Geophysical Research Abstracts
Vol. 12, EGU2010-10683, 2010
EGU General Assembly 2010
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The Influence of the Atlantic on Levant Hydroclimatic Variability Throughout the Holocene

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We compare decadal, 19th and 20th century precipitation variability in Jerusalem - as representative of the entire Levant region - with observed decadal precipitation variability in the Northern Hemisphere. The comparison points at an anti-phase relationship between Levant and sub-Saharan Africa rainfall and an in-phase relationship with precipitation in Northern Europe and North America. In addition, North Atlantic SSTs display a decadal and longer, anti-phase relationship with Jerusalem precipitation such that when the North Atlantic is persistently colder than normal the Levant is wetter than normal and vice versa. The evidence emerging from the relatively short instrumental record is supported by a comparison between the Holocene Dead Sea level record and similar long records of lake levels in sub-Saharan Africa and by Holocene proxy indicators of centennial to millennial North Atlantic SST variability.

Atlantic Multidecadal Variability (AMV, a.k.a. Atlantic Multidecadal Oscillation) is an important contributor to natural (internal) global climate variability. Its role in Sahel and North American precipitation has been addressed in many recent studies. However, the link between AMV and the Levant has so far not received much attention. We propose that the mechanisms by which AMV affects precipitation in the Levant is related to the tendency for high (low) pressure anomalies to persist over the eastern North Atlantic/Southwestern Europe when the North Atlantic is cold (warm). This, in turn affects the likelihood of cold air outbreaks and cyclogenesis in the Eastern Mediterranean region and consequently of rainfall in the Levant. Through this mechanism AMV can exacerbate or alleviate the impact of the projected anthropogenic drying of the Levant.