

Hurricanes Influencing the Richmond Area

Why should residents of the Middle Atlantic states be concerned about hurricanes during the coming hurricane season, which officially begins on June 1 and ends November 30?

After all, the big ones don't seem to affect the region anymore.

Consider the following: The last Category 2 hurricane to make landfall along the U.S. East Coast, north of Florida, was Isabel in 2003. The last Category 3 was Fran in 1996, and the last Category 4 was Hugo in 1989. Meanwhile, ten Category 2 or stronger storms have made landfall along the Gulf Coast between 2004 and 2008.

Hurricane history suggests that the Mid-Atlantic's seeming immunity will change as soon as 2009. Hurricane Alley shifts. Past active hurricane cycles, typically lasting 25 to 30 years, have brought many destructive storms to the region, particularly to shore areas.

Never before have so many people and so much property been at risk. Extensive coastal development and a rising sea make for increased vulnerability. A storm like the Great Atlantic Hurricane of 1944, a powerful Category 3, would savage shorelines from North Carolina to New England. History suggests that such an event is due.

Hurricane Hazel in 1954 came ashore in North Carolina as a Category 4 to directly slam the Mid-Atlantic region. It swirled hurricane-force winds along an interior track of 700 miles, through the Northeast and into Canada. More than 100 people died. Hazel-type wind events occur about every 50 years.

Areas north of Florida are particularly susceptible to wind damage. Leafy, shallow-rooted trees are easy prey for strong winds. Less wind-resistant building design also contributes to risk. Hurricane Isabel in 2003 was downgraded to a tropical storm when it reached Virginia but still caused billions of dollars in damage from there through Maryland and Pennsylvania.

Inland flooding is a threat any time a hurricane makes landfall. 2009 marks the 40th anniversary of Hurricane Camille and its devastating flash flooding in Virginia--the state's deadliest natural disaster. About 150 people died.

Few residents of the East Coast are aware of the region's hurricane history and the vulnerabilities it suggests. Yet, this information is now readily available through such books as *Hurricanes and the Middle Atlantic States*. Such information provides a preparation advantage lacked by previous generations. The material provides a basis for planning, preparation and action.

Since the current active North Atlantic hurricane cycle began during 1995, the Mid-Atlantic coast has yet to see a significant region-wide hurricane. The previous two active cycles featured at least a half-dozen. Interior sections are due for the next Hurricane Hazel. 2009 is not a year for complacency.

http://www.barnesandnoble.com/w/hurricanes-and-the-middle-atlantic-states-rick-schwartz/1008697469?ean=9780978628000&st=PLA&sid=BNB_DRS_Core+Shopping+Books_00000000&2sid=Google_&sourceId=PLGoP75606

To order *Hurricanes and the Middle Atlantic States*:
Send a check or money order for \$24.95, postpaid.
(Internet Special-- The regular price is \$32.95.) Virginia
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Make checks payable to *Blue Diamond Books*. Mail to:
6516 China Grove Ct., Alexandria, VA 22310
Or pay by credit or debit card through PayPal.

Past Hurricanes Influencing the Richmond Area

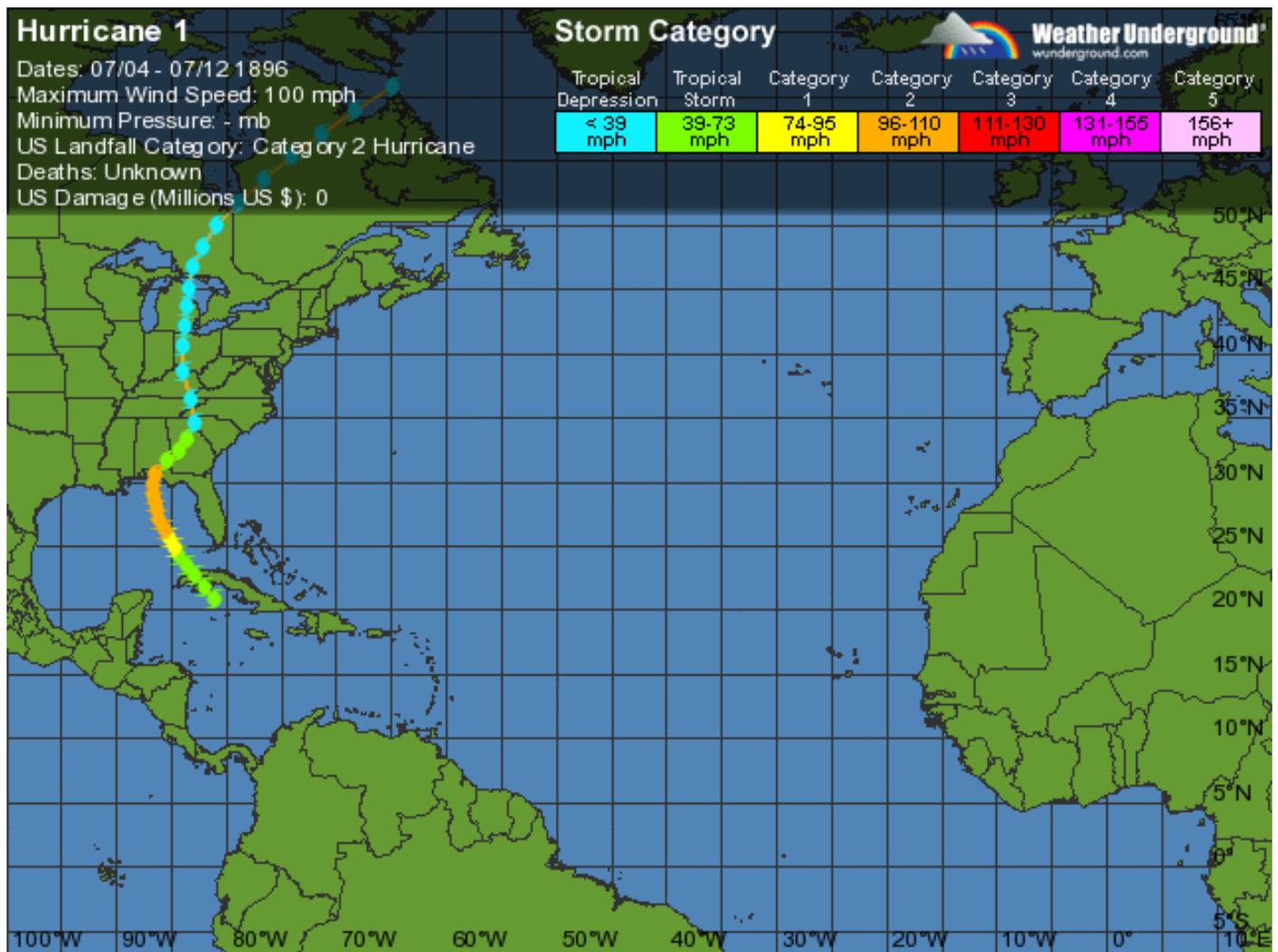
September 16, 1876 – ** p. 69

This storm and its effects of high winds and tidal flooding were comparable to those of Hurricane Isabel in 2003. This storm had near hurricane force winds and destroyed noble shade trees, damaging homes and businesses.

September 12 1878 at 4:00 PM - ** p 72.

Tornadoes hit Dinwiddie County southeast of Petersburg, Nottoway County, and Goochland County near Dover Mills. A tornado also tore through Henrico County, several miles outside of Richmond at about 4 PM.

Great Hurricane of 1896





Great Hurricane of 1896 – State Library and Archives of Florida

Dates: September 26 – 30, 1896

Top Wind Speed: 125 mph

Damages (adjusted for inflation): \$114 million

Deaths: 16

September 29, 1896 ** p. 101

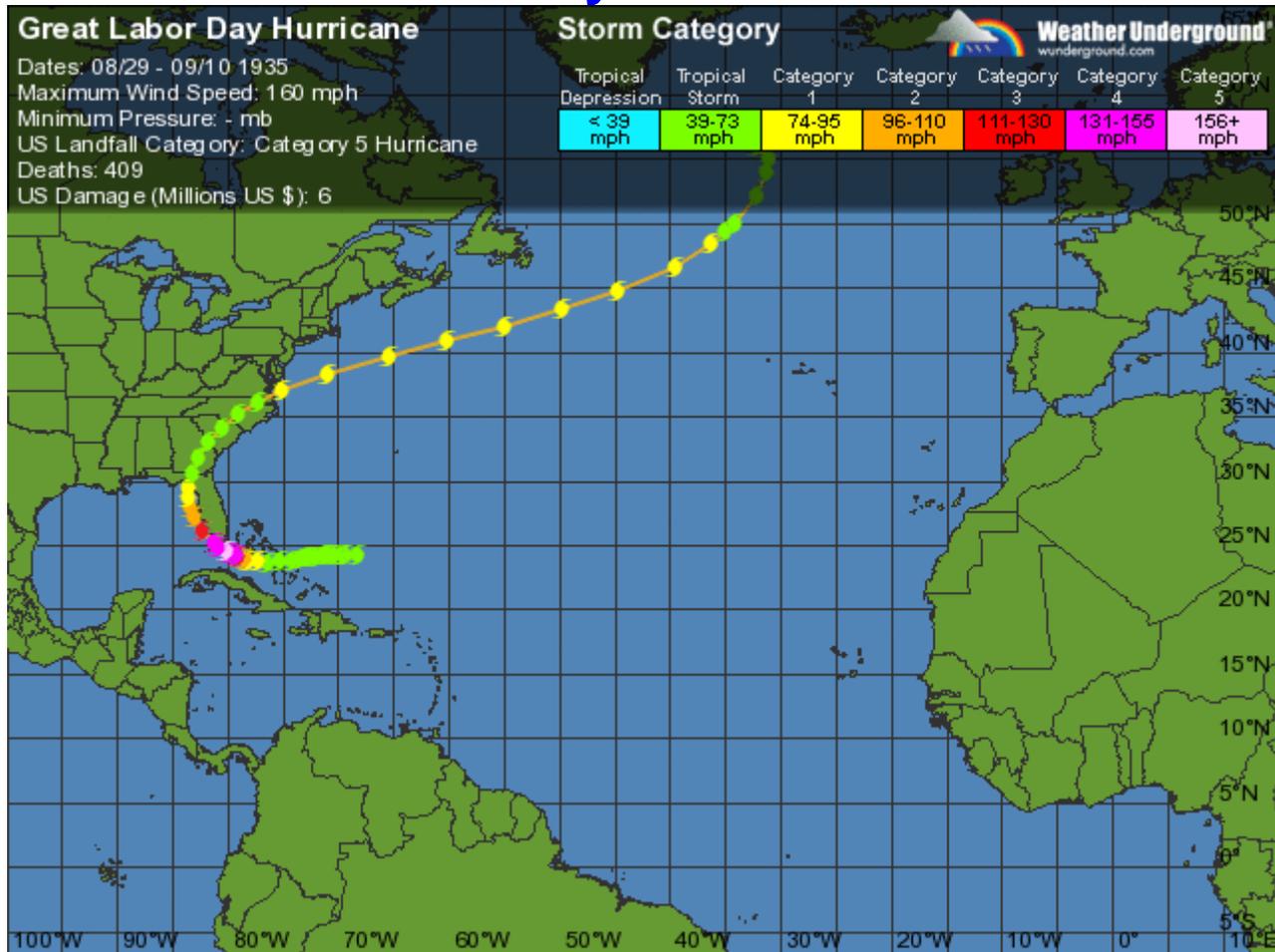
“This hurricane is Richmond’s worst wind storm. Broken windows, damaged roofs and toppled chimneys were legion.

