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Rough model simulation of the possible effect of a Sumatra-type earthquake on the Earth rotation parameters

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After the catastrophic earthquake and tsunami of Sumatra, December 2004, several issues have been published mainly in the daily news, describing that the quake has altered the position of the rotation axis and the length of the day as well. Using the database of the rotational parameters published by the IERS (International Earth Rotation and Reference System Service), the background of these statements was analised. From 1957, the IERS publishes daily the LOD (length of the day) by microsecond accuracy, and the position of the actual rotation axis with respect to the IRP (IERS Reference Pole) by 10ˆ-5 arc second (0,3 millimeter) accuracy. These figures are completed by the parameters of the actual precession and nutation models. In the present study only the data of the LOD and the position of the rotation axis were used. On the time series of the position of the axis, the interference of the Chandler and the annual periods is shown.

This study is partly a review paper and partly shows a model calculation to support the figures obtained from the literature. The study does not support the sudden variations of the rotation axis position simultaneously with the earthquakes. Using the LOD and axis variation data and the date of the quakes, upper estimations are given to the maximum values of the influence of the earthquakes. These values are maximum 0,1 millisecond in the LOD and maximum 3 millimeters in the axis position.

As these figures are very rough estimations, a model computation was carried out, using parameters of a simulated earthquake and its resulted variations to the mass density of the Earth. The result is that this large but simulated quake cause only nanosecond order variation in the LOD data. Studying the effects of the earthquakes to the rotation characteristics, the location of the quakes can be important, as well as the focal mechanism of them. The compressional directions, its angles to and distance from the rotation axis can be of great importance to the variations. These data have been unavaiable for the authors, so it is defines that as a possible continuation direcetion of the present study.