

Ice nucleating particle measurements of relevance to cloud properties in Polar Regions

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Among aerosol influences on clouds and climate, the most poorly resolved are those affecting ice phase properties of clouds that impact their climate-relevant properties for scattering radiation and forming precipitation. North and South Polar regions possess different aerosol influences at different times, making them at times remote from or impacted by continental influences. In this presentation, I will highlight a strong continental versus oceanic contrast in the properties of ice nucleating particle (INP) emissions that we have identified via sampling over land, at coastal locations in the Atlantic and Pacific Ocean basins, and from ships transecting latitudes between 70 S and 70 N since 2012. We find that marine aerosol INP emissions achieve clean background number concentrations per volume of air that are up to 2 orders of magnitude lower than for continental emissions. The consequence should be that Northern Hemisphere clouds at high latitudes should at times reflect the influence of much higher primary INP concentrations than clouds at high latitudes over the Southern Ocean. Nevertheless, the range of influences on Arctic clouds will potentially be very large, and under cloudy regimes with precipitation, it is possible that transports from open ocean regions may set a lower limit on INP number concentrations reaching Arctic stratus. We will also review the nature of Arctic stratus that make them so sensitive to INP concentrations, and mention reasons why maritime polar clouds may be less sensitive to INP due to a propensity for the occurrence of secondary ice formation processes.