



Forecasting High Energy Electron Fluxes at GEO: A New Service From the EU FP7 Project SPACECAST

D. Heynderickx

DH Consultancy, Leuven, Belgium

R.B. Horne, N.P. Meredith, S.A. Glauert

British Antarctic Survey, Cambridge, UK

D. Boscher, A. Sicard-Piet, V. Maget

ONERA, Toulouse, France

N. Ganushkina, O. Amariutei

FMI, Helsinki, Finland

H. Koskinen, R. Vainio, A. Afanasiev

University of Helsinki, Finland

S. Poedts, C. Jacobs

Katholieke Universiteit Leuven, Belgium

B. Sanahuja, A. Aran

Universitat de Barcelona, Spain

D. Pitchford

SES Global, Luxembourg



COSPAR Assembly 39

Mysore, India

16 July 2012

PSW.1-0018-12

Project background

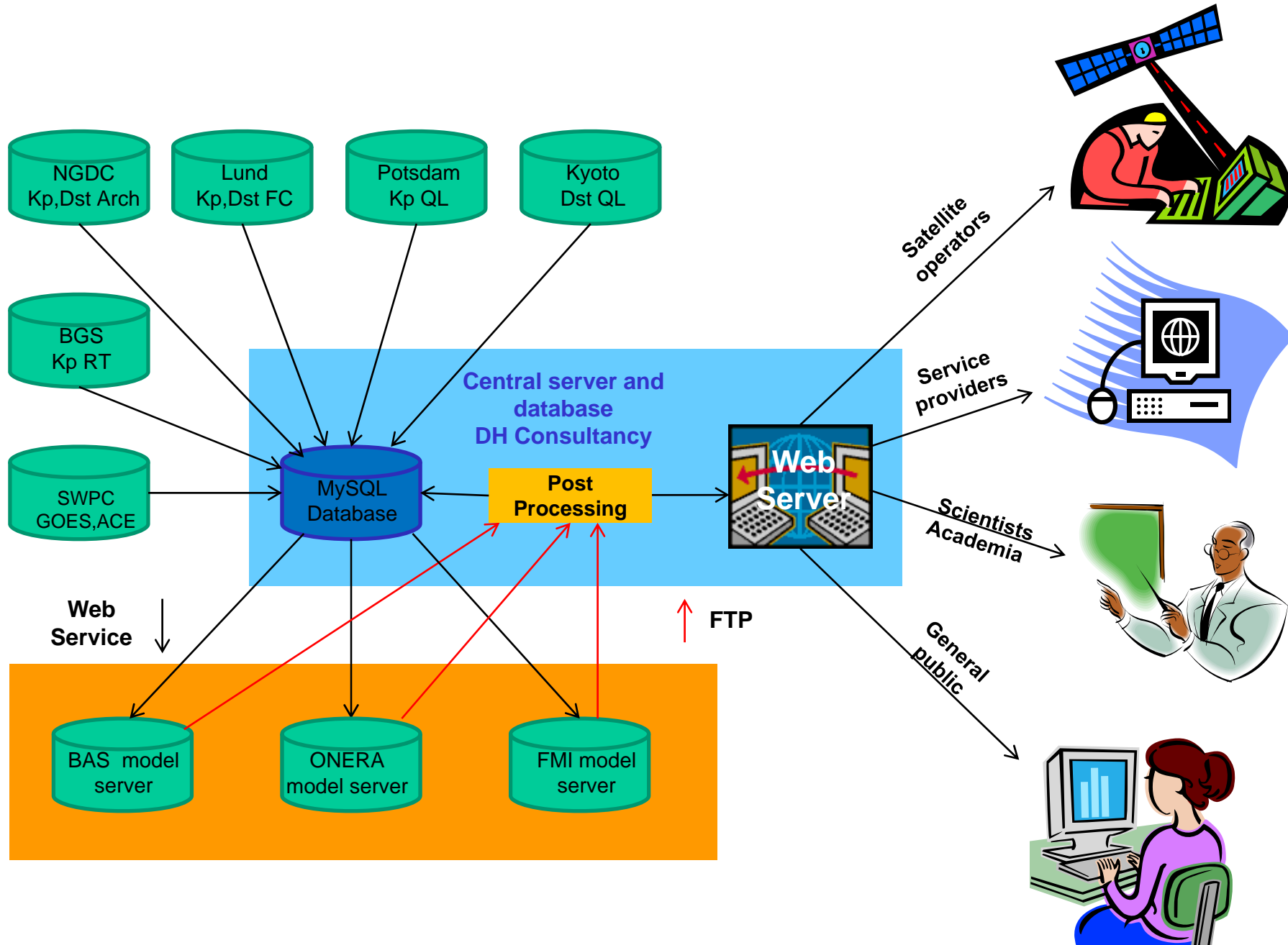
- Space is strategically important for Europe: GMES, Galileo, telecom, ...
- Space assets are vulnerable to high energy particles (deep dielectric charging, radiation damage, ...) and low energy particles (surface charging, surface erosion, solar cell degradation, ...)
- Vulnerability is increasing with time as new technology becomes more and more miniaturized and sensitive.
- Risks change with the solar cycle. Corporate memory has a much shorter time scale...
- Low frequency events have potentially large impacts, which complicates raising awareness and finding a balance between false alerts and under-prediction of hazardous conditions.
- There is a growing need for reliable and accurate alerts (near-real time environment and effect specification) and warnings (forecasts on different time scales).
- More interaction with stakeholders is needed to raise their awareness and to tailor space weather products to their needs.

