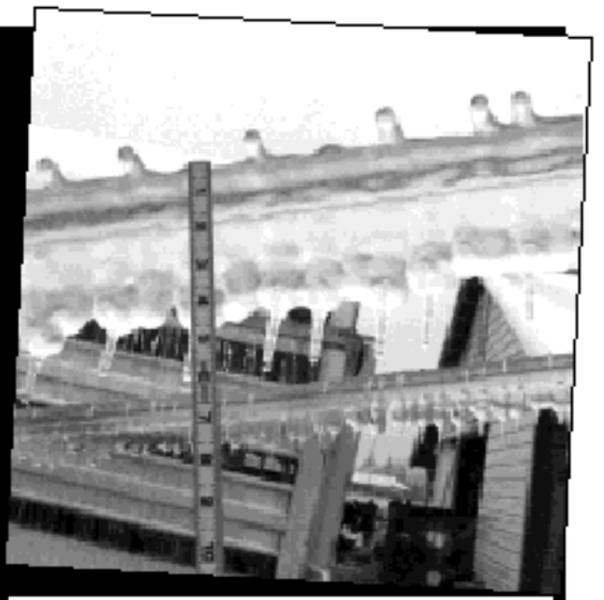
Technical Report 94-03 October 12, 1994

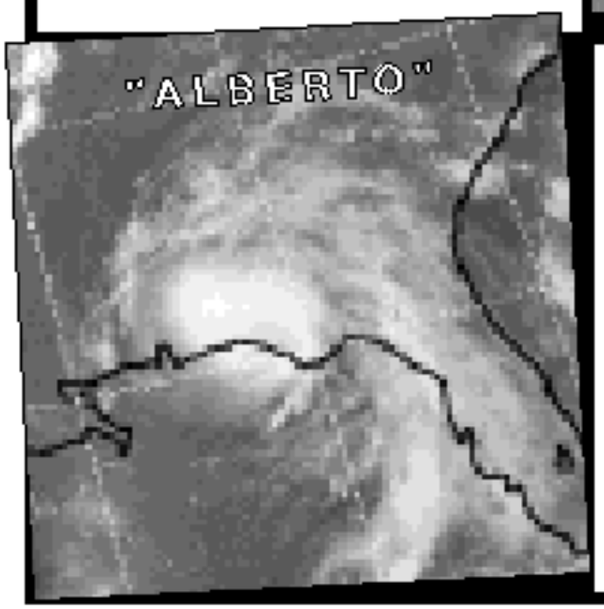
NATIONAL CLIMATIC DATA CENTER

RESEARCH CUSTOMER SERVICE GROUP

1994 WEATHER IN THE SOUTHEAST

The
February
Ice Storm
and





the
July
Flooding

NEAL LOTT
Physical Scientist

TOM ROSS
Meteorologist

INTRODUCTION

During the first seven months of 1994, the Southeast was struck by a severe ice storm in February, followed by severe flooding in July. The ice storm resulted in over $3 billion in damage, while the flooding, caused by the remnants of Tropical Storm Alberto, resulted in up to $1 billion in damage. This report provides details and climatic data from these two events.

FEBRUARY ICE STORM (FEBRUARY 9-13, 1994)

The ice storm which struck the Southeast in February 1994 resulted from a typical icing scenario: a quasi-stationary front with overrunning moisture producing freezing precipitation in colder air near the surface to the north of the front. However, this storm was very unusual in 2 respects: 1) Its areal extent was much greater than usually found in ice storms, and 2) The precipitation amounts were much higher than usually found in ice storm situations, with some amounts exceeding 5 inches for the event (see Table 1).

The ice storm began in the western sections of the Southeast on the 9th and gradually spread eastward into Tennessee,

Mississippi, and Alabama. These three states suffered the worst damage before the storm continued northeastward through the Carolinas, Virginia, and Kentucky. A large temperature gradient across the front (some temperature drops of 40-50 degrees Fahrenheit from the previous day's readings occurred) contributed to the 'energy' of the storm. Ice accumulations ranged from 1 inch to as much as 6 inches in parts of northern Mississippi--unprecedented ice thicknesses in this area for a freezing rain event.

Overall, the storm produced over $3 billion in damages and cleanup costs, and at least 9 deaths were attributed (directly or indirectly) to the storm. Also, well over 2 million customers were without electricity at some time, and 1/2 million were still without power 3 days after the storm. There were even some instances of residents without power for 1 month after the storm. Many homes, businesses, and vehicles were damaged by falling trees and limbs. Following is a state-by-state account of the destruction, for those states from which detailed information was available (some states provided much more detailed information than others):

Alabama: A 7-county area of northwest AL was devastated by the storm. Numerous trees and limbs blocked roads making travel nearly impossible, and damage to homes and businesses was

widespread. Due to the broad area with rainfall amounts of over 3 inches (some over 5 inches), flooding was also a problem, although not nearly as damaging as the ice. Total damages were estimated at nearly $500 million.

Arkansas: Southeast AR was affected more severely than the rest of the state with some areas having almost every power pole downed by the ice. Approximately 120,000 customers were without power at some time during the storm, and up to 2 weeks were required to restore power to some locations. Some power companies called this the worst ice storm in their history. Damage and cleanup costs were estimated at over $50 million.

Kentucky: The south-central and southeast sections of the state were hardest hit. Ice accumulated to over 3 inches in some locations. Over 190,000 customers were without electricity at some point, with power not restored for over a week in some locations. KY also reported 150 injuries for the event--the only state to officially report a significant number of injuries. Damage estimates were placed at over $50 million for the state.

Louisiana: Northern LA was hard hit with over 100,000 customers without power due to the storm. The Forest Service reported that 256,000 acres of forest were damaged by icing. This was the worst ice storm in LA since 1983, with damage

estimated at about $13.5 million.

