

Hurricanes - General Information for Bermuda

Prepared by the Bermuda Weather Service – updated August 2021

Hurricanes and tropical storms have had an impact on Bermuda from its earliest times. The initial colonization of Bermuda was a direct result of a hurricane in 1609 in which an English ship the "Sea Venture" ran aground. A study of local records from 1609 to the present day, of storm damage through the years indicates a damaging storm once every 6 to 7 years until the 21st century. Since 2000, an uptick in Bermuda-relevant tropical cyclones (TCs) has been noted in the record, and highlighted in the academic literature. The long-term effects of climate change on the variability of Bermuda TCs are an area of active research. However, recent studies indicate that increasing upper ocean temperatures near Bermuda are contributing to increased trends in TC activity locally.

Hurricane season in the Atlantic is June through November, however Bermuda has seen subtropical storm activity as early as April (e.g. 2003 Ana), and has occasionally experienced tropical cyclone activity through November. Bermuda is 54 square kilometres (21 sq. miles) in area, located approximately at 32.3°N 64.7°W. Despite being out of the main TC development region of the tropical Atlantic, as well as being a 'small target', Bermuda has received a number of notable TC impacts in the last 20 years.

The peak months for tropical cyclone activity for Bermuda are September and October, with over 80% of all storms coming within 'threat' range (100nm/185km) of Bermuda occurring during these months. Activity during the rest of the season is much lower than these peak months. In many years Bermuda also experiences stronger and longer duration gales from winter storm systems than from the effects of hurricanes and tropical storms.

It is also important to note that construction methods in Bermuda show a respect for the weather. Bermuda buildings are built of stone blocks with heavy stone roofs designed to withstand damaging winds. This helps explain the fact that there have been few if any fatalities in Bermuda in recent years associated with storm damage to buildings. Seawater inundation from storm surge is also not exacerbated by the local coastal topography; geographically speaking, Bermuda is a single peak rising from the deep ocean bed. Therefore, most of the surge flows past the Island and does not "pile up" as in locations with shelving coastlines.

However, there needs to be an ongoing support of public awareness of, and preparedness for, the potentially devastating effects on Bermuda of a direct hit by a major hurricane (Cat 3 or above). It can take decades for a storm of this intensity to directly affect the Island – the last was Hurricane Nicole on 13 October 2016; prior to that was Hurricane Fabian on 5 September 2003. Damaging Hurricane Emily was only a Category I Hurricane, when it swiftly passed over Bermuda in the early hours of 24 September 1987.

The seasonal conditions likely to produce a greater landfalling hurricane potential in the other regional jurisdictions (e.g. La Niña conditions) are not necessarily well-correlated with significant upticks in Bermuda TC activity, even though the overall Atlantic seasonal activity might be above average.

Seasonal predictions of Atlantic TCs are not necessarily skillful for predicting Bermuda TCs. A major hurricane can affect the Island even during an El Niño year (normally associated with decreased Atlantic Hurricane activity). Indeed, 1987 was such a year, when Hurricane Emily caused an impact in Bermuda, with embedded tornadoes resulting in extensive damage island-wide.

Tropical Cyclones that affected Bermuda since 1609

1609 Jul 24	A powerful, early season hurricane blows the Sea Venture and accompanying colonial relief fleet off course. The ship, severely damaged by the storm, came upon the shores of Bermuda leading to the islands' settling and Bermuda becoming a British colony.
1612 ?	Hurricane strikes the island, a recently built wood-framed church was blown down in this storm.
1615 Sep ?	A hurricane tracked northwards from Puerto Rico sinking 8 ships with lives lost.
1619 Nov ?	Many trees were torn up by their roots and at least one ship, the <i>Warwick</i> , sunk.
1619 Nov ?	A wood-framed watch tower built 7 years prior was destroyed, along with the entire winter crop of corn.
1620 ?	A hurricane destroyed several homes, likely due to the haste in which they were constructed. At least one fisherman out at sea drowned in the storm.
1629 Aug 16	Hurricane struck causing more destruction than any before it so far; destroying several forts, the prison, the rebuilt watch tower from ten years ago, and all the crops were flattened.
1669 Aug 24	A hurricane sank two ships near Bermuda, one French ship off of Ireland Island, and an English one off of Castle island, with at least 5 men drowning.
1712 Sep 8	Hurricane lasted for 8 hours destroying most of the churches around the island. The destruction this storm wrought proved the worth of recent legislation forcing construction in stone rather than wood. This storm likely struck Jamaica and moved out of the Caribbean towards Bermuda.
1713 ?	Two storms passed the island in this year causing vegetation damage that lasted into November.
1715 ?	Another powerful hurricane strikes the island. The wooden churches that withstood the storm of 1712 were destroyed in this storm, including the more sheltered Brackish Pond (Devonshire) Church.
1726 ?	Two hurricanes hit in quick succession causing some structural damage but decimating crops and shipping. Economic hardships following these storms and the subsequent winter gales was enough to request help from Britain. This came in the form of relaxing whaling regulations for the colony.
1728 Aug ?	A hurricane caused damages through the island before the new Governor

arrived in September.

