Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-301-RC2, 2019

Atmospheric Measurement Techniques Discussions

Interactive comment on "Atmospheric ammonia (NH_3) over the Paris megacity: 9 years of total column observations from ground-based infrared remote sensing" *by* B. Tournadre et al.

Anonymous Referee #2

Received and published: 21 October 2019

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

Printer-friendly version

Discussion paper

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 PM2.5 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 PM2.5 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 dmin, until about 120 km, then decrease again?

Minor edits and comments (suggested changes are in bold)

Page 3 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.

Page 4 Line 9: . . .located in the Paris suburbs . . . Line 15: Is there any rejection criterion based on weak signals?

Page 6 Line 13: . . .spectra, so the degree of freedom for the ammonia retrievals is 1. Line 23: . . . differences represented by the error bars . . .

Page 7 Line 7: Our analysis is the first compassion 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.

Page 8 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.

Page 9 Line 27: . . . its impact on the concentrations of fine . . .

Page 11 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*1016 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*1016 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.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2019-301/amt-2019-301-RC2-supplement.pdf

---

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-301, 2019.

Printer-friendly version

Discussion paper