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

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The evaluation of atmospheric parameters retrieved from ground-base remote sensing measurements is very problematic, since information on the atmospheric state from independent measurements is often unavailable or lacking sufficient accuracy. In this paper we propose an evaluation method that circumvents this problem by starting from a well known ground truth state. The method is applied to the physically based Integrated Profiling Technique that was developed for retrieving continuous profiles of temperature, humidity and cloud liquid water. The 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) as ground truth. Using a forward operator, we transform the atmospheric model output into the measurement space, which allows us to simulate all measurement devices used within the IPT. The IPT is then applied to these simulated measurements and the retrieved results are evaluated against the original model output. In this manner, random and/or systematic errors arising due to instrument calibration effects or microwave absorption model uncertainties can be neglected completely. We will discuss the evaluation of cloud liquid water profiles. Furthermore, retrieval of temperature and humidity profiles is dependent on a priori information which, in our approach, is taken from model profiles that simulate radiosonde observations. We will assess the quality of the retrievals depending on the distance [in space and time] of the a priori profile to the retrieval location. These results may prove valuable for evaluating the substitution of radiosonde stations by microwave profilers in a dense radiosonde network.