



## Preliminary results of the ISWAT G2B-04 Campaign CISSI over Europe

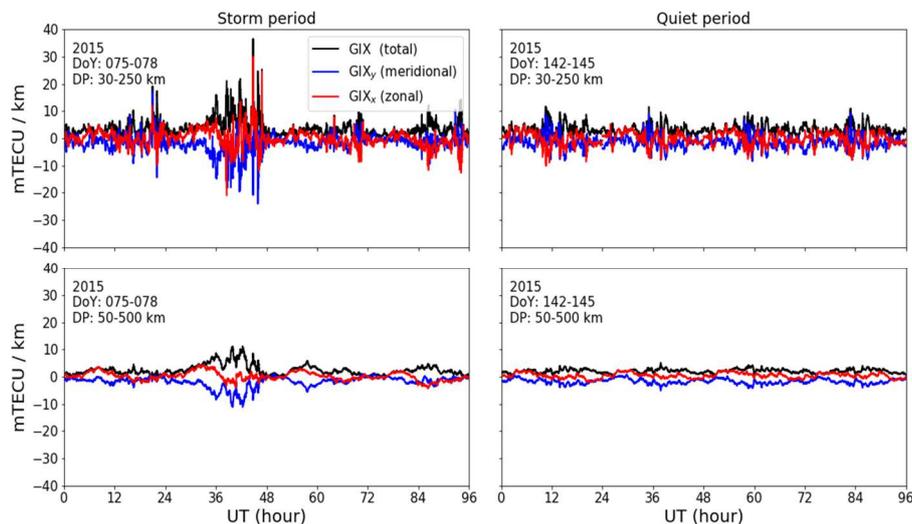
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Ionospheric perturbations may seriously degrade the performance of GNSS and other trans-ionospheric radio systems like remote sensing radars. Thus, the Coordinated Ionospheric Study of Scales and Indices (CISSI) has been initiated within the International Space Weather Activity Team (ISWAT) to study the perturbation degree of the ionosphere by using a variety of index approaches. The studies focus on the regions Europe, South- and North-America and Asia. In a first step, two time periods have been selected. The first period covers the days 16-19 March 2015 (St. Patrick storm). The second period covers the geomagnetically quiet period 22-25 May 2015 for calibration or reference purposes.

Here we present preliminary results obtained by using dual frequency GNSS measurements for estimating the Gradient Ionospheric index (GIX) and the Sudden Ionospheric Disturbance index (SIDX) over the European region. Both indices are able to estimate the spatial and temporal perturbation degree of the ionosphere instantaneously by considering only GNSS measurements from the current and previous measurement epochs [1]. To know the perturbation degree of the ionosphere in near real time is a strong requirement in safety of life applications. The indices reported here have a time resolution of 30 seconds according to the sampling rate of GNSS measurements. We report that the gradient values of GIX determined for the geomagnetically quiet days are less than 10 m(milli)TECU/km, whereas the gradient values during the St. Patrick storm are enhanced by several times, reaching values of more than 30 mTECU/km. Depending on the considered spatial scale, GIX is capable of identifying more resolved (at shorter ranges) or smoother (at larger scales) ionospheric perturbations. SIDX is sensitive to rapid temporal changes of the ionospheric ionization which may occur during solar flares or particle precipitation events. We further discuss the importance of these ionospheric indices in positioning applications.



**Fig. 1** Gradient Ionospheric Index (GIX) determined for the European territory during the St. Patrick storm (left panels) and a geomagnetically quiet period (right panels) of 2015. The GIX values over time are depicted for an index spatial scale between 30 and 250 km (upper panels) and for a less sensitive spatial scale between 50 and 500 km (bottom panels).