The sensitivity of hurricane frequency to ITCZ changes and radiatively forced warming in aquaplanet simulations

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The response of hurricane frequency to climate changes in an aquaplanet configuration of a 50-km resolution atmospheric general circulation model is examined. The lower boundary condition is an energetically consistent slab ocean with a prescribed time-independent cross-equatorial ocean heat flux, which breaks the hemispheric symmetry and moves the Intertropical Convergence Zone (ITCZ) o_ the equator. In this idealized con figuration, the hurricane frequency increases in response to warming forced by increases in the solar constant or by increases in the carbon dioxide concentration. The ITCZ moves polewards when the model is warmed with fixed cross-equatorial ocean heat flux. It is argued that the increase in hurricane frequency in this model results from the poleward shift of the ITCZ with warming. One can move the ITCZ by varying the imposed cross-equatorial ocean heat flux with fixed radiative forcing. If an increase in radiative forcing is accompanied by a reduction in the ocean heat flux amplitude by the amount needed to keep the position of the ITCZ unchanged, the simulated hurricane frequency decreases under warmed conditions. The simulation results allow the dependence of tropical cyclogensis on mean vorticity to be quantified, and they suggest that circulation changes in perturbed climate states, such as the Last Glacial Maximum, may be of comparable importance to thermodynamic changes in determining tropical cyclone frequency.