Project overview

- European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no 262468.
- Consortium of 7 teams: BAS (UK), ONERA (France), FMI (Finland), University of Helsinki (Finland), Universitat de Barcelona (Spain), Katholieke Universiteit Leuven (Belgium), DH Consultancy (Belgium).
- Consultation with SES Global (Luxembourg).
- US collaborations: NASA Goddard, UCLA, Johns Hopkins, LANL, Exploration Physics International, Inc.
- Time frame: March 2011–February 2013.
- EU budget: ~2M€.
- Web site: <http://fp7-spacecast.eu/>

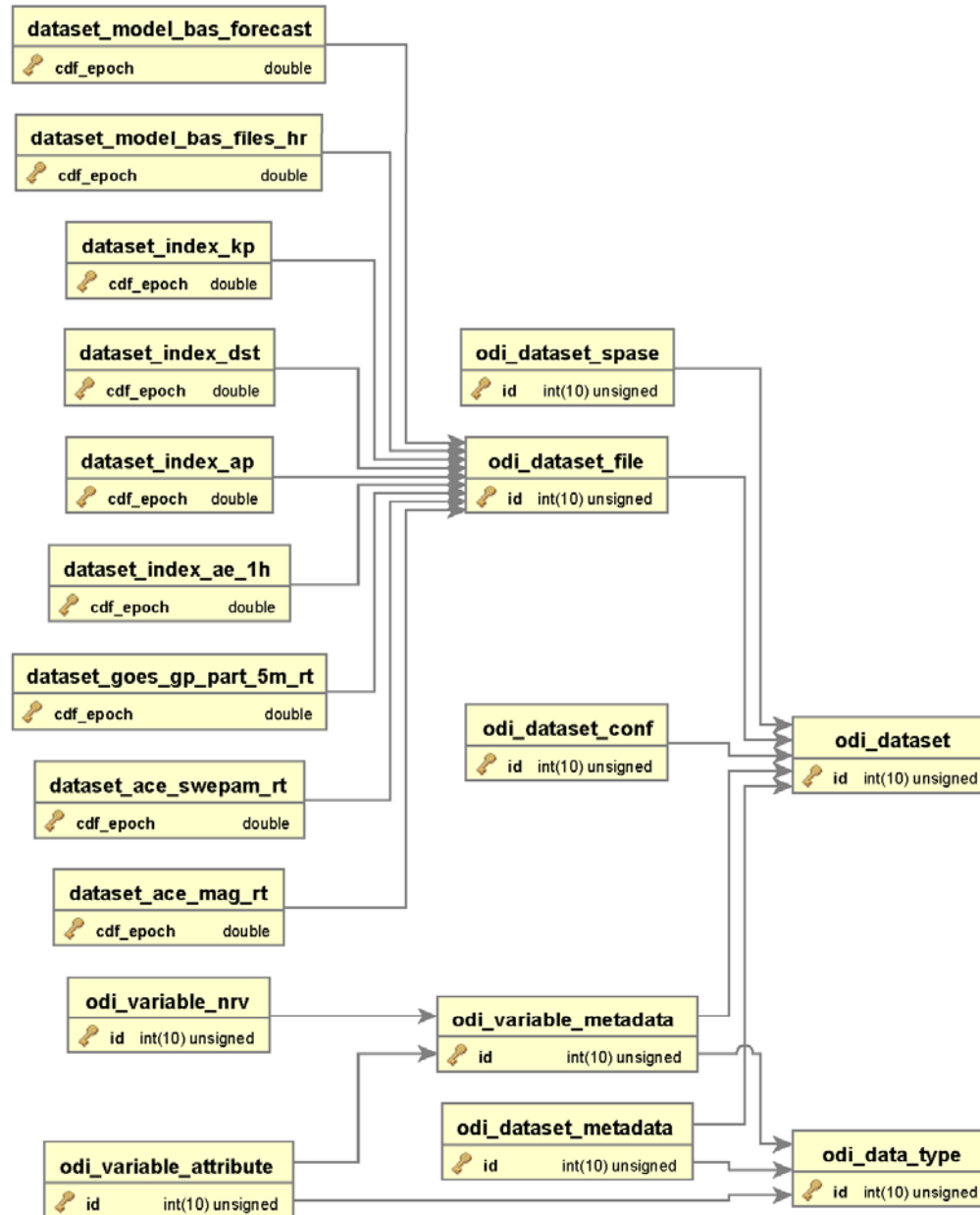
Project goals

- Forecasts of high energy and low energy electron population of the Earth's radiation belts
 - Research to improve dynamic physical models
 - Automated process chain to collect driver parameters (e.g. indices), run forecast models, post-process and display results
- Research on Solar Energetic Particles
 - MHD model shock simulations, transport models of shock accelerated protons to improve SEP flux models.
 - Development and implementation of radiation dose tools
- Definition and automated issuing of user specific alerts and warnings
 - Daily electron fluence (possibly coupled to spacecraft charging codes)
 - Radiation dose threshold crossing: generic plus user specified shielding configuration
- Development of a stakeholder community: spacecraft operators/designers, space insurance, policy makers, the public, scientists.
- Establishment of a database server and central processing server in combination with a dynamic web site.
- Validation of model results with spacecraft data.



Service components

- MySQL database server
 - ESA Open Data Interface (<http://spitfire.estec.esa.int/pubtrac/ODI/>)
 - Spacecraft data (GOES protons and electrons) and magnetic indices (Kp, Dst; AE when available in near real time)