- 1780 Oct ? The legendary 'Great Hurricane of 1780' was the deadliest hurricane in history in the Atlantic. After causing extreme destruction in the Lesser Antilles, this hurricane caused much damage to Bermuda – felling trees, stranding ships on shore, and destroying buildings. A severe famine and small pox outbreak followed this hurricane.
- 1786 Sep ? Much of the island's cotton crops were lost to a hurricane this month, yet little other damage was done.
- 1793 Oct 23 Many ships were driven ashore in St. George's Harbour, and unexpected damage was done on violent westerly winds. Severe damage to vegetable crops and the fish ponds in St. David's, while many buildings suffered roof damage. This was the worst hurricane since 1780.
- 1800 Sep 9-10 A tropical storm or hurricane brought gales to Bermuda with unremarkable impacts. There was some ship damage out at sea.
- 1800 Nov 4-5 A prolonged hurricane brought damaging winds to the islands for hours causing many ships to be blown ashore. The location of a new lighthouse was reconsidered after this storm.
- 1813 Aug 5 Bermuda was crowded with British Naval Vessels due to the ongoing War of 1812 in North America. Many of these ships were driven ashore and some wrecked, one man reportedly died on a ship at Ireland island because of the storm. Meanwhile, much damage was done to property and vegetation. Winds are estimated at 90mph.
- 1814 Oct 15-19 A hurricane brought severe gales for four days, some flooding was reported, but little damage.
- 1815 ? A hurricane separated Tucker's Town Bay by huge sand dunes that reached 120ft in height. The entire coast was altered by this storm that lasted a full 24hours.
- 1818 Aug ? Hurricane causes damage to Hamilton, the new capital that only recently has become developed. The wave action on the harbour deposited a large amount of silt causing doubts about the new capital amongst mariners.
- 1828 Sep 19 A hurricane passes to the northwest of Bermuda, bringing gales. It damaged the horse ferry causing travel interruptions.
- 1832 Jun 6 A severe early season storm came with few natural warning signs. Reports of violent winds, a brief calm and resumed winds from the opposite direction indicate Bermuda was very near the center. Only minor damage was done to shipping and only a few homes received damage. Despite this, many trees were damaged, but only a few were uprooted.

- 1839 Sep 11-12 One of the few well documented early storms in Bermuda's History, this hurricane, Reid's Hurricane (named after the Governor who duly documented its fury), moved northwards across Bermuda. It left many homes roofless and many uprooted trees. Storm surges were estimated at 11ft carrying boats to that height above normal high tide. Again a lull in winds and a wind shift followed by a resumption of hurricane force winds indicate this storm passed very near the island. The most violent and destructive storm since 1780.
- 1841 Oct 21 A hurricane strikes, severely damaging the more delicate crops just before harvest with salt spray. Only a few homes were damaged by the storm. Similarly, only several ships washed ashore.
- 1843 Aug 18 A likely small Hurricane passes nearby only bringing gales to the island. Talks of weather forecasts starting up around this time.
- 1845 Oct 27 A storm passes to the east of Bermuda bringing full gales to the island.
- 1846 Sep 17-18 Squally weather and elevated surf as a hurricane skirts to the south and recurves to the west of Bermuda. This is the first hurricane that Gibb's Hill Lighthouse was operational for.
- 1848 Oct 15 A violent hurricane recurves very near Bermuda bringing hurricane force winds from all directions. A storm surge is estimated to be between 3 and 4ft, flooding low lying areas around Hamilton and Flatt's. Several homes on the main island report roof damage.
- 1853 Sep 6-8 The outer fringes of a hurricane brush Bermuda. This hurricane damaged or sank many ships along its path out at sea.
- 1853 Sep 26-27 A category one hurricane passes 112 nautical miles to the east-northeast of Bermuda bringing storm force northeasterly winds for a time.
- 1854 Oct 21 A strong tropical storm passes 21 nautical miles east producing near hurricane force north and northeasterly winds. Several extreme gusts, possibly due to tornadoes impacted Boaz island and eastern Paget.
- 1858 Oct 24 A category two hurricane passes 19 nautical miles west-northwest of Bermuda bringing hurricane force winds that damaged many roofs and several church adornments. Storm surge rose to an estimated 3-4ft, aiding in damaging several ships. Fruit trees and many other agricultural invests were heavily damaged if not entirely lost.
- 1866 Oct 4 A hurricane passes 290 nautical miles northwest bringing 60kt winds with gusts over hurricane force. Structural damage was done to the higher floors of several buildings in Hamilton, in addition to moderate maritime and agricultural damage.

- 1870 Sep 10 A category three hurricane passes 82 nautical miles west bringing 60kt winds causing severe agricultural damage, particularly to banana crops.
- 1873 Aug 21-22 A category two hurricane passes at 198 nautical miles west. A ship that barely made it through the storm came into Bermuda, reportedly losing 19 men.
- 1874 Sep 5-6 A category one hurricane passes 46 nautical miles west. Large swells and gusty winds produced a crop-damaging salt spray.
- 1878 Aug 27-28 The center of a hurricane passed 78 nautical miles to the north-northwest of Bermuda bringing hurricane force winds. Floating Docks at Dockyard were very heavily damaged after being installed a few years ago and in the process of repairs this summer.
- 1880 Aug 29-30 A category one hurricane passes 33 nautical miles east-northeast bringing hurricane conditions as severe as that of 1839. A ship in Bermuda reported 70kt winds with a minimum pressure of 977mb. This storm likely did more damage because the island had become considerably more developed since then. St. David's lighthouse became operational the year before, and the causeway (opened in 1871), was damaged and traffic volume reduced.
- 1883 Nov 28-30 A possible hurricane passes 50 miles to the northeast bringing a prolonged period of near hurricane force winds, damaging crops.
- 1891 Sep 21-22 A category two hurricane passes to the east of the island bringing near tropical storm conditions and pressures falling as low as 980mb. Seas related to the hurricane wrecked a ship along Bermuda's shores.
- 1891 Oct 4 A category two hurricane passes 70 nautical miles west-northwest of Bermuda. Little to no damage was done in the storm. A minimum pressure of 981mb was observed in Bermuda.
- 1891 Oct 17-18 A category one hurricane passes 54 nautical miles west-southwest of Bermuda producing storm tides that caused severe damage to the causeway, up to £1000. 60kt winds and a minimum pressure of 992mb were observed in Bermuda.
- 1892 Aug 19-20 A category one hurricane passed 181 nautical miles to the west-northwest with Bermuda feeling its outer fringes. Winds were sustained at near gale force with much higher gusts causing some agricultural damage.
- 1892 Oct 15 A category one hurricane passed 80 nautical miles east with violent, near hurricane force winds recorded at Gibb's Hill lighthouse – reportedly 63kts.

