



NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE FRANKLIN (AL072017)

7–10 August 2017

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National Hurricane Center
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EXPERIMENTAL GOES-16 PSEUDO-NATURAL COLOR IMAGE OF FRANKLIN NEAR 2300 UTC 9 AUGUST. IMAGE COURTESY OF THE NOAA ENVIRONMENTAL VISUALIZATION LABORATORY.

Franklin made landfall on the east coast of the Yucatan Peninsula of Mexico as a tropical storm, and then made a second landfall in eastern mainland Mexico as a Category 1 hurricane on the Saffir-Simpson Hurricane Wind scale.

Hurricane Franklin

7–10 AUGUST 2017

SYNOPTIC HISTORY

The origin of Franklin was a tropical wave that moved westward from the coast of Africa on 27 July. Moving quickly across the tropical Atlantic, the wave reached the eastern Caribbean Sea on 3 August where the associated convection increased. Development of the system began in earnest on 5 August when a low-level vorticity center formed near the northern coast of Colombia, accompanied by a convective cluster. This center moved west-northwestward and developed into a broad low pressure area with near-gale-force winds late on 6 August between the Cayman Islands and northeastern Honduras. The circulation subsequently became better defined around 0000 UTC 7 August while it was located about 75 n mi north-northeast of Cabo Gracias a Dios on the border of Honduras and Nicaragua. Since surface observations indicated the presence of 35-kt winds, it is estimated that Tropical Storm Franklin formed at that time. The “best track” chart of the tropical cyclone’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 1¹.

Franklin moved generally northwestward after genesis toward the east coast of the Yucatan Peninsula of Mexico due to the presence of a subtropical ridge to the north. A light vertical shear environment allowed steady strengthening, and satellite imagery, as well as coastal radar data from Belize, indicated an eye was trying to form when the storm made landfall near 0345 UTC 8 August near Pulticub, Mexico (in the state of Quintana Roo), with an estimated intensity of 50 kt. The storm weakened while it moved west-northwestward across the Yucatan Peninsula, and its maximum winds decreased to 40 kt by 0000 UTC 9 August when the center emerged over the Bay of Campeche just north of the city of Campeche. Turning westward over the water, Franklin again steadily strengthened, reaching hurricane status near 1800 UTC that day and reaching a peak intensity of 75 kt at 0000 UTC 10 August. At that time, the center was located about 80 n mi north-northeast of Veracruz, Mexico.

After peak intensity, Franklin came under the influence of a strong mid- to upper-level ridge centered over northern Mexico. This caused the cyclone to turn west-southwestward, a motion that would continue for the rest of Franklin’s life. The ridge also caused moderate to strong northerly shear over the system that tilted the hurricane’s vortex and led to weakening during the last few hours before landfall. The final landfall occurred around 0500 UTC 10 August near Vega del Altorre, Mexico (in the state of Veracruz), at which time Franklin had winds near 70 kt. After landfall, the cyclone weakened very rapidly as it moved into the mountains of eastern and central Mexico, and the low-level center completely dissipated by 1800 UTC that day.

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 *bt*k directory, while previous years’ data are located in the *archive* directory.

The mid-level remnants of Franklin continued westward and emerged over the eastern Pacific Ocean on 11 August, where they contributed to the formation of Tropical Storm Jova (https://www.nhc.noaa.gov/data/tcr/EP122017_Jova.pdf).

METEOROLOGICAL STATISTICS

Observations in Franklin (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 objective Advanced Dvorak Technique (ADT) 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 flights of the 53rd Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command and the NOAA Aircraft Operations Center. In addition, dropsondes are available from one flight of the NASA Global Hawk aircraft. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Global Precipitation Mission (GPM), the European Space Agency's Advanced Scatterometer (ASCAT), the Defense Meteorological Satellite Program (DMSP) satellites, and the Belize Meteorological Service radar at Belize City, among others, were also useful in constructing the best track of Franklin.

Selected surface observations from land stations and data buoys are given in Table 2.

Winds and Pressure

Data from NOAA buoy 42057 was the basis for classifying the cyclone a tropical storm at the genesis time. The buoy reported 30–35 kt winds near 0000 UTC 7 August and reported 1-min average winds of 39 kt at 0430 UTC 7 August.

The 50-kt landfall intensity on the Yucatan Peninsula is based on aircraft data about 5 h earlier that included a 53-kt surface wind estimate from the SFMR, flight-level winds of 62 kt at 850 mb, and a central pressure of 995 mb. Since Franklin was intensifying up to the time the aircraft departed the storm, it is possible the cyclone strengthened further before landfall. However, there are no surface data in the landfall area, and satellite intensity estimates were too ambiguous to support a higher intensity.

