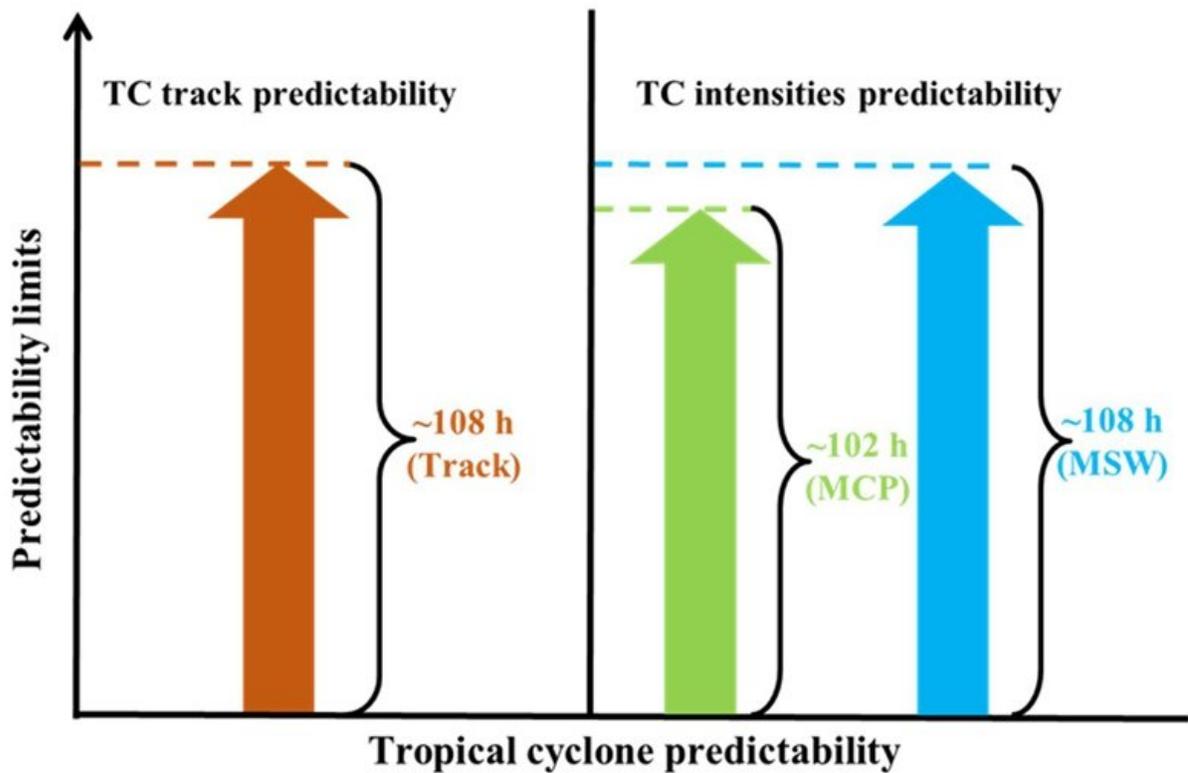


Predictability limit for tropical cyclones over the western North Pacific

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Simplified diagram showing the range of estimates of TC track and intensity [the minimum central pressure (MCP) and maximum sustained wind (MSW)] predictability obtained by the NLLE approach. Credit: Quanjia Zhong

For an atmospheric system, there exists a limit to how far ahead one can

make predictions. This is referred to as atmospheric predictability. Within this limit, however, the weather forecast will still contain some uncertainty. Given that numerical models are "perfect," the predictability of tropical cyclones (TCs) is limited by the chaotic nature of the system itself. How long, then, is the TC predictability limit?

Dr. Quanjia Zhong and Professor Ruiqiang Ding, from the Institute of Atmospheric Physics, Chinese Academy of Sciences, employed the nonlinear local Lyapunov exponent (NLLE) approach to estimate the [predictability](#) limit of TCs over the whole western North Pacific (WNP) [basin](#) using observed TC best-track data. They found that the predictability limit of all TC tracks over the whole WNP basin is about 102 hours (4.25 days), which is comparable to that of TC intensity. This provides a baseline from which we can measure the forecasting skill of operational weather models. The findings of this research have been recently published in *Advances in Atmospheric Sciences* and *Monthly Weather Review*.

The team further examined the spatial distribution characteristics of the predictability limit of the TC tracks and intensities over the whole WNP basin. They found that the predictability limit of the TC tracks over the WNP basin ranges from 48 to 120 hours, while that of the intensity ranges from 24 to 120 hours, dependent largely on the location of TC genesis. The predictability limit of TCs is highest in the eastern region of the WNP, followed by the western region and then the South China Sea (SCS).

"TCs that form in the SCS have relatively low predictability, and this may explain why achieving accurate forecasts of TCs originating from the SCS is relatively difficult," says Dr. Zhong.

Their research also reveals that the predictability limit of the TC tracks varies widely with the lifetime and intensity of TCs, which should

represent an effective means to improve our understanding of the characteristics and mechanisms of TC predictability.

"On the basis of understanding TC predictability, how to further improve the forecasting skill of TCs is of vital importance, and thus ensemble predictions of TCs is worthy of further investigation," adds Professor Ruiqiang Ding.

More information: Quanjia Zhong et al, Estimating the Predictability Limit of Tropical Cyclone Tracks over the Western North Pacific Using Observational Data, *Advances in Atmospheric Sciences* (2018). [DOI: 10.1007/s00376-018-8008-7](https://doi.org/10.1007/s00376-018-8008-7)

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