Tropical Cyclone Report
Hurricane Igor
(AL112010)
8-21 September 2010

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Igor, the strongest tropical cyclone of the 2010 Atlantic season, was a very large and intense Cape Verde hurricane that struck Bermuda with category 1 intensity. Later it hit Newfoundland and was the most damaging hurricane in recent history for that island.

a. Synoptic History

Igor's origin can be traced back to a tropical wave and accompanying broad area of low pressure that moved off the African coast late on 6 September. The system moved slowly westward for a couple of days while deep convection became more consolidated near the center of the low. By 0600 UTC 8 September, the surface circulation was sufficiently well defined and the deep convection was organized enough to designate the formation of a tropical depression centered about 80 n mi southeast of the southernmost Cape Verde Islands. The cyclone quickly strengthened into a tropical storm within 6 h. The "best track" chart of Igor'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[1].

After initially becoming a tropical storm, the cyclone failed to strengthen further for a day or so. In fact, the system lost some organization when it interacted with a trailing disturbance that rotated around the northern portion of the broad circulation. Deep convection diminished and became sheared to the west of the center, and the storm weakened back to a tropical depression by 1200 UTC 9 September. Since the tropical cyclone was embedded within the circulation of the monsoon trough over the tropical eastern Atlantic, it moved westward or west-northwestward at a slow pace for a couple of days. Around 1200 UTC 10 September, vertical shear began to relax and Igor regained tropical storm strength. By that time the steering flow became dominated by a building mid-tropospheric ridge over the eastern Atlantic, and Igor moved westward at a forward speed that increased to as much as 22 kt. Possibly due to moderate northerly shear and a relatively stable atmospheric environment, Igor's strengthening was rather unsteady over the next 36 h. The cyclone eventually reached hurricane strength by 0000 UTC 12 September. Shortly thereafter, however, the central convective cloud pattern became quite symmetric, the upper-level outflow increased markedly, and very rapid intensification took place. Igor's maximum winds increased to an estimated 130 kt by 0000 UTC 13 September. Figure 4 is a satellite image of Igor on 13 September depicting the classic appearance of an

[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.

intense hurricane. Igor slowed its forward speed on 13 September, while maintaining a nearly due westward heading across the tropical Atlantic.

After exhibiting some hints of concentric eyewall structure, Igor's maximum winds decreased to 115 kt by 0600 UTC 14 September. However, the hurricane soon re-strengthened to an estimated peak intensity of 135 kt around 0000 UTC 15 September. Igor was now moving west-northwestward in response to a weakness in the subtropical ridge created by a broad deep-layer trough near the northeastern United States. Later on 15 September, there was an eyewall replacement, and the tropical cyclone weakened again to near 115 kt. Igor's final strengthening episode occurred late on 15 September while the new, outer eyewall contracted slightly, and the maximum winds increased to an estimated 125 kt by 0600 UTC 16 September. The hurricane wobbled between a northwest and west-northwest heading as its eye passed a little over 300 n mi northeast of the northernmost Leeward Islands early on 17 September.

A persistent deep-layer trough near the northeastern United States maintained a weakness in the subtropical ridge over the western Atlantic, and over the next couple of days Igor gradually turned toward the north as it moved around the periphery of the ridge. Meanwhile, there was a fairly steady weakening of the tropical cyclone, at least partly due to southwesterly shear that became fairly strong by late on 18 September, and the intrusion of drier air into the core. Although it was weakening, Igor expanded in size and tropical-storm-force winds extended some 300 n mi from the center over the northern semicircle. By the time it passed closest to Bermuda (about 35 n mi to the west-northwest) around 0230 UTC 20 September, Igor had weakened to a 65-kt hurricane, and it brought hurricane-force winds to that island.

The hurricane turned north-northeastward, then northeastward and accelerated ahead of a trough near the Canadian Maritimes. The cyclone grew even larger in size, with the area of tropical-storm-force winds becoming roughly 750 n mi wide, and the system's forward speed increased to near 40 kt. Igor strengthened to 75 kt, possibly due to baroclinic forcing, as it made landfall near Cape Race Newfoundland around 1500 UTC 21 September. The center of the hurricane straddled the east coast of the Avalon peninsula of Newfoundland from 1500 to 1700 UTC 21 September. Almost immediately after departing Newfoundland, Igor became fully embedded in a frontal zone and became a vigorous extratropical cyclone. The cyclone turned northward and north-northwestward, its center moving over the north Atlantic between Labrador and Greenland on 22 September. The system became absorbed by another large extratropical cyclone by early on 23 September.

b. Meteorological Statistics

Observations in Igor (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 Dvorak estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison (CIMSS). Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command (53WRS). Data and imagery from NOAA polar-orbiting satellites, including the Advanced Microwave Sounder Unit intensity estimates from CIMSS, the NASA Tropical Rainfall Measuring Mission (TRMM) and Aqua, the European Space Agency's Advanced Scatterometer (ASCAT), and Defense Meteorological Satellite Program (DMSP) satellites, among others, and radar observations from Bermuda were also useful in constructing the best track of Igor.

The peak intensity of Igor was estimated to be 135 kt based on a blend of objective (Advanced Dvorak Technique) and subjective Dvorak technique estimates. Igor is estimated to have been a 40-kt tropical storm while it was located just south of the Cape Verde Islands on the basis of high-resolution ASCAT data. The 53WRS flew six missions into Igor, measuring peak 700 mb flight-level and surface winds of 130 kt and 98 kt, respectively, and a minimum central pressure of 940 mb. All of these measurements occurred near 1600 UTC 16 September on the first aircraft mission into the hurricane, about 40 h after the time of Igor's estimated maximum intensity.

Ship and marine platform reports of winds of tropical storm force associated with Igor are given in Table 2, and selected surface observations from land stations and data buoys are given in Table 3. NOAA data buoy 41044, located over the tropical Atlantic, measured a minimum pressure of 940.3 mb while the center of Igor passed about 15 n mi to its north.

