The effect of different methods of sampling reference precipitation estimates on the performance evaluation of satellite-based precipitation estimates

Linda Bogerd[1,2], Hidde Leijnse,[1,2], Aart Overeem[2,3] , Remko Uijlenhoet[1,3]

[1]*Hydrology and Quantitative Water Management Group, Wageningen University and Research, Wageningen, Netherlands*
[2] *R&D Observations and Data Technology, Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands*
[3]*Department of Water Management, Faculty of Civil Engineering & Geosciences, Delft University of Technology, Netherlands*

ABSTRACT

Over the past decades, much effort has been put into the retrieval of precipitation estimates from satellite observations. Assessing the accuracy of satellite-based precipitation retrieval is crucial to improve or implement these estimates in applications such as hydrological modelling and forecasting. Often, satellite-based precipitation products are evaluated over areas with well-established ground-based precipitation products. A well-known problem is the comparison of satellite-based estimations (often pixels) against rain gauges (point measurements). However, even when a gridded ground-based precipitation product is used as reference, the method of sampling affects the results, especially when the precipitation event has a high spatiotemporal variability.

Hence, this research is focussed on different ways of sampling and how these affect the evaluation and its conclusions of the satellite-based precipitation products. GPROF precipitation estimates retrieved from conical scanning radiometers belonging to the constellation of the Global Precipitaiton Measurement mission (GPM) are evaluated. Gauge-adjusted radar precipitation estimates and reflectivity profiles retrieved from a ground-based radar are used as reference products (both from the Royal Netherlands Meteorological Institute: KNMI). The study is performed over the Netherlands in 2019.

Five different sampling methods that are often implemented in previous research are studied: 1. one pixel in the middle of the satellite footprint, 2. averaged over a circle, 3. gaussian-weighted averaged over a circle, 4. gaussian-weighted averaged over an ellipse (based on the 19 GHz characteristics), and 5. gaussian-weighted averaged over an ellipse (based on the 89 GHz characteristics). Besides 2D observations, vertical ground- and space-based reflectivity profiles are compared. To study the latter, satellite-based radar reflectivities are evaluated against both slant and straight ground-based vertical profiles.