

SEVERE CYCLONIC STORMS OVER THE ARABIAN SEA - A RISING ECONOMIC BURDEN

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Introduction

Climate change is the outcome of natural as well as man-made reasons. What we currently see is a set of erratic climatic episodes which are predominantly correlated to excessive amounts of CO₂ and other GHGs released by mankind. Mankind definitely seems to have not been kind enough in matters of environmental protection and conservation.

Although scientists are uncertain whether climate change will lead to an increase in the number of storms, there is more confidence that warmer ocean temperatures and higher sea levels are expected to intensify their intensity and impacts. Stronger hurricanes will be far more costly in terms of damages and deaths without action to make coastal (and inland) areas more resilient.

The economic cost of climate change can be seen in the ever-growing losses caused by cyclones and hurricanes. As a result of global warming, cyclones are proving to be the worst accounting for major loss of lives as well as economic damage.

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Climatic records show that the tropical cyclone in the Indian Ocean generally tend to form between April and December. Most of the North Indian coastline is near sea level and prone to flooding, these cyclones can easily kill many with storm surge and flooding.

On an average around 2 to 4 tropical cyclones impact India every year, while most of these tropical cyclones impact the east coast of India, the West Coast of India, in general, is less prone to cyclones with one cyclone out of 2 to 4 hitting the west coast.

A very severe cyclone is defined as one with wind speeds touching 220 kmph.

Study Area:

For the purpose of this study the Indian Ocean, more particularly the Arabian Sea is taken into consideration. The recent years have seen an increased frequency in the incidence of severe cyclonic storms in the Indian Ocean.

Data Collection:

Data is collected from secondary sources such as online websites, IMD journals, etc. for the purpose of this study.

Methodology:

The data is collected for the number of cyclones that hit the west coast of India over a period of five decades. The decade-wise data is condensed to see if the number of severe cyclones impacting the Arabian have actually increased. The destruction in terms of economic cost is ascertained for every decade, the data for which is gathered from official

sources. Both variables are then analysed to find correlation and also to see if there is an increasing or decreasing trend.

Review of Literature:

The Hindu 9th December 2021 carried an article and quoted the Science Minister's speech at the Rajya Sabha, An analysis of past data of cyclones over North Indian Ocean during the period from 1891 to 2020 indicates that the frequency of very severe cyclonic storms' has increased over the Arabian Sea. However, this has not measurably increased the threat to India's western coast, as most of these cyclones were making landfall in Oman and Yemen. The Cyclone Atlas of India Meteorological Department reports that between 2010 and 2013 nine systems (depressions, cyclonic storms, severe cyclonic storms and above) formed in the Arabian Sea but only four intensified into cyclonic storms or above. Only one touched the category of severe cyclonic storm category. On the contrary, 22 systems formed in the Bay of Bengal in the same period. Of which 10 intensified into a cyclonic storm and eight turned into severe cyclonic storms.

In a new paper published in *Frontiers in Earth Science*, researchers investigated how tropical cyclones' destructive power has changed over the eastern and south-eastern regions of Asia between 1979 and 2016. They found that, during the last four decades, there has been a notable increase of tropical cyclone inland impacts over the studied regions. Future projections showed that by the end of the 21st century, western north Pacific (WNP) tropical cyclones could have doubled in destructive power over inland regions.

Tropical cyclones are one of the most dangerous types of natural disasters. They carry several hazards, such as heavy rainfall, high winds, and storm surges, which, alone or combined, can damage property and threaten life. Over the past 50 years, tropical cyclones have caused almost 780,000 human fatalities and US\$ 1,408bn in economic losses. The climate crisis will likely continue the increasing trend in land falling typhoons and their impacts on inland regions, based on high-resolution climate model projections.

Observations:

In the year 1963 the season was above average with seventeen depressions forming in the India Ocean. Out of them, six cyclones formed with four making land-fall in India. The season included the first Super Cyclonic Storm to be recorded in the satellite era. Extremely Severe Cyclonic Two caused heavy rainfall in Laccadive Islands. It was considered as one of the strongest Arabian Sea cyclone until 2001 India Cyclone based on the pressure.

The year 1964 saw a super cyclonic storm sixteen. It was the most powerful cyclone to strike Tamil Nadu and Sri Lanka. It also overturned a passenger train which killed 200 people on board. It devastated the town of Dhanushkodi because of a 25 ft. (7.6 mts) storm surge and after that, the Government of Madras said that it was 'unfit for human civilization' and declared it as a Ghost Town.

In 1966 a cyclone struck Madras (now Chennai), India on November 3, killing over 50 people and leaving 800,000 people homeless.

In November 1977 a very Severe Cyclonic Storm 05B hit Nagapattinam in Tamil Nadu and brought catastrophic damages to the agricultural crops. Nearly 560 people and 23,000 cattle were reported to be died and 10, 00,000 people were affected. It made another landfall over Karnataka which became the first and only recorded cyclone to make landfall at that state.

In 1982 an extremely Severe Cyclonic Storm ARB 01 made landfall over Porbandar in Gujarat. The rainfall recorded for the city was 120 cm, which was highest for the month of November. Nearly 340 people were reported to have died due to the storm. It was the latest date for a cyclone in the North Indian Ocean basin to make landfall at the West Coast of India.

