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Sources and Transport of Black Carbon number size distribution at Zeppelin Observatory, Svalbard

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Black carbon (BC) particles originate from incomplete combustion of biomass and fossil fuels. They are known to contribute to the warming of Earth's climate due to radiative effects and aerosol-cloud interactions. The lifetime of sub-micron BC in the troposphere is in the order of days-weeks. Through interaction with other airborne compounds, the hydrophobic nature of BC gradually becomes more hygroscopic and thus available as CCN.

An assessment of the large-scale impact on clouds and climate requires detailed insights about the lifecycle of BC in the atmosphere, understanding sources for BC, transport, transformation, and removal processes. All these processes are tightly linked to particle size, making knowledge regarding how BC distributes over a given size range substantial.

In a previous study we explored statistical methods to attribute BC mass according to particle size (in review). Combining these results with cluster analysis of long term record of aerosol number size distribution (NSD) observations from Zeppelin Observatory it was shown that the method produced reasonable results for a majority of observations. However, the cluster characteristic of NSD associated with high level of pollution presented additional challenges as the methodological approach gave an unrealistic average BC size distribution.

In the current study we focus on these inconsistencies; additional analytical methods are introduced to resolve source-receptor relationships, defining transport characteristics using extensive trajectory analysis. The analysis provides insights of the processes along the travel path to the receptor location and resolves key transport routes for the BC fraction to the Arctic.