Tropical Cyclone Report
Hurricane Otis
28 September - 3 October 2005

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Hurricane Otis was a category 2 hurricane (on the Saffir-Simpson Hurricane Scale) that threatened Baja California before weakening over cool waters.

a.   Synoptic History

Otis could have formed from the tropical wave that spawned Hurricane Philippe in the Atlantic. The wave emerged from the coast of Africa on 9 September and moved westward across the Atlantic with little development until 14 September. At that time, convection began increasing in both coverage and organization, which eventually resulted in the formation of Philippe on 14 September. The weak southern portion of the wave continued westward near the coast of South America, reaching the eastern Pacific on 22 September.

Convection associated with the wave increased on 23 September as it moved into a monsoon-like environment near the west coast of Mexico. The system showed signs of convective organization on 27 September, and it is estimated that a tropical depression formed around 0000 UTC 28 September about 120 n mi south of Manzanillo, 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.

The depression initially drifted west-southwestward, then it turned northwestward on 29 September while strengthening into a tropical storm. Otis continued moving northwestward until 2 October, becoming a hurricane on 30 September and reaching an estimated peak intensity of 90 kt on 1 October. The already-weak steering currents weakened further on 2-3 October as Otis missed connection with a mid/upper-level trough passing to the north. This resulted in an erratic north-northwestward drift on 3-4 October close to the Pacific coast of the Baja California peninsula. Otis weakened over lower sea surface temperatures during this time, becoming a tropical storm on 2 October and a depression on 3 October. The cyclone weakened to a non-convective remnant low on 4 October. This low drifted southeastward until it dissipated on 5 October.

b.   Meteorological Statistics

Observations in Otis (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB) and the U. S. Air Force Weather Agency (AFWA). Microwave satellite imagery from

NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA Aqua, the NASA QuikSCAT, the Department of Defense WindSat, and Defense Meteorological Satellite Program (DMSP) satellites were also useful in tracking Otis. Data from the Mexican radar at Los Cabos were also useful during the hurricane.

While the core of Otis remained offshore, tropical storm-force winds occurred at higher elevations over portions of southern Baja California. An automated station at Cabo San Lucas (elevation 224 m) reported a 10-min average wind of 43 kt with a gust to 55 kt at an unknown time on 30 September.

Two ships reported tropical storm-force winds during Otis. The **Volendam** reported winds of 44 kt and a pressure of 1002.0 mb at 0000 UTC 3 October, while the **Star Harmonia** reported winds of 37 kt and a pressure of 1004.3 mb at 0600 UTC 1 October.

c.   Casualty and Damage Statistics

While media reports indicate Otis caused floods in some portions of the southern Baja California peninsula, there were no reports of damage or casualties.

d.   Forecast and Warning Critique

Average official track errors (with the number of cases in parentheses) for Otis were 33 (21), 54 (19), 86 (17), 106 (15), 80 (11), 72 (7), and 100 (3) n mi for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. These errors are lower than the average of official track errors for the 10-yr period 1995-2004[1] (37, 68, 97, 123, 175, 208, and 259 n mi, respectively, Table 2). While these forecasts were better than average, several of the numerical track guidance models had even smaller average errors, particularly during the 24-48 time period. The best overall guidance model was the National Weather Service Global Forecast System (GFS).

Average official intensity errors were 6, 13, 17, 19, 17, 13, and 18 kt for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. These are close to the average official intensity errors over the 10-yr period 1995-2004 are 6, 11, 14, 17, 19, 18, and 19 kt, respectively.

The formation of Otis was not well anticipated in Tropical Prediction Center products until about 18 h prior to genesis. Before that, it was thought that a combination of vertical wind shear and proximity of the disturbance to land would hinder development.

Table 3 shows the watches and warnings issued for Otis. Hurricane warnings were issued for portions of Baja California based on forecasts that Otis would cross the peninsula as a hurricane. Since Otis never reached Baja as a tropical cyclone, these forecasts and warnings did not verify.

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[1]   Errors given for the 96 and 120 h periods are averages over the four-year period 2001-4.

Table 1.   Best track for Hurricane Otis, 28 September – 3 October 2005.

