Tropical Cyclone Report
Tropical Storm Lee
(AL132011)
2-5 September 2011

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15 December 2011

Lee was a tropical storm that evolved into a subtropical cyclone before making landfall in southern Louisiana. Lee and its remnants contributed to heavy rainfall and extensive flooding over portions of the eastern United States.

a. Synoptic History

Lee developed from a tropical wave that moved off the west coast of Africa on 18 August. The vigorous wave was accompanied by a broad low pressure area that passed over the Cape Verde Islands on 19-20 August. The low, however, moved northwestward and encountered hostile environmental conditions that prevented development. Meanwhile, the southern portion of the wave continued westward across the tropical Atlantic and eastern Caribbean Sea during the next week or so, and as it moved across the western Caribbean Sea and into the southeastern Gulf of Mexico on 30 and 31 August, shower and thunderstorm activity gradually increased and gained organization. Satellite and surface data indicate that a broad area of low pressure formed from this system over the central Gulf of Mexico on 1 September. Data from a NOAA Hurricane Hunter aircraft mission late that day showed that the circulation became better defined, and it is estimated that this system became a tropical depression around 0000 UTC 2 September, centered about 190 n mi southwest of the mouth of the Mississippi River. After development, the depression moved slowly northward and strengthened into a tropical storm 12 h later. The "best track" chart of Lee's path is given in Fig. 1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1[1].

Despite about 20 kt of westerly vertical shear, in part from an upper-level low to the northwest of the cyclone, the convective organization of the system continued to improve during the daylight hours of 2 September, and surface and reconnaissance aircraft data indicate that Lee gradually strengthened. Early the next day, the separation between Lee and the upper-level low decreased and the two systems became co-located around 0600 UTC 3 September. During this time, the overall satellite appearance of Lee began to take on the appearance of a subtropical cyclone. Although Advanced Microwave Sounding Unit (AMSU) data show that the cyclone maintained a weak warm core, the expanding radius of maximum winds, and the fact that the Lee

[1] A digital record of the complete best track, including wind radii, can be found on line at ftp://ftp.nhc.noaa.gov/atcf. Data for the current year's storms are located in the *btk* directory, while previous years' data are located in the *archive* directory.

continued to deepen despite having relatively weak convection near the center, suggests that Lee is best classified as a subtropical cyclone by 1200 UTC 3 September. During this transition, Lee turned northwestward and reached an estimated maximum intensity of 50 kt at 1200 UTC 3 September about 60 n mi southwest of Morgan City, Louisiana. After that time, Lee slowed down and meandered just off the south-central coast of Louisiana during the next 12-18 h. Dry mid-level air began wrapping around the southern and eastern portions of the circulation, which caused the convection near the center to gradually decrease. Early on 4 September, Lee turned east-northeastward and accelerated, making landfall around 1030 UTC along the coast of southern Louisiana, about 10 n mi south-southeast of Intracoastal City. Although the central pressure of Lee continued to slowly fall, reaching 986 mb at the time of landfall, the weakening gradient caused the maximum winds to decrease to 40 kt by the time the center crossed the coast. At the time of landfall, the maximum winds were occurring over water well to the south and east of the center.

After landfall, Lee moved north-northeastward and then became nearly stationary over south-central Louisiana late on 4 September. During this time, the cyclone weakened slightly but maintained subtropical storm strength, as 35-kt winds continued over the northern Gulf of Mexico. Early on 5 September, Lee merged with an unusually strong cold front that was moving southward over the south-central United States, and it became extratropical by 0600 UTC. Soon thereafter, the cyclone began to accelerate east-northeastward. The system's strongest winds increased again, this time near the frontal boundary over the Gulf waters, even as the low center moved across southern Mississippi and southern Alabama on 5 September. By 0000 UTC 6 September, winds associated with the low dropped below gale force and the extratropical low moved into northwestern Georgia shortly thereafter. After that, the low continued to weaken as it turned northward. It dissipated by 0000 UTC 7 September over extreme northwestern Georgia.

b. Meteorological Statistics

Observations in Lee (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), and Advanced Dvorak Technique estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from three flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command. The NOAA Aircraft Operations Center flew one WP-3D aircraft investigative mission into the system around the time it became a tropical depression. Data and imagery from NOAA polar-orbiting satellites including the AMSU, the NASA Tropical Rainfall Measuring Mission (TRMM) and Aqua, the European Space Agency's Advanced Scatterometer (ASCAT), and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Lee.

Lee was never designated as a subtropical cyclone operationally. However, in the post-storm analysis Lee is shown to have evolved from a tropical to a subtropical storm by 1200 UTC

3 September. By that time, Lee was located directly beneath the upper-level low and the radius of Lee's maximum winds expanded from about 75 n mi to between 120 and 150 n mi by late on 3 September. After Lee became a subtropical cyclone, it continued to deepen despite having relatively weak convection near the center. This suggests that at least a portion of Lee's energy source was related to baroclinicity associated with the upper-level low. Figs. 4 and 5 show the evolution of Lee's structure in visible and microwave satellite imagery from 2 September when Lee was a tropical storm, through its period as a subtropical cyclone, and then its transformation to an extratropical low on 5 September. The transition from a tropical to a subtropical cyclone, while rare, has been previously observed. The last Atlantic basin tropical cyclone to evolve into a subtropical cyclone was Allison (2001). Hurricane Klaus (1984) made a similar transition.

The estimated 50-kt peak intensity of Lee is based on a peak 850 mb flight-level wind of 60 kt that was measured over southeastern Louisiana about 110 n mi east-northeast of the center shortly before 1200 UTC 3 September. The peak intensity is also supported by a wind observation from the drilling rig West Sirius (call sign 3EMK6) (Table 2) that recorded 46 kt within the primary band of shower and thunderstorm activity about 140 n mi east-southeast of the center several hours earlier than the aforementioned aircraft observation.

Ship reports of winds of tropical-storm-force associated with Lee are given in Table 2. Selected surface observations from land stations, data buoys, and oil rigs are given in Table 3. Numerous oil platforms over the northern Gulf of Mexico reported tropical-storm-force winds in association with Lee. The highest wind observations were 51 kt at Mississippi Canyon 311a (KMDJ) and 52 kt at Mississippi Canyon 802 (42362) platforms. The anemometers on these oil rigs are, however, quite elevated, at 90 m and 122 m, respectively. Using the standard wind reduction factor from those heights yields a 10-m surface wind estimate of about 42 kt for both observations. The highest wind gust recorded from an oil platform was 63 kt at the Louisiana Offshore Oil Port (LOPL1- elevation 58 m).

Sustained tropical-storm-force winds were reported at some land-based observing stations near the coasts of Alabama, Mississippi, Louisiana, and extreme eastern Texas during the time Lee was classified as a tropical or subtropical cyclone. The highest 1-min sustained wind report from a land station was 43 kt with a gust to 47 kt at a University of Alabama mesonet site on Dauphin Island, Alabama at 1944 UTC 3 September. A 2-min sustained wind of 40 kt with a gust to 50 kt was observed at the Lakefront Airport in New Orleans at 1128 UTC 4 September. Winds of 34 kt with a gust to 41 kt were also reported in Galveston, Texas, early on 4 September.

After Lee became extratropical, surface observations indicate that the cyclone strengthened. The strongest winds associated with the low occurred primarily over the northern Gulf of Mexico, but some land-based observing stations recorded stronger winds when Lee was an extratropical cyclone than during its (sub)tropical storm stage. Table 4 provides selected wind observations from land-based sites in association with the extratropical low. The highest sustained winds observed over land on 5 September were 42 kt at New Orleans Lakefront Airport at 1455 UTC and 44 kt from a University of South Alabama mesonet site at Dauphin

Island at 1316 UTC. Sustained winds of 28 to 36 kt with gusts to 51 kt were reported at observing sites in the Florida Panhandle (Table 4).

Strong onshore winds from Lee along the northern Gulf Coast produced elevated water levels from Louisiana eastward into the Florida Panhandle for several days. The highest storm tides reported during the event were 4-6 ft along the coasts of Mississippi and southeast Louisiana (Table 3). The highest storm surge reported was 4.67 ft at Amerada Pass, Louisiana. Storm tides of 3-5 ft were reported in Alabama, and values of 2-3 ft were observed in portions of the Florida Panhandle. The highest storm surge in Florida or Alabama was 4.40 ft at a National Ocean Service tide gauge at the Coast Guard Sector-Mobile station, near the north end of Mobile Bay. Storm tides of 4-6 feet (Table 3) were also observed at tide gauges along the coasts of Lake Pontchartrain and Lake Maurepas in Louisiana. The highest recorded storm surge in this area was 4.09 ft at the New Canal Station in the West Lakeview section of New Orleans.

Lee produced heavy rainfall along the northern Gulf Coast and along its path across the southeastern United States (Fig. 6). Rainfall amounts of 10-15 inches were reported over a large area along the northern Gulf Coast from southeastern Louisiana eastward across southern Mississippi and southern Alabama. The highest storm total rainfall in this area was 15.48 inches at Holden, Louisiana, with 12.62 inches observed at both New Orleans Lakefront Airport and near Mobile, Alabama. A large swath of 7-10-inch rains with isolated maximum amounts of 10 to 14 inches also occurred north of the cyclone's center path across south-central Mississippi, northern Alabama, extreme northwestern Georgia, and eastern Tennessee. Moisture from Lee and its remnants spread northeastward along a frontal boundary that became stationary across the Mid-Atlantic States and southern New York. This produced a second area of extremely heavy rainfall from eastern Virginia northward across Maryland, eastern Pennsylvania, New Jersey, southern New York, and portions of southern New England from 5 through 10 September (Fig. 7). The highest rainfall totals from states in this area include: 20.96 inches at Colonial Beach, Virginia; 18.88 inches at Elkton, Maryland; 15.22 inches at Pine Grove, Pennsylvania; 11.47 inches at Stockton, New Jersey; and 10.08 inches at Binghamton, New York.

