= Tropical cyclone scales =

Tropical cyclones are officially ranked on one of five tropical cyclone scales , according to their maximum sustained winds and which tropical cyclone basin (s) they are located in . Only a few scales of classifications are used officially by the meteorological agencies monitoring the tropical cyclones , but some alternative scales also exist , such as accumulated cyclone energy , the Power Dissipation Index , the Integrated Kinetic Energy Index , and the Hurricane Severity Index .

Should a tropical cyclone form in the North Atlantic Ocean or the North @-@ eastern Pacific Ocean , it will be classified using one of the categories in the Saffir @-@ Simpson Hurricane Scale . In the Western Pacific , tropical cyclones will be ranked using the Japan Meteorological Agency 's scale . The Regional Specialized Meteorological Centre (RSMC) in New Delhi , India also uses a different scale to assess the maximum sustained winds of a tropical cyclone . In the Southern Hemisphere , the Météo @-@ France forecast center on La Reunion uses a scale that covers the whole of the South West Indian Ocean . Both the Australian Bureau of Meteorology and the RSMC in Nadi , Fiji use the Australian tropical cyclone intensity scale .

The definition of sustained winds recommended by the World Meteorological Organization (WMO) and used by most weather agencies is that of a 10 @-@ minute average at a height of 10 m (33 ft) . However , the Saffir @-@ Simpson Hurricane Scale is based on wind speed measurements averaged over a 1 @-@ minute period , at 10 m (33 ft) above the surface . The scale used by RSMC New Delhi applies a 3 @-@ minute averaging period , and the Australian scale is based on both 3 @-@ second wind gusts and maximum sustained winds averaged over a 10 @-@ minute interval . These make direct comparisons between basins difficult .

Within all basins tropical cyclones are named when the sustained winds hit 35 kn (40 mph ; 65 km / h)

= = Background = =

Tropical cyclones are defined as being warm cored , non @-@ frontal synoptic cyclones , that develop over tropical or subtropical waters , with organized atmospheric convection and have a definite cyclonic surface wind circulation . They are classified by the wind speeds located around the circulation centre and are ranked , by the World Meteorological Organisation 's Regional Specialized Meteorological Centers on one of five tropical cyclone scales . The scale used for a particular tropical cyclone depends on what basin the system is located in ; with for example the Saffir @-@ Simpson hurricane wind scale and the Australian tropical cyclone intensity scales both used in the Western Hemisphere . All of the scales rank tropical cyclones using their maximum sustained winds , which are either observed , measured or estimated using various techniques , over a period between one and ten minutes .

= = Atlantic , Eastern and Central Pacific = =

Tropical cyclones that occur within the Northern Hemisphere to the east of the anti @-@ meridian , are officially monitored by either the National Hurricane Center or the Central Pacific Hurricane Center . Within the region a tropical cyclone is defined to be a warm cored , non @-@ frontal synoptic cyclone , that develops over tropical or subtropical waters , with organized atmospheric convection and a closed well defined circulation centre . The region also defines a subtropical cyclone as a non @-@ frontal low pressure system , that has the characteristics of both tropical and extratropical cyclones . Once either of these classifications are met then the warning centers will classify the system as either a tropical or subtropical depression , if the one @-@ minute sustained winds estimated or measured as less than 33 kn (38 mph ; 62 km / h) . Should the system intensify further or already have one @-@ minute sustained winds of 34 ? 63 kn (39 ? 73 mph ; 63 ? 118 km / h) , then it will be called either a tropical or subtropical storm and assigned a name . Should the tropical system further intensify and have winds estimated or measured , as greater than 64 kn (74 mph ; 119 km / h) , then it will be called a hurricane and classified on the Saffir @-@ Simpson

hurricane wind scale . The lowest classification on the SSHWS is a Category 1 hurricane , which has winds of between 64 ? 82 kn (74 ? 95 mph , 119 ? 153 km / h) . Should the hurricane intensify further then it will be rated as a Category 2 hurricane , if it has winds of between 83 ? 95 kn (96 ? 110 mph , 154 ? 177 km / h) . When a system becomes a Category 3 hurricane with winds of between 96 ? 112 kn (111 ? 129 mph , 178 ? 208 km / h) , it is considered to be a major hurricane by the warning centers . A Category 4 hurricane has winds of 113 ? 136 kn (130 ? 156 mph , 209 ? 251 km / h) , while a Category 5 hurricane has winds of above 137 kn (157 mph , 252 km / h) .

The SSHS was originally created using both wind speed and storm surge , but since the relationship between wind speed and storm surge is not necessarily definite , the scale was changed to the Saffir @-@ Simpson Hurricane Wind Scale (SSHWS) , based entirely on wind speed .

