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What drives the intensification of long-lived storms over the West African Sahel under climate change?

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Extreme rainfall is expected to increase under climate change, but the magnitude is uncertain. The most extreme storms over the West African Sahel have, over recent decades, increased in frequency and an increased temperature gradient between the Sahara and the Guinea Coast - which enhances vertical wind-shear over the Sahel has been shown to be a likely cause, together with drier mid-levels favouring stronger cold pools and storm organisation. Increases in shear are expected under climate change. However, global models do not capture the effects of wind-shear on storms, nor the role of cold pools, since they parametrise convection. Here we present results using the first convection-permitting simulations of African climate change to provide understanding towards how changes in thermodynamics and storm dynamics affect future extreme Sahelian rainfall. The $\sim$4 K parent-model global warming gives a near 50% increase of the rain rate from the 99th percentile of MCSs in the explicit model. The Sahel moisture change on average follows Clausius-Clapeyron scaling, but has regional heterogeneity. Rain rates scale with the product of time-of-storm total column water (TCW) and in-storm vertical velocity. Pre-storm shear and CAPE both modulate vertical velocity. However, although shear affects cloud-top temperatures as seen in observational studies, it has no direct correlation with extreme precipitation rates of storms. The change in TCW across climates is the primary explanation for increased rain rates in the modelled future climate. Finally, although colder cold pools are modelled in the future climate, driven by deeper regions of dry mid-level air, we see no significant change in near-surface winds highlighting avenues for future research on the quality of our convection-permitting model.