Dataset associated with "Enhancements in ammonia and methane from agricultural sources in the northeastern Colorado Front Range using observations from a small research aircraft"

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Abstract. Quantifying ammonia (NH_3) to methane (CH_4) enhancement ratios from agricultural sources is important for understanding air pollution and nitrogen deposition. The northeastern Colorado Front Range is home to concentrated animal feeding operations (CAFOs) that produce large emissions of NH_3 and CH_4. Isolating enhancements of NH_3 and CH_4 in this region due to agriculture is complicated because CAFOs are often located within regions of oil and natural gas (O&NG) extraction that are a major source of CH_4 and other alkanes. Here, we utilize a small research aircraft to collect in-situ 1-Hz measurements of gas-phase NH_3, CH_4, and ethane (C_2H_6) downwind of feedlots during three flights conducted in November 2019. Enhancements in NH_3 and CH_4 are distinguishable up to 10 km downwind of CAFOs with the most concentrated portions of the plumes typically below 0.25 km AGL. We demonstrate that NH_3 and C_2H_6 can be jointly used to separate near-source enhancements in CH_4 from agriculture and O&NG. Molar enhancement ratios of NH_3 to CH_4 are quantified for individual CAFOs in this region, and they range from 0.8 - 2.7 ppbv ppbv^{-1}. A multivariate regression model can be used to attribute the relative contribution of O&NG versus agriculture during the brief study period.

Keywords. ammonia, methane, enhancement ratios, agricultural emissions, concentrated animal feeding operations, oil and natural gas, northeastern Colorado front range, multivariate regression

Synopsis. Airborne enhancements of ammonia to methane from cattle feedlots in northeastern Colorado are variable and larger than prior reported values.

Spatial Coverage. The northeastern Colorado Front Range. Specifically, the geographical area bound between 40.0 °N and 41.0 °N latitude and 103.0 °W and 105.25 °W longitude.

Temporal Coverage. 2019-11-09-2019-11-15

Data file names:

Flight1_2019November09.csv
Flight2_2019November13.csv
Flight3_2019November15.csv

Reported Variables:

Variable	Description	Units
Time (UTC)	time recorded in real time at 1 Hz	seconds
Avlat	latitude of the aircraft	decimal degrees
Avlon	longitude of the aircraft	decimal degrees
Avthead	heading of the aircraft	degrees
Avwdir	Wind Direction	Degrees
Avwmag	Wind Speed	$m\ s^{-1}$
Avzmsl	Altitude above mean sea level	m
Cabinp	Pressure inside the aircraft cabin	hPa
CH4	Methane	ppmv
CO	Carbon Monoxide	ppbv
CO2	Carbon Dioxide	ppmv
C2H6	Ethane	ppbv
H2O	Water	ppmv
NH3	Ammonia	ppbv
RH	Relative Humidity	percent
True Air Speed	True Air Speed of the aircraft	$m\ s^{-1}$
Air Temp	Air temperature outside the aircraft	Celsius