Although increasing echelons of the scale correspond to stronger winds , the rankings are not absolute in terms of effects . Lower @-@ category storms can inflict greater damage than higher @-@ category storms , depending on factors such as local terrain , population density and total rainfall . For instance , a Category 2 that strikes a major urban area will likely do more damage than a large Category 5 hurricane that strikes a mostly rural region . In fact , tropical systems of less than hurricane strength can produce significant damage and human casualties , especially from flooding and landslides .

Historically , the term great hurricane was used to describe storms that possessed winds of at least 110 kn (125 mph ; 200 km / h) , large radii (over 160 km / 100 mi) and that caused large amounts of destruction . This term fell into disuse after the introduction of the Saffir @-@ Simpson scale in the early 1970s .

A minor change to the scale was made ahead of the 2012 hurricane season , with the wind speeds for categories 3 @-@ 5 tweaked to eliminate the rounding errors , that had occurred during previous seasons when a hurricane had wind speeds of 115 kn (130 mph ; 215 km / h) .

= = Western Pacific = =

Tropical cyclones that occur within the Northern Hemisphere between the anti @-@ meridian and 100 ° E , are officially monitored by the Japan Meteorological Agency (JMA , RSMC Tokyo) . Within the region a tropical cyclone is defined to be a non @-@ frontal synoptic scale cyclone originating over tropical or sub @-@ tropical waters , with organized convection and a definite cyclonic surface wind circulation . The lowest classification used by the Typhoon Committee is a tropical depression , which has 10 @-@ minute sustained winds of less than 33 kn (17 m / s ; 38 mph ; 61 km / h) . Should the tropical depression intensify further it is named and classified as a tropical storm , which has winds speeds between 33 ? 47 kn (17 ? 24 m / s ; 38 ? 54 mph ; 61 ? 87 km / h) . Should the system continue to intensify further then it will be classified as a severe tropical storm , which has winds speeds between 48 ? 63 kn (25 ? 32 m / s ; 55 ? 72 mph ; 89 ? 117 km / h) . The highest classification on the Typhoon Committees scale is a typhoon , which has winds speeds greater than 64 kn (33 m / s ; 74 mph ; 119 km / h) .

The China Meteorological Administration , the Hong Kong Observatory (HKO) , PAGASA and the JMA , all divide the typhoon category further for domestic purposes . The JMA divides the typhoon category into three categories , with a 10 @-@ minute maximum wind speed below 84 kn (43 m / s ; 97 mph ; 156 km / h) assigned for the (strong) typhoon category . A very strong typhoon has wind speeds between 85 ? 104 kn (44 ? 54 m / s ; 98 ? 120 mph ; 157 ? 193 km / h) , while a violent typhoon has wind speeds of 105 kn (54 m / s ; 121 mph ; 194 km / h) or greater . The HKO and the CMA also divide the typhoon category into three categories , with both assigning a maximum wind speed of 80 kn (41 m / s ; 92 mph ; 150 km / h) to the typhoon category . A severe typhoon has wind speeds of 85 ? 104 kn (44 ? 54 m / s ; 98 ? 120 mph ; 157 ? 193 km / h) , while a super typhoon has winds of 100 kn (51 m / s ; 120 mph ; 190 km / h) . During May 2015 PAGASA introduced the term Super Typhoon and used it for systems with winds greater than 120 kn (62 m / s ; 140 mph ; 220 km / h) .

In addition to the National Meteorological Services of each nation the United States Joint Typhoon

Warning Centre monitors the basin , and issues warnings on significant tropical cyclones for the United States Government . These warnings use a 1 @-@ minute sustained wind speed and can be compared to the Saffir @-@ Simpson hurricane wind scale , however , the JTWC use their own scale for intensity classifications in this basin . These classifications are Tropical Depression , Tropical Storm , Typhoon and Super Typhoon . In addition , the Taiwan Central Weather Bureau has its own scale in Chinese but uses the Typhoon Committee scale in English .

