

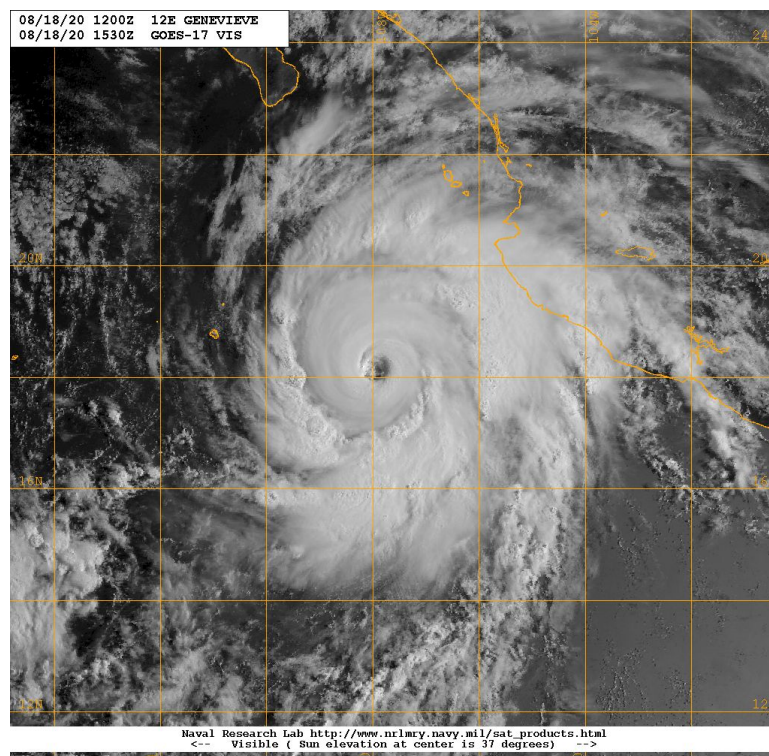


# NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

## HURRICANE GENEVIEVE (EP122020)

16–21 August 2020

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National Hurricane Center  
13 April 2021



GOES-17 VISIBLE SATELLITE IMAGE OF HURRICANE GENEVIEVE NEAR PEAK INTENSITY AT 1530 UTC 18 AUGUST 2020.  
IMAGE COURTESY OF NAVAL RESEARCH LABORATORY.

Genevieve was briefly a category 4 hurricane (on the Saffir-Simpson Hurricane Wind Scale), but weakened before it passed near Cabo San Lucas, Mexico, and brought strong winds and heavy rainfall to extreme southern Baja California Sur.

# Hurricane Genevieve

16–21 AUGUST 2020

## SYNOPTIC HISTORY

Genevieve's formation can be traced back to a tropical wave that crossed Central America on 13 August. The wave amplified somewhat after interacting with a low-level trough just west of Costa Rica that day, and the system moved slowly westward to the south of Central America. On 15 August, the associated deep convection increased and became more consolidated a few hundred n mi southeast of the Gulf of Tehuantepec. The convection became better organized the next day, and by 1200 UTC 16 August, the system acquired a well-defined low-level circulation and thus developed into a tropical depression while centered about 260 n mi south of Puerto Angel, 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 1<sup>1</sup>.

After it formed, the tropical cyclone's organization steadily increased and, while in an environment of very weak shear and over sea surface temperatures of around 30°C, it strengthened into a tropical storm around 1800 UTC 16 August. Moving northwestward parallel to the coast of Mexico and south of a large mid-level high centered over the western United States, Genevieve intensified rapidly and became a hurricane at about 1200 UTC 17 August while centered about 250 n mi south of Lazaro Cardenas, Mexico. Rapid intensification continued; Genevieve's maximum winds increased by 50 kt over 24 h, and the system became a 115-kt category 4 hurricane around 1200 UTC 18 August while centered about 195 n mi west-southwest of Manzanillo, Mexico. A well-defined eye was evident around this time (cover image). However, this intensity turned out to be short-lived, since a weakening trend began just 6 h later. After slowing in forward speed, Genevieve turned toward the north-northwest. The hurricane weakened below category 3 strength by 0600 UTC 19 August, and below category 2 status by 1800 UTC that day, probably due to increased southwesterly shear, and the southern portion of the eyewall became eroded. Genevieve's weakening was also possibly due to its passage over the wake of Tropical Storm Elida which traversed the same area about 8 days earlier, which likely cooled the waters along the hurricane's track. Around 0000 UTC on the 20<sup>th</sup>, Genevieve jogged toward the north, possibly due to the influence of a weak mid-level cyclonic circulation to its west. This change in heading brought the system nearer to the southern tip of the Baja California peninsula than earlier expected, and the center of the 70-kt hurricane passed about 45 n mi to the southwest of Cabo San Lucas around 0600 UTC 20 August, bringing near-hurricane-force winds and very heavy rains to that area.

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<sup>1</sup> 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.