- 1894 Oct 26 A category two hurricane quickly passes 51 nautical miles to the northwest bringing hurricane force winds up to 70kts for a brief period of time. Large old trees were felled as well as telephone poles. Significant agricultural damage was observed to the young crops
- 1895 Oct 24 Direct hit from a category two hurricane that passed to the near east of the island. 61kt sustained winds with gusts as high as 105kts were reported. Pressure fell as low as 988mb. Telephone poles snapped, large trees uprooted, along with some damage to public buildings.
- 1899 Sep 4-5 A category two hurricane weakened as it passed 19 nautical miles to our west-northwest causing “considerable damage”. 70kt winds were observed in Bermuda.
- 1899 Sep 12-13 A powerful category three hurricane with 100-105kt winds passed within 10 nautical miles of the island. Added to previous week’s damaging storm by demolishing the Causeway with a storm surge. Extensive damage was recorded at Dockyard and Ft. Prospect with cost in excess of £10,000. A minimum pressure of 939mb was observed in Bermuda.
- 1900 Sep 17 Near miss – a weakening category two hurricane passes 66 nautical miles east of Bermuda. Winds reached hurricane force.
- 1903 Sep 28 A category two hurricane passes 28 nautical miles east-southeast of Bermuda, hurricane force winds for a short period resulting in “a great amount of damage”. Two men were killed; one drowned and another crushed when a wall collapsed. A minimum pressure of 988mb was recorded in Hamilton.
- 1906 Sept 9 The US begins sending tropical cyclone warnings to Bermuda this year. Near miss – a category three hurricane passes 50 nautical miles north-northwest of Bermuda. Winds just reached hurricane force for a short while. One man drowned when he was blown off a bridge by a gust of wind, another when his sailboat capsized in a squall. Winds measured at 61kts with a minimum pressure of 979mb reported in Bermuda.
- 1910 Sep 25 Hurricane brushes by, passing 54 nautical miles east-southeast – causing some damage in St. Georges during a squall and possible tornado.
- 1914 Oct 27 Storm loses identity near Bermuda – gales, but little damage.
- 1915 Sep 3-9 A category three hurricane meanders within 25 nautical miles of Bermuda - brings heavy rain and 83kt winds. Lack of warning and preparation led to minor damages. The storm lingered in the area producing violent squalls and extreme seas leading to a shipwreck near Elbow Bay during which the captain drowned. A large amount of migratory birds took refuge on the island during the storm. Pressure reportedly fell as low as 984mb.

- 1916 Sep 23 A category three hurricane passes 89 nautical miles west-northwest and brings 70kt winds – severe damage especially to vegetation and roofing. Although not as powerful, it did more damage in Bermuda than the storm of 1899. Many small boats were sunk or run aground in Hamilton Harbour.
- 1917 Sep 4 A category three hurricane passes 102 nautical miles to the east with unprecedented tides and extreme swells that flooded the town of St. George's in advance of the storm's worst winds.
- 1918 Sep 4-5 A category two hurricane passes 43 nautical miles southwest – ships ran aground due to significant coastal flooding. Severe vegetation damage. Pressure fell to 972mb.
- 1921 Sep 15 A category three hurricane passed 20 nautical miles west. Winds of 87kts reported at Prospect hill, 105kt wind gusts also reported. Pressure fell to 980mb. Considerable damage to vegetation and utilities.
- 1922 Sep 21 A category three hurricane makes a direct hit on Bermuda bringing sustained winds over 100kts and an estimated 8 foot storm surge – causing widespread damage, especially to vegetation and along the coast. It was Bermuda's highest tide since the hurricane of 1899. A lull and wind shift was reported with the passing of this storm. Minimum pressure of 965mb also observed at Fort Prospect. One person drowned when he fell overboard during the storm. It caused more than £50,000 in damages.
- 1923 Sep 30 A category three hurricane passes to 160 nautical miles northwest – winds up to 54kts with gusts to 78kts at Fort Prospect. Pressure also fell to 988mb there.
- 1926 Aug 6 A small category two hurricane passes 66 nautical miles to the west bringing 47kt winds and a minimum pressure of 1000mb.
- 1926 Oct 22 A category three hurricane makes a direct hit with an hour long lull in winds and a minimum pressure of 962mb. 99kt sustained winds reported at Fort Prospect with gusts of 111kts reported in Hamilton. Significant damage particularly to roofing and vegetation. Two ships, the '*Valerian*', and the '*Eastway*' sunk nearby with few survivors and up to 88 fatalities. The sinking of the '*Valerian*' led, indirectly, to the setting up of a local Meteorological Station.
- 1932 Nov 12 A weakening category two hurricane passes 46 nautical miles to the east bringing wind gusts of 76kts to the island. Pressure fell to 972mb in St. Georges.
- 1939 Oct 16 A category four hurricane passes 36 nautical miles east – winds up to 87kts with gusts to 114kts. Heavy rains totaling 7.35". Considerable damage to homes, vegetation, and ships.

1947 Oct 20 A category three hurricane passes 56 nautical miles to northwest – winds to 87kts with gusts to 110kts. Pressure fell to 990mb as the storm passed. A BELCO worker died falling from a pole during repairs.

1948 Sep 13 A category three hurricane passes 56 nautical miles to west. Winds peaked in Bermuda at 87kts with gusts to 97kts. Pressure fell to 990mb. Around 4.85” of rain were reported. Telephones and power cut, with the Causeway blocked for a time.

1948 Oct 7 Direct hit by a category two hurricane. After a brief lull, winds over 85kts with gusts to 95kts. Pressure fell to 972mb in Bermuda. Significant roof and utilities damage occurred along north shore.

