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THIRTY YEARS AFTER HURRICANE AGNES - THE FORGOTTEN FLORIDA TORNADO DISASTER

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1. INTRODUCTION

Thirty years ago the preliminary report on Hurricane Agnes (**NOAA TM EDS NCC-1**, August 1972) found that Agnes was responsible for the costliest natural disaster in U.S. history up to that point with $3.5 billion (1972 dollars) in storm damage and 122 deaths, mostly due to historic flooding in Pennsylvania, New York, Maryland, Washington, D.C., and Virginia 20-25 June, 1972. The report noted on page 1 that: *"Agnes spawned 15 confirmed tornadoes in Florida. They all occurred on the 18th and 19th and were confined to the peninsula south of Daytona Beach. No deaths were tornado-related."* Later, on page 9 under the heading: ***Deaths and Damages***, the report noted that a series of "windstorms" cut a path 100 yards wide through Okeechobee City, killing 6 people and destroying 50 mobile homes, and another "windstorm" near La Belle in Hendry County destroyed a trailer, killing a woman. The official **Storm Data** documented the 15 tornadoes with no deaths and the two "windstorms" with 7 combined deaths.

These events remained forgotten until the early 1990's when Grazulis and Hagemeyer, independently researching significant Florida tornadoes, came to the conclusion that something was not right with the accounts of Agnes in **Storm Data**. Grazulis (1993) noted the Agnes "windstorms" (which he did not include as significant tornadoes) in a section called: ***Downbursts and Other Mysteries*** for events he found "frustrating" to classify. Hagemeyer and Hodanish (1995) noted the Agnes windstorm death classifications as suspicious and Hagemeyer (1997), while listing the Agnes deaths as due to severe thunderstorms, noted: "These "windstorms" may have been tornadoes and are a subject of ongoing debate." Hagemeyer (1998 and 1999) began calling the Agnes event the deadliest tropical cyclone (TC) tornado outbreak in Florida history on the assumption that the deaths were from tornadoes. Recently, interest was rekindled and an in-depth analysis of the event was undertaken. This brief paper has two goals: **1)** set the historical record straight by defining the Agnes tornado outbreak, and **2)** begin the process of dealing with the implications. Meteorology will be discussed in the oral presentation.

2. AGNES TORNADO OUTBREAK IN RETROSPECT

A resurvey to current **Storm Data** standards was begun by reviewing Hurricane Agnes articles from major newspapers and local weeklies in Florida from Daytona Beach, Orlando, and Tampa southward. Grazulis (1993) discussed difficulties with documenting tornadoes from old news accounts. The authors used only first-person accounts of tornadoes with specific locations or street addresses, and often damage pictures to make their assessment. The authors found 28 tornadoes (2 F3, 9 F2, 11 F1, 6 F0), including several tornado families and 7 reports of severe thunderstorms from 2:15 a.m. EDT 18 June 1972 until 4:50 a.m. EDT 19 June 1972 from Key West to just south of Daytona Beach. The plot of the tornado and severe thunderstorm locations is shown in Figure 1. There were 7 deaths from 2 tornadoes, 77 injuries requiring hospitalizations from 7 tornadoes, and 140 injuries due to 10 tornadoes. There were 217 trailers destroyed and 196 damaged. Fifteen houses were destroyed (including total destruction of CBS houses in the Keys and Brevard County) and 119 houses damaged. Six businesses were destroyed and 6 damaged, and an airport with 44 planes destroyed.

Agnes produced the most tornadoes, the most F2 and greater tornadoes, and the most death/injury producing tornadoes of any outbreak in Florida history. Agnes is the 4th deadliest tornado outbreak in Florida history. The top three deadliest were with extratropical cyclones in February 1998, March 1962, and April 1966. However, Agnes is clearly the largest and deadliest TC tornado outbreak in Florida history and, in fact, the third deadliest in U.S. history since 1900, eclipsed only by Hilda in October 1964 (22 dead) and Carla in September 1961 (13 dead) - both post-landfall outbreaks from Gulf of Mexico TC's . Beulah in September 1967 produced the most documented TC tornadoes of all, but killed only 5. Agnes stands alone as the deadliest pre-landfall TC tornado outbreak in the recorded history of the U.S. The following 2 sections lay to rest the controversy of the "killer windstorms" in **Storm Data**.

