Mechanisms and distribution of deep Earthquakes in the subducting Pacific slab beneath Japan

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The number of earthquakes in slabs decreases with depth to a depth of ~300 km, but increases again around a depth range of 400–500 km. The mechanism of this phenomenon has not been understood, even though many hypotheses for the origins of deep earthquakes have been proposed, which include dehydration-embrittlement hypothesis, shear instability and transformational faulting. In this study, we selected 93 deep earthquakes (M3.0) that occurred at depths of >300 km beneath Tokai area in Japan and analyzed waveform data to understand factors that control the high seismic activity in the mantle transition zone.
First, we read P-wave polarities and determined focal mechanism solutions of the earthquakes. Next, we relocated hypocenters by using picked arrival times of both P and S waves with double-difference earthquake relocation algorithm (Waldhauser and Ellsworth, 2000). The relocated hypocenters did not show a double-planed seismicity as that observed in Iidaka and Furukawa (1994). In the next step, we will relocate the earthquakes with differential travel-time data derived from waveform cross correlations to constrain hypocenter locations with much higher accuracy. We will present detailed hypocenter distributions together with focal mechanism solutions, and discuss a plausible mechanism that facilitates deep earthquakes in the mantle transition zone.

Keywords: deep earthquake, slab