Mississippi: Northern MS was probably the area of the Southeast hardest hit by the storm. Ice thicknesses of 3-6 inches were common and caused catastrophic damage in many areas. Over 5 inches of rainfall at some locations produced considerable flooding in addition to the ice damage. 3.7 million acres of commercial forests were severely damaged, with losses estimated at $1.3 billion. Urban tree losses were estimated at $27 million. 25% of the state's pecan crop will be lost for the next 5-10 years at an estimated cost of $5.5 million per year. Approximately 750,000 customers were without power at some point, with about the same number also without water. Electricity to some locations was not restored for 1 month. Utility damage was estimated at about $500 million, which places total damage and costs for the state at nearly $2 billion!

North Carolina: The western and north-central parts of the state were most affected, with ice thicknesses generally less than 2 inches reported. Most of the damage was to utilities as over 100,000 customers were without power at some point--some for several days. Damage estimates were rather minor compared to other states--generally less than $10 million.

South Carolina: Northwest SC was the only part of the state

significantly affected. Power outages to nearly 100,000 customers were reported, with some out for several days. Damage estimates were less than $5 million.

Tennessee: A large portion of TN was affected by the storm, with overall destruction ranking second behind MS. Many locations experienced over 5 inches of rainfall, thereby creating flooding problems in addition to the icing. Shelbyville reported 7.78 inches--the maximum for the event. About 770,000 customers lost power for some period of time, with nearly a month required to restore all of the outages. There was one traffic fatality attributed to the storm when a tree fell on a moving car. Total damages/costs were placed at nearly $500 million.

Texas: The northeast portion of the state was most affected by the storm, with over 30,000 customers without power at some point. Up to 4 inches of ice and sleet accumulated in some areas, and 2 fatalities were reported due to traffic accidents. Damages were estimated at well under $50 million.

West Virginia: WV was not as severely affected as states farther south, although about 50,000 customers were without power at some point. The southern part of the state received most of the damage, with damage estimates of less than $1 million overall.

JULY FLOODING (EARLY - MIDDLE JULY, 1994)

Severe flooding struck the southwest half of Georgia during the early to middle portion of July. The flooding was the result of the slow-moving, meandering remnants of Tropical Storm Alberto. Alberto entered the U.S. over the panhandle of Florida near Fort Walton Beach with maximum sustained winds of around 65 MPH, and a minimum pressure of 993 mb (measured just prior to landfall). The highest storm surge was near Destin, FL with a height of about 5 feet. The storm moved slowly northward into southeast Alabama, and then into west-central Georgia. It then slowed to a crawl, even drifting southward and then westward for a time, producing rainfall amounts that exceeded 10 inches in many locations, with over 20 inches in a few spots. (See Figure 1 for the storm's track.) As there were no reported tornadoes or significant wind damage, the severe damage was solely the result of extremely heavy rainfall.

Flooding also affected some parts of the Florida panhandle and southeast Alabama. The flooding severely damaged or destroyed many homes, businesses, farms, highways, dams, and bridges, with damage estimates for the three affected states now placed at between $750 million and $1 billion. Damage to government-owned structures was estimated to be nearly $60

million. Agricultural damage estimates are placed at around $100 million, but may well be higher in the final analysis.

Georgia by some accounts experienced its worst flooding in modern times. An estimated 1700 roads and 600 bridges were forced out of service, and several towns were largely under water. Over 40,000 people were evacuated due to the rising waters, and about 12,000 homes and businesses were destroyed or severely damaged by the flooding. Thirty people were killed in Georgia and 2 were killed in Alabama--many of these vehicle-related. Approximately 11,500 Georgians applied for federal disaster assistance, as 55 counties in Georgia were declared disaster areas. Also, 13 counties in Florida and 10 counties in Alabama were declared disaster areas. (See Figure 2 for a map of counties declared disaster areas.) $60 million in federal aid was approved for the flood-damaged areas.

Over 400,000 acres of farmland in Georgia were flooded, where water covered at least 60,000 acres of peanuts, 19,000 acres of cotton, and 10,000 acres of corn. Alabama also reported over 400,000 acres to have been flooded or damaged. In Georgia alone, the flood waters covered an area the size of Massachusetts and Rhode Island combined. In Georgia, Alabama, and Florida combined, over 900,000 acres were under water at one time. Also, 300,000 Georgia residents were left without safe drinking water

for periods ranging up to 3 weeks.

In Bainbridge GA, National Guard troops and prison inmates built a 10-foot earthen dam to protect a fertilizer plant. Luckily, due to their efforts and the flood crest at Bainbridge being lower than expected, the dam held. On one Georgia farm, a quarter-of-a-million chickens were reportedly killed by the flooding. Over 100 dams were breached in Georgia, and Interstate 75 was covered with over 4 feet of water in places, forcing its closure for 60 hours. In Albany GA, the east and west parts of town were separated by the closing of 4 bridges for over a week. The Flint River at Albany overflowed as far as 3 miles from its normal river edge. Numerous coffins were forced from their cemetery plots by the water pressure.

The 5 river basins most severely affected were:
The Flint River Basin in western Georgia,
the Ocmulgee River Basin in central Georgia,
the Chattahoochee River Basin along the Georgia-Alabama line,
the Choctawhatchee River Basin in Alabama,
and the Pea River Basin in Alabama.

Several 100-year (or greater) flood events are estimated to have occurred along and in the vicinity of the Flint and Ocmulgee Rivers in Georgia. The Ocmulgee River at Macon reached a level

more than 4 feet over the top of the levee. Macon and Albany were both very hard hit by the flooding. Nearly a dozen NWS river forecast locations observed record flood stages, some by 5 to 7 feet over the previous record and 20 feet over flood stage. Figure 3 graphically shows the rivers which experienced major and/or record flooding. Some of the notable flood crests included (levels in feet):

	Jul 94	Flood Stage	Old Record (* if broken)
Georgia:			
Flint River at Newton	45.2	24.0	41.3 (1925) *
Flint River at Bainbridge	37.3	25.0	40.9 (1925)
Flint River at Albany	42.7	20.0	37.8 (1925) *
Altamaha R. at Plant Hatch	84.0	74.5	N/A
Ocmulgee River at Macon	35.3	18.0	29.8 (1990) *
Kinchafoonee R. at Dawson	26.6	13.0	20.4 (1990) *
Alabama:			
Choctawhatchee R. at Geneva	42.2	23.0	N/A
Florida:			
Apalachicola R. at Blounstown	27.4	15.0	28.6 (1929)
Woodruff Dam at Chattahoochee	76.3	66.0	79.6 (1929)

Figures 4, 5, and 6 illustrate the unusually heavy rainfall.

