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Multi-decadal to centennial climate dynamics in the Holocene recorded in Red Sea sediments

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As a desert-surrounded, semi-enclosed marine environment, the northern Red Sea suffered extreme oceanographic changes in the past resulting in an amplification of paleoclimate signals in the marine records. Very special paleoclimate archives in the northern Red Sea are the anoxic sediments from the brine-filled Shaban Deep and the high-accumulation sites from the northern tip of the Gulf of Aqaba. The Shaban Deep is a small-scale basin at ∼1500 m water depth presently filled with ∼200 m of oxygen-depleted, highly saline (∼260 psu) brine. Gravity cores retrieved from this basin comprise of partly laminated olive gray to black sediments that most probably document annual deposition cycles. Between about 6,400 and 4,200 years BP one such laminated interval documents distinct multi-decadal to centennial changes in the carbonaceous (coccoliths) versus siliceous (diatoms) sedimentation. Opal-dominated intervals represent periods of more effective nutrient redistribution due to recurrent fall to winter deep mixing processes. Coccolith-dominated intervals indicate periods of low nutrient recycling and generally line up with intervals of reduced solar activity (Maunder- and Spörer type perturbations) pointing to a shift to more AO/NAO negative conditions (warmer winter), like they were suggested for the mid-1600s to the early 1700s Maunder Minimum. In the northernmost Gulf of Aqaba, Holocene variations are documented by distinct changes in the eolian dust input and density-forced changes in the vertical mixing of the water column. The combined information from these two very different Red Sea archives suggests decadal to centennial scale variations in the regional hydroclimatic system as an potential expression of long-term AO/NAO like variability that can ultimately be linked to changes in solar activity.