

HURRICANE JEANNE CHARACTERISTICS and STORM TIDE EVALUATION

(DRAFT)

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I. Synoptic History

Hurricane Jeanne developed from a tropical wave from the coast of Africa on 7 September, 2004, then moved across the Atlantic and formed as a tropical depression on 13 September. Figure 1 illustrates the track of Hurricane Jeanne. The cyclone strengthened to a tropical storm on 14 September while it moved slowly over the Leeward Islands. Jeanne crossed southeastern Puerto Rico on September 15 with a maximum sustained surface wind of 70 mph. Jeanne became the eighth hurricane of the season with 80 mph winds while over the Mona Passage and during the Dominican Republic landfall on 16 September.

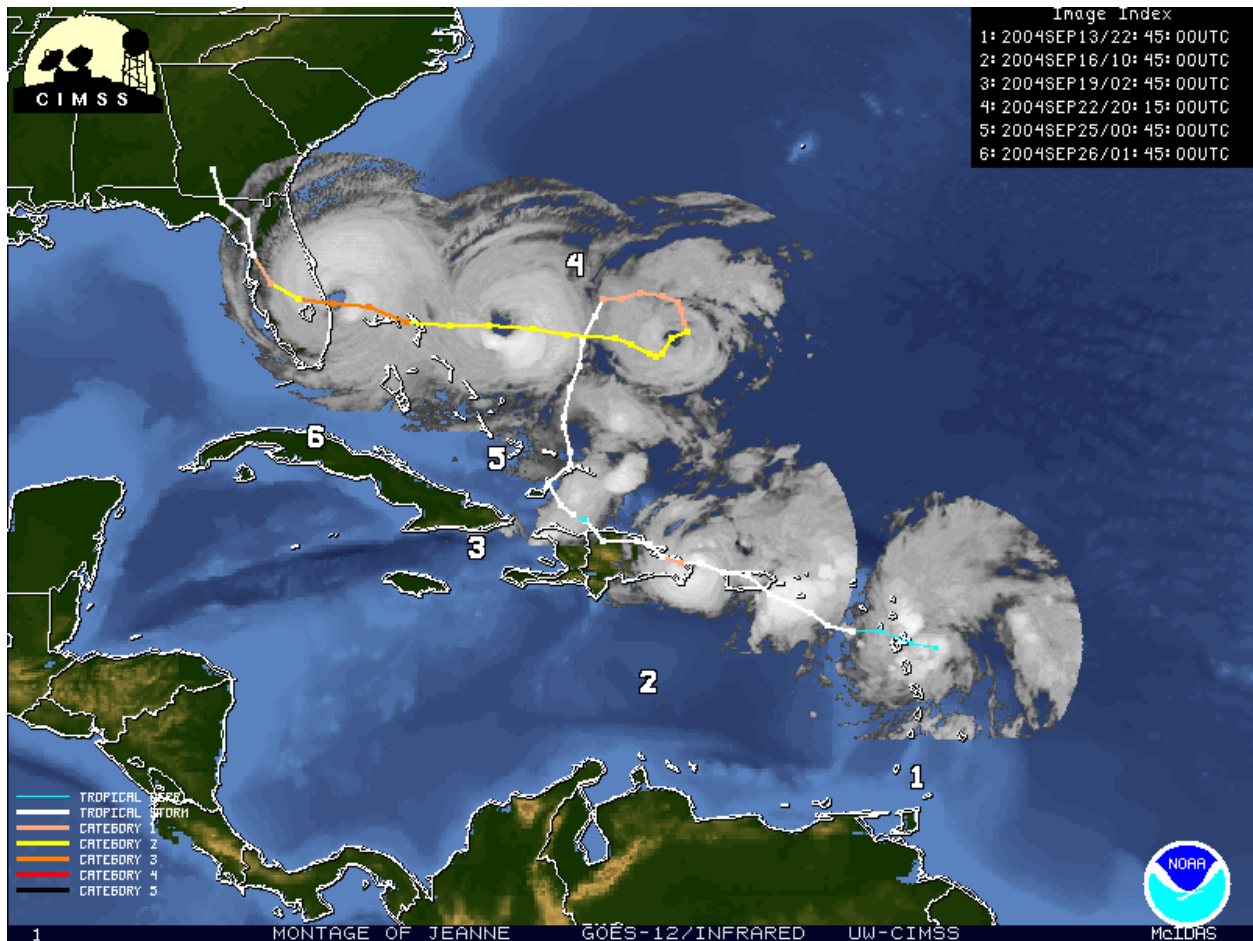


Figure 1. Hurricane Jeanne Track, 13 – 26 September 2004.
(Source: CIMSS, UW-Madison)

