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ABSTRACT

Investigating the Interaction between Ice-Nucleating Aerosol and Cloud Microphysics during the ACCACIA Campaign

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The changing climate is significantly affecting the polar regions of our planet, most visibly in the prominent decline in the Arctic sea-ice volume within the last thirty years[1] and more recent record-breaking melts, e.g. 2007[2]. The sea-ice is intricately coupled to the Arctic atmosphere[3] and a continued decline could in turn promote enhanced feedbacks on the cloud microphysics and radiative balance of this region. A key uncertainty in our ability to climatologically model how these changes will progress is in our representation of atmospheric aerosol-cloud interactions[4]. A substantial hurdle in this effort is the scarcity of in-situ atmospheric measurements in this region and, to address this, the Aerosol-Cloud Coupling and Climate Interactions in the Arctic (ACCACIA) Campaign was conducted in the European Arctic during the spring and summer of 2013. During the springtime campaign, detailed measurements were made of the Arctic atmosphere using the Facility for Airborne Atmospheric Measurements` (FAAM) BAe-146 aircraft, with a focus placed upon characterising the unique interaction between the cloud and aerosol observed.

The Arctic Haze plays a significant role in this season, allowing aerosol that has been transported over large distances to accumulate in the atmosphere and mix, age and grow[5]. This work acts to aid our understanding of how these aerosol influence the resident mixed-phase stratocumulus clouds: these long-lived clouds are common to this region, and their persistence and phase impacts strongly on the radiative budget of the Arctic. Improving our understanding of the ice within these clouds – via the identification of ice-nucleating aerosol (IN) - may infer how we can develop the representation of Arctic clouds in models and improve their portrayal in the warming climate. This work applies an Environmental Scanning Electron Microscope, coupled with Energy-Dispersive X-Ray Spectroscopy (ESEM-EDX) - to characterise in-situ, filtered samples of aerosol by their composition and size - and relates these data to observations from the variety of optical particle counters active aboard the FAAM aircraft. By developing our understanding of the subtle microphysical processes which influence the Arctic clouds observed today, we may

able to help constrain how such processes may change in the future.

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