

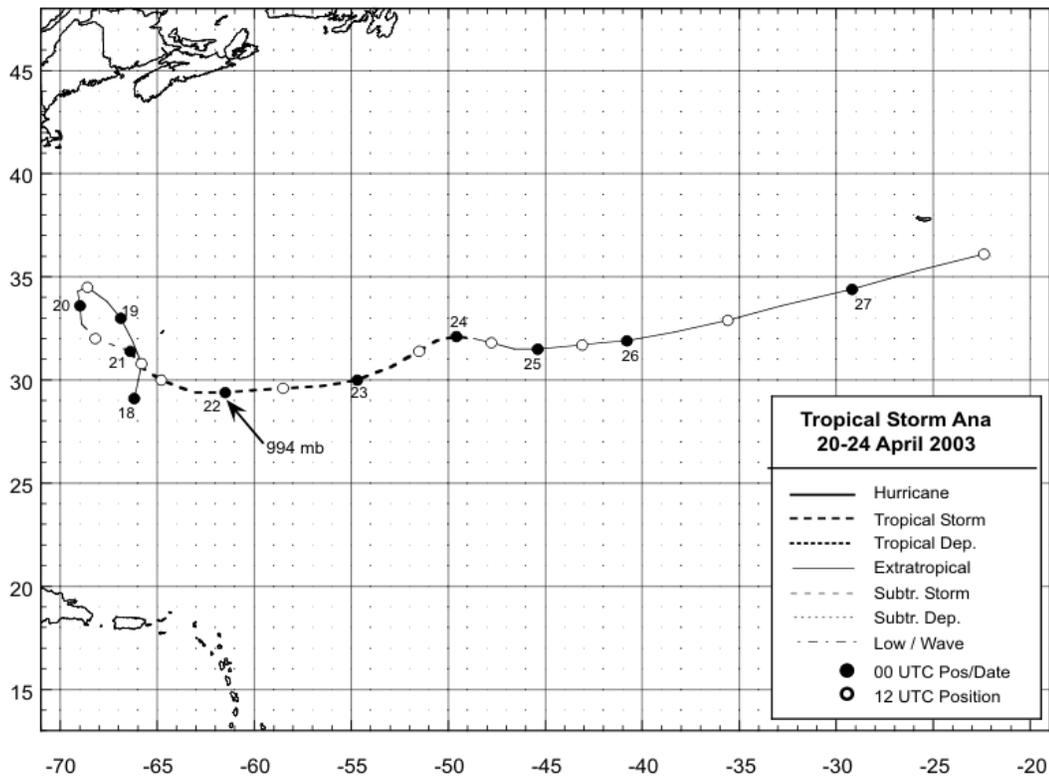
The 2003 Hurricane Season in Bermuda

Mark Guishard & Roger Williams, Bermuda Weather Service

Summary

Bermuda was affected by 5 tropical cyclones in 2003. The most significant of these by far was Hurricane Fabian, which caused substantial damage to the Island on September 5th, 2003. Fabian was one of the strongest hurricanes on record to hit Bermuda. The resulting loss of life, and damage to property, infrastructure and the local environment ensured that Hurricane Fabian would long be remembered in Bermuda. Another notable event was the development of Tropical Storm Ana from a sub-tropical cyclone in April, a full month prior to the official start of the season. Also of significance was the passage of Tropical Storm Henri, bringing unwelcome shower activity, hindering the clean up efforts following Hurricane Fabian's impact.

