= Subtropical cyclone =

A subtropical cyclone is a weather system that has some characteristics of a tropical and an extratropical cyclone .

As early as the 1950s , meteorologists were unclear whether they should be characterized as tropical or extratropical cyclones . They were officially recognized by the National Hurricane Center in 1972 . Subtropical cyclones began to receive names from the official tropical cyclone lists in the North Atlantic , South @-@ west Indian Ocean and South Atlantic basins .

There are two definitions currently used for subtropical cyclones . Across the north Atlantic and southwest Indian ocean , they require central convection fairly near the center and a warming core in the mid @-@ levels of the troposphere . Across the eastern half of the northern Pacific , they require a mid @-@ tropospheric cyclone to cut off from the main belt of the westerlies and only a weak surface circulation . Subtropical cyclones have broad wind patterns with maximum sustained winds located farther from the center than typical tropical cyclones , and have no weather fronts linked into their center .

Since they form from initially extratropical cyclones which have colder temperatures aloft than normally found in the tropics , the sea surface temperatures required for their formation are lower than the tropical cyclone threshold by 3 ° C (5 ° F) , lying around 23 ° C (73 ° F) . This also means that subtropical cyclones are more likely to form outside the traditional bounds of the North Atlantic hurricane season . Subtropical cyclones are also observed to form in the South Atlantic ; South Atlantic subtropical cyclones are observed in all months .

= = History of term = =

Throughout the 1950s and 1960s , the term semi @-@ tropical and quasi @-@ tropical were used for what would become known as subtropical cyclones . The term subtropical cyclone merely referred to any cyclone located in the subtropical belt near and just north of the horse latitudes . Intense debate ensued in the late 1960s , after a number of hybrid cyclones formed in the Atlantic Basin . In 1972 , the National Hurricane Center (NHC) finally designated these storms as subtropical cyclones in real @-@ time , and updated the hurricane database to include subtropical cyclones from 1968 through 1971 . The term " neutercane " began to be used for small subtropical cyclones which formed from mesoscale features , and the NHC began issuing public statements during the 1972 Atlantic hurricane season employing that classification . This name was not noted as controversial in contemporary news reports , but it was dropped less than a year later . Recent articles , published after the year 2000 , have suggested that the name " neutercane " was considered sexist in the 1970s , but there do not appear to be any published reports from that period making this claim .

= = Naming = =

In the North Atlantic basin , subtropical cyclones were initially named from the NATO phonetic alphabet list in the early to mid @-@ 1970s . In the intervening years of 1975 ? 2001 , subtropical storms were either named from the traditional list and considered tropical in real @-@ time , or used a separate numbering system . Between 1992 and 2001 , two different numbers were given to subtropical depressions or subtropical storms , one for public use , the other one for NRL and NHC reference . For example , Hurricane Karen in 2001 was initially known as Subtropical Storm One as well as AL1301 (or 13L for short) . In 2002 , the NHC began giving numbers to subtropical depressions and names to subtropical storms from the same sequence as tropical cyclones . From 2002 onwards , Subtropical Depression 13L would be known as Subtropical Depression Thirteen instead . Hurricane Gustav of 2002 was the first Subtropical Storm to receive a name but became tropical shortly after naming . Subtropical Storm Nicole , from the 2004 Atlantic hurricane season was the first subtropical storm that did not become tropical since the policy change . A subtropical storm from the 2005 Atlantic hurricane season also did not become tropical , but was not named

since it was not recognized until post @-@ season analysis . In the southern Indian ocean , subtropical cyclones are also named once winds reach tropical storm , or gale , force . Since 2011 , subtropical storms in the South Atlantic Ocean are named by the Brazilian Navy Hydrographic Center .

= = Formation = =

Subtropical cyclones form in a wide band of latitude , mainly south of the 50th parallel in the northern hemisphere . Due to the increased frequency of cyclones which cut off from the main belt of the westerlies during the summer and fall , subtropical cyclones are significantly more frequent across the North Atlantic than the northwestern Pacific ocean . In the eastern half of the north Pacific ocean and north Indian ocean , the older subtropical cyclone definition term is still used , which requires a weak circulation forming underneath a mid to upper @-@ tropospheric low which has cut off from the main belt of the westerlies during the cold season (winter) . In the case of the north Indian ocean , the formation of this type of vortex leads to the onset of monsoon rains during the wet season . In the southern hemisphere , subtropical cyclones are regularly observed across southern portions of the Mozambique Channel .

Most subtropical cyclones form when a deep cold @-@ core extratropical cyclone drops down into the subtropics . The system becomes blocked by a high latitude ridge , and eventually sheds its frontal boundaries as its source of cool and dry air from the high latitudes diverts away from the system . Temperature differences between the 500 hPa pressure level , or 5 @,@ 900 meters (19 @,@ 400 ft) above ground level , and the sea surface temperatures initially exceed the dry adiabatic lapse rate , which causes an initial round of thunderstorms to form at a distance east of the center . Due to the initial cold temperatures aloft , sea surface temperatures usually need to reach at least 20 ° C (68 ° F) for this initial round of thunderstorms . The initial thunderstorm activity moistens up the environment around the low , which destabilizes the atmosphere by reducing the lapse rate needed for convection . When the next shortwave or upper level jet streak (wind maximum within the jet stream) moves nearby , convection reignites closer to the center and the system develops into a true subtropical cyclone . The average sea surface temperature that helps lead to subtropical cyclogenesis is 24 ° C (75 ° F) . If the thunderstorm activity becomes deep and persistent , allowing its initial low level warm core to deepen , tropical cyclogenesis is possible . The locus of formation for North Atlantic subtropical cyclones is out in the open ocean ; the island of Bermuda is regularly impacted by these systems .

