Perhaps time will allow the mediators of the meteors to inform us more fully about the 3rd of April storm to pass over Tasmania and Southern Victoria, its causes and the likelihood of repeats.

The storm had the wind speeds of a tropical cyclone according to the Bureau's definition "A "tropical cyclone" is a tropical low pressure system intense enough to produce sustained gale force winds (at least 63 km/h). A "severe tropical cyclone" produces sustained hurricane force winds (at least 118 km/h),".

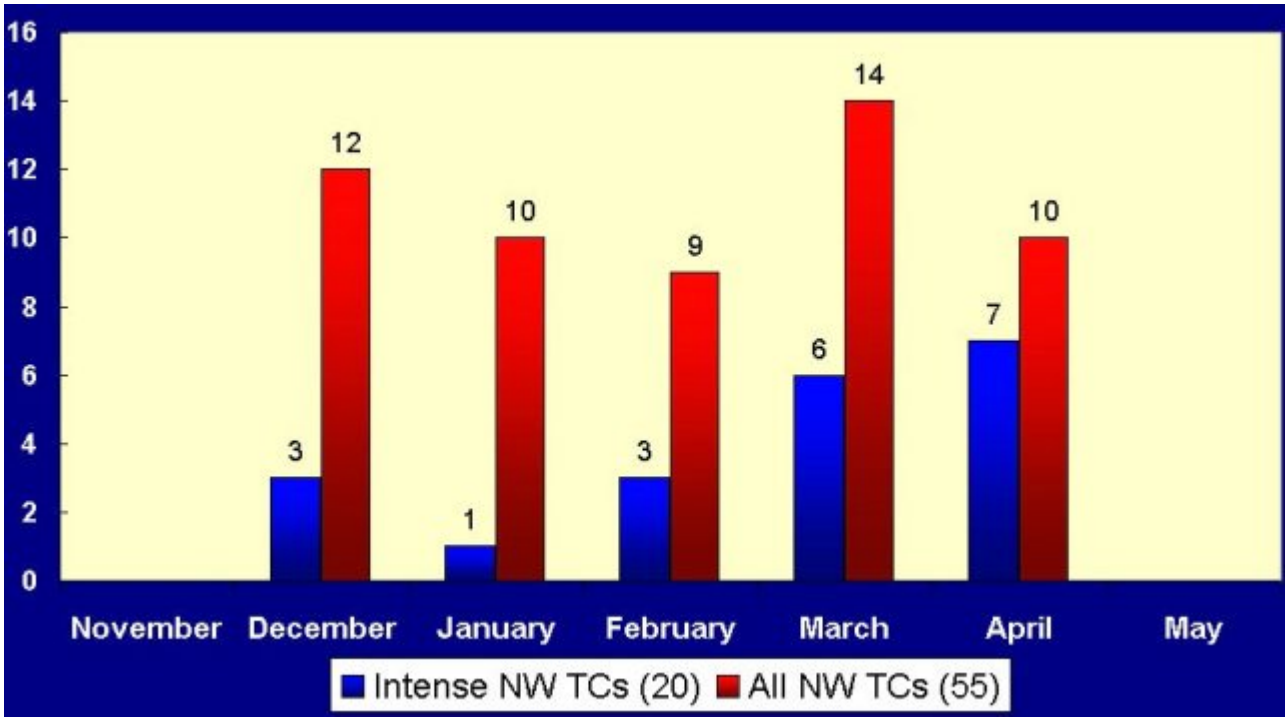
Mt Read had a 12 hour period of over 70km/h and many places had wind gusts exceeding the 118km/h. The data is not publicly available for the wind speed between 3PM and 9AM at Hobart and therefore sustained cannot be assessed by the writer.

Wednesday night's storm also fails the final part of the definition "and corresponds to the hurricanes or typhoons of other parts of the world.

It certainly wasn't the result of that other storm phenomenon, the east coast low. "Some low pressure systems outside the tropics can match tropical cyclones in strength and destructive power. One type, so-called "east coast lows", develop near the coast between southern Queensland and Tasmania, mainly between autumn and spring. These systems can intensify very rapidly, and are capable of generating violent gales, in some cases approaching hurricane intensity".