A maximum 10-min wind of 59 kt was measured at the official site in Bermuda (TXKF) with higher sustained winds reported from sites on the island with wind sensors well above the standard 10 m anemometer elevation. Applying a gust factor of 1.11 to the TXKF sustained wind observation yields an estimated peak 1-min wind of 65 kt (Harper et al. 2009). A rainfall total of 3.19 inches was measured in Bermuda, and a storm surge of 1.75 ft was measured by a NOAA tide gauge at St. George on the north coast of the island.

The highest 10-min wind report from an official observing site in Newfoundland was 66 kt at Bonavista which, after applying the 1.11 gust factor, gives an estimated peak 1-min wind of 73 kt. Wind gusts of 84 and 88 kt were measured at Bonavista and Sagona Island respectively. Rainfall totals generally ranged from 4 to 8 inches over eastern Newfoundland with a maximum total of 9.37 inches at St. Lawrence, with the latter total being unprecedented for that site. Figure 5 is a map of the rainfall totals associated with Igor in Newfoundland. Storm surges of 2 to 3 ft were measured around eastern Newfoundland with a maximum surge of 3.5 ft observed in St. John's Harbour.

c. Casualty and Damage Statistics

A woman was swept out to sea, and presumed drowned, by a large wave in Arecibo, Puerto Rico. In St. Croix, a boy drowned while swimming with his father in high surf.

Igor produced minimal damage in Bermuda. Downed trees and signs were reported across the island. The main causeway connecting St. David's and St. George's Islands sustained minor damage and was closed to one lane of traffic for several days. The *Royal Gazette* indicated that there was no loss of life, and damage was estimated at less than $500,000 (U.S.)

immediately after the storm. No further updates on the estimate of damage are available. Approximately 28,000 residents in Bermuda lost power during the storm.

In Newfoundland, the impacts from Igor were decidedly more severe. Indeed, the Canadian Hurricane Centre described Igor as “Newfoundland’s most damaging hurricane in 75 years”. The high winds toppled many trees, especially in urban areas, and caused some structural damage over the eastern peninsulas. Much of the extensive damage on the island occurred as a result of the heavy rains and associated flooding which washed out roads and several bridges. Eastern Newfoundland was essentially isolated from the rest of the island. On the Bonavista and Burin Peninsulas, road washouts were so serious that several communities were cut off from the main road system connecting those areas to the island. One death was attributed to Igor; in Newfoundland, a man was killed when his driveway washed out and he was swept out to sea. Preliminary assessments placed the damage in Newfoundland at almost $200 million (U.S.).

d. Forecast and Warning Critique

Igor’s formation was not well predicted. The area of disturbed weather that spawned Igor was first noted in the Tropical Weather Outlook (TWO) just 24 h prior to tropical cyclone formation, when it was located between the Cape Verde Islands and the coast of Africa, at which time it was given a “low” (10 percent) probability of development. The formation probability was raised to “medium” (40 percent) in a special TWO issued just 3.5 h prior to genesis.

Igor’s track was forecast quite well. A verification of NHC official track forecasts for Igor is given in Table 4a. The official forecast track errors were below the mean official errors for the previous 5-yr period at all forecast intervals, and considerably lower than the 5-yr means at 96 and 120 h. It should be noted that the mean climatology-persistence errors for this storm were not significantly lower than average, suggesting (surprisingly) that Igor’s track was not particularly easy to forecast. A homogeneous comparison of the official track errors with selected guidance models is given in Table 4b. On average, the official track forecasts were better than the numerical guidance, with the exceptions being the GFSI forecasts at 12 through 72 h, the EMXI at 24 through 120 h, TVCC at 48 h, GUNA at 12, 48 and 72 h, CGUN at 48 h, and AEMI at 48 and 72 h. There was somewhat of a right of track bias to the official forecasts. In particular, the NHC forecasts generally showed Igor turning northward prematurely while it was over the tropical Atlantic. A similar track forecast bias was noted in the GFDL and HWRF model runs during this period.

Igor’s intensity, on the other hand, was not handled very well by the NHC forecasts (Table 5a). The mean official intensity forecast errors exceeded the 5-yr mean errors at all forecast intervals. The mean climatology-persistence intensity forecast errors were larger than the long-term means, indicating that Igor’s intensity was more difficult to forecast than average. There was a predominately negative bias in the official forecasts during the first half of Igor’s life and a mainly positive bias thereafter. The former biases were mainly due to an inability to accurately predict the hurricane’s rapid strengthening. The latter biases resulted in an overforecast of Igor’s strength when it moved near Bermuda, and residents of that island were preparing for the impacts of a much stronger hurricane than they actually received. Another source of error in the NHC intensity forecasts for Igor stemmed from the inability to accurately predict changes in strength associated with the various eyewall replacement episodes. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 5b. The OCD5 model had lower mean errors than the official forecasts at 12 through 36 h indicating that, on average, the NHC intensity forecasts had no skill at these forecast intervals. The other model guidance that had lower mean intensity forecast errors were HWFI at 24 h, GHMI at 72 through 120 h, DSHP at 72 through 120 h, LGEM at all forecast intervals, ICON at all forecast intervals, IVCN at all forecast intervals, and FSSE at 12 through 72 h.

Watches and warnings associated with Igor are given in Table 6.

Acknowledgements.

The Bermuda Weather Service and the Canadian Hurricane Centre provided observations and information about impacts in Bermuda and Newfoundland, respectively. David Roth of the Hydrometeorological Prediction Center provided the rainfall map.

References

Harper, B.A., J.D. Kepert, and J.D. Ginger, 2009: Guidelines for Converting Between Various Wind Averaging Periods in Tropical Cyclone Conditions. World Meteorological Organization, 52 pp.

