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Ice Nucleating Particles in the Antarctic region

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Ice nucleating particles (INPs) are rare but important atmospheric particles as they induce the formation of primary ice in mixed phase clouds and also in some cirrus clouds. A plethora of substances which can be found in atmospheric particles can induce ice nucleation. The most important ice active particle types in the atmosphere are assumed to be mineral dust and biological particles, which can originate from a large number of sources. It is hence not surprising that INP concentrations vary over several orders of magnitude at any ice nucleation temperature, with concentrations being typically larger in continental than in marine environments. Although research concerning INP and their global occurrence has seen a steep rise in the past years, global INP concentrations are still not well known, and not all important INP sources are clear, neither are there good parameterizations for describing INP concentrations in models.

To increase the knowledge of typical global INP concentrations and to draw conclusions about INP sources, we examined INP concentrations in the Antarctic region, namely at the German research Station Neumayer III, located at shelf ice in close proximity (only some 10 km) to the ice edge, at the Belgian research Station Princess Elisabeth, located roughly 200 km inland and at an altitude of 1390 m, and during a campaign including ship- and land-based data at the Antarctic peninsula. We used our well-established methods of filter collection and off-line analysis with cold-stages to derive INP concentrations in these locations.

For Neumayer, two years of data are available. INP concentrations there were generally lower than values derived, e.g., for northern mid latitudes, and they were similar to values published for the Southern Ocean in literature. No pronounced annual cycle was observed. Around and on the Antarctic peninsula, INP concentrations were roughly similar to those observed at Neumayer. However, the Princess Elisabeth station, for which only data obtained during two austral summers are available, showed the lowest values detected in this study. Our results suggest that sources of INP in the Antarctic region are rare, and particularly so on Antarctica itself.