After passing near Cabo San Lucas, Genevieve moved northwestward over progressively cooler waters and weakened to a tropical storm by 1800 UTC 20 August. The cyclone continued to spin down while moving west-northwestward, and it was virtually free of deep convection and thus became a post-tropical cyclone by 1800 UTC 21 August. The system weakened into a remnant low by 0000 UTC on 22 August, and dissipated a couple of n mi west of the central Baja California Peninsula about 12 h later.

## METEOROLOGICAL STATISTICS

Observations in Genevieve (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. Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from two flights of the 53<sup>rd</sup> Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command. 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 Genevieve.

The estimated peak intensity of Genevieve, 115 kt, is based on a blend of objective ADT and subjective Dvorak estimates, but leans toward the ADT values. There were also a couple of SATCON intensity estimates in the 120–130 kt range around the time of the hurricane's maximum strength. The estimated minimum pressure, 950 mb, is based on the Knaff-Zehr-Courtney pressure-wind relationship

Although Genevieve became an intense hurricane on 18 August, microwave imagery suggested that it never underwent an eyewall replacement after reaching peak intensity, however this cannot be entirely ruled out due to limitations in the spatial and temporal resolution of the microwave imagery. Nonetheless, Genevieve's weakening on 18–19 August was more likely due to cooler ocean waters than an eyewall replacement cycle.

The Air Force Reserve Hurricane Hunters flew two missions into Genevieve, on 19 and 20 August, while the hurricane was weakening. Maximum surface and 700 mb flight-level winds from these missions were 69 kt and 82 kt, respectively, on the 19<sup>th</sup> and the lowest central pressure measured was 972 mb.

The highest wind reported on land in the southern portion of the Baja California peninsula was from a WeatherFlow site at Cabo San Lucas Marina, which reported a maximum sustained wind of 61 kt at 0510 UTC 20 August and a peak gust of 78 kt at 0810 UTC 20 August.

Isolated rainfall totals of around 4 inches were recorded over portions of mainland Mexico, primarily in the states of Oaxaca and Guerrero. Much heavier rainfall occurred over extreme

southern Baja California Sur, with a maximum amount of 11.2 inches reported at Cabo San Lucas (Fig. 4).

No ship reports of winds of tropical storm force associated with Genevieve were received.

## CASUALTY AND DAMAGE STATISTICS

Genevieve caused 6 direct deaths in Mexico<sup>2</sup>. In the state of Oaxaca, 2 people were killed by landslides and 2 drowned in swollen rivers. There were also 2 surf-related drownings at the resort of Los Cabos in Baja California Sur.

Flooding resulted in some limited damage to roads and structures in mainland Mexico. The governor of Baja California Sur reported that there was some damage to the hydraulic, highway, and electrical systems in the state. The total damage due to Genevieve is estimated to be at least \$50 million (USD) by the insurance company AON.

## FORECAST AND WARNING CRITIQUE

The genesis of Genevieve was well anticipated. Its potential formation was first noted in the Tropical Weather Outlook (TWO) 138 h prior to genesis, with a low (<40%) 5-day probability for development (Table 2). The system was introduced into the TWO with a low 2-day genesis probability 72 h before development. The 2- and 5-day genesis probabilities were raised to medium (40%–60%) 48 and 132 h before development, respectively, and were boosted to the high (>60%) category 36 and 96 h before development, respectively.

A verification of NHC official track forecasts for Genevieve is given in Table 3a. Official track forecast errors were higher than the mean official errors for the previous 5-yr period at the 12- through 120-h forecast intervals. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. GFSI and the GEFS ensemble mean, AEMI, were better than the official forecasts at almost all forecast intervals. Somewhat uncharacteristically, the typically reliable ECMWF (EMXI) lagged behind the official forecasts at all intervals.

A verification of NHC official intensity forecasts for Genevieve is given in Table 4a. Official intensity forecast errors were substantially larger than the mean official errors for the previous 5-yr period at the 12- through 120-h forecast intervals. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. HWFI and HMNI had the lowest errors at nearly all forecast intervals. A major factor in the relatively poor official intensity

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<sup>2</sup> 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.

forecasts was the failure to properly depict the rapid intensification and weakening of this hurricane. Figure 5 shows most of the official and HWFI intensity forecasts, and it can be seen that the official forecasts called for too much strengthening after the actual peak intensity, and did not show the cyclone weakening soon enough. In those respects, HWFI did a better job.

Coastal watches and warnings associated with Genevieve are given in Table 5. Although a Tropical Storm Warning was issued at 0900 UTC 18 August for the Cabo San Lucas area, the Hurricane Warning was only issued about 3 h before the onset of tropical-storm-force winds in that area.

## ACKNOWLEDGMENTS

John P. Cangialosi produced the track map. The Comisión Nacional del Agua (CONAGUA) National Meteorological Service of Mexico provided the rainfall map.