Table 1. Best track for Hurricane Igor, 8-21 September 2010.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
08 / 0600	14.0	22.7	1006	30	tropical depression
08 / 1200	13.8	23.3	1005	40	tropical storm
08 / 1800	13.8	23.7	1005	40	"
09 / 0000	13.8	24.1	1005	40	"
09 / 0600	13.9	24.8	1005	35	"
09 / 1200	14.2	25.5	1006	30	tropical depression
09 / 1800	14.7	26.4	1006	30	"
10 / 0000	15.4	27.5	1004	30	"
10 / 0600	15.9	28.7	1004	30	"
10 / 1200	16.3	30.4	1004	35	tropical storm
10 / 1800	16.6	32.5	1002	40	"
11 / 0000	16.9	34.8	999	50	"
11 / 0600	17.1	37.0	995	60	"
11 / 1200	17.3	38.7	995	60	"
11 / 1800	17.4	40.4	995	60	"
12 / 0000	17.6	42.0	987	65	hurricane
12 / 0600	17.7	43.5	985	70	"
12 / 1200	17.7	44.9	970	90	"
12 / 1800	17.7	46.1	948	115	"
13 / 0000	17.7	47.3	935	130	"
13 / 0600	17.6	48.3	935	130	"
13 / 1200	17.6	49.3	933	130	"
13 / 1800	17.6	50.2	937	125	"
14 / 0000	17.7	50.9	937	125	"
14 / 0600	17.9	51.5	945	115	"
14 / 1200	18.2	52.1	945	115	"
14 / 1800	18.6	52.8	935	125	"
15 / 0000	18.9	53.5	924	135	"
15 / 0600	19.2	54.1	935	125	"
15 / 1200	19.5	54.7	945	115	"
15 / 1800	19.8	55.3	942	115	"
16 / 0000	20.1	56.0	936	120	"
16 / 0600	20.4	56.5	929	125	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
16 / 1200	20.8	57.1	934	120	"
16 / 1800	21.4	57.8	940	115	"
17 / 0000	21.8	58.4	935	115	"
17 / 0600	22.2	59.1	935	110	"
17 / 1200	22.8	59.9	945	100	"
17 / 1800	23.5	60.7	947	90	"
18 / 0000	24.2	61.6	947	90	"
18 / 0600	24.9	62.5	939	85	"
18 / 1200	25.7	63.3	939	85	"
18 / 1800	26.6	64.0	945	80	"
19 / 0000	27.5	64.6	945	80	"
19 / 0600	28.4	65.2	949	75	"
19 / 1200	29.6	65.6	949	75	"
19 / 1800	30.8	65.9	952	70	"
20 / 0000	31.9	65.7	953	65	"
20 / 0600	33.2	65.2	957	65	"
20 / 1200	35.1	64.2	960	65	"
20 / 1800	37.2	62.6	960	65	"
21 / 0000	39.0	60.4	960	65	"
21 / 0600	41.5	57.0	960	65	"
21 / 1200	44.8	54.4	955	65	"
21 / 1500	46.6	53.2	950	75	"
21 / 1800	48.5	52.1	950	75	extratropical
22 / 0000	51.5	50.5	950	75	"
22 / 0600	53.5	49.5	950	70	"
22 / 1200	55.5	49.4	950	70	"
22 / 1800	57.0	50.0	955	65	"
23 / 0000	58.5	51.0	960	60	"
23 / 0600					absorbed
21 / 1500	46.6	53.2	950	75	landfall near Cape Race, Newfoundland
15 / 0000	18.9	53.5	924	135	maximum wind and minimum pressure

Table 2. Selected ship and fixed platform reports with winds of at least 34 kt for Hurricane Igor, 8-21 September 2010.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
09 / 0000	PCQL	8.0	25.7	250 / 41	1014.5
16 / 0000	PCSV	21.0	50.9	100 / 35	1011.8
16 / 0300	PCSV	20.6	51.0	110 / 35	1010.7
20 / 1200	V7SX3	33.7	69.1	340 / 44	1000.9
20 / 1500	V7SX3	33.4	68.5	350 / 45	1003.8
20 / 1500	C6FT7	41.9	68.2	340 / 36	1007.0
20 / 1600	NWS002	41.1	65.3	020 / 36	1000.6
20 / 1700	NWS002	41.0	65.5	030 / 44	999.8
20 / 1800	NWS002	40.9	65.8	010 / 46	999.2
20 / 1900	NWS002	40.8	66.0	010 / 42	998.9
20 / 2000	NWS002	40.6	66.2	360 / 39	999.4
20 / 2100	NWS002	40.5	66.4	360 / 36	1000.0
20 / 2200	NWS002	40.4	66.5	350 / 39	1001.5
21 / 0000	NWS002	40.1	66.9	350 / 40	1004.3
21 / 0000	C6FT7	43.0	65.8	330 / 39	1003.0
21 / 0600	VEP717[a]	46.7	48.7	150 / 46	1004.0
21 / 0700	PFRO	44.4	62.7	320 / 45	1001.0
21 / 0900	PFRO	44.6	62.1	320 / 50	998.8
21 / 0900	VEP717	46.7	48.7	150 / 55	997.4
21 / 0900	VOXS	46.7	48.0	130 / 38	1000.2
21 / 0900	VREX4	46.7	47.1	040 / 40	1002.0
21 / 1000	PFRO	44.7	61.8	320 / 40	999.9
21 / 1100	PFRO	44.8	61.5	320 / 40	1000.1
21 / 1200	VCXF	46.4	48.4	130 / 52	985.5
21 / 1200	VEP717	46.7	48.7	150 / 69	987.5
21 / 1200	VOXS	46.7	48.0	130 / 38	993.1
21 / 1200	VREX4	46.7	45.5	140 / 58	1002.2
21 / 1400	PFRO	45.5	59.8	280 / 50	1000.1
21 / 1500	VOCJ	46.3	60.1	320 / 41	998.3

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
21 / 1500	VCXF	46.4	48.4	150 / 67	973.5
21 / 1500	VCRG	46.5	61.9	320 / 35	1005.5
21 / 1500	VEP717	46.7	48.7	160 / 84	977.6

[a] Hibernia oil platform; anemometer height is 456 ft.