By 1800 UTC on 17 September, Jeanne had weakened to a depression and moved over Atlantic waters just north of Hispaniola. On 18 September and in a weakened condition, the lower level center moved westward away from the deep convection and dissipated and a new center reformed well to the northeast of the dissipated old center. Jeanne's slow forward motion across the Caribbean contributed to torrential rainfall along its path, causing thousands to die in Haiti.

For the next five days Jeanne was located in a weak steering flow and moved in an anticyclonic loop about 500 n. mi. east of the northwestern Bahamas. Jeanne gradually strengthened to a hurricane with 98 mph winds by the time it completed this loop on 23 September. Continuing westward at 12 to 14 mph, the winds increased to 115 mph (Category 3) by 1200 UTC on 25 September as the center moved over Abaco Island and then Grand Bahama Island. Jeanne made landfall on the east coast of Florida early 26 September with the center crossing the coast at the southern end of Hutchinson Island just east of Stuart at 0400 UTC. Maximum winds at landfall are estimated at 120 mph over a very small area north of the center (Figures 2 and 3).



Figure 2. Hurricane Jeanne Track passing over the Florida Coast.

Jeanne moved across central Florida and weakened to a tropical storm while centered about 30 n. mi. north of Tampa at 1800 UTC on 26 September and then weakened to a tropical depression about 24 hours later while moving northward across central Georgia.

The winds of Jeanne during landfall are presented in the wind swath map show in Figure 4. The data was prepared and provided by the Hurricane Research Division (HRD) at the Atlantic Oceanographic and Meteorological Laboratory (AOML) of the National Oceanographic and Atmospheric Administration. The graph given in Figure 5 depicts the best track central barometric pressure and wind speed history for Jeanne based on data obtained from Tropical Cyclone Report of Hurricane Jeanne, National Hurricane Center (Lawrence et al., 2005). Wind speed dropped and central pressure rose dramatically right after landfall.

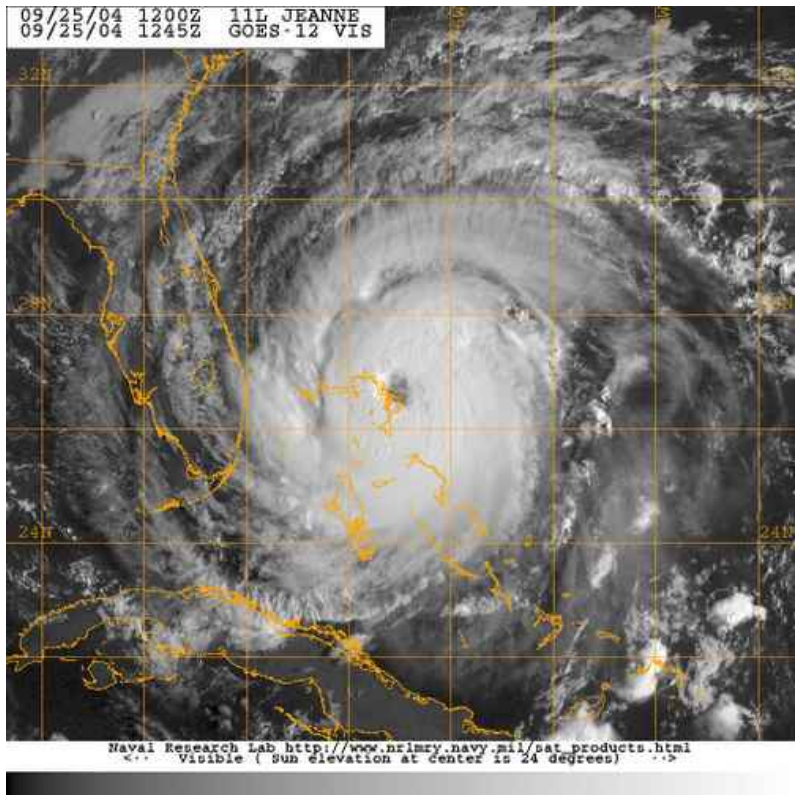


Figure 3. Eye of Hurricane Jeanne before Landfall (Source: Naval Research Laboratory).

