

Naming & classification

This information has been summarised from the Introduction to Tropical Meteorology (2nd Edition) which can be accessed, free of charge, on the [MetEd/ COMET](#) website (requires free registration).

Naming

Historical context

In 1848 the word "**cyclone**" was first used to refer to rotating storms. This term was inspired by the Greek word '**kukloma**' meaning "**coiled like a snake.**"

- The term "**tropical cyclones**" may be used anywhere in the world for tropical storms with peak wind speeds (1-minute mean, 10-minute mean or gust wind speed are used in different regions) exceeding 17 m/s (38mph).
- In the western North Pacific, the strongest of these storms (peak wind speeds exceeding 33 m/s (74mph) are called "**typhoons**" – a name that may derive from Greek, Chinese or Arabic but came into common use first in Japan.
- In the Caribbean - and, more recently, in the eastern Pacific - the strongest tropical cyclones are referred to as "**hurricanes**" after the Carib god of evil, Hurican.

Naming conventions

The concept of assigning individual names to tropical cyclones was initiated in the late 19th century by an Australian meteorologist, Clement Wragge, who used the Greek alphabet and names of politicians whom he did not like.

Later, the names came from the military alphabet but in the 1960s the **WMO** (World Meteorological Organisation) stepped in and developed a consistent, regionally-applicable naming convention for tropical cyclones in each of the affected ocean basins.

While the early lists consisted only of women's names, by the late 1970s the lists were broadened to include both male and female names and to encompass the languages of all of the affected countries.

The names of people are no longer used for storms in the western North Pacific: storm names for this region are drawn from a list of generic words.

If a tropical cyclone moves from one region to another, it is typically renamed to the next name on the list in the new region. This means that in rare cases, the same storm is assigned two names depending on its track.

Summary

- The term cyclone was first used for a rotating storm in 1848
- 'Tropical cyclone' is the global name for storms with 1-minute mean, 10-minute mean or gust wind speed exceeding 17 m/s (38mph).
- Tropical cyclones are known as Typhoons in the NW Pacific, and Hurricanes in the Atlantic/Caribbean/Eastern Pacific.

- The current naming conventions were established in the 1960s by the World Meteorological Organisation (**WMO**).
- Tropical storms that move from one region to another may have two names.

Further information

NOAA (National Oceanic and Atmospheric Administration) (USA)

- https://www.nhc.noaa.gov/aboutnames_history.shtml
- <https://www.nhc.noaa.gov/aboutnames.shtml>

WMO

- <https://public.wmo.int/en/About-us/FAQs/faqs-tropical-cyclones/tropical-cyclone-naming>

Classification of intensity

Accurate observational records are not always available after the passage of a tropical cyclone - instruments may have been blown or washed away or may not be located in the path of the storm.

In the late 1960s **Herb Saffir** and **Robert Simpson** devised a classification convention to relate the observed damage due to a North Atlantic tropical cyclone with the peak surface winds or minimum surface pressure (two measures of the "intensity" of a tropical cyclone) and storm surge in vulnerable coastal locations.

The classification system became known as the "**Saffir–Simpson Scale**" and has become shorthand for describing the destructive power expected from tropical cyclones around the world.

Recent changes

The Saffir–Simpson scale was updated by the National Hurricane Center (**NHC**) in early 2010 to remove both central pressure and storm surge from the scale.

In March 2012, the wind speeds for Categories 3-5 hurricanes were modified to resolve rounding issues associated with conversion between knots and mph.

Scales of intensity

The Saffir-Simpson scale

The Saffir–Simpson scale was initially intended to provide a link between the observed damage and the effects of wind, pressure and storm surge that could lead to such damage.

It is intended for use in the Atlantic basin and North Pacific east of the international date line.

In the table overleaf, hurricane categories are related to maximum sustained winds (1–minute average and 10 meters above ground) and consequently minimum central pressure. Maximum wind speed is used to determine the category of a hurricane.

Where associated damage is provided it refers to the expected damage in the **maximum** wind zone.

Damage will vary depending upon:

1. distance from the zone of maximum winds
2. exposure of the location (i.e. sheltered or not)
3. building standards
4. vegetation type
5. resultant flooding and wave action. (The effects of storm surge, tide, or wave action are not explicitly included in the classification).

| Saffir-Simpson Hurricane Category | Maximum Sustained Wind Speed (V_{MAX} ; 1-minute average) | | | Expected Level of Damage |
|--------------------------------------|---|--------------|---------|--------------------------|
| | $m\ s^{-1}$ | $km\ h^{-1}$ | mph | |
| 1 | 33–42 | 119–153 | 74–95 | Minimal |
| 2 | 43–49 | 154–177 | 96–110 | Moderate |
| 3 | 50–58 | 178–208 | 111–129 | Extensive |
| 4 | 59–69 | 209–251 | 130–156 | Extreme |
| 5 | 70+ | 252+ | 157+ | Catastrophic |

The Saffir-Simpson Scale (Cat 3-5 are referred to as Major Hurricanes).

Further information

Saffir-Simpson Hurricane Wind Scale (NOAA)

- Overview - <https://www.nhc.noaa.gov/aboutsshws.php>
- Impacts in greater detail - https://www.nhc.noaa.gov/pdf/sshws_table.pdf
- Narrative - <https://www.nhc.noaa.gov/pdf/sshws.pdf>

Australian region

In the Australian region a tropical cyclone scale linking maximum gust (3–5 second, 10 meter) wind speeds to expected damage in the maximum wind zone has been instituted.

