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Correlation of meteorological parameters with clustering analysis of aerosol types in High Arctic

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Introduction
Atmospheric aerosols are an important climate driver, as they alter the planetary radiation balance directly through scattering and absorption and indirectly through modification of cloud properties. These interactions depend on aerosol physio-chemical properties as well as local meteorology. Understanding the complex processes controlling aerosol formation and processing in the High Arctic remains a complex scientific challenge. One method for handling the complexity of interpreting data in this research field is the application of clustering analysis. We aim to identify and correlate distinct groups of aerosol number size distributions with meteorological parameters to elucidate the mechanisms that affect the formation, burden and processing of aerosols in the High Arctic.

Measurement Site
All measurements were taken in the Air Observatory at Villum Research Station (VRS) on Greenland. The Air Observatory (N 81°36’ W 16°39’ 24 m a.s.l.) is situated approx. 2 km upwind >95 % of the time from the Danish Military base, Station Nord.

Previous Results
Clustering analysis has been utilized before at VRS on particle number size distributions from 2012-2016, with eight distinct aerosol types identified. The previous studies characterized three clusters of accumulation mode aerosols with climate-relevant properties (e.g. hygroscopic growth factor, critical diameters, and corresponding kappa values) and the remaining five ultrafine aerosol clusters with sea ice extent to determine the source regions of these cluster types. The studies assigned event days by the majority of the cluster present and were correlated with parameter daily means. By utilizing a higher clustering time resolution, the meteorological conditions and processes (which exhibit high temporal variability) affecting aerosols can be discerned.

Future Work
Going forward, studies will utilize this clustering analysis on a longer time series and on higher time resolution. By correlating the observed meteorological parameters with a higher time resolution clustering analysis and performing air mass back trajectory analysis, insight into the different meteorological processes affecting aerosol formation, processing, and abundance in the High Arctic can be identified in more detail. This insight can help to predict how the Arctic will respond to a changing climate.

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