The maximum intensity of 75 kt near 0000 UTC 10 August is based on aircraft-measured 850-mb flight-level winds of 89 kt and SFMR surface winds estimates of 75–80 kt. The minimum central pressure at this time was 981 mb. During the ensuing 5-h period, aircraft data showed rising pressures and decreasing flight-level winds, and a storm chaser in Vega del Altorre reported a pressure of 990.5 mb as the center passed overhead. Based on the available data, it is estimated that Franklin's second landfall intensity was 70 kt. The highest reported winds in the landfall area were from a private weather station north of the center in La Vigueta, Mexico, which reported sustained winds of 51 kt and a gust of 65 kt before contact with the station was lost.

The only reliable ship report of tropical-storm-force winds was from the *Carnival Breeze* (call sign **3FZO8**), which reported 45-kt sustained winds at an anemometer height of 54.5 m at 1500 UTC 8 August. This occurred in a large convective band well to the northeast of the center of Franklin while it was centered over the Yucatan peninsula.

Rainfall and Flooding

Franklin produced heavy rains over portions of eastern Mexico, especially in the state of Veracruz (Fig. 5), with a wide area of more than 6 inches (150 mm) occurring. Locally heavy rain also occurred near the storm track in the Yucatan Peninsula, with totals of 2–6 inches (50–150 mm) common. The maximum reported rainfall was from La Vigas de Ramirez, Veracruz, which reported a storm total of 16.14 inches (410.5 mm). In addition, Acatlan, Veracruz, reported a total of 12.86 inches (326.6 mm) and La Joya, Veracruz, reported 12.71 inches (322.8 mm). These rains produced fresh water flooding in the affected areas.

CASUALTY AND DAMAGE STATISTICS

There were no reports of deaths associated with Franklin. Media and emergency management reports indicated that there was some damage to property and agriculture from wind and freshwater flooding. However, no monetary damage figures are currently available.

FORECAST AND WARNING CRITIQUE

The genesis of Franklin was generally well forecast (Table 3). The wave from which the cyclone developed was introduced in the Tropical Weather Outlook 78 h prior to genesis for both the short (48 h) and medium (120 h) range. However, the probabilities were not raised to the high category until 24 h before genesis for the medium range and 6 h for the short range. This late increase may have resulted from uncertainty as to whether a circulation would form over the northwestern Caribbean Sea before the system moved over the Yucatan Peninsula, or if genesis would be delayed until the system reached the Bay of Campeche. The first advisory was issued for this system as a potential tropical cyclone 3 h before genesis occurred and about 31 h before landfall on the Yucatan Peninsula.

A verification of NHC official track forecasts for Franklin is given in Table 4a. Official forecast track errors were much lower than the mean official errors for the previous 5-yr period at all forecast times. A homogeneous comparison of the official track errors with selected guidance models is given in Table 4b, and this shows that as good as the official forecasts were, several of the guidance models were better at various times. The best overall performer of the guidance models was the HFIP Corrected Consensus Approach (HCCA). Examination of individual NHC forecasts suggests there was a slight northward bias when Franklin was forecast to be crossing the Bay of Campeche, and some of the forecasts were slower than the actual forward motion.

A verification of NHC official intensity forecasts for Franklin is given in Table 5a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period at all forecast times except 72 hours. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 5b. Generally, the guidance and the official forecasts had comparable errors except at 72 h, where the bulk of the guidance beat the official forecast. Examination of individual NHC forecasts shows that while they correctly forecast Franklin to dissipate over Mexico, the intensity for the last forecast point before dissipation (a point inland over Mexico) was too high in every forecast. This appears to be due to Franklin moving a little faster than forecast and thus being farther inland and weaker at those forecast times. A secondary source of error was Franklin becoming stronger than forecast over the Bay of Campeche.

Watches and warnings associated with Franklin are given in Table 6. The tropical storm warning for the landfall area on the Yucatan Peninsula was issued 31 h before landfall in the first potential tropical cyclone advisory for the pre-Franklin disturbance. A hurricane warning was issued for the landfall area in mainland Mexico 26 h before landfall, with a hurricane watch issued 50 h before landfall.

Acknowledgements

The Meteorological Service of Belize provided the radar data used during Franklin's first landfall, while the Servicio Meteorológico Nacional of Mexico provided the rainfall data from Mexico.



