Interactive comment on “Channel selection method for hyperspectral atmospheric infrared sounder using AIRS data based on layering” by Shujie Chang et al.

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Received and published: 16 November 2019

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Dear Referee #4, We thank you for your review of our manuscript and your detailed remarks. We would like to improve the article here in an immediate reply. Please, find our answers/comments on your notes below:

(1) L1-3: I would like to suggest to streamline the title a bit, e.g., “A channel selection method for hyperspectral atmospheric infrared sounders based on layering”. Perhaps the reference to the AIRS instrument can be neglected in the title as the method will be applicable to other instruments, too? Yes, we agree with you. The method will be applicable to other instruments. Your suggested title “A channel selection method for hyperspectral atmospheric infrared sounders based on layering” is more proper. This has been modified.

(2) L22-24: The statement “The distribution of the temperature weight function is more continuous, more closely approximating that of the actual atmosphere” is unclear to me. Do you mean the coverage or sensitivity of the weighting functions is more evenly distributed over height with this method? Sorry about this. The statement has been rewritten. “The coverage of the weighting functions is more evenly distributed over height with this method and closer to the actual atmosphere” (L 22-L 24)

(3) L28: The term “near space layer” is not commonly used, I think. I would suggest to rephrase it by “stratosphere and mesosphere” here and in other places of the manuscript, for clarity. Yes, you are right. “In the near space layer especially” has been modified to “In the stratosphere and mesosphere especially”. (L 28)

(4) L31-35: The acronyms ICS, NCS, and PCS need to be introduced in the abstract Sorry for my carelessness. In abstract: “In general, the accuracy of the retrieval temperature of ICS is improved. Especially, from 100 hPa to 0.01 hPa, the accuracy of ICS can be improved by more than 11%; (3) Statistical inversion comparison experiments in four typical regions indicate that ICS in this paper is significantly better than NCS and PCS in different regions and shows latitudinal variations.” (L 31-L 37) This has been modified to “In general, the accuracy of the retrieval temperature of ICS (Improved Channel Selection) is improved; (3) Statistical inversion comparison experiments in four typical regions indicate that ICS in this paper is significantly better than NCS (NWP Channel Selection) and PCS (Primary Channel Selection) in different regions and shows latitudinal variations” (L 31-L 36)

(5) L 50-55: The word “detection” is frequently used in the manuscript, but considering that you are

C1

C2
referring to temperature, I would recommend to change this to “sounding”, “observation”, or “measurement” in most instances. Yes, you are right. This has been modified as follows. “...satellite detection technology has developed rapidly” has been modified to “...satellite observation technology has developed rapidly” (L 40-L 41) “From the perspective of vertical atmospheric detection, satellite instruments are developing rapidly. In their infancy, the traditional infrared detection instruments for detecting atmospheric temperature and moisture profiles ...” has been modified to “From the perspective of vertical atmospheric observation, satellite instruments are developing rapidly. In their infancy, the traditional infrared measurement instruments for detecting atmospheric temperature and moisture profiles ...” (L 47-L 50) “... in terms of detection accuracy ... filter-based spectroscopic detection instrument, therefore, ...” has been modified to “... in terms of observation accuracy ... filter-based spectroscopic measurement instrument, therefore, ...” (L 55-L 61) “... such advanced detection technologies. ... techniques of hyperspectral resolution atmospheric detection.” has been modified to “... such advanced sounding technologies. ... techniques of hyperspectral resolution atmospheric observations.” (L 72-L 75) “observation data” has been modified to “detection data” (L 80) “... the general satellite detection instrument” has been modified to “... the typical satellite instruments” (L 85) “With the development of detection technology ...” has been modified to “With the development of measurement technology ...” (L 88-L 89) “temperature detection” has been modified to “temperature observation” (L 91; L 530; L 547; L 701-L 702; L 777-L 778; L 835) (6) L 61-62: Can you add a more recent reference regarding “today’s needs” of NWP? Eyre et al. (1993) is more than 20 years old. Sorry for my carelessness. Two recent references have been added to “(Eyre et al., 1993; Prunet et al., 2010; Menzel et al., 2018)” (L 59) “Menzel, W. P., Schmit, T. J., Zhang, P. and Li, J.: Satellite-based atmospheric infrared sounder development and applications, Bull. Amer. Meteor. Soc., 99, 583–603, https://doi.org/10.1175/BAMS-D-16-0293.1, 2018.”

