EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00172, 2007
7th EMS Annual Meeting / 8th ECAM

A Climatology of Nocturnal Low-Level Jets at Cabauw

P. Baas, F.C. Bosveld and H. Klein Baltink
Royal Dutch Meteorological Institute (KNMI), De Bilt, The Netherlands (baasp@knmi.nl)

Low-level wind maxima are frequently occurring phenomena in the stable boundary layer (SBL). When turbulent exchange in the SBL is very weak, the upper part of the former mixed layer may become decoupled from the surface. In this layer the horizontal balance of forces is disturbed. As a result, the flow starts to accelerate, leading to a low-level jet (LLJ) later in the night. LLJs are important for the dynamics of the SBL and the transport of atmospheric constituents.

For modeling vertical turbulent mixing in an accurate way, it is important that the model is capable to reproduce bulk properties of the LLJ. However, current operational weather prediction models are not able to reproduce characteristics of the LLJ satisfactory. By comparing model output with observations, the ability of models to simulate the LLJ and the structure of the SBL in general can be evaluated. Model evaluation is often based on 'ideal' case studies, but in this way hardly a good picture for the model performance in operational practice can be obtained. From this perspective, a better way is to compare statistically derived model characteristics with observed climatological values. The availability of long-term observations makes the Cabauw site very suitable for deriving such climatologies.

We will present relevant climatological statistics on the behavior of nocturnal LLJs, useful for evaluating the bulk performance of atmospheric models in stable conditions. To get insight in the LLJ characteristics at Cabauw, 7 years of hourly tower and wind profiler observations are analyzed. We will specify our results for different types of SBLs by using external parameters like the geostrophic wind-speed and the nocturnal cooling as classification parameters. As such, we obtain SBL-classes ranging from high wind-speed and clouds to clear sky and calm. To illustrate how the results can be applied for model evaluation, we perform a similar analysis to ERA-40 output. The outcomes are compared to the observed climatology.