Table 1. Best track for Hurricane Franklin, 7–10 August 2017.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage*
06 / 1800	15.5	81.5	1008	30	low
07 / 0000	16.1	82.7	1006	35	tropical storm
07 / 0600	16.7	83.6	1004	40	"
07 / 1200	17.4	84.4	1002	45	"
07 / 1800	18.1	85.3	999	50	"
08 / 0000	18.8	86.6	995	50	"
08 / 0600	19.2	87.9	996	50	"
08 / 1200	19.6	88.9	998	40	"
08 / 1800	19.9	89.8	999	35	"
09 / 0000	20.2	90.9	996	40	"
09 / 0600	20.4	92.2	994	55	"
09 / 1200	20.2	93.3	987	60	"
09 / 1800	20.2	94.4	984	65	hurricane
10 / 0000	20.3	95.5	981	75	"
10 / 0600	20.0	96.8	991	60	tropical storm
10 / 1200	19.8	98.3	1000	25	tropical depression
10 / 1800					dissipated
08 / 0345	19.1	87.6	995	50	landfall near Pulticub, Mexico
10 / 0500	20.0	96.6	990	70	landfall near Vega del Altorre, Mexico
10 / 0000	20.3	95.5	981	75	maximum winds and minimum pressure

Table 2. Selected surface observations for Hurricane Franklin, 7–10 August 2017.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) ^a	Sustained (kt) ^b	Gust (kt)	
Mexico						
International Civil Aviation Organization (ICAO) Sites						
Campeche (MMCP)	08/2137	1000.0	09/0442	18	30	
Merida (MMMD)	08/2009	1004.4	08/2051	24	42	
Veracruz (MMVR)	10/0217	1001.4	10/0217	15	25	11.94
Automated Stations						
Acatlan						12.86
Banco Chinchorro (18.75N 87.30W)	08/0245	1001.2	08/0245	20	35	
Cayo Arenas (22.07N 91.40W)				34	44	
Cayo Arcas (20.20N 91.97W)				42	55	
Isla Perez (22.38N 89.68W)	08/2215	1008.0	09/1645	30	39	
La Joya						12.71
Las Vigas de Ramirez						16.14
Public/Other						
La Vigueta (20.33N 96.88W)			10/0507	51	65	
Vega del Altorre (20.03N 96.64W)	10/0509	990.4				
NOAA Buoys						
NOAA 42055 (22.12N 93.96W) (5.0m)	09/1050	1005.5	09/1620	31 (10-min)	38	
NOAA 42056 (19.92N 84.94W) (4.0m)	07/2020	1008.5	07/1745	43 (1-min)	50	
NOAA 42057 (16.91N 81.42W) (4.0m)	06/2300	1008.7	07/0430	39 (1-min)	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 reports are 2 min; buoy averaging periods are 8 min.



Table 3. Number of hours in advance of formation for Hurricane Franklin, 7–10 August 2017, associated with the first NHC Tropical Weather Outlook forecast in the indicated likelihood category. Note that the timings for the “Low” category do not include forecasts of a 0% chance of genesis.

	Hours Before Genesis	
	48-Hour Outlook	120-Hour Outlook
Low (<40%)	78	78
Medium (40%-60%)	30	72
High (>60%)	6	24



Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Franklin, 7–10 August 2017. Mean errors for the previous 5-yr period 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	19.4	19.3	25.5	23.7	56.7		
OCD5	31.0	63.7	125.6	178.7	271.9		
Forecasts	13	11	9	7	3		
OFCL (2012-16)	24.9	39.6	54.0	71.3	105.8	155.4	208.9
OCD5 (2012-16)	47.3	103.9	167.8	230.3	343.1	442.6	531.0

Table 4b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Franklin, 7–10 August 2017. 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 4a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	18.6	17.9	25.7	23.9	65.2		
OCD5	30.9	64.4	130.5	159.3	297.8		
GFSI	23.7	30.0	42.0	47.2	60.4		
HWFI	19.6	23.0	36.4	46.3	75.6		
EGRI	17.8	27.6	33.3	40.5	90.6		
EMXI	16.7	17.6	29.2	35.9	68.2		
CMCI	33.0	48.4	71.2	82.9	139.6		
TVCA	17.9	17.7	27.1	24.2	52.9		
FSSE	17.4	18.8	26.1	16.1	45.0		
HCCA	17.4	19.1	25.1	16.0	33.3		
GFEX	18.8	17.5	33.1	35.4	58.0		
TCON	18.8	20.0	24.3	19.0	53.1		
AEMI	21.7	26.9	26.4	29.7	76.0		
TABS	36.2	62.1	53.9	28.2	83.0		
TABM	25.8	26.3	31.2	46.7	35.3		
TABD	24.3	30.1	42.1	60.4	44.6		
Forecasts	10	10	8	6	2		



Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Franklin, 7–10 August 2017. Mean errors for the previous 5-yr period 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	5.8	7.3	7.2	6.4	18.3		
OCD5	8.6	14.5	17.3	19.6	25.7		
Forecasts	13	11	9	7	3		
OFCL (2012-16)	5.5	8.2	10.5	12.0	13.4	14.0	14.5
OCD5 (2012-16)	7.1	10.5	13.0	15.1	17.4	18.2	20.6

