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# Thermo-mechanically coupled subduction using AMR together with a true free surface and sticky air in ASPECT

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ASPECT (Kronbichler et al., 2012), short for Advanced Solver for Problems in Earth's ConvecTion, is a new Finite Element code which was originally designed for thermally driven (mantle) convection and is built on state of the art numerical methods (adaptive mesh refinement, linear and non-linear solver, stabilization of transport dominated processes and a high scalability on multiple processors).

Here we present an application of ASPECT to the modelling of fully thermo-mechanically coupled subduction. Our model contains in the case of a true free surface three different compositions: two different crustal compositions, one on top of the subducting plate and one on top of the overriding plate, and a mantle composition. In the case of a free surface through a sticky air layer, a fourth composition representing this sticky air is added. We implemented a viscoplastic rheology using frictional plasticity and a composite viscosity defined by diffusion and dislocation creep. The lithospheric part of the mantle has the same composition as the rest of the mantle but has a higher viscosity because of a lower temperature. The temperature field is implemented in ASPECT as follows: a linear temperature gradient for the lithosphere and an adiabatic geotherm for the sublithospheric mantle. The Initial slab temperature is defined using the analytical solution of McKenzie (1970). The plates can be pushed from the sides of the model, and correspondingly it is possible to define an additional independent mantle in/out flow through the boundaries.

We will show a preliminary set of models, highlighting the current codes capabilities, such as the fine tuned use of Adaptive Mesh Refinement in combination with topography development both through a true free surface and sticky air and solving for strongly non-linear rheologies.