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FOGCAST: Probabilistic fog forecasting based on operational (high-resolution) NWP 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. The improvement of localization, duration and variations in visibility therefore holds an immense operational value.

Fog is generally a small scale phenomenon and mostly affected by local advective transport, radiation, turbulent mixing at the surface as well as its microphysical structure. Sophisticated three-dimensional fog models, based on advanced microphysical parameterization schemes and high vertical resolution, have been already developed and give promising results. Nevertheless, the computional time is beyond the range of an operational setup.
Therefore, mesoscale numerical weather prediction models are generally used for forecasting all kinds of weather situations. In spite of numerous improvements, a large uncertainty of small scale weather events inherent in deterministic prediction cannot be evaluated adequately. Probabilistic guidance is necessary to assess these uncertainties and give reliable forecasts.

In this study, fog forecasts are obtained by a diagnosis scheme similar to Fog Stability Index (FSI) based on COSMO-DE model outputs. Probabilistic guidance is obtained by the neighborhood method and time-lagging. The FSI and the respective fog occurrence probability is optimized and calibrated with statistical postprocessing in terms of logistic regression. The first results will present objective out-of-sample verification based on the Brier score and is performed for station data over Germany.

This probabilistic fog forecast approach should serves as a benchmark for the evaluation of more sophisticated 3D fog models.