

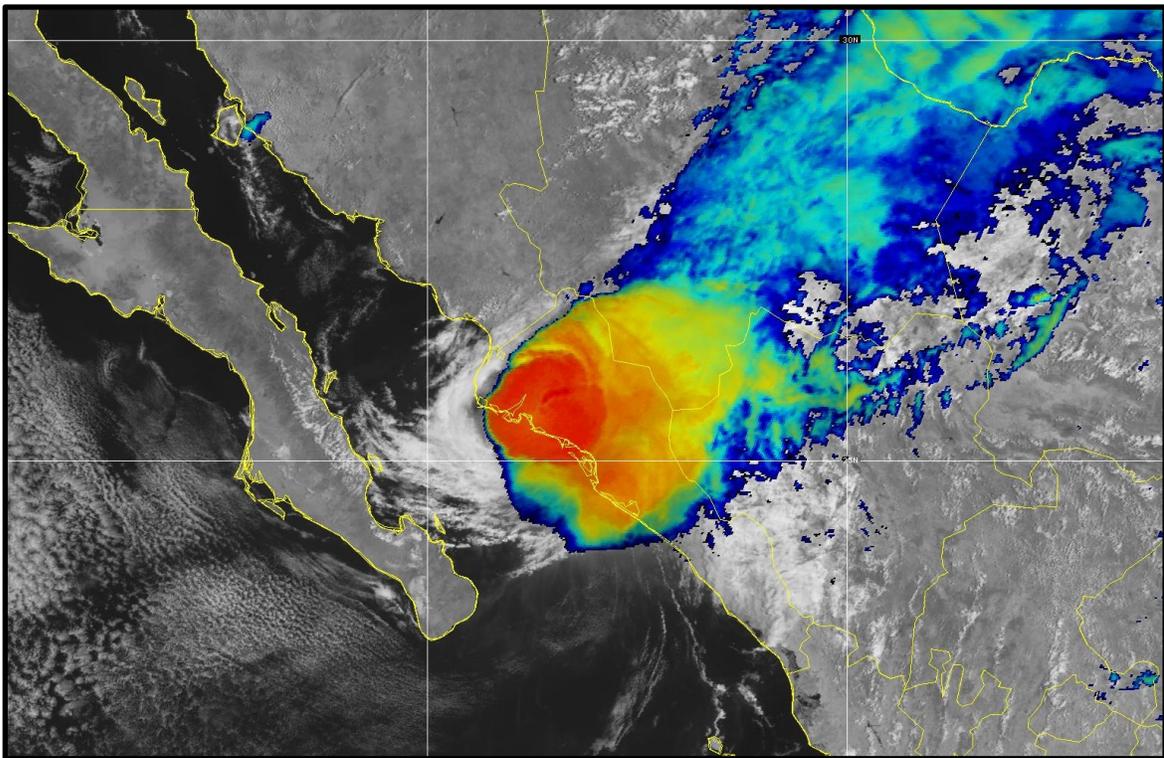


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM ILEANA (EP092024)

12–15 September 2024

Robbie Berg
National Hurricane Center
17 December 2024



GOES-18 SANDWICH COMPOSITE IMAGE OF TROPICAL STORM ILEANA AT 1800 UTC 14 SEPTEMBER WHEN IT REACHED ITS PEAK INTENSITY JUST OFFSHORE OF SINALOA, MEXICO (IMAGE COURTESY OF NOAA/NESDIS/STAR)

Ileana was a tropical storm that brushed the coasts of extreme southern Baja California Sur and northern Sinaloa, Mexico, bringing tropical storm conditions and heavy rains to portions of those areas.

Tropical Storm Ileana

12–15 SEPTEMBER 2024

SYNOPTIC HISTORY

Ileana's formation is linked to a tropical wave that moved off the west coast of Africa on 25 August. The wave moved westward across the tropical Atlantic Ocean, reaching the Lesser Antilles on 2 September and crossing the Caribbean Sea through 6 September. The wave then moved across the Yucatan Peninsula and the northern portion emerged over the southwestern Gulf of Mexico by late on 7 September, developing into Tropical Storm Francine over the western Gulf of Mexico on 9 September. At the same time, the southern portion of the wave moved over the eastern Pacific waters and began interacting with the monsoon trough located off the southern coast of Mexico, with a notable increase in convection occurring late on 8 September and on 9 September. The disturbance gradually became better organized during the next few days, and a well-defined low pressure system formed by 1800 UTC 11 September about 130 n mi southwest of Manzanillo, Mexico. Deep convection became sufficiently organized for the low to be designated as a tropical depression by 1200 UTC 12 September while located about 140 n mi southwest of Cabo Corrientes, Mexico. The depression strengthened into Tropical Storm Ileana 6 hours later. The "best track" chart of Ileana'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.

After Ileana formed, it moved north-northwestward offshore the west-central coast of Mexico and toward the southern tip of the Baja California peninsula over warm ocean waters of 30–31°C. Ileana strengthened to a 40-kt tropical storm by 0000 UTC 13 September, but a gradually drier atmosphere and weak upper-level divergence caused the storm's intensity to hold steady for roughly the next 36 hours. Moving through a break in the subtropical ridge, Ileana's center turned northward and passed very near Cabo Pulmo in southern Baja California Sur (less than 10 n mi offshore) around 0000 UTC 14 September. However, sustained tropical-storm-force winds remained offshore since the storm had an asymmetric wind field with the strongest winds confined to the east side of the circulation. Ileana slowed down while moving over the southern Gulf of California later on 14 September, and despite less-than-ideal environmental conditions, it strengthened a little more to its peak intensity of 45 kt by 1800 UTC while centered about 30 n mi south-southeast of Los Mochis, Sinaloa.

Ileana's center is estimated to have moved within a few nautical miles of Isla de San Ignacio (near Topolobampo) later that evening. However, strengthening deep-layer southwesterly shear caused the associated deep convection to be stripped away from the low-level circulation, and the exposed center abruptly turned westward in the low-level steering

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.

flow before it could make landfall (Fig. 4). With Ileana no longer producing deep convection, it degenerated into a remnant low by 0600 UTC 15 September over the Gulf of California about 20 n mi southwest of Los Mochis. The remnant low moved generally northwestward over the Gulf of California for the next two days, moving inland and dissipating near Bahía Kino, Sonora, soon after 0000 UTC 17 September.

METEOROLOGICAL STATISTICS

Observations in Ileana (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), 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 Ileana.

Selected surface observations from land stations are given in Table 2. A marine platform (vessel type unknown; call sign 2ZMV8H) reported sustained tropical-storm-force winds on 11 and 12 September very close to the coast of Mexico near Manzanillo, but that area often has topographically-enhanced winds, which in this case were not directly associated with Ileana's circulation.

Ileana was assessed in real time to have made landfall in northern Sinaloa by 2100 UTC 14 September, based on radar data from Guasave, Mexico. However, subsequent visible satellite images over the next two hours showed the center becoming exposed just offshore Sinaloa after the deep convection had been sheared away to the northeast (Figs. 4c and d). Given the satellite data, it is likely that the center observed in radar data was not at the surface and moved over land in association with the sheared convection. The final best track of Ileana's center is now analyzed to have been left behind over the Gulf of California without making landfall.

