RC3: 'Comment on essd-2025-602', Anonymous Referee #3, 24 Mar 2026

This paper presents 10 years of observational data collected at the Saclay observatory, located 20 km southwest of Paris, including greenhouse gases (CO_2, CH_4), reactive gases (NO_x, O_3, CO), and carbonaceous aerosols (eBC). This dataset is highly valuable for air quality studies in the Paris region.

My comments are as follows:

1. I downloaded and examined the dataset, which spans nearly a decade of air quality observations and is indeed of significant research value. However, as a publicly available dataset, it would be even more useful if the authors could provide a detailed assessment of the associated uncertainties.

Thank you for pointing out this issue, which is indeed important for measurement series. A comprehensive estimation of uncertainties is not always easy, but we have added 3 paragraphs providing the most accurate information possible on the uncertainties of the various measured compounds.

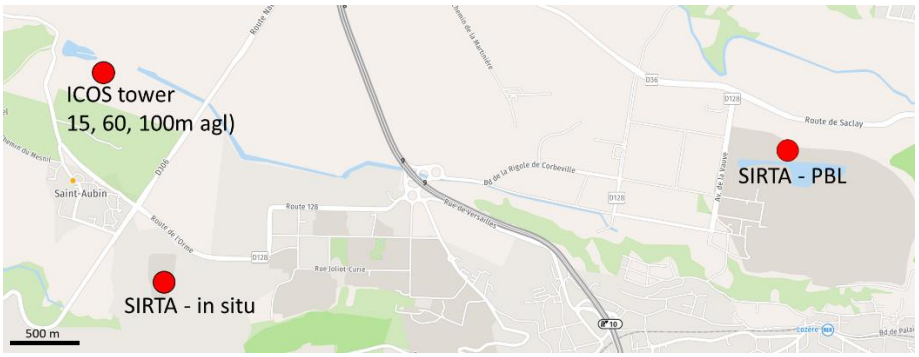
"Daily measurement of the target gas makes it possible to assess the repeatability of the measurements. For measurements taken with the GC between 2012 and 2015, the average repeatabilities are 0.06 ppm, 0.9 ppb, and 1.2 ppb for CO_2, CH_4, and CO, respectively. With regard to measurements performed using a CRDS spectrometer, the repeatability values for the 2016-2022 period are 0.03 ppm, 0.3 ppb, and 1.6 ppb for CO_2, CH_4, and CO, respectively. The measurement of the target gases does not provide a comprehensive assessment of uncertainties, particularly the error associated with the water vapor correction, since the target gases are dry. Regular measurements of air samples analyzed as part of ICOS provide an independent assessment. Based on comparisons between in-situ measurements and air samples, the measurement uncertainty can be estimated at 0.1 ppm, 1 ppb and 3 ppb for CO_2, CH_4, and CO, respectively".

"The ACTRIS CiGas (Centre for Reactive Trace Gases In Situ Measurements) audit conducted at the SIRTA observatory in December 2025 evaluated the performance of NOx measurements, reporting detection limits of 45 ppt for NO and 96 ppt for NO_2 (60 second averaging time). An intercomparison with an independent reference instrument brought by the auditor showed excellent agreement: for NO, the slope was 1.03 with a Pearson correlation coefficient of 0.90, while for NO_2 the slope was 0.97 with a Pearson correlation coefficient of 0.86 (R.Wegener, ACTRIS CiGas, , person. comm.). The uncertainty for NOx mixing ratios is therefore estimated to be below 10%."

"The reliability of BC source apportionment results mainly depends on the alpha values used for liquid-fuel and solid-fuel fractions (Favez et al., 2010). Navarro-Barboza et al. (2024) estimated an overall uncertainty not less than 20%. Given the extensive statistical work carried out at the SIRTA station regarding BC source apportionment (eg Savadkoohi et al., 2025) leading to robust and consistent couple of alpha values, a 20% uncertainty can be applied for BClf and BCsf."

2. Section 2.1 describes the observation site, but presenting this information in the form of a map would improve clarity. I suggest building on Figure 1 by including all sites along with measurement heights and related information in a single, integrated map. Placing Figure 1 within Section 2.1 would also help readers better understand the observational setup.

As recommended, we have moved Figure 1 to Section 2.1, adding a zoom feature to display information about the measurement sites.



3. To investigate the differences between urban and rural environments, the authors introduce the concept of an "urban offset." It would be helpful if the authors could provide a clearer and more explicit definition, including the corresponding calculation formula.

We have clarified the definition of "urban offset" in the section 2.3 :

"*The urban offset is defined as the difference between the fitted curve based on the data selected in the urban sector, minus the fitted curve based on the data selected in the rural sector.*"

4. Figure 4 illustrates the seasonal cycles. The data for June are particularly noteworthy, as several atmospheric composition variables show inconsistent trends. Ozone, in particular, exhibits a somewhat unusual decreasing trend. What could be the underlying reason for this behavior?

There are irregularities in the seasonal variation of certain substances, such as ozone, between April and June, which may be explained by the fact that this is a transitional season marked by rapid changes in numerous parameters, such as temperature and vegetation growth, which can vary by few weeks. It seems difficult to interpret this spring variability and attribute it to a specific process.

5. In the daily data shown in Figure 3, there appear to be many large fluctuations. Could these be due to noise? Have the authors applied any quality control procedures to the dataset, such as filtering or removing certain data points?

The daily averages shown in Figure 3 (black curve) are calculated from all valid measurements, following quality control of the various analyzers (measurements that are incorrect or contaminated by a local contamination at the station are filtered out). These measurements clearly reflect processes at different spatial scales, and in some cases, particularly when wind speeds are low, influences from close sources are evident (e.g., roads, vegetation, etc.). To minimize the influence of such sources in the rural series (blue curve), which is intended to represent background concentrations, the data used are filtered to include only period when wind speed is greater than 4 m/s.

6. Minor issues: In Line 61, "based on wind direction and speed : one" contains an extra space before the colon (should be removed). In the abstract, the atmospheric composition variables should be written in full at its first occurrence, e.g., CO2.

We have done the corrections in the revised version of the manuscript.