Improvements of the GSMaP microwave radiometer rainfall algorithm considering cloud and precipitation processes

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Microwave radiometer (MWR) rainfall algorithms consist of a rain/no-rain classification (RNC) and a rain-rate estimation [brightness temperature (TB)–rain-rate conversion] over the delineated rainy area. The rain-rate estimation has been developed under the paradigm that heavy rainfall is associated with strong cold-rain processes. Therefore, conspicuous underestimation of rainfall by MWR algorithms occurred in coastal mountains of the Asian monsoon region where heavy orographic rainfall is frequently associated with strong warm-rain processes. We have improved the heavy orographic rainfall retrievals in the Global Satellite Mapping of Precipitation (GSMaP) MWR algorithm, incorporating an orographic-nonorographic rainfall classification scheme to identify orographic rainfall associated with strong warm-rain processes enhanced by low-level orographic lifting. Further improvement in the detection of orographic rainfall by including information on the upstream flow in the low level troposphere, which determines the shift in the position of orographic enhancement on windward slopes of mountains, has been done. However, problems of missing light rainfall in coastal mountains of the Asian monsoon region remain unresolved.

Although RNCs have not been given as much scientific emphasis as the rain-rate estimation, the success of any MWR retrieval algorithm relies on proper identification of rain pixels and the elimination of surface pixels that produce a signature similar to that of precipitation. While the rain-rate estimation could be improved by considering precipitation processes (e.g. warm-rain vs cold-rain processes), RNCs should be improved considering cloud processes such as the onset of precipitation. In the presentation, improvements of GSMaP MWR algorithm considering cloud and precipitation processes are reviewed.

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