TROPICAL CYCLONE

Many of us have had experienced what is called a tropical cyclone, or may even, as most cases recall the bad memories it brings.

Solomon Islands lies in the area of Tropical Cyclones and so is frequently threatened by this destructive act of nature. In the history of mankind, all the lives that have been lost, a high proportion are attributable to Tropical cyclones.

Tropical Cyclone Namu had been claimed the most serious natural disaster in the living memory of the Solomon Islands. In a period of just four days, 103 people died, 99,000 were left homeless and one million dollars worth of damage.

Tropical Cyclone is formed as a result of the seasonal migration of the Equatorial Trough and the associated Inter tropical Convergence Zone (ITCZ) from the northern hemisphere to the tropical latitudes of the southern hemisphere. This convergence zone is a result of the converging interaction between warm moist northwesterly monsoons and the moist southeast trade winds. It is always within such a convergent zone that a tropical cyclone develops. Tropical Disturbances tend to occur in the Solomon latitudes at the beginning and the end of the season rather than at the mid - season with most are likely at the south of 10 degrees south.

The tropical cyclone is frequently described as the most devastating of all natural phenomena. In its combination of violence, duration and size of the affected area, a tropical cyclone is without equal for the sum total of destruction it can cause. In the history of mankind, there is a long catalogue of meteorological disasters and all that have been lost, a high proportion are attributable to tropical cyclones.

Tropical Cyclone is:

a A low pressure system with mean wind speed exceeding 33knots (63km/hr).
b Form in warm tropical ocean and have a life time of several days up to several weeks.
c 200 - 1000kms in distance and about 9 - 10 km in vertical extend. The word cyclone is derived from the Greek word 'Cyclos' meaning a coil of a snake.

For a Tropical cyclone to develop, six climatic conditions must occur simultaneously

Processes/factors/conditions/ causes Tropical Cyclone (TC) formation

1 Pressure must fall below 1000hectopascals
2 Sea- Surface Temperatures (SSTs) 26 degrees plus
3 location at least a few degrees pole ward of the equator (i.e 5 degrees North or 5 degrees South) giving a significant value of planetary vorticity or where there is enough Coriolis force .(Note: Over the Equator the Coriolis effect is Zero.)

4 Low level wind must come into the developing depression
5 Fairly winds up to 30,000 feet (so that low depression does not broken up)
6 Widespread convection, i.e rising of warm moist air over a tropical ocean

Right season for TC (Solomon Nov - May but there can be exceptions)

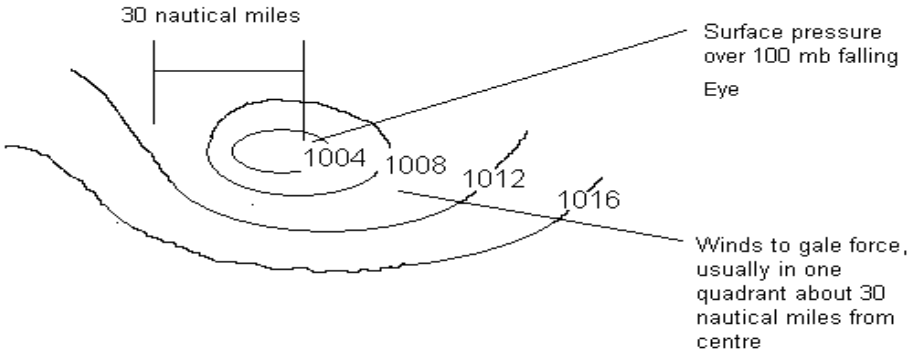
When and only when these conditions are met, a tropical cyclone can develop.

Note: TC moves in an anti - clockwise direction in Northern hemisphere and Clockwise in the southern hemisphere.

FOUR fairly distinctive stages of a TC.

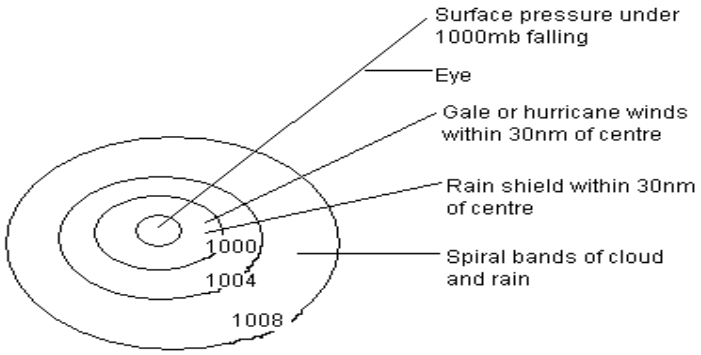
1 The Formative stage

At this stage the pressure is still above 1000 hpa and the " EYE" is just commencing to form. Winds have reached gale force (34 kts), usually only in one quadrant and approximately 3o nautical miles from the center.



