

# SOTERIA

*Giovanni Lapenta for the Soteria Consortium*

Centrum voor Plasma-Astrofysica

Katholieke Universiteit Leuven

BELGIUM

*This research has received funding from the European Commission's Seventh Framework Programme (FP7/2007-2013) under the grant agreement n° 218816 (SOTERIA project, [www.soteria-space.eu](http://www.soteria-space.eu)).*



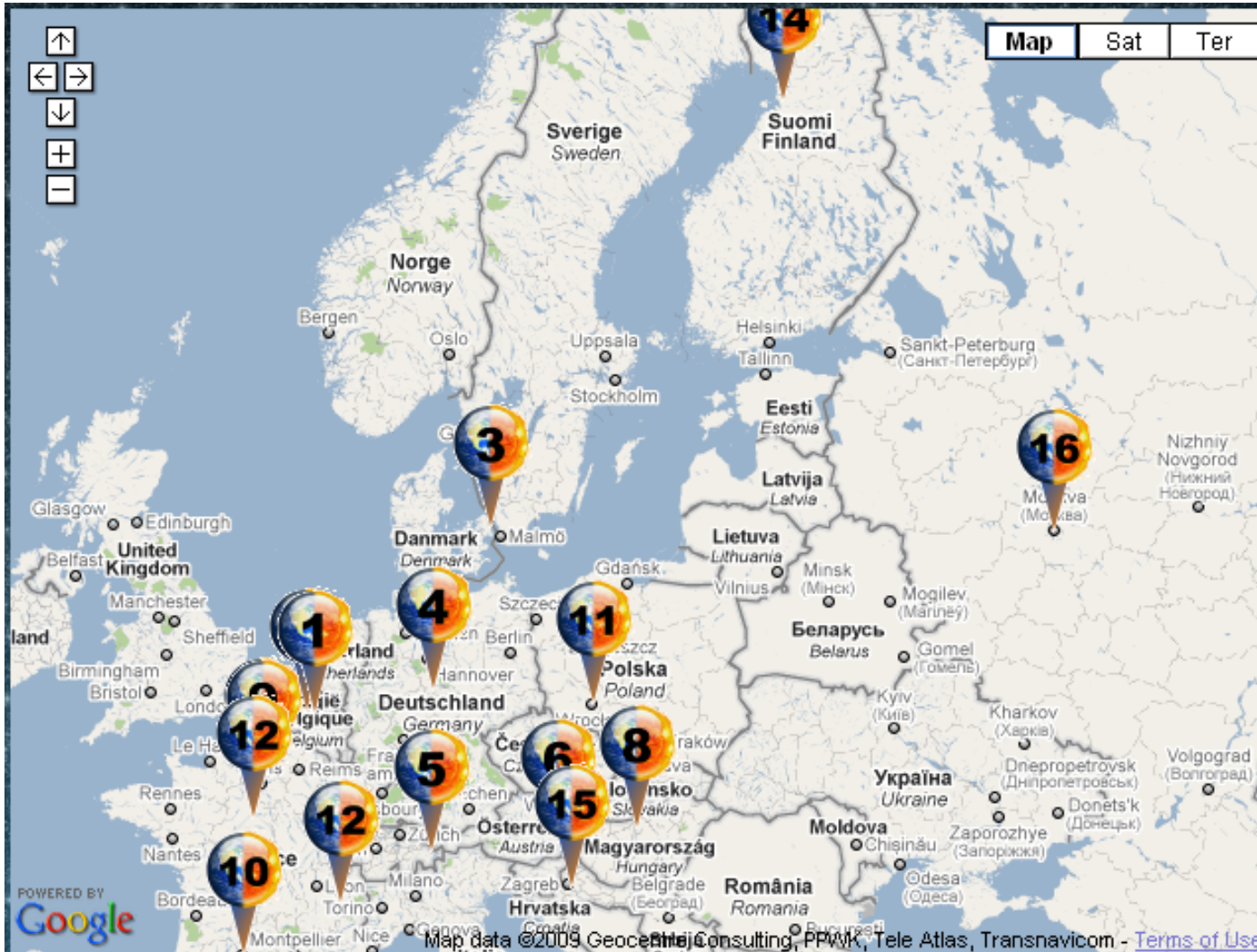


- Overview of the project
- Overview of the progress
- Future events

# Map of Soteria



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# SOTERIA EC network funded by the EC/FP7



Participant Number	Participant short name	Participant organisation name	Country
1 (coordinator)	KU Leuven	Katholieke Universiteit Leuven	Belgium
2	UNIGRAZ	Universitaet Graz	Austria
3	PMOD-WRC	Pyhsikalisch-Meteorologisches Observatorium Davos and World Radiation Center	Switzerland
4	KO	Konkoly Observatory	Hungary
5	CNRS LPCE & LP	Centre National de la Recherche Scientifique	France
6	ROB/SIDC	Koninklijke Sterrenwacht van Belgie	Belgium
7	OBSPARIS	Observatoire de Paris	France
8	SRC-PAS	Space Research Centre, Polish Academy of Sciences	Poland
9	MTA-KFKI-RMKI	MTA-KFKI-RMKI Research Institute for Particle and Nuclear Physics	Hungary
10	DTU	Technical University of Denmark	Denmark
11	UOulu	University of Oulu	Finland
12	UGOE	Georg-August-Universität Göttingen Stiftung Öffentlichen Rechts	Germany
13	HVAR	Hvar Observatory, Faculty of Geodesy, University of Zagreb	Croatia
14	NOVELTIS	Noveltis Sas	France
15	FIAN	P.N. Lebedev Physical Institute	Russia
16	IEEA	Informatique Electromagnetisme Electronique Analyse numérique	France

- Coordinator: G. Lapenta

- Data (ground & space) and simulation on:

1. Photosphere
2. Chromosphere/Corona
3. Heliosphere/Terrestrial effects
4. Irradiance

- Focus on data dissemination

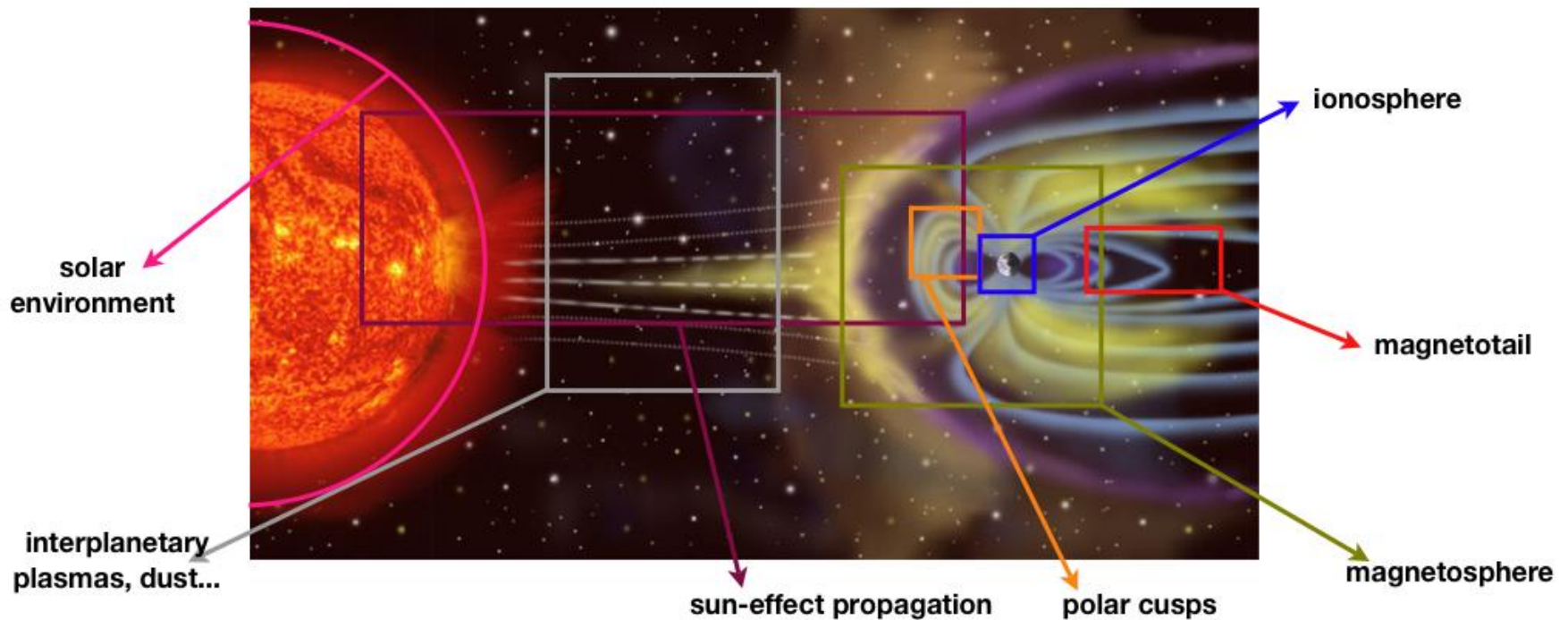
- Looking forward to collaborations outside the consortium



