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Static and dynamic support of the Pannonian basin topography

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Determination of isostatic gravity anomalies more than half a century ago indicated that the Pannonian basin was “overcompensated”, i. e. it was more elevated than predicted by an Airy-type isostatic compensation model. In other words, the isostatic equilibrium position of this strongly attenuated crust should be well below the sea level. We have revisited this early finding in the possession of reliable data on the structure of the lithosphere-asthenosphere system (Faccenna et al. 2014) and skill to simulate the effect of upper mantle convection on the topography (Becker et al. 2014).

The static component of the topography relative to a reference level can be calculated by the assumption that a lithospheric column consisting of a crustal layer and a mantle lid floats freely within the asthenosphere. The difference between the actual and calculated topography in the Pannonian basin turns out to be a robust feature with values as high as 1000 meters

This residual topography is supposed to be a dynamic feature and explained in terms of instantaneous mantle flow due to temperature anomalies as inferred from regional P and S wave tomography. Dynamic topography is derived from the radial tractions acting upon a free-slip surface boundary in a Newtonian-type fluid (Becker et al. 2014). Results show a remarkably good fit between dynamic and residual topography pattern suggesting a marked convective support of the elevated Pannonian basin.

Finally, we argue that mantle flow pattern in the Pannonian region is part of the Mediterranean upper mantle concvection system, which has been under the control of lithospheric subduction, rollback and eventual slab breakoff processes (Faccenna et al. 2014).