

## ***Interactive comment on “Contributions of the troposphere and stratosphere to CH<sub>4</sub> model biases” by Zhiting Wang et al.***

### **Anonymous Referee #2**

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This paper evaluated posterior atmospheric CH<sub>4</sub> concentrations from three inverse models using in-situ, TCCON and satellite observations. The results show systematic model biases at troposphere and stratosphere, which could adversely affect the assimilation of total column data. Overall the paper is well written, and their results are interesting. It should be accepted for publication after minor revisions.

Major comments: 1. The paper is focused on model evaluations. But no necessary detail on these models such as the surface CH<sub>4</sub> fluxes, meteorological fields, model resolution, and chemistry scheme are presented (although references are provided), or are used to explain their different performances (for example Figure 3).

2. Biases in GOSAT retrievals, and their implications on the model evaluations have not been discussed by the authors. GOSAT XCH<sub>4</sub> has not been fully validated (particularly)

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over tropical regions, and could itself have latitude-dependent bias as well. I suggest the authors use more recent version of GOSAT XCH<sub>4</sub> retrievals (such as OCPR v7) as well. Minor comments: 1. Line 37, Page 1: ‘...6.2+/-11.2’ ppb in the stratosphere ...’ The notation of +/-11.2 ppb may be mis-leading, as in this case the ‘amplitude’ as defined by the authors could not be negative.

2. Figure 1: Caption and main text does not provide necessary information, for example, the information about IMECC, and aircore data etc.

3. Line 6, Page 4: ‘...infers dry air columns from the CO<sub>2</sub> columns retrieved from the same spectra as used in the CH<sub>4</sub> retrieval’

The sentence is not clear, and no mention of model CO<sub>2</sub> concentrations, which is one of the possible sources for biases in GOSAT proxy XCH<sub>4</sub> data.

4. Line 14, page 4: ‘...F07\_10 data are applied and measurements with less than 1.4 DOFS are filtered out.’, More detailed information such as the observation coverage and errors will be helpful.

5. Line 30, Page 5: ‘...Figure 3 shows yearly and seasonal median model biases scaled by the fraction of the air column in the troposphere and stratosphere. ...’

I suggest adding the number of the TCCON observations at different months to the plot. Also it is interesting to know whether TCCON retrievals have biases depending on the solar zenith angles.

6. Line 5, Page 6: ‘...one can see that the latitudinal pattern of model biases in total column-averaged CH<sub>4</sub> results from both the stratosphere and troposphere for ...’ Some explanation of different performances of the three models shown in Figure 3 in terms of surface fluxes, transport or chemistry scheme will be helpful.

7. Line 20, Page 6: TCCON and in situ sites are selected to be located close to one another so that both instruments measure similar airmasses ...’

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The TCCON and in-situ measurements have different measurement frequencies. For example, availability of TCCON data usually has strong seasonal variations. How will these differences affect the results presented in Figure 4?

8. Table 3: typo: The latitude of the Lauder TCCON site should be -45.038.

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