

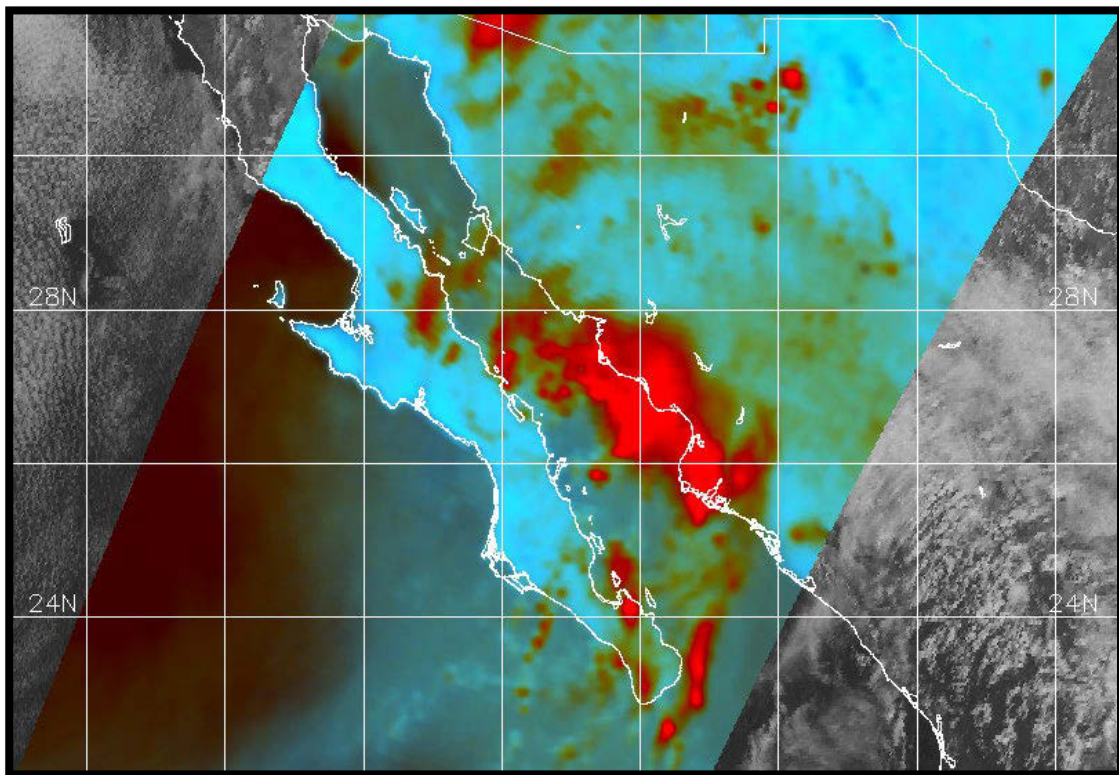


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL DEPRESSION NINETEEN-E (EP192018)

19–20 September 2018

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National Hurricane Center
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TROPICAL DEPRESSION NINETEEN-E OVER THE GULF OF CALIFORNIA FROM THE 89-GHZ CHANNEL OF THE NASA/JAXA GLOBAL PRECIPITATION MEASUREMENT (GPM) MICROWAVE IMAGER (GMI) AT 1851 UTC 19 SEPTEMBER 2018. IMAGE COURTESY OF THE FLEET NUMERICAL METEOROLOGY AND OCEANOGRAPHY CENTER (FNMOC).

Tropical Depression Nineteen-E was the first-known tropical cyclone to form over the Gulf of California. The depression was short lived but produced heavy rainfall and flash flooding over northwestern Mexico, resulting in eight direct deaths.

Tropical Depression Nineteen-E

19–20 SEPTEMBER 2018

SYNOPTIC HISTORY

The development of Tropical Depression Nineteen-E appears to be the result of the interaction between a tropical wave and a pre-existing low- to mid-level area of low pressure. The wave was convectively active when it moved off the west coast of Africa late on 29 August and early on 30 August, and it spawned Tropical Depression Six (the precursor to Hurricane Florence) over the far eastern tropical Atlantic Ocean on 31 August. The main wave axis moved westward at low latitudes and left Florence behind, and eventually moving across Central America and over the far eastern North Pacific by 6–7 September. Due to weak background flow, the wave slowed down and crawled westward to the south of Mexico for the next week.

