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# Modeling regional rainfall dataset using satellite based rainfall observations, in situ data and rainfall climatology contours: A case study for the MENA region

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Information on the spatio-temporal distribution of rainfall is critical for addressing water-related disasters, especially in the arid and semi-arid regions of the Middle East and North Africa. However, availability of reliable rainfall datasets for the region is limited. In this study, in cooperation with the U.S. Agency for International Development, we have combined observations from satellite-based rainfall data, in situ rain gauge station observations and rainfall climatology to create an improved regional rainfall dataset for Jordan, West Bank and Lebanon. First, we validated three satellite-based rainfall datasets using rain gauge observations obtained from Jordan (205 stations), West Bank (44 stations) and Lebanon (8 stations). We used daily (25-km resolution) Tropical Rainfall Measuring Mission (TRMM) data over 2000–2016; daily 10-km Rainfall Estimate (RFE) for Africa rainfall data over 2001–2016; and daily 1-km Climate Hazards Group Infrared Precipitations with Station (CHIRPS) data over 1981–2015. Validation was conducted at daily, monthly, and annual time scales. A weaker correlation was found between station observation and satellite rainfall at daily time step mainly due to the lack of dynamic range in rainfall distribution. However, agreement between satellite rainfall estimates and station observations improved at monthly and annual time scales, indicating reliability of satellite observations for monitoring hydrologic processes at longer time scales. At monthly time scale, average correlation coefficient (r) was found to be 0.22, 0.60 and 0.70 for TRMM, RFE and CHIRPS, respectively. At annual time scale, r was found to be 0.39, 0.49 and 0.60 for TRMM, RFE and CHIRPS, respectively. Based on the validation results, the CHIRPS rainfall dataset was found to perform better than the other two rainfall datasets for the region. We also combined station-derived climatology with available climatology rainfall contours to create a robust gridded climatology dataset for the region. Finally, using this climatology dataset, we quantified bias and developed a bias-corrected CHIRPS rainfall climatology dataset at daily, monthly and annual time scales. The regional rainfall datasets produced from this study will be used to i) understand spatio-temporal distribution of rainfall and water-related disasters, ii) model streamflow and, iii) identify regions potentially suitable for managed aquifer recharge.