

Tropical cyclones in 2018

Joanne Camp RMetS Understanding the Weather of 2018 23 March 2019



Met Office Global tropical cyclone activity in 2018

Southern hemisphere 2017/18

• Below-average season

• Notable storms: Gita (February 2018)



NASA

Western Pacific

- Above-averagenumber of typhoons(13)
- Notable storms: Yutu (October 2018) and Mangkhut (Philippines, Sep 2018)



BBC News

Eastern Pacific

- Most active
 hurricane season on
 record
- Notable storms: Lane (Hawaii, Aug 2018), Willa (Mexico, October 2018)



North Atlantic

- Above average
- >\$33 billion damage
- Notable storms: Florence (Sep 2018), Michael (Oct 2018)



Reuters





Cyclones Luban and Titli over the Arabian Sea and the Bay of Bengal. 10 October 2018.

North Indian Ocean

Most active season since 1992

7 cyclones

Notable storms: Sagar (Somalia, May 2018), Mekunu (Oman, May 2018), Luban (Yemen, Oct 2018).

Records:

The first time that two cyclones (Luban and Titli) were active in the Bay of Bengal and Arabian Sea at the same time. Records began in 1960.



2018 Hurricane Season

Total storms: 15

8 hurricanes (74+ mph) 2 major hurricanes (111+ mph)

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Accumulated Cyclone
Energy (ACE) index = 127
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Most intense: Michael (155 mph)

Total damage > \$33 billion



Met Office Hadley Centre Most notable records....

- 1. Florence became the wettest hurricane on record in North and South Carolina
- 2. Michael was the **strongest hurricane** to make landfall in the U.S. since Hurricane Andrew in 1992, causing more than \$14 billion in damage.

3. First time since 2008 that **4 named storms** were active at the same time: Florence, Helene, Isaac, and Joyce





Hurricane Florence NASA 12 September 2018



Hurricane Florence

- Florence was a **powerful hurricane** that \geq caused severe damage in the Carolinas in September 2018.
- "Wettest hurricane" on record in North \geq and South Carolina: 35.9 inches (~913 mm) of rain fell in Elizabethtown, North Carolina.
- High storm surge caused widespread flooding along the coast. Winds uprooted trees and caused widespread power outages.

North Carolina landfall statistics Winds: 90 mph (Category 1 hurricane) Storm surge: 6ft (1.8m) Damage: \$17.9 billion Fatalities: 55

Rain: 30" (760 mm)



North Carolina Credit: BBC



The Weather Channel demonstrates the height of the storm surge



U.S. Hurricane Hunters fly through the eye of Hurricane Florence (11 Sept 2018; winds 130 mph; category 4)



Met Office Hurricane Michael Hadley Centre

- One of the strongest hurricanes to \succ ever hit the US mainland.
- The third most intense for central \geq pressure (919 hPa); fourth most intense for wind speed (155 mph).
- \geq Caused extensive flooding in Central America and left 200,000 people without power in Cuba.
- Catastrophic damage from extreme winds and high storm surge along the Florida Panhandle.





Florida



Florida landfall statistics

Winds: 155 mph (Category 4 hurricane) Storm surge: 14ft (4.3m) **Rain**: 5" (128 mm) Damage: \$14.5 billion Fatalities: 60

NOAA





Before and after aerial view of the catastrophic storm surge and wind damage along the Florida panhandle. Source: Fox news.

Met Office Typhoon Mangkhut

- Strongest typhoon to make landfall in the Philippines since Haiyan in 2013 and Hong Kong since Ellen in 1983.
- Widespread damage to Guam, the Philippines and South China.
- Philippines: 105,000 families evacuated, landslides buried homes.



September 2018





Shattered windows in Hong Kong



Mangkhut landfall statistics PhilippinesWinds: 165 mph (Category 5 hurricane)Storm surge: 11ft (3.4m)Fatalities: 134Total affected: 5.7 million

Met Office Record breaking storms...





Cyclone Gita

The most intense cyclone to impact Tonga on record (120 mph winds). February 2018.



