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Orbital forcing on West African monsoon system revealed by KZai 02 pollen record spectral analysis

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The present-day intertropical climate is forced by yearly fluctuations of insolation reorganizing pressure cells. They control, via the wind system, the variations of the precipitation front known as the InterTropical Convergence Zone (ITCZ). Its latitudinal oscillation drives a strong seasonality of rainfalls over Africa. However, connections between African climate during Pleistocene and orbital forcing are blurred by high-latitudes and local direct influence of insolation and need further investigations.

The study of KZai 02 core pollen content provides a high-resolution record of changes in West African plant ecosystems during the last 160 kyrs. Spectral analyses were performed on pollen signals to identify periodicity in vegetation dynamics related to environmental fluctuations. The large range of frequencies detected testifies for the sensibility of African biotopes to past climate fluctuations. Milankovitch parameters, especially precession, are identified within variations of the ecological groups of KZai 02 pollen record and interpreted in terms of West African monsoon system variability. Asynchrony in the different plant ecosystem fluctuations suggests the out of step influence of several climatic parameters (precipitation, CO_2, temperature) involving local insolation and high-latitude influence. Spectral analysis also reveals sub-Milankovitch periods related to (1) Heinrich and Dansgaard/Oeschger glacial pulsation events and (2) East Asian monsoon oscillations controlled by ice sheet pulses testifying for the strong relationship between low- and high-latitude climate changes.