Electric Fluctuations in Thunderstorm Clouds. *Coherent Structures Influence*

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The presence of helicity v·rot v in atmospheric vortices increases their stability and extends their life time. The studying of helical motion generation in the application to intense atmospheric vortices (IAV) like typhoons results to the following conclusion - it is necessary to take into account the clouds charged subsystems contributions both to the forming of IAV inhomogeneous, self-consistent spatial structure and IAV following nonlinear dynamics. The experimental data on electric fields in thunderstorm clouds are demonstrating the presence of strong small-scale fluctuations with the spatial scales of the order of (10-200) m. It means that the correct model of clouds charged subsystems contribution to the generation of helical motions in atmospheric vortices must take into account the structure properties of electric fluctuations.

In the present paper it has been considered the structure functions (SF) for vertical distributions of electric field E(z) in the thunderstorm clouds. The field E(z) in thunderclouds measured in the height range z up to 13 km is used as the basic data. For experimental plott of E(z) the analytical approximation $E_a(z)$ was elaborated by the usage of localized functions. Then structure functions of the order m are calculated according to the following expression $S_m(L) = < | E_a(z_i + L) - E_a(z_i) |^m >$, where $z_i = \ell\, i$, $z < h$ with the step $\ell \approx 10$ m, $1 < i < N$, $N = h / \ell$.and the spatial averaging is performing on the height range $0 < z < h - L$. It is supposed $\ell < L < h / 2$. For the different values m the plotts of structure functions $S_m(L)$ dependence on the scale L are presented in log-log coordinates. These plotts are demonstrating the large amplitude fluctuations at scales L ~ (10-200) m and the coherent structures (CS) presence. The inertial intervals of electric fluctuations are studied and the scaling exponents g(m) are obtained.

It is performed also the modelling of chaotic geophysical fileds in the presence of finite amplitude localized coherent structures. The initial model data retrival was chosen as the superposition of the turbulent fluctuations with power-law spectrum and localized coherent components characterized by finite amplitudes and some scales. The analysis of SF-functions behaviour for such retrival was given including the investigation of coherent structures influence on SF behaviour in the dependence on scale. The presence of localized coherent structures modifies structure functions, for example, it changes the averaged SF slopes in their log-log scale plotts. Since the SF-profile in inertial range is close to the power degree law dependence, the CS presence increase scaling exponents g(m). Calculations performed are demonstrating also that due to the CS-presence the autocorrelation function increases at small-scales. The CS contribution to SF is the most essential one at scales of the order of CS typical scale.

The results obtained will be used for the following estimates of vortice charged subsystem contributions to the average helicity generation, to the forming of stable, self-consistent, inhomogeneous structure of wind flows in the long-lived vortical objects. The approach developed is of great importance for remote sensing data

processing, in particular, the atmospheric data collections and for the physical interpretation of these processing results.

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