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Testing Testing Proto-South China Sea plate reconstructions by data assimilation into TERRA global mantle convection models

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The South China Sea lies at a key junction between major plates (i.e. Pacific, Eurasian and Indo-Australian) within one of the most tectonically complex regions in the world. A great diversity of plate reconstructions has been proposed for the South China Sea area since the Cenozoic. One class of 'conventional' proto-South China Sea plate models suggests that South China Sea opening was accommodated by one-sided, southward Proto-South China Sea subduction beneath Borneo during the Eocene and Early Miocene (e.g. Hall and Breitfield, 2017; Holloway, 1982; Taylor and Hayes, 1983). In contrast, an 'alternative' model proposed double-sided Proto South China Sea subduction within the same time period (Wu and Suppe, 2017). The alternative model was proposed to explain the origin of a slab-like, sub-horizontal fast tomographic anomaly below the present South China Sea at 500 to 700 km depths that exceed 1000 km in N-S and E-W extent (Wu and Suppe, 2017). A recent mantle flow model assimilated the conventional-style plate model (Zahirovic et al.,
2016) and, despite many valuable insights, did not clearly reproduce a sub-horizontal slab below the present South China Sea.
This study assimilates these two end-member plate models into the numerical model TERRA (Bunge et al., 1998). The computational domain is discretized on a regular grid based on the icosahedron, for a total of ∼80 million grid points and a resolution of ∼25 km, allowing us to simulate convection in the same regime as the real Earth. We implemented the plate models as a set of continuously closing plates in order to generate a global self-consistent velocity field to be assimilated into the convection models. We explicitly tested the viability of the two plate models against tomography following Schuberth et al. (2009) by converting the resulting temperature field to seismic velocities and applying a resolution filter from S40RTS (Ritsema et al., 2011). Our results show that the two plate models produce fast anomalies under the present-day South China Sea that are distinguishable, even within the coarser-scale S40RTS resolution filter. The alternative model produces more slab-related cold anomalies under present-day South China Sea. We will discuss a next set of
thermochemical model results that were designed to increase realism by incorporating possible oceanic and continental compositional differences.