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Modeling studying the role of bacteria on ice nucleation processes

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Certain air-borne bacteria have been recognized to act as active ice nuclei at the temperatures warm than -10 C. Such ice nucleating bacteria commonly found in plants and ocean surface, and are readily disseminated into the atmosphere including in clouds and hailstones. The importance of bioaerosols in cloud formation process and precipitation, as well as causing diseases in plants and animal kingdom, have been considered for over two decades, but their significance in atmospheric processes are yet to be understood. A 1.5-D non-hydrostatic cumulus cloud model with bin-resolved microphysics is developed at McGill University, examining the relative importance of sulphate aerosol concentrations on the evolution of cumulus cloud droplet spectra and ice multiplication process, as well as ice nucleating bacteria in the growing stage of cumulus clouds, particularly in the ice multiplication process. In this paper, we will describe the model and present some sensitivity test results of the evolution of cumulus cloud spectra, ice concentrations at various concentrations of sulfate aerosols, and at different ideal sounding profiles. We will discuss the implication of our results in understanding of ice nucleation processes.