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Homogenization of global radiosonde humidity data

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The global radiosonde network is an important source of upper-air measurements and is strongly connected to reanalysis efforts of the 20th century. However, measurements are strongly affected by changes in the observing system and require a homogenization before they can be considered useful in climate studies. In particular humidity measurements are known to show spurious trends and biases induced by many sources, e.g. reporting practices or freezing of the sensor. We propose to detect and correct these biases in an automated way, as has been done with temperature and winds.

We detect breakpoints in dew point depression (DPD) time series by employing a standard normal homogeneity test (SNHT) on DPD-departures from ERA-Interim. In a next step, we calculate quantile departures between the latter and the earlier part near the breakpoints of the time series, going back in time. These departures adjust the earlier distribution of DPD to the latter distribution, called quantile matching, thus removing for example a non climatic shift. We employ this approach to the existing radiosonde network.
In a first step to verify our approach we compare our results with ERA-Interim data and brightness temperatures of humidity-sensitive channels of microwave measuring radiometers (SSMIS) onboard DMSP F16.

The results show that some of the biases can be detected and corrected in an automated way, however large biases that impact the distribution of DPD values originating from known reporting practices (e.g. 30 DPD on US stations) remain. These biases can be removed but not corrected. The comparison of brightness temperatures from satellite and radiosondes proofs to be difficult as large differences result from for example representative errors.