From Ørsted to SOTERIA and COMESEP
- experiences of an addicted user
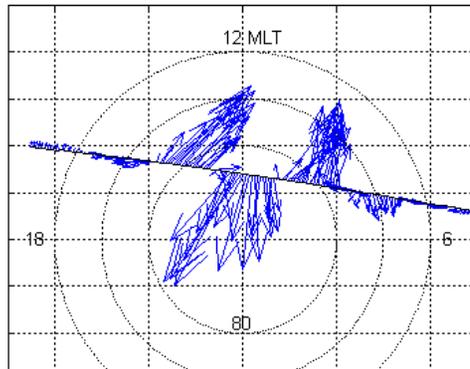
Susanne Vennerstrom

Technical University of Denmark

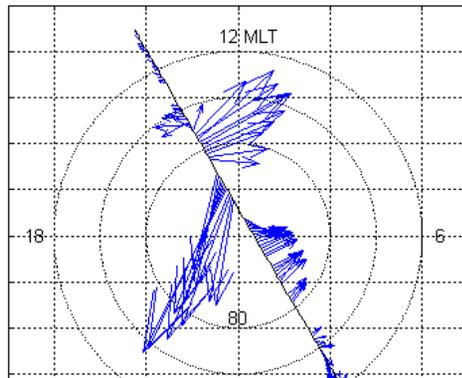# Different needs of access to modeling for an "observationalist"

1. Research support - interpretation of observations

2. Space mission planning – generation of simulated observations

3. Application – Space weather prediction
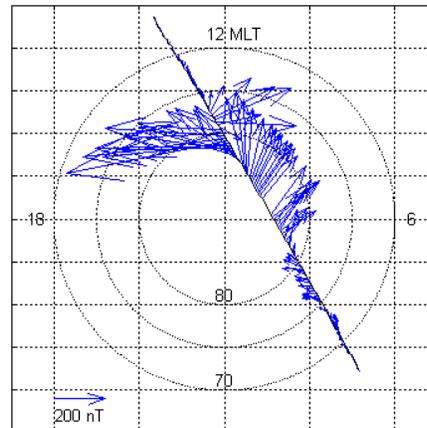
IMF By related rotation of FACs for Bz>0

