



Spatial and temporal evaluation of multiple gridded precipitation datasets over complex topography and variable climate of Turkey

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Evaluation of problems related to water resources development and management require accurate precipitation estimates. Although ground-based stations provide direct physical measurement of precipitation, the accuracy of gauge-based precipitation data in terms of quality and spatial pattern may still be controversial. On the other hand, Gridded Precipitation Datasets (GPDs) provide high spatial and temporal precipitation estimates. GPDs are continuously changing with the improving technology and updating of retrospective algorithms, but they still need to be assessed over different regions both in space and time before being used for hydro-climatic studies. This study attempts to evaluate the spatio-temporal consistency of 13 different GPDs (CPCv1, MSWEPv2.2, ERA5, CHIRPSv2.0, CHIRPv2.0, IMERGHHFv06, IMERGHHEv06, IMERGHHLv06, TMPA-3b42v07, TMPA-3b42RTv07, PERSIANN-CDR, PERSIANN-CCS and PERSIANN) over Turkey which is a country characterized by diverse climate and complex terrain. The evaluation is performed for daily and monthly time scales considering the entire period of 2015-2019 as well as seasonal (spring, summer, autumn and winter) variability. Precipitation data from 130 stations are provided as reference data for point-to-grid comparison of GPDs. The modified Kling Gupta Efficiency (KGE) is selected for qualitative analysis whereas the Hanssen–Kuipers Score (HKS) is used to identify the ability of GPDs for capturing various precipitation events. The Probability Density Function (PDF) is selected to evaluate the intensity frequency of 13 GPDs for individual daily-based precipitation events. The results indicate that all GPDs have a median KGE performance ranging between -0.11 and 0.53 for daily precipitation while their performance increases in the monthly case (median KGE from 0.16 to 0.82). Gauge-corrected GPDs exhibit slightly better results over the uncorrected datasets in comparison with ground observations. GPDs from multi-source merging perform better than only satellite-based and reanalysis precipitation datasets. Among uncorrected GPDs, ERA5 and CHIRPv2.0 perform better while PERSIANN perform worse in all conditions. MSWEPv2.2 suffers from high-altitude conditions during winter and CHIRPSv2.0 shows poor performance during dry seasons. On the overall, MSWEPv2.2 performs better than CHIRPSv2.0 during daily/monthly, while CHIRPv2.0 performs better than CHIRPSv2.0 for daily time scale.