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Lithospheric flexure, uplift and expected horizontal strain rate in the Pannonian Carpathian region

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The Apuseni mountains are located between the Pannonian basin and the Transylvanian basin along a direction of SE convergence with the Carpathian belt. A flexural model based on the cylindrical bending of a semi-infinite, isostatically supported, thin elastic plate is here examined with the Apuseni playing the role of flexural bulge, and under the assumption that the plate is deforming under the action of a vertical shear force and a bending moment applied at the end of the plate, beneath the Carpathians. The model yields estimates of the plate thickness ranging between 13 and 14.5 km, depending on the assumed density contrast between crust/sediments and mantle providing buoyancy. The vertical shear force which is necessary to bend the plate is in the range between 60 and 300 1011 N m-1, depending on the assumed density contrast. This force is shown to be modelled by a gravitational ‘slab pull’ force, using model parameters derived from seismic tomography. If the height of the flexural bulge, after correction for erosion, is allowed to increase, the model yields an estimate of the horizontal strain rate at the top of the bulge. For example, 5 mm/yr vertical change of the flexural bulge of a 14 km thick plate results in a horizontal deformation rate of approximately 7 nanostrain/year at the top of the bulge, a value which is at the threshold of sensitivity of continuous GPS measurements. Different vertical rates will change the horizontal strain rate almost proportionally.