Winds and Pressure

Ileana's estimated peak intensity of 45 kt from 1800 UTC 14 September to 0000 UTC 15 September is based on wind observations from northern Sinaloa when the center was near the coast. A station on the coast at Topolobampo (TOPS5) measured a sustained wind of 44 kt and a gust to 56 kt at 2215 UTC 14 September, while a station just inland at the Los Mochis International Airport (MMLM) reported a sustained wind of 39 kt and a gust to 42 kt at 2345 UTC.

The estimated minimum central pressure of 997 mb at 0000 UTC 15 September is based on a pressure of 1001.3 mb measured at the Topolobampo station, coincident with the sustained 44-kt winds. The 997-mb pressure is also supported by the Knaff-Zehr-Courtney pressure-wind relationship.

Tropical storm conditions occurred over coastal sections of northern Sinaloa, Mexico, with the observing sites at Topolobampo and Los Mochis measuring sustained tropical-storm-force winds, as noted above. Although Ileana's center passed within about 10 n mi of the coast of Baja California Sur, no sustained tropical-storm-force winds are analyzed to have occurred there due to the storm's asymmetric wind structure at the time. However, gusts to 38 kt and 37 kt were measured at Cabo San Lucas and Cabo Pulmo, respectively.

Rainfall and Flooding

Over the four-day period from 12 to 15 September, Ileana produced at least 4 inches (100 mm) of rain over portions of northern Sinaloa and extreme southern Baja California Sur (Fig. 5). The highest rainfall totals reported in Sinaloa were 9.51 inches (241.5 mm) at La Jaina, 9.49 inches (241.0 mm) at Gustavo Díaz Ordaz, and 7.68 inches (195.0 mm) at Guasave. In Baja California Sur, 8.61 inches (218.7 mm) were reported at San Jose del Cabo, and 5.63 inches (143.0 mm) were measured at Boca del Salado.

CASUALTY AND DAMAGE STATISTICS

No direct fatalities² were reported in association with Ileana, but some damage was reported in Sinaloa and Baja California Sur. In Sinaloa, Ileana's winds blew down trees and transformers, causing residents of several municipalities to lose electricity. The port of Topolobampo was closed, and flights were canceled at the Los Mochis airport. Heavy rains caused the Corerepe Canal to overflow in Guasave, forcing 70 people to evacuate and seek shelter at a nearby primary school. Flooding also occurred in San José del Cabo, Baja California Sur, which caused landslides and rising streams that covered some roads. About 200 people were in temporary shelters in La Paz and Los Cabos.³

FORECAST AND WARNING CRITIQUE

The possibility of Ileana's genesis was noted well in advance, but confidence in formation only increased about a day or two before its occurrence. Table 3 provides the number of hours in advance of formation with the first NHC Tropical Weather Outlook (TWO) forecast in each

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 Causa estragos tormenta tropical Ileana a su paso por Sinaloa. *La Jornada*. 14 September 2024. <https://www.jornada.com.mx/noticia/2024/09/14/estados/causa-estragos-tormenta-tropical-ileana-a-su-paso-por-sinaloa-2870>

likelihood category. A low (<40%) chance of genesis during the next 7 days was first indicated in the TWO just over a week (174 hours) before Ileana formed, and chances were raised to the medium (40–60%) category 102 h before formation. For the 2-day forecast period, the precursor disturbance was given a low and medium chance of genesis 48 and 36 hours before formation, respectively. The 7- and 2-day genesis forecasts only reached the high category 18 hours before Ileana formed. Despite the lack of confidence on when Ileana would form, the forecasts for the cyclone's genesis location were very accurate and had a 100% hit rate, lying within every genesis area depicted in NHC's Graphical TWO (Fig. 6).

A verification of NHC official track forecasts for Ileana is given in Table 4a. Official track forecast errors were greater than the mean official errors for the previous 5-yr period from 12–48 hours but comparable at 60 hours (albeit for one forecast). Figure 7 shows that many of the official forecasts were too far to the west and showed the center of Ileana crossing southern Baja California Sur, whereas the storm passed just offshore the coast of the peninsula and turned north-northeastward toward northern Sinaloa. A homogeneous comparison of the official track errors with selected guidance models is given in Table 4b and Fig. 8a. The official track forecasts were middle-of-the-road compared to the models and had similar errors to most of the consensus aids. The ECMWF (EMXI) and HWRF (HWFI) models performed particularly poorly compared to the other guidance and had little to no skill relative to climatology and persistence (OCD5) from 24–48 hours (Fig. 8b). The simple and often less skillful Medium- and Shallow-Layer Trajectory and Beta models (TABM and TABS) had the lowest errors and were some of the only models to accurately reflect that Ileana would turn north-northeastward over the Gulf of California and approach the coast of Sinaloa.

A verification of NHC official intensity forecasts for Ileana is given in Table 5a. Official intensity forecast errors were lower than the mean official errors for the previous 5-yr period at all applicable forecast times. Several NHC intensity forecasts correctly predicted that Ileana would only reach a peak intensity of 45 kt, albeit about 24 hours sooner. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 5b and Fig. 9a. The NHC forecasts were relatively skillful compared to the bulk of the intensity models. The best-performing models were generally a combination of the LGEM, HAFS-A, and COAMPS-TC models, while the HWRF, HMON, HAFS-B, and even HCCA lacked skill at several forecast times (Fig. 9b).

Coastal watches and warnings associated with Ileana are given in Table 6.

ACKNOWLEDGEMENTS

Rainfall data in Table 2 and Fig. 5 were provided by CONAGUA, the national meteorological service of Mexico. Dr. Philippe Papin (NHC) provided the genesis verification maps (Fig. 6), and Dr. Lisa Bucci (NHC) provided the official track forecast verification map (Fig. 7).



Table 1. Best track for Tropical Storm Ileana, 12–15 September 2024.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
11 / 1800	17.8	106.2	1006	30	low
12 / 0000	17.8	106.4	1006	30	"
12 / 0600	18.0	106.7	1004	30	"
12 / 1200	18.5	107.1	1002	30	tropical depression
12 / 1800	19.5	107.7	1001	35	tropical storm
13 / 0000	20.5	108.3	1000	40	"
13 / 0600	21.2	108.7	1000	40	"
13 / 1200	21.7	109.0	1000	40	"
13 / 1800	22.3	109.2	1000	40	"
14 / 0000	23.1	109.3	1000	40	"
14 / 0600	23.9	109.2	1000	40	"
14 / 1200	24.7	109.0	999	40	"
14 / 1800	25.2	108.9	998	45	"
15 / 0000	25.4	109.0	997	45	"
15 / 0600	25.4	109.3	1000	30	low
15 / 1200	25.5	109.6	1003	30	"
15 / 1800	25.6	109.9	1005	25	"
16 / 0000	25.8	110.3	1006	20	"
16 / 0600	26.3	110.7	1006	20	"
16 / 1200	27.1	111.1	1006	20	"
16 / 1800	27.9	111.5	1006	20	"
17 / 0000	28.8	111.7	1007	15	"
17 / 0600					dissipated
14 / 1800	25.2	108.9	998	45	maximum winds
15 / 0000	25.4	109.0	997	45	minimum pressure

