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Methods over Land for TRMM Microwave Imager

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To retrieve precipitation over land by microwave radiometers, it is very important to know the surface condition, because it changes largely in time and location. A fundamental approach to infer the surface condition is the classification algorithm of rain · and no-rain · pixels. For example, the rain/no-rain classification (RNC) method applied by GPROF (Goddard Profiling Algorithm), which is the standard precipitation retrieval algorithm for TMI, compares the observed brightness temperature at 85GHz (TB(85V)) with the background brightness temperature (TB*(85V)) estimated from the observed brightness temperature at 22GHz (TB(22V)). It also screens out desert and snow covered areas in order to avoid the misjudgment of low TB(85V) area caused by dry snow and sand particles. In this study, no-rain · brightness temperature database is created to infer the surface condition using simultaneous observations by TMI and PR with the resolution of one month and 1x1 degree lat/lon. New RNC methods using this database to determine TB*(85V), which do not require any screening for desert and snow covered areas are proposed.

The RNC tests for all the TMI observations in the year 2000 were done by four proposed methods (M1, M1+, M2, M2+) and GPROF, then their results were evaluated with RNC by PR as truth · M1 and M1+ simply use the average of TB(85V) under no-rain conditions as TB*(85V). M2 and M2+ use the regression line between TB(85V) and TB(22V) under no-rain conditions. TB*(85V) is calculated by substituting the observed TB(22V) into the regression equation. While M1 and M2 use the database of the years 1998 and 1999 for realistic simulations (operational purpose?), M1+ and M2+ use the database of the year 2000 for ideal simulations free from inter-annual variation of land surface.

The ratio of right rain detection to all the rain occurrences by PR is 59% for GPROF. This ratio (called RTDO) is 57% for M1 and 63% for M2. The ratio with the weight of rain rate (called RTDA) is 81% for M1 and 86% for M2, while it is 80% for GPROF. This comparison is done by setting the threshold with a constant coefficient (global parameter) to make the ratio of false rain detection to all the no-rain occurrences judged by PR (the ratio is called RFAO) same (approximately 1%) for three methods. M1 is slightly advantageous to GPROF for the detection of strong rainfall, but GPROF is slightly advantageous to M1 for the detection of weak rainfall. M1 is less accurate than M2 because M1 does not consider the effects of diurnal variation of land surface physical temperature. M2 is more accurate than GPROF because M2 can detect rainfall over desert and snow covered areas, which is almost impossible for GPROF. M1+ and M2+ show small RFAO than M1 and M2, respectively, while RTDO is almost the same, because M1 and M2 are affected by the inter-annual variation between 1998-1999 and 2000.