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Did the evolution of tropical river systems impact the Cenozoic climate system ? A preliminary study with the IPSL-CM5A2 earth system model.

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Driven by plate tectonics and geodynamics, Earth surface has been reshaped during the Cenozoic, with the uplift of numerous mountain ranges. Climate modellers have been tackling the direct impact of these changes on climate for decades, essentially thanks to sensitivity experiments to topography, aiming at quantifying the impact of mountains on atmospheric and ocean dynamics. An indirect consequence of mountain uplift is changes in the continental river routing system, that can be relocated and provide the ocean with freshwater fluxes very different from the present. Here we focus on the Amazon and the Congo river, which routing are known to have been altered by the uplifts of the Andes and the East African Rift System, respectively. We carried out numerical simulations with the IPSL-CM5A2 earth system model in which we alternatively relocated or cut the runoff of these two rivers, and compared the results to simulations where topography only has been changed. We analyze the consequences of the changes in routing in terms of ITCZ position, precipitation spatial patterns, and salinity budgets and associated AMOC strength over the oceans. We show that depending on the region considered, the direct (mechanical) and indirect (hydrology) consequences of uplift on climate can either add up or counteract each other.