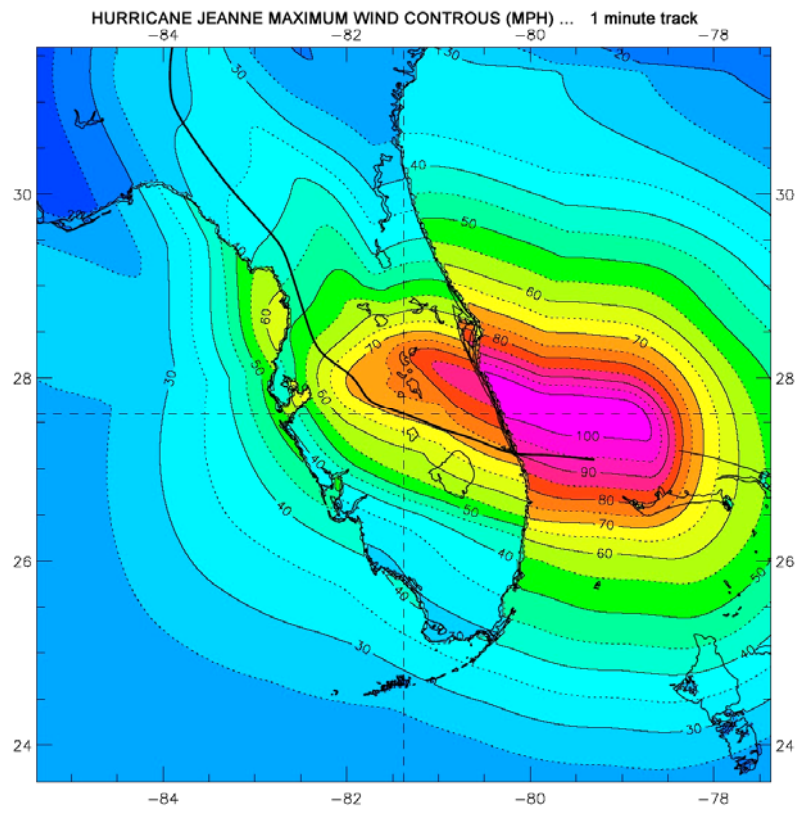


Figure 4. Surface Wind Fields Associated with Hurricane Jeanne at Landfall

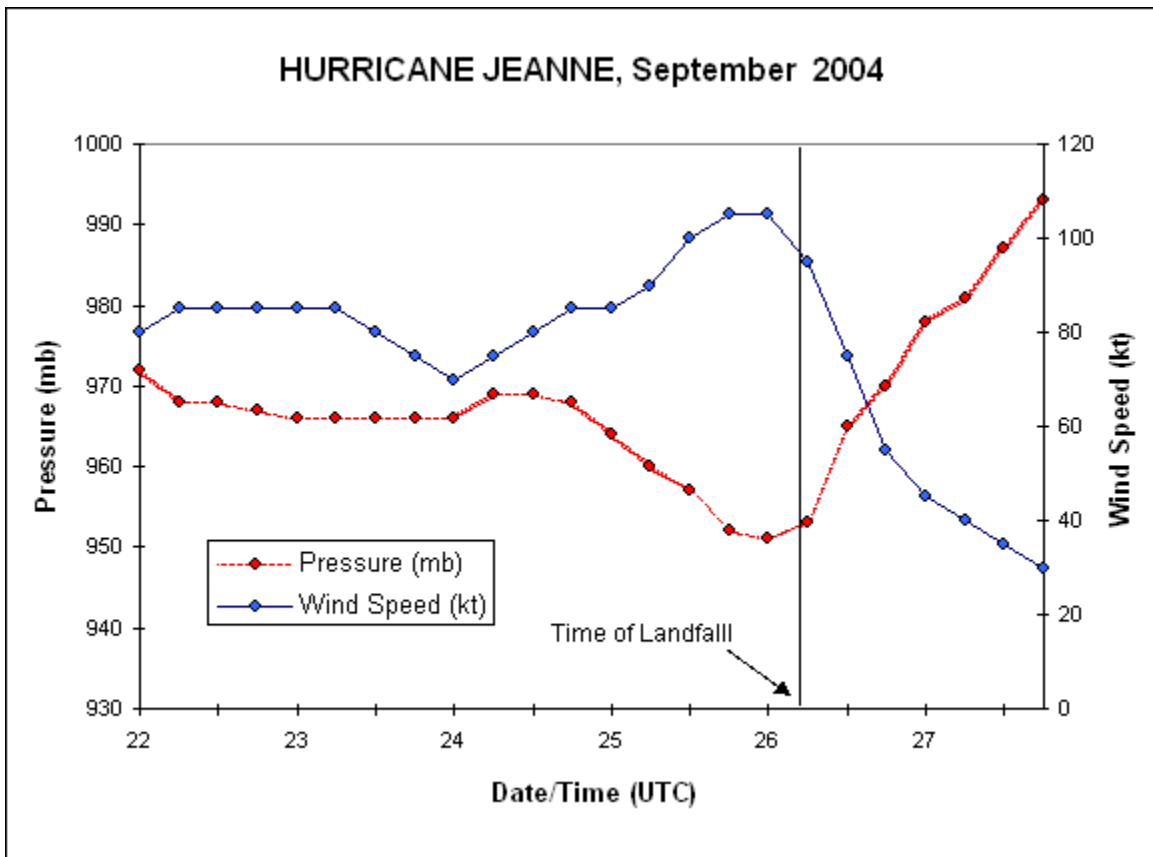


Figure 5. Best Track Pressure and Wind Speed for Hurricane Jeanne, 22 - 27 September, 2004.

II. Storm Tide Records

Hurricane Jeanne was the last of four hurricanes to hit the State of Florida during the 2004 season. It made landfall at the boundary of Martin and St. Lucie counties just 3 weeks after Hurricane Frances made landfall in the same area. Jeanne moved at about 11 mph and carried a Radius to the Maximum Wind (RMW) of approximately 23 miles before landfall. The storm tide caused by Hurricane Jeanne as a Category 3 hurricane reached a wide area which included St. Lucie, Indian River and Brevard counties.

The NOAA tide gauge at Trident Pier was in operation during the time of the hurricane. The peak elevation was measured at 5.5 feet above NGVD.

For the purpose of this report, only the interior High Water Mark (HWM) data from beach areas or flooded areas with wave setup were selected to evaluate the storm tide associated with Hurricane Jeanne. However, there is no HWM data available from FEMA or other agencies at the time this study was conducted.

III. Storm Tide Evaluation

Since there is no HWM data available at the present time for Hurricane Jeanne, it is not possible to generate a trend line of the storm tide distribution. It is, however, possible to predict that northern St. Lucie County and southern Indian River County received the worst impact by maximum wind and associated storm surge from its track and the RMW, which was estimated as 23 miles (Lawrence et al., 2005).

To provide the un-surveyed area with the predicted storm tides, the 2-D Storm Surge Model of BSRC was employed to calculate the total storm tide, (i.e. surge generated from barometric pressure and wind stress plus dynamic wave setup and astronomical tide). The 2-D grid systems and associated hydrological data of St. Lucie, Indian River and Brevard counties from the CCCL study were used to cover the study area. Hurricane track, pressure deficit and RMW of Jeanne for the 28 hours before and 14 hours after landfall were input to the 2-D storm Surge Model. The model then ran and calculated the total storm tide for 13 locations in the study area. Figures 6 to 9 display the results of model calculated total storm tides.

