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Simulation of synoptic and sub-synoptic phenomena over East Africa and Arabian Peninsula for current and future climate using a high resolution AGCM

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Climate regimes of East Africa and Arabia are complex and are poorly understood. East Africa has large-scale tropical controls like major convergence zones and air streams. The region is in the proximity of two monsoons, north-east and south-west, and the humid and thermally unstable Congo air stream. The domain comprises regions with one, two, and three rainfall maxima, and the rainfall pattern over this region has high spatial variability. To explore the synoptic and sub-synoptic phenomena that drive the climate of the region we conducted climate simulations using a high resolution Atmospheric General Circulation Model (AGCM), GFDL's High Resolution Atmospheric Model (HiRAM). Historic simulations (1975-2004) and future projections (2007-2050), with both RCP 4.5 and RCP 8.5 pathways, were performed according to CORDEX standard. The sea surface temperature (SST) was prescribed from the 2°x2.5° latitude-longitude resolution GFDL Earth System Model runs of IPCC AR5, as bottom boundary condition over the ocean. Our simulations were conducted at a horizontal grid spacing of 25 km, which is an ample resolution for regional climate simulation. In comparison with the regional models, global HiRAM has the advantage of accounting for two-way interaction between regional and global scale processes. Our initial results show that HiRAM simulations for historic period well reproduce the regional climate in East Africa and the Arabian Peninsula with their complex interplay of regional and global processes. Our future projections indicate warming and increased precipitation over the Ethiopian highlands and the Greater Horn of Africa. We found significant regional differences between RCP 4.5 and RCP 8.5 projections, e.g., west coast of the Arabian Peninsula, show anomalies of opposite signs in these two simulations.