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Long-term global radiosonde humidity measurements

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Radiosonde humidity measurements are potentially valuable indicators of upper air climate change because of their unique long-term availability and their high vertical extent and resolution.
The radiosonde network, however, is not a long-term stable measurement system, since it was designed for operational use. Changes in the observation system are frequent and surf the purpose of competitive daily weather prediction, but result in more or less clear breakpoints in the observed long-term time series. These artificial biases need to be removed and we adapt a well-known bias adjustment scheme from radiosonde temperature to radiosonde humidity measurements. We detect breakpoints from metadata and departures from reanalysis (ERA-Interim, CERA-20C, JRA-55) and independently adjust the time series to a globally more consistent data set. We apply two methods, one adjusts the mean between breakpoints whereas the other adjusts the quantiles and thus accounts for the skewness of the distribution of humidity. Given the non-normal distribution of humidity across the atmosphere, a distribution matching method is more likely to yield better results, however long-term trend estimates (1979-2017) are comparable for both methods. We compare our results with reanalysis and known estimates from the literature.