"The Australian cyclone season officially runs from November to April, although very few have occurred in November. The earliest cyclone to impact the Kimberley coast in a season was on 19 November 1910 when the eye passed over Broome. The latest cyclone was *Herbie* that formed near Cocos Islands and passed over Shark Bay on 21 May 1988.

Monthly frequency of cyclones off northwestern Australia 1988/89 to 2003/04. Intense cyclones (category 4 and 5) are shown in blue."

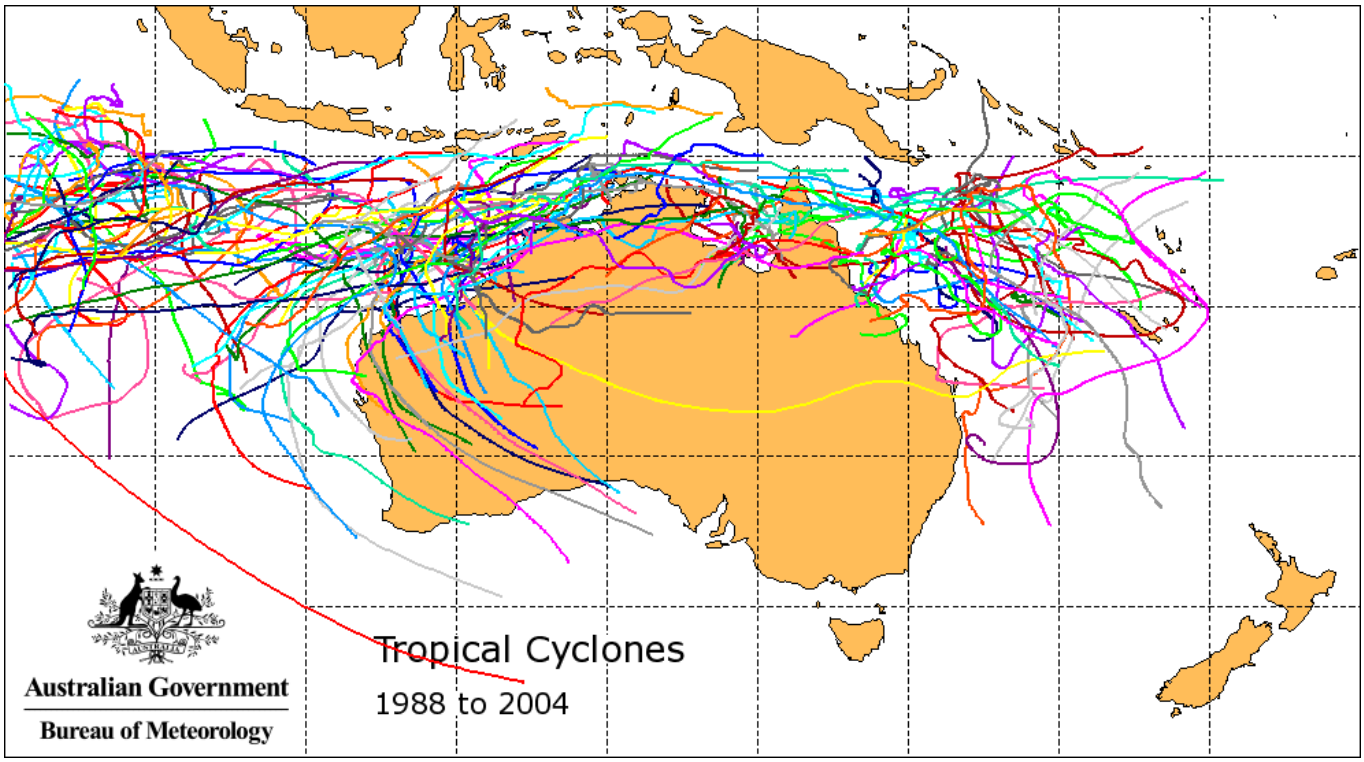


From BoM website.
The event also affected southern Victoria with Warnambool recording 117km/h and Wilsons Promotory 135. It occured the period of highest frequency for intense North West tropical cyclones for the period shown above although Cyclone Pancho lost intensity and became a tropical depression half way down the WA coast.

