

Responses to the reviews for the manuscript titled, “Ammonia measurements from space with the Cross-track Infrared Sounder (CrIS): characteristics and applications”.

We would first like to thank the Reviewers for taking the time to review the manuscript as their comments and edits strengthened the paper. Below you will find responses to each of their comments.

Referee #4:

This manuscript by Shephard et al. titled “Ammonia measurements from space with the Cross-track Infrared Sounder (CrIS): characteristics and applications” is well written and very easy to follow. They describe well about the CrIS NH₃ product and demonstrate the capabilities of this product for multiple applications, such as model evaluation and emissions estimates. The manuscript does a thorough job of describing the CrIS NH₃ CFPR algorithm and its various components. The demonstration of the applications of this dataset is also comprehensive and convincing. Overall, I think it is appropriate for publication after minor revision. I have a few specific comments below.

- 1) Page 3, Line 24-25: “higher concentration : : : near the surface. This is demonstrated later in Section 3.2 with model emissions and corresponding simulated surface concentrations.” I think this sentence is not appropriate. The higher concentrations in the model cannot demonstrate the findings from the CrIS since the emissions always emit at the surface level in the model and thus will of course get higher simulated surface concentrations.

The point here is that the spatial patterns in the ammonia emissions and concentration field from the model highly correlated. Thus, regions with higher surface ammonia concentrations are likely regions with higher emissions. This is not always the case, for example longer lived atmospheric species where large concentrations can be significantly far from sources.

- 2) Page 24: The paragraph of introducing the “31-day moving window” is not very clear to me. What is the purpose of developing these daily sets? Why do they choose 31 days? Also, I’m not sure how it helped “better capture the warm season timing of emissions”.

We chose a set of 31 days to have enough observations for an estimate. In most Chemistry Transport Models (CTMs) the emissions are prescribed, with usually a fixed seasonal, daily and hourly variation for the emissions. The daily set is helpful to better constrain the timing of for example the spring peak, following the spreading of fertilizer on fields in spring. Added to the text: “This type of analysis can be used to help better constrain the seasonal and daily timing of emissions over this region.”

Typo:

Page 3, Line 31: Since he -> Since the.

Fixed as suggested.

Page 5, Line 6: Figure A 1 -> Figure

A.1.

To be consistent, for the figures in the appendix changed to removing a space (e.g. Figure A1) and made same in text.