Table 1. Best track for Hurricane Genevieve, 16–21 August 2020.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
16 / 1200	11.3	96.5	1005	30	tropical depression
16 / 1800	11.8	98.0	1004	35	tropical storm
17 / 0000	12.3	99.5	1001	45	"
17 / 0600	12.9	101.0	998	55	"
17 / 1200	13.9	102.3	992	65	hurricane
17 / 1800	14.9	103.8	984	75	"
18 / 0000	16.0	105.3	976	85	"
18 / 0600	17.0	106.6	970	90	"
18 / 1200	17.7	107.6	950	115	"
18 / 1800	18.3	108.3	953	110	"
19 / 0000	19.1	108.8	953	105	"
19 / 0600	19.9	109.2	959	95	"
19 / 1200	20.6	109.6	964	90	"
19 / 1800	21.1	109.9	972	80	"
20 / 0000	21.7	110.0	977	75	"
20 / 0600	22.3	110.5	979	70	"
20 / 1200	22.9	111.2	983	65	"
20 / 1800	23.4	112.0	985	60	tropical storm
21 / 0000	23.7	112.9	992	55	"
21 / 0600	24.1	113.8	999	45	"
21 / 1200	24.7	114.5	1001	40	"
21 / 1800	25.4	115.2	1003	35	low



Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
22 / 0000	26.2	116.2	1005	30	"
22 / 0600	27.0	117.4	1007	25	"
22 / 1200					dissipated
18 / 1200	17.7	107.6	950	115	maximum winds and 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%)	72	138
Medium (40%-60%)	48	132
High (>60%)	36	96

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Genevieve, 16–21 August 2020. 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	24.4	41.2	59.2	74.9	82.2	94.1	131.1	183.2
OCD5	46.7	100.3	148.9	188.3	225.0	282.2	371.6	402.9
Forecasts	19	17	15	13	11	9	5	1
OFCL (2015-19)	21.8	34.0	44.9	55.3	66.2	77.1	99.1	123.2
OCD5 (2015-19)	34.3	69.9	108.7	146.8	181.4	216.0	268.7	328.0



Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Genevieve, 16–21 August 2020. 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	60	72	96	120
OFCL	23.3	41.3	62.4	75.7	81.3	93.1	178.5	183.2
OCD5	45.3	101.2	156.4	191.8	214.4	270.6	389.7	402.9
GFSI	<b>23.1</b>	<b>33.6</b>	<b>48.8</b>	<b>59.3</b>	<b>72.2</b>	<b>78.6</b>	<b>108.4</b>	<b>117.7</b>
HWFI	27.8	49.0	76.9	95.6	117.4	130.8	<b>178.4</b>	256.2
HMNI	<b>22.6</b>	<b>37.3</b>	<b>59.3</b>	<b>74.3</b>	94.5	114.0	178.5	221.7
EGRI	31.7	57.6	88.9	118.4	148.6	197.5	309.1	376.7
EMXI	29.4	50.4	73.5	94.3	114.8	145.1	240.5	183.2
NVGI	26.8	<b>36.9</b>	<b>50.7</b>	<b>75.5</b>	112.7	133.6	182.1	<b>142.7</b>
CMCI	27.6	45.7	66.9	82.2	94.5	112.4	<b>152.2</b>	184.1
TVCE	24.7	<b>41.2</b>	63.2	77.4	90.6	104.1	199.5	234.6
HCCA	25.9	43.0	62.8	<b>74.4</b>	<b>81.0</b>	<b>86.2</b>	<b>169.1</b>	<b>172.8</b>
AEMI	23.4	<b>36.7</b>	<b>59.0</b>	<b>71.8</b>	<b>79.5</b>	<b>77.3</b>	<b>79.8</b>	<b>92.3</b>
TABS	32.2	54.7	80.5	93.8	109.7	109.1	<b>63.5</b>	<b>31.9</b>
TABM	30.9	43.9	<b>61.0</b>	79.5	93.2	95.5	<b>79.8</b>	<b>95.0</b>
TABD	33.9	56.6	72.6	76.7	<b>73.2</b>	<b>63.6</b>	<b>91.7</b>	<b>10.9</b>
Forecasts	15	14	12	10	9	7	3	1

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Genevieve, 16–21 August 2020. 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	9.2	15.9	22.3	<b>27.7</b>	<b>27.7</b>	28.9	23.0	20.0
OCD5	9.9	14.0	16.6	16.9	17.9	15.8	19.4	26.0
Forecasts	19	17	15	13	11	9	5	1
OFCL (2015-19)	6.0	9.9	12.1	13.5	14.5	15.4	15.6	16.4
OCD5 (2015-19)	7.8	13.0	16.6	18.9	20.2	21.4	22.6	22.4

