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Concentrations and Properties of Cloud Condensation Nuclei (CCN) and Ice Nucleating Particles (INP) over the Southern Ocean

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During the 2016/17 Antarctic Circumnavigation Expedition (ACE), we conducted measurements of cloud condensation nuclei (CCN) and ice nucleating particle (INP) concentrations, as part of the "Study of Preindustrial-like Aerosol-Climate Effects" (SPACE) project within ACE. The data sets we gathered during the Austral summer are circum-Antartic, which makes them an important addition to the to-date still sparse aerosol data available for the Southern Ocean. Atmospheric models and satellite retrievals will benefit from this unique set of data.

A CCN-100 cloud condensation nuclei counter was operated during the cruise at 5 levels of supersaturation (0.15 to 1.0%). Fiber and polycarbonate filters were sampled with particulate matter smaller than 10 micrometer, for offline analysis of INP concentration (droplet freezing array method), and chemical composition at the Institute for Tropospheric Research (TROPOS).

CCN concentrations were in the range between 5 and 1300 #/cm^3, with high values near inhabited land and parts of the cruise close to Antarctica. Particular intervals of the open ocean sections of the cruise exhibited the lowest CCN concentrations, while both high and low wind conditions were present. Preliminary INP concentrations show a range of 0.1 to 100 #/m^3, with concentrations at -15°C below 10 #/m^3 for pristine open ocean sections and values above 50 #/m^3 near harbours. A connection between bulk chemistry and CCN number was pointed out by a first correlation analysis, excluding cross-correlation between composition and size. No such correlation was found for INP concentrations, as expected. The highest INP concentrations were also found near continents. Dominant sinks over the ocean, as well as strong land-based sources could both explain previously mentioned findings.

Back-trajectory analysis is applied for further elucidation of possible sources and quantification of CCN and INP under given pristine preindustrial-like conditions. We will present results concerning the abundance and properties of CCN and INPs and their respective sources.