



## **LaMEM (Lithosphere and Mantle Evolution Model): advancing a staggered-grid finite difference version of the code.**

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The main goal of the new staggered-grid finite difference version of the LaMEM code is a stable and efficient solution of the highly heterogeneous and nonlinear geodynamic models on the massively parallel computers.

The key components of the new branch of the code are:

- i) complete MPI-based parallelization
- ii) stable and computationally cheap spatial discretization
- iii) diffusion-resistive treatment of material advection with marker-in-cell technique
- iv) accurate treatment of the free surface by properly removing air cells
- v) consistent implementation of the viso-(elasto)-plastic rock rheologies
- vi) scalable linear and non-linear solvers via PETSc infrastructure

In this work we show details of the algorithms and implementation together with a few common benchmarks and example models.

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