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Surface deformation and mantle structure of the European region

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We present new geophysical models of surface deformation and mantle structure for the European region. Surface deformation is determined from about 3000 published GPS motion vectors which have been inverted for the present day velocity-gradient field assuming that the velocity gradient varies linearly over small sub-domains of the European region. Present-day mantle structure is determined globally from an inversion of 20 million P-wave phases. Particularly for the European region, high-quality data have been re-picked and incorporated from teleseismic tomography experiments such as TOR, EIFEL, and CALIXTO, as well as data from the ORFEUS data center. As starting models for tomography we departed from the usual 1-D reference models and used different 3-D reference models which include a laterally heterogeneous crust.

Qualitative comparisons can be made between the determined surface deformation (predicted flow field, strain- and rotation rate fields) and deep mantle structure and (interpreted) processes. The surface deformation field can be associated with a variety of processes such as isostatic adjustment in northern Europe and subduction related deformation in the Mediterranean region. Central Europe proves relatively stable although small but significant surface extension is observed which may be related to mantle upwelling. Subduction along the Hellenic arc is associated with quite different patterns of surface deformation compared to subduction under the Italian Peninsula attesting of the known differences between these subduction systems. These, and other, qualitative observations suggest links between mantle processes and surface deformation.The models presented will be used in near-future convection modeling experiments to quantitatively link mantle processes and surface deformation.