Geophysical Research Abstracts
Vol. 13, EGU2011-12880, 2011
EGU General Assembly 2011

Using grid infrastructure ti explore the deep Earth elastic structure.

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Free oscillations of the Earth are characterized by an eigenfunctions and a quality factors which depend on the physical properties of the Earth such as density, bulk modulus or rigidity modulus … Normal modes have been used since the 1960's to retrieve the Earth structure. In order to study the deep Earth structure, we couple the package HOPT (Lognonné, 1991; Lognonné et Clévédé, 2002; Millot-Langet et al. 2003) with the Neighborhood Algorithm method (Sambridge, 1999a,b) and adapted them to run on the grid formerly known as "EGEE" developed at IPGP, under the VO ESR (sub-domain seismology).
The High Order Perturbation Theory (HOPT) package is based on the perturbative theory. Perturbations are developed up to 3rd order in frequency and 2nd order in amplitude. This method allow us to compute synthetics seismograms in a 3 dimensional Earth, and take into account diurnal rotation and ellipticity of the Earth.
The Neighborhood Algorithm is based on the geometrical constructs known as the Voronoi cells. No linearization is involved and thus the NA is well adapted for non-linear problem as our study. The algorithm is easy to use, requiring only two parameters to define a search either explorative or exploitative.
We develop this method in order to study the deep Earth structure, and particularly 3D models of anisotropy and attenuation, from the lower mantle to the inner core.
Compared to the single workstation implementation of HOPT + NA, access to distributed computing facilities of the European Grid allowed to reduce the time needed to complete a complete "model iteration" of a factor 10 to 20 while also allowing to run several analysis at once, so speeding up the project by an incredibly favorable ratio compared to the time the porting to the Grid itself took, thanks to knowledge and resources provided by IPGP and other partners of the French and European Grid Infrastructures.