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Genevieve, 16–21 August 2020. 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	10.0	16.8	24.6	27.5	26.1	28.6	21.7	20.0
OCD5	10.5	<b>13.9</b>	<b>17.3</b>	<b>19.6</b>	<b>18.9</b>	<b>14.6</b>	<b>12.7</b>	26.0
IVCN	<b>8.1</b>	<b>10.6</b>	<b>17.5</b>	<b>22.1</b>	<b>19.7</b>	<b>21.4</b>	<b>13.3</b>	24.0
ICON	<b>7.9</b>	<b>10.1</b>	<b>16.5</b>	<b>19.9</b>	<b>18.1</b>	<b>18.9</b>	<b>12.3</b>	<b>17.0</b>
LGEM	10.1	<b>15.9</b>	25.8	30.9	30.2	32.1	25.0	20.0
DSHP	<b>9.9</b>	<b>16.6</b>	26.9	33.1	33.9	36.1	31.7	36.0
HCCA	<b>6.9</b>	<b>10.1</b>	<b>14.4</b>	<b>16.5</b>	<b>20.0</b>	<b>21.6</b>	<b>17.7</b>	<b>19.0</b>
NVGI	13.2	20.1	27.8	34.7	36.9	37.6	<b>15.7</b>	25.0
CMCI	14.1	23.0	31.7	37.0	34.4	<b>27.0</b>	<b>10.3</b>	<b>3.0</b>
EMXI	14.0	21.2	26.7	30.7	<b>25.7</b>	<b>17.6</b>	<b>5.0</b>	<b>5.0</b>
EGRI	13.1	21.2	29.7	39.5	37.8	<b>27.1</b>	<b>5.7</b>	<b>1.0</b>
HWFI	<b>5.4</b>	<b>5.9</b>	<b>8.3</b>	<b>11.4</b>	<b>9.1</b>	<b>6.6</b>	<b>3.7</b>	<b>5.0</b>
HMNI	<b>8.2</b>	<b>8.5</b>	<b>8.8</b>	<b>10.3</b>	<b>5.3</b>	<b>5.7</b>	<b>5.0</b>	<b>7.0</b>
GFSI	10.3	<b>14.5</b>	<b>18.0</b>	<b>22.9</b>	<b>19.8</b>	<b>20.9</b>	21.7	<b>19.0</b>
Forecasts	15	14	12	10	9	7	3	1

Table 5. Watch and warning summary for Hurricane Genevieve, 16–21 August 2020.

<b>Date/Time (UTC)</b>	<b>Action</b>	<b>Location</b>
17 / 2100	Tropical Storm Watch issued	Los Barriles to Todo Santos
18 / 0900	Tropical Storm Watch changed to Tropical Storm Warning	Los Barriles to Todo Santos
18 / 0900	Tropical Storm Watch issued	La Paz to Los Barriles
18 / 0900	Tropical Storm Watch issued	Santa Fe to Todos Santos
18 / 2100	Tropical Storm Watch discontinued	Santa Fe to Todos Santos
18 / 2100	Tropical Storm Watch issued	Puerto Cortes to Cabo San Lazaro
18 / 2100	Tropical Storm Warning modified to	Los Barriles to Puerto Cortes
19 / 0900	Hurricane Watch issued	Los Barriles to Todos Santos
19 / 1500	Hurricane Watch changed to Hurricane Warning	Los Barriles to Todos Santos
19 / 1500	Tropical Storm Watch discontinued	Puerto Cortes to Cabo San Lazaro
19 / 1500	Tropical Storm Warning discontinued	Los Barriles to Puerto Cortes
19 / 1500	Tropical Storm Warning issued	Todos Santos to Cabo San Lazaro
20 / 1500	Tropical Storm Warning modified to	Los Barriles to Cabo San Lazaro
20 / 1500	Hurricane Warning discontinued	All
20 / 2100	Tropical Storm Watch discontinued	All
20 / 2100	Tropical Storm Warning modified to	Todos Santos to Cabo San Lazaro
21 / 1200	Tropical Storm Warning discontinued	All

