

NSF Site Visit to the Computational Infrastructure for Geodynamics

Mantle Convection/Dynamics

Shijie Zhong

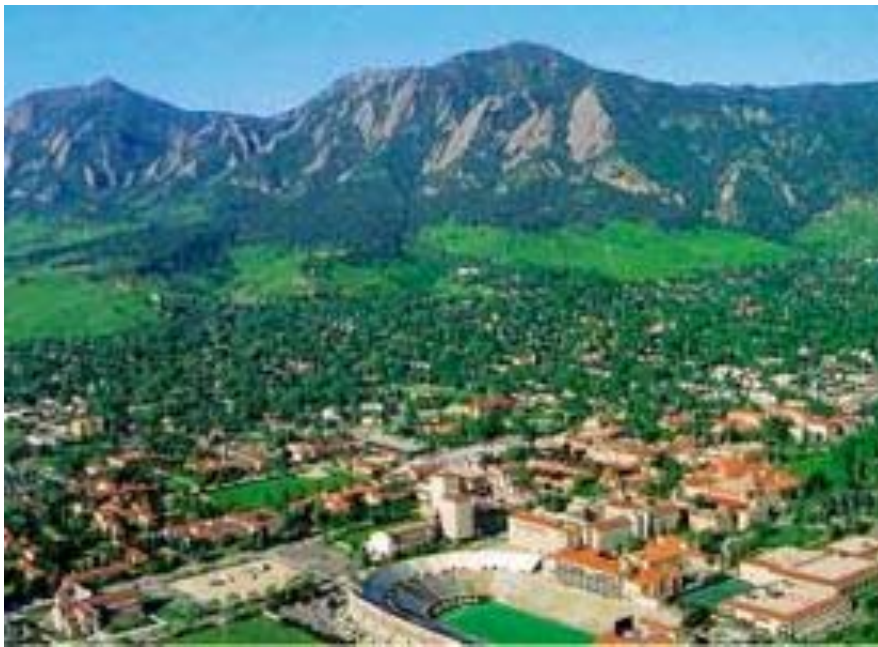
University of Colorado at Boulder



Outline

- Goals from Boulder Mantle Convection workshop
- Current Status and Projects
- Long-term Plans and Challenges

CI G Sponsored Boulder Mantle Convection Workshop



Held from June 20 to 24, 2005.

**60 participants, 29 students
and post-docs.**

Morning: science talks.

**Afternoon: tutorials and
discussions.**

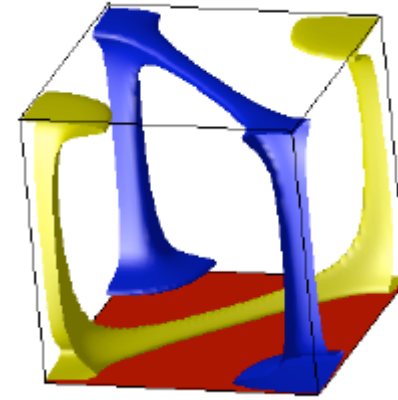
Goals and Recommendations for CIG from the Workshop

- Short Term Goals:
 - 1) 3D Cartesian convection codes
 - 2) Numerical Benchmarks
 - 3) 1D analytic mantle flow codes
- Long-Term Goals:
 - 1) 3D compressible mantle convection code with realistic thermodynamics formulation.
 - 2) Adaptive mesh and its associated solvers.

Current Status and Projects

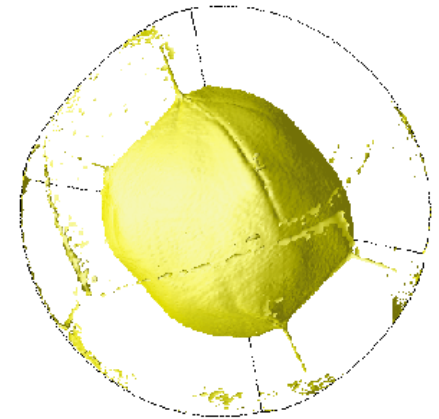
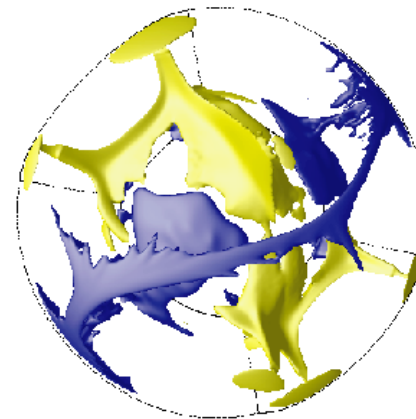
For Short Term Goals:

1) 3D Cartesian convection codes.



CitcomCU released from CIG in December, 2005.

- 3D Cartesian/Regional spherical finite element code.
- Isochemical and thermochemical convection.



Current Status and Projects

- For Short Term Goals:
 - 2) Numerical Benchmarks.
In progress. Luis Armendariz (CIG).
On spherical convection: Baumgardner, Hensen, Richards, Tackley, & Zhong.
 - 3) 1D analytic mantle flow codes.
In progress.
Thorsten Becker, Carolina Lithgow-Bertelloni, Bernhart Steinberger, & Rick O'Connell.
Recently, successfully compared with CitcomS solutions.

Current Status and Projects

- 3D Global Spherical Convection Code: CitcomS.

Directly ported from
Geoframework project.

Had 75 downloads from 59
institutions in 15 countries
since on the CIG website
(including 1 K-12 student
and 1 undergraduate
student users).



Current Status and Projects

- For Long-Term Goals:
3D compressible mantle convection code with realistic thermodynamics formulation.

Purdue workshop in March, 2006
(co-organized by King and Zhong).

Long Term Plans and Challenges

- 3D compressible mantle convection code.

Team: Tan (to join CIG in June 2006), King, Zhong, ...

Challenges: Efficient algorithms for treating compressible convection and possibly tracing.

Hope to deliver around March 2007.

Long Term Plans and Challenges

- Adaptive mesh and solvers.
The focus after delivering compressible convection code.

Linkage to General Computational Problems

- Efficient algorithms for compressible convection and tracing.
- Adaptive mesh and its solvers.
- Solvers for flows with highly non-linear constitutive relation.
- Multi-scale physics and multi-resolution.