GCOS Reference Upper Air Network: the Vaisala Reference Radiosonde Program

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Introduction

The GRUAN community has called upon the hydro-meteorological equipment industry to develop a "reference grade radiosonde" to allow for more accurate records of temperature and humidity in the atmosphere. This is the challenge that Vaisala's Reference Radiosonde Program, launched in 2009, aims to tackle. The final goal is to provide the climate research community with an instrument that is considerably easier to operate and less expensive than the current reference grade instruments, thus enabling more frequent operational climatological soundings.

Vaisala Reference Radiosonde Prototype RR01

- The program's first focus is to improve upper-air measurements of water vapor.
- RR01 is built around the DRYCAP®, a capacitive sensor originally developed for industrial applications and capable of measuring extremely low humidity levels (measuring range from -30 to -90 °C frost point temperature).
- On-flight autocalibration procedure ensures stability during flight.
- Factory calibrated down to -90 °C against a chilled mirror reference with traceability to NIST standards.
- For pressure, temperature, tropospheric humidity and GPS wind measurements Vaisala Radiosonde RS92 technology is used.

Fig. 1. Vaisala Reference Radiosonde prototype RR01.

Sounding results

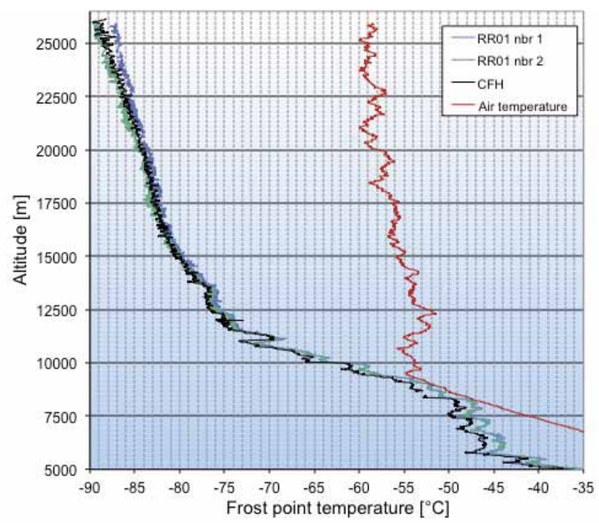

Fig. 2. Test sounding in Sodankylä, Finland on 9.10.2011.

- RR01 has been field tested against the Cryogenic Frostpoint Hygrometer (CFH).
- In the earlier tests a systematic bias of +1.5..+2.0 °C compared to the CFH was observed. However, recent developments in the sensing algorithms have decreased the bias significantly especially in the stratosphere, as evidenced by the sounding profiles in **fig. 2**
- In the tests RR01 has shown consistent performance and good repeatability, although very humid conditions (rain, fog, condensing conditions) continue to be a challenge.

Conclusions

- Test results demonstrate the promise of DRYCAP® as a new humidity measurement technology for upper troposphere and lower stratosphere.
- Development of RR01 towards an operational reference grade radiosonde continues.
- In 2012 the program will be ready to enter the beta-testing phase: regular soundings in collaboration with the Research Partners.

For more information go to **www.vaisala.com/referenceradiosonde**