Our Interpretation of the Ørsted data
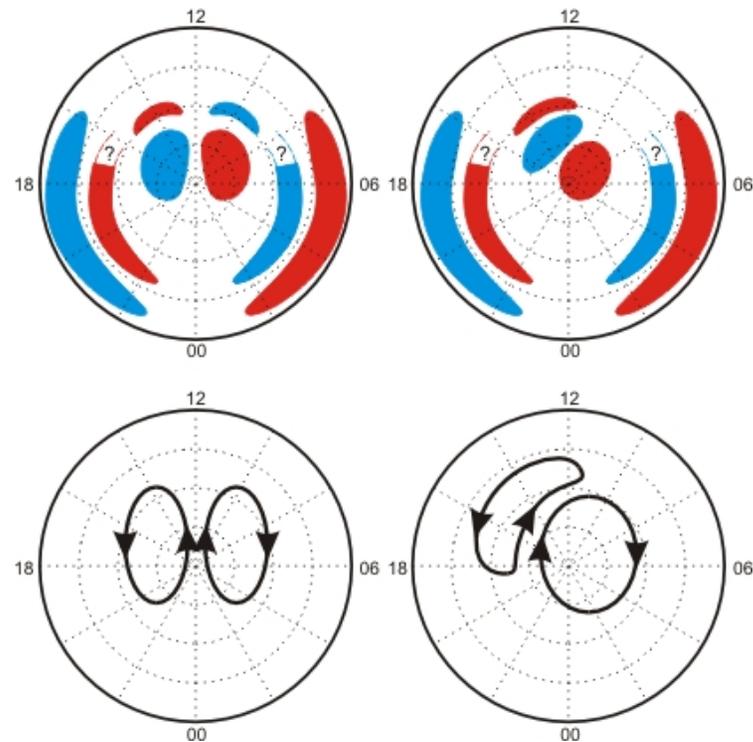
OpenGGCM run
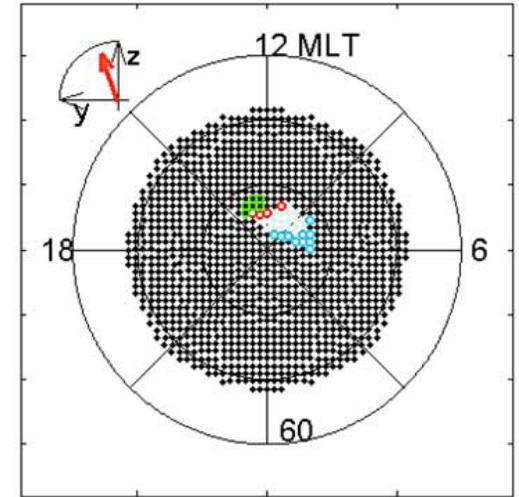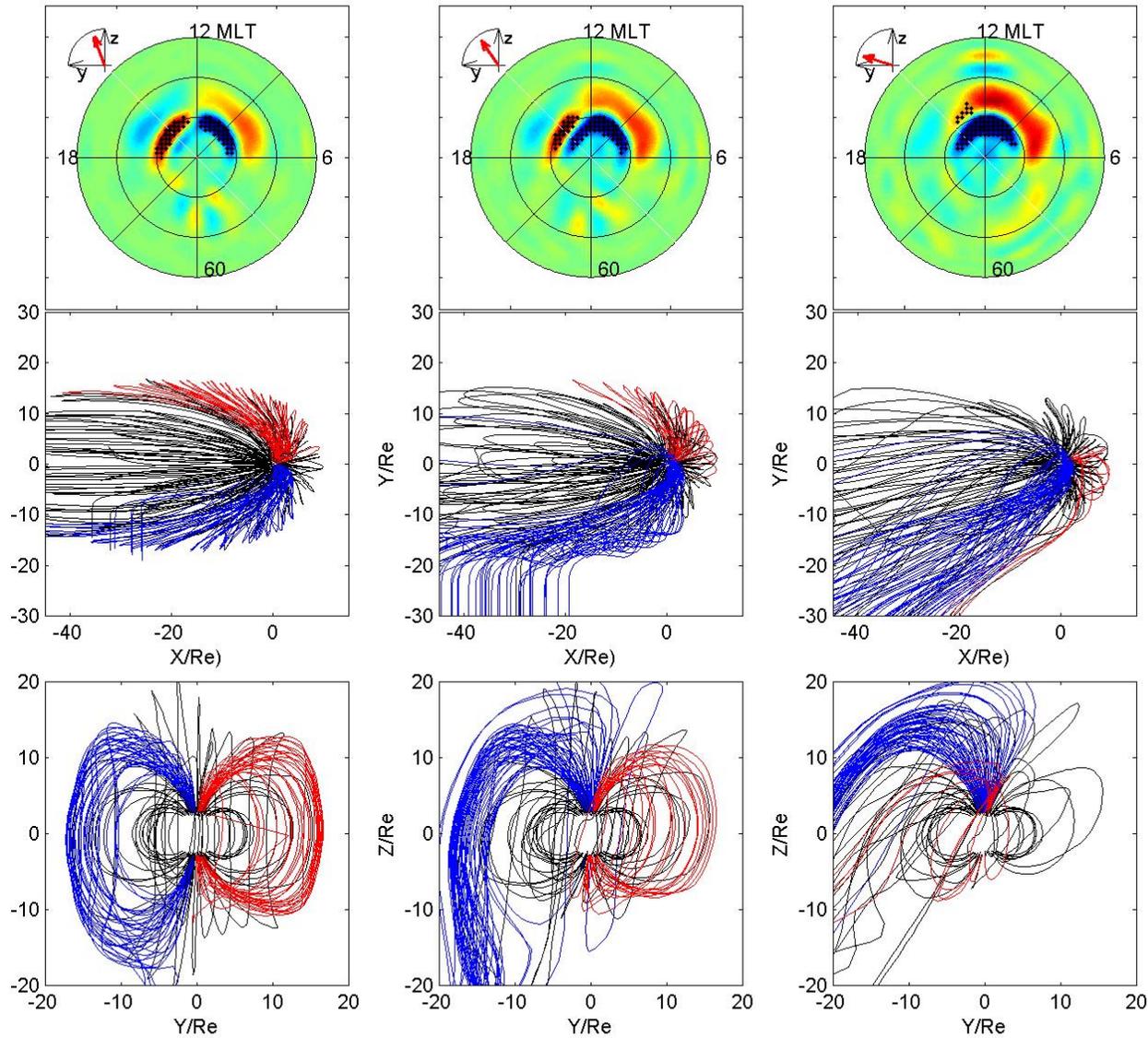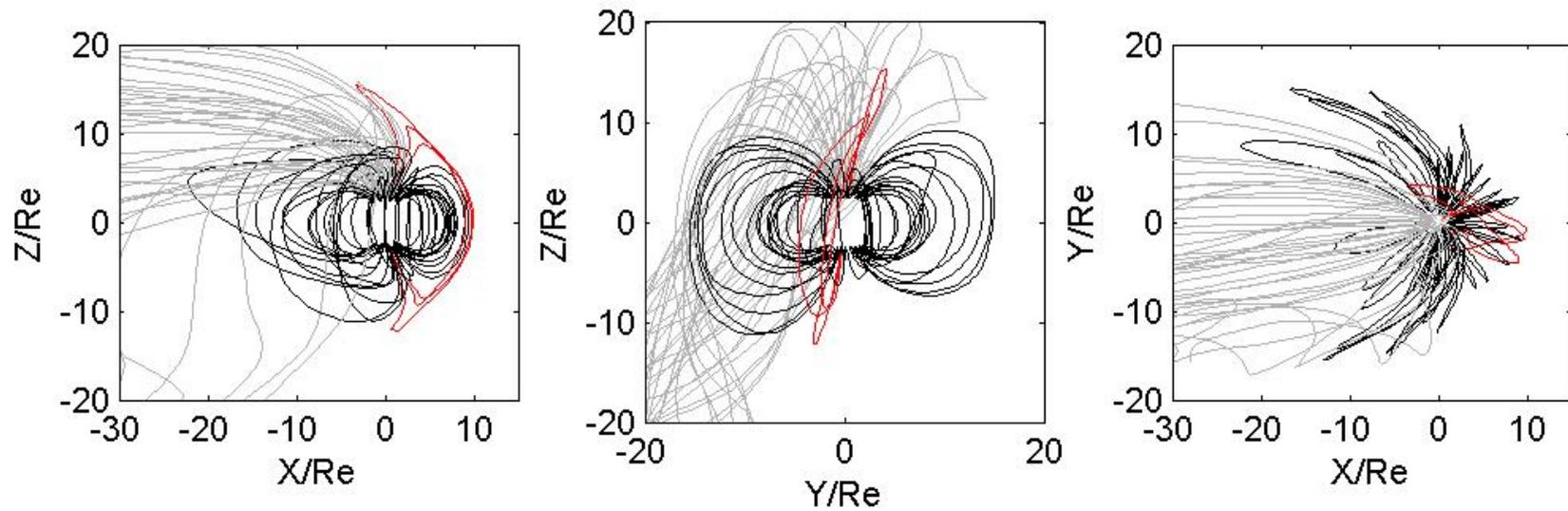