The rain over the Mid-Atlantic States fell over areas that had experienced a wet summer, including significant rains from Hurricane Irene less than two weeks before. This led to major flooding along the Susquehanna River, which in some areas broke high-water records that were set nearly 40 years earlier in the aftermath of Hurricane Agnes (1972). In Wilkes-Barre, Pennsylvania, the river crested at 42.66 ft, which broke the previous record of 40.9 ft set in June 1972. Along the Swatara Creek in Hershey, Pennsylvania, the previous record flood mark set after Agnes was bested by 10 ft during this event.

Preliminary data from the NOAA Storm Prediction Center indicate that Lee and its remnants produced 46 tornadoes, mainly across the southeastern United States. Tornadoes on 3 and 4 September occurred primarily along the northern Gulf Coast from southern Louisiana eastward to the Florida Panhandle. These tornadoes were generally short-lived and rated either EF-0 or EF-1 on the enhanced-Fujita tornado scale. On 5 September, several tornadoes and damaging thunderstorm wind gusts were reported across Georgia, North and South Carolina, and portions of north Florida. Tornado touchdowns were reported in Douglas, Cobb, and Cherokee

counties in Georgia. The Cherokee County tornado produced a nearly continuous path for 24 miles and was rated EF-1 intensity. Tornado touchdowns were also reported over central North Carolina on 6 September and in northeastern Virginia and southern Maryland on 7 September.

c. Casualty and Damage Statistics

Lee was responsible for three direct deaths during its time as a (sub)tropical cyclone: two from rough surf and one from inland flooding. The deaths from surf occurred when a Texas man drowned off Galveston beach on 3 September and a juvenile died in rough seas east of Fort Morgan, Alabama, on 4 September. The freshwater flooding death occurred in Tishomingo County, Mississippi, when three people attempted to cross a swollen creek in a car. Two of the car's passengers were rescued while the third, a 57-year old man, was swept away during the rescue attempt.

Media reports indicate that flooding largely related to the remnants of Lee was responsible for at least 12 additional deaths in the eastern United States; seven people in Pennsylvania, four in Virginia, one in Maryland, and one in Georgia. Nearly all of these deaths occurred when individuals tried to cross flooded roadways in vehicles or were swept away in flood waters.

Most of the damage from Lee was the result of storm surge or freshwater flooding. Storm surge flooding from Lake Pontchartrain inundated more than 150 houses in Jefferson and St. Tammany Parishes in Louisiana. Minor storm surge flooding was also reported outside the hurricane protection levees in St. Bernard and Orleans Parishes. Freshwater flooding was reported in low-lying areas of southeastern Louisiana and southern and central Mississippi. Several roads were inundated by floodwaters in Hancock, Jackson, and Harrison Counties Mississippi, while in Neshoba County in the central portion of the state, 35 roads were damaged with 5 of those completely washed out.

The rain from Lee's remnants exacerbated the flood situation in the Mid-Atlantic and caused some of the most severe flooding in this region's history. The worst flooding occurred along the Susquehanna River and its tributaries in western New York and Pennsylvania. In western New York, water levels topped levees along the river, which inundated several cities including Waverly, Owego, Vestal, Endicott, Johnson City, and downtown Binghamton. In some of these areas water levels broke previous record heights that were set in the Mid-Atlantic Floods of 2006. Numerous roads were closed in the area and 20,000 people were ordered to evacuate Binghamton. In Pennsylvania, the forecast of flooding led to the evacuation of about 100,000 people, including 10,000 people and the Governor's residence in the downtown Harrisburg area. The most significant flooding occurred in towns along the Susquehanna River, including Tunkhannock, Pittston, Edwardsville, Nanticoke, Wilkes-Barre, and Harrisburg. In Dauphin and Lebanon Counties in the greater Harrisburg area, nearly 5,000 homes were damaged or destroyed. Numerous roads and 18 bridges were also damaged in Pennsylvania.

Wind damage associated with Lee was more isolated and generally consisted of downed trees and power lines, and mostly minor damage to structures near the Gulf Coast. A few areas of moderate damage, likely in association with tornadoes, occurred over isolated areas of the southeastern United States. Areas that reported significant residential structure damage include: the western end of Dauphin Island, near Gulfport, Mississippi, and Pensacola, Florida. The long-lived EF-1 tornado in Cherokee County, Georgia, damaged about 400 homes in the Brookshire and Towne Lake Hills South subdivisions near Woodstock, Georgia.

According to the Property Claim Services of the Insurance Services Office, Inc., Lee produced an estimated $315 million in insured losses in the United States. Damage estimates have not been yet been obtained for individual states and it is likely that this figure includes damage from tornadoes after Lee became an extratropical cyclone. Media reports indicate the flooding from the remnants of Lee produced more than one billion dollars in damage in the Mid-Atlantic and Northeast United States. Official flood damage estimates from Lee and its remnants are not yet available from FEMA's National Flood Insurance Program. As a result, final damage estimates from Lee are pending and this report will be updated when assessments from NFIP become available.

d. Forecast and Warning Critique

The development of Lee was well anticipated. The disturbance from which Lee formed was first introduced in the Tropical Weather Outlook at 1800 UTC 30 August, about 54 h before genesis. The probability of development was initially in the low category (<30%) but was raised to the medium category (30-50%) 30 h before genesis and the high category (>50%) 24 h before tropical cyclone formation.

A verification of NHC official track forecasts for Lee is given in Table 6a. Official forecast track errors were lower than the mean official errors for the previous 5-yr period, except at 12 h were they were comparable to the long-term mean. A homogeneous comparison of the official track errors with selected guidance models is given in Table 6b. Due to the homogeneity requirement and short duration of Lee, the sample size is quite small and prevents meaningful interpretation of the errors. Only two models were consistently better than the official forecast (OFCL) for Lee. The Canadian (CMCI) and the United States (GFSI) global models both had lower mean track errors than the NHC forecasts at each forecast interval through 48 h.

A verification of NHC official intensity forecasts for Lee is given in Table 7a. Official forecast intensity errors were a little lower than the mean official errors for the previous 5-yr period. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 7b. The NHC forecasts exhibited higher mean errors than all of the intensity guidance at 24, 36, and 48 h, albeit for the small sample size. Although the first few NHC forecasts accurately predicted a peak intensity of around 50 kt, Lee strengthened and attained its peak intensity earlier than anticipated. This contributed to the larger mean intensity errors than the guidance models at 24 through 48 h.

Watches and warnings associated with Lee are given in Table 8. A tropical storm warning was issued for the northern Gulf Coast from Pascagoula, Mississippi, to Sabine Pass, Texas, with the initial NHC advisory at 0000 UTC 2 September. This was more than 48 h before the center made landfall; however, given the large size and slow forward speed of Lee, tropical storm conditions occurred over much of the warning area long before the center crossed the coast.

e. Acknowledgements

National Weather Service Weather Forecast Offices in the affected areas, the National Data Buoy Center, and the National Ocean Service supplied surface and storm surge data as well as storm summaries that were useful in constructing the data tables and the casualty and damage section of this report. David Roth of the Hydrometeorological Prediction Center contributed additional rainfall information and Figure 6.

Table 1. Best track for Tropical Storm Lee, 2-5 September 2011.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Intensity (kt)	Stage
02 / 0000	26.6	91.4	1007	30	tropical depression
02 / 0600	26.9	91.4	1006	30	"
02 / 1200	27.2	91.4	1005	35	tropical storm
02 / 1800	27.5	91.4	1003	40	"
03 / 0000	28.0	91.5	1001	40	"
03 / 0600	28.5	91.8	997	45	"
03 / 1200	29.0	92.0	993	50	subtropical storm
03 / 1800	29.2	92.2	989	45	"
04 / 0000	29.4	92.5	988	40	"
04 / 0600	29.5	92.5	986	40	"
04 / 0900	29.5	92.2	986	40	"
04 / 1030	29.6	92.1	986	40	"
04 / 1200	29.7	92.0	986	35	"
04 / 1800	30.3	91.8	988	35	"
05 / 0000	30.4	91.6	990	35	"
05 / 0600	30.4	91.4	993	35	extratropical
05 / 1200	30.6	90.1	995	40	"
05 / 1800	31.5	88.3	995	40	"
06 / 0000	32.6	86.5	995	30	"
06 / 0600	33.4	85.3	997	20	"
06 / 1200	34.2	85.1	1000	15	"
06 / 1800	34.9	85.3	1004	15	"
07 / 0000					dissipated
03 / 1200	29.0	92.0	993	50	Maximum winds
04 / 0600	29.5	92.5	986	40	Minimum pressure
04 / 1030	29.6	92.1	986	40	Landfall about 10 n mi south of Intracoastal City, Louisiana

Table 2. Selected ship reports with winds of at least 34 kt for Tropical Storm Lee, 2-5 September 2011.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
2 / 1500	KNJK	26.6	88.8	150 / 35	1008.0
3 / 1200	PCEX	27.0	91.9	290 / 35	1002.2
4 / 0000	V7MO2	27.3	90.7	230 / 35	1000.1
4 / 0000	WZJC	27.7	92.4	270 / 35	997.5
4 / 0300	WZJC	27.4	91.5	240 / 37	999.1
4 / 0600	KNJK	27.4	92.4	240 / 40	999.0
4 / 1200	C6FY5	28.4	93.0	300 / 36	1002.0

Table 3. Selected minimum sea level pressure and wind speed observations for Tropical Storm Lee, 2-5 September 2011. Storm Surge data include observations during the extratropical portion of Lee's lifecycle.

