In this study we analyze advective tendencies for the GABLS 3rd stable boundary layer case, Cabauw, 12UTC 1 July to 12 UTC 2 July 2006. At Cabauw UTC is almost equal to local mean solar time. During this night a small clear air disturbance passed over the Cabauw site. Figure 1 shows the change of geostrophic wind direction. To enable a meaningful comparison of Single Column Models (SCM) with observations, accurate advective tendencies need to be prescribed to the SCM. Here we study these tendencies with three 3D models and observations from Cabauw. Here we focus on wind, in the extended abstract also results on temperature and humidity are described.

1. Comparison of Models

RACMO, HIRLAM and WRF are run in hind cast mode. Horizontal resolutions are taken such that at least one model land grid cell is between Cabauw and the North Sea. An earlier study showed that this avoids too large horizontal diffusion in the models. Figure 2 shows horizontal dynamical tendencies of the meridional wind (North component). All models capture the feature around midnight but significant differences in strength are observed.

2. Local Observations

A low level jet develops at 200 m height due to decoupling of the flow. We simulate with a simple model the evolution of the wind vector at 200 m height taking into account the Coriolis force, the changing geostrophic wind and the horizontal dynamical tendencies of zonal and meridional wind. The model is initialized with the observed 200 m wind at sunset and integrated in time with dynamical tendencies taken from 1) RACMO, 2) The GABLS 3rd case setup and 3) No advection. Figure 3 shows in a hodogram the three simulations together with the changing geostrophic wind and the observed 200 m wind. The interaction between the processes makes that RACMO shows large difference with observations. By trial and error the tendencies for the case setup are determined.

3. Conclusions

Qualitative agreement between advective tendencies from 3D models is shown, but strengths differ.

No significant differences in advective tendencies have been found when comparing two versions of the same model (HIRLAM) with differing physical parameterizations, not shown here.

By using local observation at heights where the atmospheric flow is decoupled from the surface we have been able to assess the influence of advective tendencies and to compare these estimates from observations with model output. From this comparison the advective tendencies have been derived that are prescribed in the GABLS3 SCM intercomparison and evaluation case.

For more information on the GABLS3 SCM intercomparison and evaluation case see www.knmi.nl/samenw/gabls.

Further presentations on the GABLS3 case at this conference are 8A4, 8A5 and 8A7.