Americus GA recorded the heaviest amount with 21.10 inches for the 24-hour period ending at 7 AM on July 6th. This far exceeded the estimated 100-year return period 24-hour rainfall of about 8.50 inches for this area. In fact, 15 of the deaths in Georgia occurred in Americus. Tables 2 and 3 list locations which received at least 10 inches of rainfall. Although the amounts exceeding 20 inches are certainly noteworthy, the large area which received at least 8-10 inches was the chief culprit in the tremendous runoff and widespread flooding. In fact, some flooding continued until the end of July.

Finally, Table 4 provides a summary of weather-related disasters of the past 15 years with at least $1 billion in damages/costs. As it shows, these last 2 events to strike the Southeast are the latest in a series of very damaging events to affect the U.S. over the past 7 years, with 6 of the events occurring during the past 2 years.

ACKNOWLEDGEMENTS/REFERENCES

The information for this report was collected from numerous sources. They include the Climate Analysis Center, the National Weather Service (NWS), the Southeast Regional Climate Center, NCDC's Storm Data publication, and various news media reports.

Especially noteworthy contributors were Scott Kroczynski with the NWS Special Studies Branch (contributed Figures 1-3), William Angel and Bob Summers with NCDC's Operations and Support Division (contributed Figures 4-6 and data for Tables 2-3), and Scott Miller with NCDC's Global Climate Lab (contributed front cover). For those desiring further information or data, please contact NCDC's Climate Services Branch: Phone 704-271-4800, Fax 704-271-4876, Internet orders@ncdc.noaa.gov. Also, this and other reports, along with various on-line datasets, are available via our Mosaic/WWW system (http://www.ncdc.noaa.gov).

TABLE 1 - PRECIPITATION AMOUNTS (MELTED) FOR FEB 9-13, 1994
FOR STATIONS WITH AT LEAST 5 INCHES (MOST FELL ON
FEB 9-11)

ALABAMA:

HUNTSVILLE MADISON	6.02
RUSSELLVILLE	5.65
HALEYVILLE	5.48
ADDISON	5.40
MOULTON	5.36
HODGES	5.36
HANCEVILLE	5.30
ATHENS	5.18
HAMILTON	5.14
BELLE MINA	5.12

MISSISSIPPI:

AMORY LOCK & DAM A	5.94
VAIDEN	5.56
MINTER CITY	5.49
ABBEVILLE	5.34
VERONA EXP STN	5.24
FULTON	5.21
BALDWYN	5.19
IUKA	5.16
RIPLEY	5.16
PONTOTOC EXP STN	5.14
PONTOTOC	5.10

TENNESSEE:

SHELBYVILLE	7.78
NORRIS	7.44
KINGSTON	6.51
TULLAHOMA	6.35
PULASKI WATER PLANT	5.88
LAFAYETTE	5.86
JEFFERSON CITY	5.81
LIVINGSTON RADIO	5.80
JAMESTOWN	5.78
MONTEAGLE	5.75
TAZEWELL	5.67
WINCHESTER	5.64

ALLARDT	5.55
OAK RIDGE	5.52
DAYTON	5.42
ROGERSVILLE	5.41
MC MINNVILLE	5.33
ONEIDA	5.25
MORRISTOWN RADIO	5.12
PORTLAND SEWAGE PLAN	5.10
BRISTOL TRI CITY AP	5.07
LENOIR CITY	5.07
LEWISBURG EXP STN	5.00

TABLE 2 - PRECIPITATION AMOUNTS FOR JULY 1-7, 1994
FOR STATIONS WITH AT LEAST 10 INCHES

ALABAMA:

ENTERPRISE	21.58	
KINSTON	17.07	
ABBEVILLE	15.93	
DOTHAN	15.24	
ELBA	15.04	
HEADLAND	14.74	
CLAYTON	13.58	
GENEVA	11.63	
EUFAULA WILDLIFE REF.	11.32	
UNION SPRINGS	11.14	
HURTSBORO	10.03	

FLORIDA:

NICEVILLE	19.78	

GEORGIA:

AMERICUS	27.61	
CUTHBERT	23.87	
BUTLER	23.63	
PLAINS	21.91	
MARSHALLVILLE	20.55	
BYRON EXPERIMENT STN	16.61	
MACON	16.51	
PEACHTREE CITY	15.63	(unofficial)
MONTEZUMA	15.07	

THOMASTON	14.57
EXPERIMENT	14.31
JONESBORO	13.79
BUENA VISTA	13.65
PRESTON	13.36
LUMPKIN	11.20
JULIETTE	11.00
IRWINTON	10.22

TABLE 3 - PRECIPITATION AMOUNTS FOR JULY 5-6, 1994
FOR STATIONS WITH AT LEAST 10 INCHES

ALABAMA:

ABBEVILLE	10.75

GEORGIA:

AMERICUS	24.23
MARSHALLVILLE	20.55
BUTLER	19.88
PLAINS	17.85
BYRON EXPERIMENT STN	15.60
CUTHBERT	14.45
EXPERIMENT	13.68
JONESBORO	12.94
MONTEZUMA	12.71
THOMASTON	12.34
MACON	11.00
IRWINTON	10.22
BUENA VISTA	10.20

National Climatic Data Center
Research Customer Service Group
Federal Building, Asheville, NC 28801

The U.S. has sustained some very expensive weather-related disasters over the past 15 years. During the 1988-1994 period, the U.S. sustained 11 weather-related disasters with total damages/costs estimated over $ 100 billion. All figures reflect direct and indirect damages, costs, and deaths.

