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Fog Forecasting using Synergy between Models of different Complexity: Large-Eddy Simulation, Column modelling and Limited Area Modelling

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Fog is a hazardous weather phenomenon with a large impact on the environment and human life. In particular the transportation sector is vulnerable to fog; but fog is also important for agriculture, for leaf-wetness duration in particular, and for humans with asthma or related diseases. In addition, fog and low level clouds govern to a large extent the radiation balance of the polar regions in summer, and as such fog also influences the regional climate. Hence a thorough understanding of the fog governing processes is essential. However, due to the complexity and small scale nature of the relevant physical processes, the current understanding is relatively poor, as is our ability to forecast fog.

In order to improve our knowledge, and to identify key deficiencies in the current state of the art fog forecasting models, we present an experiment in which the synergy between models of different complexity and observations is used to evaluate model skill. Therefore, an observed case study (Cabauw; The Netherlands) of a well developed radiation fog will be innovatively run with a large eddy simulation model which allows us to evaluate the key issue of turbulent mixing. In addition, operational and research column models (PAFOG; Duynkerke, 1991) will be employed to evaluate their skill on the local scale, while at the limited area models WRF-NMMFOG (Mueller et al 2010) and COSMO-FOG will be evaluated on their skill for the regional scale. Special focus will be given to the representation of the boundary-layer vertical structure and turbulence in the latter two model types versus the LES results with its solid physical ground.