

JUNE 2020



# AAPDA SAMVAAD



**The Summer of  
Cyclones**

## Tremors in NCR

# NO NEED TO PANIC, SAY EXPERTS

In view of the recent seismic activities in Delhi-NCR region, a meeting was convened by the National Disaster Management Authority (NDMA) on 10th June 2020, to discuss the various mitigation and preparedness measures to reduce the earthquake risk in Delhi-NCR region.

Dr. B K Bansal, Director of the National Centre for Seismology (NCS), said there is no need to panic with respect to the recent seismic activities in Delhi-NCR region. But it is important to undertake preparedness and mitigation measures to reduce the earthquake risk, he underlined. Dr. Bansal was speaking at a meeting convened by the National Disaster Management Authority (NDMA) here yesterday to discuss the various mitigation and preparedness measures to reduce the earthquake risk in Delhi-NCR region.

Director, NCS informed that given the seismic history of Delhi and its vicinity, the occurrence of minor earthquakes in Delhi-NCR is not unusual. However, there is no proven technology in the world wherein earthquakes are predicted with certainty in terms of its location, time and magnitude.

Following the meeting, the NDMA has requested the States to take the following measures:

- i. Ensure compliance of building bye laws to make upcoming constructions earthquake resilient and to avoid addition of vulnerable building stock.
- ii. Identify the vulnerable priority structures, especially lifeline buildings, and retrofit them. Private buildings should also be retrofitted to reduce the risk in a phased manner, wherever required.
- iii. Conduct regular mock exercises to deal with earthquakes in future and come out with SoPs for immediate response after an earthquake
- iv. Undertake the public awareness programmes regarding do's and don'ts with regard to earthquakes.

The meeting was attended through Voice Conferencing (VC) by NDMA Members, Director General, National Disaster Response Force and senior officers of Government of NCT of Delhi, Rajasthan, Haryana and Uttar Pradesh. •



# The Summer of Cyclones

Case Study of India's effective preparedness and response

**A**mphan, meaning “sky”, the cyclone that originated as a deep depression in the Bay Of Bengal became the most severe cyclonic storm after the 1999 Odisha Cyclone to hit Odisha and West Bengal. Cyclone Amphan was exactly as the India Meteorological Department predicted, and the country was prepared.

Amidst the ongoing COVID-19 Pandemic, a super cyclone was definitely not something India needed. Paradip (Odisha) and Digha (West Bengal) were in line for the storm, and the National Disaster Management Authority (NDMA) got into action just as the prediction by IMD was made. It was time to bring into effect all our years of cyclone risk mitigation and preparedness in order to reduce risk and ensure safety to those in the affected areas. Apart from attending the meeting with the Honourable Prime Minister, Shri Narendra Modi, to discuss the

severity of the situation, and what must be done on ground, NDMA rapidly began its cyclone awareness campaigns and updated every bulletin released on the calamity on Social Media. NDMA launched an awareness campaign in the states of Odisha and West Bengal through Television and Radio, disseminating Do's & Don'ts during a cyclone.

In the meeting at the Prime Minister's Office, the Prime Minister took full stock of the situation and reviewed the response preparedness as well as the evacuation plan presented by the National Disaster Response Force (NDRF). During the presentation of the response plan, DG NDRF informed that 25 NDRF teams have been deployed on the ground while 12 others were ready in reserve. 24 other NDRF teams were also on standby in different parts of the country. By 17th May 2020, the Odisha Disaster Rapid Action Force and National Disaster



Response Force (NDRF) were pre-positioned across districts in Odisha and West Bengal to assist in preparations for Amphan and render aid where necessary. The additional units on standby could be readily airlifted to affected areas with Indian Air Force transport aircraft. Considering the pandemic, these crews and other first responders also needed personal protective equipment (PPE) and face covers. A diving team from the Indian Navy was sent to Kolkata to aid relief efforts, with ships from the navy placed on standby for relief operations.