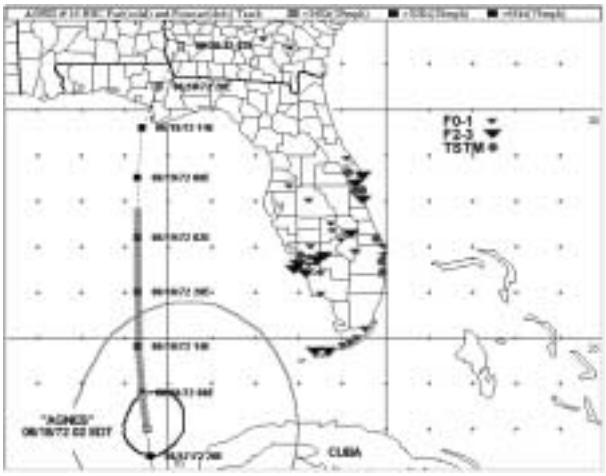

Figure 1. Plot of tornadoes by F-scale and severe thunderstorms of the Agnes outbreak. Agnes is shown at 0200 EDT 18 June 1972 with wind field radii just before the first tornado report in the Keys. Six-hourly positions are shown on the track. The heavy shaded part of the track marks the period when Agnes's rainbands were producing tornadoes.

2.1 The La Belle Killer "Windstorm" Was a Tornado

The Palm Beach Post, 19 June 1972, carried the headline ***"Tornado Kills Woman Near La Belle"*** and told

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several first-person accounts of the tornado that hit at 4:13 p.m. on 18 June 1972, none more poignant than the following:

At Fort Denaud on the south bank of the river Mrs Vickie Messer, about 30 was killed and her husband Marion injured when the twister demolished their trailer. Mr and Mrs Emile Le Clair, neighbors of the Messer's were at home when the twister struck: "It sounded like a freight train was coming." Mrs Le Clair said. Her husband went outside and stood in amazement as the tornado dropped out of the sky, clipped the tips of a dozen pine and oak trees and then "exploded" into the Messer's trailer. When it hit there was a flash and an explosion." Le Clair said, "I ran over to the spot, but there was nothing left. He (Messer) was standing over his wife when I got there. Buddy was just saying "Please help me. Please God help me." Messer's daughter, Connie, was running down the road from her home following the disaster "just holding her hands in the air and screaming." Mrs Le Clair said.

Charles Burke, Hendry County Building and Zoning Inspector, provided a detailed account of the tornado's path in the Hendry County News dated 22 June 1972.

2.2 The Okeechobee Killer "Windstorm" Was a Tornado

The Okeechobee News of 22 June 1972 carried the headline:***"5 Killed as Tornado Hits Area"*** (The 6th person died several days later) and told vivid accounts of people who saw or heard the tornado that struck around midnight on 18 June 1972. One such account: *Mrs Broome said her husband called them when he saw flashing blue lights and heard a sound like "jet engines splitting our eardrums." Mrs Broome: "We ran out and saw the funnel...it was very black...and illuminated somehow by eerie blue light." Debbie added "it was real black against the sky, and it seemed to hesitate over Four Acres."*

The definitive evidence of tornadoes was the *"Birds Eye View"* described in a Palm Beach Post article: *"It looked like a real large garbage dump." said a helicopter observer who viewed the destruction at Treasure Island yesterday by the deadly tornadoes. Gene Evans, a Medical Technician with the Palm Beach County Sheriff's Department flew over the area for five hours. "It was easy to trace the path of the tornado," he said. "It was about a quarter of a mile wide and 10 miles long - but it wasn't continuous. It touched down in three or four places."*

Florida Governor Askew's request for disaster aid and President Nixon's disaster declaration both mentioned "deadly tornadoes." Agnes was not put in proper historical perspective at the time. The authors' intentions are not to focus on second guessing survey reports of the past, but to focus on the future with the newfound knowledge of Agnes and what it means to TC tornado forecast, preparedness, and mitigation issues.

