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Bias adjustments for the global historical radiosonde network in preparation for ERA6

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In preparation for the next generation Copernicus reanalysis ERA6, we aim at providing an as complete as possible global insitu upper-air dataset, augmented with additional data and metadata that allow to reduce observation and representation errors in those data.

We first reduce representation errors using actual launch times and balloon positions (see presentation by Voggenberger et al.). This allows to get more smaller observation - background (obs-bg) departures compared to the original obs-bg departures calculated during assimilation with ERA5.

The obs-bg departures form the basis for comprehensive statistics-based adjustment of biases in temperature, wind direction and also humidity, using the RAOBCORE/RICH method. The corresponding software has been further improved compared to the past year, now including also adjustments for mobile platforms and paying attention to adjustments of the most recent parts of the time series.

Results from bias-adjusted temperature records indicate realistic spatial trend heterogeneity and very good fit to reprocessed satellite data products, clearly better than what could be achieved in preparation to the present operational reanalysis ERA5. Temperature Background departures from ERA5 increase substantially, both in terms of mean and standard deviations when going back to the early 1950s and 1940s. It is tried to shed some light whether this increase comes from poorer quality observations or from issues arising due to the less strongly observationally constrained ERA5 state during this period.

Wind direction adjustments are necessary only at a few stations but also have a clearly positive effect on trend heterogeneity and obs-bg departures. Humidity bias adjustments are more delicate, since it is not sufficient to shift the distributions by a mean value, rather one has to adjust also the shape of the distributions. Results from humidity bias adjustments, considered experimental, are quite promising up to 300 hPa. Pervasive strong drying trends over large countries like the US and China could be substantially reduced. More detailed verification is needed, however.