

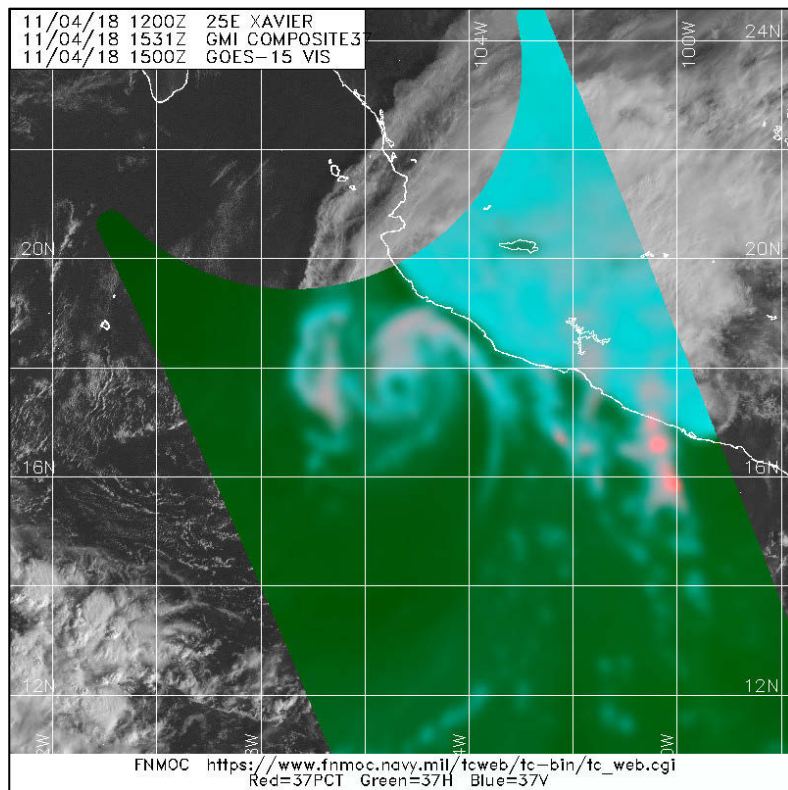


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM XAVIER (EP252018)

2–5 November 2018

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National Hurricane Center
8 February 2019



37-GHZ COLOR COMPOSITE SATELLITE IMAGE OF XAVIER AT 1531 UTC 4 NOVEMBER 2018.
IMAGE COURTESY OF THE FLEET NUMERICAL METEOROLOGY AND OCEANOGRAPHY CENTER (FNMOC).

Xavier was a late-season tropical storm that remained offshore of the southwestern coast of Mexico but brought locally heavy rainfall to portions of that area.

