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# The predictibility of the response of mixed-phase convective clouds to aerosol perturbations

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Deep convective clouds are important for the redistribution of heat, moisture, trace gases and aerosols from the boundary layer to the upper troposphere. However, the interaction between atmospheric aerosols and mixed-phase convective clouds are not well understood. There are also large uncertainties associated with the primary and secondary ice formation processes which impact upon the development of deep convective clouds. We have simulated the response of a range of mixed-phase convective clouds in both continental and maritime environments to wide variations in aerosol loading using the University of Leeds Model of Aerosols and Chemistry in Convective Clouds (MAC3). MAC3 is a 2-D, axisymmetric, non-hydrostatic, dual moment, bin-resolved cloud model which carries four hydrometeors in 34 mass-doubling size bins per hydrometeor. The model includes a detailed treatment of both warm and mixed-phase microphysical processes. MAC3 also contains a dual moment bin-resolved treatment of the aerosol size distribution using 43 bins and a detailed description of aerosol regeneration. In continental environments, we find that an increase in the aerosol loading leads to a decrease in both the accumulated precipitation and a decrease in precipitation intensity. The onset of precipitation is also delayed by increased aerosol loadings. Significntly more anvil ice was produced in continental clouds initialised in high aerosol environments and the Bergeron process was found to play an important role in ice growth. In contrast, an increase in aerosol loading leads to an increase in both the quantity and intensity of precipitation from maritime clouds together with a decrease in anvil ice, the reverse of the continental situation. Here, the warm rain process is active in modulating the cloud drop spectrum prior to significant freezing occurring.