

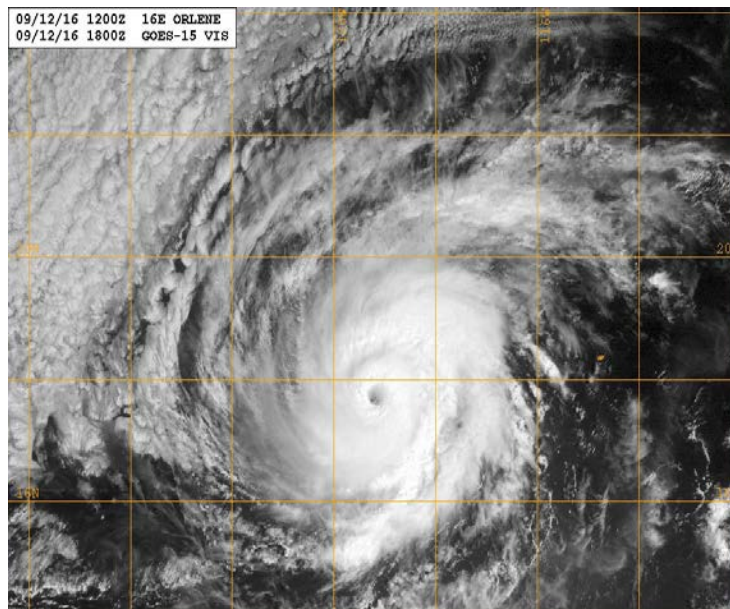


# NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

## HURRICANE ORLENE (EP162016)

11 – 16 September 2016

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National Hurricane Center  
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GOES 15 SATELLITE IMAGE AT 1800 UTC 12 SEPTEMBER SHOWING THE EYE OF ORLENE NEAR THE TIME THE HURRICANE REACHED ITS PEAK INTENSITY. IMAGE COURTESY OF THE NAVAL RESEARCH LABORATORY.

Hurricane Orlene spent its lifetime over the eastern North Pacific waters well away from southwestern Mexico.

# Hurricane Orlene

11 – 16 SEPTEMBER 2016

## SYNOPTIC HISTORY

Orlene's origin was associated with a tropical wave that moved across the west coast of Africa on 27 August. The wave travelled westward across the tropical Atlantic with little thunderstorm activity, and reached the western Caribbean Sea late on 4 September. On 6 September, the wave moved south of the Gulf of Tehuantepec with increasing convection. The system continued westward for a few more days, and early on 10 September, satellite data showed that a low-level circulation formed well south of the southern tip of the Baja California peninsula, but the associated cloudiness and thunderstorms were poorly organized. Later that day, a curved convective band formed near the center, marking the formation of a tropical depression by 0000 UTC 11 September about 700 n mi south-southwest of the southern tip of the Baja California peninsula. 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>.

The center of circulation soon became well embedded within a central dense overcast, and it is estimated that by 0600 UTC 11 September, the system was a tropical storm. Initially, Orlene moved toward the west-northwest around the periphery of a large mid-level anticyclone centered over northern Mexico, and in a favorable environment of low shear and warm ocean waters, the cyclone reached hurricane status near 0600 UTC 12 September. The hurricane developed an eye that became quite distinct at 1800 UTC, when it is estimated that Orlene reached its peak intensity of 95 kt. By then, a mid-level trough approaching from the west forced the cyclone to turn northward toward cooler waters, resulting in slight weakening. The trough lifted out and was then replaced by a high pressure system on 14 September. This flow pattern steered Orlene toward the west, and the cyclone regained some strength. Southwesterly 850–200-mb wind shear of 20 to 25 kt became established over the cyclone, and the cloud pattern began to deteriorate. The associated convection decreased significantly, and by early on 16 September, only a small area of showers was present. Orlene became a remnant low at 0000 UTC 17 September. The system continued westward and degenerated into a trough of low pressure that dissipated by 1200 UTC 17 September well east of the Hawaiian Islands.

