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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Changing characteristics of atmospheric CH_4 on the Tibetan Plateau, records from 1994 to 2017 at Mount Waliguan station" *by* Shuo Liu et al.

Anonymous Referee #1

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review of manuscript acp-2020-481

Title: Changing characteristics of atmospheric CH4 on the Tibetan Plateau, records from 1994 to 2017 at Mount Waliguan station Authors: Shuo Liu et al.

General comments: The manuscript presents an analysis of 24 years of continuous in-situ ground-based methane observations at the remote Mount Waliguan station in China. Such records are very essential for monitoring atmospheric variability and trends of this important greenhouse gas. It is challenging to keep those observations up and running for decades. Thus, I fully support publication and release of these data. However, the analysis of the data is very descriptive and lacks conclusive statements.

There is hardly any novel insight into the CH4 cycle, which is currently drawn from the analysis. Several filters are applied to the data but it is difficult to follow how the filters are applied and which filtered dataset is used in which analysis. The paper may profit from merging chapter 3 (Results) and chapter 4 (Discussion). Moreover, the paper contains quite a number of linguistic flaws. Proofreading by an English native speaker is necessary. Some language mistakes are listed below. The paper is within the scope of 'Atmospheric Chemistry and Physics' but – to my mind – requires major revisions prior to its acceptance for ACP. See my specific comments below.

Specific comments:

Abstract is rather long, you may consider shorten it.

Lines 18-19: write "A 24-year long-term record of atmospheric methane (CH4) measured in-situ at the Mt. Waliguan station, the only . . ., is presented."

Line 20: ". . . 1994-2017 . . .": why don't you use more recent data (e.g. until end of 2019)?

Line 20: "continuously" need to be "continuous"

Lines 20-22: "continuous increase" but "even negative growth trend . . . in particular periods" is a contradiction.

Lines 24-25: "but unprecendeted elevated ∼100 ppb" sounds awkward

Line 24: ". . . historic high of 1903.8 ± 0.1 ppb in 2016 . . ."; what about 2017?

Line 26: what does "ΔCO/ΔCH4" mean? Why do you look at CO to CH4 ratios?

Line 27: add "elevated" that is reads ". . . opposite to other elevated sites . . ."

Line 30: "(the Northern India)" -> "(Northern India)"

Line 35: delete "What is interesting" I do not believe that you want to mention uninteresting things in the abstract of your manuscript.

Line 47: "anomalously" -> "anomalous"

Lines 47-49: If this statement is presented prominently in the abstract, it also needs to be discussed in the manuscript. Moreover, when looking at Fig. 11 (lower panel), I do not really see an increasing growth rate (but only a mostly positive growth rate).

Line 60: write "CH4 has an 8-12 years lifetime . . ."

Line 64: ". . . CH4 rapidly increased . . ."

Lines 65-66: write "Results from ice core analyses in Antarctica showed . . ."

Line 67: write ". . . has reached a level unprecedented over . . ."

Line 68: awkward English

Line 71: delete "special"

Line 73: write ". . . (Nisbet, et al., 2019) followed by a renewed CH4 increase since then".

Line 78: don't start a sentence with "And . . ."

Lines 78-79: write "unexpected" instead of "not expected"; why the increase is "unexpected"?

Line 84: explain "C.E."

Line 85: write "Atmospheric CH4 is mainly . . ."

Lines 105-106: write "Systematic observations are a prerequisite to get an accurate understanding of spatial and temporal behavior of atmospheric CH4 concentrations."

Line 113: awkward English

Lines 114-118: There are many more stations continuously measuring CH4 levels in the atmosphere; why did you select these ones?

Lines 118-127: this is largely a repetition, merge with paragraph on the previous page (lines 85-104).

Lines 146-147: write ". . . which is the longest record in China."

Lines 157: write "WLG is the only . . ."

Line 158: write ". . . and is run by the China Meteorological Administration . . ."

Line 166: "Tibetan Plateau"

Line 167: "dial variations . . . are influenced . . ."

Line 221: write ". . . were flagged as locally influenced."; if the data are locally influenced they are poorly representative.

Lines 220-225: add percentages of rejection according to the individual filters.

Line 224: "We filtered CH4 data into local events . . ." sounds strange, how can you filter data into events?

Line 226: write "hourly CH4 data was binned into 16 horizontal wind direction classes . . ."; is this done for all data or the regionally representative data only?

Lines 235-236: elaborate on HYSPLIT: what's the spatial resolution of the model, what is the height above sea level of WLG in the model?

Line 239: write "The trajectories for January, April, . . ."

Line 285: "appropriately every five years a period" sounds strange.

