Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-945-RC1, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Changes in biomass burning, wetland extent, or agriculture drive atmospheric NH_3 trends in several African regions" *by* Jonathan E. Hickman et al.

Anonymous Referee #1

Received and published: 21 December 2020

The authors aim to explore the drivers of IASI-observed NH3 change from 2008 to 2017 over Africa through spatiotemporal analysis together with IASI CO VCDs, precipitation observations, surface temperature reanalysis data, MODIS burned area data and MODIS cropped area data. The topic is interesting and important. However, major revision is recommended before being suitable for publication due to some unaddressed issues below.

Major comments:

1. While Warner et al. (2017) shows increasing trends of AIRS NH3 across most of Africa from 2002 to 2016, this study shows decreasing trends of IASI NH3 across

most of Africa (except parts of west Africa and Lake Victoria Basin) from 2008 to 2017. In addition, section 3.5 (Figure 8) of this study shows that atmospheric CO, tropical livestock units, crop production and fertilizer N at national scale increased from 2008 to 2017, which seems to support Warner et al. (2017) rather than this study. Those information make me doubt the reliability of the trend analysis (or data processing) in this study. Can you please explain the difference between AIRS-observed NH3 trends and IASI-observed NH3 trends across most of Africa?

2. Line 128-129: "We regridded the Level-2 IASI NH3 and CO products to 0.25o x 0.25o resolution . . .". How did you regrid the data? Did you apply any averaging weight? Like column error? How large is the observation error of IASI NH3? Did you apply any data quality control procedures? Does the number of pixels in each individual grid have large spatial variability? Generally how many pixels are in one 0.25o x 0.25o grid?

Specific comments:

1. Line 36-41: ". . . with increases of over 6% yr-1 in Nigeria. . .South Sudan NH3 VCDs declined by over 2% yr-1. . .". What's the significance level of these trends?

2. Figure 1: please mark the Lake Victoria basin and Nile delta and river, and South Sudan as well as Sudd in the plots.

3. Line 237: ". . .from 2008 to 2017 (Fig. 1d)". I think it's should be Fig. 1b.

4. Line 236-243: How significant are these trends?

5. Line 279-280: Which months are the transition period, dry season and rainy season, respectively?

6. Line 278-288: Please show the trends of satellite NO2 and MODIS burned area during "this transition period" to support your points.

7. Line 291-294: Again, show the trends of observed NO2 VCDs to support your points.

8. Line 321-334: Why do you use such old data from the year 1998 while your target period is 2008 to 2017? All the data in this part is before the year 2008. Do you have any recent data to support your statements? Like sectorial emission estimates from recent bottom-up inventory? What's the percentage change in fertilizer use?

9. Figure 3: I only see significant increases over central Africa and parts of west Africa in Feb and March. For most of Africa during other months, I see more decreases. What's the driver of these decreases?

10. Figure 4: How significant are these correlation coefficients?

11. Figure S3: mark the Sudd box.

12. Figure 5 and Figure 6: It's better to show the standard error of monthly mean NH3 VCDs for each month or each year.

13. Line 670-676: I can't find these two publications online. If they are manuscripts under review, I don't think it's appropriate to cite them here.

a. Line 231: "...(Hickman et al., in review)..."

b. Line 276: "...(Hickman et al., in review)..."

c. Line 281: "...(Hickman et al., in review)..."

d. Line 285: "...(Hickman et al., in review)..."

14. Line 386-407: If the civil conflict is not significantly relevant to the NH3 change in South Sudan, please concise this part. It's better to move the Sudd flood part to previous paragraph (line 354-373).

15. Line 426-428: It's really hard to see the increases in the north and south of Lake Victoria Basin in Figure 3. It's better to make similar plots just for this region.

16. Section 3.5: So, what's the driver of the NH3 declines across those African countries? Did you try the same analysis for temperature, NO2 and SO2 observations?

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-945, 2020.