Postseismic stress field in the rupture area of the 2011 Tohoku-Oki earthquake

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The 2011 Tohoku-Oki earthquake changed the stress field around its source region. Significant coseismic rotation of the principal stress axes was observed and it was suggested that almost all the accumulated shear stress was released on the ruptured plate boundary (e.g. Hasegawa et al. 2011). About 7 years have elapsed since the occurrence of the Tohoku-Oki earthquake, coupling along the plate boundary would be recovered to cause re-accumulation of strain and the stress state starts to resume to the state before the large earthquake had occurred. It is considered that such a change can appear in the change of the orientations of principal stress axes. Hardebeck (2012) reported the temporal rotation of the stress axes for the period of about a year after the Tohoku-Oki earthquake and argued that slight strain re-accumulation after the complete stress release can account for the rapid restoration of the stress orientation. However, we showed that it is necessary to take spatial heterogeneities of stress field into account propriately in order to discuss temporal change of these stress fields (Nishimori et al., 2017).

In this study, we inverted focal mechanism solutions of earthquakes in the upper-plate of the Tohoku forearc after the Tohoku-Oki earthquake until 2017. We investigated the spatial variation of the stress field by setting a grid network of an 0.3 degree interval in the region. As a result, the direction of the axis of maximum compressive stress (σ_1) and stress ratio *R*, (σ_1- σ_2)/(σ_1- σ_3), are found to be almost constant above the region of the large coseismic slip of the mainshock. In the area, the plunge of σ_1 axis was larger than ~ 65° and the *R* is about 0.5 to 0.8. These results are consistent with those by Hasegawa et al. (2011) analyzing the stress state immediately after the Tohoku-Oki earthquake. Next, we investigated the post-2011 temporal changes of the stress field for the area, considered to show a common stress field. As a result, no significant rotations of the principal stress axes were identified although *R* value may increase in time.

