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Cloud history changes water-ice-surface interactions of metal oxide aerosols

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Atmospheric aerosol-cloud-climate interactions are complex processes which might have direct and indirect influences on our climate. So far, the majority of laboratory studies is focused on either well defined aerosol particles (e.g. laboratory synthesized) or those collected from the atmosphere (e.g. using filter methods). An open question is to which extent these particles represent real atmospheric aerosols under changing atmospheric conditions. We usually neglect the change in the surface properties occurring with time under different atmospheric conditions. Unfortunately, this is not always a good approximation, and this may explain the wide scatter of data, e.g. on ice nucleation ability, collected on the same type of aerosol particle in different laboratories [1]. This makes the parameterization of atmospheric models uncertain and in most cases unrealistic, and hence impacts our understanding of the mechanisms of cloud dynamics, precipitation formation, and interaction with incoming and outgoing radiation. We use supercooled SHG and SFG spectroscopy to probe water and ice structure next to solid surfaces [2, 3]. In this study we present a single case of a silicon oxide surface changing its surface properties and ice nucleation ability depending on its history in an aquatic environment. We find that acidic, neutral and basic environment have different effects which in some cases cause significant changes in surface properties and hence the resulting ice nucleation ability within only a few hours. Our findings may affect future perspectives of atmospheric interaction research.

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