“Tracks

The map of cyclone tracks in the Australian region (see below) shows that cyclones can move in many different directions. However, cyclones off the northwest coast do have a preferred movement. Typically they are initially steered to the west-southwest at speeds of 5-20 km/h and then take a more southerly track as they move further to the south. If they do move south of about 22°S or cross the Pilbara coast they tend to curve to the south-southeast and accelerate. Those that affect the lower part of the west coast may reach speeds of over 60 km/h.

However, the path of each storm varies considerably in response to the weather patterns occurring at the time. Tropical cyclones can be thought of as being steered by the surrounding environmental flow particularly in the middle parts of the atmosphere (from 2 to 6 km above the surface). The larger and more intense systems do influence the surrounding environment and in so doing affect their movement.



The tracks of the cyclones from the periodicity and frequency data above are shown here. A number reach down in to the mid latitudes from the west, 3 into the latitudes of the Bassian region before they loose their tropical cyclone status.

Long-term frequency

Trends in tropical cyclone activity in the Australian region (south of equator; 105-160°E) show that the total number of cyclones has decreased in recent decades (This decrease may partly be due to an improved discrimination between tropical cyclones and sub-cyclone intensity tropical lows.

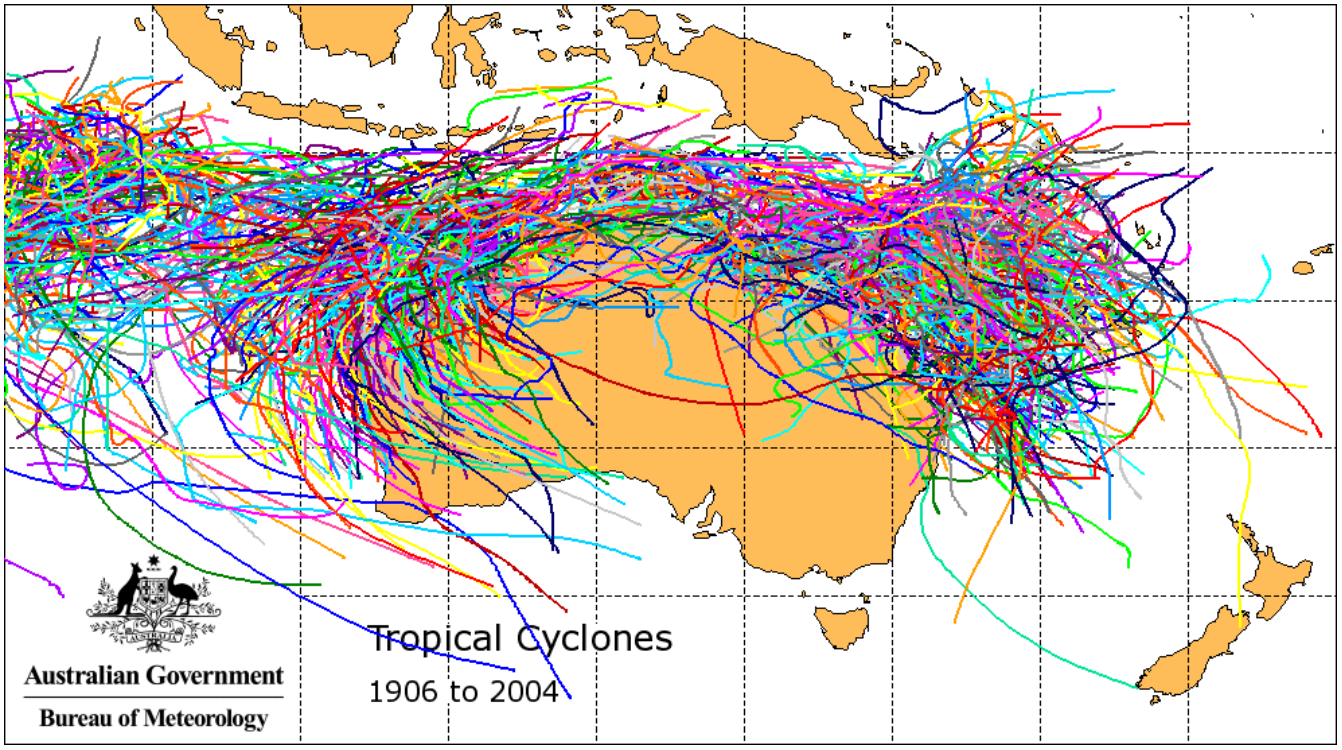
If weak cyclones are excluded from the analysis, the trend is more gradual and follows the downward trend in the Southern Oscillation Index suggesting that the decrease in cyclone numbers may be related to the greater number of El Niño events since the mid-1970s.

