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Numerical models of two-phase flow systems in the Earth : Benchmark time has come

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The dynamics of two-phase (or two-component) media is a well-studied field with numerous natural applications to solid earth physics. For example, some important geophysical problems falling within the scope of the two-phase (or multi-phase) approach are : Magma segregation and dynamics, Earth's Core formation, tectonic plate generation, water transport at subduction zone, etc.

Since a few years, in addition to the commonly used set of equations derived by McKenzie (1984), a new theoretical formulation (Bercovici et al., 2001) is available to describe two-phase flow mixtures. In parallel, improvements of computers efficiency have made numerical solving of such a complex system more and more tractable. These two facts result in the existence of a large number of numerical codes not only using different numerical techniques to solve for the governing equations but also based on different sets of governing equations.

For the sake of clarity, the need of a benchmark of available codes is now palpable. Thus we propose a set of 1-D and 2-D experiments that would allow to compare the efficiency (computer time) and accuracy of the numerical schemes and the possibilities offered by the different theoretical approaches. These experiments have been chosen to be general enough to permit the comparison of codes initially build to deal with settings as different as hydrous fluid percolation at subduction zone and magma ocean overturn. First tests with different codes will be presented, and interested people are invited to participate and discuss the set of reasonable experiments.

References

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