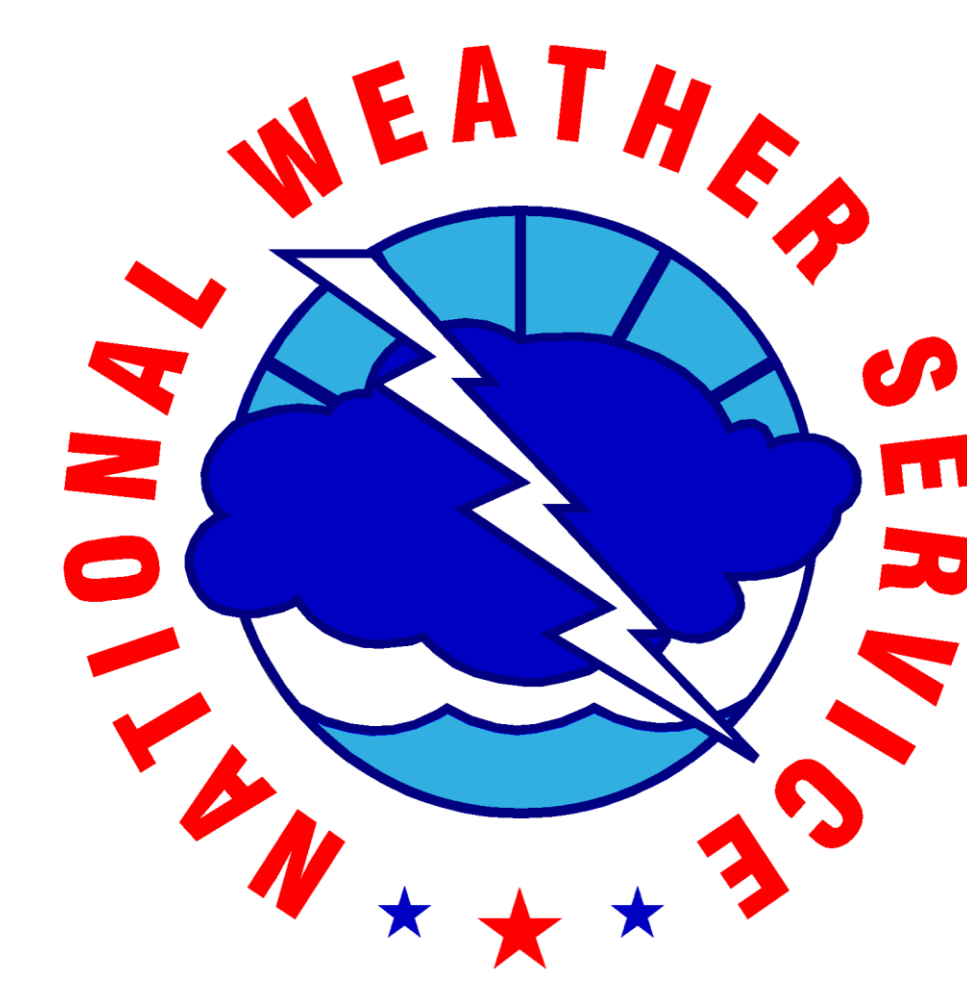


Analysis of Fatalities across North Carolina Resulting from Hurricane Matthew



Jonathan Blaes, and Brandon Locklear
NOAA/National Weather Service Raleigh, NC

Background

- Over 30 a year period ending in 2016, tropical cyclones were responsible for an average of 46 fatalities per year across the United States (U.S. Natural Hazard Statistics).
- In a 50 year period from 1963 to 2012, rainfall-induced freshwater floods and mudslides accounted for about one-quarter of the deaths (27%) associated with Atlantic tropical cyclones in the United States (Rappaport, 2014).