# Overview of the Space Covered by Soteria

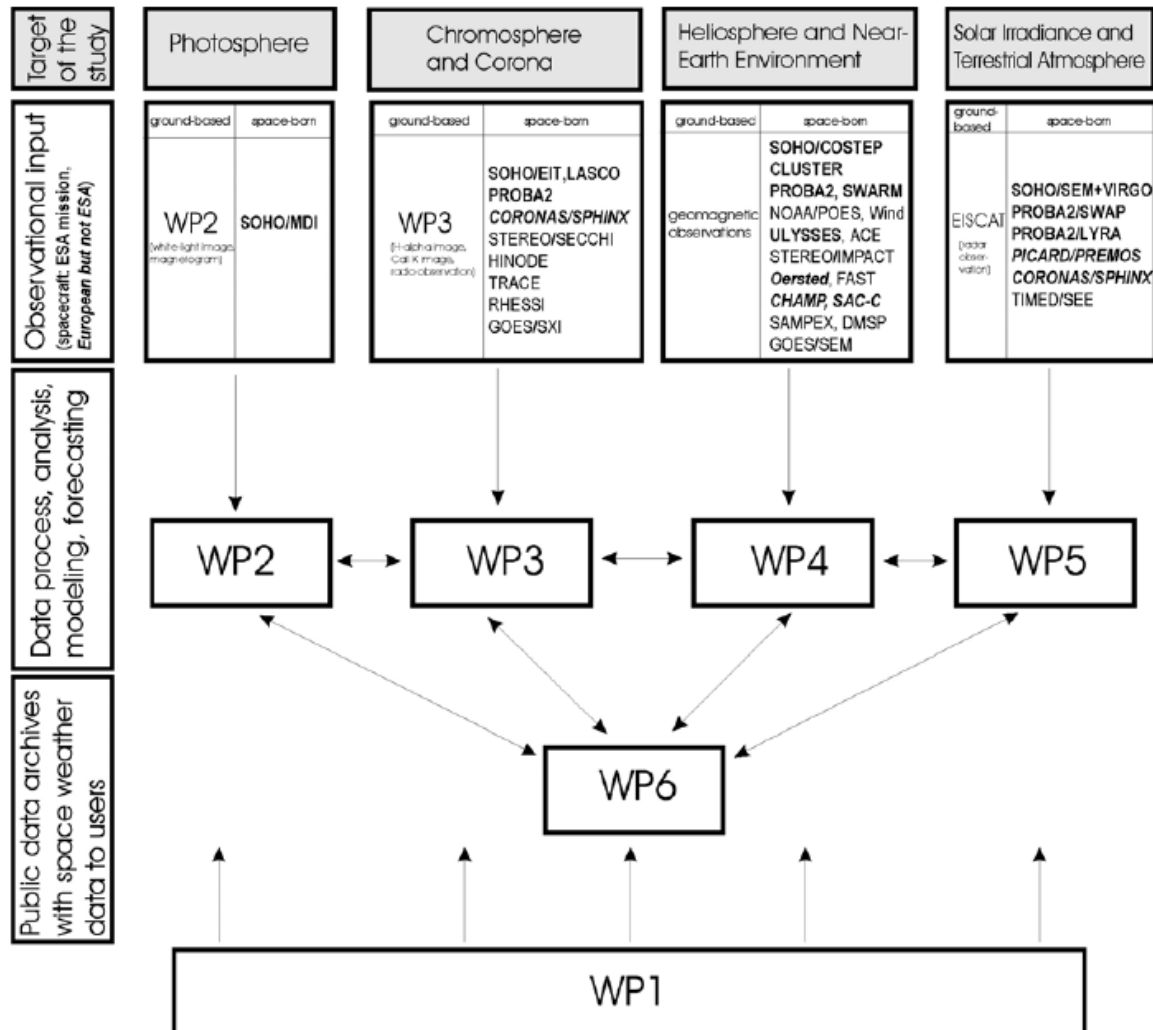


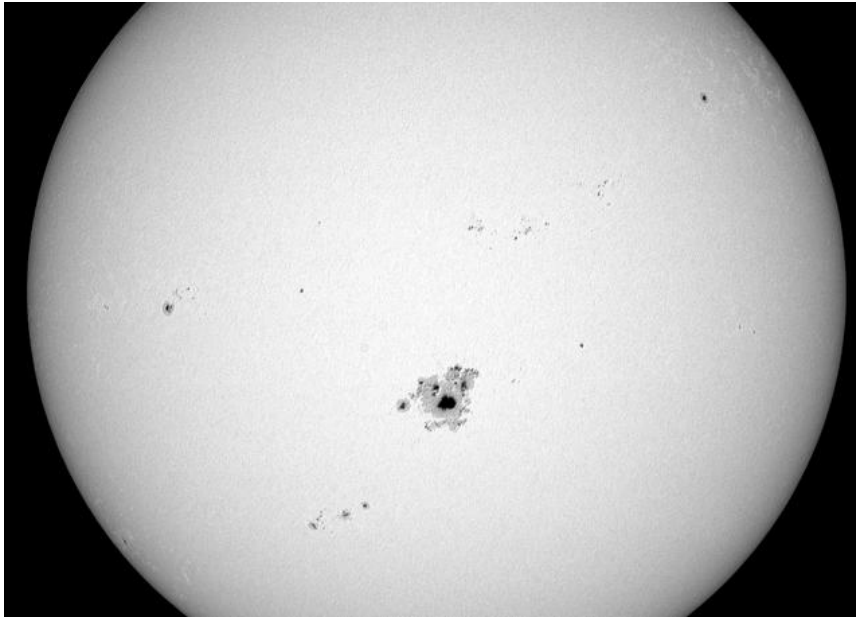
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# WP1: Management

## Goals of the project





*Major sunspot group passing central meridian: this image shows an active Sun, only two years after the last maximum of activity, with a major sunspot group passing central meridian. This whole-disk CCD image was taken on Aug. 17, 2002 with the Uccle solar telescopes (ROB, Brussels), one of the ground-based synoptic instruments that will support Work Package 2 of the SOTERIA project.*