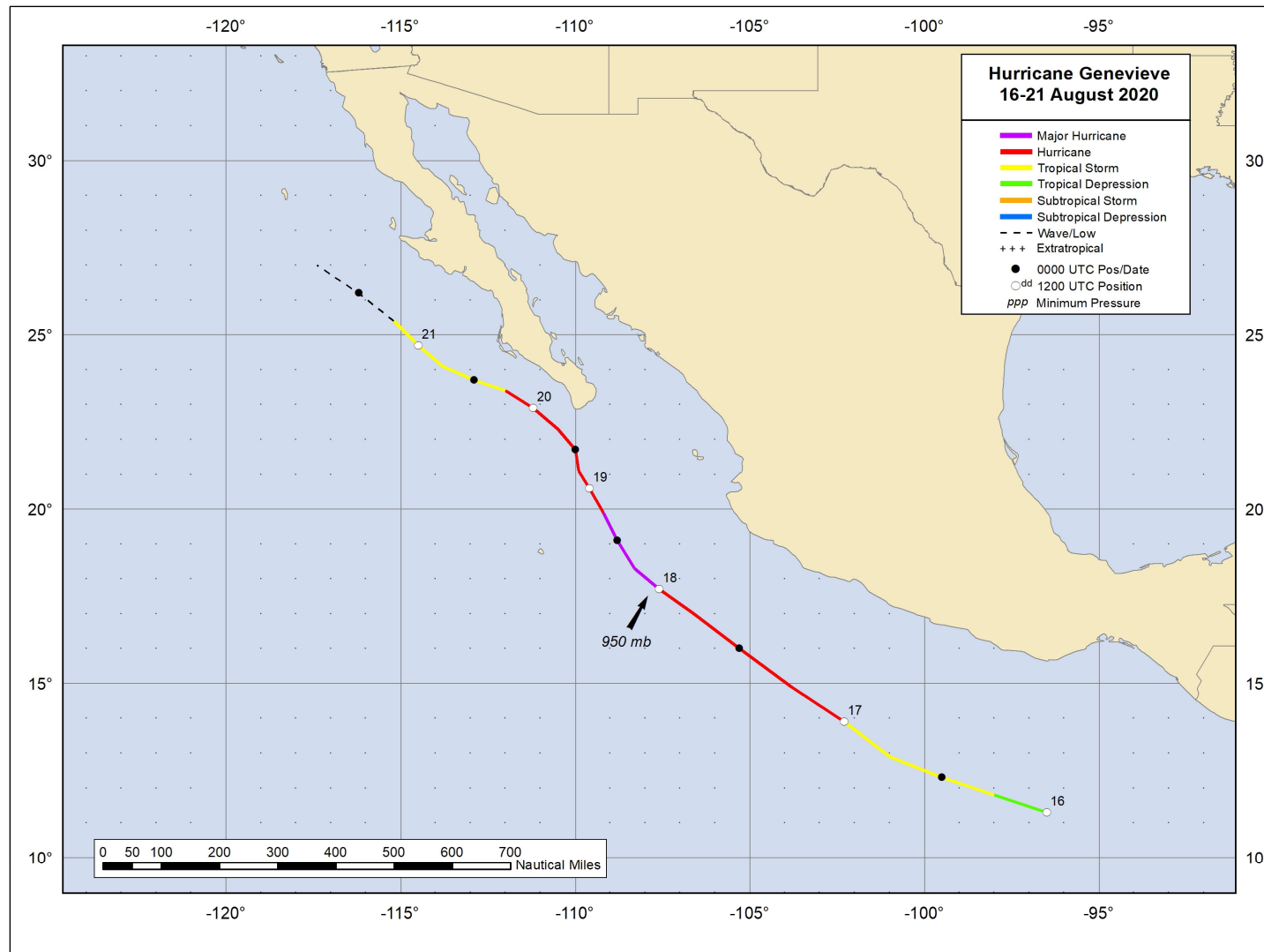


Figure 1. Best track positions for Hurricane Genevieve, 16–21 August 2020.

