ANALYTICAL AND NUMERICAL SOLUTION OF THE CHARACTERISTIC CAUCHY PROBLEM WITH INITIAL DATA, DESCRIBING GAS SWIRLING IN THE BOTTOM PART OF AN UPWARD SWIRLING FLOW

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To describe three-dimensional non-stationary flows in the bottom parts of tornadoes of varying intensity, the approach proposed in the book [2] for modeling flows in ascending swirling flows is used. In this paper, three-dimensional non-stationary flows in the vicinity of an impermeable horizontal plane $z = 0$ are presented as solutions of a system of gas dynamics equations in the form of convergent series in powers of z. The coefficients of the series are determined by solving the characteristic Cauchy problem of the standard form [2]. To construct the coefficients at the zero power of z, data from field observations of tornadoes from the refined Fujita scale are used. In this case, a special system of ordinary differential equations is first solved and, using the results obtained, initial-boundary conditions are set for a system of hyperbolic equations. This system is solved numerically using one modification of the method of characteristics. The results of numerical calculations are presented, including the time it takes for flows in tornadoes of varying intensity and a tropical cyclone to reach a stationary regime.

References

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