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Constraining the dynamics of the present-day Alps with 3D geodynamic inverse models - model version 0.2

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The ongoing formation of the alpine mountain belt is a major indicator of the active geological processes in the Mediterranean that for example causes volcanism in Italy as well as considerable hazard. To understand this complex system the European project AlpArray, with the German contribution 4D-MB, was funded in order to investigate the structure, dynamics and geology of the alpine area in more detail and through all scales. We focus on the large scale geodynamic processes that drive this complex system of multiple subduction zones, ranging from the surface to the mantle.

We will present new preliminary results obtained by thermomechanical modelling of the area. The models are based on recent large-scale seismological studies. As such we take into account complex slab gemoetries slab gaps and delaminated slabs. The Moho is created as a combination of Tesauro et al. (2008), Spada et al. (2013) and Molinari et al. (2011).

We present several instantaneous simulations with varying temperature structure, rheological parameters, boundary conditions and slab configurations, unraveling the sensitivity of the surface velocity to the existence and shape of slabs in order to answer, e.g. the question which slab is most important for the rotation of Adria? We compare the results to measured surface observables like GPS-velocities or stress directions. In addition we automatically optimize the misfit between the data and the simulation results using adjoint gradient based inversions for the rheology of the lithosphere and the slabs.

Tesauro, Magdala, Mikhail K. Kaban, and Sierd APL Cloetingh. "EuCRUST-07: A new reference model for the European crust." Geophysical Research Letters 35.5 (2008).

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Molinari, Irene, and Andrea Morelli. "EPcrust: a reference crustal model for the European Plate." Geophysical Journal International 185.1 (2011): 352-364.