 - Archive of model run output files
 - Browsing of all model outputs
 - Statistics for model validation
 - Population of the database using cron jobs.
- SOAP web service to distribute model parameters to model servers. Php client scripts run as cron jobs in synchronisation with model runs.
- Central server runs cron jobs to retrieve model output files via ftp. Files are archived and post-processed for displaying products on the web site. High energy electron models have been running automatically since Nov 2011 at an hourly cadence, with only one short service interruption.
- Under development
 - Integration of low energy electron models in the processing chain
 - Definition of alerts and warnings, with user specific parameters
 - Calculation and display of validation metrics: skill scores, RMSE plots.

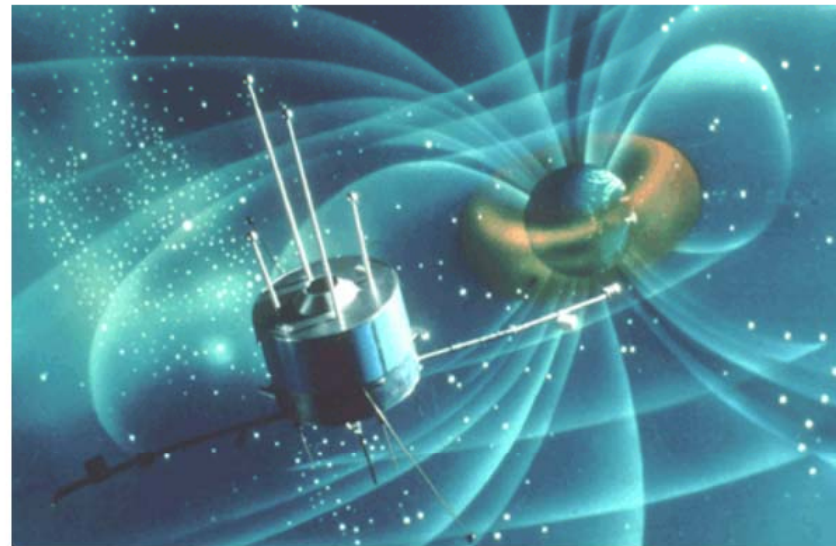




Home
SPACECAST Project
News
Publications
Links
Background
How we ...
Models
Background
Acknowledgements
Contact us
Login
Username: <input type="text" value="daniel"/>
Password: <input type="password" value="*****"/>
<input type="button" value="Log in"/>
Register for an account

High-Energy Electron Forecasts	Low-Energy Electron Forecasts	Solar Energetic Particles	Radiation Dose	Alerts and Warnings	Animations & Special Events	Validation	Archive
--	---	---	--------------------------------	-------------------------------------	---	----------------------------	-------------------------

Welcome to the SPACECAST web site, a resource providing support for satellite operators, designers and insurers, and information for the general public. SPACECAST is a Collaborative Project funded by the European Union Framework 7 programme to help protect satellites on orbit by modelling and forecasting particle radiation.