In the meantime, a mid-level shortwave trough dropped southward from the United States over northern Mexico on 9 September. The trough sunk farther south over the next few days, and a broad low- to mid-level low developed at the tail end of the trough just south of the southern tip of the Baja California peninsula on 12 September. This feature drifted southwestward during the next several days, which caused the monsoon trough and a deep column of moisture to surge northward toward the Baja California peninsula, just as the aforementioned tropical wave was reaching the area. Due to the superposition of these weather features, a surface trough became established from south to north across Baja California Sur by 18 September, with a band of disorganized showers and thunderstorms stretching from the deep tropics to the mouth of the Gulf of California. Deep convection became more concentrated near a developing center of circulation along the trough early on 19 September, and it is estimated that a tropical depression formed by 1200 UTC that day over the Gulf of California, very close to the east coast of Baja California Sur near Loreto, Mexico. 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.

The depression moved northward and north-northeastward across the Gulf of California on 19 September, ahead of a mid-latitude trough that had moved over the western United States. The depression’s winds increased slightly, reaching a maximum of 30 kt by 1800 UTC that afternoon, but the convective organization never improved much due to land interaction and southwesterly shear. The depression made landfall on the coast of Sonora between Guaymas and Ciudad Obregón around 0300 UTC 20 September, still producing maximum winds of 30 kt, but it dissipated overnight shortly after 0600 UTC over mountainous terrain about 50 n mi east of Guaymas. Heavy showers and thunderstorms continued northeastward across the states of Sonora, Sinaloa, and Chihuahua through the rest of the 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* directory, while previous years’ data are located in the *archive* directory.

METEOROLOGICAL STATISTICS

Observations in Tropical Depression Nineteen-E (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 and Satellite Consensus (SATCON) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. 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), and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Tropical Depression Nineteen-E.

The depression's estimated maximum intensity of 30 kt is based on ASCAT data, which showed winds as high as 30 kt over the Gulf of California during the afternoon of 19 September, and early on 20 September after the center had moved inland over Sonora.

Selected surface observations from land stations are given in Table 2. Sustained winds of 33 kt (1 kt below tropical storm intensity) were reported at the Los Mochis airport at 0146 UTC 20 September, however it is not clear if these winds were directly associated with the depression's circulation, since they occurred nearly 140 n mi down the coast from the landfall location within peripheral thunderstorm activity. In addition, nearby observation sites, including ones with more exposure to the Gulf of California, did not report sustained winds nearly as high. While there is some possibility that the cyclone could have attained tropical storm intensity by the time it made landfall along the Sonoran coast, there is not enough evidence to be confident that this actually occurred.

Tropical Depression Nineteen-E caused heavy rainfall across portions of northwestern Mexico, particularly in the states of Sinaloa and Sonora. A maximum of 14.15 inches (359.5 mm) occurred at Ahome, and 10.67 inches (271.0 mm) fell at El Carrizo, both in Sinaloa, during the 24-h period from 7 AM 19 September to 7 AM 20 September (Mountain Daylight Time [MDT]). A maximum of 5.51 inches (140.0 mm) was reported in Sonora at El Cazanate. A rainfall analysis produced by the Meteorological Service of Mexico (Fig. 4) indicates that the heaviest rains fell across northern Sinaloa and southern Sonora, as well as southern portions of Baja California Sur.

Based on records that go back to 1949, Tropical Depression Nineteen-E is the first-known tropical cyclone to have formed over the Gulf of California.

CASUALTY AND DAMAGE STATISTICS

Based on media reports, Tropical Depression Nineteen-E caused eight direct deaths² in the Mexican states of Sinaloa and Chihuahua due to flooding from the system's torrential rains. Two confirmed direct deaths occurred in Sinaloa, one in the state capital of Culiacán and one in the municipality of Ahome. Shortly after the event, the media had also reported that three other people in Culiacán were missing, presumably having been swept away by floodwaters. These presumed deaths bring the total number of direct deaths in Sinaloa to five. Two indirect deaths also occurred in Culiacán due to electrocution. In Chihuahua, two people drowned in a stream in the municipality of Satevó, and a third person died in Namiquipa after he tried to drive his vehicle through a swollen stream.^{3,4}

