



Regional climate modeling of Asian monsoon evolution in Late Miocene and its response to Tibetan uplift

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The uplift of the Tibetan plateau has been recognized as one of the most important forcing factors that lead to the intensification of Asian monsoon and the formation of the modern Asian monsoon system (both southern Asian monsoon and eastern Asian monsoon). However, the history of Asia monsoon evolution and its relation to the growth of Tibetan plateau remain largely uncertain. There is good evidence that there was a significant uplift of Tibetan plateau in late Miocene (11-5 Ma ago), during which Asian monsoon also intensified, but the relationship between Tibetan plateau uplift and Asian monsoon evolution in this period has not been well demonstrated yet.

Most modeling studies on Asian monsoon evolution and its relation to the uplift of the Tibetan plateau rely on global models with coarse horizontal resolution. This approach will miss detailed topography features of Tibetan plateau such as a chain of high mountains of Himalayas, which would be important to Asian monsoon development. In addition, most of the model studies on the relation between Asia monsoon and the uplift of the Tibetan plateau use a modern climate configuration. This may be misleading, because the global climate conditions were quite different, when the uplift of the Tibetan plateau really occurred.

In this study, the regional climate model (CCLM) will be used to investigate Asian monsoon evolution and its response to Tibetan plateau uplift in the late Miocene. The boundary conditions and the global atmospheric forcing for regional climate modelling will be based on existing late Miocene model runs with a global atmosphere-ocean general circulation model (AOGCM). The simulations will be conducted in three nested domains. The largest domain has relatively coarse resolution and covers the entire Asian monsoon area in which we are interested, while the smallest domain has high resolution (0.25-0.5 degree for longitude and latitude) and focuses particularly on the Tibetan plateau. Different scenarios on the uplift of the Tibetan plateau in late Miocene have been advanced by previous studies. Taking advantage of the higher resolution of our regional climate model, we will be better able to characterize topographical changes in the Tibetan plateau and test the influence of different scenarios and stages of Tibetan plateau uplift on the spatial and temporal evolution of the Asian monsoon in late Miocene. We will also address the question whether different global climate conditions used by the model will affect the interaction between Tibetan plateau uplift and the Asian monsoon. Proxy data of Asian monsoon from different locations will be applied to test between different scenarios of Tibetan plateau uplift and Asian monsoon evolution in this period.