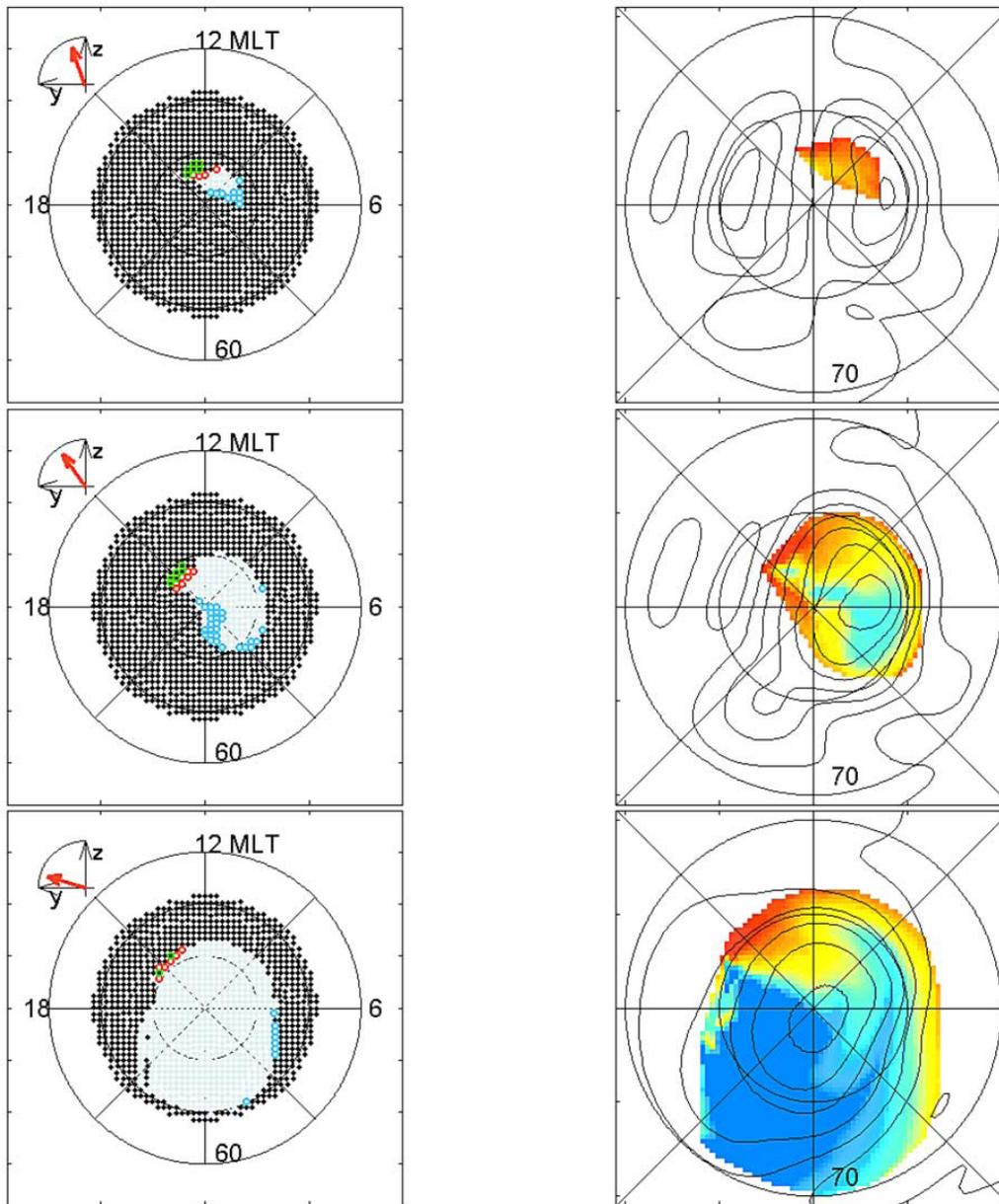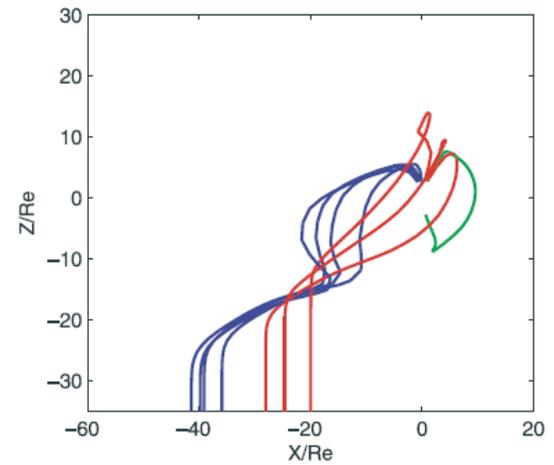
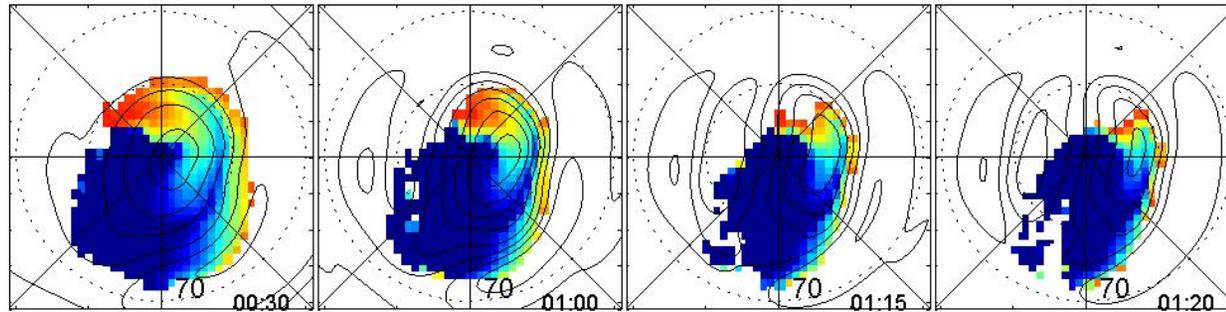# Closing the magnetosphere from the dayside by mantle reconnection