©British Antarctic Survey

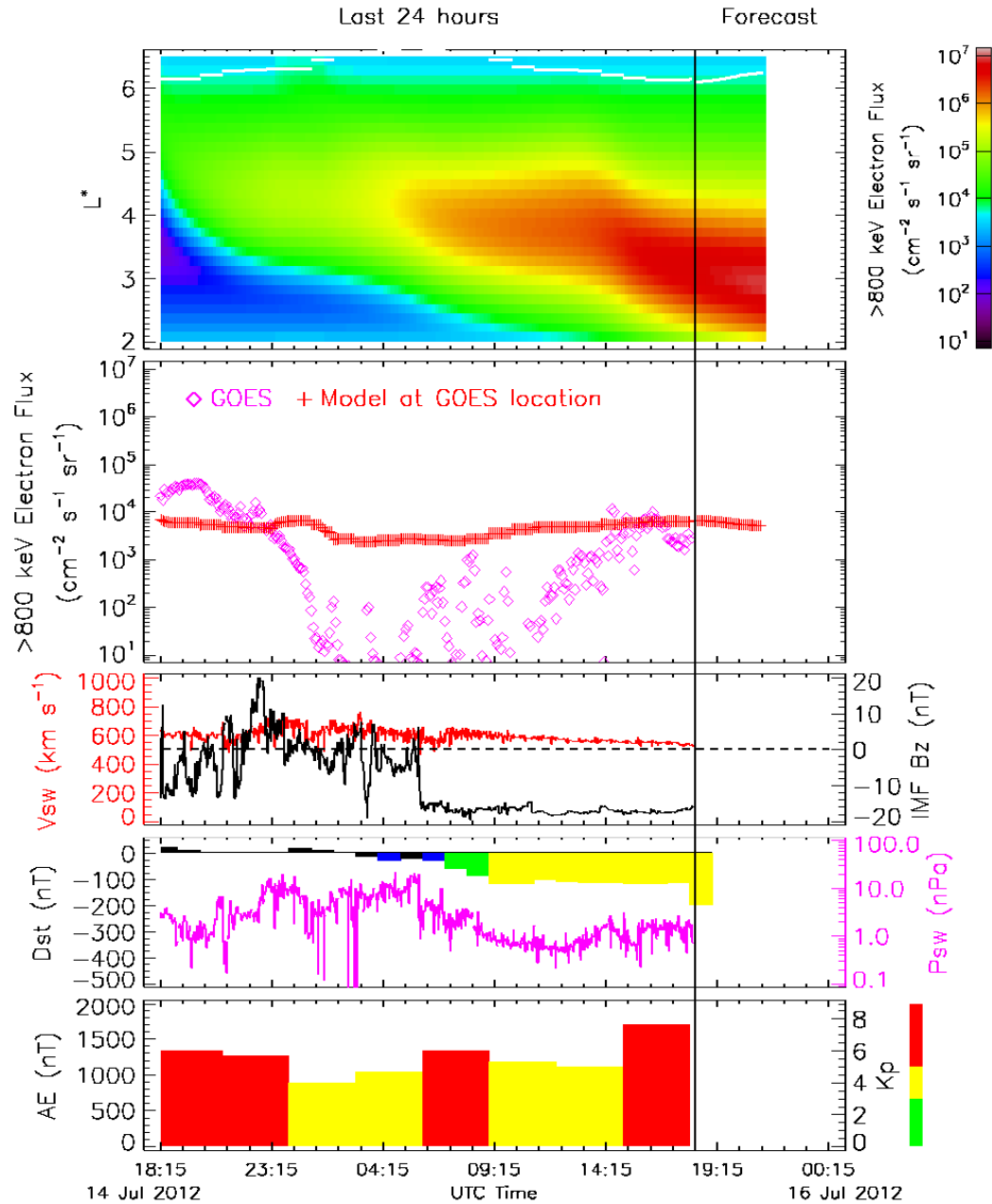
SPACECAST satellite risk index: Low risk

Last updated at 19:31 UTC on 15 Jul 2012
Next update at 20:35 UTC on 15 Jul 2012

[Check our latest high energy electron forecast!](#)

SPACECAST is a three year project which runs until 28 Feb 2014. At present, the web site provides a forecast of high energy electron fluxes and an associated risk index. The underlying models will be improved as part of the research element of the project. In future, we will also provide a forecast of low energy electrons, modelling of Solar Energetic Particles and an alert service. Visit our [site map](#) for a tour of the site.



