

Gravity gradient variations considered to have occurred 3 months before the Tohoku-Oki earthquake

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Since the launch in 2002, the Gravity Recovery And Climate Experiment (GRACE) satellite system has been measuring global gravity field of the Earth. It has produced various scientific results by measuring redistribution of land water storage and snow/ice as time-variable gravity. Fault dislocations associated with earthquakes also redistribute mass and cause subtle changes of gravity. GRACE has also enabled observations of coseismic and postseismic gravity changes of recent megathrust earthquakes, contributing to seismology (Tanaka & Heki, 2017). Preseismic gravity changes have not been considered a target of researches with GRACE. Recently, Panet et al. (2018) reported possible detection of significant change of gravity gradients around Japan a few months before the Mw9.0 2011 Tohoku-Oki earthquake. Their approach differs from conventional studies in several ways. First, they analyzed gravity gradients, which has better spatial resolution than gravity. Second, they searched for signals over wide range of temporal and spatial scales. Third, they concentrated on components with wavelengths of 800-1600 km. We tried to reproduce the results of Panet et al. (2018) by analyzing GRACE level-2 data (Stokes' coefficients) and examining gravity gradient changes a few months before the 2011 Tohoku-Oki earthquake. We could obtain preseismic gravity gradient changes fairly similar to Panet et al. (2018), although we still see certain differences due to unknown reasons. We will also report if we see similar gravity gradient changes before the other two M9 class earthquakes, 2004 Sumatra-Andaman and 2010 Maule earthquakes.

References

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