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Air-sea interaction and turbulence characteristics within the atmospheric and ocean boundary layers in the coastal zone from experimental data

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We present results of series of field experiments on hydro physics marine platform, which is located at the southern tip of the Crimea near Katsiveli. One of the tasks of the experiments is the development of new methods of the sea surface remote sensing. The goal of this work is to identify the major processes contributing to the vertical and horizontal transport in the upper layer of the ocean and at the air-sea interface under conditions of large-amplitude breaking waves. We investigated in detail air-sea interaction processes specifically in near-shore areas of the sea. Microwave angular radiometric measurements were accompanied by measurements of turbulent characteristics of wind flow and sea upper layer, the spectrum of large waves and contact measurements of hydrometeorological parameters. Analysis of data in the summer-autumn period shows the connection between the statistical parameters of two-dimensional spatial spectrum of capillary-gravity waves on the sea surface and the surface wind speed. The most interesting pattern of behaviour of the sea surface roughness with wave age is the one where the systematic changes in the width of dissipation subrange in wind waves spectra can be used for an explanation of the decrease of roughness with increase of wave age.

Air-sea interaction is closely connected with physical processes occurring in both environments. It is a bi-directional process, which reveals a kind of feedback. In case of weak winds and small waves the ocean-atmosphere heat exchange becomes an important factor affecting turbulence in the near surface water layer. After the change of the direction of the ocean-air heat flux, periodic variation of heat and momentum fluxes were observed in the atmosphere. These changes were accompanied by the varying intensity of oceanic turbulence. Our measurements demonstrated that the atmospheric boundary layer condition essentially depends on the sea surface structure, which, in turn, transfers the information from processes in the deep sea. We propose parameterizations of mixing and turbulent energy dissipation to be used in numerical models of the air-sea interface.