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Ozone vertical profiles in the Paris city center during summer 2022 ACROSS campaign.

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Understanding the ozone diurnal cycle at the surface in a Western European city like Paris is still a major issue during summer pollution episodes. Differential absorption lidar (DIAL) O₃ profiles were measured during the 2022 ACROSS summer campaign using the ALTO instrument (Klein et al., 2018). Ozone time evolution from early morning to sunset has been monitored on 26 days from June 13 to July 19, 2022 in order to study the mixing of the nocturnal residual layer with the convective boundary layer during the day.

Such DIAL measurements have been analysed in conjunction with surface O₃ concentrations of the AIRPARIF air quality network, namely the Paris 13 ground station and the Eiffel tower top (320m ASL), of the QUALAIR station at the top of the Sorbonne Université tower (120 m ASL) and with two daily IAGOS aircraft vertical profiles during take off and landing from CDG Paris Airport.

Three measurement periods have been identified when surface O₃ concentrations exceeded 100 µg/m³: case (A) from June 14 to 18 with the largest ozone concentrations recorded during the ACROSS campaign in a well mixed PBL and with advection of a dust layer aloft of the Paris PBL, case (B) with persistent positive vertical O₃ gradient during the day, case (C) corresponding to the O₃ during the onset of a heat wave event in the Paris area.

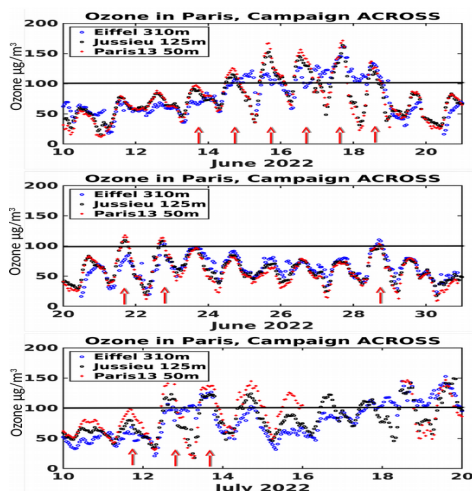


Figure 1. Surface O₃ time evolution at Paris 13 ground station and at the top of two towers, red arrows show the days analyzed with DIAL observations

Two examples of the daily temporal evolution of the ozone profile measured by DIAL are shown in Fig.2 (left-hand column) with in-situ observations (coloured pixel with black cross) at the surface and top of the 2 towers. The regional context of ozone distribution was described using the CAMS model ensemble mean to track the position of the ozone plume around Paris and its recirculation around the city center. The vertical ozone profile from the CAMS simulation (in red) is shown in Fig.2 (right-hand column) for June 16 and 17 during Case A, with the lidar profiles in blue and the IAGOS flight in green.

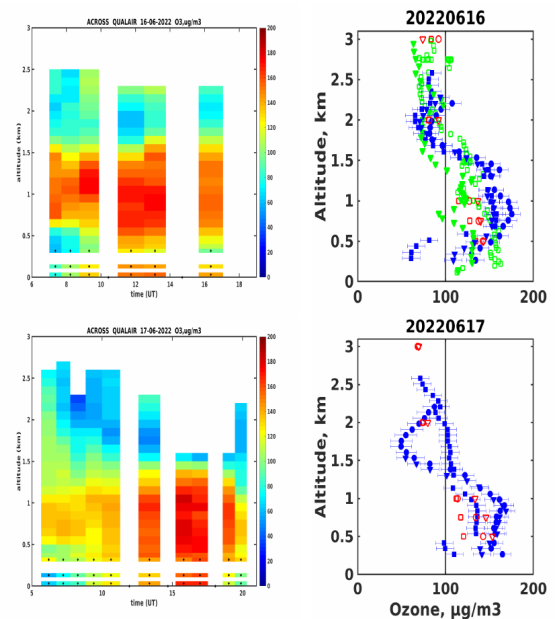


Fig.2: (left) DIAL and in situ (pixel with black cross) O₃ daily time evolution in µg/m³ on June 16 and 17 (right) comparison of O₃ profiles (red) from CAMS simulations for 5 levels at 6UT (□), 12UT (o) and 18UT (▽) with DIAL (blue) and IAGOS (green) O₃ profiles.

Analysis of the three cases show the respective role of regional transport and urban layer dynamical development.

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Klein A. et al., *Atmospheric Environment*, 2017, 167, [10.1016/j.atmosenv.2017.08.016](https://doi.org/10.1016/j.atmosenv.2017.08.016)