Panels (P)
Space Weather Modelling and Observations: from Research to Verified Operational Products (PSW1)
Consider for oral presentation.

THE RMI SPACE WEATHER AND NAVIGATION SYSTEMS (SWANS) PROJECT

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The SWANS (Space Weather and Navigation Systems) research and development project (http://swans.meteo.be) is an initiative of the Royal Meteorological Institute (RMI) under the auspices of the Belgian Solar-Terrestrial Centre of Excellence (STCE). The RMI SWANS objectives are: research on space weather and its effects on GNSS applications; permanent monitoring of the local/regional geomagnetic and ionospheric activity; and development/operation of relevant nowcast, forecast, and alert services to help professional GNSS/GALILEO users in mitigating space weather effects. Several SWANS developments have already been implemented and available for use.

The K-LOGIC (Local Operational Geomagnetic Index K Calculation) system is a nowcast system based on a fully automated computer procedure for real-time digital magnetogram data acquisition, data screening, and calculating the local geomagnetic K index. Simultaneously, the planetary Kp index is estimated from solar wind measurements, thus adding to the service reliability and providing forecast capabilities as well. A novel hybrid empirical model, based on these ground- and space-based observations, has been implemented for nowcasting and forecasting the geomagnetic index, issuing also alerts whenever storm-level activity is indicated. A very important feature of the nowcast/forecast system is the strict control on the data input and processing, allowing for an immediate assessment of the output quality.

The purpose of the LIEDR (Local Ionospheric Electron Density Reconstruction) system is to

acquire and process data from simultaneous ground-based GNSS TEC and digital ionosonde measurements, and subsequently to deduce the vertical electron density distribution. A key module is the real-time estimation of the ionospheric slab thickness, offering additional information on the local ionospheric dynamics.

The RTK (Real Time Kinematic) status mapping provides a quick look at the small-scale ionospheric effects on the RTK precision for several GPS stations in Belgium. The service assesses the effect of small-scale ionospheric irregularities by monitoring the high-frequency TEC rate of change at any given station. This assessment results in a (colour) code assigned to each station, code ranging from "quiet" (green) to "extreme" (red) and referring to the local ionospheric conditions. Alerts via e-mail are sent to subscribed users when disturbed conditions are observed.

SoDIPE (Software for Determining the Ionospheric Positioning Error) estimates the positioning error due to the ionospheric conditions only (called "ionospheric error") in high-precision positioning applications (RTK in particular). For each of the Belgian Active Geodetic Network (AGN) baselines, SoDIPE computes the ionospheric error and its median value (every 15 minutes). Again, a (colour) code is assigned to each baseline, ranging from "nominal" (green) to "extreme" (red) error level. Finally, all available baselines (drawn in colour corresponding to error level) are displayed on a map of Belgium.

The future SWANS work will focus on regional ionospheric monitoring and developing various other nowcast and forecast services.