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Simulating mountain uplift and African climate and vegetation evolution in the late Neogene

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Palaeovegetation data indicate major vegetation changes in Africa in the late Miocene. These changes, connected to the development of the African tropical rainbelt, have been hypothesized to be linked to mountain uplift processes like the East African rift system and South Africa but also the uplift of the Himalaya and the Tibetan Plateau.
To investigate changes in the tropical rainbelt due to mountain uplift we use the global climate model CCSM3. The coupled system includes atmosphere and ocean general circulation models, as well as a dynamic-thermodynamic sea ice component and a land surface scheme with dynamic vegetation. The model is run with a resolution of T85 ($\sim$1.4°) for the atmosphere and land surface and a variable resolution for the computation of ocean and sea ice down to a meridional grid spacing of 0.3° around the equator.
We performed a set of sensitivity experiments, altering elevations of the Himalaya and the Tibet Plateau and of East and South Africa separately and in combination.
The results demonstrate that uplift of both East/South Africa, as well as the Himalaya/Tibetan Plateau alter the African-Asian Monsoon circulation. Uplift of East/South Africa not only influences the atmospheric circulation patterns, but has also a considerable impact on ocean circulation in the South Atlantic region. The dynamic vegetation model responds to the changes in atmospheric parameters due to the uplift of East and South Africa with an increase in tree-coverage in Central Africa, as well as a decrease in shrub and grass coverage in both Central and East Africa.
Uplift of the Himalaya and Tibetan Plateau from half of their present level to present-day altitude shows a smaller and opposing effect. The simulation lowering elevation in both regions confirms the dominant impact of the East and South African uplift for climate and vegetation development of the African region.