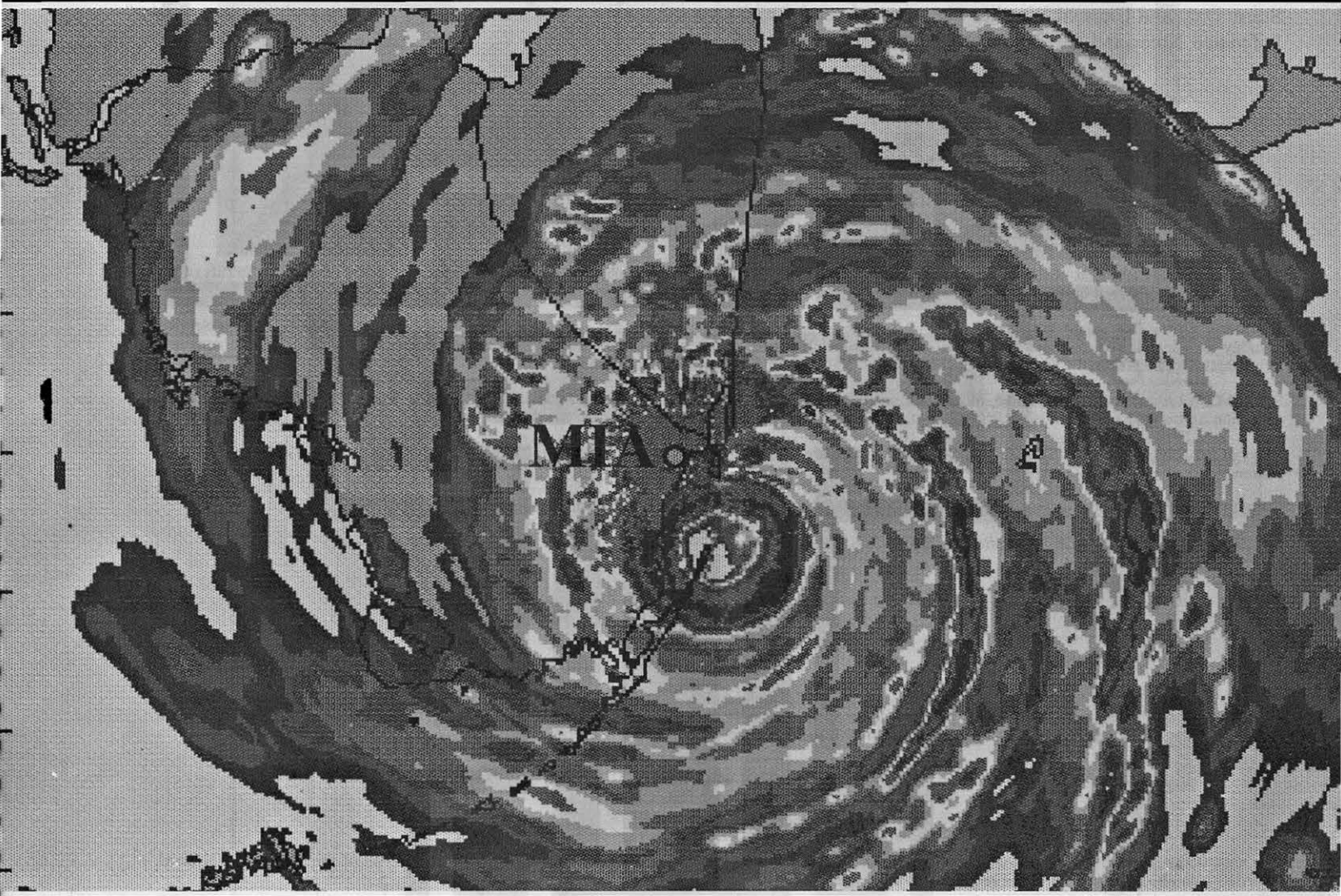


STORM DATA EXCERPT FOR HURRICANE ANDREW - AUGUST 1992



noaa

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION

/ NATIONAL ENVIRONMENTAL SATELLITE,
DATA, AND INFORMATION SERVICE

/ NATIONAL CLIMATIC DATA CENTER
ASHEVILLE, N.C.

Cover: Hurricane Andrew struck southeast Florida on August 24 with an estimated maximum sustained (1 minute average) surface wind speed of 145 mph, gusts in excess of 175 mph, and a minimum central pressure of 922 millibars (27.23 inches). Andrew crossed Florida and went on to strike south-central Louisiana on August 26. See pages 4 through 30 for additional information. (Photo courtesy: Peter Dodge, Hurricane Research Division, NOAA/AOML, Miami, FL.)

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STORM DATA

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National Climatic Data Center

Editor: Grant W. Goodge

Publication Staff: William Angel, Greg Hammer, Jay Hollifield, and Sharon Weaver

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The Storm Data and Unusual Weather Phenomena narratives and Hurricane/Tropical Storm summaries are prepared by the National Weather Service. Monthly and annual statistics and summaries of tornado and lightning events resulting in deaths, injuries, and damage are compiled by cooperative efforts between the National Climatic Data Center and the National Severe Storms Forecast Center.

STORM DATA contains all confirmed information on storms available to our staff at the time of publication. However, due to difficulties inherent in the collection of this type of data, it is not all-inclusive. Late reports and corrections are printed in each edition.

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The editor of **STORM DATA** solicits your help in acquiring photographs (prints or slides; black and white, or color), maps, clippings, etc. of significant or unusual weather events (past or present). These could be for use in the "Outstanding Storms of the Month" or "Et Cetera" sections of **STORM DATA**. We request our subscribers or other interested persons to mail such items to:

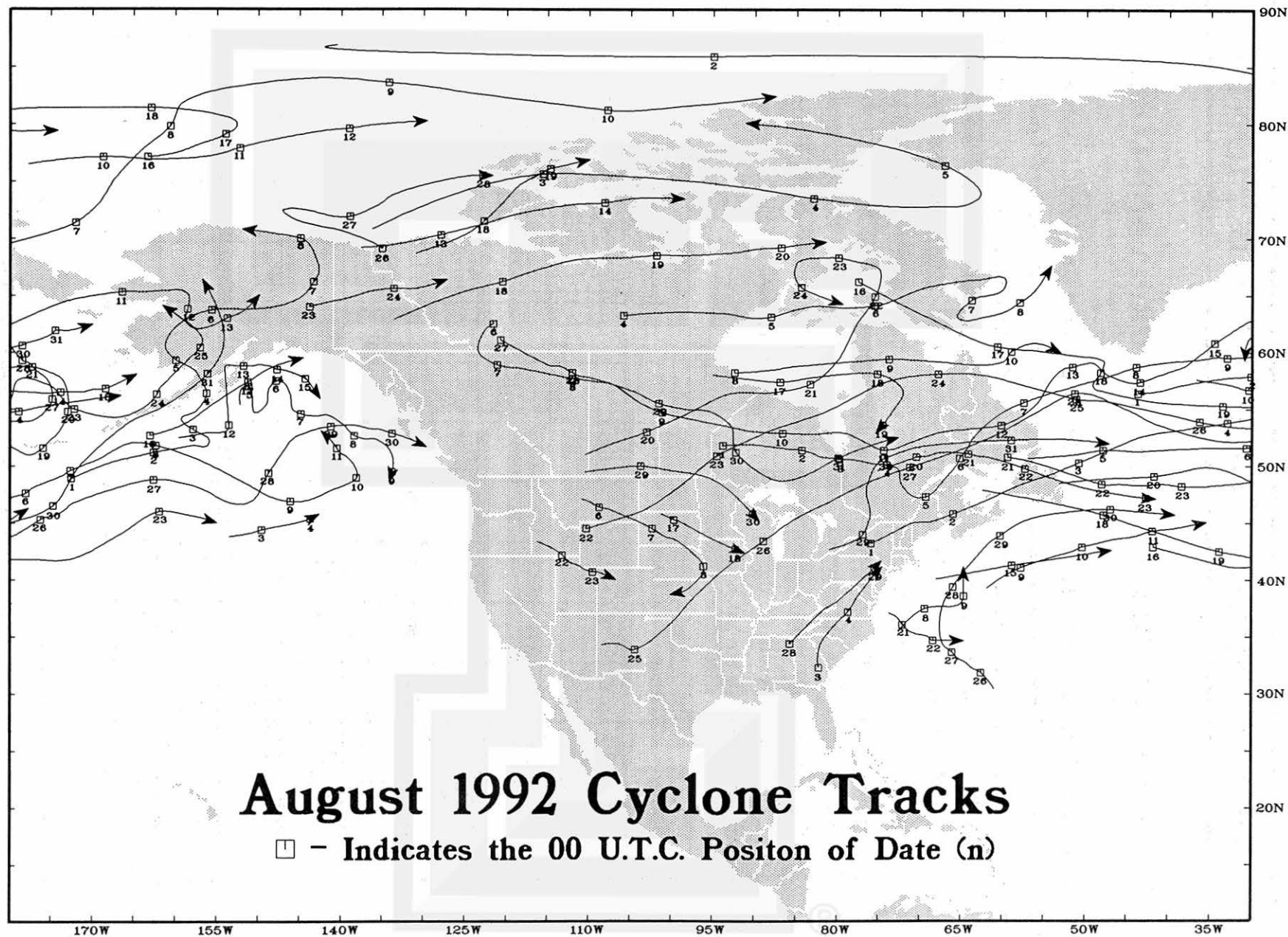
Grant W. Goodge
National Climatic Data Center
37 Battery Park Avenue
Asheville, NC 28801-2733

Any such items received by the editor will be for use in **STORM DATA** only. Any other use will be with the permission of the owner of said items. Materials submitted will be returned if requested in the original submission.

"I certify that this is an official publication of the National Oceanic and Atmospheric Administration and is compiled from information received at the National Climatic Data Center, Asheville, North Carolina 28801-2733."



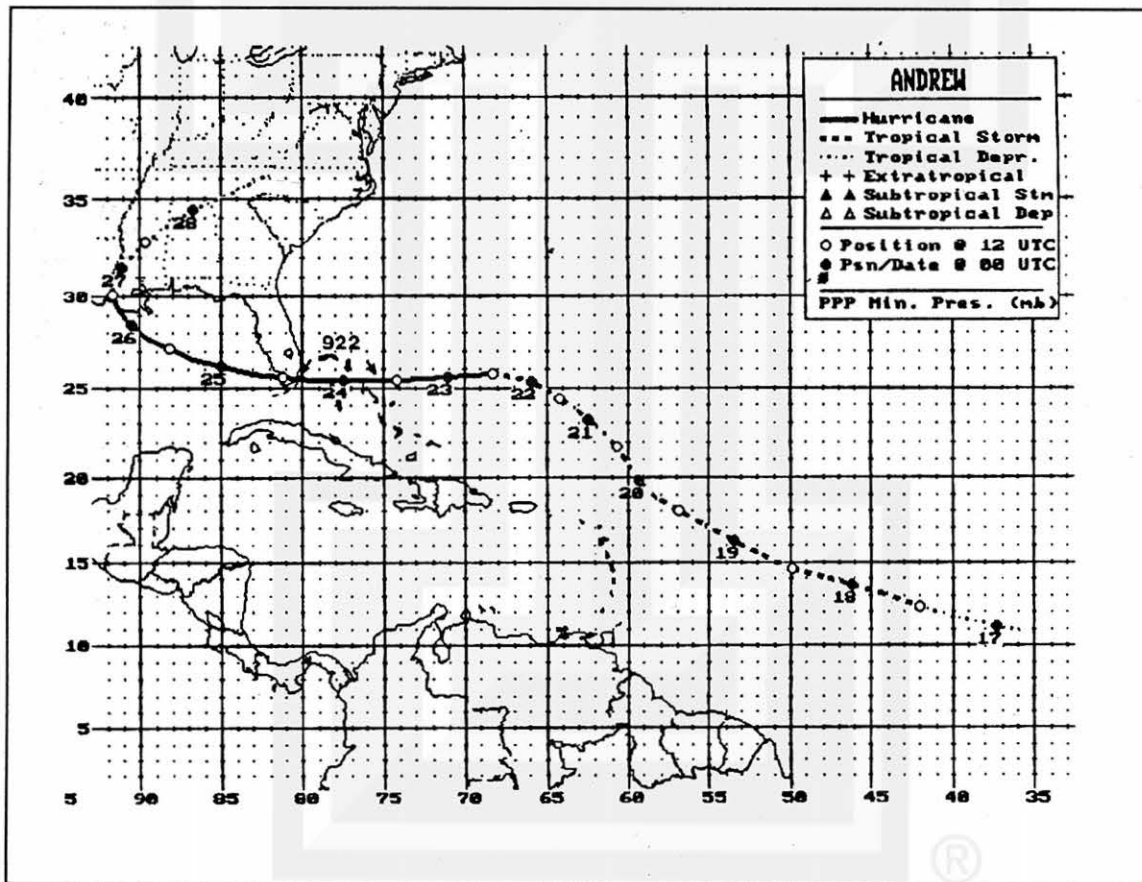
Director,
National Climatic Data Center



OUTSTANDING STORMS OF THE MONTH

1. HURRICANE ANDREW STRIKES FLORIDA AND LOUISIANA

Andrew was a small but destructive hurricane that developed in the Cape Verde Islands and eventually brought devastation to the northern Bahamas, southern Florida, and south-central Louisiana in August 1992. With a minimum central pressure of 922 millibars (the third lowest pressure this century) at the time of landfall, and a maximum sustained (1 minute average) surface wind speed of 145 mph, Andrew was rated as a category 4 hurricane on the Saffir/Simpson Hurricane Scale. Andrew was the first category 4 hurricane to strike the United States since Hugo in 1989. Prior to Hugo, Camille, a category 5 hurricane in August 1969, was the last hurricane rated 4 or higher to strike the United States. Damage resulting from Andrew was extreme and extensive with losses estimated at \$20 - 25 billion, making Andrew the most expensive natural disaster in United States history! Twenty-one people were killed as a result of the storm (15 in FL, 6 in LA). Injuries were numerous and one-quarter million people were left homeless.

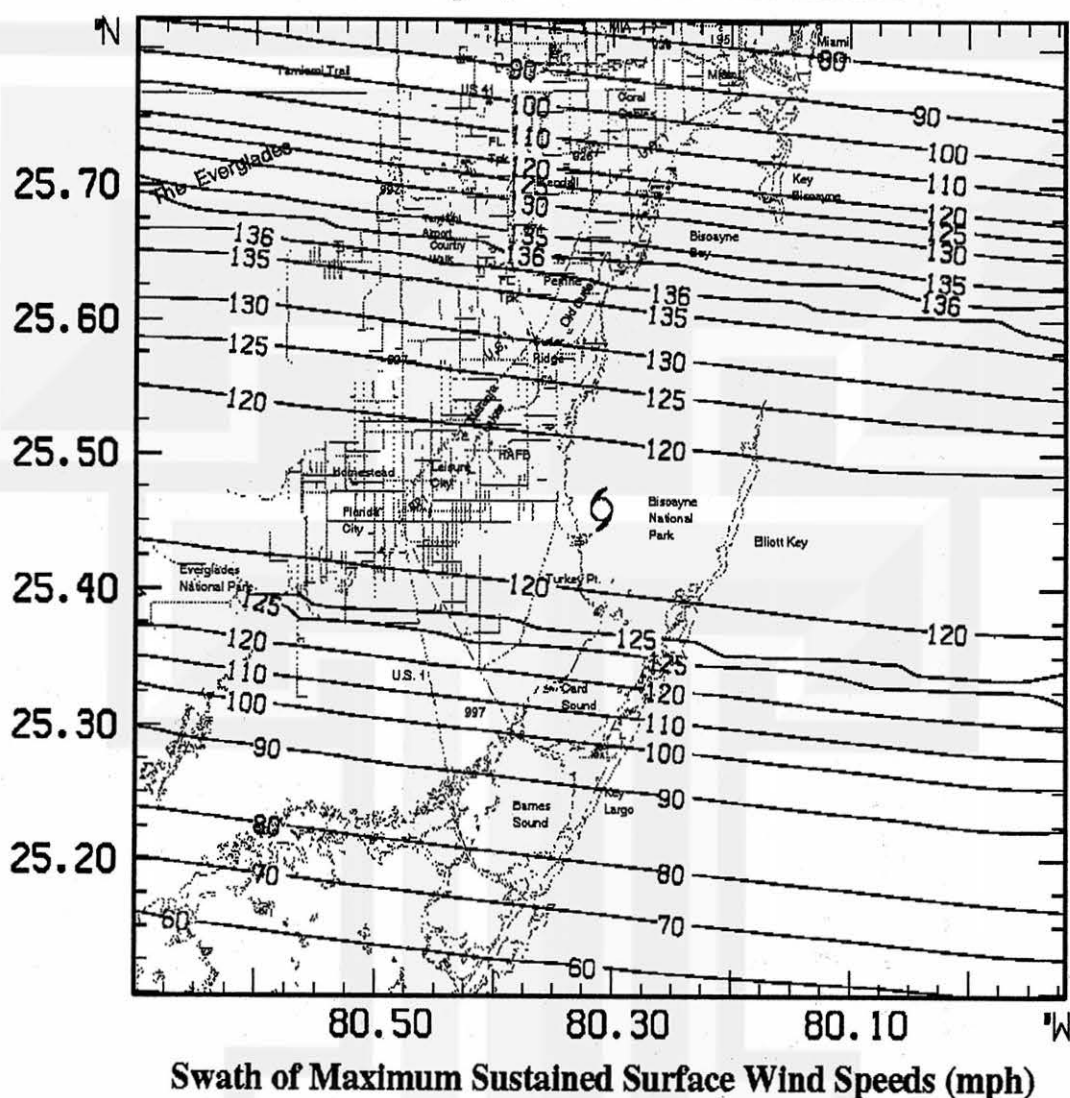


Best track positions for Hurricane Andrew.

NOAA Hurricane Research Division Surface Wind Analysis

Hurricane Andrew

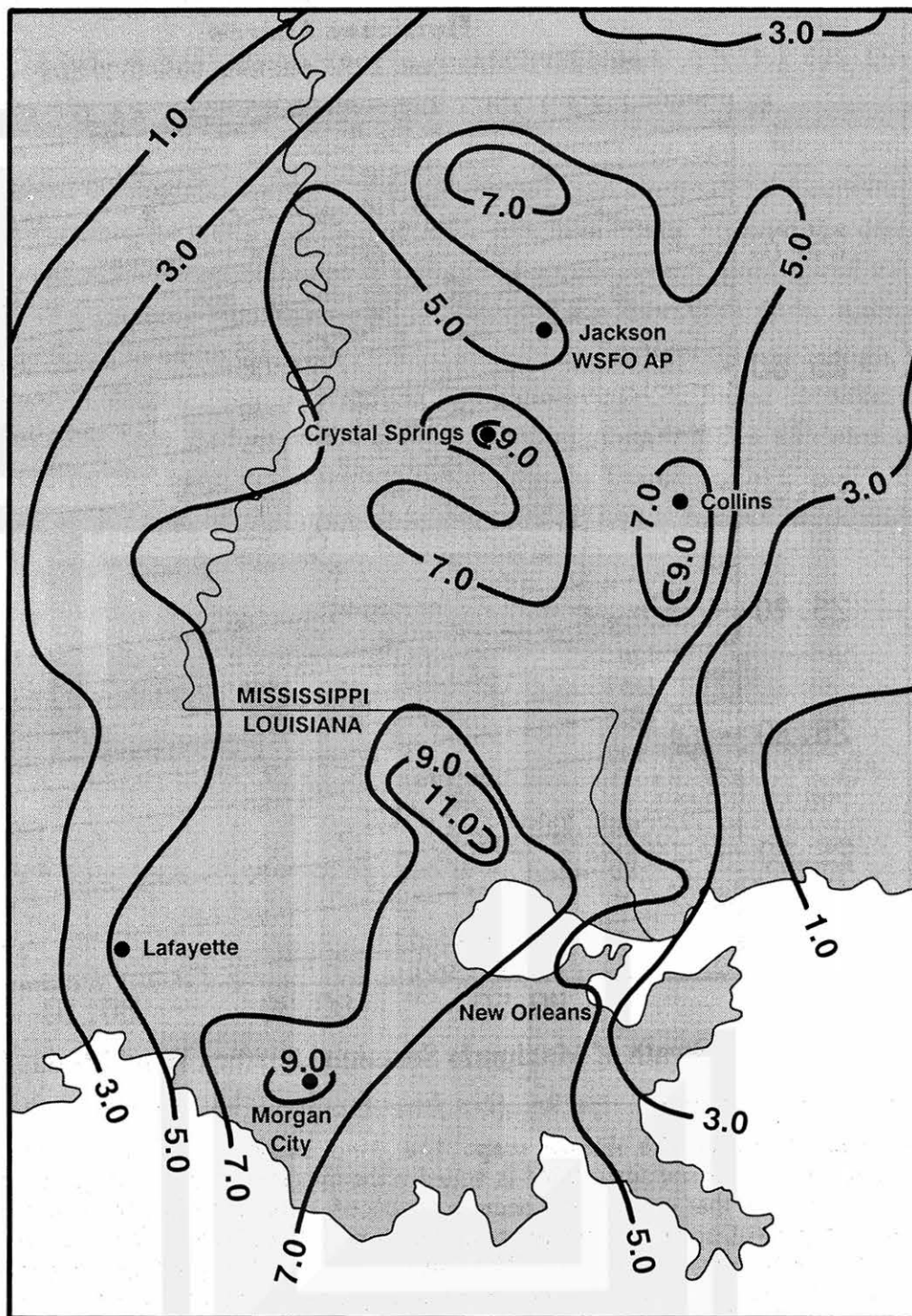
0500 EDT 24 August, 1992 data from 0030-0720 EDT



Interpretation of the Above map: The wind swath represents contours of the highest sustained wind (a sustained wind is actually the average of lulls and gusts that occur over a 1 minute period) that would have been experienced at the map locations during Andrew. These winds represent open terrain exposure over land at the 10-meter level. Open terrain is similar to that of an airport runway. The lines over water are unrepresentative because those locations would have experienced even stronger winds due to less friction. The wind swath map **DOES NOT** represent a "snapshot" of the wind field at any instant of time. Analysis is based on surface measurements and Air Force reconnaissance winds adjusted to 10 meters with a boundary layer model.