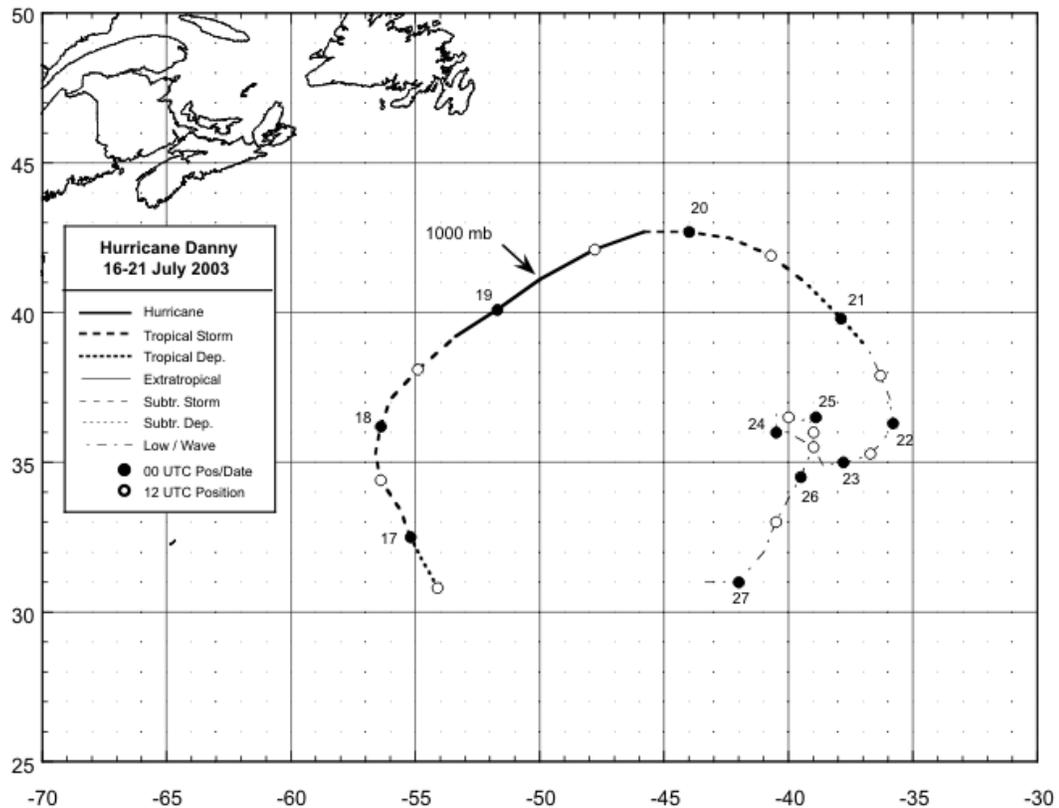
Tropical Storm Ana



National Hurricane Center Best Track of Tropical Storm Ana

Tropical Storm Ana became our first named storm of the year, forming about a month and a half before tropical season. Ana was the first Atlantic tropical storm on record to form in April. The Bermudian tradition of Good Friday kite flying was at a minimum on April 18th, with the rain and strong winds, as an area of low pressure became better organized and moved slowly towards Bermuda. Despite this, the main rain area cleared to the east of the Island on the 19th, and we had a day of mostly sunny skies, an occasional shower and light winds. The low moved back into our area on the 20th causing further outbreaks of rain throughout the day. By now, the low had developed sufficient tropical characteristics to become the first named tropical system of the year; Subtropical Storm Ana. A brief overnight Tropical Storm Warning was issued for Bermuda, as the storm moved eastwards and skirted to our south, though winds over the Island did not quite reach tropical storm force (34 knots or more). Subtropical Storm Ana was upgraded to Tropical Storm Ana on the 21st. With Ana not too far to our southeast, wet conditions continued on and off through out the day with strong winds. As Ana moved further away on the 22nd and high pressure began to build in, a few very light showers popped up, with mostly sunny skies and moderate winds. Tropical Storm Ana moved away to the east on the 23rd.