Church steeples crashed into adjacent streets and buildings. The east end suffered the greatest harm.” But the rainfall was light in Richmond for a storm of this nature because of its fast speed.

Hurricanes were not named before 1950, so this storm from the end of the nineteenth century is known only as the “Great Hurricane.” The hurricane reached Category 3 at its most powerful. It formed over the Lesser Antilles and traveled northeast into the Gulf of Mexico where it changed course and moved northeast to make landfall on the Florida Panhandle.

The storm continued to move north through the East Coast states, reaching VA on September 29 and eventually dissipating over Pennsylvania. There was tremendous property damage in Virginia, mainly from the wind. Homes and businesses were damaged or destroyed. Telegraph lines fell, and roads were blocked by debris. Hundreds or thousands of trees were downed, many snapped off 10 to 15 feet above the ground.

Great Labor Day Hurricane of 1935

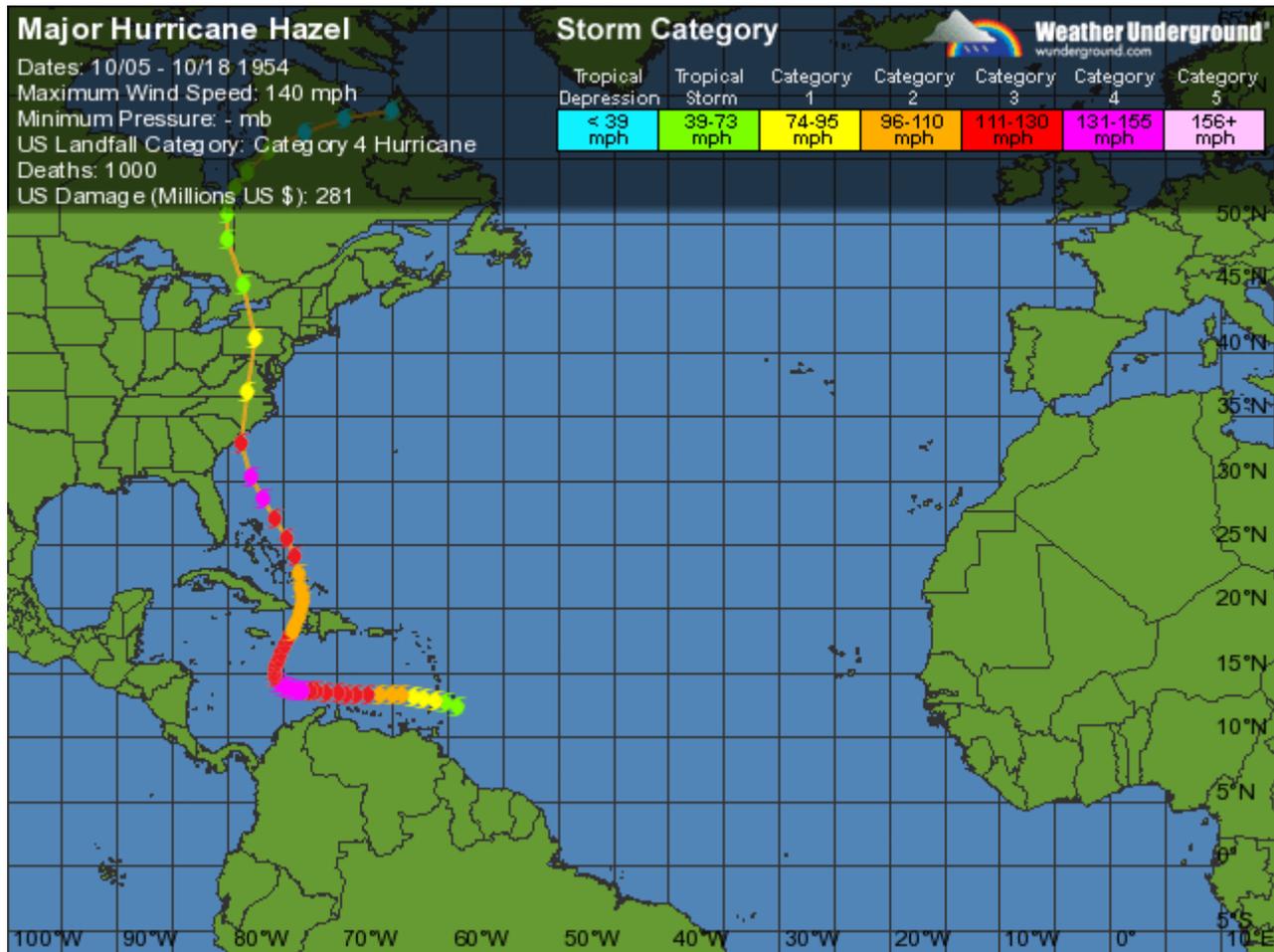


Great Labor Day Hurricane

September 5-6, 1935 ** p. 157

This hurricane was known as the “Great Labor Day Hurricane.” The James River crested at 25.5 feet above the 9 foot flood stage at Richmond, VA. The Weather Bureau estimated the total rainfall of September 5-6 at an average of 6.5 inches for the entire James River Basin. The rain however was considerably heavier east of the Blue Ridge Mountains and the river at Lynchburg did not even reach flood stage. The Richmond rainfall was 7.41 inches as a storm total and 4.91 inches fell on September 5, 1935 alone.

Hazel 1954 Richmond's 2nd Worst Hurricane



Dates: October 5 – October 18, 1954

Top Wind Speed: 125 mph

Damages (real USD): \$15 million

Damages (adjusted for inflation): \$133 million

Deaths: 13

Hurricane Hazel was a Category 4 hurricane that formed in the southern Caribbean on October 5, 1954. It traveled over the island of Haiti, causing devastating damages and killing at least 400 people, then continued north towards the Atlantic coast. Hazel made landfall in the Carolinas on October 15, still at its Category 4 strength, and traveled north. It continued through Pennsylvania and New York before turning northwest and heading into Canada near the Great Lakes where its remnants were eventually absorbed into another storm. **Due to the storm traveling very quickly, damage in Virginia was far less than it could have been. Record wind gusts were recorded all over the state, and most damage was wind-related. An estimated 18,000 homes and businesses were damaged, and roughly half of all phone and power customers were out of service for up to six days.**

Hazel was an unusual tropical cyclone, because it continued over land all the way up to Canada and caused significant flooding and damage in the Toronto, Ontario area. The storm was weakening as it moved north, but it came into the path of a powerful cold front

over New York State that gave it new life as it traveled up into Canada. In Toronto, Hazel is still known today as the “storm of the century.”

October 15, 1954 ** p. 198

Richmond had sustained winds of 68 mph with a maximum gust recorded at 79 mph and a barometer reading of 28.75 inches a new record at that time. More than 50 homes lost roofs in the Richmond area but only 1.15 inches of rain fell as the storm was traveling northward at a speed of 50 mph.

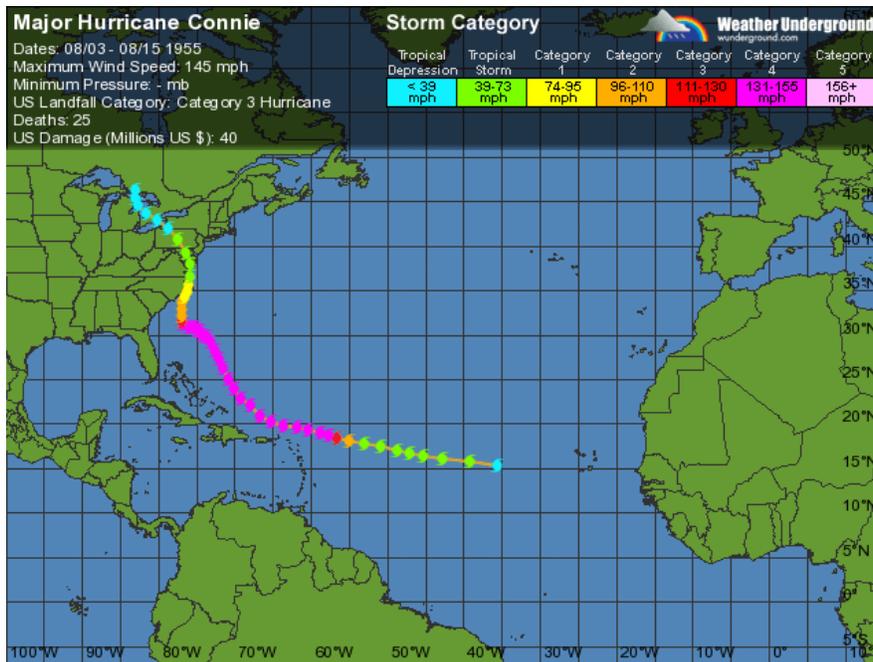
Fastest forward speed of Mid-Atlantic Hurricanes

Rank	Speed	Name	Year	Day	Time
1	70 mph	<u>Great New Eng. Hurricane</u>	1938	<u>Sept. 15</u>	0600 UTC
2	66 mph	<u>Tropical Storm Four</u>	1970	<u>Aug. 18</u>	1800 UTC
3	65 mph	<u>Hurricane Luis</u>	1995	<u>Sept. 11</u>	1200 UTC
4	63 mph	<u>Hurricane Lisa</u>	1998	<u>Oct. 9</u>	1800 UTC

Hazel was also unusual in terms of her forward speed. We all know that hurricanes usually weaken quickly once they move onshore, but Hazel was moving so fast she outpaced her collapse rate. By the time Hazel pushed into Virginia during the afternoon of October 15, she was moving nearly 50 mph. The storm caused \$15 million in damage in Virginia and eventually spread destruction as far north as Canada. Canadians count Hazel as one of their all-time greatest natural disasters.

This was one of the fastest forward speeds recorded for hurricanes. Most move at speeds no faster 20-30 mph. The record speed was recorded in the New England hurricane of 1938 which had a forward speed of 75 mph.