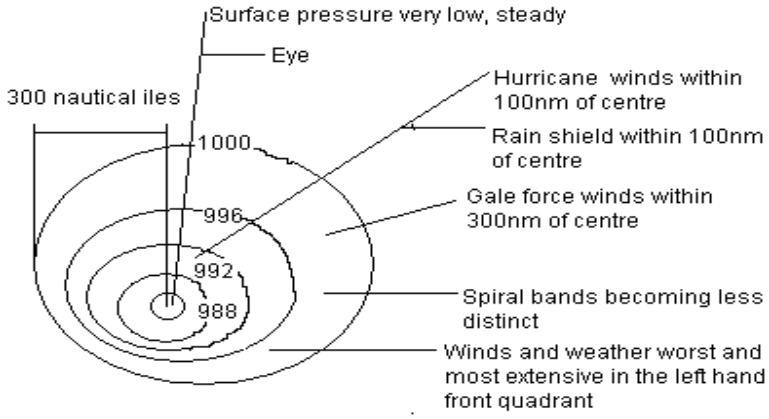
2 The Immature stage

At this stage the central pressure has fallen below 1000 hpa and continues to fall. Winds within 30 nm have reached hurricane force (64 kts) and the distinctive spiral bands are formed.



3 The mature stage

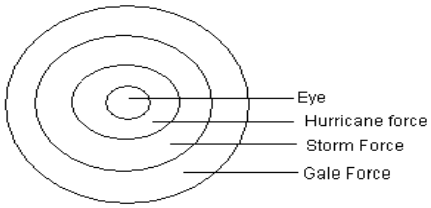
The extend of the storm is expanding with hurricane force winds extending up to 100 nm from the center. The surface pressure no longer is falling at this stage. Within the front left hand quadrant the weather and winds are at the their extreme worst.



4 The decaying stage

This frequently occurs when the tropical cyclone makes landfall. There is no longer the warm tropical ocean to feed the system, the surface pressure rises and so it slowly dissipates as a rain bearing depression. Fairly causing widespread flooding.

WIND ZONES AROUND A TROPICAL CYCLONE



Idealised winds around the cyclone system

Gale Force Winds

Average winds speeds 34 to 47 knots 62 to 88 km/hr. Damaging winds with moderate or heavy rain.

Storm Force Winds

Average winds 48 to 63 knots (89 to 117 km/hr). Very damaging winds. Storm surge. Rapid flooding by sea in coastal areas. Heavy rain and flooding. High to very high waves.

