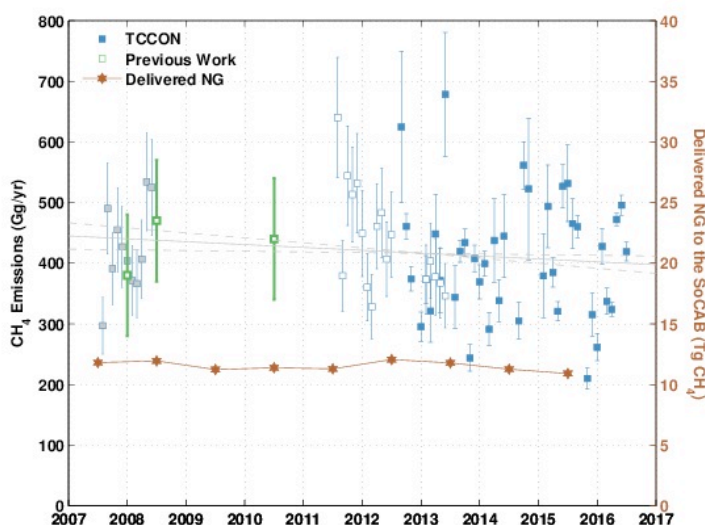


Response to Anonymous Referee #4.

We thank the referee for their valuable comments, which substantially improved the paper.

Referee comments are in *red italics*, our responses are in black text.

*However, some of the conclusions seem to be at odds with another paper currently submitted to ACPD, Wong et al., that concludes that methane emissions in the SoCAB have been decreasing since 2011, albeit with a low confidence interval. Some discussion comparing and contrasting the conclusions of Wong et al. is warranted. For instance, how well does the Caltech FTS represent the entire SoCAB methane emission, compared to the multiple measurement locations described by Wong et al.?*



We went back to TCCON measurements in the SoCAB starting in 2007 to look at longer-term trends in CH<sub>4</sub> emissions. From those data, we compute a very small decrease in CH<sub>4</sub> emissions of  $-5 \pm 4$  Gg/yr, which agrees with the Wong et al.  $-5 \pm 4$  Gg/yr value.

*Line 42, the sampling location of Hopkins et al. and Townsend-Small et al. were heavily skewed toward the western SoCAB. How well do those studies represent emissions to the entire region?*

Added in the introduction that these studies were focused on the western SoCAB.

*Line 110, why do you subtract the daily mean of ethane, CO, and acetylene and not the lowest value?*

We are interested in the daily anomalies, so either method would work. But subtracting off the daily mean has the advantage of producing anomalies with similar values to the Caltech analysis, in which we subtract morning from afternoon values.

*Line 111-113, by aggregating for an entire year, how do you account for this slope not representing the seasonal variability instead of variability due to emissions?*

We remove (to first order) the seasonal variability by computing emissions from diurnal anomalies.

Subtracting the daily means removes the seasonal changes in gas abundances.

***Line 185, is there an earlier reference you could use to support your conclusion that ethane emissions from automobiles would not have accounted for the emissions decline in the late 1980s? The conclusions from the mid-90s on are well supported, but it is unclear they are relevant to the 1980s.***

This is a good point, since many air quality control measures went into place in 1995. However, Kerchstetter et al. note that "... the remote sensors used at the time [of the 1988-1989 study of Bishop and Stedman (1990)] were not capable of measuring VOC or NOx emissions. Thus, the overall effects of oxygenated gasoline or in-use vehicle emissions remain uncertain."

We've added a statement in the revised paper about this:

Thus, emissions from vehicles are unlikely to be either a dominant source of ethane to the SoCAB atmosphere, or responsible for the significant decrease in ethane after 1995. Prior to 1995, there were fewer regulatory controls on air pollution from vehicles, and the exhaust composition is much less well-known [Kirchstetter1996].

Bishop, G. A., and D. H. Stedman (1990), On-road carbon monoxide emission measurement comparisons for the 1988-1989 Colorado oxy-fuels program, Environ. Sci. Technol., 24(6), 843–847, doi:10.1021/es00076a008.

***Line 236, can you confirm with your data that the Aliso Canyon leak did not occur before October 23? There have been some reports of skeptical homeowners questioning that it may have been leaking before this date.***

We see no peaks in our data before October 23, and this is now mentioned in the revised text.

***Line 245, is the ethane emission from Aliso Canyon found by multiplying the 4.28% anomaly by the Conley et al. methane emission of 97.1 Gg? If so, this should be stated more clearly.***

Yes. This has been clarified.

***Line 250, please state which 100-yr global warming potential you used. 25?***

Yes. Clarified in the revised paper.

***Line 262, what is the uncertainty of the 20%? This would help in the comparison with Wong et al.***

This has been removed and replaced by the figure above.

***Line 72, equation 2, a subscripted "dry air" might fit better for the "column dry air", similar to how it is done for the molecular mass?***

Fixed.

***Line 143, Conley et al. state the facility has a capacity of 168 billion cubic feet, and a "working capacity" of 86 billion***

Fixed.

*Line 151-152, Suggest swapping “near the facility” and “from aircraft”*

Done.

*Line 167, change “represents” to “represent”*

Done.

*Line 282, please define “HF”*

Done.

*Figure 4 might look “cleaner” if you used the daily average production for a given month. The variability of the days in a month results in a 3% noise, which is close to the noise between 2003 and 2010.*

This figure has been replaced by one for the Los Angeles Basin, which only has annual values and should look “cleaner”.