Geophysical Research Abstracts
Vol. 12, EGU2010-958, 2010
EGU General Assembly 2010

Tornado-type convection with moist ascending and dry descending air

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According to observations the tornado vortex in horizontal direction can be by convention divided into three parts: the internal part, the intermediate moist convective part and the surrounding part. In the convective part the moist air ascends and a big amount of latent heat is released which is the main energy source of formation and maintenance of the vortex. In the other parts of the structure takes place dissipation of this released energy. So in the second intermediate region the vertical temperature distribution is near to moist-adiabatic while in the other regions it is near to the dry- adiabatic. This leads to a complex convective process of the Ostroumov problem type infinite in horizontal direction with two vertical intermediate cylindrical boundaries. To find solution of such a problem it is necessary to make matching of the considered fields on these boundaries. This problem was considered with the use of Navier-Stokes equations and with the necessary matching at the boundaries. It was obtained that radial distribution of air flux depends on the stable vertical temperature distribution in the surrounding area. At strong stable stratification the vertical air velocity is maximal at the central part of the vortex and at weak stratification the almost neutrally stratified air is easily entrained upward by the strong vertical motion of the moist air in the second region.