3. IMPLICATIONS OF AGNES TORNADO OUTBREAK

Nearly 10 million more people are living in Florida today than in 1972. Agnes's 28 tornadoes missed major metropolitan areas, hitting smaller coastal cities and rural, inland areas; yet, still brought tremendous devastation. Perhaps many more undocumented tornadoes hit unpopulated areas. The deadliest tornado outbreak in Florida history occurred over a small area of central Florida on 22-23 February 1998, killing 42 people. There were 7 tornadoes, 4 that caused injury or death. Of the 7 tornadoes, 3 were F3's, 2 were F2's, and 2 were F1's. What if Agnes's 11 known F2 and greater tornadoes (10 that caused death or injury) were to strike today? With more people moving into Florida every year (and many choosing to live in mobile or manufactured housing), the reality of the scope of the Agnes tornado outbreak forces the meteorological and emergency management communities to ask hard questions. There is no reason to believe that in the future, a TC tornado outbreak could not kill more people than the February 1998 extratropical outbreak.

Of the 4 major TC hazards: storm surge, flooding, wind, and tornadoes, it is the tornado threat that, until Agnes, has lacked an archetype for Florida to use as a planning metric - to realize what is really possible. U.S. archetypes include Camille(1969) for storm surge, Andrew (1992) for wind, Agnes (1972) and Floyd (1999) for flooding, and now, Agnes for outer rainband tornadoes. Tornadoes are the most ephemeral and difficult to forecast of all the TC hazards.

As the 30th anniversary of Agnes approaches, what do we need to do to progress to the next level in understanding and mitigation? Significant progress has been made in the understanding of tropical and hybrid cyclone tornadoes. Researchers at NWS Melbourne, Florida, have been studying TC tornadoes since the early 90's (Hagemeyer and Hodanish 1995, Spratt, et al., 1997, and Hagemeyer, 1997, 1998, and 1999, for example). It is now recognized that any tropical or hybrid cyclone or depression or disturbance can produce at least one tornado, but the vast majority of tornadoes are weak and short-lived. Since 1995 every TC that has affected Florida with outer rainbands has had tornado watches and/or warnings put up by the Storm Prediction Center and local NWS offices, perhaps desensitizing the public. During Hurricane Georges in September 1998, tornado watches were up for 77 consecutive hours.

Flooding and tornadoes are the most likely scenarios for casualties in TC's, although storm surge remains the greatest overall risk to life. Isolated killer tornadoes occurred in Florida with the hybrid disturbance of October 1992, Gordon in 1994, and Opal in 1995. Skill at predicting the favorable environment for TC tornadoes has never been higher, but false alarms are also very high. Our ability to separate the typical TC tornado from the truly dangerous outbreaks is not nearly so advanced. One fundamental challenge and issue is that the meteorological community has to focus on research that results in tornado forecasts with sufficient lead time and accuracy to give decision makers the confidence they need to implement mitigation and preparedness actions.

An obvious question is: are there times when it would be prudent to evacuate (perhaps voluntarily) mobile homes statewide or in part of the state and/or declare a great tornado threat? In hindsight , Agnes would clearly be such a case. If we had the ability to distinguish the truly historic tornado events from the routine, it would provide a great public service. What preparedness actions are logistically and socially feasible and can the meteorological community deliver the goods? There is no doubt such a disaster as Agnes will happen again.

4. ACKNOWLEDGMENTS

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5. REFERENCES

Please see: http://www.srh.noaa.gov/mlb/research.html