Saffir-Simpson (SS) hurricane wind scale

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Why is in news? Tropical cyclones of higher intensity demand a new category

Tropical Cyclones:

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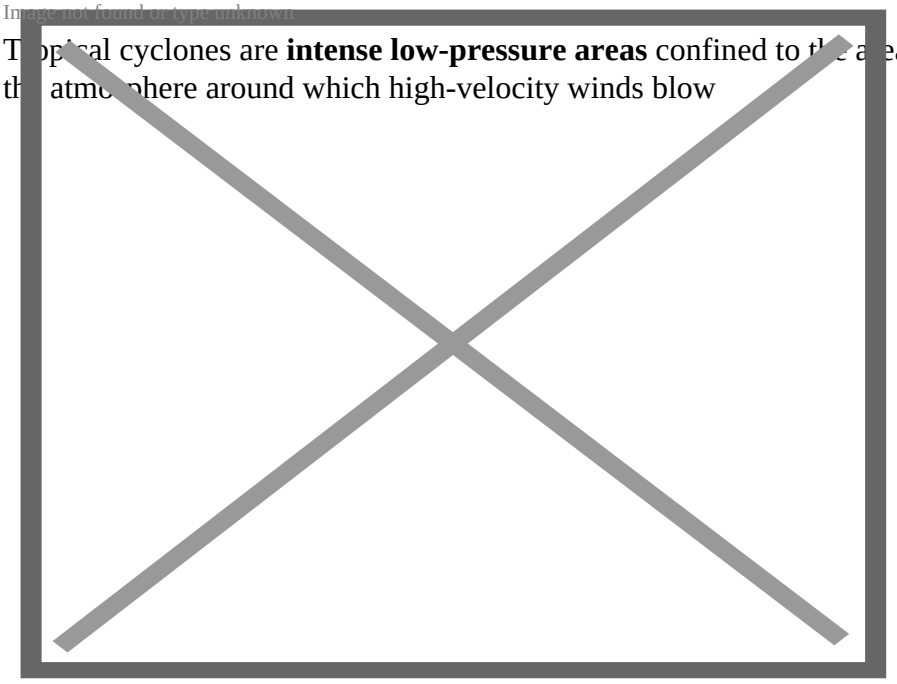


Tropical cyclones are **intense low-pressure areas** confined to the area lying **between 30°N and 30° S latitudes**, in the atmosphere around which high-velocity winds blow

Horizontally, it **extends up to 500-1,000 km** and vertically from the surface to **12-14 km**.

It is energised by the **release of latent heat** on account of the condensation of moisture that the wind gathers after moving over the oceans and seas.

Tropical cyclones are **powerful and destructive weather systems** that form over warm tropical ocean basins, where sea surface temperatures are above 26.5 degree C.

These storms are characterised by **strong winds, heavy precipitation and storm surges** and can cause significant damage to coastal communities and infrastructure.

