Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2017-31-AC3, 2017

Atmospheric Measurement Techniques Discussions

Interactive comment on "An Assessment of the Impact of ATMS and CrIS Data Assimilation on Precipitation Prediction over the Tibetan Plateau" *by* Tong Xue et al.

Tong Xue et al.

xuetong12@126.com

Received and published: 21 April 2017

Referee 3 Specific comments 1. The data usage percentage of CrIS is low. Is the full spectral data file, instead of a subset file, used and read in the GSI? Answer: Yes, you are right, the percentage of the assimilated CrIS data is low. The full spectral data are read in GSI, but the used data is low. In current study, the channels of CrIS are selected according to the NOAA operational system, there are only low percentage channels selected. Then the data will be processed through the data quality control including the data thinning, a large part of data have been kicked out. For example, the clear cloud data will be used, the other part have not been used. So the final used in GSI is very low.

2. Section 2.2.1. Model top is set at 10hPa. This may affect the performance of some high peaking channels. Higher model top may be beneficial. Answer: I totally agree with this point, model top may the performance of some high peaking channels. In our previous experiments, we made the comparison with the different model top (1hPa, 10hPa and 50hPa). We found that the higher model top is used, the more data have been assimilated, but the performance is not really improved, the reason is coming from the regional WRF model limitation. Different from the global model, the regional WRF model don't have a reasonable physical processes at the model top above 10hPa. So the performance with 1hPa model top is quite similar to the 10hPa model top. So we used the 10hPa model top in current study.

3. Line 179. The sentence "the ATMS and CrIS satellite radiance data can be read in GSI via CRTM 2.1.3" is not appropriate. After ATMS and CrIS data are read into the GSI, simulated brightness temperatures are calculated via CRTM. The CRTM is considered as observation operator. Answer: Thanks for pointing out this mistake for us. We have revised the manuscript in lines 226-228 After ATMS and CrIS data are read into the GSI, simulated brightness temperature are calculated via CRTM 2.1.3 in this study.

4. Lines 192-195. QC1 is only applied to microwave, a different cloud detection algorithm should also be applied to infrared. Emissivity check is performed not only over ocean but also over land. Regarding QC4, please clarify "retrieved the profiles which meet criterion in QC1 and QC2' – retrieval is conducted? Careful quality control is key to successful data usage. Answer: The quality control in current study is made according to the GSI used guide. Your comments is right, in GSI, each instrument has its own quality control subroutine. In order to avoid the duplication of the description for the quality control in the user's guide. The original lines 192-195 has been changed in the revised manuscript in lines 163-166. The detailed quality control can be found in the section 8.3 radiance observation quality control in the Gridpoint Statistical Interpolation (GSI) Advanced User's Guide version 3.5 by Developmental Testbed Center

(DTC) (2016). Developmental Testbed Center, 2016: Gridpoint Statistical Interpolation Advanced User's Guide Version 3.5. Available at http://www.dtcenter.org/com-GSI/users.v3.5/docs/index.php, 119 pp.

5. Figures 4 and 5. The color scheme of the color bars need to be improved. It is not easy to tell different blue/red color levels. Answer: Following your suggestion, we have modified the color scheme in Figures 4 and 5 in the revised manuscript.

6. The results in Fig. 5 indicate that, compared to the use of conventional data, the use of ATMS radiance data degrade the monthly mean precipitation, especially in the region of [25N,30N] and [77E, 80E] where conventional data are available. Does this indicate inconsistency between the two types of data? The negative impact of ATMS can also be seen in Fig. 11 (i). The information on the values of ATMS and CrIS observation errors and gross error cut-off will be helpful. Answer: you are probably right, the result seems that the error in the ATMS experiment is higher than the Conventional data experiment over the specific region. But in general, the precipitation pattern got slightly improved, for example, Figure 6 shows that ATMS looks a little better than the other three experiments but has more extreme-precipitation event forecasts than the others, followed by the CTRL and CRIS, while CONV has the lowest simulation precision. Based on the negative performance in ATMS over the specific region (25-30N, 77-80E), we can't say the two types of data is inconsistency. Because the TP has a complicated terrain pattern, the negative impact may be attributed to data quality control processing, the missing observations or the physical package of WRF-ARW having an inadequate description of snow cover over the plateau surface making the error of margin more prominent (Marteau et al. 2015). In a word, we could not understand the exactly reasons for the negative impact of ATMS according to the specific region. But we can make more experiments examine this problem in the future work. We accept the comment "The information on the values of ATMS and CrIS observation errors and gross error cut-off will be helpful", but in a reality, we hard to understand the value of ATMS or CrIS observation errors in the complicated terrain region, it is a challenge

issue for the next step study.

7. This is a comment – the rainbelt is close to the edges of the D02 domain, not sure if this may affect the results or not. Answer: It is possible that the edges of D02 domain can affect the results, but here the rainbelt is close to the upslope of mountain areas, it is consistent with the observations. This is good comment, we can do some experiments to explore the impact of the location of edges of D02 Domain on the results.

8. Due to the forecast model deficiencies, it is shown that it is challenging to improve precipitation forecast. With the water vapor channels available, it would be interesting to examine their impact on moisture analysis field. Answer: Thanks for your mention. We have analyzed the ATMS and CrIS data assimilation impacts on relative humidity (RH) at 2-meter height above the earth surface in July 2015 in another paper. The results show that the 2-m RH forecasts in July could be modified by assimilating over higher-elevation region which is the part of the TP in this manuscript. This is also a good suggestion, we can make the comparison the water vapor channels with the temperature channels or the other variable channels to examine the impacts.

9. Lines 427-430. Although it is true that microwave can penetrate clouds, I assume only clear-sky radiance data are used in this study. Answer: Yes, you are right. The clear-sky only radiance data is assimilated in this study. But in the processing of the data quality control, the cloud-radiance cannot be completely kicked out, so that the cloud radiance is possible to impact the final results. In our previous study, the result also shows a better performance in microwave radiance experiments compared to the infrared radiance experiments. It is probably related to capability of the clouds penetration for the microwave.

10. Reference Answer: Thank for pointing out this mistake for us. We have revised in the manuscript in lines 645-648.

Please also note the supplement to this comment:
http://www.atmos-meas-tech-discuss.net/amt-2017-31/amt-2017-31-AC3-supplement.zip

---

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-31, 2017.