The last African Humid Period: Evaluation of the seasonal hydrological cycle over North Africa and Sahel

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Résumé

For long, African humid period as well as sapropel events have been linked to strengthening of the summer African monsoon driven by insolation changes. Since 25 years, thanks to PMIP (https://pmip1.lsce.ipsl.fr/) , a large spectrum of different models simulate mid-Holocene. First, with only atmospheric models, then with coupled models (Ocean – Atmosphere), and more recently including vegetation and dust. However, a long-lasting mismatch still exists when comparing these models to the most recent vegetation data synthesis over North Africa. Based on precipitation seasonality reconstruction and vegetation modelling, a recent publication (Chedaddi et al., PNAS, 2017) argues that precipitations over northern Sahara are mostly due to winter precipitations for mid-Holocene optimum (9,5k).
Here, we first analyze the results of the last run of PMIP 6k simulation (https://pmip4.lsce.ipsl.fr/doku.php), especially concerning the seasonal hydrological cycle over North Africa and Sahel. Then, to produce a more realistic comparison, we provide a new simulation of the 9,5ka climate including GHG and insolation changes, but also accounting for the ice sheets that remain during this period, as well as the fresh water input due to the ongoing deglaciation process. First, it appears that there is a variability in the 16 AOGCM in the PMIP4 data base for 6k that will be analyzed. Second, we will investigate the impact of the ice sheets that remain for 9,5ka, and more specifically its interaction with atmosphere dynamics. Indeed, the sea-level for this period is still 30 m lower than today, mainly due to large ice sheets still melting mainly over North America. The impact of such ice sheets on atmosphere dynamics over the tropics and sub-tropics will be analyzed. Indeed, the interaction of the atmosphere, in winter, with this ice sheet may produce large changes on storm tracks and precipitation pattern over this region. This large-scale feature superimposed to local recycling due to the existence of many lakes (Krinner et al) could provide conditions to enhance winter precipitations.

Mots-Clés: Paleoclimate inter comparison project 6k, Holocene optimum climatic 9, 5k, Ice Sheet and Climate interaction

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