Geophysical Research Abstracts, Vol. 9, 10507, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10507


# Isostatic modelling of the Hellenic Arc

M. Staackmann (1), K. Snopek (2), U. Casten (1), D. Klatt (1)

(1) Ruhr-Universität Bochum, 44780 Bochum, Germany, (2) GeoForschungsZentrum (GFZ) Potsdam, Telegrafenberg, 14473 Potsdam, Germany (formerly Ruhr-Universität Bochum) (staackmann@angewandte-geophysik.ruhr-uni-bochum.de)

Plate tectonics in the Hellenic arc region is dominated by the subduction of the African plate beneath the Eurasian plate and the counterclockwise rotation of the Anatolian and Aegean plate elements. Additionally to this motion, an independent south-west escape of the southern Aegean part is observed. The motion implicates crustal thinning below the Cretan sea and extension of the Hellenic trench system. Furthermore geological records show an uplift of Crete.

Isostatic modelling was performed for the arc region. Several models with two different compensation mechanisms were calculated and the isostatic anomalies were determined. The applied compensation mechanisms were of the Airy type (local compensation without rigidity) and of the Vening Meinesz type (regional compensation as lowpass filtering effect of rigidity). Structural parameters were the densities of crust ($\rho_C = 2.90\,g/cm^3$), mantle ($\rho_M = 3.38\,g/cm^3$) and water ($\rho_W = 1.03\,g/cm^3$) and as compensation level the depth of Moho below Crete ($T_0 = 25\,km$). These parameters were changed into a second set of parameters with $\rho_C = 2.80\,g/cm^3$, $\rho_M = 3.20\,g/cm^3$, $\rho_W = 1.03\,g/cm^3$ and $T_0 = 35\,km$. In both cases the parameter rigidity was variied from $10^{21}\,Nm$ to $10^{23} Nm$. The results clearly demonstrate that the depth of the isostatic Moho differs from the depth of the Moho obtained by forward modelling. For example, the depth of Moho below the Cretan Sea, following the Vening Meinesz compensation with a rigidity of $10^{22}\,Nm$, is reaching $32\,km$ instead of $20\,km$ or less. Moho depth in the south-west and the south-east is $20\,km$ instead of $23\,km$ or more. The standard deviations of the calculated isostatic anomalies are in the range of $65\,mGal$ to $77\,mGal$. These results implicate that the crust of the Hellenic arc region is not balanced. Overcompensation is present in the Cretan Sea and undercompensation outward of the forearc rise.

Additionally to this regional modelling an investigation of the horizontal mass distribution along a profile crossing Crete was done. For this calculation the 3D density structure of forward modelling was used. The weight of columns, which range from the actual surface down to the top of subducting plate in a depth of $55\,km$ to $60\,km$, were computed for two different density structures. The one has a constant density of the lower crust and the second lateral density variations. The results for the second density model, which is favoured by seismic studies, demonstrate column weights for western Crete lower than for the central and the eastern part. This decreased weight is suspected to contribute to the observed, relative uplift of this part of the island.