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Millennial to orbital-scale ice-sheet effects on hydroclimatic variability in the Eastern Mediterranean over the last 360 ka

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Decadally-resolved lacustrine paleoclimate records from deep closed lakes can provide new insights into the mechanisms of past environmental changes in the continental interior. We retrieved a 220-m long sediment sequence from Lake Van (Turkey) that records over 600 ka decadal to orbital-scale climate variability.

Using a suite of proxies in this record, we reconstruct variations in run-off, lake level, water mixing, chemistry and shoreline distance. Dansgaard Oeschger (DO)-related hydroclimate variability can be traced over several glacials. Sediment-color data (B*) capture the details of DO variability and rainfall seasonality in an unprecedented manner, allowing for a detailed study of global climate linkages on centennial to millennial timescales. The reconstructed DO teleconnections and regional hydroclimate changes in Turkey are consistent with a transient 50-30 ka B.P climate model simulation, which was forced by estimates of iceberg calving in the Nordic Seas. Our detailed paleo data/model comparison supports the notion that centennial-to millennial-scale iceberg instabilities, originating from the Northern Hemisphere ice-sheets, caused major disruptions of the Atlantic Meridional Overturning circulation, which in turn shifted global hydroclimate patterns.

The Lake Van record further documents the presence of pervasive glacial DO continuum variability extending back to at least 400 ka B.P. The statistics of this variability as well as the orbital-scale hydroclimate changes in the Eastern Mediterranean are clearly modulated by glacial ice-volume changes. This result is further supported by another 408-0 ka-transient climate model simulation, which provides a means of quantifying the direct orbital effects on Mediterranean seasonal rainfall changes, as well as the ice-sheet induced changes of the large-scale atmospheric circulation and hydroclimate.