Shear wave splitting parameters from the largest aftershock of the 2015 Ogasawara deep earthquake

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For the largest aftershock of the 2015 Ogasawara deep earthquake, I show the shear wave splitting parameters computed from the F-net broadband seismic data in Japan.

Following the occurrence of a large deep earthquake (Mw7.9) beneath Ogasawara Islands on May 30, 2015, the largest aftershock with mb of 4.9 took place on June 2, 2015 (UT) at a depth estimated as 695 km by JMA and 678 km by USGS. The F-net broadband stations in Japan recorded the P and S waves from the aftershock at distances from 1 to 17 degrees. The simple P waveforms observed in western Japan were examined by Kuge [GRL 2017].

For the S waves recorded by the F-net stations in western Japan, we can see time differences between the SH and SV waves; the SH waves appear to arrive earlier than the SV waves. Such time differences may be caused by shear wave splitting as the result of anisotropic mantle structure where shear waves traversed. Assuming that they arose from shear wave splitting, I apply the waveform cross-correlation method [e.g., Ando et al., JGR 1983], which is a typical technique for shear wave splitting, to estimate fast directions and splitting times between fast and slow shear motions. I used horizontal components of velocity waveforms from the F-net data. The filter is the same as Long and van der Hilst [PEPI 2005], which has the passband between 0.02 and 0.125 Hz.

Splitting times are searched within 4 s, and most of the optimum values are smaller than 2 s. The fast directions in western Japan are estimated nearly in the east-west direction. Long and van der Hilst [2005] showed the similar directions for the Pacific coast of the Kii Peninsula and Shikoku. There are no fast directions that are perpendicular to the Nankai trough as Long and van der Hilst [2005] presented beneath the inland of western Japan. The fast directions in a region from Kanto to Niigata are aligned in the NW-SE direction. In northern Japan, the fast directions are estimated in the east-west direction.

For shear wave splitting analysis, we generally exclude S waves that arrive at the earth surface with incidence angles larger than the critical angle (35 degrees) [e.g., Oda and Shimizu, Tectonophysics 1997]. For this aftershock, the incidence angles calculated from ak135 are smaller over Japan than the critical angle, because the depth is exceptionally large.

