JHT Mid-term Report

(August 1 2006 – February 28 2007)

WSR-88D-derived Diagnosis of Tropical Cyclone Intensity Changes Near Landfall

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Accomplishments:

This document gives a mid-term progress report on the development of the Vortex Objective Radar Tracking and Circulation (VORTRAC) package for the JHT. Using the level II coastal WSR-88D data, VORTRAC tracks intensity (central pressure) and radius of maximum wind (RMW) of landfalling tropical cyclones retrieved from the ground-based velocity track display technique (GBVTD) and the hurricane volume velocity processing method (HVVP). The VORTRAC work has been focused on (1) improving the design of a user interface using the Qt tool kit, and (2) implementation of the radar algorithms on NEXRAD level-II data to be used in the overall VORTRAC package. A preliminary version of the software was installed and tested at NHC during the 2006 season.

Progress has been made on the display widget using the Qt tool kit to assign key parameters to the real-time GBVTD/HVVP algorithm and product display. Following a visit to NHC the Graphical User Interface (GUI) for the VORTRAC program was updated for use in the operational environment. The main display is shown in Figure 1, with the primary window containing the time series of central pressure (red line) and RMW (blue line) that continuously updates in real-time when the center of a TC is within the Doppler range of coastal WSR-88Ds. Uncertainty estimates, given by the hash marks about each line, provide the forecaster with confidence estimates for the radar retrievals. The analysis in Figure 1 shows the pressure and RMW trace from Hurricane Charley

(2004) utilizing archived level II WSR-88D data from NCDC recorded at Key West (KBYX). The program is capable of reading both archived and real-time level II data via an LDM feed. This test with Charley data was run in a quasi-operational setting, with the initial storm position taken from NHC advisories and allowed to proceed without additional user input.

Several other enhancements to the GUI are also shown in Figure 1. Prominent indicators in the form of a program status signal (traffic light) and storm status (hurricane symbol) provide strong visual cues as to whether the program is working properly (green light) and potential meteorological information (i.e. rapid intensification). The current central pressure, RMW, and calculated pressure deficit from the edge of the radar analysis domain are also numerically shown at the top of the GUI. Another significant addition to the program is the display of the current constant altitude PPI (CAPPI) image as illustrated in Figure 2. This enables the user to quickly examine the data going into the algorithms for quality control. Erroneous velocity unfolding or misplaced domain location can easily be spotted with this display. Additional features of the GUI include: (1) a status log indicating success or errors in the program operation, (2) a progress bar showing a graphical indication of the analysis stage, and (3) a point-and-click interface allowing the user to adjust the default operational parameters of the program.

On the algorithm development side, the radar processing algorithms have been rewritten from FORTRAN to C++ and integrated with the Qt tool kit. The automatic radar data control software has been debugged and tested, and appears to work well for a variety of cases. The GBVTD and HVVP algorithms have also been implemented and integrated into the VORTRAC package. Significant effort has gone into the debugging and testing of these algorithms. This has resulted in improved memory allocation, allowing for longer run times, and numerous bug fixes that have increased the stability and robustness of the software package.

Summary and Future Work:

The project is progressing well and on schedule. Several significant enhancements to the GUI have been performed, as well as implementation and integration of the radar processing algorithms. Debugging, testing, and further improvements to the status reporting will continue, along with the completion of the user documentation during second half of year two funding.