Table 2. Selected surface observations for Tropical Storm Ileana, 12–15 September 2024.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) ^a	Sustained (kt)	Gust (kt)	
Mexico						
Baja California Sur						
Cabo Pulmo (CPLB7) (23.45N 109.42W)	13/2320	1002.5	13/2330	30	37	2.26
Cabo San Lucas (CSLB7) (22.88N 109.93W)			14/0500	22	38	
San Jose del Cabo (MMSD) (23.15N 109.72W)	13/2340	1004.8				
Sierra La Laguna (SLGB7) (23.56N 110.0W – elev. 6394 ft.)			14/1020		41	
San Jose del Cabo (DW5450) (23.09N 109.70W)						8.61
San Jose del Cabo (CW7701) (23.10N 109.71W)						5.54
Boca del Salado						5.63
Cabo San Lucas (GW3887) (22.88N 109.91W)						3.66
Sinaloa						
Topolobampo (TOPS5) (25.59N 109.06W)	14/2215	1001.3	14/2215	44	56	
Los Mochis (MMLM) (25.68N 109.08W)	14/2345	1005.8	14/2345	39	42	7.80
La Jaina						9.51
Gustavo Díaz Ordaz						9.49
Guasave						7.68

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

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	168-Hour Outlook
Low (<40%)	48	174
Medium (40%-60%)	36	102
High (>60%)	18	18

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Ileana, 12–15 September 2024. 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	60	72	96	120
OFCL	23.0	40.8	59.5	68.4	68.4			
OCD5	33.8	54.6	84.4	114.7	186.9			
Forecasts	9	7	5	3	1			
OFCL (2019-23)	22.6	34.4	46.0	57.6	69.6	83.5	112.4	137.2
OCD5 (2019-23)	38.2	75.5	117.0	160.0	203.5	247.6	329.5	404.4



Table 4b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Ileana, 12–15 September 2024. 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	60	72	96	120
OFCL	24.8	42.1	60.6	71.3				
OCD5	31.8	52.3	78.5	86.5				
GFSI	22.9	35.6	45.2	60.1				
EMXI	25.7	57.2	84.3	99.9				
CMCI	33.8	54.9	75.1	63.8				
HWFI	26.3	42.1	78.5	90.6				
HMNI	22.6	37.1	63.1	94.8				
HFAI	30.6	37.6	54.2	51.0				
HFBI	34.7	57.9	65.3	46.9				
CTCI	27.6	40.0	53.1	55.0				
HCCA	20.7	38.9	52.2	68.5				
FSSE	22.2	36.3	54.1	65.3				
AEMI	28.2	44.7	68.1	93.1				
GFEX	24.0	43.1	62.6	79.1				
TVCE	25.0	37.6	58.6	67.6				
TVCX	24.2	38.8	60.0	69.8				
TVDG	23.0	37.0	57.3	70.2				
TABD	32.5	67.7	116.9	154.1				
TABM	23.2	20.8	16.1	20.2				
TABS	26.4	34.0	34.2	48.1				
Forecasts	8	6	4	2				



Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Ileana, 12–15 September 2024. 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	60	72	96	120
OFCL	4.4	5.7	5.0	6.7	0.0			
OCD5	6.9	5.9	5.6	9.7	5.0			
Forecasts	9	7	5	3	1			
OFCL (2019-23)	5.5	8.7	10.8	12.7	14.5	15.6	17.1	18.0
OCD5 (2019-23)	7.2	12.2	15.9	18.6	19.9	20.0	19.6	18.7



Table 5b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Ileana, 12–15 September 2024. 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	60	72	96	120
OFCL	4.4	6.7	5.0	7.5				
OCD5	6.8	5.8	6.0	11.5				
HWF1	5.1	7.2	8.2	12.0				
HMNI	4.0	5.8	8.8	16.0				
HFAI	4.6	5.3	4.5	3.5				
HFBI	4.6	8.7	11.0	2.5				
CTCI	5.5	6.2	4.5	2.5				
DSHP	7.1	5.8	6.0	8.5				
LGEM	5.9	4.0	5.0	8.5				
ICON	4.6	5.3	6.5	11.0				
IVCN	4.2	5.5	6.2	6.5				
IVDR	4.4	5.8	6.5	6.5				
HCCA	5.1	6.3	8.2	8.0				
FSSE	4.8	5.3	5.8	6.0				
GFSI	6.8	9.2	9.8	12.5				
EMXI	6.0	8.3	13.0	18.0				
Forecasts	8	6	4	2				



Table 6. Coastal watch and warning summary for Tropical Storm Ileana, 12–15 September 2024.

Date/Time (UTC)	Action	Location
12 / 1500	Tropical Storm Warning issued	Baja California Sur from Santa Fe southward and La Paz southward
12 / 1500	Tropical Storm Watch issued	Baja California Sur north of La Paz to San Evaristo
12 / 2100	Tropical Storm Warning issued	Baja California Sur north of La Paz to San Evaristo
12 / 2100	Tropical Storm Watch issued	Baja California Sur north of San Evaristo to Loreto
12 / 2100	Tropical Storm Watch issued	Mainland Mexico from Topolobampo to Huatabampito
14 / 0900	Tropical Storm Warning issued	Mainland Mexico from Altata to Huatabampito
14 / 0900	Tropical Storm Watch and Warning discontinued	All Baja California Sur
15 / 0900	Tropical Storm Warning discontinued	All Mainland Mexico