Significant flooding led to states of emergency being declared in 11 Sinaloa municipalities. Sinaloa Civil Protection estimated that as many as 300,000 homes were affected by flooding, including 70,000 in Los Mochis. Flooding also caused damage to 160 public schools, three highways, and 14,000 hectares of agricultural fields and hydro-agricultural infrastructure.⁵ The Sinaloa Secretary of Agriculture and Livestock estimated that the depression's rains and flooding caused agricultural losses in the state of about 800 million pesos (about 41 million USD).⁶

FORECAST AND WARNING CRITIQUE

Tropical Depression Nineteen-E's formation ended up occurring much later than originally anticipated, after it had appeared that genesis was no longer likely. Table 3 provides the number of hours in advance of formation associated with the first NHC Tropical Weather Outlook (TWO) forecast in each likelihood category. A low (< 40%) chance of genesis during the next five days was introduced into the TWO 204 h (8.5 days) before the depression formed, and the 5-day probability was raised to a medium (40–60%) chance 162 h (6.75 days) and a high (> 60%) chance 108 h (4.5 days) before genesis. For the shorter-term 48 h forecast, the precursor disturbance was given a low chance of formation 120 h (5 days) before genesis, but the 2-day probabilities were never raised to the medium and high categories. In fact, the overall 5-day probabilities were lowered to the medium category 42 h (1.75 days) and then to the low category 12 h (0.5 days) before genesis is estimated to have occurred. NHC forecasters assumed that the

² Deaths occurring as a direct result of the forces of the tropical cyclone are referred to as "direct" deaths. These would include those persons who drowned in storm surge, rough seas, rip currents, and freshwater floods. Direct deaths also include casualties resulting from lightning and wind-related events (e.g., collapsing structures). Deaths occurring from such factors as heart attacks, house fires, electrocutions from downed power lines, vehicle accidents on wet roads, etc., are considered "indirect" deaths.

³ Mexico News Daily (21 September 2018). Heavy rain in Sinaloa, Chihuahua leaves at least seven people dead. <https://mexiconewsdaily.com/news/heavy-rain-leaves-at-least-seven-people-dead/>

⁴ Voice of America (21 September 2018). Mexico's Sinaloa declares emergency as 3 die in flooding. <https://www.voanews.com/a/mexico-s-sinaloa-declares-emergency-as-3-die-in-flooding/4581940.html>

⁵ Mexico News Daily (22 September 2018). Up to 300,000 homes affected by flooding in Sinaloa; Los Mochis hardest hit. <https://mexiconewsdaily.com/news/up-to-300000-homes-affected-by-flooding/>

⁶ El Universal (26 September 2018). Suman 800 mdp en daños a cultivos por lluvias en Sinaloa. <http://www.eluniversal.com.mx/estados/suman-800-mdp-en-danos-cultivos-por-lluvias-en-sinaloa>



most ideal conditions for genesis would be while the system was located south of the Baja California peninsula, and once the system made it closer to the Gulf of California, land interaction and stronger shear would likely limit formation.

Due to the depression's short existence, there were only two verifying 12-h forecasts. Thus, a comprehensive verification of official and guidance track and intensity forecast errors is not provided. The two official 12-h forecasts had a mean track error of 46.0 n mi and a mean intensity error of 2.5 kt. The mean 12-h official errors for the previous 5-yr period (2013–2017) are 21.8 n mi and 5.8 kt, respectively.

Since the depression was not forecast to strengthen to a tropical storm, no coastal watches or warnings were issued.



Table 1. Best track for Tropical Depression Nineteen-E, 1920 September 2018.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
19 / 1200	26.1	111.3	1004	25	tropical depression
19 / 1800	26.7	111.2	1003	30	"
20 / 0000	27.3	110.9	1002	30	"
20 / 0300	27.6	110.6	1002	30	"
20 / 0600	27.9	110.2	1003	25	"
20 / 1200					dissipated
20 / 0000	27.3	110.9	1002	30	minimum pressure
20 / 0300	27.6	110.6	1002	30	landfall between Guaymas and Ciudad Obregón, Sonora, Mexico



