Measurement of seismic velocity anisotropy in the Tohoku region, NE Japan by shear wave splitting analysis

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Shear wave polarization anisotropy in the Tohoku region was measured using shear wave splitting, which is a phenomenon in which a shear wave splits into fast and slow shear waves when seismic waves pass through an anisotropic medium. The method used in this study was Multiple Filter Automatic Splitting Technique (MFAST; Savage et al., 2010). In this method, by inputting the three components of the seismic waveform observed at the observation station, the optimum filter is selected from the 14 filters prepared by MFAST. The orientation and magnitude of the anisotropy is measured in a number of time windows by the method of SC91 (Silver and Chan, 1991). Then, quality evaluation is performed using cluster analysis (Teanby et al., 2004) from many measured values measured from multiple time windows. MFAST is a program that automates this sequence, so it can process large amounts of data automatically and more quickly than conventional methods, and can obtain objective and reliable measurements. At first, we tested MFAST against previous measurements in the Tohoku region and confirmed its effectiveness. From December 2008 to November 2013, north-south oriented fast orientations of anisotropy were found in the coastal area (Kitakami mountain range) of the Tohoku region, consistent with the results of previous studies (e.g., Takagi and Okada, 2012). Inhomogeneous polarization anisotropy was observed in a small scale in the inland area of the Tohoku region, especially in the aftershock region of the Iwate-Miyagi Nairiku Earthquake in 2008, and the variation of direction could be explained by the stress field estimated in previous studies (e.g., Yoshida et al., 2014). In addition, we compared the anisotropy before and after the 2011 off the Pacific coast of Tohoku Earthquake, but it was considered that the direction and the delay time didn’ t change significantly during the analysis period.

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