Top-down lidar characterization of exceptional dust transport event above the Annecy lake during L-WAIVE in June 2019

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The L-Waive campaign took place over the Annecy lake in France in June 2019. In an effort to better understand the atmospheric structure and the water cycle over lakes, it involved an airborne Rayleigh-Mie lidar, ground-based Raman & wind lidars, as well as airborne measurements of water vapor and its isotopes, and aerosol particle size distribution.

This represented a unique opportunity to study the vertical structuring of the troposphere, which is poorly documented in mountainous regions and particularly in the Alpine valleys. Regular radiosoundings are generally not representative of the low atmospheric layers encountered above the valleys, which are influenced by relief winds. Lidar observations in Alpine valleys have been made in the past using Rayleigh-Mie instrumentation, but during L-WAIVE the ground-based Raman lidar WALI also measured the meteorological parameters of water vapour and temperature. The airborne lidar ALIAS carried by an ultra-light aircraft complemented aerosol measurements, in a coupled top-down inversion approach, highlighting the influence of mountains on different vertical and horizontal scales.

This setup was operational when an exceptional dust transport event overpassed south-eastern France on June 14th, 2019. The origin of this event was shown by HYSPLIT back-trajectories and thermal anomalies computed from SEVIRI as laying in the Grand Erg Occidental, Algeria. An aerosol optical thickness up to 0.8 at 355 nm was measured by the lidar on this occasion, and the instrumental lidar synergy allows to completely characterize the dust plumes in terms of particle extinction, depolarization, relative humidity, and airmass velocities and potential temperature. The dust-perturbated atmosphere will be compared to the background situation where only pollution aerosols are present. The effect of the mountain aerology on the transport will thus be discussed.