Geophysical Research Abstracts, Vol. 7, 09552, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09552

The magnitude 9.0 Sumatra (Indonesia) mega-earthquake of 26 December 2004

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The magnitude 9.0 of the Sumatra mega-earthquake occurred on December 26, 2004 is the strongest in the world since the 1964 Alaska earthquake and the fourth since 1900. The earthquake happened on the interface of the India and Burma plates and triggered a massive tsunami that affected several countries throughout South and Southeast Asia. The rupture, estimated by the aftershock distribution, start from central Sumatra northward for about 1200 kilometres. The source time function and the rupture process using 29 teleseismic broad-band data, provided by IRIS-DMC stations were analysed. The dataset was selected by mean of two criteria: data quality and azimuthal distribution. The rupture direction and velocity were determined from common pulse durations observed in P waveforms using DIRDOP computational code (DIRectivity DOPpler effect) developed by Caldeira (2004). The modified Kikuchi and Kanamori (2003) method, based on a finite fault inverse algorithm, has been used to carry out the slip distribution. Based on the subduction geometry, aftershock distribution and CMT, 3 segments of 150 km wide (along dip), 990 km total length with variable azimuth were fixed. Results show that the rupture spreads mainly to the North with an average velocity of 3 km/s. The focal mechanism shows thrust motion on a plane oriented on the NNW-SSE direction as well as horizontal pressure axes in the NNE-SSW direction. The fault slip distribution shows the following scenario: 1) in the first stage the rupture nucleated at the hypocenter as a circular crack breaking a shallow asperity of about 60 km radius during the first 50 sec; 2) in the second stage, the rupture propagated during $\sim$180 s after the initial break to the NNW and broke a middle large asperity centred at about 360 km from the epicentre; 3) finally, the rupture propagated further to the north and broke a third asperity centred at $\sim$840 km from the epicentre during at least 80 sec. The mainly direction of the displacement occurred along the

dip. The maximum slip reaches 15 m in the central segment and the total seismic moment is Mo = 2.0 x10^{22}Nm (Mw = 8.9), which is in agreement with the value given by the ESMC. The total source duration and rupture length are estimated to be above 330 sec and 1000 km, respectively.

- Caldeira, B., 2005. *Caracterização espaço-temporal da fonte sísmica. Processo de ruptura e directividade*. PhD thesis, University of Évora, Évora, Portugal, 282 p.

- Kikuchi, M. and H. Kanamori, 2003, *Note on Teleseismic Body-Wave Inversion Program*, http://www.eri.u-tokyo.ac.jp/.