Geophysical Research Abstracts, Vol. 9, 06864, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06864

Long-period mantle structure from Earth's free oscillation spectra

A. Deuss (1), J.H. Woodhouse (2)

(1) Bullard Labs, University of Cambridge, UK (deuss@esc.cam.ac.uk), (2) Dep. Earth Sciences. University of Oxford, UK

Models of the Earth's long period three dimensional structure have been obtained from the study of the splitting of Earth's free oscillation spectra. These data place important constraints on the aspherical compressional and shear wave velocity structure, and in addition have the capability to provide information on aspherical density structure. In general, *splitting functions* are measured from the normal mode spectra using a least squares inversion. These splitting functions are linearly dependent upon the aspherical velocity and density structure and are then used in a second least squares inversion to obtain tomographic velocity models. Many recent tomographic models, including S20RTS, have used splitting functions in addition to body wave and surface wave data. In principle, normal mode spectra can also be inverted directly to get tomographic models.

In order to use splitting functions, it has been assumed that modes are isolated and therefore can be studied in the self-coupling approximation or that only small groups of modes need to be coupled. We will show that for many modes, this represents a poor approximation compared to full coupling, where large groups of modes are coupled. This implies that it is actually not accurate enough to use splitting functions.

In order to access the influence of the splitting function approximation on the long period structure in tomographic models, we have performed tests for a data set of normal mode spectra of recent large earthquakes, including the Bolivia and Kuril Island events of 1994. Test were perfordmed for both real data, as well as synthetic data. We will show the different tomographic models obtained from a two-step inversions using splitting functions compared with a one-step direct inversion of the normal mode spectra. We will also show the difference between a direct inversion of normal spectra

using the self coupling approximation versus the group coupling approximation. We find that the one-step and two-step inversion methods lead to significant differences between the different tomographic models. While the splitting function techique has been very useful when computer power was not sufficient, it will now become nessecary to use the non-approximate technique of direct inversion of normal mode spectra.