Location (anemometer height if not 10 m and known)	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)		
Country or State							
Texas							
International Civil Aviation Organization (ICAO) Sites							
Beaumont (KBPT)	04/0917	996.3	03/2101	27	36		
Jasper County Bell Field (KJAS)	04/0915	999.7					
Galveston (KGLS)			04/0052	34	41		
Orange County Airport (KORG)	04/0915	996.3					
Public/Other							
Texas Point 29.7°N 93.8°W	04/0900	996.3	03/2018	35	45		
McFadden National Wildlife Refuge 29.7°N 94.1°W			03/2154	20	34		
High Island 29.7°N 94.4°W			03/1812	28	39		
National Ocean Service (NOS) Sites							
Sabine Pass North (SBPT2) 29.7°N 93.9°W 10m	04/0854	997.9	03/2006	36	50		
Louisiana							
ICAO Sites							
New Iberia (KARA)	04/1436	987.5	04/2014	28	37		
Alexandria (KAEX)	04/2223	995.6	04/2217	25	36		
De Ridder (KDRI)	04/0915	997.0	04/1955	16	37		
Chennault Airport, Lake Charles (KCWF)	04/0915	993.9					
Esler Field, Alexandria (KESF)	04/2204	994.9					
Fort Polk (KPOE)	04/0835	997.0	04/0155	23	34		

Location (anemometer height if not 10 m and known)	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)		
Fort Polk Self Landing Strip (KDNK)	04/0853	997.0	03/2053	21	37		
Lafayette (KLFT)	04/1451	989.8	03/2041	30	36		
Lake Charles (KLCH)	04/1021	994.2	03/1628	27	38		
Oakdale (KACP)	04/2155	994.6					
Patterson (KPTN)	04/0015	994.2					
Salt Point (KP92)	04/1135	989.8	03/1823	21	31		
Sulfur (KUXL)	04/0855	994.6	08/1335	23	37		
New Orleans- Lakefront Airport (KNEW)	04/0224	997.6	04/1128	40	50		
New Orleans- Armstrong Int'l Airport (KMSY)	04/0223	997.6	04/0838	32	43		
Boothville (KBVE)	04/0051	999.6	04/1652	29	39		
Baton Rouge- Ryan Field (KBTR)	04/1559	993.2	03/1420	24	34		
Slidell (KASD)	05/0559	999.0	03/1605	22	30		
Remote Automated Weather Stations (RAWS)							
Lacassine (LACL1)			04/2243	24	37		
Louisiana Agriculture Information Mesonet							
Alexandria Dean Lee Research Station 31.2°N 92.4°W			04/2333	29	43		
NOS Sites							
Bayou Gauche (BYGL1) 29.8°N 90.4°W 9m	04/0124	995.1	03/0836	26	43		
Shell Beach (SHBL1) 29.9°N 89.7°W 10m	04/0012	1000.0	03/1300	38	48	3.97	5.40
Pilots Station East (PSTL1) 28.9°N 89.40°W 24m	04/0048	999.9	03/0830	37	50	1.64	2.93
Bayou Lebranche (LABL1) 30.0°N 90.4°W 9m	04/0124	997.9	03/1236	33	39		
New Canal (NWCL1) 30.0°N 90.1°W 12m	04/0100	997.1	03/0206	30	40	4.09	4.38
Amerada Pass (AMRL1) 29.7°N 91.2°W 10m	04/1130	992.1	04/1218	19	37	4.67	5.73

Location (anemometer height if not 10 m and known)	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)		
Tesoro Marine Terminal (TESL1) 29.7°N 91.2°W	04/1312	991.7	04/1230	32	40	2.67	3.01
Freshwater Canal Locks (FRWL1) 29.7°N 92.8°W 10m	04/0930	986.1	03/1542	29	37	2.44	4.31
Calcasieu Pass (CAPL1) 29.8°N 93.3°W 6.4m	04/0136	993.8	03/1548	34	41	1.33	3.04
Lake Charles (LCLL1) 30.2°N 93.2°W	04/0912	994.5				1.05	2.06
Grand Isle (GISL1) 29.3°N 90.0°W						2.43	3.73
Port Fourchon 29.1°N 90.2°W						2.11	3.44
Bulk Terminal 30.2°N 93.3°W						0.97	1.99
Coastal Studies Institute							
Marsh Island (MRSL1) 29.4°N 92.1°W 23m	04/1000	986.2	04/1100	35	46		
Louisiana Universities Marine Consortium (LUMCON)							
Terrebonne Bay (TRBL1) 29.2°N 90.6°W 14m	03/0300	1002.5	03/0400	29	43		
Western Lake Pontchartrain (LKPL1) 30.3°N 90.3°W 13m	03/0400	1004.4	03/0400	29	43		
LUMCON Center (LUML1) 29.3°N 90.7°W 13m	03/0400	1002.3	03/0400	26	37		
United States Army Corp. of Engineers (USACOE)							
Seabrook Bridge							6.25
IHNC Surge Barrier East (near Orleans/St. Bernard Parish border) 30.0°N 89.9°W							6.08
Mandeville							5.28
Chef Pass							4.61
Pass Manchac							4.58
Cocodrie							4.57

Location (anemometer height if not 10 m and known)	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)		
Lakefront Airport, New Orleans							4.49
West End, New Orleans/Metarie							4.29
17th St. Canal, New Orleans							4.27
Rigolets							4.24
Golden Meadow							4.22
Sellers Canal							4.11
Harvey Canal							3.92
Des Allemands							3.86[g]
United States Geological Survey (USGS)							
Lapeyrouse							5.85
Point a la Hache							4.56
Little Caillou Bay							4.15
Barataria S of Lafitte							4.08
Mississippi							
ICAO Sites							
Gulfport (KGPT)	05/0559	1000.7	03/0542	34	44		
Boothville (KBVE)	04/0051	999.6	04/1652	29	39		
Pascagoula (KPQL)	05/0559	1002.4	04/1635	24	34		
McComb (KMCB)	04/2146	997.0	04/1013	22	30		
Jackson (KJAN)	05/0518	1000.0					
Tallulah Vicksburg (KTVR)	05/0216	1002.0					
Greenville (KGLH)	05/0356	1005.4					
Greenwood (KGWO)	05/0529	1003.7	05/0806	25	33		
NOS Sites							
Gulfport Outer Range (GPOM6) 30.2°N 89.0°W	03/2348	1001.4	04/1718	40[e]	58		
Gulfport West Pier (GWPM6) 30.3°N 89.0°W 14m	03/2342	1000.8	04/0142	35	45		

Location (anemometer height if not 10 m and known)	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)		
Pascagoula Range A rear (RARM) 30.3°N 88.5°W 26m	04/0736	1002.5	03/2236	33	44		
Petit Bois Island (PTBM6) 30.2°N 88.5°W 8m	04/1012	1002.7	03/2242	32	42		
Pascagoula Dock C (DKCM6) 30.4°N 88.6°W 8m	04/1030	1002.5	03/2248	31	42		
Pascagoula Dock E (ULAM6) 30.3°N 88.5°W						3.23	4.53
Pascagoula NOAA Lab 30.4°N 88.6°W						2.88	4.33
Bay Waveland Yacht						3.93	5.56
USACOE							
Biloxi Bay							4.91
Grand Pass							4.64
National Estuarine Research Reserve (NERRS)							
Grand Bay Reserve (GDXM6) 30.4°N 88.4°W 5m	03/2245	1000.2	03/2245	32			
Alabama							
ICAO Sites							
Mobile Regional (KMOB)			04/0033	29	37		
Mobile Brookley (KBFM)			03/1614	31	38		
University of South Alabama (USA) Mesonet (10m anemometer heights)							
Dauphin Island 30.2°N 88.1°W			03/1944	43	47		
Fairhope 30.5°N 87.9°W			03/2053	29	36		
Grand Bay 30.5°N 88.4W			03/2352	28	39		
Robertsdale 30.6°N 87.7°W			03/2104	31	34		

Location (anemometer height if not 10 m and known)	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)		
NOS Sites							
Weeks Bay (WKXA1) 30.4°N 87.8°W						3.16	4.20
Dauphin Island 30.3°N 88.1°W			04/0006	40	54	1.97	3.44
Dog River Bridge 30.6°N 88.1°W						3.51	4.43
East Fowl River Bridge 30.4°N 88.1°W						2.92	3.99
Coast Guard Sector (MCGA1) 30.6°N 88.1°W			3/2112		42	4.40	5.28
Fort Morgan (FMOA1) 30.2°N 88.0°W 33m			3/1942	45	51		
Mobile State Docks (OBLA1) 30.7°N 88.0°W						3.82	4.95
West Fowl River Bridge 30.4°N 88.2°W						3.02	4.27
Florida							
NOS Sites							
Panama City (PACF1) 30.2°N 85.7°W						1.92	2.95
Pensacola (PCLF1) 30.4°N 87.2°W						1.90	3.38
Offshore Observations							
Oil Platforms							
Sabine Pass 13 (KVBS) 29.5°N 93.6°W 26m	04/0715	994.2	03/1715	44	52		
Cameron 47 (KCMB) 29.4°N 93.0°W 30m	04/0700	991.5	03/1740	44	53		
Vermilion 26 (KVNP) 29.5°N 92.4°W 26m	04/0855	986.1	03/0815	34	46		
Ship Shoal 178 (KSPR) 28.6°N 91.2°W 30m	04/0935	993.9	02/1015	31	46		
Cameron 368 (KCRH) 28.9°N 93.3°W 30m	03/0915	999.3	03/0915	37	46		
Cameron 278 (KEHC) 28.4°N 92.9°W 29m	03/1815	994.9	03/2315	42	49		
High Island (KHQI) 28.0°N 93.7°W 18m	04/0015	999.0	04/1115	36	43		

