The LAUTLOS-WAVAP: tropospheric comparisons of balloon-borne instruments

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This report is an accuracy assessment for tropospheric humidity measurements with all existing types of Vaisala radiosondes basing on the LAUTLOS-WAVAP hygrosonde inter-comparison campaign. The campaign was held in the Northern Finland at Sodankylä (67.37N , 26.65E) in February 2004. The experiment consisted of 33 launches of balloon-borne multi-hygrometer payloads. LAUTLOS-WAVAP payloads included RS80, RS90, RS92 and FN -radiosondes, as well as NOAA/CMDL and Snow White chilled-mirror, and FLASH-B Lyman-alpha hygrometers.

The tropospheric radiosonde intercomparisons showed the following results. The RS92 and FN-sondes had the best mutual agreement. FN disagreed with RS92 by some % RH at low temperatures, underestimating in humid conditions and overestimating in dry layers. The disagreement was temperature-dependent. In comparison with the RS92, the RS90 had a semi-linearly growing wet bias with decreasing temperature, being sim10% RH at -60 C. As it is known, the RS80-A suffers from temperature dependent dry bias, which grows with a decreasing temperature. According to LAUTLOS comparisons, it can be over 30% RH in the cold upper troposphere (in humid environment) and of approximately 5% RH near 0 C. The RS80-A dry bias could be partly corrected with the correction algorithm by Leiterer et al. 2000.

The comparison of scientific instruments (NOAA, FLASH-B, Snow White) with the RS92 showed that the RS92 agrees well with the NOAA in the troposphere. Differences fit generally between +-5 %RH, as a result, there is no visible bias in the troposphere. However the RS92 seem to have some % RH wet bias in the vicnity of sharp RH gradients at the tropopause region. This is due to time-lag error in the RS92. Comparison showed also that the Snow White would agree well with the RS92 (and especially the NOAA) if it was more reliable; Snow White has problems with mirror temperature control and cloud-contamination. It was also shown that the FLASH-B is not calibrated for tropospheric measurements due to a large dry bias in the humid lower troposphere. These comparison flights were performed during night; and so represent differences not dependent of radiation effects to the instruments.

Stratospheric comparisons showed a good agreement between NOAA and FLASH-B. Radiosondes did not succeed to reproduce reference class hygrometer (NOAA and FLASH-B) profiles in the stratosphere. The stratospheric results are out of the scope

of this paper and reported separately.

References

Leiterer, U., H. Dier and T. Naebert, 2000: Method for Correction of RS80 A-Humicap Humidity Profiles, Available at: http:// www.met-office.gov.uk /research /interproj /radiosonde /reports /leiterer.pdf