Far Field Isotopic Signatures of a Green Sahara

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Between 11 and 5 ka, the Sahara was covered with vegetation and lakes extending beyond 30°N. This "Green Sahara" is part of cyclic changes in North Africa monsoon intensity driven primarily by precession. During periods of locally high summer insolation, the North Africa monsoon is stronger, resulting in further northward migration of the ITCZ and greater regional precipitation. Vegetation changes associated with this increase in precipitation act as a positive feedback to further enhance North Africa monsoon strength. Here, we used a water isotope enabled version CESM with a high Northern Hemisphere summer insolation orbit and different amounts of North Africa vegetation to explore far field effects of a Green Sahara. Preliminary results suggest that the presence of a Green Sahara increases global average temperature by almost 0.4°C, with greatest changes in the Northern Hemisphere subtropics and Arctic. Addition of Green Sahara vegetation further amplifies the strength of the North Africa monsoon, leading to greater regional precipitation and evaporation. The South and East Asian monsoon systems also receive greater precipitation in a Green Sahara state. These circulation, temperature, and precipitation responses modify largescale $\delta^{18}O$ signals. Oxygen isotopic composition of precipitation becomes more depleted over much of Asian and Australia and enriched over South Africa, Central America, and Central South America. Our results may provide useful insights for interpreting Holocene water isotope records.