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Parametrizing atmospheric models can help predict geophysical catastrophes FREE

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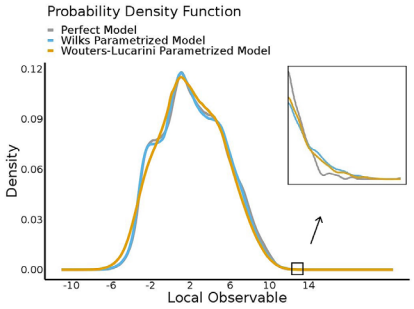
Scientists studied how different parametrizations of atmospheric models perform in representing extreme geophysical events and help predict the likelihood of natural catastrophes with climate change.



Extreme geophysical events and natural catastrophes pose great risks. To better assess and predict these while preserving computational efficiency, scientists require an accurate parametrization of weather and climate models. A new paper by Hu et al. investigates how two parametrizations perform in representing extreme events.

The researchers studied a conceptual, chaotic model of atmospheric dynamics representing three basic processes: advection, forcing and dissipation. They compared local and global observables extracted from the full data set with those extracted from two parametrizations. The Wilks parametrization aims at providing an optimal representation of typical events, while the Wouters-Lucarini parametrization uses a statistical mechanical approach that works out higher-order corrections to atmospheric variables, including extreme events.

Extreme events are very rare atmospheric occurrences that are represented on the tail ends of the observables' distributions. By studying how well the two parametrizations represent these regions, scientists can determine how accurately the parametrizations represent extreme events.

"Parametrization schemes should be rigorously and specifically tested against their performance on extreme events," said author Guannan Hu. "The way that a parametrization scheme is constructed influences the performance."

Previously, climate scientists regarded the Wilks parametrization as promising, but the authors found while the two parametrizations they studied are comparable in predicting typical events, this does not guarantee a good representation of rare events. In some cases, the Wouters-Lucarini parametrization performed better at reproducing extreme values.

"Under climate change, the frequency and the duration of extreme events are changing. The situation typically becomes worse with global warming," said Hu. "Therefore, when we specifically want to predict extreme events or their statistics, we should consider a different parametrization."

Source: "Effects of stochastic parametrization on extreme value statistics," by Guannan Hu, Tamás Bódai, and Valerio Lucarini, *Chaos: An Interdisciplinary Journal of Nonlinear Science* (2019). The article can be accessed at https://doi.org/10.1063/1.5095756.