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Mantle flow modeling of the anomalous topography in the south-east Carpathians

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The neotectonic evolution of the Carpathians is dominated by collisions of irregular continental fragments and accretion of nappe stacks due to the Alpine orogenic activity. The geological record indicates that the uplift of the Carpathian fold thrust belt and subsidence of the adjacent Focsani (foredeep) basin occurred coevally in the aftermath of Alpine collision. Recent seismological studies indicate a distinct high velocity body (Vrancea slab) beneath the Focsani basin (42 km thick crust) and low velocity upper mantle beneath the high Carpathians (35 km crustal thickness). A suite of models has been proposed to explain the pattern of anomalous surface topography in the region; however no models have considered the role of underlying mantle dynamics/flow. Here we test that whether the observed anomalous uplift/subsidence in the southeastern corner of the Carpathians – with a > 1 km elevation- and adjacent 13 km deep Focsani basin may have been formed due to the dynamical effects of mantle flow. A conversion of seismic tomography velocity anomalies to temperature field was performed as an input into a series of 2-D thermo-mechanical numerical models. Based on the simple isostasy formula, we quantify the residual topography calculations (non-isostatic component of topography) to further reconcile them with our dynamic modeling interpretations. Our results suggest that active mantle flow beneath the Carpathians may possibly explain the current topographic anomalies (e.g., dynamic uplift/subsidence) beneath this region.