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Dynamic evolution of continental and oceanic lithosphere in global mantle convection model with plate-like tectonics and one sided subduction.

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Drifting of continents, spreading of the seafloor and subduction at convergent boundaries shape the surface of the Earth. On the timescales of several hundreds of millions of years, divergent boundaries at mid-ocean ridges are created and destroyed in within the Wilson cycle. This controls the evolution of the Earth as it determines the heat loss out. Presence of floating continents facilitates the Earth-like mobile lid style of convection as convective stresses are concentrated on the rheological boundary between oceanic and continental lithosphere. Subducting slabs allow for the surface material to be buried down into the mantle and have an important effect on surface tectonics. The main feature of the subduction zones observed on Earth is that it is single-sided forming the deep trenches. Recently, different numerical models were successful in reproducing one-sided subduction by allowing for the vertical deformation of the Earth surface (Crameri and Tackley 2014). In the meantime, advances were made in modelling continental break-up and formation (Rolf et al. 2014).

In this study we perform numerical simulations of global mantle convection in spherical annulus geometry with strongly depth and temperature dependent rheology using StagYY code (Tackley 2008). In these models plate tectonics is generated self-consistently and features one-sided subduction on ocean-ocean plate boundary as well as floating continents. We focus on determining (1) the influence of one-sided subduction on the dynamics of the system (2) formation and breakup of continents.

Rerefences:

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