ABSTRACTS OF AFFECTS USER WORKSHOP PRESENTATIONS

Space Weather Data and Services at RWC Belgium

C. Verbeeck on behalf of the RWC team

The Royal Observatory of Belgium hosts the Regional Warning Center (RWC) Belgium since 2000. We monitor the solar and geomagnetic activity over time scales from the solar cycle (the sunspot index) down to real-time space weather alerts. We will describe the different products that are currently generated and distributed by RWC Belgium, as well as the models, automated detection algorithms and other tools that we employ for this purpose. We will discuss some results on statistical quality control of our forecasts, and will end by a short outlook on future data and services that we anticipate to incorporate into the RWC.

Solar Demon: Near real-time dimming and EUV wave detection on SDO-AIA

E. Kraaikamp, C. Verbeeck

Solar Demon is a near real time dimming and EUV wave detector on quicklook SDO-AIA data. As dimmings and EUV waves are often the precursors of CMEs, careful detection and characterization of these features will aid space weather forecasters, leading to more accurate forecasts. A Solar Demon catalog is planned, which will help further research on dimmings and EUV waves. In this demo, the basic principles of Solar Demon will be illustrated by running it on a few interesting events.

CAT CME parametrization

J. Hesemann, G. Millward, V. Bothmer, E. Bosman

The CME Analysis Tool (CAT) is a modelling tool of NOAA-SWPC developed by G. Millward et al. using a rotationally symmetric cone approach. We present implications of using such a geometric shape for real-time modelling if compared to the GCS geometric approach and its purpose for space weather forecasts for Earth's orbit.

3D parametrization of CMEs with the Graduated Cylindrical Shell Model

E. Bosman, V. Bothmer, J. Hesemann, M. Venzmer

The presentation illustrates how the 3D structure of CMEs can be parameterized in real-time based on STEREO/SECCHI beacon data and how the results are used as input for the forecast of space storms at Earth's orbit by ENLIL and other models.

CME arrival, Kp, aurora and GNSS-error forecast

V. Bothmer, J. Hesemann, M. Venzmer, E. Bosman

We present our first version of a forecasting tool developed at University of Göttingen which is capable of inferring both CME arrival times and geomagnetic parameters (Kp and Aurora boundary) from real-time geometric modelling using GCS or CAT tools. The tool under development is modular and different methods can be used on each step of the forecast. The essential ingredients of the forecast base on correlated analysis of solar remote sensing

and in-situ solar wind data, including theoretical models for CME and solar wind propagation in the inner heliosphere.

L1 solar wind, aurorae, Kp and GNSS-error alert
M. Venzmer, V. Bothmer, J. Hesemann, E. Bosman

The RSS feed alerts use in-situ L1 real-time ACE data to provide short-time warnings. The L1 solar wind alert creates a new alert if thresholds of specified solar wind parameters are exceeded. The L1 Kp/aurora alert is used for an empirical Kp estimate with additional auroral boundary information. This RSS feed creates a new alert if the predicted Kp value exceeds a specified threshold.

Geomagnetic forecast tool
A. Parnowski

The geomagnetic forecast tool provides near real time forecasts of the geomagnetic indices Dst (1 to 4 hours in advance) and Kp (3 hours in advance). In contrast to other Kp forecasting tools, this one provides forecast of the official Kp index based on 13 stations worldwide, rather than the estimated Kp based only on 1 station. The demo will provide the users with detailed information on the tool's capabilities and operation procedures.

Real-time determination and monitoring of the auroral electrojet boundaries
M. G. Johnsen

A method for nowcasting of the auroral electrojet location from real-time geomagnetic data in the European sector is presented. Along the auroral ovals strong electrojet currents are flowing. The variation in the geomagnetic field caused by thesepace Weather Data and Services at RWC Belgium auroral electrojets are observed on a routine basis at high latitudes using ground-based magnetometers. From latitude profiles of the vertical component of these variations it is possible to identify the boundaries of the electrojets. Using real-time data from ground magnetometer chains is the only existing method for continuous monitoring and nowcasting of the location and strength of the auroral electrojets in a given sector. This is an important aspect of any space weather program.

The method for obtaining the electrojet boundaries is described and assessed in a controlled environment using modelling. Furthermore a provisional, real-time electrojet tracker for the European sector based on data from the Tromsø Geophyiscal Observatory magnetometer chain is presented.

The relationship between the electrojet and the diffuse auroral oval is discussed, and it is concluded that although there may exist time dependent differences in boundary locations, there exist a general coincidence. Furthermore, it is pointed out that knowledge about the latitudinal location of the geomagnetic activity, that is the electrojets, is more critical for space weather sensitive, ground-based technology than the location of the aurora.

New Forecast Products for the High Latitude Ionosphere and its Impacts on Radio Communication and Navigation
R. Viereck

With the expansion of shipping and oil exploration into arctic regions, the importance of accurate specification and forecast of the high latitude ionosphere and its impact on GPS/GNSS and HF Communications is more important than ever. At the NOAA Space Weather Prediction Center, we are developing several new products to address these customer requirements. A new Kp-driven aurora forecast model is under development which will provide 1-3 day forecasts of the location and intensity of the aurora. And new results from a statistical study of the impact of the aurora on GPS systems will allow for a greatly improved specification of when and where the aurora and geomagnetic activity will cause problems for precise satellite navigation.