1949 Sep 8 A category three hurricane passes 58 nautical miles to southeast bringing 55kt winds with hurricane force gusts. Pressure fell to 990mb.

1950 Sep 8 Hurricane Dog passes 168 nautical miles to southwest as a category three hurricane bringing 40kt tropical storm force winds.

1950 Oct 2 Hurricane George passes 92 nautical miles to the south-southwest as a category one hurricane, brings 40kt tropical storm force winds with higher gusts.

1952 Sep 27 Hurricane Charlie passes 155 nautical miles north-northwest as a category three and brings brief period of tropical storm conditions.

1953 Sep 5 A weakening category three, Hurricane Carol passes 175 nautical miles west giving Bermuda 45-50kt winds.

1953 Sep 12 Tropical Storm Dolly passes within 45 nautical miles of Bermuda, weakening from hurricane strength, producing over 2.00” of rain.

1953 Sep 17 Hurricane Edna passes within 45 nautical miles with 75kt winds and a 110kt wind gust, torrential rain and much damage to roofs – but only three people were injured. Edna was a weakening category three hurricane.

1958 Sep 28 Ilsa passes by 200 nautical miles off as a category two hurricane – only 25kt winds but heavy pounding surf.

1961 Oct 6-7 Category three Hurricane Frances veers away from the island – little wind but heavy pounding surf and 1.35” of rain.

1962 Oct 6 Category two Hurricane Daisy misses Bermuda by 105 nautical miles – winds up to 57kts and heavy surf.

1963 Aug 9 Strengthening category one Hurricane Arlene is a direct hit – winds over

78kts, and 6.05" of rain resulting in much damage to vegetation due to few powerful storms for a decade and reforestation efforts after Cedar blight. Over £100,000 in damage was reported.

- 1964 Sep 13 Hurricane Ethel passes 85 nautical miles northwest as a category two. 45kt winds and gusts near hurricane force along with 4.05" of rain were reported in Bermuda.
- 1966 Aug 31 The fringe of category two Hurricane Faith brings heavy rain and winds up to 50kts.
- 1970 Oct 16 Small unnamed hurricane passes 20 nautical miles northwest of Bermuda as category one. It brought gales that resulted in interruptions to businesses.
- 1973 July 3-4 Category one Hurricane Alice came within 20 nautical miles of Bermuda. 64kt winds and gusts near 76kts reported with heavy rains up to 4.57", ending a 3 month drought.
- 1975 Sep 26 Hurricane Faye approaches to within 35 nautical miles as a category two, then veers away. Winds reached 40kts with gusts to 60kts and 2.80" of rain were reported.
- 1977 Sep 27 Hurricane Dorothy passes 50 nautical miles southeast as a tropical storm with heavy rain totaling 3.74".
- 1981 Sep 2-3 Hurricane Emily passes over as a tropical storm only producing 30kt winds, but dumping very heavy rain totaling 4.92".
- 1981 Sep 8 Hurricane Floyd misses by 35 nautical miles as a strengthening tropical storm/category one hurricane with minor impacts.
- 1982 Sep 15 Hurricane Debby passes about 70 nautical miles west of island as a category two. Gusts reached 60kts causing minor damage.
- 1987 Aug 13 Tropical Storm Arlene passes to the west bringing strong winds with gusts near 50mph and 1.65" of rain.
- 1987 Sep 25 Hurricane Emily moves unexpectedly swiftly across Bermuda as a category one. This small but vicious storm spawned several damaging tornadoes that caused widespread injuries and damage before Emily made landfall. Sustained winds reached 75kts with gusts to 101kts at Kindley Field where 2.65" of rain was observed. \$35million of damage was reported.
- 1989 Aug 6 Hurricane Dean passes by at 20 nautical miles as a category two putting Bermuda in the eastern eyewall. 70kt winds with gusts to 98kts were reported at Kindley Field resulting in \$8.9million of damage to Bermuda and the base. 3-5" of rainfall fell.

- 1991 Oct 27-29 Category one Hurricane Grace makes an erratic path forming very near the island producing massive seas. Peak sustained winds were near 36kts with a gust to 53kts just before the storm's closest approach at 50 nautical miles south of the island. This storm produced 3.21" of rain.
- 1995 Aug 14 Hurricane Felix passes by at just over 45 nautical miles as a category one. Peak sustained winds reach 55kts with gusts to 70kts. Three days of pounding surf causes extensive erosion along south shore including some damage to the Causeway. Damage estimated at \$2.5million in Bermuda.
- 1996 Oct 20 Lily brushes by 120 nautical miles to the southeast as a category two, some rain but winds only gust to 42kts.
- 1997 Oct 8-9 Category three Hurricane Erika breaks a quiet streak in the Atlantic and heads towards Bermuda before turning away over 260 nautical miles to the southeast. Sending only large ocean swells to Bermuda.
- 1998 Sep 2-3 Hurricane Danielle passes 175 nautical miles to the northwest of Bermuda as a category one, producing showers/thunderstorms and wind gusts to 40kts.
- 1998 Sep 21-22 A disturbance brings heavy rain and thunderstorms with wind gusts to 38kts. It develops into Hurricane Karl just to the east of Bermuda on the 23rd.
- 1998 Nov 6 Hurricane Mitch, "The Deadliest Atlantic Hurricane since 1780", did most of its damage far from Bermuda. The storm's remnants passed north of Bermuda giving showers, blowing spray, sustained winds of 42kts and gusts to 60kts.
- 1999 Sep 21 Hurricane Gert passed about 105 nautical miles east of Bermuda on the 21st as a category two. Sustained winds of 30-35kts with gusts of 60-65kts occurred for a while as Gert moved past. Higher winds were reported at Harbour Radio. Heavy pounding surf and high seas damaged south and east beaches.
- 2000 Sep 16 Category one Hurricane Florence missed Bermuda by about 60 nautical miles. Tropical storm conditions occurred with maximum sustained winds at 38kts and gusts to 50kts at the airport. Harbour Radio recorded 43kt winds with gusts to 56kts. Winds in the west end may have been stronger as they were closer to the center of the storm.
- 2001 Sep 9 Category three Hurricane Erin brushed by 90 nautical miles to the east of Bermuda. Only tropical storm force winds reached Bermuda with little damage, mainly in the form of coastal erosion from large battering waves.
- 2001 Oct 11 Sub-tropical Storm One forms over Bermuda and transitions to Tropical