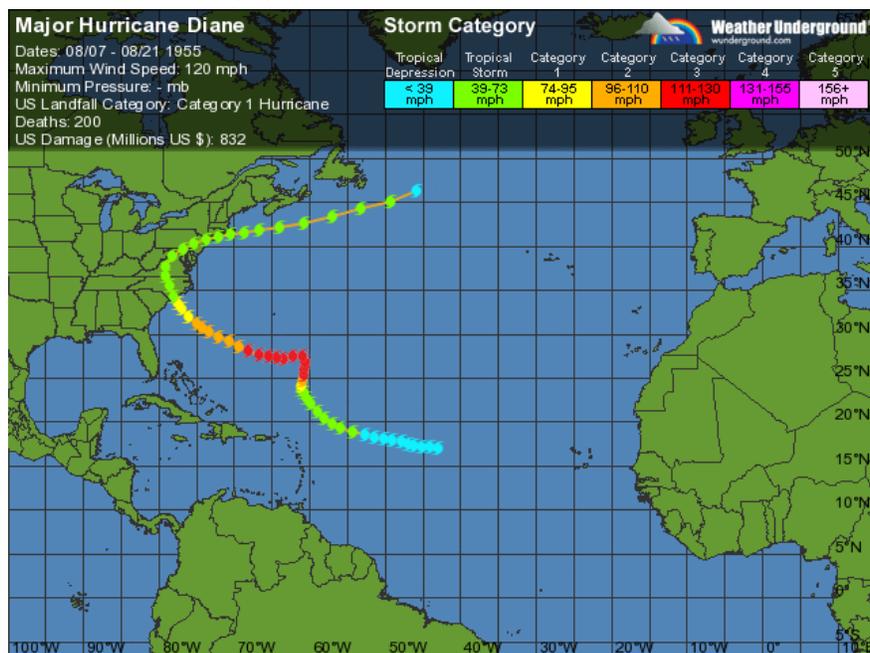
1955 Hurricane Connie



August 12, 1955 ** p. 211

Hurricane Connie was also a flood maker in the Richmond area dumping 8.71 inches of rain on the 12th. Connie deposited 5-10 inches of rain within 100 miles of its track but gave Richmond little in the way of wind.

1955 Hurricane Diane

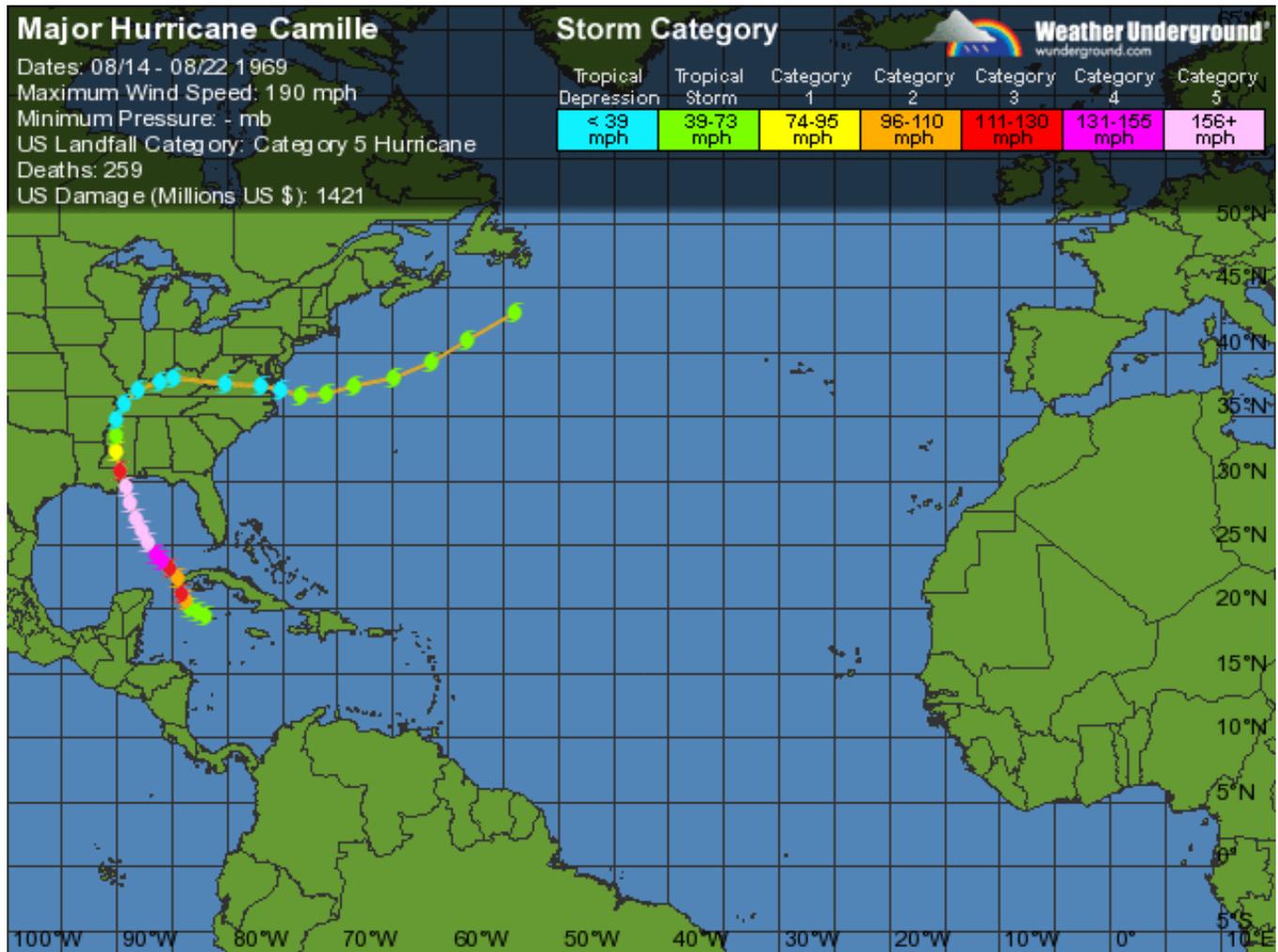


August 17, 1955 ** p. 215

Hurricane Diane gave Richmond an additional 2.16 inches after giving 8.79 inches eight days before adding to the problem of flooding in the area. But the flood situation was worse to the west and in

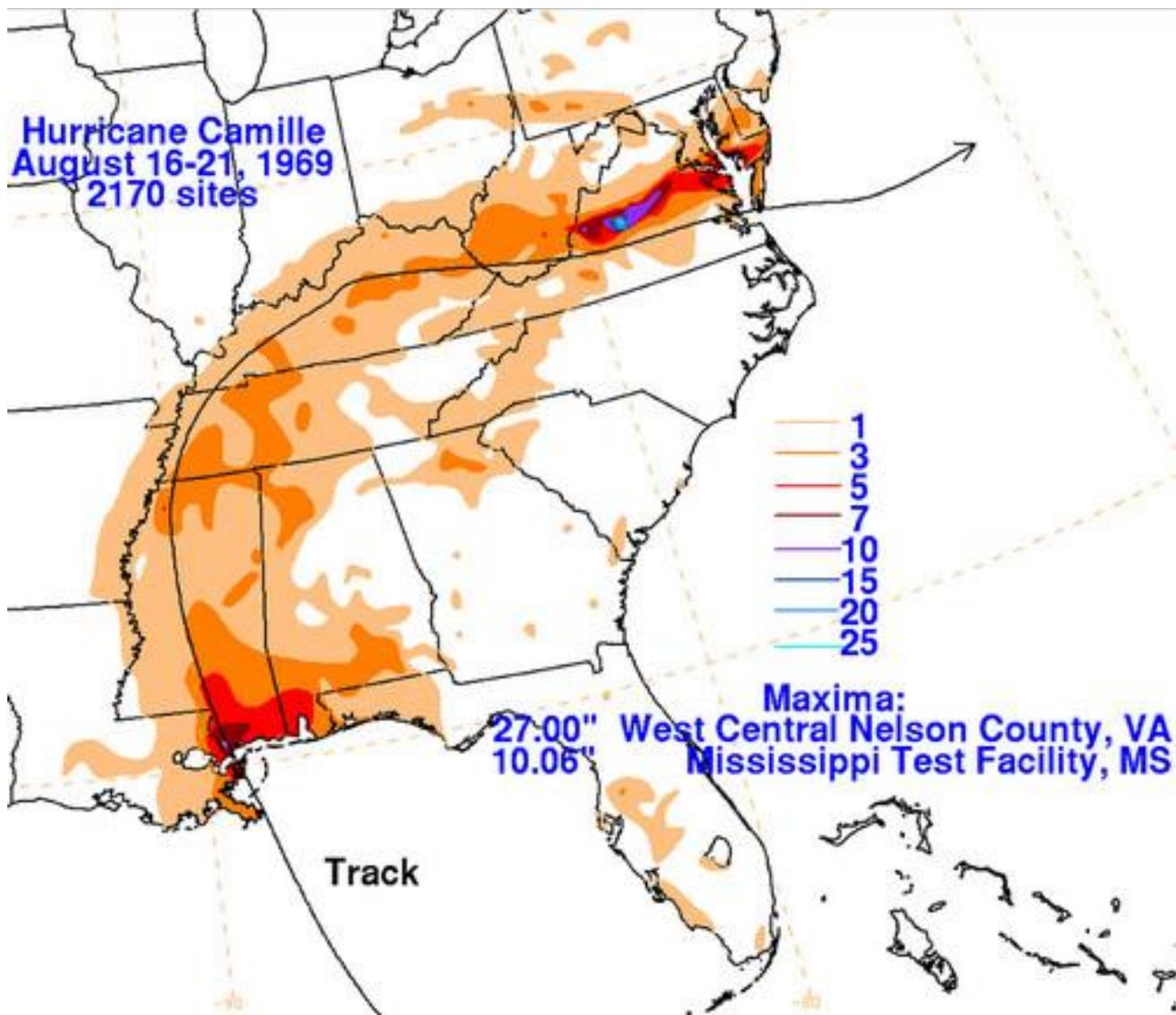
the Shenandoah Valley it was the worse flooding since 1942. This storm caused worse flooding conditions to the north as the Pocono, Catskill and Berkshire Mountains received between ten and twenty inches of rain.