Billion Dollar U.S. Weather Disasters 1980 - 1994

*1. **Georgia Flooding** July 1994. Remnants of slow-moving Alberto brought torrential 10-25 inch rains, widespread flooding in parts of Georgia, Alabama, and panhandle of Florida; preliminary estimates up to $1.0 billion damage/costs; 32 deaths.*

*2. **Southeast Ice Storm** February 1994. Intense ice storm with extensive damage in portions of TX, OK, AR, LA, MS, AL, TN, GA, SC, NC, and VA; estimated over $3.0 billion damage/costs; 9 deaths.*

*3. **California Wildfires** Fall 1993. Southern California, at least $1.0 billion damage/costs, 4 deaths.*

*4. **Midwest Flooding** Summer 1993. Central U.S., $15.0-$20.0 billion damage/costs, 48 deaths.*

*5. **Drought/Heat Wave** Summer 1993. Southeastern U.S., about $1.0 billion damage/costs, death toll undetermined.*

*6. **Storm/Blizzard** March 1993. Eastern U.S., over $3.0 billion damage/costs, estimated up to 270 deaths.*

*7. **Hurricane Iniki** September 1992. Hawaiian island of Kauai, about $1.8 billion damage/costs, 6 deaths.*

*8. **Hurricane Andrew** August 1992. Florida and Louisiana, about $25.0 billion damage/costs, 58 deaths.*

*9. **Hurricane Bob** August 1991. Mainly coastal North Carolina, Long Island, and New England, $1.5 billion damage/costs, 18 deaths.*

*10. **Hurricane Hugo** September 1989. Carolinas, $7.1 billion damage/costs, 57 deaths.*

*11. **Drought/Heat Wave** Summer 1988. Central and Eastern U.S., estimated $40.0 billion damage/costs, estimated 5,000 to 10,000 deaths (includes heat stress-related).*

*12. **Hurricane Juan** October-November 1985. Louisiana and Southeast U.S., $1.5 billion damage/costs, 63 deaths.*

*13. **Hurricane Elena** August-September 1985. Florida to Louisiana, $1.3 billion damage/costs, 4 deaths.*

*14. **Hurricane Alicia** August 1983. Texas, $2.0 billion damage/costs, 21 deaths.*

*15. **Drought/Heat Wave** June-September 1980. Central and Eastern U.S., estimated $20.0 billion damage/costs, estimated 1300 deaths (includes heat stress-related).*

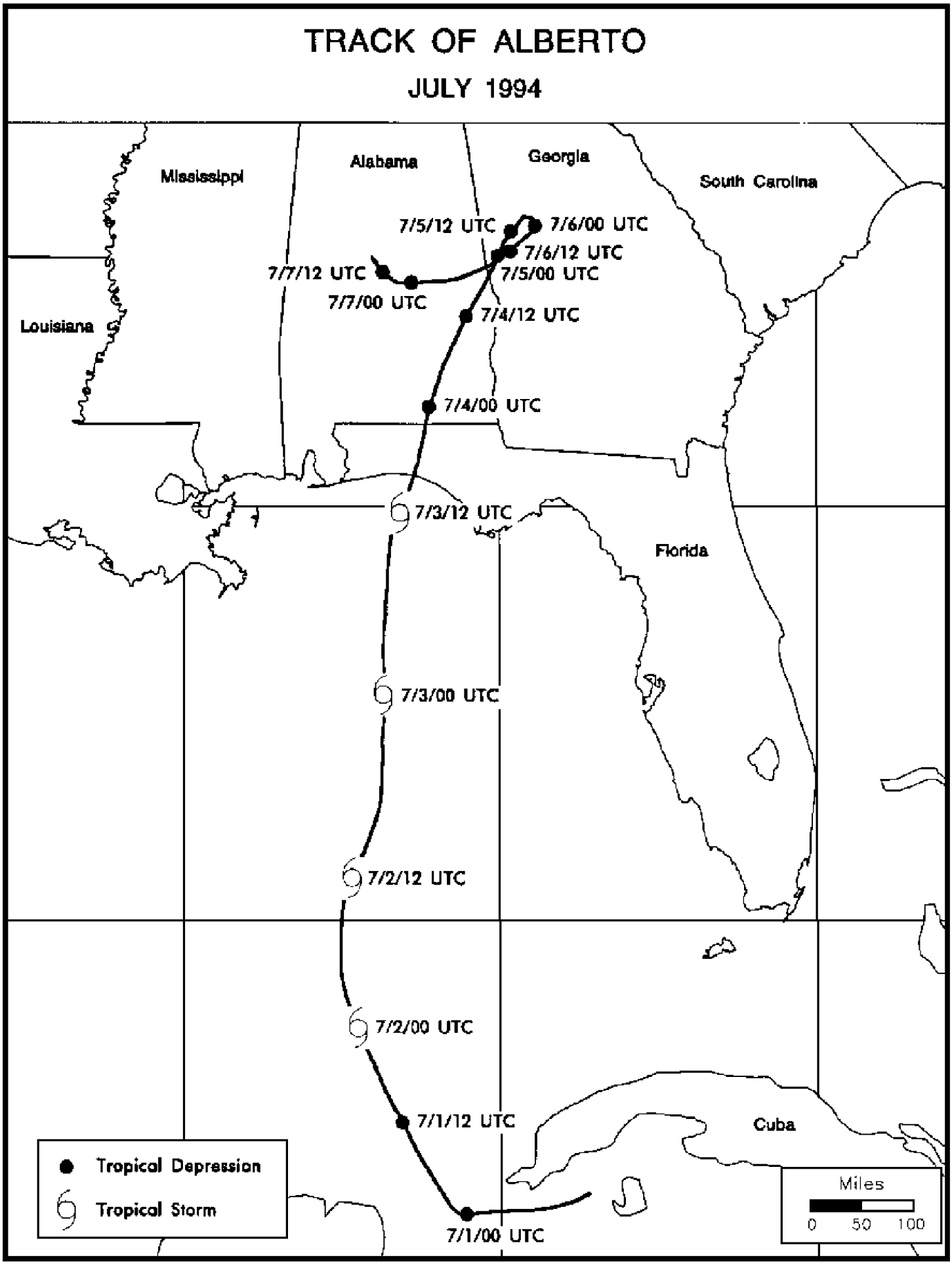

TRACK OF ALBERTO
JULY 1994
Mississippi
Alabama
Georgia
South Carolina
Louisiana
Florida
Cuba
7/5/12 UTC
7/6/00 UTC
7/6/12 UTC
7/5/00 UTC
7/7/12 UTC
7/7/00 UTC
7/4/12 UTC
7/4/00 UTC
7/3/12 UTC
7/3/00 UTC
7/2/12 UTC
7/2/00 UTC
7/1/12 UTC
7/1/00 UTC
Tropical Depression
Tropical Storm
Miles
0 50 100