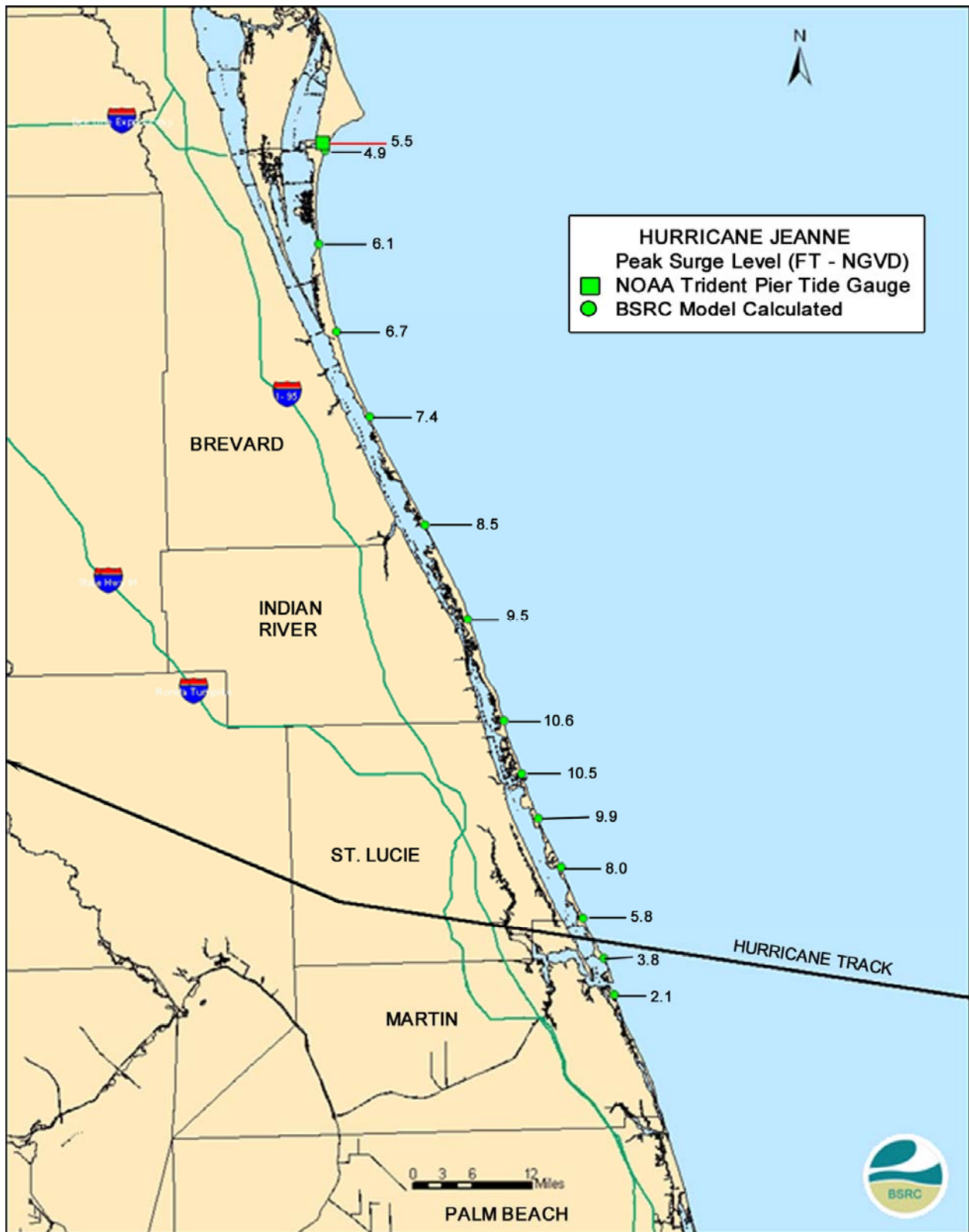


Figure 6. Peak Surge Levels along the Atlantic coast for Hurricane Jeanne.

