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Modelling vegetation dynamics in West Africa during the Holocene and links to in situ proxy data

J. Watrin, A. Friend, S. Zaehle and A.-M. Lézine

Laboratoire des Sciences du Climat et de l'Environnement, CNRS-CEA, Orme des Merisiers, 91191 Gif-sur-Yvette cedex, France

The distribution of vegetation in tropical West Africa during the Holocene was punctuated around 6 kBP by a widespread expansion of moist ecosystems into the Sahara, resulting in the so-called "green Sahara", presumably due to a large increase in precipitation. During this period the Sahelian-Saharan boundary moved approximately 700 km north of their previous, and subsequent, latitudes. However, understanding of the complex feedbacks between vegetation structure and climate, and responses to forcings such as sea surface temperatures and orbital parameters, remain significant challenges, particularly due to the relative data-poor nature of this period and the complex interplay of internal and external feedbacks in maintaining savanna ecosystems.

We have tested our ability to simulate the dynamic nature of vegetation distributions during the Holocene using output from a climate model as input to dynamic vegetation models for present, 6 kBP, and 9 kBP time slices. We used two ecosystem models, ORCHIDEE and Hybrid6, and simulated the distribution of vegetation along a transect at 10°E, between the equator and 20°N. We applied the modern observed climate and the anomalous climate simulated by the LMDZ General Circulation Model (GCM) at the historical time slices. Comparison of ORCHIDEE output with modern vegetation shows difficulties in simulating savanna ecosystem dynamics and distributions. We subsequently developed new parameterisations for the Hybrid6 model in order to improve the simulation of this vegetation type and to better simulate its dynamics.

We analyse the modern pollen data available for the region in order to make the link between the model output and historical pollen proxy data. Methodologies are developed that exploit the improved vegetation model for improved characterisation of historical climates through new interpretations of proxy data over the whole of tropical

West Africa.