Progress in CIG

Computational Science

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Past goals

- Bringing the Computational Science and Geodynamics communities together
- Adaptivity
- Scaling to very large numbers of machines
- Integrating current codes with existing libraries (e.g. PETSc)

Current efforts

- Bringing the Computational Science and Geodynamics communities together:
  - Workshop in Santa Fe, NM, 9/15-9/17/2008
  - Objectives:
    . Bringing together solid-earth geoscientist, mathematicians, computational scientists to focus on specific issues arising from a range of solid earth dynamics problems
    . Specifically, 3 grand challenge problems:
    Mantle convection and lithospheric deformation
    Magma dynamics
    Crustal dynamics and the earthquake cycle

Current efforts

- Adaptivity: Work has finally started on two projects
  - Ghattas, Gurnis & Zhong are working on a new massively parallel mantle convection code:
    . cartesian 3d simulations run on up to 32k cores
    . MINRES solver/BoomerAMG preconditioner scale well algorithmically, but suffer from communication
    . extension to more general geometries in the works
  - Bangerth is working on a suite of tutorial programs for deal.II that illustrate using adaptivity for geodynamics applications

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    . extension to more general geometries in the works
  - Bangerth is working on a suite of tutorial programs for deal.II that illustrate using adaptivity for geodynamics applications:
    . Stokes solver finished
    . Boussinesq (thermal convection) solver nearly finished
    . 4 more programs coming till 9/2009

Current efforts

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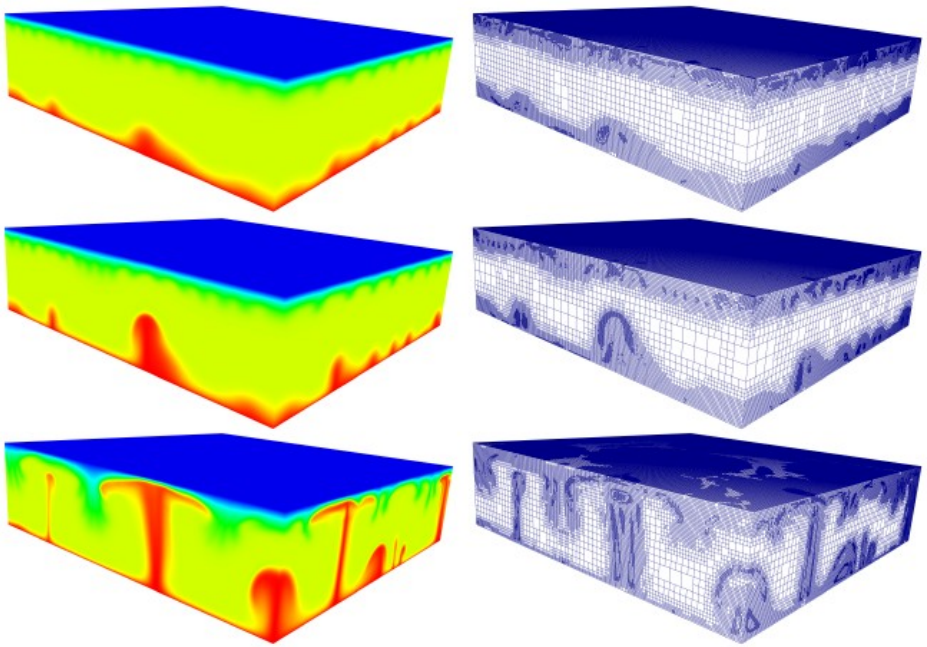

