



Post Storm Data Acquisition Aerial Wind Mapping Mission Hurricane Frances - 2004



November 8th, 2004

Overview

The large eye of Hurricane Frances moved ashore onto the east Florida coast during the night of September 4th and morning of September 5th, 2004, near Stuart, Florida. Frances was a Category Two Hurricane on the Saffir-Simpson Scale. A 120 mile wide area of wind gusts above 80 MPH swept ashore with Frances. Frances moved west-northwest across the Florida peninsula and exited the state near New Port Richey.

On September 7th, 2004, a Post Storm Data Acquisition (PSDA) aerial wind mapping mission was conducted by the NOAA National Weather Service (NWS) in the areas most significantly affected by Frances. The following summarizes the mission.

Flight Tactics and Objectives

The PSDA aerial wind mapping mission was flown from the Fort Lauderdale Executive Airport in a Cessna 172. The aircraft was rented from Airborne Systems of Fort Lauderdale. At the time of the PSDA mission, a memorandum of understanding (MOU) between the NWS and the Civil Air Patrol (CAP) was not in place, necessitating the use of a rented aircraft. A pilot from Airborne Systems flew the mission. An NWS meteorologist on board the aircraft guided the flight and recorded data for later analysis.

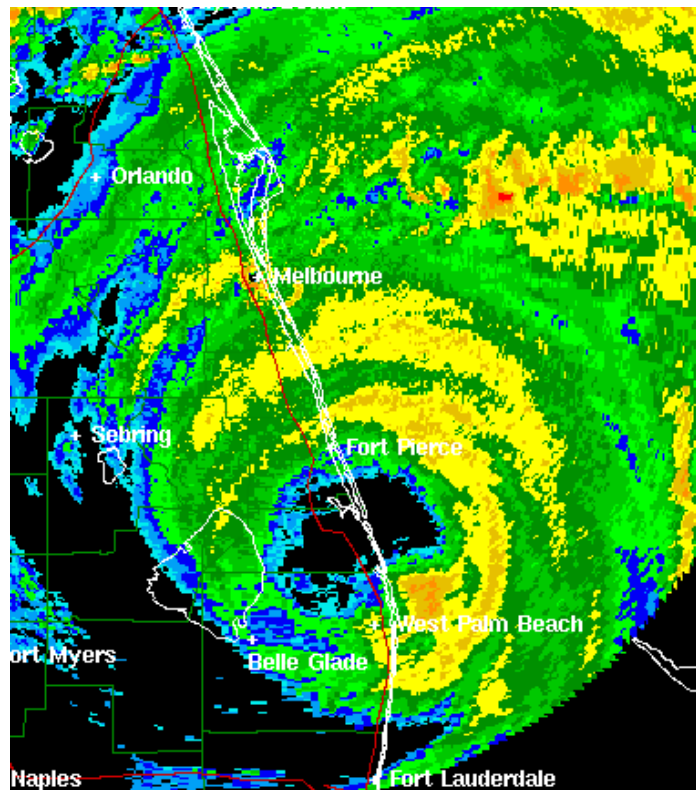


Figure 1 – NWS WSR-88D 0.5 degree Reflectivity - KMLB
1:31 AM EDT 5 September 2004

As seen from an aircraft, the sporadic nature and less striking appearance of damage caused by wind gusts below 100 MPH resulted in the PSDA team concentrating on the Florida east coast.

Data Collection

At flight levels of 1000 to 2000 feet above ground level, video of the damage was recorded. Aircraft position data, utilizing a Global Positioning System (GPS) and a laptop computer, was time synchronized with the onboard camera to facilitate a detailed analysis. Approximately 40% of the data collected during this mission lost time synchronization due to a failure of the laptop computer. This resulted in a more tedious analysis process.

Data Analysis

Digital video of damage and aircraft's position data were reviewed subsequent to the flight. Using subjective estimation techniques associated with determining Fujita Scale damage ratings, peak wind values were estimated. Such estimates should be considered as 3 to 5 second gusts. Where possible, observed wind data were used to calibrate the visually determined damage ratings

It should be noted that the accuracy of gust estimates from just an airborne inspection of the damage is limited due to a lack of first-hand knowledge of the affected building construction quality, soil conditions, and vegetation characteristics. Therefore, the analysis (Figure 2 and Appendix B) should be just one input into any final wind field analysis of Hurricane Frances.