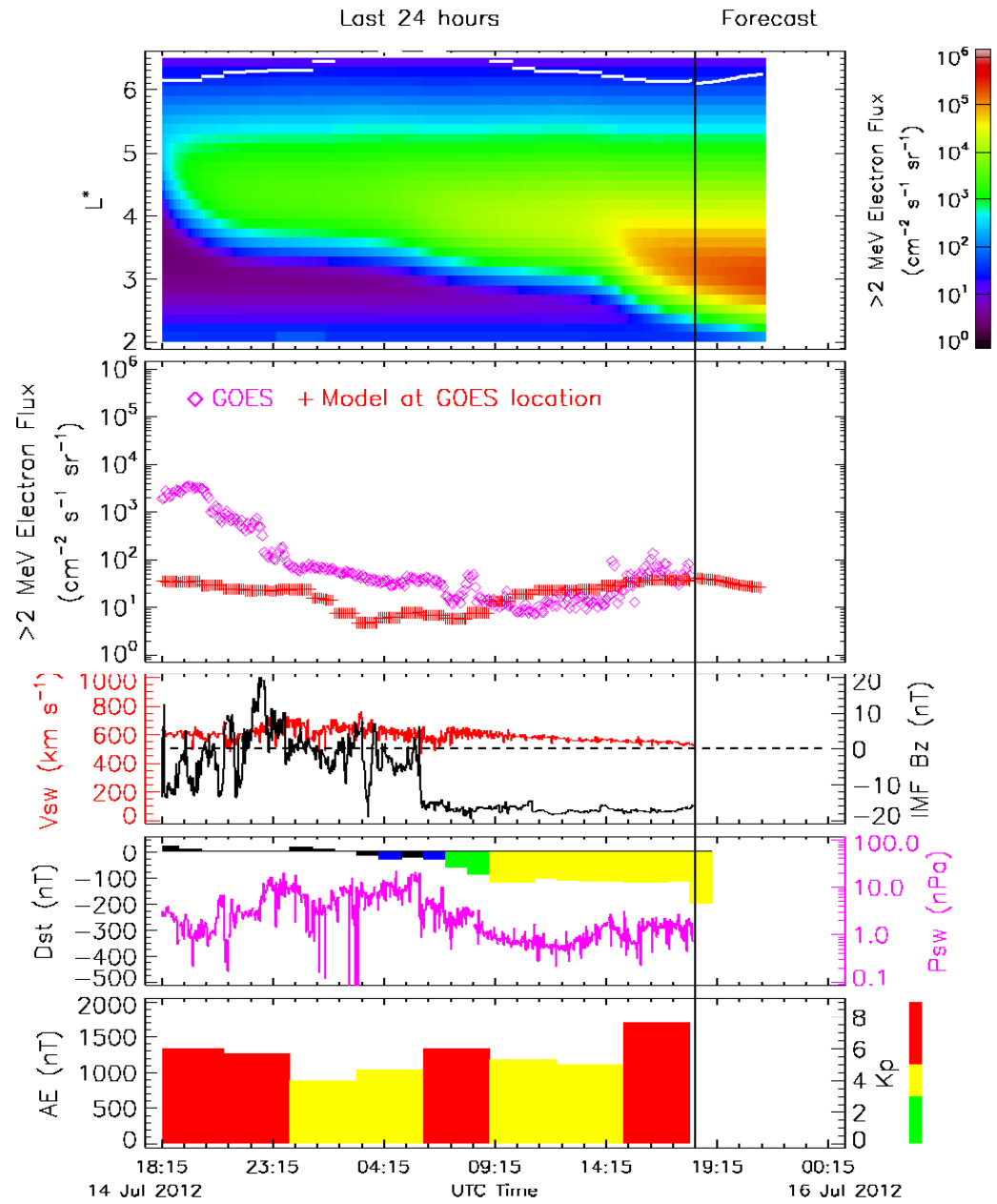


Plot created on Sun Jul 15 18:31:05 2012

SPACECAST Project

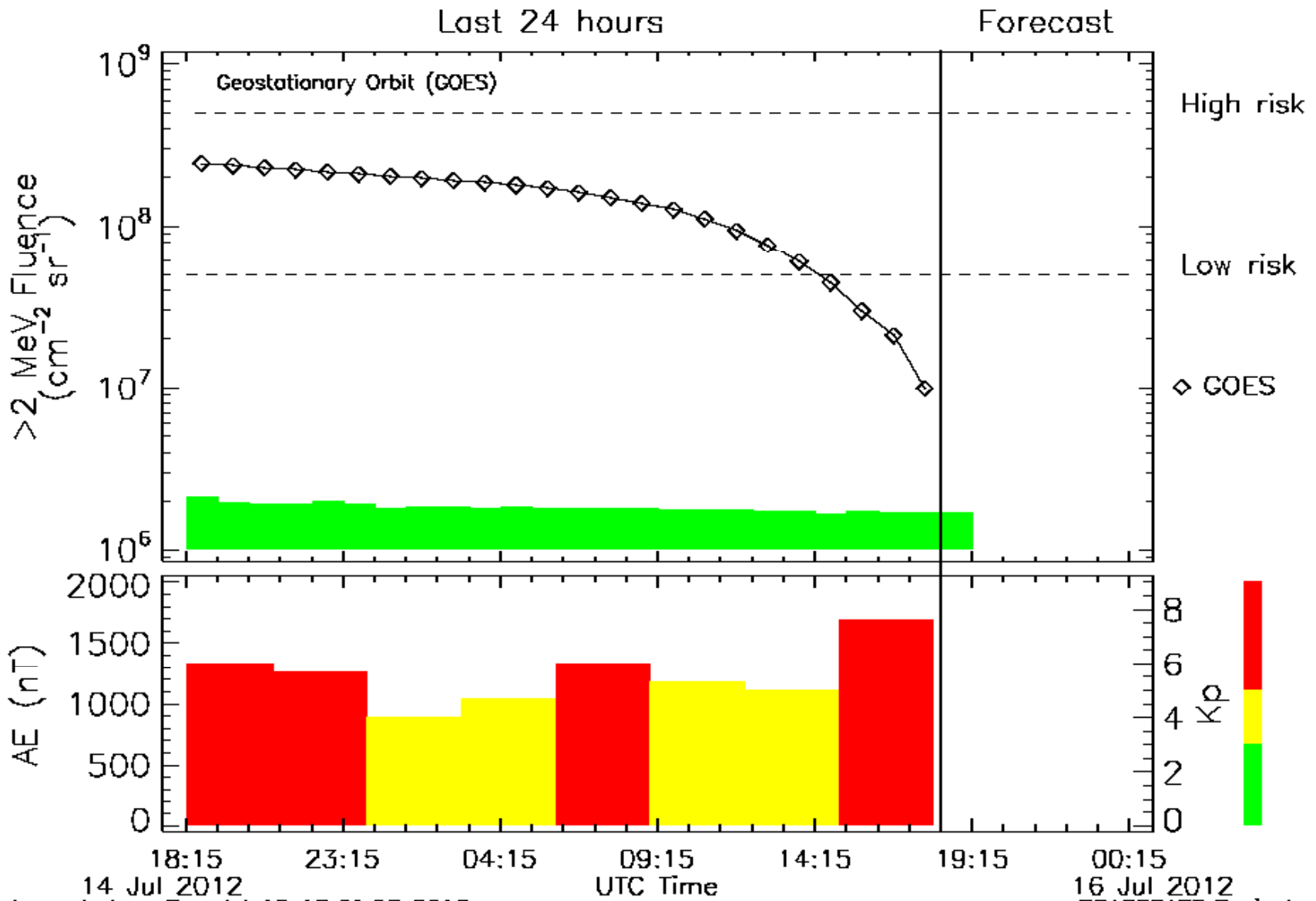
COSPAR Assembly 39, Mysore, India 9





Plot created on Sun Jul 15 18:31:06 2012 SPACECAST Project

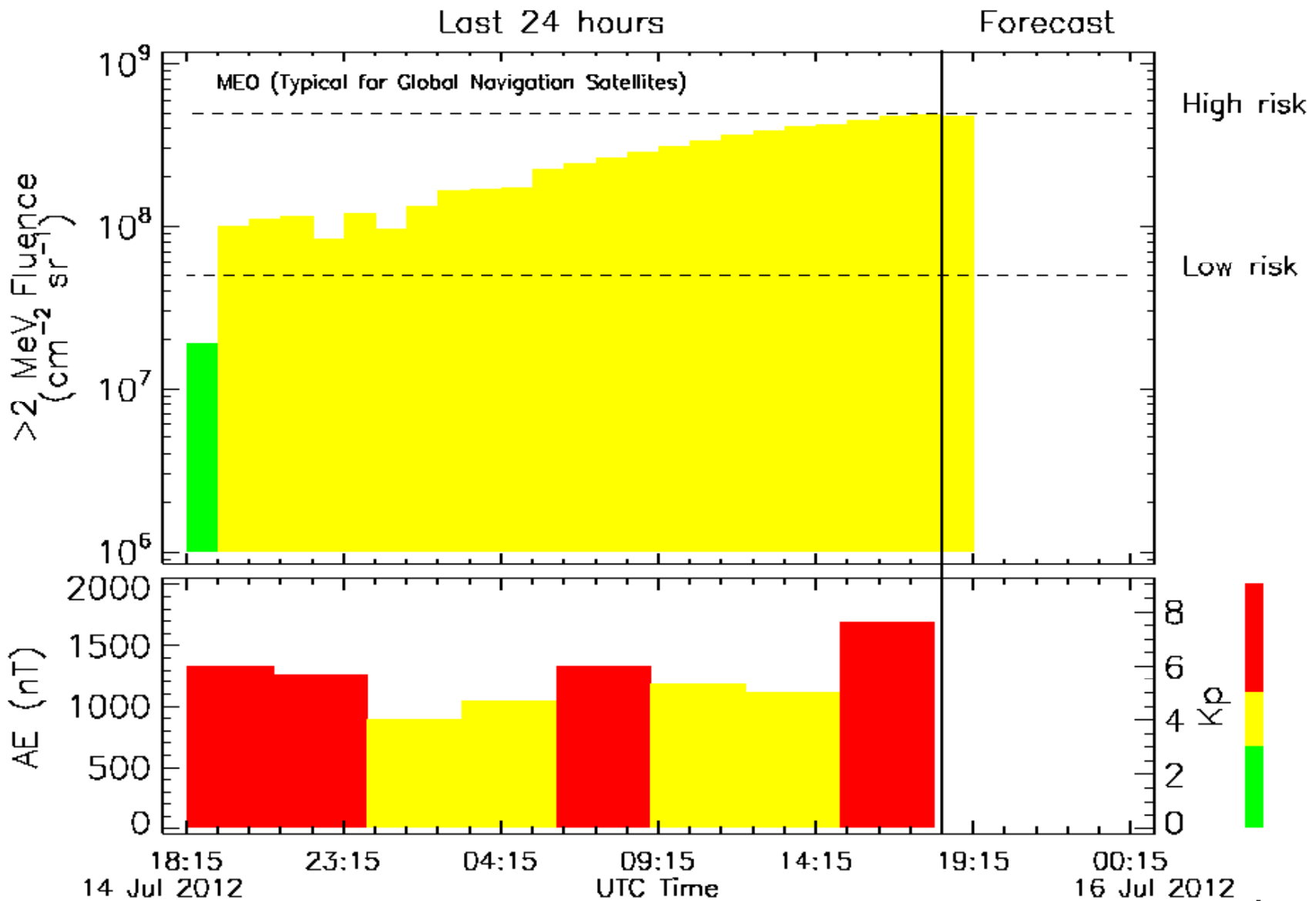




Plot created on Sun Jul 15 18:31:07 2012

16 Jul 2012
SPACECAST Project

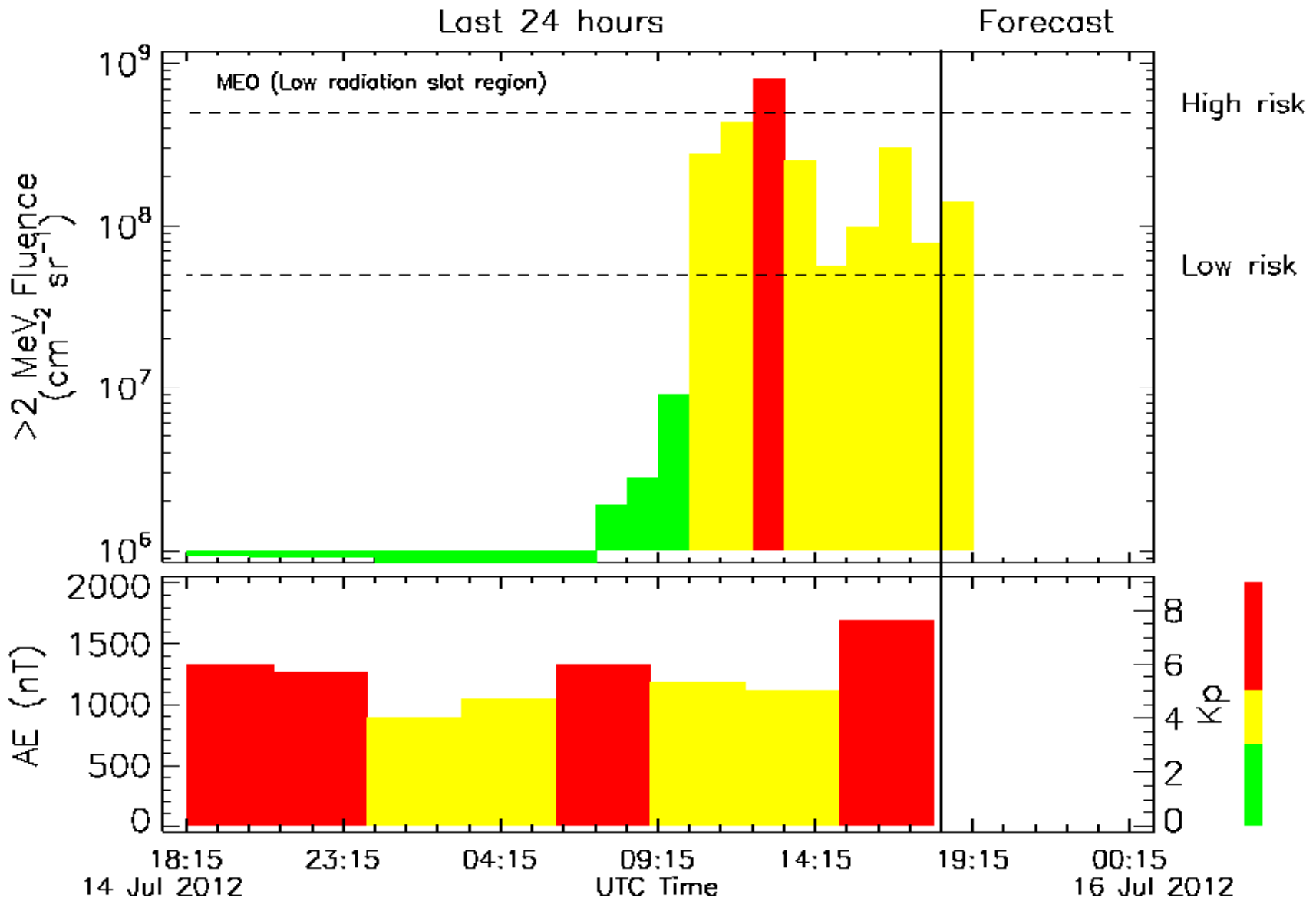




Plot created on Sun Jul 15 18:31:07 2012