Table 2. Selected surface observations for Tropical Depression Nineteen-E, 19–20 September 2018.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Total rain (in) ^a
	Date/time (UTC)	Press. (mb)	Date/time (UTC)	Sustained (kt)	Gust (kt)	
Mexico						
Sinaloa						
Los Mochis (MMLM)	19/2347	1005.5	20/0146	33		
Topolobampo	20/0100	1004.2	20/0230		30	
Ahome						14.15
El Carrizo						10.67
Guamúchil						7.18
Los Mochis						6.43
Ruiz Cortines						5.39
Huites						4.92
Badiraguato						4.92
Higueras de Zaragoza						4.81
Rancho Viejo						4.33
Bacurato Gustavo Díaz Ordaz						4.29
El Fuerte						4.21
Choix						4.13
Sufragio						4.06
El Sabino						3.62
Culiacán						3.48
Sonora						
El Cazanate						5.51
Navojoa (FW0757)	20/0249	1003.4				
Guaymas	20/0300	1006.3				
Baja California Sur						
Loreto	20/0000	1003.4				

^a Rainfall amounts are for the 24-h period from 7 AM 19 September to 7 AM 20 September (Mountain Daylight Time [MDT]).



Table 3. Number of hours in advance of formation 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%)	120	204
Medium (40%-60%)	-	162
High (>60%)	-	108

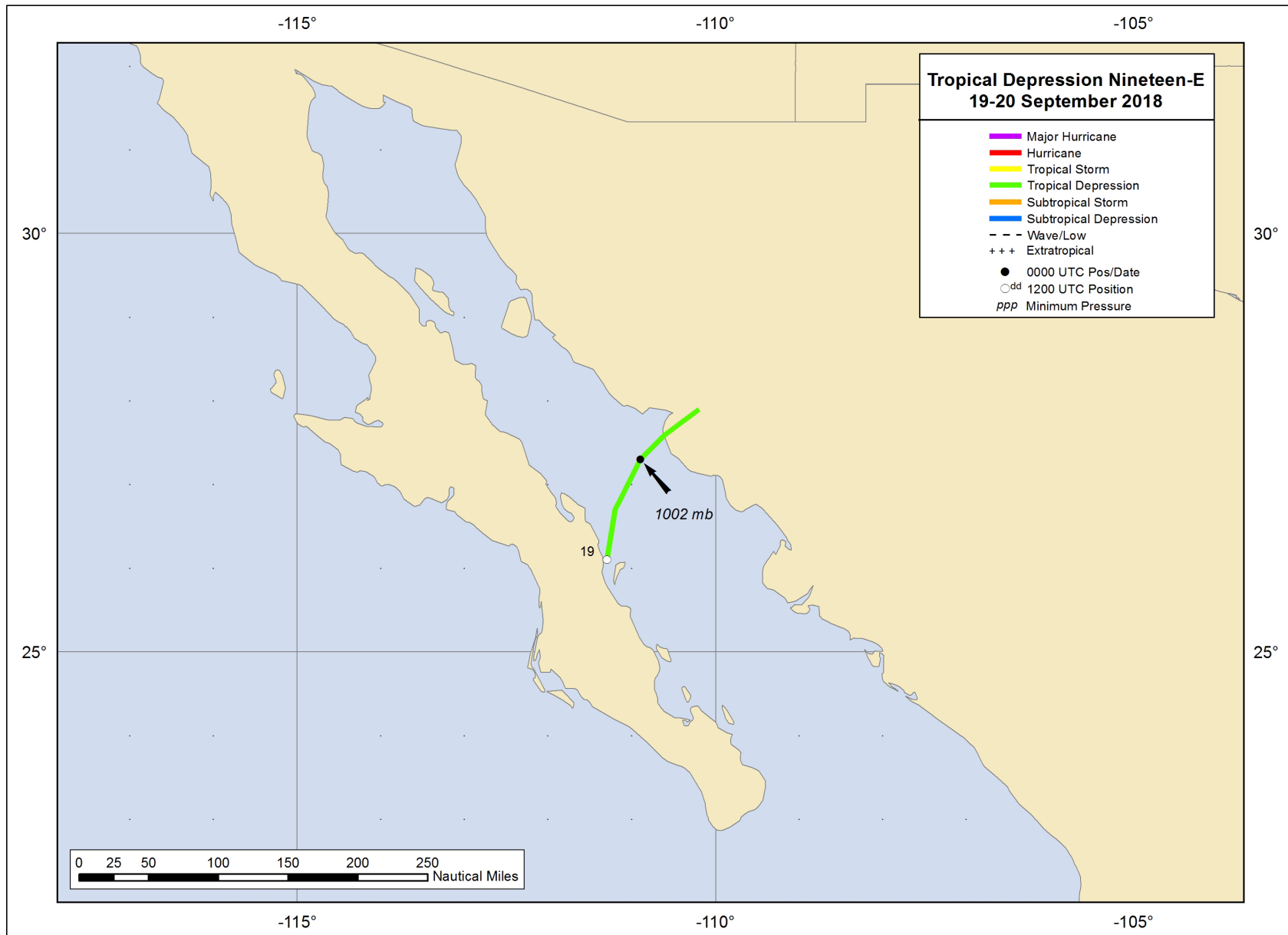


Figure 1. Best track positions for Tropical Depression Nineteen-E, 19–20 September 2018.

