

Long waves on the shelf of the southwest coast of Sakhalin Island

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Abstract. The results of the study of long-wave motions with periods of more than 20 hours on the shelf of the southwest coast of Sakhalin Island using the time series of sea level fluctuations obtained in full-scale experiments with a discreteness of 1 s and a duration of 4 to 6 months are considered. Spectral analysis of the time series of sea level fluctuations for the period range from 8 to 200 hours revealed the presence of long-wave processes with periods from 26.1 to 46.7 hours, which significantly exceed the inertial period of 16.48 hours. Numerical modeling of shelf waves for exponentially convex profiles of the seabed, carried out using the dispersion relation of V.T. Buchwald and J. K. Adams for waves of the continental shelf, showed that the detected wave processes with periods from 31.2 h to 46.7 h are shelf waves. Their amplitudes increase during storms. The possibility of energy transferring from atmospheric disturbances to shelf waves, which contribute to the formation of sea level, is shown, that confirms the earlier made assumption. Using the calculation of the phase difference of the observed shelf waves at a distance of 12.4 km between Nevelsk and Gornazovodsk and determined by means of the theoretical model, it is shown that the second mode of the shelf wave with a frequency of 0.152 cycle/h is close to the theoretical one. It is shown for the wave with a period of 26.1 h recorded in Ilyinsky and Gornozavodsk for the distance between the points of 173.6 km, that this wave cannot be a shelf wave, but it is a Kelvin wave. This is confirmed by the calculated dispersion diagram, according to which the wavelength of about 689 km corresponds well to the phase difference for the distance Ilyinsky – Gornozavodsk. It is found that shelf waves, one of the generation mechanisms of which is the wind tension along the coast, have the different amplitudes in summer and winter, that is due to the seasonal direction of the offshore wind. In summer, the directions of shelf wave propagation and wind are opposite, which weakens the shelf waves.

Keywords:

long and shelf waves, Kelvin wave, spectral analysis, modeling, dispersion diagram

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