= = North Indian Ocean = =

Any tropical cyclone that develops within the North Indian Ocean between 100 ° E and 45 ° E is monitored by the India Meteorological Department (IMD , RSMC New Delhi) . Within the region a tropical cyclone is defined as being a non frontal synoptic scale cyclone , that originates over tropical or subtropical waters with organized convection and a definite cyclonic surface wind circulation . The lowest official classification used in the North Indian Ocean is a Depression , which has 3 @-@ minute sustained wind speeds of between 17 ? 27 kn (20 ? 31 mph ; 31 ? 49 km / h) . Should the depression intensify further then it will become a Deep Depression , which has winds between 28 ? 33 kn (32 ? 38 mph ; 50 ? 61 km / h) . The system will be classified as a cyclonic storm and assigned a name by the IMD , if it should develop gale force wind speeds of between 34 ? 47 kn (39 ? 54 mph ; 62 ? 88 km / h) . Severe Cyclonic Storms have storm force wind speeds of between 48 ? 63 kn (55 ? 72 mph ; 89 ? 117 km / h) , while Very Severe Cyclonic Storms have hurricane @-@ force winds of 64 ? 89 kt (73 ? 102 mph ; 118 ? 166 km / h) . Extremely Severe Cyclonic Storms have hurricane @-@ force winds of 90 ? 119 kn (166 ? 221 km / h , 104 ? 137 mph) . The highest classification used in the North Indian Ocean is a Super Cyclonic Storm , which have hurricane @-@ force winds of above 120 kn (138 mph ; 222 km / h) .

Historically , a system has been classified as a depression if it is an area where the barometric pressure is low compared with its surroundings . Other classifications historically used include : cyclonic storm where the winds did not exceed force 10 on the Beaufort scale and a Cyclone where the winds are either force 11 and 12 on the Beaufort scale . Between 1924 and 1988 , tropical cyclones were classified into four categories : depression , deep depression , cyclonic storms and severe cyclonic storms . However , a change was made during 1988 to introduce the category " severe cyclonic storm with core of hurricane winds " for tropical cyclones , with wind speeds of more than 64 kn (74 mph ; 119 km / h) . During 1999 the categories Very Severe Cyclonic Storm and Super Cyclonic Storm were introduced , while the severe cyclonic storm with a core of hurricane winds category was eliminated . During 2015 another modification to the intensity scale took place , with the IMD calling a system with 3 @-@ minute maximum sustained wind speeds between 90 ? 119 kn (166 ? 221 km / h , 104 ? 137 mph) : an extremely severe cyclonic storm . The United States Joint Typhoon Warning Centre also monitors the basin , and issues warnings on significant tropical cyclones on behalf of the United States Government . These warnings use a 1 @-@ minute sustained wind speed and can be compared to the Saffir @-@ Simpson hurricane wind scale , however , regardless of intensity in this basin the JTWC labels all systems as tropical cyclones .

= = South @-@ Western Indian Ocean = =

Any tropical cyclone that develops within the Southern Hemisphere between Africa and 90 ° E is monitored by Meteo France 's La Reunion tropical cyclone centre (MFR , RSMC La Reunion) . Within the region a tropical disturbance is defined to be a non @-@ frontal synoptic scale low pressure area , originating over tropical or sub @-@ tropical waters with organized convection and definite cyclonic surface wind circulation with the average wind speed estimated to be not exceeding 27 knots (50 km / h)) .

A tropical disturbance is MFR 's generic term for a non @-@ frontal area of low pressure that has organized convection and definite cyclonic surface wind circulation . The system should be estimated to have wind speeds of less than 28 knots (50 km / h , 32 mph) .

A system is designated as a tropical depression or a subtropical depression when it reaches wind

speeds above 28 knots (50 km / h , 32 mph) . Should a tropical depression reach wind speeds of 35 knots (65 km / h , 40 mph) then it will be classified as a moderate tropical storm and assigned a name by either the Sub Regional Center in Mauritius or Madagascar . No matter how strong a subtropical system is in this basin , it is always designated as a subtropical depression .

Should the named storm intensify further and reach winds speeds of 48 knots (89 km / h , 55 mph) , then it will be classified as a severe tropical storm . A severe tropical storm is designated as a tropical cyclone when it reaches wind speeds of 64 knots (118 km / h , 74 mph) . Should a tropical cyclone intensify further and reach wind speeds of 90 knots (166 km / h , 103 mph) , it will be classified as an intense tropical cyclone . A very intense tropical cyclone is the highest category on the South @-@ West Indian Ocean Tropical Cyclone scale , and has winds of over 115 knots (212 km / h , 132 mph) .

At the tenth RA I tropical cyclone committee held during 1991 , it was recommended that the intensity classifications be changed ahead of the 1993 @-@ 94 tropical cyclone season . Specifically it was decided that the classifications : Weak Tropical Depression , Moderate Tropical Depression and Severe Tropical Depression would be changed to Tropical Depression , Moderate Tropical Storm and Severe Tropical Storm . This change was implemented ahead of the 1993 @-@ 94 tropical cyclone season . The United States Joint Typhoon Warning Centre also monitors the basin , and issues warnings on significant tropical cyclones on behalf of the United States Government . These warnings use a 1 @-@ minute sustained wind speed and can be compared to the Saffir @-@ Simpson hurricane wind scale , however , regardless of intensity in this basin the JTWC labels all systems as tropical cyclones .