Mapping of field-line morphology to the polar cap

Simulation results – slowly rotating IMF

**Wish:
User generated field-line tracing**
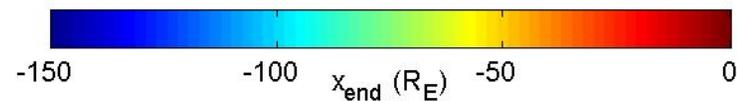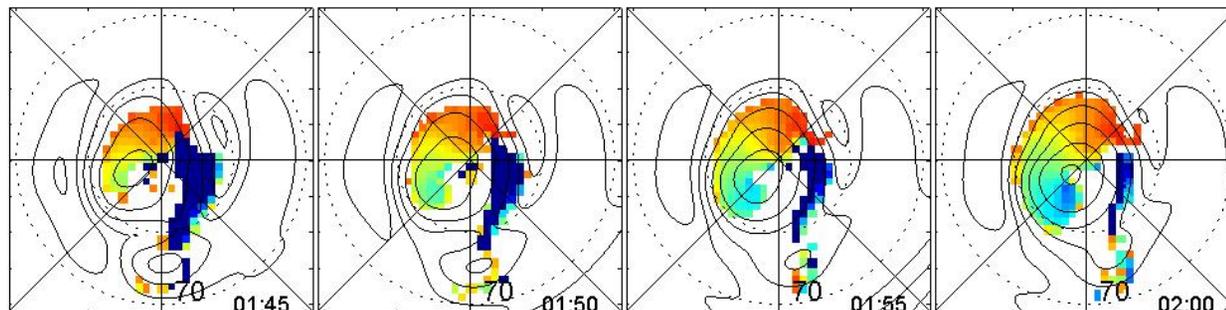
Use of OpenGGCM to create simulated data for the ESA *Swarm* mission
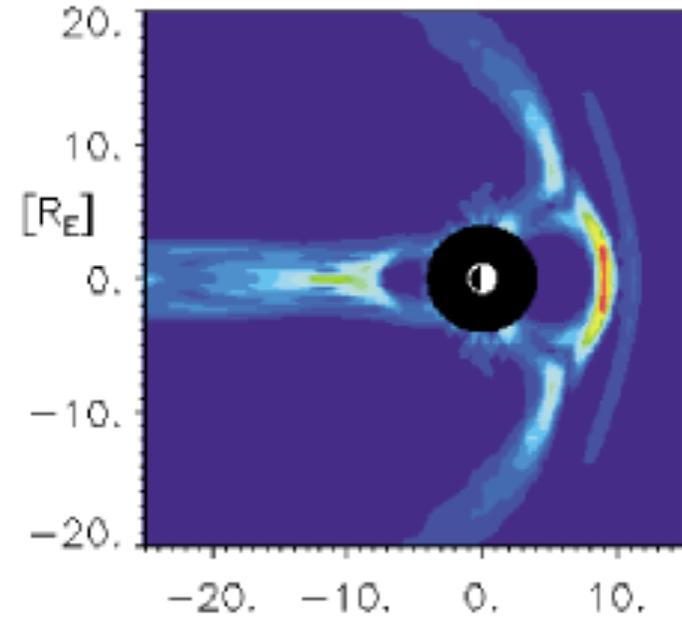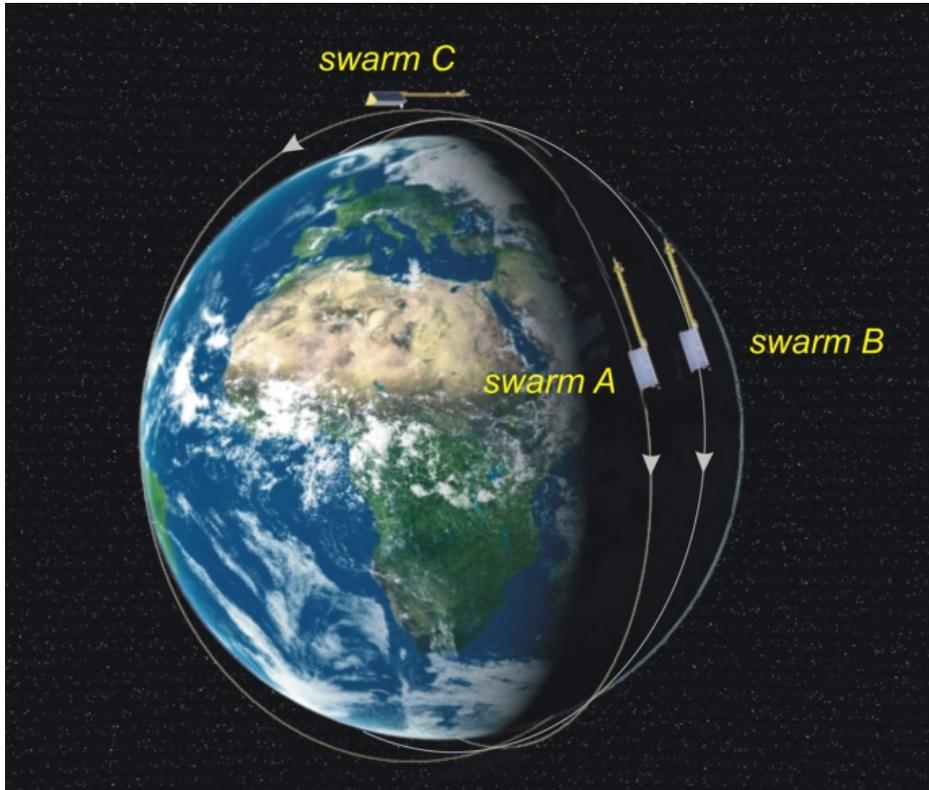
Use of OpenGGCM to create simulated data for the ESA *Swarm* mission
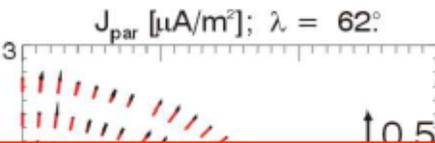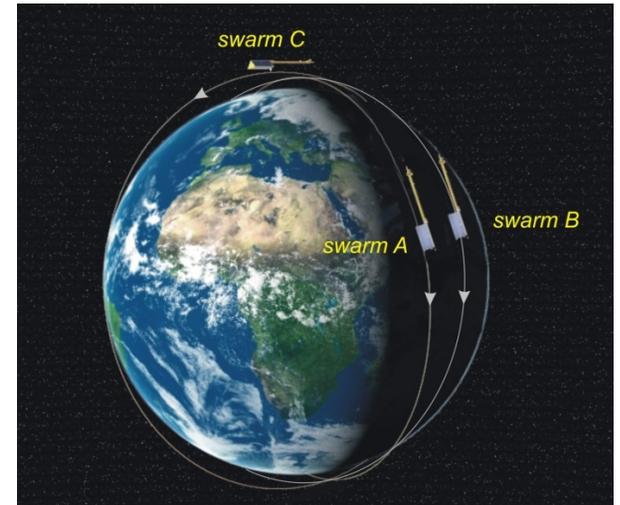
Wish:
Better reproduction of region 2 FACs
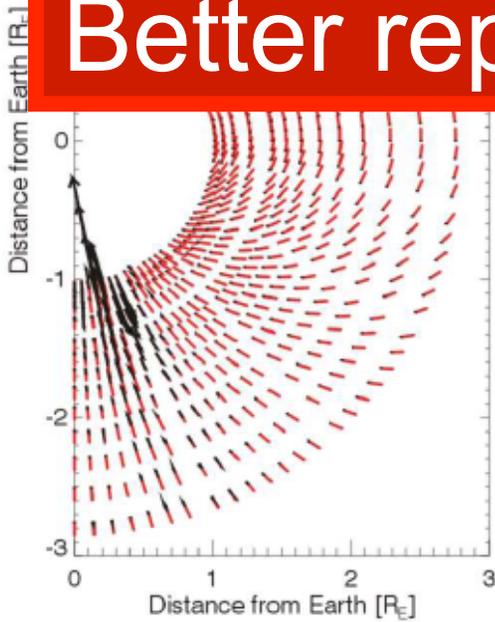
Vennerstrom et al. 2004

