TROPICAL REVOLVING STORMS VS SHIP COMPANIES

Climate change

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Introduction

After every storm the sun will smile, for every problem there is a solution, and the soul's indefeasible duty is to be a good cheer (William. R. Alger). I strongly agree with this statement, but the problem start where the storm affects us as people, environment and shipping companies which causes major impact to transportation of goods from one country to another. This essay will elaborate more about tropical revolving storms as a risk of climate change; impacts and costs it does to environment, people and shipping companies; and ways to avoid and reduce this TRS.

1. Tropical Revolving Storms TRS

(Pictured above is a satellite picture of Cyclone Pam which hit the American Samoa and *New* Zealand in March 2015)

A tropical revolving storm (TRS) is a storm system with a low-pressure centre, around which winds of gale force (34 knots or force 8) or more blow spirally inwards, anticlockwise in the Northern Hemisphere (NH) and clockwise in the Southern Hemisphere (SH).

The diameter of a tropical storm is generally less than 500 nm and often only 100 nm in its early stages of development. With pressure, frequently about 960 millibars, and often much less, the pressure gradient is such that winds regularly reach hurricane force.

The circulatory velocity of these storms is so great that, once formed, no frontal structure can persist, and they become almost symmetrical circular depressions.

The seasons of TRSs and their regional names around the world are:

Name	Area	Season
Hurricane	North Atlantic/West Indies	May-December
Hurricane	North-East Pacific	May-October
Cyclone	Fiji, Samoa, New Zealand	November-March
Cyclone	Australia	November-March
Cyclone	Bay of Bengal	April-November
Cyclone	Arabian Sea	April-June, October-December
Cyclone	South Indian Ocean	November-March
Typhoon	North-West Pacific	May-December

Causes of TRS

- Warm (over 27C) moist air rises from the surface of the sea.
- As it rises it meets cooler air and condenses to make clouds and rain.
- This condensation releases huge amounts of energy, producing strong winds.
- The winds are driven by the spin of the earth and go round and round.
- As the earth rotates the winds are sucked violently upwards in a vortex which can be 1,000km wide. Wind speeds can be as high as 200km per hour.
- These storms are fuelled by damp air when they reach land, dry air is being sucked up and they loose energy.

Important terms for TRS

- Track - The route over which a TRS is already passed.
- Path -The predicted route, over which, there is a possibility of the TRS passing at near future.
- Another point on the route is called the Vertex, which is the westernmost point, of the TRS, when recurving takes place.
- Right-hand semicircle) (RHSC) - It is the half of the storm, which lies to the right of the observer, who faces along the route of the storm. For a stationary observer, here the wind veers (changing direction clockwise) steadily.

- Left-hand semicircle (LHSC): It is the half of the storm, which lies to the left of the observer, who faces along the route of the storm. For a stationary observer, here the wind backs (turns counter-clockwise with height) steadily.
- Navigable semicircle - It is the side of a tropical cyclone, which lies to the left of the direction of movement of the storm in the Northern hemisphere (to the right in the Southern Hemisphere), where the winds are weaker and better for the navigation purpose, although all parts of TRS are dangerous to mariners.
- Dangerous semicircle - It is the side of a tropical cyclone, which lies to the right of the direction of movement of the storm in the Northern Hemisphere (to the left in the Southern Hemisphere), where the storm has the strongest winds and heavy seas.

Structure of TRS

A well-developed TRS has three distinct parts:

The eye or vortex: A calm central area of lowest pressure, having a diameter between 4 miles and 30 miles, the average being about 10 miles. It is a roughly circular area of comparatively light winds and fair weather, available at the centre of a severe tropical cyclone. Weather in the eye is normally calm but the sea can be extremely violent. There is little or no precipitation and sometimes blue sky or stars can be seen. The eye is the region of lowest surface pressure than the surrounding environment. In severe cyclones, the eye usually looks like a circular hole in the central cloud mass.

