

Experimental evaluation of four microwave radiative forward models based on ground-based radiometer data near 20 and 30 GHz.

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Abstract

In this work we study the differences in brightness temperature (Tb) as computed using a variety of four commonly used microwave absorption models. Furthermore, we compare theoretical predictions with ground-based radiometer measurements, in order to evaluate the ability of each model to reproduce the actual behaviour of the atmosphere. The four models we consider are from Liebe and Layton (NTIA Rept.87-24,1987), Liebe et al. (AGARD Conf. Proc. 542,1993), Rosenkranz (*Radio Sci.*, **33**, 919-928,1998) and MONORTM model of S. Clough (Turner et al., *J. Atmos. Oceanic Technol.*, in press). By processing three appropriate historical datasets of radiosonde observations with these models, we computed the main Tb for each model in three contrasting environments, at tropical, medium and arctic latitudes. Then, we discuss the difference in computed Tb between the four models. We focus on the spectral range 20-30 GHz, which is commonly used for ground-based estimates of atmospheric water vapor by microwave radiometers, and for which routine measurements are often available. Both remotely sensed and in situ data were collected during the Water Vapor Intensive Operating Period, held in September/October 2000 at the Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) site, near Lamont, Oklahoma, USA. Three microwave radiometer (MWR) units were deployed, with a total of seven channels from 20.6 to 31.65 GHz. In addition to radiometric observations, during the WVIOP2000 there were three-hourly radiosonde launches, deploying two different types of Vaisala humidity sensors, the RS80 and RS90. Since RS90 are believed to reduce the “dry-bias” affecting the RS80 (Wang et al., *J. Atmos. Oceanic Technol.*, **19(7)**, 981-1002, 2002), the WVIOP2000 provided a unique opportunity of having high quality atmospheric profiles and ground-based observations. Thus, we show the comparison of Tb computed from RS90 measurements using the four models with Tb observations from the MWR units, and discuss a possible choice between the considered models.