Abstract Details

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Title: (NL6) Study on nolinear Ekman pumping

Abstract:

Ekman (1905) proposed a physical model of the planetary boundary (PBL) dynamics, in which a balance among three forces, the Coliolis f the pressure gradient force and a viscous force is assumed. The Ekma theory predicts a vertical velocity at the top of PBL, which is called th Ekman pumping. In the Ekman theory, the inertial terms in the gover equation, which are important for phenomena of geophysical fluids, a ignored. After the pioneering work by Ekman (1905), many studies h generalized the Ekman theory to include the action of the inertial terr However, little has been described the mechanisms of the nonlinear e induced by the inertial terms. Therefore we examine in detail the effe nonlinearity on the Ekman pumping theoretically and numerically. He follow the study by Benton et al. (1964). They studied the Ekman pur using the vorticity and the divergence equations derived from the prir equations. From perturbation analysis, we find that the Ekman pumpi within the first order of Rossby number perturbation expansion consis that of Ekman momentum (EM) theory of Tan and Wu (1993). From numerical computation, the following results are obtained: the most e nonlinearity on the Ekman pumping comes from the coupling betwee vertical component of vorticity and the horizontal divergence appeare vorticity equation. The second is the vertical advection of the vertical component of vorticity. We propose a physical interpretation of the ef these terms on the Ekman pumping. Effects of these terms on the Ek pumping have the opposite senses. The other nonlinear terms in the and the divergence equations have negligible effect on the Ekman pu References [1] Benton, G. S. et al., Tellus, 16, 186-199 (1964). [2] E V. W., Arkiv. Mat. Astron. Fysik, 2(11), 1-53 (1905) [3] Tan, Z., and R Bound.-Layer Meteor., 68, 193-199 (1993).

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