



Airborne hygrometer calibration inter-comparison against a metrological water vapour standard

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Water vapour is the most important atmospheric greenhouse gas, which causes a major feedback to warming and other changes in the climate system. Knowledge of the distribution of water vapour and its climate induced changes is especially important in the upper troposphere and lower stratosphere (UT/LS) where vapour plays a critical role in atmospheric radiative balance, cirrus cloud formation, and photochemistry. But, our understanding of water in the UT/LS is limited by significant uncertainties in current UT/LS water measurements. One of the most comprehensive inter-comparison campaigns for airborne hygrometers, termed AQUAVIT (AV1) [1], took place in 2007 at the AIDA chamber at the Karlsruhe Institute of Technology (KIT) in Germany. AV1 was a well-defined, referred, blind inter-comparison of 22 airborne field instruments from 17 international research groups. One major metrological deficit of AV1, however, was, that no traceable reference instrument participated in the inter-comparison experiments and that the calibration procedures of the participating instruments were not monitored or interrogated.

Consequently a follow-up inter-comparison was organized in April 2013, which for the first time also provides a traceable link to the international humidity scale. This AQUAVIT2 (AV2) campaign (details see: http://www.imk-aaf.kit.edu/aquavit/index.php/Main_Page) was again located at KIT/AIDA and organised by an international organizing committee including KIT, PTB, FZJ and others. Generally AV2 is divided in two parallel comparisons: 1) AV2-A uses the AIDA chamber for a simultaneous comparison of all instruments (incl. sampling and in-situ instruments) over a broad range of conditions characteristic for the UT/LS; 2) AV2-B, about which this paper is reporting, is a sequential comparison of selected hygrometers and (when possible) their reference calibration infrastructures by means of a chilled mirror hygrometer traced back to the primary National humidity standard of PTB and a validated, two-pressure generator acting as a highly stable and reproducible source of water vapour.

The aim of AV2-B was to perform an absolute, metrological comparison of the field instruments/calibration infrastructures to the metrological humidity scale, and to collect essential information about methods and procedures used by the atmospheric community for instrument calibration and validation, in order to investigate e.g. the necessity and possible comparability advantage by a standardized calibration procedure.

The work will give an overview over the concept of the AV2-B inter-comparison, the various general measurement and calibration principles, and discuss the outcome and consequences of the comparison effort.

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[1] H. Saathoff, C. Schiller, V. Ebert, D. W. Fahey, R.-S. Gao, O. Möhler, and the aquavit team, The AQUAVIT formal intercomparison of atmospheric water measurement methods, 5th General Assembly of the European Geosciences Union, 13-18 April 2008, Vienna, Austria

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