Tropical Storm Xavier

2–5 NOVEMBER 2018

SYNOPTIC HISTORY

Xavier appears to have formed from a tropical wave that departed the west coast of Africa on 17 October. The wave moved westward across the tropical Atlantic Ocean and Caribbean Sea with a limited amount of deep convective activity. The wave slowed down as it entered the southwestern Caribbean Sea and crossed Central America on 26 October. Over the next few days, the wave continued to move slowly westward to the south of the southern coast of Mexico where a favorable phase of the Madden-Julian Oscillation (MJO) was passing through. On 31 October, the wave moved into the eastern portion of a large cyclonic gyre that extended across the eastern Pacific basin from several hundred miles southwest of the southwestern coast of Mexico westward to about 130°W longitude. Shortly thereafter, deep convection began to increase, likely due to the passage of a convectively coupled Kelvin wave, and this led to the development of a broad area of low pressure several hundred n mi southwest of Manzanillo, Mexico. Deep convection associated with the system continued to increase and become better organized early on 2 November, leading to the formation of a tropical depression by 1200 UTC that day about 450 n mi southwest of Manzanillo. 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 tropical depression initially moved east-northeastward between a mid-level ridge to its southeast and a mid- to upper-level trough to its north and northwest. The depression was located within an area of strong southwesterly shear, but the upper-level flow over the tropical cyclone was quite divergent, allowing the system to strengthen. The depression became a tropical storm by 0000 UTC 3 November, and it continued to gradually strengthen over the next 36 h while moving northeastward at 8 kt. Xavier reached its peak intensity of 55 kt by 1200 UTC 4 November (cover photo) when it was centered about 115 n mi southwest of Manzanillo. The tropical storm turned northward and slowed down as it made its closest approach to the southwestern coast of Mexico around 0000 UTC 5 November, when it was centered about 80 n mi southwest of Manzanillo. Shortly thereafter, stronger southwesterly shear and the entrainment of drier mid-level air caused the tropical storm to weaken. The system began to decouple vertically, and the convective activity became separated from the low-level center by 1200 UTC 5 November. Xavier became a vertically shallow system and turned west-northwestward while being steered by the low-level trade wind flow. Later that day, the convective activity dissipated, and Xavier became a post-tropical cyclone with 40-kt winds by 0000 UTC 6 November. Winds associated with the post-tropical low decreased below gale force by 1800 UTC 6 November, when it was located about 90 n mi east of Socorro Island, Mexico. The remnant low turned west-

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.

southwestward and passed near that island at 0600 UTC 7 November. The remnant low continued to weaken, and it degenerated into a trough of low pressure shortly after 0000 UTC 9 November nearly 300 n mi west-southwest of Socorro Island.

METEOROLOGICAL STATISTICS

Observations in Xavier (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 Xavier.

Xavier was best organized around 1500 UTC 4 November when a mid-level eye was present in microwave imagery (cover photo). A pair of ASCAT passes about 12 h later detected winds of 45 to 50 kt in association with the tropical storm. Since the system was better organized before the scatterometer data were available, it is estimated that Xavier reached a peak intensity of 55 kt at 1200 UTC 4 November. UW/CIMSS SATCON estimates peaked at 54 kt at 0141 UTC 4 November, although subjective Dvorak T-numbers from both TAFB and SAB were never higher than T3.0 (45 kt).

An automated weather observing station on Socorro Island measured a wind gust of 35 kt at 0445 UTC 7 November as the remnant low of Xavier passed nearby. The station reported a pressure of 1003.0 mb at 1000 UTC that day, but the pressure at that station appears to be several millibars too low. Scatterometer data on 4 November indicated that tropical-storm-force winds were occurring just offshore of portions of the southwestern coast of Mexico. This data resulted in the government of Mexico issuing a Tropical Storm Warning for a portion of the coast of southwestern Mexico, however, there were no reports of tropical-storm-force winds within that section of coastline.

Two ship reports of winds of tropical storm force were received in association with Xavier. The ship *Zim San Diego* (call sign A8SI7) reported 39-kt winds at 1900 UTC 4 November and the ship *Leo Voyager* (call sign C6AB7) reported 45-kt winds at 0400 UTC 5 November. Both of these ship observations were within about 30 n mi of the coast of southwestern Mexico where some funneling of winds between Xavier and the mountainous terrain of southwestern Mexico likely occurred.

Reports from Mexico indicate that Xavier produced 1 to 2 inches of rainfall along portions of the coast of southwestern Mexico, primarily in the states of Jalisco, Colima, and Michoacán. The highest storm totals in Michoacán were 2.20 inches (56 mm) at Zicuirán and 1.77 inches (45 mm) at Los Olivas. In Jalisco, 1.93 inches (49 mm) was recorded at Chamela-Cuixmala.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Xavier.

