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THE COMPLEX RESPONSE OF ARCTIC AEROSOL TO SEA-ICE RETREAT

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Loss of Arctic sea ice will lead to a large increase in the emission of aerosols and precursor gases from the ocean surface. It has been suggested that these enhanced emissions will exert substantial aerosol radiative forcings. Here, we investigate the potential for these forcings using a global aerosol model to examine the response of Arctic aerosol to sea-ice retreat. In response to a complete loss of ice, we find that north of 70ºN emission fluxes of sea-salt (SS), marine primary organic aerosol (OA) and dimethyl sulphide (DMS) increase by a factor of ~10, ~4 and ~15 respectively. However, the CCN response is weak, with negative changes over the central Arctic Ocean (Fig. 1). The weak response is due to the efficient scavenging of aerosol by extensive drizzling stratocumulus clouds. In the scavenging-dominated Arctic environment, the production of condensable vapour from oxidation of DMS grows particles to sizes where they can be scavenged. This loss is not sufficiently compensated by new particle formation, due to the suppression of nucleation by the large condensation sink resulting from primary emissions. Thus, our results suggest that increased aerosol emissions will not cause a climate feedback through changes in cloud microphysical and radiative properties.

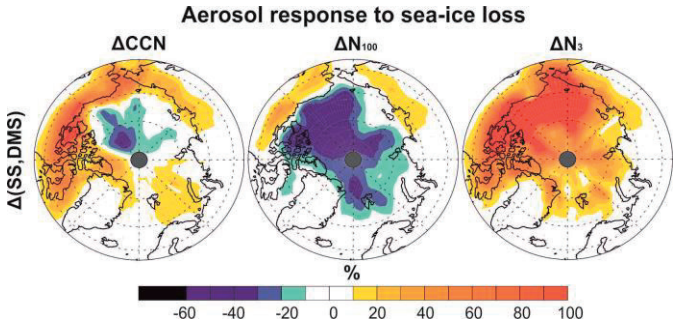

Figure 1: Response of Arctic CCN (ΔCCN), large aerosol (ΔN100) and total aerosol (ΔN3) to sea-ice retreat