## METEOROLOGICAL STATISTICS

Observations in Hurricane Orlene (Figs. 2 and 3) include subjective satellite-based Dvorak

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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 *bt* directory, while previous years' data are located in the *archive* directory.

technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), and objective Advanced Dvorak Technique (ADT) 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 Orlene.

Orlene's estimated peak intensity was based on a blend of both subjective and objective Dvorak estimates.

## CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Hurricane Orlene.

## FORECAST AND WARNING CRITIQUE

A low probability of Orlene's genesis during the following 5 days was first indicated in the Tropical Weather Outlook about a week before it formed, when the wave was still over the central Caribbean Sea. A medium chance of genesis during the following 5 days was indicated by NHC 126 h before genesis, while a high probability was issued 60 h in advance. However, the high probability of tropical cyclone formation during the following 2 days was introduced only 24 h before genesis. All of the genesis forecast lead times are given in Table 2.

A verification of NHC official track forecasts for Hurricane Orlene is given in Table 3a. Official forecast track errors were lower than the mean official errors for the previous 5-yr period during the first 36 h only. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Only the GHMI and the NVGI models performed better than the official forecast (OFCL) at most of the times. The GFSI and EMXI global models were worse than OFCL at all times.

A verification of NHC official intensity forecasts for Hurricane Orlene is given in Table 4a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period except at 12, 24 and 120 h. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The NHC official intensity forecasts consistently outperformed nearly all of the guidance through 96 h.

There were no coastal watches and warnings associated with Hurricane Orlene.



Table 1. Best track for Hurricane Orlene, 11-16 July 2016.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
10 / 1200	12.3	113.1	1009	25	low
10 / 1800	13.0	113.8	1009	25	"
11 / 0000	13.7	114.5	1008	30	tropical depression
11 / 0600	14.5	115.4	1007	35	tropical storm
11 / 1200	15.3	116.2	1005	40	"
11 / 1800	15.9	117.2	1003	45	"
12 / 0000	16.4	118.0	1001	55	"
12 / 0600	16.8	118.7	994	65	hurricane
12 / 1200	17.2	119.1	980	80	"
12 / 1800	17.7	119.2	967	95	"
13 / 0000	18.4	119.1	970	95	"
13 / 0600	18.9	118.9	971	90	"
13 / 1200	19.2	118.8	974	85	"
13 / 1800	19.6	118.7	977	80	"
14 / 0000	19.8	118.6	980	75	"
14 / 0600	20.1	118.6	984	70	"
14 / 1200	20.1	119.0	984	70	"
14 / 1800	20.2	119.4	987	65	"
15 / 0000	20.3	120.0	991	60	tropical storm
15 / 0600	20.2	120.7	991	60	"
15 / 1200	20.0	121.5	985	70	hurricane
15 / 1800	19.9	122.3	990	65	"
16 / 0000	19.9	123.3	998	55	tropical storm
16 / 0600	19.9	124.4	1002	45	"
16 / 1200	19.9	125.4	1003	40	"
16 / 1800	20.0	126.2	1005	35	"
17 / 0000	20.1	127.1	1006	30	low
17 / 0600	20.2	128.0	1006	30	"
17 / 1200					dissipated
12 / 1800	17.7	119.2	967	95	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%)	60	168
Medium (40%-60%)	42	126
High (>60%)	24	60

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Orlene. 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	<b>18.1</b>	<b>27.3</b>	<b>41.3</b>	62.8	100.2	138.4	181.1
OCD5	38.2	89.3	158.3	232.3	323.7	308.1	310.6
Forecasts	22	20	18	16	12	8	4
OFCL (2011-15)	23.4	36.4	47.2	59.4	89.0	123.6	159.5
OCD5 (2011-15)	36.6	74.2	116.5	159.7	245.6	331.1	427.4



Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Orlene. 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	17.8	27.5	42.4	61.1	97.5	135.6	187.5
OCD5	38.3	90.9	164.8	244.3	332.3	308.6	325.5
GFSI	21.6	35.0	52.3	72.6	125.4	173.8	207.9
EMXI	18.7	32.9	53.8	73.2	108.7	184.7	255.5
EGRI	24.9	39.6	54.1	64.3	<b>70.3</b>	<b>92.9</b>	<b>71.5</b>
NVGI	17.9	<b>25.8</b>	<b>31.5</b>	<b>36.0</b>	<b>64.0</b>	<b>115.6</b>	<b>161.1</b>
CMCI	21.8	36.4	46.4	<b>58.3</b>	<b>81.6</b>	<b>129.8</b>	243.5
GHMI	18.9	<b>27.2</b>	<b>33.6</b>	<b>40.9</b>	<b>60.2</b>	<b>80.2</b>	<b>122.8</b>
HWFI	22.9	38.0	56.6	72.9	111.1	161.1	252.6
HCCA	<b>17.0</b>	29.9	<b>41.1</b>	<b>54.5</b>	<b>86.0</b>	<b>129.0</b>	<b>158.9</b>
GFNI	24.6	40.2	<b>42.2</b>	<b>44.8</b>	<b>87.3</b>	190.3	373.3
TVCE	<b>17.5</b>	<b>26.1</b>	<b>39.7</b>	<b>52.0</b>	<b>83.3</b>	<b>118.4</b>	<b>150.9</b>
TVCX	18.1	27.5	<b>41.2</b>	<b>54.1</b>	<b>86.1</b>	<b>128.2</b>	<b>166.9</b>
TCON	18.5	<b>26.0</b>	<b>37.8</b>	<b>49.6</b>	<b>80.6</b>	<b>105.4</b>	<b>122.6</b>
GFEX	18.4	31.9	49.5	70.7	113.8	177.1	228.8
FSSE	19.1	27.9	<b>41.8</b>	<b>57.0</b>	<b>94.9</b>	<b>126.5</b>	<b>146.4</b>
AEMI	<b>15.7</b>	28.5	<b>40.6</b>	<b>56.8</b>	<b>80.7</b>	<b>114.8</b>	<b>136.5</b>
BAMS	28.4	50.5	74.4	94.2	130.7	184.7	270.9
BAMM	24.5	45.3	63.2	87.0	128.3	160.1	226.2
BAMD	26.9	48.1	64.5	91.9	149.1	205.5	245.9
Forecasts	20	18	16	14	11	7	3



Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Orlene. 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	6.8	9.8	<b>10.3</b>	<b>10.0</b>	<b>4.6</b>	<b>11.9</b>	20.0
OCD5	7.9	13.6	15.4	15.9	8.9	12.9	3.5
Forecasts	22	20	18	16	12	8	4
OFCL (2011-15)	5.9	9.8	12.5	14.0	15.5	16.3	14.9
OCD5 (2011-15)	7.7	12.8	16.4	18.8	21.1	20.9	19.7



Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Orlene. 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	7.3	9.7	9.7	8.6	4.5	12.9	23.3
OCD5	8.5	13.8	14.9	14.1	8.0	13.6	<b>3.3</b>
DSHP	7.4	11.7	11.6	9.6	6.1	<b>12.4</b>	24.7
LGEM	<b>7.1</b>	10.7	11.1	10.6	5.1	14.9	<b>21.3</b>
GHMI	10.9	16.7	18.3	14.7	12.3	<b>11.9</b>	<b>19.3</b>
HWFI	7.8	12.3	14.6	10.6	8.9	23.9	<b>10.7</b>
HCCA	<b>6.8</b>	<b>9.3</b>	9.9	<b>8.4</b>	4.8	14.7	<b>22.0</b>
GFNI	9.6	16.6	21.6	18.7	14.2	17.0	<b>11.7</b>
ICON	7.5	11.3	11.9	9.0	<b>3.9</b>	14.4	<b>17.7</b>
IVCN	7.6	11.3	12.1	9.1	<b>4.0</b>	<b>11.9</b>	<b>17.7</b>
FSSE	6.9	9.7	10.3	8.6	6.1	<b>10.4</b>	<b>22.3</b>
EMXI	10.4	17.3	20.3	21.5	23.5	29.6	37.3
GFSI	7.7	13.7	15.4	14.5	19.1	27.3	34.7
Forecasts	20	18	16	14	11	7	3