The eye-wall: An inner ring of hurricane force winds having a width usually between 4 miles and 30 miles. The winds in the eye-wall blow in a perfectly circular path with a speed as high as 130 knots with occasional gusts up to 150 knots. The pressure gradient in the eye-wall is very steep and, therefore, the barograph would register a near vertical trend, downward before the eye and upward behind it. Eye wall consists of a dense ring of cloud and tall thunderstorms that produce heavy rains and usually the strongest winds (about force 6 or 7) at about circular path. Changes in the structure of the eye and eye wall can cause changes in the wind speed, which is an indicator of the storm's intensity.

The Outer storm area: The area surrounding the eye-wall, having a diameter between 50 miles and 800 miles, the average being about 500 miles. Winds in this region are strong (about force 6 or 7) and the pressure gradient is much less than in the eye-wall. Here angle of indraft of wind is about 45º and this gradually decreases to 0º in the eye wall. In this area, the cirrus cloud can be in the form of strands or filaments with aligned conditions and points towards the storm centre. Here visibility is excellent, except in occasional shower's areas

2. Impact of TRS to shipping companies, environment and people

The weather associated with these storms is violent; torrential rain accompanied by thunder and lightning, severe turbulence within active convective cloud and frictional turbulence generated by strong winds. Static electricity may make navigation aids unreliable.

A Tropical Revolving Storm can cause significant damage to infrastructure and high loss of life. Areas affected by a significant storm can take months or even years to recover from the human, economic, and environmental damage.

Impact on the weather

Storm Surge - Hurricanes bring about storm surge, the powerful spiral wind action carries water a couple of feet high and lashes it ashore. This can destroy structures and items very close to the shore. Storm surges are the main causes of the floods they bring. *What is a Storm surge?* This is a rise in the ocean's water level because of extreme winds blowing over the sea surface, water levels can rise to 15 feet and a lot more. As the storm makes a landfall, the high sea level brings water inland, causing major flooding and destruction.

Floods - Hurricanes carry a lot of rains with it and even after the hurricane has subsided, it may continue to rain. This causes a lot of floods and brings about other types of destructive results.

Winds - Houses, cars, farms, and many other structures are blown away by the powerful winds that come with hurricanes.

Impact on the economic

Anytime there is a disaster caused by a natural phenomenon like hurricanes, floods and fires, there is extensive damage to property (ship, cargo, homes, ports etc.). People's livelihoods are wiped away and may take many years to get things together again. In many cases, there are fatalities and entire communities are severely affected.

Storms come in all different shapes, sizes, and types, and because of this, they can have a variety of effects on supply chains. For example, heavy snow storms may block off crucial highways and create back-ups of trucks and other vehicles. It could be days before the obstruction clears. Likewise, severe flooding, such as the case of hurricane Harvey can make most traditional forms of transportation impossible. In fact, it has been estimated that Harvey has caused upwards of $50 billion dollars' worth of damage. Not to mention the loss of economic activity in Houston, which is the fourth most populous city in the U.S. These types of effects can have a markedly negative impact on the efficiency of supply chains. Which can lead to higher costs and customer dissatisfaction. On the other hand, severe

winds or in some cases even tornadoes can simply destroy an urban centre's infrastructure, forcing businesses to radically change many of their shipping strategies. The damage these storms can cause can result in huge financial losses, not to mention personal pain and suffering.

Impacts and costs TRS cause in shipping companies.

When I am talking about shipping companies, I am talking about shipowners, cargo owners, navigators, businesses which uses ships to transport goods and service for their businesses. They are all affected by TRS in the following manner:

When the ship did not manage to avoid TRS, that ship will be damaged and lost, people on board will lost their lives, cargo inside the ship will not be delivered to port of discharge, cargo owners will encounter loss to his business, businesses will also be in loss for their product/service not been delivered to port of discharged and ship owner will need to buy another ship, get new crew members, new certificates and documents for a ship, by the way start from scratch every process from ship registration.

The following are links of videos showing how does TRS/ Hurricane affects ships at sea.