(L 974- L 977) “Prunet, P., Thépaut J. N., and Cass, V.: The information content of clear sky IASI radiances and their potential for numerical weather prediction, Q. J. Roy. Meteor. Soc., 124, 211-241, https://doi.org/10.1002/qj.49712454510, 2010.” (L 978- L 981) (7) L 70-72: IASI became operational in 2007 and not in 2010. Yes, you are right. This has been modified to “The United States and Europe, in 2010 and in 2007, also installed the CRIS (Cross-track Infrared Sounder) and the IASI (Inter-Attractive Atmospheric Sounding Interferometer) on polar-orbiting satellites” (L 68-L 71) (8) L 129-130 and L 140-142: Which instruments are you referring to here? AIRS has more than 2000 channels. Yes, you are right. AIRS has more than 2000 channels. We are sorry for the confusion. This has been modified as follows. “Richardson et al. (2010) analyzed the Shannon information content and degrees of freedom in channel selection when retrieving CO2 concentrations using thermal infrared remote sensing and indicated that 40 channels could contain 75% of the information from the total of 1016 channels.” has been modified to “Kuai et al. (2010) analyzed both the Shannon information content and degrees of freedom in channel selection when retrieving CO2 concentrations using thermal infrared remote sensing and indicated that 40 channels could contain 75% of the information from the total of 1016 channels.” (L 125-L 129) “Richardson et al. (2018) selected 75 from 853 channels using information content analysis to retrieve the cloud optical depth, cloud properties, and position.” has been modified to “Richardson et al. (2018) selected 75 from 853 channels based on the high spectral-resolution oxygen A-band instrument on NASA’s Orbiting Carbon Observatory-2 (OCO-2), using information content analysis to retrieve the cloud optical depth, cloud properties, and position.” (L 138-L 142) (9) L 147: I would suggest to rephrase “weight function” by “weighting function” here and throughout the manuscript. Yes, we agree with you. “weight function” has been modified to “weighting function” throughout the manuscript. (10) L 147-148: The statement “... use only the weight function to study appropriate numerical methods, the use of which allows sensitive channels to be selected.” is unclear to me. Please rephrase. Sorry for this. “Today’s main methods for channel selection (such as the data precision matrix method (Menke, 1984), singular value decomposition method (Prunet
corresponding to the optimum value of \( C_{N \hat{p}} \), but it still satisfies the optimum value in a certain sense." has been removed. (L 265) (18) L 283-285: I did not understand how you are actually making use of the different channel selections for the different heights in the retrieval process. Does this mean the different channel sets are used to evaluate only certain heights in the retrieved profile? Yes, you are right. This has been explained "In this way, different channel sets can be used to evaluate corresponding height in the retrieved profiles." (L 276-L 278) (19) L 330 and 344: I got confused about the notation, what is \( \hat{T}' \) referring to? Sorry for my carelessness. "where \( T \hat{\mu} \) and \( \hat{T}_{b} \) are the corresponding average values of the elements, respectively. \( T' \) and \( T_{b}' \) represent the corresponding anomalies of the elements, respectively." has been modified to "where \( T \hat{\mu} \) stands for the retrieval atmospheric temperature. \( T \hat{\mu} \) and \( \hat{T}_{b} \) are the corresponding average values of the elements, respectively. \( T' \) and \( T_{b}' \) represent the corresponding anomalies of the elements, respectively." (L 326-L 329) (20) L 379-380: "after retrieval of observations has been complete several times" is unclear to me. Sorry for the confusion. "It should be noted that the least squares solution obtained here aims to minimize the sum of the error variance for each element in the atmospheric state vector after retrieval of observations has been completed several times." has been modified to "It should be noted that the least squares solution obtained here aims to minimize the sum of the error