Geophysical Research Abstracts,
Vol. 12, EGU2010-38, 2010
EGU General Assembly 2010

Influence of source extension of 26 December 2004 Sumatra earthquake on character of tsunami wave propagation

Raissa Mazova (1), Broneslav Kisel'man (1), Natalya Baranova (1), and Leopold Lobkovsky (2)

(1) Nizhny Novgorod State Technical University, Dept.of Applied Mathematics, Nizhny Novgorod, Russian Federation (raissamazova@yandex.ru), (2) P. P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russian Federation

The analysis of the Indian Ocean earthquake and tsunami on 26 December 2004 carried out in a number of works demonstrates that rupture process in the seismic source was realized during several minutes. In some works, there was suggested that a source probably consists of several segments with width near above hundred of kilometers and with total length more than 1000 km. Such a picture is consistent with subduction keyboard model of tsunamigenic earthquake (see, e.g. [1]) which treats the anomalously long source of Indian Ocean tsunami, caused by oblique subduction, as a multiblock piston mechanism with non-simultaneous realization of each block. Because of existing in literature uncertainty with source structure and movements at all its extent, it is interesting for given event to study in details the dependence of characteristics of surface water wave induced by seismic source on its extent [1,2]. In the work it was studied the influence of submarine seismic source extention to wave field distribution in basin of Bengal bay and central part of Indian ocean. To analyze, it was considered separately the influence of large segment of seismic source for given tsunami. On the basis of keyboard model it is considered the earthquake origin with extension near 1200 km comprises 3 seismic source: Sumatran, Andaman and Nicobar ones, each of which comprises 6, 4 and 3 keyboard blocks, respectively (1, 2 and 3 scenarios). It was calculated the maximal vertical displacement of these segments on 2-5 meters. The velocity of block movement was taken in correspondence with available data on characteristic times in the source. For scenario 1 tsunami source, formed at the ocean surface, generates almost circular wave which, due to bathymetry of given basin, preserve its form and propagates most quickly in west and south-west direction. To north-east, to Indian coast, the wave came with large delay, as compared with records of real mareographs. As follows from the wave field picture for second series of calculations, the wave front, as it was expected, becomes to be more elongated, and the time of approach of the wave front up to east Indian coast is decreased, as compared with the case of wave generation by only Sumatra segment. At turning on of third segment wave field is characterized by else more elongated to north wave front, and time of approach of wave front the south-east Indian coast is more decreased. It's seen that from the source side faced to Bengal bay there are well pronounced three wave fronts in correspondence with marked segments. These fronts evolve then in plane enough united front with bend in the region of Nicobar islands. The change of wave field character for three taken cases is well seen on accounted satellite altimetry. Adequateness of the calculations performed was verified by comparison of mareograms, obtained from real mareographs with records of virtual mareographs placed us in calculating basin and obtained by us for each scenario. The same verification was performed by comparison of real altimetric records of satellite "Yason-1" with virtual altimetric record obtained by us for each scenario. The computations performed explain the complex character of tsunami wave propagation for given earthquake.
This work was supported by the Russian Foundation for Basic Research, project no. 08-05-01027

1.Lobkovsky L.I., Mazova R.Kh. The mechanism of source of Indian Ocean tsunami 2004: analysis and numerical simulation // Physics of Earth, v.43, № 7, pp.46-56, 2007.
2.Lobkovsky L.I., Mazova R.Kh., Garagash I.A., Kataeva L.Yu., Nardin I. To analysis of source mechanism of the 26 December 2004 Indian Ocean tsunami, Russ.J.Earth Sci. V.8, ES5001, doi:10.2205/2006ES000208 http://dx.doi.org/ 10.2205/2006ES000208 (2006b).