Studying the extremes: Hydrometeorological investigation of a flood-causing rainstorm over Israel

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Analysis of extreme hydrometeorological events is important for characterizing and better understanding meteorological conditions that can produce heavy rainfall and hydrological and geomorphologic factors that play a major role in the consequently generation of floods. These analyses are also important in the context of global climate change that according to model forecasts will cause a decrease in total rain amounts and an increase occurrence of extreme events at the eastern Mediterranean.

The current study presents analysis of the extreme event occurred over Israel at the beginning of April, 2006. Heavy rainfall that last for several hours was observed in few locations, but extreme conditions developed over small area of few km^2 caused severe flash floods, casualties and heavy damages.

The synoptic conditions of the event were quite unusual. Tropical moisture originated in an equatorial low at eastern Africa was transported through Saudi Arabia, Iraq, and Syria toward Israel around a deep low pressure located over Jordan. The flood-causing rainfall occurred when Israel was positioned at the western sector of the deep upper-level trough under inferior conditions, i.e., convergence and negative vorticity. The high rain amounts at the core area were generated by a narrow band of rain cells that crossed the region. These extremes were partly due to “train effect” - successive rain cells move over the same spot like the carriages in a train.

In the vicinity of the most damaged area more than 100 mm of rain in less than 12 hours were recorded by rain gauges. However none of the stations were located within the core. Analysis of high resolution rainfall data from a meteorological radar system revealed at the storm core rain amounts significantly higher than those observed by gauges at the surroundings. Radar-based estimations of rain amounts and intensities for different time durations and areal extents were derived for the event.

The flash floods caused by the heavy rainfall were larger than any recorded flow in similar regions in Israel. The specific peak discharge values estimated from high watermarks along the flooded channels were 30 $m^3s^{-1}km^{-2}$ for catchments smaller than 1 km^2 and 10 $m^3s^{-1}km^{-2}$ for catchments in size of 5 km^2. The high specific discharge caused severe channel scouring up to 3 m deep, in some cases down to the underlying

bedrock, and development of nick points. Nearby, numerous of landslides were observed on steep natural slopes and soil erosion especially on cultivated fields, result of the heavy rainfall.

The above findings indicate that the analyzed event was meteorological, hydrological and geomorphologic extreme. Further investigation is currently conducted to study in details these extremes, their interrelations and the major physical processes that underlie them.