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Ionospheric corrections estimation in a local GNSS permanent stations network: improvement of Code Point Positioning at sub-metric accuracy level

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It is well know that GNSS permanent networks for real-time positioning were mainly designed to generate and transmit products for RTK (or Network-RTK) positioning. In this context, RTK products are restricted to users equipped with geodetic-class receivers. This work is a first step toward using a local network of permanent GNSS stations to generate and transmit real time products that could remarkably improve positioning accuracy for C/A receiver users.

A simple experiment was carried out based on 3 consecutive days of data from 3 permanent stations that belong to the RESNAP-GPS network (w3.uniroma1.it/resnap-gps), located at the Lazio Region (Central Italy) and managed by DITS-Area di Geodesia e Geomatica, Sapienza University of Rome.

In the first step the RINEX files were corrected for the differential code biases according to IGS recommendations and then processed with Bernese 5.0 CODSPP module (single point positioning using code measurements), using IGS precise ephemeris and clocks. One position per epoch (every 30 seconds) was estimated for P1 and for the ionosphere free combination (P3). The accuracy obtained with the P3• combination for the vertical component, which ranged from -1 to +1 m, was taken as the reference for the following discussion. For P1 observations, the vertical coordinate errors showed a typical signature due to the ionospheric activity: higher errors for day-time (up to 5 m) and smaller ones for night-time (around 1.5 m).

In order to improve the accuracy of the P1 solution, ionospheric corrections were estimated using the La Plata Ionospheric Model, based on the dual-frequency observations from the RESNAP-GPS network. Those corrections were applied to the RINEX files of a probing station located within the reference network. With this procedure, the vertical coordinate errors were reduced to the range from -0.8 to 0.8 m. This methodological approach shows the possibility to remarkably improve the real time positioning based on Code measurements only using ionospheric corrections estimations and CODE DCB products.