

# **Postseismic self-healing of geoid undulations by water after the 2004 Sumatra-Andaman earthquake observed with GRACE**

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## **ABSTRACT**

GRACE (Gravity Recovery and Climate Experiment) is a satellite system composed of two identical satellites, and precise range measurements between them provide information on time varying gravity field of the earth. Its level-2 data sets are composed of the Stokes' coefficients with degree/order complete to 60 or so, and have been used mainly to infer seasonal and secular variations of hydrological masses. Global Positioning System (GPS) receivers have been routinely used to study changes related to earthquakes in terms of movements of crustal surface, and the advent of GRACE is opening a new possibility of detecting such changes in gravity and geoid height.

Earthquakes are accompanied with mass redistributions and cause changes in gravity field and shape of geoid, an equipotential surface coincident with the mean sea surface. Such coseismic changes were detected by GRACE after the 2004 Sumatra-Andaman Earthquake (Han et al., 2006), but little has been known on what happens on geoid after the earthquake. Here I report slow postseismic recovery of coseismic geoid depression from GRACE. This cannot be explained with simple afterslip or viscous relaxation of Maxwellian upper mantle. It suggests the relaxation of coseismic dilatation and compression by the diffusion of supercritical H<sub>2</sub>O abundant in the upper mantle. Such a self-healing system of coseismic geoid undulations, a brand-new role of water in mantle, would significantly reduce the amount of permanent shifts of the Earth's rotation axis by earthquakes.

## **Reference**

Ogawa R. and K. Heki, Slow postseismic recovery of geoid depression formed by the 2004 Sumatra-Andaman Earthquake by mantle water diffusion, *Geophys. Res. Lett.*, 2007.