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2011年東北地方太平洋沖地震前後の応力 Stress before and after the 2011 Mw9.0 East off Tohoku earthquake

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Temporal change in the stress field before and after the 2011 Mw9.0 East off Tohoku earthquake was observed by stress tensor inversion analyses of earthquake focal mechanisms of events near the source region. Focal mechanism data are those estimated from moment tensor inversions of broadband seismic waveforms. The maximum principal stress axis before the earthquake has a direction toward the plate convergence, dipping oceanward at an angle of about 25-30 degree. Its dip angle significantly increased by 30-35 degree after the earthquake, and the maximum principal stress became to intersect with the plate interface at a very high angle of about 80 degree. The observed 30-35 degree rotation of the maximum principal stress axis was used to estimate the ratio of mainshock stress drop to the background deviatoric stress to be 0.9-0.95. This shows that the shear stress on the plate interface causing the Mw9.0 earthquake was mostly released by the earthquake, or the stress drop during the earthquake was nearly complete. Adopting the average stress drop obtained by GPS observation data, the deviatoric stress magnitude is estimated to be as low as 22MPa, suggesting that the plate interface is weak. The nearly complete stress drop by the earthquake caused by a high dip angle (~60 degree) of the maximum principal stress axis, which is the reason why not a small number of normal fault type aftershocks have occurred after the present earthquake, despite the predominance of thrust type earthquakes there in the pre-mainshock period.

キーワード: deviatoric stress, stress tensor inversion, focal mechanism, weak plate interface