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Towards UKESM: Recent developments in the representation of aerosols using the GLOMAP-Mode aerosol scheme

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The next generation UK Earth System model (UKESM) is a joint development effort between the UK Met Office and the wider UK academic community supported through NERC (National Environmental Research Council). UKESM will build on the latest global coupled (GC) climate configuration of the Met Office Unified Model (MetUM) which describes the core physical-dynamical processes of the land, atmosphere, ocean and ice systems (Walters et al. 2013). For the 1st version of UKESM we will extend the physical-dynamical approach to also include key biogeochemical cycles and phenomena that may; (i) provide an important (amplifying or damping) feedback onto physical climate change and/or (ii) change themselves in response to changes in the physical climate and thereby impact society or natural ecosystems. Atmospheric aerosols are one important component of such an ES model due to their impacts on the radiation characteristics of the atmosphere (termed direct effects) and cloud and precipitation processes (termed indirect effects). Aerosols also interact with atmospheric chemistry and biogeochemical cycles in the atmosphere, ocean, and ice surfaces (Carslaw et al., 2010). However, aerosol distributions and in particular aerosol-cloud interactions remain one of the key uncertainties in the latest estimates of anthropogenic radiative forcing on climate. Improved representation of tropospheric chemistry-aerosol processes is therefore an integral part of the development of UKESM which will use the UKCA stratospheric-tropospheric chemistry (Telford et al. 2014) and GLOMAP-mode aerosol microphysics (Mann et al. 2010) schemes. This paper evaluates the performance of the latest configuration of GLOMAP-Mode in the Global Atmosphere 6.0 (GA6) configuration of the MetUM, as a step towards UKESM1. Aerosol microphysical and optical properties are evaluated against a wide-range of ground-based and satellite measurements. Impacts of the new scheme on key components of the physical model relative to its predecessor CLASSIC are also presented and discussed.

References:
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