ESA SSA Space Weather Services - Federated Service Concept

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“The objective of the Space Situational Awareness (SSA) programme is to support the European independent utilisation of, and access to, space for research or services, through the provision of timely and quality data, information, services and knowledge regarding the space environment, the threats and the sustainable exploitation of the outer space surrounding our planet Earth.”

- ESA Ministerial Council November 2008
SSA Programme Participants

- 18 Participating States
- In Period 2, Focus on Space Weather
SSA/SWE Precursor System in 2013

SSA-SWE Users

SSA-SWE Service Portal: swe.ssa.esa.int

SWE Service Coordination Centre, Space Pole, Belgium

SWE Data Centre Redu, Belgium

SWE Expert Service Centres

- Solar Weather
  - ROB, Belgium (coord.)
  - Uni. Graz, Austria

- Ionospheric Weather
  - DLR, Germany (coord.)
  - NMA, Norway
  - NOA, Greece
  - CLS, France

- Space Radiation
  - BIRA, Belgium (coord.)
  - AIT, Austria
  - UOA, Greece

- Geomagnetic Conditions
  - TGO, Norway (coord.)
  - FMI, Finland

- Heliospheric Weather
  - TBD
SSA SWE Coordination Centre

- SSA Space Weather Coordination Centre (SSCC) was established by the SSA Programme
- Inauguration ceremony was in April 2013
- SSCC will synthesise the available SWE information and make it available to the end users
- SSA SWE applications and SSCC user support currently in verification and validation phase
  => Support currently provided during normal working hours + dedicated campaigns
- SSA SWE Coordination Centre
  Space Pole
  Avenue Circulaire, 3 - Ringlaan
  1180 Uccle - Ukkel (Brussels)
  BELGIUM
  Tel: +32-2-7903-913
  Email: helpdesk.swe@ssa.esa.int
- SWE services available from:
  http://swe.ssa.esa.int
Solar Weather ESC

- Coordinator: Royal Observatory of Belgium, Belgium
- Participants: University of Graz, Austria
- Centralises the expertise on solar drivers of the space weather
- Federated SWE services
  - PROBA2 / SWAP - EUV 17.4 nm and LYRA
  - USET / H-alpha full disk and White-light
  - HUMAIN Radiospectrogram
  - SDO AIA & HMI
  - SIDC-International Sunspot Index and F10.7 index forecast
  - SIDC Daily SWE bulletin
  - CACTus - CME service
  - SIDC fast alerts and all quiet alert
  - Kanzelhöhe / H-alpha full disk movie and flare and filament eruption alerts
Space Radiation Environment ESC

- Coordinator: **Belgian Institute of Space Aeronomie, Belgium**
- Participants:
  - **Seibersdorf Laboratories GmbH, Austria**
  - **National and Kapodistrian University of Athens (UOA), Greece**
- Expertise on radiation environment in space and for aviation
- End user support includes
  - Solar Energetic Particle (SEP) events
  - Trapped radiation particles
  - Cosmic rays
- Applications and services
  - **SPENVIS (SPace ENVironment Information System)**
  - **AVIDOS (AVIation DOSimetry)**
  - **ANeMoS**: (GLE) event alerts and multi-station Neutron Monitor data
Ionospheric Weather ESC

- Coordinator: Deutschen Zentrums für Luft- und Raumfahrt, Germany
- Participants: Norwegian Mapping Authority (NMA), Norway; National Observatory of Athens (NOA), Greece, CLS (France)
- Expertise on the ionized upper layers of the atmosphere
- Disturbances in the ionosphere impact satellite telecommunication, navigation and VHF/UHF radio communication
- Federated services include:
  - Regional and global maps and forecasts of Total Electron Content (TEC)
  - Ionospheric disturbance information and alerts
  - Ionospheric scintillation information
  - 2D electron density in the plasmasphere
Geomagnetic Conditions ESC

- Coordinator: Tromsø Geophysical Observatory, Norway
- Participants: DTU, Denmark, SIDC, Belgium, FMI, Finland
- Federated services include
  - Norwegian/Danish station magnetograms
  - Provisional K-index
  - Geomagnetic activity in Auroral Zone
  - Long term geomagnetic activity index
  - Provisional AA-index
  - Aurora visibility forecasts (under development)
  - Geomagnetic services for resource exploitation (under development)
Heliospheric Weather ESC (development starting in 2014)

- Focus on magnetospheric response to solar wind disturbances
  - Multi-point remote sensing of heliospheric phenomena
  - Physical modelling of solar wind/CME initiation and evolution, Interaction solar wind/IP CMEs
  - SEP event modelling
  - Nowcast & forecast techniques to be prototyped and tested
- Tasks include space weather at other locations of interest within the heliosphere
- Heliospheric and Solar Weather ESC outputs form key inputs to the ESC network
SSA SWE Space Segment Development

- Objective is to ensure data availability and continuity for the ESA SSA system and collaboration partners
- SSA Period 2 includes activities for
  - Operation of the PROBA-2 spacecraft
  - SWE instruments as Hosted Payload (HP) for GEO, MEO and LEO missions
    - NGRM mission on-board EDRS-C under implementation
    - Other HP missions to GEO and LEO under investigation
    - Phase C/D developments of new SWE instruments for HP missions (e.g. magnetometer, EUV imager, 3D energetic electron spectrometer, ...)
  - Phase 0/A/B1 study of operational missions to L1 + away from Sun-Earth line
  - Prototyping of a compact wide angle coronagraph
  - Phase A/B studies on new space based SWE instruments in ESA technology programmes
SWE G/S technology development

• G/S technology developments include
  ➢ Ground based observation systems
  ➢ Data networking, transfer and processing and ingestion
  ➢ Standardisation of instruments and intercalibration
  ➢ Development of physics based and empirical modelling
  ➢ Virtual, distributed data, modelling and service systems

• Virtual Space Weather Modelling Centre (VSWMC): https://esa-vswmc.eu/
  ➢ First European end-to-end modelling effort
  ➢ Prototype under development in ESA GSTP
  ➢ Development to be continued within SSA Programme in 2014
THANK YOU

For more information:
swe.ssa.esa.int
www.esa.int

European Space Agency