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REGIONAL CHARACTERIZATION OF IONOSPHERIC PERTURBATIONS DEGREE WITH GIX AND SIDX

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Ionospheric perturbations deteriorate the accuracy, integrity, availability and continuity of precise and safety-of-life Global Navigation Satellite Systems (GNSS) applications. Therefore, a reliable characterization of the spatial gradients and rapid changes in the total electron content (TEC) is crucial in order to mitigate their impact. With this aim, we present here the results achieved by using dual-frequency GNSS measurements for estimating the Gradient Ionospheric indeX (GIX) and the Sudden Ionospheric Disturbance indeX (SIDX) over Europe and South America. The advantage of these two index approaches is their capability to estimate the spatial and temporal perturbation degree of the ionosphere instantaneously without statistical analyses of historical data.

Our dataset covers two periods of 2015 with contrasting geomagnetic activity selected in the framework of the Coordinated Ionospheric Study of Scales and Indices (CISSI) initiation within the COSPAR-related International Space Weather Action Team (ISWAT) G2B-04. The first period covers the St. Patrick Day storm (DoY 75-78) and the second period covers a period of geomagnetically quiet conditions (DoY 142-145).

Our estimate of GIX for the quiet days shows a regular pattern of diurnal variation with values of less than 10 milliTECU/km. On the contrary, the gradient values during the perturbed period are enhanced by several times, reaching values of more than 30 milliTECU/km over stormy conditions. By computing GIX at different horizontal scales, we find that the higher values of gradients are obtained for the shorter ranges (e.g. 30-250 km) rather than for larger scales (e.g. 50-500 km). This agrees with essentially stronger smoothing over longer distances. Also, by considering ionospheric piercing points (IPPs) at three different latitude ranges over Europe, our estimates of GIX show different behavior that depend on the propagation mechanism of ionospheric storms. This is also valid for SIDX which is sensitive to rapid temporal changes of

the ionospheric ionization, e.g. initiated by solar flares or particle precipitation events.

We further discuss the potential of the ionospheric indices GIX and SIDX for GNSS positioning applications and space weather services.