Winter Atmospheric Circulation Patterns, Near East Excess Rainfall and Droughts and the Historic Dead Sea Lake Level Variations

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The Dead Sea is an amplifying terminal lake of one of the largest hydrological systems in the Levant and may thus be viewed as a large rain gage for the region. Its level variations are indicative of the climate variations in the region. Here, we first present the decadal- to centennial-resolution Holocene lake-level curve of the Dead Sea (Bookman et al., 2004). Then, we determine the regional hydroclimatology that affected level variations. To achieve this goal we compare between modern natural lake levels variations and instrumental rainfall record and quantify the hydrology relative to lake-level rise, fall, or stability. To quantify that relationship under natural conditions rainfall data predating the artificial Dead Sea level drop since 1960s are used. In this respect, Jerusalem station offers the longest, pre-1960s uninterrupted rainfall record. Jerusalem rains serve as an adequate proxy for the Dead Sea headwaters rainfall because principal component analysis ($\sim$70% of the total variance explained by PC1) indicates that temporal variations of annual precipitation in all stations In Israel north of the current 200 mm yr^{-1} average isohyet during 1940-1990 are largely synchronous and in phase. This station also represents well northern Jordan and the area all the way to Beirut, Lebanon, especially during extreme drought and wet spells. We determine a) the modern, and propose the past regional paleohydrology and Eastern Mediterranean (EM) climatology that affected the severity and length of droughts/wet spells associated with multi-year episodes of Dead Sea level falls/rises; and b) that EM cyclone tracks were different in average number and latitude in wet and dry years in Jerusalem. The mean composite sea level pressure and 500 mb height anomalies indicate that the potential causes for wet and dry episodes span the entire EM and is rooted in the larger scale Northern Hemisphere atmospheric circulation. The remarkably close association (within radiocarbon resolution) of the climatic changes as reflected by level changes and culture shifts in this and the wider region are shortly discussed