*Forecasting the weather
- ensemble techniques
in probabilistic weather prediction*

Radius of reliability: A distance metric for interpreting and verifying spatial probability forecasts

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High resolution forecasts of high impact weather such as heavy rain, severe thunderstorms, or tropical cyclone landfall, can have poor skill at point scale due to uncertainty in the precise location and/or timing of the event. To give credit to deterministic spatial forecasts that are close but not perfect, neighborhood verification methods such as the fractions skill score are now being used. These methods evaluate forecasts in the neighborhood of a point against the observation at that point, or to the corresponding neighborhood of observations. By verifying forecasts for a range of neighborhood sizes it is possible to determine the scale for which forecasts attain a certain level of skill.

A similar philosophy can be applied to probabilistic forecasts, to determine the spatial scale for which the forecast probabilities at a point are reliable. The existence of an observed event is assessed within a range of spatial neighborhoods centered on that forecast point. The neighborhood size for which the probability forecasts are reliable (over many forecasts) determines the "radius of reliability" (ROR). For a given forecast probability P, ROR can be interpreted as the search radius around the forecast within which at least one observed event can be expected to occur with frequency P. This concept is similar to the "cone of uncertainty" used in tropical cyclone track prediction to denote the region with 70% likelihood of enclosing the observed track.
Similarly, the ROR can be used to convey the spatial precision of probabilistic forecasts. When used as a forecast quality metric, lower values of ROR indicate more skilful forecasts.

The ROR is best suited for evaluating and interpreting probabilistic nowcasts and short-range forecasts of rare events, such as those generated using convection resolving ensembles. The ROR will be demonstrated using forecast probabilities of heavy rainfall in landfalling tropical cyclones.