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Interactions between tectonics, climate and vegetation during the Cretaceous. A context for the diversification of Angiosperms.

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It has long been thought that the Angiosperms diversification occurred within a context of warmer-than-present and equable climate during the Cretaceous. However, during the last decade, the view of a uniformely warm Cretaceous climate has been challenged both by paleoclimate proxies and numerical simulations. Among the processes likely affecting climate during this time, atmospheric pCO_2 and tectonics appear to be pivotal to drive temperature and precipitation changes, while the feedbacks from vegetation cover changes on the hydrological cycles remain to be explored. Here we attempt to provide a review of the main studies exploring climate-vegetation interactions during the Cretaceous. Then we present climate simulations aiming at quantifying the impact of landmasses redistribution on climate and vegetation distribution from 225 Ma to 70 Ma. In our simulations, the Pangea breakup triggers the decrease of arid belts from the Triassic to the Cretaceous and a subsequent onset of humid conditions during the late Cretaceous. Positioning angiosperm-bearing fossil sites on our paleo-bioclimatic maps confirm that the rise of flowering plants occured within a context of changing climate. With additional simulations in which we modified physiological parameterizations of the vegetation, we explore the combined impact of paleogeography and shift to angiosperms-dominated land surfaces on climate at the regional and global scales. This gives us the opportunity to test earlier ideas that the angiosperms takeover could have benefited from a positive feedback induced by their particular transpiration capacities.