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Rapid determination of Earthquake centroid moment tensor

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This application, ported routinely on EGEE, is to provide
first order informations
on seismic source for large Earthquakes occuring worldwide.
These informations are: the centroid, which corresponds to
the location
of the space-time barycenter of the rupture. In this
demonstration some
examples will be shown and the functionalities of LCG and
gLite used.

Summary

The goal of this application is to provide first order informations
on seismic source for large Earthquakes occuring worldwide.
These informations are: the centroid, which corresponds to the
location
of the space-time barycenter of the rupture; the first moments of
the rupture in the point-source approximation,
which are the scalar moment giving the seismic energy released
(from which the moment magnitude is deduced), the source duration,
and the moment tensor that describes the global mechanism of the
source
(from which is deduced the orientation of the rupture plane
and the kind of displacement on this plane).
The data used are three-components long-period seismic signals
(from 1 to 10 mHz) recorded worldwide. In the case of a 'rapid'
determination
we use data from the GEOSCOPE network that allows us to obtain
records from a dozen of stations within a few hours after the
occurence
of the event.
In order to deal with the trade-off between centroid and moment
tensor
determinations, the centroid and the source duration are estimated
by an exploration over
a space-time grid (longitude, latitude, depth and source duration).
When the centroid is supposed to be known and fixed, the relation
between
the moment tensor and the data is linear.
Then, for each point of the centroid parameter space, we compute
Green functions (one for each of the 6 elements of the moment tensor)
for each receiver, and proceed to linear inversions in the spectral

domain, for each different source durations.
The best solution is determined by the data fit.

This application is well adapted to the EGEE grid, as each point of the
centroid parameter space can be treated independently, the main part of the time computation being the Green functions computation.
For a single point, a run is performed in a few minutes.
In a typical case, an exploration
grid (longitude, latitude, depth and source duration) of 10x10x10x10 requires about 100h of time computation, which is reduced to about 1 hour
over a hundred different jobs submitted to the EGEE grid.

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