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Representation of the Angolan low and Southern African Summer Precipitation in the CORDEX and CMIP5 models.

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The impact of climate change on precipitation over Southern Africa is of particular interest due to its possible devastating societal impacts. To add to this, simulating precipitation is challenging and models tend to show strong biases over this region, especially during the Austral Summer (DJF) months. One of the reasons for this is the mis-representation of the Angolan Low (AL) and its influence on Southern Africa's Summer precipitation in the models. Therefore, this study aims to explore and compare different models' ability to capture the AL and its link to precipitation variability as well as consider the impact climate change may have on this link. We also explore how the interaction between ENSO, another important mode of variability for precipitation, and the Angolan Low, impact precipitation, how the models simulate this and whether this could change in the future under climate change.

We computed the position and strength of the AL in reanalysis data and compared these results to three different model ensembles with varying resolutions. Namely, the CORDEX-CORE ensemble (CCORE), a new phase of CORDEX simulations with higher resolutions (0.22 degrees), the lower resolution (0.44 degrees) CORDEX-phase 1 ensemble (C44) and the CMIP5 models that drive the two RCM ensembles. We also used Self Organizing Maps to group DJF yearly anomaly patterns and identify which combination of ENSO and AL strength scenarios are responsible for particularly wet or dry conditions. Regression analysis was performed to analyze the relationships between precipitation and the AL and ENSO. This analysis was repeated for near (2041-2060) and far (2080-2099) future climate and compared with the present to understand how the strength of the AL, and its connection to precipitation variability and ENSO, changes in the future.

We found that, in line with previous studies, models with stronger AL tend to produce more rainfall. CCORE tends to simulate a stronger AL than C44 and therefore, higher precipitation biases. However, the regression analysis shows us that CCORE is able to capture the relationship between precipitation and the AL strength variability as well as ENSO better than the other ensembles. We found that generally dry rainfall patterns over Southern Africa are associated with a weak AL and El Nino event whereas wet rainfall patterns occur during a strong AL and La Nina year. While the models are able to capture this, they also tend to show more neutral ENSO conditions associated with these wet and dry patterns which possibly indicates less of a

connection between AL strength and ENSO than seen in the observed results. Analysis of the future results indicates that the AL weakens, this is shown across all the ensembles and could be a contributing factor to some of the drying seen. These results have applications in understanding and improving model representation of precipitation over Southern Africa as well as providing some insight into the impact of climate change on precipitation and some of its associated dynamics over this region.