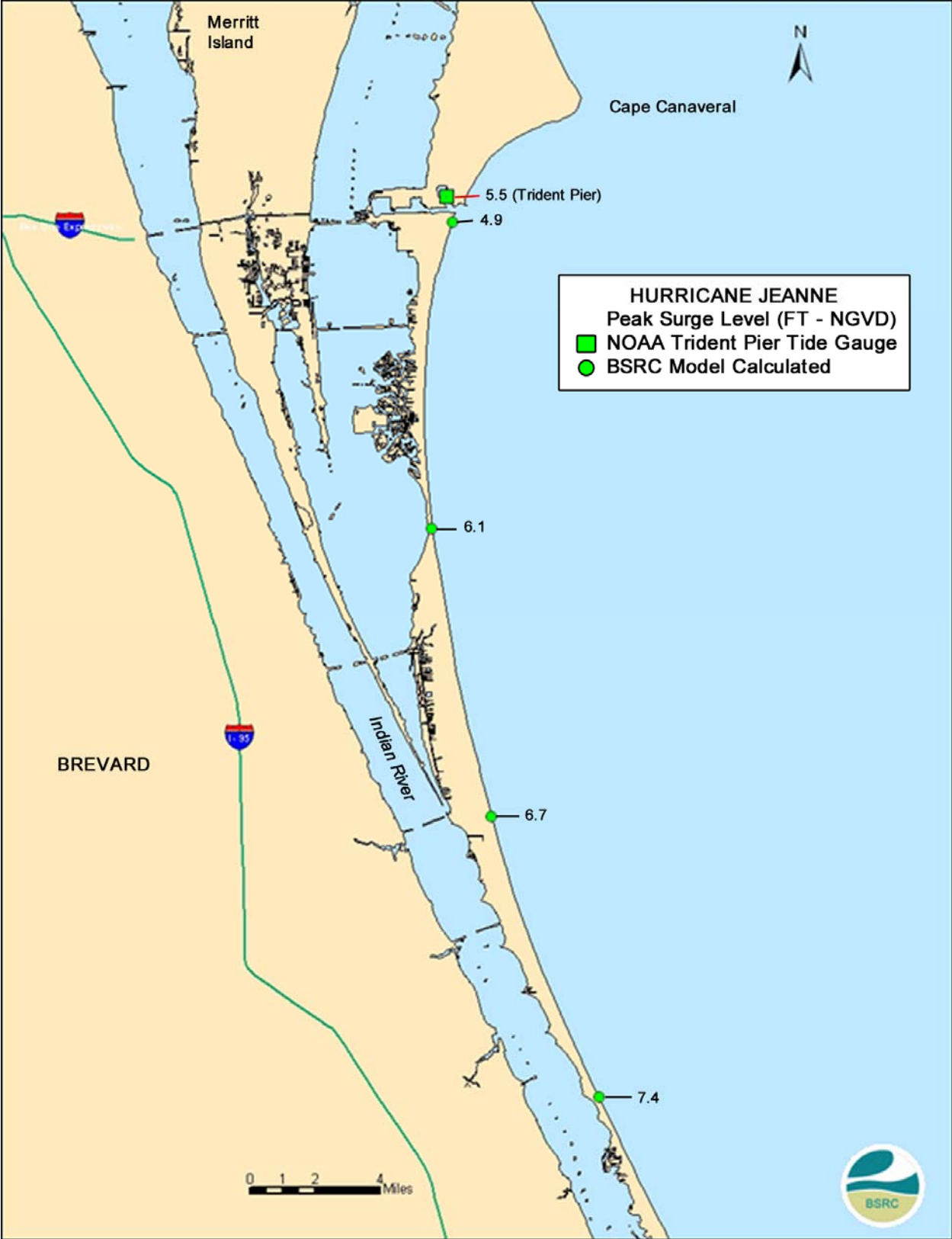


Figure 7. Peak Surge Level in the Brevard County area for Hurricane Jeanne.



Figure 8. Peak Surge Levels in the Indian River County area for Hurricane Jeanne.

