BNL-90861-2009-CP

EVALUATING CLOUD RETRIEVAL ALGORITHMS WITH THE ARM BBHRP FRAMEWORK

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Presented at the
Eighteenth Annual Atmospheric Radiation Measurement (ARM)
Science Team Meeting,
Norfolk, VA
March 10-14, 2008

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ABSTRACT

Climate and weather prediction models require accurate calculations of vertical profiles of radiative heating. Although heating rate calculations cannot be directly validated due to the lack of corresponding observations, surface and top-of -atmosphere measurements can indirectly establish the quality of computed heating rates through validation of the calculated irradiances at the atmospheric boundaries. The ARM Broadband Heating Rate Profile (BBHRP) project, a collaboration of all the working groups in the program, was designed with these heating rate validations as a key objective. Given the large dependence of radiative heating rates on cloud properties, a critical component of BBHRP radiative closure analyses has been the evaluation of cloud microphysical retrieval algorithms. This evaluation is an important step in establishing the necessary confidence in the continuous profiles of computed radiative heating rates produced by BBHRP at the ARM Climate Research Facility (ACRF) sites that are needed for modeling studies.

This poster details the continued effort to evaluate cloud property retrieval algorithms within the BBHRP framework, a key focus of the project this year. A requirement for the computation of accurate heating rate profiles is a robust cloud microphysical product that captures the occurrence, height, and phase of clouds above each ACRF site. Various approaches to retrieve the microphysical properties of liquid, ice, and mixed-phase clouds have been processed in BBHRP for the ACRF Southern Great Plains (SGP) and the North Slope of Alaska (NSA) sites. These retrieval methods span a range of assumptions concerning the parameterization of cloud location, particle density, size, shape, and involve different measurement sources. We will present the radiative closure results from several different retrieval approaches for the SGP site, including those from Microbase, the current 'reference' retrieval approach in BBHRP. At the NSA, mixed-phase clouds and cloud with a low optical depth are prevalent; the radiative closure studies using Microbase demonstrated significant residuals. As an alternative to Microbase at NSA, the Shupe-Turner cloud property retrieval algorithm, aimed at improving the partitioning of cloud phase and incorporating more constrained, conditional microphysics retrievals, also has been evaluated using the BBHRP data set.