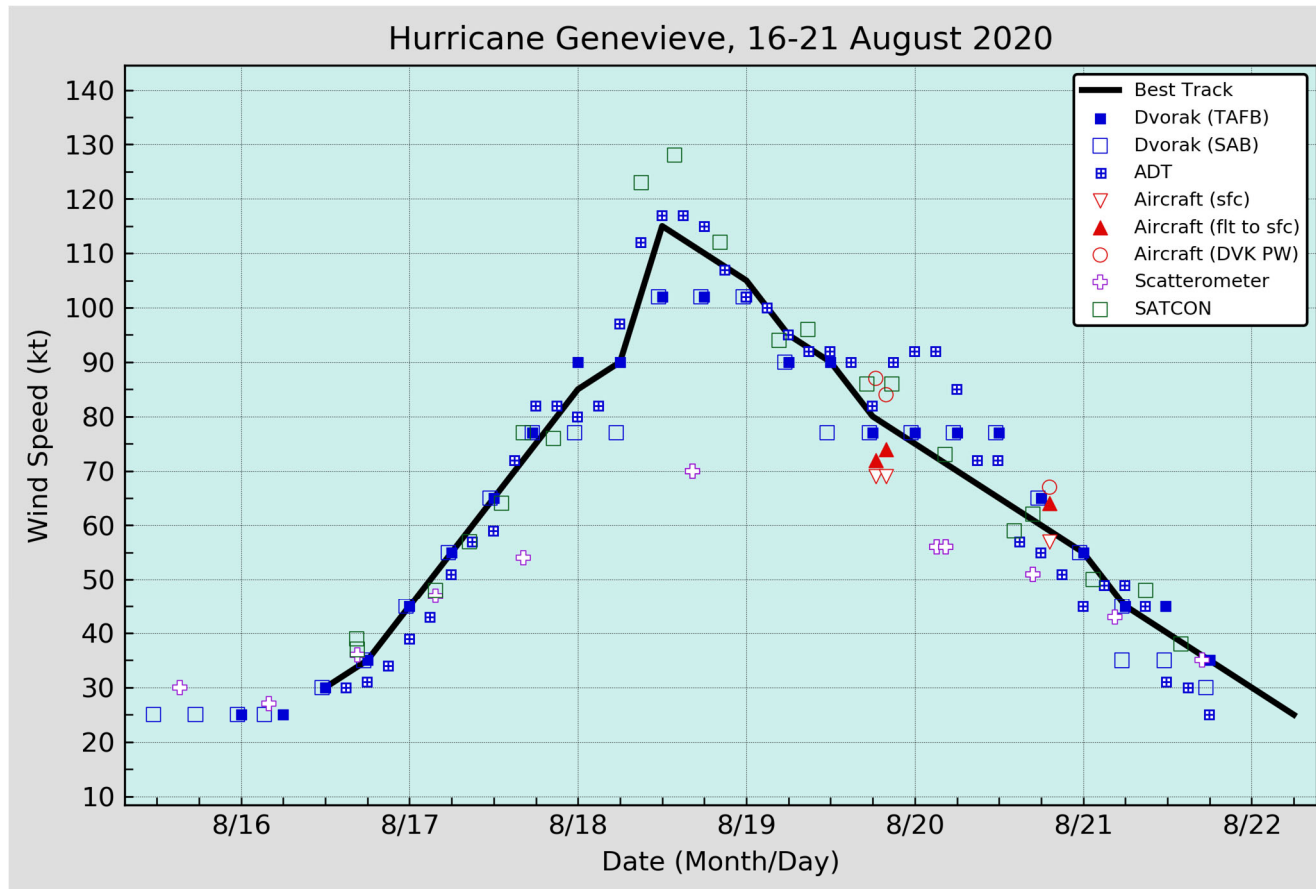


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Genevieve, 16–21 August 2020. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. Advanced Dvorak Technique (ADT) 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.

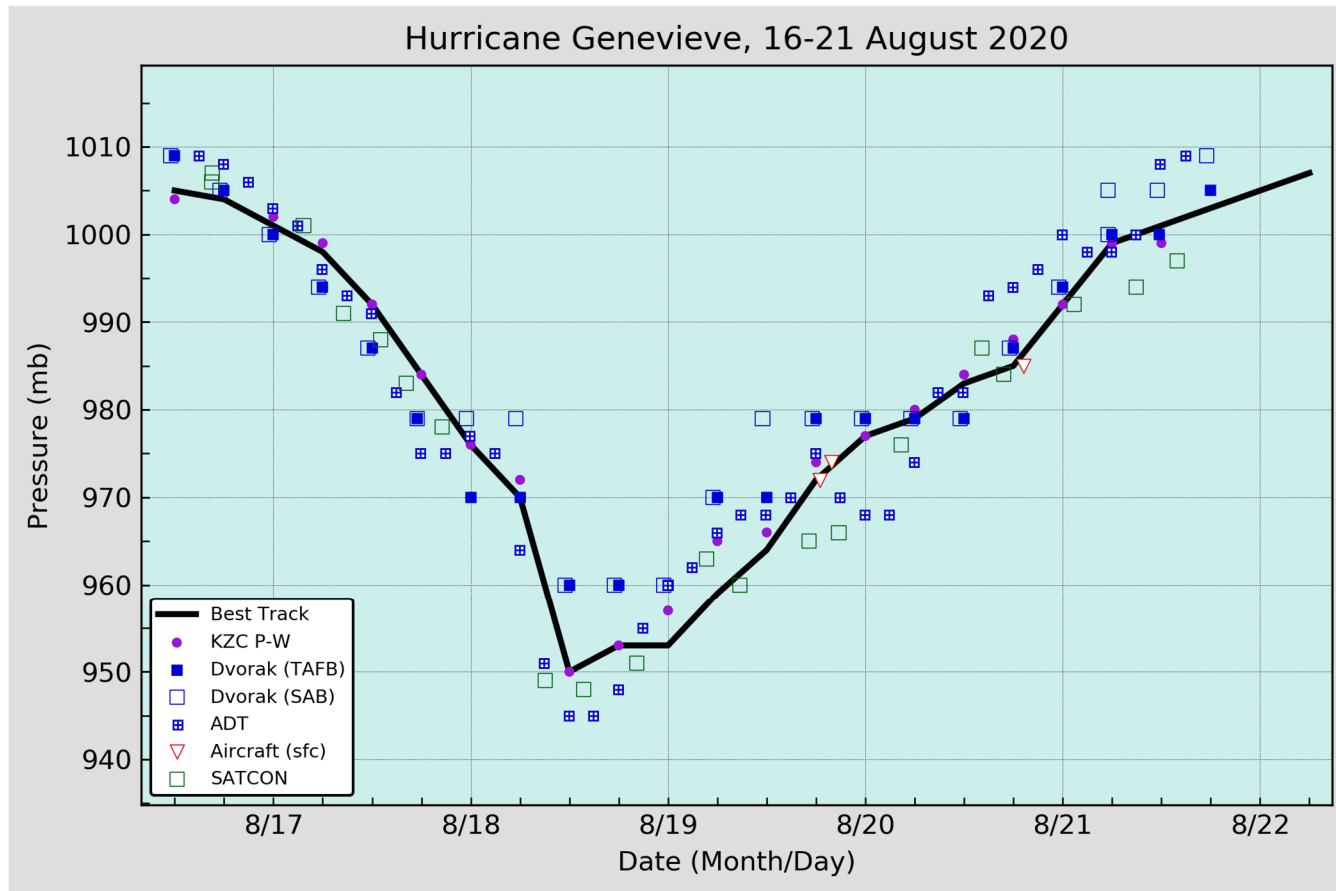


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Genevieve, 16–21 August 2020. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological 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.

