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SPECTRAL AND CLASSICAL METHODS IN THE EVALUATION OF MOHO UNDULATIONS FROM GRAVITY DATA: THE NE ITALIAN ALPS AND ISOSTASY

C. BRAITENBERG,[1]* F. PETTENATI[1,2] and M. ZADRO[1]

[1] Department of Earth Sciences, University of Trieste, Trieste, Italy and [2] Osservatorio Geofisico Sperimentale, Trieste, Italy

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Abstract—The mapping of the crust–mantle boundary surface is an important geophysical task, which the method of seismic profiling has dealt with profitably. There are, however, areas where the crustal structure is not known up to the present, and where the Moho has as yet not been determined by geophysical sounding. In such areas the isostatic theory may be applied to give a first estimate of the depths of the crust–mantle boundary. However, young orogenic regions are not necessarily in isostatic equilibrium. Therefore the isostatically calculated crust–mantle boundary must be corrected. In our method, the long wavelength observed gravity anomalies are inverted in an iterative process to model the crust–mantle boundary, assuming thus that the mass responsible for the observed gravity anomalies is located at the level of the crust–mantle boundary. After illustrating the proposed method in different model situations, it is applied to two N–S-oriented profiles in the NE/Italian Alps, an area only scarcely studied with seismic deep sounding. We obtain a maximum crustal thickening of 60 km in the western profile, beneath the Hohe Tauern, whereas to the east a lower value of 50 km (Niedere Tauern), is retrieved. The eastern profile shows a secondary crustal thickening further to the south, below the Dinarides. The analysis shows that the Moho depth beneath the crest of the Alps is in the order of 10 km in excess compared to what we would expect for the Airy-Heiskanen (AH) isostatic model.

INTRODUCTION

The crust–mantle boundary in continental areas is well known to correlate with the topography variation on a large scale, in particular in the case of orogenic belts. This observation is explained by the isostasy hypothesis which states that an excess load on the Earth's surface such as a mountain range is compensated by a mass deficiency beneath the surface features but above the depth of compensation. Two important classes of isostatic crustal models are the Airy-Heiskanen (AH) and the Vening-Meinesz (VM) models. The AH model accounts for local equilibrium only, assuming no shear strength in the crust (free vertical movement of crustal columns), whereas the VM model achieves equilibrium on a regional scale by assuming an elastic crustal plate. The crust is modelled as a uniform layer of density (ρ_c) and initial crustal

* Author to whom correspondence should be addressed.