

## ***Interactive comment on “Space-borne observation of methane from atmospheric infrared sounder version 6: validation and implications for data analysis” by X. Xiong et al.***

**Anonymous Referee #1**

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The paper describes the results of the work performed by the authors to improve the inverse processing of AIRS/AQUA spectral radiances and the validation of AIRS-V6 retrieved profiles of methane against collocated airborne measurements acquired in different field campaigns. A thorough analysis is conducted using a large set of temporal and spatial coincidences between satellite and aircraft data, thus providing a sound basis to evaluate the effects of improved features introduced in the retrieval of CH<sub>4</sub> vertical profiles with respect to previous versions (i.e., higher number of retrieval layers, further optimisation of channels selection, damping parameter adjusted accordingly, etc.). Despite the quality of the presentation of the optimization of quality control and of

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the results and discussion is not always as clear as desirable and missing details prevent somewhere to follow the adopted procedures for data comparison and testing of AIRS-v6 CH<sub>4</sub> products, the overall scheme appears reasonable and effective to derive conclusions about a key atmospheric target as methane.

Even if I do not have any major remarks, I firmly recommend at least:

- To indicate the meaning of the values attributed to AIRS quality flag before using this flag in the discussion of the results and in other sections of the paper.
- To clarify the meaning of the term “a-priori” reported in parenthesis after the term “first-guess profile” (see page 9, line 7, in section 2). Do the authors mean, they have used the same source of data for both the first guess and a priori profile? Or what else?
- The use of the terms “obvious” and “obviously” appears to be inappropriate or misleading throughout the paper. Could you please elucidate the exact meaning in the different contexts or directly replace them with a more suitable terms (e.g., “evident” rather than “obvious” or “clearly” rather than “obviously”)?

Minor corrections I suggest to the current version of the paper before publication are also listed here below:

- Page 2, line 8: the expression “some characterizations” is too general and uninformative. I recommend replacing it with a different formulation conveying at least some specific information.
- Page 3, line 9: change “significant” to “significantly”.
- Page 13, line 1: change “in-situ” to “in situ”; I suggest to use the same notation in other parts of the paper (i.e., in situ, rather than in-situ or in-situ (in italic)).
- Page 13, line 9: change “as well their relationship” to “as well as their relationship”
- Page 14, line 16: change “spectrometer which” to “spectrometer, which”
- Page 15, line 20: change “CH<sub>4</sub>” to “CH<sub>4</sub>”.
- Page 17, line 9: change “In this paper we used” to “In this paper, we used”.
- Page 18, line 5: I suggest replacing “obvious oscillation” with “evident oscillation”.

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Page 18, line 8: change “a big “bump” of over 1950 ppb” to “a big “bump” over 1950 ppb”. - Page 18, line 9: change “400 hPa but a low value” to “400 hPa, but a low value” - Page 18, line 15: the statement “From the experiences we learned from this validation study, the quality flag for a retrieved profile that has the quality flag as 0 or 1 but does not pass the following two tests needs to reset to 2:” is not easy to read. I suggest rephrasing it in a more linear manner (e.g., the quality flag of a retrieved profile equal to 0 or 1 shall be reset to 2, if the profile does not pass the following two tests). - Page 20, line 11: change “firstguess” to “first guess”. - Page 20, line 12: change “Below 400 hPa the bias is less than 0.5% and RMS error is less than 1.5%, and” to “Below 400 hPa the bias is less than 0.5%, the RMS error is less than 1.5% and”. - Page 20, line 15: change “(Figure 6b) we can see” to “(Figure 6b), we can see”. - Page 20, line 20: change “Here we” to “Here, we”. - Page 22, line 5: change “AIRS retrievals with collocated” to “AIRS retrievals and collocated”. - Page 23, line 23: change “from different campaign” to “from different campaigns”. - Page 23, line 10: change “this is part of reason why” to “this partly explains why” - Page 26, line 4: change “micron which” to “micron, which”. - Page 26, line 4: change “altitude(Xiong” to “altitude (Xiong”. - Page 26, line 6: change “propagation since” to “propagation, since”. - Page 26, line 6: change “impact to the retrieval” to “impact the retrieval”. - Page 26, line 11: change “miss-match” to “mismatch”. - Page 26, line13: change “but over land” to “over land”. - Page 26, line 13: change “sources, this error” to “sources this error”. - Page 26, line 16: change “Here we” to “Here, we”. - Page 26, line 16: change “relationships” to “relationship”. - Page 27, line 18: change “Examination to the correlation” to “Examination of the correlation”. - Page 28, line 4: change “reflect” to “reflects”. - Page 28, line 5: change “include” to “includes”. - Page 29, line 5: change “liner” to “linear”. - Page 29, line 11: change “include” to “includes”. - Page 29, line 14: change “( above” to “(above”. - Page 29, line 21: change “number retrieval profiles” to “number of retrieved profiles”. - Page 30, line 12: change “show” to “shows”. - Page 30, line 16: change “cover when” to “cover, when”.

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Interactive comment on Atmos. Meas. Tech. Discuss., 8, 8563, 2015.

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