However, the number of severe cyclones has increased and this does not appear to be due to improved discrimination between cyclones or trends in the Southern Oscillation Index. The actual cause of this is unknown.

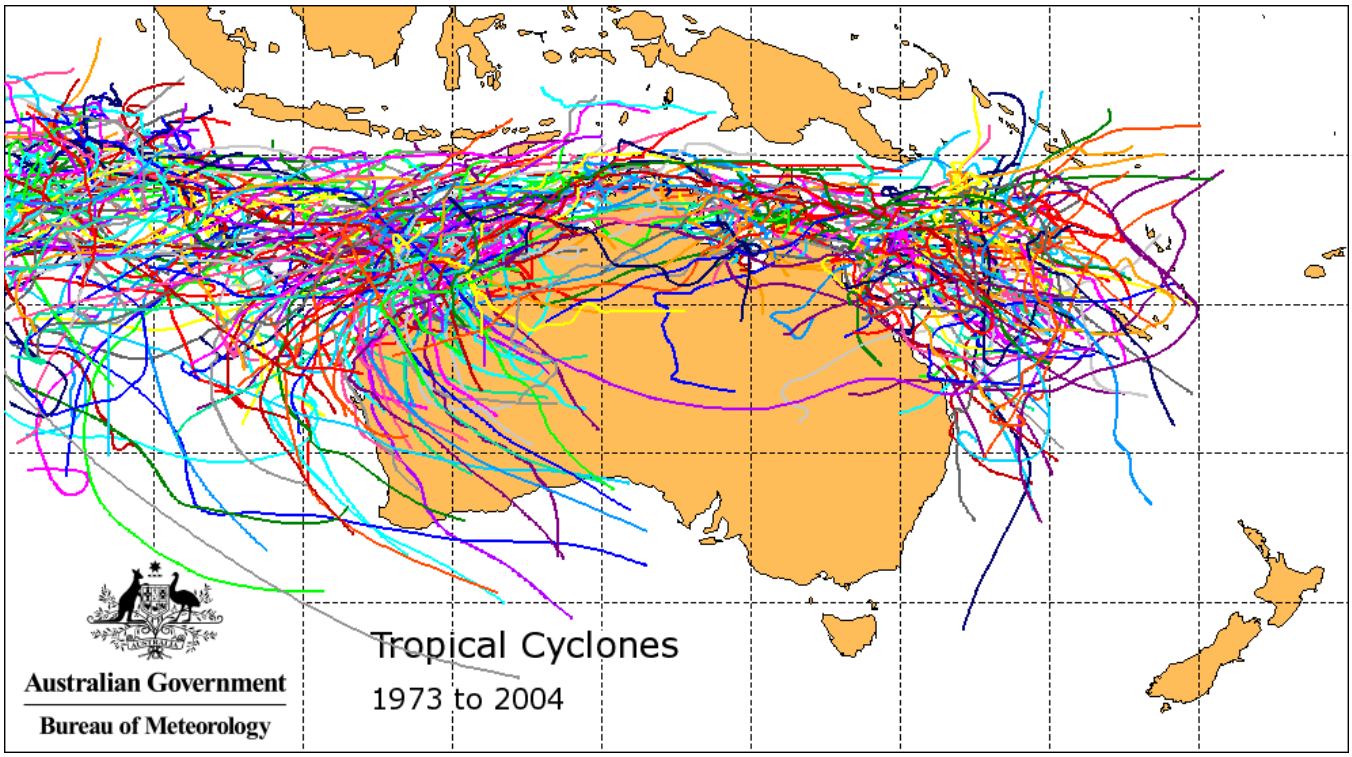
According to the International Panel on Climate Change (IPCC), tropical cyclone activity has risen in the northwest Pacific and north Atlantic since 1950. However, there has been little change in the number of very strong typhoon-force or hurricane-force systems. There has been little change in the number of tropical cyclones in the north Indian Ocean,

southwest Indian Ocean and southwest Pacific Ocean east of 160°E. [A line about the SA VIC border]

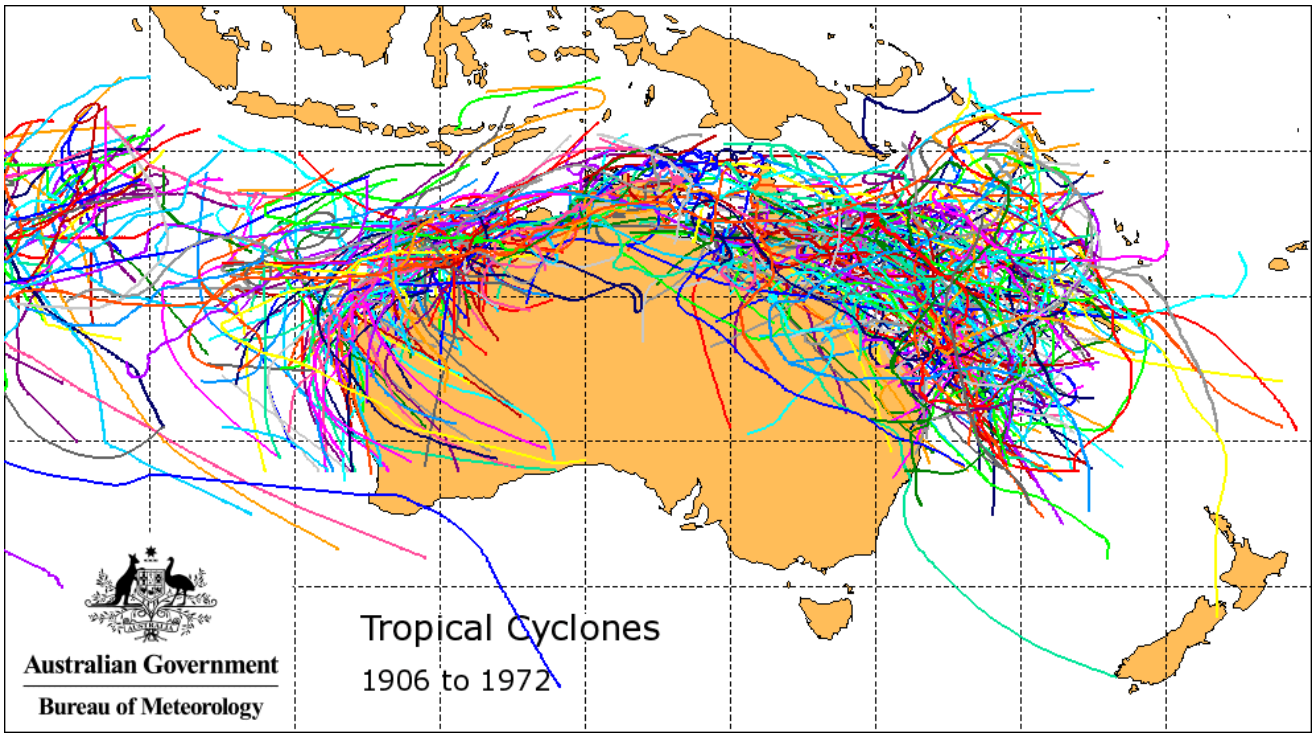
Despite advances in computer modelling of the global climate using various scenarios of greenhouse gas emissions, making projections of how tropical cyclones may change in frequency and intensity remains a significant challenge. Since tropical cyclone activity is modulated by the El Niño Southern Oscillation (ENSO), projections of cyclone frequency will partly depend on the projections of future ENSOs. It is uncertain how ENSO will change in a warmer world. Some studies have suggested that peak winds in cyclones may increase by 5-10 % and peak rainfall rates may rise by 20-30 %. “