## Relevance to space weather:

Active regions

Sunspot size, position, polarities and trends

Emerged field structures

Unstable configurations and current layers

Magnetic reconnection and initiation of CMEs

## Relevance to irradiance (weather, climate)

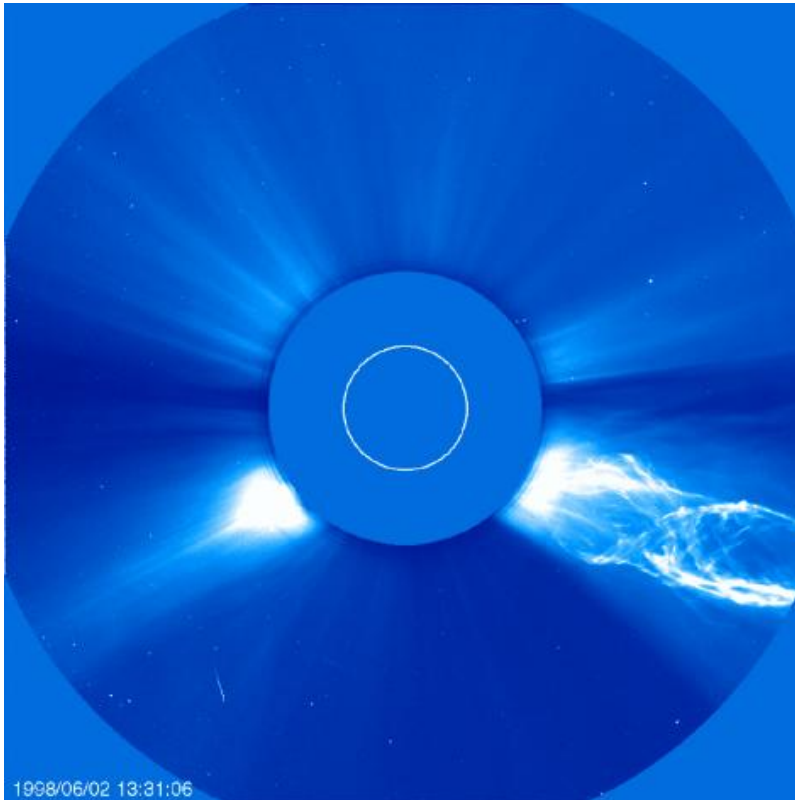
Positive: faculae

Negative: sunspots



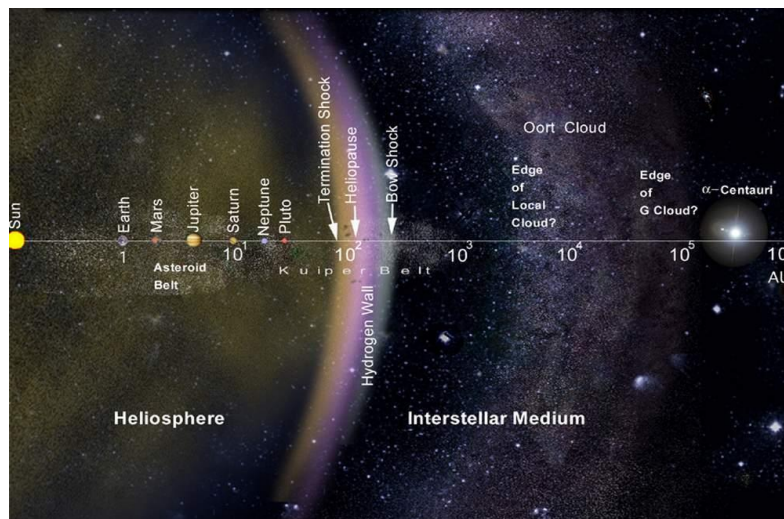
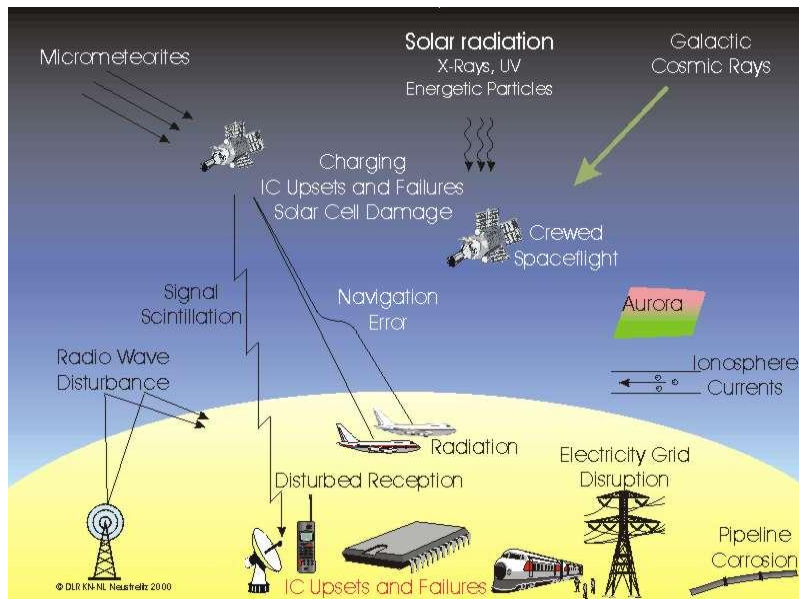
## Focus on:

- Flares
- CMEs
- Coronal heating
- Wind creation in coronal holes (fast)
- Wind creation in helmet streamers (slow)
- Constraining models with observations



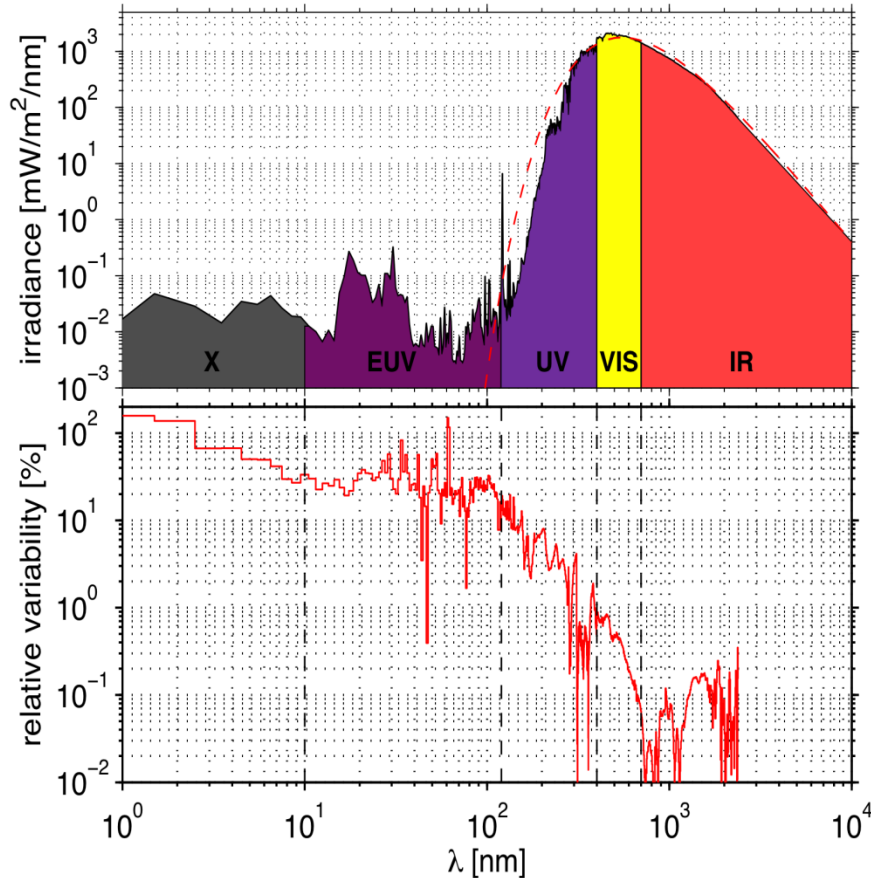


# WP4: Heliosphere and Terrestrial Effects



- Solar effects on the Earth, other planets, human activities
- Energetic particles streaming from the Sun
- Magnetic storms
- Variability and interactions with magnetospheres
- Processes initiated in the magnetospheres (e.g. substorms)

# WP5 *Irradiance*: Background



How does the **solar irradiance** vary in the EUV-UV-visible range ?