Authors and suppliers of the above map: Mark Powell and Sam Houston, NOAA, Hurricane Research Division, AOML, Miami, Florida.

ANDREW RAINFALL OVER LOUISIANA AND MISSISSIPPI - AUGUST 25 - 28

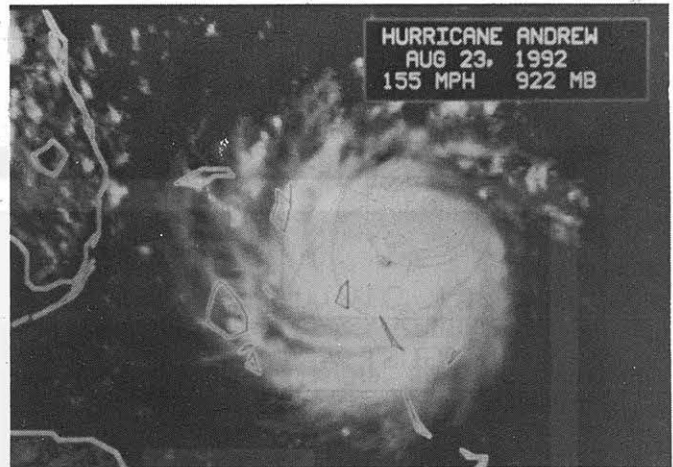


Above: Map based on Cooperative Observer data supplied to the National Climatic Data Center, Asheville, North Carolina.

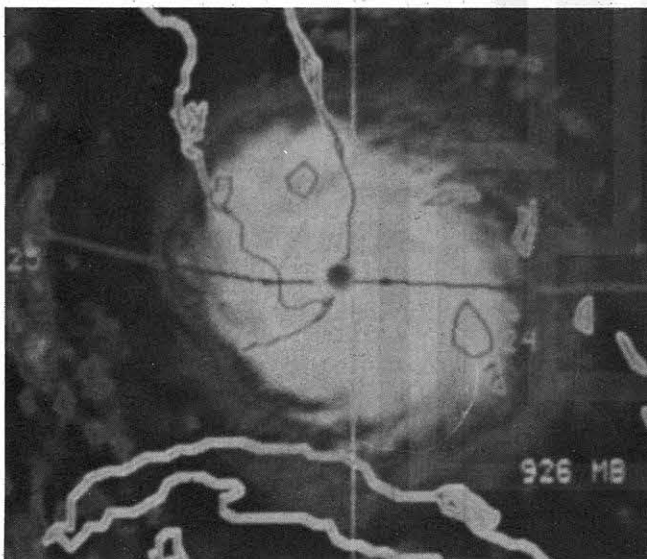
Note: Abbreviations used for the following pages:

NHC = National Hurricane Center; NESDIS = National Environmental Satellite, Data, and Information Service; NOAA DST = National Oceanic and Atmospheric Administration Disaster Survey Team.

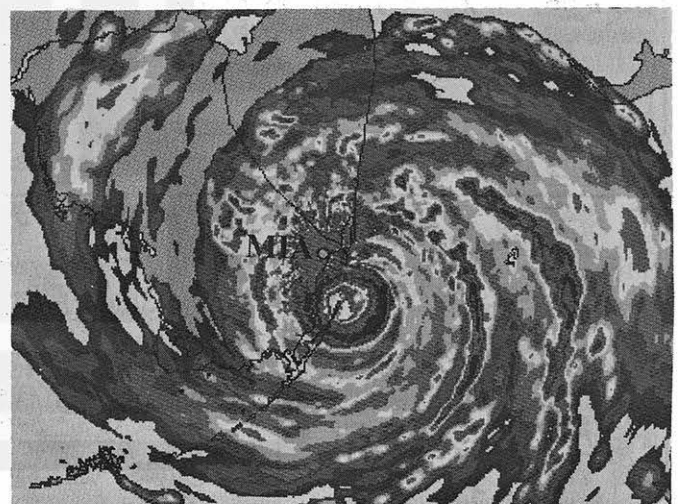
ANDREW'S LIFE CYCLE



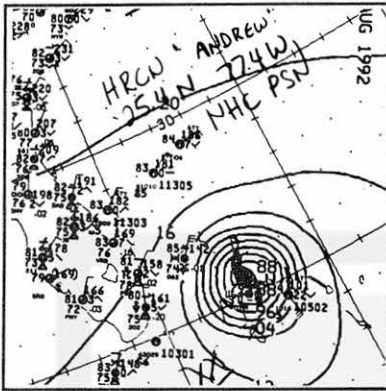
Above(left): Water vapor satellite image taken by METEOSAT 3 on August 19, 1992. The image depicts the presence of the upper level low north of Andrew. Also shown is the superimposed track of Andrew. **Above(right):** Visible satellite image taken by METEOSAT 3 during the period of Andrew's maximum intensity over the Bahamas on August 23, 1992. **Left:** Infrared satellite image of Andrew taken by METEOSAT 3 with Andrew's entire storm track superimposed. **Bottom(left):** Infrared satellite image taken by GOES 7 on August 24, 1992 showing Andrew at the time of landfall in Dade County, Florida. **Bottom(right):** Radar composite at the time of Andrew's landfall. (Photo courtesy: NESDIS and NHC)



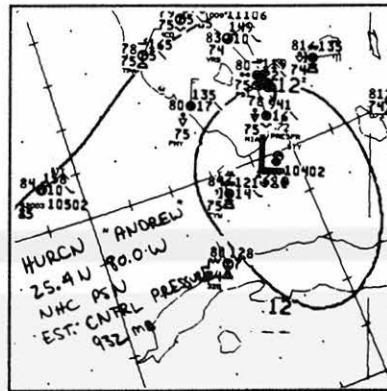
August 24, 1992



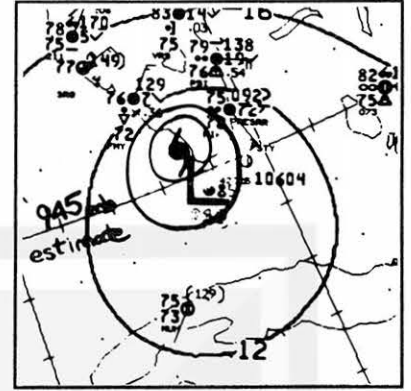
August 24, 1992



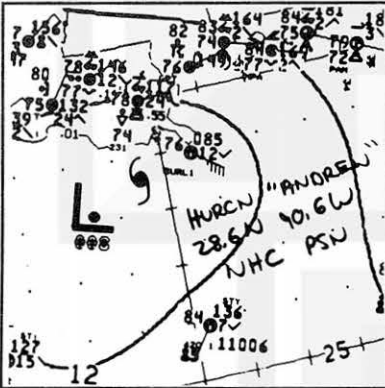
00Z MON AUGUST 24



09Z MON AUGUST 24

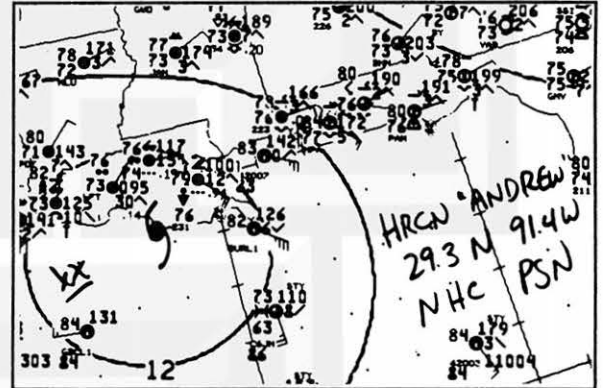


12Z MON AUGUST 24

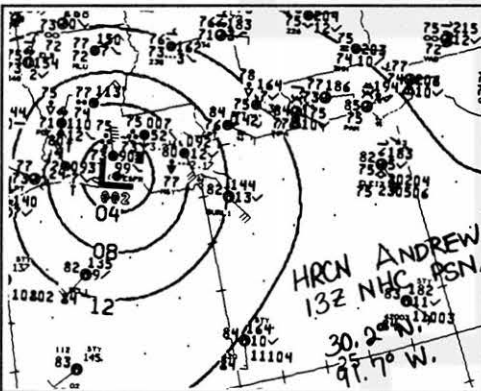


00Z WED AUGUST 26

Top(left): Hurricane Andrew east southeast of Miami. Top(center): Andrew one-half hour after landfall. Top(right): Andrew moves into the Gulf. Left and Right: Andrew south of the Louisiana coast.



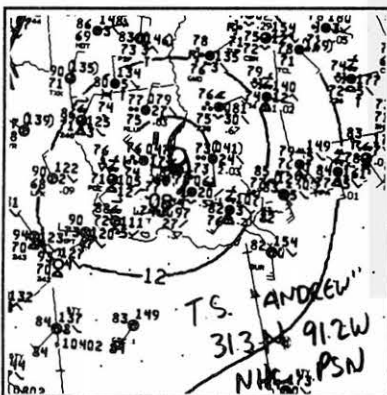
06Z WED AUGUST 26



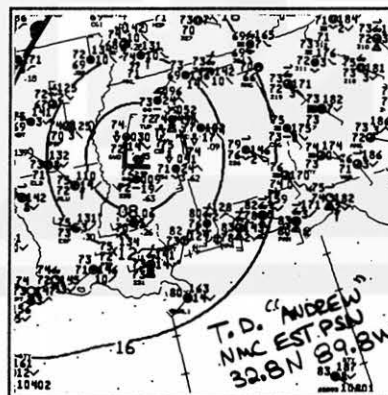
12Z WED AUGUST 26

Left: Andrew inland and weakening into a tropical storm, below (left). Below(middle): After continued weakening, Andrew became a tropical depression. The remnants of Andrew after merging with the frontal system over the mid-Atlantic States, below(right).

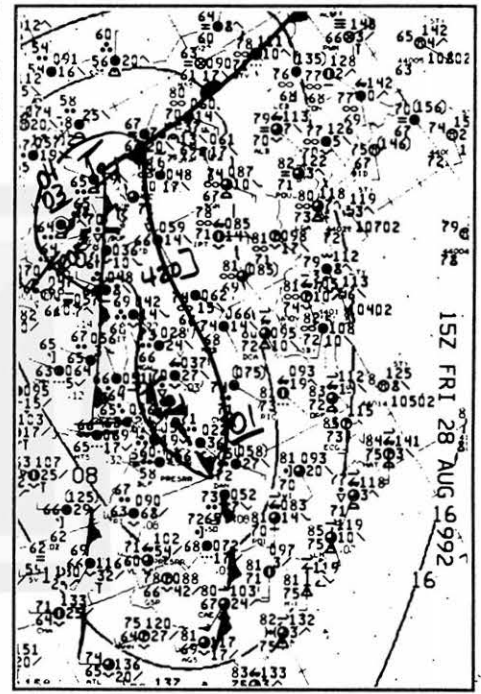
Maps provided by National Climatic Data Center.



00Z THU AUGUST 27



12Z THU AUGUST 27



15Z FRI AUGUST 28

A N D R E W H I G H L I G H T S

- August 14:** A tropical wave crossed the west coast of Africa.
- August 15:** The wave, moving westward at 20 knots, passed to the south of the Cape Verde Islands.
- August 16:** Convection became more organized. At 1800 UTC, the tropical wave was upgraded to a depression.
- August 17:** The depression intensified into Tropical Storm Andrew at 1200 UTC. Andrew continued to move quickly in a west-northwest direction, toward the Lesser Antilles.
- August 18-20:** Andrew continued to intensify as winds increased to 45 knots, then weakened due to strong wind shear. The wind shear was caused by a strong upper air system. With the forward speed decreased and directional change, the Lesser Antilles were spared.
- August 21:** Strong wind shear ends and the steering currents turn Andrew toward the west. Andrew accelerated to 16 knots and quickly intensified.
- August 22:** Andrew reached hurricane status during the morning. An "eye" formed later in the morning as further strengthening occurred.
- August 21-23:** Andrew became a category 4 hurricane with the central pressure at 922 millibars on the 23rd. The central pressure fell 92 millibars (mb) between 0000 UTC on the 21st and 1800 UTC on the 23rd. A pressure fall of 72 mb occurred during the last 36 hours of the period.
- August 22-24:** A strong high pressure system over the southeast coast of the United States, and a high pressure ridge into the southwestern Atlantic, just north of Andrew, dominated Andrew's course as it moved due west for two and half days.
- August 23:** Andrew, a category 4 hurricane, struck northern Eleuthera Island in the Bahamas at 2100 UTC with winds of 130 knots (about 150 mph). The hurricane directly caused three deaths on the North Eleuthera mainland. A huge storm surge at the Current (a settlement near the northern end of Eleuthera Island) reached an astonishing 23 feet! Damage in the Bahamas has been placed at \$0.25 billion. There were no tornadoes.
- August 24:** Early in the day, Andrew hit the southern Berry Islands in the Bahamas, and continued moving toward south Florida. Andrew weakened, pressure rose to 941 mb, when it passed over the Great Bahama Bank. It then quickly reintensified over the Straits of Florida before landfall. Andrew struck south Florida approximately 4:30 a.m. EDT with a central pressure of 922 mb, near Homestead Air Force Base. Maximum sustained surface wind speed is estimated at 125 knots (approx. 145 mph) with gusts to at least 150 knots (approx. 175 mph).
- Andrew continued to move westward over Florida. When Andrew exited Florida four hours later at Marco Island, it had weakened to a category 3 hurricane with a central pressure of about 950 mb.
- August 25:** Andrew reintensified (not to the extent before landfall in Florida) over the waters of the Gulf of Mexico. A gradual turn to the west-northwest took place with Andrew heading toward Louisiana.
- August 26:** As the steering currents changed, the forward speed of Andrew dropped to 8 knots. Still rated as a category 3 hurricane, Andrew struck a sparsely populated section of south-central Louisiana approximately 1:30 CDT, 20 nautical miles west-southwest of Morgan City.
- August 26-28:** Andrew weakened rapidly after landfall to tropical storm status in 10 hours and to tropical depression status 12 hours later. Andrew made a turn first toward the north and then northeastward and an increase in forward speed occurred. By midday of the 28th, the remains of Andrew merged with the frontal system over the mid-Atlantic states.

SURFACE WEATHER REPORTS

PRESFR/PRESRR = PRESSURE FALLING/RISING RAPIDLY, PKWND 1461 20 = PEAKWIND FROM 140° AT 61 KNOTS OCCURRING 20 MINUTES AFTER THE HOUR, TRW+ = HEAVY THUNDERSHOWER, R+ = HEAVY RAIN, RW+ = HEAVY RAIN SHOWER, 941 = 941 MILLIBARS, E0470G100 = ESTIMATED WIND FROM 40° AT 70 KNOTS, GUSTING TO 100 KNOTS

MIAMI, FLORIDA - AUGUST 24, 1992 (Time below is in GMT, subtract 4 hours for EDT)

MIA SA 0755 14 SCT E30 BKN 140 OVC 2RW 004/78/75/E3640G60/954/PRESFR/

MIA SA 0850 10 SCT E30 OVC 2RW 941/78/75/E3655G80/935/PRESFR/

MIA SP 0923 10 SCT E30 OVC IRW+ E0470G100/953

MIA SA 0950 10 SCT E30 OVC 1/2RW+ 964/78/76/E1075G100/942 PRESRR LOWEST PRES 926 0900

MIA SA 1050 10 SCT E35 OVC 1/8RW+ 034/77/75/E1275G90/632 PRESRR

MIA SP 1117 10 SCT E35 OVC 35 OVC 3R E1470G80/974 PRESSRR

MIA SA 1152 10 SCT E30 SCT 80 OVC 4R- 092/75/72/E1660G70/981 PRESSRR

MIA SA 1250 13 SCT E30 BKN 80 OVC 4R- 106/75/73/E1045G70/984

MIA SA 1350 20 SCT E100 BKN 200 OVC 7RW- 107/76/74/E1225G40/989

BATON ROUGE, LOUISIANA - AUGUST 26, 1992 (Time below is in GMT, subtract 5 hours for CDT)

BTR SA COR 1154 M15 OVC IRF 007/75/73/1939G52/955/PK WND 1952/52/

BTR SA 1251 E15 OVC IR 988/75/74/1238G51/950/PK WND 1153 16

BTR SA 1355 M15 OVC IR+ 973/75/74/1235G51/945/PK WND 1259 25

BTR SP 1446 M12 OVC ITRW+ 1536G51/944/TB45 N-E MOVG NE

BTR SA 1454 M14 OVC ITRW+ 969/76/75/1440G55/944/TB45 N-E MOVG NE PK WND 1551 21/

BTR SA 1551 M11 OVC ITRW+ 976/75/75/1535G51/946/T NW-E MOVG E PK WND 1461 20

BTR SP 1602 M9 OVC 11/2R+ 1635G47/946/TE01 MOVD E

BTR SA COR 1651 M9 OVC 11/2R+ 991/75/74/1536G46/951/TE01 MOVD E R+ OCNLY R PK WND 1753 22

BTR SP 1746 M12 OVC 11/2R 1729G45/955/

Notice the different wind directions between Baton Rouge and Lafayette. Andrew passed between the stations!

LAFAYETTE, LOUISIANA - AUGUST 26, 1992 (Time below is in GMT, subtract 5 hours for CDT)

LFT SA 0850 M15 OVC 4R+ 017/75/73/0330G40/958/CIG RGD PKWND 0346/29/

LFT SA 0950 M20 OVC 5R+ 976/75/73/0240G52/946/PRESFR PKWND 32652/43

LFT SA 1050 M17 OVC 3R+ 932/75/73/0140G56/933/PRESFR PKWND 3656/45

LFT RS 1152 M20 OVC 11/2R+ 908/75/73/3646G60/926/CIG RGD PRESFR PKWND 3662/1057/

LFT SA 1250 E20 OVC 11/2R+ 905/75/73/E3640G54/925/95 WND E3555/25

LFT SA 1350 E20 OVC 11/2R-F 926/75/73/E3440G50/931/PRESRR PK WND E3450/45

LFT SP 1422 E13 OVC 3R-F E3338G48/935/PRESRR

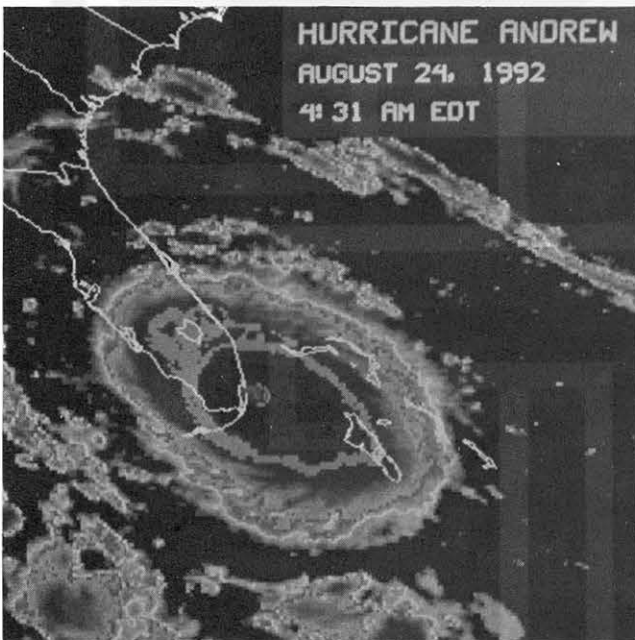
LFT SA 1450 E13 OVC 3R-F 956/74/73/E3340G52/940/ PRESRR/ PK WND 3354/35/

Three letter station identifier/type of report/cloud level (hundreds of feet) and amount of cloudiness/visibility (miles)/present weather/sea level pressure/temperature (°F)/dew point (°F)/wind direction and speed (degrees and knots)/altimeter (inches)/remarks

A. FLORIDA

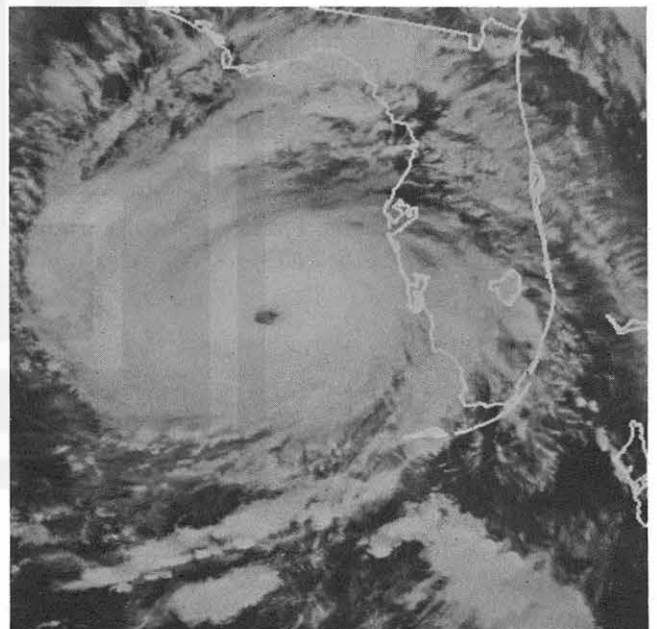
Andrew brought total destruction to parts of southern Florida. In all, property damage was estimated at more than \$25 billion and crop damage at least \$1 billion. Andrew destroyed at least 25,524 homes and damaged 101,241 other homes. Natural reefs of coral and other marine life, were very badly damaged. About 660,000 customers were without electrical power for periods that ranged from a few hours to several months.