variance for each element in the atmospheric state vector after retrieval for several times." (L 372-L 374) (21) L 380-383: How do you deal with non-linearity inherent atmospheric radiative transfer? Isn’t that a major problem for multiple regression? Yes, you are right. We have explained this as follows. "Because the statistical inversion method does not directly solve the radiation transfer equation, it has the advantages of fast calculation speed. In addition, the solution is stable, which makes it one of the highest precision methods (Chedin et al., 1985)." (L 288-L 290) This study is aimed to examine the effectiveness of a channel selection method for hyperspectral atmospheric infrared sounders based on layering. The most particular aspect of this work is that it takes the height dependencies of the kernel functions into account. Thus, considering the calculation speed, the statistical inversion method is used for our channel selection experiment. (22) L 387: Add a reference for the AIRS instrument, e.g. (Aumann et al., 2003). Sorry for my carelessness. The references have been added. ". . . (Aumann et al., 2003; Hoffmann and Alexander, 2009)" (L 383-L 384) (23) L 395: The AIRS footprint size 13.5 km at nadir, please check. Yes, you are right. The AIRS footprint size 13.5 km at nadir. "The spatial footprint of the infrared channels is 1.1° in diameter, which corresponds to about 15 x 15 km at the nadir." has been modified to "The footprint size 13.5 km at nadir (Susskind et al., 2003)." (L 389) "Susskind, J., Barnet, C. D. and Blaisdell, J. M.: Retrieval of atmospheric and surface parameters from AIRS/AMSU/HSB data in the presence of clouds, IEEE Trans. Geosci. Remote Sensing, 41, 390-409, https://doi.org/10.1109/TGRS.2002.808236, 2003." (L 1005-L 1008) (24) L 396-398: 4.3 and 15 micron are used simultaneously for both, temperature and carbon dioxide retrievals, I think. Yes, you are right. "The spectral range includes 4.2 \( \mu \text{m} \) for important temperature observation, 15 \( \mu \text{m} \) for CO\(_2\), 6.3 \( \mu \text{m} \) for water vapor, and 9.6 \( \mu \text{m} \) for ozone absorption bands." has been modified to "The spectral range includes 4.3 \( \mu \text{m} \) and 15.5 \( \mu \text{m} \) for important temperature observation and CO\(_2\), 6.3 \( \mu \text{m} \) for water vapor, and 9.6 \( \mu \text{m} \) for ozone absorption bands (Menzel et al., 2018)." (L 389-L 392) (25) L398: When you refer to "absolute accuracy", does this include noise as well? Noise should not be included as it counts as "precision". Yes, you are right. "The absolute accuracy of the measured radiation is better than 0.2 K." has been modified to "The root mean square error (RMSE) of the measured radiation is better than 0.2 K (Susskind et al., 2003)". (L 392-L 394) (26) L 399-401: "the four imaging channels of visible/near infrared are always filled" is unclear, please explain or remove. Yes, you are right. The sentence has been removed. (L 394-L 395) (27) L406-411: This paragraph can be deleted. Everything was already said in the introduction. Yes, you are right. This paragraph has been deleted. (L 400) (28) L412: Does the "root-mean square error" include both, accuracy and prediction, in this study? Root mean square error (RMSE) in this study can be described as accuracy in this study. (29) L 416-417: Delete the sentence "Moreover, not all channels possess the same measurement error." This is
obvious from the figure. Yes, you are right. The sentence “Moreover, not all channels possess the same measurement error.” has been deleted. (L 404) (30) L 415: Please provide a reference or a web link for the RMS errors shown here. Yes, you are right. “There are a few with extremely large measurement errors, which reduce the accuracy of prediction to some extent.” has been modified to “There are a few channels with extremely large measurement errors, which reduce the accuracy of prediction to some extent. Among them, some extremely large measurement errors reduce the accuracy of prediction to some extent. (Susskind et al., 2003)” (L 404-L 406) (31) L 429: Introduce acronym and provide reference for RTTOV. Yes, you are