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Contrasting aerosol composition in and out of Paris plume during the ACROSS campaign at the Rambouillet supersite

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Based on a combination of ground-sites and aircraft observations, the ACROSS (Atmospheric ChemistRy Of the Suburban foreSt) project seeks to better understand how the pollution from Paris affects air quality over large regional scales, particularly through interaction with biogenic species. A field campaign took place in June-July 2022 at three sites: a forested remote site (Rambouillet, 50 km southwest from downtown Paris) a peri-urban (SIRTA) and an urban ones (PRG). The extensive instrumentation deployed at those sites allows to gain insights into the transformation of gaseous and particulate species from local to regional scales. Besides, the Rambouillet site has not only served as a receptor site from Paris plume but also led to detailed observations of freshly emitted biogenic compounds and their role in local chemistry, reactivity, and aerosol properties.

This work focuses on the real-time aerosol composition at the Rambouillet site. High resolution time-of-flight aerosol mass spectrometry sampled air from below (3 m above ground level) and above the canopy (40 m), and has been complemented by a suite of aerosol instruments including PTRMS-CHARON (targeting semi-volatile species above the canopy), and the PEGASUS mobile facility sampling below the canopy. Furthermore, data will be combined with SIRTA and PRG observations for case studies where Paris plume was transported into the supersite, or conversely, clean air masses were first observed at the remote site, and then advected towards the urban area. During the six-week observation period, the average PM₁ (non-refractory PM₁ + equivalent BC) was 8.4 µg m⁻³, with significant variability (10th-90th percentiles of 2.3 and 17.9 µg m⁻³). The

dominant component was organics with an average contribution to PM₁ of 62%, and peak contribution during periods of warm temperature of up to 90%. The organic aerosol was fairly oxidized at the site (average O:C ratio of 0.6), as expected for such an environment, with a negative trend of oxidation with organic aerosol loading, indicating primary or relatively fresh particles contributing the most to polluted episodes. Secondary inorganic aerosols (sulfate, nitrate, and ammonium) represented about 34% of PM₁, with the highest contribution during cold, rainy periods, and equivalent BC only had a minor contribution of about 4%. This presentation aims at providing a large picture of aerosol composition in the Ile-de-France region during the ACROSS experiment.

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