The South Atlantic environment for formation of subtropical cyclones has both stronger vertical wind shear and lower sea surface temperatures , yet subtropical cyclogenesis is regularly observed in the open ocean in the South Atlantic . A second mechanism for formation has been diagnosed for South Atlantic subtropical cyclones : lee cyclogenesis in the region of the Brazil Current .

= = = Transition from extratropical = = =

By gaining tropical characteristics , an extratropical low may transit into a subtropical depression or storm . A subtropical depression / storm may further gain tropical characteristics to become a pure tropical depression or storm , which may eventually develop into a hurricane , and there are at least three cases of tropical storms transforming into a subtropical storm (Hurricane Klaus in 1984 , Tropical Storm Allison in 2001 and Tropical Storm Lee in 2011) . Generally , a tropical storm or tropical depression is not called subtropical while it is becoming extratropical , after hitting either land or colder waters . This transition normally requires significant instability through the atmosphere , with temperature differences between the underlying ocean and the mid @-@ levels of the troposphere requiring over 20 ° C , or 72 ° F , of contrast in this roughly 5 @,@ 900 meters (19 @,@ 400 ft) layer of the lower atmosphere . The mode of the sea surface temperatures that subtropical cyclones form over is 23 ° C (73 ° F) . Transition from subtropical cyclones into tropical cyclones occurs only in very rare cases over the South Atlantic Ocean , such as Hurricane Catarina in 2004 .

= = Characteristics = =

These storms can have maximum winds extending farther from the center than in a purely tropical cyclone and have no weather fronts linking directly to the center of circulation . The maximum recorded wind speed for a subtropical storm is 33 m / s (119 km / h , 65 knots , or 74 mph) , also the minimum for a hurricane . In the Atlantic Basin , the United States NOAA classifies subtropical cyclones similarly to their tropical cousins , based on maximum sustained surface winds . Those with winds below 18 m / s , 65 km / h , 35 knots , or 39 mph are called subtropical depressions , while those at or above this speed are referred to as subtropical storms .

Subtropical cyclones are also more likely than tropical cyclones to form outside of a region 's designated hurricane season . North Atlantic examples include Subtropical Storm Alex (which became Hurricane Alex) in mid @-@ January of the 2016 Atlantic hurricane season , Subtropical Storm Ana (which became Tropical Storm Ana) in late April of the 2003 hurricane season , Subtropical Storm Andrea in early May and Subtropical Storm Olga (which became Tropical Storm Olga) in mid @-@ December of the 2007 Atlantic hurricane season , and Subtropical Storm Beryl (which became Tropical Storm Beryl) in late May of the 2012 hurricane season . Diagrams which depict a cyclone 's phase depict subtropical cyclones with a shallow warm core and as asymmetric systems , similar to tropical cyclones which have begun the transition to an extratropical cyclone .

= = Types = =

= = = Upper @-@ level low = = =

The most common type of subtropical storm is an upper @-@ level cold low with circulation extending to the surface layer and maximum sustained winds generally occurring at a radius of about 160 kilometers (99 mi) or more from the center . In comparison to tropical cyclones , such systems have a relatively broad zone of maximum winds that is located farther from the center , and typically have a less symmetric wind field and distribution of convection .

= = = Mesoscale low = = =

A second type of subtropical cyclone is a mesoscale low originating in or near a frontolyzing zone of horizontal wind shear , also known as a dying frontal zone , with radius of maximum sustained winds generally less than 50 kilometers (31 mi) . The entire circulation may initially have a diameter of less than 160 kilometers (99 mi) . These generally short @-@ lived systems may be either cold core or warm core , and in 1972 this type of subtropical cyclone was referred to as a " neutercane " .

= = Kona storm = =

Kona storms (or Kona lows) are deep cyclones that form during the cool season of the central Pacific ocean . A definition change in the term during the early 1970s makes categorization of the systems more complex , as many kona lows are extratropical cyclones , complete with their own weather fronts . Those across the northeast Pacific ocean consider them subtropical cyclones as long as a weak surface circulation is present . Kona is a Hawaiian term for leeward , which explains the change in wind direction for the Hawaiian Islands from easterly to southerly when this type of cyclone is present .

= = Australian East Coast Lows = =

Australian east coast lows (known locally as east coast lows and sometimes as east coast

cyclones) are extratropical cyclones , the most intense of these systems have many of the characteristics of subtropical cyclones . They develop between 25 ? south and 40 ? south and within 5 ? of the Australian coastline , typically during the winter months . Each year there are about ten " significant impact " maritime lows . Explosive cyclogenesis is seen on average just once per year , but these storms cause significant wind and flood damage when they occur . Australian east coast cyclones vary in size from mesoscale (approximately 10 km to 100 km) to synoptic scale (approximately 100 km to 1 @,@ 000 km) . These storms which mostly affect the south east coast should not be confused with Australian region tropical cyclones which typically affect the northern half of the continent .