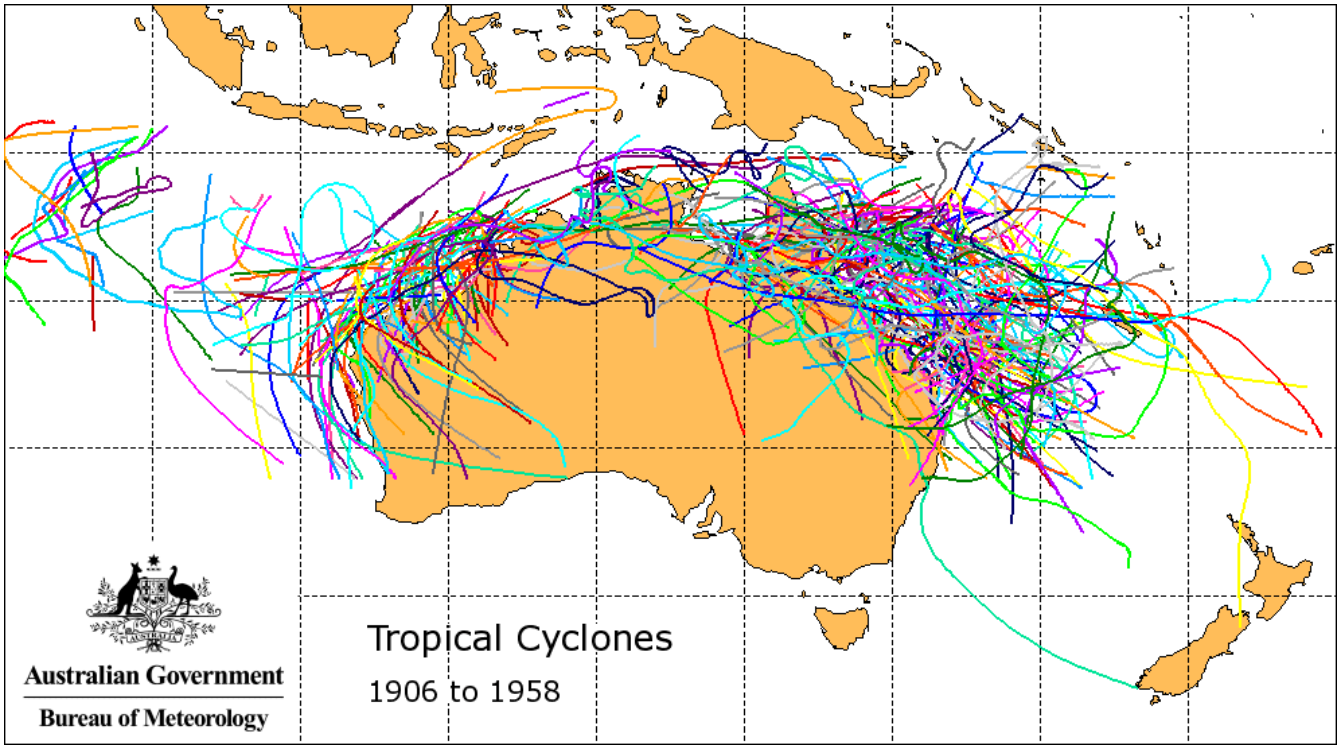
The accuracy of the path of cyclones and their classification may be affected by the data collection systems so below is the period of satellite tracking.



Note Tropical Cyclone Gertie in 1995 the most southerly record of a coast to coast transit. Such southerly transits across the land appear to also be a recent phenomenon. Further, the east coast cyclone appear to be extending further south and becoming more frequent in the latter half of the 100 years of data



The 5 tropical cyclones tracked to below Cape Leewin in WA prior to 1973 were from 1960 to 1972.



Note the cut off line for tropical cyclones migration prior to 1960. Here was the point where they were declared ex tropical cyclones. If the behavior at which they cease to be

tropical cyclones remains the same then their path has extended into higher latitudes as shown by the last 15 years of behavior as shown by the first map of the 1988 – 2004 activity.

The Hadley Climate Center modeled for cyclones in the South Atlantic about 2070. One occurred in 1991 but did not strike land and another [Catarina] in 2004 along with a storm that resembled a tropical depression in January of the same year. Both came ashore.

Here is the current explanation for tropical cyclones extending outside their usual range.

