NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM AMANDA

(EP022020)

30–31 May 2020

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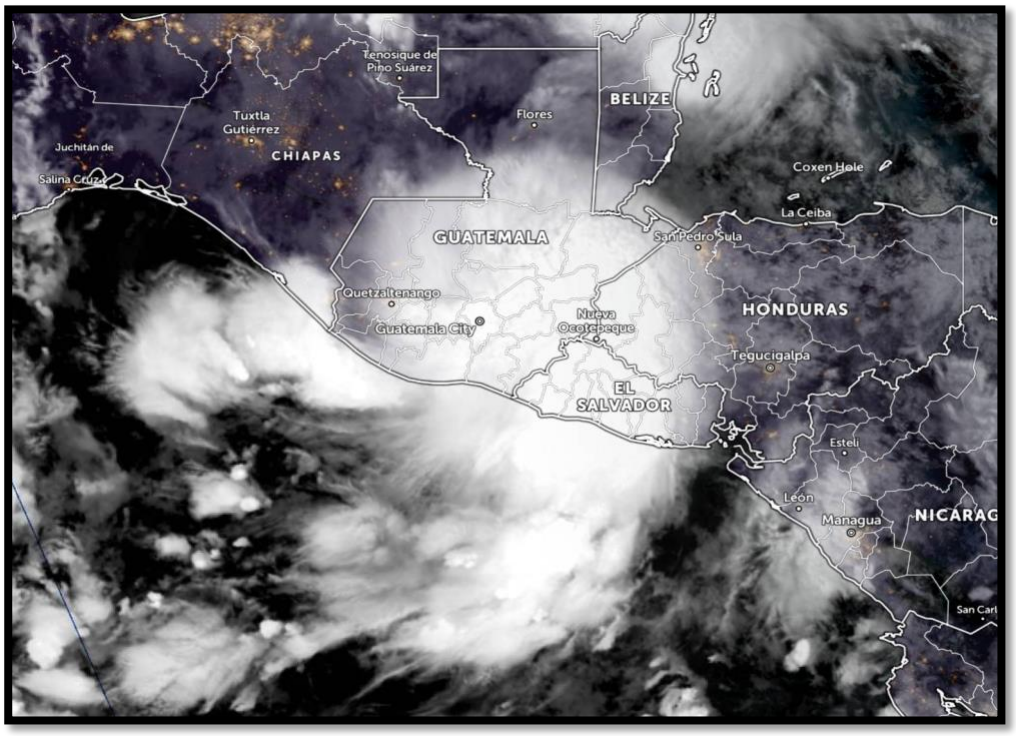
National Hurricane Center
10 September 2020



GOES-EAST GEOCOLOR IMAGE OF TROPICAL STORM AMANDA AT 1200 UTC 31 MAY 2020, A COUPLE OF HOURS AFTER THE STORM MADE LANDFALL IN SOUTHEASTERN GUATEMALA (IMAGE COURTESY OF NOAA/NESDIS/STAR)

Amanda is the second-known tropical storm to make landfall along the Pacific coast of Guatemala, after Tropical Storm Agatha of 2010. In conjunction with a larger weather system over Central America and Tropical Storm Cristobal over the Bay of Campeche, Amanda produced significant rainfall and flooding over portions of Central America and southeastern Mexico, resulting in 40 deaths in El Salvador, Guatemala, and Honduras.

Tropical Storm Amanda

30–31 MAY 2020

SYNOPTIC HISTORY

Multiple factors appear to have led to Amanda's formation. The convectively active phase of an eastward-moving Kelvin wave spread over the far eastern part of the North Pacific Ocean between 26 and 31 May, while at the same time a mid- to upper-level low closed off over northeastern Mexico. The upper-level diffluence associated with these features caused an overall increase in convection over the far eastern Pacific during that period, as well as the development of a broad area of low pressure south of Guatemala and El Salvador by 27 May. A low-latitude tropical wave, which had moved off the coast of Africa around 18 to 19 May, moved into the Pacific basin on 29 May and caused the broad low and associated convection to become more organized. The low developed a well-defined center of circulation the next day, and it is estimated that a tropical depression formed by 1800 UTC 30 May while located about 100 n mi south of Puerto San José, Guatemala. 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 1[1].

Coincident with the depression's formation, a larger Central American gyre[2] became established and was centered near the Mexico/Guatemala border. The depression moved slowly northeastward and then north-northeastward, embedded within the gyre's circulation, and continued to gain some organization as it approached the coasts of Guatemala and El Salvador. The depression strengthened into a tropical storm by 0600 UTC 31 May while centered about 30 n mi south-southwest of the Guatemala/El Salvador border. Amanda appeared most organized around the time of its landfall around 1000 UTC that day near Las Lisas, Guatemala, when a pronounced convective band extended from southeastern Guatemala, across El Salvador, and southward over the Pacific waters. After landfall, Amanda moved northward across Guatemala, and its center dissipated before 1800 UTC 31 May over the mountainous terrain of the country. Amanda's remnants rotated northward and northwestward within the Central American gyre, leading to the formation of Atlantic Tropical Depression Three (which became Tropical Storm Cristobal) over the Bay of Campeche the next day on 1 June.

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[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.

[2] A Central American gyre (CAG) is a broad lower-tropospheric cyclonic circulation occurring near Central America. For more information, please refer to Papin, P., L. F. Bosart, R. D. Torn, 2017: A Climatology of Central American Gyres. *Mon. Wea. Rev.*, 145, 1983–2000. http://journals.ametsoc.org/doi/pdf/10.1175/MWR-D-16-0411.1

METEOROLOGICAL STATISTICS

Observations in Amanda (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) 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 Amanda.