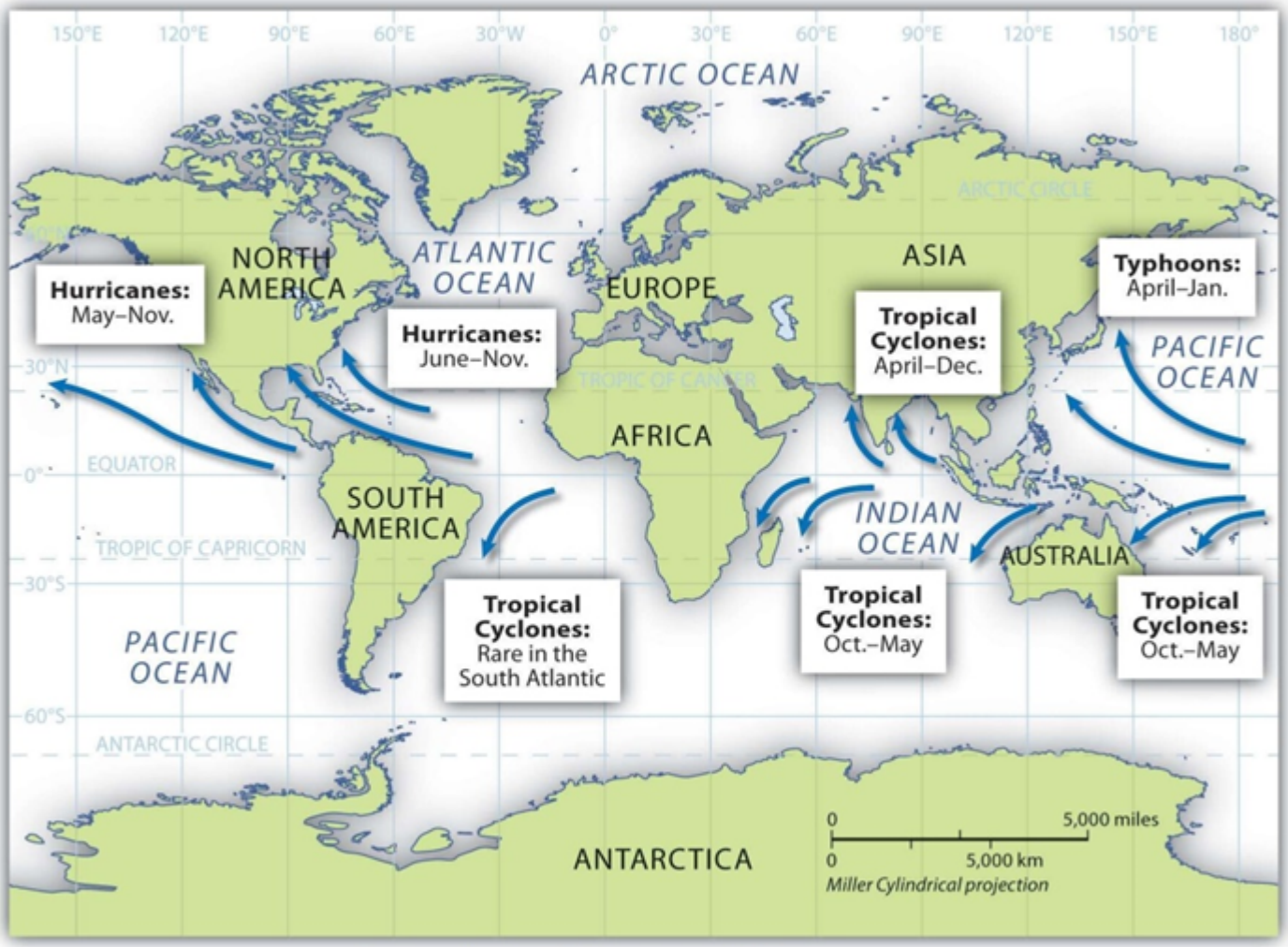


Fig: Distribution of cyclones in tropical regions.

Category	Australian name	US*	NW Pacific	Arabian Sea /Bay of Bengal
-	Tropical low	Tropical depression	Tropical depression	Depression or severe depression
1	Tropical cyclone	Tropical storm	Tropical storm	Cyclonic storm
2	Tropical cyclone	Tropical storm	Severe tropical storm	Severe cyclonic storm
3	Severe tropical Cyclone	Hurricane	Typhoon	Very severe cyclonic storm
4	Severe tropical cyclone	Hurricane	Typhoon	Very severe cyclonic storm
5	Severe tropical cyclone	Hurricane	Typhoon	Super cyclonic storm

Climatologically, tropical cyclones form mainly in the **North Atlantic, East Pacific, West Pacific, South Pacific and the Indian Ocean**.

Out of 85 tropical storms that develop annually over the warm tropical oceans, **more than half (45) of them intensify** into tropical cyclones.

The **Western Pacific basin is the most active region** for tropical cyclones and accounts for about a third of the world's tropical cyclones.

The **North Indian basin** accounts for **only about 4% of the global total**, although it is one of the most vulnerable regions in the world to the effects of such cyclones.

Conditions favourable for the formation:

Large sea surface with temperature higher than 27° C;

Presence of the Coriolis force;

Small variations in the vertical wind speed;

pre-existing weak low-pressure area or low-level-cyclonic circulation;

Upper divergence above the sea level system.

