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Hygroscopicity effect of mineral dust particles on cloud formation and climate studied with the chemistry-climate model EMAC

Dong Yeong Chang (1), Benedikt Steil (1), Andrea Pozzer (1), Holger Tost (2), Jongmin Yoon (1), Jos Lelieveld (1,3)

(1) Max Planck Institute for Chemistry, Atmospheric Chemistry, Mainz, Germany (dongyeong.chang@mpic.de), (2) Johannes Gutenberg University, Mainz, Germany, (3) The Cyprus Institute, Nicosia, Cyprus

Mineral dust is one of the most abundant aerosols in the atmosphere and influences the earth's radiation balance directly by scattering sunlight and indirectly by acting as cloud condensation nuclei (CCN) and ice crystal nuclei (IN) in cloud formation, and thereby impacts the climate system. The level of understanding of the dust impacts is typically lower than of pollution particles since the chemical composition and size distribution of the mineral dust strongly varies with the sources and physicochemical processes (i.e. dry and wet deposition, chemical aging), as indicated by laboratory experiments and field measurements. Therefore, the physicochemical properties of mineral dust parameterized in models are important to improve the simulation of clouds and climate. In this study, we focus on the interactions of mineral dust particles with clouds depending on their hygroscopicity. We have simulated clouds and climate with the EMAC model (ECHAM5/MESSy for Atmospheric Chemistry) using various hygroscopic parameters of dust particles to represent different chemical compositions, and have estimated the potential to influence cloud formation and to change cloud radiative properties depending on hygroscopicity.