Amanda's peak intensity of 35 kt at 0600 UTC 31 May and at landfall at 1000 UTC 31 May is based on a blend of UW-CIMSS ADT and SATCON estimates. ADT estimates peaked at T2.5/35 kt while SATCON estimates of 38 kt and 39 kt were measured at 0353 UTC and 0755 UTC, respectively.

There were no reports of tropical-storm-force winds from land or marine stations.

Significant heavy rainfall occurred over portions of Central America and southeastern Mexico over a nine-day period (29 May–7 June) due to Tropical Storm Amanda, Atlantic Tropical Storm Cristobal, and the Central American gyre within which both cyclones were embedded. Selected rainfall totals for the entire event are shown in Table 2, and an analysis of the total rainfall over Central America is provided in Figure 4. Some of the most significant rainfall occurred near El Salvador's coastal volcanic chain, where more than 30 inches (more than 750 mm) was reported at several stations. During Amanda (through May 31), maximum rainfall totals of 22.70 inches (576.7 mm) and 20.43 inches (519.0 mm) were reported at Volcán Conchagua and Volcán de San Miguel, respectively, in eastern El Salvador. The respective maximum rainfall totals measured at these sites during the entire nine-day period were 42.80 inches (1087.1 mm) and 38.57 inches (979.8 mm). An overall total of 31.37 inches (796.7 mm) was measured at Ilopongo International Airport in an eastern suburb of San Salvador. An analysis of rainfall from the government of El Salvador is shown in Figure 5.

The most significant rain accumulations in Guatemala also occurred near the Pacific coast and the coastal volcanic chain. Amanda itself produced a maximum rainfall total of 11.80 inches (299.7 mm) at Jutiapa in the southeastern part of the country from 30 to 31 May, with the town also registering a seven-day total of 26.48 inches (672.5 mm) from 30 May to 5 June. Other rainfall totals during the seven-day period include 16.52 inches (419.6 mm) at Puerto San José, 16.26 inches (413.1 mm) at San Marcos, and 15.92 inches (404.4 mm) at Santa Teresa. This rainfall produced landslides as well as flooding along the Ríos Suichiate, Cabuz, and El Naranjo in San Marcos department and the Ríos Sis and Icán in Suchitepéquez department. The Ríos Nahualate and La Paz also flooded in Jutiapa department.

In Honduras, the maximum rainfall registered during Amanda was 4.06 inches (103.2 mm) at Erandique. More than 10 inches (250 mm) occurred between 29 May and 7 June at sites in the southwestern part of the country along the Sierra Madre Mountains on the border with El

Salvador. Maximum totals were 13.73 inches (348.7 mm) at Sabana Grande and 12.74 inches (323.6 mm) at Caridad.

Daily distributions of rainfall across Belize were highly variable. During and just before Amanda (29–31 May), the highest rainfall totals reported were 11.82 inches (300.2 mm) at Belmopan and 11.78 inches (299.1 mm) at Hershey in the central part of the country. More than 10 inches (250 mm) of rain occurred at many other locations in Belize, particularly in the northwestern part of the country, during the longer period from 29 May to 7 June. Maximum accumulations were 13.89 inches (352.8 mm) at Yo Chen and 12.92 inches (328.2 mm) at Hershey.

Although portions of southeastern Mexico were more severely affected by the rainfall from Tropical Storm Cristobal, significant rains occurred beforehand from 28 to 31 May around the time of Amanda, particularly in the state of Chiapas. During this period, maximum rainfall totals reported were 15.68 inches (398.2 mm) at San Joaquín, Chiapas, and 14.38 inches (365.3 mm) at Sayula, Chiapas. Over the entire period from 29 May to 7 June, maximum totals of 34.06 inches (865 mm) and 29.65 inches (753 mm) were reported at Ocotepec, Chiapas, and Xpujil, Campeche, respectively. An analysis of rainfall accumulations over Mexico during the period of Amanda from the government of Mexico is shown in Figure 6. Additional information on rainfall in Mexico can be found in the NHC Tropical Cyclone Report for Tropical Storm Cristobal.

CASUALTY AND DAMAGE STATISTICS

Amanda and the continued affects from Cristobal and peripheral heavy rains caused 40 deaths[3] in El Salvador, Guatemala, and Honduras. At latest report, the government of El Salvador indicates that 30 people died in the country, with one person still missing.[4] In particular, a family of seven (two adults and five children) died in the town of Santo Tomás when a landslide buried their home.[5] The president of El Salvador said that the storm caused 200 million USD worth of damage. In Guatemala, the National Coordinator for Disaster Reduction (CONRED) reported that five people lost their lives, including a nine-year-old boy who was swept away by a river in Izabel and a 17-year-old girl who died when her home collapsed in Chiquimula.[6,7] Three additional people died in the country due to a landslide in El Progreso, a rockslide in Quiché, and a fallen tree in Quetzaltenango. The Permanent Commission for Contingencies (COPECO) reported that

[3] 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.
[4] Reporte de Emergencia Climática. Gobierno de El Salvador. http://emergencia.marn.gob.sv/
[5] “Al menos 27 personas yah an muerto en El Salvador a causa de las lluvias.” *Noticias Telemundo*. https://www.telemundo.com/noticias/2020/06/04/al-menos-27-personas-ya-han-muerto-en-el-salvador-causa-de-las-lluvias-tmna3795114

five people died in Honduras, including a brother and sister whose car was swept away by a current when they were trying to cross a bridge in the outskirts of Tegucigalpa.[6,7]

Amanda is considered to be the most devastating weather event in El Salvador since Hurricane Mitch affected the country in 1998. The storm affected nearly 30,000 families (119,000 people), with more than 12,100 people seeking shelter at a time when the country was dealing with the COVID-19 pandemic. Almost 700 landslides were reported across the country, which along with flooding, damaged or destroyed 3,000 houses and restricted or closed access to 19 traffic routes. Over 3,000 hectares of crops, 92% of which were maize, were damaged or lost.[7]

In Guatemala, CONRED reported that more than 520,000 people were affected, with over 1,200 having to seek shelter. More than 1,000 homes were moderately or severely damaged. In Honduras, COPECO indicated that 249 families had been affected. Figure 7 shows images of the types of flooding and damage caused by Amanda in El Salvador, Guatemala, and Honduras.