Saffir-Simpson (SS) scale:

The Saffir-Simpson (SS) hurricane wind scale, introduced in the early 1970s, is the **most widely used metric for warning the public about the dangers of tropical cyclones**.

Developed by **Herbert Saffir and Robert Simpson**, an engineer and a meteorologist, respectively, the scale differentiates storms based on sustained wind speed to describe estimated property damage.

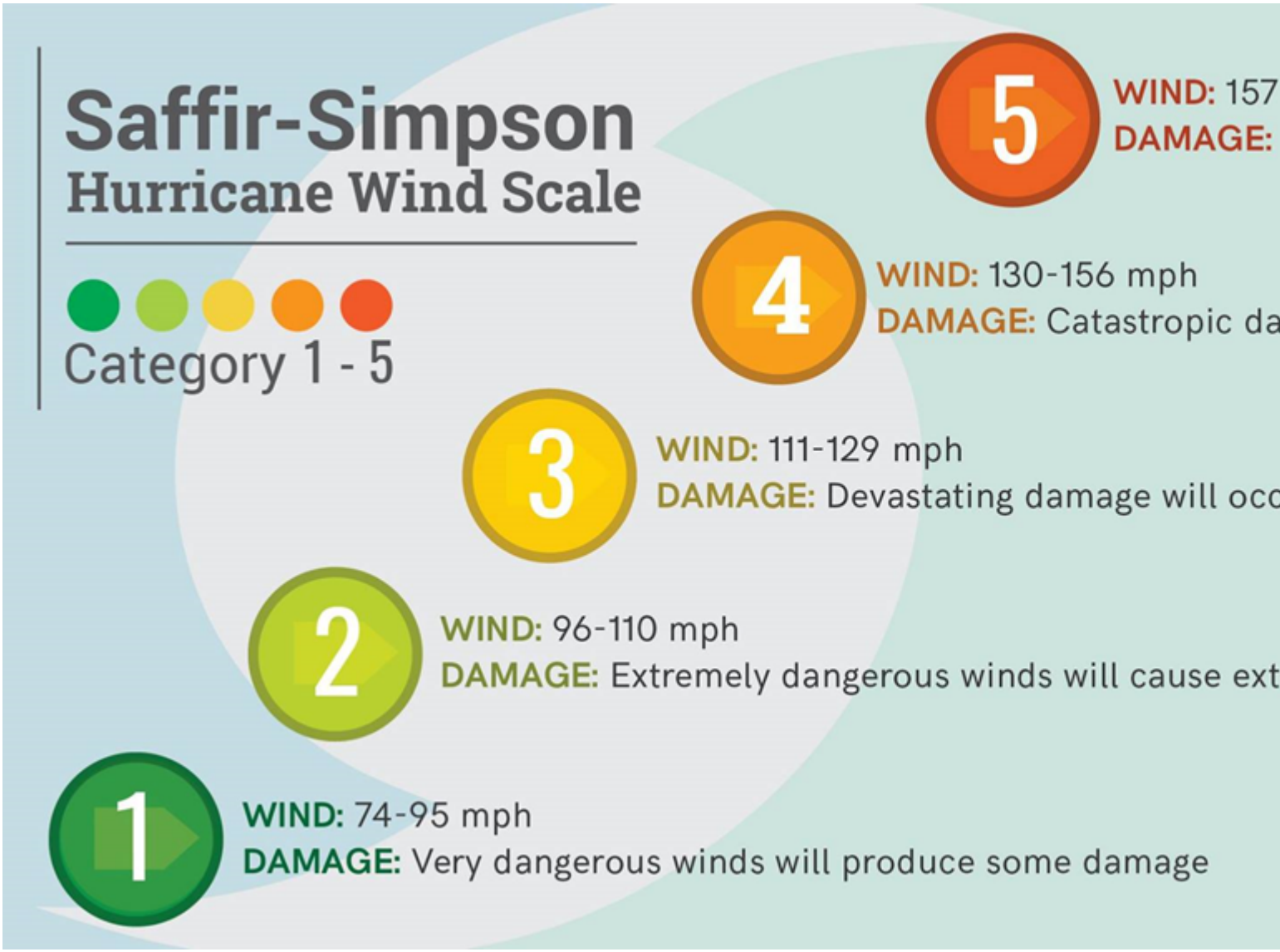
Saffir and Simpson wanted to be able to **better relay the dangers of a storm to the public**.

