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Sensitivity of trends to estimation methods and quantification of subsampling effects in global radiosounding temperature and humidity time series

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Inaccurate climate trend detections may lead to incorrect conclusions about the current state and future evolution of the climate. Trend estimation based on the use of radiosonde historical time series may be significantly affected by the choice of the estimation method. In addition, the dataset subsampling both in time (due to gaps in the data records) and in space (due to need of selecting the most reliable subset of stations for each specific application) can further increase the trend uncertainty.

Uncertainties of trend estimations have been quantified in few past investigations, considering the difference between pairs of regression methods, although limited to datasets affected by several inhomogeneities and characterized by smaller trend rates than those observed over the last two decades.

This work, carried out in the frame of the Copernicus Climate Change Service (C3S), aims to examine the sensitivity of trend estimations to linear estimation methods and to subsampling effects. The analysis is carried out using about 600 historical radiosounding time series for the period 1978-2018 available within version 2 of the Integrated Global Radiosonde Archive (IGRA).

The sensitivity of linear trends to the choice regression methods and the subsampling effects have been quantified through the comparison of four regression methods (parametric and non-parametric). The uncertainties introduced by missing data in each time series has been also quantified using a new approach, selecting different samples of stations with different amounts of missing monthly data equivalent to 0, 5, 10 and 20 years from 1978 to present. Instead, the spatial subsampling effects are quantified artificially reducing the size of the IGRA stations.

The presented work will shortly discuss results obtained for temperature and relative humidity for both night and day times (at 0000 and 1200 UTC, respectively) at different pressure levels and latitudes.