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Observations and analysis of tropospheric and stratospheric aerosols layers detected over Lille in summer 2017

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In August and September 2017, Lidar system at LOA (Laboratoire d'optique atmosphérique), observed intensive aerosol intrusions in the Lower Troposphere (LT) and Upper Troposphere/Lower Stratosphere (UTLS). Back trajectories indicate large scales of Canadian wildfires are possibly responsible. In this study, we present measurements from a multi-wavelength Raman Lidar – LILAS, which is able to measure depolarisation ratio at 3 wavelengths. Aerosol layers in both LT and UTLS have been studied. We report several important optical properties estimated from Lidar measurements: the Aerosol Optical Depth (AOD) of the UTLS aerosol layers at 355 nm and 532 nm, Angstrom exponent (AE), mean Lidar ratio (MLR), volume and particle linear depolarization ratio (VLDR and PLDR) at three wavelength (355, 532 and 1064 nm). AOD of the UTLS layer on 29 Aug is up to 0.21 (at 532), which is significant regarding radiative forcing. AE varies from -0.60 to -0.10. Particle depolarization ratio decreases as wavelength increases: 23 $\sim$ 28% (355 nm), 17% $\sim$ 19% (532 nm), 3.5 $\sim$ 5.0% (1064 nm). Measurements in the night of 31 August suggest that the layer in LT has distinctive PLDR ($\sim$5% at 532 nm and $\sim$10% at 355 nm), comparing with layers in the UTLS. Aerosol microphysical properties retrieved from regularisation algorithm [Veselovskiy 2002] suggest particles, from the layers in LT and UTLS, are mostly small particles (radius $< 1\mu$m). Differences in the size distribution and complex refractive indices are revealed. These differences may result from aerosol aging transport, mixing with other aerosol types or different conditions in the transport process. At last, uncertainties resulting from the limitations of methodology and techniques will be discussed.