

Shear-wave splitting beneath SW Japan

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This paper investigates shear-wave splitting beneath SW Japan using local S phases to constrain a spatial pattern of mantle flow generated by the subduction of the Pacific and Philippine Sea plates. Detailed investigation of shear-wave splitting in subduction zones would provide important information concerning tectonic deformation and dynamic process of the mantle wedge.

We applied the cross-correlation method [Ando et al., 1983] to S-wave arrivals of local events to constrain fast polarization directions and delay time between fast- and slow-shear waves for each event and station pair. In the cross-correlation method, seismograms are rotated at angles ranging from 0 to 175 degrees in steps of 5 degrees. One of the horizontal components is shifted by a time lag ranging from 0 to 1 sec with an interval of 0.01 sec. The length of the time window used to calculate the correlation coefficient was set to nearly equal to one cycle of the wave. When the value of cross-correlation coefficient reaches its maximum, the direction of rotation is regarded as the fast direction, and the amount of time lag as the delay time. If the maximum cross-correlation coefficient is less than 0.8, the data is rejected. All of the observed seismograms were filtered with band-passed ranges of 2-8 Hz. Waveforms of 557 intermediate-depth earthquakes recorded at 457 seismic stations were used, and 2062 splitting parameters, the leading shear-wave polarization direction (fast direction) and delay time between two split waves, were observed.

Obtained results show that most fast directions observed in SW Japan are nearly E-W, which is roughly consistent with the direction of the maximum dip direction of the Pacific plate. We also found that fast directions polarized in N-S are locally observed around the Hida Mountains, central Japan, which has been pointed out by the previous studies [e.g., Ando et al., 1983; Hiramatsu et al., 1998]. This direction is sub-parallel to the maximum-dip direction of the subducted Philippine Sea plate and hence this anisotropy is inferred to be related to a mantle return flow generated by the subduction of the Philippine Sea plate.