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Enabling Numerical Modeling of Mantle Convection on the Grid

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Mantle convection is the driving force of plate tectonics. The Numerical Modeling of Mantle Convection (NMMC3D) application is focusing on the structure and dynamics of the mantle plumes. In collaboration with the MTA SZTAKI Application Porting Centre the application has been ported to the SEE-GRID-SCI infrastructure. The presentation introduces the steps that were taken to enable NMMC3D on gLite. The work has exploited the parameter study support tools of P-GRADE grid Portal.

Impact

Mantle convection is the driving force of the plate tectonics, a principal theory of geosciences. As scientific impact, the modeling of mantels will help us to understand better the dynamics of the Earth. As social impact, we can name the theoretical research, direct impact mostly in the research community of geosciences. The application initiated collaboration between the Seismological Observatory from Geodetic and Geophysical Research Institute, Department of Geophysics from Eötvös Loránd University, Institute of Geography and Earth Sciences in Hungary and other institutes from the Southern Eastern European region. The presentation will introduce the technical details of the application porting process, providing a reusable porting pattern for attendees of the User Forum.

URL for further information

Geophysical Research Institute: seisun.seismology.hu
SZTAKI Porting Centre: www.lpds.sztaki.hu/gasu

Conclusions and Future Work

NMMC3D was ported to the SEE-GRID-SCI infrastructure as a workflow based parameter study. As the next step we will extend the gridified NMMC3D program with an application specific portlet. The portlet will provide extremely simplified user interface to perform mantel simulations on the grid, making earth scientist capable of using EGEE through the NMMC3D application service. Our work demonstrates a model to publish grid applications as easy to use services.

Keywords

application porting, NMMC3D, open source, P-GRADE Portal

Detailed analysis

The outer part of the Earth consists of moving, rotating and interacting plates. Numerical calculations suggests that plates are formed by sheet-like elongated downwellings (subduction zones) and narrow, cylindrical upwellings (mantle plumes, at the hotspots). The main goals of our research are the quantitative study of the structure and surface manifestation of mantle plumes and to make systematic investigation of the parameters influencing the characteristics of mantle convection in 3D. Using the parameter study features of P-GRADE Portal environment we have created a grid application that enables end users to run NMMC3D on gLite middleware. Significant speedup in numerical modeling of Mantle Convection was achieved by the grid-enabled

version. End users can configure and manage the execution process from a user friendly grid portal environment. By the parameter study services of P-GRADE Portal the application has been ported to gLite quickly and effectively.

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