Location (anemometer height if not 10 m and known)	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)		
Mississippi Canyon 311a (KMDJ) 28.6°N 89.8°W 90m			03/0855	51 (42[h])	58		
Louisiana Offshore Oil Port (LOPL1) 28.9°N 90.0°W 58m	04/0034	996.1	03/0939	46	63		
Vissco Knoll 786 (KVOA) 29.2°N 87.8°W 160m			03/0255	43	53		
Mississippi Canyon 711 (KMYT) 28.2°N 89.6°W 32m			02/1655	43	50		
Garden Banks 426 (42361) 27.6°N 92.5°W 122m	03/2000	997.6	04/0800	47			
Green Canyon 158 (42362) 27.8°N 90.7°W 122m			3/0545	41			
Mississippi Canyon 807 (42363) 28.2°N 89.2°W 122m	03/2000	1002.4	03/1330	52 (42[h])			
Viosca Knoll 936 (42364) 29.1°N 88.1°W 122m	4/0245	1005.4	03/1800	47			
BW Pioneer Buoy- Walker Ridge (42360) 3m			03/1100	35[f]	53		
Main Pass 289c (KVKY) 29. 2°N 88.4°W 115 m			04/0735	39	59		
MP 140B AWOS (KMIS) 29.3°N 88.8°W 85m			04/1715	37	42		
Ship Shoal 178 (KSPR) 28.6°N 91.2°W 75m			03/0655	37	46		
Fourchon Heliport (KXPY) 29.1°N 90.2°W 30m			02/1635	25	36		
South Timbalier Block 52 (SPLL1) 28.9°N 90.5°W 40m			02/2000	37	47		
West Sirius (3EMK6) 27.9°N 89.2°W	03/0800	1003.7	03/0500	46			
Buoy and C-MAN							
Sabine (SRST2), TX 29.7°N 94.1°W 9m	04/0900	997.2	03/2140	26	32		
Buoy 42035 29.3°N 94.4°W	04/0750	997.7	03/2250	33	40		

Location (anemometer height if not 10 m and known)	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)		
Southwest Pass, LA (BURL1) 28.9°N 89.4°W	04/0000	1000.0	03/0800	44	52		
Buoy 42040 29.2°N 88.2°W 10m	03/2050	1003.0	03/1850	33	43		
Buoy 42067 (University of Southern Miss.) 30.0°N 88.6°W 5m	04/1040	1001.8	03/0540	31	39		
Dauphin Island (DPIA1), AL 28.9°N 89.4°W			03/2150	39	55		

[a] Date/time is for sustained wind when both sustained and gust are listed.
[b] Except as noted, sustained wind averaging periods for C-MAN and land-based ASOS reports are 2 min; buoy averaging periods are 8 min.
[c] Storm surge is water height above normal astronomical tide level.
[d] NOS values are relative to Mean Lower Low Water (MLLW). USACOE and USGS observations are above National Geodetic Vertical Datum (1988 mean sea level), except as noted.
[e] Peak wind occurred during a short-lived squall and is not representative of the overall intensity of the cyclone.
[f] Anemometer height is 3 m above sea level but data are adjusted to 10 m by the owner of the buoy.
[g] Above National Geodetic Vertical Datum (1929 mean sea level).
[h] Wind after a reduction to a standard height of 10 m using the mean hurricane dropwindsonde profile.

Table 4. Selected minimum pressure and maximum wind observations from land stations associated with post-tropical cyclone Lee, 5 September 2011.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed		
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)
Louisiana					
Boothville (KBVE)	05/1323	998.0	05/0921	34	46
New Orleans (KNEW)	05/1341	995.6	05/1455	42	49
New Orleans- Armstrong Intl Airport (KMSY)	05/1236	996.3	05/1411	25	36
Slidell (KASD)	05/1419	995.6			
Mississippi					
ICAO Sites					
Gulfport (KGPT)	05/1609	996.6			
Pascagoula (KPQL)	05/1757	997.0			
Jackson (KJAN)			05/1525	28	40
Meridian (KMEI)	05/0737	998.6	05/0810	32	43
Tallulah Vicksburg (KTVR)			05/1006	31	38
Hattiesburg (KHBG)	05/0820	997.3	05/1022	28	41
Greenville (KGLH)			05/1401	36	45
McComb (KMCB)	05/1059	997.6			
Alabama					
ICAO Sites					
Mobile Regional (KMOB)	05/1733	996.6	05/1301	30	42
Mobile Brookley (KBFM)	05/1746	997.0	05/2143	36	48
University of South Alabama (USA) Mesonet (10m anemometer heights)					
Andalusia 31.3°N 86.5°W			05/1713	30	37
Dauphin Island 30.2°N 88.1°W			05/1316	44	48
Elberta 30.4°N 87.6°W			05/1029	33	39
Fairhope 30.5°N 87.9°W			05/2158	36	37

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed		
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)
Grand Bay 30.5°N 88.4W			05/1244	32	37
Loxley 30.6°N 87.7°W			05/1812	31	38
NOS Sites					
Fort Morgan (FMOA1) 30.2°N 88.0°W 33m			05/1700	44	51
Florida					
ICAO Sites					
Pensacola Naval Air Station (NAS) (KNPA)	05/1956	998.2	05/1739	34	46
Pensacola Regional (KPNS)	05/2057	997.6	05/1647	37	51
Milton (KNSE)	05/2056	995.6	05/1732	29	51
Crestview (KCEW)	05/2138	998.0	05/1949	26	40
Mary Esther (KHRT)	05/2113	998.7	05/1905	29	47
Valpariso (KVPS)	05/2055	998.8	05/1639	29	45
Destin (KDTS)	05/2123	998.6	05/1816	28	51
USA Mesonet					
Jay 30.9°N 87.2°W			05/1817	36	49
Walnut Hill 30.9°N 87.5°W			05/1811	32	42

[a] Date/time is for sustained wind when both sustained and gust are listed.

[b] Except as noted, sustained wind averaging periods for C-MAN and land-based ASOS reports are 2 min; buoy averaging periods are 8 min.

Table 5. Selected storm total rainfall amounts associated with Lee and its remnants, 2-10 September 2011.

Location	Total Rain (in)		Location	Total Rain (in)
State			**Louisiana (Cont.)**	
Texas			Grangeville	11.57
Port Arthur (KBPT)	3.97		New Orleans- Moisant	11.05
Orange (KORG)	3.64		Alexandria	10.96
Jasper (KJAS)	3.15		Olive Branch (2 NE)	10.95
Hemphill	2.76		Metairie (10 N)	10.78
Burkeville (16 NNE)	2.57		Terrytown	10.73
Sonora (19 S)	2.42		Abita Springs	10.41
Town Bluff (2 NE)	2.42		Jonesville (10 SSW)	10.30
Bon Weir	2.38		New Roads (5 NE)	10.27
Sour Lake (5 SE)	2.28		Abita River	10.18
China	2.20		Bayou Manchac Point	10.05
Wildwood	2.19		Denham Springs	10.00
Galveston (KGLS)	0.70		Slidell- NWS	9.64
Lufkin (KLFK)	0.42		Boothville (KBVE)	9.12
Houston (KHOU)	0.07		Baton Rouge (KBTR)	8.81
			Slidell (KASD)	8.36
Louisiana			Alexandria (KESF)	6.24
Holden	15.48		New Iberia (KARA)	6.16
New Orleans- Carrolton	14.56		Lafayette (KLFT)	5.90
Springfield- Killian	14.10		Alexandria (KAEX)	5.14
Maurepas	13.64		Lake Charles (KLCH)	4.35
Ponchatoula	13.24		Fort Polk (KPOE)	3.49
Convent (2 S)	13.12		Monroe (KMLU)	2.85
Galliano	12.90			
New Orleans Lakefront Airport (KNEW)	12.68		**Mississippi**	
Covington	12.33		Florence	13.55
Livingston	12.15		Forest (3 S)	12.82
Baptist	12.01		Mize (3 SW)	12.75
New Orleans- Audubon	11.93		Walnut Grove (2 S)	12.59
Peairs	11.93		Philadelphia (5 E)	12.00
Robert	11.80		Hattiesburg (8 WSW)	11.64
Slidell	11.75		Prentiss	11.33

Location	Total Rain (in)		Location	Total Rain (in)
Mississippi (Cont.)			**Alabama (continued)**	
Pascagoula (KPQL)	11.22		Pinson	10.10
Pearl (3 ESE)	11.15		Birmingham (KBHM)	8.30
Jackson (KJAN)	11.15		Tuscaloosa (KTCL)	7.17
Gulfport (KGPT)	11.14		Muscle Shoals (KMSL)	6.21
Biloxi- Keesler AFB (KBIX)	10.77		Huntsville (KHSV)	5.72
Hattiesburg (5 SW)	10.53		Troy (KTOI)	4.33
Wiggins (6 E)	10.31		Alabaster (KEET)	4.24
Sumrall	10.10		Maxwell AFB (KMXF)	2.92
Conehatta	10.00		Ozark (KOZR)	2.88
Hattiesburg (KPIB)	8.11			
McComb (KMCB)	7.57		**Florida**	
Hattiesburg (KHBG)	6.42		Milton (KNSE)	8.73
Tupelo (KTUP)	6.10		Milligan	8.48
Natchez (KHEZ)	4.81		Mary Esther (KHRT)	6.50
Meridian (KMEI)	3.84		Niceville	6.32
Columbus AFB (KCBM)	2.69		Destin (KDTS)	6.29
Greenwood (KGWO)	2.35		Apalachicola	6.00
Greenville (KGLH)	2.29		Pensacola (KPNS)	5.81
			Eglin AFB (KVPS)	5.70
Alabama			Crestview (KCEW)	5.51
Mobile (10 WSW)	12.62		Apalachicola (KAAF)	5.49
Tilmans Corner (4 WNW)	12.17			
Robertsdale	11.98		**Georgia**	
Grand Bay	11.70		New England	10.86
Mobile (KMOB)	11.64		Lafayette (5 SW)	10.53
Theodore (4 WNW)	11.58		Armuchee	9.25
Coden	11.51		Ringgold	8.45
Mobile- Bates Field	11.30		Curryville	7.87
Milton	11.04		Boone	7.40
Scottsboro	10.86		Hurst	6.60
Orange Beach	10.83		Rome (KRMG)	6.26
Mobile (6 WSW)	10.68		Hammond	6.22
Guntersville	10.59		Calhoun	6.09
Walnut Grove	10.50		Cohutta	6.04

