Spatiotemporal changes in the b-value along the plate interface before and after the 2011 Tohoku earthquake constrained by ocean bottom seismic network: Post-Tohoku

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Changes in seismicity before and after the occurrence of megathrust earthquakes provide key information to better understanding the extension of its source area and the rupture propagation. In particular, it has been proposed that spatiotemporal variation of the b-value along the subduction zone megathrust reflects the interplate coupling [e.g., Ghosh et al., 2008, GRL]. In the case of the 2011 Tohoku earthquake, a target of this study, several studies have already reported the spatiotemporal changes of the b-value within its source area. However, it still remains controversial, because of problems with existing catalogs in completeness of magnitude after the first few months of the main shock and accuracy of focal depths for offshore earthquakes. Therefore, in this study, we analyze seismicity including small earthquakes along the plate interface using data from ocean bottom seismometers (OBSs) obtained during extensive seafloor aftershock observations [Shinohara et al., 2011, 2012] and recurrent OBS observations off Miyagi by Tohoku University. In order to automatically detect and locate interplate earthquakes, we applied a back projection method based on semblance analysis [Nakatani et al., 2015, GRL] to the data. In order to inspect validity of our method, we conducted three kinds of tests: synthetic tests, focal mechanism tests, and focal depth tests. We confirmed the validity of our method to evaluate seismicity along the plate interface. Also, we appropriately corrected event magnitudes determined by OBS records, which are, in general, overestimated due to large amplifications caused by seafloor sediments, by comparing with those listed in the JMA (Japan Meteorological Agency) catalog. Finally, we obtained an original earthquake catalog which shows an improvement in completeness of magnitude for interplate earthquakes. The resulted distribution of seismicity for the first three months after the main shock shows mutually complementary relationship between the active area of interplate aftershocks and the large coseismic slip zone. We also observe spatial variation of the b-value during the same observation period.
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