From the point of inception on 13th May 2020 to its landfall on 20th May 2020, how effective was our preparedness to take on the super cyclonic storm? Cyclone Amphan peaked on 18 May 2020 to upto 240 kmph - 260 kmph wind speed, and made its landfall in Digha. West Bengal on 20th May 2020 as a Very Severe Cyclonic Storm with a speed of 155-165 kmph. Over 2 Million people were evacuated in India, approximately 40,000 from Sagar Islands and approximately 50,000 from Sunderbans, and they were provided shelter, while maintaining physical distance. Coastal areas of Odisha, as well as Kolkata, Hooghly, Howrah, East Midnapur, North 24 Parganas, and South 24 Parganas in West Bengal, were among the affected areas.

Despite being the strongest tropical cyclone to strike the Ganges Delta since the 2007 Cyclone Sidr, the powerful and deadly Cyclone Amphan, India's preparedness contained the loss of lives to just double digits, which was mostly due to electrocution or collapse of homes. The mass destruction caused

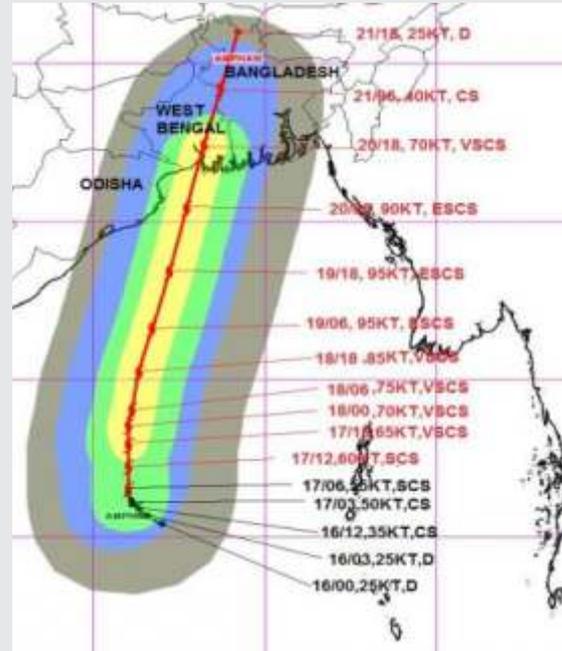
by the cyclone included damage to the rice paddies and vegetable and sesame fields, along with major power cuts in the areas affected.

While natural hazards such as a cyclone is not something we have control over, but India's readiness and response to Cyclone Amphan during the COVID Era proved that we are an adaptable, forward-thinking, disaster prepared nation which has, once again, emerged stronger when posed with a challenge.. The livelihoods of hundreds of locals, and their families, have been saved. This has certainly proven one thing - communities can come together and become one, when faced with calamity. It is so, as while there is life - there is hope!



# The Chronology of India's accurate Early Warnings on Cyclone Amphan

- In the extended range outlook issued on 7th May, Cyclogenesis was predicted in the later part of week during 8th-14th May 2020.
- In the regional bulletin for 13 WMO/ESCAP Panel member countries (Tropical Weather Outlook) issued on 9th May, it was indicated that a low pressure area (LPA) would form over the southeast BoB on 13th May (96 hours prior to formation of LPA).
- In the Tropical Weather Outlook issued on 11th May, it was indicated that cyclogenesis (formation of depression) would occur around 16th May (48 hours prior to formation of LPA & 120 hours prior to formation of depression) over BoB.
- In the first press release and special message issued on 13th May (on the day of development of LPA and 3 days prior to formation of depression), it was indicated that the system would intensify into a cyclonic storm by 16th evening and would move initially northwestwards till 17th and then recurve north-northeastwards towards north BoB.
- In the bulletin issued at 0845 IST of 16th May (104 hrs prior to landfall) with the formation of Depression, it was indicated that the system would intensify into a cyclone and will move north-northwestwards till 17th May followed by north-northeastwards movement towards West Bengal coast during 18th-20th May and cross



West Bengal coast with maximum sustained wind speed of 155-165 kmph gusting to 180 kmph.

- In the bulletin issued at 0845 hrs IST of 17th May (80hrs prior to landfall), it was precisely mentioned that the system would cross West Bengal-Bangladesh coasts between Sagar Island (West Bengal) and Hatiya Islands (Bangladesh coast) during afternoon to evening of 20th May with maximum sustained wind speed of 155-165 kmph gusting to 185 kmph.

