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Development of computational routines to compute a library of Fréchet kernels for finite frequency tomography in SE Brazil

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Abstract

We develop a set of computational tools (CT) to calculate a library of Fréchet sensitivity kernels (K) for finite-frequency tomography. The Frechét kernels are computed following the methodologies proposed by Zhao & Chevrot (2011) and Fuji et. al. (2012), which consist in the calculation of strain Green's tensors using the Direct Solution Method to solve the weak form of the elastic equation of motion in the frequency domain. Assuming that K varies insignificantly with the assumed moment tensor and velocity structure, the first module of our CT automates the generation of synthetic waveforms for the Earth's reference model AK135. We use the source parameters of the Global CMT for events 080596G (August 5, 1996; Tonga) for S-waves and 060994A (June 9, 1994; Bolivia) for P-waves and station azimuths of 90° when P- and S-wave radiation is strongest. To calculate K, with the second module of our CT, we graphically analyze synthetics low-pass filtered waveforms to determine a time window of length t2-t1, where t1 and t2 are the travel times picks around the target phase. The third module of our CT involves the filtering of the calculated sensitivity kernels for suppression of numerical noise and interference of phases arriving within the time window of the target phase. The computed library of K will be used to derive new P-wave and S-wave velocity models for the mantle beneath SE Brazil.

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