Geophysical Research Abstracts
Vol. 15, EGU2013-11103, 2013
EGU General Assembly 2013

Orbital, greenhouse gas, and meltwater effects on the African Humid Period during the last deglaciation

Bette L. Otto-Bliesner (1), James Russell (2), Peter deMenocal (3), Zhengyu Liu (4), Feng He (4), Peter Clark (5), and Sharon Nicholson (6)

(1) National Center for Atmospheric Research, Boulder, United States (ottobli@ucar.edu, +1-(0)303-4971348), (2) Brown University, Providence, United States, (3) Lamont-Doherty Earth Observatory of Columbia University, Palisades, United States, (4) University of Wisconsin, Madison, United States, (5) Oregon State University, Corvallis, United States, (6) Florida State University, Tallahassee, United States

Proxy records from Africa identify large and abrupt changes in the hydrological cycle during the last deglaciation. Explaining the complex spatial and temporal variations in African hydrology faces two challenges. First, orbital forcing of local summer insolation should have reduced precipitation in southeastern tropical Africa during the deglaciation in contrast to proxy evidence that indicates that the African Humid Period (AHP) encompassed this region. A second issue is that hydrologic changes tended to be abrupt, in contrast to the more gradual orbital forcing, and several of the changes occurred at the same time as the abrupt changes in Northern Hemisphere deglacial climate. To address these issues, we use a transient simulation of the climate evolution from the LGM (∼21 ka) to the early Holocene (11 ka) with a coupled atmosphere-ocean general circulation model, the Community Climate System Model version 3 (CCSM3).

The model simulates an AHP in both the Sahel and the equatorial Southeast African Great Lakes regions, with increased precipitation during their respective summer seasons. In the Sahel region, the orbital summer insolation changes play a primary role in explaining the increase in monsoon precipitation, but with the deglacial increases in the greenhouse gases also being important. In contrast, orbital forcing does not contribute to the simulated precipitation increase in the Great Lakes region. Rather, CCSM3 indicates that the deglacial increases in the greenhouse gases are key for explaining the AHP in this region. The start of the AHP is abrupt in both the Sahel and Great Lakes regions of Africa, correlating well and thus suggesting a strong influence of variations of meltwater, the North Atlantic deep water, and North Atlantic climate on precipitation in these regions.