In 1985 a cyclonic Storm ARB 02 made landfall near Dwarka (Gujarat) in the month of June with less damage and No deaths reported.

In 1987 Cyclonic Storm 07A made landfall twice over the nation. Once near Tondi as a weak depression and next near Murud Janjira as a tropical storm. Damages were reported to be minimal.

In 1998 an Extremely Severe Cyclonic Storm ARB 02 strengthened into the equivalent of a major hurricane with wind speed touching 195 km/h (115 mph) on 9 June before making landfall near Porbondar in the Indian state of Gujarat. 1173 died from the storm and 1774 were reported missing. It was the worst storm to hit Gujarat since 1982.

Cyclonic Storm ARB 05 brought considerable rainfall over Gujarat. Damage was less expected as it was already affected by Extremely Severe Cyclonic Storm ARB 02. But 250 fishermen were reported to be missing by the storm.

In 2004 Severe Cyclonic Storm ARB 01 brought heavy rainfall over the southern states of Kerala, Karnataka and Goa which later became the first cyclone to directly threaten Kerala since records began in 1891. It also brought torrential rainfall over Lakshadweep Islands and killed 9 people. 230 cm of rainfall fell over the island of Amindvi which became second wettest storm in North Indian Ocean basin and 15th wettest storm worldwide on record.

Severe cyclonic storm Onil became the first named storm in the North Indian Ocean basin on record which formed in the month of September. It skirted the coast of Gujarat and brought considerable rainfall there. Nearly 900 fishermen were feared to have lost in the storm. It brought little damage to nearby Pakistan.

In 2007 the season was near normal with four cyclones forming but the season has no Indian landfall. But depressions formed in this season were the deadliest. It saw the first Super Cyclonic Storm in the basin since 1999 and the first to ever record in the Arabian Sea. It was also the first time to have two category 5 equivalent cyclones in a single season.

Cyclonic storm Yemyin formed over Bay of Bengal in the month of June as a Deep Depression over the Arabian Sea brought widespread floods over A.P., Telangana, Karnataka, Gujarat and Maharashtra killing 150 people. This was because the storm maintained its intensity and crossed into the Arabian Sea where it intensified further into a Cyclonic Storm and brought catastrophic damages over Pakistan which was the first cyclone to hit the nation since 1999.

In 2009 Depression ARB 01 formed on June 23 and made landfall in the state of Gujarat. It killed nine people due to lightning. Cyclonic Storm Phyan formed on November 4 and made landfall in Pune and became the fifth wettest tropical cyclone in India.

In 2015 depressions formed during monsoons were the deadliest. Deep Depression ARB 02 affected Gujarat, causing \$260 million in damage and 81 deaths.¹

In the year 2018 seven cyclones formed with four causing destructions to states on both the east and west coast of India. The season saw simultaneous cyclones on either sides of the North Indian Ocean (Bay of Bengal and Arabian Sea) at a same time. The brunt was felt in western UP and New Delhi too which received 226 mm of rain in 24 hours. The river Yamuna crossed the danger level and reached to 205.5 meters by July 29, prompting the evacuation of more than 1,500 people in Delhi.

In 2019 the remnants of Very Severe Cyclonic Storm Vayu impacted Gujarat causing some damage. 8 deaths were reported. The outer bands of the same storm caused heavy rainfall in some portions of Western India. It also caused an increase in vector borne diseases in some areas.

2020 Severe Cyclonic Storm Nisarga made landfall near the coastal town of Alibag in Maharashtra June 3. Nisarga was the strongest tropical cyclone to strike Maharashtra in the month of June since 1891. It was also the first cyclone to impact Raigad & Mumbai since Phyan of 2009. Nisarga rapidly weakened once inland and dissipated on 4 June. The State Government of Maharashtra put the total damage from Nisarga at Rs.60.48 billion (US\$803 million), and the state required Rs11 billion (US\$146 million) to recover from the damage caused by Nisarga.

In 2021 an extremely severe cyclone Tauktae caused heavy rainfall with very gusty winds in Goa, Maharashtra and Gujarat... It made landfall on the southern coast of Saurashtra peninsula in Gujarat and caused moderate to heavy

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Y damage to Gujarat It was the worst storm to hit Gujarat in 20 years since the 1998 Gujarat Cyclone.

Conclusion:

The data collected from several online e-books and Climate journals shows that slowly and steadily the number of Severe Cyclones are increasing their frequency and intensity in the Asian subcontinent. Data gathered for the tropical storms generating over the Arabian Sea show that they are getting fiercer with the passage of time. Scientists have attributed the cause for this, to the warming of oceans which is triggering the formation of storms in these areas. Data also reveals that episodes of severe cyclonic storms was a common phenomena in the Bay of Bengal, wherein the state to be most affected used to be Orissa. But the current trend shows a tilt towards prevalence of severe storms in the Arabian Sea too. This implies that States particularly Kerala, Goa, Karnataka, Gujarat and Maharashtra need to brace themselves for more such disasters.

Disasters such as these cause severe damage to life and property. The data gathered points towards Gujarat being the state that has experienced most landfalls, and therefore bore heavy economic losses. While currently Maharashtra seems to be in the line of fire with regards to bearing huge economic losses due to the disastrous storms almost regularly.

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