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Tropical Cyclones in Reduced Rossby Wave Breaking Environments

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Tropical cyclones are a weather phenomenon that can devastate coastlines and cause substantial harm to human life and infrastructure every year. Their seasonal prediction is an effort that has been undertaken for several decades. These predictions are generally useful and have skill. The 2013 season was predicted as above average in activity by all forecasting agencies, but was one of the least active on record. A previously proposed reason for this is the abundance of Rossby wave breaking in the north Atlantic, which dries and cools the tropics by mixing in extratropical air. While the existence of this mechanism is not disputed, other pathways linked to the interactions between tropical and extratropical air masses are suggested and evaluated in this study

The numerical model ICON is used in Limited Area Mode (~13 km horizontal resolution) to simulate the north Atlantic, using ERA5 data for the hurricane season of 2013 to prescribe initial and boundary conditions. To influence Rossby wave breaking, a set of simulations uses 30 day running mean boundary conditions in the northern part of the domain, while a reference set uses regular boundary conditions everywhere along the boundary. Though the results do not falsify the aforementioned hypothesis of the abundance of Rossby wave breaking influencing tropical cyclone activity, they suggest that other mechanisms, such as changes in steering flow, tropopause temperature and wind shear, could also be responsible for changes in tropical cyclone activity. Furthermore, the accumulated cyclone energy seems to be rather closely related to the mean latitude of the 2 potential vorticity unit contour on the 350 K isentropic surface within a small longitudinal window in the western Atlantic.