Dear Anonymous Referee #2,

Thank you for your hard work and constructive comments on "Tomographic retrieval algorithm of OH concentration profiles using Double Spatial Heterodyne Spectrometers". The helpful comments have substantially improved our paper. We agree with points raised and modify them in the revised version of the manuscript.

On behalf of the authors
Kind regards,

Yuan An

A Point-by-Point response to the reviewer's comments

Reviewer: Abstract: The abstract only describes the method used in the paper. It should give more related results.
Reply: We agree with your points. Some related results are given in the revised version of the manuscript.

Reviewer: Page 2, Line 48: The introduction part of the OH radical method should be more summarized, including principle and results.
Reply: We agree with your points. The principle and results of OH radical methods have been summarized. We hope the entire modification is clearly described in the revised version of the new manuscript.

Reviewer: Page 7, line 210: The T2-1 and T2-2 position should be defined more clearly.
Reply: We apologize for the unclear expression about the T2-1 and T2-2 position. There are two T2 positions which are meeting the requirements of three-dimensional limb mode with the T1 position. We defined the satellite position on the same side to the time of T1 is defined as the position at the time of T2-1, and on the opposite side to the time of T1 is defined as the position at the time of T2-2.

Reviewer: Page 7, line 212: It should be the distance of satellite position fromT1 to T2-1 moment, and T1 to T2-2 moment.
Reply: We apologize for the unclear expression about these parts in the question. We change the sentence in question to "The distance of the satellite position at the time of T2-2 from the time of T1 is farther than the satellite position at the time of T2-1..." for more accurate expression.

Reviewer: Page 7, line 214: Consider replacing "cannot reflect the actual OH distributions" with "make bigger difference".
Reply: Changed as suggested. Thank you very much! We change "...cannot reflect

the actual OH distributions…" to "…make bigger difference…".

Reviewer: Page 9, Line 237: Consider making the flow chart more clear and nice looking? Same with other flow charts in the essay.
Reply: We changed the flow chart as your suggestion. We hope the flow chart is clearer and nicer in the revised version of the manuscript.
Reviewer: Page 11, Line 297: The "Grating width" in the table 1 should have some unit.
Reply: Apologize for this mistake. The unit "line/mm" has added in the table.
Reviewer: Page 11, Line 304: Figure 8 should be replaced by a higher definition picture.
Reply: We apologize for this question. Figure 8 has replaced by a new figure which has the resolution of 600 dpi to be clearer.

Reviewer: Page 17, Line 467: Gave a lots description of the LSUV retrieval algorithm, which was not used in the essay, and did not explain the reason why it was incredible in lower atmosphere. The tomographic retrieval algorithm is an improved version of LSUV or two independent algorithms? Could you analyze the advantages of the tomographic retrieval algorithm by combining the inversion results of LSUV?
Reply: The LSUV retrieval algorithm have been used for many years. The tomographic retrieval algorithm and the LSUV are two independent algorithms. We use LSUV retrieval algorithm to highlight the advantages of the tomographic retrieval algorithm. We hope the entire modification is clearly described in the revised version of the manuscript.

Reviewer: Page 18, Line 487: when using the lookup table, the accuracy of the tomographic observed database will affect the OH results? Have you considered proper amount of the data? And the parameter setting of the influencing factors? The accuracy of this database is not described in this paper. And is there any other method to prove the accuracy of the database?
Reply: We analyzed the errors of forward model in Sect. 3 and have considered the parameters which affect the OH concentrations. So, we consider the tomographic observed database is accurate.

Reviewer: Page 20, Line 550: Consider giving more detailed description of the calculation of relative errors.
Reply: Changed as suggested. The descriptions of the calculation of relative errors have been added in the revised manuscript.

Reviewer: Page 23 line 627: the method of cubic spline interpolation is used to obtain the OH concentration that cannot use the lookup table. In essence, the interpolation result is not the actual measurement, and the error estimation of interpolation results in this paper may be inaccurate!
Reply: Thank you for your comment. Although an effective and reasonable lookup

table inversion algorithm have been constructed, it cannot be obtained the OH concentrations in all cases because 1) the size of lookup table is limited and 2) we cannot consider all situations when the sensor will work in the orbit. The interpolation methods and the threshold judgment methods are always used to solve such problems. A scientific and precise threshold in the threshold judgment method can be obtained according to a lot of OH concentrations data and experiments. However, the OH concentrations data are little now. The interpolation methods are chosen. The cubic spline interpolation method not only has higher stability but also can ensure the continuity and smoothness of the interpolation function under the premise of the ensuring the convergence compared with other interpolation methods like linear interpolation method and some others. The error estimation of the interpolation results is as accurate as possible. We will also improve the accuracy of the OH concentrations when the DSHS work officially in the future.

Reviewer: Page 25, Line 673,677,679,680: How were these errors calculated?
Reply: We apologize for being unclear about this part. The OH concentrations which are obtained by the LSUV algorithm have been given by Yibo Gao in his graduation thesis and some other papers by researchers. These errors in the question are calculated by the Eq (17) and the error transfer formula. The entire modification is given in the revised version. We hope it is clearly described.

Reviewer: Page 27, line 745: When will the DSHS used in the satellite and obtain the actual data for the OH measurement? The only way to verify the feasibility and correctness of the method is the deeply analysis of the obtained data.
Reply: We agree to this point deeply. The actual observed data is the key point. The DSHS and research results have been shown and communicated with the related departments. It has been included in the relevant satellite projects for 2020 to 2030.

Reviewer: The writing of the whole essay needs to be improved.
Reply: Thank you very much for your pertinent suggestion. Our English language do need to be improved. We have found a lot of phrases and grammatical errors through re-reading of the full manuscript carefully. All of the errors have been revised. I hope it is more accurate now on the English expression in the revised paper.