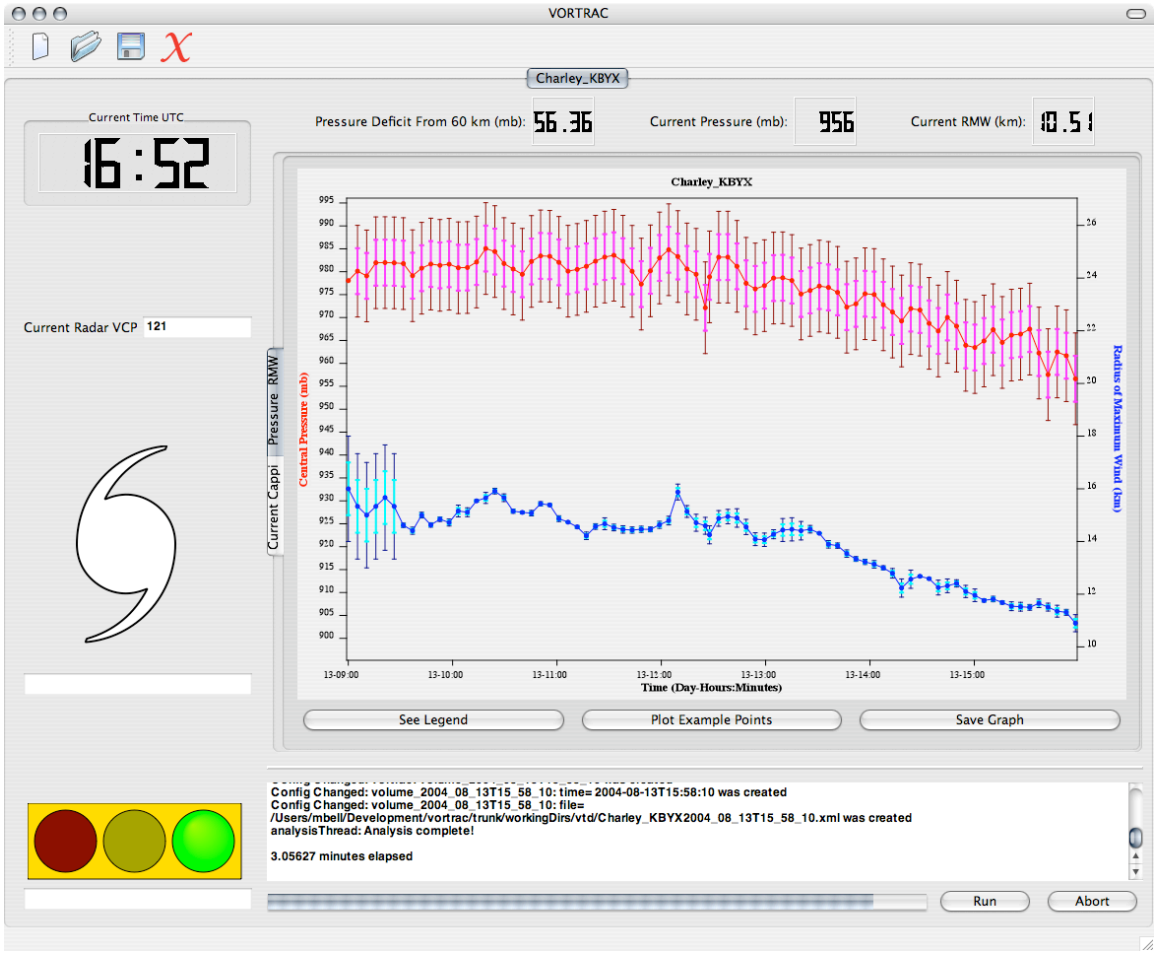

Figure 1. Time series display (screen shot) of central pressure (in red) and radius of maximum wind (in blue) in VORTRAC using archived WSR-88D from Hurricane Charley (2004). Hash marks represent the uncertainty estimate associated with each computation. See text for details.

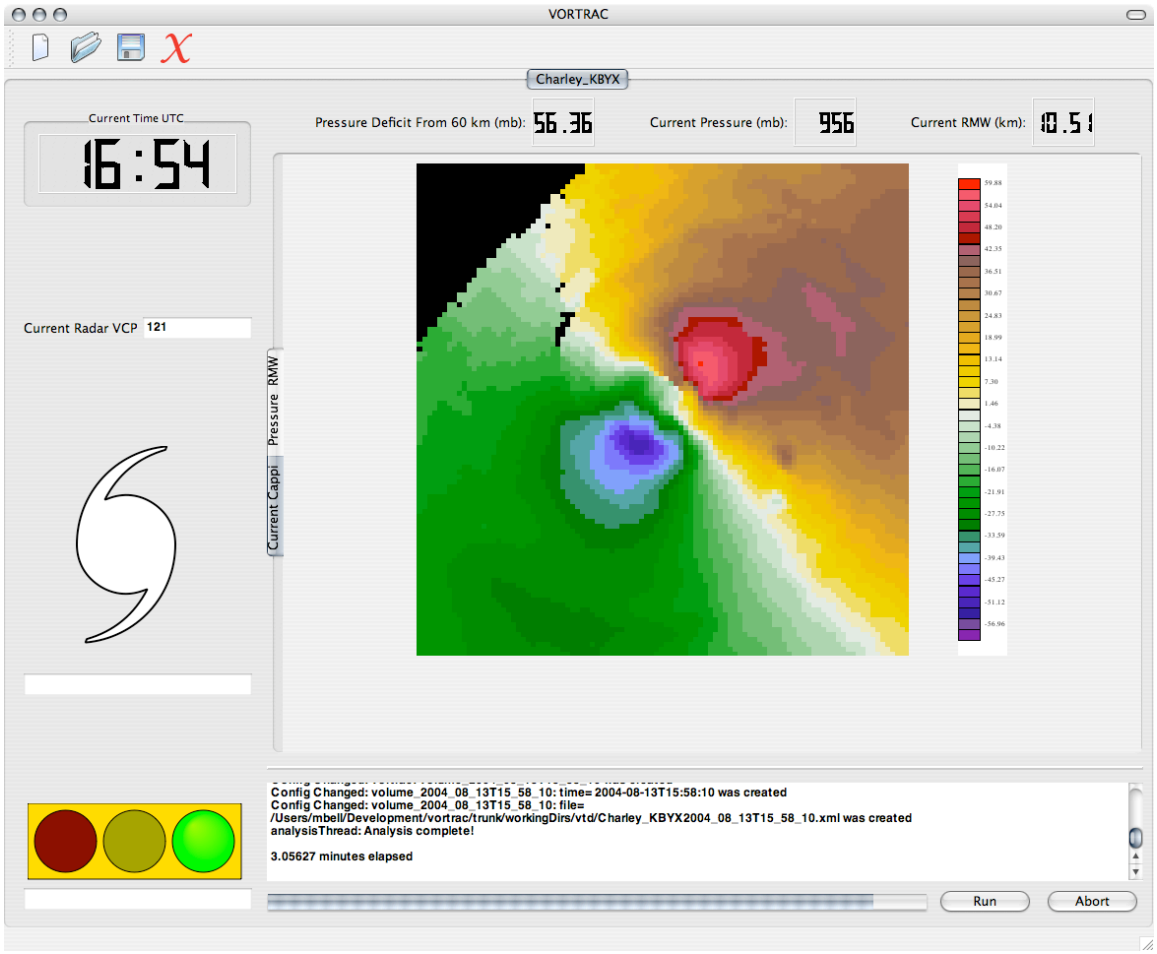

Figure 2. Example of the CAPPI display of Doppler velocity from the WSR-88D data. See text for details.