# Cyclone Nisarga

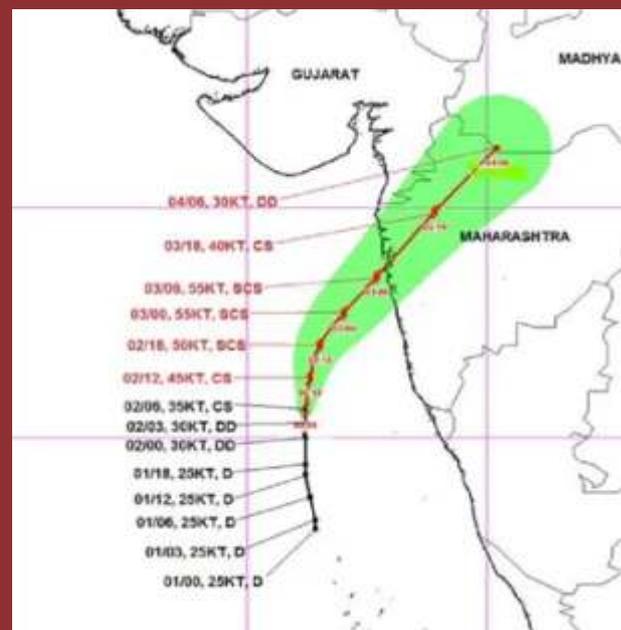
No sooner had the country seen a major severe cyclone on the east coast, news of yet another cyclone arrived via India Meteorological Department – this time on the Western Coast. The first news of a development of a low pressure area over southeast Arabian Sea was issued 10 days prior to its formation over the southeast and adjoining east central Arabian Sea and Lakshadweep on 31st May 2020. It was about 77 hours prior to the landfall that IMD issued its first bulletin indicating that the system would intensify into a cyclonic storm and reach north Maharashtra and Gujarat coasts by 3rd June. However, the National Disaster Management Authority got into action the day the prediction came out and immediately launched a Social Media Awareness campaign disseminating Do's & Don'ts during Cyclones, in order to empower citizens, and keep them prepared and safe.

By 1st June 2020, IMD predicted that Cyclone Nisarga, meaning “Nature”, was to intensify into a severe cyclonic storm with maximum sustained wind speed of 105-115 kmph gusting to 125 kmph and cross north Maharashtra and south Gujarat coasts.

India was prepared as we had just triumphed over another severe cyclone. It was being reviewed at the highest level in New Delhi by the Hon'ble Prime Minister, who had assured of all help from the Centre during his telephonic talks with the CMs of Maharashtra and Gujarat. Precautionary measures were taken. NDRF had pressed 43 Teams in the

states of Maharashtra and Gujarat, evacuating one lakh people, including Coronavirus patients, ahead of time.

By the time severe Cyclone Nisarga made landfall in Maharashtra on the afternoon of 3rd June 2020, the speed had reduced to 100-110 kmph and the impact of the cyclone on Mumbai, fortunately, was less severe. Even though power lines disrupted, houses and roads damaged in Raigad, Mumbai and Thane, lives lost were in single digits. It was yet another success story of accurate forecast, solid preparedness and quick pre-emptive action.





## Dr M Mohapatra,

(Director General, Indian Meteorological Department)

## on Cyclone Amphan and Nisarga

**1. Recently we have seen two back to back cyclones – Cyclone Amphan and Nisarga. What are your primary comments about them?**

**Reply:** The development of two back to back cyclones Amphan and Nisarga during 2nd half of May and first week of June was really challenging. Back to back development of a super cyclone followed by a severe cyclone making landfall over Indian coast is a rare phenomenon. However, India Meteorological Department (IMD) in association with other sister organisations of Ministry of Earth Sciences (MoES) monitored these two systems quite well in advance and provided forecast and warning services. As a result it helped the disaster managers to minimize the loss of life and property.

To describe, how minutely we monitored and forecasted these two systems, well in advance, I want to inform that the genesis of Amphan occurred with the formation of a low pressure area (LPA) over south Andaman Sea and adjoining southeast Bay of Bengal (BoB) on 1st May. India Meteorological Department (IMD) maintained round the clock watch over the north Indian Ocean. We started monitoring the system much earlier, since 23rd April - about three weeks prior to the formation of LPA over the southeast BoB on 13th May. Similarly, in case of Nisarga, watch was maintained since 21st May, about 10 days prior to the formation of low pressure area over the southeast & adjoining eastcentral Arabian Sea and Lakshadweep on 31st May and 11 days prior to the formation of depression over southeast Arabian Sea on 1st June.

