An Assessment of Microwave Absorption Models and Retrievals of Cloud Liquid Water using Clear-Sky Data

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Abstract – Passive microwave radiometers have a long history in the remote sensing of atmospheric liquid and water vapor. Retrievals of these quantities are senstitive to variations in pressure and temperature of the liquid and water vapor. Rather than use a statistical or climatological approach to account for the natural variability in atmospheric pressure and temperature, additional information on the atmospheric profile at the time of the radiometer measurements can be directly incorporated into the retrieval process. Such an approach has been referred to in the literature as "physical-iterative" solution. This paper presents an assessment of the accuracy of the column liquid water path that can be expected using such an iterative technique. It is shown that the retrieval accuracy is influenced by the accuracy of the instrument measurements and the quality of the atmospheric profiles of temperature and pressure, as one would expect. But also critical is the uncertainty in the absorption coefficients used in the underlying microwave radiative transfer model. The uncertainty in the absorption coefficients is particularly problematic in that it may well bias the liquid water retrieval. The differences between 3 absorption models examined in this presentation are equivalent to a bias of 15 to 30 g/m^2, depending on the total column water vapor. An examination of typical liquid water paths from the Southern Great Plains region of the United States shows that errors of this magnitude have significant implications for shortwave radiation and retrievals of cloud effective particle size.