right. “For the radiative transfer model and its weight function matrix, K, the RTTOV v12 fast radiative transfer model is used. RTTOV is an evolution of RTTOV v11, adding and upgrading many features.” has been modified to “For the radiative transfer model and its weighting function matrix, K, the RTTOV (Radiative Transfer for TOVS) v12 fast radiative transfer model is used. Although initially developed for the TOVS (TIROS Operational Vertical Sounder) radiometers, RTTOV can now simulate around 90 different satellite sensors measuring in the MW (microwave), IR (infrared) and VIS (visible) regions of the spectrum (Saunders et al., 2018).” (L 417-L 423) (32) L 429-430: Delete sentence saying “RTTOV is an evolution of...” as this does not provide really useful information. Yes, you are right. The sentence has been deleted. (L 423) (33) L 431: What is ATOVS? Sorry for my carelessness. “ATOVS (Advanced TOVS)” has been added. (L 424) (34) L 440-443: Table 1 is not needed at all in this manuscript, I think. What is the reader supposed to do with it? Just provide the web link for reference. Yes, we agree with you. Table 1 and table 2 is not needed. The two tables have been shifted to the Appendix A. (L 846-L 854) (35) L 451-452: The phrase “The weight function matrix K...” can be deleted, as this is clear. Yes, you are right. The sentence has been deleted. (L 437) (36) L 465: What is H(X0)? Is it needed for anything here? Sorry for the confusion. It has been explained “The RTTOV_K (the K mode), is used to calculate the matrix H(X0) (Eq. (1)) for a given atmospheric profile characteristic.” (L 448-L 450) (37) L 473-475: Which “products” are you referring to? Is there a reference for the NWPSAF requirements? Sorry for this. This has been modified and a reference for the NWPSAF has been added. “NCS is short for NWP channel selection in this paper. NCS were released by the NWPSAF 1DVar (one-dimensional variational analysis) scheme, in accordance with the requirements of the NWPSAF.” (Saunders et al., 2018). (L 448-L 450) (38) L 492-495: At this point the reader does not know anything about the IFS-137 data set. It is introduced much later in the manuscript. Yes, you are right. Because the main idea of this part is to introduce the channel selection experiment, we will introduce IFS-137 data set in Sect. 4. It has been explained “The error covariance matrix of the background, S_a, is calculated using 5000 samples of the IFS-137 data provided by the ECMWF dataset (The detailed information will be introduced in Sect. 4). The last access date is April 26th, 2019 (download address: https://www.nwpsaf.eu/site/update-137-level-nwp-profile-dataset/, 2019).” (L 476-L 482) (39) L 500: What is causing the off-diagonal bands in the temperature covariance matrix? For instance, why is the temperature at 100 hPa closely correlated with temperature at about 60-70 hPa? Yes, you are right. We have noticed the off-diagonal bands in the temperature covariance matrix, especially from 50hPa to 200hPa. There should be some dynamic processes here. But this study is aimed to examine the effectiveness of a channel selection method. As the temperature covariance matrix is the same, so we do not introduce it further here. (40) L 516: The color bar unit is “K°E2”, but shouldn’t this be “K/K”, as it refers to a change of brightness temperature with respect to atmospheric temperature, i.e., dBT/dT? (Same for Fig. 7) Sorry for this. This has been modified (Fig. 3: L 500; Fig.6: L 575-L 577) (41) L 532-544: Wavenumbers are missing the unit “cm-1”. Replace “11 micron” by “10 micron”. Yes, you are right. The wavenumber unit “ cm-1” has been added. (L 518; L 520; L 524; L 527; L 534) “11µm” has been replaced by “10µm” (L 517) (42) L 546: The term “high temperature zone” is used here and elsewhere in the manuscript, but what does it refer to? Please explain. Sorry for this. We have added our explana-
400 hPa and 600–700 hPa, without scattering, which is closer to the situation in real atmosphere.” (L 585-L 588) (47) L 615-619: Please provide a reference for the IFS-137 data set here. Sorry for my carelessness. The corresponding references have been added.