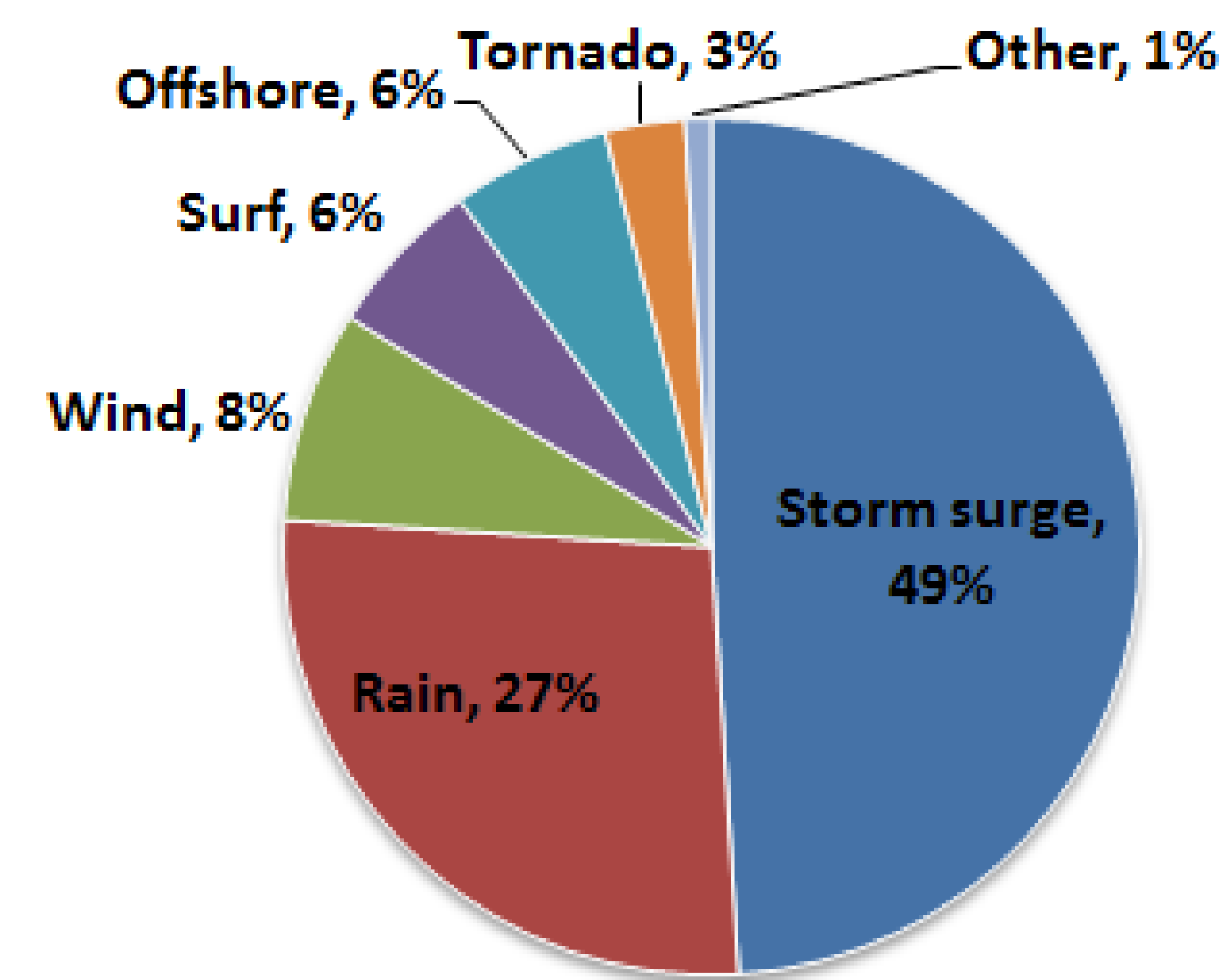


Fig 1. Cause of death in the United States directly attributable to Atlantic tropical cyclones, 1963-2012 (adapted from Rappaport 2014).

Matthew

- Hurricane Matthew impacted North Carolina with heavy rain and wind from late 07 October through early 09 October 2016.
- Matthew made landfall just south of McClellanville, South Carolina and then moved quickly east and offshore. The observed track is shown in the map below.
- The storm did not make landfall in North Carolina. The center moved as close as 15 miles WSW of Cape Fear, NC at 5PM EDT on 08 October, 2017.
- A swath of 10-20 inches of rain resulted in widespread flooding and fatalities.

