

The influence of the plate properties on the dynamics of subduction

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In the subduction dynamics the following factors play an important role: mantle flow, viscosity structure of the mantle, buoyancy forces, different rheologies. In a systematic study we investigated the influence of the plate properties such as thickness, density contrast between the subducting plate and mantle, plate viscosity and pore pressure factor in the Byerlee law on the subduction process. For the modelling we used the 2D finite difference code FDCON. The viscoplastic plate is described by the density and viscosity contrast between the plate and the mantle, and the mantle is stratified with a constant viscosity of the upper and lower part. The different rheologies and densities in the model are advected with a tracer method.

The low value of the pore pressure factor in the Byerlee law leads to the low viscosity of the slab bending region in the case of plates of different viscosity. This causes insensitivity of the subduction and trench retreat velocities to the variation of the plate viscosity. The trench tends to retreat at all subduction stages for all viscosities and plate thicknesses.

The high value of the pore pressure factor in the Byerlee law leads to strong bending region. For thick plates, the increase of plate viscosity by a factor 20 results in the decrease of subduction and retreat velocity by about 30%. At the late subduction stage we observe trench advance for the slabs with a strong bending region.