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Quality Control of Selected Historical Radiosonde Observations from 1948-1966

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High quality 3-dimensional observational data sets are crucial for a wide range of geoscientific applications. In particular, high quality data is required to generate atmospheric reanalysis products that widely serve as data source for studying numerous scientific questions. As the observational data form the basis for reanalysis products, any non-systematic uncertainty in the observations translates into uncertainty in the reanalysis data. Hence, under the assumption that systematic (e.g. radiation and lag) errors have been previously corrected, the quality of the observation and the reanalysis data is constrained by the same (independent) uncertainties that arise from the instrumentation of the sonde and from uncertainties in the pressure (altitude) measurements. The uncertainty in the observation data may be determined by hand, whereas a direct uncertainty measure of the reanalysis data is unavailable.

The error estimation technique applied in this study makes use of a station-to-station comparison using pairs of radiosonde stations with a high spatial correlation and a high regional representativeness in order to avoid both station pairs with apparently dissimilar climatology as well as stations at extreme locations. Geopotential height and temperature of the period 1948-1966 is extracted from the corrected radiosonde data set of the Comprehensive Historical Upper Air Network (CHUAN, www.historicalupperair.org). Besides a minimum spatial relation, the selected 2-dimensional radiosonde observation series must be gapless, and each ascent must reach the 300 hPa level. The quality of the observational data is assessed by determining the bias and its significance (t-test) in between the observational series and the NCEP/NCAR reanalysis (which itself is not free of errors either). The bias points at potential errors in the data, but also facilitates the detection of potential short-term atmospheric disturbances (e.g. cold fronts) that are only poorly represented in the reanalysis.

Having estimated the uncertainty, the observational data can be used to assess the quality of various reconstructions, other observations, and reanalysis products at each grid point in proximity to an observation profile. Besides a presentation of both the methodology and the preliminary results, we will also provide a brief outlook on the next steps within this project.