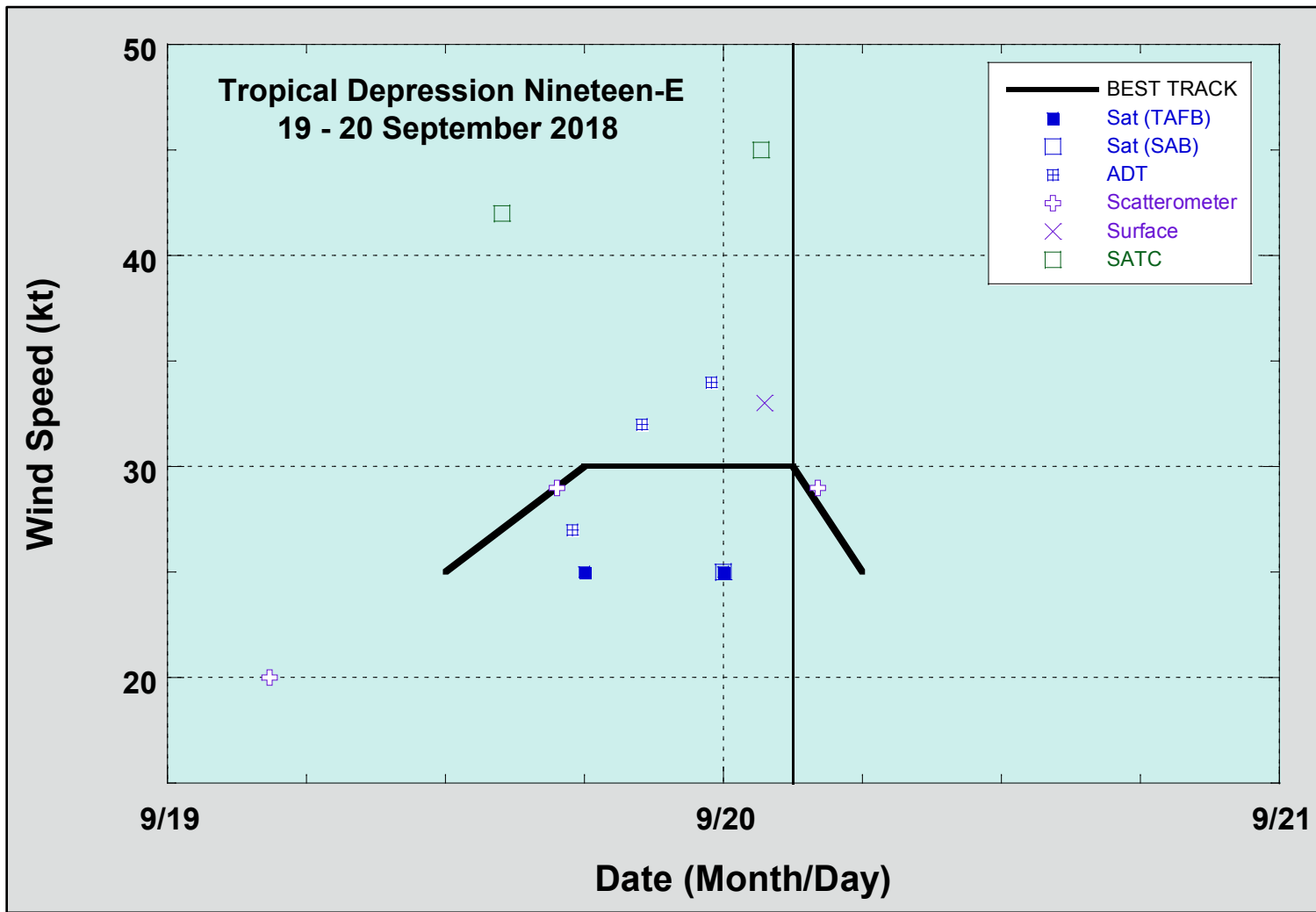


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Depression Nineteen-E, 19–20 September 2018. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC, and solid vertical lines correspond to landfalls.