As with the Saffir–Simpson scale, the weakest tropical cyclones are designated as Category 1, with the strongest possible tropical cyclones being assigned Category 5.

| Categories | Range of strongest gusts | | Summary Description of Typical Damage Expected |
|------------|--------------------------|----------------------|--|
| | (km h ⁻¹) | (m s ⁻¹) | |
| 1 | < 125 | < 34 | Negligible house damage. Damage to some crops, trees and caravans. |
| 2 | 125 – 170 | 34 – 47 | Minor house damage. Significant damage to trees and caravans. Heavy damage to some crops. Risk of power failure. |
| 3 | 170 – 225 | 47 – 63 | Some roof and structural damage. Some caravans destroyed. Power failure likely. |
| 4 | 225 – 280 | 63 – 78 | Significant roofing loss and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris. Widespread power failure. |
| 5 | > 280 | > 78 | Extremely dangerous with widespread destruction. |

Australian region Tropical Cyclone categories based on gust wind speed.

(Category 2 or higher are referred to as **Severe Tropical Cyclone**).

Western North Pacific and Indian Ocean regions

The tropical cyclone intensity scale in these basins is based upon the maximum sustained (10-minute average) surface (10 meter) wind speeds. While the wind speed ranges in these basins are consistent, their naming conventions vary.

| Range of 10-min mean wind (km h ⁻¹) | Range of 10-min mean wind (m s ⁻¹) | Categories by Region | | |
|--|---|-----------------------|-----------------------|-------------------------|
| | | Western North Pacific | North Indian | South Indian |
| 60 - 119 | 17 - 33 | Tropical Storm | Tropical Storm | Tropical Storm |
| 120 - 227 | 34 - 63 | Typhoon | Severe Cyclonic Storm | Tropical Cyclone |
| > 227 | >63 | Super Typhoon | | Severe Tropical Cyclone |

Overview

| Scale | Max. wind speed method | | | Category/name | Damage |
|----------------|-----------------------------|----------------------------|------------------------------|-------------------------------|--|
| | V _{max} (1-min) | V _{max} (3-5s) | V _{max} (10-min) | | |
| Saffir-Simpson | 33-42 | | | 1 | Minimal |
| Australian | | <34 | | | Negligible house damage. Damage to some crops, trees and caravans |
| WNPIO | | | 17-33 | Tropical storm | - |
| Saffir-Simpson | 43-49 | | | 2 | Moderate |
| Australian | | 34-47 | | | Minor house damage. Significant damage to trees and caravans. Heavy damage to some crops. Risk of power failure. |
| WNPIO | | | | - | - |
| Saffir-Simpson | 50-58 | | | 3 | Extensive |
| Australian | | 47-63 | | | Some roof and structural damage. Some caravans destroyed. Power failure likely. |
| WNPIO | | | 34-63 | - | - |
| Saffir-Simpson | 59-69 | | | 4 | Extreme |
| Australian | | 63-78 | | | Significant roofing loss and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris. Widespread power failure. |
| WNPIO | | | | - | - |
| Saffir-Simpson | 70+ | | | 5 | Catastrophic |
| Australian | | >78 | | | Extremely dangerous with widespread destruction. |
| WNPIO | | | >63 | - | - |
| | | | | NI Severe Tropical cyclone | |

WNPIO=Western North-Pacific & Indian Ocean; WNP=Western North Pacific; NI=North Indian; SI=South Indian

Classification inconsistencies

Different conventions for determining peak wind speeds can lead to inconsistencies in classification between Regional Specialized Meteorological Centres (**RSMCs**) and Cyclone Warning Centres (**TCWCs**) around the world.

For example, the World Meteorological Organization (**WMO**) convention for recording peak wind speeds records the 10-minute average surface wind speed, whereas the United States only applies a 1-minute average. This means a western North Pacific storm can be assigned two very different intensities depending on whether recorded by one of the national meteorological agencies of the region or the US Joint Typhoon Warning Centre (JTWC) in Pearl Harbour.

Which scale is best?

An overview of categories with exemplars, and discussion of which scale is best and whether we need higher category numbers as storm intensity increases with climate change can be found at https://en.wikipedia.org/wiki/Saffir%E2%80%93Simpson_scale .

Summary

- Classifications of intensity vary by region.
- Each basin has an intensity scale that relates damage to maximum wind speeds. Differences between basins generally relate to how maximum wind speed is calculated, the number of categories, and the descriptions of related damage.
- In the Atlantic and NE Pacific the SS scale is used. Created in the 1960s and modified in 2010 and 2012. It relates damage to wind, pressure and storm surge.

Further information

- General overview
<http://www.wmo.int/pages/prog/www/tcp/documents/FactShtTCNames1July05.pdf>
- Storm surge
https://www.nhc.noaa.gov/pdf/sshws_statement.pdf
- Joint Typhoon Warning Centre (Warnings, current map, reports, tracks, overlays)
<https://www.metoc.navy.mil/jtwc/jtwc.html>
- Australian Bureau of Meteorology
(Map, warning info/services, prep and safety, FAQs, plotting a track)
<http://www.bom.gov.au/cyclone/index.shtml>
<http://www.bom.gov.au/cyclone/about/plotting.shtml>)
- https://en.wikipedia.org/wiki/Portal:Tropical_cyclones