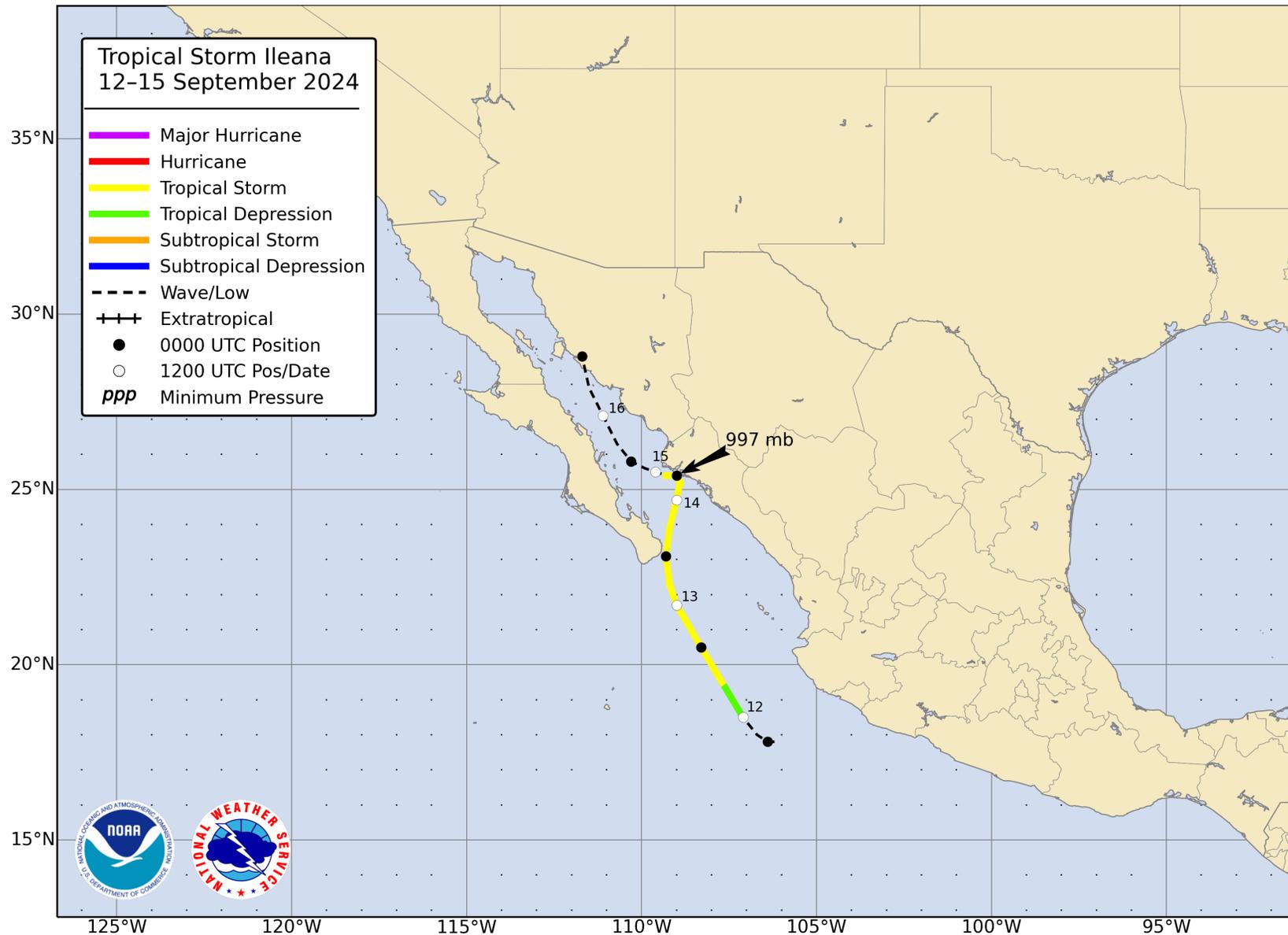


Figure 1. Best track positions for Tropical Storm Ileana, 12–15 September 2024.

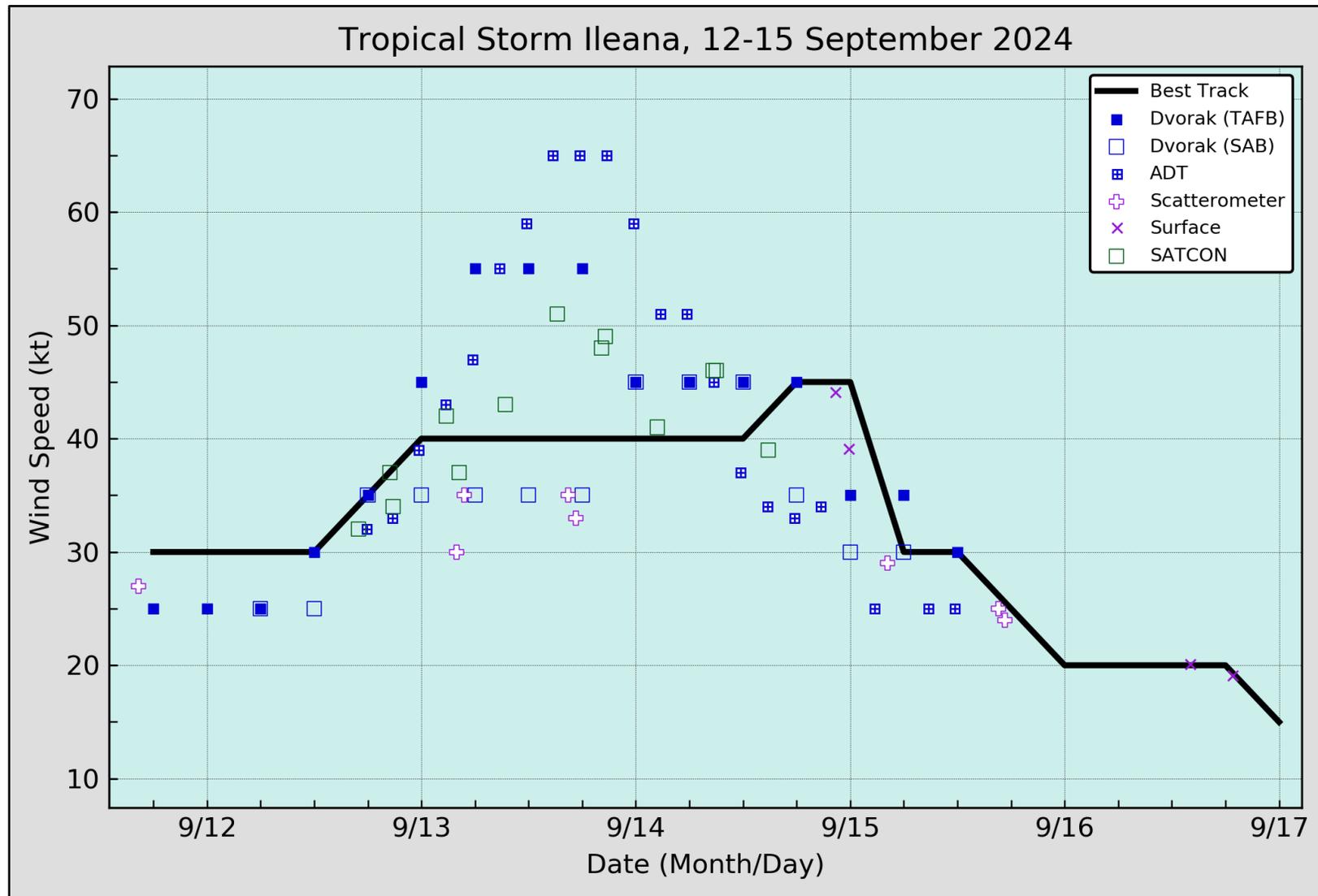


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Ileana, 12–15 September 2024. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

