Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SSS39-P03 Room:Convention Hall Time:May 25 13:45-15:15

Strain of the East Japan Super Earthquake M9.0 have been accumulated around marginal swell of Pacific Plate

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The third aftershock M7.5 just 40 minits after East Japan Super Earthquake occurred at outside of the Japan Trench. The aftershock of outer trench earthquake with forcal mechanism of normal fault was a fracture caused by pulling force on the Pacific Plate just after the removal of obstacle to subduct, and can be treated as the simplest example in the plate dynamics. The outer trench earthquake occurs simply with reaching over the limit of fracture by the balance of pushing and pulling forces along the trench. The normal fault type focal mechanism is caused by excess of pulling force of subducting slab over pushing force.

The analysis are carried on the hypocenter of initial shock and CMT (Centroid Moment Tensor) focal mechanism of 128 outer trench earthquakes in the last 17 years are available from Homepage of Meterorological Agency. Because the normal fault type forcal mechanisms were counted 95, which overwhelm the reverse fault type of 26, we can suggest the driving force of the motion of the Pacific Plate is slab pull along the trenchs.

Japan Trench had been on a condition of exess pushing force with reverse fault type outer trench earthquakes since December 2008 after the last normal fault type outer trench earthquake of Nobember 2005, however, exess pulling force conditions had been along Kuril Trench since January 2009, Ogasawara Trench since August 2008 and Izu Trench since Septmber 2010. The East Japan Super Earthquake can be understand as an event of the removal of obstacle to subduct by the pulling forces along the Kuril Trench and Izu-Ogasawara Trench, both wings of Japan Trench.

The consisitensy between the distribution of 54 normal fault type outer trench earthquakes after the Super Earthquake and the slip distribution drived from the inversion analysis on strong motion at the Super Earthquake, indicates that the strain of the Super Earthquake have been accumulated not on East Japan side, but on outer trench side of Pacific Plate and the duration for accumulation of the strain is shorter than 6 years since November 2005.

The strain release has not been observed after the Super Earthquake along the East Japan, as occurring of reverse fault type earthquakes, subsidence of more than several tens cm along the Pacific coast on the trend of subsidence with the rate 1cm/ year for the last 100 years. Tsunamite for Keicho-Sanriku Earthquake 16011 requires wide source area over Japan Trench and Kuril Trench. Tsunami of the East Japan Super Earthquke also requires source area along Japan Trench.

The maximum slip at the Super Earthquake of 50m requires width of zone for accumulation of the strain of 500 km ~ 5000km, coreponding rate of ten thousandth and hundred thousandth for strain limit of fracture on the crust. The required zone is too wide for the narrow inhomogenous East Japan side, but capable for the Pacific Plate side with the distance of 5000km to Hawaii. Pacific Plate has Marginal Swell along the trench chain with positive gravity anormally. The gravity anormally represent that the uplifting Swell is supported by the forces against isostasic balance. The pushing up force for the swell should be directely related with flexure for the subduction of Pacific Plate along the trenches. The Swell gives flexibility to maintain constant rate of plate motion against accidental obstacle to subduct along trenches, which means that the strain for the earthquake along the trench can be accumulated in the flexure of Marginal Swell. Tsunami might be induced by reducing flexure on the swell just after the earthquake.

The results supports that the strain for the East Japan Super Earthquake had been acculated in the flexure of Marginal Swell. The wide tsunami source area represented by the Tsunamite for Hoei-Nankai Earthquake 1707 and Yaeyama Earthquke 1771 can be also explained by the Marginal Swell along Nankai Trough and Ryukyu Trench.

Keywords: Marginal Swell, outer trench earthquake, plate dynamics, gravity anomaly, slab pull, East Japan Super Earthquake