Employing Hurricane Wind Probabilities to Convey Forecast Uncertainty and Potential Impact through NWS Field Office Forecast Products

Pablo Santos, NOAA/NWS, Miami, FL, **David Sharp**, NOAA/NWS, Melbourne, FL; and Matthew Volkmer, and Guy Rader

Since 2005, the National Hurricane Center (NHC) has produced gridded tropical cyclone wind speed probabilities for 34-, 50-, and 64-knot winds through 120 hours during operational forecast cycles for active systems in the Atlantic and Pacific Basins. The probabilities are centered about NHC's official track, intensity, and wind radii forecast, and incorporate average error statistics over recent years for those variables. Since probability information is often designed to answer specific questions, these probabilities are produced in several forms to include the interval-, cumulative-, and incremental-forms for each successive period of the forecast. In an effort to improve the usefulness of wind speed information delivered during tropical cyclone events, the NWS Weather Forecast Offices (WFOs) at Miami and Melbourne have collaborated to examine the value of using the wind speed probabilities in conveying forecast uncertainty and potential impact within local forecast products. This paper will address two such initiatives. The first initiative involves a consistent method for providing coherent expressions of uncertainty within text forecast products, while the second initiative endeavors to graphically depict the potential impact due to the associated wind hazard.

In preparation for tropical cyclone events, decision-makers not only demand a meteorologist's best deterministic wind speed forecast, but they also require an accompanying expression of uncertainty. That requirement reveals the shortcoming of deterministic-only wind speed forecasts such as those found within the current Zone Forecast Product (ZFP) and Coastal Waters Forecast (CWF). To address the shortcoming, The Miami and Melbourne WFOs have developed a means by which the incremental probabilities are employed to enhance the ZFP and CWF by introducing expressions of forecast error (e.g., uncertainty) within the body of the text. Experimentally, the enhancements have been incorporated within the legacy (zone-based) versions, and also within the dynamic point-and-click versions found on the WFO Web sites. Together with hazard information (e.g., tropical storm/hurricane watches/warnings) and wind speed information, incremental probabilities of wind speed are used to trigger prescribed expressions through automated text formatters. The formatters weigh respective gridded inputs to determine the appropriate expression of uncertainty according to the situation. For each period of the 5-day forecast, they are able to then convey whether hurricane or tropical storm conditions are *possible*, *expected*, or *imminent/ongoing*. Preliminary results have been positive and, if transitioned to official policy, stand to elevate the usefulness of the ZFP and CWF. It will foster a greater consistency between NHC and adjacent WFOs, while reducing the workload associated with manual post-editing. Similar improvements in the utility of tabular products, such as forecast matrices, can be easily accommodated, if desired.

In a parallel initiative, certain graphics which show the geographical distribution of potential impact associated with high winds during tropical cyclone situations have continued to evolve. Here, cumulative probabilities for select wind speeds are used to derive an automated first-guess of the local wind threat (e.g., threat assessment grids). Forecasters then have the opportunity to make final adjustments before translating the assessed threat into potential impact. The final output is a Web-ready *High Wind Impact* map which is updated with each advisory. In practice, the first-guess threat assessment is created by compositing the 10 percent probability for exceeding the 34-, 50-, and 64-knot wind thresholds, along with additional 64-knot probability variations for handling hurricanes of Category Two or greater on the Saffir-Simpson scale. Using the cumulative probabilities has promoted increased efficiency during product preparation. Synoptic considerations are now made quickly and consistently, freeing up more time for inherent mesoscale considerations. The *High Wind Impact* map is very useful for motivating less sophisticated users to action regarding preparedness activities, while hopefully preventing information paralysis. For more sophisticated users, the map serves as an excellent starting point for critical decision-making and is a coherent briefing tool. The initiative is part of a larger experimental project within the National Weather Service to provide impact graphics of all hazards associated with tropical cyclones.