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EURho: Density structure of the European crust and lithospheric mantle

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We present a new density model of the (1) European crust and (2) lithospheric mantle by integrating seismic, thermal and gravimetric data. (1) **Crustal density**: We obtain crustal segment thicknesses (i.e. sediments, upper crust, middle crust, lower crust and lowermost crust) and mean p-wave segment velocity (v_p) from the recent seismic crustal model EUNAseis (Artemieva and Thybo, 2013). By converting each mean crustal segment v_p into mean crustal segment rock density using Brocher's empirical polynomial relationship (Brocher, 2005), we calculate mean crustal density for the entire crustal column as a weighted mean. (2) **Lithospheric mantle density**: Due to strong seismic anisotropy in the European lithospheric mantle, we limit the v_p to rock density conversion to the crust. Instead, we estimate lithospheric mantle densities from residual mantle gravity. We use crustal segment densities to calculate the total crustal gravimetric contribution. We find a strong linear relationship between crustal thickness and crustal gravimetric contribution, and we exploit this relationship as our reference model. We remove the anomalous crustal gravimetric contribution by subtracting it from the Free-Air Anomaly in WGM2012 (Balmino et al., 2012). By implementing the thermal model TC1 (Artemieva, 2006) and by defining the base of the lithosphere as the depth where the local geotherm reaches a temperature of 1300 ^{o}C we effectively constrain the thickness of the thermal lithosphere. We remove the effect of undulating Moho and LAB (Lithosphere Asthenosphere Boundary) depth variations, and the effect of thermal expansion. From the resulting residual mantle gravity, we estimate lithospheric mantle density on a 1 x 1 degree's grid. Our results show that the thick crust in the East European Craton (East European Platform and shield and the Baltic shield) is significantly denser (2.83 ± 0.05 Mg m^{-3}) than the thin crust in Western Europe (2.77 ± 0.04 Mg m^{-3}). Contrastingly, the thick lithospheric mantle in Eastern Europe is slightly less dense (3.34 ± 0.03 Mg m^{-3}) than the thin lithospheric mantle in Western Europe (3.36 ± 0.03 Mg m^{-3}). The weighted mean density for the entire lithosphere of Eastern and Western Europe is remarkably similar with a mean density of 3.21 ± 0.03 Mg m^{-3} and 3.2 ± 0.04 Mg m^{-3} respectively. Additionally, we find very high densities (3.4 – 3.46 Mg m^{-3}) in the lithospheric mantle beneath the Peri-Caspian basin and the North German basin, suggesting that eclogitization processes could play a role in the formation of these basins.