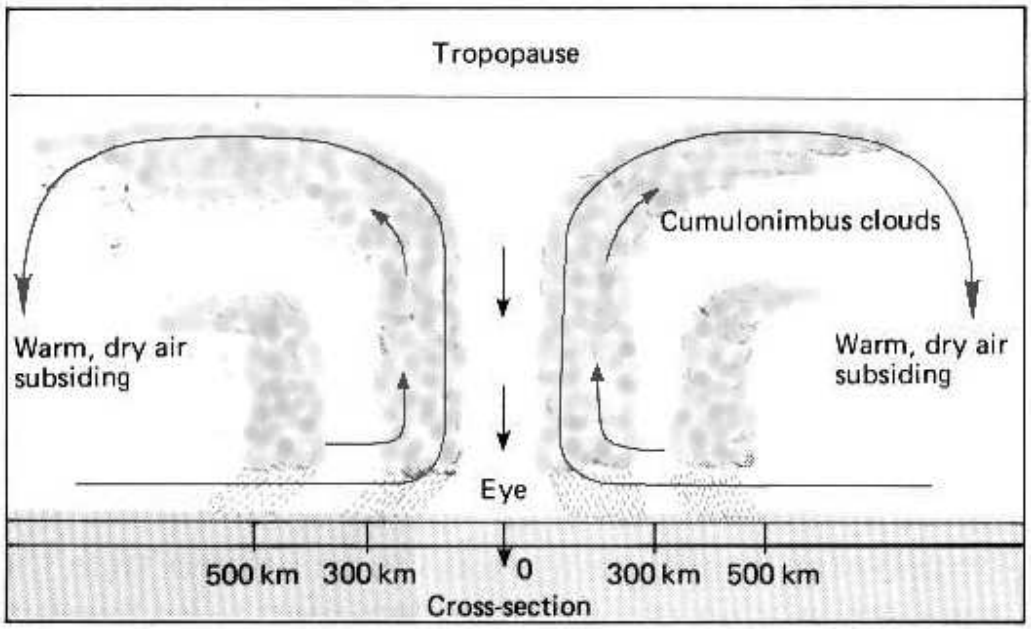
Hurricane Force winds

Average winds 64 knots (118 km/hr. Severe damaging winds. Storm surge – rapid flooding by sea coastal areas. Very heavy rain causing severe flooding. High wave.

Eye or Centre

Calm or very light winds, or very light winds. 30 – 100 kilometers in diameter.

CROSS SETION OF A TROPICAL CYCLONE



TROPICAL CYCLONE IMPACTS ON PEOPLE AND ENVIRONMENT

The principal damaging forces associated with Tropical Cyclone that has impacts on people and environment are:

Strong and violent winds
High seas and storm surge
Flooding caused by heavy rain

Out of these destructive elements the storms surge is responsible for nearly 90% of loss of life and property in the case of cyclonic disasters. However, the greater damage may be due to induce flooding and landslide.

A Strong Winds

The devastating force of the winds from a tropical cyclone are made up of three component: Air pressure, Suction and Gusts. During a tropical cyclone's life cyclone wind of gale force – 34 knots, Storm force – 48 knots and Hurricane force – 63 knots are experienced. Beyond this, there can be winds of major hurricane force – 90 knots and super hurricane force 120 knots.

These winds cause extensive damage to buildings and vegetation, as well as endangering lives with flying debris.

Severe damage can also be inflicted upon he nation's utilities, such as power poles and telephone communications links.

Loss of personal effects and household goods, expensive repairs, loss of foods crops

and livestock and hence income. The tragic loss of life and physical injury.

In the Solomon exceptionally strong surface winds blow around the center of a tropical cyclone in a clockwise direction reaching their peak of 60 – 70 knots causing extensive damages to the national and local properties.

B High Seas and storm surge

This is a tropical cyclone components that causes abnormally high ocean tides which may rise up to 3-6 meters above the regular tide. These are due to the piling up of sea water by the frictional effect of very strong winds persistently blowing on shore (and the "suction" effect reduced atmospheric pressure) s the cyclone approaches a shallow coastline. It causes greater loss of lives.

It can inundate low lying coastal plains causing greater damages to properties, installations, soil salinity and sanitations.

C Heavy rain – flooding

Another devastating component of a Tropical cyclone is flooding caused by heavy rain. Flooding can cause destruction to properties, land, vegetation, personal effects, lives and utilities.

Tropical Cyclone impacts on people and Environment would be considered in many areas such:

A **Physical**
B **Social**
C **Economical**

A. Physical

- Destruction of buildings - urban houses, (offices, commercial and homes) rural dwellings, public facilities such as hospitals,
- dispensaries, clinics, markets, Disable Care Centers, telecom and emergency centers
- Destruction of infrastructure - wharves, airports, roads, bridges etc.
- Utilities (Electricity, sewerage and water pollution)
- Agricultural crops (both subsistence and commercial), lives stock etc...
- landslide, soil erosion

B. Social

People

lost of lives targeted on

- single parents families
- women pregnancy
- mentally and physically handicapped people
- people living and working in remote areas
- urbanization - overcrowded more problems resulted in high death rates
- Poverty
    * poorer people at risk
    * lack of public awareness
    * high populated area with less or no support at all.

Health

* poor water and sanitation,
* lack of proper food quality
* no housing
* widespread diseases (more deaths)

Education

* classes either delayed or closed
* low results output
* unemployment rises

C. Economical

- losses to economic assets
- evaluating processes the direct loss potential e.g destruction of physical and social infrastructures and its repairs or replacement costs
- Crops damaged and loss potential
- The impacts on lost production, employment, essential services and income
- earning activities secondary effects

* Epidemics
* Inflation
* Income disabilities and isolation of outlying areas

STRATEGIES USED TO MINIMIZE THE IMPACTS.

Similar to other natural disasters economic losses and deaths can be reduced if the monitoring and forecasting capability for TC can be improved. Warning procedures and strategies necessary to make optimum use of the meteorological skill to combat disasters such as:

1. Monitoring

* To define cyclone's position, intensity and structure

* Meteorological data, coastal radar network, satellite observations, aircraft reconnaissance, ship's observation and upper air sounding.

