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Recent Global Tomography Models: Where are We Heading for?

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Many high-resolution global tomography models have been obtained and we now have consensus about overall features of 3-D heterogeneous structure in the Earth. Majority of models have been obtained by using conventional ray theory which assumes that scale length of lateral heterogeneities is sufficiently large compared with wavelength of seismic waves analyzed.

Primary efforts in recent studies appear to introduce better theories to overcome resolution limits caused by the above-mentioned assumption. The efforts include delay time tomography with finite frequency kernels (e.g., Montelli et al. 2004, Science; Obayashi et al. 2013, GRL) and waveform tomography with 2-D (e.g, Li and Romanowicz 1996, GJI, Panning and Romanowicz 2004, Science) or 3-D (e.g, Takeuchi 2007, GJI; Takeuchi 2012, EPSL) finite frequency kernels. Waveform tomography with further better theories is also becoming feasible (e.g., Lekic and Romanowicz 2011, GJI; French et al. 2013, Science).

In this presentation, I want to propose another direction to improve resolution: use of a new type of dataset. I will propose to use incoherent part of seismic signals (i.e., scattering waves or coda waves). Scattering waves are sensitive to heterogeneities whose scale length is comparable with wavelength of seismic waves analyzed. Use of such waves therefore should provide new information beyond resolution limit of ray theory. At the time of the presentation, I plan to show feasibility and examples of such analyses to reveal distribution of smaller scale heterogeneities in the subduction zone around Japan.

Keywords: tomography, scattering wave, seismology