“Because 4.2 μm and 4.3 μm bands are sensitive to high temperature, the higher temperature is, the better observation can be obtained” (L 531-L 533) “...in the high temperature zone.” has been modified to “...to the higher temperature.” (L 546-L 547) “...the channel combination of ICS is superior to that of PCS and NCS for atmospheric temperature observation in the high temperature zone” has been modified to “...the channel combination of ICS is better than that of PCS and NCS for atmospheric temperature observation to the higher temperature.” (L 775-L 778; L 834-L 836) (43) L 575-576: “Moreover, the temperature profile of each layer can be retrieved.” How can you retrieve a profile for a layer? Please clarify. Sorry for this. After 324 channels are selected for each layer, the temperature profile of each layer can be retrieved based on statistical inversion (see at Sect. 4). “In this paper, the atmosphere is divided into 137 layers, and based on the information content and iteration, 324 channels are selected for each layer. Moreover, the temperature profile of each layer can be retrieved.” has been modified to “In this paper, the atmosphere is divided into 137 layers, and based on the information content and iteration, 324 channels are selected for each layer. Then, the temperature profile of each layer can be retrieved based on statistical inversion (see at Sect. 4)” (L 560-L 564) (44) L 569 and 583: Figs. 5 and 6 could be combined in a single figure to allow for a comparison. Yes, we agree with you. Figs. 5 and Figs. 6 has been combined in a single figure. (Figure 5: L 556) The following figure numbers (Fig. 7-13) have been modified (Fig. 6-12). (45) L 596-605: You are describing the PCS distribution as “scattered”, but I would rather apply this word to the ICS distribution. The ICS distributions seems to jump or scatter Thank you for your notice. Sorry for my carelessness. In Fig. 6 “(a) PCS. (b) ICS.” should be “(a) ICS. (b) PCS.” Which has been modified. (L 576-L 577) (46) L 604-605: Sorry, but I don’t know what you mean by "scenario in the real atmosphere" in this context? Sorry for the confusion. “(2) regardless of the number of iterations, the maximum value of the weighting function is stable near 300-400 hPa and 600–700 hPa, without scattering, which resembles more closely the scenario in real atmosphere.” has been modified to “(2) regardless of the number of iterations, the maximum value of the weighting function is stable near 300–
The average temperature profiles in these four regions have been modified (Fig.10). (L 727-L 731) (55) L 774-775 and 813: It is okay to say that ICS works “better” than NCS or PCS, but saying it is “greatly superior” or “impressive” is overselling the results, I think. Suggest to rephrase this and use more moderate wording. Yes, we agree with you. “Generally, the retrieval temperature by ICS is greatly superior to that of NCS and PCS.” has been modified to “Generally, the retrieval temperature by ICS is better than that of NCS and PCS.” (L 750-L 751) “According to Fig. 12, ICS takes channel sensitivity as a function of height into consideration, so its retrieval result is impressive.” has been modified to “According to Fig. 11, ICS takes channel sensitivity as a function of height into consideration, so its retrieval result is better.” (L 786-L 788) Other similar problems have been modified. “...the channel combination of PCS is superior to that of NCS for atmospheric temperature observation in the high temperature zone.” has been modified to “…the channel combination of PCS is better than that of NCS for atmospheric temperature observation to the higher temperature.” (L 546-L 547) “…the ICS method is superior to that of PCS.” has been modified to “the ICS method is better than that of PCS.” (L 567-L 568) “…the channel combination of ICS is superior to that of PCS and NCS for atmospheric temperature observation in the high temperature zone” has been modified to “…the channel combination of ICS is better than that of PCS and NCS for atmospheric temperature observation to the higher temperature” (L 775-L 778; L 834-L 836) “…ICS is superior to PCS.” has been modified to “…ICS is better than PCS.” (L 821-L 822) “Moreover, ICS takes channel sensitivity as a function of height into consideration, so its retrieval result is impressive.” has been modified to “Moreover, ICS takes channel sensitivity as a function of height into consideration, so its retrieval result is improved.” (L 703-L 704) (56) L 819-834: Tables 4 to 7 are largely redundant and can be removed from the paper, I think. Yes, we agree with you. Tables 4 to 7 have been removed from the paper. And the corresponding indication has been modified. (L 795) In abstract “Especially, from 100 hPa to 0.01 hPa, the accuracy of ICS can be improved by more than 11 %; (3) Statistical inversion comparison experiments in four typical regions indicate that ICS in this paper is significantly better than NCS.
(NWP Channel Selection) and PCS (Primary Channel Selection) in different regions and shows latitudinal variations. Especially, from 100 hPa to 0.01 hPa, the accuracy of ICS can be improved by 7% to 13%, which means the ICS method selected in this paper is feasible and shows great promise for applications." has been modified to "(3) Statistical inversion comparison experiments in four typical regions indicate that ICS in this paper is significantly better than NCS (NWP Channel Selection) and PCS (Primary Channel Selection) in different regions and shows latitudinal variations, which shows potential for future applications." (L 32-L 36) (57) L 849 and 882: Suggest to simply delete the headings for Sects. 6.1 and 6.2, as they appear in the wrong order. The conclusions should follow the discussion. Yes, you are right. The headings and the correct order have been modified. (L 796-L 840)

