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Atmospheric Measurement Techniques Discussions

Interactive comment on "Estimating observation and model error variances using multiple data sets" *by* Richard A. Anthes and Therese Rieckh

Anonymous Referee #1

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Title: Estimating observation and model error variances using multiple data sets

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General Comments:

The authors estimate the observation and model error variances by using the "N-cornered hat method". In this study, they estimate the error variances for observation and model in several variables, e.g., refractivity, temperature, specific humidity and relative humidity. They compare their results with previous studies and find that the error patterns are consistent. The errors characters for the GPS RO retrieved temperature and moisture are rarely discussed in previous studies, and it is good to see the

estimation in the study. For the manuscript, I have some comments as follows.

Specific comments:

1. The manuscript discusses the observational error variances for the refractivity, temperature, and moisture (q and RH) from GPS RO, but not for the bending angle. The bending angle from GPSRO has been assimilated in several operational centers for weather forecast. Is it possible to provide the error estimation for the bending angle as well? This could be interesting and useful for community users and/or the NWP people.

2. The samples are picked up within 600km and 3h for comparison, is the criteria the same for ERA and GFS? For example, do the authors apply a spatiotemporal interpolation when comparing ERA and RO? If it uses the co-location criteria, how much could this affect the error variance?

3. The abstract does not point out the major conclusion of the study. I would suggest to add the part into the abstract.

4. The statistics are based on samplings near the four stations. According to previous studies, the observational error variance could vary with latitudes, can the results in this study be applied globally?

5. In Fig. 5a, A1 and A3, there are several gaps in STD (ERA-True). The ERA-Interim data should be continuous.

6. In the manuscript, the "N" can be represented for several meanings, e.g., RO refractivity, the number of samples for statistic, and number of data sets, etc. It would be better to use different characters to avoid confusing.

7. Page 4 line 15: There are three types of COSMIC data provided from CDAAC, i.e., re-processed, post-processed, and real-time data. In this manuscript, it uses the ERA-Interim data as the background for the 1DVAR retrieval, do the authors get the COSMIC data from re-processed data?

Technical corrections:

1. The variables should be in the same form with italics, for example, page 4 line 17: “Specific humidity q” → please change to “Specific humidity *q*”; page 4 line 18: “water vapor pressure e” → “water vapor pressure *e*”.

2. Page 22 line 14 and line 16: three-cornered hat (THC) → three-cornered hat (TCH)

3. Pages 24 and 25: The descriptions for equations (13)-(15) are inconsistent, for example, the equation (13) is computed from Eqs. (3), (5) and (6), not (1), (2) and (3) that indicated in line 26.

4. Page 29 Fig. A4 figure caption: Mean of six . . .of normalized “specific humidity” → should be “refractivity”

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