



Spectral analysis of Chilean tsunami (February 27, 2010) records on the Pacific coast of Russia

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Russian Tsunami Warning Service was developed considerably with the installation of group of telemetric bottom pressure gauges on the Pacific coast in the late 2009. The most important information was obtained from the gauges which were installed on the Pacific coast of Russia: Bering Island (Nikolskoe), in the Avachinsaya Guba Bay (Petropavlovsk-Kamchatsky), on south-eastern coast of Kamchatka (Vodopadnaya) and on the coast of Paramushir Island (Severo-Kurilsk). Three stations were installed on the southeastern coast of Sakhalin (Poronaisk, Starodubskoe, Korsakov) and four on the coasts of Sea of Japan (Vladivostok, Preobrazhenia Bay, Rudnaya Pristan and Kholmsk). We received a tidal gauge tape with Chili tsunami records from Malokurilskoe (Shikotsn Island). The tape records were digitized and used for analysis too. We used data of several gauges which located on the coast of Hokkaido and Honshu Islands (Hanasaki, Ofunato and others). These data we found on the NOAA website <http://wcatwc.arh.noaa.gov/about/tsunamimain.php>.

The tsunami heights were more than 1 meter on the Pacific coast of Russia in spite of the large distance from the source. The maximal heights (from the trough to the crest) were recorded by the Severo-Kurilsk (228 cm), Vodopadnaya (120 cm) and Malokurilskoe gauges (110 cm). As opposed to these stations, the tsunami heights in Petropavlovsk-Kamchatsky (16 cm) and Nikolskoe (19 cm) were significantly smaller. The narrow channel which connected the Pacific Ocean and Avachinskaya Guba Bay is probably a cause of tsunami weakening at Petropavlovsk-Kamchatsky. The cause of tsunami weakening in the area adjacent to the Bering Island is difficult to explain.

To examine spectral properties of long wave oscillations for each gauge, we calculated wave spectra using two different data segments (both of two day long because of very long tsunami-caused oscillations): The period from 00:00 of February 26 to 24:00 of February 27 (UTC), preceding the tsunami event, we identified as "normal" and selected for analysis of the background signal; the period from 00:00 of February 28 to 24:00 of March 1h ("tsunami period") was chosen for analysis of tsunami-caused oscillations.

Two well-expressed peaks with periods about 60 and 45 min were found in the spectra of tsunami records obtained at the Severo-Kurilsk and Vodopadnaya stations. One well-expressed peak with period about 45 min was found in the spectra of tsunami-caused oscillations in the Nikolskoe and Petropavlovsk-Kamchatsky. The same peak in the spectra at different stations (Hanasaki, Korsakov and so on also) is probably connected with tsunami source features. The peak with period 60 min is probably connected with shelf resonant effect in the area adjacent to Paramushir Island and southeastern coast of Kamchatka peninsula.

There are some peaks in the high frequency band in the spectra of different stations. These peaks are induced by the local topography resonant effects probably. Low-frequency oscillations with period about 4.8 hours we found in the tsunami records at Korsakov and Petropavlovsk-Kamchatsky. These oscillations are connected with resonant modes of large-size Aniva Bay and Avachinskaya Guba Bay. The same oscillations in these bays were caused by Great Chilian tsunami (May, 1960) too. Similar spectra of both Chilean tsunamis were obtained at Hanasaki and some other stations.