FORECAST AND WARNING CRITIQUE

The genesis of Xavier was only anticipated a few days before formation. The disturbance from which Xavier developed was introduced in the Tropical Weather Outlook at 1200 UTC 30 October, about 3 days before development. Although the system was initially assigned a low (<40%) chance of formation over the next 5 days (Table 2), it was raised to the medium (40–60%) category 60 h before formation, and the high category 36 h before development occurred. The 2-day genesis probabilities did not provide quite as much lead time, as the system was assessed to have a medium (40–60%) and high (>60%) chance of development 36 h and 18 h before formation, respectively. The somewhat shorter-than-typical lead times for genesis were due to the fact that there were multiple disturbances embedded within the larger gyre, and the global models had some trouble identifying which disturbance had the best chance to develop into a tropical cyclone.

A verification of NHC official track forecasts for Xavier is given in Table 3a. At all forecast intervals, official track forecast errors were larger than the mean official errors for the previous 5-yr period. This is not surprising since Xavier was a low to moderate strength tropical storm throughout its lifetime, and NHC track errors are typically larger for weak tropical cyclones. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Several dynamical models had lower errors than the NHC forecasts at various lead times. The HWRF (HWFI) was the best individual dynamical model and had lower mean track errors than the official forecast at all lead times. Several of the consensus aids also performed better than the NHC forecasts for Xavier, with the TCON and TVCE models besting the NHC forecasts at each lead time and having the lowest mean errors among the consensus aids. The simple TABM trajectory model also had some of the lowest mean track errors for this storm. The typically reliable ECMWF (EMXI) did not perform well for Xavier and had the highest mean errors among the dynamical models. The track models and the NHC track forecast initially did not predict that Xavier would move as far north or east as it did (Fig. 4), and this likely resulted in the larger-than-average NHC track forecast errors.

A verification of NHC official intensity forecasts for Xavier is given in Table 4a. Official intensity forecast errors were slightly lower than the mean official errors for the previous 5-yr period at lead times from 24 to 72 h. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The best performing intensity model was the GFSI, which beat the NHC forecast at each lead time. The corrected consensus models HCCA and FSSE also had intensity errors that were slightly lower than the NHC forecast at 12, 24, and 36 h. The statistical guidance (DSHP and LGEM) exhibited the largest intensity errors for Xavier. These models did not strengthen the storm nearly enough since Xavier was diagnosed to remain within an area of high 850–200-mb vertical wind shear. The shear calculation used by these models uses a radius of 500 km, which was likely too large in this case. The LGEM and SHIPS



models are also part of the ICON and IVCN consensus models, and contributed to a low bias in those intensity aids as well.

Watches and warnings issued by the government of Mexico in association with Xavier are given in Table 5.



Table 1. Best track for Tropical Storm Xavier, 2–5 November 2018.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage*
02 / 0000	13.7	111.0	1008	25	low
02 / 0600	14.0	110.6	1008	25	"
02 / 1200	14.2	109.9	1007	30	tropical depression
02 / 1800	14.3	109.2	1007	30	"
03 / 0000	14.4	108.5	1006	35	tropical storm
03 / 0600	14.5	107.8	1004	40	"
03 / 1200	14.8	107.1	1002	45	"
03 / 1800	15.2	106.4	1000	45	"
04 / 0000	15.8	105.9	999	50	"
04 / 0600	16.6	105.5	998	50	"
04 / 1200	17.4	105.3	996	55	"
04 / 1800	17.9	105.4	995	55	"
05 / 0000	18.2	105.5	995	55	"
05 / 0600	18.4	105.8	999	50	"
05 / 1200	18.5	106.0	999	50	"
05 / 1800	18.8	106.5	1001	45	"
06 / 0000	18.9	107.2	1004	40	low
06 / 0600	18.9	107.9	1005	35	"
06 / 1200	18.9	108.6	1006	35	"
06 / 1800	18.8	109.4	1007	30	"
07 / 0000	18.7	110.1	1007	30	"
07 / 0600	18.4	110.7	1008	25	"
07 / 1200	18.0	111.4	1008	25	"
07 / 1800	17.8	112.2	1008	25	"
08 / 0000	17.7	112.9	1008	25	"
08 / 0600	17.6	113.6	1009	20	"
08 / 1200	17.5	114.4	1009	20	"
08 / 1800	17.4	115.1	1009	20	"
09 / 0000	17.3	115.7	1009	20	"



Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage*
09 / 0600					dissipated
04 / 1200	17.4	105.3	996	55	maximum winds
04 / 1800	17.9	105.4	995	55	minimum pressure



Table 2. 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%)	60	72
Medium (40%-60%)	36	60
High (>60%)	18	36



Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Xavier, 2–5 November 2018. Mean errors for the previous 5-yr period are shown for comparison.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	29.8	56.5	80.1	87.9	93.4		
OCD5	33.7	71.0	96.6	122.9	55.8		
Forecasts	11	9	7	5	1		
OFCL (2013-17)	21.8	33.2	43.0	53.9	80.7	111.1	150.5
OCD5 (2013-17)	34.9	70.7	109.1	146.1	213.8	269.0	339.7

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Xavier, 2–5 November 2018. 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 3a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	29.8	53.7	79.1	83.7			
OCD5	36.3	78.4	108.4	145.1			
GFSI	30.7	54.0	75.6	74.3			
HMNI	27.9	54.9	92.2	92.5			
HWFI	24.5	39.6	49.5	35.0			
EGRI	35.3	57.9	61.7	49.9			
EMXI	41.9	80.2	112.7	138.0			
CMCI	40.6	67.9	78.0	65.3			
NVGI	36.6	58.0	64.7	74.0			
CTCI	25.3	42.9	70.5	75.7			
AEMI	37.8	65.4	96.9	97.1			
HCCA	28.7	49.6	70.6	76.5			
FSSE	31.4	57.9	82.1	89.4			
TVCX	29.0	51.6	71.5	77.6			
GFEX	34.7	63.6	93.6	106.1			
TCON	23.2	38.4	48.6	43.4			
TVCE	27.5	48.1	69.1	69.1			
TABD	45.3	113.2	183.1	277.4			
TABM	27.3	34.2	31.3	63.1			
TABS	33.5	70.3	89.2	85.9			
Forecasts	9	7	5	3			



Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Xavier, 2–5 November 2018. 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	5.9	7.8	8.6	9.0	10.0		
OCD5	5.4	6.4	7.3	6.6	1.0		
Forecasts	11	9	7	5	1		
OFCL (2013-17)	5.8	9.6	11.8	13.2	15.1	15.1	14.6
OCD5 (2013-17)	7.6	12.4	15.6	17.7	19.8	20.8	19.6



Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Xavier, 2–5 November 2018. 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	6.0	8.1	9.2	8.8			
OCD5	5.4	6.5	7.2	5.5			
GFSI	5.4	7.8	6.7	5.0			
HMNI	4.5	7.4	12.7	17.8			
HWFI	4.9	6.1	10.0	10.0			
EMXI	7.5	11.0	12.7	14.5			
HCCA	5.3	8.0	8.7	9.5			
FSSE	4.2	5.9	7.7	9.0			
LGEM	7.8	15.1	20.5	27.0			
DSHP	10.5	18.9	24.5	30.0			
ICON	5.9	10.1	13.0	15.8			
IVCN	5.6	9.4	12.0	14.2			
Forecasts	10	8	6	4			



Table 5. Watch and warning summary for Tropical Storm Xavier, 2–5 November 2018.

Date/Time (UTC)	Action	Location
04 / 1800	Tropical Storm Warning issued	Punta San Telmo to Playa Perula
05 / 2100	Tropical Storm Warning discontinued	Punta San Telmo to Playa Perula

