

Review of : “Atmospheric ammonia (NH₃) over the Paris megacity: 9 years of total column observations from ground-based infrared remote sensing “

In situ data records of NH₃, especially over a long period, are very rare. This paper presents a nine year dataset of NH₃ total column measurements from an FTIR located in a suburb of Paris. This is a valuable resource for validating NH₃ satellite data and for determining the relationships between satellite and surface measurements. That the data is from one of the largest cities in Europe makes it especially relevant, given that the fraction of the world’s population living in urban areas is increasing significantly, with all the attendant air quality problems. The paper provides both a mostly very clear description of the data and the results of a comparison against the IASI ANNI-NH3-v2.2R product, along with analyses of the seasonal variability captured by the FTIR NH₃ and correlations between the FTIR data and measured PM_{2.5} amounts.

I have many of the same comments posted by Reviewer#1, and will refer to them in the next few paragraphs.

Comment 2: The authors need to confirm that the PROFIT retrievals only provides a scaling factor. As the first reviewer stated, this type of retrieval can be strongly influenced by the *a priori* profile shape; therefore showing a plot of the selected *a priori* profile and comparing it against the *a priori* profiles used in the papers listed is an excellent idea. The authors did test a different *a priori*, but did not state which one and without the plot we suggest it is not possible to ascertain how different it is from the selected *a priori*.

Comments 3 and 4: here I partially disagree with the first reviewer: if the PROFIT algorithm does not retrieve a profile it cannot provide an averaging kernel (AK); the IASI product also does not generate an AK for each observation, though some AKs are available (see van Damme et al., 2014). The authors could use an optimal estimation algorithm (possibly the FORLI code (van Damme et al., 2014)) on a subset of the data in order to obtain an AK that could provide at least a sense of the vertical sensitivity of the OASIS-NH, then compare it to the IASI AK. I leave it to the editor to decide if this exercise is required. It would certainly be useful for interpreting the results.

Comment 5: The section on PM_{2.5} is poorly written and not very informative; it should either be expanded and rewritten or eliminated.

Comment 6: Here I strongly agree that a section on diurnal variability observed by OASIS-NH₃ would be very interesting and useful, since there are large uncertainties in the diurnal cycle. However, it appears the authors will present this analysis in a separate paper. Can they confirm?

Comment on Figure 7: Can the authors explain why the slopes increase with increasing $d_{\min}$, until about 120 km, then decrease again?

Minor edits and comments (suggested changes are in bold)

Lines 13-16: ...infrared remote sensing **from satellites**. ... These methods **measure over large footprints rather than at points, but** are noticeably **Current space-based NH3 data are available from the IASI** ...

Line 19: ...Partnership, **Shephard and Cady-Pereira, 2015**, Dammers ...

Line 28: The authors should contact the IASI team for their estimates of the IASI-NH3 precision and uncertainty.

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Line 9: ...located **in the** Paris suburbs ...

Line 15: Is there any rejection criterion based on weak signals?

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Line 13: ...spectra, so **the degree of freedom for the** ammonia retrievals is 1.

Line 23: ... differences **represented by** the error bars ...

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Line 7: Our analysis is the first comparison of surface NH3 measurements from a megacity with NH3-IASI data and covers seven years of data

Line 26: omit colocation criteria, as it has just been cited above.

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Line 6: ...centered on **the** OASIS ...

Line 8: ... the 15 km width of the rings **was chosen to minimize the impact of ammonia spatial variability and** to maximize ...

Line 11: ...show the **number** of coincident ...

Line 21: ... between the surface and the lower **troposphere and to the spatial variability of the IASI footprint**.

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Line 27: ... its **impact on the concentrations** of fine ...

Line 11: Besides lower sensitivity to the surface ammonia concentrations, spatial heterogeneity within the IASI footprint can lead to lower values.

Line 13-22: These sentences required some rewriting for clarity; my suggestions are below.

This study used the 9 year OASIS-NH₃ time series to focus on seasonal variability of atmospheric NH₃ in the Paris region. The predominance of NH₃ peaks occurring in March is particularly noticeable: all measurements above 2×10^{16} molecules NH₃ cm⁻², which corresponds to the mean of data plus one standard deviation over the springtime period (March/April/May), occur in this month, and are well correlated with manure spreading time periods (Ramanantenasoa et al., 2018).

The sentence below is confusing. It's not clear if mineral fertilizers are applied in spring or summer, and if their application contributes to the March or summer peak.

Mineral fertilizers are mainly applied in Île-de-France region because there are major arable crop (especially cereals) farming areas, which could generate high ammonia concentrations under sunny conditions, when the solar OASIS measurements are performed.

This study also found high summer values above 1.5×10^{16} molecules NH₃ cm⁻², which corresponds roughly to the mean of data plus one standard deviation over the June/July/August time period, which could be due to increased volatility of ammonia under warm meteorological conditions.