“Occasionally a cyclone moves south and interacts with a mid-latitude trough and undergoes *extra-tropical transition* changing from a warm-cored tropical low to a cold-cored mid-latitude low. The structure, distribution of winds and rainfall changes significantly

This process is observed in other tropical cyclone basins around the world and can result in a re-intensification of the system even though it loses tropical cyclone characteristics. These accelerating tropical lows have been shown to be associated with intensifying cold fronts that moved to the northeast towards the tropical low. This 'capture' process and the resulting weather is shown schematically in figure 1. This is also demonstrated in the description of cyclone *Alby [1978]*.”

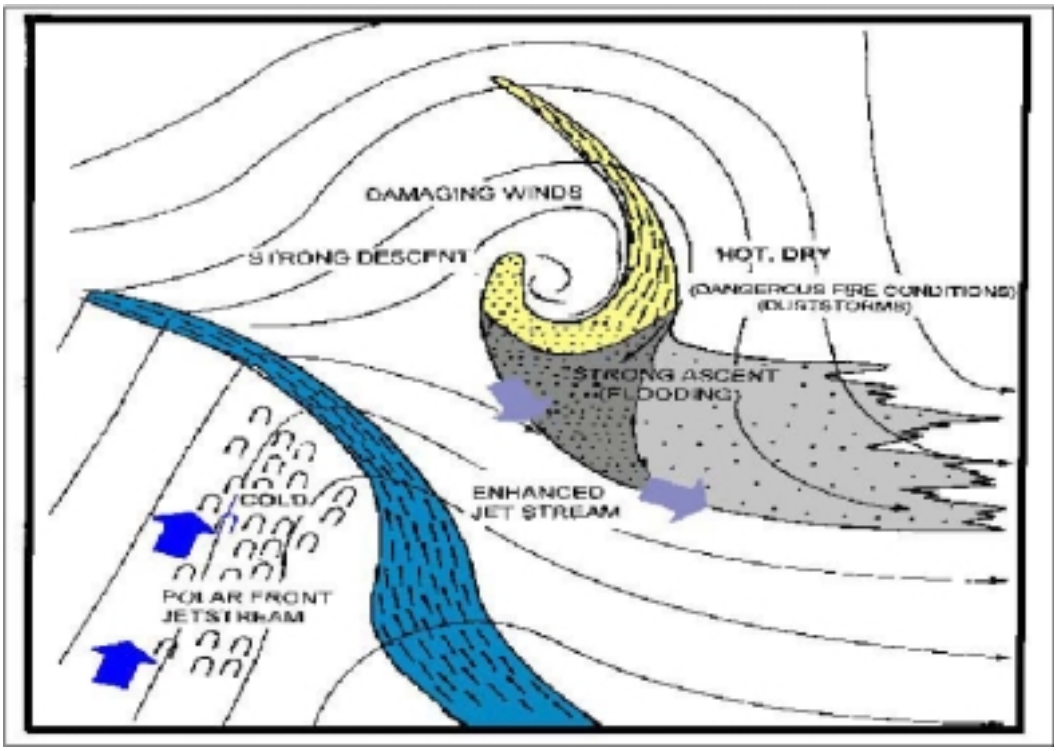


Figure 1. Schematic diagram showing features of a tropical cyclone undergoing extra-tropical transition from Tropical Cyclones affecting Perth. From BoM website

Certainly there is a strong element of chance in such phenomena and Wednesday nights cyclonic storm was generated with the assistance of a tropical storm combining with a southern ocean low unlike in the South Atlantic.

However, are conditions in the atmosphere changing in response to changes in the earth's heat balance.

If so how far will these lead beyond the drying currently associated with a popular understanding of the changes we are inducing in the climate.

What can we expect in changes in the behavior of short term extreme weather events such as recently experienced as greenhouse gas concentrations rise and warming follows.

The modeling predicts an increase in storms, the data indicates a changed behavior for cyclones and peoples experience tells them something has changed.

There were storm impacts on built environment, the important electricity distribution network suffering considerable damage and in urban areas the above ground system left many people without power for days. In Melbourne power was not restored until the weekend.

Among adaptive responses South Eastern Australia could take would be to progressively underground power supply in built up areas to harden the distribution system and to review the building code to take account of higher wind intensities against the impacts of what is likely to become an increasingly frequent phenomenon as storm intensity continues to rise along with the climate warming.

Thanks to the Bureau of Meteorology for providing a site where the portents of the heavens can be viewed.

phill Parsons