Moretto et al. 2006
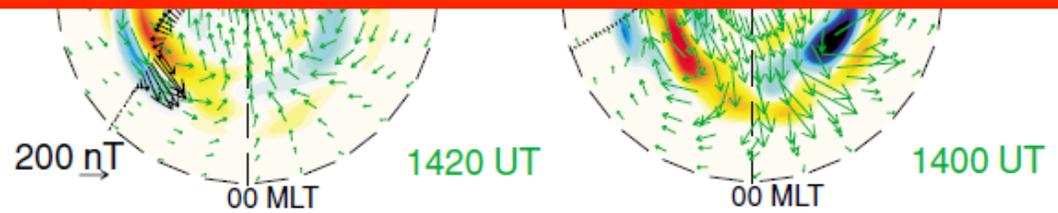
This capability was eventually implemented at the CCMC

Investigating other planets

__Mercury__ - Preparations for the ESA BepiColombo mission
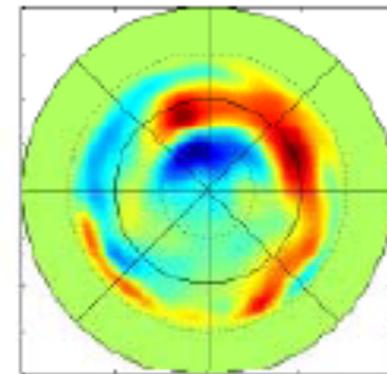
Using global MHD to
simulate magnetic

uno..)

Wish:
Models of solar wind interaction
with other planets
in PARTICULAR Mars

?

Future possibility? (MAVEN)

DTU

Or at least predict solar wind near Mars?

