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Tidal and polar Modeling Effects in regional GPS Networks

L. Biagi (1), G. Pietrantonio (2) and F. Riguzzi (2)

(1) Politecnico di Milano, Polo regionale di Como, Como, Italy, (2) Istituto Nazionale di Geofisica e Vulcanologia, sez. CNT, Roma, Italy (ludovico.biagi@polimi.it)

The paper deals with two main questions, related to the processing of a regional GPS permanent network aimed at monitoring the reference system and the geophysical deformations. Which error is introduced in the time series by a mis-modeling of the solid tide? Does the adoption of different models of the polar motion cause a difference in the time series? Particularly, the moon-sun induced Earth tide can reach values up to some decimeters; its time series shows typical bands centered on low, diurnal and semidiurnal periods; the tide difference between two points depends on both the length and the orientation of the baseline connecting the points. In the time series analysis of a permanent network, only the tidal differences are relevant; the problem considered here is the correct modeling of the tidal difference behavior in time. At present, the tidal correction model described in the IERS 2003 Conventions should be applied in the processing of permanent networks: in brief, the model involves the computation of a first order tidal correction plus some corrective terms, as functions of space and time. In the BERNESE software, one of the main scientific software for GPS network processing, the IERS tidal model is implemented; in July 2004, an error in the tidal correction routine was identified and corrected: the error concerned a second order term, related to the semidiurnal tidal signal. The polar motion contains three major components: a linear trend, a quasi-annual (435 days) period and seasonal variations. In the analysis of global or continental GPS networks, polar motion can be estimated (typically on a daily basis); on the contrary, in the analysis of a regional network, polar motion estimates need to be a priori fixed, in order to correctly transform between celestial frame (satellite orbits) and terrestrial frame (station positions). At present, several estimates of the polar motion are produced by several institutions: usually, in GPS network analysis the IERS bulletins or the IGS products are adopted; more-

over, both IERS and IGS provide predicted and estimated series, with different scales of latency. In terms of estimated accuracies, the different polar motion estimates are characterized by significant differences; from the "user" point of view the real question is whether the differences can influence the station coordinates estimated by the data elaborations. In order to answer to the starting questions, a permanent GPS network in Italy has been selected ensuring heterogeneity in the length and the orientation of the baselines; one year of data has been considered. As regards the tidal modeling, two elaborations of the data have been performed using the BERNESE software, by applying the same processing strategy and, respectively, the wrong (old) and the right (corrected) tidal correction routine. As regards the polar motion modeling, several elaborations have been performed, by using final IGS products, and the different bulletin types produced by the IERS. The differences in the results (coordinates and time series) are discussed.