Table 5b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Franklin, 7–10 August 2017. 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 5a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	5.5	7.5	7.5	5.8	18.3		
OCD5	8.9	15.7	17.3	17.8	25.7		
HWFI	7.4	6.3	8.3	7.8	8.0		
HMNI	7.8	4.9	9.8	5.5	14.0		
HCCA	6.8	7.6	6.3	7.3	12.7		
FSSE	6.5	6.1	6.9	6.8	14.7		
ICON	7.7	10.4	10.0	9.2	14.7		
IVCN	7.3	9.5	7.8	7.5	15.0		
DSHP	8.3	11.5	11.5	12.0	15.7		
LGEM	9.1	13.8	13.5	11.2	20.7		
GFSI	7.9	7.8	5.3	9.2	12.3		
EMXI	10.7	12.7	9.1	11.7	21.7		
Forecasts	11	10	8	6	3		

Table 6. Watch and warning summary for Hurricane Franklin, 7–10 August 2017.

Date/Time (UTC)	Action	Location
6 / 2100	Tropical Storm Watch issued	Coast of Belize from Belize City to Belize/Mexico Border
6 / 2100	Tropical Storm Warning issued	Coast of Mexico from Chetumal to Campeche
7 / 0300	Tropical Storm Watch issued	Coast of Mexico from Campeche to Sabancuy
7 / 0900	Hurricane Watch issued	Coast of Mexico from Chetumal to Punta Allen
7 / 1200	Tropical Storm Watch changed to Tropical Storm Warning	Coast of Belize from Belize City to Belize/Mexico Border
8 / 0300	Hurricane Watch issued	Coast of Mexico from Puerto de Veracruz to Rio Panuco
8 / 0300	Tropical Storm Warning issued	Coast of Mexico from Chetumal to Sabancuy
8 / 0300	Hurricane Watch discontinued	Coast of Mexico from Chetumal to Punta Allen
8 / 0300	Tropical Storm Watch issued	Coast of Mexico west of Sabancuy to east of Puerto de Veracruz
8 / 1200	Tropical Storm Warning discontinued	Coast of Belize from Belize City to Belize/Mexico Border
8 / 1500	Tropical Storm Warning discontinued	Coast of Mexico east of Rio Lagartos to Chetumal
8 / 1500	Tropical Storm Warning issued	Coast of Mexico from Puerto de Veracruz to Rio Panuco
9 / 0300	Hurricane Warning issued	Coast of Mexico from Puerto de Veracruz to Tuxpan
9 / 0300	Tropical Storm Warning discontinued	Coast of Mexico east of Celestun
9 / 0300	Tropical Storm Warning issued	Coast of Mexico east of Puerto de Veracruz to Sabancuy
9 / 0900	Tropical Storm Warning discontinued	Coast of Mexico east of Ciudad del Carmen
9 / 0900	Tropical Storm Warning issued	Coast of Mexico north of Rio Panuco to Barra del Tordo
9 / 1200	Hurricane Warning issued	Coast of Mexico north of Puerto de Veracruz to Cabo Rojo



Date/Time (UTC)	Action	Location
9 / 1500	Tropical Storm Warning discontinued	Coast of Mexico east of Puerto Dos Bocas
10 / 0900	Tropical Storm Warning discontinued	Coast of Mexico east of Roca Partida and north of Cabo Rojo
10 / 0900	Tropical Storm Warning issued	Coast of Mexico from Cabo Rojo to Roca Partida
10 / 0900	Hurricane Watch discontinued	Coast of Mexico
10 / 0900	Hurricane Warning discontinued	Coast of Mexico
10 / 1500	All remaining coastal warnings discontinued	

