Hurricane Track Morphometry in the North Atlantic Ocean

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Track sinuosity has been under-utilised as a metric in studies of hurricane track morphometry, but can easily be applied to best-track data in the IBTrACs archive maintained by NOAA. Here, morphometric analysis is carried out on the shape of over 420 hurricane and tropical storm tracks in the North Atlantic over the 1965–2011 period, by applying GIS, mapping and simple statistical methods. Using such tools, temporal and spatial patterns in track sinuosity can be investigated.

Temporally, there is no evidence of underlying long-term trends in track sinuosity over the past 4.5 decades. This implies an absence of climatic-change forcing on track shape at the basin scale. Instead, large inter-annual variability and notable episodes of cyclic swings in average track shapes are dominant. Strong seasonality in track shape is also pronounced. During the early months of the hurricane season (May to July), more predictable straight and quasi-straight tracks are common (64–100%), but this changes in the peak and later phases of the season (September, November) to a tendency for quasi-sinuous and sinuous tracks (58–70%).

Spatially, morphometric analysis according to the zone of cyclogenesis longitude can help in predicting likely track shapes over subsequent storm lifespans: Whereas 62–68% of storms forming west of 80°W in the Caribbean Sea – Gulf of Mexico follow straighter tracks, in contrast 67–72% of storms formed east of 40°W in the central-eastern North Atlantic follow more sinuous tracks. Such zonal differences in track shape influence the geographic areas of landfall. This is important for the vulnerability of coastlines at risk, because hurricanes and tropical storms with more sinuous trajectories are shown to generally outlive storms with straighter trajectories. Sinuously-tracking storms therefore pose a greater threat of inflicting damage over wider areas, as they survive longer, migrate farther and cover bigger distances.