Wish:
Possibility to play with magnetograms as input to solar wind modelling

Vennerstrom et al. 2003, 2011

SOTERIA – Solar Terrestrial Investigations an Archives

Photosphere	Chromosphere and Corona	Heliosphere and Near-Earth Environment	Solar Irradiance and Terrestrial Atmosphere

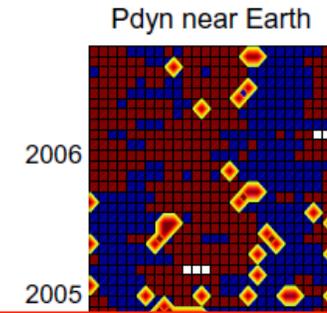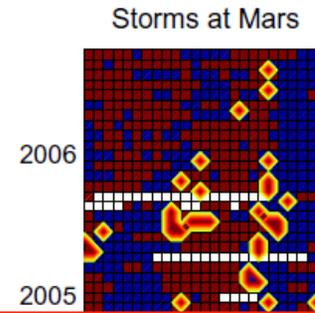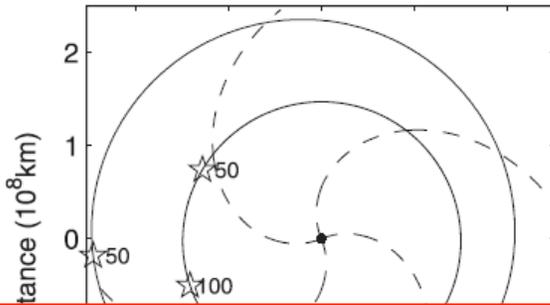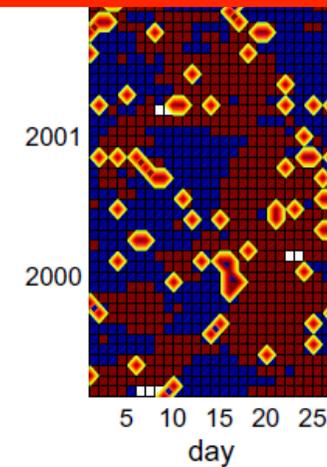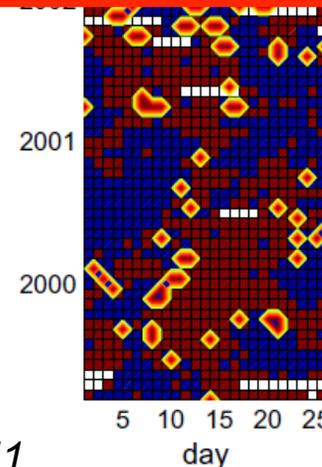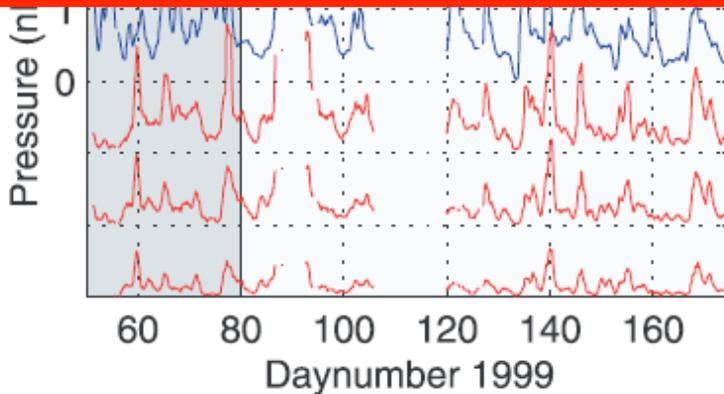|	
Katholieke Universiteit Leuven	Belgium
IGAM, Universität Graz	Austria
Physikalisch-Meteorologisches Observatorium Davos & World Radiation Center	Switzerland
Konkoly Observatory, Debrecen	Hungary
Centre National de la Recherche Scientifique, Laboratoire de Physique & Chimie de l'Environnement, Orléans	France
Laboratoire de Planétologie de Grenoble	France
Royal Observatory	Belgium
Observatoire de Paris	France
Space Research Center, Polish Academy of Sciences, Wrocław	Poland
Research Institute for Particle and Nuclear Physics	Hungary
Technical University of Denmark	Denmark
University of Oulu, Department of Physical Sciences	Finland
Georg-August-Universität, Institute for Astrophysics Univ. Göttingen	Germany
Hvar Observatory, Faculty of Geodesy, University of Zagreb	Croatia
Noveltis SA, Toulouse	France
P.N.Lebedev Physical Institute, Russian Academy of Sciences, Moscow	Russia
Informatique Electromagnétisme Electronique Analyse Numérique	France

SEVENTH FRAMEWORK PROGRAMME

3 year project 2009-2011

SOTERIA – WP4: Heliosphere and Terrestrial effects

Focus

A selected set of important Space Weather Parameters

- CME arrival time
- L1 Solar wind parameters
- SEP flux
- Magnetopause location
- Geomagnetic activity, Dst
- Auroral oval position
- Ionospheric Joule Heating
- Ionosperic Scintillations/TEC

