The original IRI ModelWeb site can be found here.

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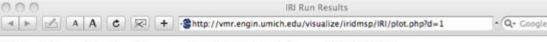


### VMR: ModelWeb Interface (2)

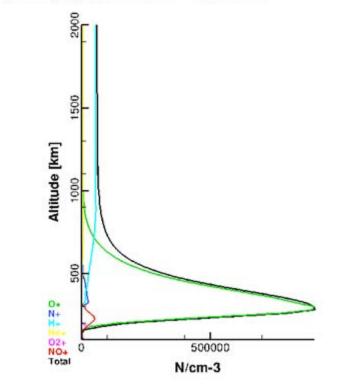


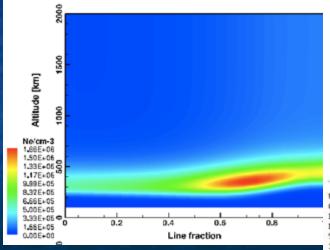


- Runs ModelWeb at NASA
- Gathers data at UM
- Create plots at UM



IRI plot results for January 1, 2000 at lat/lon = 40.5/239.5





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CCIR maps are used for the F2 peak hei		100000000000000000000000000000000000000
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IRI-95 option is used for the D-regi		
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Peak Densities/cm-3: NmF2= 907837.7	NmF1= 0.0	NmE= 6898.4
Peak Heights/km: hmF2= 285.75	hmF1= 0.00	hmE= 110.00
Solar Zenith Angle/degree		98.3
Dip (Magnetic Inclination)/degree		64.67

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# VMR: DMSP Data



- DMSP Data is available from University of Texas at Dallas.
- Want to make the web page a little more intuitive, for people who don't think in terms of orbit.
- Also want to compare data to ModelWeb IRI results.
- Created web page at UM to gather metadata at UTD about orbits, satellites, dates, etc.
- Choose date you want.
- Data downloaded from UTD (on the fly)

Virtual Modeling Repository

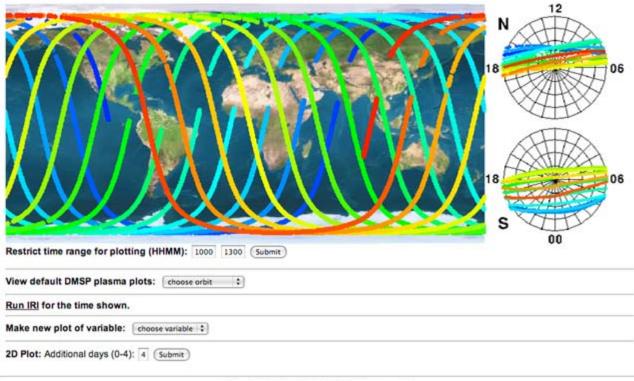
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### VMR - VIRTUAL MODELING REPOSITORY

Home Search & Visualize Other VxOs Publications & Presentations Help > IRI/DMSP > CCMC Search

#### Plot DMSP data from UT-Dallas

Date selected: 20011104 (View all cached dates) Satelite selected: f13 (View all satelites for selected date)



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# VMR: DMSP Data Plotter

10**-4**5 870.4 -77.2

153.9 -82.5 3.7

10.00 657.5 56.5 317.4



 Once data is downloaded from UTD, can do many things:

CSE

- Choose portion of data to examine.
- Plot different variables available within the data files.
- Compare to ModelWeb IRI run.