A 16.9 foot storm tide (storm surge plus astronomical tide) was recorded near the Burger King World Headquarters, which is a record maximum for the southeast Florida peninsula. The maximum storm tide over the southwest coast was estimated at 5 to 7 feet. Maximum recorded rainfall totals in southeast Florida were in excess of 7 inches. There were no reports of tornadoes.

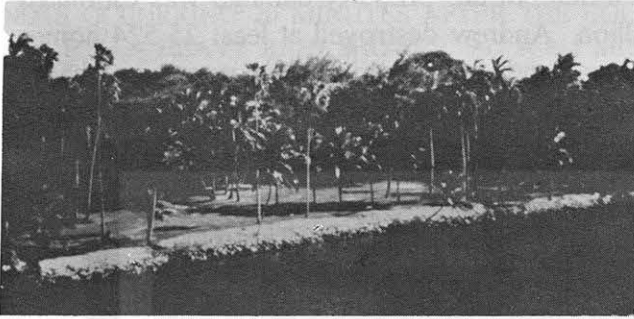


Infrared satellite imagery of Andrew taken by GOES-7 on August 24, 1992 at 0431 EDT. (Photo courtesy: Ralph E. Meiggs)

Visible satellite imagery of Andrew was taken by NOAA-11 on August 24, 1992 at 1640 EDT. (Photo courtesy: Ralph E. Meiggs)



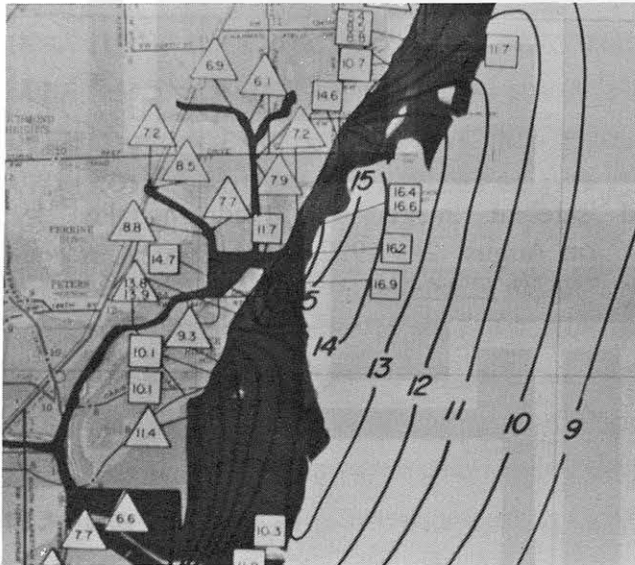
ANDREW'S STORM SURGE IN FLORIDA



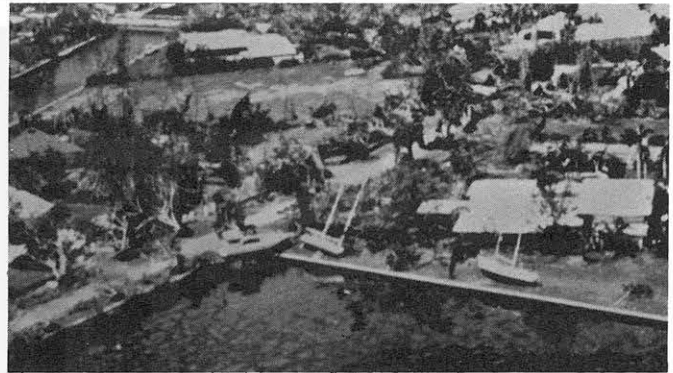
Before . . .



. . . After



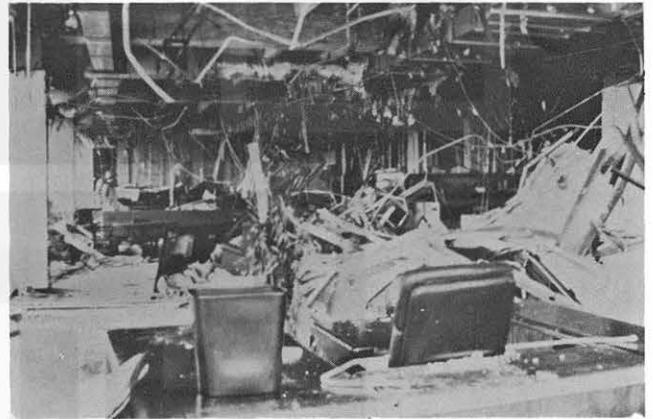
Above(left): Sewell Park before Andrew. **Above(right):** Sewell Park early morning of August 24. **Below:** The Gables-by-the-Sea marina located near Gables Estates where numerous boats were forced ashore by the 9 to 16 foot storm surge. Also note the downed trees. *(Photo courtesy: NHC)*



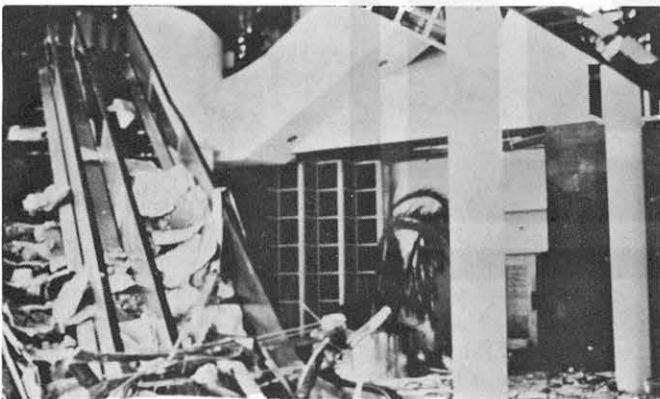
Above: An analysis of the maximum storm surge (feet) along the southeast Florida coast. A maximum storm tide of 16.9 feet, was recorded near the Burger King World Headquarters! *(Photo courtesy: NHC - Brian Jarvinen)* **Below:** Boat damage at Black Point Marina, Dade County. *(Photo courtesy: NHC)* **Right:** Sailboat stranded on a residential street in the Gables-by-the-Sea development of Coral Gables, Florida. *(Photo courtesy: Roger Edwards, Kansas City, MO.)*



DAMAGE FROM WINDS AND STORM SURGE



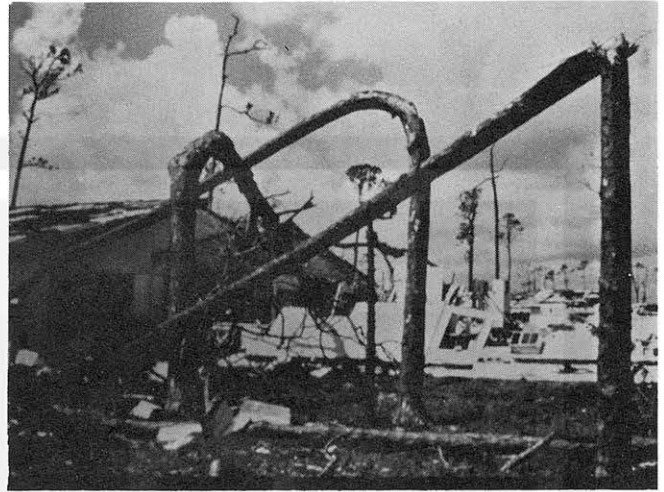
Top(left): Damaged vehicles at the Towers Condominium (Key Biscayne) adjacent to Cape Florida State Park. Note the flooded parking lot. *(Photo courtesy: Ralph Clark)* **Top(right):** The Seaward Explorer, an ocean-going tug, was forced ashore just south of the Deering Estate by the combination of wind and storm surge. **Above(left):** An aerial view of the World Headquarters for Burger King. Note the number of windows blown out by the strong winds. **Above(right):** Wind damage to the Chief Executive Office located on the top floor of the Burger King World Headquarters. **Below(left):** Water and wind damage to the main floor of the building. **Below(right):** Damage to homes in "Saga Bay" resulted from both the winds and storm surge. *(Photo courtesy: NHC)*



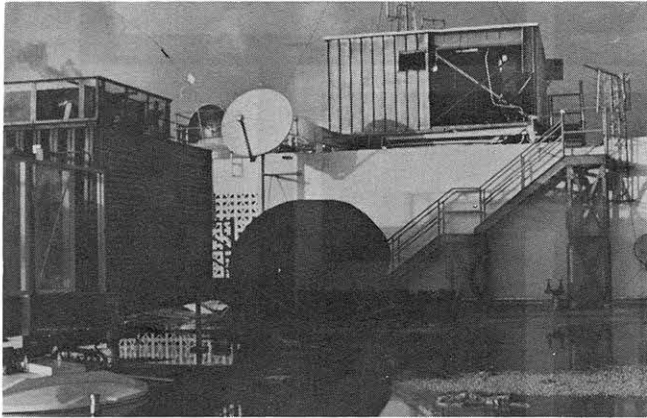
ANDREW'S POWERFUL WINDS INFLICT DAMAGE



Above: Winds still gusting to 50 mph bend the remaining trees at Coconut Grove after the passage of Hurricane Andrew. *(Photo courtesy: Steve Wachholder)*



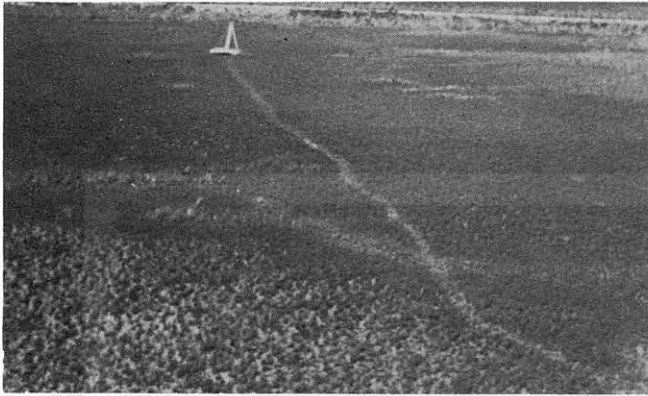
Above(right): Broken pine trees in the Pinewoods Villa development indicate the different directions of the first and second winds. *(Photo courtesy: Roger Edwards)*



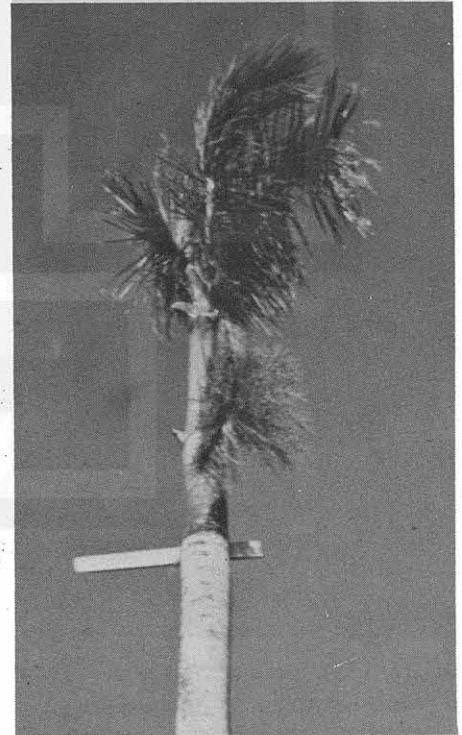
Above: A view of some of the wind damage to NHC's communications equipment atop the IRE Financial Building. The radar dome of the WSR-57 weather radar was blown off the highest structure seen at the center right of the photograph. *(Photo courtesy: Roger Edwards)* **Above(right):** The Holiday Inn at Cutler Ridge, north of Homestead, suffered extensive wind damage with nearly every window blown out! *(Photo courtesy: NHC)* **Below(left):** Outside wall almost completely removed from the east side of an apartment building in the Saga Bay development, near Cutler Ridge. **Below(right):** Partial removal of the outside wall from the south (right) and west faces of the building. *(Photo courtesy: Roger Edwards)*



ANDREW'S WINDS PRODUCE AMAZING RESULTS



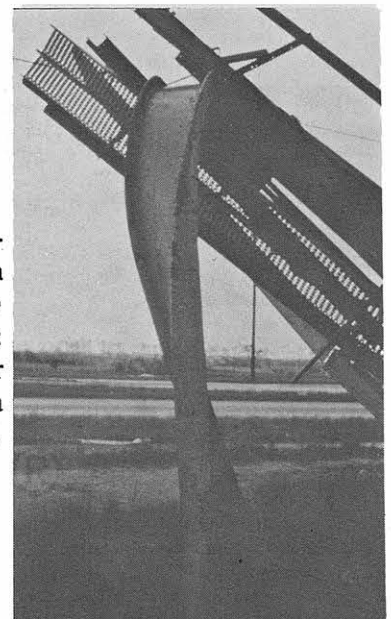
Top(left): Hurricane force winds blew this sailboat well inland. The photograph was taken south of Homestead Air Force Base. **Top(right):** The wind overturned the two cars in this garage, located west of



Whispering Pines. **Above:** Two cars lifted and moved by the wind. The cars had been parked next to the IRE Financial Building. **Right:** A royal palm tree in the Homestead area that was penetrated by a foreign object. The object was a 1 x 4 inch board which penetrated the tree about 40 feet above ground level. (Photo courtesy: Roger Edwards)



Right: An 18-inch wide structural I-beam bent and twisted in the Naranja community. (Photo courtesy: Ralph Clark) **Left:** Another royal palm tree near Homestead was pierced by a wind driven sheet of plywood. (Photo courtesy: NHC)



EXAMPLES OF WIND DAMAGE TO HOMES



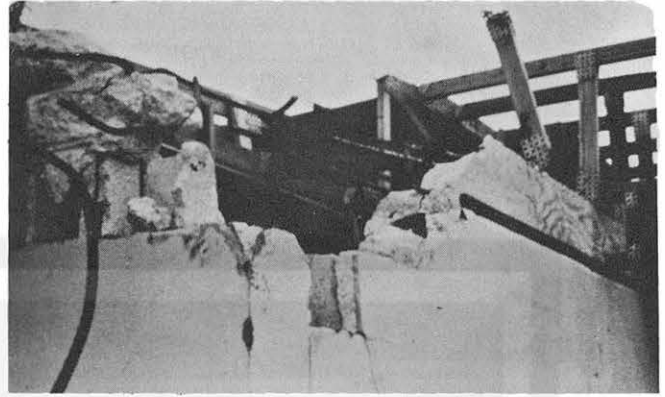
Above(left): This aerial view depicts the uneven damage pattern found in various wood structures in the Lakes By the Bay residential development. **Above(right):** A close-up view of a home in the development. The gable end of the roof failed during the storm. This was a frequent problem in homes of mixed wood and concrete block construction. *(Photo courtesy: NHC)*



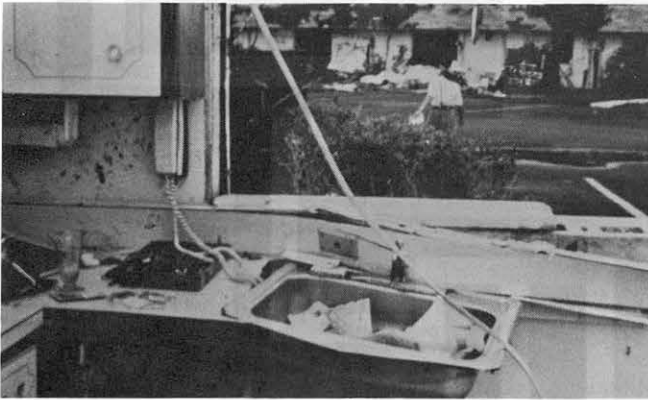
Above(left): Ground view of the devastation in the Pinewoods Villa. In the foreground are broken segments of a large tie beam. **Above(right):** Another ground level view in the Pinewoods Villa. *(Photo courtesy: NHC)*



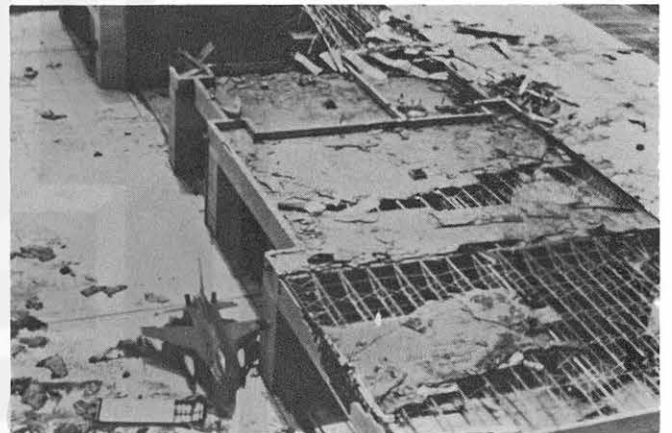
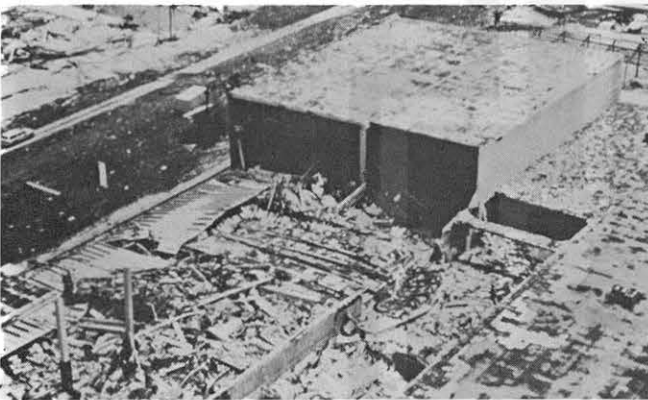
Above(left): Many roof trusses failed during the hurricane force winds. **Above(right):** These rustic shops were part of Gauley Square, a shopping area located north of Homestead. Both new and old buildings suffered significant damage. *(Photo courtesy: NHC)*



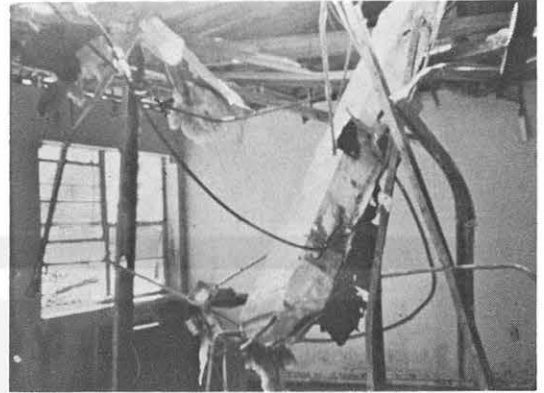
Above(left): Naranja Lakes homes were primarily concrete block and stucco (or CBS) construction. The force of Andrew's wind was strong enough to lift concrete tie beams and propel them into nearby structures. **Above(right):** This home in Naranja Lakes shows inadequate tie beam construction. Note that there were no vertical ties to the foundation. Many homes in Naranja Lakes lacked any vertical tie columns. (Photo courtesy: NHC)



Above(left): The owner of this house, Mary Cowen, was killed during the storm. Amazingly the phone on the wall continued to work after the storm and served the neighborhood during the first few days following Andrew's passage. **Above(right):** People standing in long lines were a frequent sight throughout south Florida and Louisiana. This aerial photograph shows the Publix Supermarket in Homestead. Residents were standing in line awaiting rations of ice. (Photo courtesy: NHC)



Above(left): An aerial view of the remnants of a Levitz Furniture Warehouse and Showroom located along U.S. 1, west of the community of Whispering Pines. **Above(right):** Fortunately, most of the planes at Homestead Air Force Base had been flown out before the storm, however this F-16 fighter was under repair at the time and had to be left behind. (Photo courtesy: NHC)



Above(left): This aerial view of a section of Pinewoods Villa, a development located in Whispering Pines, shows an uneven damage pattern. Also note the roof damage to the building located in the center foreground. This damage resulted from a tie beam that was torn from a home 300 feet away and then dropped through the roof of the structure. **Above(right):** A view of the tie beam from inside the structure. This type of tie beam typically weighs at least 1,000 pounds! *(Photo courtesy: NHC)*



