EGU22-10449, updated on 14 Aug 2022
https://doi.org/10.5194/egusphere-egu22-10449
EGU General Assembly 2022

Modelling the regional paleoclimate of southern Africa: Sub-orbital-scale changes and sensitivity to coastline shifts

Ozan Mert Göktürk[1,3,4], Stefan Pieter Sobolowski[2,3,4], Margit Hildegard Simon[2,3,4], Zhongshi Zhang[2,3,4], and Eystein Jansen[1,3,4]

[1]University of Bergen, Department of Earth Science, Norway (ozanmert@gmail.com)
[2]NORCE Norwegian Research Centre AS
[3]Bjerknes Centre for Climate Research
[4]Centre for Early Sapiens Behaviour (SapienCE)

Paleoclimatic changes in South Africa, especially around the southern Cape region, are of intense interdisciplinary interest; as this is an important area in the context of human evolution, hosting a number of prominent archaeological sites such as Klipdrift Shelter and Blombos Cave (both located near today's shoreline). Questions surrounding how large-scale and local variability (and change) influenced the local human populations are abundant. Here we present results from downscaling simulations performed for southern Africa, with a high resolution (12 km) regional climate model (WRF), forced by a global earth system model (NorESM). We focus on two time-slices, 82 and 70 ka BP, when orbital parameters and global sea level were markedly different from each other. Changes from 82 to 70 ka BP are generally in line with orbital forcing; indicating, for example, a widespread and significant (> 40%) increase in summer precipitation over inland southern Africa (south of 15°S) due to higher insolation at 70 ka BP compared to 82 ka BP. In contrast, the western and southern Cape coasts became drier at 70 ka BP, owing in part to a 40 m lower sea level, as the coastline shifted and the paleo-Agulhas plain got exposed. The effect of the coastline shift on temperatures in the southern Cape region is evident from the significant (up to 6°C) increases (decreases) in maximum (minimum) temperatures, which are strong enough to overwhelm changes arising from orbital forcing. These inferences are further supported with a separate set of coastline-sensitivity simulations at 70 ka BP, which indicate not only drying, but also larger diurnal and interseasonal temperature ranges when the coastline extends southwards, and once-coastal areas become more continental. For instance, at the archaeological site of Blombos Cave, temperature extremes (1st and 99th percentiles) of the modelled marine climate become 25 to 50-fold more probable to occur as the coastline shift leads to a continental climate. Our results indicate that regional to local-scale processes, which tend to not be represented in most coarse resolution global models, have a strong influence on the paleoclimate of southern Africa, highlighting both the coastal-inland contrasts and the importance of changes in coastline position.