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Some experiences in Low Cost GNSS Ionosphere

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Some experiences and new approaches proposed during the recent years in the applications of one-hundred-dollars-cost single-frequency GNSS receivers, as sounders of the ionosphere, are summarized.

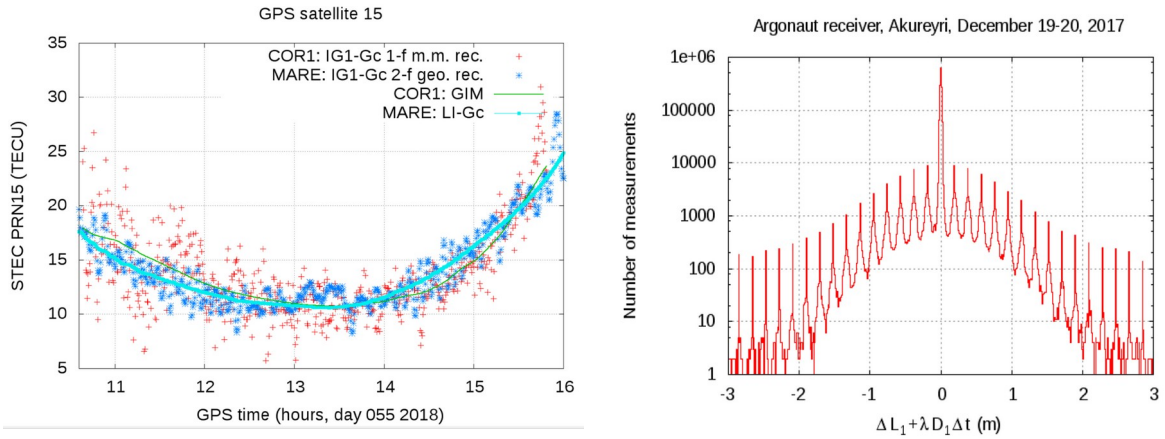

Figure 1. Left: Comparison of the STEC obtained from UQRG GIM-calibrated dual-frequency LI=L1-L2 (light blue) and from single-frequency IG1=(P1-L1)/2, both from MARE geodetic receiver of the ICGC at Catalonia, close to the low-cost single-frequency receiver COR1, at Cornellà de Llobregat (Spain). **Right:** Histogram of the distribution of the residual between the L1 carrier phase change vs the predicted value from the high rate Doppler measurement at Akureyri (Iceland). In both locations the same Argonaut U-blox receiver were used (extracted from Hernández-Pajares et al. 2018).

The sidereal-day ionospheric graphic (SIg) combination of single-frequency GNSS measurements was proposed in Hernández-Pajares et al. (2018). It allows to monitor, for each given GNSS transmitter–receiver pair, the vertical total electron content (VTEC) relative to the previous observation with the same or almost the same line-of-sight (LOS) vector (after 1 and 10 sidereal days for GPS and Galileo, respectively), and corresponding multipath reduction or cancellation. We also showed (Fig.1-left) that the GIM-calibrated STEC obtained from the iono-graphic single-frequency combination appeared almost as accurate as those based on the dual-frequency technique, i.e., at few TECU or better, and with much more resolution and precision than the GIM values in the ionospheric region sounded by each given single-frequency receiver. At high latitudes, under scintillation and urban canyon, the carrier phase measurements suffered many cycle slips, which can be easily detected and fixed, working at 5 or 10 Hz, with the new method conceived at Hernández-Pajares et al. (2018) and applied in Zhao et al. (2020), see Fig.1-right. Finally, the on-going campaign of low cost GNSS Ionosphere in the Antartica, CLOW-GIA, coinciding with PITHIA-NRF & DISPEC projects, will be briefly presented.

1.Hernández-Pajares, M., Roma-Dollase, D., Garcia-Fernàndez, M., Orus-Perez, R. and García-Rigo, A., 2018. "Precise ionospheric electron content monitoring from single-frequency GPS receivers". GPS solutions, 22(4), p.102.
2.Zhao, J., Hernández-Pajares, M., Li, Z., Wang, L. and Yuan, H., 2020. "High-rate Doppler-aided cycle slip detection and repair method for low-cost single-frequency receivers". GPS Solutions, 24, pp.1-13.