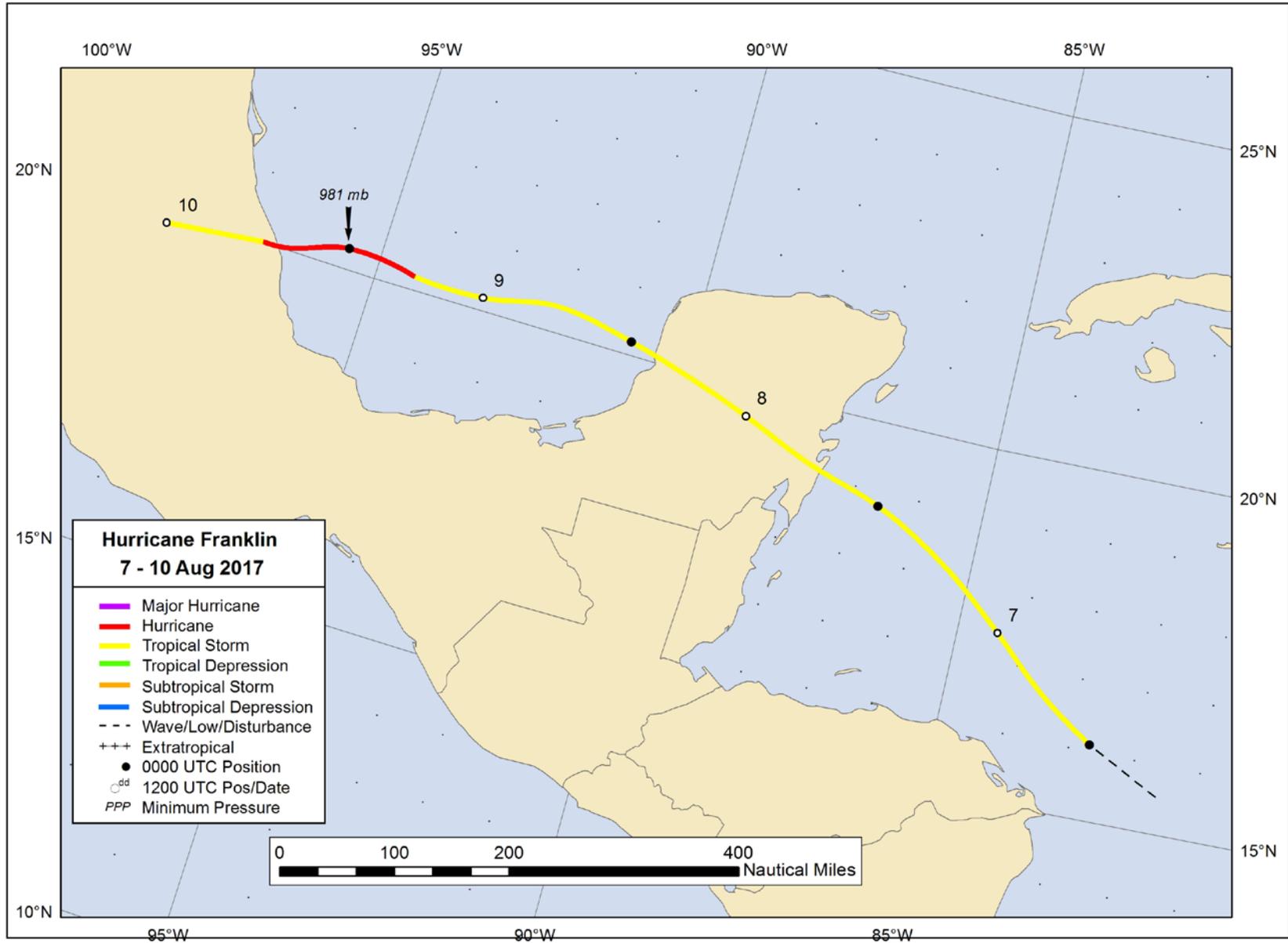


Figure 1. Best track positions for Hurricane Franklin, 7–10 August 2017.

