Transient gravity perturbations due to a buried gravitational source in a homogeneous elastic half space

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Earthquake ruptures induce transient deformations which result in changes in the gravity field (Harms, *et. al* (2015)). Prompt elastogravity signals due to the earthquake source arrive before any seismic wave from the source and it has been proposed that these signals could be used for earthquake early warning systems. In this work, we study the model of a buried gravitational load in an isotropic, homogenous elastic half-plane or half-space. The response at the surface is determined for a suddenly applied gravitational line-load in an elastic half-plane. Also, the response at the surface is calculated for a suddenly applied gravitational point-load in an elastic half-space. Due to the gravitational field induced by a suddenly applied line-mass, every point in the half-plane acts as a source by itself. The elastic response due to each point in the half-plane is calculated using the solution of Garvin (1956) for a buried line blast load in an elastic half-plane. The total response at the receiver point on the surface of the half-plane is determined numerically by the convolution of Garvin's solution with the gravitational force. Similarly, the elastogravitational response to a suddenly applied point mass in a half-space is determined using the solution of Johnson (1974) to Lamb's problem of a source buried in a half-space. We show that in both these models, prompt gravity signals are obtained.Earlier, Kame and Kimura (2018) had considered the elastic response to a suddenly applied point mass in an unbounded medium. They showed that the ground acceleration at any receiver point is exactly cancelled by the gravity perturbation during the entire duration of the prompt period so that a gravimeter at the receiver will not detect any prompt signals. This appears to be a peculiarity of the model of an unbounded medium.

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