Geophysical Research Abstracts
Vol. 16, EGU2014-471, 2014
EGU General Assembly 2014

CHIC - Coupling Habitability, Interior and Crust

Lena Noack, Francois Labbe, Thomas Boiveau, Attilio Rivoldini, and Tim Van Hoolst
ROB, Royal Observatory of Belgium, Reference systems and geodynamics, Brussels, Belgium (lena.noack@oma.be)

We present a new code developed for simulating convection in terrestrial planets and icy moons.
The code CHIC is written in Fortran and employs the finite volume method and finite difference method for solving energy, mass and momentum equations in either silicate or icy mantles. The code uses either Cartesian (2D and 3D box) or spherical coordinates (2D cylinder or annulus).
It furthermore contains a 1D parametrised model to obtain temperature profiles in specific regions, for example in the iron core or in the silicate mantle (solving only the energy equation). The 2D/3D convection model uses the same input parameters as the 1D model, which allows for comparison of the different models and adaptation of the 1D model, if needed.

The code has already been benchmarked for the following aspects:
– viscosity-dependent rheology (Blankenbach et al., 1989)
– pseudo-plastic deformation (Tosi et al., in preparation phase)
– subduction mechanism and plastic deformation (Quinquis et al., in preparation phase)

New features that are currently developed and benchmarked include:
– compressibility (following King et al., 2009 and Leng and Zhong, 2008)
– different melt modules (Plesa et al., in preparation phase)
– freezing of an inner core (comparison with GAIA code, Huettig and Stemmer, 2008)
– build-up of oceanic and continental crust (Noack et al., in preparation phase)

The code represents a useful tool to couple the interior with the surface of a planet (e.g. via build-up and erosion of crust) and it's atmosphere (via outgassing on the one hand and subduction of hydrated crust and carbonates back into the mantle). It will be applied to investigate several factors that might influence the habitability of a terrestrial planet, and will also be used to simulate icy bodies with high-pressure ice phases.

References:

- Blankenbach et al. (1989). A benchmark comparison for mantle convection codes. GJI 98, 23-38.
- Huettig and Stemmer (2008). Finite volume discretization for dynamic viscosities on Voronoi grids. PEPI 171(1-4), 137-146.
- King et al. (2009). A Community Benchmark for 2D Cartesian Compressible Convection in the Earth's Mantle. GJI 179, 1-11.
- Leng and Zhong (2008). Viscous heating, adiabatic heating and energetic consistency in compressible mantle convection. GJI 173, 693-702.