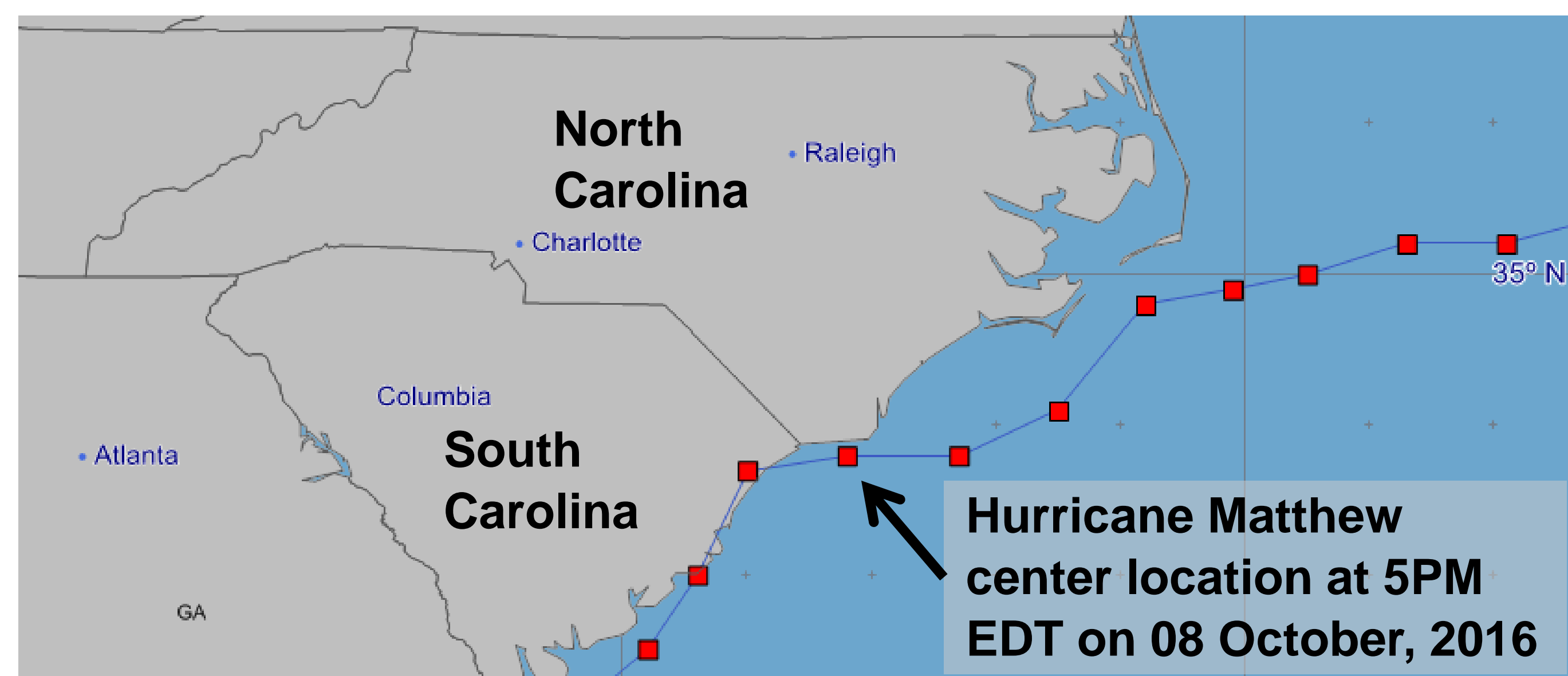


Fig 2. Best track positions for Hurricane Matthew as it moved northeast.