Strongest storm in Pacific: https://www.youtube.com/watch?v=r4-IGFNJYyk

How cruise ships affected: https://www.youtube.com/watch?v=IbrnO8s3Jnw

How merchant ships affected: https://www.youtube.com/watch?v=9k-g2VmyFCo and https://www.youtube.com/watch?v=mSl0A1gC3sc

How the port of Tuticorin port in south India looked like when damaged by Irma hurricane.

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Impact of TRS to the environment and human beings

A powerful storm which killed dozens of people in the Philippines is now making its way across southern China. According to the state media of China “Typhoon Mangkhut is one of the most powerful storms to hit the region in decades” and mentioned the following:

- Two people have been killed in the Chinese province of Guangdong, and more than 2.5 million people have been evacuated in Guangdong and on Hainan island because of this typhoon took place there.
- In Hong Kong, the storm wrecked buildings and shut down the city. Apartments swaying in the wind, scaffolding crashing to the ground and commercial buildings with windows shattered. Transport services have also been suspended, with flights cancelled, trains stopped, and major roads closed.
- The city managed to avoid serious casualties but now faces a difficult recovery as thousands remain affected by flooding and travel disruptions.

Here is the picture showing how was the Hong Kong city looked like, this is Downtown roads pictured deluged with water, strand.

How about Philippines? , according to government officials:

- In the Philippines, 33 miners have been confirmed dead and at least 29 are missing after a landslide hit a mining site in Itogon in Benguet province.
- The storm ploughed across the main Philippine island of Luzon, most of the deaths there were caused by landslides. Dozens of people are still missing after the storm, which is being called Ompong locally vehicles

- Itogon Mayor Victorio Palangdan told news wire AP that dozens of miners and their families had rushed into an old bunkhouse that had been turned into a chapel for refuge when the typhoon hit

TRS is not only affecting ship owners, cargo owners and businesses which their products or services are transported by ocean mode of transport which are merchant ships, it also affects and costs us as people and environment as you can see what happened to China and Philippines.

Impact of Storms to supply chain and South African logistics.

Storms are very annoying to shipping companies and they all cry with this matter because once a ship is influenced by hurricane the cargo inside the ship may be discharged on sea to avoid TRS for ship's safety, safety of crew and safety of some cargo. That cargo may be delayed being discharged because of the vessel not be in port of discharged in time. So, businesses loose almost their profit and their cargo just because of this storm. If TRS happened near port it can affects that port in such a way that discharged and loaded cargo may be lost and damage the environment also lost of lives sometimes.

3. **Action to avoid and ways to reduce TRS**

The signs and symptoms of approaching TRS are as follows:

- Heavy and long swell from Cyclone centre. Swell can be experienced as much as a thousand miles away. Swell is usually the first indication of the storm centre, hence an approaching TRS.
- Pressure will be very much lower than the normal. When barometric pressure falls below 5 MB than normal, along with other TRS, confirmation factors, the approach of TRS is confirmed.
- Cirrus clouds in bands or filaments aligned towards the direction of the storm centre.
- At sunset, cloud colour will be dark red or copper.
- Clouds will be dense and heavy with threatening appearances.
- Frequent lighting will be experienced.
- Availability of storm warnings from the local authority. Weather reports based on satellite pictures and. observations from other vessels may contain storm warnings which give the position and pressure of the storm centre and also the probable direction of movement of the storm.
- The occurrence of squalls, which are increasing in frequency and intensity.
- The possibility of rain with violent torrential character.
- Sea waves are becoming heavy and dangerous.

- The shift of wind direction, in accordance with the rotation of winds of cyclonic spin.

When the TRS is confirmed to approach the vessel, the following actions must be taken by people on board:

- Obtain the bearing of the storm centre,
- Determine in which semi-circle the vessel lies,
- Take avoiding action.

How an officer onboard obtains the bearing of storm centre?

- He or she needs to face the wind, then the storm centre will be within 8 to 12 points on the right hand in NH (on the left hand in SH). - Buys Ballot's Law
- The direction of the swell, this indicates roughly the storm centre.
- The direction of the densest part of the huge bank of clouds also indicates the storm centre.