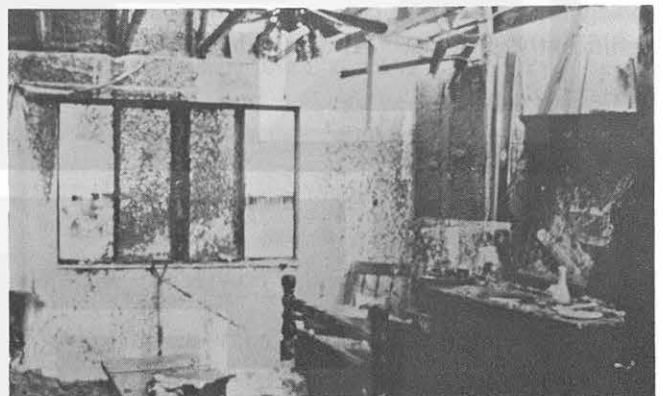
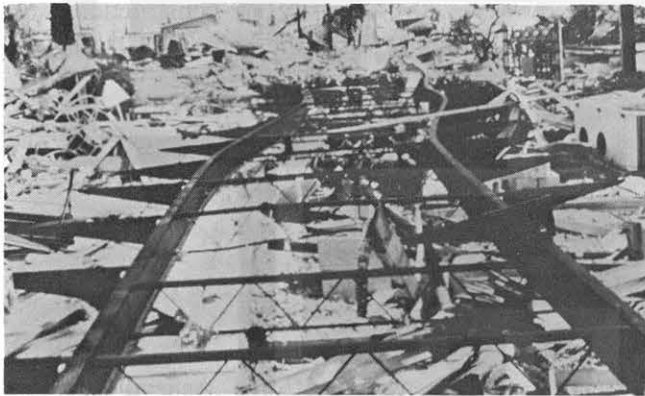
Above(left): An aerial view of a damage streak through Naranja Lakes, located between Cutler Ridge and Homestead. These damage streaks were evident throughout the hardest hit areas of south Florida. The streak in this photograph extends in to the distance from the center foreground. *(Photo courtesy: NHC)* **Above(right):** Extreme wind damage at a mobile home community in Homestead. The Homestead water tower, distant left in the photograph, became the major remaining landmark after the hurricane. *(Photo courtesy: Ralph Clark)*



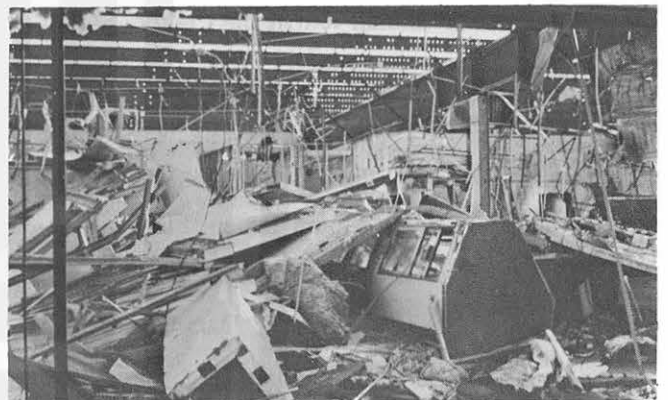
Above(left): Despite the devastation, some residents of Country Walk exhibited a sense of humor. **Above(right):** The roof structure of many homes in Country Walk development failed because of unsupported gables. *(Photo courtesy: NHC)*



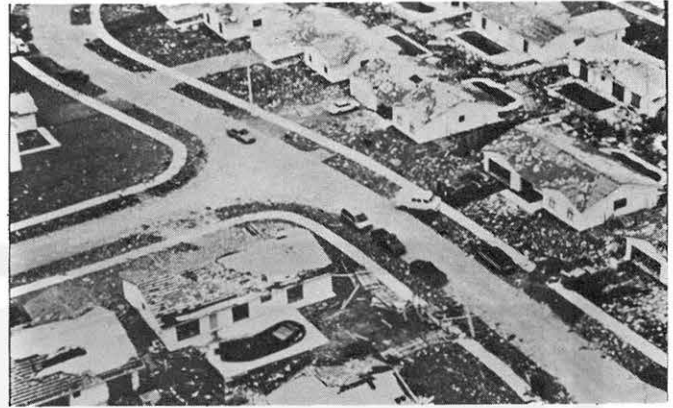
Above(left): An aerial view of the damage to the Dadeland Mobile Home Park. **Above(right):** A ground view of the same damage. *(Photo courtesy: NHC)*



Above(left): The frame is all that remains of this mobile home. This demonstrates the high risk to residents who must ride out severe wind storms in such a structure. **Above(right):** A damaged home in the Saga Bay development clearly shows the damage inflicted by high wind and heavy rain. Insulation is splattered across the bedroom walls. *(Photo courtesy: NHC)*



Above(left): Front view of the east (windward) face of a strip shopping center on the north side of Quail Roost Drive, near the Florida Turnpike. Winds flowing in through the broken plate glass windows, pushed the walls outward a sufficient distance to allow the pre-cast concrete roof to fall into the store. **Above(right):** View of the rubble inside a "Food Stop" convenience store, at the same shopping center. *(Photo courtesy: Roger Edwards)*



Above(left): This aerial view shows a large contrast in damage between neighboring developments. The development in the background sustained heavy damage while those in the foreground only experienced minor damage. Both were constructed of concrete block and stucco, however the integrity of construction was significantly different. **Above(right):** A closer view of the well built homes. Most of the homes lost shingles,

A SPECIAL THANKS

TO THE FOLLOWING PEOPLE FOR THEIR CONTRIBUTIONS TO THIS ISSUE OF *STORM DATA*

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William Brown, National Climatic Data Center, Global Analysis Branch, Asheville, North Carolina;

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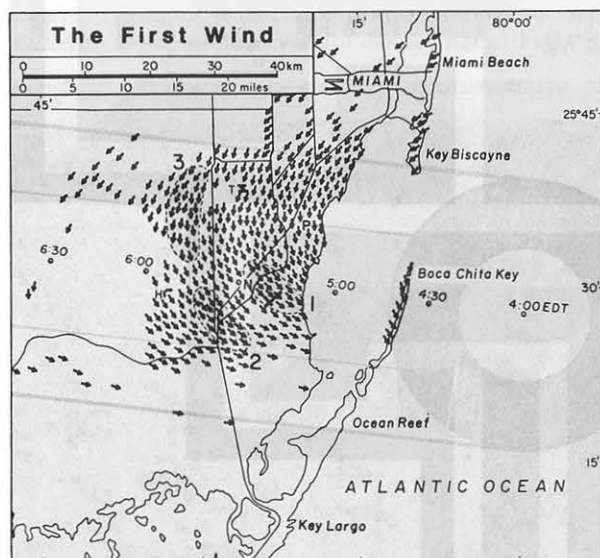
Shawn Harley, Warning Preparedness Meteorologist, and Albert Shipe, National Weather Service Forecast Office, Indianapolis, Indiana;

Jack "Thunderhead" Corso, Harrison, New York.

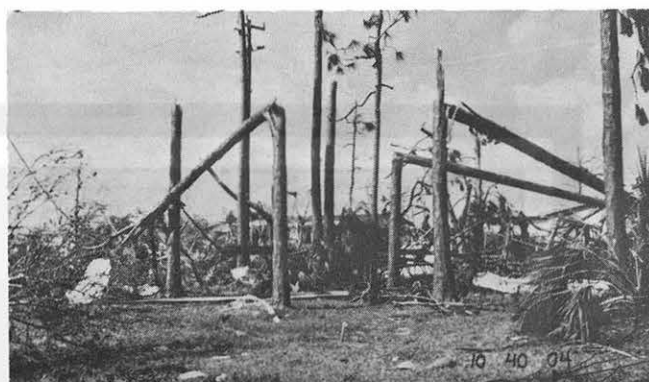
Damage Survey of Hurricane Andrew in South Florida by Ted Fujita

The vast areas of south Florida damaged by Hurricane Andrew on 24 August were mapped by Fujita based on his 500 high-resolution aerial photos and 1,500 9" X 9" vertical aerial photos purchased from Continental Aerial Survey, Pan American Survey and Aerial Cartographics of America.

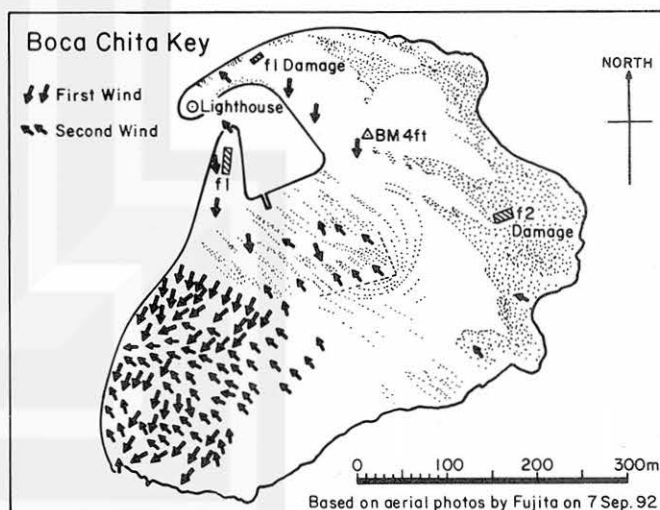
Three scales of wind systems were isolated and studied in detail. They are (1) Overall hurricane, (2) Swath of high wind, and (3) Mini-swirl and microburst. The damage-causing peak winds of (2) and (3) were far stronger than ordinary peak gusts experienced along the path of Andrew.



Above: Direction of the first damaging wind occurring during the approach phase of Andrew. **Below:** Damage by the second wind, during the receding phase.

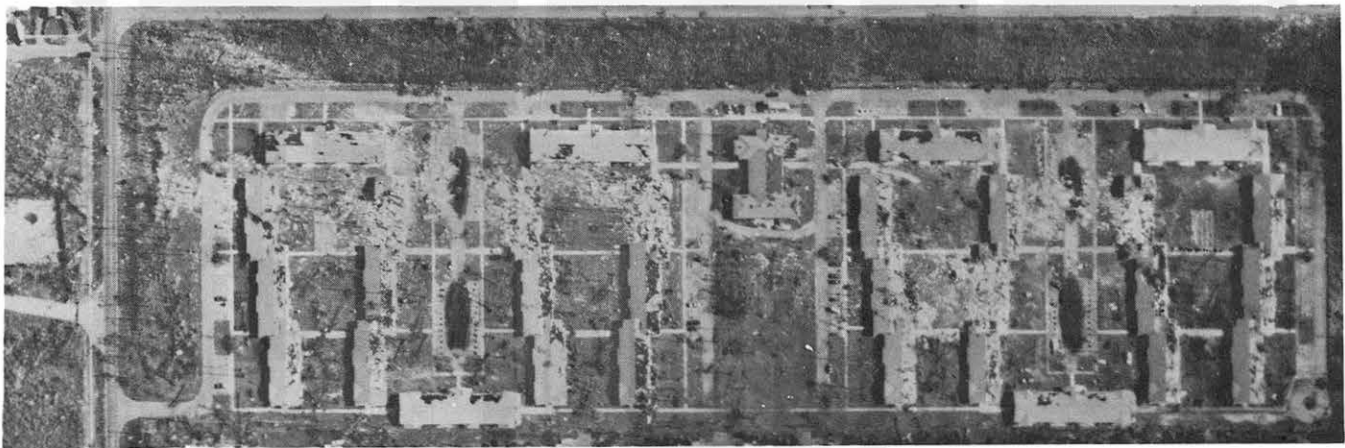
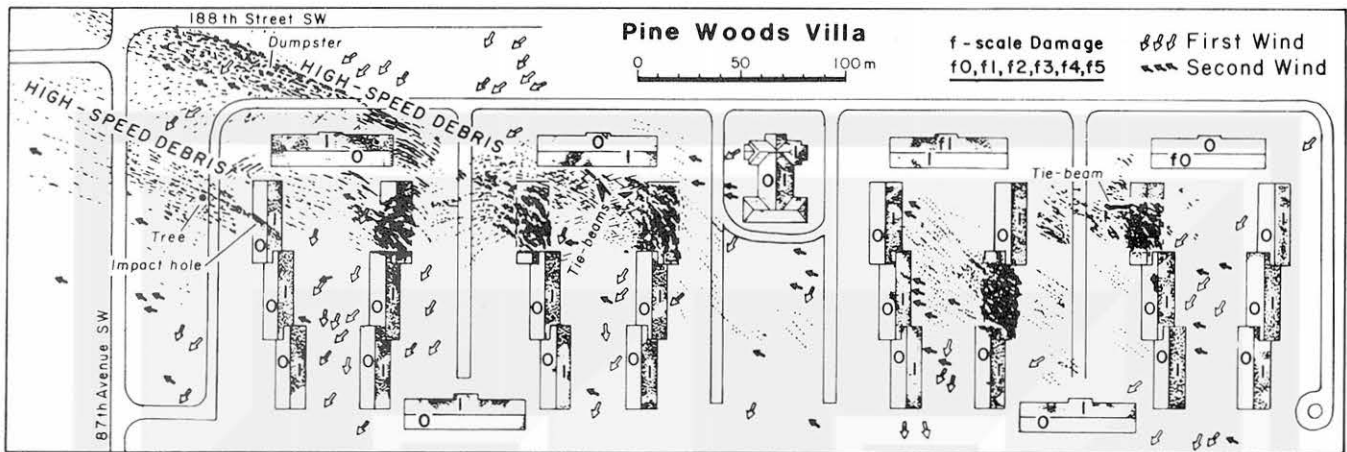


Typical damage of pine trees caused by the first and second winds. Numerous Australian pines were blown down by the first wind. Fujita photo 1040 EDT 9/9/92



Above: Boca Chita Key, 2 to 3 miles north of the eye center, received the first storm fury. Fujita photo 1742 EDT 9/7/92. **Below:** Damage map showing the average direction of the first wind from 10° and the second wind from 125°.

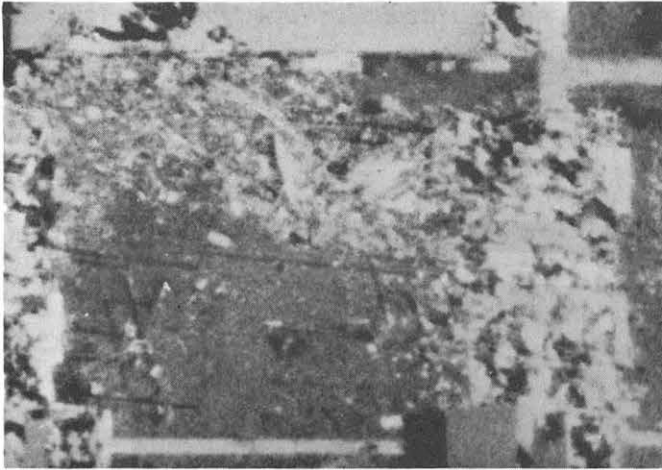
Mini-swirl Damage at Pine Woods Villa Southeast of 188 St and 87 Av SW



Above: Structural and tree damages at the Villa located inside the Tamiami Swath. Although trees were damaged by both first and second winds, the first wind did not cause structural damage, suggesting that the first wind was weaker than the second wind in the Tamiami Swath. The second wind caused the f1 damage to the east-side roofs while west-side roofs were not damaged (f0).
Below: An enlarged view of a 9"X9" vertical photo taken by Continental Aerial Survey on 8/27/92.



Left: Aerial photo of a tie-beam (see map) blown off toward the west. Fujita photo 1245 EDT 9/14/92.
Right: Ground view of the tie-beam reinforced with one-inch steel rods. Fujita photo 1649 EDT 9/15/92.



Left: Tie-beams at Pine Woods Villa (see map) blown apart by a mini-swirl. Continental Aerial Survey photo taken on 8/27/92. **Right:** Ground view of the tie-beams. Fujita photo 1109 EDT 9/9/92.

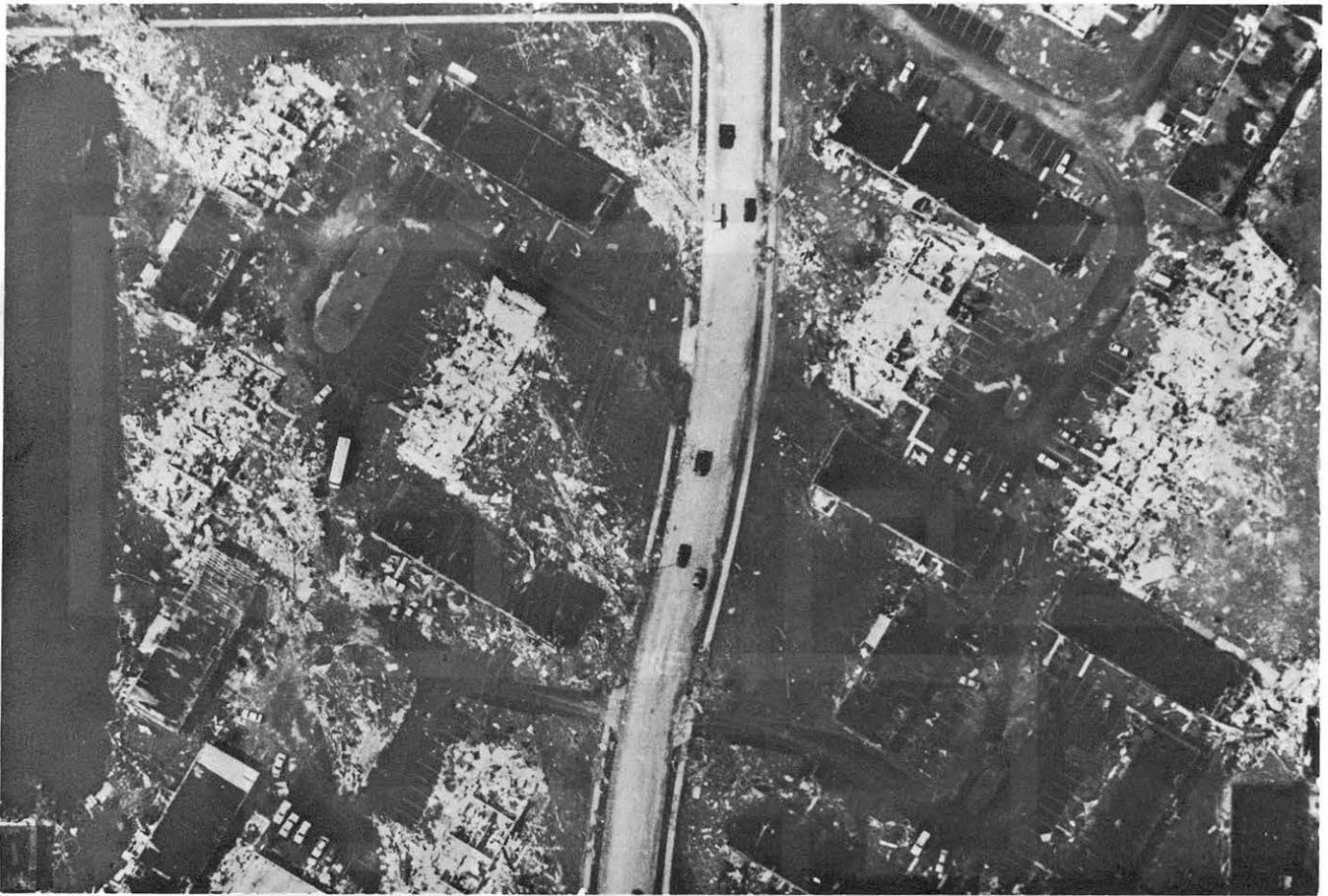


Left: A dumpster found inside the high-speed debris (see map). Some trees in this photo were blown down by both first and second winds. Fujita photo 1234 EDT 9/14/92. **Right:** Bi-directional tree damage seen near the dumpster site. Fujita photo 1109 EDT 9/9/92.



Left: An impact hole (see map) created by a falling tie-beam. Fujita photo 1245 EDT 9/14/92. A piece of flying plywood cut through the trunk of the tall pine tree shown at the lower left of the picture. **Center:** Drs. Robert Sheets and Peter Black examining the tree trunk. **Right:** A close-up view of the deep cut. Fujita photos 1057 EDT 9/9/92.

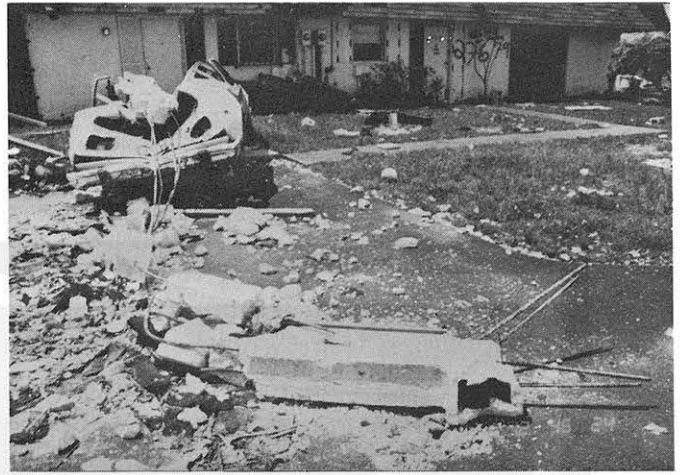
Condos at Naranja Lakes in Wind-parallel and Perpendicular Directions



Center of Andrew's eye passed directly over Naranja Lakes, resulting in a 180° shift of the first wind from NNW into the second wind from SSE. Many buildings oriented WSW-ENE (wind-perpendicular) direction received the f3 damage while those in the NNW-SSE (wind-parallel) direction were spared. Enlargement of a Continental Aerial Survey photo taken on 8/26/92.