Restrict time range for plotting (HHMM): 100 1300 Submit	
View default DMSP plasma plots: choose orbit	
Run IRI for the time shown.	
Make new plot of variable: Ni(cm^-3) 🛟	
DMSP f13 data for Nov 04, 2001 10:00 to 13:00	
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600000 - 	
( <sup>1</sup> √ <sup>1</sup> / <sub>2</sub> <sup>1</sup> /	
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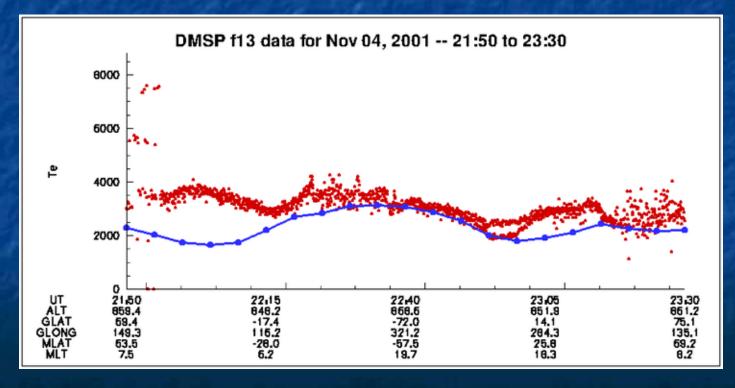
11.30 663.0 75.6 63.1 70.7 16.6 12,15 863.0 -56.7 255.4 -45.3 6.6 13,00 655.6 36.2 71.3 31.0 16.2



### **VMR: Data Comparison**



- Plot of data downloaded from UTD (ANY TIME!)
- IRI run at ModelWeb site utilizing location and time of data.
- None of this is pre-loaded
  - Data is downloaded on the fly (and cached)
  - IRI is run when you select compare to IRI
  - Matches variables between IRI and DMSP

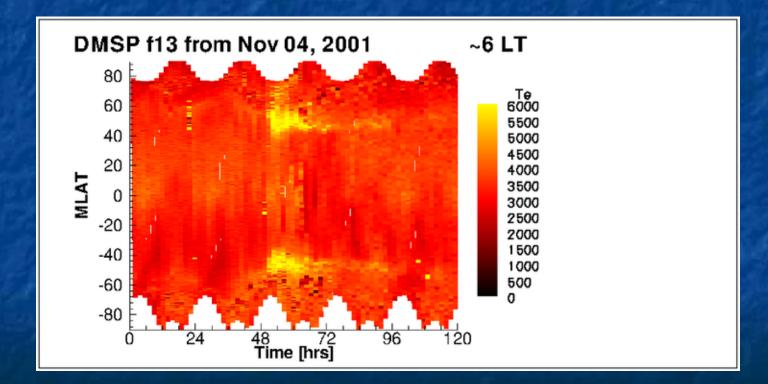




### VMR: DMSP New Plots



 Multiple days can be combined together to create new plots types that enable further science insight.





## VMR: Coupling with other VxOs



# We have coupled to other VxOs, here to capture satellite data, with availability lists.

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## VMR: Coupling with other VxOs



# We have coupled to other VxOs, here to capture satellite data, with availability lists.

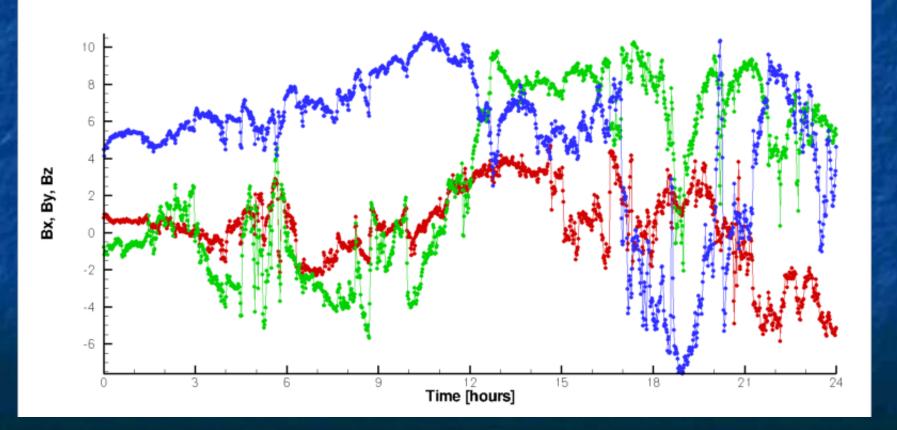
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(plot may be	e slight	ly diffen	ent)									
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start	2006	11	22	00	00	00						
end	2006	11	22	23	59	59						
plot												



## VMR: Coupling with other VxOs



We have coupled to other VxOs, here to capture satellite data, with availability lists.





