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Excitation of Earth rotation and gravitational field changes by the December 26, 2004 Indonesian earthquake

R. S. Gross (1), and B. F. Chao (2)

(1) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA,
(2) NASA/Goddard Space Flight Center, Greenbelt, Maryland, USA
(Richard.Gross@jpl.nasa.gov / Fax: +1 818-393-6890 / Phone: +1 818-354-4010)

Besides generating seismic waves, which eventually dissipate, an earthquake also generates a static displacement field everywhere within the Earth. This global displacement field rearranges the Earth's mass, causing the Earth's rotation and gravitational field to change. The size of these changes depends upon the size, focal mechanism, and location of the earthquake. The Indonesian earthquake of December 26, 2004 is the largest earthquake to have occurred since the 1964 Alaskan earthquake. The coseismic effect of the Indonesian earthquake upon the Earth's length-of-day, polar motion, and low-degree harmonic coefficients of the gravitational field are computed. It is found that this earthquake should have caused the length-of-day to decrease by 2.68 μsec, the position of the mean rotation pole to shift 0.821 mas towards 145°E longitude, the Earth's oblateness J_2 to decrease by 0.90 x 10^{-11}, and the Earth's pear-shapedness J_3 to decrease by 0.19 x 10^{-11}. This predicted change in the length-of-day is probably not detectable by current measurement systems, the change in oblateness is perhaps just detectable, and the change in the mean position of the rotation pole is perhaps detectable if other effects, such as those of the atmosphere, oceans, and continental water storage, can be adequately removed from the observations.