5th International Conference on Fog, Fog Collection and Dew
Münster, Germany, 25–30 July 2010
FOGDEW2010-82-1

On the potential of numerical short range fog forecast and low clouds with three-dimensional fog forecast models

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The presence of fog and low clouds in the lower atmosphere can have a critical impact on both airborne and ground transports and is often connected with serious accidents. An improvement of localisation, duration and variations in visibility therefore holds an immense operational value for the field of transportation in conditions of low visibility. However, fog is generally a small scale phenomenon which is mostly affected by local advective transport, radiation, turbulent mixing at the surface as well as its microphysical structure. Therefore, a detailed description of the microphysical processes within the three-dimensional dynamical core of the forecast model is necessary.

For this purpose, three-dimensional fog forecast models with a high vertical resolution with different microphysical complexity have been developed. COSMO-FOG and NMMFOG include a new microphysical parameterisation based on the one-dimensional fog forecast model. The implementation of the cloud water droplets as a new prognostic variable allows a detailed definition of the sedimentation processes and the variations in visibility. Also, we compare WRF mesoscale model results using different boundary-layer schemes that ignore or account for specific fog microphysics.

In some realistic fog situations (radiative fog) the potential of these three-dimensional fog models will be presented. The fog spatial extension will be compared with MSG satellite products for fog and low cloud. It will be shown that the initialisation and the interaction between the earth's surface and the atmosphere is one of the most important issues for reliable fog forecasts.