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# Nile River discharge and Eastern Mediterranean Sea surface freshening during sapropel S1 formation

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Cyclically reoccurring sapropels, layers of organic rich deposits, found in the Eastern Mediterranean sediment record during the Holocene to Pliocene are manifestations of extreme oceanographic events. However, the driving forces that lead to severely reduced deep- water ventilation and the collapse of benthic ecosystems have not been sufficiently identified. The cease in circulation has long been considered a response to major surface water freshening episodes caused by enhanced riverine input from the surrounding continents, with the main source being the Nile River, the Black Sea outflow or a combination thereof. Here we generate a dataset of trace element and stable isotope measurements that record runoff and sea surface temperature (SST) and focus on the most recent Eastern Mediterranean Sea (EMS) sapropel to determine the main freshwater sources driving sapropel formation. Based on the sequence of events, we rule out a role of Black Sea outflow in triggering and sustaining the EMS Holocene surface freshening. Our results indicate that the timing and duration of the extreme events reflect a combined effect of significantly enhanced Nile River runoff and EMS surface warming during winter. We suggest that the coincidence of these factors arose due to concomitant strengthening of the East African summer monsoon and most likely persistently negative mode of the North Atlantic Oscillation, a meteorological phenomenon that has a strong impact on Eastern Mediterranean winter hydroclimate.