FORECAST AND WARNING CRITIQUE

The genesis of Amanda was generally well forecast with relatively accurate lead times. 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. The potential for Amanda's formation was first cited in the TWO with a low (<40%) chance of genesis 138 h (5.75 days) before it formed. The chance of formation over the next 5 days was increased to the medium (40–60%) category 126 h (5.25 days) and high (>60%) category 96 h (4 days) before formation occurred. For the 2-day forecasts, a low chance of formation was first indicated 84 h (3.5 days) before genesis, with a medium chance indicated 54 h (2.25 days) beforehand. The one deficiency in NHC's genesis forecasts for Amanda is that the 2-day formation potential never reached the high category before Amanda is estimated to have formed.

Due to Amanda'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 17.8 n mi and a mean intensity error of 5.0 kt. These errors were slightly lower than the mean 12-h official track and intensity errors for the previous 5-yr period (2015–2019) of 21.8 n mi and 6.0 kt, respectively.

Watches and warnings associated with Amanda are given in Table 4.

[6] Tropical Cyclone Amanda – May 2020. ReliefWeb. https://reliefweb.int/disaster/tc-2020-000142-slv
[7] Tropical depression/storm Amanda impact in El Salvador. Humanitarian Situation Report No. 1. UNICEF. https://reliefweb.int/sites/reliefweb.int/files/resources/UNICEF%20El%20Salvador%20Humanitarian%20Situation%20Report%20No.%201%20%28Tropical%20Storm%20Amanda%29%20-%2031%20May-10%20June%202020.pdf

Table 1. Best track for Tropical Storm Amanda, 30–31 May 2020.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
30 / 1800	12.2	90.9	1006	25	tropical depression
31 / 0000	12.7	90.6	1005	30	"
31 / 0600	13.3	90.4	1003	35	tropical storm
31 / 1000	13.8	90.3	1003	35	"
31 / 1200	14.1	90.3	1003	35	"
31 / 1800					dissipated
31 / 0600	13.3	90.4	1003	35	maximum winds and minimum pressure
31 / 1000	13.8	90.3	1003	35	landfall near Las Lisas, Guatemala

Table 2. Select rainfall totals in Central America and southeastern Mexico over a multi-day period from Tropical Storm Amanda, Atlantic Tropical Storm Cristobal, and a Central American gyre.

Location	Amanda Rainfall (in) (on or before 31 May)	Cristobal Rainfall (in) (on or after 1 June)	Total Rainfall (in)
El Salvador[a]			
Volcán Conchagua	22.70	20.10	42.80
Volcán de San Miguel	20.43	18.14	38.57
Panchimalco	19.12	13.83	32.95
Nuevo Cuscatlán	18.13	13.93	32.06
Aeropuerto de Ilopango	19.60	11.77	31.37
Finca Los Andes	18.65	12.30	30.95
Izalco	16.09	14.22	30.31
Acajutla	12.05	17.76	29.81
Los Naranjos	11.50	18.08	29.58
San Vicente	18.47	10.80	29.27
Chilama	15.20	13.93	29.13
Santiago de María	14.28	14.52	28.80
La Canoa	9.54	19.03	28.57
Conchagua	12.21	15.50	27.71
Chiltuipán	15.78	11.58	27.36
El Naranjo	10.31	16.75	27.06
Apaneca	10.96	15.78	26.74
Santa Cruz Porrillo	14.06	12.56	26.62
El Piro	16.20	10.38	26.58
La Piedra	11.71	14.79	26.50
Tepetitan	16.52	9.87	26.39
Cara Sucia	10.59	15.77	26.36
Santa Cruz Porrillo	16.85	9.37	26.22
Puente Cuscatlán	16.84	8.36	25.20
Tepezontes	13.02	11.70	24.72
Huizucar	12.68	12.03	24.71
Hda Melara	12.62	11.70	24.32
La Union	10.74	13.38	24.12
Puerto Parada	12.65	11.35	24.00

Location	Amanda Rainfall (in) (on or before 31 May)	Cristobal Rainfall (in) (on or after 1 June)	Total Rainfall (in)
Picacho	16.16	7.53	23.69
Zoológico Nacional	13.86	9.78	23.64
Guatemala[b]			
Jutiapa	11.80	14.68	26.48
Puerto San José (Aeropuerto)	5.86	10.66	16.52
San Marcos	1.63	14.63	16.26
Santa Teresa	7.35	8.57	15.92
La Reforma	0.69	14.27	14.95
Ixchiguan	0.84	12.50	13.34
Sábana Grande	3.34	9.87	13.21
Todos Santos Cuchumatán	1.95	10.95	12.90
Quezada	7.54	5.13	12.67
Santa Rosa	5.55	7.02	12.57
Yepocapa	4.09	8.16	12.25
Catarina	0.18	11.77	11.94
Pochuta	3.20	8.68	11.88
La Máquina	4.28	7.50	11.77
Escuintla (La Giralda)	4.38	7.37	11.75
Siquinalá	2.64	9.02	11.65
Los Esclavos	5.27	6.35	11.62
San Andrés	1.77	9.70	11.48
Escuintla (Ing. Concepción)	3.09	7.72	10.81
San Marcos (Alamo)	4.37	6.10	10.47
San Rafael	3.06	7.20	10.26
Santa Lucía Cotzumalguapa	2.81	7.38	10.19
Jalapa	7.34	2.65	9.98
Lorena	2.25	7.61	9.87
Concepción	2.56	7.05	9.61
Potrero Carrillo	7.50	2.11	9.61
Mazatenango	1.19	8.30	9.49
Escuintla (Petén Oficina)	2.52	6.78	9.30
El Platanar	2.30	6.98	9.28