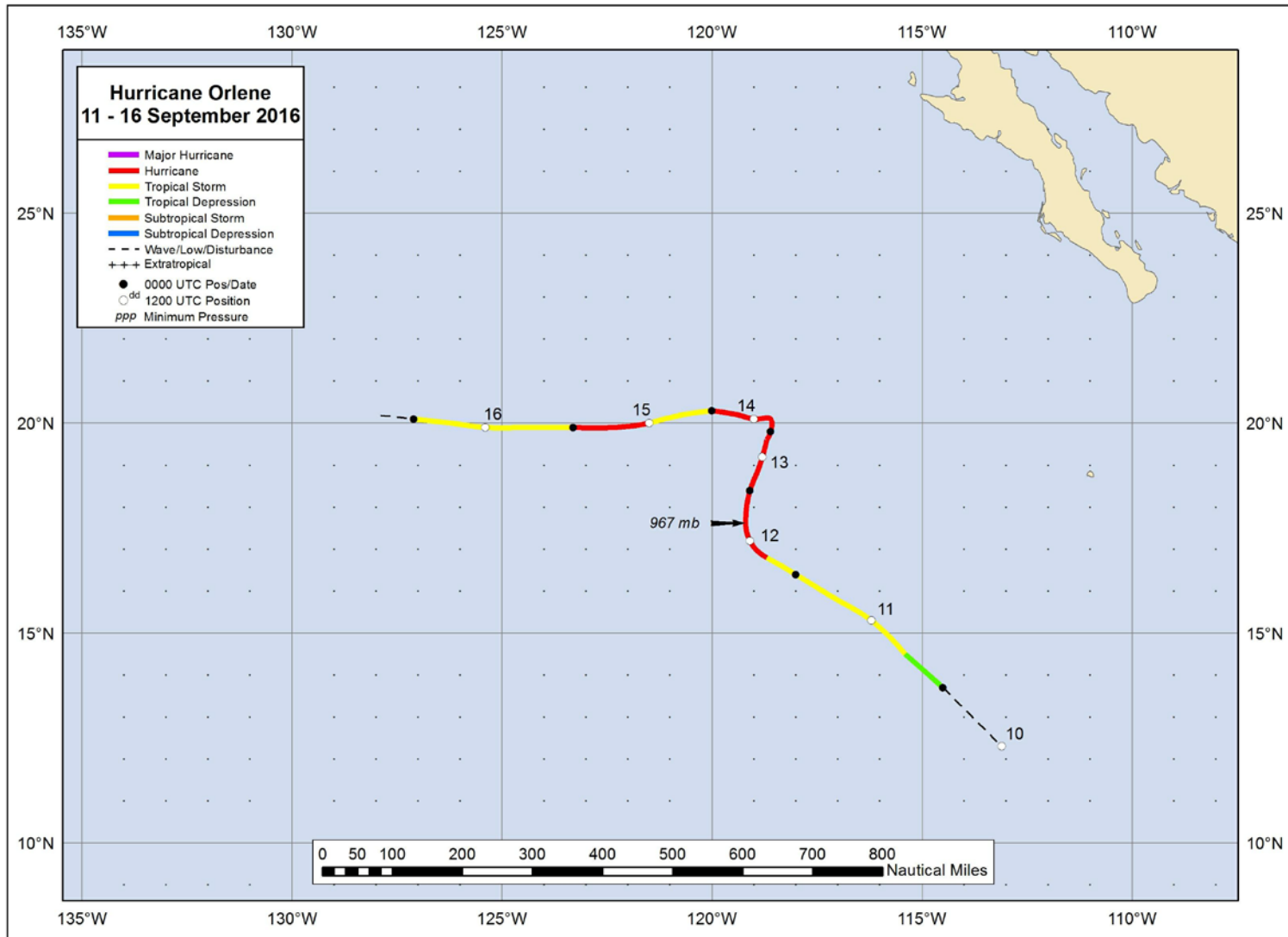


Figure 1. Best track positions for Hurricane Orlene, 11-16 September 2016.

