A new method to improve tropical cyclone intensity forecasts

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In numerical weather forecasting research, how to improve short-term forecasts of tropical cyclone intensity is a challenging problem that has long plagued meteorologists and operational forecasters, despite that

meteorologists have increased the accuracy of the initial field through increasing observations in either quantity or quality. So, what else are we missing?

According to a recently published study in *Advances in Atmospheric Sciences*, the missing piece of the jigsaw is reducing the model error of numerical weather forecasting models.

There are many reasons for model errors, such as our incomplete understanding of tropical cyclone physical processes, the uncertainty in many parameters of parameterization schemes, the insufficiently fine resolution, truncated errors, and oversimplification of parameterization schemes to save on calculation costs, and so on.

"It would cost too much [computationally] if we try to overcome all the model errors of different sources one by one," said Duan Wansuo, a senior scientist from the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences.

Duan's team proposed a new idea to solve the above problems, based on the Nonlinear Forcing Singular Vector (NFSV) method, which was also proposed by the team. "We consider the model errors, caused by different sources, as a whole to explore their impact on the forecast accuracy," he said.

Through this method, the team employed the WRF model to identify the uncertainty of which variable and which area is more likely to cause large errors in short-term tropical cyclone intensity forecasts.

Considering the characteristics of observations made by the Fengyun-4 satellite, they used the above method and identified that the uncertainty of the rate of change in atmospheric temperature in the middle and lower layers of the typhoon core area has the greatest influence on the

uncertainty of the typhoon's simulation.

"Satellites can adaptively collect corresponding observations in a given region, which then will be further used to reduce the model errors and improve short-term forecasts of tropical cyclone intensity," said Duan.

More information: Xiaohao Qin et al. Sensitivity to Tendency Perturbations of Tropical Cyclone Short-range Intensity Forecasts Generated by WRF, *Advances in Atmospheric Sciences* (2020). DOI: 10.1007/s00376-019-9187-6

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