1969 Hurricane Camille



August 20, 1969 ** p. 235

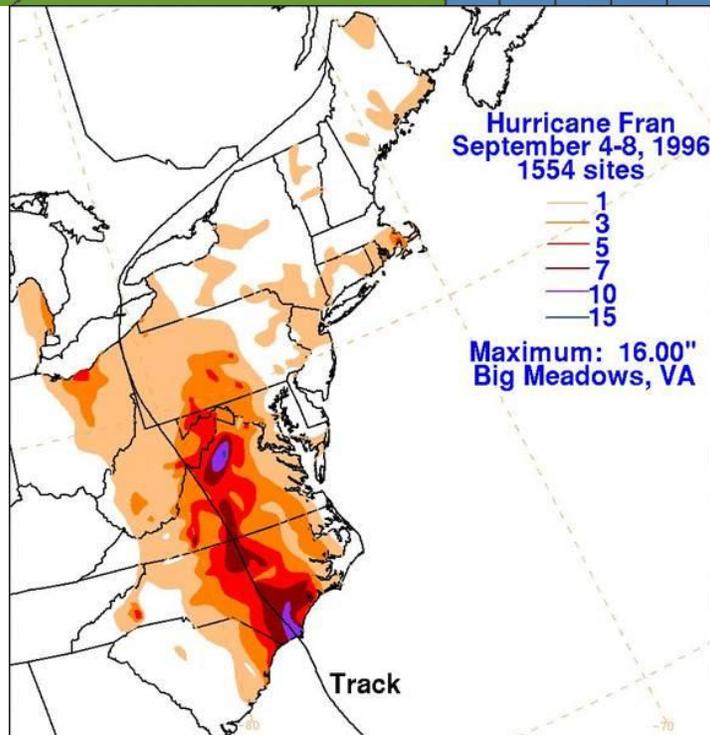
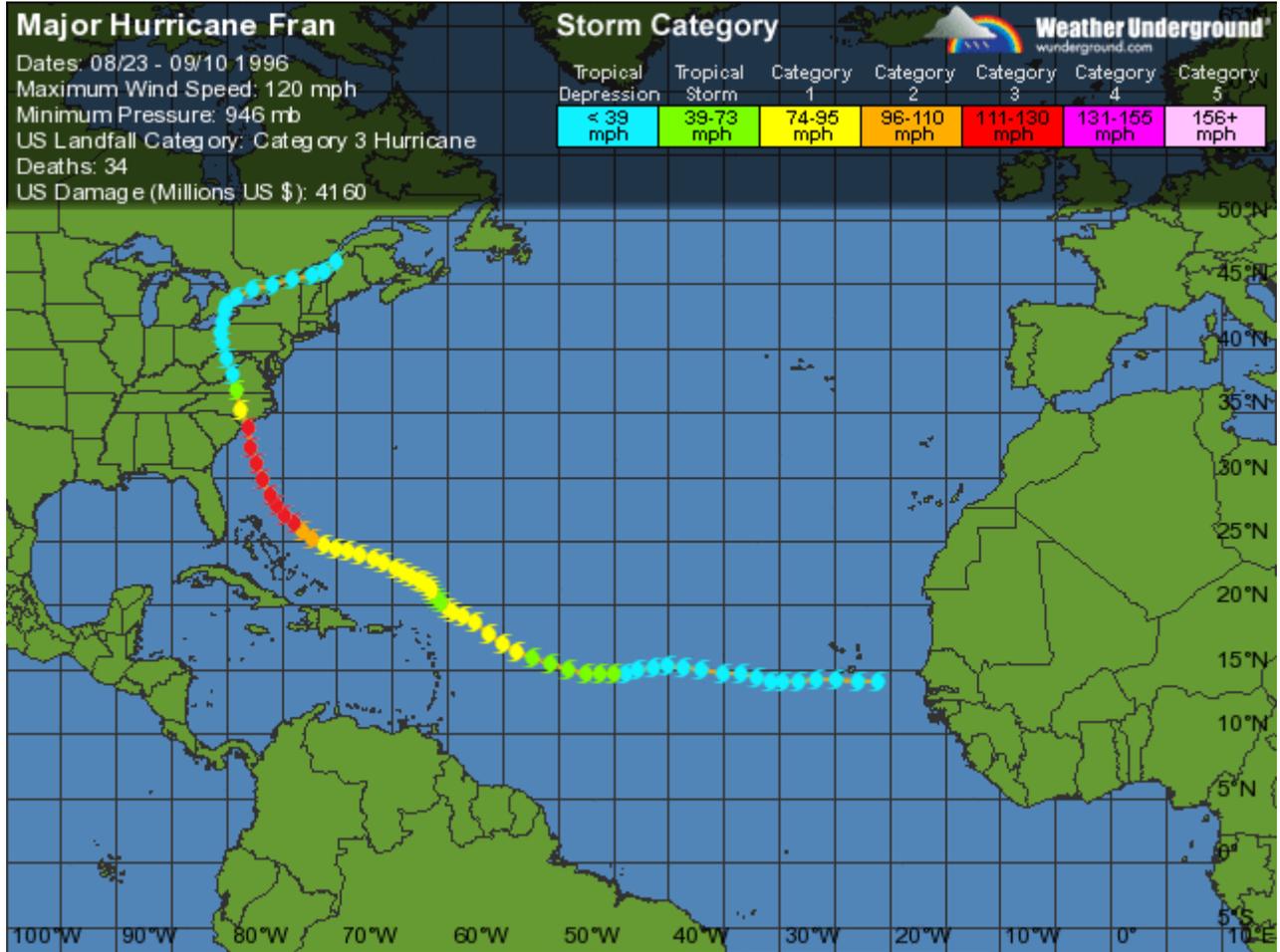
Camille gave Richmond 2.68 inches of rain but this was nothing compared to what the James River Basin received. More than 25 inches of rain fell in a 5 hour period in Nelson County, VA. This is still a 6 hour period record rainfall amount for the United States. The James River crested at 26 feet in Lynchburg which was the highest since 1877. More than 10 inches of rain fell on Scottsville about 15 miles south of Charlottesville where the James River crested at 30.5 feet eclipsing a 17 foot flood stage. The James River crested in Richmond at 28.6 feet with a flood stage of only 9 feet. This was the highest recorded flood stage for the James River in Richmond in nearly 200 years.



When Hurricane Camille struck land near Bay Saint Louis, Mississippi, it was a **category five hurricane**, with recorded wind speeds at more than 200 miles per hour. Wind damage killed 143 people in the Gulf Coast region. Unexpectedly, however, Camille turned east across Kentucky and Virginia, and during the evening of August 19, 1969, the rain intensified dramatically. This map, produced by the National Weather Service, shows both the storm's path across the southeast and the volume of rainfall.

The darkly colored band through central Virginia represents Camille's heaviest downpour. Nelson County, Virginia, received the brunt of the storm with at least twenty-seven inches of rainfall. So much rain fell in such a short time in Nelson County that, according to the National Weather Service at the time, it was "the probable maximum rainfall which meteorologists compute to be theoretically possible."

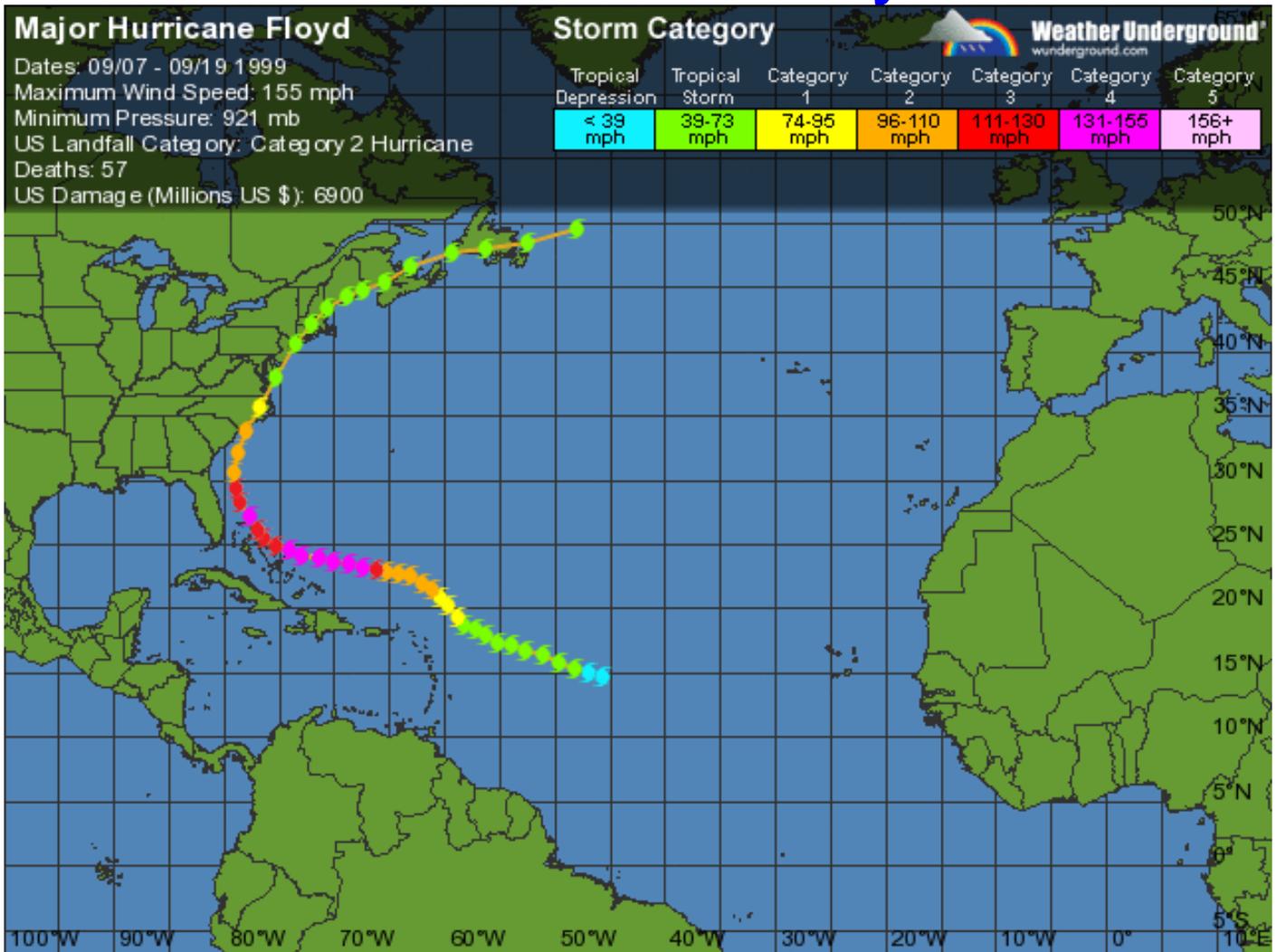
1996 Hurricane Fran



September 6-7, 1996 ** p. 290

Hurricane Fran gave Big Meadows, VA had the highest wind gust in the state at 71 mph and a rainfall storm total amount of 16.77 inches and Richmond, VA received only 2.1 inches. Page County, VA was the hardest hit in the state and as rainfall amounts were greatest in the Shenandoah Valley it caused more flooding along the Potomac River than the James River. However, the James River reached a crest of 23.8 feet in Richmond which has a flood stage of only 9 feet.