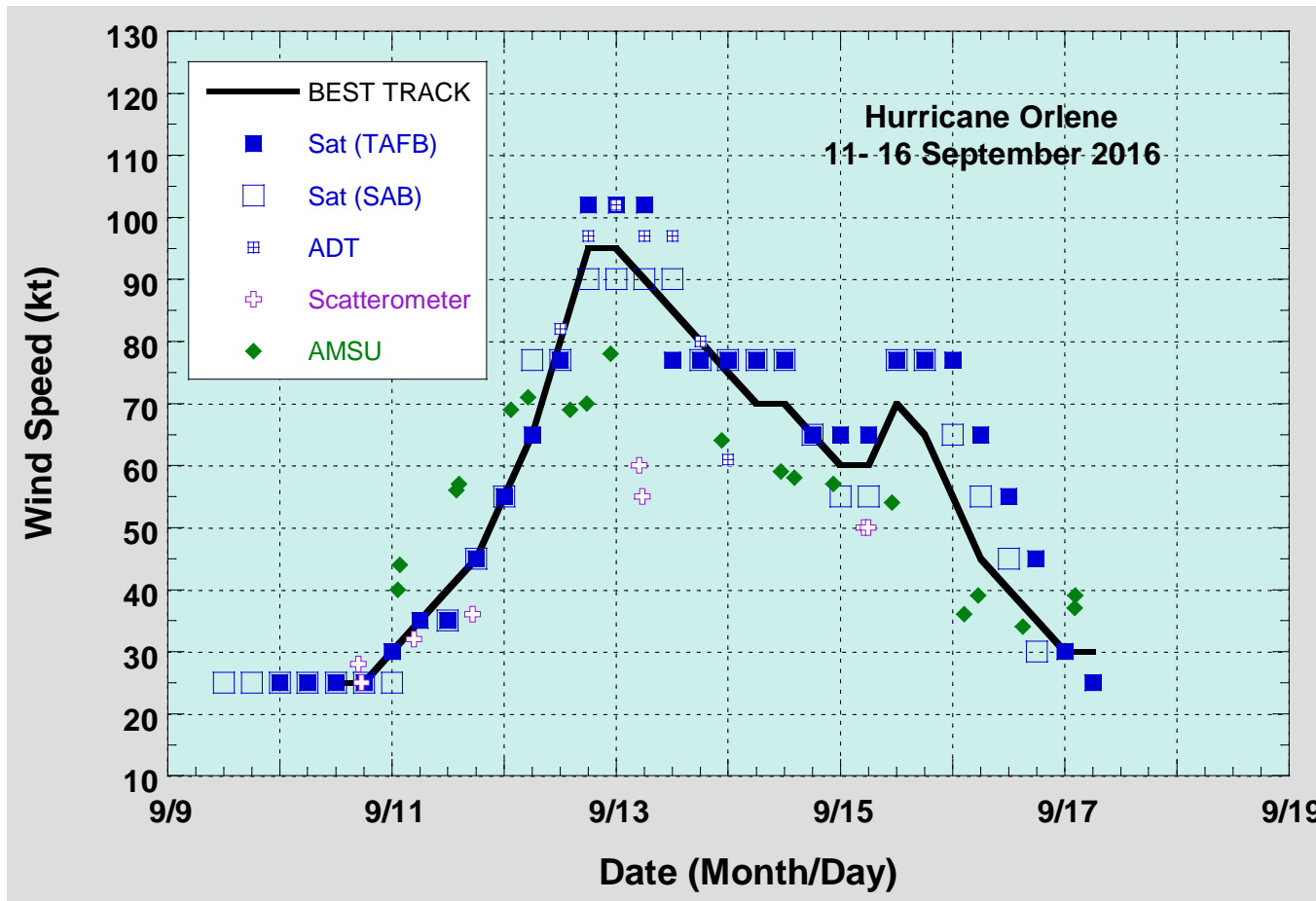


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Orlene, 11-16 September 2016. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique.