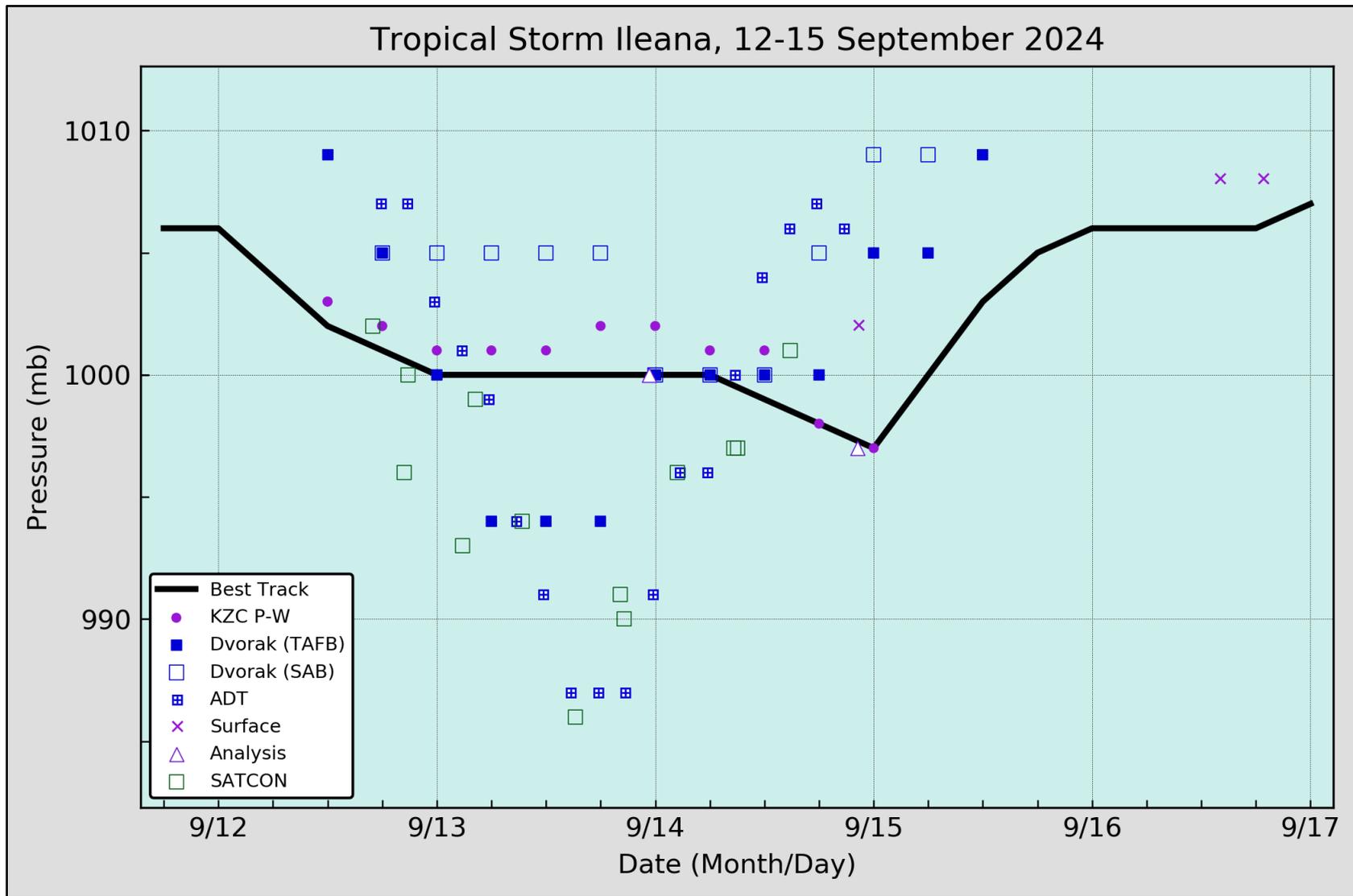


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Ileana, 12–15 September 2024. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.

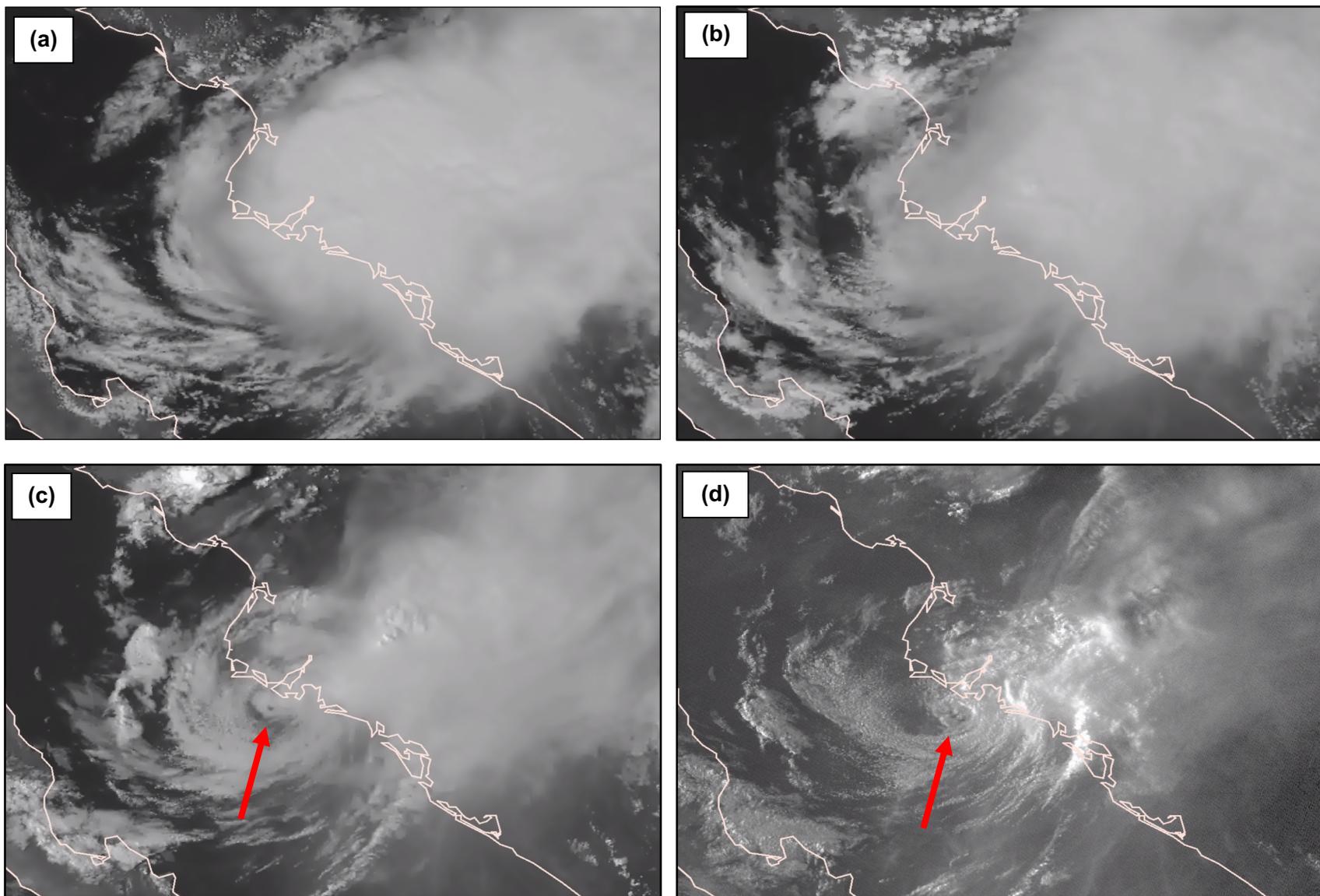


Figure 4. Sequence of GOES-18 nighttime proxy-visible satellite images of Tropical Storm Ileana at (a) 1900 UTC 14 September, (b) 2100 UTC, (c) 2300 UTC, and (d) 0100 UTC 15 September. The center is denoted by the red arrows once it became evident offshore at 2300 UTC.