CCMC Involvement and support

CCMC Involvement and support
Validating and comparing models
- 2 examples

1. Dst index:

Global MHD ⟷ **Observation**
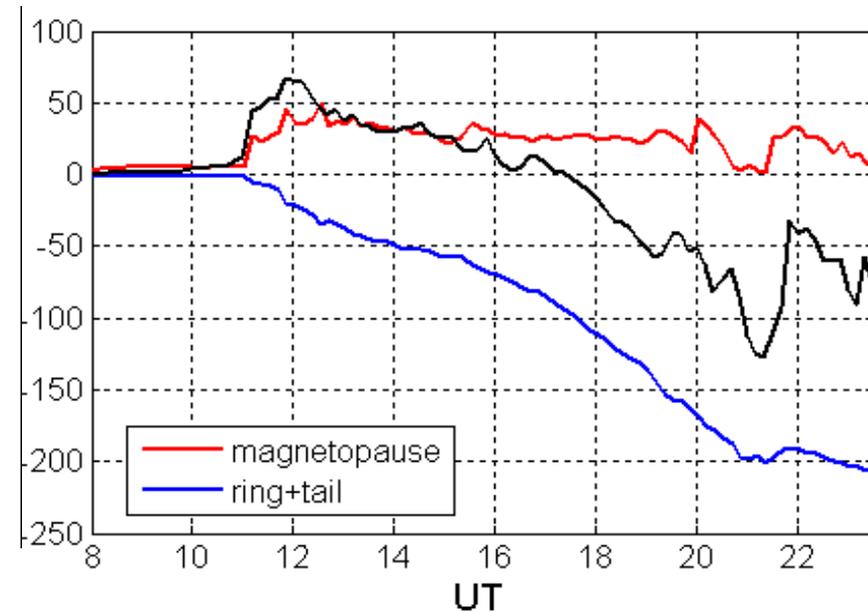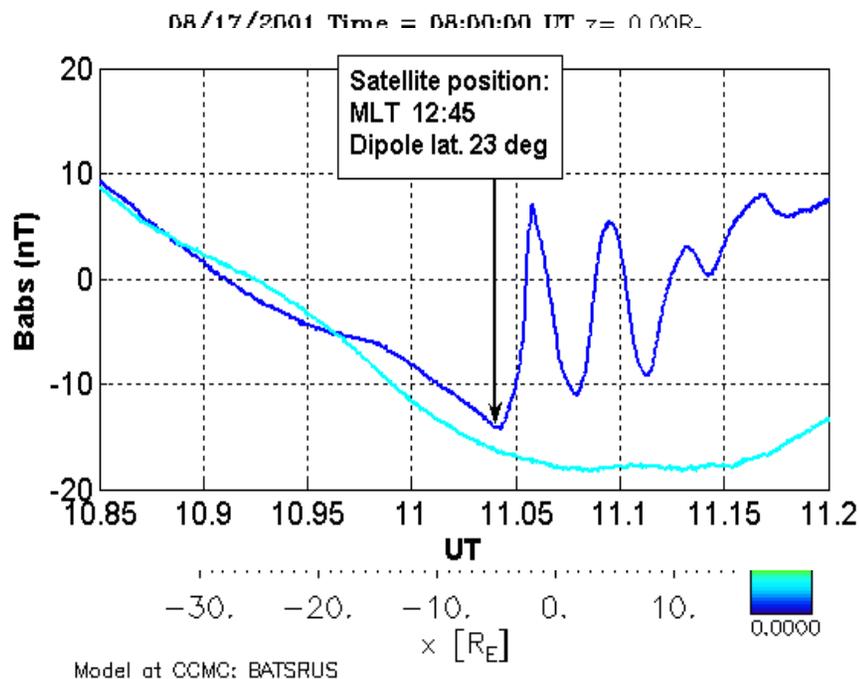
CCMC Involvement and support
Validating and comparing models
- 2 examples

2. ICME-arrival time:

ENLIL ⟷ **simple 1D model, Observations**
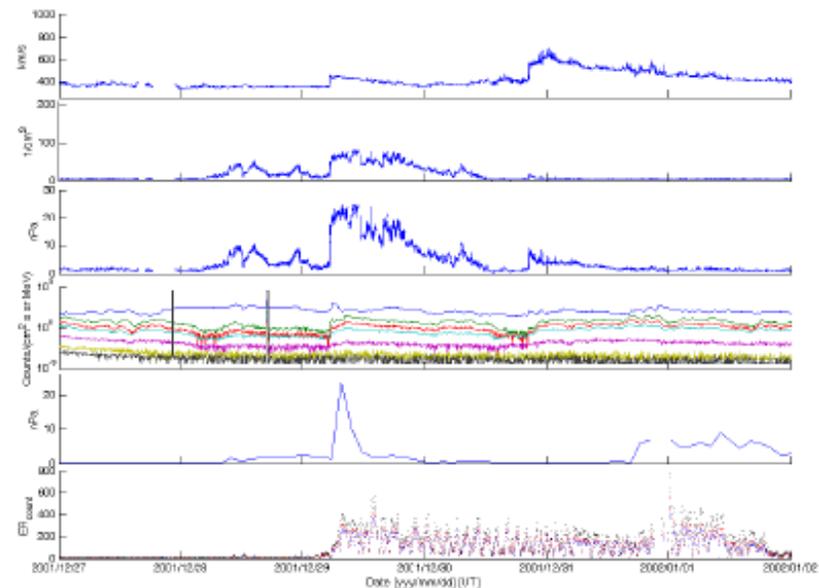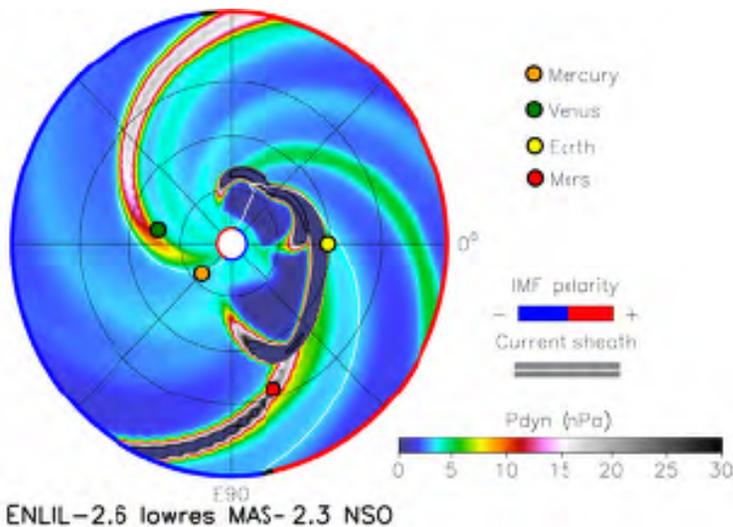
Falkenberg et al. 2011