Technical Corrections (58) L30: remove "evidently" Yes, you are right. "evidently" has been deleted. (L 30) (59) L 38-39: suggest to rephrase "... is feasible and shows great promise for application" as "... shows potential for future applications" Yes, we agree with you. "(3) Statistical inversion comparison experiments in four typical regions indicate that ICS in this paper is significantly better than NCS (NWP Channel Selection) and PCS (Primary Channel Selection) in different regions and shows latitudinal variations. Especially, from 100 hPa to 0.01 hPa, the accuracy of ICS can be improved by 7% to 13%, which means the ICS method selected in this paper is feasible and shows great promise for applications." has been modified to "... which shows potential for future applications." (L 839-L 840) (60) L44: the Earth's Yes, you are right "...observe Earth's atmosphere..." has been modified to "...observe the Earth's atmosphere..." (L41) (61) L 67-68: suggest to rephrase "AIRS has 2378 spectral channels with subpoint at 13 km and a detection height from the ground of up to 65 km" as "AIRS has 2378 spectral channels providing sensitivity from the ground to up to about 65 km of altitude" Yes, you are right. This has been modified. (L 66-L 68) (62) L 73: change "attaches" to "devotes" (or similar) Yes, you are right. This has been modified. (L 72) (63) L 76: change "detection" to "observations" (or similar) Yes, you are right. This has been modified. (L 75) The similar problems have been modified. "...satellite detection technology has developed rapidly" has been modified to "...satellite observation technology has developed rapidly" (L 40-L 41) "From the perspective of vertical atmospheric detection, satellite instruments are developing rapidly. In their infancy, the traditional infrared detection instruments for detecting atmospheric temperature and moisture profiles ..." has been modified to "From the perspective of vertical atmospheric observation, satellite instruments are developing rapidly. In their infancy, the traditional infrared measurement instruments for detecting atmospheric temperature and moisture profiles ..." (L 47-L 50) "... in terms of detection accuracy ... filter-based spectroscopic detection instrument, therefore, ...To meet this challenge, ...for the creation of high-spectral resolution atmospheric detection instruments ..." has been modified to "... in terms of observation accuracy ... filter-based spectroscopic measurement instrument, therefore, ...To meet this challenge, ... for the creation of high-spectral resolution atmospheric measurement instruments...." (L 55-L 61) "... such advanced detection technologies. ... techniques of hyperspectral resolution atmospheric detection," has been modified to "... such advanced sounding technologies. ... techniques of hyperspectral resolution atmospheric observations." (L 72-L 75) "detection data" has been modified to "observation data" (L 80) "... the general satellite detection instrument" has been modified to "... the typical satellite instruments" (L 85) "With the development of detection technology..." has been modified to "With the development of measurement technology..." (L 88-L 89) "temperature detection" has been modified to "temperature observation" (L 391; L 530; L 547; L 701-L 702; L 777-L 778; L 835) (64) L 80: change "atmospheric detectors" to "instruments" Yes, you are right. This
you are right. This has been added. (L 594-L 595) (99) L 675: mode_l_. Then, the _simulated AIRS spectra are_ obtained. Yes, you are right. This has been modified. (L 651) (100) L 696: delete "obviously" Yes, you are right. This has been deleted. (L 671) (101) L 704 and 719: _at_ different heights Yes, you are right. Those have been modified. (L 679 and L 694) (102) L 729: change "impressive" to "improved" Yes, you are right. This has been modified to "...its retrieval result is improved". (L 704) (103) L 740: change "weather conditions" to "atmospheric conditions" (also elsewhere in the manuscript) Yes, you are right. Those have been modified. (L 715 and L 722) (104) L 743: change "and divides it" to "have been divided" Yes, we agree with you. "...the atmospheric profile is from the IFS-137 database introduced in Sect. 4, and divides it into four regions..." has been modified to "...this paper has divided the atmospheric profile from the IFS-137 database introduced in Sect. 4 into four regions..." (L 716-L 720) (105) L 777: replace "optimized to" by "improved by" Yes, you are right. This has been modified. (L 753) (106) L 785: _d_ Arctic Sorry for my carelessness. This has been modified. (L 761) (107) L 892: _is_ proposed Yes, you are right. This has been modified. (L 806) Thanks again for your careful review. Hopefully our response can enable a further review of the manuscript. Many thanks for your work so far and best regards, Shujie Chang and Co-authors. Please also note the supplement to this comment.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2019-183/amt-2019-183-AC3-supplement.zip


C19