AGU FALL MEETING
San Francisco | 14 – 18 December 2015

S23C-2717: The effect of truncating the normal mode coupling equations on synthetic spectra

ABSTRACT

Tuesday, 15 December 2015
13:40 - 18:00
Moscone South - Poster Hall

The free oscillations, or normal modes, of the Earth provide important constraints on the long-wavelength structure of our planet. Calculations using normal modes are also necessary if the effects of gravity are to be fully modeled in seismic waveforms, which becomes important at low frequencies. To implement these calculations, we typically initially compute the normal modes (eigenfunctions) of a spherically-symmetric model such as PREM. These form a complete set of basis functions, which may then be used to describe the seismic response of laterally heterogeneous models. This procedure is known as ‘mode coupling’.

In order to implement the calculation, it is necessary to select a finite subset of modes (invariably defined by a frequency range) to be considered. This truncation of the infinite-dimensional equations necessarily introduces an error into the results. Here, we consider the fundamental question: if we wish to calculate synthetic spectra in a given frequency range, how many modes must we couple for the resulting spectra to be sufficiently accurate?

To investigate this question, we compute spectra in the 3D model S20RTS up to 2mHz, but allowing coupling with all modes up to 5mHz. We then explore how the spectra change as we reduce the upper frequency used in the coupling. We compare this to the effects introduced by altering the 3D density structure of the model. Clearly, if we wish to image Earth’s density structure accurately, it is important that the truncation error is small compared to this signal.

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