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## RS41 GRUAN Data Product Version 1 (RS41-GDP.1) - Reference Radiosonde Data for the Troposphere and Lower Stratosphere

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One of the main goals of the GCOS Reference Upper Air Network (GRUAN) is to perform reference observations of profiles of atmospheric temperature, humidity and wind for monitoring climate change. Two essential criteria for establishing a reference observation are measurement-traceability and the availability of measurement uncertainties. Radiosoundings have proven valuable in providing in-situ profiles of temperature, humidity, pressure and wind at unmatched vertical resolution. Data products from commercial radiosondes often rely on black-box or proprietary algorithms, which are not disclosed to the scientific user. Furthermore, long-term time-series from these products are frequently hampered by changes in the hardware and/or the data processing.

The GRUAN data products (GDP's) comply with the above-mentioned criteria for a reference product. Correction algorithms are open-source and well documented and the data include vertically resolved best estimates of the uncertainties. Another major advantage of a GRUAN data product is that it includes the radiosonde's raw measurement data, which allows for reprocessing when new or improved corrections become available. Currently, GDP's are available for the Vaisala RS92 and Meisei RS-11G radiosondes. Data products for additional radiosonde models, as well as for other measurement techniques are in the making. The GDP's are used to determine trends, constrain and calibrate data from more spatially comprehensive observing systems (including satellites and current radiosonde networks), and provide appropriate data for studying atmospheric processes.

This presentation introduces the GRUAN processing of Vaisala RS41 radiosoundings, the correction algorithms that are applied, and the derivation of the vertically resolved uncertainty estimates. Well-known, dominant error sources for the RS41 profiles are related to solar radiation, causing a temperature error, and time-lag of the humidity sensor at low temperatures. The corrections for these error sources are based on dedicated experiments that were performed at Lindenberg observatory to measure the response of the RS41 temperature sensor to solar irradiance and to determine the time-lag of the humidity sensor at temperatures down to -70 °C. The RS41-GDP.1 is planned to become available in 2021. The majority of the 30, globally distributed, GRUAN sites employ the RS41, and its predecessor the RS92 before, establishing a continuous data record of more than 10 years of reference climate observations.

