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Rainfall depth and coverage of flashflood-producing storms in the Levant drylands

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Scarce, but sometimes intense rainstorms leading to flashfloods characterize the Levant drylands. These flashfloods are the hydrogeomorphic agents for channel incision, sediment transport and filling of lowlands by sediment and water. These floods can damage infrastructure and cause loss of life. This study characterizes the large-scale meteorological conditions leading to rainfall, the rainfall space-time patterns, and the hydrology of the largest flashfloods. We studied two major flashfloods related to each of the three main synoptic systems, Mediterranean Cyclone (MC), Active Red Sea Trough (ARST) and Tropical Plume (TP). Calibrated radar, meteorological reanalysis, and measured hydrological data indicate that (a) TP associated flashfloods generate the highest rainfall depths, simultaneously on the broad region. Thus, this system produces widespread intense flashfloods in all catchment areas in the drylands of the southern Levant. (b) High-rate convective-spotty rainfall of the ARST generates isolated rain cores producing intense flashfloods. (c) The MC generate flashfloods primarily at the northern parts of the Levant's drylands a limit attributed to the steep rainfall gradient inland from the Mediterranean. During TP atmospheric moisture is advected to the Levant from western equatorial regions and precipitates due to subtropical-jet forcing over the southern Levant. During ARST flashfloods, moisture is present in the region and precipitates by mesoscale forcing concurring with diurnal heating. MC flashfloods combine advected moisture from the Mediterranean Sea and meso- and synoptic-scale forcing. TP is the primary synoptic system that may lead to flashfloods in the 103-104 km2 catchment areas, due to the simultaneous generation of multiple flashfloods on numerous smaller catchments. This type of synoptic scale system is rare and therefore was absent from earlier analyses.