Typhoon Yutu

- Most powerful tropical cyclone worldwide in 2018 (185 mph winds).
- 2. Strongest typhoon to impact the Mariana Islands on record. Caused catastrophic damage. October 2018.





BBC News

Hurricane Lane

Wettest hurricane on record in Hawaii (52 inches, 1.3m). August 2018.

Met Office What about the UK?

The UK saw the remnants of two Atlantic storms passing over our shores:

The remnants of **Tropical Storm Ernesto** impacted the UK and Ireland in August 2018 bringing strong winds and heavy rain.



Ex-hurricane Helene (Storm Helene) tracked across northern England in September 2018 bringing strong winds and heavy rain, but with minimal impacts.





2018 saw below-average activity in the southern hemisphere but above-average throughout the northern hemisphere.

- 1. The **North Atlantic** recorded 15 named storms. There was catastrophic damage in the U.S. from **Hurricanes Michael and Florence**.
- 2. The **eastern Pacific had record-breaking activity** and caused significant impacts in Hawaii.
- 3. The **western Pacific** saw **Typhoons Yutu and Mangkhut** cause devastation across Pacific islands, the Philippines and China.
- 4. South Pacific saw Cyclone Gita become the strongest to impact Tonga on record.



Hurricane Florence viewed from the International Space Station 12 September 2018.

Credit: NASA

Thank you

te Florence



Record breaking activity in the eastern Pacific...

Record ACE index The 2018 Pacific hurricane season produced the highest

Accumulated Cyclone Energy (ACE) index on record (318) – average is 130.

Fourth most active on record with 23 named storms.

Only the third season on record to feature three Category 5 hurricanes

Damage in Hawaii

Hawaii was impacted by 5 storms: Hector, Lane, Norman, Olivia and Walaka.

Hurricane Lane

- Wettest hurricane on record in Hawaii. Second wettest hurricane on record in the U.S. after Hurricane Harvey (2017).

Tropical storm Olivia

- The first cyclone to make landfall on Maui in recorded history. Heavy rain caused flash flooding; trees were downed and there were widespread power outages.





Why was it so active?

- El Niño reduces wind shear across the basin
- Higher than average sea surface temperatures
- Madden-Julian Oscillation (MJO) a large scale tropical disturbance that circles the globe every 30 to 60 days – created wet and stormy conditions in the eastern Pacific.

Met Office Met Office seasonal forecast June–November 2018



Forecast mean:	Tropical storms 11	Hurricanes 6	ACE index 105	(
70% range:	7-15	4-8	55-155 ←	ł
Observed:	14*	8	127	1

Observed numbers of **tropical storms**, **number of hurricanes and ACE index** were within the forecast range.

* Tropical storm Alberto formed in May and is therefore outside the period covered by this forecast

Met Office 1. Warm tropical Atlantic

Hurricanes need warm tropical waters >26.5°C to form and intensify

- Tropical Atlantic sea-surface temperatures were above normal throughout 2017.
- By September they were the third warmest on record. This provided lots of fuel for the hurricanes to intensify.



Hurricane Irma strengthens over warm Atlantic



Met Office 2. Low wind shear

Atlantic wind shear September 2017

42 42 36 36 30 30 24 24 **High shear** 18 18 12 12 Low shear -20 -80 -60-409 12 15 18 21 3 6 ms-1 Mid-September 2017 45 45 30 ARSO COL · · · 15 15 -100-80 -40-20

-60

Hurricanes need low wind shear (**<10 ms**⁻¹) to form and intensify



 During September 2017 wind shear remained low in the tropical Atlantic and Caribbean. This allowed the hurricanes to intensify.

Met Office 3. Steering flow

Three major hurricanes **Irma, Maria, Harvey** made landfall in 2017.

• In the Atlantic, hurricanes are steered around the edge of a region of high pressure in the Atlantic Ocean.

• High landfalls occurred because the high pressure was stronger and extended further west, pushing storms closer to the coast.

