# Fun with Point-Downscaling

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Determining the atmospheric and oceanic conditions that are favorable or unfavorable for tropical cyclone (TC) genesis is a matter of great interest. Such interest has increased further due to the possibility that TC activity may increase (or decrease) due to global climate change. Until recently, determining the favorability of a particular climate for TC genesis has been achieved through three methods: 1) combining large-scale environmental parameters such as sea surface temperature, shear, and stability into a single "genesis parameter;" 2) counting the number of tropical cyclone-like vortices simulated in global climate models; 3) counting the number of tropical cyclones in a higher-resolution, regional model with boundary conditions from a global model, the so-called "regional downscaling."

We present a new method which allows for much higher resolution simulations and more direct control over the surrounding environment. A doubly-periodic domain is initialized with pre-defined profiles of temperature, humidity, and wind as a function of height. These profiles may be idealized, may come from observations, or from future climate scenarios. With small modifications to the equations of motion, the winds can be balanced so that the wind profiles remain nearly constant across the domain as the simulation proceeds. The development of a pre-cursor tropical cyclone disturbance embedded in this environment is then simulated. The rate of development (or failure) is an indicator of the favorability of that particular sounding and wind profile for TC genesis. Since the entire environment may be described by a single "point" sounding, we call this "point-downscaling." Along with TC genesis, the point-downscaling technique can be used to evaluate favorability of particular soundings for rapid intensification and other structural changes.