Left: A Naranja Lakes condo oriented in the wind-perpendicular (broadside) direction. The roof was lifted into a vertical position and dropped upside-down after a 180° rotation. Connected and broken tie-beams weighing one ton per 20 ft are visible on the downwind side. Fujita photo 1253 EDT 9/14/92. **Right:** Mobile homes at Naranja Lake oriented by luck in the wind-parallel (streamline) direction. Fujita photo 0906 EDT 9/8/92.



Left: An f3 damage of Naranja Lakes condo caused by a mini-swirl that formed inside the second wind. Fujita photo 1253 EDT 9/14/92. **Right:** Pieces of a connected tie-beam which flew 150 feet (45m) from a Naranja Lakes condo in the second wind. Fujita photo 1246 EDT 9/10/92.



Left: A confusing stop sign at 82 Ave and 163 St SW in Cutler located near the north edge of the Tamiami Swath. Fujita photo 1024 EDT 9/16/92. **Right:** Triple junction of f-scale damages. An f4 damage at a trailer park (upper left), f2 at the lower-left subdivision, and f0 to f2 at the upper right subdivision. Relatively uniform peak winds (F-scale winds) expected at the junction caused a wide range of f-scale damages between f0 and f4. Fujita photos 0945 EDT 9/8/92. **Note that the Fujita Scales, now applied to both tornadoes and hurricanes, refer to the Fujita Wind Speed scale (F scale) and Damage scale (f scale),** because an F-scale wind would cause different f-scale damages to different types of structures. See examples.

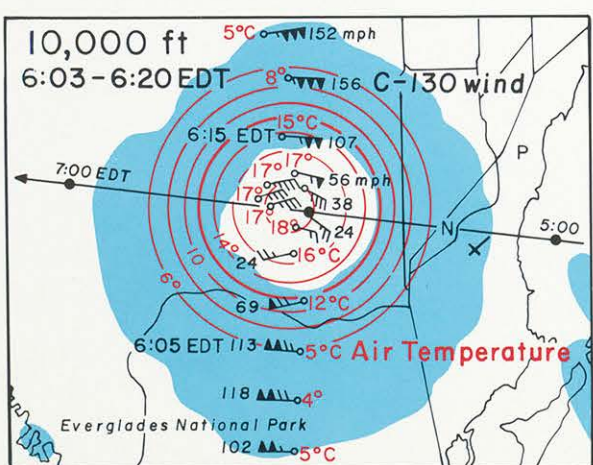
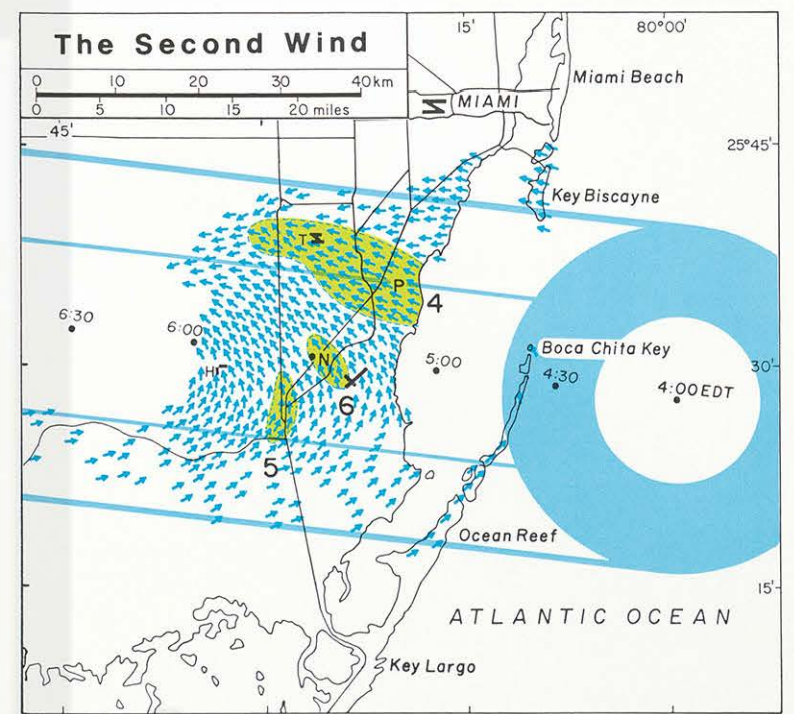
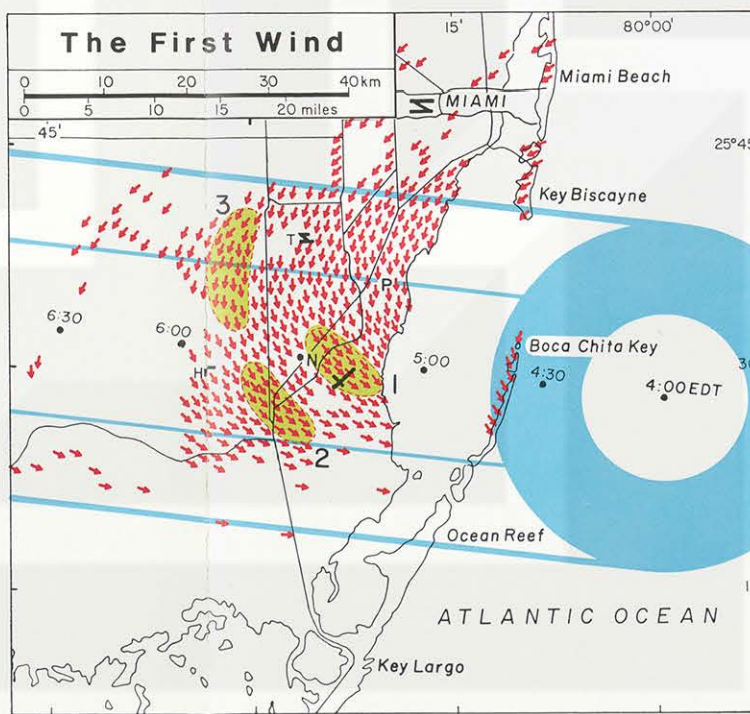
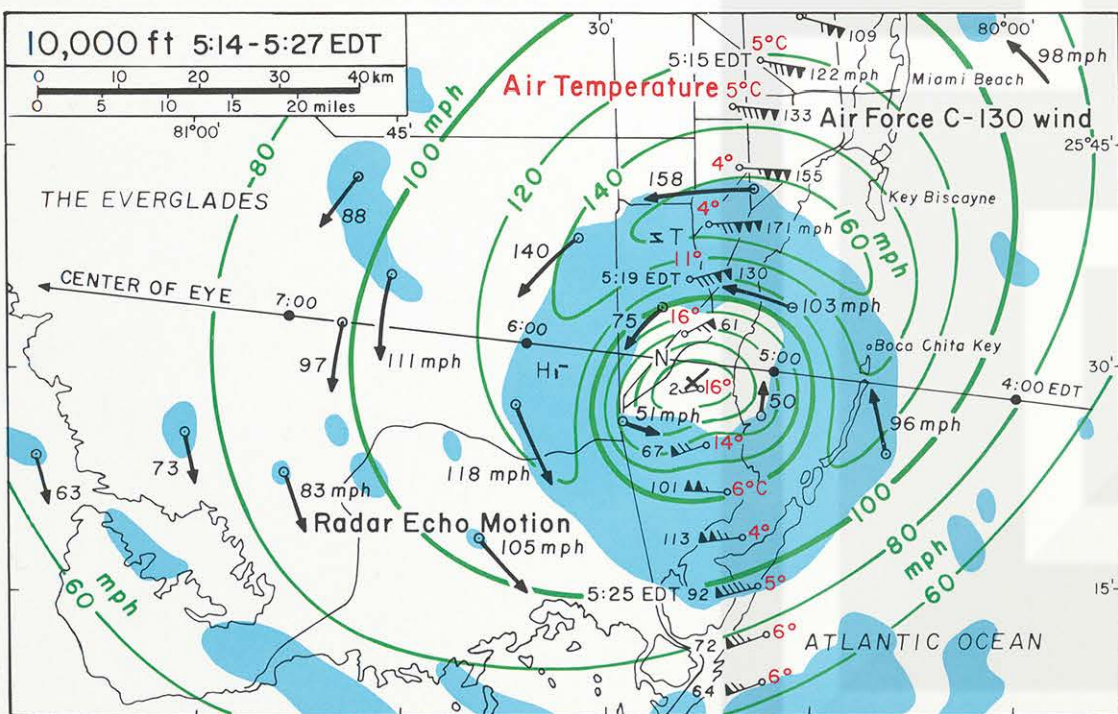
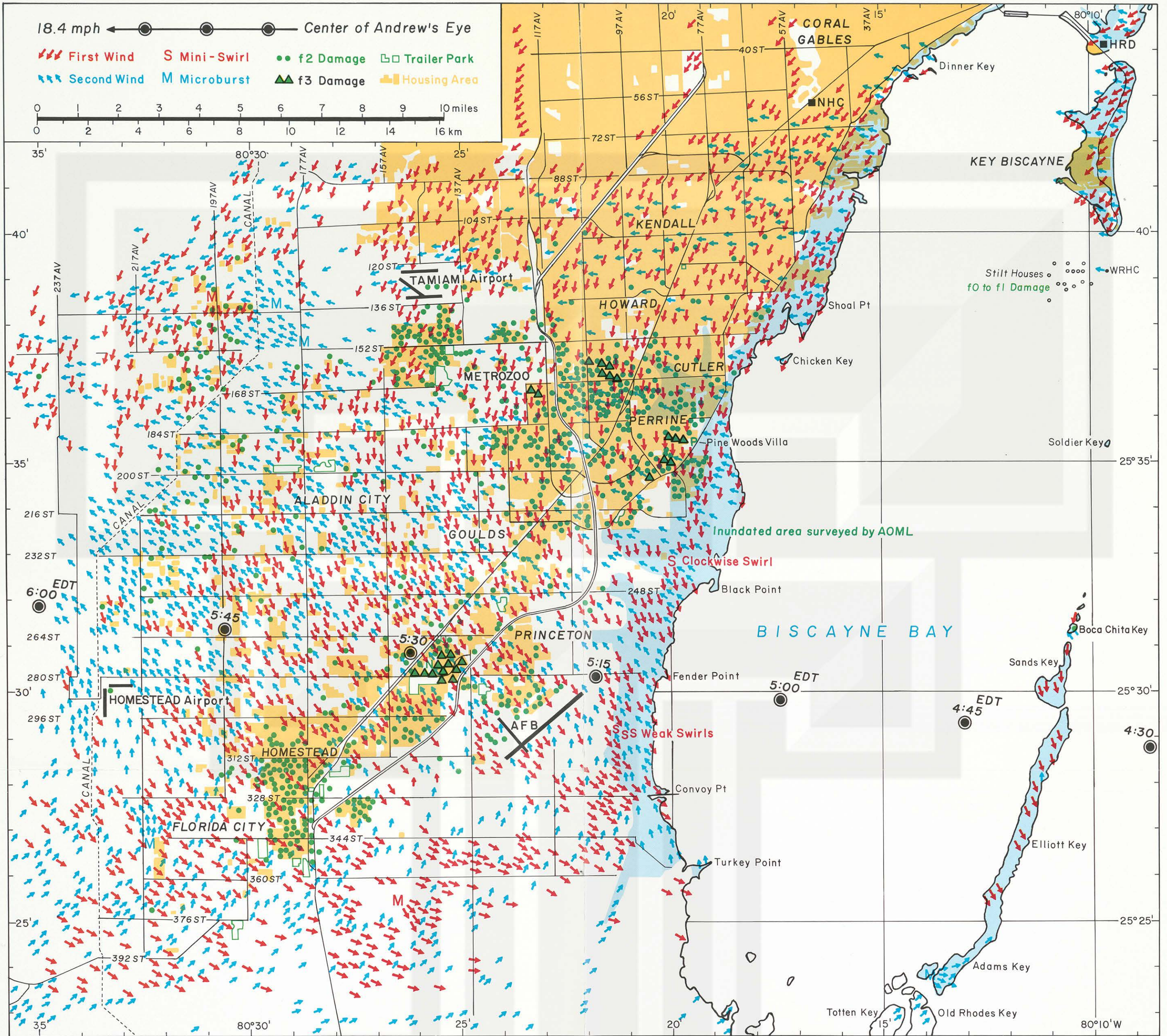
FOLDING COLOR MAP OF HURRICANE ANDREW

This issue of STORM DATA includes the following four maps printed in multiple colors on a 15" x 21" folding sheet. These maps are:

1. Overall Damage Map of Andrew
2. Map of the first wind
3. Map of the second wind
4. Estimated winds at 10,000 ft altitude

The research presented in this contributed paper by T. Theodore Fujita, of the University of Chicago, has been sponsored by NASA under Grant NAG8-886 and ONR under Grant N00014-91-J1136.

Damage Map of Hurricane Andrew on August 24, 1992



The large map in this color poster presents the wind damage caused by the first and the second winds which blew during the approach phase and the receding phase of hurricane Andrew, respectively. In completing this damage map, house to house and tree to tree damages in 2,000 aerial photos were examined.

The overall hurricane wind characterized by a combination of its rotational and translational motions was depicted by the Air Force C-130 which penetrated Andrew's eye at 5:21 EDT and 6:07-14 EDT, when destruction was in progress. The flight data provided by LtCol Carter who supervised the flight was analyzed in the lower-left charts. The aircraft encountered on the north side of the eyewall frequent lightning, occasional downdrafts, moderate to severe turbulence, and soft hail.

The First Wind and the Second Wind were presented separately in the two lower-right maps. It was found that relatively severe damage occurred inside the swaths of high winds, 3 to 7 miles wide and 5 to 15 miles long. Six swaths identified are: **1** First Naranja Lakes Swath, **2** Homestead Swath, **3** Everglades Swath in the first wind, and **4** Tamiami Swath (worst of all), **5** Florida City Swath, and **6** Second Naranja Lakes Swath in the second wind. The strongest damaging winds were induced by the mini-swirls and microbursts with their dimensions, less than 500 m across. They were the inducers of 175 to 200 mph peak winds in Andrew. A large number of mini-swirls and microbursts were found inside the high-wind swaths listed above. Refer to the damage pictures in Storm Data.

This folding poster is a part of the contributed paper by T. Theodore Fujita, **Damage Survey of Hurricane Andrew in South Florida**. NOAA Storm Data, August 1992, Vol. 34, No.8 pp 25-29.

Acknowledgments: The author wishes to express his appreciation to Dr. Robert Sheets of NHC for escorting him on September 9 into restricted and unsafe damage areas and to LtCol Robert Carter of Keesler AFB for providing him with the historic flight data. Gratitude is also due to Messrs. James Partacz and Ji Chung for their assistance in photography and cartography. This research at the University of Chicago has been sponsored by NASA under Grant NAG8-886 and **ONR** under Grant N00014-91-J1136.

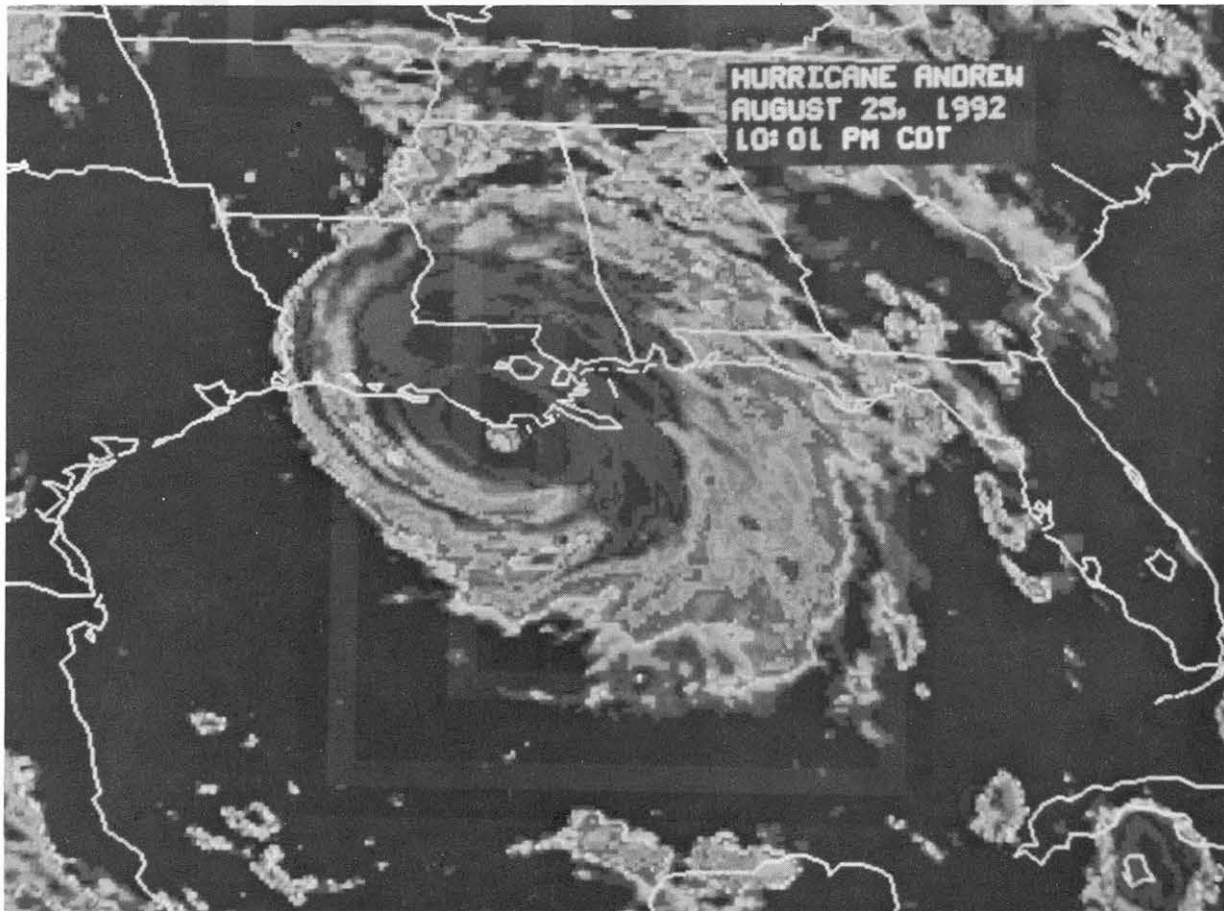
Conversions for International Users: 4:00EDT(8:00GMT), 5:00(9:00), 6:00(10:00), 7:00(11:00); 10,000ft(3,048m); 1 mile(1.6km), 5(8.0), 15(24.1); 100mph(45m/s), 150(67), 175(78), 200(89).

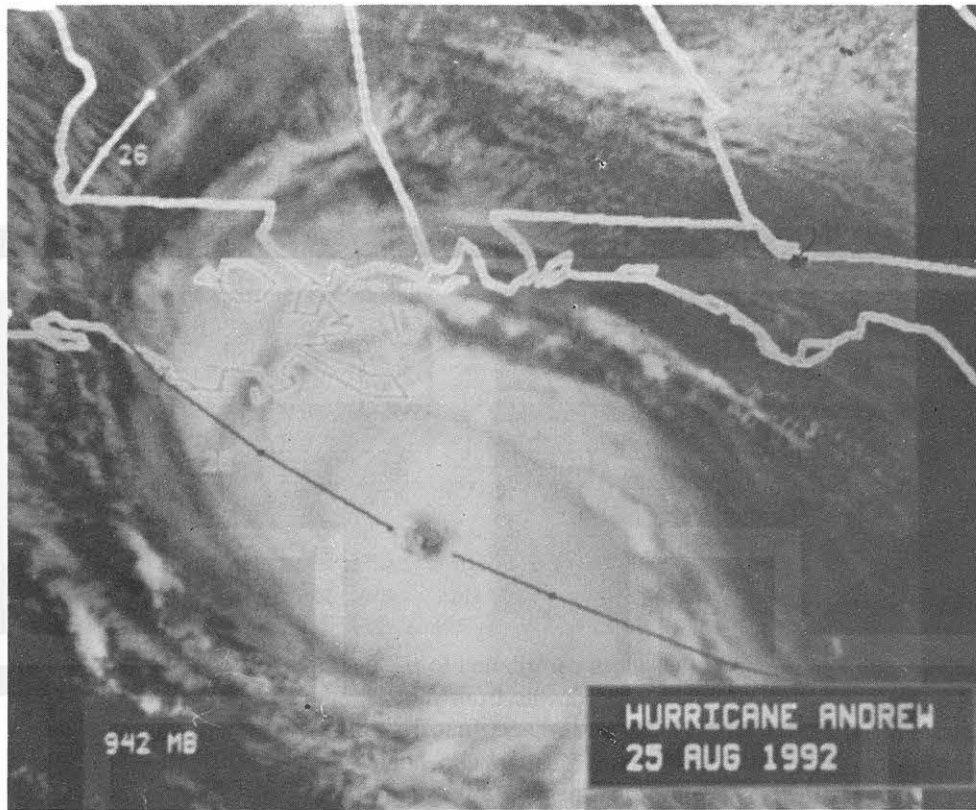
B. LOUISIANA

The center of Hurricane Andrew struck Louisiana 24 miles west-southwest of Morgan City at 0230 CST on August 26. Andrew was a weakening category 3 hurricane with estimated maximum sustained winds of 126 mph. Andrew weakened quickly as it moved inland. At 1200 CST, Andrew was downgraded to tropical storm status near Angola with sustained winds estimated at 60 mph. Due to a large scale evacuation of approximately 1.3 million people, deaths directly attributed to Hurricane Andrew were few. Six fishermen were killed in the Gulf of Mexico. Andrew produced 14 tornadoes. One on August 25 was F3 in strength and killed two people in the town of Reserve. Even in its weakened stage, Andrew still caused \$1.76 billion in damage.