- Storm Karen. Winds 60-65kts were observed with gusts between 78 and 85kts, a ship reported a gust to 103kts in the west end where the storm's center was closer. This system surprised many, quickly forming from an ordinary frontal low pressure system. Considerable damage to vegetation and ships were reported along with 22,000 customers losing power.
- 2001 Nov 7 Hurricane Michelle approached the island but fizzled. Winds barely reached tropical storm force though the Cable and Wireless tower anemometer (175ft asl) recorded a short period with 53kt winds and gusts to 58kts. Little damage was reported.
- 2002 Sep 30 Hurricane Kyle meanders slowly westward over the central Atlantic for 22 days. It came within 100 nautical miles of the island during its journey, yet had little impacts.
- 2003 Apr 18-21 Sub-tropical Storm Ana brought an early start to the Hurricane Season, skirting to the west of Bermuda bringing showers and strong winds for Good Friday. It then looped around and passed close to the south on the 21st as a tropical storm with further rain and strong winds.
- 2003 Sep 5 Cat 3 Major Hurricane Fabian skirts just to the west of Bermuda putting the entire island in the eyewall for several hours. Sustained winds of 100-105kts with gusts around 130kts led to a storm surge likely over 8ft that caused coastal inundation along with large battering waves. Widespread property and vegetation damage came with 25,000 customers losing power. 4 deaths were reported in Bermuda as the Causeway was compromised by the storm surge. Harbour Radio reported a gust to 143kts before their anemometer failed. Fabian resulted in \$300million in damage. As one of the strongest, costliest, and the only storm to cause fatalities in Bermuda since the satellite era, the name 'Fabian' was retired and the name was replaced with 'Fred' for future hurricane seasons. See more information here:
http://www.weather.bm/TropicalArchive/fabian/fabian_home.html
- 2003 Sep 26 Tropical Storm Juan strengthens to a Hurricane as it passed 125 nautical miles to the east of Bermuda. Winds neared tropical storm force for a time.
- 2004 Oct 9-10 An extratropical storm produced gales and heavy rain for Bermuda before transitioning to Sub-tropical Storm Nicole. Gusts reached 52kts as the low passed 50 nautical miles to the northwest of the island.
- 2005 Aug 3-4 Tropical Storm Harvey brought heavy showers and thunderstorms to the island with maximum winds reaching 33kts and gusts to 44kts. In exposed locations sustained winds reached 40kts. Rainfall totaled 4.88" as Harvey passed 20 nautical miles to the south.
- 2005 Sep 8-9 Hurricane Nate threatens as a category one, prompting watches and

warnings. It passes 105 nautical miles to the south-southeast and gusts reach 41kts in widespread shower activity. This is one of the first storms to be observed by Bermuda's new Doppler Weather radar and island wide AWOS stations.

2005 Oct 25

After moving through the Caribbean sea and Gulf of Mexico as a major hurricane, Wilma sped northeast from its landfall over Florida, under the influence of an upper mid-latitude trough. Hurricane Wilma passes 315 nautical miles west of Bermuda, yet still brought tropical storm force winds and showers. The hurricane was transitioning into an extratropical storm so gale warnings were issued for Bermuda. Because the storm was moving so quickly past Bermuda, gales only lasted a brief period. Wilma is notable for disrupting the flight patterns of many birds. Most notable of these was the frigatebird, which is a rare visitor to Bermuda, and was sighted around the island in abundance for weeks after Wilma passed to the west.

2006 Sep 10-11

Hurricane Florence moved within 50 nautical miles of Bermuda as a Category one storm. A brief, weak tornado was reported in associated with an outer rain band, causing some structural damage in Southampton. Winds reached 59kts with gusts to 78kts at the airport, while they peaked at 71kts with gusts to 91kts at the St. David's Lighthouse AWOS. Very little boat damage was reported. Power outages affected up to 25,000 customers, but around half of that was restored in 24hours. The storm caused some erosion to the foundation of the Causeway, reducing traffic to one lane for repairs. Around \$200,000 in damage was reported.

2007 Nov 2

Category one Hurricane Noel moved northwards out of the Bahamas bringing southeasterly gales to the island as it began its extratropical transition. Southeasterly winds peaked at 30kts while gusts reached 46kts at the airport. Winds of 34kts gusting to 48kts were recorded at the St. David's Lighthouse AWOS.

2008 July 12-14

Hurricane Bertha slows on approach to the distant southeast producing large swells by the 9th of July. The hurricane then became nearly stationary, weakening to a tropical storm, and a far removed rain band produced some rain on the 12th. Occasional showers continued on the 13th as the storm resumed its motion towards Bermuda. Bertha passed about 40 nautical miles to the east of the island during the afternoon of the 14th lashing Bermuda with tropical storm force northerly winds and heavy rain. Eastern parts of the island were in an 'eye-like' region of this sprawling storm with light winds for a time. Bertha then moved more quickly off to the northeast re-strengthening to a hurricane once well away from the island. Winds at the airport peaked at 43kts while gusts reach 59kts. The Commissioner's Point AWOS recorded sustained winds at 54kts with gust to 79kts; similar winds were observed at Bermuda Maritime Operations. Bertha's rainfall totaled 5.41" over these three days with 4.63" falling on the 14th. There were some reports of flooding and

power outages associated with the passage of Bertha. See more products related to Bertha here:

