Validation of radiosonde data prior to 1958

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Historical radiosonde data suffer from numerous homogeneity issues due to changes in instrumentation, launch practices, station locations, and launch times. This is especially the case prior to 1958 when the global radiosonde network was still under development. Additionally a worldwide change in launch times occurred in 1958 in preparation for the International Geophysical Year. Prior to then, radiosondes were launched at 0300 and 1500 UTC; beginning in 1958 launch times were changed to 0000 and 1200 UTC to match standard synoptic surface observation times. The Integrated Global Radiosonde Archive (IGRA) contains approximately 300 stations with records prior to 1958. We have developed a validation procedure based on comparing the monthly mean radiosonde data to a suitable reference series. As reference series we use statistically reconstructed upper level fields which are based on surface temperature and pressure data. These reconstructions reach back to the early 20th century and allow validation even for the very early upper-air data. During the digitisation process an adjustment is made for launch time based on a diurnal cycle interpolated from NCEP-NCAR Reanalysis climatology.

This technique was developed to validate historical radiosonde and pilot balloon data reaching back to the 1920s which we have digitised. It has also been applied to pre-1958 IGRA data to validate the data and to evaluate the robustness of the diurnal cycle adjustment across the 1957-1958 launch time inhomogeneity. Validated data is shown for selected stations in Finland, Germany, and North America which were internally digitised as well as selected IGRA stations. A summary of statistics is presented including error types and magnitudes. We detected large errors in some series while others proved to be of excellent quality. Typical problems included station relocation (especially during war years), uncorrected (or insufficiently corrected) radiation and lag errors, temperature biases, and inconsistent unit conversion.