# Verification of probabilistic rainfall forecasts

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**Abstract**

We illustrate verification of probabilistic rainfall forecasts by presenting a sample of verification results for official forecasts which underlie those on the Bureau's external website. We compare these to verification of the same forecasts based on an ensemble of model outputs. We will present results for a three-month period, comparing forecasts to observations at automatic weather stations in Southern Australia. The data and main verification techniques are described in Griffiths *et al.,* 2017.

Our verification is motivated by a need to assess the suitability of the ensemble-based output to replace the official forecast to deliver the public service. As such, our verification is based on definitions of the service and this informs choices made in conducting the verification. For example, it informs the choice of observations against which the forecasts are assessed.

A complete suite of probability forecasts defines a probability density function. Our verification does not assess the whole probability density function at one time, as is done by the Continuous Ranked Probability Score. Instead, we focus on forecasts which form part of the public service. We assess the official and ensemble-based forecasts in ways that allow us to comment on their performance at different lead times and in different situations, or when being used for different purposes.

We present results for examples of two types of probabilistic forecast. One is the forecast of the Chance of Rainfall (%) exceeding 1 mm in a 24-hour period. The other is a percentile forecast, namely the amount of rain forecast (mm) which will be exceeded in a 24-hour period with a 25% confidence. The 25th percentile forecast is defined as 0 mm if the chance of any rain is ≤ 25%.

We use the Brier Score to verify the Chance of Rainfall forecasts. The Brier Score is the analogue to the mean square error which is popular for verifying single value forecasts. We use reliability diagrams to provide detail of bias conditional on the forecast values. We use relative economic value curves to explore the ability of the forecasts to distinguish rain from non-rain events, or heavy rain from lighter rain events, in a manner that is valuable to users of the forecasts.

Percentile forecasts are another view into the probability density function. As the percentile forecasts are a prominent part of our service we assess them directly, providing information about biases conditional on the forecast values.

# References

Griffiths, D., Jack, H., Foley, M., Ioannou, I. and Liu, M. 2017: Advice for Automation of Forecasts: A Framework, Bureau Research Report 21