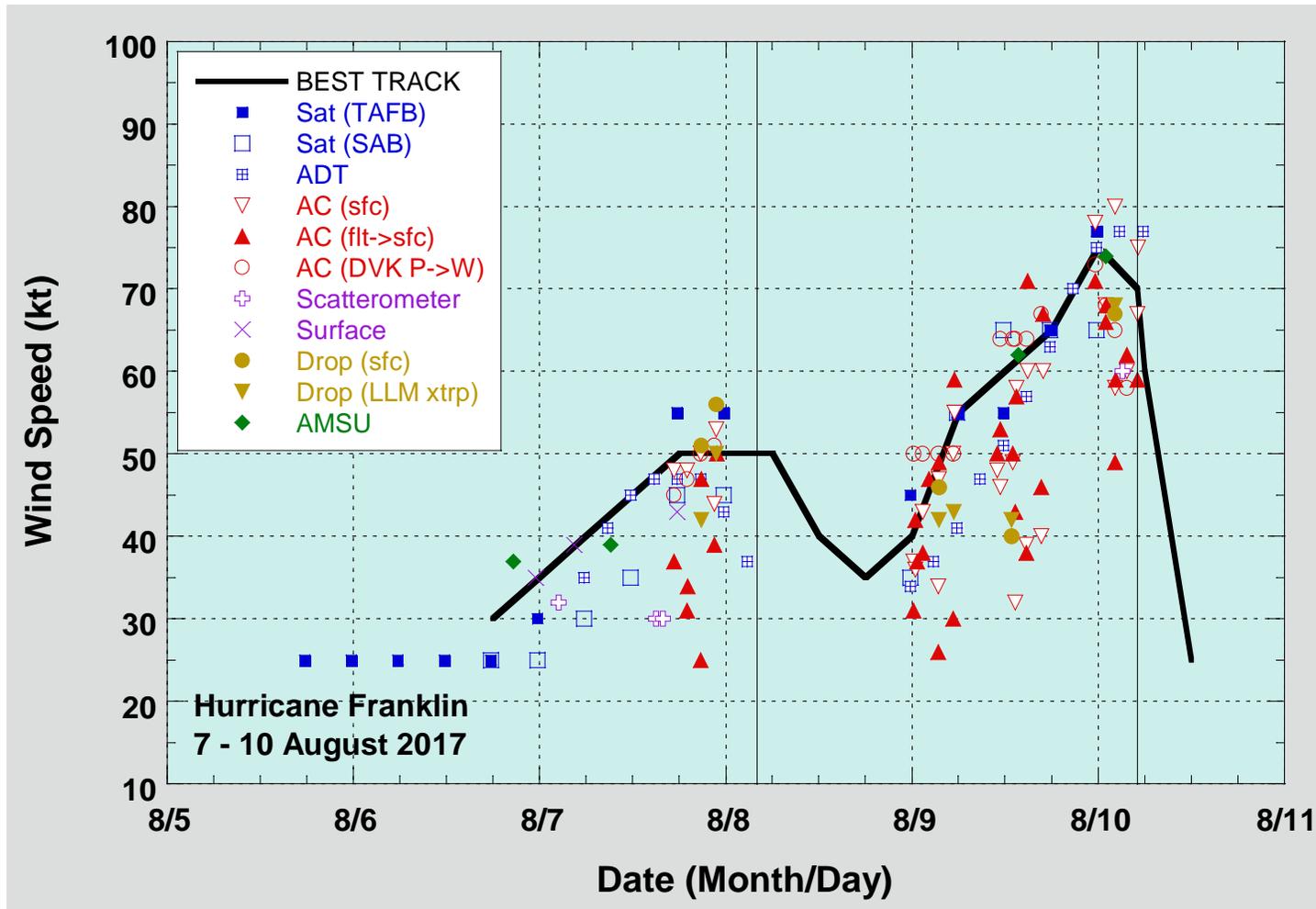


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Franklin, 7–10 August 2017. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM). Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC, and solid vertical lines correspond to landfalls.

