Glacial isostatic adjustment in Northern Europe and the Mediterranean Sea: the role of the mantle viscosity profile

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Relative sea level indicators witness the response of the Earth to the great ice and water mass redistribution which occurred since the time of the Last Glacial Maximum. While the GIA signal dominates the modern instrumental observations in the formerly glaciated Fennoscandia, it represents a second order term in the central Mediterranean Sea, where horizontal and vertical velocities testify the effects of the collision between the African and Eurasian plates. To investigate the role of the mantle viscosity profile on the GIA in Northern Europe and the central Mediterranean basin we consider relative sea level data representative of the last 14 ka from Fennoscandia and the coasts of Italy. The Italian Palaeo sea level indicators come from areas that are considered tectonically stable on the basis of the local elevation of the MIS 5.5 shorelines (Last Interglacial, 125 ka BP) with respect to the present-day mean sea level. By employing a 1D spherical Earth model we perform an exploration of the parameters space of mantle rheology and determine the viscosity profiles which best fit both the whole dataset and the two regional sub-sets. To test the difference in the sensitivity to the mantle viscosity profile between the relative sea level data and the GPS measurements we perform the same analysis by using the vertical velocities from a densified regional GPS network in Northern Europe. Finally, by means of a flat 3D FEM Earth model for the Northern Europe we test the sensitivity of the relative sea level data and the vertical GPS velocities to lateral variations in mantle viscosity and lithospheric thickness.