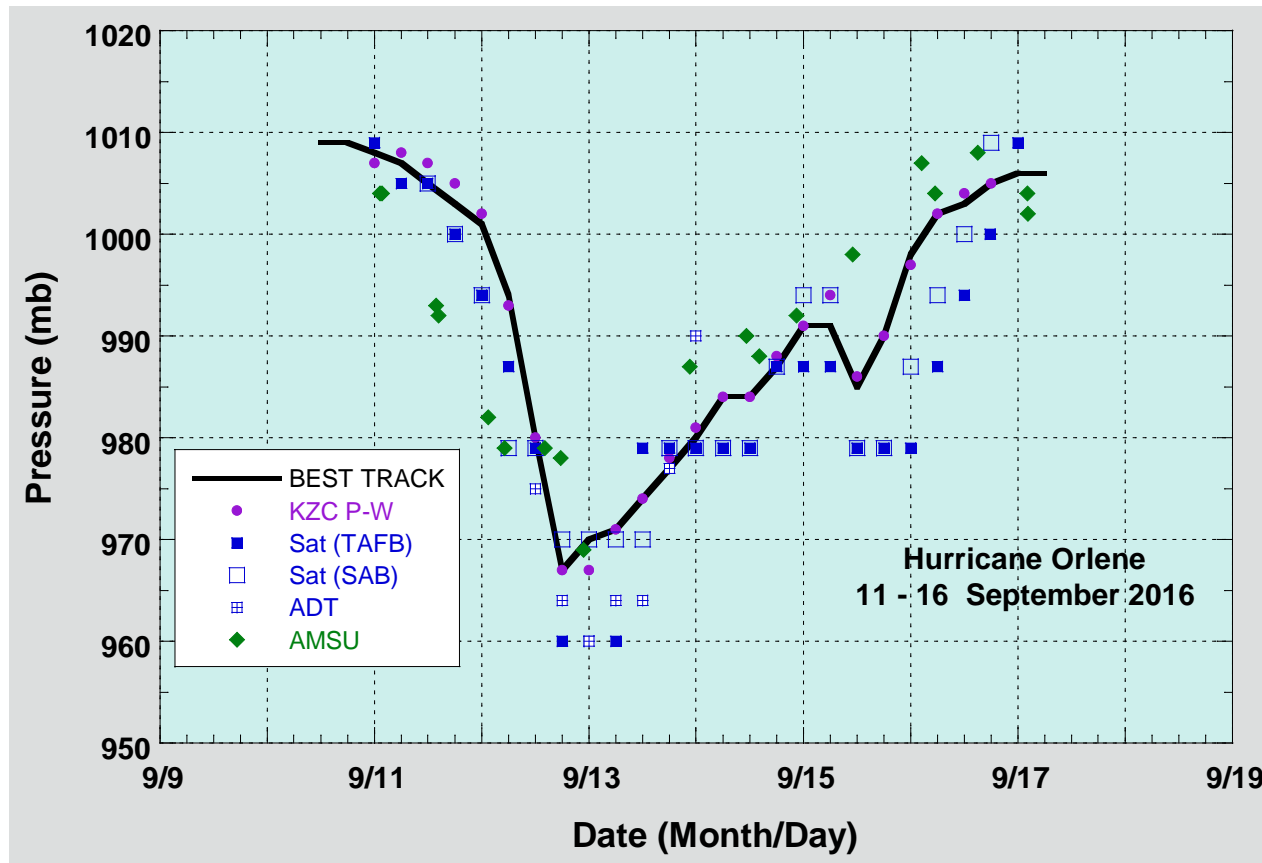


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Orlene, 11-16 September 2016. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship.