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Assessing the performance of satellite-based precipitation products over the Mediterranean region

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Detailed knowledge about the spatial and temporal patterns and quantities of precipitation is of high importance. This applies especially in the Mediterranean region, where water demand for agricultural, industrial and touristic needs is growing and climate projections foresee a decrease of precipitation amounts and an increase in variability. In this region, ground-based rain gauges are available only limited in number, particularly in northern Africa and the Middle East and lack to capture the high spatio-temporal character of precipitation over large areas. This has motivated the development of a large number of remote sensing products for monitoring rainfall. Satellite-based precipitation products are based on various observation principles and retrieval approaches, i.e. from thermal infra-red and microwaves. Although, many individual validation studies on the performance of these precipitation datasets exist, they mostly examine only one or a few of these rainfall products at the same time and are not targeted at the Mediterranean basin as a whole.

Here, we present an extensive comparative study of seven different satellite-based precipitation products, namely CMORPH 30-minutes, CMORPH 3-hourly, GPCP, PERSIANN, SM2Rain CCI, TRMM TMPA 3B42, and TRMM TMPA 3B42RT, focusing on the whole Mediterranean region and on individual Mediterranean catchments. The time frame of investigation is restricted by the common availability of all precipitation products and covers the period 2000-2013. We assess the skill of the satellite products against gridded gauge-based data provided by GPCC and E-OBS. Apart from common characteristics like biases and temporal correlations we evaluate several sophisticated dataset properties that are of particular interest for Mediterranean hydrology, including the capability of the remotely sensed products to capture extreme events and trends.

A clear seasonal dependency of the correlation results can be observed for the whole Mediterranean basin as well as for the individual catchments. While high correlation values are achieved for basins north of the Mediterranean Sea, the African Nile catchment is showing the lowest correlation values. When examining the climate indices, e.g. number of (very) heavy precipitation days, the maximum precipitation amount of five consecutive wet days, maximum number of consecutive wet days, it becomes clear that the satellite-based precipitation products are having difficulties in capturing consecutive rainfall events. More promising results are obtained when calculating the total annual amount of precipitation or the number of heavy precipitation days.