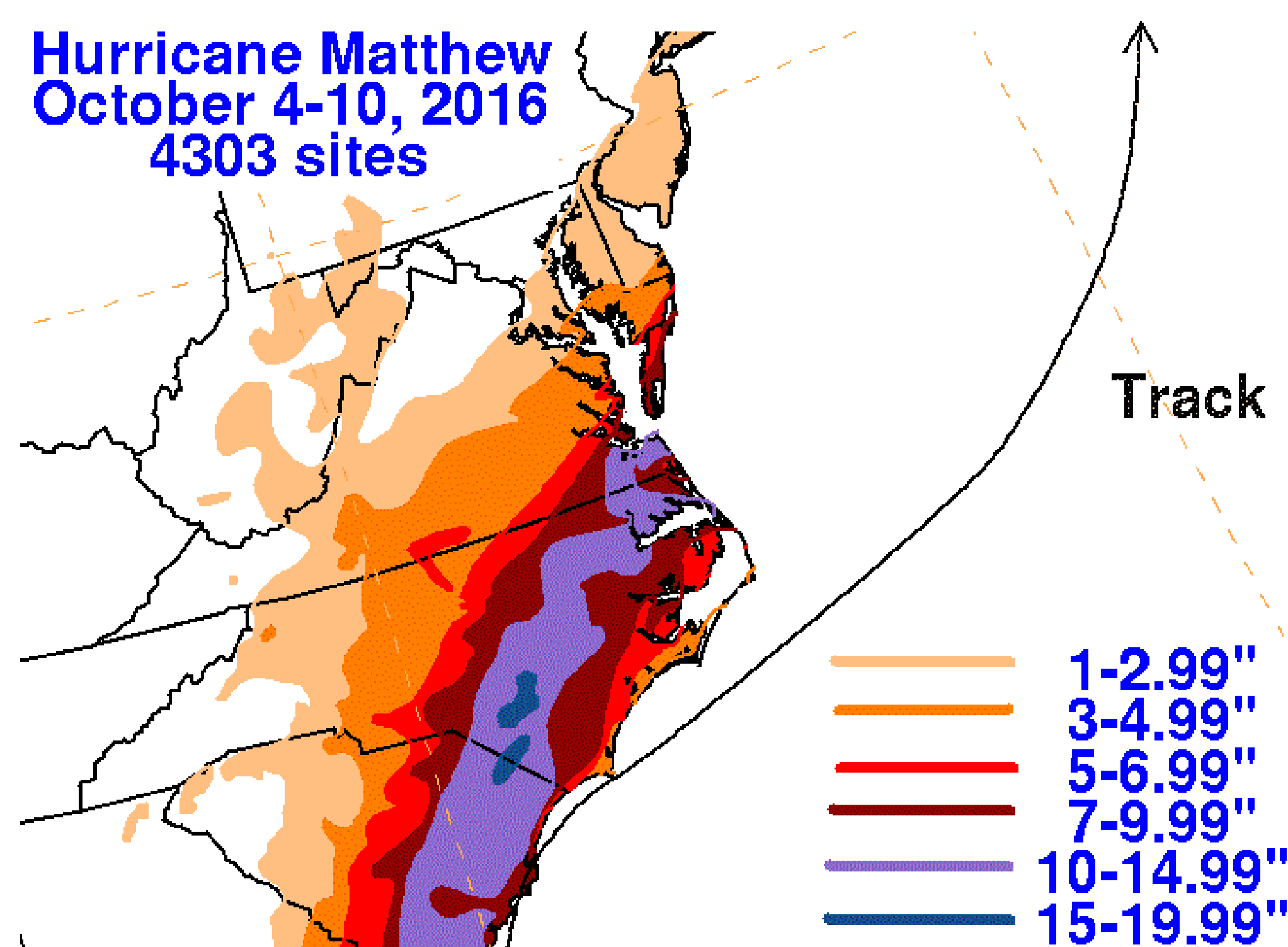


Fig 3. Precipitation analysis for Hurricane Matthew from the Weather Prediction Center (image edited from the original).