Location	Total Rain (in)		Location	Total Rain (in)
Georgia (continued)			**Kentucky**	
Summerville	5.95		Cranks Creek Reservoir	6.88
Resaca	5.75		Cumberland	6.29
Chatsworth	5.53		Whitesburg	6.25
Eton (5 W)	5.15		Pikeville	5.66
			Middlesboro (2 SE)	5.64
Tennessee				
Charleston	13.11		**West Virginia**	
Georgetown	11.92		Mt. Storm	7.09
Cleveland	10.72		Huck	5.81
Chattanooga (KCHA)	10.35		Paw Paw	5.40
Athens	10.24		Knobly Tunnel	5.34
Decatur (7 NE)	9.99		Barnum	5.15
McDonald	9.75		Walker Ridge	5.15
Watts	9.70		Keyser (3 E)	5.01
Chickamauga Dam	9.05			
Oak Ridge (KOQT)	8.25		**Virginia/ District of Colombia**	
Knoxville (KTYS)	6.93		Colonial Beach	20.96
			Vienna (3.3 N)	18.02
North Carolina			Woodbridge	16.09
Mt. Mitchell State Park	6.84		Lorton	15.07
Globe	6.41		Fort Belvoir (KDAA)	13.15
Triplett	5.97		Franconia	12.81
Blowing Rock	5.59		Burke	11.85
Newfound Gap	5.43		Fairfax	10.29
Highlands	5.42		McLean	9.83
Franklin (11 SW)	5.30		Mantua	9.81
Lake Toxaway	5.30		Fairfax (2.3 W)	9.66
Grandfather Meadows	5.28		Hanover (5.9 ESE)	9.55
Wilbar	5.08		Fairfax (7 NW)	9.54
Little Switzerland	5.07		Vienna	9.54
Banner Elk	5.07		Mount Vernon	9.36
Linville Falls	4.89		McLean	9.14
Murphy	4.84		Quantico (KNYG)	9.13

Location	Total Rain (in)		Location	Total Rain (in)
Virginia/ District of Colombia (continued)			**Pennsylvania (continued)**	
Fancy Gap	9.01		Fort Indiantown Gap	13.58
Washington Dulles (KIAD)	8.74		Dehart Dam	13.54
Arlington/Washington (KDCA)	7.82		Joliett	13.40
Richmond	6.06		Harrisburg (KMDT)	13.31
Wakefield (KAKQ)	5.98		Elizabethville	13.20
			Hershey	12.28
Maryland			Laporte	12.27
Elkton (3.8 NNW)	18.88		Sunbury	11.94
Bowie	12.07		Lapport	11.80
Waldorf (2.2 E)	11.93		Perulack	11.50
Crofton	11.85		Bethel	11.48
Waldorf (3.3 S)	11.84		Beavertown	11.45
Bowie	11.52		Shunk	11.36
Bowie (2.4 NNE)	11.45		Everett	11.15
Churchton	11.27		Dushore (3 SSW)	11.09
South Gate (3 SSW)	11.25		Unityville (4 NW)	10.80
Jacksonville	11.20		Monroeton	10.74
Catonsville	11.13		Friedensburg	10.63
Ellicott City	11.08		Fort Indiantown (KMUI)	10.61
La Plata	10.96		Pine Summit	10.50
Elkridge (1.8 W)	10.71		Lewisburg	10.36
Cedarmere	10.44		New Bloomfield	10.28
Reisterstown	10.43		Harrisburg	10.25
Gaithersburg (2 WNW)	10.22		Schellsburg	10.21
Andrews AFB (KADW)	8.74		Hugos Corners	10.19
Baltimore/Washington Airport (KBWI)	7.32		Honey Grove	10.07
Baltimore Inner Harbor (KDMH)	6.32		Lancaster (KLNS)	9.80
			Williamsport (KIPT)	9.17
Pennsylvania				
Pine Grove	15.22		**New Jersey**	
Lebanon	14.40		Stockton	11.57
Hershey (1 NW)	14.27		Belvidere Bridge	8.61

Location	Total Rain (in)		Location	Total Rain (in)
Lake Hopat	8.34		**New York (continued)**	
Phillipsburg Easton	8.00		Rock Hill	7.06
Pottersville	7.82		White Plains (KHPN)	6.80
Clinton	7.80		New York- LaGuardia (KLGA)	4.19
Sussex	7.79			
Ironia	7.37		**Connecticut**	
Montague Milford	7.34		West Hartford	7.04
Washington	7.31		Norfolk	6.78
Skillman	7.16		Thomaston (2 NNE)	6.27
Pellettown	7.15		Danbury (KDXR)	5.74
West Milford	7.04		Windsor Locks	5.66
Rieglesville	7.01		Wallingford	5.60
Clinton	6.95		Bakersville	5.42
Bershire Valley	6.86		Deep River	5.08
New York			**Rhode Island**	
Apalachin (2.8 ESE)	12.73		Providence (KPVD)	3.89
Endicott	11.46		Newport (KUUU)	3.35
Vestal	10.49			
Binghamton (KBGM)	10.08		**Massachusetts**	
Owego (3 WSW)	8.89		Worthington	8.40
Waverly	8.87		West Otis	6.15
Whitney Point	8.58		Pittsfield (KPSF)	5.53
Phoenicia	8.31		Bridgewater	4.88
Montgomery (KMGJ)	8.22		Worchester (KORH)	4.88
Tannersville	8.00		Chester	4.63
Unadilla	7.95		Taunton (KTAN)	4.41
Hunts Corners	7.90			
Ellenville	7.65		**Vermont**	
Newark Valley	7.50		Jamaica (3 NNW)	4.83
Norwich	7.26		Townshend	4.06
Elmira	7.23		Springfield (KVSF)	4.01
Cortland	7.17		Searsbury Reservoir	3.68
Oneonta	7.17		Mt. Washington (KMWN)	3.60

Location	Total Rain (in)		Location	Total Rain (in)
Vermont (continued)				
Bennington (KDDH)	3.49			
Thetford	3.34			
South Burlington (KBTV)	3.11			
Sunderland	3.02			
New Hampshire				
Keene	5.64			
Marlow	5.04			
Walpole	4.63			
North Walpole	3.94			
Colebrook	3.30			
West Hopkinton	3.07			

Table 6a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Lee, 2-5 September 2011. Mean errors for the 5-yr period 2006-10 are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	32.9	**41.8**	**43.8**	**37.3**	**49.4**		
OCD5	38.9	73.7	102.7	98.7	69.5		
Forecasts	11	9	7	5	1		
OFCL (2006-10)	31.0	50.6	69.9	89.5	133.2	174.2	214.8
OCD5 (2006-10)	47.7	98.3	156.4	218.1	323.3	402.2	476.1

Table 6b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Lee, 2-5 September 2011. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 6a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	29.3	33.9	33.3	33.3			
OCD5	41.7	82.5	138.3	172.8			
GFSI	**23.9**	**32.3**	**25.7**	**24.0**			
GHMI	30.5	60.4	33.3	35.8			
HWFI	32.4	47.5	69.9	98.5			
GFNI	48.3	83.2	92.1	113.3			
NGPI	**17.5**	40.4	43.2	70.0			
UKMI	**28.6**	57.1	**26.9**	39.3			
EGRI	**28.6**	57.1	**26.9**	39.3			
EMXI	**26.3**	41.7	**23.6**	50.5			
CMCI	**28.4**	**28.9**	**23.8**	**26.1**			
NAMI	35.1	97.6	76.7	85.4			
AEMI	32.0	44.0	48.9	67.5			
FSSE	**27.9**	39.1	38.0	43.1			
TVCA	29.5	48.0	36.7	**28.5**			
TVCC	**28.6**	44.1	34.5	33.3			
LBAR	**24.8**	44.6	59.6	66.5			
BAMD	34.9	55.0	84.8	101.2			
BAMM	**24.8**	39.5	49.8	61.9			
BAMS	40.5	76.1	119.9	201.2			
Forecasts	6	5	3	1			

Table 7a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Lee, 2-5 September 2011. Mean errors for the 5-yr period 2006-10 are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	**3.6**	**8.9**	**10.0**	**14.0**	**15.0**		
OCD5	3.1	2.9	7.7	11.8	2.0		
Forecasts	11	9	7	5	1		
OFCL (2006-10)	7.2	11.0	13.2	15.1	17.2	17.9	18.7
OCD5 (2006-10)	8.5	12.3	15.4	17.8	20.2	21.9	21.7

Table 7b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Lee, 2-5 September 2011. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 7a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	3.8	11.7	12.5	15.0			
OCD5	**3.3**	**3.5**	**8.3**	**8.5**			
GHMI	6.8	**7.0**	**8.3**	**9.0**			
HWFI	4.6	**4.0**	**3.3**	**5.5**			
DSHP	6.1	**6.2**	**9.3**	**5.0**			
LGEM	7.0	**6.3**	**8.5**	**4.5**			
ICON	5.3	**4.3**	**5.0**	**3.5**			
IVCN	5.6	**5.0**	**5.8**	**5.5**			
FSSE	7.9	**6.0**	**10.3**	**6.0**			
Forecasts	8	6	4	2			

Table 8. Watch and warning summary for Tropical Storm Lee, 2-5 September 2011.

