

Interaction between Normal Faulting Earthquakes and Large Inter-plate Earthquakes in Subduction Zones

Takanori Wada[1]; # Yuji Yagi[2]

[1] Earth Evolution Sciences, Univ. Tsukuba; [2] Univ. of Tsukuba

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We investigated normal faulting earthquakes in the adjacent regions where large thrust type earthquakes occurred in 1980-2000 in the world from Global CMT Catalog, to evaluate interaction between intra-plate earthquakes and large inter-plate earthquakes in subduction zones.

From comparison of seismicity of intra-plate earthquakes before and after a large inter-plate earthquake, we found that in nearly all regions seismic activity of normal faulting earthquakes does not change. This shows that the stress change caused by a large inter-plate earthquake may be minor for seismic activity of normal faulting earthquakes in the adjacent intra-plate region. On the other hand, we found that seismic activity of normal faulting earthquakes increased remarkably after three Tsunami earthquakes: 1992 Nicaragua Tsunami earthquake; 1994 Java Tsunami earthquake; 2006 Java Tsunami earthquake.

For understanding of normal faulting seismicity in three regions, we estimated the precise hypocenters in each region using double-difference method which was modified to apply teleseismic data with iasp91 earth model. The relocated hypocenters show that these normal faulting earthquakes are located in intra-slab near trench, and are located around the slip area estimated using waveform inversion. Furthermore, the strikes of focal mechanisms of the normal faulting earthquakes are consistent with that of Tsunami earthquake. These results imply that the normal faulting earthquakes are caused by Tsunami earthquake.

It seems that the normal faulting earthquakes in three regions are attributed to a loss of rupture strength in shallow subduction zone by arisen pore fluid pressure based on invasion of barrier hypothesis which explains the characteristic of Tsunami earthquake. Conversely speaking, the occurrence of the normal faulting earthquakes may support the invasion of barrier hypothesis of Tsunami earthquake.