1999 Hurricane Floyd

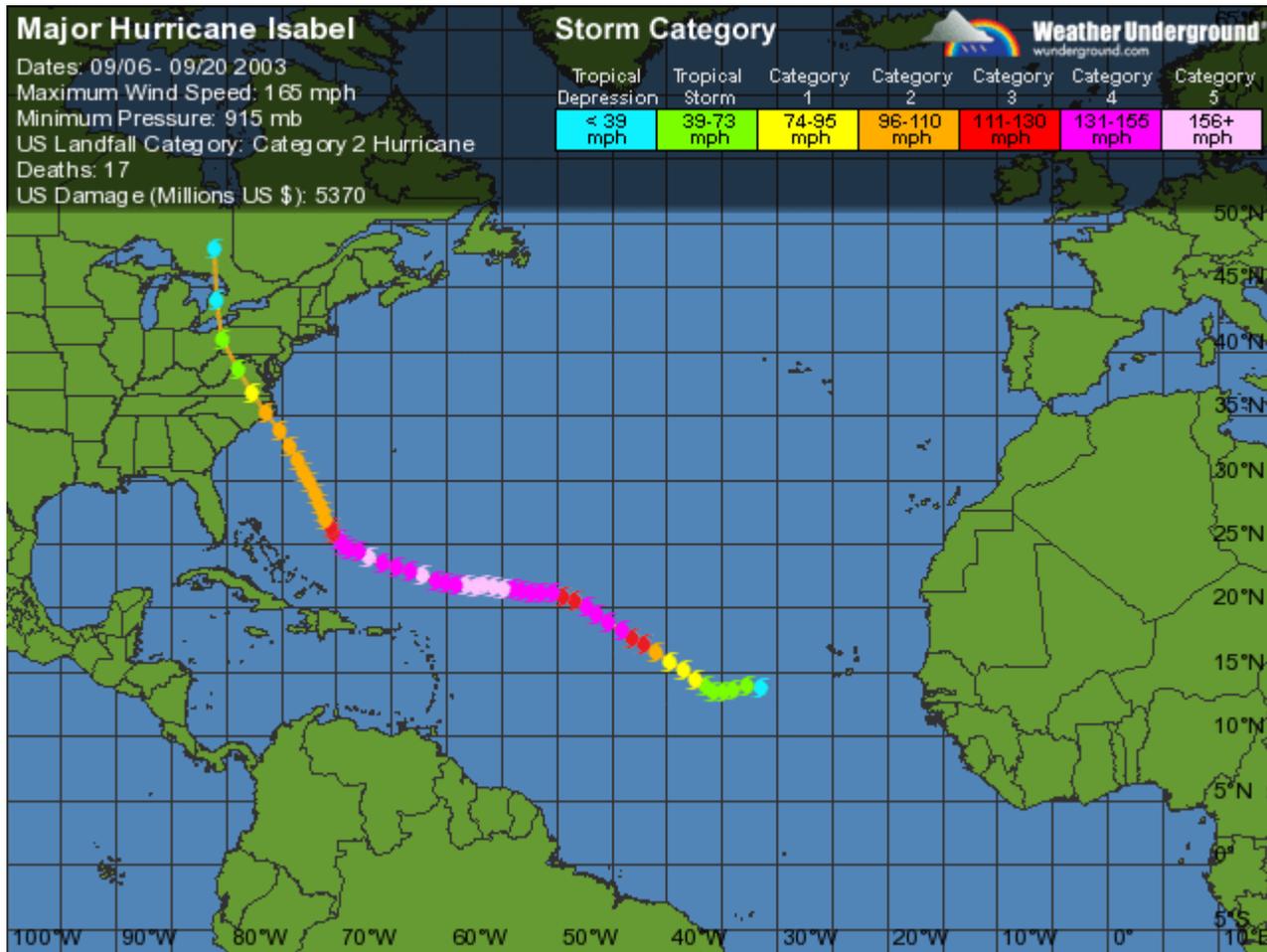


September 16, 1999 ** p. 296

Hurricane Floyd passed well to the east of Richmond but gave Richmond 4.53 inches of rain on the 16th a new daily rainfall record for the date and a storm total of 6.54 inches. Richmond had a maximum wind gust of 51 mph at 10:11 AM on the 16th of September. It also gave Norfolk, VA the fourth lowest

barometric pressure of 28.85 inches. The top three were Donna 1960 at 28.65 inches, the 1933 storm at 28.68 inches and Hurricane Connie 1955 at 28.77 inches.

2003 Hurricane Isabel



September 18, 2003 ** p. 305

Governor Mark Warner described Isabel as “probably the worst storm in a generation.” Isabel not only affected Richmond but nearly the entire state. Gale force winds uprooted trees and knocked out power to much of Virginia. Isabel by number: Fatalities 36, Total damage was \$1.9 billion, homes destroyed 1,124, and homes damaged 9, 027, businesses destroyed or seriously damaged 1477. The Richmond International Airport recorded a wind gust of 74 mph and Richmond received 4.32 inches of rain.

NAT. WEATHER SERVICE WAKEFIELD VA 910 AM EDT OCT 9 2003

ISABEL BECAME A TROPICAL STORM ON SEPTEMBER 6...EAST OF THE LEEWARD

ISLANDS...STRENGTHENING TO A HURRICANE ON SEPTEMBER 7. ISABEL INCREASED TO A CATEGORY 5 HURRICANE ON SEPTEMBER 11...NORTHEAST OF THE LEEWARD ISLANDS...PEAKING IN STRENGTH ON SEPTEMBER 12...WITH 160 MPH WINDS. ISABEL WEAKENED TO A CATEGORY 2 HURRICANE ON SEPTEMBER 18...WHEN LANDFALL OCCURRED NEAR OCRACOCK INLET IN NORTH CAROLINA.

STRONG HIGH PRESSURE OVER NEW ENGLAND AND SOUTHEAST CANADA... PREVENTED ISABEL FROM TAKING THE TYPICAL NORTH TO NORTHEAST TRACK THAT PARALLELS THE EAST COAST OF THE UNITED STATES. INSTEAD THE HIGH PRESSURE SYSTEM DEFLECTED ISABEL TO THE NORTHWEST...THROUGH EASTERN NORTH CAROLINA AND CENTRAL VIRGINIA. BY MIDDAY SEPTEMBER 19...ISABEL HAD TRACKED INTO WESTERN PENNSYLVANIA.

THE WIND FIELD OF ISABEL EXPANDED WELL NORTHWARD AS IT TRACKED THROUGH NORTH CAROLINA AND VIRGINIA...DUE TO THE PRESSURE GRADIENT BETWEEN ISABEL AND THE STRONG HIGH PRESSURE TO THE NORTH. SUSTAINED TROPICAL STORM FORCE WINDS...WITH FREQUENT WIND GUSTS APPROACHING AND EXCEEDING HURRICANE FORCE...WERE OBSERVED OVER AN UNUSUALLY EXTENSIVE AREA OF NORTH CAROLINA...VIRGINIA AND MARYLAND.

THE WINDS ALSO CONTRIBUTED TO THE MOST SIGNIFICANT TROPICAL CYCLONE RELATED STORM SURGE ON THE OUTER BANKS OF NORTH CAROLINA...HAMPTON ROADS...AND THE MAIN STEM RIVERS FEEDING INTO THE CHESAPEAKE BAY...SINCE THE 1933 CHESAPEAKE-POTOMAC HURRICANE. IN SOME CASES...THE STORM SURGE ON THE MAIN STEM RIVERS EXCEEDED THE 1933 STORM SURGE.

HEAVY RAIN CAUSED FLOODING OVER CENTRAL AND SOUTHERN VIRGINIA... CAUSING HIGH WATER ON MANY ROADS UNTIL LATE ON FRIDAY...SEPTEMBER 19.

ISABEL WILL BE REMEMBERED FOR THE GREATEST WIND...AND STORM SURGE IN THE REGION...SINCE HAZEL IN 1954...AND THE 1933 CHESAPEAKE-POTOMAC HURRICANE. ISABEL WILL ALSO BE REMEMBERED FOR THE MOST EXTENSIVE POWER OUTAGES EVER IN VIRGINIA...AND PERMANENT CHANGE TO THE LANDSCAPE FROM ALL THE FALLEN TREES...AND STORM SURGE.

A. HIGHEST WINDS...ALL WINDS IN MPH AND TIMES IN UTC
ANEMOMETER AT CHESAPEAKE BAY BRIDGE TUNNEL AND CHESAPEAKE LIGHT ARE AT ROUGHLY 90 FEET ABOVE THE WATER.

LOCATION	SUSTAINED WIND	MAX GUST	MAX GUST TIME
DUCK NC (DUCN7)	73	92	1834 UTC
ELIZABETH CITY NC**	59	74	1543 UTC (KECG)
ROANOKE RAPIDS NC**	37	63	2147 UTC (KRZZ)
BAY BRIDGE TUNNEL (CBBT)	61	74	2048 UTC
CHESAPEAKE LIGHT (CHLV2)	72	93	2137 UTC
KIPTOPEKE VA	45	68	2218 UTC
LANGLEY AFB VA	53	76	1808 UTC (KLFI)
LEWISSETTA VA	53	68	2300 UTC
NEWPORT NEWS INTL ARPT**	44	65	1756 UTC (KPHF)
NORFOLK INTL AIRPORT VA**	47	74	2049 UTC (KORF)
NORFOLK NAVAL STATION	58	83	2110 UTC (KNGU)
OCEANA NAVAL STATION	55	69	2056 UTC (KNTU)
RICHMOND INTL ARPT	38	73	0013 UTC (KRIC)
WALLOPS ISLAND VA	50	62	1747 UTC (KWAL)
GLOUCESTER PT VA (VIMS)	69	91	2200-2300 UTC

CAMBRIDGE MD	45	57	2055 UTC
OCEAN CITY MD	41	53	2252 UTC (KOXB)
SALISBURY MD	37	51	2009 UTC (KSBY)

** - OBSERVATIONS AT THESE LOCATIONS ARE BASED UPON ALL AVAILABLE DATA...AS THESE LOCATIONS LOST POWER AND WERE POTENTIALLY UNAVAILABLE WHEN THE HIGHEST WIND GUSTS OCCURRED.

OTHER WIND GUSTS (ONLY GUSTS AVAILABLE)
 ANEMOMETERS AT MOST OF THESE LOCATIONS ARE NOT AT THE STANDARD 33 FOOT LEVEL. ANEMOMETERS AT HAMPTON AND GWYNNNS ISLAND ARE AT THE TOP OF BUILDINGS...POSSIBLY ABOVE THE STANDARD 33 FOOT LEVEL.

LOCATION	GUST SPEED	TIME OF GUST
ELIZABETH CITY NC (FROM CLEMSON UNIV. OBS. SITE IN ELIZ. CITY)	97 MPH	1900-2000 UTC
HAMPTON VA (SPOTTER) (SUSTAINED 67 MPH)	92 MPH	2130 UTC
RICHMOND VA (WWBT-TV)	63 MPH	UNKNOWN
PORTSMOUTH VA (SPOTTER)	55 MPH	1944 UTC
CHASE CITY VA (SPOTTER)	53 MPH	2010 UTC
RICHMOND COUNTY VA (SPOTTER) (SUSTAINED 48 MPH)	65 MPH (ESTD)	UNKNOWN
SMITH ISLAND VA	83 MPH	UNKNOWN
CHINCOTEAGUE VA (USCG STATION)	71 MPH	
ONLEY VA (ACCOMACK CO.)	62 MPH	
PARKSLEY VA (ACCOMACK CO.)	65 MPH	
FIVE FORKS VA (JAMES CITY CO.)	80 MPH	
REEDVILLE VA (MIDDLESEX CO.)	100 MPH	
GWYNNNS ISLAND VA (MATHEWS CO.)	107 MPH	0042 9/19
HURLOCK MD (DORCHESTER CO.)	62 MPH	

