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Seismological applications on the EGEE European Grid project at IPGP

E. Clévédé, E. Stutzmann, Y. Capdeville, G. Patau, P. Cupillard, E. Delavaud, D. Weissenbach

Seismology, IPGP, UMR CNRS 7154

IPGP seismology team and the GEOSCOPE network (french worlwide network of digital seismological stations) are involved the EGEE project throught the Earth Science Research Virtual Oganization.

Several applications have been ported and are presently running on the EGEE grid:

- Source and mechanism determinations for large earthquakes: Long-period data (T>100s) from the GEOSCOPE network delivered within 24h after an event are used to determine the location, depth and moment tensor for the centroid of earthquake with Mw>6.5. The solution is obtained by exploration on a 4D parameter grid (latitude,longitude,depth,duration) where a linear inversion is performed to determine a moment tensor for each grid point. A typical run requires about 200 CPU-hours. (application using Fortran 90 and C)

- Average seismic noise level for the GEOSCOPE stations: The seismic noise, the signal collected between earthquakes, represent more than 99% of the data. Average seismic noise level per day is computed over the past years. The totality of the GEOSCOPE database, representing 26 years of digital records, will be achieved in about 300 days. (application using Fortran 90, Matlab and Perl)

- Polarized noise and source determination from the GEOSCOPE data: This application aims to analyze the noise data in order to locate its sources. The application benefits from the average seismic noise level study, as the GEOSCOPE dataset is registered in EGEE catalogues. (application using Fortran 90, Matlab and Perl)

- Modeling of seismic noise correlation: It has been theoretically demonstrated that correlations between seimic noises recorded at two stations allow to determine the Green functions between these stations without earthquake signal. However, the actual seismic noise in the Earth is not ideal. The goal of this application is to comprehend the consequences on the Green function determinations by numerical simulation of a non-ideal noise. Each simulation represents about 800 CPU-hours. (application using Fortran 90)

- Numerical simulation of wave propagation in complex geological media: This application is based on the spectral element method in order to model 3D seismic wave propagation on a regional scale, taking into account geometrical complexities such as topography of surfaces and interfaces. (application using MPI and Fortran 90)