High Accuracy TEC estimation based on Ionospheric Observable from PPP with Ambiguity Resolution.

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PPP (Precise Point Positioning) is a positioning method based on GNSS (Global Navigation Satellite Systems), in which the SSR (State Space Representation) concept is used and may provide centimeter accuracy solutions. Real-time PPP (RT-PPP) is also possible, thanks to the availability of precise products for orbits and clocks, provided by the International GNSS Service (IGS), as well as by its analysis centers such as CNES (Centre National d'Etudes Spatiales), BKG (Bundesamt für Kartographie und Geodäsie) and others. As in several applications, the ionospheric layer of the atmosphere considerably affects the GNSS signals. Such effects have a negative impact on GNSS positioning, especially for real-time applications. To reduce the ionospheric effects, it is usual to estimate from data of multiple frequencies receivers the slant ionospheric delay over L1 observable in real-time PPP and with ambiguity resolution, known as PPP-RTK. However, this estimation has a cost in terms of time convergence for the positioning solution, which may reach the order of 60 minutes. In order to solve this drawback, some works have directed efforts to model the ionospheric observables-based estimations from a GNSS Reference Network. Thus, such estimation can feed the modelling algorithm providing corrections for the ionospheric effects over the network coverage area at a good level of quality. Such procedure has been the state of the art when PPP is used for positioning. The main challenging when modelling the ionospheric observables, which are estimated from data of a Network Reference Stations throughout RT-PPP with ambiguity resolution, is to remove the receiver hardware biases influence. The estimation of the hardware biases is essential to provide a proper ionosphere model with physical meaning. In this work it was implemented a method to estimate the receiver hardware biases based on the ionospheric observables derived from a PPP-RTK solution. The implemented strategy provided a quality of a few cm to the estimated receiver biases, which is coherent with PPP-RTK performances. In contrast, when the geometry free observable is used to estimated TEC (Total Electron Contents), the receiver bias quality is expected be in the level of about 30 cm. Therefore, a high quality TEC is also possible of being derived from the ionospheric observables. The methodology, including software used and implementation, quality control and preliminary results will be presented for few stations in the Brazilian territory. Comparison with the traditional method based on geometry free observable will also be presented.