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**Paper title:**
**Accuracy assessment of an integrated profiling technique for temperature, humidity and liquid water content profiles**

**Abstract:**
Evaluating atmospheric parameters measured with ground-based remote sensors is often problematic, because information on the atmospheric state from independent measurements is often unavailable or lacking sufficient accuracy. In this paper we propose an evaluation which avoids this problem by starting from a well known ground truth state. The method is applied to the physically-based Integrated Profiling Technique (Löhnert et al. 2004) that was developed for retrieving continuous profiles of temperature, humidity and cloud liquid water. This IPT combines a microwave profiler, a cloud radar, a ceilometer, standard surface meteorological measurements and the closest (in time and space) operational radiosonde. In this evaluation approach we use model output from a regional climate model (RCM), which is run continuously over a two-month period corresponding to the first BBC campaign (August/September 2001). Applying a so-called forward operator, we can transform the atmospheric model output into the measurement space, which allows us to simulate measurements of all instruments used within the IPT. The IPT is then applied to these simulated measurements and the retrieved results are evaluated against the original model output. A major advantage of this approach is that random and/or systematic errors arising due to instrument calibration effects or microwave absorption model uncertainties can be neglected completely – or they can be added artificially to study the impacts concerning retrieval accuracy.
One main result we will show is the evaluation of cloud liquid water profiles, which are predicted by the RCM. After these profiles have been retrieved from the simulated measurements, they are evaluated systematically and quantitatively against the original profiles as a function of e.g. liquid water path, cloud vertical extent or height above cloud base. A second result is the evaluation of temperature and humidity profiles, where the main information originates from the spectrally resolved microwave profiler measurements. Since the IPT is a physically based method, this information needs to be supplemented via so-called a priori information. In a real world application this a priori information is assumed to be available from a nearby operational radiosonde, separated from the measurement both in time

(Δt) and space (Δd). In the model world, the a priori information is taken from designated model grid columns. We evaluated the IPT results as a function of Δt and Δd in order to examine how much information remote sensing observations can supply to the retrieval of temperature and humidity in addition to the a priori information. These results may prove valuable for evaluating the possibility of substituting radiosonde stations by microwave profilers in a dense enough radiosonde network. Furthermore, results obtained in this study will also prove valuable in studies that seek to calculate accurate radiative fluxes throughout the troposphere.

**References:**

Löhnert, U., S. Crewell, C. Simmer, 2004: An integrated approach towards retrieving physically consistent profiles of temperature, humidity, and cloud liquid water, *Journal of Applied Meteorology*, Vol. 43, No. 9, 1295-1307