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Aerosol activation: parameterised versus explicit calculation for global models

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A key process in studies of the aerosol indirect effects on clouds is the activation of particles into droplets at 100% relative humidity. To model this process in cloud, meteorological and climate models is a difficult undertaking because of the wide range of scales involved. The chemical composition of the atmospheric aerosol, originating from both air pollution and natural sources, substantially impacts the aerosol water uptake and growth due to its hygroscopicity.
In this study a comparison of aerosol activation, using state-of-the-art aerosol activation parameterisations, and explicit activation due to hygroscopic growth is performed.For that purpose we apply the GMXe aerosol model - treating both dynamic and thermodynamic aerosol properties - within the EMAC (ECHAM5/MESSy Atmospheric chemistry, an atmospheric chemistry general circulation) model. This new aerosol model can explicitely calculate the water uptake of aerosols due to hygroscopicity, allowing the growth of aerosol particles into the regimes of cloud droplets in case of sufficient water vapour availability. Global model simulations using both activation schemes will be presented and compared, elucidating the advantages of each approach.