Tropical Storm Danny

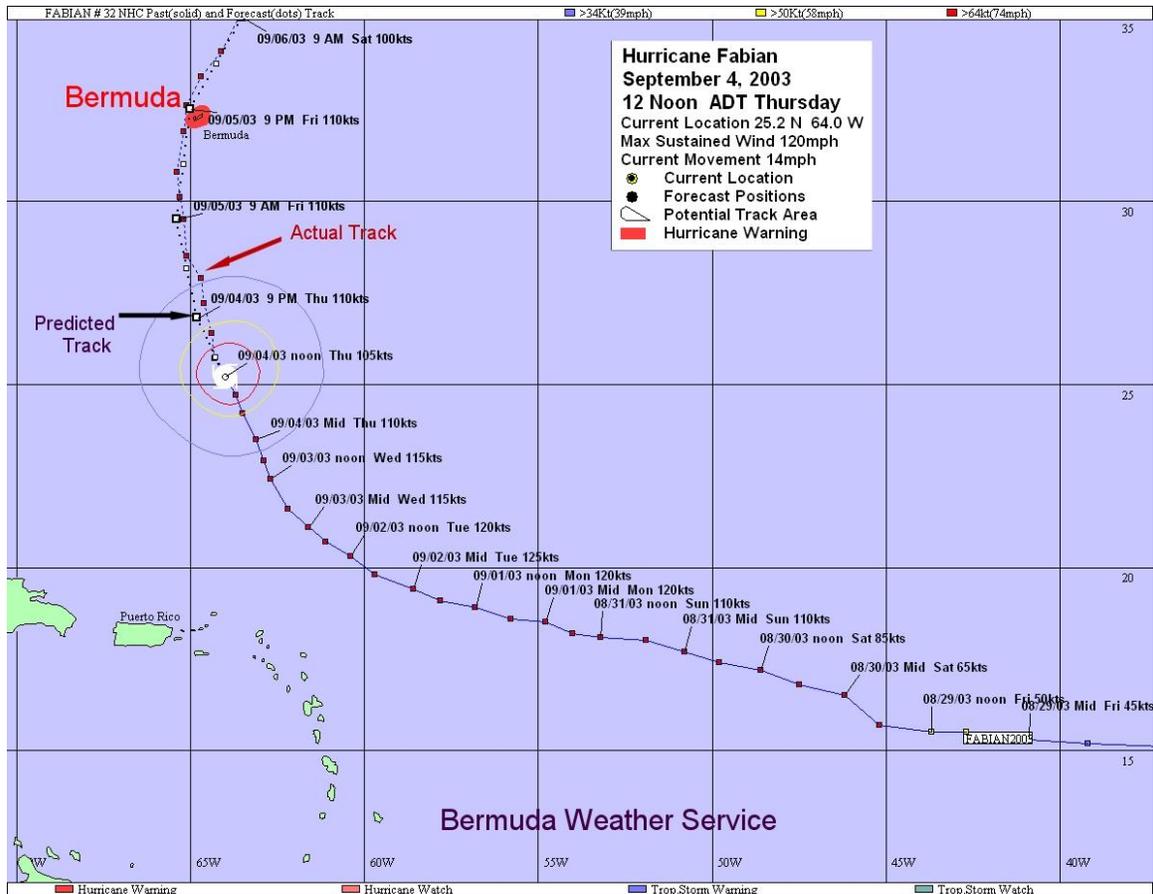


National Hurricane Center Best Track of Tropical Storm Danny

A surface low to the east-southeast of Bermuda developed into a tropical depression on July 16th, eventually intensifying into Tropical Storm Danny on the 17th. Although Danny had been moving towards Bermuda, it began to take a turn to the north, with a ridge of high pressure and pleasant weather remaining over Bermuda into the 18th. Tropical Storm Danny turned towards the northeast, and was forecast to continue to moving away from Bermuda.

Hurricane Fabian

Fabian started life as Tropical Depression 10, which formed in the afternoon of the August 27th, 2003, around 2,100 nautical miles (nm) east southeast of Bermuda. By the 29th, the system was upgraded to Hurricane Fabian. located approximately 1450 nm south east of the Island, and forecast to be around 600 nm to our south by the beginning of September. Meanwhile, the Bermuda-Azores high pressure system remained in place through the end of the month, with light winds and sunny skies.



Track Details and forecast track at Noon on Thursday 4th Sept.