Date/Time (UTC)	Action	Location
2 / 0000	Tropical Storm Warning issued	Pascagoula, MS to Sabine Pass, TX
3 / 0300	Tropical Storm Watch issued	Destin, FL to AL/FL border
3 / 0300	Tropical Storm Warning modified to	AL/FL border to Sabine Pass, TX
3 / 2100	Tropical Storm Watch discontinued	All
3 / 2100	Tropical Storm Warning modified to	Destin, FL to Sabine Pass, TX
4 / 1800	Tropical Storm Warning modified to	Destin, FL to Intracoastal City, LA
4 / 2100	Tropical Storm Warning modified to	Destin, FL to Morgan City, LA
5 / 0300	Tropical Storm Warning discontinued	All

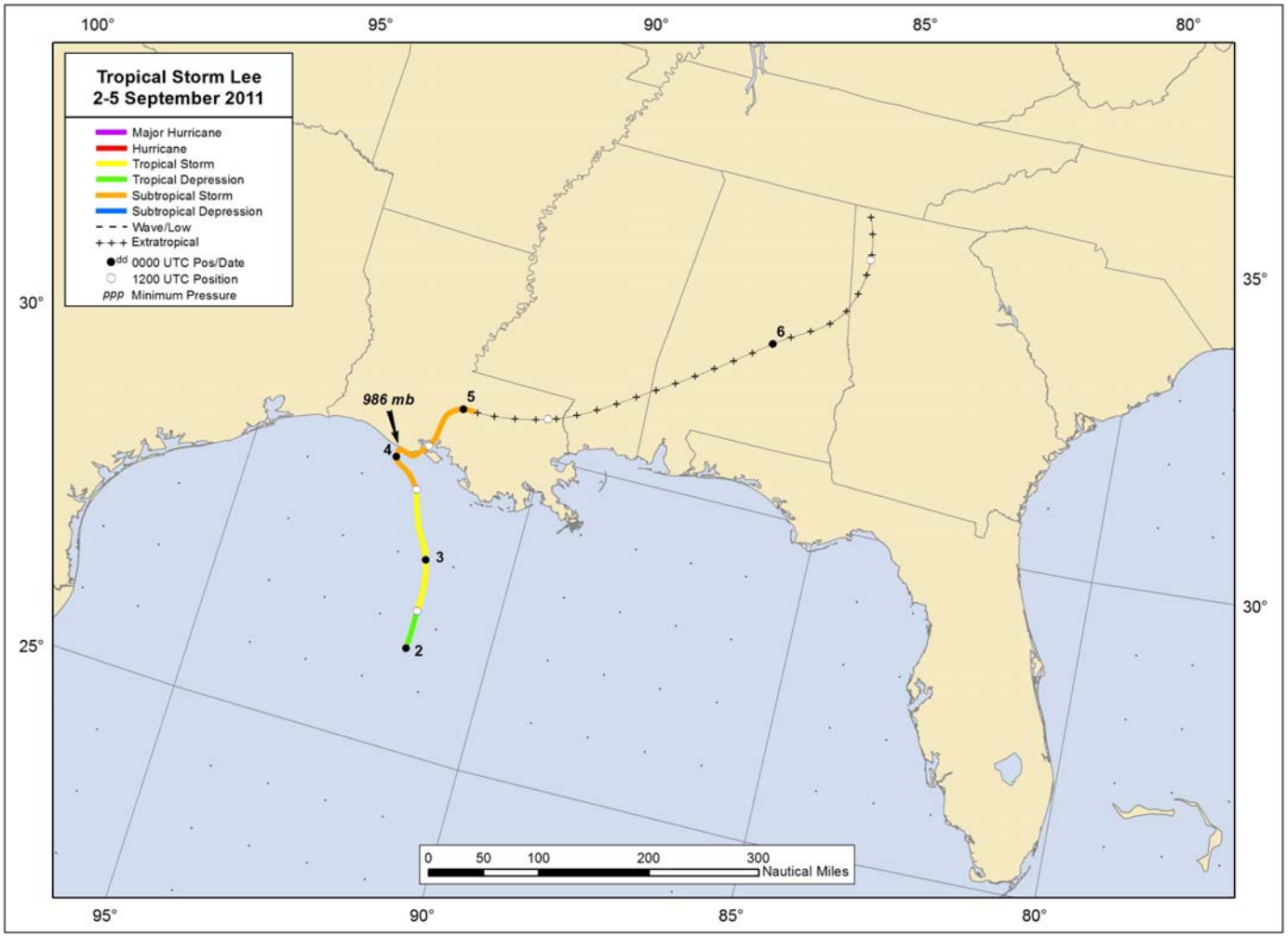

Figure 1. Best track positions for Tropical Storm Lee, 2-5 September 2011. Track during the extratropical stage is partially based on analyses from the NOAA Hydrometeorological Prediction Center.

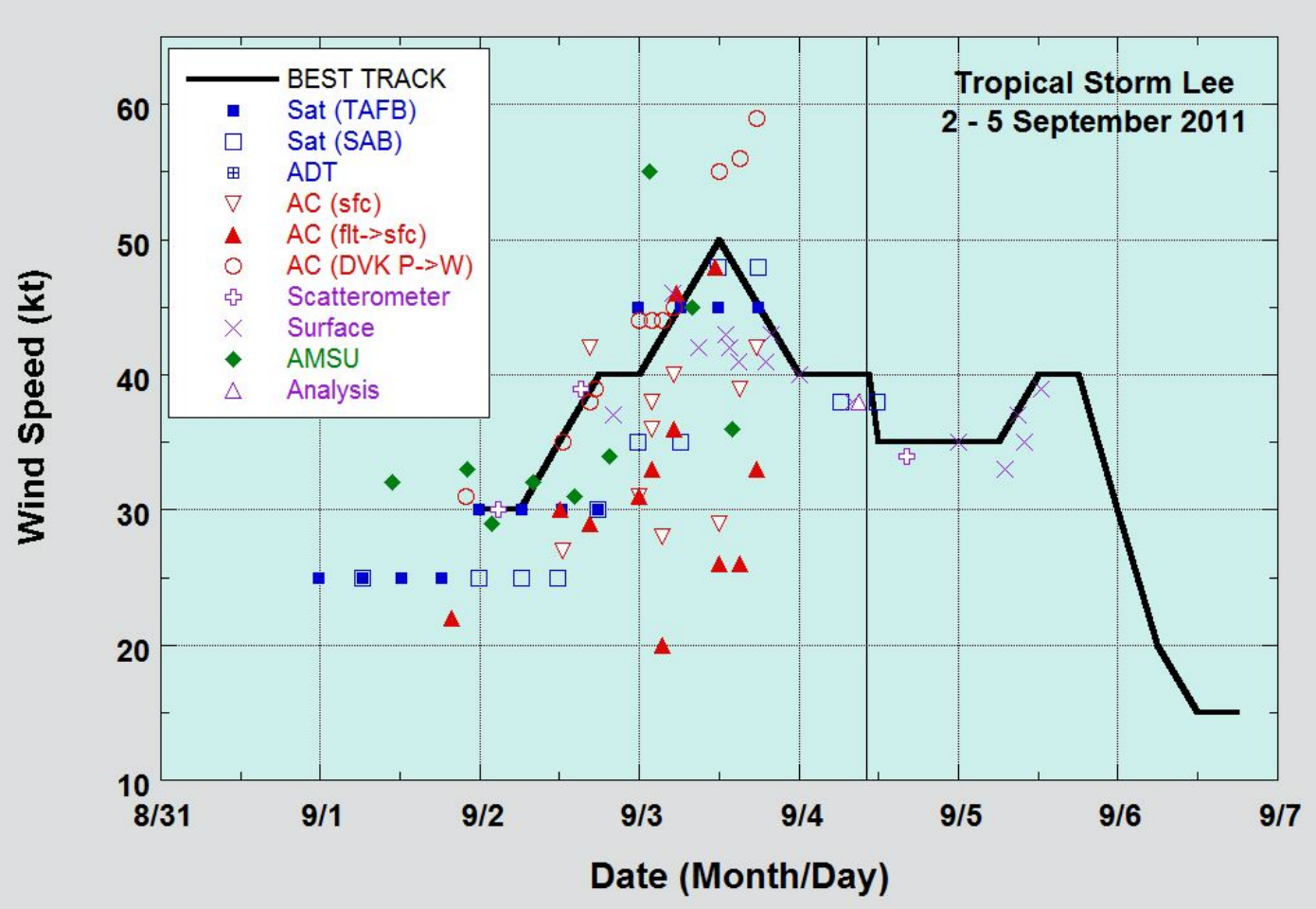

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Lee, 2-5 September 2011. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Estimates during the extratropical stage are partially based on analyses from the NOAA Hydrometeorological Prediction Center. Dashed vertical lines correspond to 0000 UTC and the solid vertical line corresponds to the time of landfall.