Table 3. Selected surface observations for Hurricane Igor, 8-21 September 2010.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Bermuda								
Bermuda Airport (TXKF)	20/0251	963.7	20/0223	59	81			3.19
Fort Prospect[e]			20/0350	52	90			
St. David's[f]			20/0550	79	102			
St. George (Bermuda Esso Pier)	20/0248	963.6	20/0812	57[g]	69		1.75	
Commissioner's Point[h]			20/0340	70	101			
Canada (Newfoundland)								
Cape Pine[i]			21/1645	70	93			
Sagona Island	21/1500	970.7	21/1500	61	88			
Bonavista	21/1700	961.8	21/1900	66	84		3.0	10[j]
Pouch Cove					79			5.59
Pool's Island	21/1800	963.8	21/1900	56	79			
St. John's (airport) (CYYT)	21/1600	954.9	21/1800	50	74		3.5[k]	4.72
St. John's West					72			5.28
Grates Cove	21/1700	955.9	21/1745		73			
Twillingate	21/1900	976.8	21/1900	54	71			
Argentia	21/1500	962.4	21/1700	51	71		2.9	
St. Lawrence	21/1400	969.9	21/1400	45	67			9.37
Lethbridge								7.64
Gander (CYQX)	21/1800	975.4	21/1900	39	52			4.88
Bay D'Espoir								4.88
Cape Race					66			2.13
Burego					62			1.61
Winterland					69			
Englee					68			
Stephenville					61			
Port Aux Basques					59			
St. Anthony					50			

France								
St. Pierre	21/1200	978.0	21/1200	49	73			6.3
Buoys								
41044 – 21.65N 58.7W	17/0050	940.3	16/2354	68	91			
41049 – 27.5N 63.0W	18/2115	976.8	18/1657	58	68			
41047 – 27.47N 71.49W	19/0833	1006.7	19/0315	32	35			
41048 – 31.98N 69.65W	19/2150	998.7	19/1919	43	50			
41001 – 34.66N 72.7W	20/0750	1007.7	20/1030	27	35			
44008 – 40.50N 69.25W	20/1750	1007.6	20/2100	28	37			
44018 – 41.26N 69.31W	20/1750	1008.4	20/2020	29	35			
44020 – 41.44N 70.19W	20/1750	1010.0	20/1840	27	37			
44139 – 44.24N 57.10W	21/0600	970			86			
44251 – 46.44N 53.39W	21/1500	952			84			
44138 – 44.25N 53.63W	21/1100	957			76			
44140 – 42.87N 51.47W	21/1100	976			61			
44255 – 47.27N 57.34W	21/1500	985			56			

[a] Date/time is for sustained wind when both sustained and gust are listed.
[b] Except as noted, sustained wind averaging periods for land stations outside of the U.S. are 10 min; buoy averaging periods are 8 min.
[c] Storm surge is water height above normal astronomical tide level.
[d] Storm tide is water height above National Geodetic Vertical Datum (1929 mean sea level).
[e] 32° 17' 57.6882"N, 64° 45' 53.4774" W Elevation 230ft AMSL
[f] 32°21.825’ N 64°39.368’ W, Elevation 159ft AMSL
[g] 6-min average.
[h] 32° 19' 44.5584"N, 64° 49' 55.9596" W Elevation 262ft AMSL
[i] Sustained wind estimated; anemometer height is 302 ft.
[j] Rainfall total is estimated. The station stopped reporting precipitation several hours before significant rainfall ended.
[k] St. John’s Harbour.

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Igor, 8-21 September 2010. Mean errors for the 5-yr period 2005-9 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 (Igor)	**29.8**	**45.9**	**63.4**	**82.8**	**124.0**	**139.4**	**158.2**
OCD5 (Igor)	42.8	88.5	146.4	202.5	315.3	384.6	442.4
Forecasts	51	49	47	45	41	37	33
OFCL (2005-9)	31.8	53.4	75.4	96.8	143.8	195.6	252.1
OCD5 (2005-9)	46.9	97.3	155.4	211.6	304.8	387.9	467.8

Table 4b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Igor, 8-21 September 2010. 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	26.7	40.9	59.0	78.3	115.0	126.1	144.9
OCD5	39.8	80.1	145.4	181.6	307.8	352.3	405.9
GFSI	**26.0**	**39.6**	**58.2**	**68.1**	**105.0**	134.8	188.6
GHMI	34.5	57.7	83.0	91.6	147.6	213.1	324.4
HWFI	33.5	55.4	80.1	99.1	142.5	151.0	169.5
GFNI	38.0	67.4	104.7	131.5	194.0	199.6	281.6
NGPI	35.9	61.4	94.3	122.8	184.3	184.3	224.2
EGRI	29.7	52.3	81.7	98.2	141.5	150.0	169.3
EMXI	26.8	**38.7**	**55.2**	**64.1**	**94.0**	**106.0**	**129.0**
TCON	27.7	43.3	64.9	79.6	117.7	135.6	175.4
TCCN	29.0	43.7	65.9	79.5	118.8	138.9	170.5
TVCN	27.3	42.2	64.2	79.6	117.5	128.0	166.3
TVCC	28.2	42.5	64.3	**78.0**	116.4	131.8	161.2
GUNA	**26.6**	41.2	63.4	**77.1**	**114.8**	135.6	180.9
CGUN	28.0	41.7	64.5	**77.9**	116.4	137.5	171.3
FSSE	27.5	43.9	63.8	78.7	116.3	132.6	166.4
AEMI	27.2	44.4	65.2	**75.4**	**114.9**	150.8	202.8
BAMS	62.7	107.2	168.2	172.4	243.7	214.0	280.0
BAMM	51.1	89.7	138.8	144.6	204.9	181.7	218.4
BAMD	35.8	64.4	103.4	136.7	214.7	237.0	262.1
Forecasts	40	38	38	34	32	26	23

Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Igor, 8-21 September 20010. Mean errors for the 5-yr period 2005-9 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 (Igor)	9.8	15.0	17.4	19.0	22.3	23.5	22.1
OCD5 (Igor)	9.5	13.8	16.6	20.4	25.3	30.1	31.8
Forecasts	51	49	47	45	41	37	33
OFCL (2005-9)	7.0	10.7	13.1	15.2	18.6	18.7	20.1
OCD5 (2005-9)	8.6	12.5	15.8	18.2	21.0	22.7	21.7

Table 5b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Igor, 8-21 September 2010. 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	72	96	120
OFCL	10.2	14.9	17.4	19.2	20.5	22.8	20.0
OCD5	**9.7**	**13.2**	**16.0**	19.8	22.7	28.2	27.5
HWFI	10.6	**13.8**	17.4	19.4	21.6	24.8	23.6
GHMI	11.1	15.7	18.9	20.2	**19.6**	**21.3**	**18.6**
DSHP	**10.0**	15.0	18.3	19.7	**19.3**	**20.9**	**18.5**
LGEM	**9.3**	**12.5**	**14.9**	**16.4**	**16.9**	**17.4**	**15.5**
ICON	**9.4**	**13.2**	**16.4**	**17.8**	**18.6**	**20.0**	**18.2**
IVCN	**9.8**	**13.3**	**17.2**	**18.5**	**19.3**	**19.8**	**17.5**
FSSE	**9.4**	**12.9**	**15.5**	**16.8**	**18.6**	23.7	24.0
Forecasts	48	46	44	42	38	34	30

Table 6. Watch and warning summary for Hurricane Igor, 8-21 September 2010.

Date/Time (UTC)	Action	Location
8 / 1500	Tropical Storm Watch issued	Southern Cape Verde Islands
9 / 2100	Tropical Storm Watch discontinued	All
17 / 0300	Hurricane Watch issued	Bermuda
17 / 1800	Hurricane Watch changed to Hurricane Warning	Bermuda
20 / 0900	Hurricane Warning changed to Tropical Storm Warning	Bermuda
20 / 0900	Tropical Storm Watch issued	Stones Cove to Jones Harbor, Newfoundland
20 / 1200	Tropical Storm Warning issued	St-Pierre to Miquelon
20 / 1800	Tropical Storm Watch discontinued	All
20 / 1800	Tropical Storm Warning discontinued	Bermuda
20 / 1800	Tropical Storm Warning issued	Stones Cove to Charlottetown
21 / 0600	Tropical Storm Warning discontinued	Stones Cove to Charlottetown
21 / 0600	Tropical Storm Warning issued	Burgeo to Triton
21 / 0600	Hurricane Watch issued	Stones Cove to Fogo Island
22 / 0000	Hurricane Watch discontinued	All
22 / 0800	Tropical Storm Warning discontinued	All