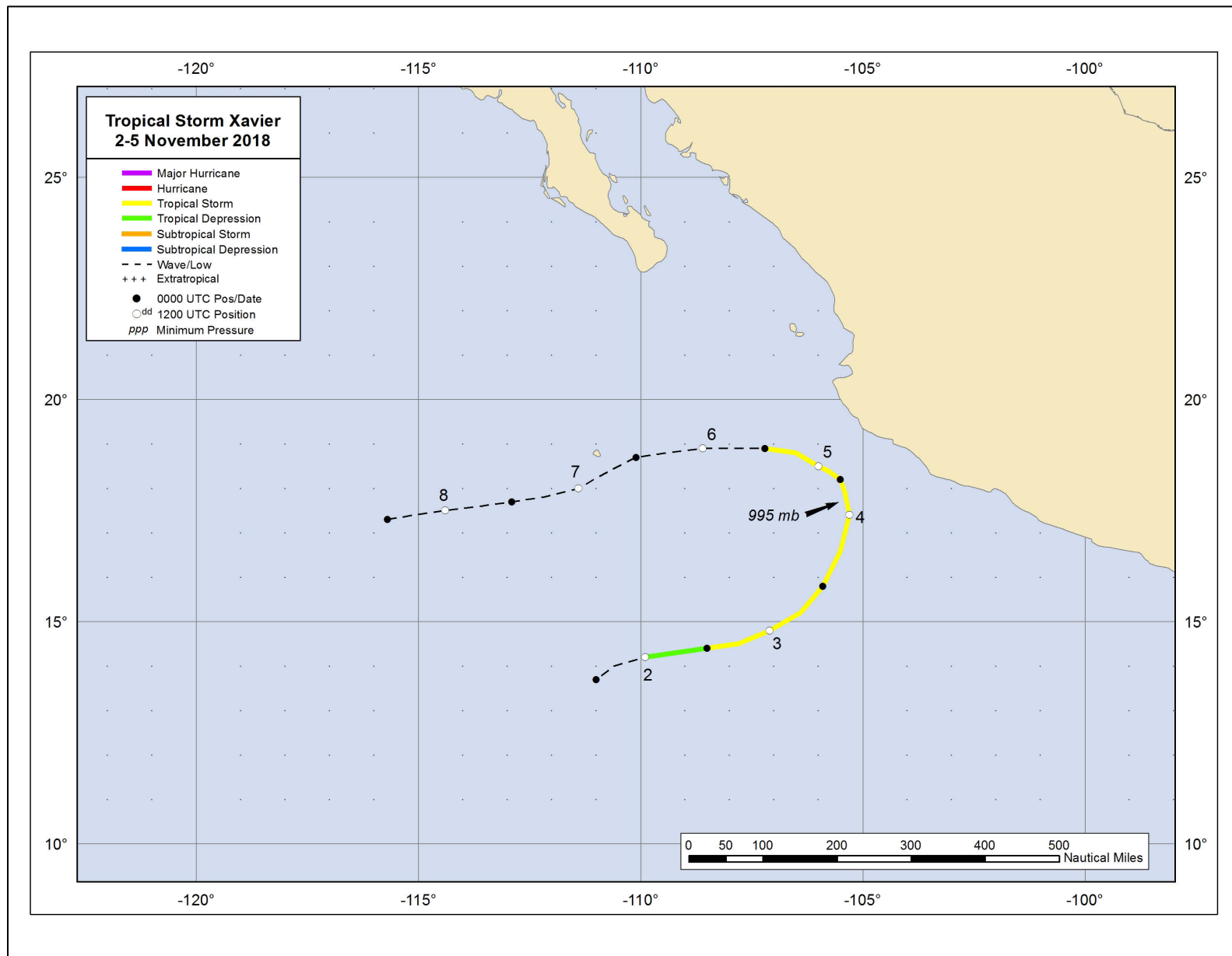


Figure 1. Best track positions for Tropical Storm Xavier, 2–5 November 2018.

