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From slab rollback to orogenic plateau formation – a numerical modeling study of ocean-continent subduction systems

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The crustal structures of overriding plates in subduction settings around the world can vary between a wide range of deformation styles, ranging from extensional structures and back arc opening induced by slab roll back as in the Hellenic subduction zone to large, plateau-like orogens such as the central Andes. Both end member types have been intensively studied over the last decades and a range of hypotheses have been proposed to explain their characteristics. Here we model ocean-continent collision using lithospheric scale plane-strain thermo-mechanical models, which also account for phase changes of rocks which enter the eclogite stability field. We consider the oceanic plate velocity, back-arc crustal strength, back-arc lithospheric strength, subduction interface strength, strain weakening thresholds in the crust and mantle flow patterns as the main variables in upper plate deformation and conducted a sensibility study with those parameters. The influence of eclogitized lower continental crust is also accounted for and shows to have a modulating effect. To verify and discuss our modeling results, we also present a comparison of the models with natural subduction systems.