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Global patterns of tropical cyclones clustering

Renato Vitolo (1), David Stephenson (1), Jane Strachan (2), Pier Luigi Vidale (2), Gero Michel (3), and Ian Cook (3)

(1) College of Engineering, Mathematics and Physical Sciences, University of Exeter, Exeter, United Kingdom, (2) Department of Meteorology, NCAS and University of Reading, United Kingdom, (3) Willis Re, London, United Kingdom

We investigate the spatial dependence of and the large-scale atmospheric and climatic effects on the temporal clustering of tropical cyclones. Observed tropical cyclone tracks are extracted from the IBTrACS archive for the North Atlantic and Western Pacific basins. Modelled tropical cyclone tracks are obtained from 250 years of simulations with a state-of-the art coupled Global Climate Model (HiGEM).

We study the transit of tropical cyclones near points belonging to grids covering parts of the oceanic basins and perform comparison between the observed and the modelled tracks. Clustering is characterized by the dispersion (ratio of the variance and the mean) of the yearly counts of cyclone transits at distance less than a radius R from the gridpoints.

For the observed cyclones in the North Atlantic basin, coherent patches of overdispersion are found for large radii (R>=300km) in the main development region, in the central North Atlantic, off the Mexican coast in the Gulf of Mexico and in the Caribbean sea. Transits of tropical cyclones with intense windspeeds (>60kt) are overdispersed in smaller regions. The modelled tracks exhibit similar features, although the overdispersion is smaller. For the Western Pacific, there are more marked discrepancies between the patterns of overdispersion of the observed and the modelled tracks, particularly in the South China Sea between the Philippines and the coast of the Indochina peninsula.

The influence of large-scale atmospheric and climatic processes is analysed for both the observed and modelled tracks by Poisson regression with a time-varying rate that depends on climatic indices such as the Atlantic Multidecadal Oscillation (AMO) and the North Atlantic Oscillation (NAO).