Fatalities

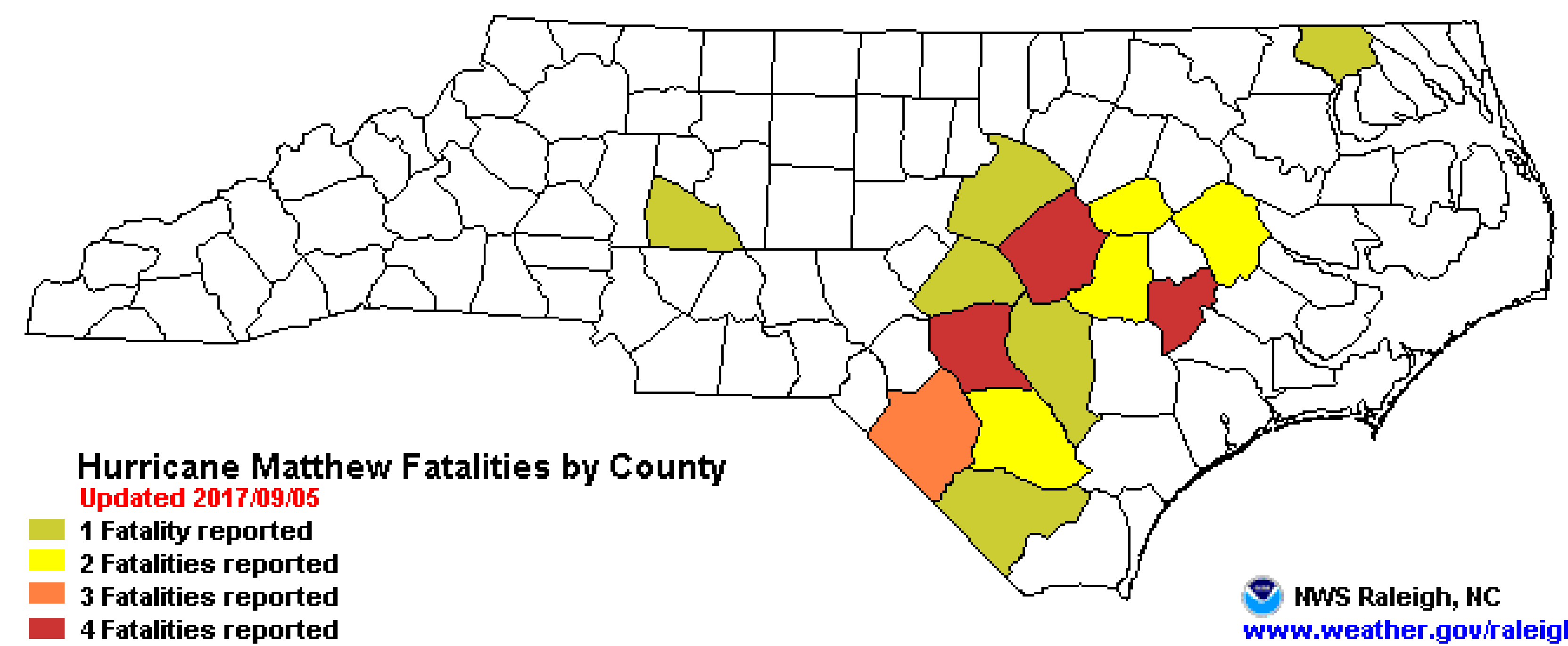


Fig 4. Map of fatalities by county across North Carolina attributed to Hurricane Matthew.

Manner of Death	Number of Fatalities	Percent of all Fatalities
Drowning	24	83%
Drowning complications	1	3%
Wind-fire	1	3%
Wind-tree on car	1	3%
Car accident	1	3%
Medical emergency	1	3%

Date	Number of Fatalities	Percent of all Fatalities
8-Oct-16	8	28%
9-Oct-16	7	24%
10-Oct-16	5	17%
11-Oct-16	1	3%
12-Oct-16	2	7%
13-Oct-16	1	3%
14-Oct-16	1	3%
1-Nov-16	1	3%
26-Oct-16	1	3%

	Number of Fatalities	Percent of all Fatalities
Car-related	22	76%
Not car-related	7	24%

	Number of Fatalities	Percent of all Fatalities
Male	21	72%
Female	8	28%

Age of Fatalities	Number of Fatalities	Percent of all Fatalities
< 18	0	0%
18-29	2	7%
30-44	3	10%
45-59	12	41%
60-74	7	24%
> 74	7	24%

Analysis

- Information on fatalities was collected from the NC Department of Public Safety, NC Emergency Management (NCEM) Division and merged with other local governmental and media reporting to produce a complete database.
- Rainfall-induced freshwater flooding was responsible for more than three-quarters of the deaths (83%) associated with Hurricane Matthew.**
- The manner of death for (83%) of the fatalities was from drowning.
- A total of 22 fatalities (76%) occurred in or in association with vehicles.** Several of these fatalities were reportedly from drivers ignoring barricades on closed roads.
- All of the fatalities in North Carolina occurred across inland counties. **Not a single fatality occurred in a county bordering the ocean, a sound or a bay.** This is despite the fact that Matthew remained offshore and never made landfall in North Carolina.
- The axis and location of the bulk of the fatalities shown in Fig 4 is consistent and corresponds well with the location of the heaviest rain shown in Fig 3.
- Nearly three-quarters of the victims were males (72%).**
- A plurality of fatalities (41%) were reported in the 45 to 59 year-old age group.
- Nearly 72% of the fatalities occurred on 9 October or later, after the heavy rain had ceased. **Nearly half of all of the fatalities (48%) occurred two days or more after the storm.**

