Geophysical Research Abstracts
Vol. 20, EGU2018-10877, 2018
EGU General Assembly 2018

Quantification of African monsoonal freshwater runoff during the last interglacial sapropel S5

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The Mediterranean has great potential for reconstructing past climate. Due to the geography of a semi-enclosed basin, climate signals are amplified in Mediterranean sedimentary records, and high sedimentation rates enable high resolution records. Recently, planktic foraminiferal δ^{18}O records from the Mediterranean were used to reconstruct a 5.3 Myr sea-level record (Rohling *et al.,* 2014), the first millennially resolved reconstruction extending beyond 0.5 Myr which is independent from deep-sea benthic δ^{18}O.

However, the Mediterranean's sedimentary record is punctuated by sapropels: periodic deep-sea anoxic events strongly associated with times of African monsoon intensification. The increased freshwater influx to the basin during sapropels decreases the δ^{18}O of surface waters, creating anomalies in foraminiferal δ^{18}O records which prevent robust interpretation of Mediterranean δ^{18}O, and hence of palaeoclimatic reconstructions over these intervals. Despite extensive research on sapropels, the magnitude of monsoonal intensification and freshwater runoff, along with its influence on δ^{18}O, remains elusive.

Using a case study of sapropel S5 ($\sim$128-121 ka) which occurred during the last interglacial, we present a method to obtain estimates of monsoonal freshwater runoff. Our method uses a box model of the Mediterranean Sea which represents different water masses, and has been calibrated using δ^{18}O from planktic foraminifera species of different depth and seasonal habitats. The model was then inverted to deconvolve the δ^{18}O signal of the surface dwelling foraminiferal species *Globigerinoides ruber* (w). Using records of δ^{18}O, sea-level and sea surface temperature over S5 as inputs, the model calculates the freshwater runoff volume that would be expected to produce the observed δ^{18}O during S5. This method has the potential to be further applied to estimate monsoonal freshwater runoff during other sapropels.

In addition to providing quantification of African monsoon intensification, this study has led to new insights into the stratification and warming of eastern Mediterranean surface waters during sapropels, adding to our understanding of the system dynamics during these events. Furthermore, it may permit full application of the Mediterranean sea-level method in order to more accurately quantify global ice volumes for interglacial highstands over the past 5 Myr.