EGU21-12735
https://doi.org/10.5194/egusphere-egu21-12735
EGU General Assembly 2021

Intercomparison of the Vaisala RS92 and RS41 Radiosonde GRUAN Data Products (GDP) in the Troposphere and Lower Stratosphere

Tzvetan Simeonov, Ruud Dirksen, Christoph von Rohden, and Michael Sommer
Deutscher Wetterdienst (DWD), Meteorological Observatory Lindenberg, Lindenberg, Germany (tzvetan.simeonov@dwd.de)

The GCOS Reference Upper Air Network (GRUAN) consists of 30 globally distributed measurement sites that provide reference observations of essential climate variables such as temperature and water vapour for climate monitoring. At these sites, radiosondes provide in-situ profiles of temperature, humidity and pressure at high vertical resolution. However, 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. Therefore, GRUAN data products (GDP) are developed, that employ open-source and well-documented corrections to the measured data, thereby complying with the requirements for reference data, which include measurement traceability and the availability of measurement uncertainties. The GRUAN data processing is applied to the raw measurement data of temperature, humidity, pressure, altitude, and wind, and includes corrections of errors from known sources, such as for example solar radiation error for temperature and sensor time lag for humidity measurements. The vertically resolved uncertainty estimates include the uncertainty of the applied corrections and the calibration uncertainty of the sensors.

A substantial number of GRUAN sites employ the Vaisala RS41 radiosonde, and its predecessor, the RS92, before that. This large-scale change of instrumentation poses a special challenge to the network, and great care is taken to characterize the differences between these instruments in order to prevent inhomogeneities in the data records. As part of this effort, the GRUAN data products for both radiosonde types are compared. In this study we used data from approximately 1000 RS92+RS41 twin-soundings (two sondes on a rig attached to one balloon) that were performed at 11 GRUAN sites, covering the main climate zones.

The first analysis shows that daytime temperature differences in the stratosphere increase steadily with altitude, with RS92-GDP up to 0.5 K warmer than RS41-GDP above 25 km. In addition, at daytime the RS41-GDP is 0.2 K warmer than the manufacturer-processed RS41-EDT product above 15 km. Analysis of the humidity profiles shows a slight moist bias of the RS41 compared to the RS92 for both GDP and manufacturer-processed data. Differences between the RS41-EDT and GDP humidity products are most pronounced in the upper troposphere - lower stratosphere region and are attributed to the time lagcorrection. The analysis of the temperature differences will be refined by investigating the influence of the solar radiation in conjunction with sonde

orientation and ventilation. Furthermore, the uncertainty of the humidity data will be assessed by comparing with coincident measurements of the water vapor profile by the Cryogenic Frostpoint Hygrometer (CFH).

Key words: Radiosonde, RS41, RS92, humidity, temperature, uncertainty, GRUAN, troposphere, lower stratosphere