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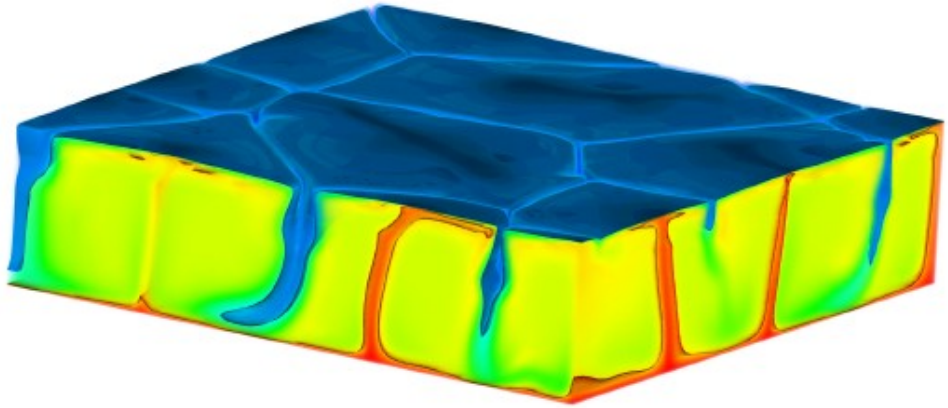

