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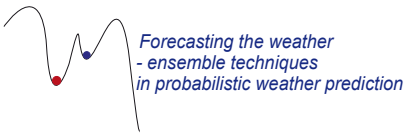

Long-term evaluation of COSMO forecasting using ceilometer, GPS, and MSG observations during the GOP period

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Two years of observations (2007-2008) from the General Observation Period (GOP) are used to evaluate forecasts of the operational COSMO model applications (COSMO-DE and COSMO-EU) of Deutscher Wetterdienst (DWD). As a part of the German Priority Program on Quantitative Precipitation Forecasting (PQP), the GOP gathered a comprehensive data set from existing instrumentation not used in routine verification and corresponding model output.

In this paper we focus on the water cycle variables: integrated water vapor (IWV), cloud base height (CBH), and precipitation. In addition brightness temperatures (BT) from the satellite Meteosat Second Generation (MSG) are included. The biases in IWV and BT 6.2 μm data are small for COSMO-DE and COSMO-EU. CBH data show a larger bias with a maximum in the summer season. The largest biases aren found for precipitation and BT 10.8 μ. The latter can probably be explained by deficiencies in modelled clouds in the upper troposphere.

A classification into different weather condition types (CWT) gives some additional insight into model deficits. For northerly/north-westerly (maritime) flows, model forecasts are too dry (cold) and for southerly (continental) flows too humid (warm). When looking at the CWT-dependency of CBH, a similar picture to IWV emerges. During southerly flow the model overestimates humidity, and therefore ascending air parcels reach saturation earlier, leading to a lower cloud base. Although the CWT-dependency of CBH is weak compared to the IWV for the entire domain, the signal becomes much clearer if only Northern Germany is considered. The IWV bias also affects the BT 6.2 μm and BT 10.8 μm data, forecasting too many high clouds for COSMO-DE and especially for COSMO-EU for southerly flows (too humid conditions). However, even if IWV is too low (north-westerly flow), high clouds are forecasted too often pointing at a deficit in the description of ice nucleation.