

**Forecasting the Probability of Tropical Cyclone Formation: the reliability
of NOAA forecasts from the 2012 hurricane season**

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Abstract

Atlantic tropical cyclones are responsible for some of the world's greatest economic losses due to natural hazards. Short-term (48 hour) probabilistic forecasting has become an integral part of the prediction of these events. Forecasters from the National Oceanic and Atmospheric Administration's (NOAA) National Hurricane Center (NHC) post subjective probability tropical cyclone forecasts out to 48 hours during each hurricane season. Reliability diagrams provide an immediate indication of the quality of a probabilistic forecasting system by illustrating the degree of correspondence between the observed frequencies of an event and the forecast probabilities assigned to it. In their most common format, however, reliability diagrams fail to provide a truly representative measure of reliability, as they do not clearly indicate the variability expected even in a perfectly reliable forecast system. A revised format (J. Broecker and L. A. Smith, *Weather and Forecasting*, 22(3), pp651-661, 2007) aids the visual evaluation of the likelihood of the observed relative frequencies of tropical cyclones during the 2012 hurricane season. This is done by indicating the variability expected under the assumption that the NHC's probability forecasts were genuinely reliable. The strengths and weaknesses of the 2012 forecasts are examined. For most categories, the forecast probabilities are consistent with the observed frequencies of tropical cyclones. The verisimilitude of forecasts of very high probability and very low probability (including forecasts of "zero" probability) are discussed. In addition, relationships between "time until event" and forecast probability are analysed. In 2012, forecasts of a probability of 70% or more were each followed by events (52 out of 52). It is interesting to note the distribution of time of onset of these events within the 48 hour window. It is hoped that these observations may suggest ways to improve the utility and evaluation of operational tropical cyclone forecasts.

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