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Evaluation of synthetically derived brightness temperatures from COSMO forecast models with Meteosat–Second-Generation (MSG) data.

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The objective of this study is to develop a reliable evaluation method of NWP forecasts with thermal infrared satellite measurements. Three years of observations from 2007 to 2009 are used to evaluate corresponding forecasts of German Weather Service's (DWD) operational COSMO models. This study shows a capability of tracking different sources of measured atmospheric properties such as Brightness temperatures (BTs), water vapor and cloud cover. BT's observed with the geostationary satellite Meteosat Second Generation (MSG) were compared with calculated synthetically BT's from the forward operator RTTOV_v7 as used in the COSMO forecast models. For the present comparisons of the systematical deviations of the 6.2 μm upper troposphere water vapor and the 10.8 μm cloud detection channel were considered.

Diurnal cycle studies are able to detect day/night dependencies of cloud development. Furthermore, the annual cycle observations allow to distinguish between typical seasonal appearance of clouds. This study shows in particular (1) shortcomings related to data assimilation by observed spin up phases of the model starts; (2) over-forecasting of cloud height, spatial cloud cover and diurnal dependencies; and (3) convective cloud development deficits monitored with the help of an advanced cloud-tracking algorithm. The largest observed bias is linked to the BTs of 10.8 μm data. Most likely in consequence of differences in cloud fraction of the upper troposphere. In brief, the model-to-observation approach provides additional insight into model deficits in particular in the treatment of cloud developing processes.