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Direct aerosol radiative fluxes and heating rates. A sensitivity study using the EMAC chemistry-climate model

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Aerosol particles influence the Earth's radiative balance directly by the scattering and absorption of the solar radiation and they can contribute to climate change. Uncertainties in aerosol radiative forcing, contribute to uncertainties in the total anthropogenic forcing. Our aim is to understand the climate sensitivity to specific aerosol perturbations The ECHAM-MESSy-Atmospheric-Chemistry model (EMAC) has been used to investigate the effects of aerosols on the radiative fluxes and on the heating / cooling rates at the Earth's surface due to the presence of absorbing and scattering aerosol particles. Changes in the aerosol horizontal and vertical size distribution and aerosol water uptake appear to be very important for the aerosol heating rate estimations. In this work we focus on three aerosol species, nitrate, dust and black carbon, and we examine the pure radiative effects and the combined radiative and chemical / microphysical effects of these aerosol species on the net surface solar and thermal radiation and on the surface and atmospheric heating rates on a global scale and in regions where biomass burning, dust and anthropogenic pollution dominate.