What causes the irradiance to change on short (days) to long (years) time scales ?

How does this affect the upper terrestrial atmosphere ?

# WP6: Distribution of data and dissemination



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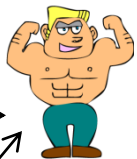
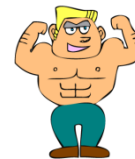
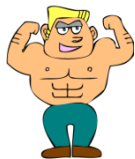
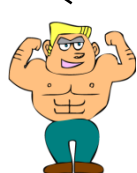
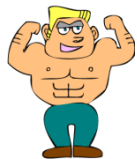
## BEFORE SOTERIA

## SOTERIA

Science journal

Science journal

public



GB data

space data

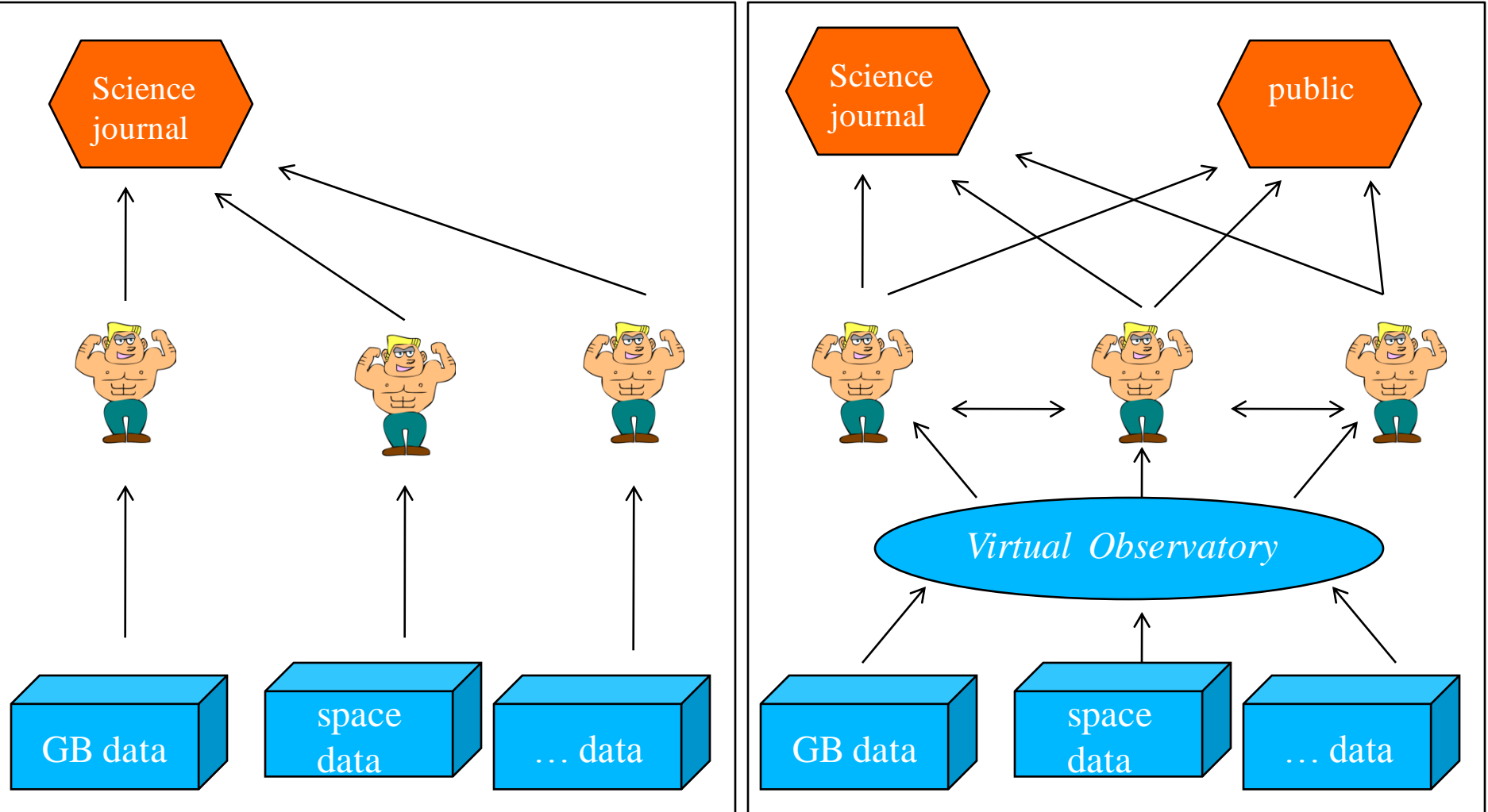
... data

GB data

space data

... data

*Virtual Observatory*



# Overview of the progress of each WP



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**WP1: Management (Lapenta)**

**WP2: Photosphere: Dr. – Ludmany**

**WP3: Chromosphere and Corona: Dr. Bothmer**

**WP4: Heliosphere and Terrestrial Effects: Dr.  
Vennerstrom**

**WP5: Irradiance: Dr. Dudok de Wit**

**WP6: Distribution of and dissemination: Dr. Berghmans**

# Soteria Web Page



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The screenshot shows a web browser window displaying the Soteria website. The browser's address bar shows the URL <http://soteria-space.eu/>. The website's header features a large banner with the word "SOTERIA" in a stylized font, with "SOLAR TERRESTRIAL INVESTIGATIONS AND ARCHIVES" written below it. The banner also includes images of the sun and Earth, and a row of flags representing various countries.

Below the banner is a navigation menu with the following items: Home, Meetings, Documents, Soteria Wiki, Positions, Pictures, News Archive, and Space-Weather tools. The "Soteria Wiki" item is highlighted.

The main content area is divided into three columns:

- Left Column:** A vertical menu with icons and text for: Institutions, Research, Publications, Repository, Links, Data Assimilation, Advisory Board, Contact us, and Soteria map. Below this menu is a small image of the Soteria logo and a YouTube icon.
- Middle Column:**
  - SWAP & LYRA data release**

The ESA micro-satellite PROBA2 was launched last November with two solar instruments onboard: SWAP, an EUV imager, and LYRA, a UV radiometer. SWAP and LYRA have an open data policy.

We are happy to announce the beta data release of the science data products: click [here](#) for further information.

New data will become available in (near) real time. Older data will gradually become available as we backward process the received telemetry. Users are encouraged to feedback problems and questions such that we can further fine-tune the format of the data products. The latest SWAP image and a recent LYRA time-curve can be found on the front page of <http://sidc.be>. More information on the instruments and data will become available on <http://proba2.sidc.be>.
  - PROBA2 Guest Investigator Program: DEADLINE**

We announce the open call for the PROBA2 Guest Investigator Program to promote & fund SWAP and LYRA data analysis by external scientists (submission deadline June 10).

A Guest Investigator Program is available to promote the use of PROBA2 data. Selected proposers will be invited to spend one or a few months with the PI teams to obtain expert knowledge on the instruments and to participate in the daily commanding of SWAP and LYRA. Each guest investigator will get reimbursed for travel, accommodation and living expenses. Details on the PROBA2 Guest Investigator Program can be found [here](#).
- Right Column:**
  - SOTERIA Consortium**

SOTERIA aims at creating a wide synergy in the fields of solar-space and geophysics among different centers in a number of European countries to achieve a higher level of quality and accessibility for the observational data and for the models. Our goal is to help creating the basis for a deeper understanding of solar and space processes having terrestrial impact.

