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# Estimating the predictability limit of tropical cyclone tracks over the western North Pacific using observational data

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The nonlinear local Lyapunov exponent (NLLE) method can provide a quantitative measure of the predictability limit associated with atmospheric and oceanic variables. In this study, the NLLE approach was used to quantitatively determine the predictability limit of tropical cyclone (TC) tracks based on observed TC track data (best track data) obtained from the Joint Typhoon Warning Center (JTWC). The results show that the predictability limit of all TC tracks over the whole western North Pacific (WNP) basin is about 102 hours (4.25 days), and this provides a baseline from which to measure the forecast skill of the operational weather models. The predictability limit of the TC tracks depends on the TC genesis location, lifetime, and intensity, and further analysis indicated that these three metrics are closely related. The more intense and longer-lived TCs tend to be generated on the eastern side of the WNP (EWNP), whereas the weaker and shorter-lived TCs tend to form in the west of the WNP (WWNP) and the South China Sea (SCS). The relatively strong and longer-lived TCs, which are generated mainly in the EWNP, have a longer travel time before they curve northeastwards and hence tend to be more predictable than the relatively weaker and shorter-lived TCs that form in the WWNP region and SCS. Furthermore, the results show that the predictability limit of the TC tracks obtained from the best track data may be underestimated due to the relatively short observational records currently available. Future work is required to use a numerical model to assess the predictability of TC tracks.