Geophysical Research Abstracts
Vol. 19, EGU2017-13150, 2017
EGU General Assembly 2017

Explicit solvers in an implicit code

Beatriz Martinez Montesinos, Boris J.P. Kaus, and Anton Popov
Johannes Gutenberg University, Mainz, Germany (bmartine@uni-mainz.de)

Many geodynamic processes occur over long timescales (millions of years), and are best solved with implicit solvers. Yet, some processes, such as hydrofracking, or wave propagation, occur over smaller timescales. In those cases, it might be advantageous to use an explicit rather than an implicit approach as it requires significantly less memory and computational costs.
Here, we discuss our ongoing work to include explicit solvers in the parallel software package LaMEM (Lithosphere and Mantle Evolution Model). As a first step, we focus on modelling seismic wave propagation in heterogeneous 3D poro-elasto-plastic models. To do that, we add inertial terms to the momentum equations as well as elastic compressibility to the mass conservation equations in an explicit way using the staggered grid finite difference discretization method. Results are similar to that of existing wave propagation codes and are capable to simulate wave propagation in heterogeneous media.
To simulate geomechanical problems, timestep restrictions posed by the seismic wave speed are usually too severe to allow simulating deformation on a timescale of months-years. The classical (FLAC) method introduces a mass-density scaling in which a non-physical (larger) density is employed in the momentum equations. We will discuss how this method fits simple benchmarks for elastic and elastoplastic deformation.
As an application, we use the code to model different complex media subject to compression and we investigate how mass scaling influence in our results.