STUDY OF CURRENTS IN THE BOTTOM PARTS OF ASCENDING TWISTED TORNADO-TYPE FLOWS TAKING INTO ACCOUNT THE EFFECTS OF GRAVITY AND CORIOLIS FORCES

I. Yu. Krutova

Snezhinsky Institute of Physics and Technology National Research Nuclear University "MEPhI", Snezhinsk, Russia

E-mail: IYKrutova@mephi.ru

The study is devoted to analytical and numerical modeling of a mathematical model for studying complex polytropic gas flows in the bottom parts of ascending swirling air flows of the tornado and medium-intensity cyclone type. The relevance of the study is due to the need to understand the essence of physical processes occurring in ascending flows, the need for a thorough and in-depth study of the nature of the occurrence of vortices (tornadoes, tornadoes, tropical cyclones) for early warning and effective control of their destructive consequences.

The model [2–3] examines in detail the processes of occurrence and development of three-dimensional stationary air movement, when initiating flow swirling by the Coriolis force, which is an inertial force arising from the rotation of the Earth around its axis.

For the selected mathematical model in the form of a system of gas dynamics equations taking into account the action of gravity and Coriolis forces, initial conditions are set, consistent with the data of in-kind observations, allowing us to numerically find solutions for describing a stationary three-dimensional gas flow in ascending swirling flows. The theorems proved in the proposed mathematical model allow us to interpret the cause of the air swirl in the corresponding direction. Using the numerical method of characteristics, solutions for the coefficients of the series are numerically found, which are determined through a system of gas dynamics equations taking into account the action of gravity and Coriolis forces, which describes a three-dimensional non-stationary bottom flow of polytropic gas in ascending swirling flows.

The presented model of a three-dimensional polytropic gas flow presents an analysis and study of the coefficients of converging series for gas-dynamic parameters of various classes based on field observations that repeat the natural phenomenon. In addition, instantaneous streamlines are calculated for a non-stationary case of a three-dimensional polytropic gas flow.

References

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