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Assessment methodology for global ionospheric maps of electron content and potential adaptation to real-time

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The increase in the number of permanent GPS receivers distributed worldwide and working in real-time (RT) are opening new ways of monitoring the ionospheric and space weather phenomena. This is the case, for example, for travelling ionospheric disturbances (TID), solar flares and scintillation. Moreover the computation of vertical total electron content ionospheric maps (VTEC-GIMs) in RT and at global scale is becoming feasible due to continuous improvement in the required global coverage with this kind of stations. And the RT assessment of these new RT-GIMs is needed for different applications, such as the generation of a future combined RT-GIM within the International GNSS Service (IGS). In this context we will focus in this presentation on summarizing the methodology for assessing the VTEC-GIMs which has been and are been successfully applied in IGS, and the potential adaptation to RT.

In particular the real-time ionospheric indices and products, generated in real-time by UPC-IonSAT since 2010 in the context of the MONITOR project funded by ESA, will be summarized. Indeed, the UPC-IonSAT RT-TOMION software is providing continuously in RT, from more than 150 worldwide receivers and with a sampling time of 30 seconds, mostly based on techniques developed by the UPC co-authors: (1) the Single Receiver Medium Scale TID index (SRMTID), indicating the activity of the most frequent ionospheric waves, an important degradation factor in the quality of precise GNSS-based navigation; (2), the Solar EUV Rate GNSS (SOLERA) index (formerly GSFLAI); (3) the Rate of TEC Index (ROTI); and (4) RT-TOMION generates simultaneously the Global Ionospheric Maps of VTEC (GIMs), and the fraction of topside electron content, computed with a dual-layer voxel model.

Finally we will discuss different options to assess in real-time the RT GIMs, based on the so called dSTEC ionospheric observations derived from the dual-frequency measurements (with typical errors below 0.1 TECU) from certain worldwide distributed independent receivers, adapting the algorithm used for assessing and combining different GIMs.