B. PRESSURE DATA...ALL TIMES IN UTC (SUBTRACT 4 HOURS FOR EDT)

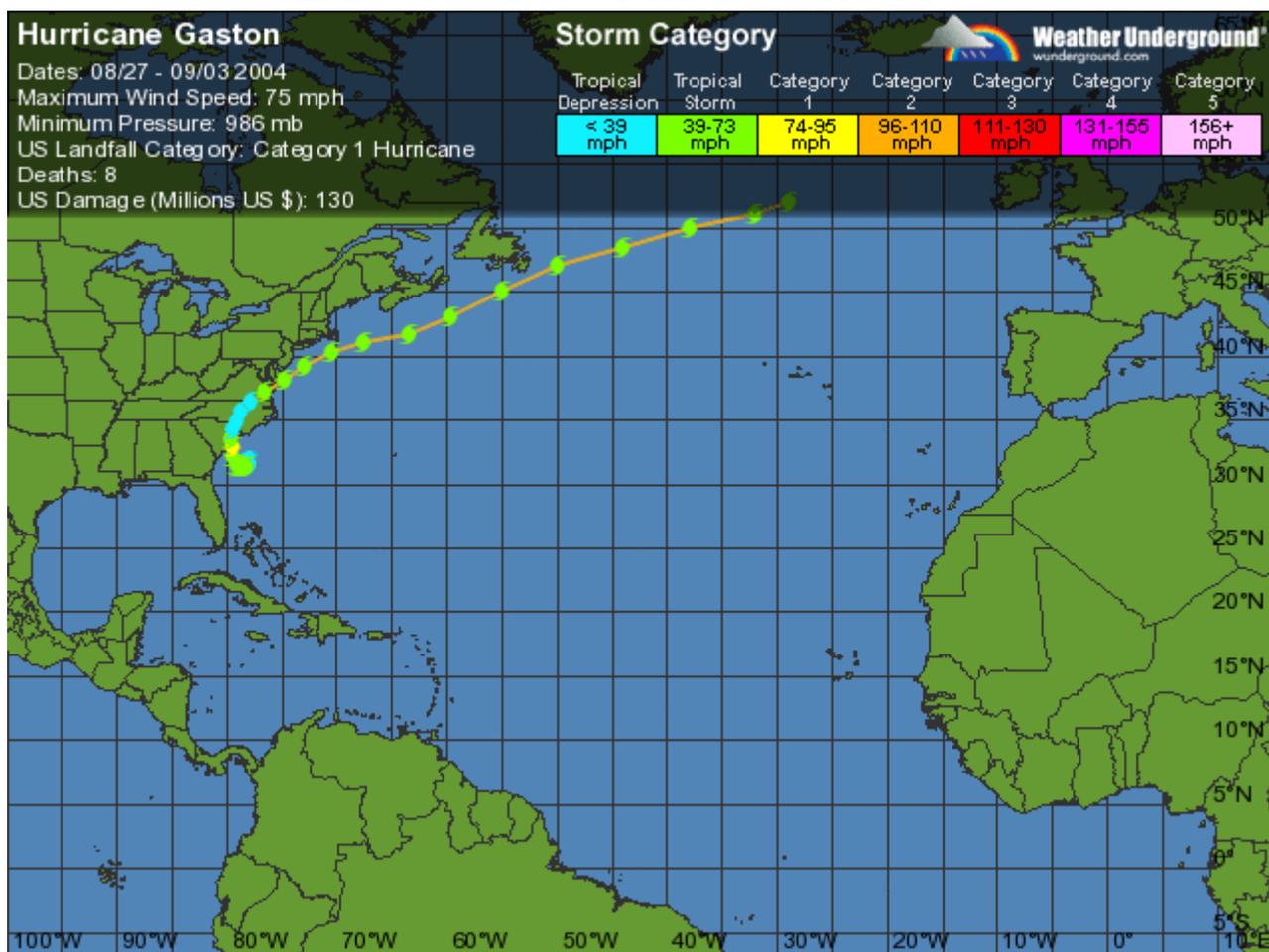
NORFOLK VA (ORF)	2151 9/18	29.24 INCHES
OCEANA NAVAL STATION (NTU)	2056 9/18	29.26 INCHES
NEWPORT NEWS VA (PHF)	2237 9/18	29.24 INCHES
HAMPTON VA (LFI)	2348 9/18	29.29 INCHES
WALLOPS ISLAND VA (WAL)	0012 9/19	29.62 INCHES
OCEAN CITY MD (OXB)	2257 9/18	29.71 INCHES
SALISBURY MD (SBY)	0331 9/19	29.68 INCHES
DUCK NC (DUCN7)	1900 9/18	29.06 INCHES
ARROWHEAD BEACH NC (NEAR EDENTON)***	2030 9/18	28.26 INCHES
CHESAPEAKE LIGHT (CHLV2)	2100 9/18	29.26 INCHES
FALSE CAPE (44014)	1900 9/18	29.41 INCHES
DELAWARE BAY BUOY (44009)	0000 9/19	29.74 INCHES
PORTSMOUTH VA	2225 9/18	29.15 INCHES
CHESAPEAKE BAY BRIDGE TUNNEL VA	2154 9/18	29.29 INCHES

***DENOTES LOWEST PRESSURE OBSERVATION REPORTED TO NWS WAKEFIELD. THIS OBSERVATION WAS TAKEN WITH UNOFFICIAL EQUIPMENT AND MAY BE SLIGHTLY LOW.

C. RAINFALL...STORM TOTALS IN INCHES

LOCATION (COUNTY OR SITE ID)	AMOUNT (INCHES)
AMELIA VA (AMELIA)	5.50
ASHLAND VA (HANOVER)	5.20
BLACKSTONE VA (NOTTOWAY)	7.00
BOWLING GREEN VA (CAROLINE)	4.22
BUMPASS VA (LOUISA)	5.45
CARSON VA (DINWIDDIE)	6.20
CARTERSVILLE VA (GOOCHLAND)	4.91
CHARLES CITY VA	4.90
CHESTER VA (CHESTERFIELD)	5.50
CHESTERFIELD VA (CHESTERFIELD)	5.80
CHINCOTEAGUE VA	1.50
CREWE VA (NOTTOWAY)	5.10
EMPORIA VA (DOWNTOWN)	6.41

2004 Hurricane Gaston



August 30, 2004 ** p. 319

After striking the Carolinas as a minimal Category 1 on August 30, the storm tracked into southern Virginia. Expected to churn through the state as uneventful, it stalled for hours over metropolitan Richmond. Up to 14 inches of rain cascaded down, drowning a forecasted 2-4 inches.

Downpours lasted about five hours. Rainfall rates in some neighborhoods exceeded 4 inches per hour. Richmond International Airport, about eight miles from downtown, had 6.68 inches. Ashland, about 20 miles away, recorded 10.61 inches, including 4.33 inches in one hour. Other totals included: Richmond (West End) 12.60", Mechanicsville 10.70", Sandston 8.10".

Gushing runoff targeted the historic Shockoe Bottom neighborhood, along the James River. Streets on adjacent hillsides became waterslides, simultaneously discharging their contents. The 25-square-block district, home to an age-old farmers market and upscale shops, condominiums and office building, became engulfed in a river. Dozens of cars floated through the streets, some with occupants pleading for rescue. Merchants, residents and tourists scrambled to safety.

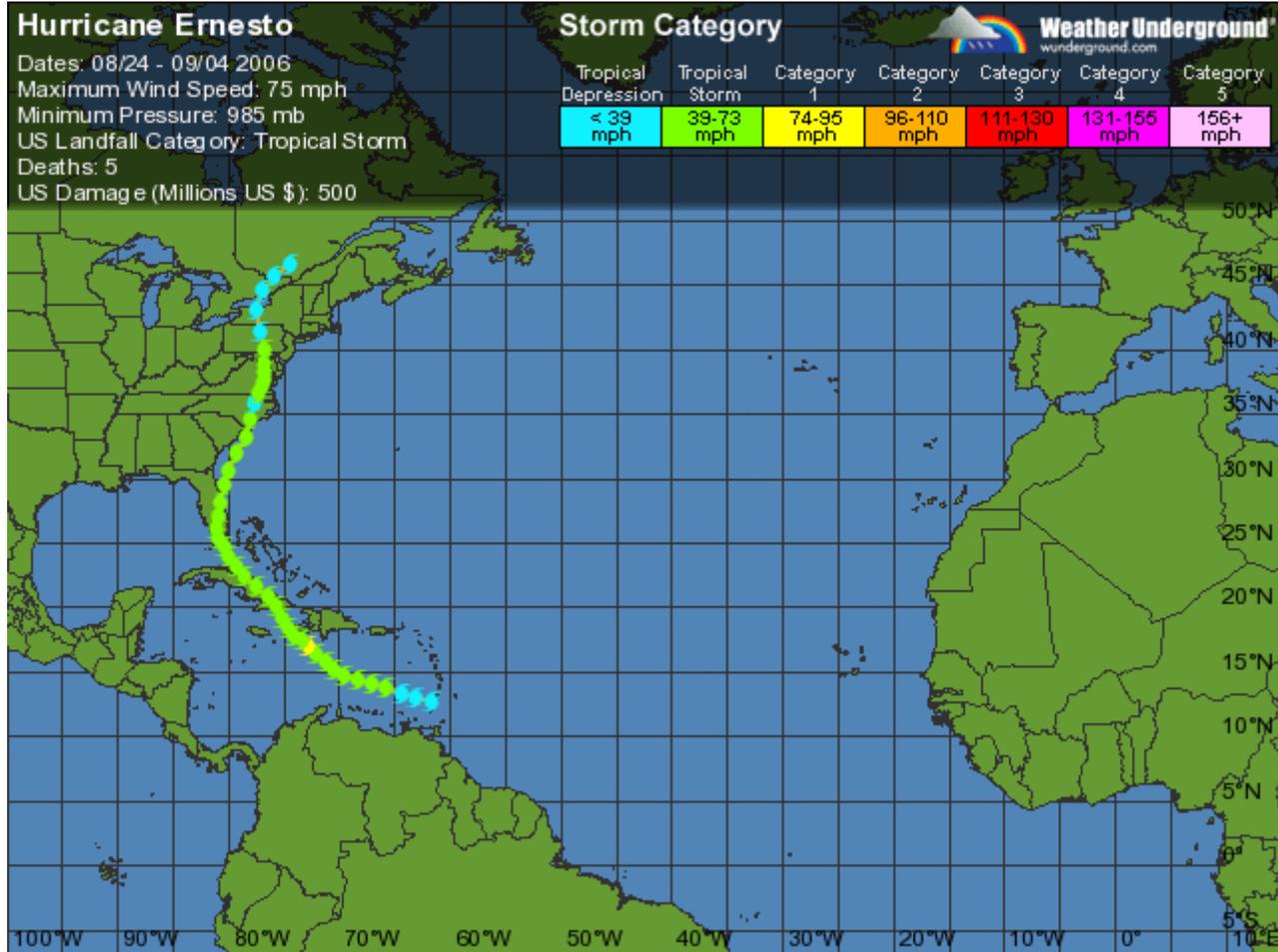
Nature seemed to mock the efforts of man. Richmond's James River flood wall, completed in 1994 at a cost of \$135 million, proved useless. Gaston ambushed the city by creating its own James, a watercourse that flowed behind the "protective" barrier. (A bitter irony: Confident that the wall would protect them, many businesses and residents had no flood insurance.)

Gaston struck during rush hour, causing massive traffic jams. Floodwater carried away vehicles, overwhelming roadways within minutes. There were scores of narrow escapes. At least eight people died.

Water reached a critical height at Falling Creek Dam in Chesterfield County, forcing the hasty evacuation of hundreds of families. The structure survived.

Gaston produced several tornadoes in southeastern Virginia. They were weak, short-lived F-0's, inflicting only minor damage.

