ON THE PREDICTABILITY OF EXTREMES: DOES THE BUTTERFLY EFFECT EVER DECREASE?

A.E. Sterk[1], D.B. Stephenson[2], M.P. Holland[2] & K.R. Mylne[3]

[1]*Johann Bernoulli Institute, University of Groningen, The Netherlands*
[2]*College of Engineering, Mathematics and Physical Sciences, University of Exeter, United Kingdom*
[3]*Met Office, United Kingdom*

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We have studied whether or not predictability always decreases for more extreme events. Predictability is measured by the Mean Squared Error (MSE), estimated here from the difference of pairs of ensemble forecasts, conditioned on one of the forecast variables (the "pseudo-observation") exceeding a threshold.

Using an exchangeable linear regression model for pairs of forecast variables, we show that the MSE can be decomposed into the sum of three terms: a threshold-independent constant, a mean term that always increases with threshold, and a variance term that can either increase, decrease, or stay constant with threshold. Using the Generalised Pareto Distribution to model wind speed excesses over a threshold, we show that MSE always increases with threshold at sufficiently high threshold. However, MSE can be a decreasing function of threshold at lower thresholds but only if the forecasts have finite upper bounds.

The methods are illustrated by application to daily wind speed forecasts for London made using the 24 member Met Office Global and Regional Ensemble Prediction System from 1 Jan 2009 to 31 May 2011. For this example, the mean term increases faster than the variance term decreases with increasing threshold, and so predictability decreases for more extreme events.