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Can an Earth System Model Reproduce the Palaeo-Climate Proxy Record in eastern Africa during the Eemian?

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The climate of the Eemian period is characterized by higher than present day temperatures at the poles and a substantially increased sea level compared to the present day, which has led to its use as a proxy for future climate change scenarios. Regionally, the Eemian climate in eastern Africa has been defined by a number of different proxies. Evidence from the region's lakes indicate generally wetter conditions. At Lake Tana, Ethiopia, there is evidence that this wetter period is punctuated by variable precipitation. These changes have been related to shifts in the position of the ITCZ caused by warmer North Atlantic SSTs, but they may also be related to the steep insolation gradient through the Eemian period that gave greater warming at the high latitudes and cooling in the tropics and low latitudes.

The EC-Earth fully coupled earth system model includes ocean, atmosphere, sea ice and land surface modules and has been run for a time-slice within the Eemian period at a resolution of 1 degree in a number of different experimental configurations to determine the relative importance of internal (SST, sea ice) and external (orbital driven insolation forcing) climate drivers on the climate of the Eemian in eastern Africa.

Here, we present initial results that show the EC-Earth GCM can replicate the proxy record for the Eemian period though substantial uncertainties related especially to the resolution of the proxy record remains. The model simulations suggest that insolation driven cooling in combination with changes in SSTs can explain climate changes recorded in eastern Africa. This gives us further confidence in both future projections of climate change and the regional downscaling proposed in the DACEA project to understand the hydrology of the Nile basin and eastern African climate.