EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00623, 2007
7th EMS Annual Meeting / 8th ECAM

Exploring the potential of mass flux concepts for momentum transport in the dry convective boundary layer

J.S. Schröter (joel.schroter@wur.nl), A.F. Moene
Meteorology and Air Quality Group, Wageningen University, Wageningen, The Netherlands

Non-local transport and entrainment due to large rising thermals are typical and dominant features of Convective Boundary Layers (CBLs). For scalar fluxes, such as the thermodynamic variables, this is generally accepted implying that local diffusion alone is not an appropriate concept. In order to account for these effects different parameterizations, such as counter-Gradient (CG) and explicit entrainment schemes have been developed. Most recently also Mass Flux (MF) concepts, which primarily have been used for cumulus parameterizations, have been adapted highly successfully on the dry CBL. Such MF schemes were shown to be capable of simulating both non-local transport as well as entrainment.

However in the case of momentum transport the role of non local-effects is still not understood. In atmospheric models momentum transport in the sub grid scale is mostly treated as a pure local diffusion process, which leads to systematic errors in the simulated wind fields. Investigation of Large Eddy Simulation (LES) and observations indicate that non-local effects are also important for the transport of momentum. But a deeper understanding of these processes is still missing. Thus, also no consensus exists in literature about the question, to what extent turbulent transport of momentum in the CBL could also be interpreted in a mass-flux-manner.

In the present study we analyze LES data of sheared dry CBLs and investigate similarities and differences between the turbulent transport processes of thermodynamic variables (scalars) and horizontal momentum Thereby we evaluate the potential of different mass flux formulations to account for momentum transport associated with large convective structures in the CBL.