<http://www.weather.bm/TropicalArchive/Bertha2008/Bertha2008.asp>

- 2008 Sep 27-28 Tropical Storm Kyle tracked northwards out of the Caribbean bringing gusts to tropical storm force to the airport along with some heavy showers. The airport saw winds reach 29kts with gusts to 39kts while winds peaked at 39kts with gusts reaching 50kts at the Commissioner's Point AWOS as the storm passed about 250 nautical miles to the west. A total of 1.53" of rain were also reported at the airport for these two days.
- 2009 Aug 21 Hurricane Bill passes 166 nautical miles to the west of Bermuda as a category two, bringing heavy and squally thunderstorms, tropical storm force winds and massive swells. The airport recorded sustained winds of 40kts with gusts to 52kts. The Commissioner's Point AWOS recorded peak sustained winds of 53kts with gusts reaching 85kts. 0.55" of rain were recorded at the airport.
- 2010 Aug 7 Tropical Storm Colin approaches from the south prompting tropical storm watches. The storm slowed and fizzled on approach bringing a few showers that allowed wind gusts to 32kts at the airport and 40kts at the Commissioner's Point AWOS.
- 2010 Aug 28 Hurricane Danielle passes to the distant east providing very high surf and enhancing northerly winds behind a weak front. Northerly winds gusted to 34kts at the airport, and a light shower brought only 0.01" of rain. Very low relative humidity filtered in as Danielle moved away.
- 2010 Sep 4 Weakening Tropical Storm Fiona becomes post-tropical to the south of Bermuda. Winds only gusted to 20kts and 0.21" of rain were reported at the airport with the passage of the remnant low of Fiona.
- 2010 Sep 18-21 Large Hurricane Igor weakens to a category 1 storm on approach bringing more than a day of tropical storm force winds, large battering waves, and heavy rain with embedded squally showers. Sustained winds reached 59kts, gusting to 81kts at the airport, with 2.87" of rain. Peak winds reached 79kts with gusts to 102kts at the St. David's Lighthouse AWOS as the storm passed 40 nautical miles to the west of Bermuda. Despite being 'only' a category 1, Hurricane Igor produced a storm tide that caused localized coastal flooding in areas of onshore winds, particularly in parts of Great Sound and St. George's Harbour. Around 28,000 customers lost power during the storm and several boats ran aground, there were only a few reports of structural damage. About \$500,000 in damage was reported.
- 2010 Oct 29 Small Hurricane Shary passed around 75 nautical miles to the southeast, but its small size and track kept any adverse weather associated with the hurricane away from the island. Only some showers were reported but

they were likely due to an approaching cold front that helped steer the storm away.

- 2011 Aug 28 Weak Tropical Storm Jose forms to the southeast of Bermuda and quickly passed about 60 nautical miles to the west. It only produced 0.01" of rain at the airport where winds reached 32kts with gusts to 40kts. Peak sustained winds reached 40kts with gusts to 53kts at the Commissioner's Point AWOS, a little closer to the small storm.
- 2011 Sep 8 Hurricane Katia passes to the distant southwest producing generous swells. A few light showers accompanied the outer bands of this hurricane.
- 2011 Sep 15 Tropical Storm Maria passed about 100 nautical miles to the west of Bermuda bringing a brief period of tropical storm force winds to the island. The airport reported 34kt winds with peak gusts to 45kts in a squall that crossed the island. Peak winds reached 45kts with gusts to 60kts at the Commissioner's Point AWOS. Only about 0.23" of rain were recorded in association with this storm.
- 2011 Oct 1 Category 4 Hurricane Ophelia passes about 120 nm to the east of Bermuda, but its small size kept any weather impacts limited to a few gusty showers. However, some significant swells and surf was observed. Winds reached 30kts and precipitation totaled 0.38" in association with this hurricane.
- 2011 Nov 11 Once a nearby gale system, Sub-tropical Storm Sean transitioned to a Tropical Storm then passed to the north of Bermuda bringing tropical storm force winds to the island. The airport recorded peak sustained winds of 37kts gusting to 49kts and 0.11" of rain. Sustained winds peaked at 42kts with gusts to 59kts at the Commissioner's Point AWOS.
- 2012 June 17 A tropical disturbance quickly become more active on a mesoscale level as it crossed the island from the south-southwest. It brought a fairly unexpected but short lived bout of gales with storm force gusts. The airport reported peak sustained winds of 40kts and gusts to 56kts with 0.49" of rain. Sustained winds at 48kts gusting to 68kts were recorded at the St. David's Lighthouse AWOS. This disturbance went on to become Hurricane Chris in the far North Atlantic.
- 2012 June 29 Tropical Storm Debby becomes post-tropical and passes to the near north. It brought some light showers with near gale force winds, warranting a small craft warning. Sustained winds reached 31kts with gusts to 37kts at the airport. Gusts reached 48kts at the Commissioner's Point AWOS.
- 2012 Sep 9 Hurricane Leslie slows down to a crawl on the 4th and 5th and weakens to a tropical storm, not before churning up large swells. The now tropical storm passed 115 nautical miles to the east of the island bringing tropical

storm force winds and very heavy rains to the island on the 9th. This sprawling storm brought sustained winds that peaked at 35kts with gusts to 48kts at the airport, and 5.17" of rainfall. The Commissioner's Point AWOS recorded sustained winds at near 50kts with gusts to 63kts, almost hurricane force. Only minor interruptions to electricity were reported.

2012 Oct 16-17

Category one Hurricane Rafael passes about 100 nautical miles to the east-southeast of Bermuda bringing a brief period of heavy rain and some gusts over tropical storm force. Sustained winds reached 31kts with gusts to 45kts at the airport, along with 2.11" of rain. Elsewhere, sustained winds reached 44kts with gusts to 57kts at the Commissioner's Point AWOS.

