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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Top-down estimation of carbon monoxide emissions from the Mexico Megacity based on FTIR measurements from ground and space" *by* W. Stremme et al.

Anonymous Referee #1

Received and published: 15 January 2013

Overall comments:

The authors describe a method of combining several years of ground-based total column measurements and IASI space-based column measurements to determine a top-down CO emissions estimate for the Mexico City metropolitan area (MCMA). This analysis takes the spatial and temporal heterogeneity of the MCMA into account in a novel way. The top-down CO emissions estimate suggests that the bottom-up inventory is too low. This paper should be published after major revisions.

Major comments:

It would be very helpful if every section (especially subsections in section 2) began with

a sentence or two describing the contents of the section and why the data processing step about to be described is important. It is easy to lose the thread of your argument throughout the paper.

I am worried that seasonal cycle or long-term changes may complicate the slope calculated in Fig 3c. Could you address this by subtracting a daily mean (or a daily minimum, or 10am value) from the CO column signal each day to reduce the potential impact of any long-term trends or seasonal cycle changes?

If you scale up the UNAM FTS fluxes under the assumption that the MCMA is well-mixed, by how much do you overestimate or underestimate the emissions? (That is, can you quantify the importance of the heterogeneity in the MCMA?)

Minor comments:

The terms in the equations are not always defined, and this can lead to confusion. Please ensure that all variables are defined.

You mention a MOPITT bias in v3 on P29919. Does this statement hold for v5, where the NIR+MIR retrievals were introduced, increasing sensitivity to surface CO? (e.g. Worden et al. JGR, 2011). If not, an analysis using the MOPITT v5 data may be beneficial to your analysis (an extra two datapoints per day).

P29923L27: Please explain what a "cluster analysis" is.

P29942L24: define "sufficient" in this case

P29943L12: "This indicates that the spatial distribution used in the emissions inventory might be much more inaccurate than the absolute amount reported for the entire region." Could this also mean that your column measurements are more representative of the entire basin than the local emissions?

P29944L9 : How do you get the 17.3 mass ratio from Wunch et al?

P29944L23: Gisi et al. (2012) do not report gases other than CO2 (except for O2,

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which is only used to compute DMFs).

Figure 7: Is this figure necessary, or can it be combined with Figure 3 or 5?

Technical Comments:

Spelling and grammatical errors significantly detract from the flow of this paper. I have tried to list as many of the errors that I can, but this paper should be read through carefully before resubmission.

There is a table of acronyms, but not all acronyms used in the paper are listed. I think they should all be defined in the text once as well.

Abstract: Define UNAM and IASI

P29917L23: on the basin –> in the basin

L24: According to the 2010 census (INEGI, 2011)

P29918L18: Remove "as will be presented in this study"

P29919L13: Define UNAM

P29920L8 : Define MILAGRO

P29921L17: Define MIRAGE - do you mean MILAGRO?

P29922L3 : course –> coarse

L5 : and the Hase et al. (2006) solar background spectral data and model were used.

L6 : This is confusing. Are there two solar trackers on this instrument?

L8 : remove "varying" and "retrieved"

L19: can be used as reference –> can be used as a reference

P29923L8 : Define SMA-GDF

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L14: associated with new emissions mainly –> associated mainly with new emissions.

L16: should be avoided, thus low ventilation (add the ',')

L26: "clean the city" seems a bit strange, consider rewording

L27: We selected low ventilation days using cluster analysis.

P29925L17: remove "rather"

P29926L1 : lager –> larger

L2 : systematic –> systematically

L17: This effect prevents the data from being suitable

L18: remove "not a single but"

P29927L1 : remove "interferometer"

L10: profile retrievals from the ACE-FTS spaceborne instrument (Clerbaux et al., 2008b)

L11: aircraft based profile measurements from MOZAIC

L12: define MOZAIC

L20: remove "realized"

L21: explain what you mean by ill-posed problem

L22: remove "are taken as measurements" and put (TC_IASI) in brackets

P29928L1 : CO distribution mainly depends on the constraint

L7 : I'm not sure what you mean by "on the base of an average"

L10: define epsilon

L13: are prf1 and prf2 supposed to have VMR as a superscript to match the text?

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L21: operated on the profiles

P29929L4 : remove "actually"

L7 : remove the comma between "here" and "that".

P29930L20: an –> a

L20: visible as CO hotspots from the daytime measurements

P29931L9 : contains information about the ith grid point.

L16: by an empirically adjusted

L19: and how consistent the solution is with the a priori

L21: describes the weighting

P29932L1 : replace "realized" with "applied"

L5 : A diagonal matrix constrains the background layer, avoiding problems arising when the background CO column differs...

P29933L18: we iteratively optimized the constraints

L21: while the CO anomaly

L24: Sensibility –> Sensitivity

P29934L5 : The latter can be estimated by

P29935L11: in –> at; no comma after "column"

P29936L1 : mean wind velocity at the ground

P29940L8 : write out "wind direction" and "wind speed" instead of WD/WS

P29941L4 : This sentence is awkward. I'm not sure how to fix it.

L6 : in –> on

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L10: of –> on

P29942L7 : slightly –> slight

L8 : slightly –> slight

L19: CO column growth-rate under low ventilation conditions, and during a reliable time interval to prevent contamination from inhomogeneity (11:15-13:15 LT).

P29943L1 : anual –> annual

P29944L9 : mass ratios –> mass ratio

L19: under –> in

Figure 2 caption: remove "the" before Mexico City.

Figure 4 caption: line5: circle –> diamond, and add "line" after horizontal

Figure 6 caption: The NCAR measurements during the MILAGRO campaign.

The supplementary material has many grammatical errors as well, but given that there are no line numbers, it will be too difficult to write them down usefully for you. My main concern about the supplementary material is section 1.3, which I had trouble following.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 29915, 2012.

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