The SS hurricane wind scales are categorised by the maximum sustained wind speed at a height of 10 metres.

Although most tropical cyclone-related deaths are caused by storm surge and heavy rainfall, wind hazard remains an important metric for communicating risk to the public and a critical metric for measuring the impact of these cyclones.

There are **five categories** on the SS hurricane wind scale — **category 1 to category 5** — with **category 5 wind speed exceeding 252 km/hour.**

The combined effects of wind, storm surge, and rainfall in a category 5 impact would completely raze any structure.



Category 5:

The storms are occurring at intensities well above Category 5 and that record wind speeds are likely to continue as the planet continues to warm.

At the time of its introduction, the SS wind scale did not foresee the need for a tropical cyclone-beyond category 5.

However, due to global warming, there is now a need to define a category 6 cyclone.

Some authors proposed to introduce a hypothetical modification of the SS wind scale to tie category 5 to peak wind speeds between 252-309 km/hour and to include an **additional category 6 above 309 km/hour**.

Observations indicate that of the 197 tropical cyclones categorised as category 5 in the 42-year period from 1980 to 2021, half occurred in the last 17 years of the period.

Five of these storms which occurred in the last nine years of the record, exceeded the hypothetical category 6 (with wind speeds of over 309 km/hour).

Simulations of future climate change suggest that the annual exceedance of the category 6 threshold will increase even more in the regions where intense tropical cyclones currently occur.

It is expected that the proposed 6th category of the SS wind scale could raise awareness of the dangers of the increased risk of large cyclones due to global warming.

At present, **the North Indian Ocean is not as vulnerable to category 6 storms**.

However, as **global warming continues unabated**, there is a good chance that a category 6 storm with maximum wind speeds of over 309 km/hour may occur over the North Indian Ocean in the near future.

Therefore, there is a need to revisit India's disaster management strategy for tropical cyclones and the early warning systems.

Reasons for the short frequency for the cyclone:

The **sharp rise in man-made greenhouse gas emissions** has led to global warming of the order of 1.10 degree C since pre-industrial times.

The warming can be observed not only at the sea surface, but also in the depths of the ocean, which increases the heat content of the ocean and thus favours the intensification of tropical cyclones.

Long-term data indicate that the **frequency of intense tropical cyclones is increasing** in the large ocean basins.

For every degree of warming, an increase in wind speed of 12% is observed in the strongest cyclones, which corresponds to a 40% increase in destructive potential.

As warm waters extend further poleward, cyclones are shifting poleward with more storms forming at higher latitudes than in the past.

A warmer atmosphere can hold more moisture, leading to heavier rainfall when tropical cyclones make landfall.

As the oceans warm, cyclones also strengthen faster and spend more lifetime over the oceans.

In 2023, **tropical cyclone Freddy** spent 37 days over the oceans, making it the longest-lived cyclones ever recorded.

Consequences of Tropical Cyclones:

Sudden, brief onslaught, high winds cause major damage to infrastructure and housing.

Storm Surge: It is an abnormal rise in the sea level. It results in inundation of human settlements, and agricultural fields.

Contamination of Water: Ground and pipe water supply may get contaminated by flood waters.

Ruin of Crops: High winds and rains ruin the standing crops and food stock lying in low-lying areas.

Salt from the seawater may get deposited on the agricultural land and increase the salinity. `The loss of the crop may lead to acute food shortage.

Damage to Infrastructure: Disruption in the communication links as the wind may bring down the electricity and communication towers.

Transport lines (road and rail) may be curtailed, Lack of proper communication affects the effective distribution of relief materials.

Conclusion:

More and more, meteorologists are learning about the importance that the size of a storm plays. Due to its massive size, while not technically a hurricane upon landfall, reflected that of a Category 1 hurricane in regard to flooding and storm surge.

A lower category does not mean that it is necessarily safe for people to remain in their homes during a storm. That’s the reason why people have to pay particular attention to what their local officials are saying.