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Future projections in tropical cyclone activity over multiple CORDEX domains from RegCM4 CORDEX-CORE simulations

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Under the Coordinated Regional Downscaling Experiment (CORDEX) initiative, simulations of tropical cyclones were performed using the latest version of the International Centre for Theoretical Physics (ICTP) Regional Climate Model 4 (RegCM4) at a spatial resolution of 25 km over four domains (Australasia, Central America, Western Pacific and South Asia). These simulations cover the 130-year period, 1970-2099, for two Representative Concentration Pathways, 2.6 (RCP2.6) and 8.5 (RCP8.5) emission scenarios and were driven by three General Circulation Models (GCMs) from phase 5 of the Coupled Model Inter-comparison Project (CMIP5). In these simulations, the potential changes in TC activity for future climate conditions over five areas of tropical cyclone formation (North Indian Ocean, the Northwest Pacific, North Atlantic, Australasia and Eastern Pacific) are investigated, using an objective algorithm to identify and track them. The RegCM4 simulations driven by GCMs are evaluated for the period of 1995–2014 by comparing them with the observed tropical cyclone data from the International Best Track Archive for Climate Stewardship (IBTrACS); then the changes in two future periods (2041-2016 and 2080–2099), relative to the baseline period (1995–2014), are analyzed for RegCM4 simulations driven by GCMs. Preliminary results show that RegCM4 simulations driven by GCMs are capable of most of the features of the observed tropical cyclone climatology, and the future projections show an increase in the number of tropical cyclones over the North Indian Ocean, the Northwest Pacific and Eastern Pacific regions. These changes are consistent with an increase in mid-tropospheric relative humidity. On the other hand, the North Atlantic and Australasia regions show a decrease in tropical cyclone frequency, mostly associated with an increase in wind shear. We also find a consistent increase in the future storm rainfall rate and the frequency of the most intense tropical cyclones over almost all the domains. Our study shows robust and statistically significant responses, often, but not always, in line with previous studies. This implies that a robust assessment of tropical cyclone changes requires analyses of ensembles of simulations with high-resolution models capable of representing the response of different characteristics of different key atmospheric factors.