Date/Time (UTC)	Latitude (EN)	Longitude (EW)	Pressure (mb)	Wind Speed (kt)	Stage
28 / 0000	17.2	104.9	1007	25	tropical depression
28 / 0600	16.9	105.3	1006	30	"
28 / 1200	16.8	105.7	1005	30	"
28 / 1800	16.8	106.1	1005	30	"
29 / 0000	16.9	106.6	1004	30	"
29 / 0600	17.3	107.2	1003	35	tropical storm
29 / 1200	18.0	108.1	1001	40	"
29 / 1800	18.8	108.7	1000	45	"
30 / 0000	19.6	109.3	994	55	"
30 / 0600	20.3	110.0	987	65	hurricane
30 / 1200	20.8	110.5	983	70	"
30 / 1800	21.2	110.9	980	75	"
01 / 0000	21.4	111.2	977	80	"
01 / 0600	21.6	111.5	970	90	"
01 / 1200	21.7	111.7	973	85	"
01 / 1800	21.8	111.9	976	75	"
02 / 0000	22.0	111.9	979	70	"
02 / 0600	22.1	112.0	986	65	"
02 / 1200	22.3	112.1	992	55	tropical storm
02 / 1800	22.6	112.3	998	45	"
03 / 0000	23.1	112.3	1000	45	"
03 / 0600	23.9	112.7	1002	40	"
03 / 1200	24.8	112.9	1003	30	tropical depression
03 / 1800	25.2	113.1	1004	25	"
04 / 0000	25.5	113.3	1004	25	remnant low
04 / 0600	25.7	113.3	1005	20	"
04 / 1200	25.4	113.1	1005	20	"
04 / 1800	24.9	112.6	1005	20	"
05 / 0000	24.4	112.1	1005	20	"
05 / 0600	23.9	111.4	1006	20	"
05 / 1200	23.7	110.7	1006	20	"
05 / 1800					dissipated
01 / 0600	21.6	111.5	970	90	minimum pressure