Coordinator: prof. G. Lapenta

    - K.U. Leuven
    - Univ. of Graz
    - PMOD-WRC
    - Space Research Center
    - Konkoly Observatory
    - CNRS
    - Royal Observatory of Belgium
    - Observatory of Paris
    - Research Institute for Particle and Nuclear Physics
    - Technical Univ. of Denmark
    - University of Oulu

# Document Repository



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Document repository at <http://www.spaceweather.eu>

European Space Weather Portal | The European gateway to Space Weather resources

http://www.spaceweather.eu/en/repository/list

EUROPEAN SPACE WEATHER PORTAL

Home | Search | Log in

The European gateway to Space Weather resources

Navigation

- Home
- About
  - COST
  - SOTERIA
  - STCE
  - SWENET
  - SWWT
- Services
  - Model Access
  - Repository
  - Data Access
  - Now / forecasting
  - Software
- Outreach
  - Images
  - Introduction
  - Bibliography
  - Glossary
  - Drawings
  - Books
  - SWEETS2007
  - Your Language
- Other resources
  - Events
  - Topical Links
  - Audio
  - Publications
- Feedback
- Groups

User login

Username: \*  
Password: \*

Log in

- Create new account
- Request new password

Search

72 documents found.

Order by:

Title	Author(s)	Insert date	File size	
CACTUS: Long-term properties of CMEs	BERGHMANS, D. (ROB); ROBBRECHT, E. (NRL); VAN DER LINDEN, R. (ROB)	06/05/09	4270 KB	<a href="#">details</a>
Energy release through flares and CMEs, their evolution and geo-space impact parameters for special events	SLEMZIN, V. (LPI); BOTHMER, V. (UGOE)	11/26/09	10012 KB	<a href="#">details</a>
ESSW6 - session 1, Fletcher	FLETCHER, E. (ESA)	12/03/09	2392 KB	<a href="#">details</a>
ESSW6-Greece's National Assets	DAGLIS, I. (NOA)	12/17/09	10380 KB	<a href="#">details</a>
ESSW6-HELIO-The Heliospherics integrated Observatory	BENTLEY, R. (UCL)	12/18/09	875 KB	<a href="#">details</a>
ESSW6-Latest developments with SPENVIS- The space Environment Information System	LAWRENCE, G. (RHEA)	12/18/09	6358 KB	<a href="#">details</a>
ESSW6-Modelling electron radiation belt variations during geomagnetic storms with the new BAS Global radiation model	HORNE, R.B. (BAS)	12/18/09	3027 KB	<a href="#">details</a>
ESSW6-Radiation belt data driven modelling	CROSBY, N. (BIRA)	12/18/09	1411 KB	<a href="#">details</a>
ESSW6-session2:Space Weather and the upper atmosphere at auroral latitudes and near the magnetic equator	HOPPE, U. (FFI)	12/03/09	2562 KB	<a href="#">details</a>
ESSW6-session2:Space Weather effects in the upper atmosphere	PROELLS, G. (AIFA)	12/03/09	843 KB	<a href="#">details</a>
ESSW6-Session4: Impacts of ground enhancements on the Radiation exposure in aviation	MATTHIA, D. (DRL)	12/03/09	28059 KB	<a href="#">details</a>
ESSW6-session4:Relation imposed Risks	APEL, U. (HS-BREMEN)	12/03/09	672 KB	<a href="#">details</a>
ESSW6-Session4:Time-frequency behaviour of medical diseases and their relation with solar activity	DIAZ-SANDOVAL, R. (); EDERLYI, R. (TUOS)	12/03/09	3114 KB	<a href="#">details</a>
ESSW6-Webservices for distributed acces to space weather models	RUHL, K. (); BELTRAMI, P. (ETAMAX)	12/18/09	817 KB	<a href="#">details</a>
ESWW6 - Keynote Lecture: Are we alone?	BENZ, W. (PIUB)	12/03/09	19426 KB	<a href="#">details</a>
ESWW6 - Session 1: Belgium Space Weather Assets	KRUGLANSKI, M. (BIRA-IASB)	01/14/10	914 KB	<a href="#">details</a>
ESWW6 - Session 1: Fletcher	FLETCHER, E. (ESA)	12/03/09	2392 KB	<a href="#">details</a>
ESWW6 - Session 3: Latest developments with spenvis	LAWRENCE, G. (RHEA)	12/08/09	4242 KB	<a href="#">details</a>
ESWW6 - Tutorial: Quiz	BERGHMANS, D. (ROB); D'HUYS, E. (ROB); SEATON, D. (ROB)	12/01/09	1581 KB	<a href="#">details</a>
ESWW6 - Tutorial: Science behind Space Weather	DE GROOF, A. (ESA)	12/01/09	49540 KB	<a href="#">details</a>

1 2 3 4

Contributing countries:

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Plasmapause location

2010-01-17 18:30

SEP event forecast

2010-01-18 09:15:00

(Add your forecast)

Maintenance and hosting:

# Newsletters



The screenshot shows a web browser window with the address bar containing `http://sotera-space.eu/wiki/index.php/Newsletters`. The page title is "Newsletters". Below the title, there are two sub-sections: "Newsletters" and "Newsletter Mar, 2010", followed by "Newsletter May, 2010". On the left side, there is a navigation menu with links: Main Page, Community portal, Current events, Recent changes, Random page, and Help. Below the navigation menu is a search box with "Go" and "Search" buttons. Further down is a toolbox with links: What links here, Related changes, Upload file, Special pages, Printable version, and Permanent link. At the bottom of the page, there is a footer with the text: "This page was last modified on 18 May 2010, at 14:27. This page has been accessed 110 times. Privacy policy About Sotera Disclaimers". The footer also includes a "Powered By MediaWiki" logo.

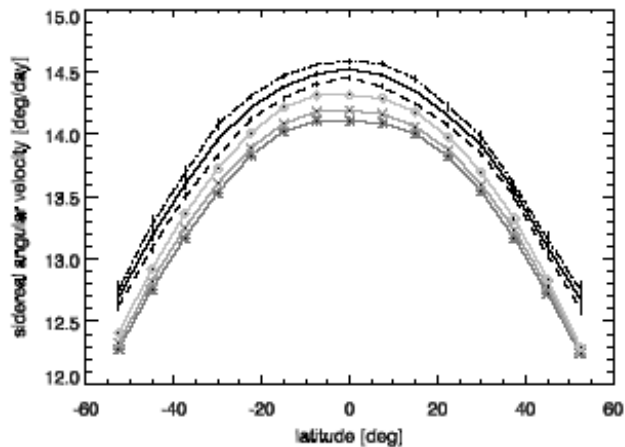
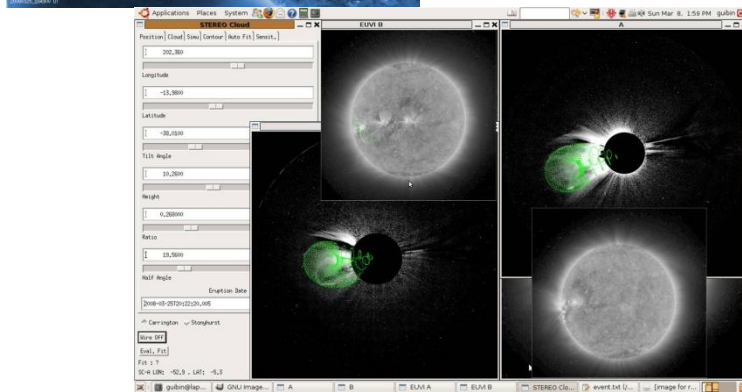
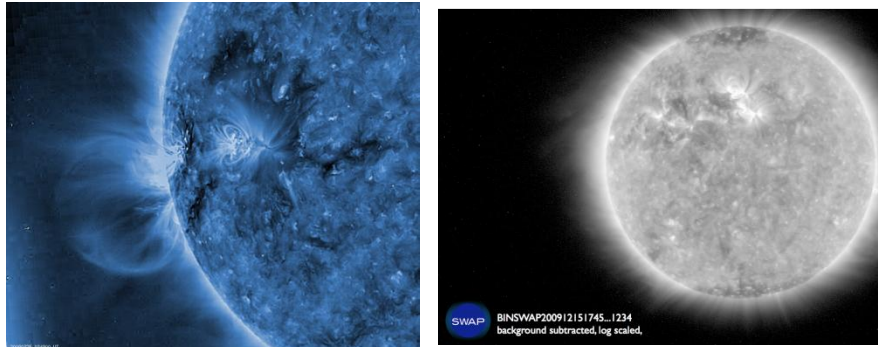


Fig. 1. Rotation velocity derived from ring-diagram analysis at 3Mm (asterisk), 7Mm (cross), 15Mm (diamond) (lines from dark to light grey) and SBCS tracing (black) averaged over the periods: August 2001 – March 2004 (dashed), April 2004 – December 2006 (dashed dotted).

