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Circum-Arctic mantle structure from global P-wave tomography – how consistent is it with plate-tectonic reconstructions?

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I present a preliminary, global-scale tomographic P-velocity model, and discuss it with a focus on the Arctic hemisphere. The model was obtained from waveform inversion of teleseismic P-waves, specifically using the method of multi-frequency inversion, an extension of finite-frequency tomography that systematically exploits the entire usable body-wave spectrum.

The transition zone and mid-mantle are decently sampled, since the Arctic is surrounded by well-instrumented continents (Eurasia, North America, Japan). In addition, the past decade has seen the addition of a significant number of stations on Greenland and surrounding islands. I use a rigorously quality-controlled data set of broadband seismograms from IRIS, which is rather complete for the years 1999-2009, together with a smaller data set from the European data center ORFEUS.

Global tomography models have rarely been discussed with a focus on the circum-Arctic region. Accordingly, this integrated investigation of tomography and plate tectonics is still in a reconnaissance stage. I compare my own model and a few other body-wave tomographies to a plate reconstruction model, in an attempt match up seismically fast anomalies (subducted slabs), with predicted paleo-trench locations. Shallow anomalies should correspond to recent subduction, deeper slabs to older subduction episodes. Slabs that are not overlain by a modeled trench at any time, or paleo-trenches without fast anomaly observed underneath, can point to gaps in our current understanding of the Arctic's plate-tectonic evolution.