16 Jul 2012
SPACECAST Project



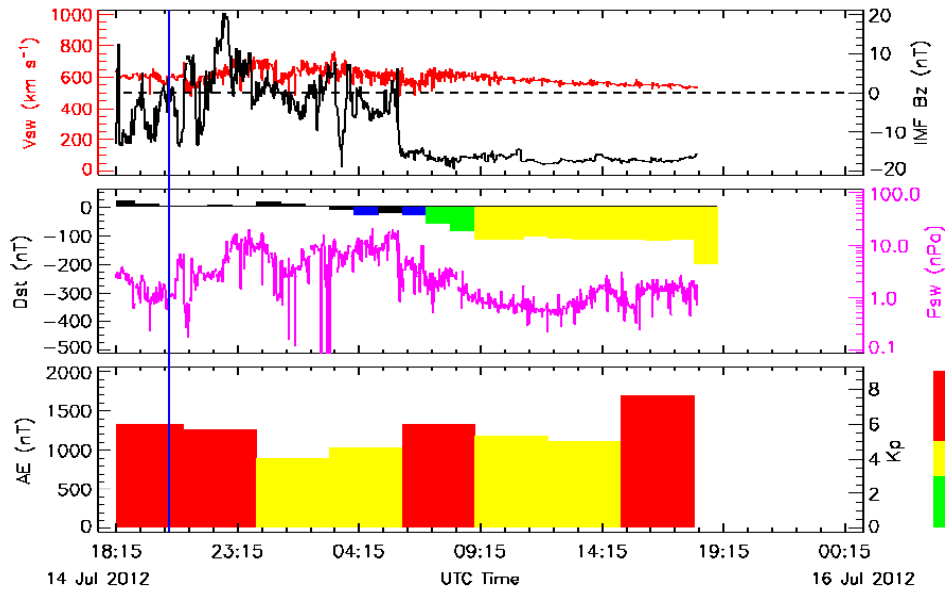
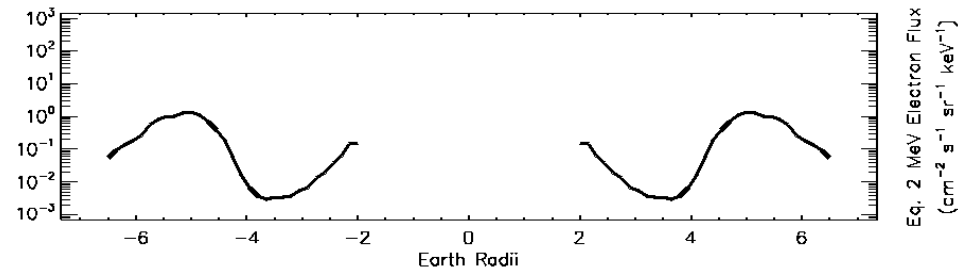
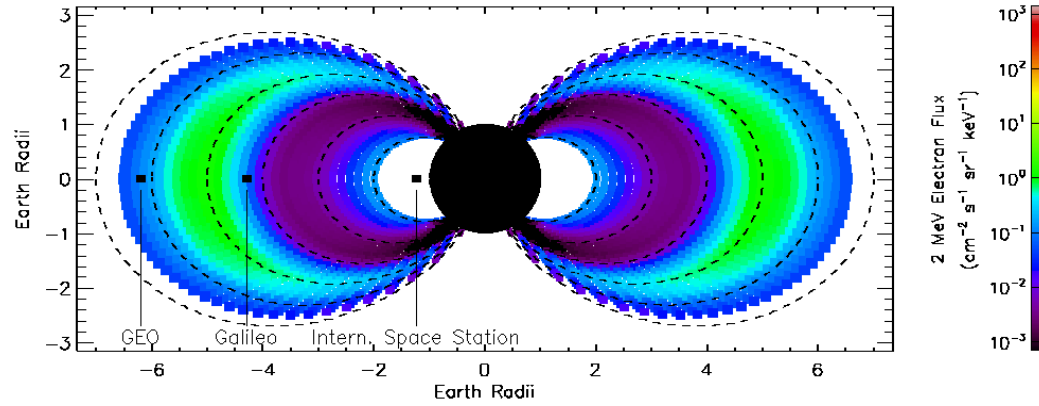


Plot created on Sun Jul 15 18:31:07 2012

SPACECAST Project



14 Jul 2012 18:15



Plot created on Sun Jul 15 18:31:09 2012

SPACECAST Project

Summary

- SPACECAST is enhancing the European capacity for
 - Forecasting the high energy and low energy electron populations of the radiation belts
 - Modelling SEP proton flux spectra
- A fully automated processing chain for running and post-processing high energy electron physical models is operational, and is being extended with a low energy electron model.
- SPACECAST will allow users to define alert and warning thresholds and to configure issuing of messages.
- SPACECAST is involving stakeholders to
 - Raise awareness of space weather hazards
 - Tailor forecast products to user needs
 - Enhance information exchange
- Validation metric products (skill score and RMSE plots and tables) will be available for peer validation of the product quality.
- The SPACECAST web site is the focal point for consulting the forecast and warning products.

Acknowledgements

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no 262468, and is also supported in part by the UK Natural Environment Research Council.

<http://fp7-spacecast.eu>