2006 Hurricane Ernesto



Hurricane Ernesto – 2006

Dates: August 24 – September 1, 2006

Top Wind Speed: 69 mph

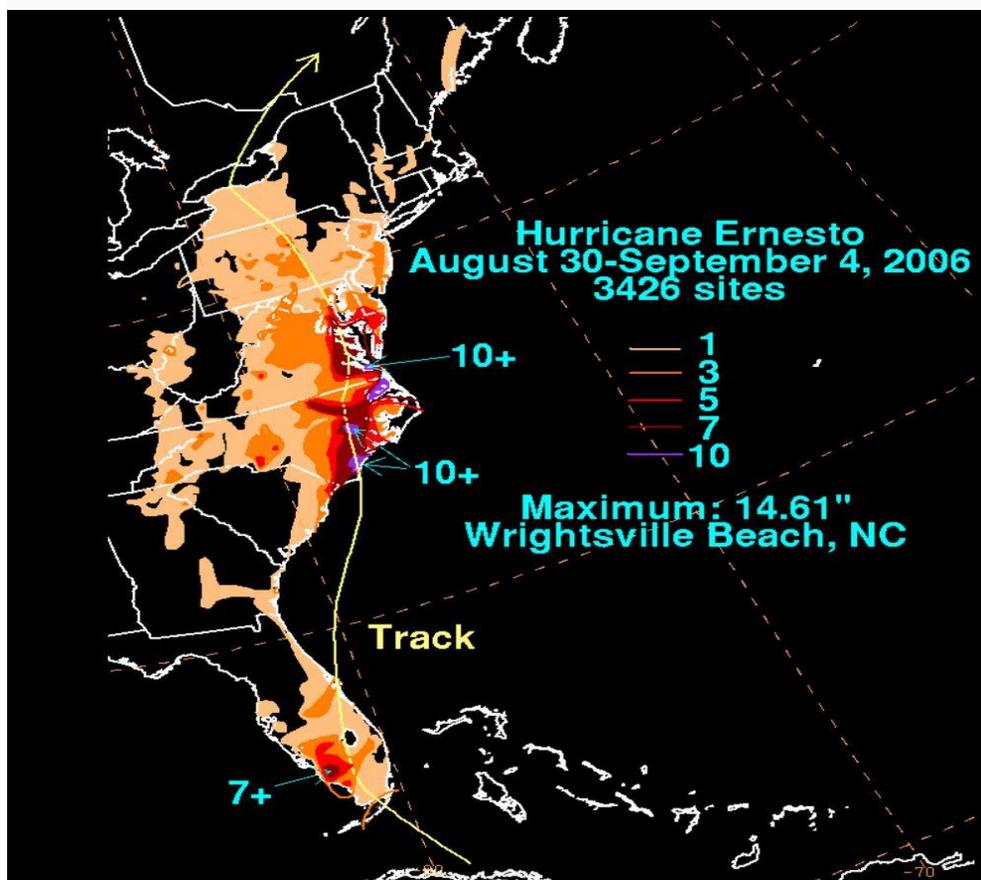
Damages in Virginia was estimated at over \$118 million (2006 USD), prompting the declaration of a federal disaster area. Total damage in the United States was estimated at \$500 million (2006 USD).

Deaths: 7 in Virginia

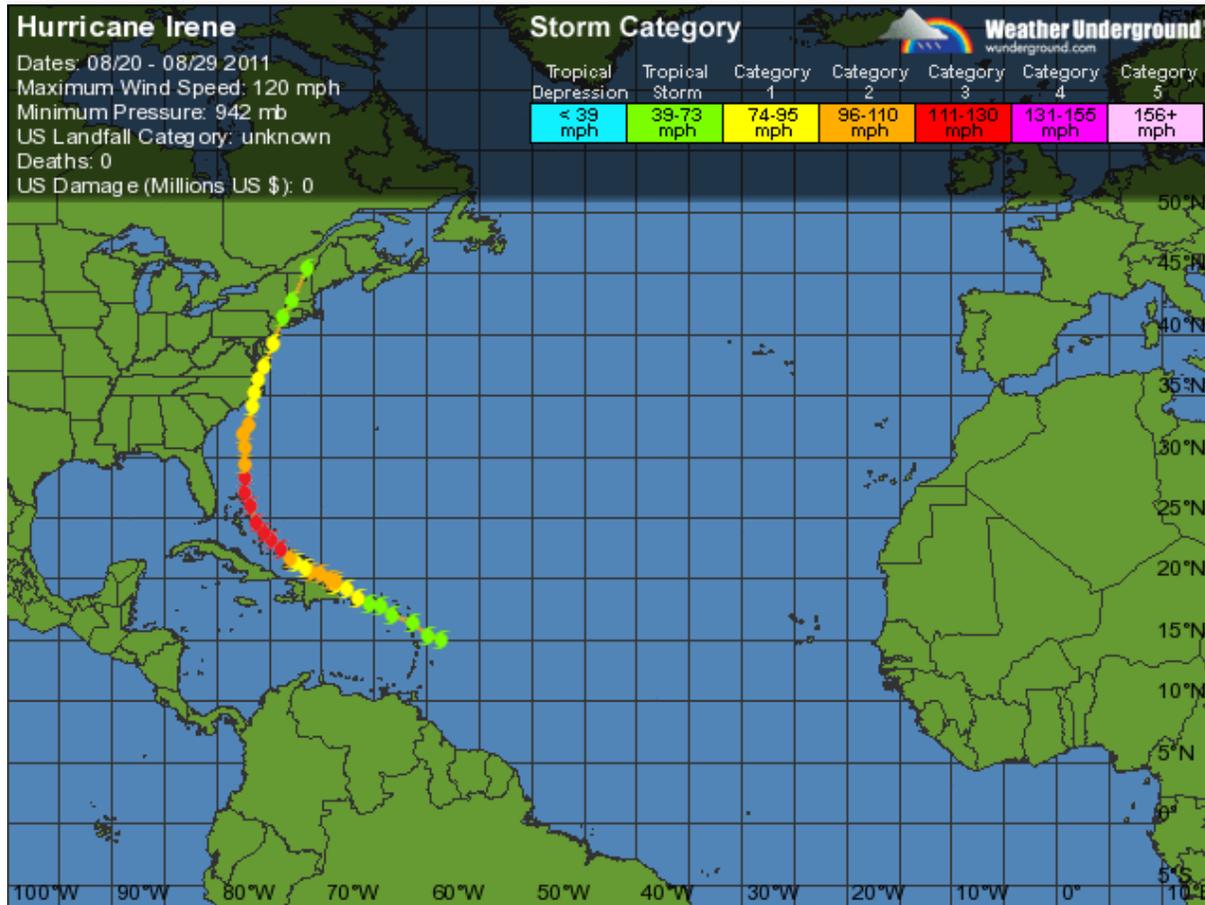
Hurricane Ernesto was a Cape Verde hurricane that only briefly reached Category 1 status over the Caribbean Sea. It moved north as a tropical storm and made landfall on August 30 in the Florida Keys before moving out to sea again, still moving northward. Ernesto gained strength and made landfall again on August 31 near the North Carolina/Virginia border with wind speeds of 69 mph, although it weakened quickly after this and was downgraded to a tropical depression. The storm weakened further and dissipated over southern Virginia later that day.

Though technically only a tropical storm when it reached Virginia, Ernesto caused plenty of damage. Most of the damage from the storm was the result of flooding, and some areas reported up to 12 inches of rain. There was some wind damage reported as well. Two Gloucester residents were killed when a tree fell on their home, and two traffic deaths are also attributed to the storm. Ernesto transitioned into an extratropical cyclone as it entered southern Virginia, bringing heavy rainfall which peaked at 10.6 inches in Wakefield. The precipitation caused flash flooding, which closed several roads but did not cause serious damage. The interaction between Ernesto and a strong ridge over the western Atlantic produced a tight pressure gradient, resulting in strong winds across the state; wind gusts peaked at 87 mph at a station near the mouth of the York River. Strong winds downed numerous trees, including in Gloucester where two people died after a tree hit their home. The winds caused widespread power outages; **Dominion Virginia Power reported about 600,000 customers as losing power sometime during the storm.** The storm produced a storm tide of 6.12 feet near Virginia Beach; along the Chesapeake Bay, tidal flooding in combination with strong waves damaged boats and piers, and left a few homes flooded. Storm surge flooding also occurred along the Potomac River, with heavy beach erosion, light property damage, and flooded roadways reported in Alexandria. Across the state, the storm damaged or destroyed 609 houses, with damage totaling at least \$118 million (2006 USD).

Seven people were killed in the state, of which two directly to the storm; three of the deaths were from traffic accidents, and one person died from carbon monoxide poisoning, due to operating a power generator inside after a power outage.



2011 Hurricane Irene



Hurricane Irene

From Wikipedia -- Category 3 Hurricane

Hurricane Irene at peak strength over the southern Bahamas on August 24, 2011

Formed August 21, 2011 Dissipated August 30, 2011

(extra tropical after August 28)

Highest winds 1-minute sustained: 120 mph

Lowest pressure 27.82 in Hg

Fatalities 49 direct, 7 indirect

Damage \$16.6 billion (2011 USD)

Hurricane Irene was a large and destructive tropical cyclone, which affected much of the Caribbean and East Coast of the United States during late August 2011.

Irene is ranked as the seventh-costliest hurricane in United States history.

The ninth named storm, first hurricane, and first major hurricane of the 2011 Atlantic hurricane season, Irene originated from a well-defined Atlantic tropical wave that began showing signs of organization east of the Lesser Antilles.

Due to development of atmospheric convection and a closed center of circulation, the system was designated as Tropical Storm Irene on August 20, 2011.

After intensifying, Irene made landfall in St. Croix as a strong tropical storm later that day. Early on August 21, the storm made a second landfall in Puerto Rico.

While crossing the island, Irene strengthened into a Category 1 hurricane. The storm paralleled offshore of Hispaniola, continued to slowly intensify in the process.

Shortly before making four landfalls in the Bahamas, Irene peaked as a 120 mph (195 km/h) Category 3 hurricane.

Thereafter, the storm slowly leveled-off in intensity as it struck the Bahamas and then curved northward after passing east of Grand Bahama.

Continuing to weaken, Irene was downgraded to a Category 1 hurricane before making landfall on the Outer Banks of North Carolina on August 27, becoming the first hurricane to make landfall in the United States since Hurricane Ike in 2008.

Early on the following day, the storm re-emerged into the Atlantic from southeastern Virginia. Although Irene remained a hurricane over land, it weakened to a tropical storm while making yet another landfall in the Little Egg Inlet in southeastern New Jersey on August 28.

A few hours later, Irene made its ninth and final landfall in Brooklyn, New York City. Early on August 29, Irene transitioned into an extra tropical cyclone hitting Vermont/New Hampshire after remaining inland as a tropical cyclone for less than 12 hours.

Throughout its path, Irene caused widespread destruction and **at least 56 deaths.**

Damage estimates throughout the United States are estimated near \$15.6 billion, which made it the seventh costliest hurricane in United States history, only behind

Hurricane Andrew of 1992

Hurricane Ivan of 2004

Hurricanes Wilma 2005

Katrina of 2005

Hurricane Ike of 2008

Hurricane Sandy in 2012

In addition, monetary losses in the Caribbean and Canada were \$830 million and \$130 million respectively for a total of nearly \$16.6 billion in damage.