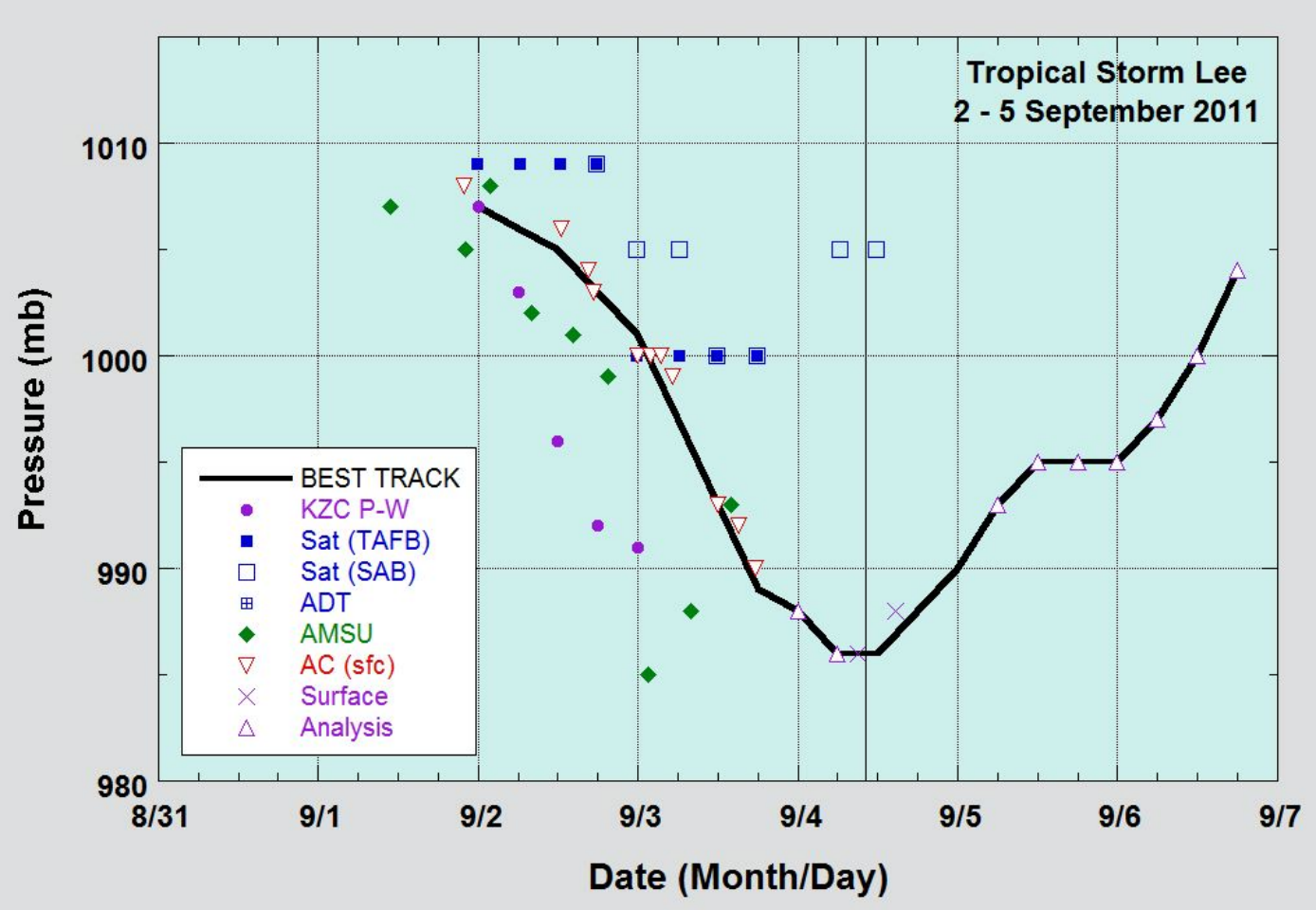

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Lee, 2-5 September 2011. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. The KZC P-W values are obtained by applying the Knaff-Zehr-Courtney pressure-wind relationship to the best track wind data. Estimates during the extratropical stage are partially based on analyses from the NOAA Hydrometeorological Prediction Center. Dashed vertical lines correspond to 0000 UTC and the solid vertical line corresponds to the time of landfall.

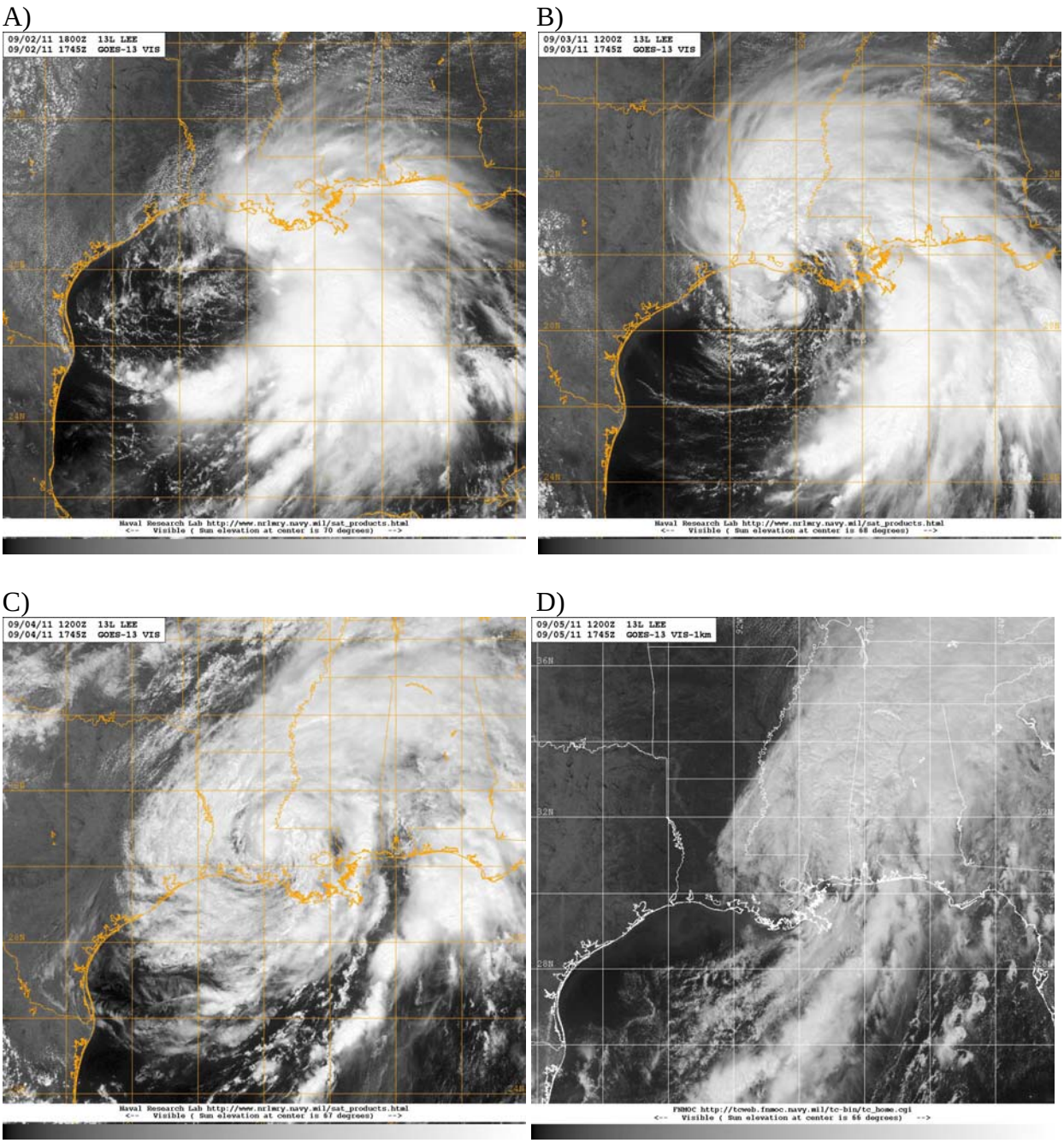

Figure 4. Evolution of Lee as seen in visible satellite imagery from 1745 UTC 2 September through 1745 UTC 5 September. The first two images (A and B) show the transition from Lee as a tropical cyclone to subtropical cyclone. In image B (1745 UTC 3 September), note that the banding features are removed from the center and that there is a convective-free region wraps around the east side of the circulation. Lee is over land in image C (1745 UTC 4 September) and has become an extratropical cyclone along a frontal zone in image D (1745 UTC 5 September).

