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The close linkage of atmospheric composition and weather prediction

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Atmospheric composition (AC) has been recognized to be an important source of predictability at different time scales. Several meteorological
centres are now incorporating increasingly complex physical/chemical processes and interactions between the different Earth's components into the models. At ECMWF, for example, development activities have built a capacity to simulate and assimilate a variety of AC species
in the Integrated Forecasting System. Stratospheric ozone is a prognostic variable in Numerical Weather Prediction applications, and is included interactively
in the radiative transfer model used for radiance assimilation. The radiation scheme still relies on climatologies of aerosols, ozone and trace gases,
although considerable collaborative effort has been made in the last few years to use the Copernicus Atmosphere Monitoring Service
products to improve the degree of realism of these AC climatologies and of the related AC-weather feedbacks.

Several studies have shown positive impacts of using interactive prognostic aerosols to improve medium-range prediction.
Very often the impacts are significant, but limited to specific areas with large aerosol loads. Recent work has also shown the potential of AC to enhance model skill at the subseasonal-to-seasonal scales. An overview of this research will be presented and discussed along with a general review of the AC-weather coupling problem.

As a specific example, ECMWF's AC priority developments for numerical weather prediction (NWP), which will be considered for testing and possibly operational implementation by 2022, will be introduced. These were collected in publicly available document which propose to improve the representation of AC to the level of complexity and coupling beneficial for NWP, leveraging the CAMS developments with focus on
ozone, aerosols, and CO_2.

Finally, recent WMO-supported initiatives, jointly promoted by the Working Group on Numerical Experimentation (WGNE) and the
Sub-seasonal to Seasonal Prediction Project (S2S) to understand the impact of aerosols on weather prediction models at different spatial and
temporal scales, will be presented. Results from the first phase of this initiative, led by WGNE, will be shown. Plans for the second phase, in which also S2S models will participate, will be also briefly introduced.