P4.15 AN IMPROVED LEVEL-3 OCEANIC RAINFALL ALGORITHM FOR THE TRMM MICROWAVE IMAGER (TMI) AND THE ADVANCED MICROWAVE SCANNING RADIOMETER (AMSR)

T. T. Wilheit *, J. Huang, K.-W. Jin, D. H. Lee, J. L. Thomas-Stahle and R. Weitz
Texas A&M University, College Station, Texas

The present version of the Level-3 algorithm for oceanic rainfall retrieves monthly rainfall totals for 5° x 5° boxes. It is based on histograms of a linear combination of 19.35 (or 18) and 21 (22 or 23) GHz brightness temperatures. A histogram of brightness temperatures is computed from an assumed log-normal distribution of rain rates and a radiative transfer model. The parameters of the log-normal distribution are adjusted to achieve satisfactory agreement between the computed and observed histograms.

While there are many obvious shortcomings to this algorithm, it has performed extremely well both for TRMM and (when applied to the SSM/I) for the Global Precipitation Climatology Project.

In order to eliminate some of these shortcomings, in particular to enable the use of more of the available frequencies, a new algorithm has been developed. The success of the previous algorithm has established a high standard for determining that the new algorithm is, in fact, an improvement.

In this algorithm the rain-rates are computed using 10.7, 19.35 and 37 GHz. Each of the retrievals has a valid range of rain rates. Each also has a different spatial resolution because of the properties of microwave antennas. The rain rates are brought to a common resolution by smoothing to the 10.7 GHz resolution. The higher the frequency, the greater the sensitivity to rain relative to other interfering phenomena. However, at brightness temperatures above about 250 K, the retrievals become doubtful as they become overly dependent on poorly known details of the modeling assumptions. For each smoothed pixel, the highest frequency not contaminated with the doubtful retrievals is used.

Histograms of all of the retrievals at each frequency are accumulated. By knowing the most probable rain rate (0 mm/hr) any small offset due to modeling errors or instrument calibration can be detected and corrected. Offsets can occur because of modeling errors such as the non-precipitating cloud assumption or the surface emissivity or an instrumental calibration error. The modeling errors listed or a cold end calibration error would result in a total optical depth error. Since the absorption coefficient is very nearly linear in the rain rate at these frequencies, to a very good approximation, this results in an additive error in the rain rate.

It has been found that having the full range of frequencies has eliminated the need for the log-normal assumption. The monthly total rainfall is simply summed from the individual observations.

Comparisons of retrievals from this algorithm with rain gauges on small atolls are quite reasonable. Some small apparent artifacts in the retrievals from the present version are eliminated in this version.

* Corresponding author address: T. T. Wilheit, Department of Atmospheric Sciences, Texas A&M University, College Station, TX 77843-3150