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Abrupt aridities in the Levant-Sahel linked with solar activities

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Observations of 19th and 20th century precipitation in the Dead Sea watershed region display a multidecadal, anti-phase relationship to North Atlantic (NAtl) sea surface temperature (SST) variability, such that when the NAtl is relatively cold, Jerusalem experiences higher than normal precipitation and vice versa. This association is underlined by a negative correlation to precipitation in the sub-Saharan Sahel and a positive correlation to precipitation in western North America, areas that are also affected by multidecadal NAtl SST variability. These observations are consistent with broad range of Holocene hydroclimatic fluctuations from the epochal, to the millennial and centennial time scales, as displayed by the Dead Sea and Sahelian lake levels and by direct and indirect proxy indicators of NAtl SSTs. On the epochal time scale, the gradual cooling of NAtl SSTs throughout the Holocene in response to precession-driven reduction of summer insolation is associated with previously well-studied wet-to-dry transition in the Sahel and with a general increase in Dead Sea lake levels from low stands after the Younger Dryas to higher stands in the mid- to late-Holocene. On the millennial and centennial time scales there is also evidence for an antiphase relationship between Holocene variations in the Dead Sea and Sahelian lake levels and with proxy indicators of NAtl SSTs. However, the records are punctuated by abrupt lake-level drops and extensive expansion of the desert belt at ∼8.1, 5.7, 3.3 and 1.4 ka cal BP, which appear to be in-phase and which occur during previously documented abrupt major cooling events in the Northern Hemisphere. We link these cooling to solar activity variations that were identified in the North Atlantic IRD and cosmogenic isotopes records.