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Transition from slab stagnation to penetration

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The subducted slabs in the northwestern Pacific region show a complicated morphology; the slabs subducted from the south Kurile, Japan, Izu-Bonin arcs tend to be trapped in the mantle transition region, while to the north beneath the north Kurile and to the south beneath Mariana the slabs tend to penetrate the 660-km seismic discontinuity.
To understand the relationship between such different behaviors of the subducted slabs, broadband seismic networks in the western Pacific Ocean and in the Russian Far East were deployed along with the Stagnant Slab Project (Japan) from 2005 to 2007. We obtained a three-dimensional P-wave velocity structure of the whole mantle with a focus on the Western Pacific by adding data from these new networks. We manually picked arrival times of P-waves on the seismograms. When the signal to noise ratio of the data is not high enough for the manual picking, we measured relative arrival times of P-waves using a waveform cross-correlation. After visual evaluation of the waveform data, we collected approximately 4300 relative times for western Pacific Ocean BBOBS data and 900 for Russian Far East data. We also manually picked about 600 0 of P-wave arrival times using the Chinese digital seismometer network: National Seismograph Network of China from 2001 to 2006. We weighted these originally obtained data 4 or 10 times as large as ISC data in the tomographic inversion.
The tomographic model has been improved in the northwestern Pacific as expected and finer structures of the subducted slabs are observed. In particular the slabs in the transition from stagnation to penetration are clearly imaged. This image shows that stagnant slab starts to fall into the lower mantle at the junction of the dipping part and flatten part.

Keywords: slab, tomography, transition zone, slab stagnation, slab penetration