### Precipitación acumulada (mm) del 16 al 21 de agosto de 2020 por el huracán Genevieve

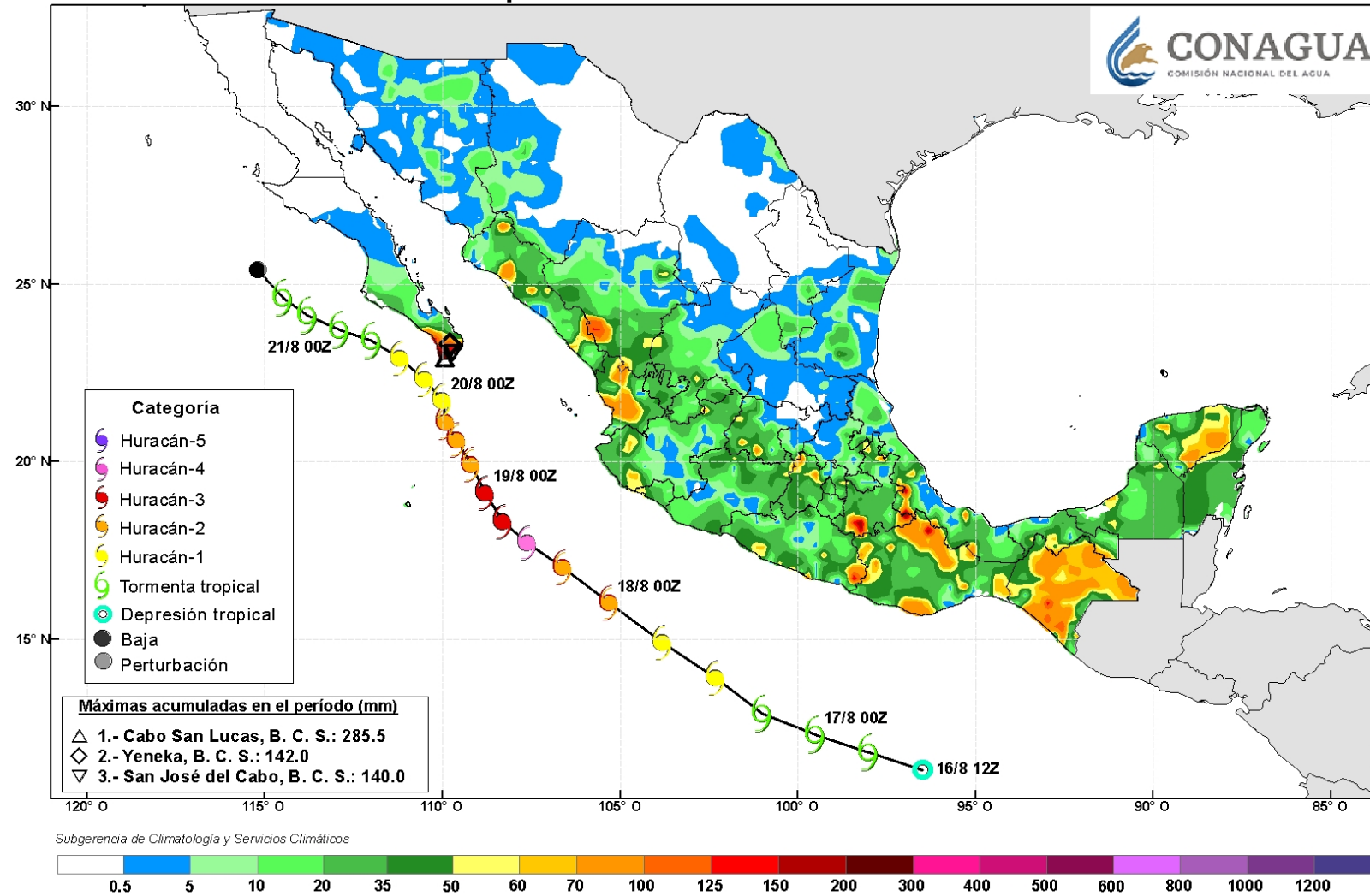


Figure 4. Map of rainfall totals (mm) associated with Hurricane Genevieve. Figure courtesy of CONAGUA.