Location	Amanda Rainfall (in) (on or before 31 May)	Cristobal Rainfall (in) (on or after 1 June)	Total Rainfall (in)
Amatitlán	3.09	6.11	9.20
Lo de Coy	2.56	6.54	9.10
Escuintla (Amazonas)	4.27	4.77	9.04
Volcán de Fuego	0.68	8.35	9.03
Escuintla (Costa Brava)	2.93	6.06	8.99
Asunción Mita	5.58	3.29	8.87
Plan de Avila	2.60	6.18	8.78
Escuintla (Tehuantepec)	2.43	6.22	8.65
Volcán de Agua	4.11	4.43	8.54
Champerico	0.73	7.74	8.47
Chiquirines	0.27	8.00	8.27
Retalhuleu (Xoluta)	1.70	6.52	8.22
El Porvenir	2.75	5.46	8.21
Escuintla (Cengicaña)	1.79	6.27	8.06
Honduras[a]			
Sabana Grande	2.71	11.02	13.73
Caridad	2.95	9.79	12.74
Erandique	4.06	8.65	12.72
El Carrizo	3.93	6.82	10.74
Nacaome	0.59	9.83	10.43
Maraita	0.60	6.97	7.57
La Esperanza	1.23	5.77	7.00
Las Flores	2.17	3.90	6.07
La Labor	2.33	3.56	5.90
Pespire	0.47	4.94	5.41
Ocotepeque	1.68	3.54	5.22
Lepaguare	2.33	2.57	4.91
Mercedes	3.96	0.00	3.96
Yoro	2.04	1.15	3.18

Location	Amanda Rainfall (in) (on or before 31 May)	Cristobal Rainfall (in) (on or after 1 June)	Total Rainfall (in)
Mexico[c]			
San Joaquín, Chiapas	15.68		
Sayula, Chiapas	14.38		
Juan de Grijalva, Chiapas	13.36		
Belize[a]			
Yo Chen	3.70	10.19	13.89
Hershey	11.78	1.14	12.92
Yo Creek	5.83	7.04	12.87
Belmopan	11.82	0.88	12.70
August Pine	7.85	4.37	12.22
Middlesex	10.03	2.06	12.09
Libertad	2.56	8.59	11.15
Douglas	3.72	6.75	10.47
Tower Hill	4.14	6.20	10.34
Ranchito	2.19	7.53	9.72
San Estevan	2.87	6.74	9.61
Little Belize	2.16	7.29	9.45
Shipyard	6.01	3.20	9.21
Chunox	1.62	6.75	8.37
Blue Creek	8.15	0.00	8.15

[a] Rainfall totals in El Salvador, Honduras, and Belize cover the period from 29 May to 7 June 2020.
[b] Rainfall totals in Guatemala cover the period from 30 May to 5 June 2020.
[c] Rainfall totals in Mexico cover the period from 28 to 31 May 2020.

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%)	84	138
Medium (40%-60%)	54	126
High (>60%)	0	96

Table 4. Watch and warning summary for Tropical Storm Amanda, 30–31 May 2020.

Date/Time (UTC)	Action	Location
30/2100	Tropical Storm Warning issued	Coast of El Salvador
30/2100	Tropical Storm Warning issued	Pacific coast of Guatemala
31/1800	Tropical Storm Warning discontinued	All

