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SENSITIVITY STUDY OF HRD'S H*WIND SURFACE WIND ANALYSES FOR TROPICAL CYCLONES

Samuel H. Houston, NOAA/NWS/WFO, Central Pacific Hurricane Center, Honolulu, HI 96822
Mark D. Powell, NOAA/AOML, Hurricane Research Division,, Miami, FL 33149

The Hurricane Research Division's (HRD's) H*WIND system has been used to generate surface wind analyses for tropical cyclones (TCs) in real-time in the last few years. These wind products are used routinely as guidance for operational TC forecast and advisory products, including the determination of wind radii (e.g., radius of 17, 25, and 33 m s^{-1} winds by quadrant) by hurricane forecasters at the National Hurricane Center and the Central Pacific Hurricane Center. There has already been extensive development of the methodologies and techniques used in the analysis of all available surface wind observations to derive the TC wind fields that are generated by the H*WIND application. Considerable work with post-storm analyses of significant tropical cyclones, such as Hurricanes Andrew (Powell and Houston 1996) and Iniki (Phadke et al. 2002) of 1992, Hurricane Floyd of 1999 and Super Typhoon Paka (Houston et al. 2002) of 1997, has led to significant improvements in the software used in the wind analysis algorithms contained in H*WIND.

The routine use of H*WIND to determine the characteristics of relatively weak and poorly defined TC surface wind fields during recent hurricane seasons has exposed some unexpected problems in the analysis of the surface winds. Asymmetric systems such as Central Pacific Hurricane Daniel (2000) and Atlantic “hybrid” TCs such as Tropical Storms Gordon and Helene of 2000 had particularly complicated surface wind structures that severely tested the algorithms contained within the H*WIND application.

This sensitivity study is similar to the one developed by Houston et al. (1999). In this case, a "known" analytic wind fields is sampled at discrete locations to simulate typical data sampling patterns near the surface in TCs. The output from H*WIND using these sampled "known" winds as input is compared with the original analytic fields to quantify the errors. Parameters involved in the objective analysis of the surface wind data, such as the analysis domain, the mesh sizes for the multi-nested grid used by H*WIND, filtering wavelengths, and the methods of filling in data void regions with subjective data are varied to determine which values reduce the errors between the analyzed and the "known" wind field. This study not only examines well developed and intense TCs, but also examines the weaker, less well developed, and often more complicated storm structures. Using the results of these sensitivity studies the optimal parameters as a function of TC strength and intensity for the objective analyses are used to determine the parameters used in H*WIND during future hurricane seasons. An additional benefit from this work may be the proposal for new sampling strategies for aircraft reconnaissance flight patterns. For example, the benefits of rotating or modifying the "Figure 4" flight pattern may be potential outcomes within the framework of this study.

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