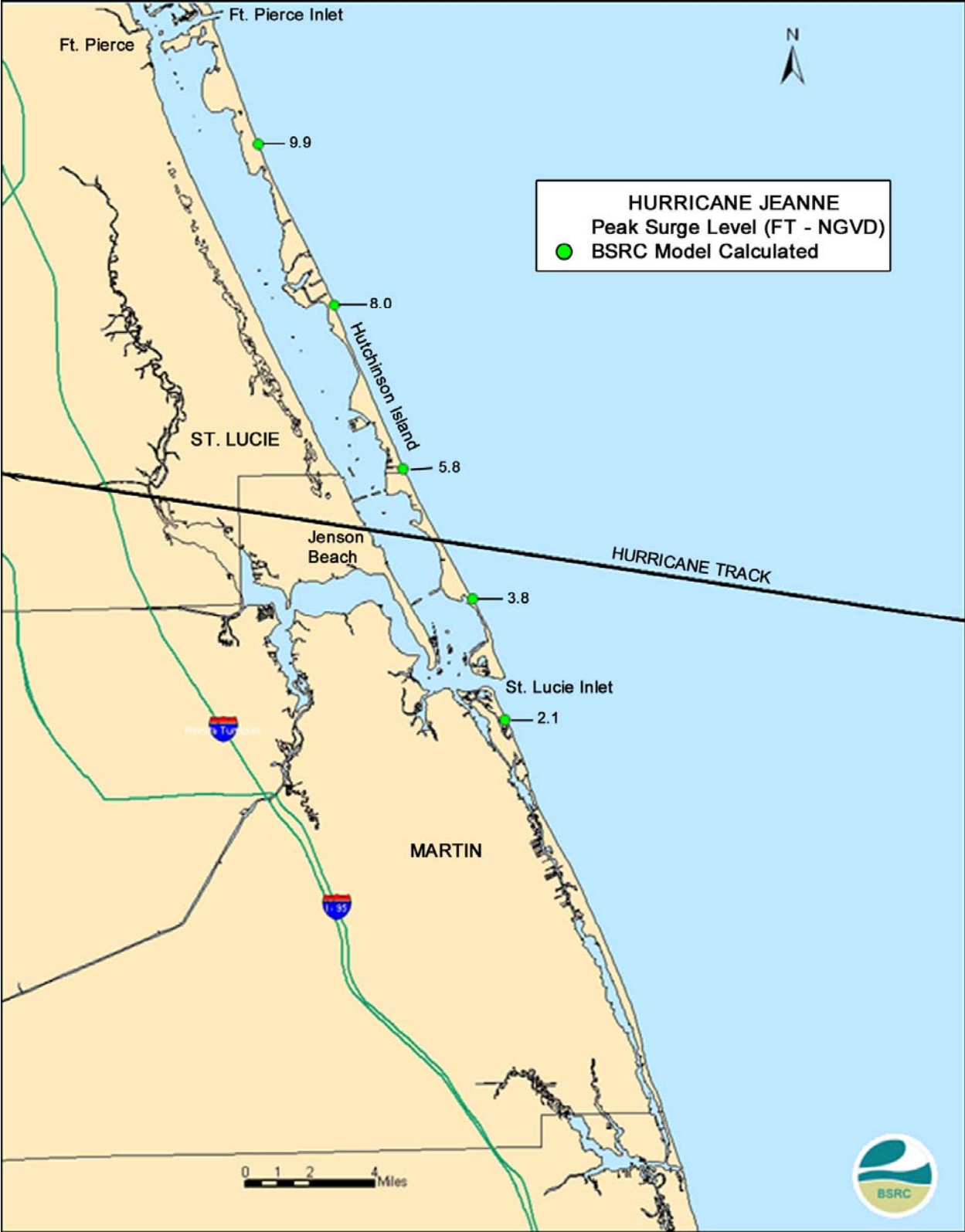


Figure 9. Peak Surge Levels in the Hurricane Jeanne landfall areas.

V. Storm Tide Return Period

The total tide values for various return periods in the CCCL study for St. Lucie, Indian River and Brevard counties were used to provide a storm tide return period for the BSRC Model calculated storm tide during Hurricane Jeanne.

