Temporal variation of intermediate-depth earthquakes around the time of the M 9.0 Tohoku-oki earthquake

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The temporal evolution of intermediate depth seismicity before and after the 2011 M 9.0 Tohoku-oki earthquake reveals interactions between plate interface slip and deformation in the subducting slab. We investigate seismicity rate changes in the upper and lower planes of the double seismic zone beneath northeast Japan using both a beta-statistic approach and a temporal epidemic type aftershock sequence(ETAS) model. We do not observe an anomalous precursory increase in intermediate-depth earthquake activity preceding the mainshock, however, following we observe a rate increase for the intermediate-depth earthquakes in the upper plane. The average ratio of upper plane to lower plane activity and the mean deep aseismic slip rate both increased by factor of two. An increase of down-dip compression in the slab resulting from coseismic and postseismic deformation enhanced seismicity in the upper plane, which is dominated by events accommodating down-dip shortening from plate unbending.

Keywords: intermediate-depth , seismogenesis, intraslab, Tohoku-oki

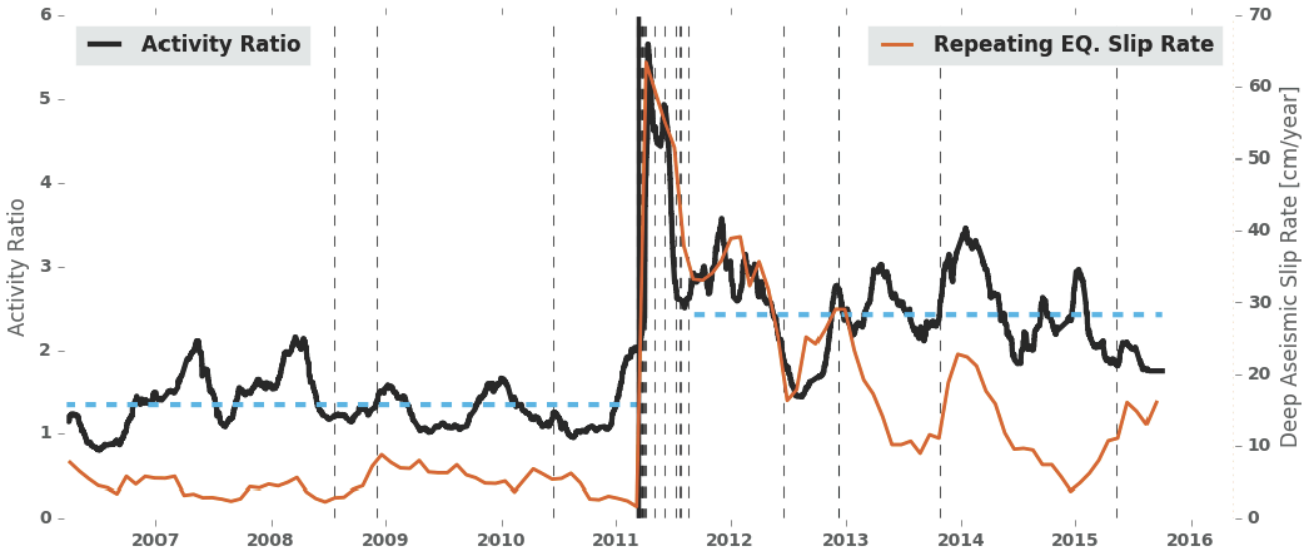

Fig 1. Intermediate-depth earthquake rates near the rupture area of the 2011 M9.0 Tohoku-oki Earthquake estimated from the ETAS model using M>2 events and deep aseismic slip rates. The ratio of the background rates of the upper and lower planes, termed the activity ratio, is shown by the black line. The deep aseismic slip rate estimated from repeating earthquakes is shown by the orange curve. The vertical black dashed lines show the origin times of large magnitude earthquakes (M>6.0). The solid black line shows the time of the M9.0 March 11 Tohoku-oki mainshock.