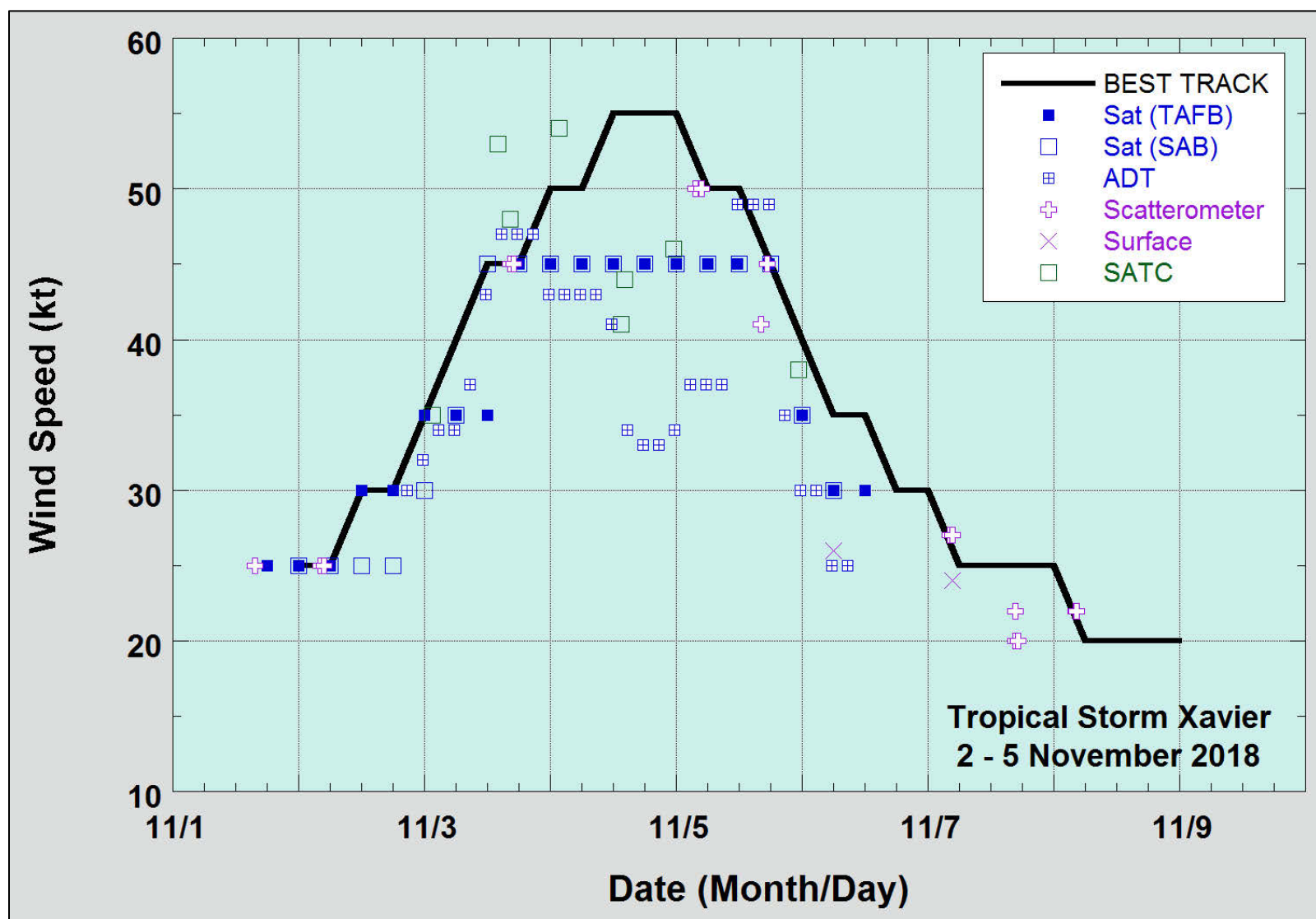


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Xavier, 2–5 November 2018. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