Results and Discussion chapters (Chapters 3 and 4): I strongly encourage the authors to merge these two chapters. Results should be discussed in stronger conjunction with existing literature, preferably from Asian sites; I don't see the rationale why some findings are compared with conclusions from non-elevated sites in Europe.

Lines 297-298: awkward English

End of Chapter 3.1: interpretation/conclusion missing.

Line 315: "As observed by the previous short-term observations"; I don't understand this statement.

Line 326: Delete "What interesting is"

Line 345: Write "It's obvious that CO showed . . ."

Line 348: write "when percentages ranged from 0 to 40."; write "When data exceeded the 60% percentile, the high area probability areas . . ."

End of Chapter 3.2: interpretation/conclusion missing.

Line 365: awkward English

Lines 368-369: awkward English

End of Chapter 3.3: interpretation/conclusion missing.

Line 389: write "regionally representative"

Line 390: write ""locally influenced"h

Line 391: "data was . . . larger than . . .. events"; awkward English

Line 394: Does it hold true for all data or regionally representative data?

Line 396 (reference to Fig. 7): I suggest to move Fig. 7 above and make it to Fig. 2; show first the whole dataset before you analysis of the data

Line 402: what is deltaCO and deltaCH4? I assume it is excess CO and excess CH4, i.e. data above baseline (looks like when looking at Fig. S1); if so, how was the background determined? Please elaborate; show also the CO time series.

Line 411: incomplete sentence.

End of Chapter 3.5: what do we learn from the different deltaCO to deltaCH4 ratios?

Lines 415-419: this is a different filtering than the one described above, right? Move these lines to Chapter 2.3.

Line 426: write ". . . the seasonal averages of regionally representative CH4 were . . ..."; do these numbers relate to regionally representative data?

End of Chapter 3.6.1: interpretation/conclusion missing.

Line 442: write ". . . growth rates were very small or even negative . . ."

Lines 466.468: How is this filtering exactly done? Please explain. How many data (in %) are remaining?

Line 481: "no significant trend was found . . ." what does that mean? How do you interpret this finding?

Line 495: Write "WLG was increasingly affected by local sources . . ." which ones are these?

Line 500: ". . . higher CH4 . . . in past years"; which years, be more explicit.

Line 505: this statement is trivial as Zhou et al. used the same data, right?

Line 509: ". . . which could emit large amount of CH4 by human activities"; write "large amounts"; statement is very vague, can you be more specific?

Line 512: write ". . . may also contribute to the high CH4 . . ."; statement is very vague, can you be more specific?

Chapter 4.1 misses quantitative statements; what's new compared to existing literature?

Line 530: "It was possibly due to . . ."; very vague statement, can you be more conclusive?

Line 536: "the southwest or northwest region . . . may be also strong source regions"; very vague statement.

Line 540-542: awkward English; no conclusive statement.

Lines 544-545: add reference.

Line 556: "It is of great possible . . ." awkward English

Line 573: Hateruma Island is at sea level, why do you compare WLG with this station?

Line 582: awkward English

Chapter 4.2 is very descriptive and lacks conclusions

Lines 592-597: move in front of line 591.

Line 602: start station names with upper case letters; why do compare with these stations, which have different characteristics.

Line 611: why is the photochemical capacity weak? I would expect a high photochemical activity.

Lines 630-631: numbers were already given in lines 454 ff.; repetition won't be needed if Results and Discussions are merged.

Lines 644-645: why do you compare with a Swiss site? You may compare with composite numbers, e.g. from the WDCGG data summary report (most recent version is #43); downloadable on the WDCGG webpage.

Lines 656-657: are the conclusions drawn for the Swiss site also true for WLG?

Lines 658-680: this paragraph may better fit into the introduction.

Lines 691-692: "suggested that there were possibly other strong CH4 sources . . .": which ones? The following lines do not provide any answer.

Line 702: "due to the emission from the two largest source regions": be more specific.

Lines 704-705: I don't understand what wants to be said here.

Line 705: "anomalously" -> "anomalous"

Lines 706-707: how about trends in other regions in the world? This statement is the same as in the abstract and I still don't understand it. This is rather a statement that fits to a synthesis analysis as it is e.g. done in the annual WMO GHG bulletin.

Lines 722-723: ". . . the long-term verification is extremely important to . . . understand CH4 variations . . ."; did the understanding improve based on the present analysis? Which are the lessons-learnt?

Lines 725-726: "Tibetan Plateau was with the highest average altitude . . ." awkward English.

Line 727: "anomalously" -> "anomalous"

Data availability statement: very strangely, this paragraph only refers to the data from the other stations but nothing is said how to access WLG data. The data used in the analysis doesn't seem to be freely available since WDCGG only contains daily and monthly CH4 averages from WLG; where can anybody access hourly CH4 data from WLG?

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