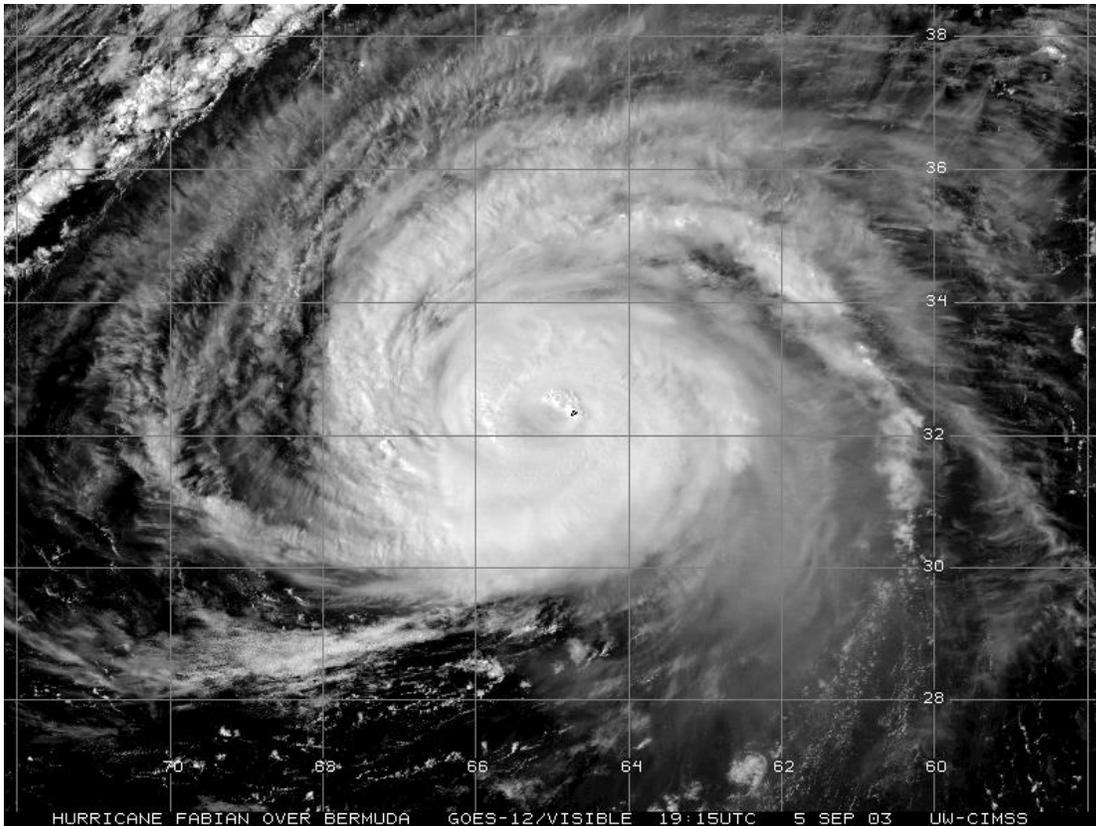
By 6pm. on August 30th Fabian had attained Category 3 hurricane status and became the first major storm of the 2003 Atlantic hurricane season. Fabian was further upgraded to a category 4 storm on the evening of August 31st, with estimated maximum winds of 115 knots (kt) with gusts to 140 kt and a central pressure of 948 millibars (mb). By the beginning of September, all eyes in Bermuda began watching out for Fabian, as

computer models indicated a turn to the north in the forecast track, during the outlook period, although the storm was still expected to steer well to our west.

Meanwhile, high pressure continued to bring sunny skies to the Island, with light winds from the east.

During the 2nd and 3rd of September, each successive predict bulletin brought Fabian's predicted path closer to Bermuda and an Emergency Measures Organization (EMO) meeting was called and began planning for the worst and alerting all relevant agencies. The Bermuda Weather Service (BWS) issued a Hurricane Watch, early on the morning of the 4th, and this was upgraded to a Hurricane Warning at midday. Fabian was forecast to make a direct hit on Bermuda on the afternoon of the 5th, and although downgraded to a Cat. 3 hurricane, with predicted maximum winds of 105kt., substantial damage was anticipated. Following a further meeting of the EMO in the early afternoon of Thursday the 4th, with widespread press and TV coverage, the general public begun to batten down in earnest.

Tropical storm force winds arrived on the Island on the morning of Friday September 5th, increasing to hurricane force by early afternoon. Strong winds, rain, blowing sea spray, and heavy surf reduced visibility and pounded the island. The highest (10 minute) sustained winds recorded were between 102 to 105 kt, at elevated mast locations around the Island. The official National Hurricane Center (NHC) post storm analysis 'best estimate' of the maximum 1 minute sea level (10 metre) wind was 100 kt. The highest gust of 143 kt was reported from Harbour Radio, (just before the mast collapsed). The strongest winds lasted for approximately 3-4 hours, as the eye of Fabian passed just west of Bermuda, with most of the Island in the eyewall region for this period. Conditions calmed on the 6th as Fabian made its way north and skies became mostly sunny again.

