**Advances in methods for evaluating Tropical Cyclone forecasts and hazards**

*Barbara Brown*, Louisa Nance, Paul Kucera, Tressa Fowler, Mrinal Biswas, Kathryn Newman, John Halley Gotway, and Christopher Williams

National Center for Atmospheric Research

Boulder, Colorado USA

**Abstract**

 Verification methods for tropical cyclone (TC) forecasts have traditionally focused on evaluation of TC track and intensity predictions, as a measure of the level of forecasting success. While this approach to evaluating tropical cyclone predictions appears to be rather straightforward, many nuances are associated with determining the “goodness” of TC predictions (e.g., related to the observations and analyses used for the evaluation). Moreover, in recent years, the focus of TC evaluation has expanded to consideration of other aspects of the forecasts, including impact-related variables such as precipitation and storm surge, and new types of forecasts, including ensemble predictions. This presentation will consider some new approaches to summarizing the performance of TC forecasts of track and intensity, as well as approaches that are being developed and applied for the evaluation of impact variables. For track and intensity, approaches include conditional evaluation, assessment of relative performance (e.g., to compare model performance among modeling systems), examination of distributions of errors, and consideration of forecast consistency. For impact variables such as precipitation, a number of approaches have been proposed and applied, with new approaches based on spatial methods considered more recently. Applications of these methods will be considered. The presentation will also briefly discuss a new WMO/WWRP document that focuses on verification methods for TC forecasts, which was prepared by the WMO’s Joint Working Group on Forecast Verification Research (JWGFVR). This recent document provides an overview of the state of the art of forecast evaluation approaches for TC forecasts.