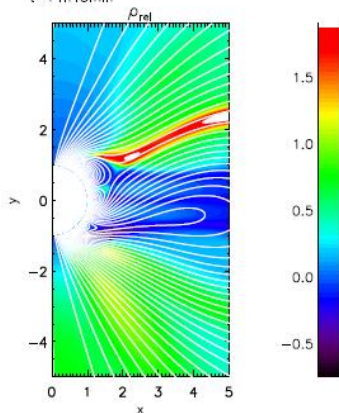
Zaatri et al. (Brajsa) 2009  
*A&A*, **504**, 589.

- Vibrant collaborations established among the observatories
- Historical data, example of summer student at ROB
- Online repositories to be linked with the VO (list on web site), examples:
  - SOHO/MDI Continuum faculae: produced by schedule
  - SOHO/MDI Sunspot Data (SDD): produced by schedule
  - daily magnetic observations
  - Debrecen Photoheliographic Data sunspot catalogue
- Publications
  - differential rotation (published, see figure)
  - torsional oscillation of hemispheric cycles (submitted)
  - active longitudes - cooperative study, in progress
  - comparative analysis of DPD, SDD and ISN - cooperative study, in progress





t=14h45min



- STEREO operations and archiving smoothly proceeding.
- Coronas/Photon successfully launched and operated. TESIS and SphinX instruments databases established.
- Proba2 successfully launched and operated. SWAP and LYRA database in progress.
- Report on 3D structure (STEREO) and energy release of flares and CMEs.
- Ground-Based Telescope Developments
- Data Analysis Modelling, Simulations in Progress.
- E/PO Material Established (DVD, blu-ray).

# WP4: Progress so far - Heliosphere

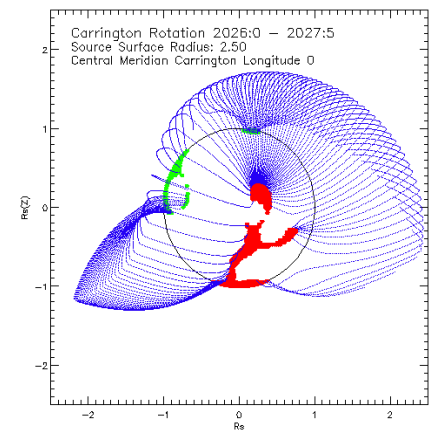
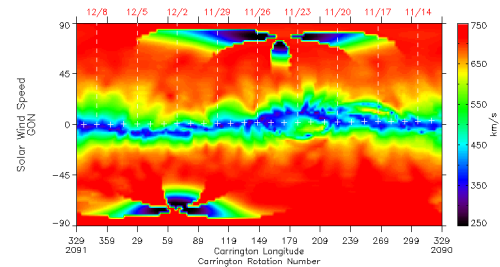
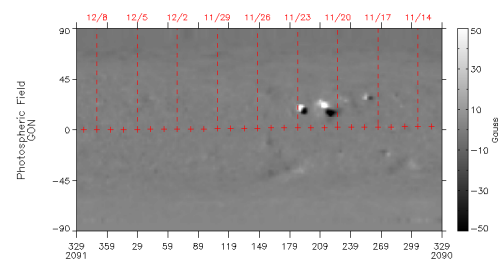


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## Soalar Wind, CME propagation: Comparing/validating models

## Data assimilation into solar wind modelling

WSA-1.6



Negative Open  
Field Line  
Footpoints

Closed  
Field Lines

Positive Open  
Field Line  
Footpoints

Science/Educational uses of CCMC runs - Microsoft Internet Explorer provided by DTU Space

http://ccmc.gsfc.nasa.gov/langroup/ctr/soteria.php

Science/Educational uses of CCMC runs

COMMUNITY COORDINATED MODELING CENTER

Related Links | Frequently Asked Questions | Community Feedback | Download

About Us | Space Weather Models at CCMC | Request A Model Run | View Model Run Results | Instant Run | Experimental Real-Time

**Results of simulations performed in support of SOTERIA**

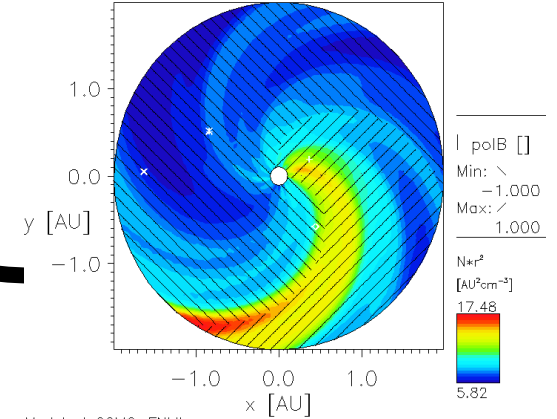
SOLAR-TERRESTRIAL INVESTIGATIONS AND ARCHIVES

Presented below are results of simulations performed in support of SOTERIA (Solar-Terrestrial Investigation and Archives).

**Heliospheric runs:**

Run Number	Key Word	Model	Model Version	Carrington Rotation Start	Carrington Rotation End	Input Type	Grid Resolution
Thea_Falkenberg_020909_SH_6	July2004event soteria	ENLIL	2.5b	2004/07/22 08:38:38.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90
Thea_Falkenberg_021109_SH_1	July2004event soteria	ENLIL	2.5b	2004/07/22 08:38:38.5600	2004/08/18 14:02:06.7200	Time-Independent	256x30x90

12/08/2009 Time = 06:31:48 UT lat= 0.00°  
 + Mercury at r=0.42 CLON=225.  
 + Earth at r=0.98 CLON=345  
 + Venus at r=0.72 CLON=145.  
 + Mars at r=1.62 CLON= 15.



