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Evaluating alternative models of intra-oceanic subduction of northeastern Panthalassa since the Jurassic

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Renewed interest in the palaeogeography and deep mantle structure of North America, the Arctic and Northeastern Panthalassa has reignited a discussion of the region's Mesozoic subduction history. In particular, accounting for the origins of numerous accreted terranes, ranging from Gondwana, Laurentia, Baltica, the Tethys, Siberia, China and Panthalassa has facilitated several alternative tectonic scenarios. Kinematic variability is manifested in terms of the origin and timing of ocean basin opening and closure, the evolution of intra-oceanic and/or continental subduction, subduction polarities, relative plate velocities, convergence and the rate of subduction, age of subducting lithosphere and dip of subducting slabs. With ever-increasing detail of global plate motion models, advances in numerical modeling and the resolution of seismic tomography, these alterative plate reconstructions can now be robustly tested within a geodynamic framework. Having generated several alternative plate models since the start of the Jurassic, complete with self-consistent and dynamic plate boundaries, here, we test the spatial and temporal evolution of slabs through forward models of mantle flow. In turn, we undertake a qualitative and quantitative comparison of our modelled present-day mantle structure to that inferred from models of seismic tomography, therefore providing an additional dataset to which plate reconstructions of the region can be iteratively refined.