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Retrieval of the atmospheric boundary layer parameters in a tropical cyclone based on the data from GPS dropsondes

Nikita Rusakov, Yuliya Troitskaya, Evgeny Poplavsky, Olga Ermakova, Daniil Sergeev, and Galina Balandina

The dynamic velocity and turbulent momentum flux are critical parameter in the theory of tropical hurricanes. It is of special interest now in connection with the problem of atmospheric boundary layer parameters restoration for the construction of GMF based on the collocated remote sensing and field data for hurricane conditions.
The main problem in determining the dynamic velocity in the atmospheric surface boundary layer at extreme wind speeds from field measurements are large errors near the surface. In addition, there is the problem of correctly compiling the statistical ensemble for which the averaging is performed. For averaging, measurement data from falling GPS dropsondes obtained in the Atlantic basin for the period 2003-2017 was used. The parameters of the boundary layer flow (friction velocity and roughness height) were retrieved from the airflow velocity profile, which is known to have the logarithmic asymptotic close to the surface. Here we apply a method successfully used in technical fluid dynamics . It is based on the use of the self-similarity of the velocity defect in the boundary layer, which includes the layer of constant fluxes with a logarithmic profile and the wake part, where the flow adapts to the undisturbed flow. The self-similarity allows one to restore the roughness parameter and friction velocity from measurements in the wake part. The self-similar velocity profiles in the turbulent boundary layer are applicable only to the values averaged over the statistical ensemble. The dependence of CD on U10 and u* was obtained. The dependence of CD on U10 decreases with increase of wind speed in agreement with the meteorological and oceanographic data . However, quantitatively the drag coefficient and dynamic wind speed are slightly lower than the values obtained on the basis of the traditional profiling method.

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