



## **Assessing impact of aerosol direct radiative effect on numerical weather prediction over Europe using MACC reanalysis and HARMONIE NWP model**

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Aerosol feedback is becoming more accepted as a necessary physical mechanism needed to be accounted for to improve the accuracy of the numerical weather forecasts. Many numerical weather prediction models utilise climatological distribution of aerosols to account for the average impact of aerosols. However, more heavily polluted situations deviate strongly from the average climatological aerosol distribution. This study focuses on the aerosol direct radiative effect in the European region.

The variability of aerosol optical depth of different aerosol species and the variability of aerosol direct radiative effect in Europe according to Monitoring Atmospheric Composition and Climate – Integrated Forecast System (MACC-IFS) reanalysis is quantified and the necessity of considering near real time aerosol distribution in the numerical weather prediction in Europe is evaluated. The default set up in Hirlam Aladin Research for Mesoscale Operational Numerical Weather Prediction in Euromed (HARMONIE) model includes monthly aerosol climatology. The aerosol direct radiative effect of monthly averaged aerosols is simulated with HARMONIE model and aerosol direct radiative effect during heavily polluted situations is studied.

There are cases in Europe when direct radiative effect of aerosols is large and during these cases the radiation budget could be substantially improved by considering the direct radiative effect of realistic aerosol distribution. Improved radiation budget during heavily polluted cases can have positive impact on the accuracy of the numerical weather forecast. The forecast of near surface temperature and atmospheric temperature vertical profile is shown to be in the better agreement with the observations when the aerosol direct radiative effect of near real time aerosols is considered in HARMONIE in case of extreme aerosol concentration in the atmosphere.