Ice nucleating aerosol particles and the cloud-phase climate feedback

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Abstract:

An enigmatic population of atmospheric aerosol particles is capable of catalyzing the formation of ice in the atmosphere. These ice-nucleating particles, which make up a very small fraction of aerosol, have a disproportionate impact on cloud hydrometeor size, precipitation and radiative properties, but their concentration around the globe is poorly defined. In this talk I will focus on shallow oceanic cloud systems in the mid- to high-latitudes which are responsible for substantial biases in climate models and appear to be linked to the larger equilibrium climate sensitivities in CMIP6 verses CMIP5 models. We have shown that the concentration of ice nucleating particles is a first order driver for the properties of these clouds and their role in climate feedbacks. However, the concentration, temperature spectra and sources of ice nucleating particles relevant for these specific clouds types is very poorly understood. As well as reviewing the relevant literature, I will discuss our recent laboratory, field and modelling research on ice nucleating particle sources in the mid- to high-latitudes relevant for these specific cloud systems. Finally, I will summarize what the key questions are and speculate on how changes in future ice nucleating particle emissions might amplify future warming.