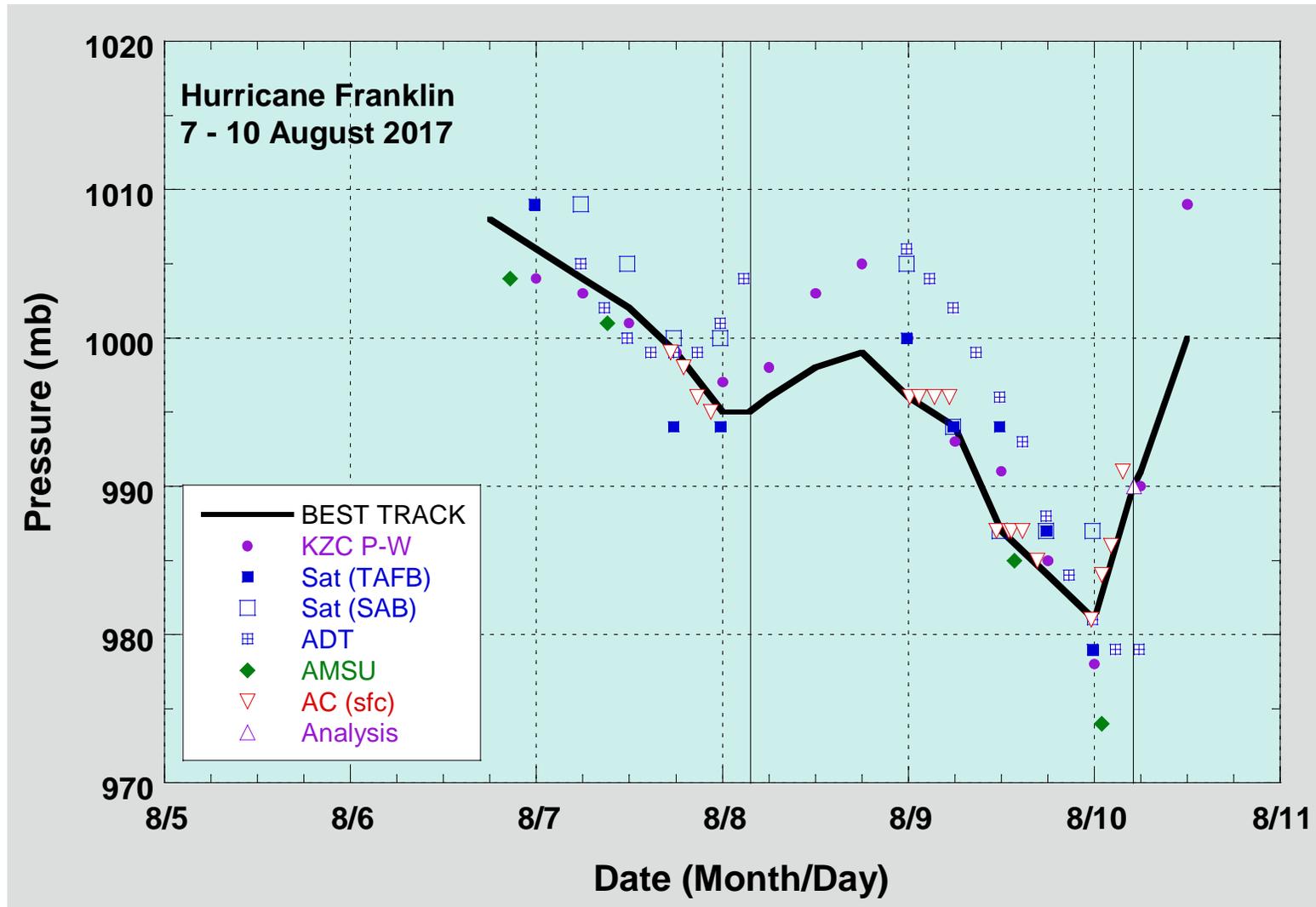


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Franklin, 7–10 August 2017. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC, and solid vertical lines correspond to landfalls.

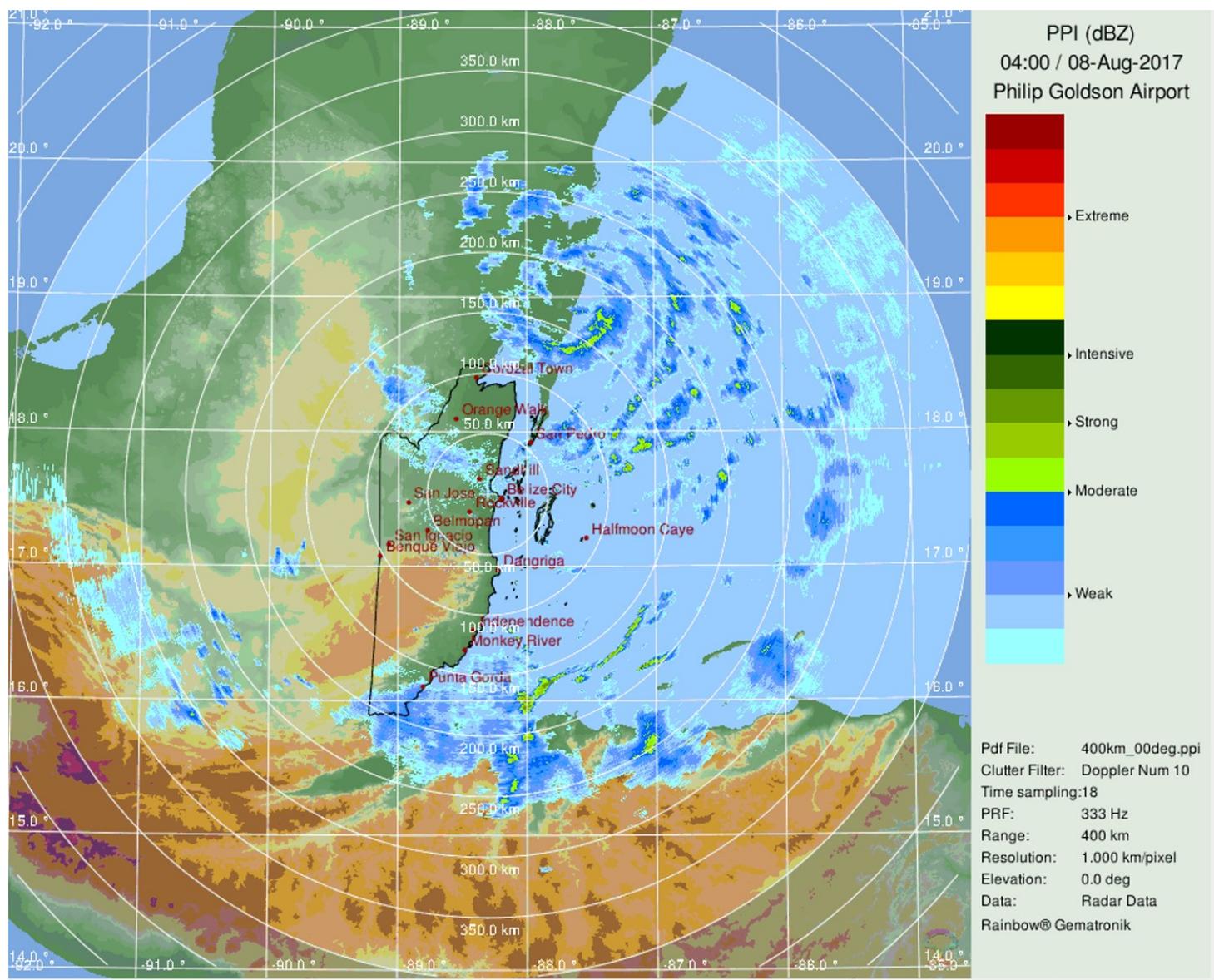


Figure 4. Radar image from the Belize City, Belize radar at 0400 UTC 8 August showing Franklin making landfall on the Yucatan Peninsula. Image courtesy of the Meteorological Service of Belize.

