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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source apportionment of methane and nitrous oxide in California's San Joaquin Valley at CalNex 2010 via positive matrix factorization" *by* A. Guha et al.

Anonymous Referee #1

Received and published: 18 March 2015

The authors use positive matrix factorization (PMF; a factor analysis method) and a suite of trace gas measurements from the CALNEX campaign during May and June, 2010 to resolve source categories of CH4 and N2O affecting a measurement site near Bakersfield, CA, in the San Joaquin Valley. PMF, combined with the large suite of measurements at half-hourly time resolution, seems to be an appropriate tool for this problem. The main conclusions are that none of the observed enhancements in CH4 come from the oil and gas sector, despite significant activity nearby, and that none of the N2O comes from vehicle emissions, in sharp contrast to California Air Resources Board inventories. Both results are somewhat surprising, but the analysis, as pre-

sented, is convincing. I recommend this paper for publication after the authors address the comments below to the satisfaction of the editor.

General comments:

1. The paper needs editing to reduce excess words and improve clarity of the discussion.

2. Given the strong latitudinal and vertical gradients in CH4, comparison of measurements at Bakersfield and Mauna Loa Observatory are not appropriate. A suitable site at mid-latitudes would be more appropriate.

3. Many experimental details, for example choice of standards, are glossed over. Was the water vapor correction checked experimentally? If so, how? If not, how can you trust it?

4. Lack of benzene measurements seems odd, given the spectrum of VOCs reported.

5. Uncertainties are not used consistently nor treated clearly. It seems odd to state the fraction of total emissions of a gas from a particular source as a range, then give an uncertainty.

6. Information in the introduction should be updated to the most recent IPCC report and original literature should be cited where possible.

7. How is the footprint of the observations affected by differing night and day meteorology? Is it reasonable to lump measurements from both periods? Aren't most of the enhancements coming from nightime build-up of species in the shallow boundary layer when the site's footprint would be much smaller?

8. Are comparisons appropriate of these results for the southern portion of the SJV with CARB inventories for the entire state?

Editing comments:

1. While a space is commonly used between an integer and unit, this is not the case for "%" (and per mil symbol).

2. There are many cases of improper number agreement between subject and verb.

3. When a citation is included in a sentence, remove the parentheses, e.g., "...guidelines set forth by Williams et al. (2010) were adopted to calculate..."

4. Remove excess and unnecessary words, e.g., "in order"; replace "Data points representing enhancement values above the 99th percentile are often extreme data points." with "Enhancements above the 99th percentile are often extreme."; replace "The east–west Highway 58 is located about 0.8 km to the north;" with "East–west Highway 58 is $\sim$0.8 km north;"; "during the nighttime" -> "during nighttime"; etc.

Specific comments:

p6078,l20-22: I am not sure how to interpret the fairly wide range of values for the fraction of CH4 enhancements related to dairy and livestock, with a large uncertainty. Is the uncertainty a relative percentage, or absolute in magnitude? I suggest using a clearer method of stating these fractions, e.g., central value +/- uncertainty (stating the confidence interval).

p6079: If you are going to list GWPs, update them to AR5 values, regardless of whether or not CARB inventories use different values.

p6080,l1: 15% is larger than AR5, which is more like 10%.

p6080,l9: Figure 1 caption indicates 13.4 MMtCO2-eq for N2O.

p6083,l23: Is the wind rose plot only for the period of measurements used?

p6084,l10-11: The meteorology does not result in more significant source contributions at night; emissions are diluted less in a shallower boundary layer.

p6084,l24, and elsewhere: Precision is a qualitative term in metrology, so how did you

determine precision reported here? Is that a general value stated by LGR or was it determined under the field conditions of this campaign?

p6085,l10-11: What are "scuba tank standards"? The important (missing) point is, what standard scales were used, especially for CH4 and N2O, which are compared to other background measurements? Are they comparable, i.e., on the same scales?

p6085, l16: metrology = measurement science; meteorology = atmospheric science. I believe you want to refer to the latter.

p6086, l9-10; PMF does not attribute the weights, the scientist does based on measurement uncertainties.

p6088,l7-8: delete "a period from" and other excess words through out; this time range is different from that given in the abstract.

p6088,l22; "short-duration footprints"? Do you mean small-area footprints? Doesn't this mean that all nighttime enhancements have completely different footprints than daytime samples? Is it appropriate to use day and night data in the analysis?

p6091,l9: earlier you use "collocated", here, "co-located"; if I looked in more detail would I find "colocated" too? Chose one spelling and use it consistently.

p6092,l3-7: I don't know what this 0.9-0.95 (0.82-0.92) refers to? Does it refer to a particular table or figure?

p6092,l17: The comparison with Mauna Loa Observatory (not "station") is inappropriate for CH4. Mauna Loa is in the tropics, far S of Bakersfield, and there is a significant gradient in latitude. There is also a significant gradient in the vertical for CH4. You need to compare with a Pacific Ocean mid-latitude site. This will cut your background enhancement in half, I suspect.

p6093, 4.2: Is the lack of CH4 consistent with Peischl et al. (2013) for the LA basin?

p6094,l2: who concluded...

p6095,l5: delete "in the night"; 2200 makes it clear it is night.

p6095,l6: replace "the reasonably lesser number of" with "fewer".

p6095,l10: delete "factor"

P6095,l23: should that read "CARB"?

p6096,l1: without uncertainties, these values are not comparable.

p6096,l17: what propagation of errors? Where is this procedure described?

p6097,l4: replace "aircrafts" with "aircraft".

p6097,l7: "measured by PMF"? Determined by, assigned by, but not "measured".

p6097,l8"...dominant sources..."

p6097,l13: "feed is..."

p6099,l6-10: Will this PMF analysis work with CO2, which has negative fluxes during the day?

p6099,l14-15: suggest "At night, when the atmospheric dilution is low, monoterpene emissions...

p6100,l6: Fig. 5e, not c, I believe.

p6100,l23: Fig. 5f, not e, I believe.

p6101,l6: myriad = a great number, so "There are a..."

p6101,l28: suggest "that is upwind of the site..."

p6102,l5-6: Is this C, CO2-eq, or should it be gC/gN for CH4/N2O?

p6113: Units (pptv, etc.) are not SI and therefore not appropriate. The units are dry-air mole fraction, so the "v" would only apply if all the gases were ideal, which they are not.

p6119: A distance scale is needed. Also, I suggest adding a box to the inset map designating the large map region, perhaps in place of the county highlight.

P6121: The lack of benzene is striking. Also, as I read it, x- and y-axes are mislabeled in figure caption.

P6122: As I read it, x- and y-axes are mislabeled in figure caption.

p6123: State sampling period in place of "over the entire sampling period".

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 6077, 2015.