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Investigating the vertical gradient of ozone in the lower troposphere in Paris using LIDAR

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Ozone is a secondary air pollutant whose surface concentrations are influenced by atmospheric dynamics, such as vertical mixing. Knowledge of ozone vertical profiles makes it possible to address competition between transport and chemistry in the urban boundary layer to account for surface ozone variability. Here, we use four years of ground based LIDAR measurements to understand the seasonal cycle of ozone in the lowermost troposphere in Paris. In summer, ozone is well mixed and exhibits no vertical gradient in the boundary layer. During winter, a strong vertical gradient is observed in the boundary layer, with low ozone values closer to the surface. This points to ozone titration and deposition processes, which account for the observed vertical gradient. In addition, we present results from an intensive campaign (VEGILOT) conducted in September 2014. The campaign focused on understanding the interaction between the free troposphere over Paris and the boundary layer using ozone, wind and aerosol LIDAR measurements. An ozone poor layer is observed at night above the boundary layer. It is reincorporated into the boundary layer in the morning hours and accounts for decreased surface ozone, which was observed on 10 September 2014. We use the regional Weather Research and Forecasting model (WRF) combined with FLEXPART-WRF to show the ozone poor layer over Paris is transported in a low level nocturnal jet (LLNJ) away from Paris to the southwest. Transport of this air mass results in lower surface ozone observed at surface stations in the region southwest of Paris. Future work will address the role of transport, vertical mixing and chemistry on ozone urban vertical gradient and surface ozone in urban influenced regions in order to better estimate the contribution of these processes to the local and regional ozone budget.