Model at CCMC: ENLIL

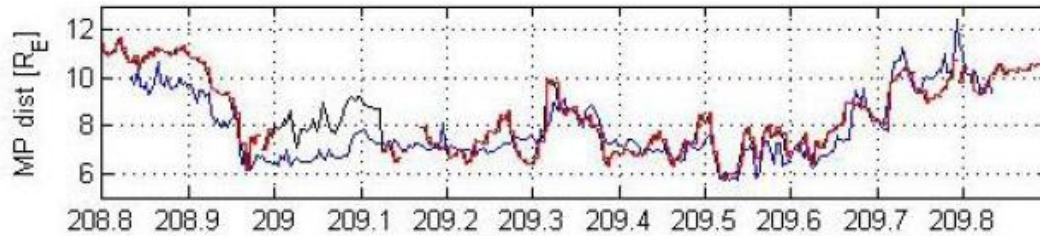
# WP4: Progress so far - Magnetosphere



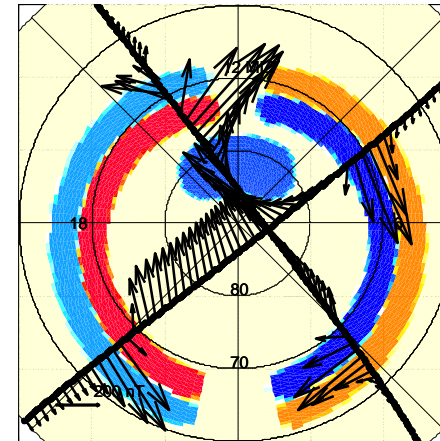
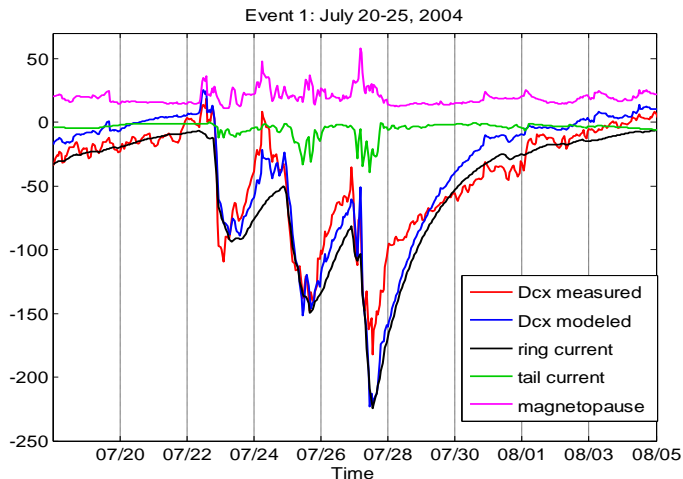
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Magnetopause location: Validating and comparing models

Coronal holes  
- Predicting Dst



Geomagnetic monitoring: Dst/Dcx – separating contributions

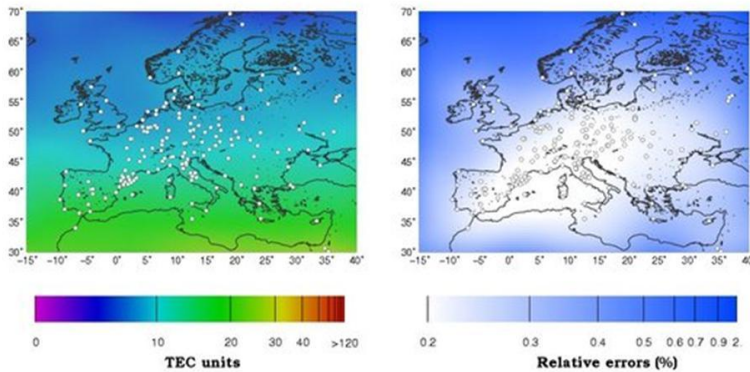


Auroral oval  
currents –  
Inversion of  
magnetic  
satellite data

# WP4: Progress so far - Ionosphere



SPECTRE TEC maps 2008/03/30 12:00:00

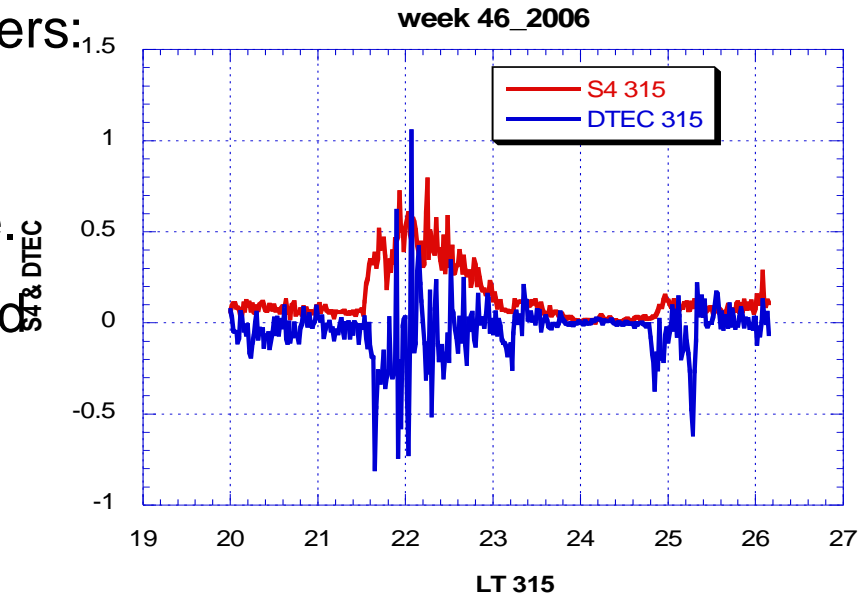


Provision of TEC Maps and timeseries from GPS data

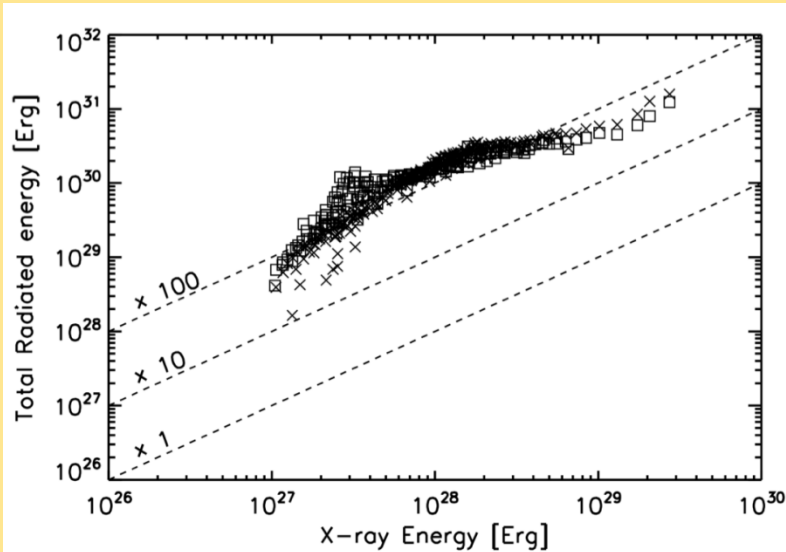
Comparison between focus parameters:  
Scintillations, TEC and Dst

Evidence for relation between  
scintillations and TEC rate of change.

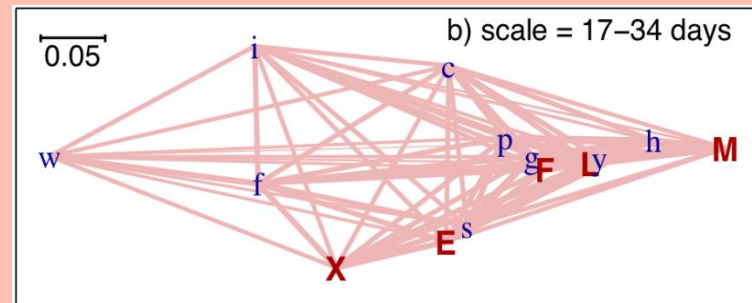
No correlation found between Dst and  
low latitude scintillations



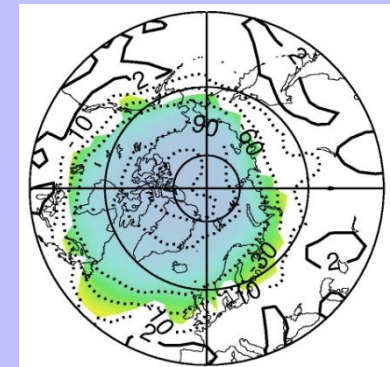
All solar flares emit most of their energy in visible light (*Kretzschmar et al., 2009*)



How well do various solar proxies describe spectral bands ? (*Dudok de Wit et al., 2009*)