Figure 1

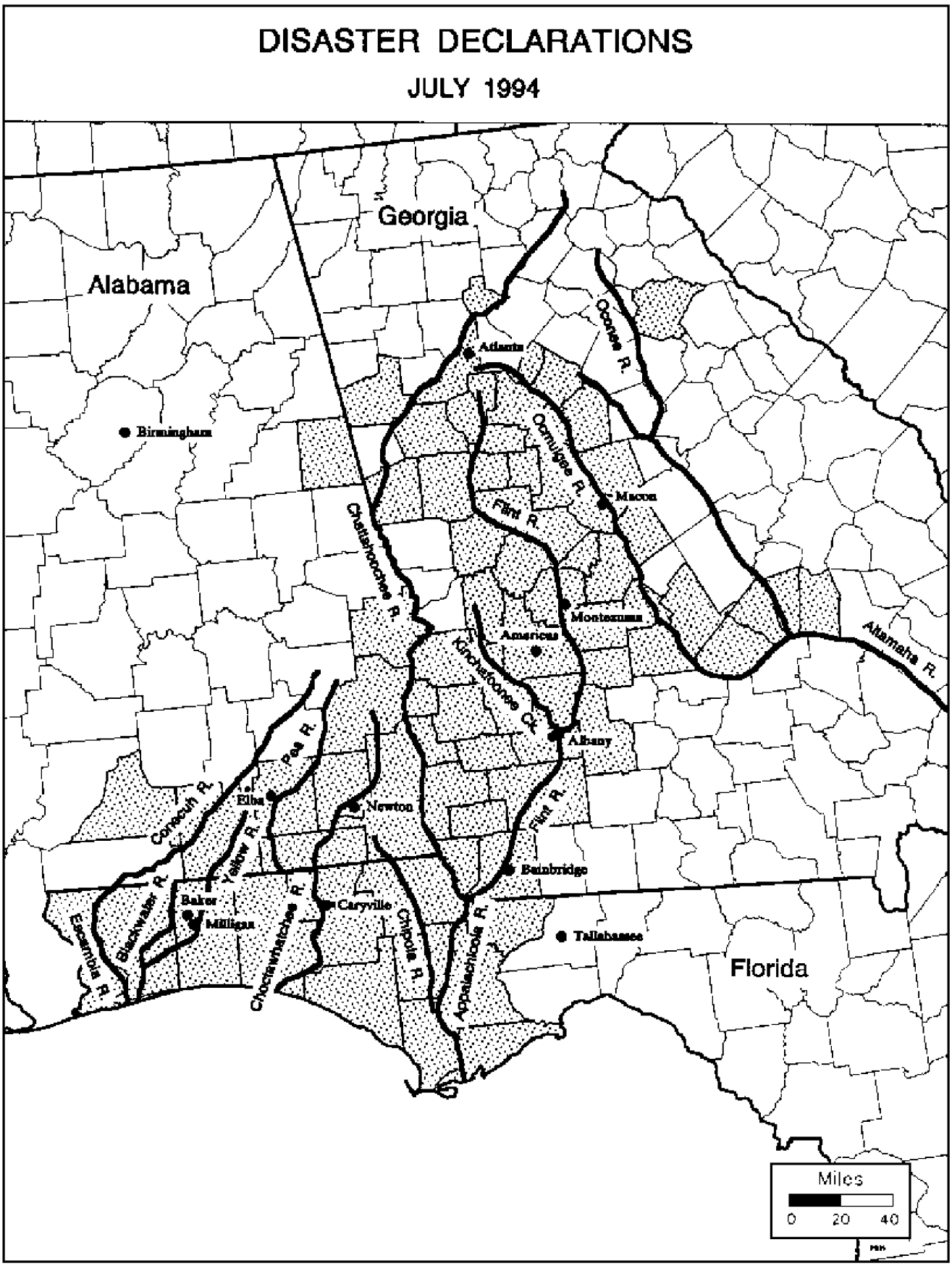

DISASTER DECLARATIONS
JULY 1994
Georgia
Alabama
Florida
Atlanta
Birmingham
Macon
Montezuma
Americus
Albany
Newton
Bainbridge
Caryville
Tallahassee
Baker
Milligan
Elba
Ocmulgee R.
Flint R.
Chattahoochee R.
Kinchafoonee Ck.
Pea R.
Conecuh R.
Yellow R.
Blackwater R.
Escambia R.
Choctawhatchee R.
Chipola R.
Apalachicola R.
Ocmulgee R.
Altamaha R.
Miles
0 20 40

