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Detection of seismic anisotropy from low frequency earthquake

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Recently, members of family of slow earthquakes have been detected in a subduction zone by densely deployed seismic observation network. They occur at the plate interface, and the source regions of them delineate the rupture zone of a future mega-thrust earthquake in the southwestern Japan. Non-volcanic tremor is the most active phenomena within the family of slow earthquakes and has been found to correlate temporally and spatially with other slow earthquake (e.g., Rogers and Dragert, 2003). Therefore, there have been many studies on mechanism of non-volcanic tremor since the detection of the phenomena (Obara, 2002). However, the mechanism of the tremor has not been fully elucidated, although a lot of studies suggest a relationship between tremor and fluid rebated from the subducting slab. Thus, we examine the relationship between fluid and the behavior of non-volcanic tremor on the basis of special and temporal variations in seismic anisotropy, which is strongly related to the behavior of fluid.

In this study, we detected seismic anisotropy at the plate interface of the PHS slab from the isolated phase during non-volcanic tremor episode, which are categorized as low frequency earthquakes by the JMA (Nishide et al., 2000). The phases are regarded as S-wave and used by hypocenter determination. Therefore, in order to detect anisotropy, we utilized S-wave splitting method (e.g., Ando et al., 1983), in which seismic anisotropy is represented by polarization direction of fast S-wave (direction of anisotropy) and delay time between two S-waves.

Preliminary result of S-wave splitting analyses showed that the directions of anisotropy are tend to be orientated in the East-West trending direction and the delay times are 0.2-0.4 sec. In general, however, anisotropy obtained by S-wave splitting analysis is strongly affected by anisotropy near the receiver. In fact, the obtained anisotropy in this study is consistent with crust anisotropy in the study area. In order to rigorously discuss anisotropy around the source region, we have to remove the effect of the anisotropy in the crust.

Keywords: low frequency earthquake, seismic anisotropy, fluid