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Constraints on lithospheric structures of the Eastern Alps from gravimetry

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The Eastern Alps and their transition to the surrounding tectonic provinces (Bohemian Massif, Carpathians, Pannonian domain and Dinarides) include the transition from the head-on collision between the European and Apulian plates in the central part of the Eastern Alps, the extrusion of the eastern Eastern Alps into the Pannonian domain and the transition of the Eastern Alps to the Dinarides. This area was investigated by two recent 3D-seismic refraction experiments in Central Europe, CELEBRATION 2000 and ALP 2002, which provide new images of the P-wave velocity structure of the upper crust and the Moho discontinuity. In general, the velocity information on the crust is not complete, since the diving wave tomography does not penetrate the lower crust sufficiently. However, the gravity field can set further constraints on the velocity of the lower crust and subsequently on the Moho depths. The conversion of P-wave velocity to density values for the crust was performed using the Christensen and Mooney (1995) velocity-density relationship. The gravity modelling has been done by a superposition of the gravity effects of prismatic bodies after Nagy (1966). Relative densities were used in order to avoid side effects. The basis of the calculation is the Bouguer anomaly map of the area. The gravity effect of the uppermost 10 km of the crust was calculated and stripped from the Bouguer anomaly at the surface. The crust beneath was modelled with different P-wave velocities and gradients at 10 km depth, and the calculation of Moho depths from two-way travel times followed. The overall gravity effect was calculated and subtracted from the stripped Bouguer anomaly, resulting in a residual Bouguer gravity. The solution for velocity and gradient was found by minimizing the correlation between the calculated Moho depths and the residual gravity field. The residual no longer correlates with the structure of the Moho and shows

regions of systematically higher or lower density situated deeper than 10 km. The obtained velocity and gradient is in good agreement with the results of Christensen and Mooney (1995) for the mean crust. The residual has been compared with tectonic and geophysical structures. Evidence for a "Dinaridic subduction" is indicated by positive anomalies. Strong positive anomalies are also found in the transition from the Northern Pannonian domain to the European platform, where high velocities in the lower crust are obtained from the seismic model. Negative anomalies can be correlated with the South Bohemian Pluton and the Tauern Window.

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Nagy, D.(1996): The gravitational attraction of right angular prism. Geophysics 31, pp. 362-371, 1966