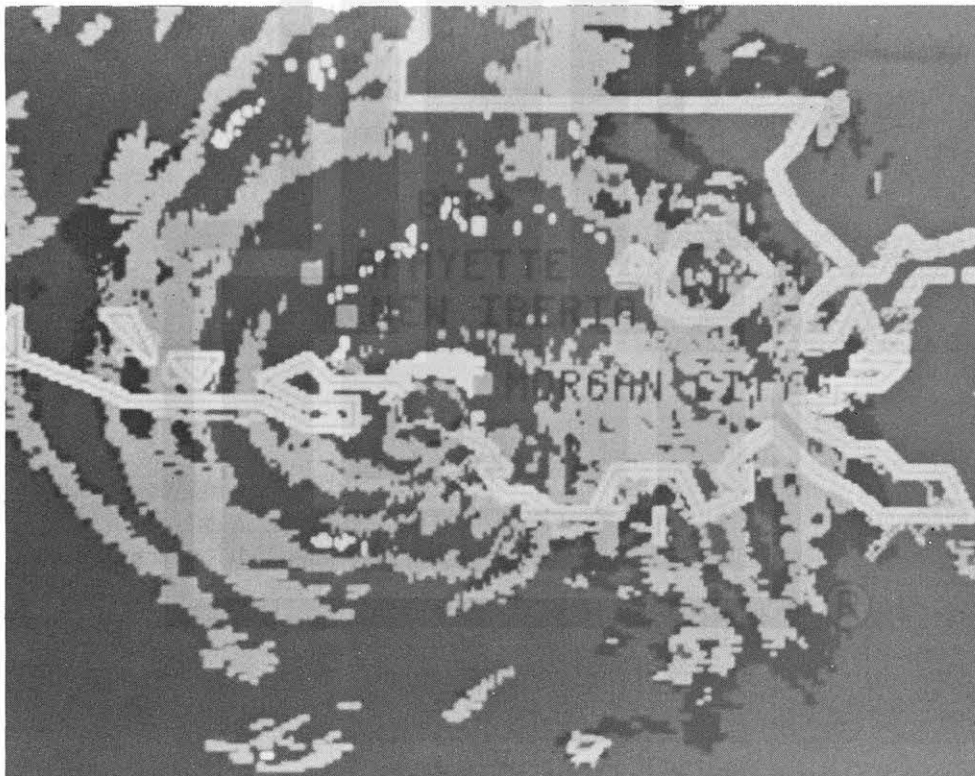
Damage in Louisiana was extensive. A survey conducted by the American Red Cross showed 23,000 homes were damaged. Andrew caused an estimated \$1 billion damage to private property, \$289 million to agricultural interest with sugar and soybeans being hardest hit, \$266 million to the fishing industry. About 240 oil and gas platforms received a total of \$200 million in damage. The storm tide of at least 8 feet caused flooding from Lake Borgne westward through Vermillion Bay.

Infrared satellite imagery of Andrew taken by GOES-7 on August 25, 1992 at 2201 CDT. (Photo courtesy: Ralph E. Meiggs)





Above: A METEOSAT 3 satellite view of Hurricane Andrew. Andrew's track across the Gulf of Mexico and into Louisiana is superimposed over the satellite image. *(Photo courtesy: NESDIS)* **Below:** Radar composite view of Hurricane Andrew making landfall along the south-central Louisiana coast. *(Photo courtesy: NHC)*



ANDREW SPAWNS TORNADOES ON AUGUST 25



In southern Louisiana and Mississippi, tornadoes contributed to the damage of the hurricane. Fourteen tornadoes occurred in Louisiana and 27 in Mississippi. The only deaths from the tornadoes occurred in Louisiana, in the community of Reserve (30 miles west of New Orleans). The F3 tornado, first touched down in La Place and moved into Reserve. It moved through an area of Reserve where individual mobile homes were located on residential lots. The track of the tornado was about 9 miles in length and a quarter of a mile in diameter. Pictured, **above(left)**, is damage to one of the mobile homes near the beginning of the most destructive portion of the tornado path. **Above(right)**: One Reserve resident fell victim to the tornado when a portion of his home collapsed. *(Photo courtesy: NOAA DST)*

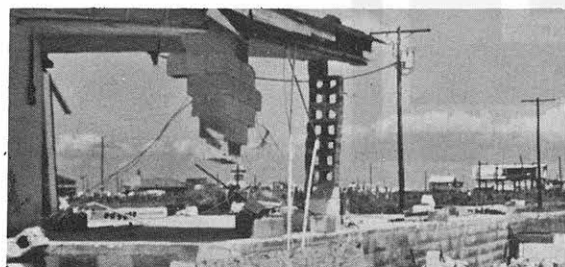
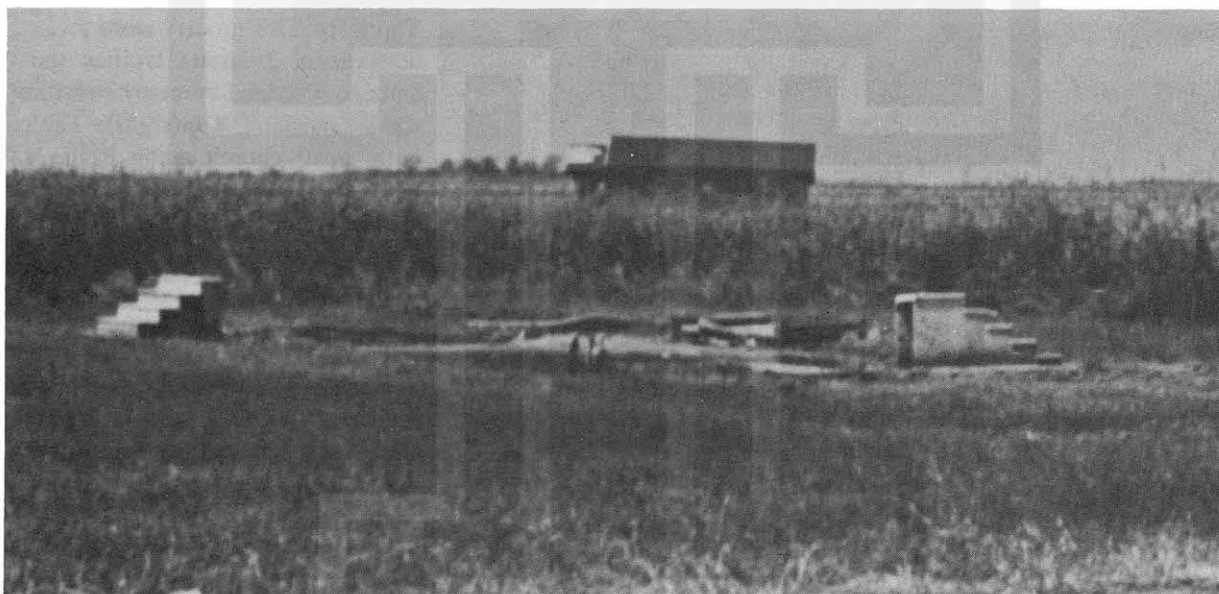


Above: Additional view of the damage in La Place. A total of 122 homes, 32 mobile homes, and 25 business were damaged or destroyed. **Left:** These Ironwood trees were literally snapped off and splintered by the force of the tornado. *(Photo courtesy: NOAA DST)*

TIDAL STORM SURGE DAMAGE

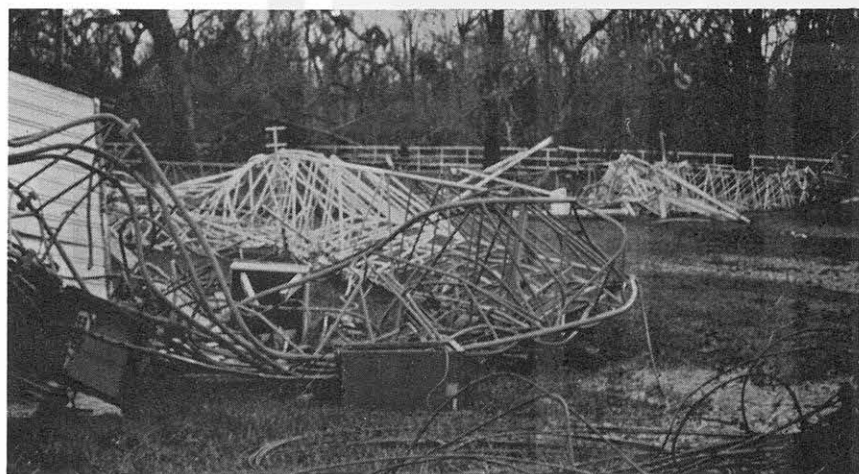
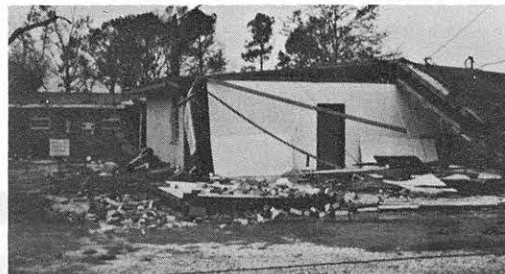


Left: The Louisiana Universities Marine Consortium (LUMCON) experienced a tidal surge of 5 to 7 feet. Note the silt and mud deposited by the storm surge. **Right:** The debris along Parish Highway 57, between the Cocodrie Petroleum Depot and LUMCON, was also left by the storm surge. Part of the debris had been originally strewn across the road surface before being cleared by highway crews. *(Photo courtesy: NOAA DST)*



Above: This photograph was taken several miles north of the Cocodrie Petroleum Depot. Notice the steps that once provided access to the house. The combined effects of the storm surge and wind pushed the structure from its foundations and deposited it in the marsh. The roof in the center background is the only portion of the house that is still visible. **Left:** Another view of the damage caused by the likely combination of wind and storm surge. *(Photo courtesy: NOAA DST)*

ANDREW DAMAGE IN LOUISIANA



Top(left): This grocery store located on the outskirts of Jenerette typifies the type of damage sustained by many structures across south Louisiana. **Top(right):** The remnants of a small church along Route 182 near Franklin, Louisiana. **Above:** Mobile home located along one of the many inlets and channels south of Dulac that did not fare well in Andrew's fury. **Left:** Remnants of a twisted and tangled radio tower, north of Garden City along U.S. Highway 90. **Bottom(left and right):** Numerous large trees were uprooted and fallen on houses along Parish Road 329, north of Avery. Fortunately, the residents were not at home when the trees fell. (Photo courtesy: NOAA DST)



Storm Data and Unusual Weather Phenomena

August 1992

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
FLORIDA									
FLZ018-021 > 023 Broward, Collier, Dade, Monroe Counties	24 24	0325EST- 0900EST			15	?	9	9	Hurricane Andrew
Hurricane Andrew roared ashore in southern Dade County near Homestead and Florida City. The Category 4 hurricane caused widespread damage to homes and businesses, with many destroyed in south Dade. Numerous trees, power lines, light poles, etc were downed in many areas from Broward County on the north to Collier County on the west and to Dade County and the upper Keys on the south. Fifteen people were killed as a direct result of the storm, mostly from flying debris and collapsing roofs, walls, or falling furniture. Twenty-six others were killed indirectly as a result of storm damage while cleaning up debris. Debris came from an auto accidents related to non-functional traffic lights, across roadways and so forth. In all property damage was estimated to have exceeded \$25 billion, and crop damage was at least \$1 billion. The natural reef housing coral and other marine life was very badly damaged. Ocean Reef in the extreme upper Keys also suffered heavy damage. About 660,000 customers were without power for periods of from a few hours to several months. (M67P)(F12P)(M41P)(F67P)(M46P)(M32P)(M46P)(M49P)(F91P)(M62P)(M40P)(M30P)(M57P)(M74P)(M37P).									

LOUISIANA

LAZ008-009-010- 012-013-014	25 26 26 27	1600CST- 1200CST 1200CST- 2400CST			6	65	9	9	Hurricane Andrew
									Tropical Storm Andrew
St. John Baptist 2 E La Place to 4 NW Reserve Iberville Parish Indian Village	25 26	2010CST- 2020CST 0142CST	9.0 1.0	150 20	2 0	32 0	7 4	6 ?	Tornado (F3) Tornado (F1)
St. Tammany 5 N Lacombe to 4 N Covington Pointe Coupee Ventress	26 26 26	0825CST- 0845CST 0927CST	14.0	20	0	0	4	?	Tornado (F1)
St. Tammany Mandeville	26	1430CST	1.0	20	0	0	3	?	Tornado (F1)
Morehouse Parish 1 W Beekman to Stevenson	26 26	1430CST- 1435CST	2.0	50	0	3	5	?	Tornado (F1)
Union Parish 1 W Marion 5 SW Point	26 26	1500CST 1517CST	0.5 2.0	20 20	0 0	0 4	0 4	?	Tornado (F0) Tornado (F1)
Madison Parish 4 E Tallulah Tangipahoa	26	1810CST	0.5	20	0	0	0	0	Tornado (F0)
1 W Tickfaw to Loranger	26	1815CST	7.0	20	0	0	5	?	Tornado (F1)
Madison Parish 4 SE Tallulah Mound	26 26	1900CST 1900CST	0.5 1.5	20 40	0 0	0 0	0 4	0 ?	Tornado (F0) Tornado (F1)
15 SW Tallulah Franklin Parish	26	1904CST	1.5	40	0	0	4	?	Tornado (F1)
10 E Winnsboro	26	1920CST	1.5	40	0	0	0	?	Tornado (F1)

Hurricane Andrew made landfall about 24 miles west-southwest of Morgan City at 0230 CST Aug 26, 1992 as a weakening Saffir Simpson Category 3 hurricane with maximum estimated winds 126 mph near the eye. Andrew continued to lose strength rapidly as it moved inland. At 0600 CST, the center of Andrew was 12 miles east-southeast of Lafayette; highest winds were 96 mph (Saffir Simpson Category 1). Andrew was downgraded to a tropical storm about 1200 CST when its center was near Angola; estimated maximum winds were about 60 mph. During the 8-hour period prior to landfall, Andrew's circulation interacted with land causing it to rapidly lose strength. The 5- to

Storm Data and Unusual Weather Phenomena

August 1992

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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LOUISIANA Cont'd

8-foot NVGD storm tide produced by Andrew during this period was partially due to the nearly parallel course Andrew took as it approached the central Louisiana coast. Andrew's most devastating effects were primarily felt in the following parishes: St. Mary, Iberia, St. Martin, Lafourche, Terrebonne, and St. John the Baptist. A survey conducted by the American Red Cross indicated that over 23,000 homes were damaged by Andrew. An estimated \$1 billion damage was done to private property. Agricultural losses were estimated to be about \$289 million; the most severely affected crops were sugar and soybeans. The fishing industry suffered a \$266 million loss when Andrew caused a massive fish kill. About 240 oil and gas platforms received about \$200 million in damages. Thus, even in its weakening stage, Hurricane Andrew produced about \$1.76 billion dollars in damages in Louisiana. Due to the large scale evacuation of an estimated 1.3 million people in southeastern and southcentral Louisiana, the deaths directly attributed to Hurricane Andrew were low. The bodies of six fishermen were recovered in the Gulf of Mexico by the Coast Guard about 5 days after Andrew made landfall. Andrew spawned 14 tornadoes; the majority of them were weak and brief in duration. A strong tornado produced on the outer edge of Andrew killed two people in Reserve during the evening of August 25, 1992. The number of homes, mobile homes, and apartments that were destroyed, or sustained major, minor damaged were obtained from the American Red Cross unless otherwise stated. A damage summary follows:

Gulf of Mexico: Two-hundred-forty oil and gas production platforms were damaged over an 85-mile-wide area off the central and southeast Louisiana coast according to the U.S. Mineral Management Service. Estimated losses amounted to \$200 million. The U.S. Coast Guard found the bodies of six crewmen from the fishing vessel Lucky Lee floating in the Gulf of Mexico about 5 days after Andrew made landfall. The Coast Guard rescued four people from the 65-foot Night Stalker that floundered in high seas and strong winds about 50 miles south of Houma around 1030 CST on August 25, 1992. (M26O) (M30O) (M32O) (M33O) (M44O) (M??O)

Mississippi River: Two ocean going freighters, the Formosa Three and the Probo Hawk, were run aground near Vacherie. Two towboats, the MV Harvison and the Jolly Jack, foundered and sank near St. Francisville while attempting to retrieve breakaway barges; 10 crewmen were rescued. The Mississippi Queen steamboat evacuated 250 passengers at Baton Rouge around 0900 CST on August 26, 1992 because it was having difficulty in remaining at its berth and due to break away barges in the Mississippi River.

Atchafalaya River Basin to Bayou Lafourche: An upwelling of bottom sediment rapidly depleted oxygen in these basins and along the shallow coastal waters of Terrebonne and Lafourche Parishes. An estimated 187 million freshwater fish were killed in the Atchafalaya River basin and along Bayou Lafourche. Nine million salt water fish and a large number of oysters were killed in the shallow coastal waters of Terrebonne and Lafourche Parishes. Total losses to the fish and wildlife industry were estimated to be \$266 million.

St. John the Baptist Parish: A strong tornado moving rapidly west on an intermittent 9-mile path through Laplace and Reserve between 2010 CST and 2020 CST, killed two people and injured 32. Both fatalities, a 2-year-old girl and a 63-year-old man, occurred in their Belle Pointe subdivision homes in Reserve. A joint damage survey conducted by the St. John the Baptist Office of Emergency Preparedness and National Weather Service indicated that 66 homes and 33 mobile homes were destroyed; 56 homes or mobile homes sustained moderate damage; and 130 homes or mobile homes had some minor damage. Twenty-five businesses were either destroyed or sustained moderate damage. This includes the River Parishes Hospital which had its roof damaged by the tornado and had to be evacuated. Seven public buildings including two schools were damaged. Estimated damages to homes and mobile homes were \$6,726,250; businesses, \$3,428,500; public buildings, \$1,957,500. Agricultural losses to the sugar crop were \$1 million, and \$100,000 to the soybean crop. (M63H) (F02H)

Lafourche Parish: A 5.6- to 6.2-foot NGVD storm tide washed away about 500 feet of LA1 below Leeville and about 75% of LA3090 (Port Fourchon Road). Estimated damages to Port Fourchon including rebuilding LA3090 were \$2,200,000. Approximately 20 homes and 32 mobile homes were destroyed; 154 homes and 66 mobile homes had moderate damage; 589 homes and 68 mobile homes received minor damage. The bulk of this damage was in the south part of the parish especially in the towns of Golden Meadow, Leeville and Port Fourchon. Nicholls State University in Thibodaux suffered a \$1 million loss when strong winds damaged 28 roofs which allowed wind driven rain to soak the interior of these buildings.

Storm Data and Unusual Weather Phenomena

August 1992

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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LOUISIANA Cont'd

Terrebonne Parish: A 5- to 7-foot NGVD storm tide inundated the towns of Cocodrie, Pointe aux Chenes, Montegut, Dulac, and Chauvin. The Louisiana University Marine Consortium in Cocodrie was inundated by 5 feet of water; in addition, it sustained major wind damage when strong winds blew in heavy plate glass windows. The Grand Caillou and Montegut elementary schools were flooded by storm tides. Approximately 255 homes and 547 mobile homes were destroyed; 1,726 homes and 290 mobile homes sustained moderate damage. Strong winds did an estimated \$1 million damage to 201 bed L. J. Chabert Hospital in Houma when part of the roof was torn off and wind driven rain soaked the interior; 70 patients were evacuated. In addition, several businesses in Houma sustained heavy wind damage. Andrew caused an estimated \$350,000 to Terrebonne Parish schools; three schools needed major roof repairs. Forty percent of the Isles Dernieres barrier islands were destroyed by Andrew according to the Louisiana Geological Survey.

St. Mary Parish: A 7- to 8-foot NGVD storm tide flooded unprotected areas of this parish. Non National Weather Service standard anemometers at the Morgan City Steam Plant and at the Berwick Fire Station measured sustained winds of 96 mph with gusts between 112 to 124 mph around 0305 CST on August 26, 1992. Wind damage was most severe in Morgan City, Berwick, Patterson and Franklin areas; 477 homes and 890 mobile homes were destroyed; 1,394 homes and 634 mobile homes received major damage; 3,970 homes, 652 mobile homes, and 148 apartments sustained minor damage. In Morgan City, Fairview and Lakewood hospitals had major wind and rain water damage. The Franklin Foundation Hospital sustained an estimated \$350,000 in damage. Twenty-six St. Mary Parish schools were damaged for an estimated loss of \$2.6 million. Berwick High School that was being used as a last resort shelter for 2,000 people, lost its roof during the height of the hurricane. Louisiana Power and Light Company said that 102 miles of transmission lines and 300 electrical towers were blown down by Andrew between Morgan City and New Iberia. Total property damage was \$150 million.