Precipitation Accumulation (mm)
0600 UTC 19 September to 0300 UTC 20 September 2018
Tropical Depression Nineteen-E

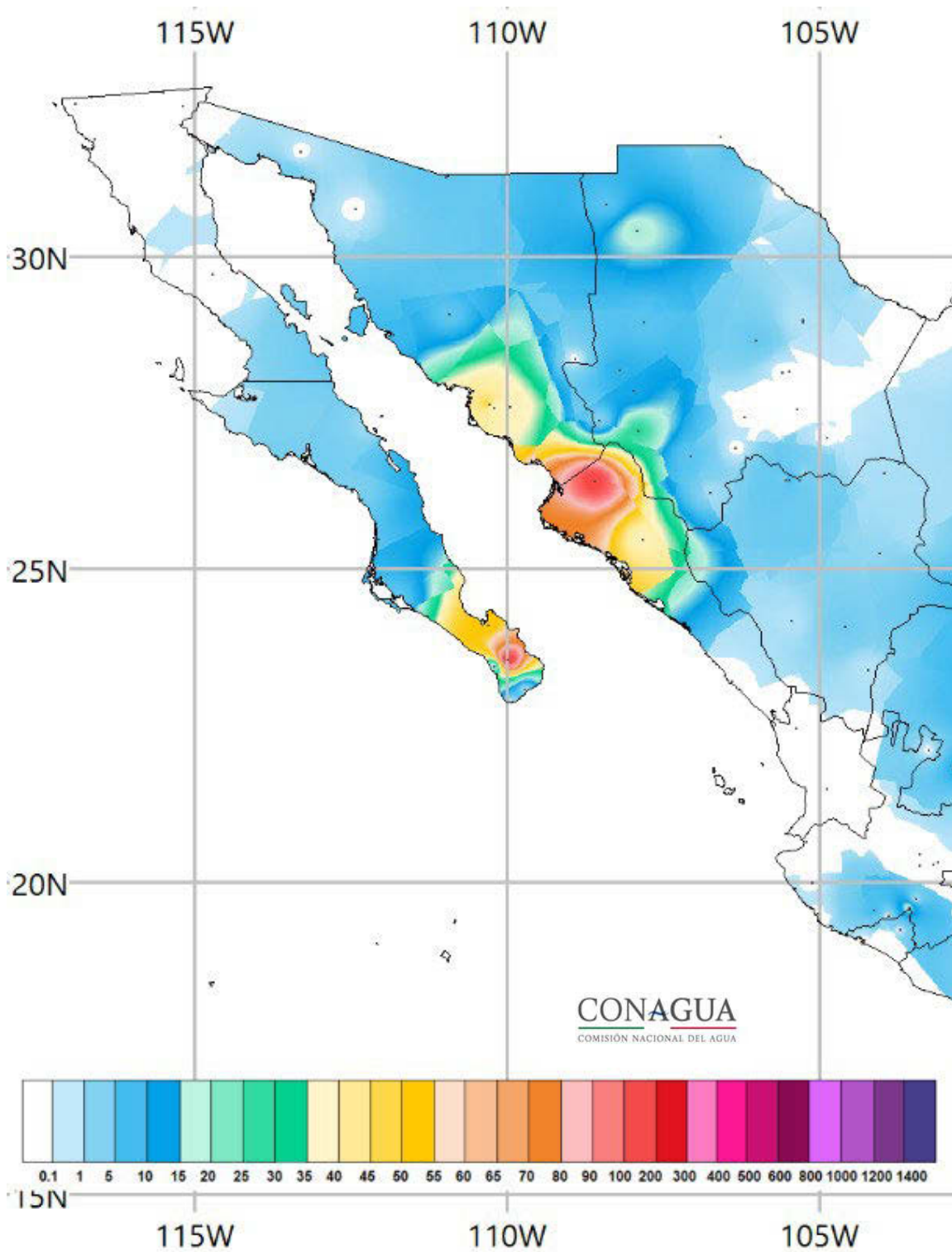


Figure 4. Rainfall accumulation (mm) in Mexico from Tropical Depression Nineteen-E between 0600 UTC 19 September and 0300 UTC 20 September 2018. Image courtesy of CONAGUA, the National Meteorological Service of Mexico.