2012 Oct 27-29

Massive Hurricane Sandy spread strong to tropical storm force winds from the United States East coast to Bermuda. Gusty showers brushed the island for days as the storm passed hundreds of miles to the west. A brief tornado was reported in Somerset causing minor structural damage in the Mangrove Bay area, and it was rated an F0 by the Bermuda Weather Service. Sustained winds peaked at 32kts with gusts to 50kts at the airport. Three day rainfall totals of 0.98" were reported there. Peak gusts reached 56kts at the St. David's Lighthouse AWOS.

2013 Sep 10-11

Tropical Storm Gabrielle redevelops to the near south of Bermuda and passed 20nm to the west of Hamilton, Bermuda overnight on the 10-11th. Gabrielle brought tropical storm conditions to Bermuda with sustained winds peaking at 39kts and a peak gust of 49kts at the airport and 1.43" of rain. A peak gust of 65kts was reported at Harbour Radio. These conditions led to mainly vegetative damages, but a dock and boat were reportedly damaged during the storm in Dockyard.

2014 Aug 25-28

Hurricane Cristobal passed around 245nm to the northwest as a category one resulting in enhanced surf along the south shore beaches. Cristobal's approach warranted a Tropical Storm Watch and winds reached 30kts with gusts to 39kts at the airport, while elsewhere on island, peak gusts to 50kts were measured at Commissioner's Point. Tropical storm conditions might have occurred in the western marine area.

2014 Sep 15-17

Passing roughly 363nm to the east-southeast of Bermuda as a category three hurricane, Edouard's impacts were limited mainly to elevated surf and swells around 9-10ft. A small craft warning was issued for the high sea state. Hurricane Hunter aircraft staged numerous research missions into Edouard using Bermuda as a launch base.

2014 Oct 11-12

Hurricane Fay made landfall in Bermuda at 5:10am 12 October as a category one hurricane, the first landfall since Emily in 1987. Sudden violent northwesterly winds struck around 7:30am as Fay moved away. Winds peaked at 53kts with gusts to 71kts at the airport. Commissioner's Point saw the highest winds around the island peaking at 75kts with a

peak gust of 105kts. Widespread tree damage and utility disruption in addition to scattered structural damage (mainly to roofing) resulted from these winds. Damage estimates for Fay were at \$3.8million as of December 2014.

2014 Oct 17-18

Less than a week after Fay's landfall, Hurricane Gonzalo made a late night landfall on Bermuda as a borderline category two/three hurricane. Gonzalo is the most significant hurricane impact to Bermuda since Fabian in September 2003. Seas as high as 44ft were analyzed in/near the marine area outside the reefs before Gonzalo's landfall. Storm surge impacts were minimal as Gonzalo made landfall at low tide around 9:30pm, and the Hurricane's winds largely paralleled the island. Easterly winds and heavy rain ahead of the eye calmed for over half an hour as the eye passed overhead. Winds resumed and sustained winds peaked at 81kts with a peak gust to 98kts on the Causeway. Island wide, sustained winds peaked at 95kts at Commissioner's Point, and the highest gust of 125kts was measured at St. David's lighthouse. These violent winds resulted in additional widespread tree, utility, and structural damage that hampered recovery from Hurricane Fay. Gonzalo also caused much more marine damage than Fay. No fatalities were reported, but an estimated \$200-400million was done in property damage.

2015 Oct 4-5

Hurricane Joaquin was the only tropical cyclone to directly affect Bermuda during the 2015 season, passing 59nm to the west-northwest on the evening of the 4th as a strong Category 2 hurricane. The system proved to be a difficult forecast early in its lifetime as it meandered northeast of the Bahamas. Early model consensus showed a U.S. landfall with the one outlier being the ECMWF, which eventually verified with the passage near to our west. Winds on the airfield peaked at 49 knots gusting 63 knots, with winds in the northern marine area reaching 55 knots gusting 69 knots on the Crescent sensor. The very exposed and elevated site of RCC Bermuda Radio at nearly 300ft recorded gusts as high as 100 knots. Tropical storm force winds were sustained for just over 24 hours. The island only suffered minimal damage and any threat from storm surge was minimized by the timing of low tide occurring in tandem with the closest point of approach.

2016 Sept 23-24

Tropical Storm Karl passed about 44 nm to southeast about 6am on the 24th. The forecast track remained very consistent, however the intensity forecast remained uncertain and both a tropical storm warning was valid along with a Hurricane Watch as Karl passed. Peak winds at the airport were recorded as 30kts with gusts to 41kts about 8-9am on the 24th; after Karl had passed. Elsewhere MAROPS recorded 38kts with a gust to 59kts and the Heliport recorded 38 knots with a gust to 50kts during the same time period. Storm surge was minimal at an estimated 1ft around the Island while very rough southeasterly swells, up to 18ft, affected the marine area. Karl was also accompanied by extensive rainfall that caused many problems around the Island due to localized flooding. The recorded

4.71" ensured that this was wettest September on record.

2016 Oct 12-13

Hurricane Nicole reached a peak intensity of 120kts about 120nm southwest of Bermuda after a period of rapid intensification. Nicole then rapidly weakened; classified as a weak category 3, and direct wind impacts were recorded up to a category 2 on Bermuda. The center of Nicole remained just to the east of the Island. The model agreement was generally very good on the track several days out; however the intensity forecast was very poor with initial forecasts indicating category 1 or 2. Rough swells impacted the marine area for several days ahead of landfall and both the local wave model and the NOAA OPC Wind/Wave Analysis had seas to 35ft as Nicole passed. The Esso Pier Tide Gauge recorded a storm surge of 4ft which was mitigated by the fact that it was low tide when Nicole passed. Localized flooding occurred as Nicole brought about 7 inches of rain along with isolated thunderstorms. The eye passed directly over the Island at noon on the 13th and it took about 1 to 1.5 hours for the eye to cross the entire Island. The strongest winds recorded at the airport were 72kts with gust up to 91kts. The Heliport recorded 61kts sustained with gusts up to 89kts and Commissioner's Point Windguru station recorded a peak of 87kts with a gust up to 118kts. Damage was not widespread across the Island, however there were multiple downed trees and powerlines as well as structural damage to houses and boats. No casualties were reported and the damage was estimated at \$15 million.

