SCIENTIFIC REPORT

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Produced by: Bernhard POSPICHAL (University of Leipzig, Germany)
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Contribution by: Ulrich LÖHNERT (University of Cologne, Germany)

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Introduction

Performing optimal calibrations is one of the major issues for accurate remote sensing observations. When operated in networks, a common calibration and error assessment is vital. For ground-based microwave radiometers, absolute calibration is a crucial point for obtaining meaningful and useful data. Maschwitz et al. (2013) give an overview of calibration types and possible sources or error including. They derive a detailed error propagation estimation to specify a total uncertainty for a state-of-the-art radiometer. Still, many open issues remain on how to optimally perform calibrations for a microwave radiometer within an operational network. Therefore, WG3 in TOPROF decided to realize a series of two calibration campaigns.

Following J-CAL1 in Lindenberg (August 2014), the SWP meeting J-CAL2 (Joint Microwave Calibration Experiment) took place in Meckenheim (Germany) at Radiometer Physics GmbH from 14-16 September 2015. The goal was to continue experiments for absolute calibration and error estimation of passive microwave radiometers. Together with the results from J-CAL1, on-site recommendations for operators of network instruments considering absolute calibration and general measurement configuration will be compiled in order to reach a higher standardization and traceability for instrument uncertainty specification.

Fig. 1: Some participants of J-CAL2 on the measurement platform at Radiometer Physics GmbH

At the SWG meeting, 14 people from seven organizations in five countries were attending. We had in total six microwave radiometers from different operators (Netherlands, Poland, Romania, and Germany) which allowed an intercomparison of

these radiometers of different generations. The instruments continued to run in parallel for three more weeks after the J-CAL2 to assess the stability of the instruments and to get a larger dataset for the calibration examination.

Results or Achievements

Due to the availability of six HATPRO radiometers (Rose et al., 2005) which were operating synchronously, we could address a question which is still open, namely whether the use of sky-tipping calibration would be beneficial for the routine operation of microwave radiometers. The sky-tipping calibration (Han and Westwater, 2000) can be automatically performed using the instrument software, and is an absolute calibration standard for K-Band channels using the opacity / airmass relation during clear sky and homogeneous atmospheric conditions. However, previous experience shows that the conditions for automatically accepting a sky-tipping calibration needed some revision. At J-CAL2 we performed these sky-tipping calibrations with all available radiometers at the same time, so that we can calculate calibration parameters for all instruments in parallel.

Before starting the experiment, all instruments were re-calibrated manually using liquid nitrogen. In addition, radiosondes were launched during clear sky periods in order to have an independent validation source.

A further evaluation of the MWR data consists of the comparison with clear-sky radiosondes that were launched in parallel. Using a radiative transfer model, the simulated brightness temperatures will be compared to the measured ones by all six instruments. Therefore, receiver drifts, outliers or failed calibrations can be detected.

Conclusions

During J-CAL2, several issues regarding calibration of passive microwave radiometers were addressed, particularly the repeatability of sky-tipping calibrations. Therefore, six instruments were operating in parallel in order to assess the comparability of the radiometer observations. The obtained data will be examined and evaluated, the scientific results will be part of the recommendations for microwave radiometer operations in networks.

The scientific report will be posted on the TOPROF website: www.toprof.eu.

References

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