Future: COMESEP
Coronal Mass Ejections and Solar Energetic Particles
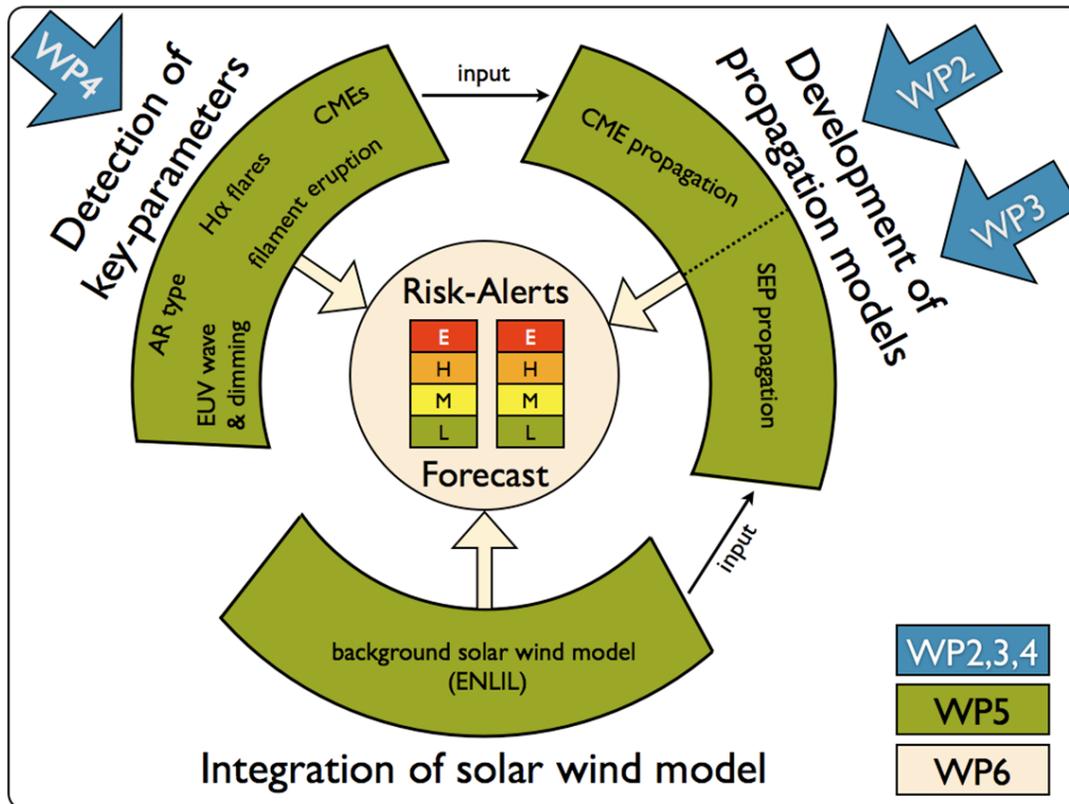
Future: COMESEP
Coronal Mass Ejections and Solar Energetic Particles

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Severe
Almost certain	M	H	H	E	E
Likely	M	M	H	H	E
Possible	L	M	M	H	E
Unlikely	L	M	M	M	H
Rare	L	L	M	M	H
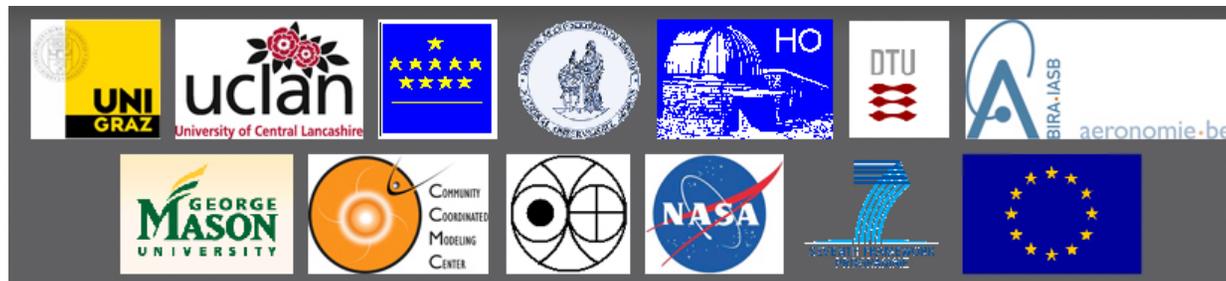
Summary

- CCMC is a great facility!

- Global modeling is **widely** needed:
  - Global modeling is an indispensible tool for interpretation of magnetic field observations.
  - Global Modeling is necessary for space mission planning (simulated data).
  - Global Modeling is a requirement for space weather prediction.

- It takes some effort to get started….but once you start you easily get addicted ☺

- The best results are obtained if the interface allows you to play with the model and the model output

- Users will always want more…. and they should!

Exstras

Future: Education

- DTU Space will in 2012 start a new education:
"Earth and Space Science and Technology"
 including both a bachelor and a master degree.

- This will include courses in both Space Weather
  and Space Physics. It would be obvious to
  include CCMC educational resources.