EMS Annual Meeting Abstracts
Vol. 10, EMS2013-53, 2013
13th EMS / 11th ECAM

Radiation fog at Cabauw: Evaluation of the Dutch Atmospheric Large Eddy Simulation model and the 1D WRF model.

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Fog is a critical weather phenomenon for many aspects in society, in particular for the health and transportation sectors. Due to the multiplicity of processes fog forecasting remains a challenge, even with the currently available computer resources. Typically, even mesoscale meteorological models have difficulties with the timing of the onset and dissipation of the fog, as well as its vertical extension.
In this study we document the case study of a severe radiation fog (about 200 m deep) as observed at the Cabauw tower (Netherlands) on the night of 6-7 October 2005. We evaluate the single column model version of the Weather Research and Forecasting model (WRF), for a number of permutations of the turbulence scheme, the radiation scheme, and the microphysics scheme. Concerning the fog onset, the YSU turbulence scheme delays the start of the fog substantially compared to the observations and compared to the local MYJ and QNSE schemes. Especially the fog forecast with the double moment microphysics scheme WDM6 outperforms the single moment schemeWSM6 for the fog dissipation. The variation of relevant variables for the fog formation is then explained using so called process diagrams in which the land surface coupling, boundary-layer mixing and longwave radiation intensity are varied. In addition, we evaluate the Dutch Atmospheric Large Eddy Simulation model for this fog episode and critically compare the turbulent intensity relative to the 1D WRF model forecasts.