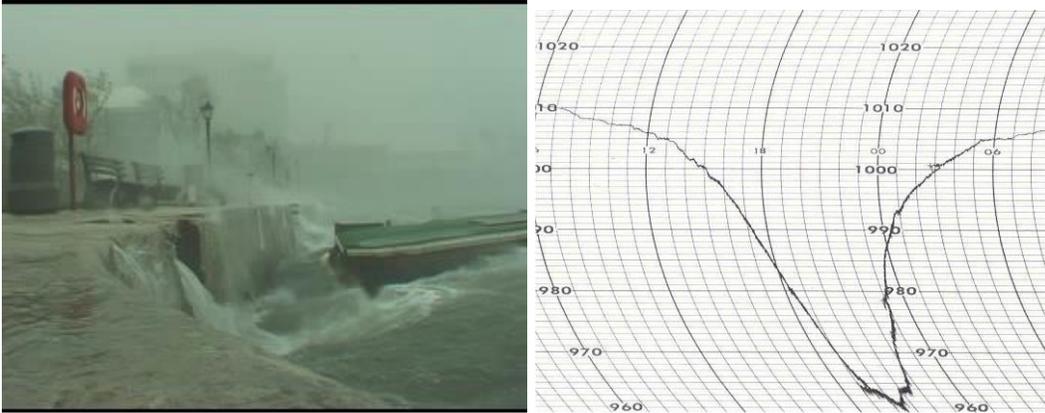


Visible Satellite Image of Category 3 Hurricane Fabian over Bermuda.

There was very strong storm surge and huge battering waves associated with Fabian, causing extensive damage to the coastline, especially along the south shore. The winds blew down hundreds of trees Island-wide. Electrical power was lost in the majority of homes and businesses outside the City of Hamilton, and approximately 25,000 out of 32,031 customers experienced outages, due to downed power lines. Remarkably, power was restored to most consumers within three weeks. However various parts of the electrical supply distribution system were substantially weakened and a rehabilitation plan was implemented in October 2003.

In strictly meteorological terms, Fabian was a well behaved storm. The relatively consistent track, accuracy of the numerical model predictions and good liaison with the NHC enabled the BWS to issue timely warnings and useful guidance on Fabian. This gave most public and private concerns sufficient time to implement and complete their hurricane preparedness plans, prior to the onset of damaging winds and storm surge. Tragically, four people were swept to their deaths off the Causeway¹, at around 2.30 pm on the 5th, most likely due to the storm surge, and only one body was subsequently recovered.

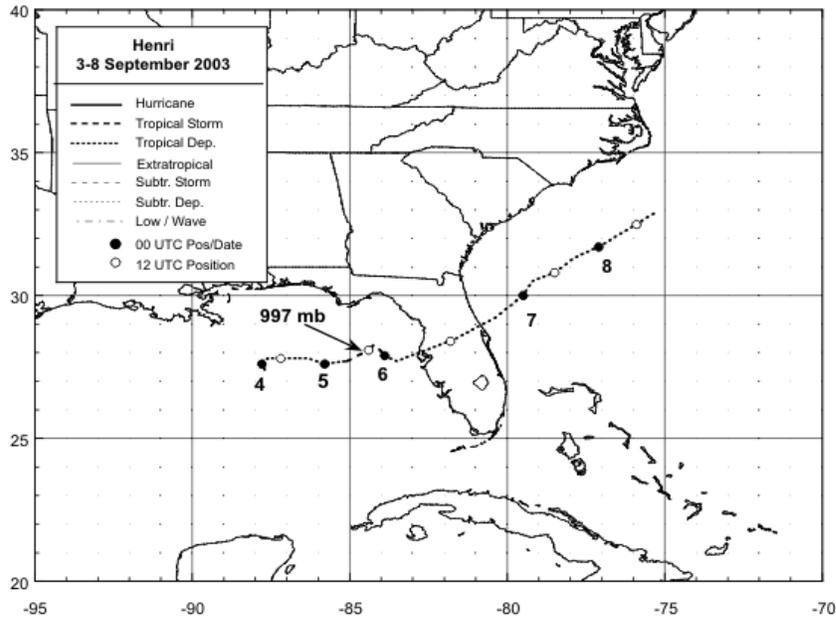
¹ The Causeway connects St George's and St David's Islands with the main Island of Bermuda



Large battering waves in Hamilton Harbour and Fabian's pressure trace from Bermuda Weather Service.

Tropical activity in September continued, with influence from Tropical Storm Henri and Hurricane Isabel. Hurricane Juan sent the ended the month with excitement as it rapidly formed and developed just south of Bermuda.

