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Pollution in Paris assessed using the synergy of IASI satellite and the QUALAIR super-site ground-based observations

Camille Viatte[1], Nadir Guendouz[1], Yongli Wang[1], Gérard Ancellet[1], Anne Boynard[1,2], Sarah Safieddine[1], Julien Jumelet[1], Arjan Hensen[3], Martin Van Damme[4,5], Lieven Clarisse[4], Pierre Coheur[4], and Cathy Clerbaux[1,4]

[1]LATMOS/IPSL, Sorbonne Université, UVSQ, CNRS, Paris, France

[2]SPASCIA, Ramonville-Saint-Agne, France

[3]Netherlands Organisation for Applied Scientific Research (TNO), P.O. Box 15, 1755 ZG, Petten, the Netherlands

[4]Université libre de Bruxelles (ULB), Spectroscopy, Quantum Chemistry and Atmospheric Remote Sensing (SQUARES), Brussels, Belgium;

[5]BIRA-IASB - Belgian Institute for Space Aeronomy, Brussels, Belgium;

Ammonia (NH_3) is an important air pollutant which, as precursor of fine particulate matter, raises public health issues. Ozone (O_3) pollution poses significant challenges for air quality management during summer due to its harmful effects on human health and ecosystem. The increasing occurrence of biomass burning induced by climate change is now identified as the prevalent source of air pollution in many regions of the world.

First, 2.5-years of NH_3 observations derived from ground-based (miniDOAS) and the IASI satellite remote sensing instruments are analyzed to quantify, for the first time, temporal variabilities (from interannual to diurnal) of NH_3 concentrations in Paris. We show that NH_3 concentrations in Paris are driven by sporadic agricultural emissions influenced by meteorological conditions, with a non-negligible source controlled by traffic-related emissions.

Second, we analyze IASI tropospheric ozone data during the ACROSS campaign held in summer 2022 with numerous aircraft flights around Paris and LIDAR observations to monitor the diurnal cycle of ozone in the Paris city center. Several ozone pollution episodes have been encountered during this period. IASI observations in the lowermost column (0-3km) have been compared to aircraft and LIDAR observations, and the Copernicus Atmosphere Monitoring Service (CAMS) model.

Finally, using this instrumental synergy, fire and dust pollution events that occurred in Paris in the last few years are investigated, inventoried and analyzed in time and space to assess their impact on the local air quality.

This study analyzes the complementarity of multiple datasets from space and ground to check the intercomparison potential of the instrumental array and spaceborne validation capabilities featured at the french QUALAIR super-site in Paris city-center. The QUALAIR platform's own infrastructure allows for the co-location of observation resources in order to promote instrumental synergies, which are a key element in the understanding of atmospheric processes.