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# The spatial distribution and evolution characteristics of North Atlantic cyclones

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Mid-latitude cyclones play a large role in determining the day-to-day weather conditions in western Europe through their associated wind and precipitation patterns. Thus, their typical spatial and evolution characteristics are of great interest to meteorologists, insurance and risk management companies. In this study a feature tracking algorithm is applied to a cyclone database produced using the Hewson-method of cyclone identification, based on low-level gradients of wet-bulb potential temperature, to produce a climatology of mid-latitude cyclones. The aim of this work is to compare the cyclone track and density statistics found in this study with previous climatologies and to determine reasons for any differences. This method is found to compare well with other cyclone identification methods; the north Atlantic storm track is reproduced along with the major regions of genesis. Differences are attributed to cyclone lifetime and strength thresholds, dataset resolution and cyclone identification and tracking methods.

Previous work on cyclone development has been largely limited to case studies as opposed to analysis of climatological data, and does not distinguish between the different stages of cyclone evolution. The cyclone database used in this study allows cyclone characteristics to be tracked throughout the cyclone lifecycle. This enables the evaluation of the characteristics of cyclone evolution for systems forming in different genesis regions and a calculation of the spatial distribution and evolution of these characteristics in composite cyclones. It was found that most of the cyclones that cross western Europe originate in the east Atlantic where the baroclinicity and sea surface temperature gradients are weak compared to the west Atlantic. East Atlantic cyclones also have higher low-level relative vorticity and lower mean sea level pressure at their genesis point than west Atlantic cyclones. This is consistent with the hypothesis that they are secondary cyclones developing on the trailing fronts of pre-existing 'parent' cyclones. Furthermore, it was found that a higher proportion of east Atlantic cyclones are type C cyclones with strong upper-level forcing but weak low-level forcing suggesting that latent energy plays a more important role in their intensification than for west Atlantic cyclones.