EMS Annual Meeting Abstracts
Vol. 15, EMS2018-398, 2018

Using satellite-observed clouds to improve the short-term cloud and solar radiation forecasts in the HARMONIE NWP

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Numerical Weather Prediction (NWP) models are highly capable of predicting several meteorological parameters. In general the clouds and radiation are forecasted well, but still, there are and will always be some uncertainties in the forecasts depending on model limitations and the predictability of the weather situation. Previous work has indicated that NWP models slightly tend to overpredict the solar radiation, either because of displacement of clouds or depending on the transparency of cloud-layers. In this study, the focus has been to improve the representation of clouds in the HARMONIE NWP model, and thereby improve also the quality of the radiation output with an emphasis on short-term forecasts (e.g. nowcasts). Improvements would be beneficial for solar energy and aviation applications, where the forecast focus is on time-scales from the nearest hours up to 1-2 days ahead.

In this study, developments have been made within the HARMONIE-AROME NWP system, by introducing new methods using and combining satellite cloud information (EUMETSAT's NWCSAF) with in-situ observations (Metar and Synop). Based on these data, the methodology attempts to estimate the cloud top and cloud base in each column of the model grid. The model clouds are initialized by adding (or removing) moisture between the cloud top and cloud base. This is done following specific criteria in order not to create instabilities in the model dynamics. Different model configuration experiments have been performed and compared with the operational "reference" setup of the model system for summer 2016 and results from spring-summer 2018 are being prepared.

The preliminary verification scores show that with the new cloud initialization method, using satellite observations, the results improve the cloud and radiation forecasts out to approximately +24 hours. The location and timing of clouds is corrected in the initial state and the model predictability of clouds and radiation becomes better for the short-term forecasts. An important aspect is that other forecasted parameters (e.g. surface and upper-air temperatures) are not deteriorated, which is a positive indication of using this initialization strategy.