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Interactive comment on "Comparison of microwave satellite humidity data and radiosonde profiles: a survey of European stations" *by* V. O. John and S. A. Buehler

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This paper is a very interesting study comparing the upper tropospheric humidity measured by radiosondes with AMSU observations. Both data sets are heavily used in weather forecasting systems as well as climate models and the comparison of these data sets is very important.

The comparison between the AMSU instruments and radiosondes implicitly assumes that the different radiosonde types used in this study behave similarly. However, this is not the case and the results clearly depend on the type of humidity sensor that is used.

There are two types of Vaisala radiosondes that are used in this study, i.e. the Vaisala RS80 and the Vaisala RS90. The Vaisala RS80 comes with two different humidity sensors, i.e. the A type humicap and the H type humicap. The A type humicap has a well documented temperature dependent dry bias which is based on the improper calibration of this sensor at cold temperatures. This temperature dependent calibration error has been corrected in the H type humicap. The A type, is a slightly faster sensor, which means that biases due to time lag are less pronounced compared to the H type. There is no clear statement, whether the time lag induces a dry bias or a wet bias, since this depends on the shape of the RH profile. In radiosonde archives it may not possible to distinguish, which humidity sensor was used, but it may be assumed that the majority of RS80 soundings use the H type sensor. The RS90 has a much faster response as well as a slightly better calibration model and the study should clearly separate between the RS80 and the RS90 comparisons.

Humidity sensors may also suffer from a radiation error, which most likely would lead to a systematic dry bias in daytime soundings. This has been indicated in a few studies, but not yet well documented. Sine the NOAA-15 and NOAA-16 have orbits that are shifted by 6 hours, it may be speculated that this radiation error on the humidity sensor shows up differently for the two satellites. It would be most useful to separate the comparison at least for day/night overpasses or better still for solar zenith angle if there is a sufficient statistics to do that.

In 2000 Vaisala began shipping their RS80 radiosondes with a protective cap, which significantly reduced the contamination of the humidity sensor. The H type humicap was very strongly impacted by this contamination dry bias, the A type humicap was also impacted by this effect, although to a lesser extent. If a radiosonde site had used sondes in 2001, which were shipped in 2000 without the protective cap, then this would contribute to a larger scatter in the comparison with the satellite observations in 2001. One can probably assume that by 2002 only radiosondes that had been shipped with protective cap were used.

It would be most useful if the authors could specify, which altitude range contributes most to the measured radiances since the humidity sensor biases are strongly temperature and therefore altitude dependent.

The introduction mentions the “capacitive hygristor”. This should be “capacitive humidity sensor” or “polymer sensor”.

The introduction should also mention the work by Miloshevich et al.: Miloshevich, L. M., A. Paukkunen, H. Vömel, S. J. Oltmans, Development and validation of a time-lag correction for Vaisala radiosonde humidity measurements, J. Atmos. Ocean.Technol., 21, 1305-1327, 2004. Miloshevich, L. M., H. Vömel, A. Paukkunen, A. J. Heymsfield, S. J. Oltmans, Characterization and correction of relative humidty measurements from Vaisala RS80-A radiosondes at cold temperatures, J. Atmos. Oceanic Technol., 18, 135-156, 2001.

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