Forecast of Total Electron Content over Europe for disturbed ionospheric conditions
J. Berdermann

A general picture of the occurrence of ionospheric storms as function of local time, season and location is known from numerous studies over the past 50 years. Nevertheless, it is not yet possible to say how the ionosphere will actually respond to a given space weather event because the measurements of the onset time, location of maximum perturbation, amplitude and type of storm (positive or negative) deviate much from the climatology. However, statistical analyses of numerous storm events observed in the Total Electron Content (TEC) since 1995 enable to estimate and predict a most probable upcoming perturbed TEC over Europe based on forecasts of geomagnetic activity. A first approach will be presented here. The forecast of perturbed TEC is part of the Forecast System Ionosphere built under the umbrella of the FP7 project AFFECTS (Advanced Forecast For Ensuring Communication Through Space). It aims to help users mitigating the impact on communication systems.

Forecast System Ionosphere: a new system for predicting space weather effects in Europe
J. Berdermann, H. Barkmann

A Forecast System Ionosphere (FSI) is developed as part of the FP7 AFFECTS project (Advanced Forecast For Ensuring Communication Through Space, http://www.affects-fp7.eu/), led by University Göttingen. It is intended to help European citizens mitigating the impact of space weather events on its communications systems. For this purpose the FSI will operationally provide a prediction of space weather related geomagnetic and ionospheric perturbations for Europe. Solar observations and measurements are used for forecasting of geomagnetic activity and Total Electron Content (TEC). Additionally, high latitude geomagnetic monitoring and early warning for GNSS users is incorporated in the FSI. The FSI is developed as a subsystem of the Space Weather Application Center - Ionosphere (SWACI) service (http://swaciweb.dlr.de/), running at the DLR in Neustrelitz, using its approved infrastructure.

AFFECTS partners are contributing to the FSI either by provision of data or by delivering processing modules. Here we present the layout and system architecture of the FSI, describing the data input, processing, checking, archiving and output of the FSI.

Early warning for GNSS
J. Berdermann, H. Barkmann

The early warning for GNSS users is especially directed to customers of space based radio systems used in telecommunication, navigation/positioning and remote sensing. The warning informs customers and operators of GNSS on approaching space weather events. Thus, GNSS customers and service providers will be aware of potential performance degradation of their systems due to space weather impacts. Based on the early warning, customers shall become prepared to undertake efforts to help mitigate the space weather impacts on the operated systems.

The early warning message for GNSS users presented here is recently in its verification phase. The warning message is send automatically to external test users, who will give comments and suggestions to the present service.

STAFF: The Solar Timelines viewer for AFFects
V. Malisse, C. Verbeeck

STAFF, the Solar Timelines viewer for AFFects (http://www.staff.oma.be) is a powerful, fast and easy tool for viewing, combining and exporting a whole range of timelines related to solar activity and space weather. Timelines include the International Sunspot Number, the four Lyra EUV channels, the GOES X ray curves, GOES electrons and protons, ACE solar wind parameters and Interplanetary Magnetic field measurements, F10.7 radio flux and various K and A indices. This demo will provide the user a hands-on overview of STAFF.

Inter-comparison of EUV data products and their usability for modeling/forecasting ionospheric disturbances
R. Brunner, G. Schmidtke, M. Pfeifer

The EUV Solar Spectral Irradiance (EUV-SSI) plays a major role as the primary energy input into the Ionospheric/Thermospheric (IT) system. Specific solar EUV emissions are to be used to a) recognize geomagnetic disturbances and to estimate their magnitudes, b) to derive information on solar processes relevant to geomagnetic disturbances and c) defining the basis state of the IT system.

End of 2012 a special ISS maneuver (bridging) was achieved in order to perform continuous measurements of SOLAR during a full solar rotation. First results of the inter-comparison of SDO/EVE spectral data with SolACES calibration measurements do agree well with each other. The inter-comparison is extended from an ISS bridging period back to the beginning of SDO operation in 2010. Based on the combined SEE/TIMED, SDO/EVE and SolACES data the work on EUV-TEC proxy is progressing.

SEPS – The low-cost EUV/plasma-sensor: Vision of a sensor network as a versatile data source to support space weather forecasting products
R. Brunner, G. Schmidtke, M. Pfeifer

The SEPS sensor developed by Fraunhofer IPM is a versatile and low-cost EUV and plasma sensor. Being able to measure many different plasma and EUV key parameters a satellite based sensor network could serve as a versatile data source to support space weather simulation and forecast. Beside the working principle of the sensor and first measurement results a vision of such a network is presented.

Online Monitoring of the total EUX flux with temporal resolution of down to 100ms gets thinkable, which makes it possible to identify short-time solar events like flares. Through the combination with other detectors like LEED (Low Energy Electron Detector) and LEPD (Low Energy Proton Detector) more detailed information can be gathered.