



Global mean stratospheric warm bias of 1K in radiosonde temperatures in the 1980s.

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The discrepancy between global mean temperature series from homogenized radiosondes and temperature estimates from Microwave Sounding Unit (MSU) data is a long standing problem in upper air climatology. While the confidence in MSU satellite products is increasing, several authors argue that the known warm biases in many historical daytime radiosonde ascents are insufficiently adjusted in homogenized global radiosonde datasets.

This work compares time series of MSU-equivalent temperature layers at individual radiosonde station locations as well as their global averages. Radiosonde data provided by RAOBCORE (Haimberger 2006, *Journal of Climate*), ERA-40 background data and satellite data are compared.

It has been found that the general cooling of tropical and global mean radiosonde temperatures compared to MSU satellite data since the early 1980s can be remarkably well reproduced by a composite of individual radiosonde time series with breaks larger than 0.5K. The breaks have been detected with an automatic method (RAOBCORE). This breaks can be safely attributed to the radiosonde time series since the differences between satellite data and ERA-40/ECMWF background time series are much smaller than that, on the order of 0.2K on the grid scale. The warm bias of radiosondes in the 1980s is estimated 0.8K in the global mean, 1.1K in the tropical mean for the lower troposphere. A comparison with the recently available TTS satellite data indicates that the radiosonde biases are also sizeable in the upper troposphere.

RAOBCORE uses ERA-40 and ECMWF background data as a reference for homogenization. The consistency of the ERA-40 background with MSU satellite products from 1987 onwards is quite high. Only for the pre-1987 period some inhomogeneities

in the ERA-40 background data due to insufficient bias correction of early NOAA satellite data are evident.

The issue of poor sampling due to sparsity of radiosondes away from the northern hemisphere midlatitudes has been revisited as well. The sampling influence on trends tends to be less than in recent other studies, probably because of the more complete data used by RAOBCORE.