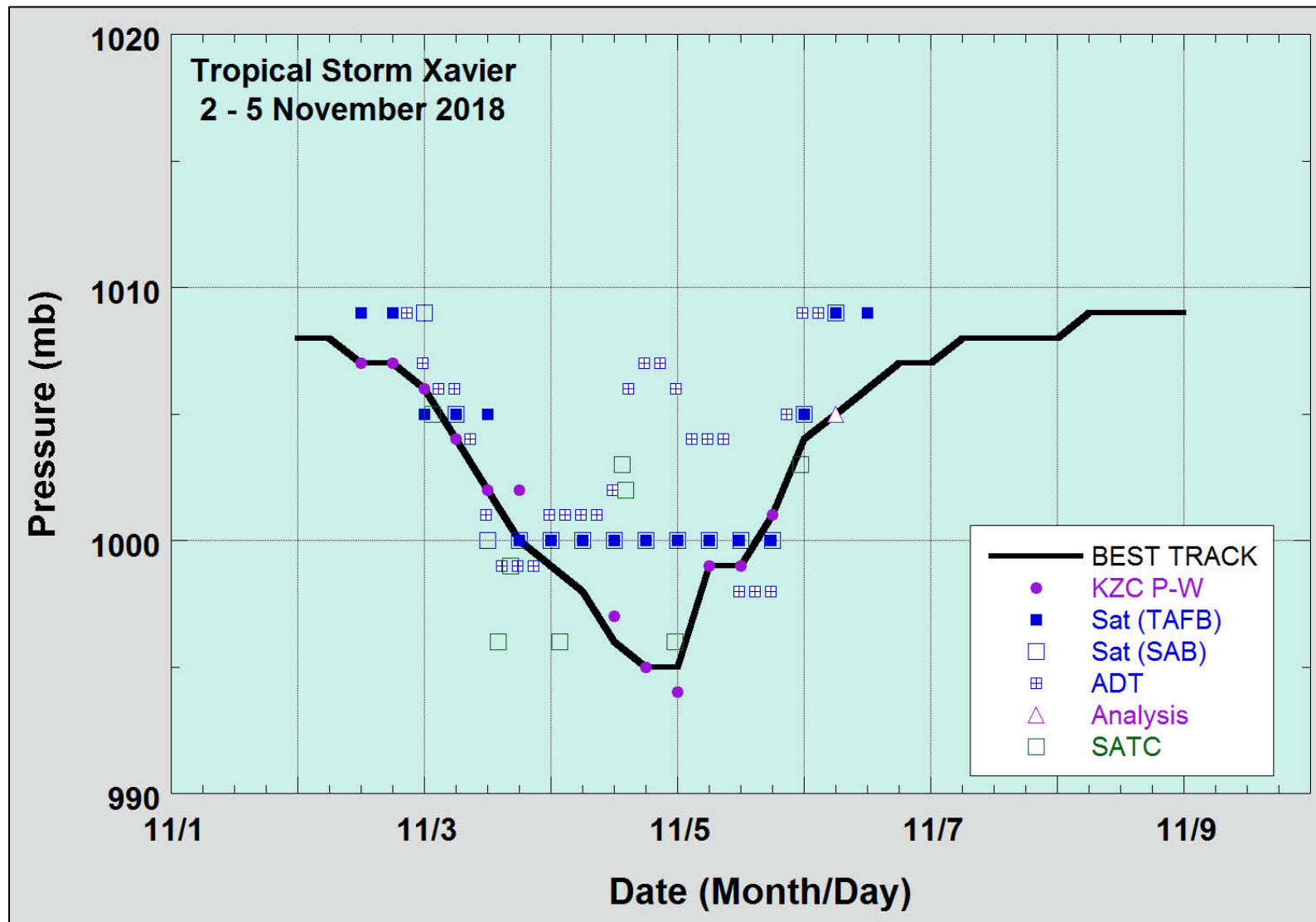


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Xavier, 2–5 November 2018. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.

