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From Eocene to present day, the northward drift of the Tibetan plateau as a key factor for understanding East Asian climate.

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Previous climate modeling studies demonstrated that the height evolution of Himalaya and Tibetan Plateau (TP) during Cenozoic was a driving parameter to understand hydrological cycle and monsoons pattern changes over Asia. Superimposed to this forcing factor, the Paratethys shrinkage during the same period has also been shown to be an important parameter modifying drastically the pattern of Asian monsoon. We show here that the northward drift of the TP from the initial collision of Indian plate with an Asian continent that took place in the tropics, during Eocene, to the present day subtropical location of this mountain range is also very important to account for. It explains East Asian monsoon and aridification of inland Chinese deserts. Indeed, most of these studies have only considered the Himalaya–TP in its present location between ∼26°N and 40°N despite numerous recent geophysical studies that reconstruct the Himalaya–TP 10° or more of latitude to the south during the early Paleogene.

To pinpoint the role of location of the TP (from tropical to subtropical areas) on hydrological changes (monsoon/aridification) we have designed a series of climate simulations including changes in paleogeography and vegetation to explore the sensitivity of East Asian climate to the latitude of the Himalaya–TP. Our simulations show that the interaction between the mountain range and the monsoon system is drastically dependent on its location. Surface uplift of the Himalaya–TP in the subtropics intensifies aridity throughout inland Asia and enhance precipitation over East Asia. In contrast, the rise of the Himalaya–TP in the tropics slightly intensifies aridity in inland Asia, and it weakly increases precipitation in East Asia. Importantly, this climate sensitivity to the latitudinal position of the Himalaya–TP is non-linear. The simulated climate effects of the Himalaya–TP are significantly different between scenarios in which the plateau is situated between ∼11°N and ∼25°N rather than between ∼20°N and ∼33°N, but are similar when the plateau translates northward from between ∼20°N and ∼33°N to its modern position.

Our simulations, when interpreted in the context of climate proxy data from Central Asia, support geophysically-based paleogeographic reconstructions in which the southern margin of a modern-elevation proto-Himalaya–TP was located at ∼20°N or further north in the Eocene.