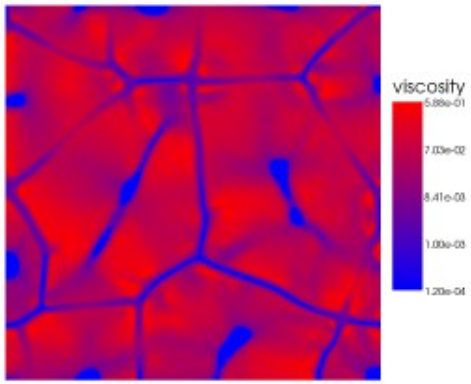

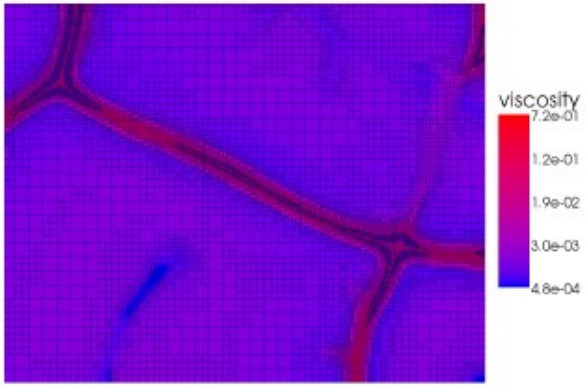

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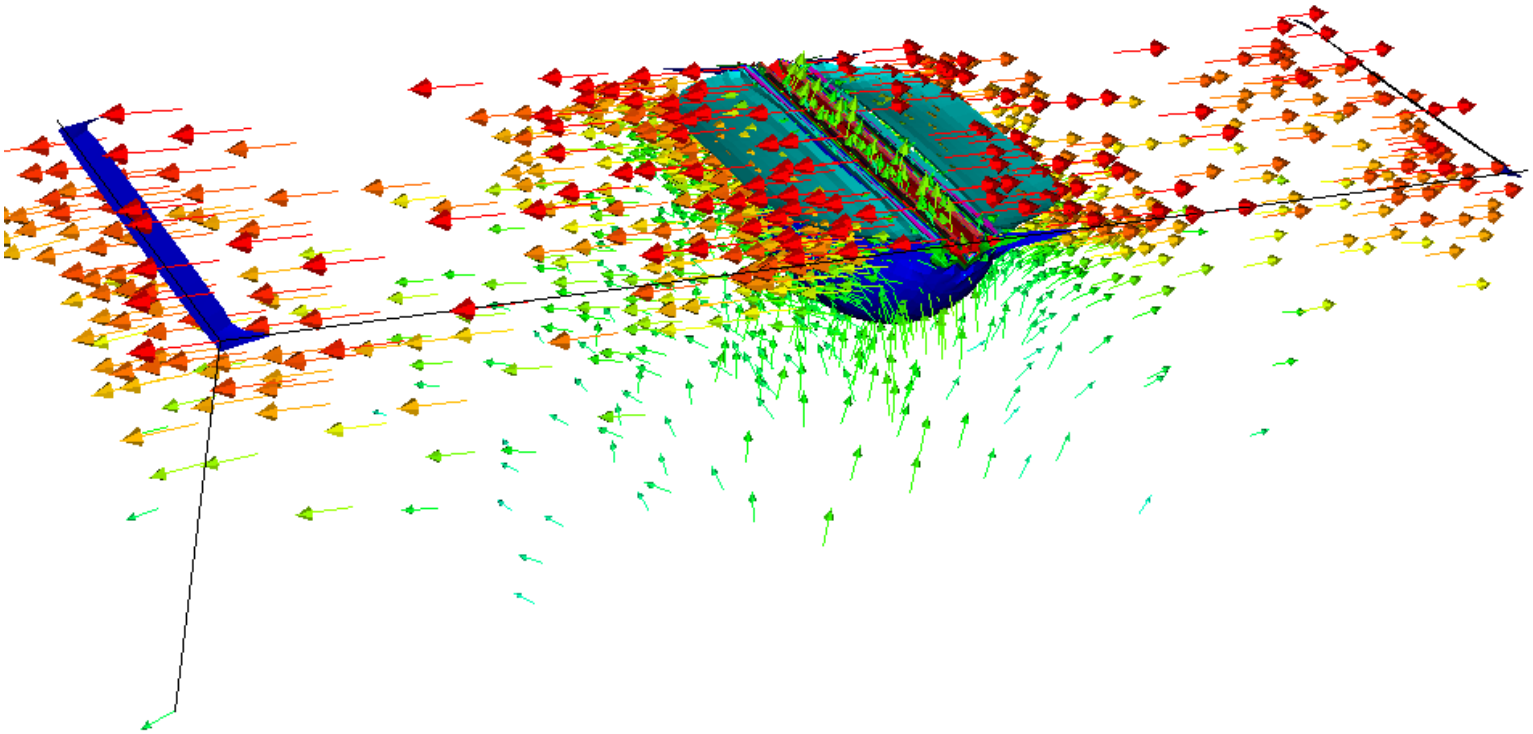

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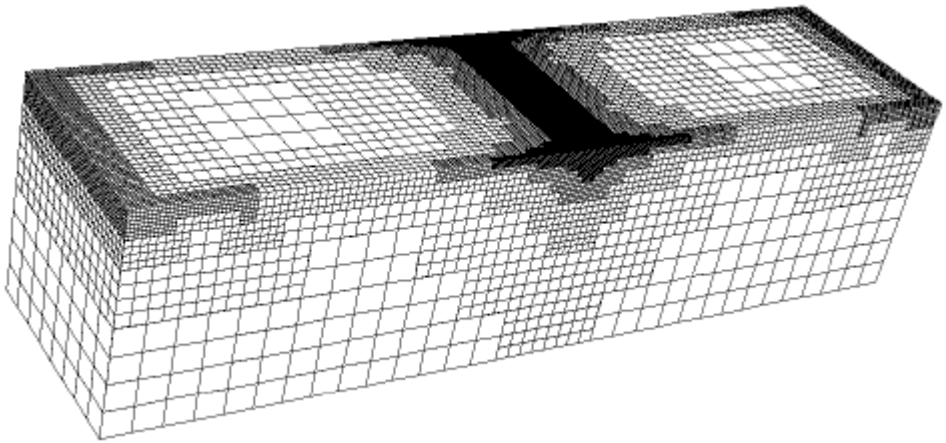

Current efforts

- Scaling to very large numbers of machines
  - This has been achieved by a number of codes, e.g. the one by Ghattas, Gurnis & Zhong
  - Work underway to incorporate Ghattas' parallel forest library into deal.II

Current efforts

- Integrating current codes with existing libraries (e.g. PETSc)
  - PETSc appears to be the basis of all new codes
  - Work is under way to provide a set of tutorial programs that use deal.II as the basis for geodynamics applications