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Strength distribution in the European lithosphere and its effect on the crustal ductile flow

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Strength distribution within the European lithosphere was estimated based on the high resolution crustal model for Europe EuCRUST-07, and the new thermal model of the lithosphere (Tesauro et al., 2009). Differently from previous studies, the new model adopts lateral variations of lithology and density, which are derived from the crustal model. Using these results we estimate variations of the elastic thickness of the lithosphere. Furthermore, variations of the crustal thickness and density are used to compute lateral pressure gradients that may eventually drive horizontal ductile flow in the lowermost parts of the crust. Accumulation of sediments in any basin may also drive a horizontal flow in the crust resulting in accelerated subsidence below the basin and uplift of its borders. Consequently, this enables prediction of potential horizontal mass exchanges and stresses within the European crust, which may be responsible for significant horizontal and vertical movements and be associated with formation of zones of compression, extension or subsidence. The new results demonstrate that the lithosphere of Western Europe is more heterogeneous than that one of Eastern Europe. Western Europe with predominant crust-mantle decoupling is mostly characterized by lower values of the strength and elastic thickness. The lower crust of the Alps and Apennines may flow laterally, which is proved by high values of the strain rates observed. High strength values are found in the areas having the average/low thermal regime and strong crustal rheology (the East European Platform, the North German Basin and the Bohemian Massif). Weak zones correspond to the areas affected by the Tertiary volcanism and mantle plumes, such as the European Cenozoic Rift System (ECRIS) and the Massif Central. Both the integrated strength of the lithosphere and of the crust demonstrate similar trend in most parts of the study area. One of the most interesting results is the high contribution provided by the crustal strength ($\sim$50% of the integrated strength for the whole lithosphere) in the most part of the study area ($\sim$60%). The contribution of the mechanical strong mantle part of the lithosphere to Te is low (<10 km) in most parts of Western Europe.