Stress field in the subducted Philippine Sea plate beneath the Ryukyu-arc Taiwan junction area

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We computed the stress tensor inversion to estimate the state of stress in the subducted Philippine Sea plate beneath the junction area between Taiwan and Ryukyu arc. Focal mechanisms of the NIED-CMT solutions for the period January 2000 to December 2005 are used in the present study. The moment-magnitude is in the range greater than 3.0. We used the events whose depths are deeper than 40 km to avoid the crustal earthquakes. The inverse method by Gephart and Forsyth (1984) is used for studying the distribution of stress field in this region. This inverse technique allows for determining the directions of the principal stresses and the ratio R. The value of R estimates the magnitude of the intermediate principal stress relative to the maximum and the minimum principal stresses. This algorithm inverts for the orientations of principal stresses and the value of R by a grid search at 5-degrees spacing, systematically varying the orientation of the principal stresses and the value of R over a range of possible models. The best-fit stress tensor is found by minimizing the average sum of all the individual misfits. We computed the stress tensor with the horizontal spacing of 20 km. For the inversion, we employed the CMT solutions whose epicentral distances are within 30 km. We compute the stress tensor inversion for the points if the 10 or more events are distributed within the epicentral distance of 30 km.

Directions of the P and T axes and pattern of stress tensor are different between eastern and western part of the slab, separating at 123ºE. Directions of the P axes are dipping downward along the slab at the eastern part. Directions of the T axes are normal to the slab at eastern part. Result of the stress inversion shows the down-dip compressional stress and slab-normal extensional stress at the eastern area. Direction of the compressional stress axis is parallel to that of the trench axis at shallow part of eastern part.

Directions of the T axes are dipping downward along the slab at western area. Directions of the P axes are parallel to that of the trench at western area. Results of the stress inversions show the trench-parallel compressional stress and down-dip extensional stress along the slab at the western area.

Result of the hypocenters relocation show that the slab is bending or torn at the range of 122-123E (Nakamura et al., 2005). These suggest that the oblique subduction of the Philippine Sea plate to the Ryukyu arc and Taiwan causes the compressional stress to the subducted Philippine Sea slab, which would induce the bending or tear fault at the slab.