Geophysical Research Abstracts, Vol. 8, 01156, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01156

Non-Local PBL Models Based on Higher Order Moments Closure

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One of the aims of the activity of our group is the search for a reliable turbulence model to describe the Planetary Boundary Layer (PBL). Models are usually tested in very simple and schematic situations, like those reproduced in the wind tunnels, and different stability conditions, from shear driven boundary layer to convective boundary layer, are considered. Best results are obtained when differential equations of the higher order moments are accounted for in the model. Turbulence models including up to the third order moments (TOMs) of the wind velocity fluctuations are capable of describing the non-local properties of turbulent flows, generally underestimated by low order models. The non-local transport is very important when the flows considered are characterized by large scale structures, such as in the case of convective boundary layer (CBL), but plays an important role also in the case of pure shear boundary layer, allowing, for example, to better determine the PBL height. In this work we present the results of the numerical simulation obtained using a third order moments closure model. Pure shear driven BL, convective BL and mixed cases are analyzed and results are compared with Large Eddy Simulation data and with aircraft data, when available. In particular the problem of the closure for the fourth order moments (FOMs) is discussed: the Q.N. approximation together with newer methods is considered and new parameters aimed to damping the unrealistic growth of the TOMs are proposed.