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Sub-seasonal reconstructions of Middle East climate during the Holocene from northern Red Sea corals

T. Felis (1), H. Kuhnert (1), M. Herold (1,2), G. Lohmann (2), S.A. Al-Rousan (3), J. Pätzold (1)

(1) DFG-Research Center for Ocean Margins, University of Bremen, Bremen, Germany, (2) Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, Germany, (3) Marine Science Station, University of Jordan & Yarmouk University, Aqaba, Jordan (tfelis@uni-bremen.de)

An abrupt termination of the early Holocene humid period in the southeastern Mediterranean/Middle East around 6.2 kyr ago is indicated by marine sediment records from the northernmost Red Sea. Not much, however, is known about changes in the region's hydrologic balance on seasonal to interannual timescales during the mid to late Holocene. Hydrologic changes on these timescales should have potentially affected past civilizations in this arid region. Here we present sub-seasonally resolved proxy records of mid- to late Holocene climate in the southeastern Mediterranean/Middle East, based on annually-banded reef corals from the northernmost Red Sea. Oxygen isotope and Sr/Ca records generated from individual coral colonies cover time windows of decades to a century. Relative to modern and late Holocene conditions, the coral records suggest an increased seasonality in the hydrologic balance for time windows around 6.0, 4.6 and 4.4 kyr ago. Such an increased seasonal cycle of hydrologic balance could result from both enhanced evaporation during winter or increased precipitation during summer, although the latter is rather unlikely in this arid region. Furthermore, slightly increased temperature seasonality is indicated for most of the time windows between 5.6 and 3.6 kyr ago. Combining our coral records with state-of-the-art climate model simulations will help to identify the controlling mechanisms for changes in the seasonal cycle in this region during the Holocene. This provides a crucial step in understanding and predicting pronounced changes in past, present and future Middle East climate.