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Constraints on the 3D shape of the ultra low shear velocity zone at the base of the mantle beneath the central Pacific

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Prominent postcursors to S/Sdiff waves with delays as large as 26 s are observed in Northern America for Papua New Guinea events (To et al., 2011). The emergence of the postcursor is explained by placing a laterally localized ultra low shear velocity zone (ULVZ, dVs/Vs $<$ -25%) on the CMB, which is fully or partially covered by a broad and weak anomaly region (dVs/Vs -5%). The ULVZ is located beneath the central Pacific.

In the previous study, we limited our focus to an azimuthal range around 60 degrees from the source in Papua New Guinea, where the records show a relatively small azimuthal variation, suggesting a relatively small 3D effect there. We attempted 2D structural modelling along the great circle plane towards stations in southern US. The modelling was limited in 2D, partly due to the sparse station distribution in Midwestern US at the time.

In this study, I investigated USArray station data and further constrained the 3D shape of the ULVZ. The postcursors to S/Sdiff waves are observed at 240 USArray stations for an event, which occurred at Papua New Guinea in 2010. The records from the large number of stations enable me to conduct array analysis. First, I mapped the variation of the incident azimuth of the secondary arrival to the stations. In southern stations, which are located along the azimuth of approximately 60 degrees from the source, the postcursors arrive approximately from the direction of the great circle plane between the source and stations. On the other hand, in northern stations, which are located along the azimuth of 52 degrees from the source, the postcursors arrive from the azimuth of 5 to 10 degrees to the south with respect to the direction of the great circle plane. Second, I compared the observed amplitude of the main S/Sdiff phase with synthetic waveforms created by Direct solution method (Kawai et al., 2006). The comparison shows that the amplitude of the main phase become very small at stations which are located at the distance around 100 degrees and the azimuth of 50 degrees from the source. These observations indicate that the ULVZ, located beneath the central Pacific, is elongated in the east-west direction.