If barometric pressure falls 5 MB below normal, then there is a possibility that ship is in the well-developed outer storm area. If barometric pressure falls 20 MB or more below normal, then there is a possibility that ship is near the eye of a well-developed TRS.

Determines which semi-circle the vessel lies, How?

- Bring the ship in stationery or "heave to" (moving very slowly in one direction) to the position. Carefully monitor and write downwind directions, every after 2 hours. If wind direction changes clockwise (wind veers), then the vessel is at Right-hand semicircle (RHSC) and if wind direction changes anti-clockwise (wind backs), then the vessel is at Left-hand semicircle (LHSC), in both hemispheres.
- Veering or backing, once detected, should be continuous while the observer remains stationary, i.e. a veering wind should continue to veer and a backing wind should continue to back. If the wind veers at first and then backs, or if it backs at first and then veers, the vessel must have passed from one semicircle into another, due to change of path of the storm.

Take avoiding action.

When the vessel is at port, then she must first try to go to sea at a safe distance with plenty sea room and sufficient depth of water. Else do the following:

- Double the moorings
- Keep Engine standby
- All persons to be onboard

- No slack tanks
- All hatches should be securely battened down
- All derricks should be lowered and secured

If the vessel is in the dangerous quadrant at sea she needs to:

- Proceed as fast as practicable with the wind 1 to 4 points on the starboard bow (port bow in SH) - 1 point for slow vessels (less than 12 knots) and 4 points for fast vessels (more than 12 knots) altering course as the wind veers (backs in SH).
- This action should be kept up until the pressure rises back to normal i.e. until the vessel is outside the outer storm area. If there is insufficient sea room, the vessel should heave to with the wind on the starboard bow (port bow in SH) until the storm passes over.

In the Southern Hemisphere:

- If the wind is veering, the vessel is in the navigable semi-circle.
- If the wind is backing the vessel is in the dangerous semi-circle.
- If the wind is steady, the vessel is in the path of the TRS.
- If located in the dangerous semi-circle, put the wind on the port bow and alter course to port as the wind backs.
- If located in the navigable semi-circle or the path of the TRS, put the wind on the port quarter and alter course to starboard as the wind veers.

Once aware of the vessels location in relation to the TRS appropriate actions must now be taken to avoid the TRS and the inverse is true to Northern Hemisphere.

Ways to reduce storms

The first step in reducing the risk of storms to any business supply chain is acknowledging that they do in fact happen. Storms have been a constant part of our world since the beginning. However, despite knowing this, most storms take businesses completely by surprise. No plans have been made to counter the inevitability of storms, and because of this, the devastation is far worse than it could have been. It is easier to think that bad things will never happen rather than morbidly plan for the worst. But this Ostrich-in-the-sand mentality can put you and your business at extreme risk. So, before any other action is taken, we must first accept the threatening reality of storms.

Secondly, it is important to pay close attention to forecasts from reputable weather analysts. Knowing ahead of time that a storm is coming can be all the difference in the damage it causes. You should create backup plans for transportation routes that may be compromised

by storms. For example, when hurricane Katrina struck New Orleans, many tanker companies could divert their products to the port of Mobile, Alabama. This greatly reduced the damage of losing access to New Orleans. So, as a rule, it is incredibly important that your business develops alternate strategies and contingency plans in the case of a natural disaster.

Conclusion

Storms are an unfortunate and often tragic part of life. The damage that these events can cause is staggering to see. As a business, it is important that you understand the danger posed by storms, especially if you operate in a high-risk area. Pay close attention to weather forecasts to boost your response time to potential disasters. You should also engage in worst-case scenario analysis so that you can develop contingency plans and alternatives when faced with a powerful weather event.

Storms and other natural disasters can cause fear and uncertainty in even the most experienced supply chain managers. One way to combat this uncertainty is to surround yourself with qualified people who have the expertise to help you through these trying times.

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