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A new high precision gravity and geoid model for the Azores archipelago

J. Catalão(1), M. Bos(2), C. Antunes(1)

(1) LATTEX, IDL, University of Lisbon, Portugal (2) Observatorio Astronomico "Prof. Manuel Barros" V.N. Gaia, Portugal (jcfernandes@fc.ul.pt, Phone: ++351217500833)

In the last decade several relative and absolute gravity campaigns were made in Azores archipelago (Mid - North Atlantic). Marine and land surveys performed by different institutions, with different sensors, have contributed to the progressive filling of a gravity database with increasing temporal and spatial resolution. We combined all multisource gravity data recently acquired with earlier gravity data into a comprehensive gravity database which were complemented with a high precision digital terrain model and the most recent geopotential model GGSM02c to derive a high precision gravity field model and also the geoid model for this area. Marine and land gravity data was carefully edited, validated and adjusted with minimum constraints and combined with satellite altimeter derived gravity (KMS02 model) by least squares optimal interpolation, improving the spectral and spatial resolution of the derived gravity field. A new digital terrain model (AZDTM06) with a resolution of 100m was also generated from the compilation of altimetric data from 1:50,000 and 1:25,000 cartographic charts on Azores, and from Gebco 1' grid. This digital terrain model was used on the reduction of the gravity data and a grid of gravity anomalies, with 1 km spatial resolution, was generated by least squares collocation with an estimated internal accuracy of 3.2 mGal on marine areas and 1.2 mGal on land. Based on this grid a gravimetric geoid model was derived using the remove-restore procedure through direct computation of Stokes´ integral with a spherical cap radius of 0.8 degree. As a result of persistent volcanic and tectonic activity it is expected, on most of Azores islands, some vertical deformation on the centimetre level, at small temporal scales. Because of this, the geoid accuracy was assessed by comparing relative geoid heights (between two stations) with a small set (26 observations) of simultaneous GPS and levelling observations performed immediately after the 1998 earthquake. From this comparison it

was found that the external accuracy of the geoid model is 1.7 cm, corresponding to a great improvement relative to earlier solutions. This solution will allow, with enough precision, the conversion of old orthometric heights to ellipsoidal heights useful for temporal geodynamic studies and also for vertical datum unification.