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Mantle convection simulation with subducted continental materials as a heat source

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Geological studies have suggested that significant amount of granitic crustal materials have been lost from the surface. According to recent numerical studies, most of the granitic materials subducted at ocean-margin subduction zones from the surface are expected to be conveyed through subduction channels by viscous drag from the surface to 270km depth. In addition, the subducted crustal materials might be trapped in the mid-mantle owing to the density difference from peridotitic materials induced by the phase transition from coesite to stishovite at 270km depth. In other words, strong heat source materials are most likely to be accumulated around the mantle transition zone, at least, near the plate subduction zones.

In this study, we conduct numerical experiments of mantle convection with subducted continental materials as a chemically distinct heat source at the bottom of the mantle transition zone together with a laterally drifting motion of a surface supercontinent. The simulations deal with a time-dependent convection of fluid under the extended Boussinesq approximation in a model of a two-dimensional rectangular box. We found that the addition of the heat source considerably reduces the time scale of continental drift.

Keywords: continental crust, subduction channel, mantle convection simulation, continental drift