Does accounting for the direct-radiative effect of prognostic aerosols improve 5-day temperature forecast of the ECMWF weather forecast model?

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The Copernicus Atmosphere Monitoring Service (CAMS) produces operationally global 5-day forecast of atmospheric composition and the weather using ECMWF's Integrated Forecasting System (IFS) since 2015. Beginning with a system upgrade in June 2018 (45r1), the ozone and aerosol fields have been used in the radiation scheme to account for their radiative impact in the global CAMS forecasts. This approach replaced an aerosol and ozone climatology, which had been used before and which is still used in ECMWF's operational high-resolution medium-range NWP forecasts. The CAMS forecast system, which runs at a resolution of about 40 km, is applied here as a test-bed to explore the importance of aerosol direct feedback in an operational configuration, which can guide developments on composition-weather feedbacks for ECMWF's medium-range, monthly and seasonal forecasts.

We will discuss the changes and improvements of temperature forecast errors (i) using typical NWP scores and (ii) by applying an event based approach that focuses on episodes of high aerosol burdens such as the transport of Sahara dust to Europe during the heatwave in June 2019. In more detail we will show to what extent the realism of the prognostic aerosol fields influences the temperature response by considering aerosol forecast which were, or were not, improved by data assimilation of aerosol optical depth at the start of the forecast. We will further demonstrate that the consistent updates of both the climatological and prognostic aerosol fields are an important prerequisite for a making progress.