= = Australia and Fiji = =

Tropical cyclones that occur within the Southern Hemisphere to the east of 90 ° E , are officially monitored by one or more tropical cyclone warning centres . These are run by the Fiji Meteorological Service , New Zealand 's MetService , Indonesia 's Badan Meteorologi Klimatologi dan Geofisika , Papua New Guinea 's National Weather Service , while three others are run by the Australian Bureau of Meteorology . Within the region a tropical cyclone is defined as being a non @-@ frontal low pressure system of synoptic scale that develops over warm waters , with a definite organized wind circulation and 10 @-@ minute sustained wind speeds of 34 kn (63 km / h ; 39 mph) or greater near the centre . Once this definition has been met then all of the centres name the system and start to use the Australian tropical cyclone intensity scale , which measures tropical cyclones using a five category system based on 10 @-@ minute maximum sustained winds . A Category 1 tropical cyclone is estimated to have 10 @-@ minute sustained wind speeds of 34 ? 47 kn (39 ? 54 mph ; 63 ? 87 km / h) , while a Category 2 tropical cyclone is estimated to have 10 @-@ minute sustained wind speeds of 48 ? 63 kn (55 ? 72 mph ; 89 ? 117 km / h) . When a system becomes a Category 3 tropical cyclone it is reclassified as a Severe tropical cyclone and has wind speeds of 64 ? 85 kn (74 ? 98 mph ; 119 ? 157 km / h) . A Category 4 severe tropical cyclone has winds of 86 ? 110 kn (99 ? 130 mph ; 157 ? 200 km / h) , while the maximum rating a Category 5 severe tropical cyclone has winds of above 110 kn (130 mph ; 200 km / h) .

For systems below tropical cyclone strength there are various terms used , including Tropical Disturbance , Tropical Low and Tropical Depression . A tropical disturbance is defined as being a non ? frontal system of synoptic scale originating over the tropics , with persistent enhanced convection and / or some indication of a circulation . A tropical depression or tropical low is a disturbance with a defined circulation , where the central position can be estimated , and the maximum 10 @-@ minute average wind speed is less than 34 kn (39 mph ; 63 km / h) near the centre . The FMS numbers these systems when they have a potential to develop into a tropical cyclone or persist to cause significant impact to life and property , within its area of responsibility and have been analysed for the previous 24 hours . The Australian tropical cyclone intensity scale was introduced by the BoM , ahead of the 1989 @-@ 90 cyclone season . The United States Joint Typhoon Warning Centre also monitors the basin , and issues warnings on significant tropical cyclones on behalf of the United States Government . These warnings use a 1 @-@ minute

sustained wind speed and can be compared to the Saffir @-@ Simpson hurricane wind scale , however , regardless of intensity in this basin the JTWC labels all systems as tropical cyclones .

= = Alternative scales = =

There are other scales that are not officially used by any of the Regional Specialized Meteorological Centres or the Tropical Cyclone Warning Centres . However they are used by other organizations , such as the National Oceanic and Atmospheric Administration . An example of such scale is the Integrated Kinetic Energy index , which measures the destructive potential of the storm surge ; it works on a scale that ranges from one to six , with six having the highest destructive potential .

Accumulated cyclone energy (ACE) is used by the National Oceanic and Atmospheric Administration and other agencies to express the activity of individual tropical cyclones that are above tropical storm strength and entire tropical cyclone seasons . It is calculated by taking the squares of the estimated maximum sustained velocity of every active tropical storm (wind speed 35 knots or higher) at six @-@ hour intervals . The numbers are usually divided by 10 @,@ 000 to make them more manageable . The unit of ACE is 104 kn2 , and for use as an index the unit is assumed . As well as being squared for ACE , wind speed can also be cubed , which is referred to as the Power Dissipation Index (PDI) .

The Hurricane Severity Index (HSI) is another scale used and rates the severity of all types of tropical and subtropical cyclones based on both the intensity and the size of their wind fields . The HSI is a 0 to 50 point scale , allotting up to 25 points for a Tropical cyclone 's intensity and up to 25 points for wind field size . Points are awarded on a sliding scale , with the majority of points reserved for hurricane force and greater wind fields .

= = Comparisons across basins = =

The terminology for tropical cyclones differs from one region to another . Below is a summary of the classifications used by the official warning centres worldwide .