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Comparison of two optical particle counters used to measure the insoluble aerosol load in the NEEM ice core

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Insoluble Aerosol particles deposited on the Greenland ice sheet have been identified to originate mainly from East Asian deserts. Information on atmospheric transport times and source strengths can be deduced from the total mass concentration and the size distribution of these aerosols in ice cores. On glacial-interglacial timescales the lognormal mode of the size distribution has been shown to vary between 1.2 and 1.7 μm in diameter and the concentrations can vary up to a factor 100.
Existing Greenland ice cores have the potential of giving this information for the last 120.000 years continuously, when an in-situ analyzer is coupled to a continuous flow analysis (CFA) system. A CFA system consists of a melt head on which the core is uniformly melted and the melt water from the uncontaminated inner part is distributed to be analyzed for various impurities, such as insoluble dust and ionic species.
The attempts made so far to obtain high-resolution insoluble aerosol profiles from ice cores using CFA applied a laser particle counter that used the light attenuation caused by particles flowing through the beam. For this study, a Flow Cytometer has been running in parallel to a laser particle counter on sections from the NEEM ice core that is currently drilled in Northwestern Greenland. Flow Cytometers are widely applied in biological and medical applications and compared to laser particle counters they have the advantage that they are single particle counters. Each hydrosol is focussed into the focal point of a laser by a sheath fluid and the side scatter and widening of the beam are detected.
It is investigated to what extend the Flow Cytometer can add information on insoluble aerosols and circumvent the disadvantages of the laser particle counter, which are the detection limit close to the lognormal mode and the high sample consumption.