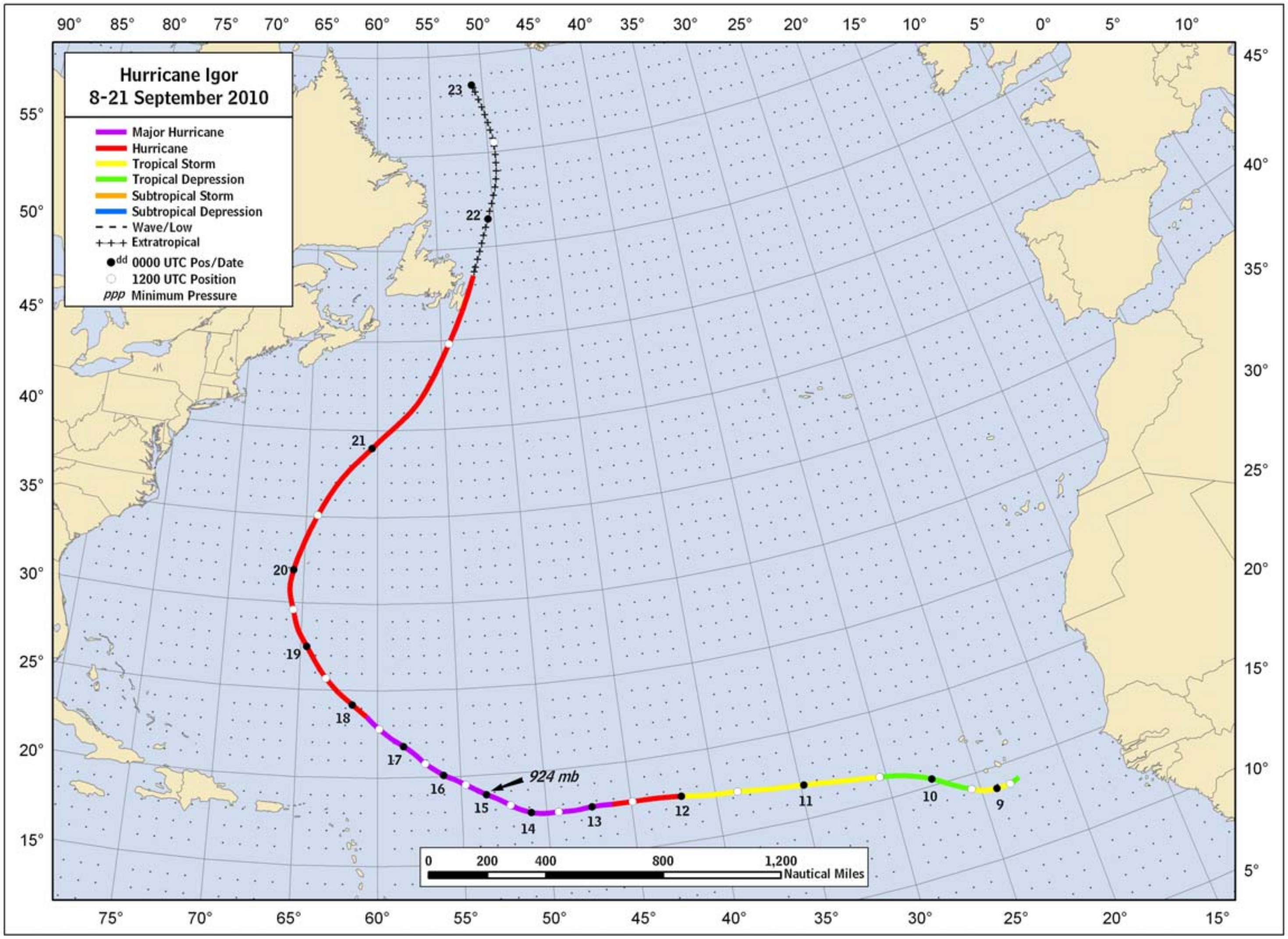

Figure 1. Best track positions for Hurricane Igor, 8-21 September 2010. Track during the extratropical stage is based partially on analyses from the NOAA Ocean Prediction Center.

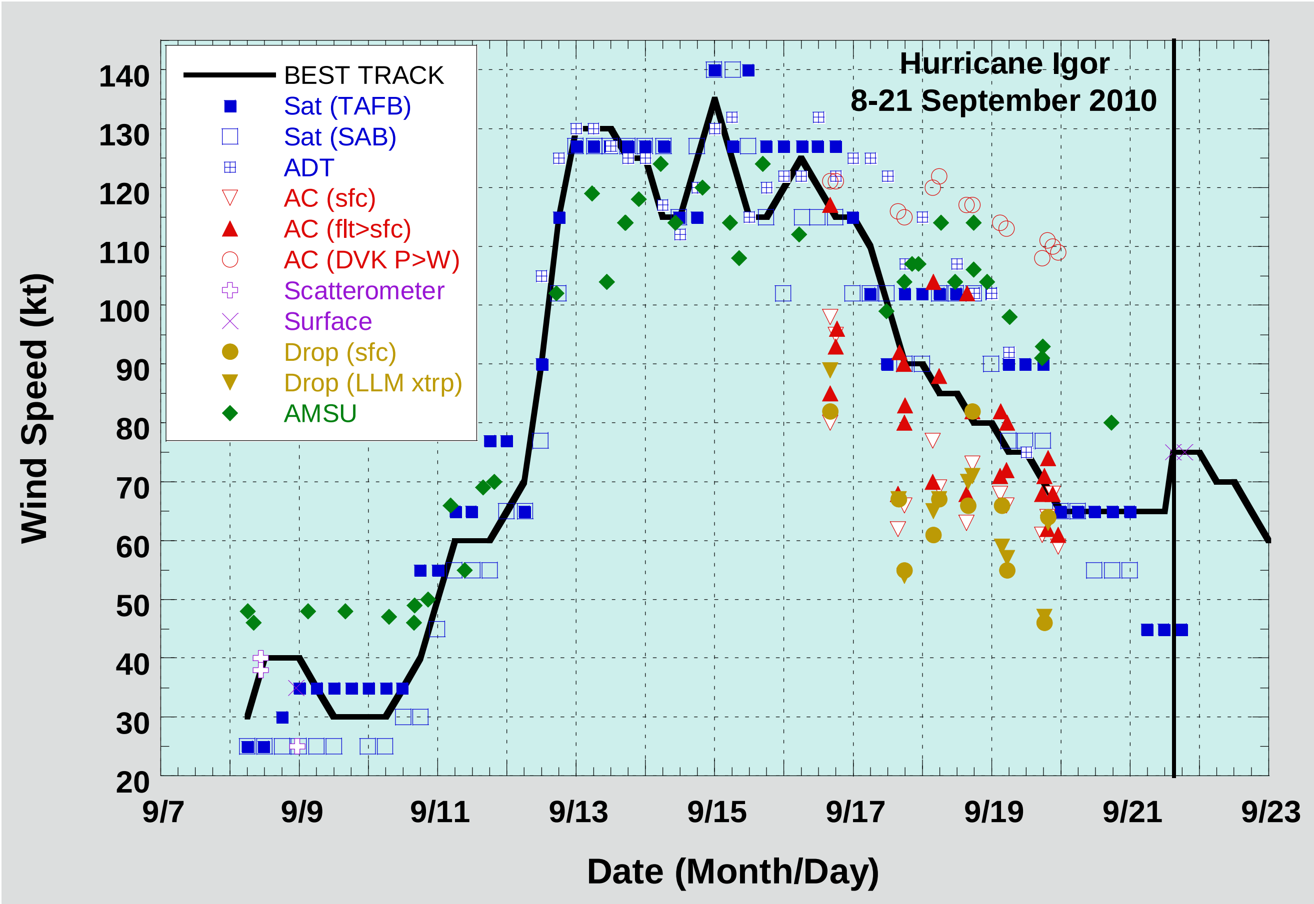

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Igor, 8-21 September 2010. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM). Advanced Dvorak Technique (ADT) and AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Estimates during the extratropical stage are based partially on analyses from the NOAA Ocean Prediction Center. Dashed vertical lines correspond to 0000 UTC. The solid vertical line corresponds to landfall.