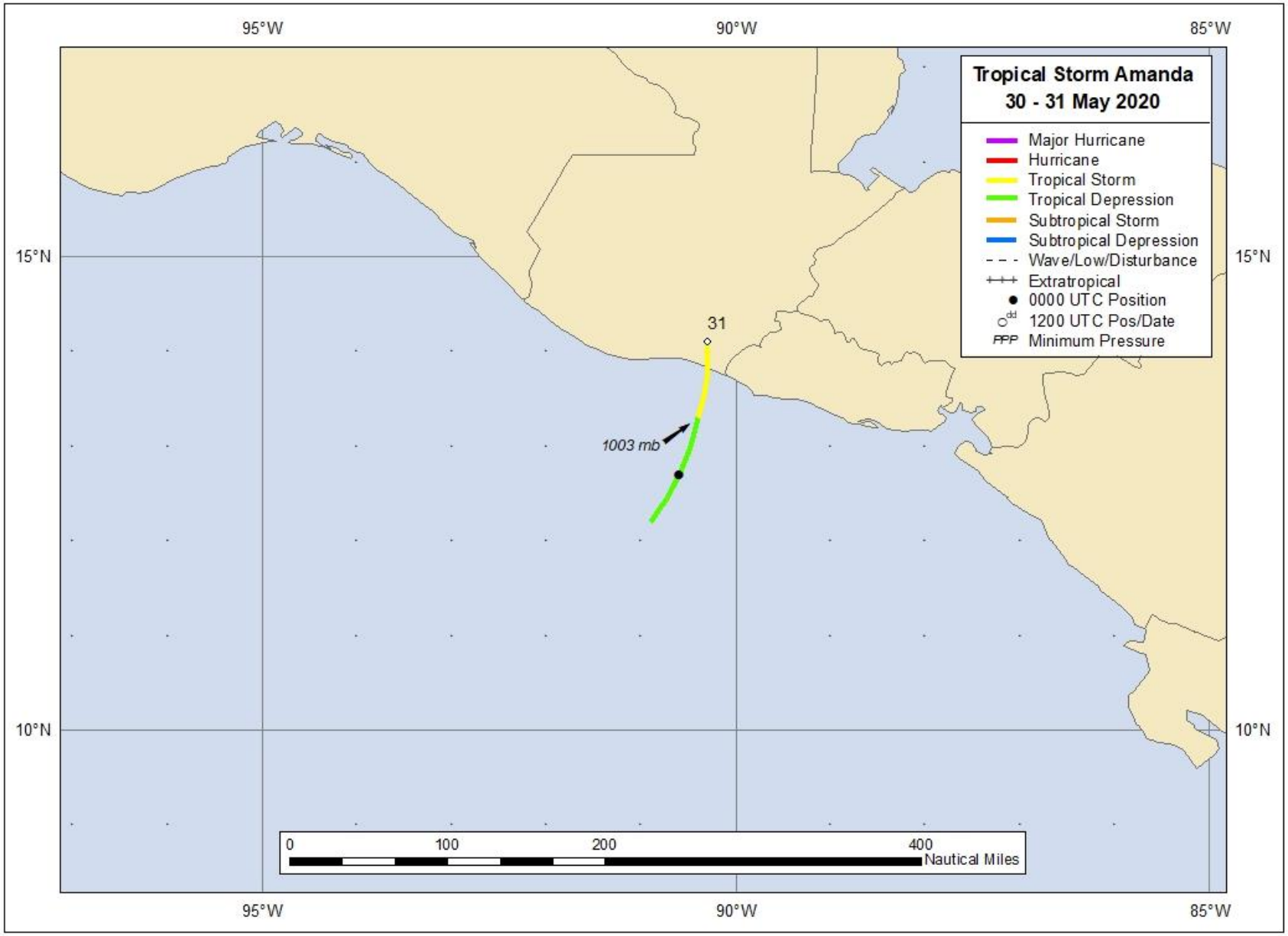

Figure 1. Best track positions for Tropical Storm Amanda, 30–31 May 2020.

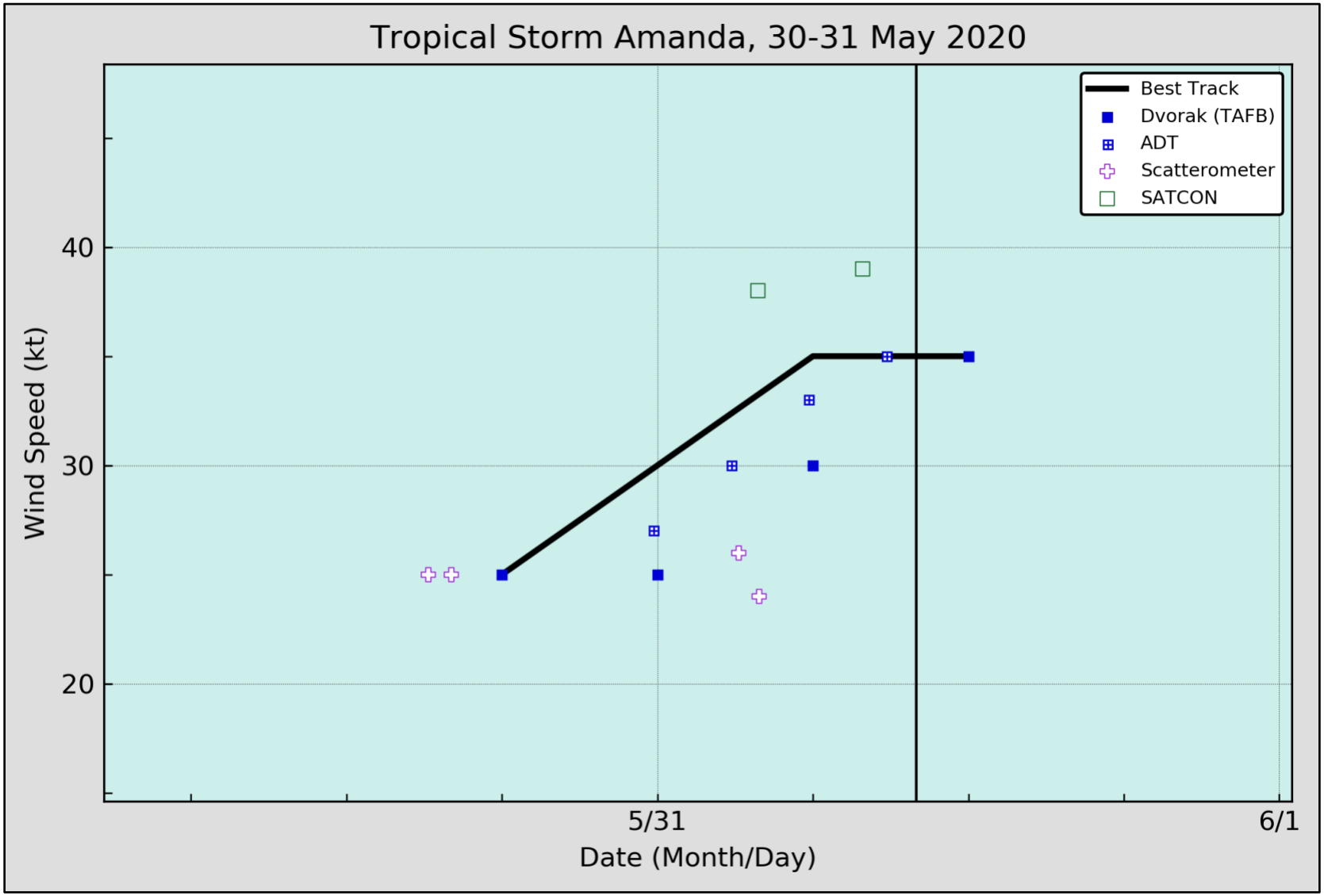

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Amanda, 30–31 May 2020. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC, and solid vertical lines correspond to landfalls.

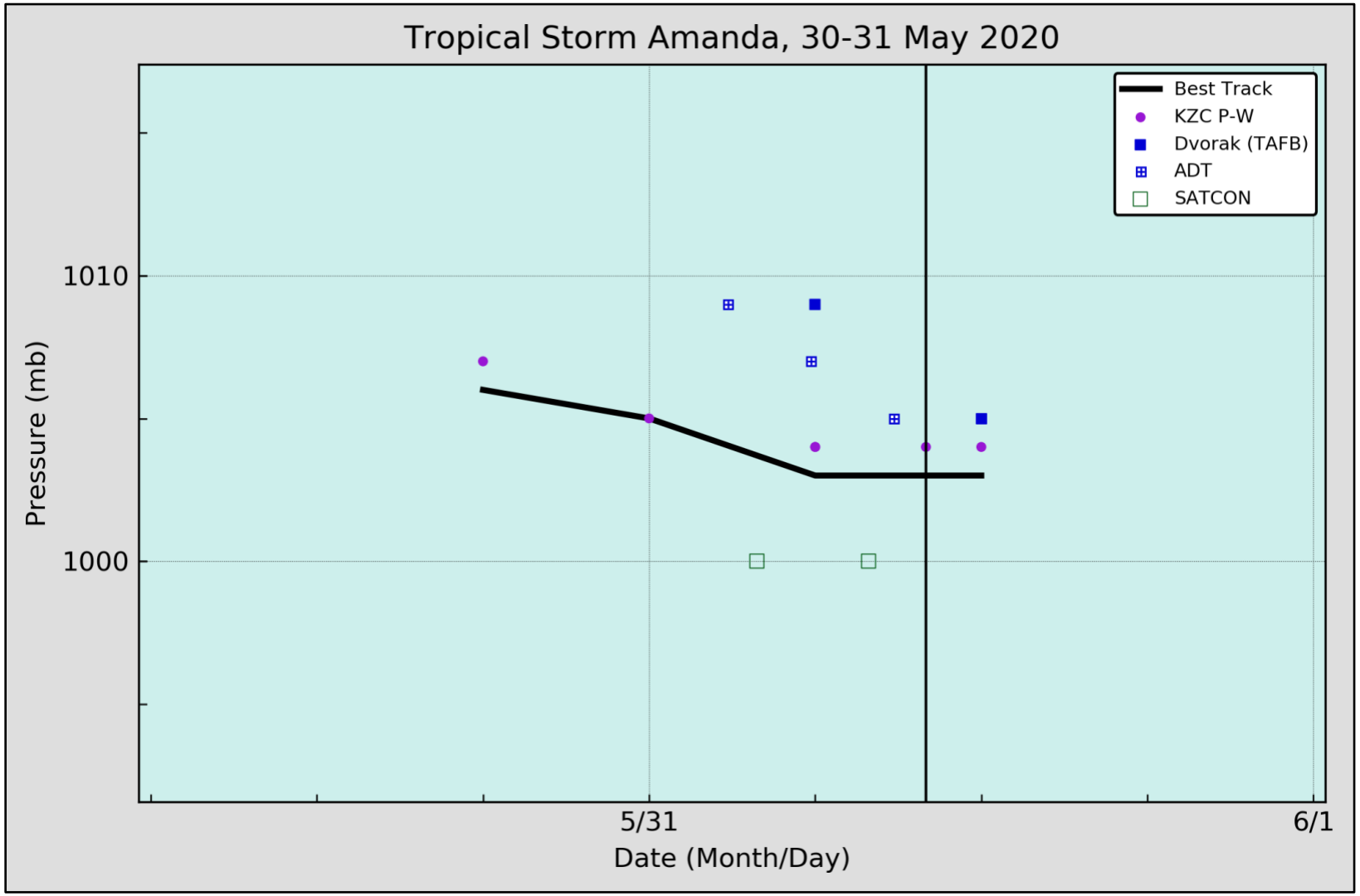

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Amanda, 30–31 May 2020. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. 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.

