



Coupling Stokes and Darcy Flow in Melt Migration Modelling

Ragnar Lehmann (1,2), Boris Kaus (1,2), Mária Lukáčová-Medvid'ová (1,3)

(1) Computational Science Mainz, Gutenberg University Mainz, Mainz, Germany, (2) Gutenberg University Mainz, Institute of Geosciences, Mainz, Germany (r.lehmann@uni-mainz.de), (3) Gutenberg University Mainz, Institute of Mathematics, Mainz, Germany

Melt migration can be modelled by coupling variable-viscosity Stokes flow and Darcy flow. Stokes Flow, generally, captures the long-term behavior of the mantle and lithosphere while Darcy flow models the two-phase regime.

We present preliminary results on two different approaches of coupling Stokes and Darcy flow to simulate melt migration on a lithospheric scale using the Finite Element Method. In the first approach we solve the problem in a decoupled manner where we solve incompressible variable-viscosity Stokes flow for (solid) velocity and pressure and use these as input parameters to solve Darcy flow for fluid velocity.

In the second approach, we couple the two systems of partial differential equations for viscoplastic rheologies and solve the system as a whole more strictly capturing all interdependencies (a two-phase compressible formulation). Both approaches are tested and compared for various rheological setups.