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GPS application to the study of deformation in the volcanic-tectonic system of Graciosa Island (Azores)

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In the scope of the Azores seismovolcanic monitoring programme a geodetic network was implemented in Graciosa island. The network is composed by thirty-five geodetic benchmarks distributed according to the main volcanic and tectonic structures of the island. A continuous GPS station installed in the Graciosa island since 2003 was used as reference. Three GPS observation campaigns were carried out in the last two years, specifically in September 2003, March and August 2004.

GPS observations data were processed using Bernese GPS Software 4.2, developed at the University of Berne. The preliminary data processing for the September 2003 and March 2004 campaigns had the main purpose to obtain coordinates for Graciosa island network in the ITRF2000. In order to accomplish this, the processing of the campaigns of September 2003 and March 2004 was carried out including four IGS stations (CASC, SFER, VILL and GRAS). The resulting coordinates were used as reference for the local network processing.

For the September 2003, March and August 2004 campaigns data, three processing strategies to study the effect of the correction of troposphere refraction were tested, resulting in three different solutions: one solution with pure modeling (no estimation of troposphere parameters), and two solutions with estimation of one and two troposphere parameters, using Niell's hydrostatic mapping function. The solutions for the horizontal components of each strategy were evaluated taking into consideration the *a posteriori* root-mean-square (RMS) of unit weight for each processing, the RMS for

the combination of the daily solutions and the quality of the estimates for the corrections to the zenithal troposphere delay and associated RMS. It was concluded that the solutions for the strategy with the estimation of two troposphere parameters were the less reliable. On the other hand, the strategy with no estimation troposphere parameters leads to high uncertainties in the estimated velocity vectors for some stations, leading to the conclusion that the estimation of one troposphere parameter presents the best results.

In relation to the vertical component, using the strategy with estimation of one troposphere parameter, it was possible to verify that the estimates for the velocities have RMS values much larger than the estimates. Comparing the results between strategies without additional troposphere parameters and the results with estimation of one troposphere parameter, it can be concluded that the estimates of vertical velocities for the major part of the network decreases for the processing without estimates of troposphere parameters.