Extension of Plate Tectonics to subducting Slab

*Nobuaki Niitsuma[1]

1.Institute of Geosciences,Shizuoka University, Sendai

Understanding of process for subduction of the oceanic plate has remained in the qualitative stage as the oceanfloor spreading theory. Abandon of the central dogma of Plate Tectonics “non-deformational Plate” should be require for subduction along the ocean trench, which can not be realized without deformation.
The seismic activity along the trench should be correlated with the subduction of oceanic plate. The seismic activities represent that Pacific Plate subducts along the Japan Trench with concentric bending and then unbending to continueing with deep seismic plane of Wadati, paticulaly, since the East Japan Mega Earthquake 2011.3.11.
In this study, deformation of the plate is tolerable quantitically to extent Plate Tectonics for subducting slab continueing to oceanic Plate, in following way restrictively.
1) The outline of trench axis bends along small circles as arc. In the case of Japan Trench, the small circles are named as Erimo, Mogami and Kashima.
2) The movement of the point on oceanic plate and slab should be on the parallel of Euler latitude for the Euler rotaion.
3) The distances of the Euler movement are equal on the surface both of oceanic plate and slab. The apperent geocentric movement on slab is slower than on oceanic plate, depend on the inclination of slab.
4) The depth of slab surface is controlled with the distance from the small circle center of trench outline. The depth profile of slab is rotational symmetry alound the small circle center.
5) Oceanic plate subducts along trench with concentric bending and then unbending to continueing with deep seismic plane (Fig). The paramaters of the bending radius and unbending angle and so on is determined to fit with seismic activities for each small circle area.
Under these restrictions, the movement of Pacific slab is calculated in the intervals, ca 10km and 0.125my, and analysed with focal mechanism solusions of initial motion (IM) and centroid of moment tensor (CMT) by Japan Meteorological Agency (JMA). Because Japan Trench area locates outside of seismetric network of JMA, the hypocenters in the area were cross checked with data of ocean bottom seismometry (OBS) by Shinohara el al. (2011, 2012) and Obana et al. (2011, 2012, 2013). The distributions of epicenters are concordant with each other, but the initial motion depths of CMT solutions are larger than initial motion depth of OBS.
The distance between surface and 5km below the surface of oceanic floor is maintained with 5km, but of the slab is changed extreamly large, more than 10%, because the radius of concentric bending is slightly shorter on 5km depth than the surface. The 5% contour is correlated well with the Pacific coast of Japanese Island.
Lateral distance along the parallel of Euler longitude is maintained constant for oceanic plate, but the distance changes upto +/- 1% for slab, because of the difference in the depth. The lateral distance increases for the island arc side position of small circle center, and decreases for oceanic side position. The feature of the changes in the lateral distance is controlled with the position of small circle center and direction of plate motion, and correlated to the distributions of tentional focal mechanisms with the increase, and compressional focal mechanisms with the decrease.
Geocentric 3-dimentional least square method allows us to describe deep seismc plane numerically, and the cross line with slab surface could be calculated along Japan Trench. Compressinal focal

mechanisms distributed along the cross line and the number of foci suddenly decrease on the continental side of the cross line. Distribution of CMT on the deep seismic plane is limited in the narrow zone of the dip direction where the deep seismic plane intersects at higher position of slab surface.

Keywords: Plate Tectonics, subducting slab, Euler rotation, concentric bending, unbending, changs in 3d distance