The Analysis

The analysis of information collected during the Hurricane Frances PSDA Aerial Wind Mapping Mission suggests that peak wind gusts at

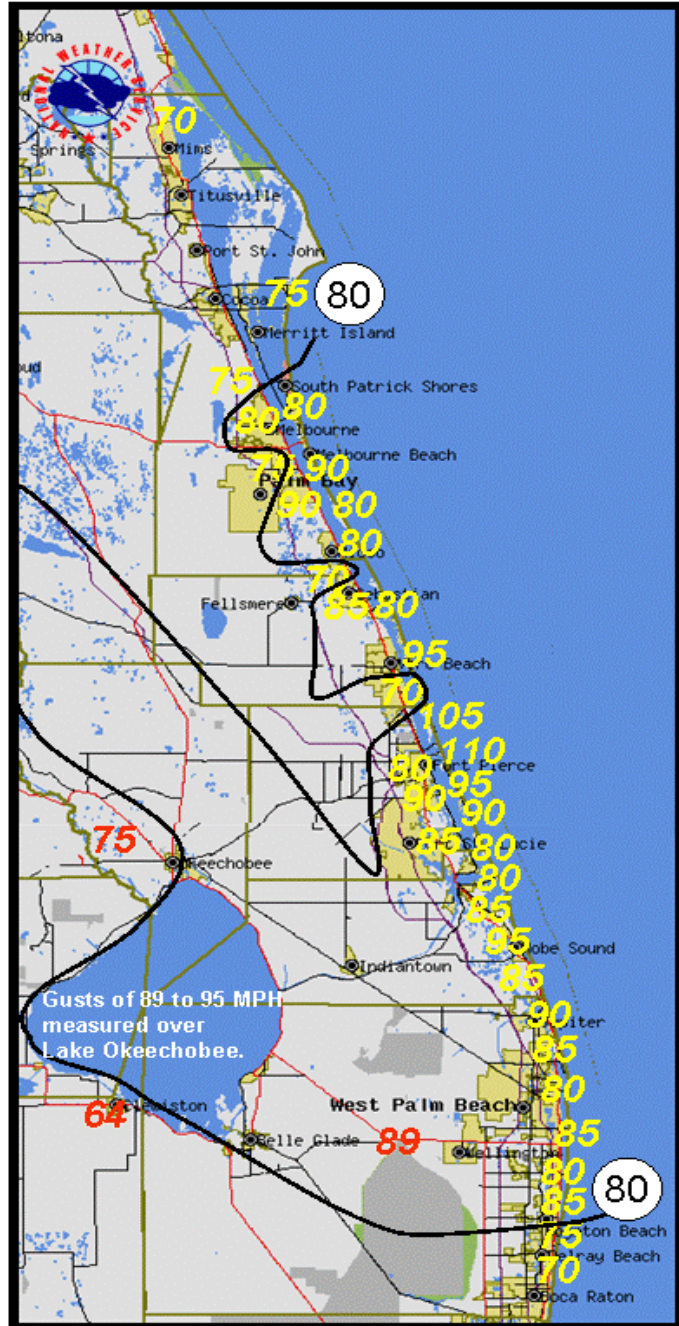
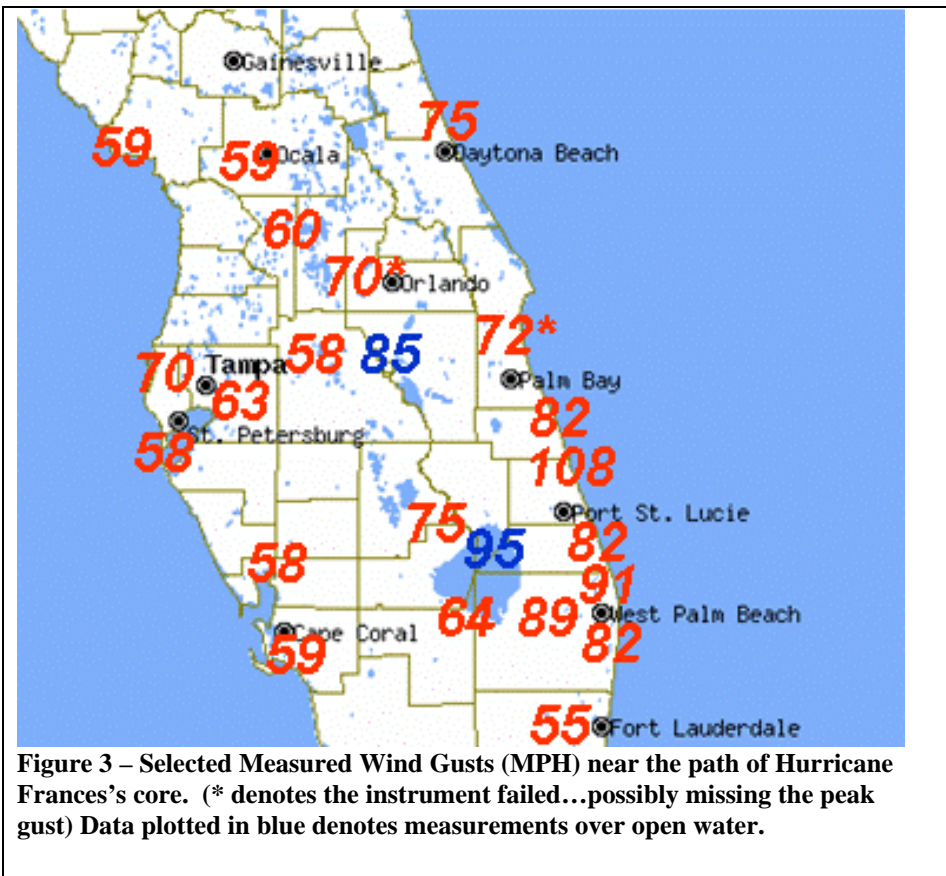


