What sets the dynamical dependence of tropical cyclone genesis and size on latitude?
Dynamical experiments in a world where cyclones reach the poles.

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Existing hypotheses for meridional variations of tropical cyclone genesis and size depend principally on the Coriolis parameter. These hypotheses are tested in an Earth-like climate model setup in which land is removed, and sea surface temperature and solar radiation are set to be constant everywhere. The Control simulation is compared to a present-day real-Earth simulation, and experiments are performed varying planetary rotation rate and planetary radius relative to Earth values. Across experiments, genesis rate collapses to a quasi-universal dependence on Coriolis parameter, $f$. The minimum genesis distance from the equator is set by the equatorial deformation scale rather than by a minimum value of $f$. Outer storm size increases slowly with latitude equatorward of 45° in the Control, similar to the real-Earth simulation and observations, but then decreases towards the pole. These behaviors can be understood in terms of the interplay of two dominant length scales in the system that depend on the Coriolis parameter and its meridional gradient. This theory can also explain the results of existing rotating radiative-convective equilibrium research on an $f$-plane, thereby bridging the gap between the $f$-plane and the sphere. Overall, spherical geometry is likely important for understanding genesis and size on Earth-like planets.