

# **Orbital cycles and Cretaceous anoxia : perspectives from Earth system modelling approach**

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Cretaceous anoxic events are thought to be connected – to some extent – to orbital cycles. Phasing of OAE event with peculiar orbital configuration has been widely discussed. Insolation patterns, determined by orbital parameters, influence continental climate, precipitation in particular, with direct impact on erosion and chemical weathering fluxes. Oxygen fluxes, as well as sediments and nutrients export to the ocean thus respond to orbital forcing, with consequences on the production, preservation and burial of oceanic organic matter. Moreover, orbital variations also modulate oceanic circulation, which can potentially play a determinant role in the organic carbon cycle. The multiplicity of connections between orbital cycles and the organic carbon cycle is a challenge for understanding the causality of one on the other.

This challenge is further complicated by the dynamic nature of orbital cycles, with a timescale – 20 to 400 kyrs – similar or lower than the residence time of carbon and phosphorus in Earth superficial reservoirs. This timescale also falls within the range of response time of continental weathering profiles (thousand to million years).

Here we wish to address this challenge with a holistic vision of the response of the Earth system to the orbital forcing. We use for this the geochemical cycle model GEOCLIM, coupled to the climate model IPSL-CM5A2. The modelling framework of GEOCLIM allows to represent the temporal variations of precipitation patterns, as predicted by the climate model, and to explore their effects on continental fluxes. The ocean resolution of GEOCLIM also makes possible to examine the first order effect of variations of oceanic circulation. Finally, this modelling framework is suitable to simulate the dynamical evolution of geochemical cycles over multiple orbital cycles, with emphasis on the organic carbon cycle.