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Homogenization of the global radiosonde temperature dataset using composites of reference stations and ERA-40 background forecasts

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Radiosonde timeseries provide important information about upper air temperature, humidity and wind from the 1940s onward. These timeseries are affected by numerous changes in the observation instrumentation and these changes lead to artificial breaks. This work concentrates on correcting breaks in temperature timeseries, and for this purpose composites of "nearby" radiosonde station timeseries are used. Conventional methods compare the observed temperature or temperature anomalies. If there are breaks in the tested series, these are visible in the series of differences between the two stations. However, the size of the break can be estimated well, only if the distance between the two stations is small compared to the spatial scale of short time climate anomaly patterns. This restriction can be avoided, if not the observed teperatures are compared, but the innovations available at every radiosonde station. These innovations are the differences between observations and ERA-40 background forecasts, which are available from the ERA-40 feedback data. The ERA-40 background follows spatial climatological anomaly patterns very well. Therefore the innovations should not be affected by different climate anomaly patterns. Even stations that are several thousand kilometers away from the tested station can be used as reference stations, without the risk that different climate anomalies seriously affect the breaksize estimate.

The breaksize estimates are calculated from differences in innovations between the intervals before and after the break for every reference station. The average of the estimates from all reference stations can be calculated as a simple aritmethic mean or a more sophisticated one, like an inverse distance weighted mean. Since the ERA-40 background is only used for spatial interpolation, the adjustment estimates from

the present method are less dependent on the temporal homogeneity of the ERA-40 background than the recently published homogenization method (RAOBCORE, Haimberger 2006, Journal of climate).

The global radiosonde dataset (more than 1000 stations) has been adjusted with this method. The spurious negativ trend in the layer 100-50 hPa from 1979 to 2004 is reduced from -0.83 K/10a to -0.6 K/10a in the global mean. In the tropics the trends are reduced from -0.94 K/10a to -0.55 K/10a with the adjustment. These trend values are much more consistent with temperature trends estimated from MSU satellite data.