Figure 2

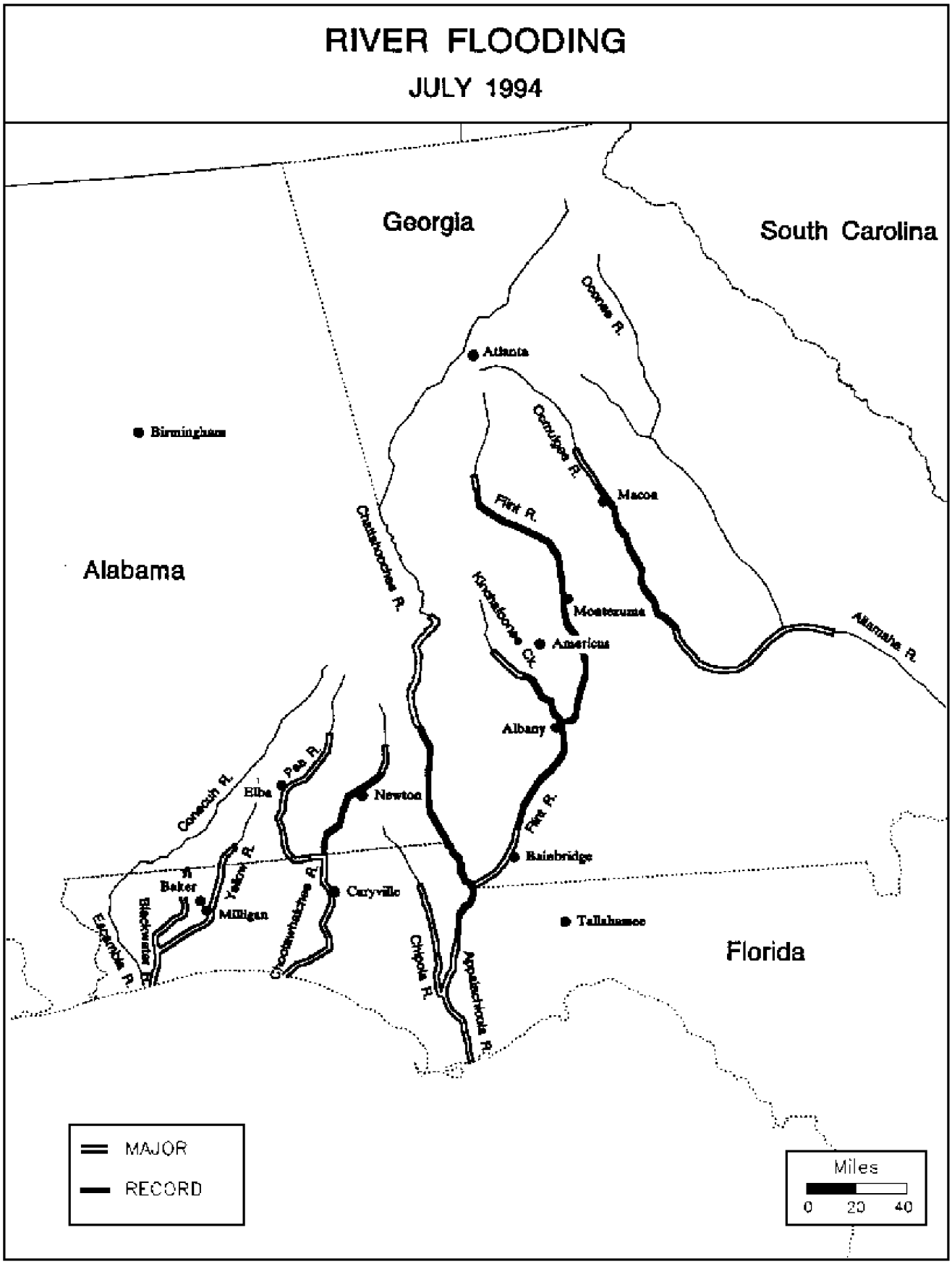

RIVER FLOODING
JULY 1994
Georgia
South Carolina
Alabama
Florida
Atlanta
Birmingham
Macon
Montezuma
Americus
Albany
Newton
Elba
Bainbridge
Tallahassee
Caryville
Milligan
Baker
Ocmulgee R.
Flint R.
Chattahoochee R.
Kinchafoonee Ck.
Pea R.
Yellow R.
Blackwater R.
Escambia R.
Choctawhatchee R.
Chipola R.
Apalachicola R.
Alamaha R.
MAJOR
RECORD
Miles
0 20 40

