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2011 年東北地方太平洋沖地震の発生後に活発化した正断層地震の発生原因
A generation mechanism of normal-faulting earthquakes in northeast Japan, activated after the 2011 Tohoku earthquake

今西 和俊 [1*], 安藤 亮輔 [1], 桑原 保人 [1]
Kazutoshi Imanishi[1*], Ryosuke Ando[1], Yasuto Kuwahara[1]

[1] 産業技術総合研究所
[1]National Institute of Advanced Industria

After the occurrence of the 2011 Mw 9.0 Off the Pacific Coast of Tohoku Earthquake, shallow normal-faulting earthquake sequence occurred near the Pacific coast at the Ibaraki-Fukushima prefectural border. We investigated why normal-faulting earthquakes were activated in northeast (NE) Japan, which is characterized by E-W compression. Focal mechanisms of microearthquakes that occurred before the 2011 Tohoku earthquake have been determined from P-wave polarity data as well as body wave amplitudes. We found that earthquakes occurring in the studied area are characterized by normal faulting, strike-slip faulting and a mixture of both the two components. A stress tensor inversion reveals that the pre-shock stress field in the area shows a normal-faulting stress regime in contrast to an overall reverse-faulting regime in NE Japan. We then computed stress changes due to the mainshock, in which calculations were made in an elastic half-space by assuming a shear modulus of 32 GPa and a Poisson's ratio of 0.25. The stress changes produced normal faulting stress fields with E-W extension over a wide region including the target area. We estimated that the E-W extensional stress with a few MPa was added to the target area. These results suggest that the 2011 Tohoku earthquake could trigger the normal-faulting earthquake sequence in combination with the estimated pre-shock normal-faulting stress regime. In other words, the stress changes alone could not trigger this sequence if this area was in the ambient reverse fault regime, because the horizontal compressional stress could be comparable to 100 MPa simply assuming Byerlees's friction law under the lithostatic pressure. We also explore why the normal-faulting stress field can exist at a specific area at convergent plate boundary.

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