A total of 27 storm tides in 9 profile transact lines from the CCCL studies for St. Lucie, Indian River and Brevard counties were selected to generate return periods of 10, 20 and 50 years. Figure 10 depicts a comparison between the calculated storm tide for Jeanne and the CCCL's total storm tide for various return periods. The figure shows that the BSRC Model predicted that Hurricane Jeanne would have generated a storm tide ranging between 10 and 50 years return period for most of the study area. In Indian River County, storm tide was calculated as 8.5 to 10.6 feet above NGVD and was between the 20 and 50 years return period. The predicted storm tides return period gradually reduced from 20 years at Indian River County's northern boundary to 10 years at Brevard County's middle profile. The storm tide return period dropped quickly from 50 years at the Indian River County's southern boundary to below 10 years at St. Lucie County's southern boundary.

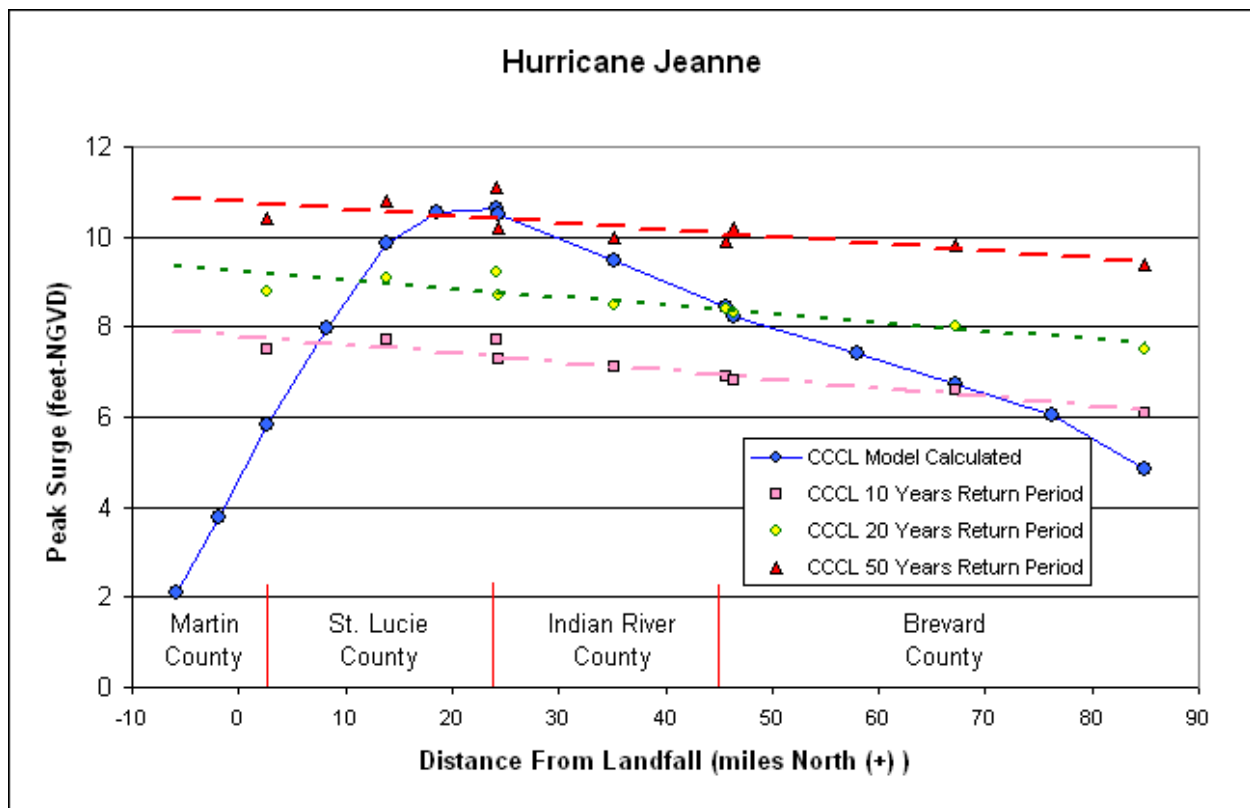


Figure 10. Hurricane Jeanne Storm Tide Return Period

V. Reference

Lawrence, M.B. and Cobb, H. D., "Tropical Cyclone Report, Hurricane Jeanne, 13 - 28 September, 2004", Tropical Prediction Center, National Hurricane Center, January 2005.

Lawrence, M.B., Personal Communication, February 2005.