The impact of the vertical resolution on fog forecasting with the AROME model

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Fog events have important socio-economic consequences. Despite great improvements in the representation of physical processes, initial conditions and spatial resolution in operational NWP systems over the last decades, fog forecasting remains a big challenge because of the variety of physical processes (surface processes, turbulence, radiation, aerosols, microphysics and dynamics) involved and interacting during the fog life cycle.

The impact of the vertical resolution on the fog forecasting has been studied at the Paris Charles-de-Gaulle airport with the kilometric scale model AROME NWP model. Three vertical resolutions have been compared on a case study and over the winter season 2011-2012. It has been found that vertical resolution impacts both the onset time, the spatial development and also the physical processes involved at the fog onset. There is no significant impact on the mature and the dissipation phases. One important result is that a finer vertical resolution leads to more horizontal heterogeneity and more local fog events than a coarser vertical resolution. These simulations have emphasized that the model overestimates the cloud base height whatever the vertical resolution.

Because the computational cost of a very high vertical resolution is not yet affordable in operational NWP models, two numerical methods representing the surface boundary layer and allowing a finer vertical resolution at a low computational cost have been tested for the case study and during the winter season. A diagnostic method and a method based on the parametrization of condensation/evaporation of clouds in a prognostic surface boundary layer scheme have been compared. The benefits and limitations of both methods will be also presented.