Table 2. Preliminary forecast evaluation (heterogeneous sample) for Hurricane Otis, 28 September – 3 October 2005. Forecast errors (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verification includes the depression stage, but does not include the extratropical stage, if any.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	37 (22)	76 (20)	114 (18)	142 (16)	169 (12)	197 (8)	248 (4)
GFDI	34 (22)	**52** (20)	**65** (18)	**72** (16)	93 (12)	146 (8)	371 (4)
GFDL*	**29** (21)	**41** (19)	**55** (17)	**65** (15)	81 (11)	126 (7)	496 (3)
GFNI	49 (17)	75 (15)	96 (13)	115 (11)	94 (7)	125 (5)	219 (1)
GFDN*	46 (17)	82 (15)	106 (13)	124 (11)	112 (7)	81 (5)	236 (2)
FV4	36 (21)	**48** (19)	**59** (17)	**68** (15)	**64** (11)	83 (7)	253 (3)
AF1I	39 (19)	66 (17)	97 (15)	123 (13)	150 (9)		
AFW1*	64 (10)	72 (9)	89 (8)	114 (7)	141 (5)		
COEI	56 (19)	118 (17)	168 (15)	192 (13)			
COCE*	51 (10)	99 (9)	148 (8)	184 (7)			
ETAI	36 (19)	60 (17)	99 (15)	134 (13)	170 (9)		
ETA*	42 (20)	65 (18)	90 (16)	122 (13)	146 (9)		
GFSI	38 (20)	60 (18)	**83** (16)	107 (14)	**75** (10)	119 (6)	**97** (2)
GFSO*	44 (21)	59 (19)	**78** (17)	113 (15)	98 (11)	110 (7)	218 (3)
AEMI	36 (20)	60 (18)	**83** (16)	**102** (14)	84 (10)	118 (6)	260 (2)
AEMN*	43 (21)	63 (19)	**81** (17)	**103** (15)	107 (11)	128 (7)	210 (3)
NGPI	39 (21)	71 (19)	103 (17)	135 (15)	173 (11)	153 (7)	225 (3)
NGPS*	46 (20)	71 (18)	103 (16)	134 (14)	142 (9)	126 (6)	128 (2)
UKMI	40 (19)	75 (17)	133 (15)	185 (13)	182 (7)	116 (5)	238 (1)
UKM*	33 (10)	**46** (9)	**76** (8)	144 (7)	221 (4)	80 (3)	222 (1)
CMC*	38 (10)	**45** (9)	**61** (8)	**81** (7)	163 (5)	267 (1)	
CEMN*	44 (5)	**40** (4)	**58** (4)	**67** (3)	110 (2)	214 (1)	
EMXI	**23** (11)	**43** (10)	**69** (9)	**93** (8)	125 (5)	154 (3)	203 (1)
EMX*	**32** (11)	**36** (10)	**62** (9)	**87** (8)	127 (6)	140 (4)	202 (2)
EEMN*	36 (5)	74 (5)	**79** (4)	113 (4)	165 (3)	225 (2)	301 (1)
P91E	36 (22)	69 (20)	103 (18)	143 (16)	200 (12)	214 (8)	340 (4)
P9UK	34 (11)	64 (10)	102 (9)	145 (8)	218 (6)		
BAMD	38 (22)	74 (20)	107 (18)	133 (16)	160 (12)	221 (8)	285 (4)
BAMM	36 (22)	63 (20)	87 (18)	110 (16)	147 (12)	171 (8)	205 (4)
BAMS	41 (22)	64 (20)	**75** (18)	**82** (16)	138 (12)	166 (8)	265 (4)
LBAR	34 (22)	66 (20)	118 (18)	163 (16)	228 (12)	268 (8)	335 (4)
CONU	34 (22)	**52** (20)	**75** (18)	**101** (16)	107 (12)	100 (8)	186 (4)
GUNA	33 (19)	57 (17)	87 (15)	112 (13)	105 (7)	75 (5)	169 (1)
GUNS	33 (19)	58 (17)	90 (15)	113 (13)	122 (7)	90 (5)	210 (1)
FSSE	**32** (18)	**53** (16)	**80** (14)	109 (12)	87 (8)	76 (4)	187 (1)
OFCI	37 (20)	64 (18)	92 (16)	**105** (14)	**74** (10)	72 (6)	134 (2)
OFCL	33 (21)	54 (19)	86 (17)	106 (15)	80 (11)	72 (7)	100 (3)
NHC Official (1995-2004 mean)	37 (2654)	68 (2378)	97 (2096)	123 (1829)	175 (1386)	208 (355)	259 (224)

* Output from these models was unavailable at forecast time.

Table 3.   Watch and warning summary for Hurricane Otis, 28 September – 3 October 2005.