**Precipitación acumulada (mm) del 8 al 10 de agosto de 2017
por el huracán Franklin**

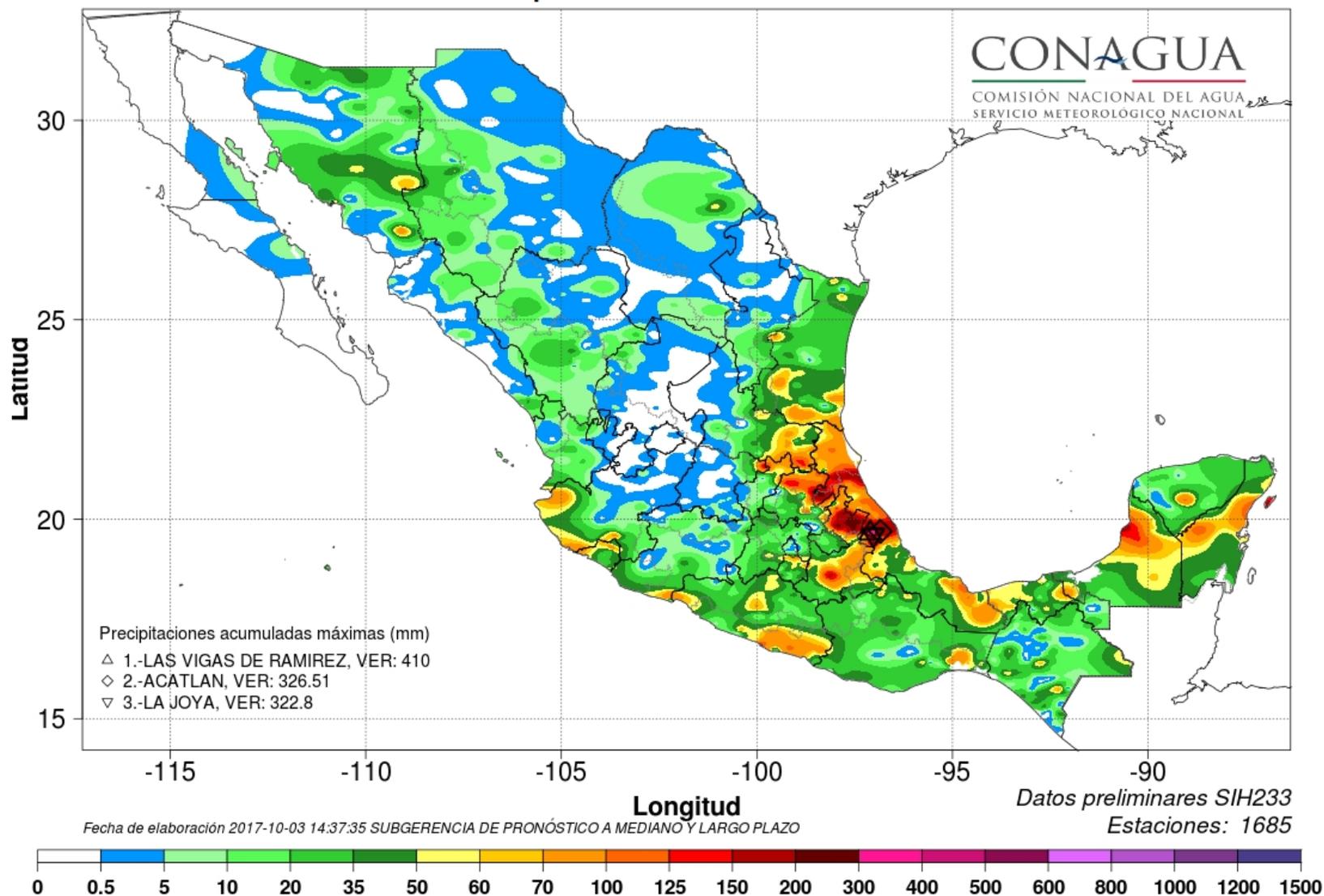


Figure 5. Rainfall totals (mm) for Mexico from 8–10 August 2017 during the passage of Hurricane Franklin. Image courtesy of the Servicio Meteorológico Nacional of Mexico.