



Verification Approaches for Ensemble Forecasts of Tropical Cyclones

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In addition to billions of US dollars in economic losses, tropical cyclones (TCs) can cause the loss of numerous human lives. Such a toll can be minimized with adequate warning and subsequent evacuations. However, evacuations can also be expensive, leading to a high cost associated with false alarms. Recently, probabilistic and ensemble forecasts of TCs have become available, and this kind of quantitative guidance is invaluable for improving evacuation decision support systems. Ensemble NWP systems have the potential to provide the necessary probabilistic forecast information. However, to develop optimal ensemble prediction systems, appropriate evaluations of ensemble hurricane forecasts must be conducted. Standard methods of TC evaluation typically involve analyzing track and intensity errors independently, and often do not utilize appropriate distance measures. In this study, we demonstrate new approaches such as minimum spanning tree rank histograms and concepts from circular statistics applied to verification of ensemble forecasts of TCs. These approaches handle directional information, and analyze performance of both track and intensity forecasts together. These methods will be demonstrated using ensemble forecast datasets that have been generated as part of the NOAA Hurricane Forecast Improvement Project (HFIP), which is a 10 year program with the goal of reducing hurricane track and intensity errors by 50%. The presentation will provide an overview of the ensemble verification methodology along with a summary of our results.