Dear Editor,

We have thoroughly revised our manuscript and also responded to the comments from two reviewers.

Associate editor

The manuscript presents the considerable work done by the authors to apply the ATMS TPW and CLW retrieval algorithm to the instruments on the Feng-Yun 3D platform. This is an interesting project, as observations from Feng-Yun 3D potentially fill a gap between successive orbits of other satellite-borne microwave instruments. However, the approach adopted by the authors is based on the reconstruction of observations in the window channels at 23.8 and 31.4 GHz, which are not available to MWTS and MWHS. Machine learning is arguably a very powerful tool, yet it cannot re-create information unique to the missing channels from the observations in other channels. Therefore, the suggestion by both reviewers is to develop a new algorithm based on the strengths of the channels that are available to MWTS and MWHS.

In its current form, the manuscript cannot be accepted for publication in AMT. But I encourage the authors to use the reviewers' recommendations to improve the algorithm, perform extensive validation, and submit an updated version of the paper in due time.

Response: Thanks for the editor's comment. We have responded to all the questions focused by the reviewers.

From the distribution of the weighting function of all channels in ATMS that although Ch1 and Ch2 are window channels, the weighting distributions of Ch3, Ch4, Ch5 and Ch16 are very similar to those of Ch1 and Ch2, and other channels can also provide certain information in the lower layer (Figure R1). Therefore, we can establish the relationship between two low-frequency window channels and other channels of ATMS through the machine learning method for all FOVs.

Since MWTS and MWHS contain all channel settings in ATMS except for the two low-frequency window channels, and the weighting function of these channels is also consistent with the corresponding channel in ATMS, we can match FY-3D data to ATMS level by cross calibration, thus realizing the prediction of missing channel values in FY-3D using ATMS training model.

We also added some quantitative assessments in the revised manuscript. A total of five days of data were selected as data sources from different months. Quantitative evaluation result for five independent days can be found in Table R1. Overall, the accuracy and stability of the two channel simulation are satisfactory. The total correlation coefficient of Ch1 is more than 0.9, and the correlation coefficient of Ch2 is also close to 0.9. The MAEs of the two channels between ATMS and CMWS are 6.74 and 5.73K, respectively. Although the simulation errors of the two missing channels still seem to be a little large, the accuracy and stability of the two channel simulation are still satisfactory, especially the simulation accuracy is sufficient to meet the quality control requirements of satellite data assimilation. After strict cross calibration and high-precision machine learning training, the correlation coefficients between TPW and CLW retrieved by two simulated channels and those retrieved by ATMS can still reach 0.95 and 0.85.

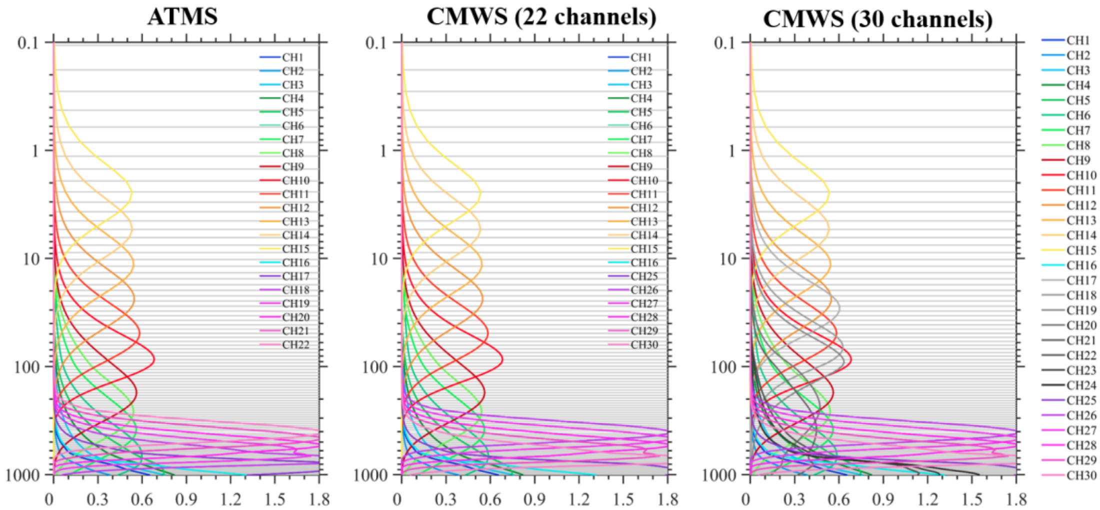

Figure R1 Weighting function of ATMS and FY-3D CMWS

Table R1. Quantitative evaluation results between ATMS and CMWS

Date (2018)	Matched pixels	Correlation Coefficient				Mean Absolute Error			
		Ch1	Ch2	TPW	CLW	Ch1 (K)	Ch2 (K)	TPW (mm)	CLW (mm)
June 2	54,831	0.90	0.82	0.94	0.85	7.27	8.66	5.43	0.15
July 2	53,322	0.94	0.90	0.95	0.89	6.75	4.4	5.34	0.08
August 2	40,565	0.94	0.90	0.95	0.89	6.24	4.60	5.11	0.08
September 2	22,955	0.93	0.88	0.96	0.87	6.37	4.62	4.48	0.07
October 2	8,936	0.88	0.88	0.89	0.86	6.61	3.77	4.03	0.07
Total	180,609	0.92	0.85	0.95	0.85	6.74	5.73	5.14	0.10