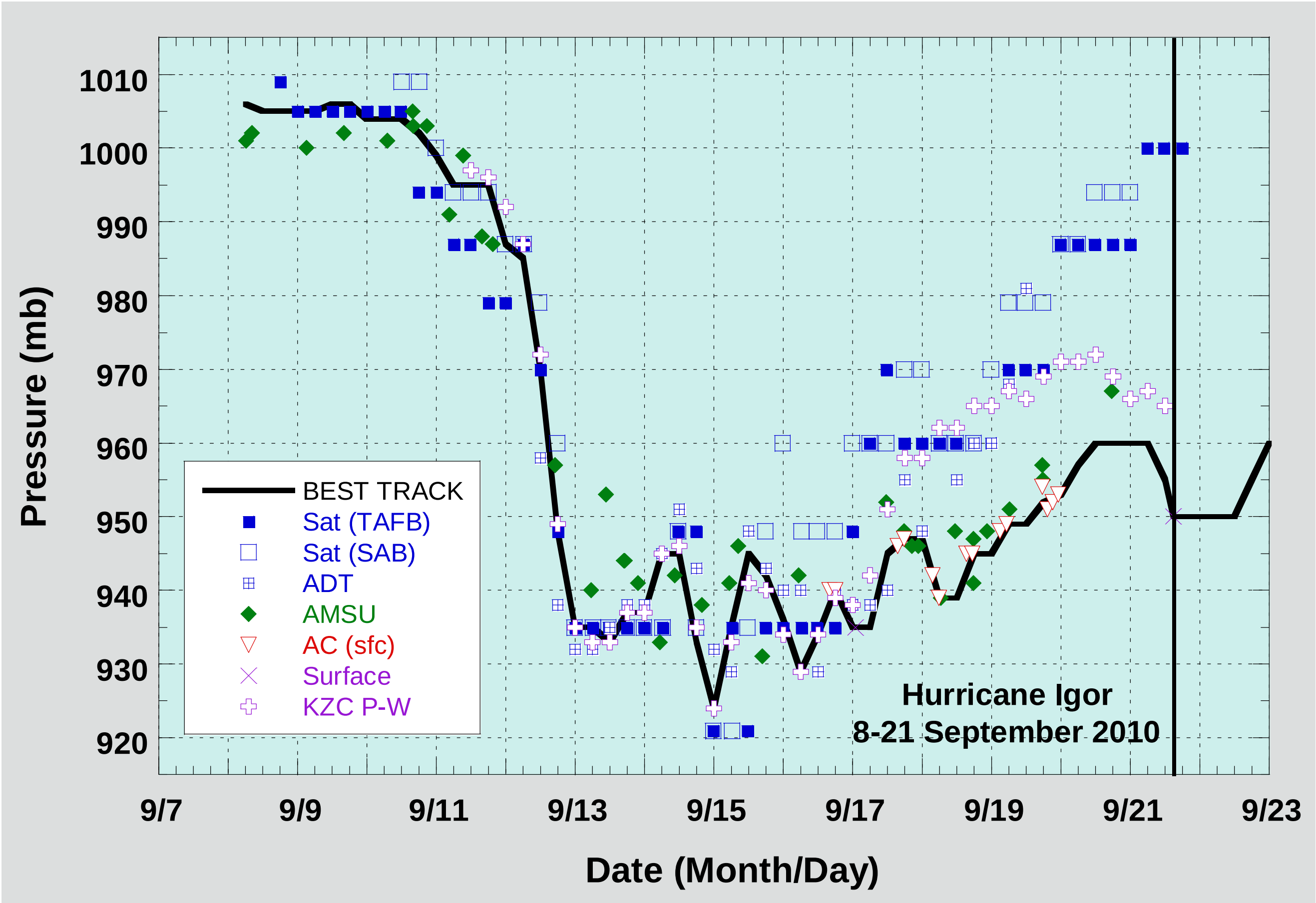

Figure 3. Selected pressure observations and best track minimum central pressure curve for name/dates. Advanced Dvorak Technique (ADT) and AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Estimates during the extratropical stage are based partially on analyses from the NOAA Ocean Prediction Center. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC. Dashed vertical lines correspond to 0000 UTC. Solid vertical line corresponds to landfall.

