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Seismic velocity and attenuation tomography of the source zone of the 2011 Tohoku-oki earthquake (Mw 9.0)

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Detailed 3-D P and S wave velocity (Vp, Vs) and attenuation (Qp and Qs) tomography of the crust and upper mantle under the entire Northeast Japan arc from the Japan Trench to the Japan Sea coast is determined (Zhao et al., 2011; Huang and Zhao, 2013; Liu et al., 2014). The suboceanic earthquakes under the Pacific Ocean and the Japan Sea are used in this work and they are relocated precisely using sP depth phases. Vp and Vs tomography is determined using a large number of high-quality arrival times, whereas the Qp and Qs tomography is obtained using a large number of t∗data measured precisely from P and S wave spectra of local earthquakes. Our results reveal the high-V and high-Q subducting Pacific slab, and significant low-V and low-Q anomalies in the crust and mantle wedge under the volcanic front and the back-arc area. Large megathrust earthquakes (M >6.0) during 1900-2013 including the great 2011 Tohoku-oki earthquake (Mw 9.0) sequence are generally located in high-V and high-Q patches which are surrounded by low-V and low-Q anomalies in the megathrust zone. The high-V/high-Q patches in the megathrust zone generally exhibit large coseismic slips of megathrust earthquakes and large slip deficit on the plate interface. We think that these highV/high-Q patches represent asperities in the megathrust zone, whereas the low-V/low-Q anomalies reflect weakly coupled areas. These results suggest that structural heterogeneities in the megathrust zone control the interplate seismic coupling and the nucleation of megathrust earthquakes.

References

Huang, Z., D. Zhao (2013) Mechanism of the 2011 Tohoku-oki earthquake (Mw 9.0) and tsunami: Insight from seismic tomography. J. Asian Earth Sci. 70, 160-168.

Liu, X., D. Zhao, S. Li (2014) Seismic attenuation tomography of the Northeast Japan arc: Insight into the 2011 Tohoku earthquake (Mw 9.0) and subduction dynamics. J. Geophys. Res. 119, doi:10.1002/2013JB010591.

Zhao, D., Z. Huang, N. Umino, A. Hasegawa, H. Kanamori (2011) Structural heterogeneity in the megathrust zone and mechanism of the 2011 Tohoku-oki earthquake (Mw 9.0). Geophys. Res. Lett. 38, L17308.

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