Iberia Parish: A non National Weather Service anemometer in Jeanerette measured sustained winds of 80 mph with gusts to 90 mph. Damage consisted of 100 homes, 305 mobile homes, and 2 apartments were destroyed; 457 homes, 325 mobile homes, and 1,745 apartments sustained major damage; 2,767 homes, 539 mobile homes, and 220 apartments received minor damage. The towns of Jeanerette, New Iberia, and Loreauville received the bulk of the wind damage. Both the Jeanerette and New Iberia high schools which were being used to shelter 3,600 people lost their roofs during Andrew. Two people at the Jeanerette high school suffered heart attacks and were hospitalized in stable condition. While enroute to the hospital one of the heart attack victim's ambulance and its escorting firetruck became trapped on a road by strong winds and fallen trees for over an hour before they could be rescued by road crews. One of the trees hit the fire truck, injuring a fireman who was hospitalized. Damage consisted of \$125 million in property and \$200 million in sugar crop. A 33-year-old electrical utility worker was electrocuted around 1240 CST on September 3, 1992 in New Iberia.

St. Martin Parish: Fourteen homes and 27 mobile homes were destroyed; 47 homes, 52 mobile homes, and 9 apartments sustained major damage; 418 homes, 125 mobile homes, and 3 apartments received minor damage. Wind damage was concentrated in the towns of St. Martinville, Catahoula, Henderson, Coteau Holmes, and St. John. Eight businesses were destroyed and over 300 were damaged in this parish. \$600,000 loss occurred when the St. Martin Sugar Cooperative in St. John was destroyed. An automotive dealer in St. Martinville had four large plate glass windows and the entire front show room wall blown in. \$250,000 damage was done to 16 St. Martin parish schools.

Assumption Parish: Two homes and 4 mobile homes were destroyed; 6 homes and 20 mobile homes sustained major damage; 79 homes and 4 mobile homes received minor damage. The towns of Pierre Part, Napoleonville, Paincourtville, and Plattenville received the bulk of the wind damage.

Vermilion Parish: Fourteen homes, 27 mobile homes were destroyed; 47 homes, 58 mobile homes, and 9 apartments sustained major damage; 418 homes, 125 mobile homes, and 3 apartments received minor damage. Most of the wind damage occurred in the towns of Abbeville and Delcambre. Two schools sustained roof damage and a warehouse of the Vermilion Parish School system amounting to \$23,134 in damage. Property damage was estimated to be \$975,000.

Lafayette Parish: A National Weather Service standard anemometer measured sustained winds of 55 mph and gusts of 74 mph at the Lafayette airport between 0557 CST to 0652 CST on August 26. Nine homes and ten mobile homes were destroyed; 14 homes and 10 mobile homes sustained major damage; 43 homes and 13 mobile homes received minor damage. Most of the wind damage was confined to the towns of Lafayette, Broussard and Carencro. Sixty-two people received minor

Storm Data and Unusual Weather Phenomena

August 1992

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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LOUISIANA Cont'd

injuries from flying debris during the hurricane. There was one traffic fatality which occurred early on August 26, 1992 at a traffic intersection. Estimated property damages were \$17,250,000.

Iberville Parish: Nine homes and 22 mobile homes were destroyed; 55 homes, 27 mobile homes, and 2 apartments sustained major damage; 313 homes, 618 mobile homes, and 7 apartments received minor damage. Most of the wind damage was concentrated in the towns of White Castle and Bayou Goula. About \$100,000 damage was done to the parish public schools. The White Castle high school lost its roof. A small, brief tornado occurred in Indian Village around 0142 CST on August 26, 1992. Some \$2.7 million in property and \$10 million in crop damage occurred in this parish.

Ascension Parish: One home and two mobile homes were destroyed; 9 homes and 7 mobile homes received major damage; 88 homes, 10 mobile homes, and 10 apartments sustained minor damage. Most of the wind damage was concentrated in the Donaldsonville area. Louisiana Power and Light Company said strong winds toppled 11 steel electrical towers near Donaldsonville. About \$5 million damage was done to the sugar cane crop and \$700,000 damage was sustained by 35 businesses.

East Baton Rouge Parish: The National Weather Service Office at Baton Rouge measured 48 mph sustained winds with gusts of 70 mph between 1000 CST and 1030 CST on August 26, 1992. Eight homes, 2 mobile homes, and 13 apartments were destroyed; 62 homes, 2 mobile homes sustained major damage; 100 homes, 1 mobile home, and 4 apartments received minor damage. Most of the wind damage was concentrated in the Baton Rouge, Zachary areas. The Louisiana State University School of Music received about \$50,000 in damages when it lost its roof to strong winds. Estimated property damages were about \$700,000.

West Baton Rouge Parish: A non National Weather Service standard anemometer at Brusly Landing measured sustained winds at 96 mph. One home and 8 mobile homes were destroyed; 12 homes, 9 mobile homes, and a apartment received major damage; 112 homes, 18 mobile homes, and 5 apartments sustained minor damage. The majority of the wind damage was in the Brusly Landing, Addis areas. A 37-year-old Addis man was injured when he fell off his roof while attempting to make emergency repairs around 0700 CST on August 26, 1992.

Pointe Coupee Parish: Two homes and 8 mobile homes were destroyed; 17 homes; 10 mobile homes and 1 apartment sustained major damage; 119 homes, 16 mobile homes, and 23 apartments received minor damage. About 300 trees and 30 power poles were blown down. Most of the wind damage was concentrated in the New Roads, Livonia areas. Fifty businesses sustained damage. A small tornado occurred in Ventress around 0927 CST on August 26, 1992. Estimated property damage was about \$5 million.

Livingston Parish: Two homes and 6 mobile homes were destroyed; 4 homes and 3 mobile homes sustained major damage; 9 homes and 10 mobile homes received minor damage. Most of the wind damage was concentrated in the Denham Springs area. Four schools had minor roof damage. A 34-year-old Denham Springs man was electrocuted from a fallen wire while cleaning debris in his yard about 0900 CST August 29, 1992.

St. Helena Parish: One mobile home was destroyed; 3 homes and 2 mobile homes sustained major damage; 1 home received minor damage. Most of the wind damage occurred near Montpelier. About \$3 million damage was done to timber.

St. Tammany Parish: Two homes were destroyed; 7 homes and 1 mobile home sustained major damage; 10 homes received minor damage. Two fast-moving small tornadoes were spawned by Hurricane Andrew. The first tornado damaged several homes along an intermittent path that began 5 miles north of Lacombe and ended 4 miles north of Covington between 0825 CST and 0845 CST on August 26, 1992. The second tornado took off the roofs of several homes near Mandeville around 1430 CST. There was some storm tide flooding in Mandeville and Slidell. Several businesses near the Mandeville lakefront were flooded with up to a 1.5 feet of water; in addition, the Mandeville seawall was damaged by high waves. A few homes in the Palm Lake subdivision in south Slidell had some minor flood damage. A barge broke free from its moorings on the Tchefuncte River and was lodged against the Tchefuncte River draw bridge in Madisonville; fortunately, the bridge received only minor damage. Some \$1 million in property damage occurred in this parish.

Storm Data and Unusual Weather Phenomena

August 1992

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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LOUISIANA Cont'd

Tangipahoa Parish: Newspaper accounts indicate that two mobile homes were destroyed, and three homes suffered major damage. The Tangipahoa Sheriff's Office reported a small, fast moving tornado was responsible for some of this damage along an intermittent path from Tickfaw to Loranger around 1815 CST on August 26, 1992; in addition, some 300 trees were blown down. Two people were injured when they drove into a large fallen tree in Hammond. A cafe lost its roof and a car wash was destroyed in Pontchatoula. Strong winds blew down a radio tower near Independence. Only a few homes were flooded in Tangipahoa Parish even though 10.00 to 11.00 inches of rain were reported in Hammond, Robert and Amite.

Plaquemines Parish: The National Weather Service automated C-Man Station at the Southwest Pass of the Mississippi River recorded sustained winds of 67 mph with gusts of 77 mph around 1600 CST on August 25, 1992. One home was destroyed; 6 homes and 1 mobile home sustained major damage; 2 mobile homes received minor damage. A 62-year-old man was killed in his vehicle near Empire while evacuating during the afternoon of August 24, 1992; 2 other people were injured in this accident.

St. Bernard Parish: One home and mobile home was destroyed; 1 home and 3 mobile homes sustained major damage; 4 homes and 1 mobile home received minor damage due to strong winds. A 6-foot NGVD storm tide flooded roads outside the federal hurricane protection levee.

Jefferson Parish: One home and 23 mobile homes were destroyed; 3 homes and 5 mobile homes sustained major damage; 17 homes and 8 mobile homes received minor damage. Most of this damage was confined to Grand Isle where the National Weather Service automated C-Man recorded sustained winds of 58 mph and gusts to 77 mph at 1600 CST on August 25, 1992.

St. Charles Parish: Five homes sustained major damage; 35 homes and 5 mobile homes received minor damage. Most of the wind damage was concentrated in the Luling and Hahnville areas.

Morehouse Parish: A brief tornado moving rapidly west from Beekman to Stevenson destroyed a mobile home, did major damage to another home, and minor damage to 6 homes around 1430 CST on August 26, 1992. Three people received minor injuries when the mobile home was destroyed near Beekman.

Union Parish: A tornado blew down a few trees just west of Marion around 1500 CST on August 26, 1992 according to police. A second tornado blew down some trees and rolled over a mobile home injuring four people 5 miles southwest of Point at 1517 CST.

Madison Parish: Four brief tornadoes were reported in this parish. Two occurred in open country east and southeast of Tallulah. A tornado heavily damaged a barn, rolled over a farm tractor, and caused minor damage to four homes near Mound around 1900 CST on August 26, 1992. Another tornado did minor damage to two homes 15 miles southwest of Tallulah at 1904 CST.

Franklin Parish: A tornado blew down many trees 10 miles east of Winnsboro at 1920 CST on August 26, 1992 according to the Franklin Parish Office of Emergency Preparedness.

MISSISSIPPI

MSZALL

26-27

Hurricane Andrew

Early on August 26 spiral bands from Hurricane Andrew, then located along the Louisiana coast, began to affect Mississippi. Andrew was downgraded to a Tropical Storm by the time it entered the extreme southwestern corner of Mississippi during the afternoon of August 26. Andrew moved northeast across Mississippi and was downgraded to a Tropical Depression shortly after entering the state. Andrew exited the northeastern corner of the state on the afternoon of August 27. During the 24 hour period, Andrew was responsible for 29 incidents of wind damage, many of which were caused by weak tornadoes. A 100-mile-wide band of rainfall between four and eight inches fell along the storm's track, with isolated totals of over nine inches recorded.

Walthall County

26 0625CST 0 0 3 0 Thunderstorm Winds
Scattered trees were blown down throughout the county.

Pike County

26 0635CST 0 0 3 0 Thunderstorm Winds
Scattered trees were blown down throughout the county.

Storm Data and Unusual Weather Phenomena

August 1992

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
MISSISSIPPI Cont'd									
Lincoln County	26	0635CST			0	0	3	0	Thunderstorm Winds
									Scattered trees were blown down throughout the county.
Lawrence County Topeka	26	0700CST	2.0	1	0	1	4	0	Tornado (F1)
									The tornado damaged a house and two mobile homes. Several trees were blown down.
Lawrence County 3 NW Topeka	26	0705CST	1.0	8	0	0	2	0	Tornado (F0)
									Several trees were blown down.
Lincoln County 3 S Brookhaven	26	0720CST	2.0	100	0	0	4	0	Tornado (F1)
									A tornado lifted the roof off of a house and blew down several trees.
MSZ10 and MSZ11	26	0800CST 2100CST			0	0	5	0	High Winds
									Tropical Storm Andrew caused widespread damage over the following counties: Adams, Amite, Claiborne, Copiah, Franklin, Jefferson, Jefferson-Davis, Lawrence, Lincoln, Marion, Pike, Simpson, Walthall; and Wilkinson. Strong winds as high as 65 mph at Natchez, in Adams County, blew down numerous trees and powerlines over much of Southwestern Mississippi. Several houses and buildings throughout this area received minor damage, mainly to roofs. Much of this area went without power for several days.
Lawrence County 3 NE Tilton	26	0825CST	1.5	100	0	0	3	0	Tornado (F0)
									Numerous trees were blown down.
Copiah County 3 W Bowerton	26	0826CST	2.0	150	0	0	3	0	Tornado (F0)
									Numerous trees were blown down.
Copiah County Hazelhurst	26	1015CST			0	0	2	0	Thunderstorm Winds
									A funnel cloud was reported over Hazelhurst but never touched down. High wind with this thunderstorm did blow down several trees in Hazelhurst.
Claiborne County 1 SE Rock Springs	26	1025CST	2.0	100	0	0	2	0	Tornado (F0)
									Several trees were blown down along the Natchez Trace Parkway.
Warren County Yokena	26	1040CST	1.5	80	0	0	2	0	Tornado (F0)
									Several trees were blown down.
Leake County 2 SE Thomastown	26	1600CST	1.5	150	0	0	4	0	Tornado (F1)
									The tornado lifted the roof and chimney off of a house, bent several road signs, and blew down a few pine trees.
Copiah County 5 W Crystal Springs	26	1620CST	1.0	100	0	0	2	0	Tornado (F0)
									Several trees were blown down.

Storm Data and Unusual Weather Phenomena

August 1992

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
MISSISSIPPI Cont'd									
Kemper County 10 SW DeKalb	26	1625CST	1.0	100	0	0	4	0	Tornado (F1)
									One mobile home was destroyed and numerous trees were blown down.
Yazoo County Yazoo City	26	1627CST	1.0	100	0	0	2	0	Tornado (F0)
									Numerous trees and limbs were blown down.
Humphreys County Belzoni	26	1640CST	1.0	100	0	0	3	0	Tornado (F0)
									Several trees and limbs were blown down. An awning was blown off of a building.
Attala County 4 SW Possumneck	26	1700CST	2.0	150	0	0	3	0	Tornado (F0)
									A tornado did minimal damage to a farm and blew down several trees.
Holmes County Lexington	26	1700CST	1.5	100	0	0	4	0	Tornado (F0)
									Several trees were blown down and two houses were damaged.
Clarke County 2 W Middleton	26	1700CST	1.0	50	0	0	2	0	Tornado (F0)
									Several trees and debris were scattered across a highway.
Lauderdale County 10 SE Meridian	26	1735CST	2.0	150	0	2	5	0	Tornado (F1)
									One mobile home was destroyed, five houses were damaged, and numerous trees and powerlines were blown down.
Smith County 2 SW Mize	26	1840CST	2.0	150	0	0	3	0	Tornado (F0)
									Lots of trees were blown down. The tops of several chicken houses were blown.
Copiah, Hinds, Lawrence, Leake, Lincoln, Madison, Rankin, Scott, Simpson, Smith, and Warren Counties	26 27	2000CST- 0800CST			0	0	5	0	Flood
									Heavy rainfall from Tropical Storm Andrew caused flooding across the following counties during the night of August 26 and the morning of August 27: Copiah, Hinds, Lawrence, Leake, Lincoln, Madison, Rankin, Scott, Simpson, Smith, and Warren. Most of the reported flooding was of low lying creeks overflowing their banks, low lying areas, and poor drainage areas. Many county roads were covered with water and were not passable. A bridge was washed out in Copiah County and another bridge was washed out in Lincoln County.
Yazoo County Satartia	26	2000CST	1.5	100	0	0	3	0	Tornado (F0)
									Many trees were blown down.
Simpson County	26	2010CST			0	0	3	0	Thunderstorm Winds
									Trees were blown down over many areas of the county.
Sharkey County 5 SW Spanish Fort	26	2020CST	2.0	100	0	0	3	0	Tornado (F0)

Storm Data and Unusual Weather Phenomena

August 1992

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
MISSISSIPPI Cont'd									
									Numerous trees were blown down.
Simpson County Harrisville	26	2030CST	2.0	150	0	0	2	0	Tornado (F0)
									Many trees were blown down.
Yazoo County 3 NE Yazoo City	26	2125CST	1.5	100	0	0	3	0	Tornado (F0)
									Numerous trees were blown down.
Clarke County 8 N Quitman	27	0110CST	1.0	100	0	0	2	0	Tornado (F0)
									Numerous trees were blown down.
Lauderdale County 10 NW Meridian	27	0140CST	1.0	100	0	0	2	0	Tornado (F0)
Lauderdale County 3 NW Meridian	27	0201CST	1.0	50	0	0	2	0	Tornado (F0)
									Several trees were blown down.
Clarke County 8 W Quitman	27	0220CST	1.0	50	0	0	2	0	Tornado (F0)
Lauderdale County 6 N Meridian	27	0240CST	1.0	100	0	0	2	0	Tornado (F0)
									Numerous trees were blown down.
Lauderdale County and Clarke County	27	0500CST			0	0	0	0	Flood
									Numerous streets and roads were under water, but no apparent damage was done.
Clay County West Point	27	1000CST			0	0	3	0	High Winds
									Winds of up to 50 mph uprooted several trees and knocked over a few powerlines in West point.
Prentiss County	27	1600CST			0	0	0	0	Flash Flood
									Many small streams and creeks flooded low lying areas. Some county roads were covered and had to be closed.
Lamar County 1 E Sumrall	27	1815CST	2.0	100	0	0	3	0	Tornado (F0)
									Numerous trees were blown down.

STORM DAMAGE CATAGORIES

REFERENCE NOTES

1	Less than \$50	0/Blank	None reported.
2	\$50 to \$500	*	Miles instead of yards.
3	\$500 to \$5,000	**	Yards instead of miles.
4	\$5,000 to \$50,000	@	Includes heavy sleet storm.
5	\$50,000 to \$500,000	#	Freezing drizzle and freezing rain, commonly known as glaze.
6	\$500,000 to \$5 Million	≠	Report incomplete.
7	\$5 Million to \$50 Million	≠≠	Report not received.
8	\$50 Million to \$500 Million	o/c	Indicates Crop Damage amount is included in the value given for property damage.
9	\$500 Million to \$5 Billion		

When reports are not received or are incomplete, the Storm Summary National Death and Injury totals may also be incomplete.

Definition of Fujita Tornado Scale (F scale)

(F0) Gale tornado (40-72 mph): Light damage
Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage sign boards.

(F1) Moderate tornado (73-112 mph): Moderate damage
The lower limit (73 mph) is the beginning of hurricane wind speed; peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads.

(F2) Significant tornado (113-157 mph): Considerable damage
Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.

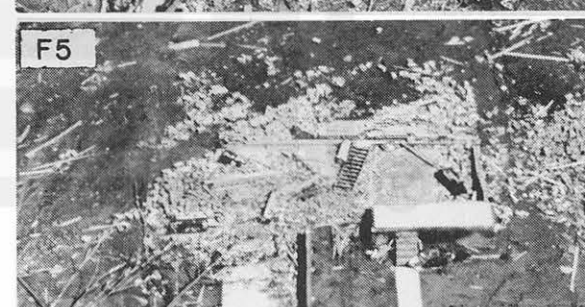
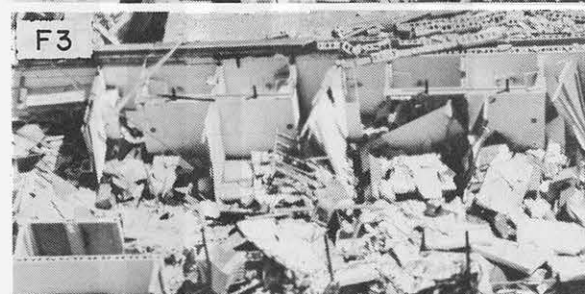
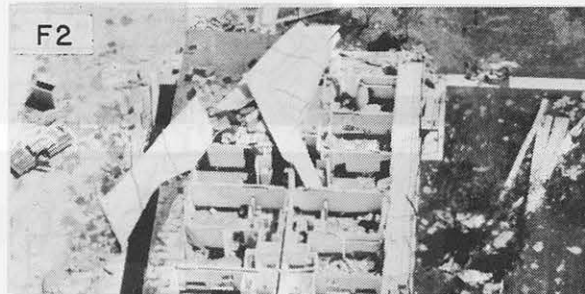
(F3) Severe tornado (158-206 mph): Severe damage
Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown.

(F4) Devastating tornado (207-260 mph): Devastating damage
Well-constructed houses leveled; structure with weak foundation blown off some distance; cars thrown and large missiles generated.

(F5) Incredible tornado (261-318 mph): Incredible damage
Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 m; trees debarked; incredible phenomena will occur.