Figure 3

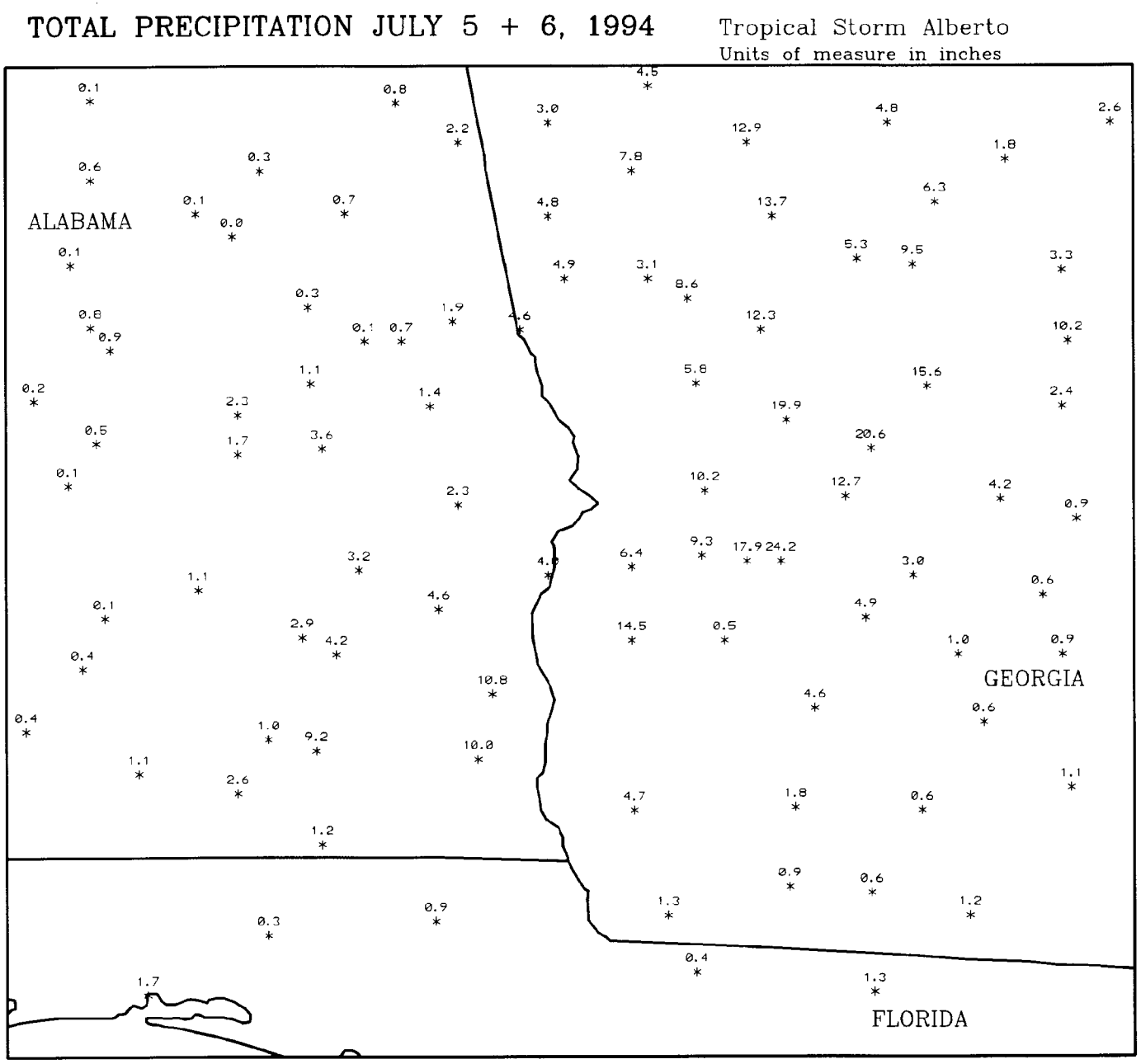

TOTAL PRECIPITATION JULY 5 + 6, 1994
Tropical Storm Alberto
Units of measure in inches
ALABAMA
GEORGIA
FLORIDA
0.1 0.8 4.5
3.0 4.8 2.6
2.2 12.9 1.8
0.3 7.8
0.6 6.3
0.1 0.7 4.8 13.7
0.0
0.1 5.3 9.5 3.3
4.9 3.1 8.6
0.3 1.9 4.6 12.3 10.2
0.8 0.9 0.1 0.7
1.1 5.8 15.6
0.2 1.4 2.4
2.3 19.9
0.5 1.7 3.6 20.6
0.1 10.2 12.7 4.2
2.3 0.9
9.3 17.9 24.2
3.2 6.4 3.0
1.1 0.6
4.6 4.9
0.1 2.9 14.5 0.5 1.0 0.9
4.2
0.4 10.8 4.6
0.4 1.0 9.2 0.6
10.0
1.1 1.1
2.6 4.7 1.8 0.6
1.2
0.9 0.6
0.3 0.9 1.3 1.2
0.4
1.7 1.3