| Date/Time (UTC)	Action	Location
30 / 0300	Tropical Storm Warning and Hurricane Watch issued	West coast of Baja California south of Santa Fe and east coast of Baja California south of La Paz
30 / 1500	Tropical Storm Warning and Hurricane Watch extended northward	West coast of Baja California from Santa Fe to Bahia Magdalena
30 / 1500	Tropical Storm Watch issued	East coast of Baja California from La Paz to San Evaristo
30 / 1500	Hurricane Watch discontinued	East coast of Baja California
01 / 0300	Tropical Storm Warning and Hurricane Watch extended northward	West coast of Baja California from Bahia Magdalena to Punta Abreojos
01 / 0300	Tropical storm warning extended northward	East coast of Baja California from La Paz to San Evaristo
01 / 0300	Tropical Storm Watch issued	East coast of Baja California north of San Evaristo to Loreto
01 / 1500	Hurricane Warning issued	West coast of Baja California from Agua Blanca to San Andresito
01 / 1500	Tropical Storm Watch extended northward	East coast of Baja California north of Loreto to Mulege
02 / 1200	Hurricane Warning changed to Tropical Storm Warning	West coast of Baja California from Agua Blanca to San Andresito
02 / 1200	Hurricane Watch discontinued	West coast of Baja California
02 / 1500	Tropical Storm Warning extended northward	East coast of Baja California north of San Evaristo to Loreto
02 / 2100	All watches and warnings discontinued	East coast of Baja California
02 / 2100	All watches and warnings discontinued	West coast of Baja California north of Bahia Magdalena and south of Agua Blanca
03 / 1500	All warnings discontinued	Baja California
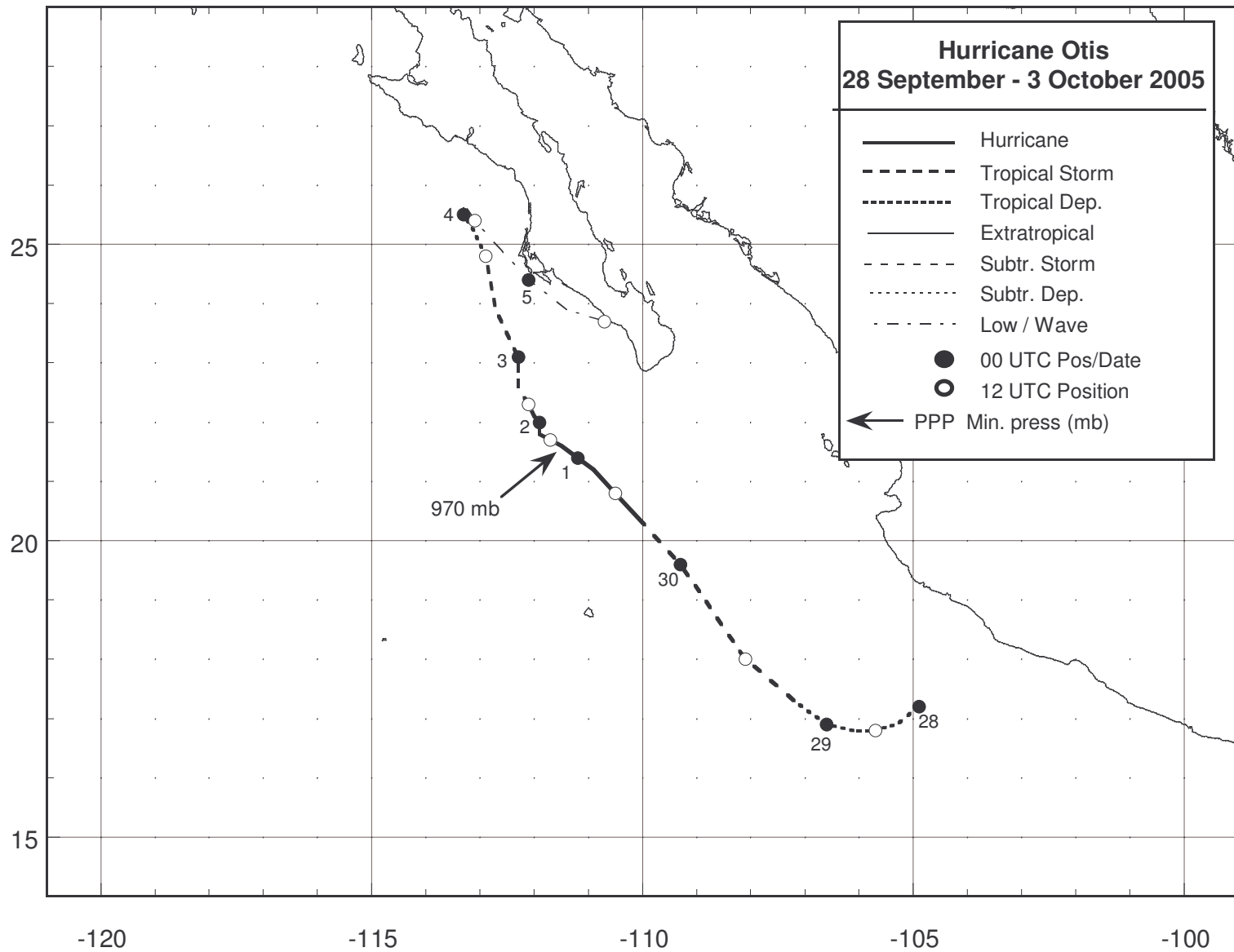
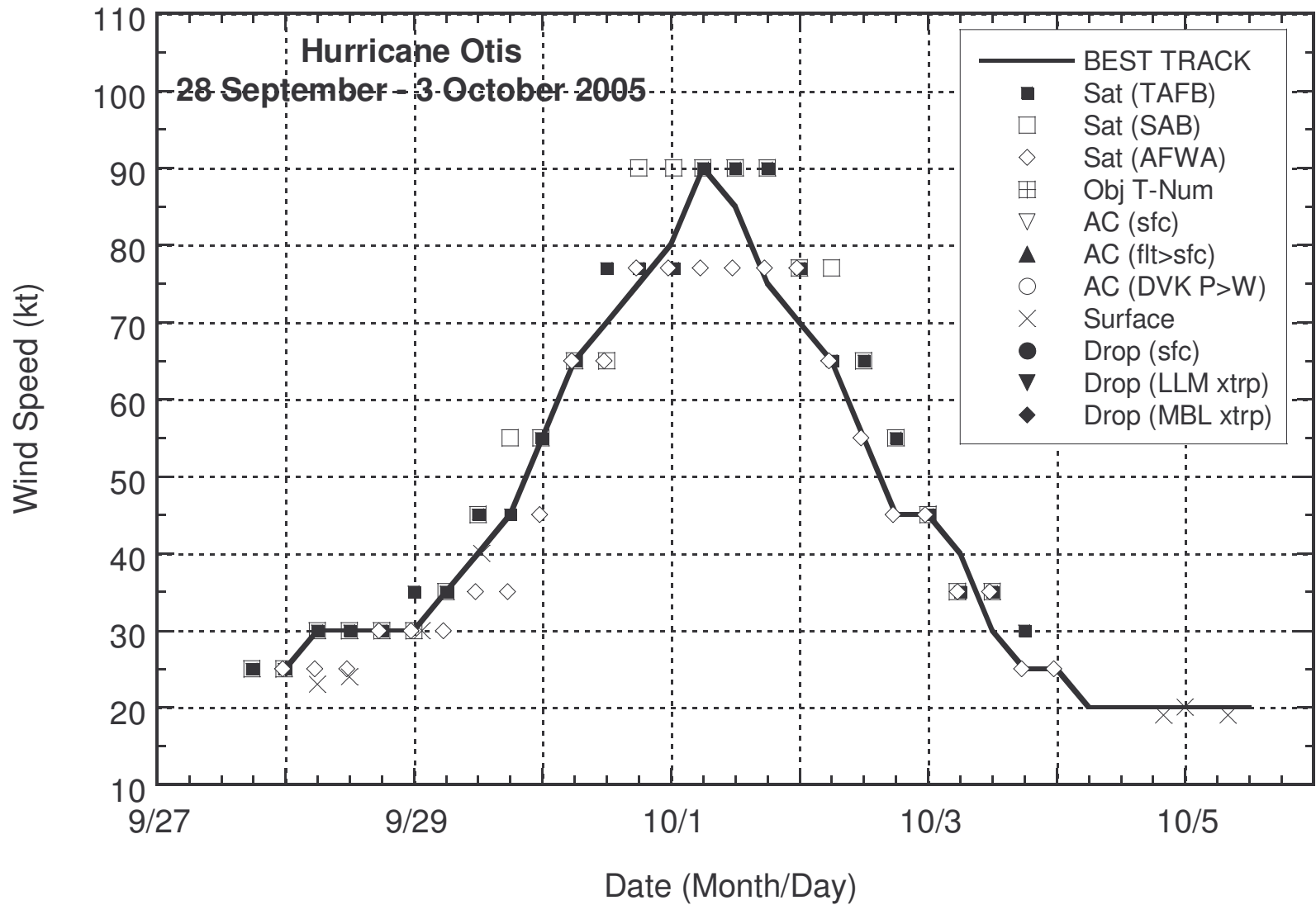Figure 1. Best track positions for Hurricane Otis, 28 September – 3 October 2005.