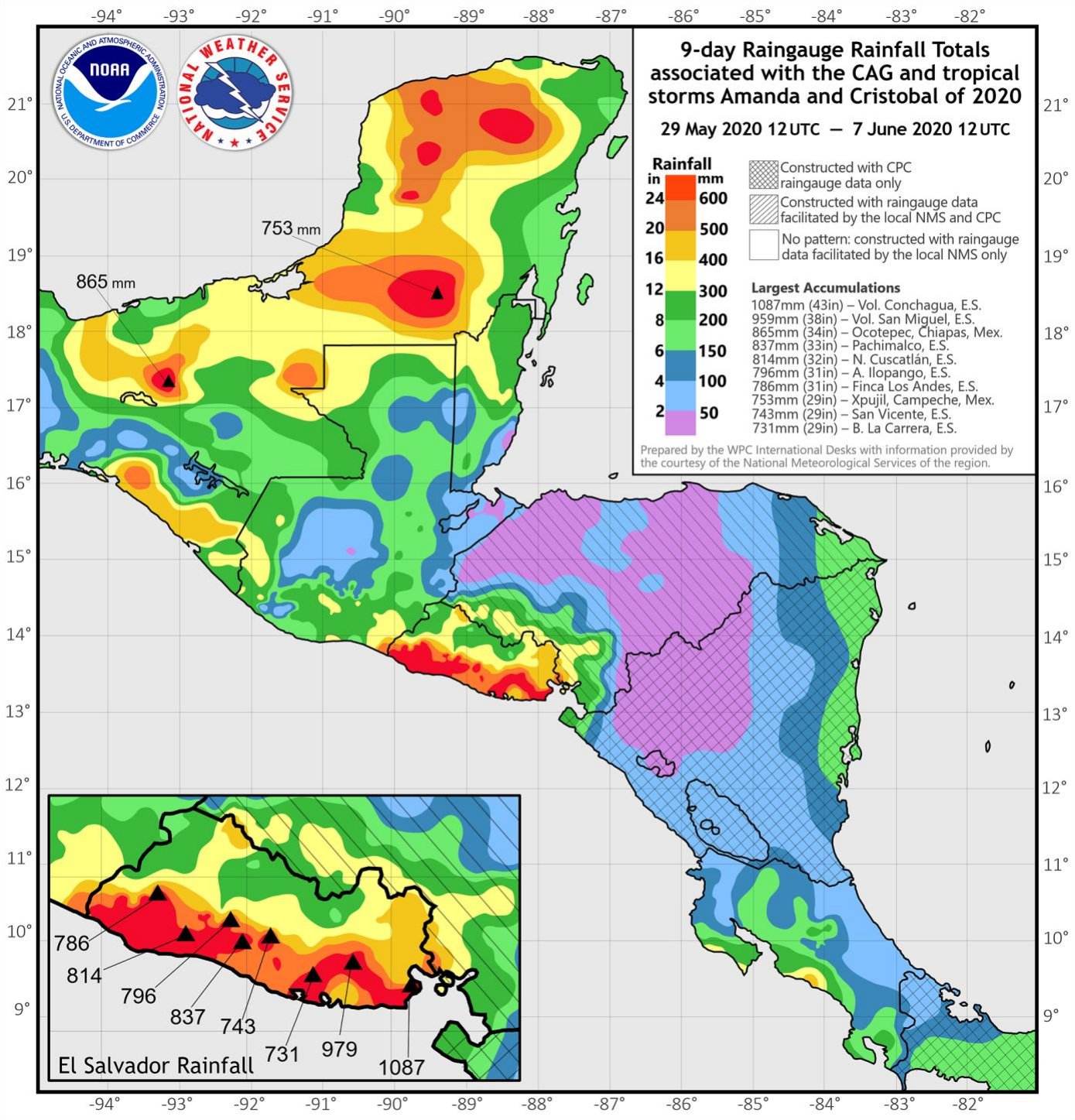

Figure 4. Nine-day rainfall accumulations (mm) in Central America and southeastern Mexico from 29 May to 7 June 2020, covering the period that the region was affected by Tropical Storm Amanda, Tropical Storm Cristobal, and a Central American gyre (CAG). Analysis and image courtesy of the NOAA Weather Prediction Center International Desk and the national meteorological services of the region.

