2.120 Increased volatility in cloud residuals compared to ambient aerosols.

Early Career Scientist

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Abstract:

Aerosols play a significant role in Earth’s radiation budget, where the direct and indirect aerosol effects result mainly in a net cooling. An important parameter characterizing the aerosol properties is volatility. It provides information about the particle mixing state and composition, and can help to understand the ageing and other processes influencing the aerosol.
In this work, the volatility of ambient aerosols and cloud residuals was studied during the Cloud and Aerosol Experiment at Åre (CAEsAR 2014). A volatility tandem differential mobility analyser (VTDMA) connected to a counterflow virtual impactor (CVI) inlet was setup at Mt Åreskutan (1265 m a.s.l.) located in central Sweden. The station location and meteorological conditions provide a unique opportunity to study air masses of different origin, from clean Arctic to polluted European regions. The combination of VTDMA and CVI inlet enabled the distinction between ambient aerosols and cloud residuals.
Particle volatility was analysed for three different initial particle diameters, 100 nm, 200

nm, and 300 nm. The volatility of the ambient aerosols slightly decreases with increasing size, while cloud residuals do not show such trend and display higher volatility. One possible explanation is that smaller organic molecules, which are more volatile, tend to be more water soluble. However, the volatility of the smallest initial particle size did not reveal any changes for cloud residuals compared to ambient (non-activated) aerosol. The reason for this is still unclear, but it may be related to size-dependent chemical composition. This study will provide new information for resolving the chemistry and physics of aerosol – cloud processing, and for representing these processes in atmospheric models.