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Warm intervals climate in the Levant from U and Sr isotopes in lacustrine salt sequences

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The present climate in the Levant is highly variable and suffers occasionally form droughts. There is a strong meridional gradient in precipitation and evaporation and influence of both tropical and north hemisphere climates. The Dead Sea Deep Drilling Project (DSDDP) cores allow for the first time reconstruction of past climate during the warmest and driest periods in this region. We focus here on both the Holocene and Marine Isotope Stage (MIS) 5e intervals, which were globally warm. These intervals are characterized by thick layers of halite reflecting the driest periods over the past 200 ky. The fast sedimentation rate (several mm to several cm) allows identifying the climatic changes in high resolution along various orbital forcings. Based on the amount of salt and major elements (Mg, Cl and Na) in pore waters and fluid inclusions we were able to quantify the average runoff that decreased to 30-50% of the present (pre-1964 before the diversion of the Jordan River) runoff during that time reaching 20% during the most arid intervals over decades to centuries. 234U/238U activity ratios and 87Sr/86Sr ratios in the primary minerals indicate drastic shifts in the lake's hydrology during the driest times, both in MIS 5e and the Holocene. These changes: e.g. 234U/238U activity ratios decrease $\sim$1.5 activity ratio to $\sim$1.1) suggesting a shift toward tropical influence rather than the typical Mediterranean-north Atlantic influence. Combining the DSDDP record with other climate records and with CCSM3 runs of the last interglacial (130, 125 and 120 ky) highlights the temporal variability due to changes in the orbital forcings between 125 ky (peak summer insolation) and 120 ky. While 125 ky, which is temporally salt-free in the core, is characterized by increase in both summer and winter precipitation, 120 ky, which is reflected by the thickest salt layer, is characterized by dry winters, increase in fall season precipitation and scarce but intense rainfall events causing flooding