Tropical Storm Henri



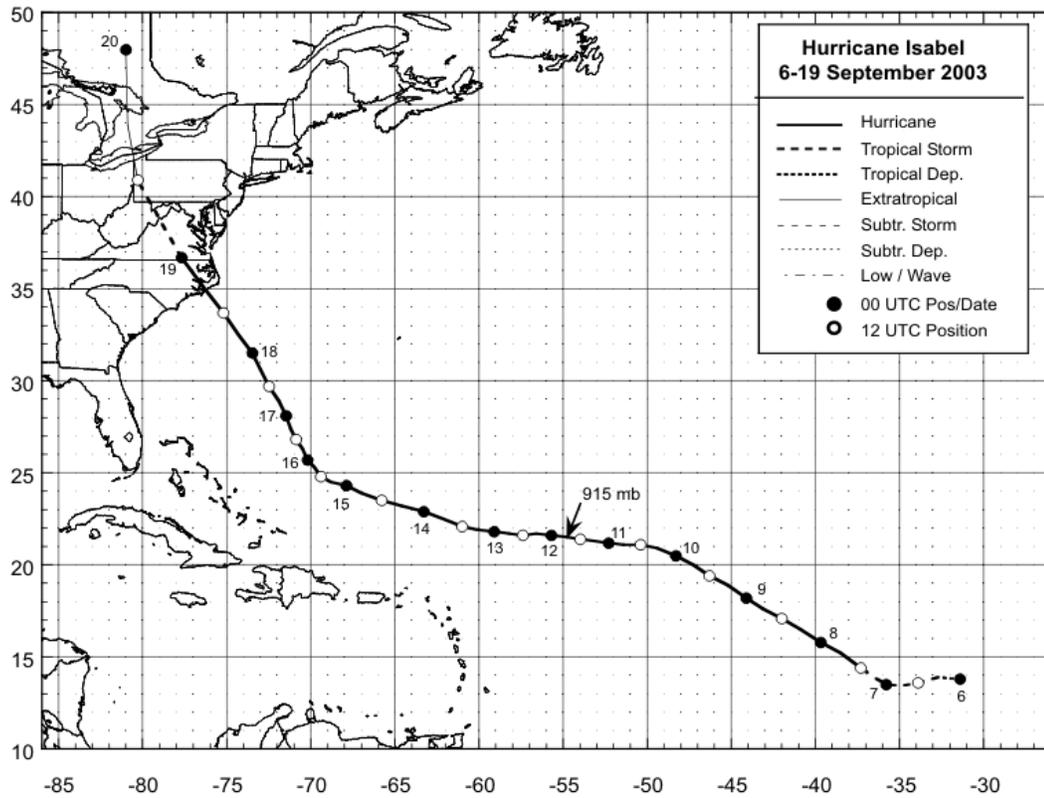
National Hurricane Center Best Track of Tropical Storm Henri

A moist unstable air mass associated with Tropical Storm Henri moved into the area on September 8th, bringing exactly what Bermudians did not need as they began to repair damage after Fabian: torrential rain and thunderstorms. Unstable conditions due to Henri

continued on the 9th. Isolated showers and partly sunny skies continued on the 10th as the remnants of Henri moved north.

Hurricane Isabel

Hurricane Isabel, about 700 miles south of Bermuda was upgraded to a Category 4 hurricane on September 11th. Unstable air brought scattered showers to the island through the day of the 12th, as Isabel was upgraded to a category 5 hurricane. Bermuda began to feel the affects of Isabel on the 13th, with mostly cloudy skies and winds moderate to strong from the east, and a few scattered showers. Isabel began to move to the northwest on the 14th, towards the U.S. coastline. Bermuda experienced strong surf, and strong winds from the east, with mostly cloudy skies and a few brief showers.