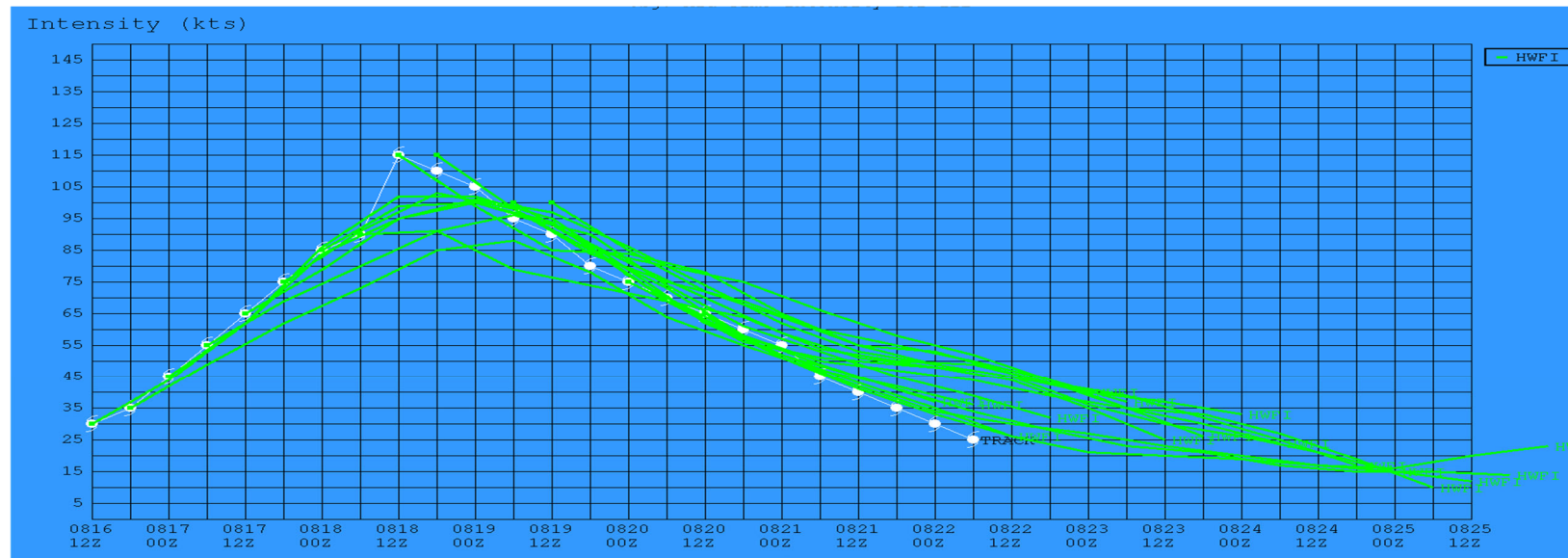
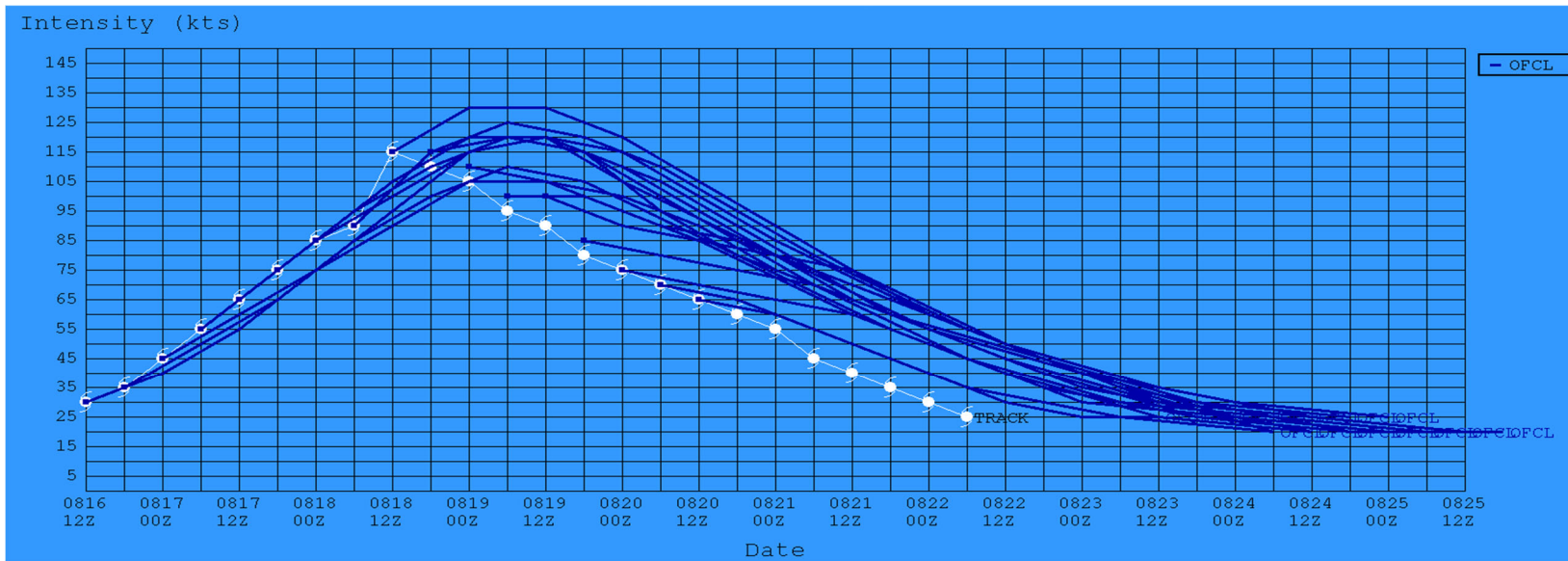


Figure 5. Official NHC (top) and HWFI (bottom) intensity forecasts (kt) for Hurricane Genevieve from 16– 20 August 2020. The best track (observed) intensity (kt) is shown by the white curve.