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Laboratory investigations of the heat and momentum transfer in the stably stratified air turbulent boundary layer above the wavy surface

Daniil Sergeev, Yuliya Troitskaya, and Maxim Vdovin

Institute of Applied physics RAS, Nonlinear Geophysical Flows, Nizhny Novgorod, Russian Federation (daniil@hydro.appl.sci-nnov.ru)

Investigation of small scale transfer processes between the ocean and atmosphere in the boundary and its parameterization on the meteorological conditions (wind and surface waves parameters) is very important for weather forecasts modeling [1]. The accuracy of the predictions taking in to account the so named bulk-formulas strongly depends on the quality empirical data. That is why the laboratory modeling sometimes is preferable (see [2]) then in situ measurements for obtaining enough ensembles of the data with a good accuracy in control conditions, first of all in a case of severe conditions (strong winds with intensive wave breaking and sprays generation).
In this investigation laboratory modeling was performed on the Thermostratified Wind-Wave Channel of the IAP RAS (see. [3]). Experiments were carried out for the wind speeds up to 18.5 m/s (corresponding the equivalent 10-m wind speed 30 m/s). For the possibility of varying parameters of surface roughness independently on the wind flow a special system basing on the submerged mosquito mesh (cell of 2*2 mm) was used (see [4]). The roughness was controlled by the depth of the mesh installation under the free surface (no waves when the mesh was on the surface and maximum wave amplitude for the maximum depth). So, for each wind speed several cases of the waves parameters were investigated. During experiments a stable stratification of the boundary layer of air flow was obtained. Temperature of the heating air was 33-37 degrees (depending on the reference wind speed), and the water temperature was 14-16 degrees. The Pitote gauge and hotwire were used together for measuring velocity and temperature profiles. Also indirect estimations of the total volume of the phase of sprays were obtained by analyzing hotwire signals errors during droplets hits. Then aerodynamic drag CD and heat transfer Ch coefficients were obtained by profiling method. It was shown that that these parameters are very sensitive to the intensity of the spray of droplets generation, especially heat transfer.
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