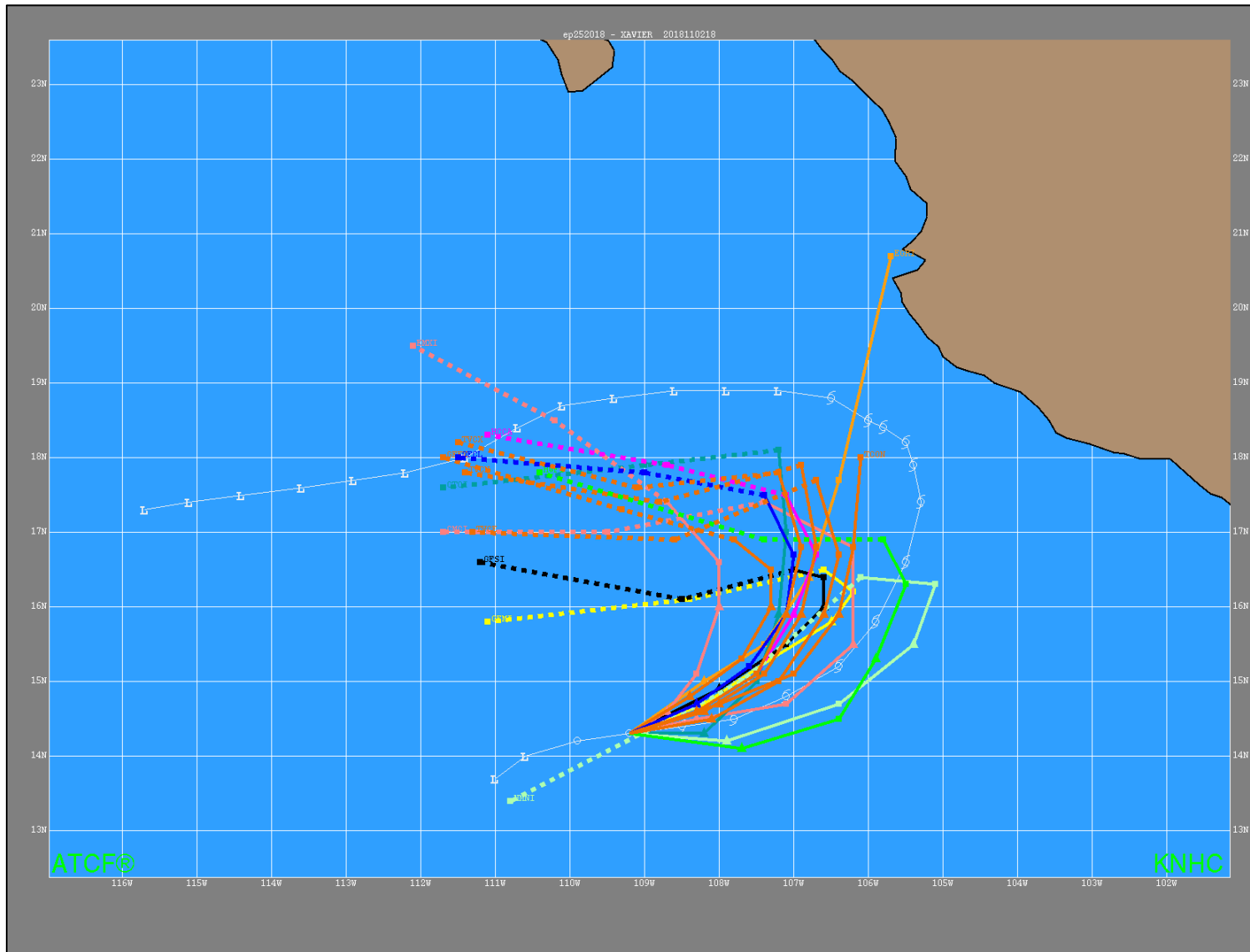


Figure 4. Selected track model forecasts and the NHC official forecast (dark blue) at 1800 UTC 2 November. The best track of Xavier is indicated by the thin white line. Note that the majority of the models did not bring Xavier far enough north or east near the coast of southwest Mexico.