Figure 2 – PSDA Aerial Wind Mapping Derived Peak Gust Estimates. Data plotted in yellow are the subjective estimates. These estimates are in general agreement with the available measured gusts. Data in red are measured gusts. The lone contour marks the estimated 80 MPH gust isopleth.

landfall were approximately 110 MPH near Fort Pierce (Figure 2). Because of the inherent limitations associated with this style of analysis, as described above, the estimate variation could easily be +/- 15 MPH. The saw-tooth appearance in the 80 MPH contour from Port Saint Lucie to Melbourne is apparently the result of strong winds in the individual convective bands / rings (See Figure 1). The inland portion of 80 MPH contour is a blend of the subjectively estimated gusts and measured gusts. Note that gusts of 89 to 95 MPH were measured over the open water of Lake Okeechobee.

Measured wind gust information retrieved by NWS Weather Forecast Offices (WFOs) in Miami, Tampa, and Melbourne (Figure 3) were in basic



agreement with the PSDA derived gust map.

Another limiting factor in this style of gust analysis is the potential underestimation in areas where there is a paucity of structures. The vegetation damage seen in Figure 4 is located near where the peak wind with Frances was estimated to have occurred. Assigning a gust value is problematic in this area.

Summary

Hurricane Frances resulted in a wide swath of wind damage across the state of Florida. On the Florida east coast, the wind swath was comparable to a 120 mile wide F1 tornado.

Virtually all the imagery on the PSDA mission was collected on a consumer grade video



Figure 4 – Vegetation damage near Fort Pierce. Dimension of an apparent wind streak / microburst is marked with the yellow contour.

camera; therefore, the PSDA team did not assemble a collection of high quality digital pictures for later publication. The PSDA team understands that other components of the government accomplished this.

The PSDA Team would like to thank all those at Airborne Systems of Fort Lauderdale, especially manager Vinny Billisi, for their exceptional support to these missions.

Appendix A

PSDA Hurricane Frances Wind Mapping Mission Team

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Appendix B

Full PSDA damage analysis graphic is contained on the next page.



Hurricane Frances

September 5-6th, 2004

Peak Gust Analysis

The analysis is derived from a visual assessment of damage as recorded on video tape during aircraft over-flights. Speeds should be interpreted as 3 to 5 second gusts (MPH), consistent with determining Fujita Scale values.

Wind gusts of 60 to 80 MPH occurred throughout the analysis area with higher gusts noted by the contour and plotted values.

Data in yellow are estimates from the over-flight data. Red values denote measured gusts from areas where over-flights did not occur. The 80 MPH contour is a blend of the estimated and measured gusts.

Note – The estimation of wind gusts from aerial imagery taken of the affected area should be considered as just one input into a final analysis. Information from ground surveys, where variations of building construction, soil conditions, and vegetation types can be more directly assessed, should also be integrated.

