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# New insights on the deep geodynamic processes within Vrancea active seismic zone as inferred from non-tidal gravity changes

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Vrancea experiment
Located in the bending zone of East Carpathians, just at the junction of three major lithospheric compartments, the so-called Vrancea zone exhibits unusual intermediate-depth seismicity within full intra-continental environment. The dominant idea is that the upper mantle seismicity is due to a slab relict hanging below the Vrancea crust. However, several aspects, among which the issues of its connection with the crust, are under debate. The presence of the intermediate-depth earthquakes with vertical-extension mechanism advocate for an active attachment of the oceanic lithosphere relict sinking into the upper mantle, but some seismic tomography images seem to point out a completely detached high velocity body. However, the low resolution makes the results questionable.
A gravity experiment has been conducted in order to infer the lithosphere dynamics within the Vrancea seismic region from the space-time change of the gravity field in the area. Systematic high accuracy gravity observations have been performed within a dedicated gravity network consisting of 13 epoch-stations regularly spread over the study area and a geo-traverse crossing the epicentre zone.

Instruments and methodology
Using a Scintrex CG-5 relative meter, absolute gravity values have been transferred on each pillar from the both second order Romanian national gravity reference network and the Central Europe UNIGRACE network.
Gravity values on the base stations located along the geo-traverse have been referred to one of the end base-stations, located outside the active geodynamic area in a stable environment.
All gravity observations were corrected for tide and drift. Due to the short distance between the stations, corrections for atmospheric pressure change have not been considered.

Main results
As the second order Romanian national gravity network provides absolute gravity for the 1980's epoch, and the UNIGRACE network offers absolute gravity for 2000's epoch, pairs of absolute gravity values separated by a 20 years time-span have been obtained and compared on each pillar of the gravity network.
Overall, a gravity decrease has been revealed in the area. The lowest gravity low has been recorded just within the epicentre area, along with a slight subsidence of topography. This unusual coupling of altitude decrease and gravity lowering looks clearly connected to deep geodynamic processes.
2D and 3D computer models simulating the gravity change have revealed a mass deficit (starting at approx 10 km depth) located in the epicentre area of the intermediate-depth earthquakes. It has been interpreted in terms of volume increase caused by an assumed lithosphere stretching created by the eclogitization of the lower crust penetrating the upper mantle.
Sets of gravity values obtained along the geo-traverse from successive yearly campaigns have confirmed the previous assumption revealing the crust stretching as an on-going process.
Based on the gravity results and their interpretation along with other kind of observations (e.g. high resolution tomography provided by joint inversion of the seismic and gravity data), some concluding remarks and speculations on the genesis of the intermediate-depth seismicity are finally presented.

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