Precipitación acumulada (mm) del 12 al 15 de septiembre de 2024 por la tormenta tropical Ileana

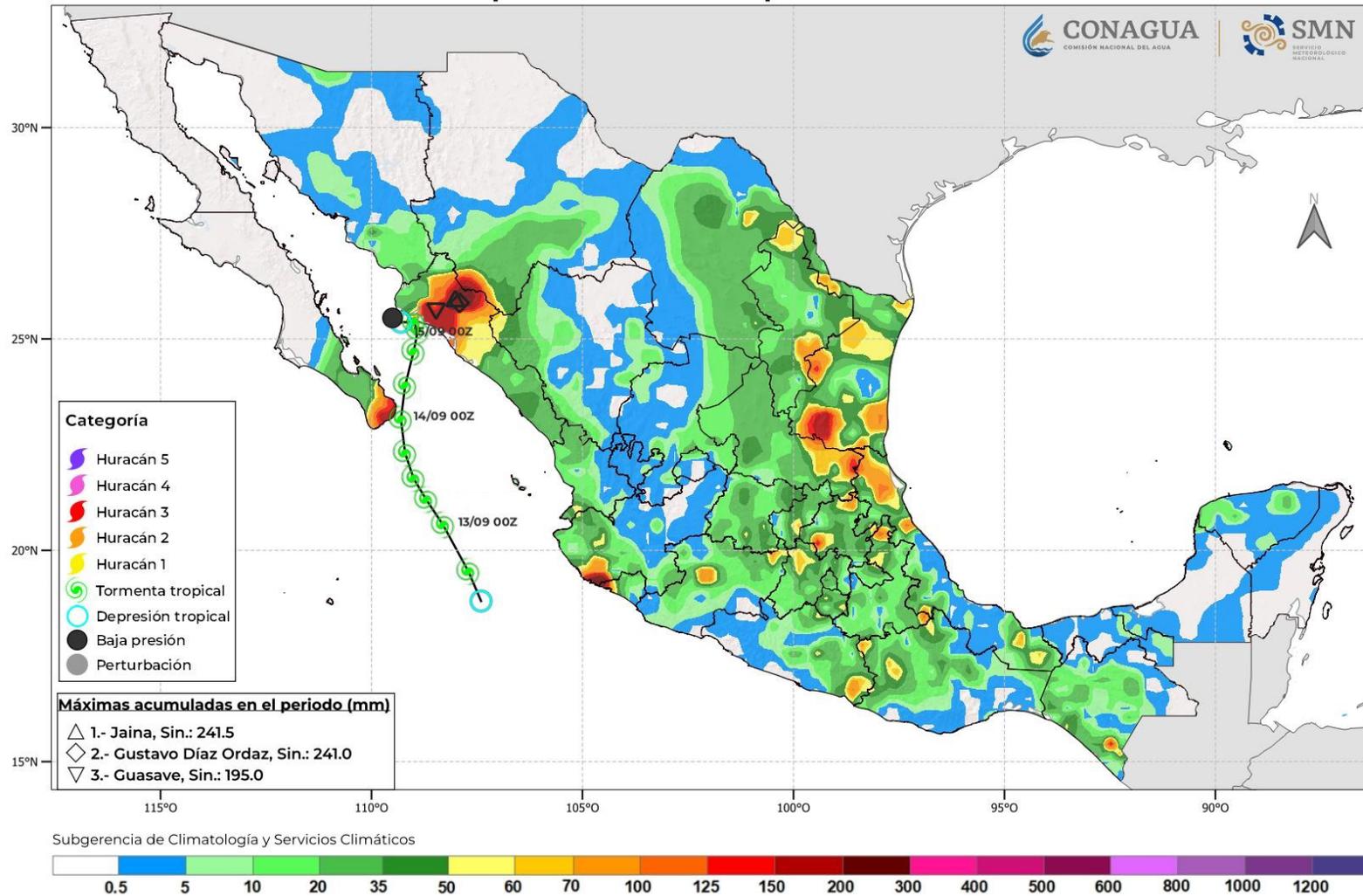


Figure 5. Rainfall accumulations (mm) in Mexico from 12 to 15 September 2024, including the effects of Tropical Storm Ileana. Ileana's track is based on operational location and intensity estimates. Note that not all rainfall depicted is directly related to Ileana. Image courtesy of CONAGUA, the National Meteorological Service of Mexico.

