

Temporal change in stress field in the northern part of Tohoku district associated with the 2011 Tohoku-oki Earthquake

KOSUGA, Masahiro^{1*}

¹Graduate School of Sci. & Tech., Hirosaki Univ.

We have investigated the stress field in the northern part of Tohoku district for the both periods before and after the 2011 off the Pacific coast of Tohoku (Tohoku-oki) Earthquake. We determined focal mechanisms using data of P-wave first motion, then estimated stress field by a stress tensor inversion method. After the Tohoku-oki earthquake, the seismicity is quite high in Akita prefecture, forming newly activated three major clusters and many minor ones. The location of major clusters is complementary for the periods before the Tohoku-oki earthquake. Seismicity in some clusters started almost immediately after the Tohoku-oki earthquake, however, beginning was delayed even for months in some clusters, and the duration of activity is highly variable among the clusters. Focal mechanisms of earthquakes in the new clusters show predominantly strike-slip or oblique-slip solutions with consistently NW-SE trending T-axis. The stress tensor inversion using focal mechanism data indicates clear temporal change in the stress field due to the Tohoku-oki earthquake, from reverse-faulting regime to strike-slip regime. Thus the new stress field brought the quiescence of seismicity in the former clusters with predominantly reverse faulting, which is consistent with the Coulomb stress calculation. This change is explained qualitatively by the static stress change due to the slip of megathrust of Tohoku-oki earthquake; compressional stress in WNW-ESE direction was reduced by the slip. However, the spatiotemporal variation in seismicity and focal mechanisms suggest the need of additional factors to bring temporal change. Possible factors are, for example, fluid migration in the crust following the static stress change, delayed response of crustal materials, and viscoelastic response in the lower crust and uppermost mantle.

Acknowledgments

We used hypocentral parameters of the JMA catalog that was prepared by the JMA and the Ministry of Education, Culture, Sports, Science and Technology in Japan. The hypocenters of the catalog were determined by the data of JMA, NIED, Hirosaki University, Tohoku University, Hokkaido University, University of Tokyo, and Aomori Prefecture. We thank these institutions for providing waveform data used for the determination of focal mechanisms.

Keywords: Off the Pacific coast of Tohoku Earthquake, induced seismicity, focal mechanisms, stress field, temporal variation