# Iterative Stokes solvers in geodynamic modeling

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The conservation equations of momentum, mass, and energy for a fluid with infinite Prandtl number are solved in a 2-D Cartesian domain as well as in a 3-D spherical shell. In every time step a stationary Stokes system is solved. Viscosity varies by several (5 to 10) orders of magnitude, according to the conditions in the Earth's mantle, providing challenges for both, multigrid and Krylov subspace solvers. Finite-element discretization and solution methods are parallelized with MPI and domain decomposition.

We make a comparison between a preconditioned MINRES method and a CG method to the Schur complement equation and analyze the convergence behavior. Validity of the preconditioner-induced MINRES norm for the original Stokes system and the necessity to scale the preconditioner for the Schur complement will be discussed and appropriate stopping criteria for the iteration process will be derived.

Even more important for handling high viscosity variations is a multigrid solver for evaluating the inverse of the momentum operator. We use a geometric multigrid with matrix-dependent and grid-dependent transfer operators. A possible further improvement of the coarsening strategy is also discussed in Markus Müller's talk.

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