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Characterization of atmospheric pollen with active remote sensing in Finland

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Pollen is a common type of primary biogenic atmospheric aerosol. In addition to the commonly known allergic impact, pollen has also various climatic and environmental impacts. By decreasing the visibility through scattering of sun light, pollen can act as environmental pollutant. Furthermore, pollen can act as ice nuclei (IN) and cloud condensation nuclei (CCN) and thus has impact on cloud formation and cloud optical properties as well.
The standard way to measure pollen is the collection with so-called Burkard pollen collectors which enable the determination of pollen species and their concentration with 2-hour time resolution. In Finland, a network of 9 stations collect pollen samples for further analysis. These traditional methods provide the pollen concentration at ground level but very little is known on the vertical distribution and its optical properties. However, the vertical information is important when modeling the dispersion of pollen.
Aerosol lidars (light detection and ranging) provide vertical information of the atmosphere with good vertical and temporal resolution and can therefore improve our understanding on pollen. It has been observed that the non-spherical pollen grains generate strong laser depolarization, and thus information on particle shape can be retrieved. We have combined measurements with the multi-wavelength Raman polarization lidar Polly^{XT} and the traditional Burkard pollen collector to investigate the optical properties of pollen and to enable a pollen classification with lidar measurements.
Our measurement campaign was carried out in summer 2016 at Kuopio, Finland, providing a dataset of particle optical properties for several different pollen species. These data revealed that certain pollen species show higher depolarization and thus the classification of different pollen species is possible. Additionally, meteorological data and backward trajectories were used to take the meteorological situation and possible long-range transported pollen into account.