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Three-dimensional instantaneous dynamics modeling of present-day Aegean subduction

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The Aegean region (Eastern Mediterranean) is exemplary of the interaction between crustal tectonics, plate motion, subduction and mantle flow: African subduction underneath the region has been continuous for at least the last 100 My, leading to about 2100-2500 km of subducted lithosphere residing in the mantle (van Hinsbergen et al., 2005). During this subduction, decoupled upper continental and oceanic crust accreted into a wedge of stacked nappes. In turn, these nappes have been significantly extended, predominantly during the last 25 My, due to the retreat of the African slab relative to Eurasia (van Hinsbergen and Schmid, 2012).

As a first step to better understanding the coupling of the tectonic evolution of the crust and the underlying mantle dynamics, we are developing 3-D numerical models of the instantaneous dynamics of the present-day Aegean subduction system using the finite element code ASPECT (Kronbichler et al., 2012). The instantaneous models are set up with initial slab geometries derived from tomography and realistic plate boundary configurations and incorporate the major crustal weak zones of the overriding plate. Our modeling results in predictions of flow fields and stress, strain rate and rotation rate fields for the present-day tectonic setting of the Aegean region.

By comparing our various model predictions to the widely available observations, such as focal mechanisms, GPS velocities and seismic anisotropy, we aim at an improved understanding of how mantle flow, subduction morphology and possibly slab segmentation, as well as the rheological behavior of the overriding plate, control present-day tectonic deformation. We expect to show preliminary results of this comparison.

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