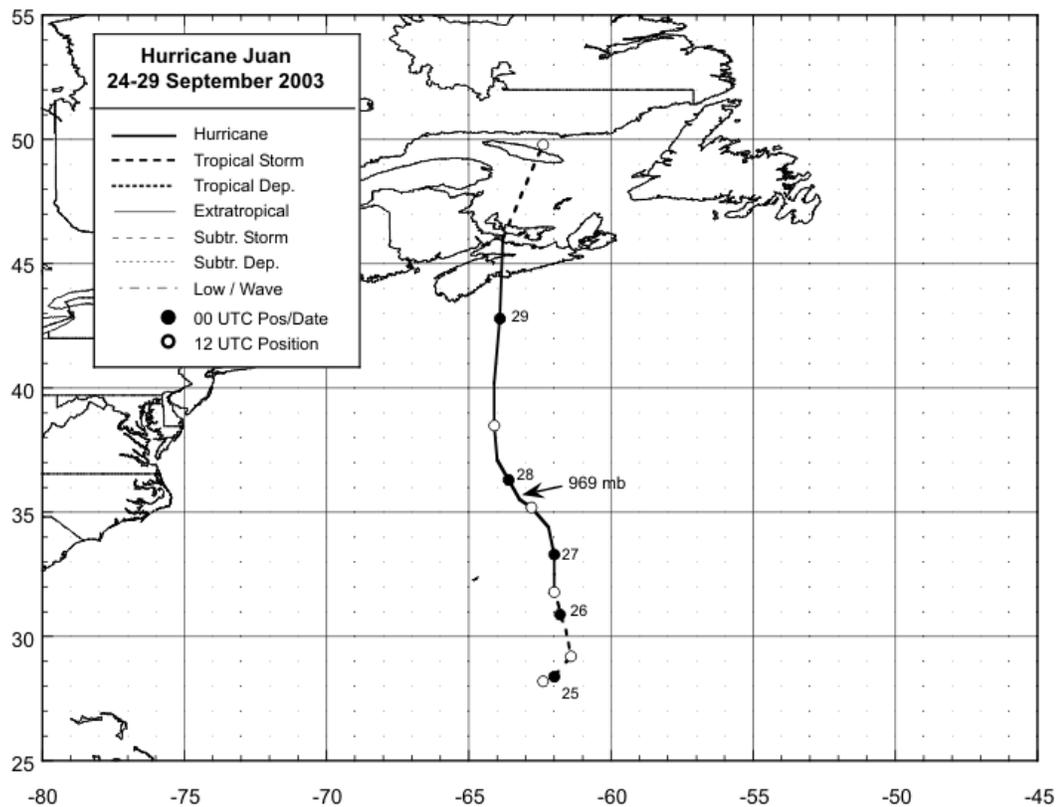


National Hurricane Center Best Track of Hurricane Isabel

Moist air, strong winds and strong surf from Hurricane Isabel continued to affect Bermuda on the 15th with mostly cloudy skies, and a Small Craft Warning was issued. Strong winds from the east and mostly cloudy skies persisted into the 17th. Hurricane Isabel made landfall on the Carolina coastline of the United States causing considerable damage and loss of life on the 18th.

Tropical Storm Juan

An area of low pressure to Bermuda's south developed into a tropical depression on September 25th, and by later in the day Tropical Storm Juan was named. Conditions in Bermuda remained pleasant with mostly sunny skies and winds increasing through the day from light to strong. However, due to the storm's close proximity and rapid development, Bermuda Weather Service issued a tropical storm warning for the 26th, after conferring with the NHC. Tropical Storm Juan was upgraded to a category 1 hurricane on the 26th, and made its way northward, bringing strong winds to Bermuda. However, the winds over Bermuda did not reach tropical storm strength, and by mid afternoon the Tropical Storm Warning was cancelled, even though Hurricane Juan was at its closest point of approach of 125 nm. Juan continued its track to the north on the 27th, still providing Bermuda with strong winds but as high pressure built in mostly sunny skies prevailed. Juan went on to hit Nova Scotia as a category 2 hurricane, and "will be recorded as one of the most damaging tropical cyclones in modern history for Halifax", according to the US National Hurricane Center.



National Hurricane Center Best Track of Hurricane Juan

Appendices

The Saffir-Simpson Scale:

Type	Category	Pressure	Winds		Surge
			<u>mb</u>	<u>kt.</u> <u>mph</u>	
Depression	TD	-----	< 34	< 39	-----
Tropical Storm	TS	-----	34- 63	39- 73	-----
Hurricane	1	> 980	64- 82	74- 95	4- 5
Hurricane	2	965-980	83- 95	96-110	6- 8
Hurricane	3	945-965	96-112	111-130	9-12
Hurricane	4	920-945	113-134	131-155	13-18
Hurricane	5	< 920	> 134	> 155	> 18

NOTE: Pressures are shown in millibars (or hectoPascals) and winds shown are in knots, with equivalent speeds in miles per hour. Typical storm surge values are in feet.

2003 Hurricane Season Names:

Ana, Bill, Claudette, Danny, Erika, Fabian, Grace, Henri, Isabel, Juan, Kate, Larry, Mindy, Nicholas, Odette, Peter