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Future changes in heatwaves over Africa at the convection-permitting scale

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Mean temperatures and their extremes have increased over Africa since the latter half of the 20th century and this trend is projected to continue, with very frequent, intense and often deadly heatwaves likely to occur very regularly over much of Africa by 2100. It is crucial that we understand the scale of the future increases in extremes and the driving mechanisms. We diagnose daily maximum wet bulb temperature heatwaves, which allows for both the impact of temperature and humidity, both critical for human health and survivability. During wet bulb heatwaves, humidity and cloud cover increase, which limits the surface shortwave radiation flux but increases longwave warming. It is found from observations and ERA5 reanalysis that approximately 30% of wet bulb heatwaves over Africa are associated with daily rainfall accumulations of more than 1 mm/day on the first day of the heatwave. The first ever pan-African convection-permitting climate model simulations of present-day and RCP8.5 future climate are utilised to illustrate the projected future change in heatwaves, their drivers and their sensitivity to the representation of convection. Compared to ERA5, the convection-permitting model better represents the frequency and magnitude of present-day wet bulb heatwaves than a version of the model with more traditional parameterised convection. The future change in heatwave frequency, duration and magnitude is also larger in the convective-scale simulation, suggesting CMIP-style models may underestimate the future change in wet bulb heat extremes over Africa. The main reason for the larger future change appears to be the ability of the model to produce larger anomalies relative to its climatology in precipitation, cloud and the surface energy balance.