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Source mechanism of the Aceh-Sumatra 2004 earthquake from very long period free oscillations of the earth

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The giant Aceh 2004 earthquake (Mw=9.0) strongly excited the free oscillations of the earth, including some usually elusive very long period modes which are conspicuous in the very first calculated spectra.

Several source models, published in the first days after the event, obtained from teleseismic body waves, show a rupture length of 400-500 km with a source duration of 200 sec approximately. On the other hand, the spatial distribution of aftershocks fills a much longer region, going further than 1000 km north of the epicenter, and some short period teleseismic observations suggest a source duration as long as 8 minutes. Both observations indicate a giant rupture, difficult to model with the standard teleseismic bodywave analysis due to overlapping of different phases.

In order to gain some insight into the details of the rupture process, we model the very long period seismic and gravitational world wide records (IRIS, Geoscope, GGP) corresponding to this event. From the amplitude of the splitted singlets of the earth free oscillations we study the seismic moment, focal mechanism and depth of the source of the Aceh earthquake, for different frequencies. Variations in such parameters could give information about the heterogeneity of the rupture process.