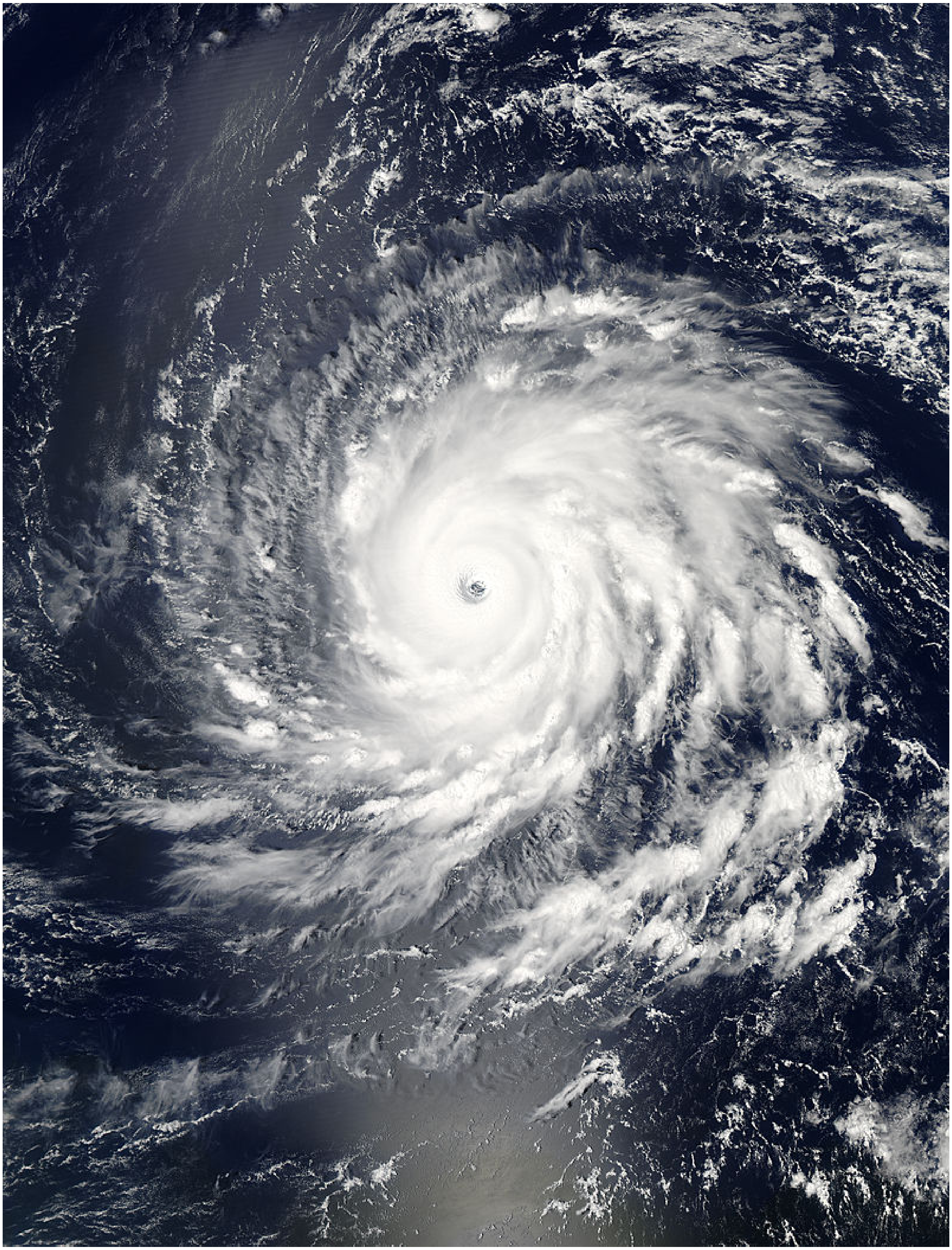

Figure 4. MODIS image of Hurricane Igor at 1640 UTC 13 September 2010. The estimated intensity was near 130 kt at this time. Image courtesy of NASA.

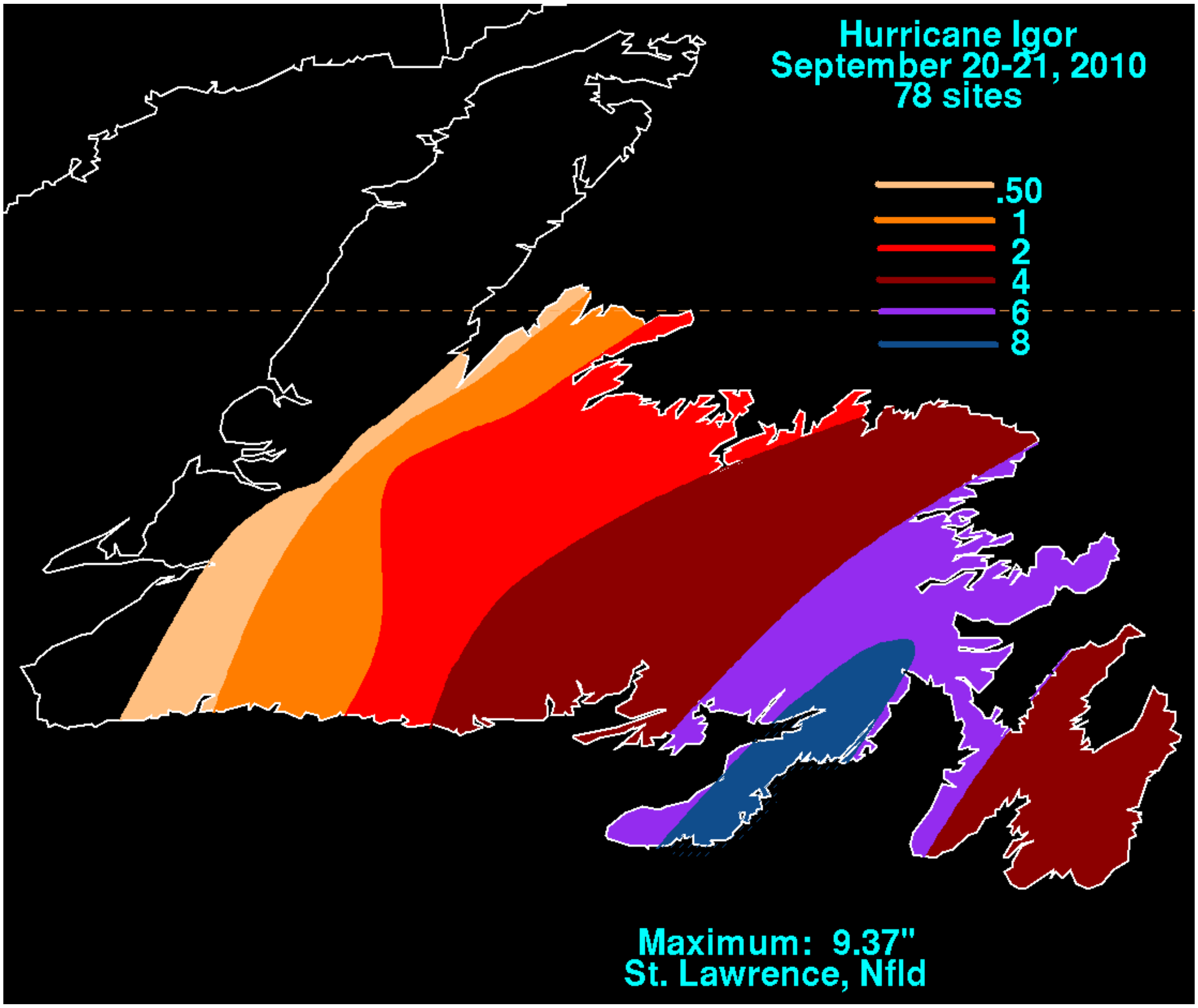

Figure 5. Rainfall totals (inches) associated with Hurricane Igor in Newfoundland. Analysis courtesy of David Roth of the Hydrometeorological Prediction Center.