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# MC Kernel: Broadband Waveform Sensitivity Kernels for Seismic Tomography

Simon C. Stähler (1), Martin van Driel (2), Ludwig Auer (2), Kasra Hosseini (1), Karin Sigloch (3), and Tarje Nissen-Meyer (3)

(1) LMU München, Geophysics, Earth and Environmental Sciences, München, Germany (staehler@geophysik.uni-muenchen.de), (2) Department of Earth Sciences, ETH, Zürich, Switzerland, (3) Department of Earth Sciences, University of Oxford, Oxford, Great Britain

We present MC Kernel, a software implementation to calculate seismic sensitivity kernels on arbitrary tetrahedral or hexahedral grids across the whole observable seismic frequency band.

Seismic sensitivity kernels are the basis for seismic tomography, since they map measurements to model perturbations. Their calculation over the whole frequency range was so far only possible with approximative methods (Dahlen et al. 2000). Fully numerical methods were restricted to the lower frequency range (usually below 0.05 Hz, Tromp et al. 2005). With our implementation, it's possible to compute accurate sensitivity kernels for global tomography across the observable seismic frequency band. These kernels rely on wavefield databases computed via AxiSEM (www.axisem.info), and thus on spherically symmetric models. The advantage is that frequencies up to 0.2 Hz and higher can be accessed.

Since the usage of irregular, adapted grids is an integral part of regularisation in seismic tomography, MC Kernel works in a inversion-grid-centred fashion: A Monte-Carlo integration method is used to project the kernel onto each basis function, which allows to control the desired precision of the kernel estimation. Also, it means that the code concentrates calculation effort on regions of interest without prior assumptions on the kernel shape. The code makes extensive use of redundancies in calculating kernels for different receivers or frequency-pass-bands for one earthquake, to facilitate its usage in large-scale global seismic tomography.