



Numerical simulation of earthquake and tsunami May 9, 1877 at the Chile coast

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Numerical modeling of the generation and propagation of tsunami waves during the earthquake of 1877 in Chile was performed. The possible dynamics of the seismic source are estimated, the wave characteristics of the process and the distribution of the maximum tsunami wave heights along the coast of the considered water area are obtained. On May 9, 1877, at 9:16 pm local time, an earthquake and subsequent tsunami were recorded in the area of Iquique. The epicenter of the earthquake was in the Pacific Ocean near the city of Iquique. The calculated magnitude of the earthquake was estimated at 8.5-8.8. The highest intensity was noted between the cities of Arica, Iquique and Antofagasta, Tokopiglia, Gatiko and Kobikha were also severely affected. All these cities were destroyed. Earthquake victims were reported from Pisco to Antofagasta. In the area of the cities of Iquique, Gatico and Kobiha, five minutes after the earthquake, tsunami waves arrived with a first wave height of 10 to 15 meters. The second wave she came in 15 minutes after the main shock, she was more powerful - her height was from 20 to 23 meters. It should be noted that in various documentary sources the data for a number of points on the Chilean coast are contradictory. So, for example, in Arica the spread of wave heights from 9 to 20m, in Iquique 6-9m, in Kobikha 9-12m, in Mejilones a spread from 12 to 21m. Given the very diverse information on the tsunami wave height on the coast and based on the conclusions of the authors of [1] on the similarity of the continental slope of the deep sea trench near Arica city and Kuril-Kamchatka area, for which the earthquake key model was successfully applied in [2] [3], we suggested that the 1877 earthquake had complex dynamics. For the numerical implementation of this process, it was decided to use the key model of the earthquake, which allows breaking the earthquake source into a large number of block keys, taking into account aftershock activity and bathymetry of the earthquake source area. In this process, the displacement of each block in the source of the earthquake occurs by a different amount at different times. When numerically simulating an earthquake and generating tsunami waves, the key model of the earthquake source allows you to

obtain a complex distribution of the maximum wave heights on the shore, for a given dynamics of blocks in the earthquake source.

[1] **Mazova R.Kh, Ramirez J.F.** Tsunami waves with an initial negative wave on the Chilean coast // Natural Hazards 20 (1999) 83-92.

[2] **Lobkovsky, L. I., Mazova, R. Kh, Kataeva, L Yu., & Baranov, B.V.** Generation and propagation of catastrophic tsunami in the basin of Sea of Okhotsk. Possible scenarios, // Doklady, 410, 528–531 (2006).

[3] **Lobkovsky L.I., Baranov BV.** Keyboard model of strong earthquakes in island arcs and active continental margins // Doklady of the Academy of Sciences of the USSR. V. 275. № 4. P. 843-847. 1984.