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Towards an improved representation of fog in the Swiss numerical weather prediction models

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Aviation safety can be strongly affected by the reduction in visibility due to fog occurrence. We investigate the performance of COSMO-1, the high-resolution numerical weather prediction model employed operationally at MeteoSwiss. For short-range prediction, forecasters at MeteoSwiss heavily rely on COSMO-1. However, COSMO-1 in many cases struggles to adequately represent the geographical distribution of fog in the analysis as well as the temporal evolution of the fog. For a short series of case studies we examine the impact of assimilating humidity measured by both ground stations and radiosoundings. Furthermore, we test the model's sensitivity to replacing the standard one-moment microphysics with the two-moment microphysics scheme PAFOG in the lower model atmosphere. We explore the benefits and shortcomings of these approaches by comparing simulations to various measurements, including a dense network of transmissometers (for visibility), ceilometers (for the cloud base height) and satellite imagery (for the spatial distribution).