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Extreme precipitation events and related weather patterns over Iraq

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This study aims to investigate the extreme precipitation events and the associated weather phenomena in the Middle East and particularly in Iraq. For this purpose we used Baghdad daily precipitation records from the Iraqi Meteorological and Seismology Organization combined with ECMWF (ERA-Interim) reanalysis data for the period from January 2002 to December 2013. Extreme events were found statistically at the 90% percentile of the recorded precipitation, and were highly correlated with hydrological flooding in some cities of Iraq. We identified fifteen extreme precipitation events. The analysis of the corresponding weather patterns (500 hPa and 250 hPa geopotential and velocity field distribution) indicated that 5 events were related with cut off low causing the highest precipitation (180 mm), 3 events related with rex block (158 mm), 3 events related with jet streak occurrence (130 mm) and 4 events related with troughs (107 mm). . Five of these events caused flash floods and in particular one of them related with a rex block was the most dramatic heavy rain event in Iraq in 30 years.

We investigated for each case the convective instability and dynamical forcing together with humidity sources. For convective instability we explored the distribution of the K index and SWEAT index. For dynamical forcing we analyzed at several levels Q vector, divergence, potential and relative vorticity advection and omega vertical velocity. Source of humidity was investigated through humidity and convergence of specific humidity distribution. One triggering factor of all the events is the advection and convergence of humidity from the Red Sea and the Persian Gulf. Therefore a necessary condition for extreme precipitation in Iraq is the advection and convergence of humidity from the Red Sea and Persian Gulf. Our preliminary analysis also indicates that extreme precipitation events are primary dynamical forced playing convective instability a secondary role.