Ileana 7-day Tropical Weather Outlook Areas

From: 0600 UTC 5 Sep 2024 to 1200 UTC 12 Sep 2024

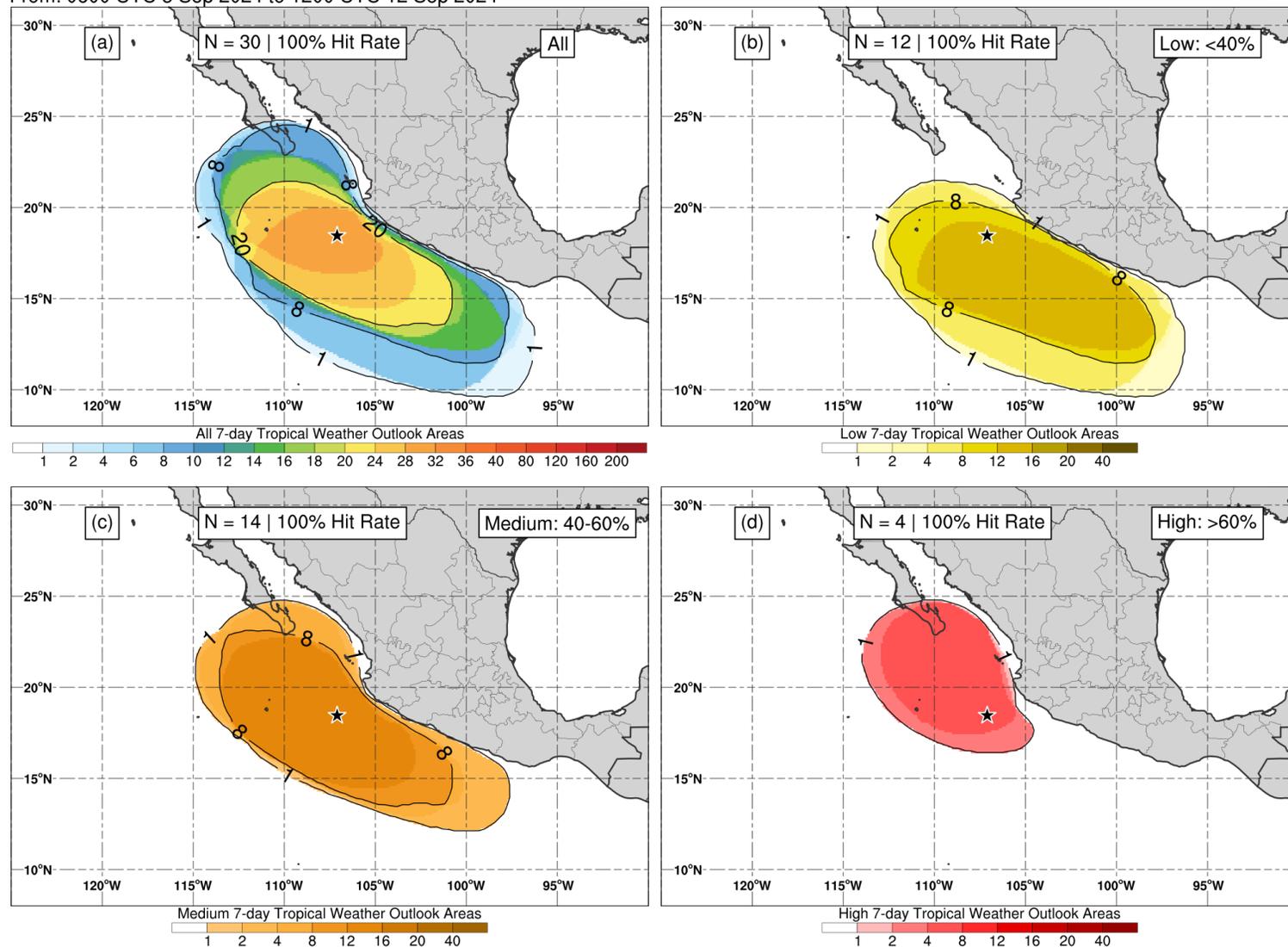


Figure 6. Composites of 7-day tropical cyclone genesis areas depicted in NHC’s Tropical Weather Outlooks prior to the formation of Ileana for (a) all probabilistic genesis categories, (b) the low (<40%) category, (c) medium (40–60%) category, and (d) high (>60%) category. The location of genesis is indicated by the black star.

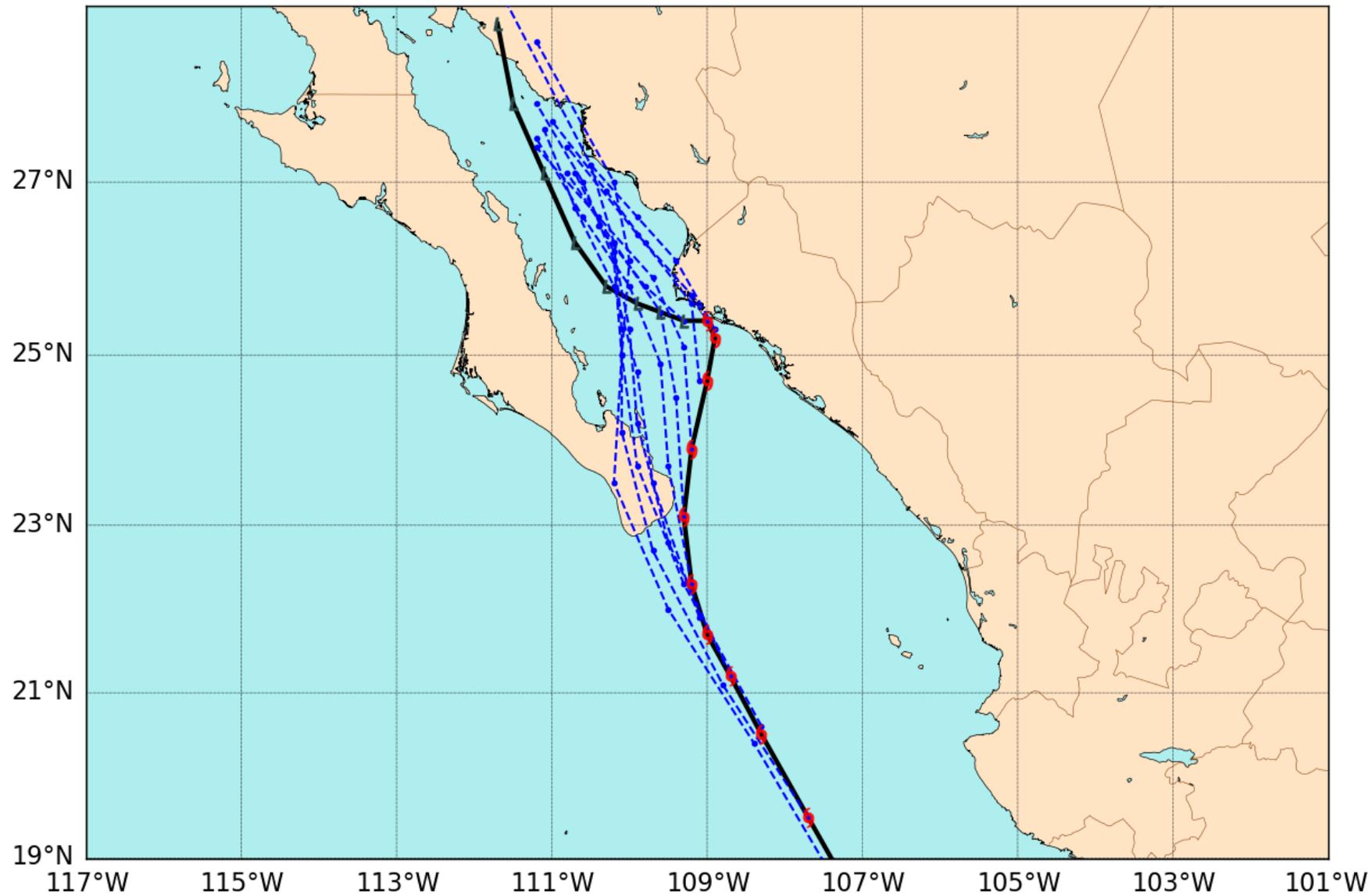


Figure 7. Official track forecasts (blue dashed lines) for Tropical Storm Ileana from 1200 UTC 12 September to 0600 UTC 15 September 2024. The best track is given by the black line with positions and designations given at 6-hour intervals (red and black symbols).

