An Attempt to Detect the Propagating Gravitational Disturbance From Earthquakes

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Two types of propagating gravitational effects, which obtain from the mass redistributic within the Earth due to a large earthquake, are investigated: (1) the velocity of the change of th Newtonian potential field; and (2) the gravitational luminosity of the seismic source. The mass redistribution caused by an earthquake within the Earth and the resulting change in the gravitational potential field is computed through application of geophysical dislocation theory. The global mass redistribution is postulated to be progressive, starting at the instant (and location) of the nucleation of the earthquake fault rupture, and then spreading globally at the velocities of various seismic waves. Information about the changes of the gravitational potenti is postulated to travel at the velocity of light. Superconducting gravimeters (SG) can resolve changes of the order of 10 ngal, (10^{-9} cm/s^2), sufficient to detect the changes in the potential field. The time difference between observation of the change of the potential field and the arriv of the primary seismic wave from the earthquake would allow a crude estimation of the velocit of the gravitational effect. A preliminary search for the pre-seismic gravitational signal using a SG has given inconclusive results, primarily due to the limitations of the spline curve fitting methods. Despite this, we suggest that the observation of pre-seismic gravitational potential changes should be feasible, with the existing array of SGs in the Global Geodynamics Project (GGP) network, and by detectors designed to observe gravitational radiation (e.g. the Laser Interferometer Gravitational-wave Observatory (LIGO)). We have used published values of th changes in the Earth's inertia tensor due to the Alaska earthquake of 1964 to estimate the magnitude of the metric perturbation of the gravitational wave produced by an earthquake. The results are of the order of 10^{-34}, much lower than the predicted detection level for LIGO of 10^{-22}. The gravitational luminosity is estimated at 1.9×10^{-10} erg/s.