Figure 4

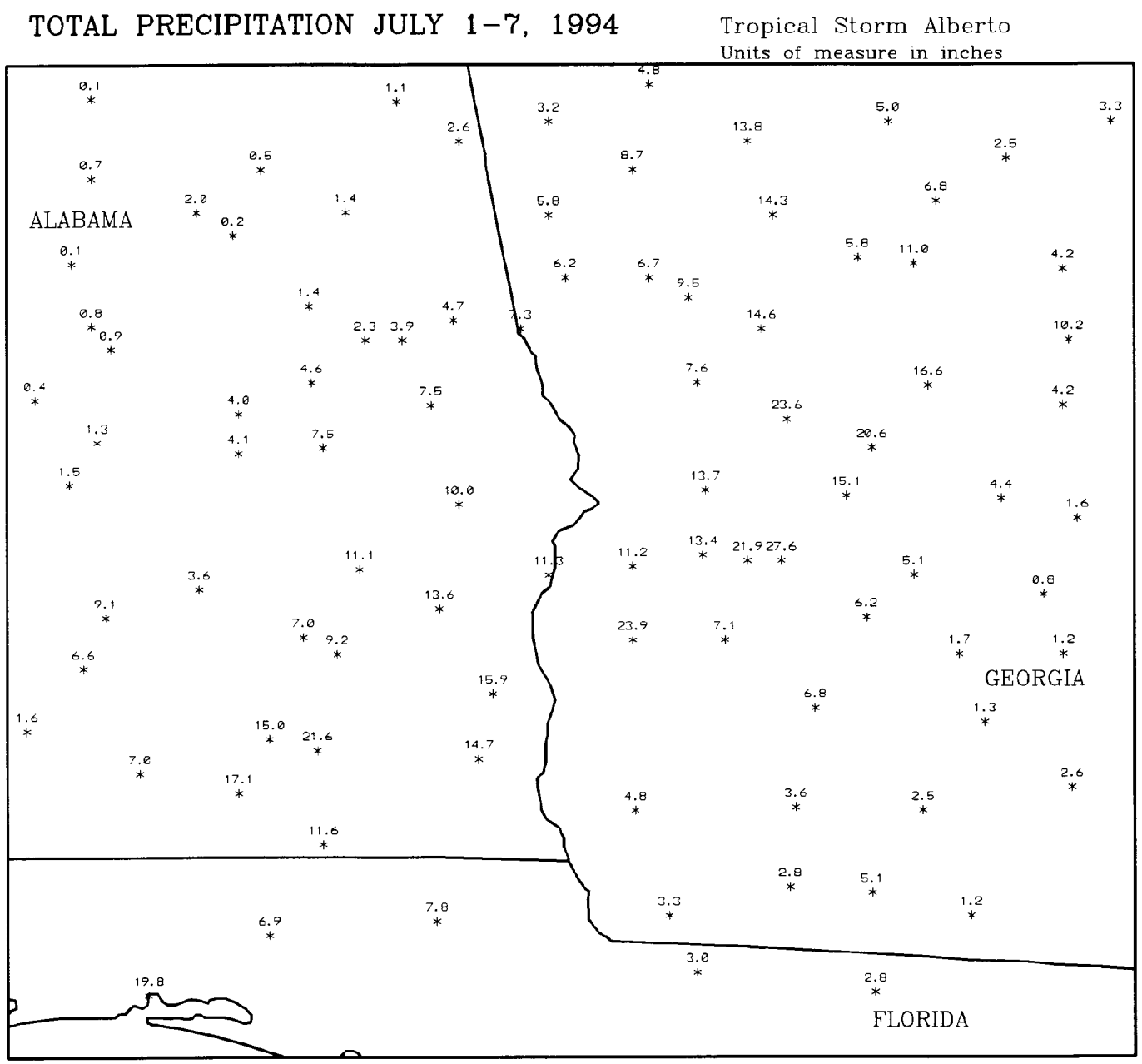

TOTAL PRECIPITATION JULY 1-7, 1994
Tropical Storm Alberto
Units of measure in inches
ALABAMA
GEORGIA
FLORIDA
0.1
1.1
4.8
3.2
5.0
3.3
2.6
13.8
0.5
8.7
2.5
0.7
6.8
2.0
1.4
5.8
14.3
ALABAMA
0.2
5.8
11.0
0.1
4.2
6.2
6.7
9.5
1.4
4.7
14.6
0.8
2.3
3.9
10.2
0.9
4.6
7.6
16.6
0.4
7.5
4.2
4.0
23.6
1.3
7.5
20.6
4.1
1.5
13.7
15.1
4.4
10.0
1.6
13.4
21.9
27.6
11.1
11.2
5.1
3.6
0.8
13.6
6.2
9.1
7.0
23.9
7.1
1.7
1.2
9.2
6.6
15.9
GEORGIA
6.8
1.6
15.0
21.6
1.3
14.7
7.0
2.6
17.1
4.8
3.6
2.5
11.6
2.8
5.1
7.8
3.3
1.2
6.9
3.0
19.8
2.8
FLORIDA

Figure 5

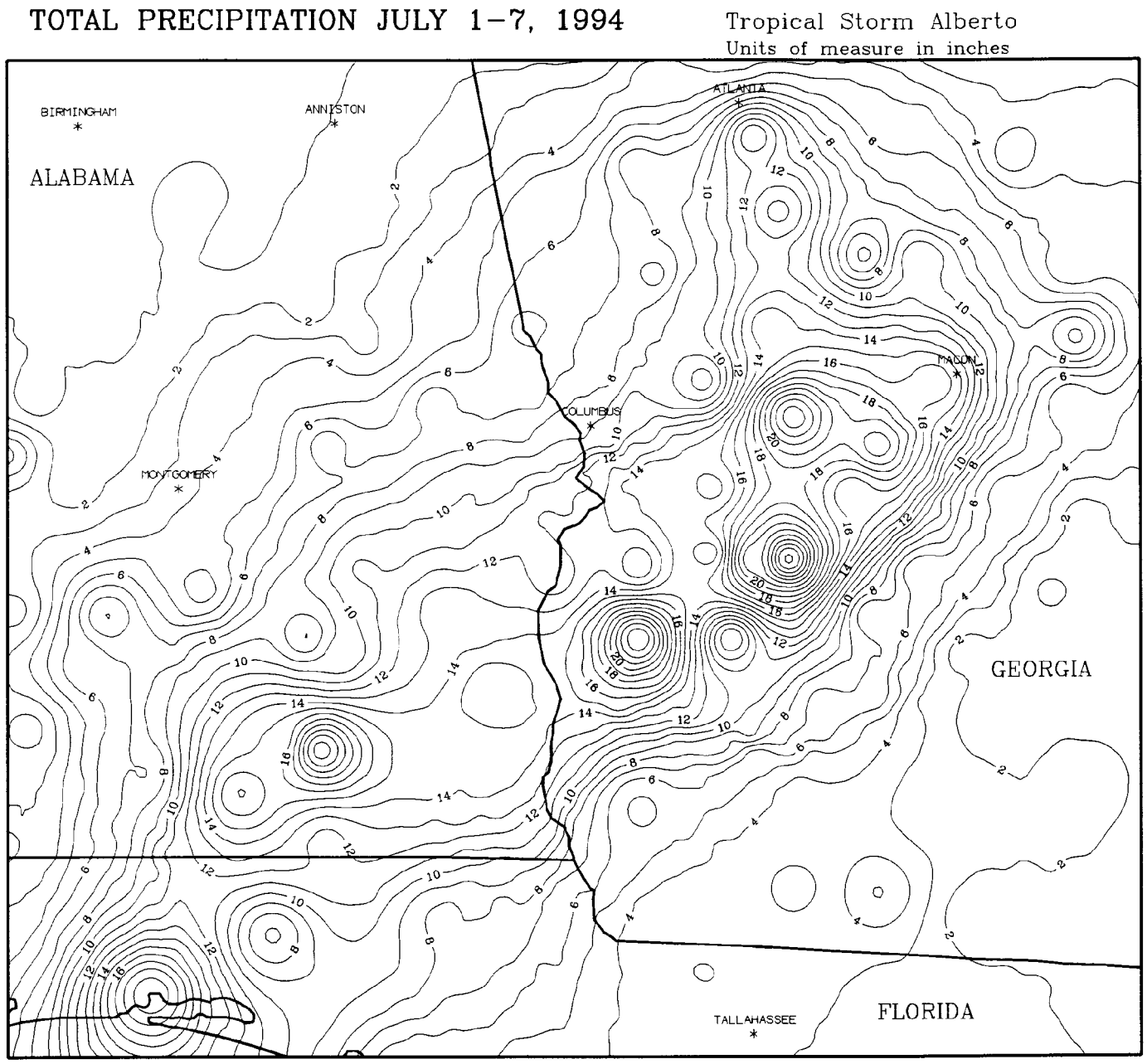

TOTAL PRECIPITATION JULY 1-7, 1994
Tropical Storm Alberto
Units of measure in inches
BIRMINGHAM
ANNISTON
ATLANTA
ALABAMA
MACON
COLUMBUS
MONTGOMERY
GEORGIA
TALLAHASSEE
FLORIDA

Figure 6