Dear Kang Sun,

We appreciate your comments to improve the manuscript. Below you will find our response in blue and modifications to the manuscript in green.

Page 4, line 108-109: ACE-FTS and MIPAS are not sensitive to the lower troposphere. Nadir remote sensing of ethane is extremely challenging because 3000 cm^{-1} is right at the gap between reflected solar short-wave radiation and emitted earth long-wave radiation. Ground-based SOF is arguably the only way to directly quantify the VCD of ethane. The author may emphasize this point here or in section 3.5.

This is a good point. We will make the gap in observational capabilities in the lower troposphere (in absence of aircraft) transparent in the revised manuscript, and add reference to Streets et al. (2013) in support of the limited satellite sensitivity.

Streets, D. G., et al., Emissions estimation from satellite retrievals: A review of current capability, Atmos. Environ., 77, 1011-1042, 2013.

Line 113-114: However, satellite observations remain not very well validated (Dammers et al., 2016) and satellites quantifying C_2H_6 VCDs are not sensitive to the lower troposphere (Streets et al., 2013).

Page 5, line 114-115: The authors claim that "there currently is no attempt to characterize the sub-satellite ground pixel variability of VCDs for NH_3". The large pixel-scale variability of NH_3 near CAFOs has already been demonstrated by Sun et al. "Validation of TES ammonia observations at the single pixel scale in the San Joaquin Valley during DISCOVER-AQ", DOI: 10.1002/2014JD022846. The value of this work is directly quantifying the VCD without assumptions of vertical profiles.

We agree, and note that our sentence correctly refers to the lack of information about the variability of "VCDs for NH_3". In the revised manuscript, we will mention explicitly that this eliminates assumptions about vertical distributions of NH_3, and allows for a more direct comparison with satellites.

We will also include reference NH_3 validation of TES (Sun et al., 2014) and CrIS (Shephard and Cady-Pereira et al., 2015) using near surface in-situ measurements of NH_3, and aircraft.

Sun, K., et al., Validation of TES ammonia observations at the single pixel scale in the San Joaquin Valley during DISCOVER-AQ, J. Geophys. Res. Atmos., 120, 5140-5154, doi:10.1002/2014JD022846, 2015.

Shephard, M. W. and Cady-Pereira, K. E., Cross-track Infrared Sounder (CrIS) satellite observations of tropospheric ammonia. Atmos. Meas. Tech., 8, 1323–1336, doi:10.5194/amt-8-1323-2015, 2015.

Line 114-115: Previous satellite comparisons have used mobile in situ measurements of NH_3 to characterize the near surface NH_3 mixing ratio variability in the San Joaquin Valley in California, and compare with data from TES (Sun et al., 2015), and CrIS (Cross-track Infrared Sounder) satellites (Shephard and Cady-Pereira et al., 2015). To our knowledge there currently is no attempt to characterize the sub-satellite ground pixel variability using mobile VCD observations of NH_3 and C_2H_6. Mobile VCD measurements eliminate the need for assumptions about NH_3 and C_2H_6 vertical distributions

Conclusion Section: Mobile SOF measurements of trace-gas VCDs are complementary to in-situ observations, eliminate assumptions about vertical distributions, and allow for a more direct comparison with satellites.

Table 6: Eddy-covariance measurements of NH_3 flux have been performed in cattle feedlots just 30 miles away from the CAFOs sampled in this study, but in colder temperature (Sun et al. "Open-path eddy covariance measurements of ammonia fluxes from a beef cattle feedlot", DOI: 10.1016/j.agrformet.2015.06.007). The flux measured in November was 20 m^2/head × 36.7 $\mu g/m^2/s$ = 2.64 g/hr/head, 25% of the summer flux reported in this study. Ammonia flux has also been shown to be highly temperature dependent. It will be interesting to consider the seasonality when comparing to the inventory.

We have added the data point to Table 6, and also added reference to Sun et al., 2015. We agree that temperature as well as seasonal variations in soil conditions are likely contributing factors to explain the differences in NH3 fluxes.

Sun, K., et al., Open-path eddy covariance measurements of ammonia fluxes from a beef cattle feedlot, Agric. For. Meteorol., 213, 193-202, doi:10.1016/j.agrformet.2015.06.007, 2015.

The data will be added to Table 6