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Atmospheric Measurement Techniques Discussions

Interactive comment on "Direct assimilation of Chinese FY-3C Microwave Temperature Sounder-2 radiances in the global GRAPES system" *by* J. L. Li and G. L. Liu

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This paper presents the use of the FY3C MWTS-2 data in the GRAPES system. The paper discusses the data, a short summary of the GRAPES system, the quality control schemes for the data and a few experiments using the data. The presentation of the work is reasonable and straightforward, but has a few significant issues that can easily be corrected in the revision process. In addition there are some additional minor issues involving the English, spelling and small clarifications.

Significant issues:

1. In the paper, there is no discussion of the observational error assigned to the data

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Discussion paper

within the data assimilation system. Without this information, it is difficult to interpret the results of the experiments.

2. On page 2, the authors state that "the performance of atmospheric sounding instruments in particular meets or exceeds the specification." There is no reference or results to support this statement.

3. Page 3 lines 1-16. It should be noted that the MWTS-2 instrument differs from the ATMS instrument in that it contains only the 50Ghz frequencies and thus the other frequencies cannot be used for quality control.

4. Page 3 lines 17-24. This appears to be repetitious with the previous paragraphs.

5. Page 5 line 19. In general the B matrix is not ill-conditioned, just large. For example when it is defined in spectral space as a diagonal matrix, it is well conditioned and easy to invert.

6. Page 6 Channel selection. The authors were very conservative in the choice of channels. With a model top at 3-4 hPa, it would seem that channels 9 and 10 could easily be considered for assimilation. Fig 1. demonstrates that most of the signal from these channels would be below the model top. Of course the vertical distribution of model levels may also enter into the choice of channels.

7. Pages 6-7, Section 4.2.1. In this section, the authors use a different radiative transfer model (CRTM) and a different background field (post-processed GFS). While it is probably true that the radiative transfer models probably give similar results if trained with similar data, it is not clear why the authors choose to do this and it is not demonstrated that the results are similar. The non-terrain following aspects of the post-processed GFS fields, the low top for this data set and the different vertical distribution of layers can easily introduce biases and inconsistencies when compared to the GRAPES native model coordinate.

8. Page 8 lines 16-17. The larger standard deviation of the MWTS-2 data than the

ATMS data when compared to the same background indicates that either the data from the MWTS-2 has much more noise in it or the radiative transfer for this instrument is inaccurate. Referring to point 1, it would be interesting to know how much less weight was given this data than the ATMS data in the following experiments.

9. Page 10 lines 11-12. Is the size and shape of the FOV taken into account when determining the land/sea/ice mask?

10. Page 10 line 17. The "bi-weighting quality control procedure" should be described in more detail. It is not clear what is the basis of this procedure without going to the references.

11. Page 11 lines 12-13. It is not clear what the authors mean by the statement "However, only SAT1 is implemented in the operational GRAPES assimilation system." This may just be a matter of use of English, but it is confusing.

12. Page 11 Figure 6 and lines 20-22. I do not see the bi-weighting quality control in Fig. 6. Is this the same as O-B check?

13. Page 11 lines 23 and 24. It should be noted that some operational centers are currently using or developing the ability to use microwave all-sky data.

14. Page 12 lines 15-16. Please note that it is not good to remove the "the error in the first-guess model profile" with the bias correction. Otherwise, the analysis cannot correct these signals.

15. Page 14 line 9. If the impact of the MWTS-2 data is negligible when other data is used, why use this data?

16. Figure 7. It is unclear what color are observations that pass all of the quality control steps. Are these points included in this figure?

Minor Issues

1. Throughout the paper, the English can be improved. It is certainly not the worst

I have seen, but there are places where it could be made more readable. Below I will point out some of the specific issues, but that does not mean there are not other additional English improvements that could be made.

2. Page 1. Lines 22-25. The QC steps. Quality control steps does not imply removal of data. In the 5 steps, the consequence of the check needs to be stated. i.e., instead of "eight outmost FOVs" should be "eight outermost FOVs are not used" or "coastal FOVs" should be "coastal FOVs are removed"

3. Page 2. Lines 1 and 2. "The quality control scheme of extracting the striping noise may contribute to the analysis and forecast <accuracy>". Add accuracy.

4. Page 2. Kozo et al., should be Okamoto et al. References also needs to be make correct and reordered.

5. Page 2. Line 30. "Thesis" is probably not the best word here.

6. Page 2. Line 30 "assimilation" spelling error

7. Page 4. Line 24 "discretization" spelling

8. Page 4. Line 25 "package" spelling

9. Page 4. Line 25 "Chen" capitalization.

10. Page 5 Line 26 "could" –> "can"

11. Page 8 Line 10 "corresponding" spelling

12. Page 10 Line 19 "than2" –> "than 2"

13. Page 19 Line 13 "Courtier" spelling

14. Fig. 1. It would be nice if the lines could be made a little thicker. When printed, some of the lines disappear.

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