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3D subduction modelling of the Betic-Rif Alboran region.

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Our project is concerned with the 4D evolution of Western-Mediterranean region from ∼30 Ma until the Present. Slab rollback and lithosphere tearing play an important role in the evolution of this region and affects the development of surface geology (Spakman and Wortel(1)).

The project was started with 2D numerical simulations of self-consistent slab rollback for the different model setup. We investigate the influence of different boundary conditions (open boundaries versus closed boundaries), different domain size and different far-field generated intraplate stresses applied to the overriding plate on the subduction process. We have found that free slip implemented either on the both sides of the domain or on one side leads to results that are influenced by the boundary for any reasonable domain size. For the model with open boundary conditions such an influence is only observed in the magnitude of the velocity, which can be successfully scaled by an iterative procedure. Thereby, the model with open boundaries allows us to investigate the subduction dynamic process under conditions that are free from disturbing boundary influences. By being able to model the subduction process in a smaller domain size we significantly decrease computational expenses.

Generally our research is now focused on 3D models. We start from the reconstruction of the subduction process in the Betic-Rif Alboran region. This region has a long and complicated subduction history, which consists of slab rollback, lithosphere detachment and tearing processes leading to a narrow curved subduction zone (Spakman and Wortel, 2004). So far analogue models failed to reconstruct such a high-curved structure. We have implemented and tested the open boundary conditions in a 3D setting, which allowed us to significantly decrease the domain size. Different initial plate tectonic settings and kinematic boundary conditions are now being tested in order to reconstruct this complex subduction process.

Spakman, W., and R. Wortel, 2004, A tomographic view on Western Mediterranean Geodynamics, in: The TRANSMED Atlas, The Mediterranean Region from Crust to Mantle, Edited by: Cavazza W, Roure F, Spakman W., Stampfli GM, Ziegler P., p. 31-52.