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Multisatellite rain rate estimation over land with correction for cloud properties

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One of the major uncertainties in precipitation estimation over land using satellite imagery originates from the inadequate treatment of cloud properties. Different cloud types produce different amount of precipitation, and often it is difficult to distinguish between raining and non-raining cloud systems. Due to the cold tops, cirrus clouds are often misinterpreted as high cumulonimbus clouds or they mask real precipitating systems, which cover the very top of the convective cloud anvils. This can be overcome by utilizing modern spaceborn radar systems, but in order to produce a consistent long-term precipitation dataset a better treatment of rain and cloud properties observed by passive instruments is required.

In this study we propose a rain rate retrieval correction method based on multispectral multisatellite passive measurements. Its main purpose is high spatial resolution rain intensities estimation applicable to the historical satellite records and to various cloud conditions. The approach is based on using microwave information from sensors like SSM/I and AMSU, while information from newer AMSR/E or TRMM instruments can be utilized as well. Rain rate estimates from passive microwave sensors are merged with cloud types and cloud physical properties retrieved from IR sensors like SEVIRI, AVHRR or MODIS. By combining these data types spatial resolution of 10 km is achieved. Methods for disaggregating coarse resolution microwave records are examined.

The performance of the approach is analyzed through a case study for the year 2006, where corrected rain rate retrievals were compared with hourly accumulated precipitation records from German meteorological stations. For this study cloud properties information was obtained from EUMETSAT Satellite Application Facility on Climate Monitoring (CM-SAF) and combined with rain intensity retrievals based on SSM/I calibrated records from the University of Hamburg.