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Homogenization of the global radiosonde dataset using ERA-40 analysis feedback information

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Data from the global radiosonde network are a valuable source of information about climate change at upper atmospheric levels. They reach further back in time than satellite data, with acceptable global coverage from 1958 onwards. The applicability of radiosonde temperature records for climate change research is affected by frequent breaks in these records due to changes in observation practice. These breaks need to be removed before the temperature records can be applied to studies on trends or low frequency variability. It is demonstrated that many breaks can be effectively removed by a statistical method that uses 6h background forecasts from the ERA-40 project as a reference. The ERA-40 project generated global upper air analyses and forecasts for the period 1958-2002 with high temporal (6h) and spatial (˜150km) resolution. The time series of temperature differences between radiosonde temperatures (obs) and the 6h background forecasts (bg) is referred to as analysis feedback information. The differences are available for every radiosonde at 16 pressure levels and they are analysed with a variant of the Standard Normal Homogeneity Test. The statistical information is combined with metadata available from the Comprehensive Aerological Reference Dataset (CARDS) to a score that allows to objectively determine breakpoints in the radiosonde time series. The size of the breaks at each level is estimated from the bg-obs differences before and after a detected breakpoint. Then the older part of the time series is adjusted. After the adjustment the trends calculated from radiosonde temperature time series (about 900 stations) are spatially much more coherent. The cooling trend observed in the stratosphere, especially in the tropics during the period 1979-2001, is reduced significantly (by a few tenths of K/decade). The method also has its difficulties since the ERA-40 bg temperature time series are affected by some inhomogeneities as well. This problem and some prospects for improvements of the method

and for applications of the method to wind data are also discussed.