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A year round dataset of the aerosol phase function recorded at the high-alpine research station of Jungfraujoch

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The aerosol phase function is an important parameter for radiative transfer calculations in the Earth's atmosphere. It describes the angular distribution of the light scattered by aerosols and varies with the aerosol size, shape and chemical composition. The phase function of aerosols is needed for many satellite and lidar data retrievals but is often not well known. Based on assumed aerosol properties, calculated phase functions are then used instead of measurements, leading to uncertainties in the data process.

A commercially available polar nephelometer (Ecotech PtyLtd), measuring the aerosol phase function, with a 5°-angular resolution, at three wavelengths was installed for one year at the high-alpine research, on top of the Jungfraujoch, (alt. 3580m) Switzerland. The high-alpine research station is a unique place to investigate aerosol properties, as it is most of the time in the free troposphere. As a Global Atmosphere Watch (GAW) station, it is equipped with numerous instruments continuously characterizing the chemical and physical properties of the aerosol. Throughout the year, time periods with air masses originating from the free troposphere, from the planetary boundary layer below the station and long-range transported Saharan dust were measured, resulting in a unique dataset.

The influence of particle size and chemical composition on the aerosol on the asymmetry factor and on the aerosol phase function is here investigated. The asymmetry factor G is defined as the cosine-weighted average of the phase function, where the phase function is the probability of radiation being scattered in a certain direction. However, due to technical limitations, G is currently calculated using the backscattering measurement of a nephelometer rather than the full phase function. A clear difference, changing with the time of the year, was observed between the asymmetry parameter calculated using these two methods (phase function and backscattering measurements), highlighting the need for further investigations.
In addition, a comparison between the phase function measurements and Mie theory predictions is also here presented, based on the measured chemical and physical properties of the particles.