Comparison of global cloud liquid water path derived from microwave measurements with CERES-MODIS

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Cloud liquid water path (LWP) is a crucial parameter for climate studies due to the link that it provides between the atmospheric hydrological and radiative budgets. Satellite-based visible/infrared techniques, such as the Visible Infrared Solar Split-Window Technique (VISST), can retrieve LWP for water clouds (assumes single-layer) over a variety of surfaces. If the water clouds are overlapped by ice clouds, the LWP of the underlying clouds can not be retrieved by such techniques. However, microwave techniques may be used to retrieve the LWP underneath ice clouds due to the microwave's insensitivity to cloud ice particles. LWP is typically retrieved from satellite-observed microwave radiances only over ocean due to variations of land surface temperature and emissivity. Recently, Deeter and Vivekanandan (2006) developed a new technique for retrieving LWP over land. In order to overcome the sensitivity to land surface temperature and emissivity their technique is based on a parameterization of microwave polarization-difference signals. In this study a similar regression-based technique for retrieving LWP over land and ocean using Advanced Microwave Scanning Radiometer - EOS (AMSR-E) measurements is developed. Furthermore, the microwave surface emissivities are also derived using clear-sky fields of view based on the Clouds and Earth's Radiant Energy System Moderate-resolution Imaging Spectroradiometer (CERES-MODIS) cloud mask. These emissivities are used in an alternate form of the technique. The results are evaluated using independent measurements, such as surface-based microwave radiometer (MWR) retrievals of LWP, and further compared to global CERES-MODIS LWP retrievals. These LWP retrievals will aid in the identification of multi-layered clouds over land and potentially lead to improvements in the derivation of surface, atmosphere, and top-of-atmosphere radiation budgets using CERES data.