7TH EUROPEAN SPACE WEATHER WEEK

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BRUGES, BELGIUM
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ABSTRACT BOOK

Research - Applications - Products - Services

- **Space Situational Awareness**
- **Space Weather in support of European critical infrastructure**
- **Spacecraft Environments and Effects**
- **New Techniques for Tracking Heliospheric phenomena**
- **Space Weather Fair: provider meets user**
- **Business meetings covering topics such as ground effects of space weather, ionospheric effects, direct effects of solar radio weather...**

Local Organisation: SIDC, Solar-Terrestrial Centre of Excellence, Belgium

A new, Ground Based Data-Assimilative Model of the Plasmasphere - a Critical Contribution to RB modeling for SW Purposes

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The security of space assets are affected by the high-energy charged particle environment in the radiation belts. The controlling principal source and loss mechanisms in the radiation belts are not yet completely understood. During a geomagnetic storm the length of time during which space assets are in danger is determined by the loss mechanisms, particularly by relativistic electron precipitation. The primary mechanism for this precipitation is the interaction of several wave modes with resonant electrons which leads to scattering into the atmospheric loss cone. The nature of the wave activity and the interactions between the waves and radiation belt particles are strongly governed by the properties of the plasmasphere. At this point there are few existing and regular measurements of plasmaspheric properties, with existing plasmaspheric models lacking the structures known to exist in the real plasmasphere. There is evidence that enhanced wave activity and enhanced radiation belt losses occur due to such structures. In addition, there are large uncertainties concerning the fundamental nature of relativistic electron precipitation (REP), due to the difficulties of undertaking quality in-situ measurements.
To address these uncertainties in this proposed project we will provide regular longitudinally-resolved measurements plasmaspheric electron and mass densities and hence monitor the changing composition of the plasmasphere, one of the properties which determines wave growth. This will allow us to develop a data assimilative model of the plasmasphere. At the same time, we will monitor the occurrence and properties of REP, tying the time-resolved loss of relativistic electrons to the dynamic plasmasphere observations.
Our approach will primarily use ground-based networks of observing stations, operating in the ULF and VLF ranges, deployed on a worldwide level. Our proposal is made up of 6 work packages to meet these science goals.

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Protecting space assets from high energy particles by developing European dynamic modelling and forecasting capabilities (SPACECAST)

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Solar activity can trigger sporadic bursts of energetic particles and increase the number of high energy (MeV) particles trapped inside the Earth's radiation belts. These high energy particles cause damage to satellites and are a hazard for manned spaceflight and aviation. They are difficult to predict due to uncertainties over the basic physical processes, and the need to access reliable data in real time. European space policy is committed to the Galileo radionavigation system consisting of 30 satellites, the use of space assets to protect the security of its citizens (GMES), and a strong and competitive space industry. It is therefore imperative that Europe develops the means to protect these space assets from all forms of space weather hazards, and especially now as solar activity will increase to a maximum over the next few years and will increase the hazard risk. This proposal will draw together European and international partners to increase knowledge, reduce uncertainty, and to develop a forecasting capability. We will undertake targeted studies of particle source, transport, acceleration and loss processes in the Earth's radiation belts to improve understanding of how they respond to solar activity. We will transform research models into space weather models to forecast the radiation belts in near real time, and provide alerts for periods of high risk to stakeholders. We will test models of how solar energetic particles are accelerated by shocks in the solar wind, and are transported through the interplanetary medium, in order to improve engineering tools for predicting the intensity and fluence of solar energetic particle events. We will develop a stakeholder community for valuable feedback and deliver the results in a form accessible to the public. The project will deliver a space weather forecasting capability that will continue beyond the lifetime of the project and which will lay the foundation for an operational system.

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