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Otis, 28 September – 3 October 2005. Objective Dvorak estimates represent linear averages over a three-hour period centered on the nominal observation time.
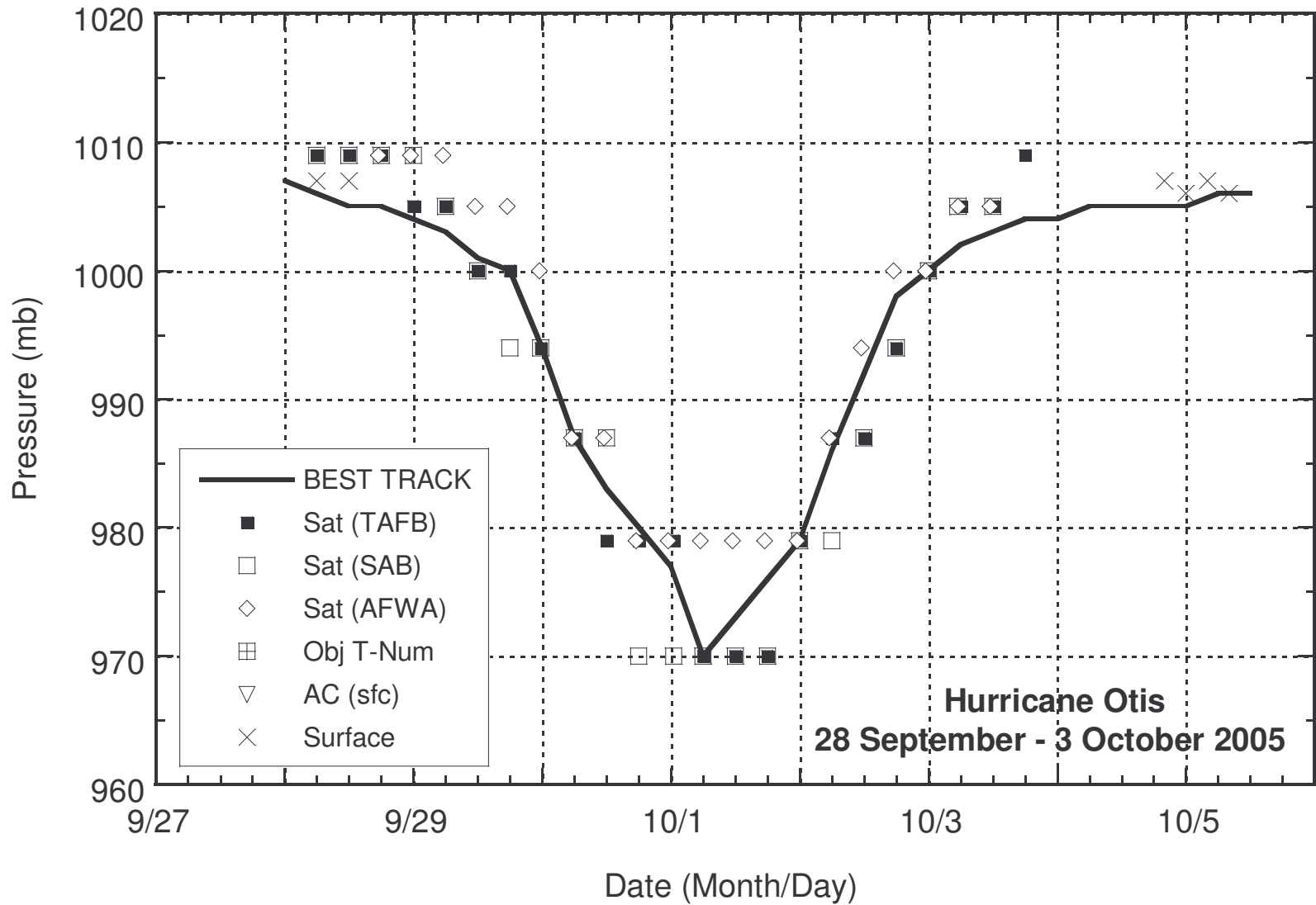
Figure 3.   Selected pressure observations and best track minimum central pressure curve for Hurricane Otis, 28 September – 3 October 2005. Objective Dvorak estimates represent linear averages over a three-hour period centered on the nominal observation time.