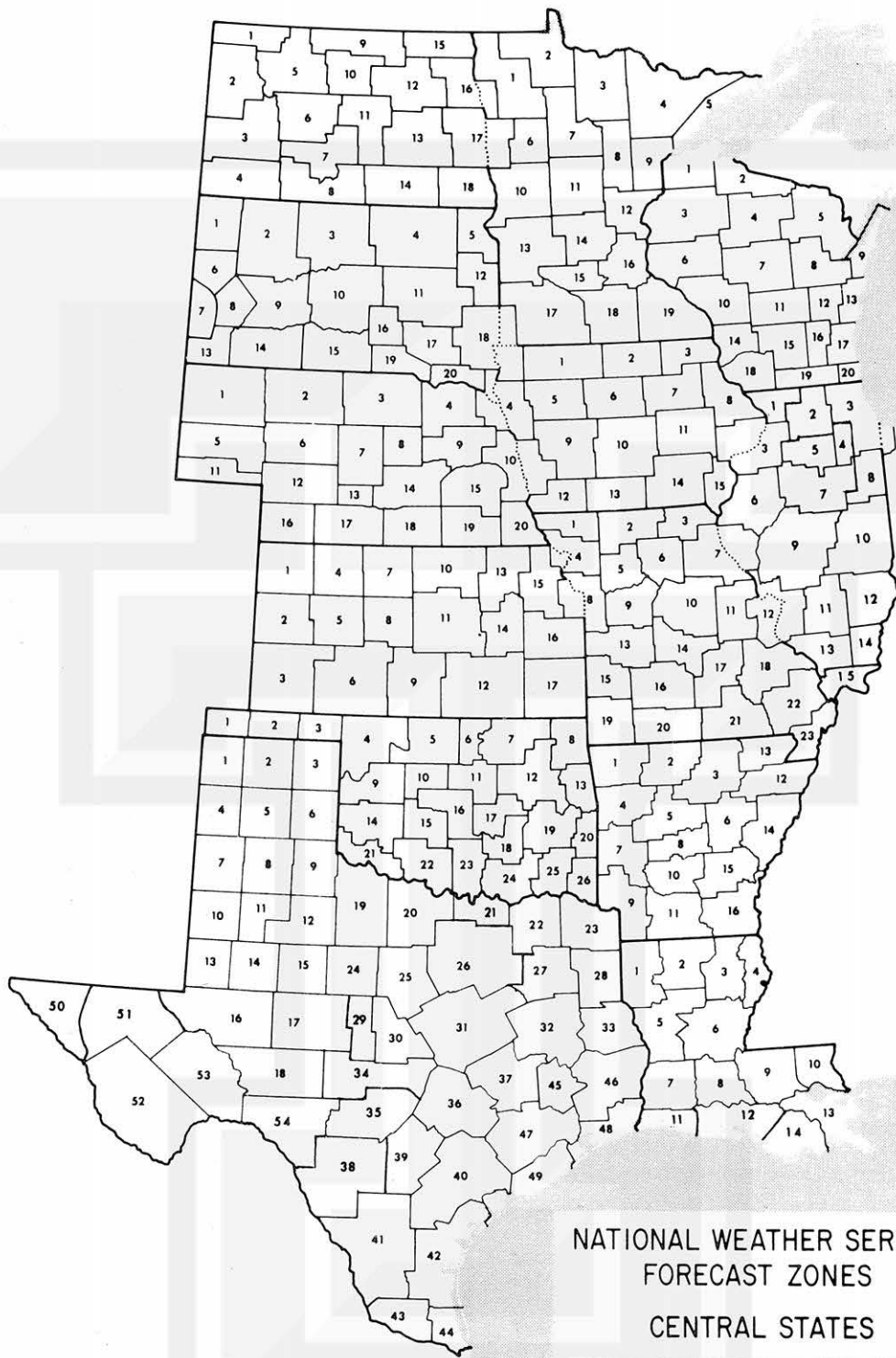
(F6-F12) (319 mph to Mach 1, the speed of sound):
The maximum wind speeds of tornadoes are not expected to reach the F6 wind speeds.

(F0+F1) Weak Tornado
(F2+F3) Strong Tornado
(F4+F5) Violent Tornado



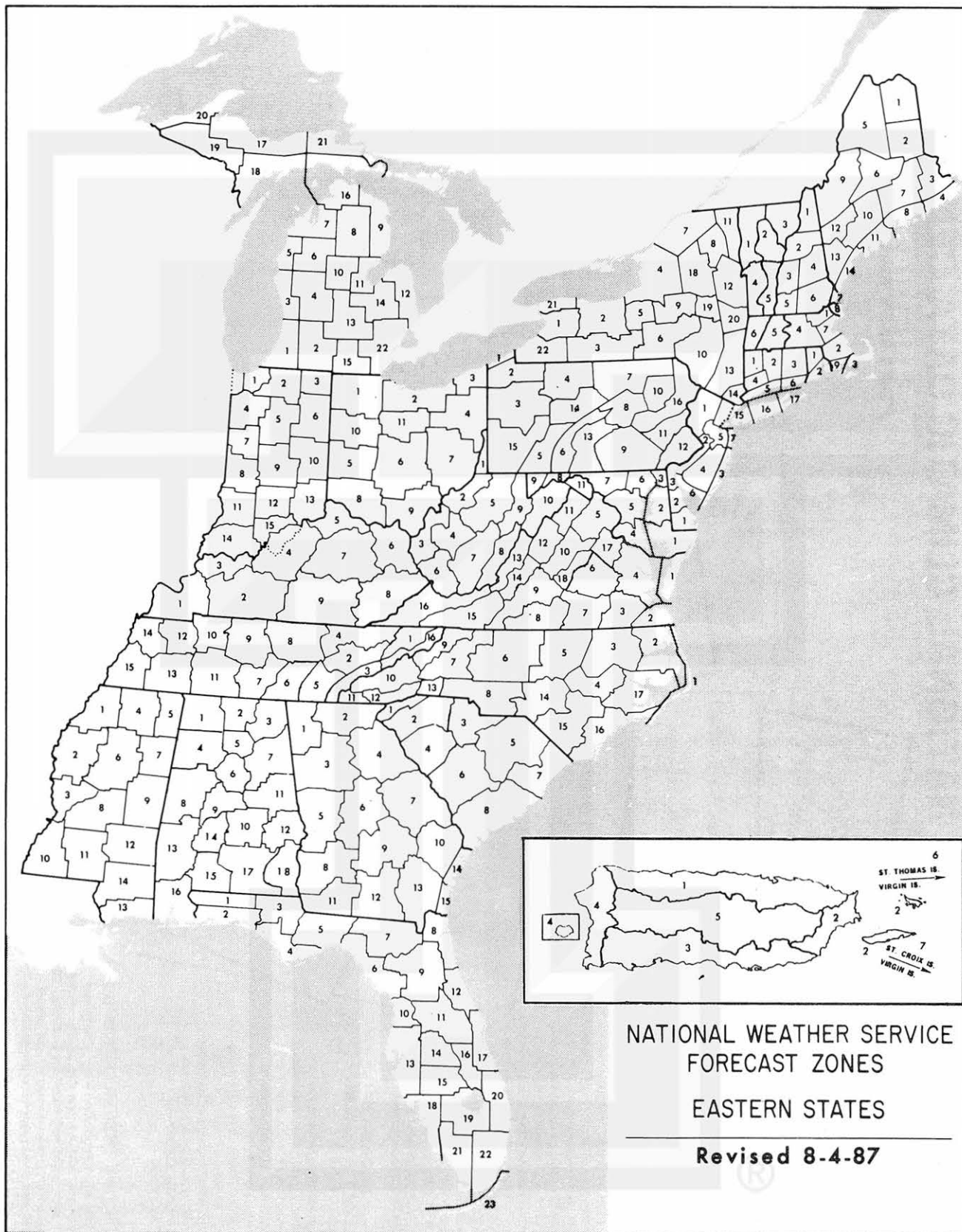
From J. Atmos. Sci., August 1981, p. 1517-1519

USCOMM-NOAA-ASHEVILLE, N.C. 1993- 500



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STORM DATA

Monthly issue presents a chronological listing, by states, of occurrences of storms and unusual weather phenomena, together with data on the paths of individual storms, deaths, injuries, and estimated property damage, and a brief narrative description of each event. A new section in the bulletin entitled "OUTSTANDING STORMS OF THE MONTH" highlights severe weather and includes descriptive photographs of storms, their tracks, and analyzed maps. The December issue includes annual summaries of tornadoes and lightning and North Atlantic tropical cyclones.

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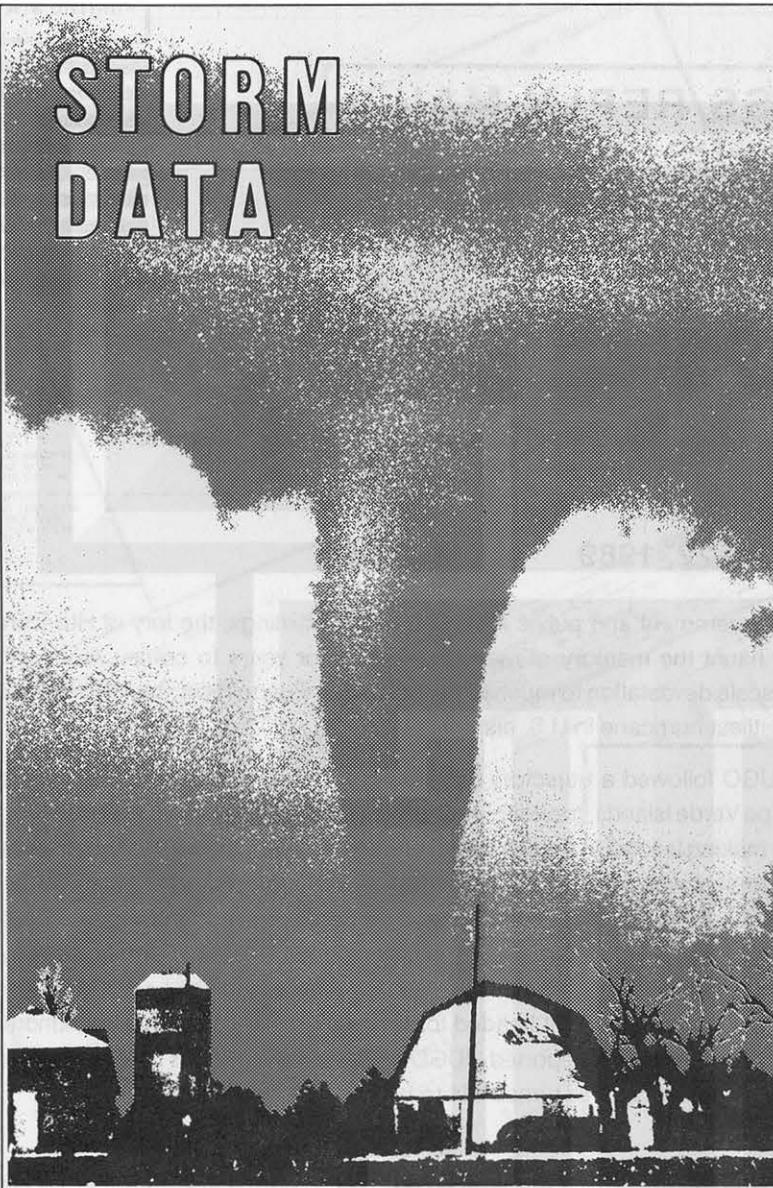
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STORM DATA

Photo courtesy: Larry Miller, Kansas Heritage Photography



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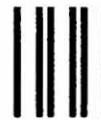
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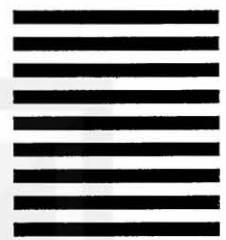
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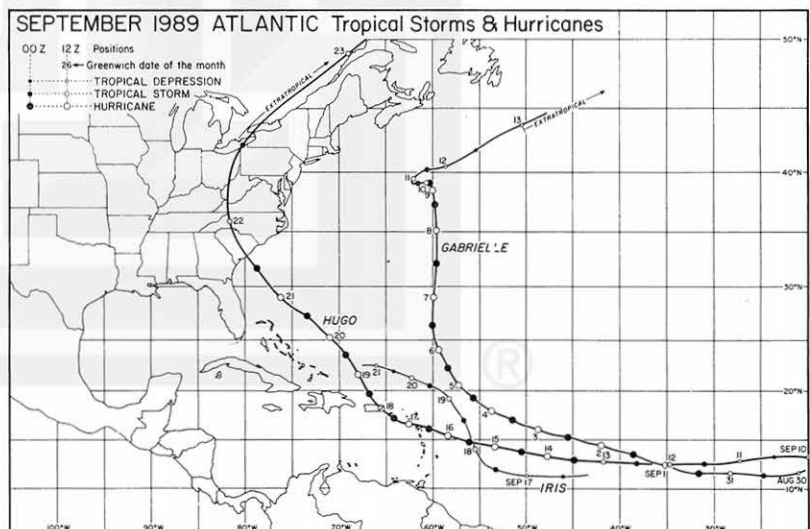
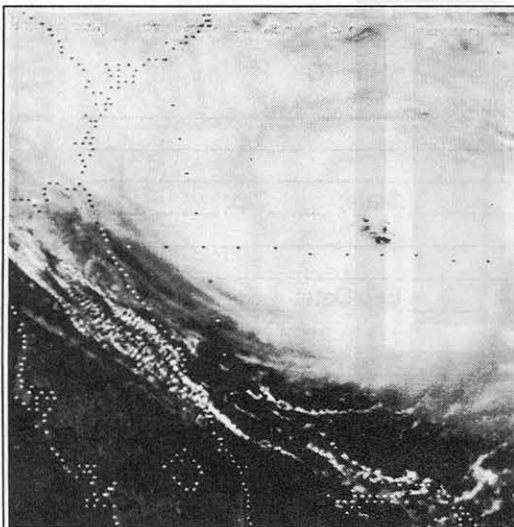
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HURRICANE HUGO, SEPTEMBER 10-22, 1989

Despite excellent warning lead times and excellent government and public response to the warnings, the fury of Hurricane Hugo took many by surprise and will undoubtedly haunt the memory of many Americans for years to come. Along with numerous deaths and injuries, HUGO brought large-scale devastation to much of the Carolinas, Puerto Rico, the Virgin Islands and other islands of the Caribbean, making it the costliest hurricane in U.S. history.

Over the course of slightly less than two weeks, HUGO followed a trajectory that was typical for an Atlantic Basin tropical system: originating near Africa in the vicinity of the Cape Verde Islands, traveling west across the tropical Atlantic to the Leeward Islands, turning northwest toward the U.S. coast until making landfall in the Carolinas, and once inland, turning northeast under the influence of the Westerlies and becoming extratropical while skirting the eastern U.S.-Canada border (see map below). The system originated from a cluster of thunderstorms that moved off the African coast on September 9th and organized into a tropical depression on the 10th just southeast of the Cape Verde Islands. The system moved west at 18 knots, attaining storm status on the 11th, and hurricane status on the 13th while located about 1100 nautical miles east of the Leeward Islands. HUGO gradually turned west-northwest and slowed in its translation as it headed for the Islands. While still several hundred miles east of the Islands on the 15th, the first reconnaissance aircraft reported HUGO as having a minimum central pressure of 918 mb and an estimated maximum surface wind of 140 knots. This turned out to be HUGO's maximum intensity.



MONTHLY PRECIPITATION TOTALS												1987 NORTH CAROLINA						
STATION	ANNUAL	MONTH										SEP	OCT	NOV	DEC			
		JAN	FEB	MAR	APR	MAY	JUN	JUL										
NORTH CAROLINA																		
ASHEVILLE WSO AP	34.57	1.11	1.85	2.75	0.57	3.55										4.19	5.28	4.28
ASHEVILLE	25.67	0.71	1.57	1.81	0.53	2.88										2.77	4.15	2.94
ASHFORD	36.74E	1.20	2.70	2.90	0.54E	2.88										3.80	4.90	4.80
BADIN	-	1.30	2.60	3.60	1.20											2.40	4.10	2.90
B EVERETT JORDAN DAM	-	1.70	1.50													-	1.70	
BOONER 5 WSW	-	1.00	2.10															
BURLINGTON 3 NNE	-	0.80	1.92E															
CAPE HATTERAS WSO	48.86	5.75																
CARTHAGE 8 SE	-	1.70																
CATALDOCHEE	-	0.6																
CHARLOTTE WSO AP	26.91																	
CLINTON 2 NE	35																	
DALTON																		
DOBSON																		
EDEN																		
ELIJAH																		
ELI																		
FAYE																		
FRANK																		
GREENS																		
GREENVILLE																		
HELTON																		
HOBOKEN																		
LAKE LURE																		
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ROANOKE RAPIDS																		
ROARING GAP 1 NW																		
SHELBY 2																		
SNEADS FERRY 2 ENE																		
SWANNANOA 2 SSE																		
WILKINGTON WSO AP																		
WILSON 3 SW																		
YADKINVILLE 6 E	29																	

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HOURLY PRECIPITATION DATA is published monthly and presents daily, hourly, and maximum short duration data for recording rain gage stations in each state except Alaska. Also included are a published station index and a locator map for the state. In addition to the regularly published data, the December publication contains a tabulation of monthly and annual total precipitation amounts as an annual supplement.

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* **MONTHLY** editions contain:

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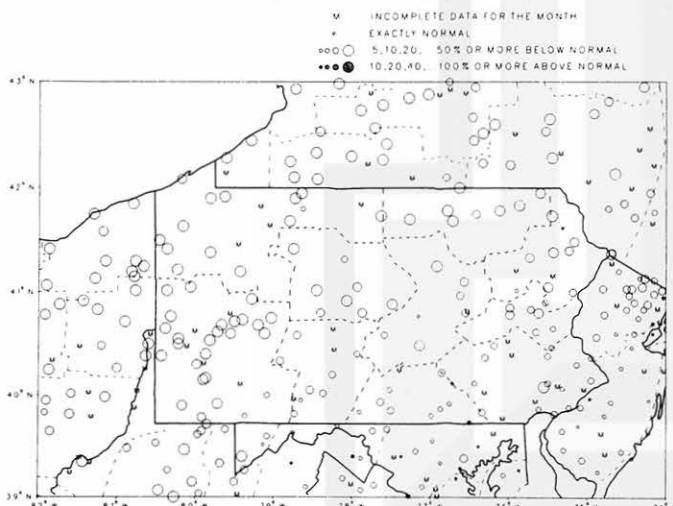
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MONTHLY PRECIPITATION DEPARTURE FROM
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CIRCLE DIAMETER IS PROPORTIONAL TO DEPARTURE ON A CONTINUOUS SCALE

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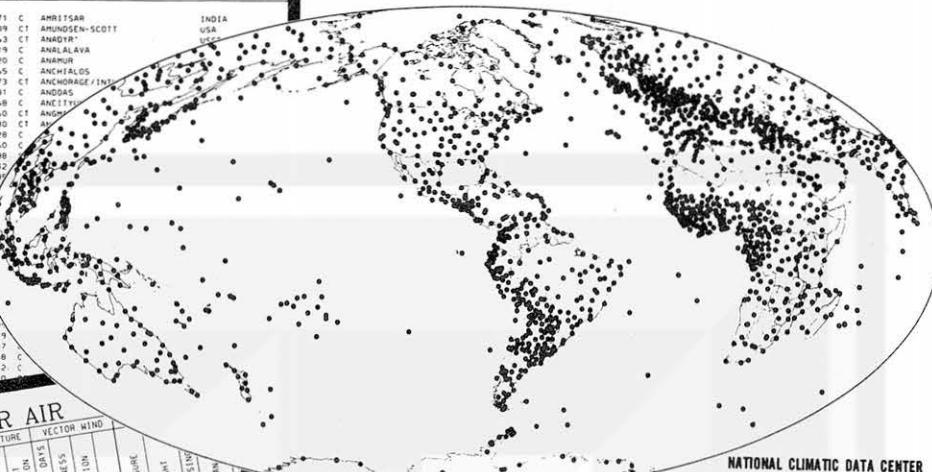
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64756	C	ABEHCHE	CHAD	17320	C	ANAMUR
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12246	C	ABILENE, TX	USA	91568	C	ANENITH*
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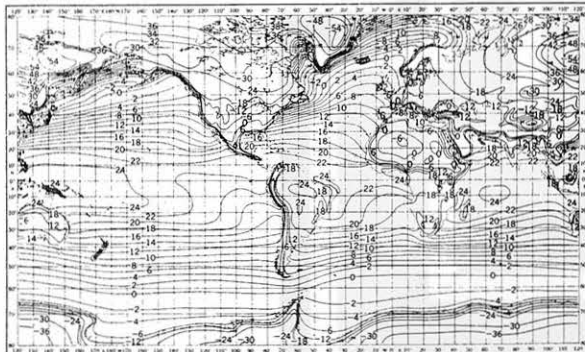
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Tables of both Surface and Upper Air data are presented. Surface data tables contain elements of pressure, temperature, vapor pressure, precipitation, and sunshine. Upper Air tables contain geopotential heights, temperatures, dew point depressions, and vector winds for ten selected pressure levels between the surface and thirty millibars (hectopascals). A Station List is also provided which, in the January and July editions, contains all stations authorized for publication. In other months the list contains only those stations from which data no more than two months old have been recently received.

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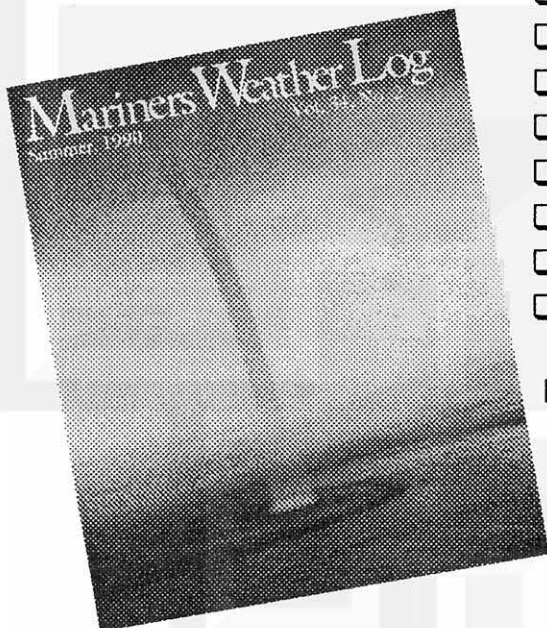
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