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Starphotometry at two High Arctic stations.

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Aerosols can significantly alter the Arctic's delicate radiative balance, both directly by absorbing and scattering solar and terrestrial radiation, and indirectly by influencing cloud properties through their critical role as cloud condensation nuclei. Aerosol optical depth (AOD), a multi-spectral indicator of the total vertical extinction due to atmospheric aerosols, is one of the most important (aerosol) radiative forcing parameters. During the day, it is traditionally measured using the well-known sunphotometry technique. Night-time AOD measurements at all latitudes are very scarce; this data gap is especially critical in the Arctic where the sun-free Polar winter lasts about 6 months. Recently developed starphotometry techniques based on extinction measurements of bright-star radiation help to mitigate the lack of any type consistent and regular Polar Night measurements.

Two starphotometers (denoted as SP-NY and SP-EU respectively) are currently installed in the Arctic region: at Ny Alesund (Spitsbergen, 78˚55"N, 11˚55"E) and Eureka, Canada (79˚59'N, 85˚56'W). SP-NY has been in operation since 1995 and together with sunphotometry has provided day-night (summer to winter) AOD-derived indicators of multiyear aerosol dynamics at Ny Alesund. SP-EU has been in limited operation since 2008. Key sunphotometry parameters such as multi-band AOD, Angstrom exponent and fine-mode (sub-micron) and coarse-mode (super-micron) optical depth can be derived from the star extinction measurements. It is useful to co-locate starphotometers with other optical and microphysical instruments (zenith-pointing lidars and total sky imagers being examples of the former) as this enables optical consistency checks and correlation analysis between different types of data.

Since Oct-Nov 2010, both starphotometers (and, in the case of Eureka, starphotometer's mount and dome) were upgraded to become essentially identical in the way they acquire and process stars' spectra. We will summarize the preliminary analyses of the AOD measurements acquired with SP-NY in the recent years. We will also present initial comparisons between SP-NY and SP-EU during the 2010-11 Polar winter - the first time both instruments operate simultaneously.