Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS31-P19 Room:Convention Hall Time:May 21 18:15-19:30

Progress of bending process of Pacific Plate and flattening process of bent slab detected with CMT solusion of JMA

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The hypocenters and forcal mechanisms distribute symmetrically with an axis crossing through the bending head of trench axis toward ocean side. The hypocenter of the East Japan Super Earthquake M9.0 of 2011 March 11 locates on the axis. The seismic free area appeared on the cross point of Japan Trench and the axis after the East Japan Super Earthquake.

The seismic free area surrounded by hypocenters with normal fault type forcal mechanism mainly and lateral fault type in island arc side. The forcal mechanisms are determined with orientations of principal stress axes.

The strengths of 3 principal stress can be calculated with moment tensor and nonDC (double couple) component ratio in CMT(centroid, moment tensor) forcal mechanism solution from Japan Meterological Agency. Normal fault type forcal mechanism can be defined using the strengths into push apart normal fault type of excess compressional stress with negative nonDC component, pull away normal fault type of exess tentional stress with positive nonDC component, and double couple normal fault type without nonDC component.

The normal fault type forcal mechanisms around the seismic free area are refined into push apart type for deeper earthquakes with deeper intial shoch hypocenter (e.g. 2011 March 11 M7.5), and pull away type for shallower hypocenter (e.g. 2012 December 7 M7.3). The depth dependence of excess compressional stress and excess tentional stress is consistent with bending process of oceanic plate along trench. Bending process should induce compressional stress for deeper layer and extensional stress for shallower layer of oceanic Plate. When the compressional principal stress with vertical orientation decreases with shallowing and reachs comparable to intermediate principal stress with horizontal orientation by the bending process, the stress axes exchange and the forcal mechanism changes from normal fault type with horizontal intermediate principal axis to lateral fault type with vertical intermediate principal stress axis. The lateral fault type hypocenters around the seismic free area (e.g. 2011 July 10 M7.3) consisitent with the stress axes exchange.

Oceanic Plate bends along trench and subducts as bent slab. The bent slab flattens under the East Japan coast area and subduct under the west coast of Japan Sea as a flat plane. Reverse fault type earthquakes dominate in the decending slab under the East Japan coast area. The forcal mechanisms with compressional principal axis parallel to the slab surface are classified into collisional reverse fault type of excess compressional stress with negative nonDC component (e.g. 2003 May 26 M7.2) and suctional reverse fault type of execess tentional stress with positive nonDC component (e.g. 2011 April 7 M7.2), which consistent with flattening process of bent slab. Flattening process of descending bent slab should induce compressional stress for extended shallower layer and tention to rip off bent slab.

CMT forcal mechanism solutions reporting by Japan Meteological Agency are usefull for monitoring the progress of bending process of oceanic plate and flattening process of bent slab.

Keywords: CMT solution, bending process, flattening process, Japan Trench, nonDCcomponent, seismic free area