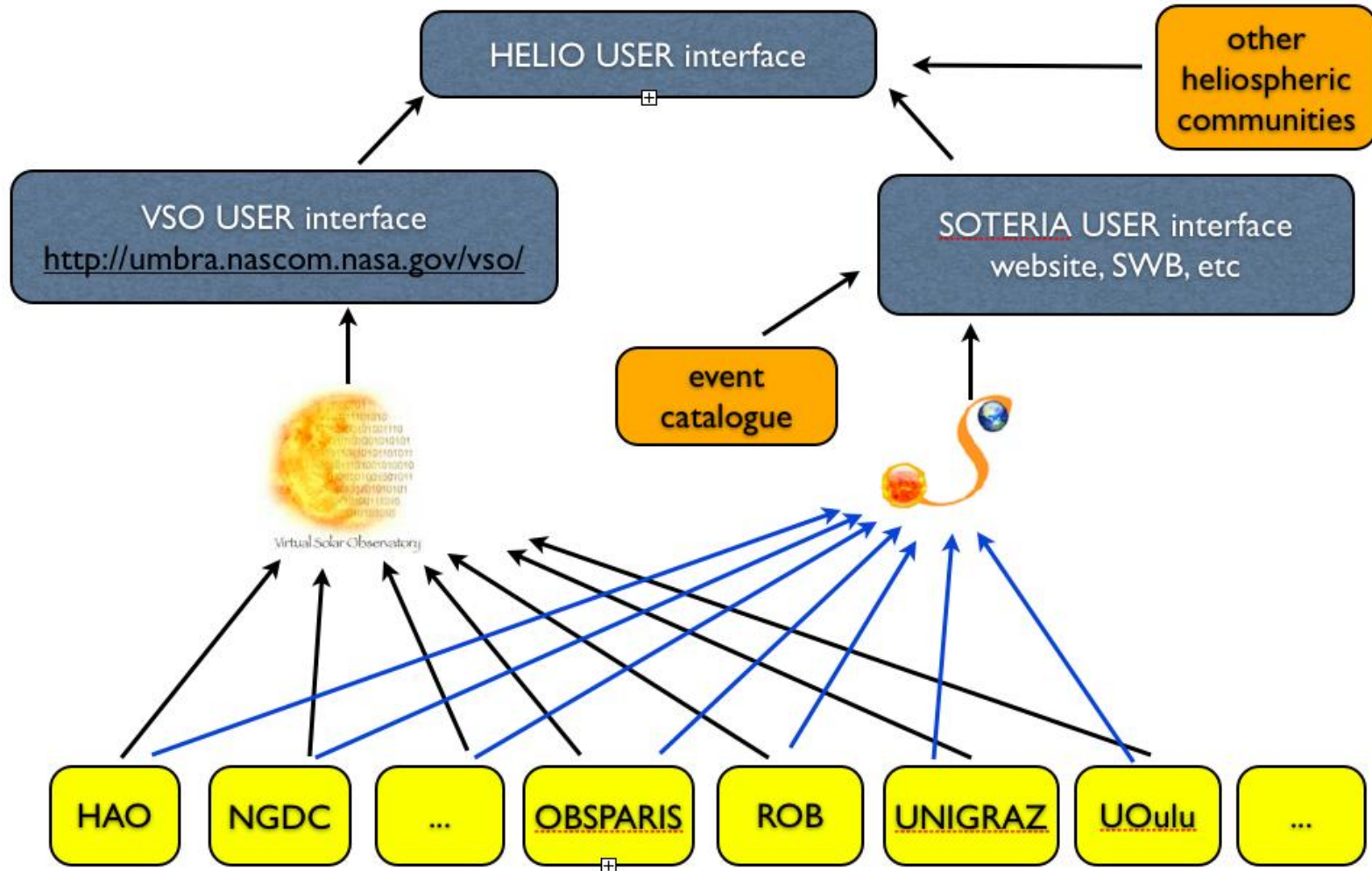
Expanding the global chemistry-climate-ionosphere model SOCOL-i to the lower ionosphere (*Egorova et al., 2010*)



## New directions :

- \* Long-term variability of the total solar irradiance : modelling and implications on climate change
- \* Response to ESA Space Situational Awareness programme : input to orbitography models
- \* Workshop on future trends in solar spectral irradiance measurements

## CASSIS FP7 coordination activity



# Major upcoming events



- School organised with COST and ICTP
- Capacity Building Workshop organised in Brussel
- Full exploitation of PROBA2 that now is operative
- Full exploitation of SDO that now is operative
- Focus on continuing and increasing the collaborations established so far
- Thematic workshops, visits and exchange of personnel among the beneficiaries
- Second annual meeting in October
- Web resources



# Summer School

## Summer School

In collaboration with:

- COST Action on space weather
- ICTP Trieste
- To be held in Trieste
- Public outreach event, educational and involving scientists outside Soteria

## Capacity Building Workshop

Internal event organized by  
ROB Brussel

In Brussel

The scope is to train all Soteria members to the use of a common data management software and practice



# School on Space Weather



The Abdus Salam  
International Centre for Theoretical Physics



## INTERNATIONAL ADVANCED SCHOOL ON SPACE WEATHER MODELLING AND APPLICATIONS

18 - 29 October 2010

Miramare, Trieste, Italy

The School is organised jointly by ICTP, the EC COST Action ES0803 "Developing Products and Services for Space Weather in Europe", and the EC FP7 Project SOTERIA "SOLAR-TERrestrial Investigations and Archives".

### PURPOSE AND NATURE

Space Weather is the physical and phenomenological state of natural space environments under the effect of solar and non-solar driven perturbations.

In Europe the study of Space Weather has been promoted by the European Space Agency (ESA) and this triggered various cooperation initiatives like the former EC COST Action 724 "Developing the Scientific Basis for Monitoring, Modelling and Predicting Space Weather", the new EC COST Action ES0803, and the EC FP7 Project SOTERIA.

This school is a follow-up to the "International Advanced School on Space Weather" co-organized in 2006 by ICTP, EC COST Action 724, USNSWP, SCOSTEP/CAWSES, INAF, and INFN.

It is aimed at providing the scientific knowledge and the applied aspects of Space Weather, i.e., the monitoring and modelling resources based on advanced data handling, and it will address the following topics: a. Space Weather Drivers and the Relevant Physical Environments; b. Space Weather Impacts on Technological Systems and Humans; c. Space Weather Monitoring and Data Handling; d. Space Weather Modelling Techniques. Morning sessions will be focused on theory and afternoon sessions to practicals with the direct participation of the attendees.

### PARTICIPATION

Scientists and students from all countries that are members of the United Nations, UNESCO or IAEA may attend the School. Although the main purpose of the ICTP is to help researchers from developing nations through a programme of training activities within a framework of international cooperation, students and postdoctoral scientists from developed countries are also welcome to attend. As the School will be conducted in English, participants must have a good working knowledge of that language.

As a rule, travel and subsistence expenses of the participants are borne by the home institution. However, limited funds are available for some participants (not more than 45 years of age) from, and working in, developing countries, to be selected by the organizers. Such financial support is available only for those who attend the entire activity. Every effort should be made by candidates to secure support for their fare (or at least half fare) from their home country. There is no registration fee to attend the School.

### HOW TO APPLY FOR PARTICIPATION

The application form can be accessed at the activity website:

<http://agenda.ictp.it/smr.php?2171>

Once in the website, comprehensive instructions will guide you step-by-step, on how to fill out and submit the application form.

Telephone: +39-040-2240226      Telefax: +39-040-22407226

E-mail: [smr2171@ictp.it](mailto:smr2171@ictp.it)  
ICTP Home Page: <http://www.ictp.it>

April 2010

- Over 180 applicants
- Two weeks
- Speakers being invited now
- Topics in space physics, space weather events, effects on technology and people

### DIRECTORS

A. Belhaki (NOA, GR)  
M. Messerotti (INAF, IT)  
G. Lapenta (KU Leuven, BE)  
S. Radicella (ICTP, IT)



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### MAIN CO-SPONSORS

- the Abdus Salam International Centre for Theoretical Physics (ICTP)
- EC COST Action ES0803 "Developing Products and Services for Space Weather in Europe"
- EC FP7 Project SOTERIA "SOLAR-TERrestrial Investigations and Archives"
- National Institute for Astrophysics (INAF) (Italy)
- European Space Agency (ESA)

### APPLICATION DEADLINE

31 May 2010