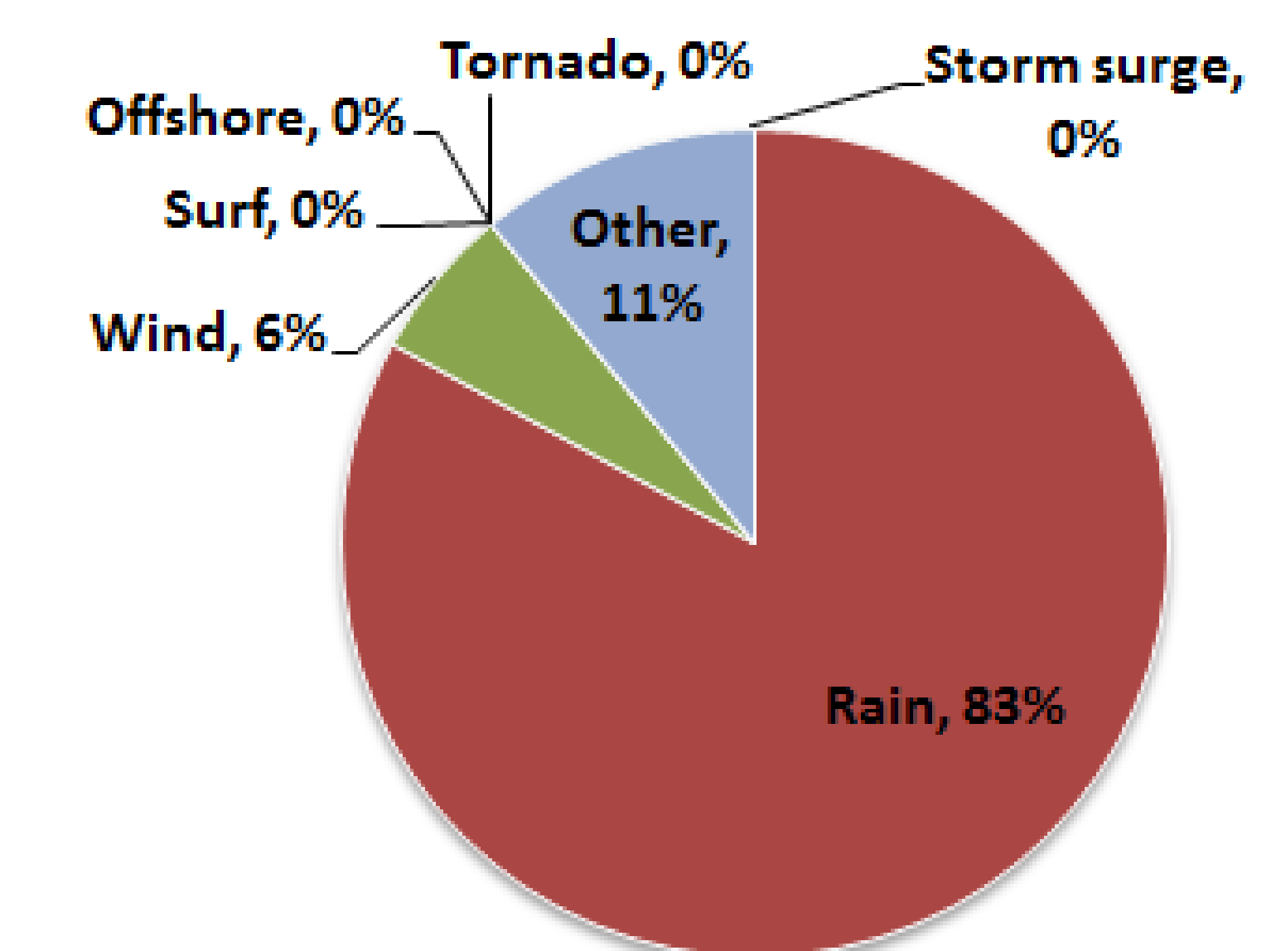


Fig 5. Cause of death in North Carolina from Hurricane Matthew.

References and Acknowledgements

Rappaport, E. N., 2014: Fatalities in the United States from Atlantic tropical cyclones: new data and interpretation. *Bull. Amer. Meteor. Soc.*, **95**, 341-346.

NOAA National Weather Service: U.S. Natural Hazard Statistics. <http://www.nws.noaa.gov/om/hazstats.shtml>

NOAA National Hurricane Center: Hurricane Matthew Tropical Cyclone Report. http://www.nhc.noaa.gov/data/tcr/AL142016_Matthew.pdf

NOAA Weather Prediction Center: Hurricane Matthew Precipitation Estimate <http://www.wpc.ncep.noaa.gov/tropical/rain/matthew2016filledrainwhite.gif>

Thanks to Katie Webster from the NC Department of Public Safety, NC Emergency Management Division for providing the NCEM fatality data.