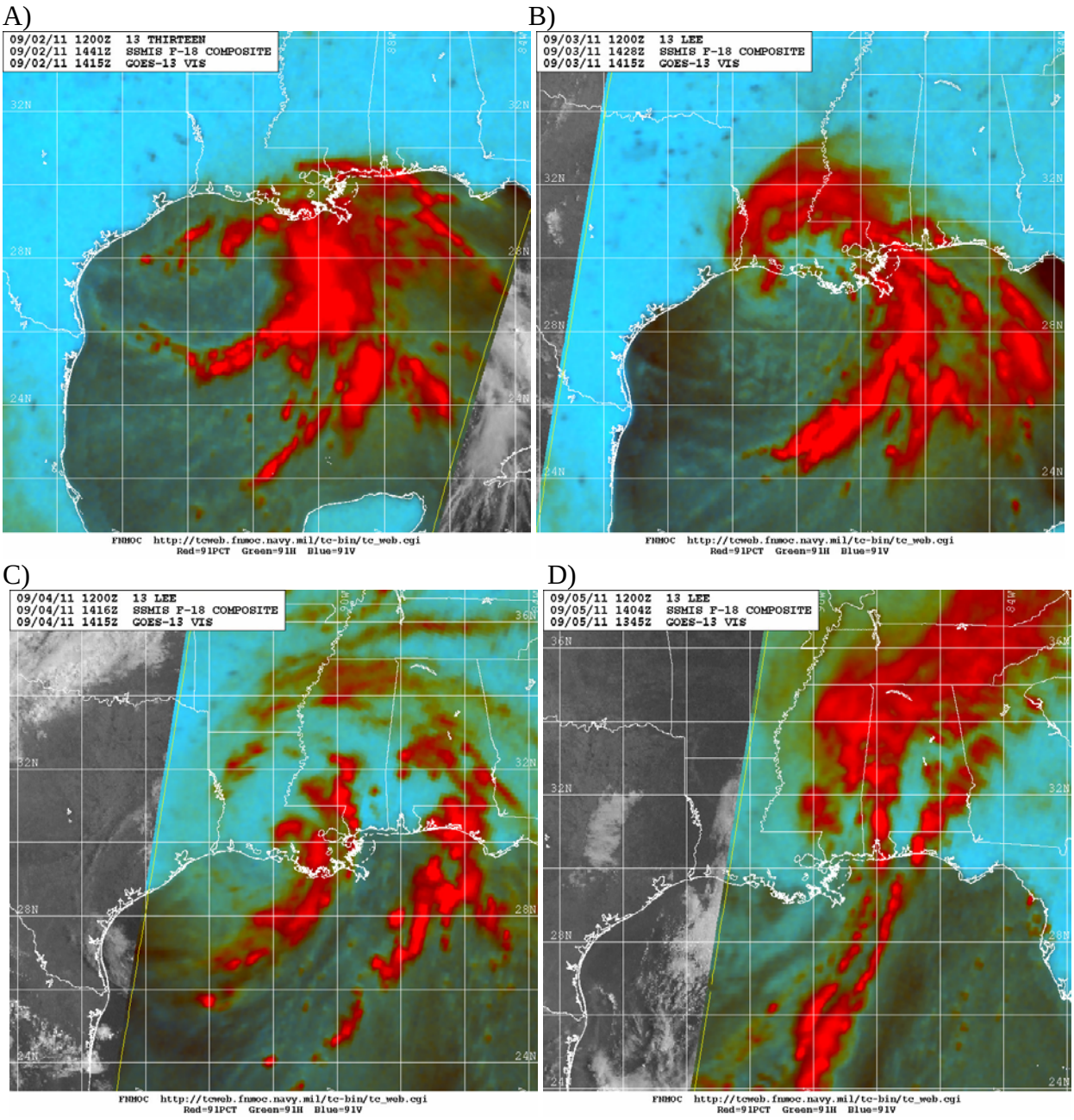

Figure 5. Evolution of Lee in the Special Sensor Microwave Imager/Sounder (SSMIS) 91-GHz composite images from 1441 UTC 2 September to 1404 UTC 5 September. Lee transitions from a tropical cyclone to a subtropical cyclone between images A and B. Images courtesy of the U.S. Navy's Fleet Numerical Meteorology and Oceanography Center (FNMOC) tropical cyclone webpage.

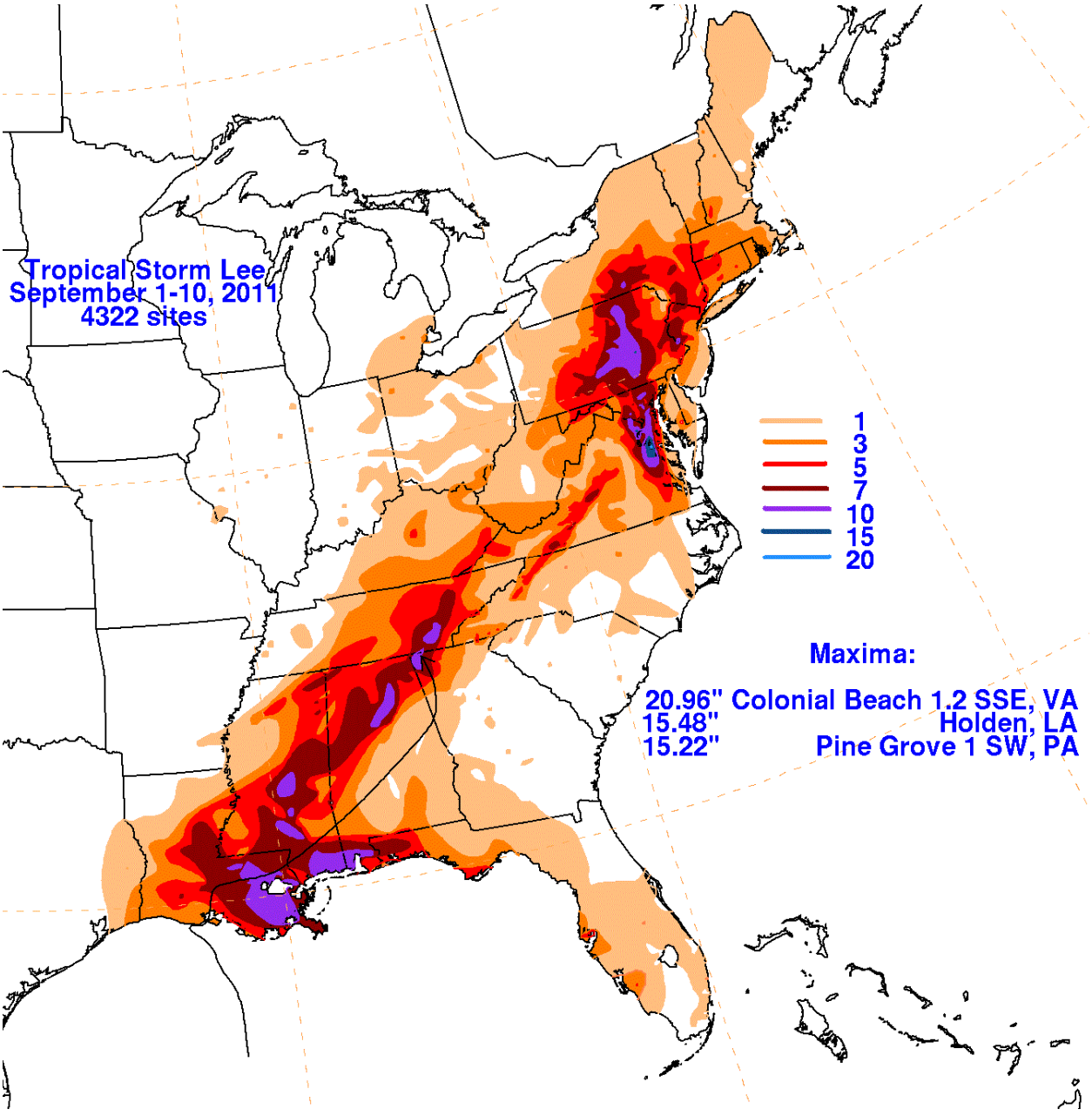

Figure 6. Rainfall associated with Lee and its remnants over the eastern United States. Image courtesy of the Hydrometeorological Prediction Center.

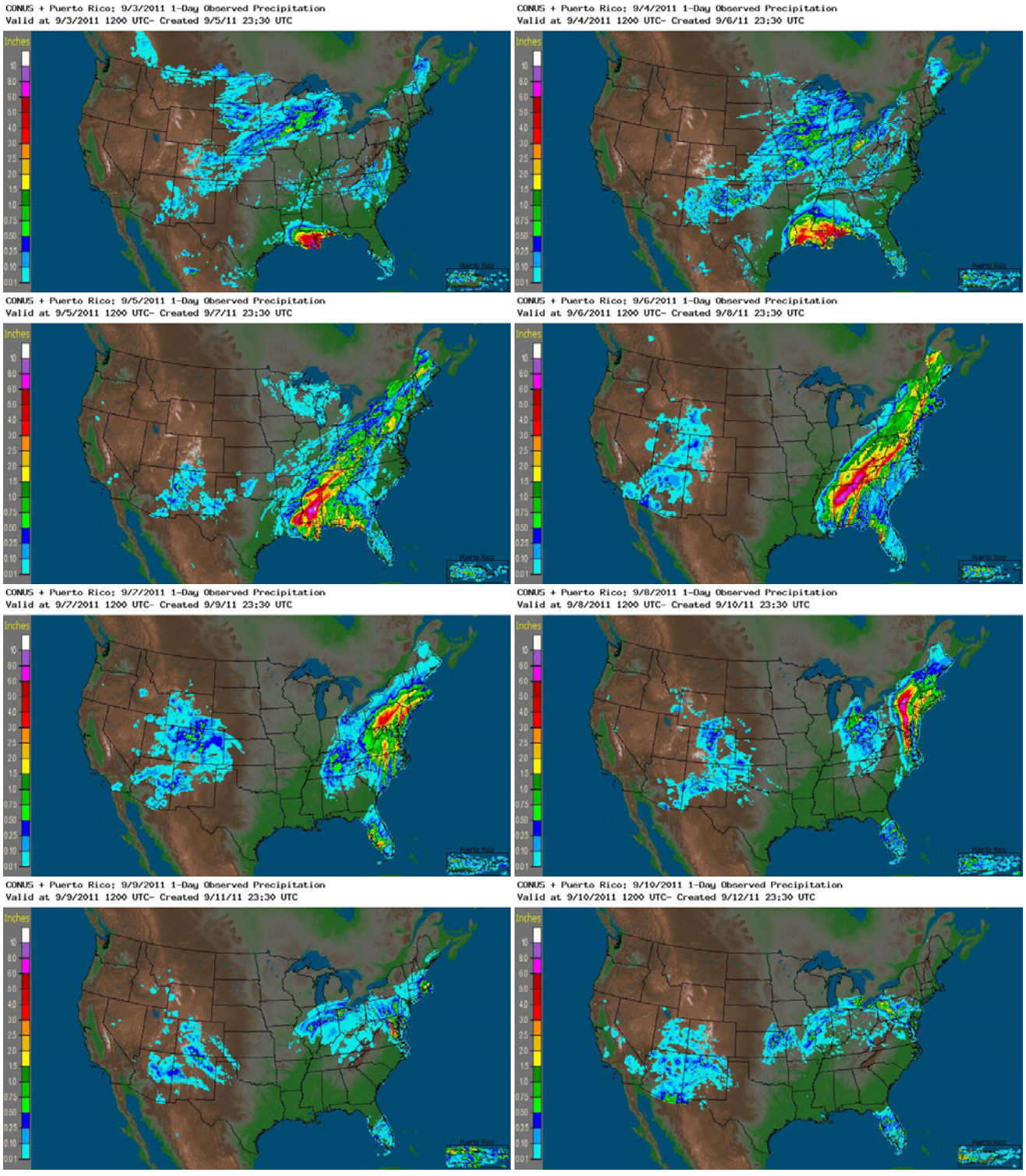

Figure 7. Daily observed (radar estimates/rain gauge composite) rainfall maps for the 24-h period ending at 1200 UTC each day from 3-10 September 2011. Note the area of heavy rainfall that begins along the northern Gulf Coast on 3 September and spreads northeastward through the period.