2019 Sep 18-19

Bermuda's main impact during the 2019 season was category 3 Hurricane Humberto. The track of Humberto was very well forecast with a close passage (~55nm/100km) towards Bermuda's northwest. However, the intensity forecast was somewhat more challenging, due to unusual intensification at such a northerly latitude (mid-latitude influences) and an expanding wind field of hurricane force winds. Nevertheless, tropical watches and warnings were issued in a timely manner, with a Tropical Storm Warning (initially only expected TS winds) issued at 9am on Tuesday 17th September, further upgraded to a Hurricane Warning at 6pm that same day once it became increasingly apparent from the NHC hurricane specialist that Bermuda would experience hurricane force winds for a time during the evening of Wednesday 18th September. Multiple agency/stakeholder briefings took place in advance of the impact, including the local Emergency Measures Organisation (EMO). There was also a press conference, as well as notification on a new Government cell phone app (Tree Frog) for public interests. Suitable preparations were rushed to completion in advance of Humberto, including shutting down schools and businesses at midday on Wednesday 18th September, ensuring everyone was home safe well in advance of the height of the hurricane. Bermuda's main shipping dock was shut down, cruise ship visits were cancelled or rerouted and the airport was also shut down along with the Causeway, a main road artery to the airport. The Island's only official storm shelter was also opened for those most vulnerable, whilst the

Emergency Broadcast Radio (EBR) station 100.1FM was initiated to keep the public regularly informed throughout the event. The period of strongest hurricane force, mostly westerly, winds occurred from around 7pm and 10pm on 18th September, when a gust of 101 knots was recorded at the airport and 125 knots at an elevated site in St George's. This coincided with the closest point of approach at around 9pm on 18th. During this period, significant damage to both property and vegetation occurred, including extensive damage around the Bermuda Weather Service compound. Widespread electricity outages occurred peaking at around 80% of customers. Despite a storm surge of around 2-3 feet, there were minimal impacts from inundation. Most notable was roof damage, especially to properties across the west end of the Island. Despite the hurricane's ferocity and widespread damage, there was no loss of life or life-threatening injuries. Damages were estimated at around \$25 million.

2020 Sep 14

Hurricane Paulette was a direct hit – the eye passed over the island, 6AM ADT, Monday 14 Sept 2020, with Paulette as a Category 1 storm, intensifying to the Category 2 storm before exiting the area. Paulette has the distinction of being the 100th hurricane to be a threat (come within 100nm) during the official record of Atlantic tropical cyclones 1842-present. This was a well-forecast and straightforward situation, with the passage of Paulette's eye forecast to come close to Bermuda several days in advance. 24/7 staffing was maintained at Bermuda Weather Service (BWS) throughout Paulette's impact. Measurement equipment, Doppler radar stayed in service and online throughout Paulette, despite a direct hit. Communications between BWS and NHC remained robust. Regular updates (twice daily) for the Emergency Measures Organization were conducted, with daily press briefings in the lead up to Paulette's passage. Through the duration of potentially damaging conditions, hourly broadcasts were in place with Bermuda's Emergency Broadcast Station. Backup channels for communications worked well – ad hoc social media posts were well-received by the public according to online posts and messages of gratitude from the public. This was in spite of network connectivity challenges that periodically prevented regular updates to the BWS website. Observational and forecast information, warnings and tropical bulletins were all disseminated via email social media during website outages. Hurricane Paulette caused 25,000 electricity outages (~70% of total), & an estimated >US\$50mill in damage. No injuries or fatalities were reported.

2020 Sep 21

Hurricane Teddy was a wave and surge event in Bermuda vs. one with damaging winds (analogous to Hurricane Gert, 1999). The intensity of Teddy was reasonably well forecast. However, Teddy's track and size (extent of tropical storm force winds) was poorly constrained in our area, leading to an erroneous forecast of a prolonged period of tropical storm force winds.

The closest point of approach of Hurricane Teddy was about 150nm east of Bermuda 3PM ADT Monday 21 Sept 2020. Teddy had, at that stage weakened from a Category 2 to a Category 1 storm. While the NHC forecast tracks from 5 consecutive advisories put Bermuda firmly in tropical storm-force winds (indeed for a time in 50 knot winds), these did not materialize, as Teddy was hindered by ridging in between itself and a non-tropical gale to the northwest. The models and scatterometer observations had this situation clearly defined. As it turned out, the gale that impacted Bermuda after Teddy's CPA inflicted higher wind speeds in Bermuda (none were damaging). Teddy's passage was a complex forecast scenario, including its interaction with the front in our area, followed by a non-tropical period of gales. As Teddy underwent extra-tropical transition north of Bermuda, it was ambiguous where the storm circulation ended and the gales began.

2020 Oct 22

Hurricane Epsilon came within 160 nm of Bermuda at 9PM ADT Thursday 22 October 2020, and similar to Teddy, only imposed marine impacts on Bermuda. A Tropical Storm Warning was posted for Bermuda, but no TS force winds were observed in Bermuda. A Tropical Storm Warning was issued by BWS to cover the eventuality of TS-force winds in the Bermuda Marine Area.

Contributors:

Mark Guishard, May 2007, with tropical cyclone references for period 1609-1995 partially sourced from Terry Tucker's book, 'Beware the Hurricane', Island Press Ltd.

Annual contributions from BWS staff 2007-2021

Updated by James Dodgson, February 2020

Mark Guishard 17 August 2021