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Performance evaluation of ensemble precipitation forecasts and satellite products for the spring 2019 severe floods in Iran

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In this study, the performance of ensemble precipitation forecasts of three numerical weather prediction (NWP) models within the TIGGE database as well as the integrated multi-satellite retrievals for global precipitation measurement (GPM), namely IMERG-RT V05B, for precipitation estimates were evaluated in recent severe floods in Iran over the March–April 2019 period. The evaluations were conducted in two modes: spatial distribution of precipitation and the dichotomous evaluation in four precipitation thresholds (25, 50, 75, and 100 mm per day). The results showed that the United Kingdom Met Office (UKMO) model, in terms of spatial coverage and satellite estimates as well as the precipitation amount, were closer to the observations. Although, generally, the models captured the spatial distribution of heavy precipitation events, the hot spots were not located in the correct area. The National Centers for Environmental Forecast (NCEP) model performed well at low precipitation thresholds, while at high thresholds, its performance decreased significantly. On the contrary, the accuracy of IMERG improved when the precipitation threshold increased. The UKMO had better forecasts than the other models at the 100 mm/day precipitation threshold, whereas the Medium-Range Weather Forecasts (ECMWF) had acceptable forecasts in all thresholds and was able to forecast precipitation events with a lower false alarm ratio and better detection when compared to other models. Although, the models and IMERG product underestimated or overestimated the amount of precipitation, but they were able to detect most extreme precipitation events. Overall, the results of this study show the IMERG precipitation estimates and NWP ensemble forecasts performed well in the three major flood events in spring 2019 in Iran. Given wide spread damages caused by the floods, the necessity of establishing an efficient flood warning system using the best precipitation products is advised.