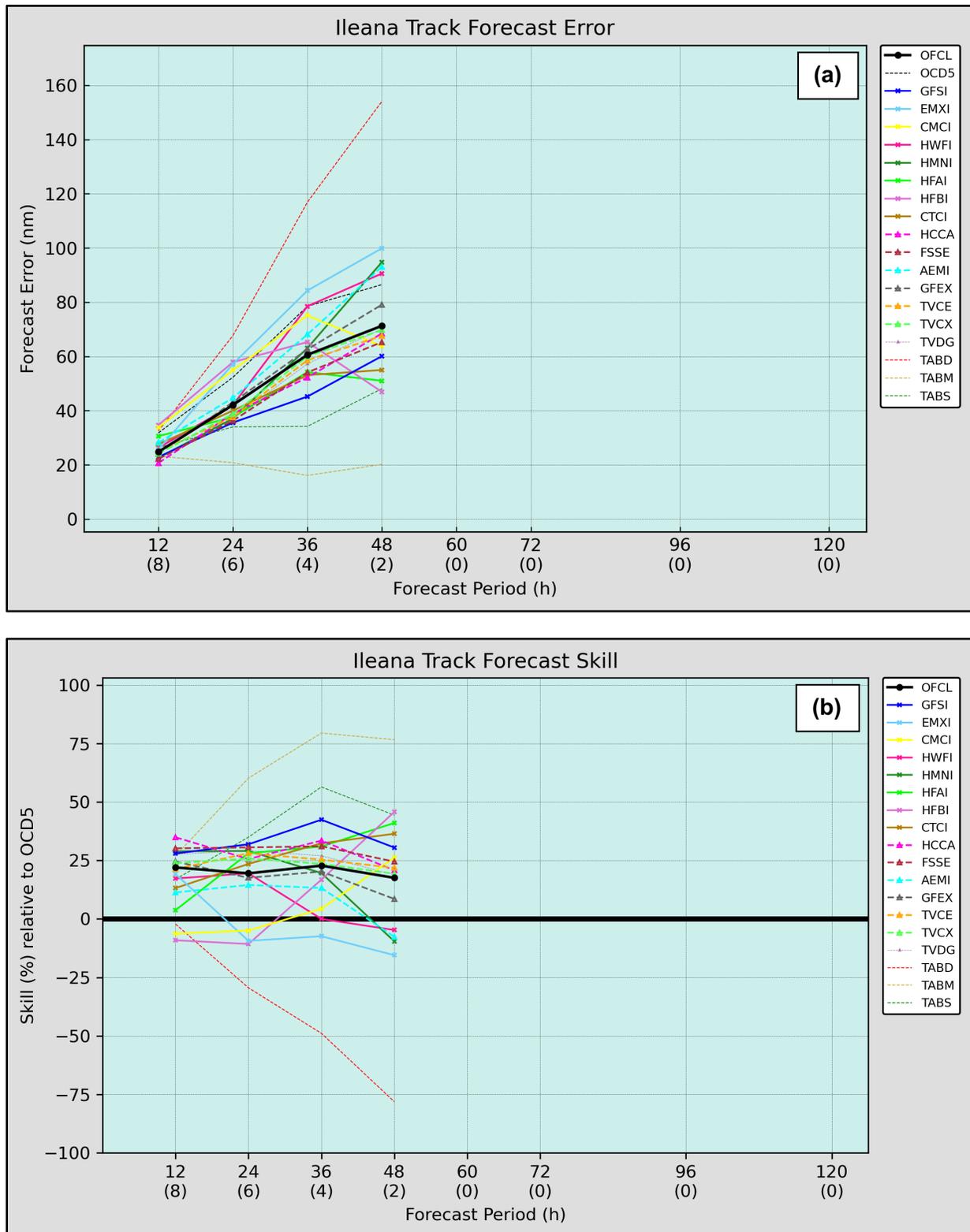


Figure 8. Homogeneous comparison of selected (a) track forecast guidance model errors (in n mi) and (b) track forecast skill relative to climatology and persistence (OCD5; %) for Tropical Storm Ileana, 12–15 September 2024. Official NHC track errors and skill are denoted by the thick black line.

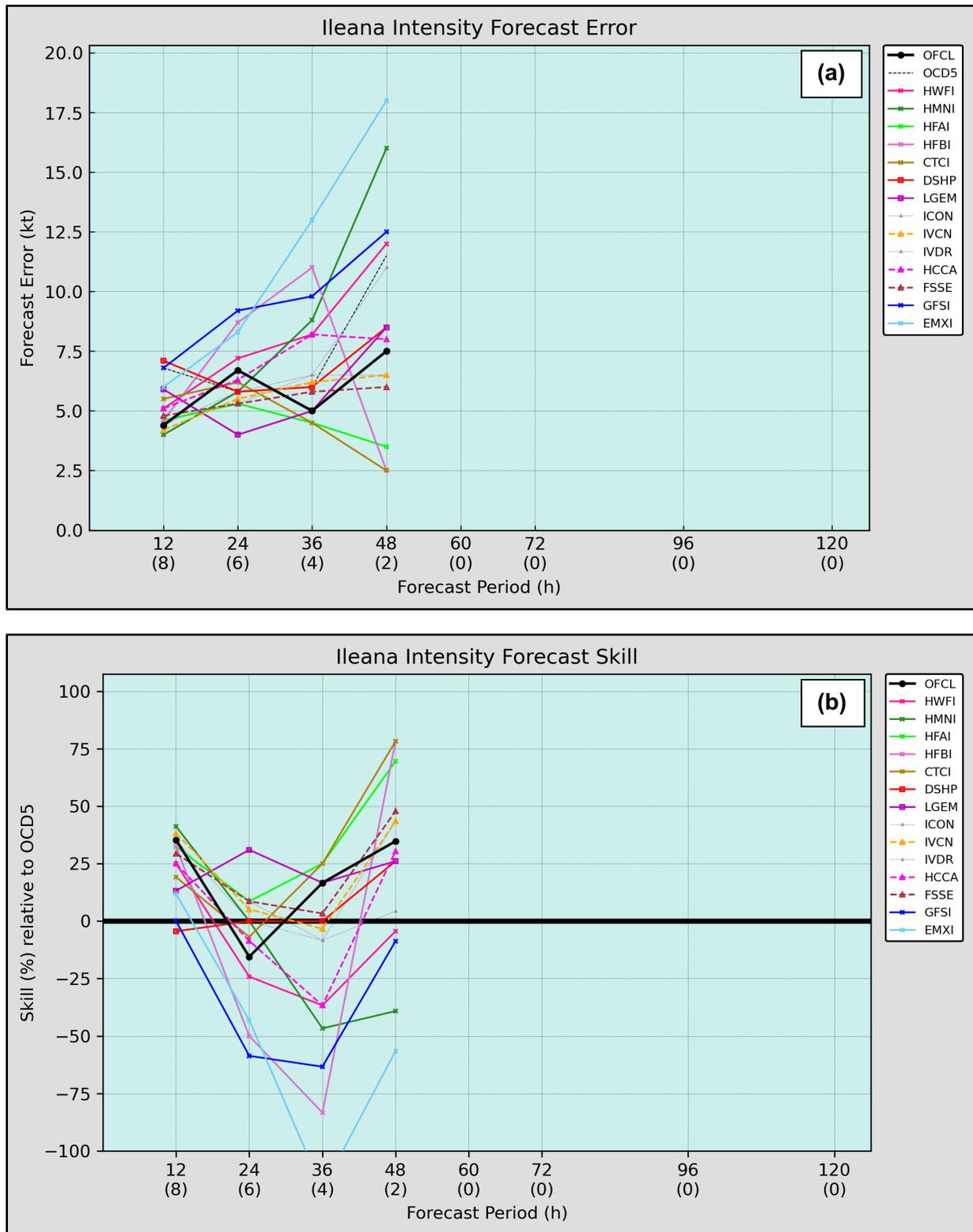


Figure 9. Homogeneous comparison of selected (a) intensity forecast guidance model errors (in kt) and (b) intensity forecast skill relative to climatology and persistence (OCD5; %) for Tropical Storm Ileana, 12–15 September 2024. Official NHC intensity errors and skill are denoted by the thick black line.