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CLOUD RADIATIVE FORING IN AN ICE-FREE ARCTIC

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Polar cloud microphysical properties, and the associated surface radiative forcing, are expected to change with global warming. With the transition to an ice-free Arctic the emission of dimethyl-sulphate (DMS) from the ocean biosphere, converted to sulphate aerosols, provides an increase in cloud condensation nuclei (CCN). Both increased SCC and cloud liquid water path increase cloud top albedo reducing surface down-welling short wave radiation. The effectiveness of DMS emissions on cloud-top albedo, the indirect aerosol effect, is investigated in the HadGEM2-ES climate model. The model creates sulphates, from DMS but does not loft them to cloud-top. Consequently, the aerosols do not significantly increase the cloud albedo. The dominant radiative effect is the increase in liquid water droplets, and decrease in ice particles, which results in a 40 W/m2 reduction in short wave radiation reaching the surface. The reduction in radiative forcing of the summer sea ice delays an ice-free autumn by a decade.