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Interactive comment on "Characterization of the Long-term Radiosonde Temperature Biases in the Lower Stratosphere using COSMIC and Metop-A/GRAS Data from 2006 to 2014" *by* Shu-Peng Ho et al.

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The authors have done a lot of careful work and there are interesting results in their paper on the different accuracies, stabilities and trends of various types of radiosonde data. The authors use radio occultation (RO) data in the upper troposphere and lower stratosphere as a reference data set for the period June 2006 to April 2014. Since radiosonde data are often used in climate studies, it is important to document the accuracies and uncertainties of different types of radiosondes in different countries.

However, the paper is too long (58 pages) and Sections 3-5 on results are tedious and

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difficult to read because of too much detail in the text that merely repeats what is in the tables and figures, as well as too many symbols in the text (e.g. ΔT (RS92200701-201012)). Furthermore, there is too much listing and discussion of statistics that are small and probably not significant or of general interest. The reader is thus overwhelmed with the reporting of many numbers without a focus on what is really important. The paper would be improved and have much more impact if it were shortened significantly and only the major results included in the text.

There are many statistics of radiosonde minus RO temperatures from various types of radiosondes at different levels of the atmosphere between 200 and 20 hPa over six different regions of the world. It is not clear which of these results are statistically significant. This makes interpretation of the results difficult as we could be looking at small, quasi-random differences that have no physical meaning, nor even meaning relative to the specific types of radiosonde data. Differences are often 0.1K or less, which are well below the accuracy of radiosonde sensors. When the different atmospheric sampling volumes of the radiosondes and RO are considered, sampling errors alone can be much larger than 0.1K.

The authors compute trends of the differences between individual types of radiosonde and RO over a 7-year period. Most of the trends are small (of order 0.2 K per five years) and quite different, with some being positive and some being negative. It is not clear what these trends mean, except as an indication of the uncertainty of the radiosonde minus RO temperatures over this short time period. An estimate of the statistical significance of these trends would be useful. A comparison of actual (observed) and/or climate model temperature trends at these levels due to long-term climate change would be useful as well. For example, from climate models we might expect a temperature trend in the lower stratosphere to be something like 2-3 K per 100 years or 0.1 – 0.15 K per five years. Trends reported in this paper for the Vaisala RS92 radiosonde at 50 hPa (Table 3) range from -0.211 K/5 years (U.S., night) to 0.264 K/5 years (England, day), so they are comparable or slightly larger than what one would expect for a long-term

climate trend signal.

It would also be interesting to compare these trends in radiosonde-RO temperature differences to the corresponding trends in the RO temperatures over this period. Indeed, Tables 3 and 4 give the RO trends, but they are never mentioned in the text. The RO temperature trends at 50 hPa (Table 3) range from -0.69 (Canada, day) to 1.143 (England, night). Quite different values are found at 150 hPa (Table 4), with the 5-year trends ranging from -0.797 (Canada, day) to 1.508 (U.S. day). In general, the magnitudes of the trends of radiosonde-RO temperature differences are smaller than the trends in RO temperatures, which is an indication of the consistency between the radiosonde and RO temperatures. The large differences in RO temperature trends between regions (much larger than expected for a long-term climate change signal) probably indicates natural variability in the six different regions. The fact that they are larger than the trends in the differences indicates to me that they represent a real signal in the different regions over this 7-year time period. Presumably, since the radiosonde-RO trends are smaller, the radiosondes (at least the most accurate ones) would pick up similar trends to the RO trends. A discussion of what the trends in radiosonde minus RO temperatures and RO temperatures means is needed.

In summary, the paper contains some interesting and important results and should be published, but it requires significant editing, and shortening with greater emphasis on what the important results are and less detail on all the individual numbers.

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