



Field investigation of the peculiarities of wind-wave interaction under conditions of water reservoirs

Georgy Baydakov, Vladislav Papko, Nikolay Bogatov, Alexander Kandaurov, Alexandra Kuznetsova, Daniil Sergeev, and Yuliya Troitskaya

Institute of Applied Physics RAS, Nizhny Novgorod, Russian Federation (baydakov@ipfran.ru)

The article describes a series of field experiments to study the characteristics of wind-wave interaction under the short fetches conditions. Measurements were carried out in the waters of Gorky Reservoir (Volga River) from May to October in 2015-2017. The depth of the reservoir is 4-20 meters, the depth in the point of measurement is 9-12 meters. The value of the wave fetches is 6-8 km.

The methods of the experiment focus on the study of airflow in the close proximity to the water surface. The sensors were positioned at the oceanographic Froude buoy including five two-component ultrasonic sensors WindSonic by Gill Instruments at different levels (0.1, 0.75, 1.25, 2.2, 5.3 meters above the mean water surface level), one water and three air temperature sensors, and three-channel wire wave gauge. One of wind sensors (0.1 m) was located on the float tracking the waveform for measuring the wind speed in the close proximity to the water surface.

Basic parameters of the atmospheric boundary layer (the friction velocity u_* , the wind speed U_{10} and the drag coefficient C_D) were calculated from the measured profiles of wind speed. Parameters were obtained in the range of wind speeds of 1-14 m/s. For wind speeds stronger than 5 m/s C_D values were lower than those obtained before and those predicted by the bulk parameterization. However, for weak winds (less than 3 m/s) C_D values considerably higher than expected ones. The new parameterization of surface drag coefficient was proposed on the basis of the obtained data.

Investigation of the characteristics of surface waves showed that the asymptotics of the wave spectra are f^{-5} and k^{-3} . Parametrization of the dependence of the saturation constant on the parameter $\Omega = U_{10}/c_p$ was proposed. The interrelation between the wind characteristics and the directional spatial spectrum is considered.

The work was supported by the Russian Foundation for Basic Research (Grants No. 17-05-41117, 16-05-00858).