2. Forecasting

* achieving the desired public response to TC warning system for the accuracy of forecast,
* Techniques currently use for TC formation, intensity and movement,
* However, poor forecasting may occur when abnormal situations develop e.g. sudden changes in direction, speed, intensity and heavy rain. Problems - inadequate observation, limited understanding of physical processes involved TC motion and intensity changes.

3. Warning

* An effective warning system must be concerned with

* more than just the meteorological content, e,g language of warning must simple and easy for the public to understand

* Criteria for issuing of warnings, increase of warnings to indicate an increasing threat, timing of warning must be designed to meet the needs of the affected in the threatened area.
* Distribution of TC warnings through Meteorological telekom network, news media, newspapers, government departments at different level concerned, navigation, ports, public transport, aviation and public at large.

The effectiveness of the warning system is directly linked with the social and economic benefits of disaster prevention and preparedness activities.

STRATEGY FOR ACHIEVING RESPONSE

Five aspects that are important in formulating the warning response strategies are as follows:

1 Improve monitoring, forecasting and warning distribution system

- Monitoring is extremely important if TC exhibits abnormal behavior,
- If changes detected early modification of warnings may still be effective in reducing losses.
- Improvements of forecasting capability for TC tract, intensity, and precipitation to the overall warning system
- Effective timely warning distribution system to generate the appropriate level of response to the actual threat.

2. Strengthen the international cooperation

* Cooperation between threatened countries is an effective method to minimize damage
* Exchange of information and data must be facilitated
* Coordination of the warnings can be useful in achieving the appropriate preparations for TC disaster.

3. Improve leadership in combating disasters

* Decision - making of disaster preparedness activities should be under unified leadership. e.g government departments responsible, NDC and other responsible authorities
* Various organizations must be prepared in advance appropriate plans to response to warning

* Different measures for different levels of the warning and the potential severity of TC should be taken into account during the planning and design of offshore structures.

4. Education

* More educational awareness of disaster preparedness to be incorporated in the schools curricula,
* Involve NGOs mainly in community education which fosters community solidarity and self-reliance, targets that would also minimize social disruption in times of disasters.
* Use news media and newspapers for disaster preparedness
* More seminars and workshops
* Videos, brochures/maps and simulations

5. Establishment of disaster assessment, processing, and archiving system

* The defense system for dealing with TC disasters is a multi level, comprehensive organization composed of decision - making, management and coordination, public education and implementation
* Develop effective disaster model for accurate information on TC events is collected
* Disaster data bank to be used to improve decision - making and efficiency in combating disaster.

FORECASTING OF TROPICAL CYCLONE

The Forecasting Section within the Solomon Islands Meteorological Service is responsible for the issuing of Tropical Cyclone warnings from Nadi(Fiji) and Brisbane Tropical Warning Centers when parts of the country is threatened by a TC within the next 36 hours. Although the information for issue of TC warnings comes from Fiji and Australia TCWCs, the actual warning is issued I the SI by the Forecasting Section of the SIMS.

TYPES OF WARNINGS:

A TC Watch Phase Warning

This watch phase warning declared when a depression formed outside of SI region and poses a threat of gale force winds of 34 to 47 knots to any parts of SI. This TC advise is issued if threat is expected within the next 48 hours but NOT within 24 hours.

B TC Warning Phase

This warning phase is declared for SI when the gale force winds of 34 to 47 knots expected to affect any part of SI within 24 knots.

TC warning is issued when an existing TC has a forecast movement, which would extend gale force winds to any part of SI within 24 hours.

