

The paper under consideration entitled “Analysis of CO<sub>2</sub>, CH<sub>4</sub> and CO surface and column concentrations observed at Reunion Island by assessing WRF-Chem simulations” by S. Callewaert et al. presents in situ and remote sensing data collected at two sites on Reunion Island during two periods in the time frame 2015 to 2017. The authors perform an insightful comparison of the measurements with WRF-GHG simulations.

I have mainly minor comments (listed below). Overall, the paper is very readable: the applied methods are appropriate and the treatment of topics is well structured. Nevertheless, I would recommend that the discussion of those findings the authors would assign the highest importance should be enhanced. Currently, the conclusions read like a long listing of various minor items – all correct, most of them interesting and worth to mention – but altogether leaving the reader somewhat with the impression that the study lacks a scientific focus.

Comments in detail:

Introduction:

Paragraph starting line 33 – this paragraph details a bit on strengths and weaknesses of remote sensing (NDACC and TCCON) and in-situ measurements. The more recent COCCON network should be mentioned here, as it aims to fill in the gap between global and small-scale measurements (allowing arrangements of portable spectrometers for observing dedicated areas of interest as, e.g., metropolitan areas). See

<https://amt.copernicus.org/articles/8/3059/2015/>

<https://acp.copernicus.org/articles/19/3271/2019/>

<https://amt.copernicus.org/articles/14/1047/2021/>

line 54: “near the surface, winds ... originate in” -> “near the surface, air masses ... originate in”

Line 59: “However ...” -> “However, ...”

Line 69ff: Here, WRF studies in the context of city emissions conducted by other groups should be mentioned here as well, e.g.,

<https://acp.copernicus.org/articles/19/11279/2019/>

<https://acp.copernicus.org/articles/21/13131/2021/acp-21-13131-2021.pdf>

Paragraph starting line 128: this explanation has some redundancy (FTIR observations ... providing mole fractions in an atmospheric column ... . The spectra are used ... to retrieve the total column-averaged dry-air ...)

Paragraph starting at line 147: The authors correctly stressed earlier the tying of TCCON results to WMO standards. The systematic error budget of NDACC vs TCCON should be mentioned here explicitly (as both data sets are mixed together later in the discussion) – which amount of bias between the two remote sensing data sets might be expected?

Line 309: “agree less” -> “agree less well”

Figure 6 and associated discussion: Given the elevated altitude of the MA station, it might be worth to appropriately filter the in-situ data (selecting those data which are sampling free tropospheric air) and specifically discuss the resulting subset, see a study following this approach for the Izaña station on Tenerife here: <https://amt.copernicus.org/articles/7/2337/2014/>

Para starting line 373 discussing long-range transport. The findings reported by Frey et al. for the Gobabeb station (see section “influence of African biosphere”) might be of special relevance here: <https://amt.copernicus.org/articles/14/5887/2021/>.

Statement line 380: Does this imply that remote sensing measurements are more useful than in situ measurements for studying long-range transport (possibly also reflected by the fact that lower model resolution is sufficient for achieving good correlation between model and measurements)?

Line 391: “in more details” -> “in more detail”