Geophysical Research Abstracts
Vol. 21, EGU2019-4586, 2019
EGU General Assembly 2019

2D Numerical models for oppositely dipping subduction zones

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We use the viscous-plastic numerical code 'Underworld' to investigate the subduction initiation of two oppositely dipping subducting slabs. Such a setting is comparable to the Scotia Plate that, during its early existing stage, was bounded by the east-ward subducting Nazca and Phoenix plates, which formed one continuous subduction zone along the western side of the South American and Antarctic continents, and later in time by the South Sandwich trench, which formed in response to the westward dipping Atlantic slab to the east of the Scotia Plate.

In a first attempt, we test various parameters, such as slab thickness, lithosphere thickness, angle of subduction and width of the overriding plate with a simplified 2D numerical setup that includes the upper mantle down to the 660 km boundary of the transition zone. Our aim is to identify controlling parameters of this geometry of oppositely dipping slabs.

The preliminary results show that strain localisation happens along both subducting slabs. Only along the already subducting slab that compares to the Nazca-Phoenix subduction zone, does the slab subduct below the overriding plate. With the viscosity and density parameters used in this study, a smaller width of the overriding plate provides a higher strain on the oppositely dipping slab, which compares to the Atlantic subducting slab, but no initiation of subduction occurs. This higher strain only develops when the contact between the overriding plate and the subducting Atlantic plate is favourable. Additionally, an angle that is too low or too high will not result in the localisation of strain at this contact.