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Assimilation of radar precipitation and satellite data into a NWP model using a physical initialisation scheme

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We implemented a PI (Physical Initialization) method in the non hydrostatic limited-area model COSMO (version 4.2) of the DWD (German Meteorological Service). The goal is the improvement of quantitative rain nowcasting with a high resolution NWP model.
Input radar data is a DWD product: the national radar composite for 16 radars with a spatial resolution of one kilometer and a time resolution of 5 minutes. The conversion from reflectivity to rain rate is already made by DWD. This data is interpolated on the LM grid (2.8×2.8 km resolution) in order to calculate the analysed precipitation rate which depends on the observed precipitation and the model precipitation.
The PIB (Physical Initialization Bonn) takes as input the radar based precipitation product and a cloud top height field retrieved from satellite observations, in our case we are using the SAFNWC products generated from Meteosat Second Generation data by DWD.
During the assimilation window PIB adjusts the vertical wind, humidity, cloud water and cloud ice in order to force the model state towards the measurements. The most distinctive feature of the algorithm is the adjustment of the vertical wind profile in the framework of a simple precipitation scheme. The PIB assumes that the rain rate is proportional to the vertical humidity flux at cloud base and the vertical wind is adapted according to the conversion efficiency of saturated water vapor into rain water at the cloud base. This parameter is dynamically adjusted by the comparison between the model precipitation and the radar precipitation.
The model is tested in convective cases over Germany, an identical twin experiment is used in order to demonstrate the consistency of PIB with the physics of the NWP model. In the tests which we have already performed this method has improved the forecast of the precipitation patterns, as well as the dynamics of the events. These improvements are found both during the assimilation window and for the first hours of the free forecast.
The evaluation of these simulations compared to radar observations in terms of skill scores will be discussed.