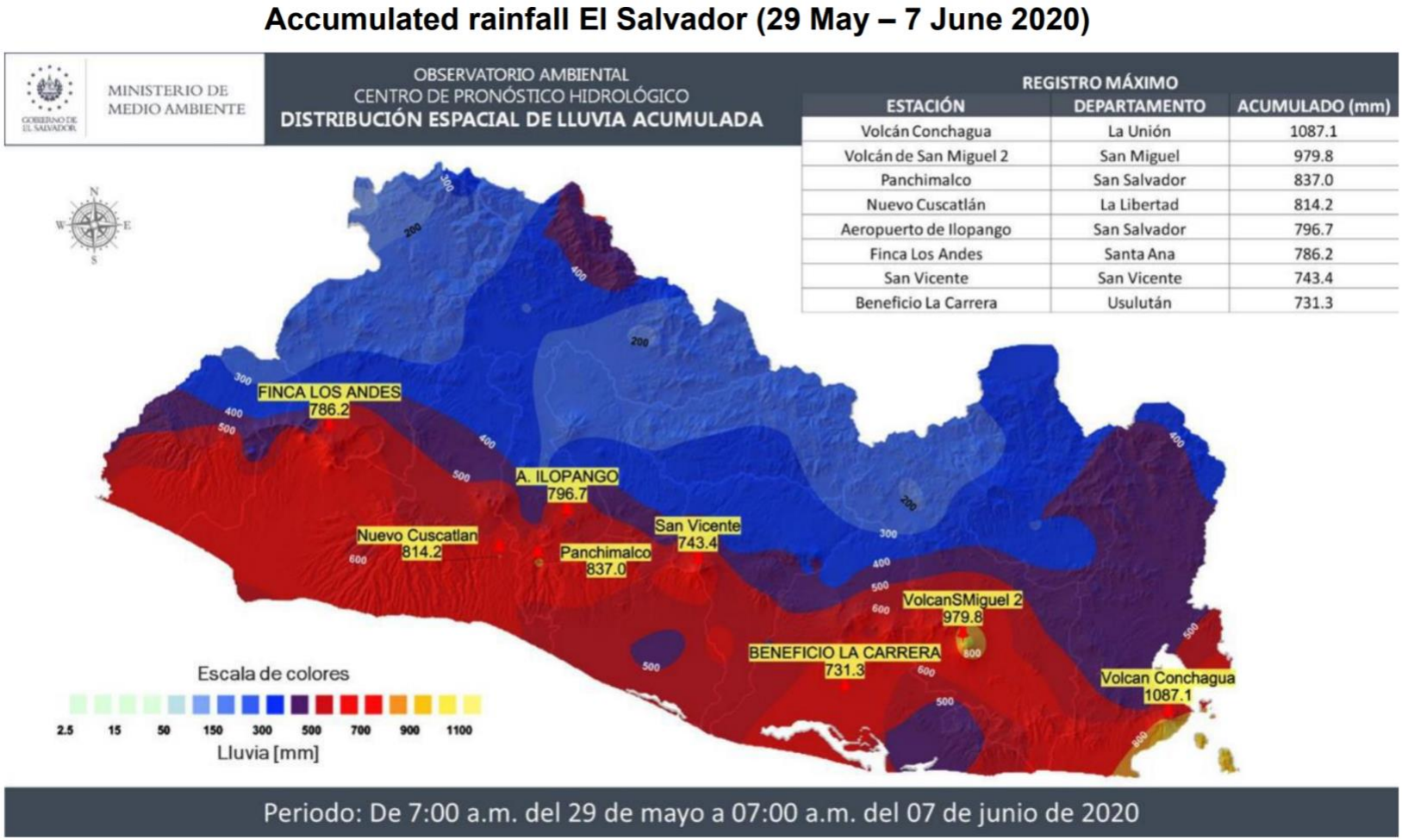

Figure 5. Nine-day rainfall accumulations (mm) in El Salvador between 7 am LST 29 May and 7 am LST 7 June, covering the period that the country was affected by Tropical Storm Amanda, Tropical Storm Cristobal, and a Central American gyre. Image courtesy of el Ministerio de Medio Ambiente y Recursos Naturales de El Salvador.

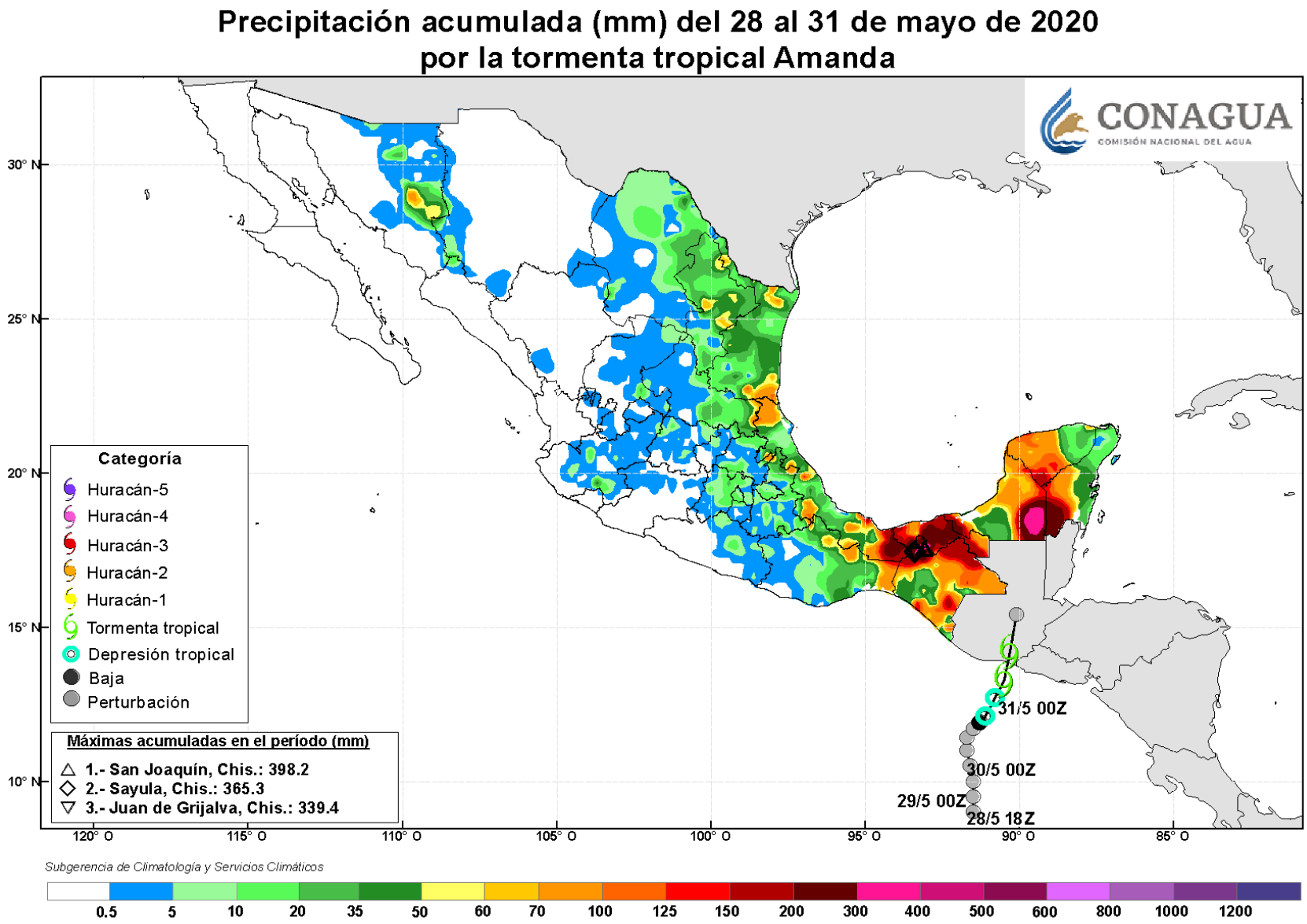

Figure 6. Rainfall accumulations (mm) in Mexico from 28 to 31 May 2020, mainly covering the period that portions of the country were affected by Tropical Storm Amanda. Image courtesy of the Comisión Nacional del Agua (CONAGUA).

Figure 7. (a) Destruction caused by the flooding of Río Acelhuate in the New Israel community of San Salvador, El Salvador (UNICEF) (b) Cars damaged from flooding in the streets of San Salvador, El Salvador (Reuters) (c) A family being rescued from floodwaters in Jalapa, Guatemala (@teleSURtv) (d) Flooding along the Río Goascorán in Valle Department, Honduras (COPECO).