Magnitude and Frequency of the Largest Palaeofloods during the Holocene in Nahal Ze'elim and Nahal Rahaf, Judea Desert, Israel

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The Judea Desert constitutes a distinctive hydrological region characterized by short and steep ephemeral streams draining eastward to the Dead Sea Valley. The aridity of the Judea desert is caused by the rain-shadow effect of the north-south, mountainous back bone (MBB) of Israel, as well as by the low elevations within the Dead Sea valley. The hydrological data for these streams is scarce, which leads to poor estimation of the magnitude and frequency of floods. The lack of data is particularly significant when planning infrastructure such as roads, bridges, reservoirs, dams etc. Flood frequency analysis for risk assessment is therefore, based on various models such as rainfall-runoff, empirical, regional models etc.

The current study is based on Palaeoflood Hydrology which uses geomorphological evidence for real floods that accumulate in typical natural traps, along the course of the streams for hundreds and thousands of years. The collection of these data enables us to reconstruct the history of the floods in the streams including/at least the largest event that occurred in the stream in the last hundreds to thousands years. By combining these data with measured and historical data (if any), a long, solid database can be reconstructed. The applicability of the system in Israel has been proven in the larger streams in the Negev. However, the Negev Desert is a significantly different hydrological environment. The largest flood that occurred in the stream is important for regional envelope curves. Long palaeoflood records can indicate on changes in the hydrological regime, which testify for climatic fluctuations.

The method is based on field evidence in the form of slackwater deposits and other high water marks, which accumulate in typical sites and indicate on the minimum water elevation enabling discharge calculations using HECRAS hydraulic engineering software. The ages of the floods are determined by dating the flood deposits using radiocarbon and OSL.

In the Upper Nahal Rahaf stream (50 km²), three sites were located with 2-4 flood deposits at each site, including a rock shelter within which 2 flood remnants with reconstructed peak discharges of 1,200-1,300 m³/s. These flood sediments are overlying an Upper Paleolithic site dated to about 30 ka.

In Nahal Ze'elim stream (245 km²) 5 sites were located - 4 of which close to the outlet. Each site recorded between 2-8 sedimentary units with reconstructed peak discharges of 200-900 m³/sec.
The integration of the floods from all sites with their age revealed a vast information regarding major events. In further study this will also allow a renewed frequency analysis on the basis of wider knowledge.