## VMR: Coupling with CCMC



### Similarly, we can show availability of events run at the CCMC

000					_				TEST											
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plot																				



### VMR Data-Model DB Search



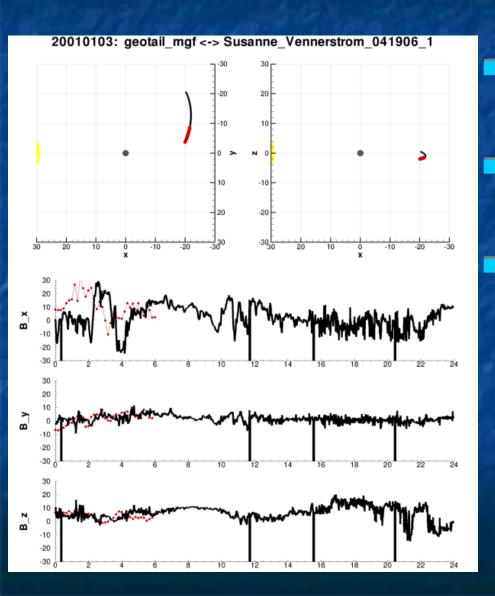
We can search by event date and run type and plot comparisons with data, even if not created at runtime.

000	http://vmr.engin.umich.edu/ccmcTMP/search_event.php		
< > A A C 🖂 + Sh	ttp://vmr.engin.umich.edu/ccmcTMP/search_event.php	😋 - 🔍 Google	
VMR Database	D		
Search Model Run Events By	y Date:		
Model Type Magnetosphere : Region Earth.Magnetosphere :			
Date         Year         Month         Day           Start         2001         1         1         1           End         2001         2         1         1			
(Submit)			
Model-Data Comparisons Cached:			
DATE CCMC	INST		
20070629 James_McCollough_072808_1	geotail_mgf plot		
19990511 Jan_Merka_112502_1	geotail_mgf plot		
20071212 Martin_Connors_083108_1	geotail_mgf plot		
20010103 Susanne_Vennerstrom_041906_1	geotail_mgf plot		
19980206 Takuma_Nakamura_102608_1	geotail_mgf plos		



### VMR Data-Model Plot





Black is satellite data & trajectory Red is model run at CCMC Positions are taken from satellite cdf for model plot times, data at those positions are extracted, and comparison plot is made.



 SWMF GUI: Visualize Run Output

 Image: Swm Subscription of the system of the s

### SPACE WEATHER MODELING FRAMEWORK

SWMF GUI: Create Plots for "default-tec-

SWMF GUI Home SWMF Manual REFERENCE Manual

CSE

Create Code Directory Configure Code Compile Code Manage Codes

Create Run Directory Setup & Execute Run Monitor & Process Run Manage Runs

#### Create Plots

default default-tec default-tec-long Manage Plots

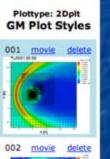
LINKS



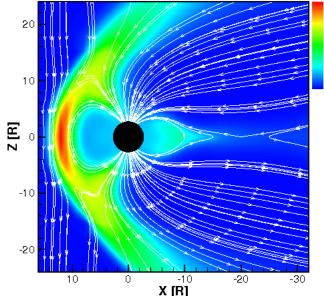


UNIVERSITY OF MICHIGAN

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p [n Pa]

0.932512



# SWMF Component Visualization







### VMR Plans



We are currently working on a web portal that will organize our internal UM run library, help with setup and filing of new runs at the CCMC, pull visualization tools from the SWMF GUI and other visualization work, and interact with the VMR for public viewing.

- Enhanced data/model comparison will be provided.
- It will have public, authenticated, and admin sections.
- It is under development now, with a working prototype expected soon.