** Hurricanes and the Middle Atlantic States.

Published by Blue Diamond Books

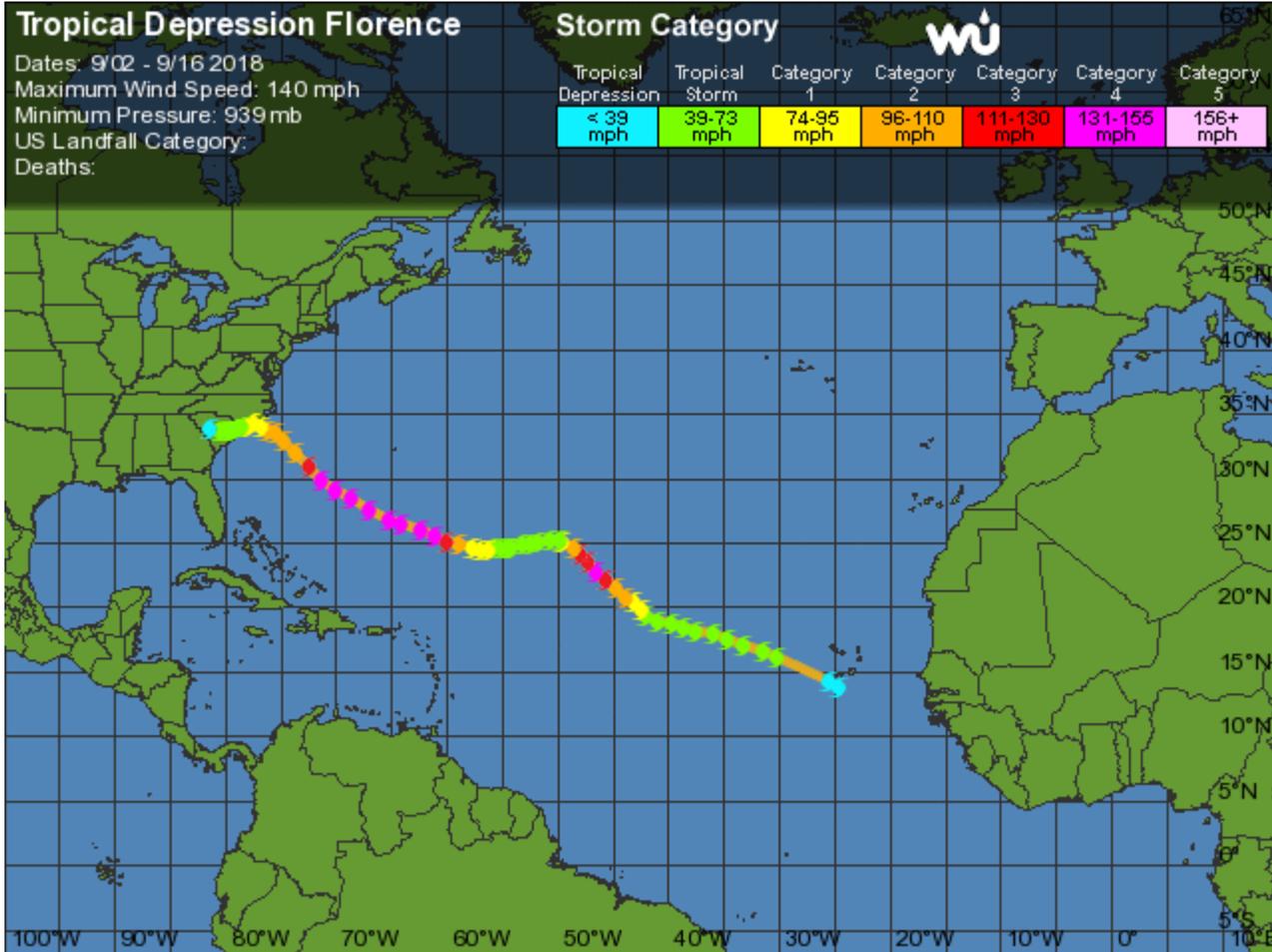
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2018 Hurricane Florence



Hurricane Florence

Made Category 4 Strength

Near peak intensity SE of Bermuda on Sep. 10

Started Aug. 31, 2018

Ended Sep. 19, 2018

(Remnant low after Sep. 17)

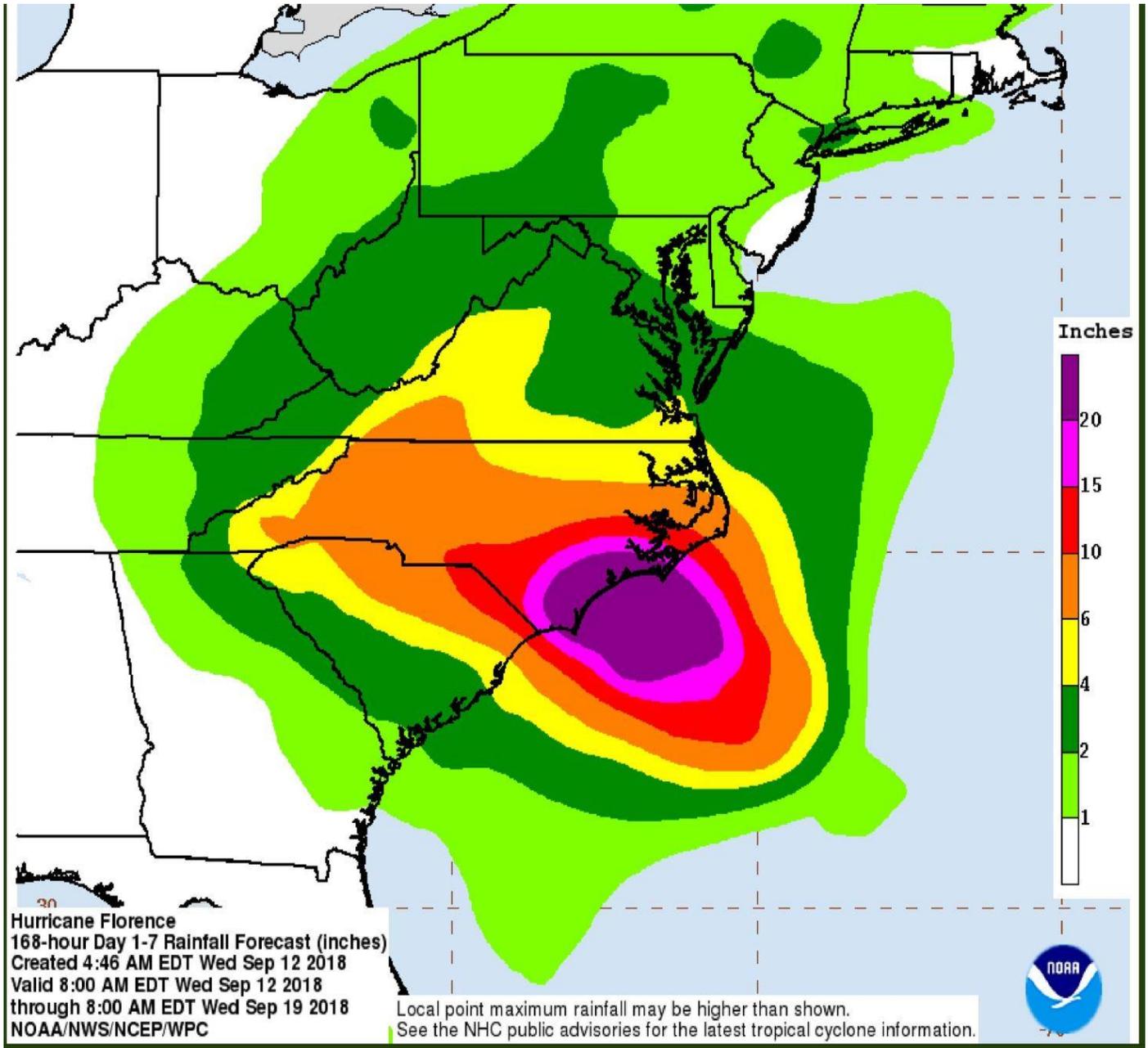
1-minute sustained 140 mph (220 km/h)

939 mbar (27.73 inches of Mercury)

Fatalities 24 direct, 16 indirect

Damage \$17 billion (2018 USD)

[For More Information on Florence Use This Link](#)
Hurricane Florence Rainfall Amounts



Hurricane Florence

Florence has been included with the Richmond storms because at one time it looked like it was going to be another Isabel that took out the power to many in Richmond for one to two

weeks. For people in low laying areas it also looked like they might be flooded out of their homes. The news media was also saying the flood water may require Henrico to shut the floodwall to protect the city. As it turned out NC and SC took the brunt of the storm. Southern coastal Virginia also had some flooding and on the 16th. It looked like a minor storm for Richmond but on the 17th the Richmond area had 8 tornadoes one of which was an F2. The 17th was Henrico's day to deal with Florence. Florence was located at Lat. 39 North Long 81west in western West Virginia but we were on the east side of the storm that generated a string of thunderstorms that trained over our area. We were in the warning cone for tornadoes twice and on the edge of the 3rd. My daughter-in-law had just gotten home from school and soon found they were in a tornado warning cone. The NWS even mentioned their street as being in the path of a tornado. They were in the downstairs bathroom with couch cushions and a flashlight in case the power went out. I was concerned as it was the most tornado activity in this area since Hurricane Ivan in 2004. We got torrential rains and had 3.03 inches and a lot of heavy lightning and very loud thunder but we didn't see any funnel clouds or tornadoes here luckily. A music teacher thought she heard the winds of a funnel just east of granddaughter's school a little after 3 PM. The tornado on Hull Street SW of us was at least a F2 and one person was killed. Henrico Schools kept the children until 8PM as it wasn't safe to be on the roads. As of September 18, 2018 Springfield Park had 7.39 inches of rain.

I found out that many of the North Topsail beach dunes are washed into the road. The metal canopy over the BP station where we bought gas this summer was blown down. It is going to cost a lot to get Topsail back in shape. I know they will retire Florence's name as she really tore up Wilmington. The wet ground with more than 26.58-inches of rain caused many trees to be uprooted. This morning they couldn't find an open road into Wilmington, NC. NC is really a mess even route 95 is closed in several places because of flooding and they said it would still be days before the water level would let them open the road.

We had our American Meteorology Society meeting on Sunday and the talk was on the Petersburg F4 tornado, the strongest on record in VA, on August 6, 1993. The September 17, 2018 tornado outbreak in Virginia was the worst since September 17, 2004 when the remnants of Hurricane Ivan went through Virginia.

Tornado damage



The part of the building collapsed on a vehicle on Speeks Road in Chesterfield on Monday, September 17, 2018.

DANIEL SANGJIB MIN/RTD

One killed as tornadoes rip through the F region

By ALI ROCKETT, VANESSA REMMERS, GRAHAM MOOMAW and SEAN GORMAN Richmond Times-Dispatch 13 hrs ago



Chesterfield Fire & EMS



Storm damage



Firefighters inspect tornado damages at businesses on Speeks Road in Chesterfield on Monday, September 17, 2018.

DANIEL SANGJIB MIN/RTD

Tornado damage



Trees down on a home on Weldon Drive.

Alexa Welch Edlund/RTD