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Atmospheric Measurement Techniques Discussions

Interactive comment on "Assessment of COSMIC radio occultation retrieval product using global radiosonde data" *by* B.-R. Wang et al.

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Reply to Anonymous Referee #1

Comment: Please add more, thorough explanation of the "COSMIC data." In section 2, the authors explains that they use COSMIC 1DVAR retrieval product wetPrf profiles, without further explanation about, e.g., the use of ECMWF analysis data as the 1DVAR retrieval background. In later sections, they also discusses "ecmPrf data" and "Observed N and Retrieved N." These were quite confusing. In section 2, please write about the whole picture for various "COSMIC data," and then add more specific information on the data that are actually used in this manuscript. Also, in Introduction, the authors cite several previous works. Please specify which type of COSMIC data each

of them used (if this information is critical). I do not have detailed knowledge about various types of COSMIC data.

Answer: We added more description of "COSMIC data" in section 1 and section 2, including description of 1DVAR retrieval product wetPrf, the 1DVAR retrieval background ecmPrf and their parameters.

Comment: Please remove all the discussions/figures for relative humidity/water vapour above the 200 hPa level. Radiosonde humidity data (not corrected for the time-lag error) above the 200 hPa level cannot be trusted. ECMWF humidity data above this level are of no use for this kind of purpose, because no observations are assimilated there. I also think that GPS radio occultation has virtually no sensitivity to stratospheric water vapour. Stratospheric water vapour can be measured with very special balloon-borne, aircraft-borne, and satellite-borne instruments. See, for example, Kley et al., SPARC Report, 2, 2000 (http://www.sparcclimate.org/publications/sparc-reports/sparc-report-no2/) and the SPARC water vapour II activity website, http://www.sparc-climate.org/activities/water-vapour-ii/ Later in the manuscript, the authors restricted their discussion below the 200 hPa level for humidity, but I think that they had better omit the profiles above the 200 hPa level from the beginning to avoid any confusion/misunderstanding.

Answer: We have removed all the discussions and figures for relative humidity/water vapour above the 200 hPa level. The comparison of humidity above the 200 hPa level is not suitable. We also changed the data filtration method. If one data point exceeds the limit, we removed the whole profile instead of the single one data point.

Comment: Page 8410. Does the wetPrf data set also contain pressure data as well as the altitude data? How is the pressure calculated for each data point? What is the influence of the potential errors in the pressure calculation for the temperature and humidity comparisons?

Answer: According to the documents of CDDAC data sets, the geometric height is

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retrieved when retrieving the refractivity profile, and the refractivity is directly proportional to density. So, the pressure could be retrieved by integration of the hydrostatic equation. The errors of pressure will influence the errors of retrieved temperature and humidity. Because, the function N=77.6P/T+373000Vp/Tˆ2 was used as the observation operator for neutral atmospheric condition in the 1DVAR process. The errors of pressure will also influence the interpolation of wetPrf profile in the comparisons of temperature and humidity.

Comment: Section 3.1 and elsewhere. Is it possible that GPS radio occultation retrievals of temperature and humidity near the surface have much larger uncertainty for technical reason compared to the upper layers?

Answer: Yes, the retrieved temperature and humidity near the surface have much larger uncertainty compared to the upper layers. It's more difficult to trace the GPS signals from lower troposphere. The conditions are more complicated in lower troposphere. Phenomenon, such as super-refraction, would affect the trace of the GPS signals.

Comment: Section 3.2. Is the point that a small number of extreme values significantly affect the statistics?

Answer: Yes, a small number of extreme values significantly affect the statistics, especially the extreme positive bias. The differences in comparison result between the two data filtration criteria could be seen in Fig. 2.

Comment: Section 3.4 and elsewhere. Please add more explanation about the background data issues. My understanding might not be correct, but, the problems may be in the biases in the original ECMWF analysis data (i.e., the "background" data in this manuscript) or in the local radiosonde data or in the way the assimilation was made in the ECMWF analysis. If the forecast model output for the analysis (this is the "background" for the ECMWF analysis) and local radiosonde data differ much, the radiosonde data may be rejected in the analysis data. In this case, the difference between the wetPrf data and radiosonde data can also be large.

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Answer: We added more description about the background data in section 2. Yes, if the radiosonde data was rejected in ECMWF analysis, the difference between wetPrf and radiosonde data could be large.

Comment: Page 8419, line 9. I suspect that Chinese radiosondes could have large biases in the relative humidity measurements.

Answer: Yes, the Chinese radiosondes could have large biases in the relative humidity measurements. We have changed the sentences to "The temperature of the two Chinese radiosonde types performed well. However, the humidity of the two Chinese radiosonde types were significantly smaller compared with the other types.".

Comments: Typos. p.8409, l.5. which p.8412, l.18. which p.8413, l.6. Figure 6 p.8413, l.15. Figure 7 p.8413, l.19. first p.8414, l.10. systematically p.8415, l.17. significantly influenced

Answer: We have corrected all the wrong phrases.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 8405, 2012.