

Detailed stress fields in the focal region of the Tohoku Earthquake; Implication for the distribution of moment release

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A giant earthquake of Mw 9.0 occurred off the Pacific Coast of the Tohoku region on March 11, 2011. We examined the focal mechanism distributions in the focal region of this earthquake before and after the mainshock using the F-net data and then performed a stress tensor inversion by using the multiple inverse method(Otsubo et al., 2008). It is found that earthquakes were mainly reverse fault type events all over the focal region before the main shock, whereas after the main shock, many normal fault type events occurred in the hanging wall but focal mechanisms did not change in the deepest part in the focal region(Asano et al., 2011). It is inferred from the stress tensor inversion that the stress state is reverse fault type in the deepest part before and after the mainshock but that in the central part, the stress state changed from reverse fault type before the mainshock to normal fault type after the mainshock. These results suggest that absolute strength along the plate boundary is very weak in the central part(Hasegawa et al.,2011; Yagi and Fukahata, 2011). Furthermore, we examined the focal mechanism distribution and stress states in the shallower part near the trench axis off the Miyagi Prefecture in detail and found that the strike slip events with the P-axis in the NS direction occurred in the footwall east of the mainshock hypocenter, which can be well explained by the slip model with a large moment release near the hypocenter. It is expected that these findings well constrain the spatial distribution of moment release of the 2011 off the Pacific Coast of Tohoku earthquake and lead to better understanding of this earthquake.

Keywords: focal mechanism, stress inversion, multiple inverse method, fault model, seismic moment release, stress change