



Prompt gravity anomaly induced to the 2011Tohoku-Oki earthquake

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Transient gravity changes are expected to occur at all distances during an earthquake rupture, even before the arrival of seismic waves. Here we report on the search of such a prompt gravity signal in data recorded by a superconducting gravimeter and broadband seismometers during the 2011 Mw 9.0 Tohoku-Oki earthquake. During the earthquake rupture, a signal exceeding the background noise is observed with a statistical significance higher than 99% and an amplitude of a fraction of μGal , consistent in sign and order-of-magnitude with theoretical predictions from a first-order model.

While prompt gravity signal detection with state-of-the-art gravimeters and seismometers is challenged by background seismic noise, its robust detection with gravity gradiometers under development could open new directions in earthquake seismology, and overcome fundamental limitations of current earthquake early-warning systems (EEWS) imposed by the propagation speed of seismic waves.