

Interactive comment on “Atmospheric CO and CH₄ time series and seasonal variations on Reunion Island from ground-based in-situ and FTIR (NDACC and TCCON) measurements” by Minqiang Zhou et al.

Anonymous Referee #1

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The paper by Zhou et al reports ground based data from two measurement sites in the Indian Ocean, namely Maito and St Denis, both located on La Reunion Island. The datasets, from the NDACC and TCCON networks, are analysed for CO and CH₄ columns, and then the X_{CO} and X_{CH₄} mole fractions are computed (TCCON via O₂, and NDACC via pressure). These data are compared with in-situ vmr data of CO and CH₄ from Picarro instruments. St Denis has the full range of NDACC, TCCON and in-situ instrumentation, while Maito does not have a TCCON instrument. These data are then compared with model data from GEOSCHEM.

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The datasets are described for each instrument, their respective measurement details and analysis procedures, and the information content of the column data is discussed in terms of the FTIR data. A comparison between the FTIR data and in-situ data is first described in terms of methodology. Tropospheric components are developed based on partial columns from the NDACC data, while a stratospheric N₂O based method is used to obtain the equivalent TCCON tropospheric product. The paper does a good job to describe the instrumentation, what to expect from each dataset (the FTIR's in particular), the limitations of FTIR technique in terms of the information content and how this can be managed to compare the remote sensing data with both in-situ data and model output.

The discussion part gives a good account of how these quite different measurement techniques can still produce useful comparisons even though at first glance they are sampling different parts of the atmosphere and are indeed influenced by different air-masses. Via the use of models (both GEOSCHEM and FLEXPART), they are able to tease out a nice coherent picture of how land masses and the oceans play a part in the observed behaviour of CO and CH₄ on short to medium time scales.

In general the paper is well written and quite clear in its purpose, outline, methods, discussion and conclusions. There are only a few relatively minor points to correct, but the paper is scientifically sound. Below is a short list of corrections and comments for the authors to consider.

- 1). Page 1, line 19; “by the vertical transport” => “by vertical transport”
- 2). Page 2, line 2; “CH₄ of” => “CH₄ trend of”
- 3). Page 2, line 14; reference missing
- 4). Page 2, line 31, “to measure” => ”of measuring”
- 5). Page 3, line 31; “labellisation” is a French word. The equivalent English word is "labeling", but in this context the word should probably be "certification"

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- 6). Page 4, table 1 caption; insert space between random and uncertainty
- 7). Page 4, table 1 caption; why would TCCON to in-situ validation set the systematic uncertainties to zero. Would this not actually quantify the uncertainty?
- 8). Page 4, line 16; “provide a continuous” => “provide continuous”
- 9). Page 5, line 9; “range or the” => “range of the”
- 10). Page 9, line 26; “to a year-to-year” => “to year-to-year”
- 11). Page 10, line 4; if this is the statistical standard deviation, then should this be written as 15+/-10?
- 12). Page 10, line 11; “is a also” => “is also a positive”
- 13). Page 13, line 14; There are a few instances of the phrase “layers’ information”. The copy editors might correct me but a apostrophe after the word is used in the possessive noun case. The word layer is not a noun. So should read "layers of ".
- 14). Page 18, figure 11 top left; “partical” => “partial”
- 15). Page 18, line 5; “kernels such as to” => kernels to”
- 16). Page 19, line1; “we tested by using”? We tested what exactly? Subject of sentence is missing.
- 17). Page 19, line 2; “and without smoothed model” => “and unsmoothed model”
- 18). Page 19, line 5; “than the one without” => “than the Xch4 without”
- 19). Page 19, line 17; “air particles over” => air parcels over”
- 20). Page 20, line 17; “systematically larger than the CO”. This does seem reasonable but can this be quantified in someway. Is it a 5% or 20% effect? Is it always higher or just is there are biomass burning plumes for example.
- 21). Page 20, line 19; “the one” => “the trend of”

22). Page 20, line 29; “by the vertical” => “by vertical”

23). Page 21, line 7; “which could be obtained” => “which can be obtained”. Just assuming that you do really want to release the data, yes?

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