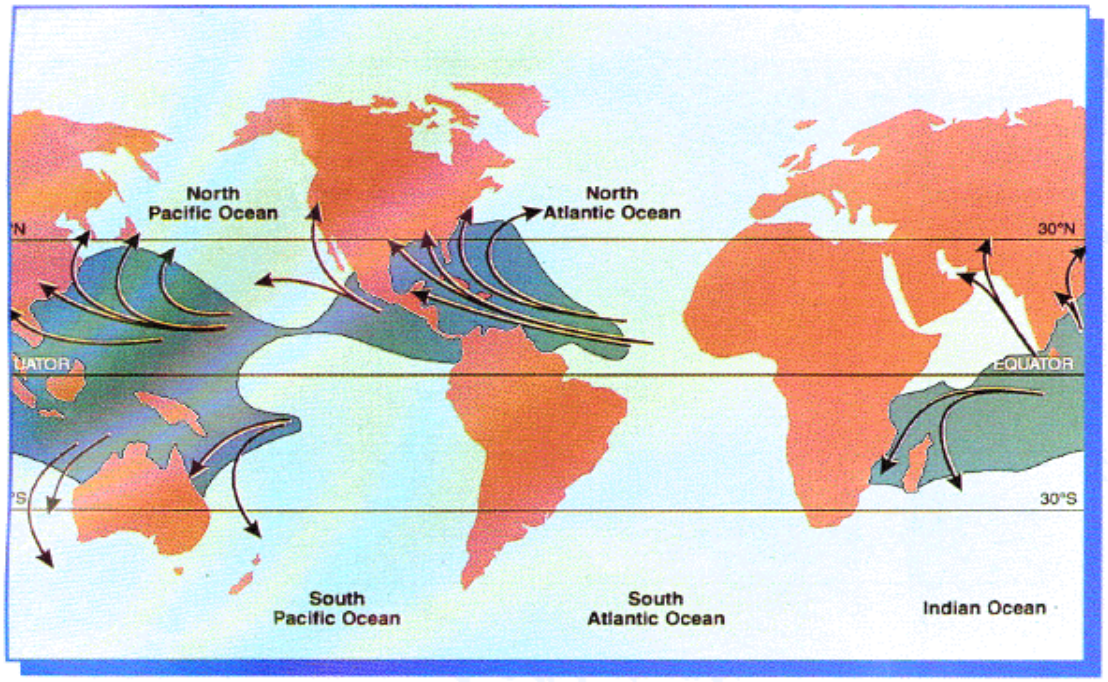
On receipt of a Special Advisory from Nadi and Brisbane TCWCs, the SIMS immediately prepares and issues a Tropical Cyclone Warning to the General Public, through SIBC, NDC, Marine, Aviation and other Organizations.

The message included in a warning includes: Location of depression, Name of TC, Position, Intensity – Severity, Direction, Movement or Stationary.

GLOBAL DISTRIBUTION AREAS OF TROPICAL CYCLONES

Tropical cyclone always forms over oceans, and the major ocean areas are the Pacific Ocean, the Atlantic Ocean and the Indian Ocean. Tropical cyclone forms there because they depend on the oceans water for heat and moisture to provide them with the enormous amount of energy in the storm. And they form between 5 and 20^{o} north and south of the equator. Further more tropical cyclone form as result of the seasonal migration of equatorial troughs and the associated inter tropical convergence zone (ITCZ) from the latitude in the northern hemisphere to the latitude in the southern hemisphere.

This convergence zone is a result of the converging interaction between worm moist northern westerly monsoon and the moist south east trade wind. It is always within such a convergent zone that tropical cyclone form.



Planet Earth: Storm/Bill Hezlep © 1982 Time-Life Books, Inc.

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TROPICAL CYCLONE OCCURENCES AND DISTRUBUTION IN SOLOMON ISLANDS

Using a 31 year history from 1958 to 1988 the possibility of a disturbance from south of 10 degrees South during November to May of a given season is 2 every 3 years. Of those disturbances, there is 45% chance that they occur in March/April and this accounts for 80% of the occurrences in those two months.

However, north of 10 degrees South the likelihood is 1 every 2 years, with the majority occurring from November to January and May. Cyclone Namu was one of those that came from the north which caused extensive damages worth millions of dollars and

causing the death of more than a hundred people, and leaving more than 90,000 people homeless.

On average, for the 31 year period a tropical disturbance can occur at least once a year.

The preferred areas for their development are in order:

(1) South of 10 degrees South and east of 160 degrees East, with the majority
formed in December/January and March/April.

(2) North of 10 degrees South and east of 160 degrees East at the beginning of the season in the months of November/December.

G.C. Revell (Weather and Climate (1986): 67-69) studied tropical cyclones which had significant impact on some parts of the Solomon Islands. He identified "21 occurrences in 37 seasons, from 1949 to 1986 and these were spread over all months from November to May with a minimum in February and a maximum in March". He pointed out that "the risk of a strike is clearly greatest in November, December, April and May relative to the South Pacific region as a whole. Moreover in these months every one of these cyclones originated over the Solomon Islands or else approached from the north or east whereas in January, February and March less than half did so, the majority formed further south".

The yearly distribution had a maximum in 1972. It is interesting to note that over 45% (16) of the 35 tropical disturbances occurred in what seems an active period from 1966 to 1972 averaging just over 2 disturbances per year, twice the annual average.