**2. Can cyclones be forecasted easily?**

**Reply:** Cyclone forecasting is not an easy task. It is mainly because cyclones develop over sea. Sea is a data sparse region. The expanse of the BoB and Arabian Sea (AS), is still more data sparse. Also, we do not have aircraft reconnaissance unlike North



Atlantic. Further, we have many poor and developing countries in the North Indian Ocean (NIO) RIM which cannot afford to have latest observational tools like automated weather stations (AWS), Doppler weather radars (DWRs) etc. along their coast. However, IMD and MoES monitor remotely sensed observations with the help of satellites/ radars deployed by IMD & Indian Space Research Organisation (ISRO), the meteorological buoys deployed by National Institute of Ocean Technology (NIOT), sea surface winds from SCAT SAT of ISRO and other satellite observations around the globe.

The cyclone forecasting consists of various steps including i) monitoring and detection, ii) analysis, iii) numerical modeling, iv) forecasting & predicting and v) warning generation & dissemination to various stake holders & public. IMD and MoES continuously augment all the above components. So as to upgrade the cyclone forecasting system in the country, we have deployed DWRs all along the coast, 20 buoys over the BoB & AS, 30 coastal ships equipped with AWS, dense deployment of AWS along the coast (1 in 30 km) for a realistic assessment of the state of ocean and atmosphere. We have state of the art numerical weather prediction (NWP) models to have guidance about the genesis, track, intensity and landfall. IMD also has an objective



decision support system (DSS) to compare, comprehend and analyze various observations from different sources and NWP model products to arrive at a consensus cyclone forecasting. This objective consensus is modulated by a subjective consensus derived through exchange of knowledge, experience and expertise of the cyclone forecasters through a daily video conferencing system. Thereafter, the digital forecast is translated to simpler language catering to the requirement of various stake holders like shipping, port, fisheries officials, fishermen, surface transport, power, health, railways, aviation etc.

To carry out all these aspects of cyclone forecasting, the IMD works on war footing; commencing with genesis of the system involving all its human resources and technology to provide forecast update every 3-6 hourly and gradually hourly as the cyclone approaches the coast. All these warnings are provided in different stages like (i) Special Informatory Message, (ii) Pre-Cyclone Watch, (iii) Cyclone Alert, (iv) Cyclone Warning, (v) Post Landfall Outlook.

**3. The Indian Meteorological Department (IMD) has been consistently improving the Early Warning Systems of Cyclone. What are your thoughts on India's capability in Cyclone early warning and what makes us stand-out vis-à-vis**

**other early warning systems, considering the case of the recent cyclones?**

**Reply:** Comparing the cyclone forecasting and warning system accuracy over the years, you will find that there has been paradigm shift in the early warning system of IMD. As a co-author of the Vision-2020 document of MoES published in 2010, we anticipated an improvement in cyclone forecasting by 20% by 2015 and 40% by 2020. However, if we compare the forecast accuracy in terms of 24 hour landfall forecast error, it is found that landfall forecast errors have reduced from 117 km (2010) to about 45 km (2020), registering a reduction of about 63%. We have already achieved better than the target. Similar has been the case for the forecasting of adverse weather.

Comparing the forecast accuracy of IMD with other leading centres in the world, you will be happy to know that, IMD's cyclone warning system is second to none in the world. The recent forecast accuracy during cyclones Phailin (2013), Hudhud (2014), Vardah (2016), Fani (2019) and recently Amphan and Nisarga (2020) are a few notable demonstrations of our achievements. This pin pointed accuracy in landfall point & time, track, intensity and adverse weather prediction has helped disaster managers to effectively mitigate the disaster and reduce loss of lives to double digit. It has helped not only India, but also all the 13 members of WMO/ESCAP Panel

bordering the Bay of Bengal & Arabian Sea. The death toll in these countries has also been contained to double digit. To mention a few FANI in 2019 (64 deaths in India), HIKAA in 2019 (13 deaths in Oman), TITLI in 2018 (78 deaths in India), MEKUNU in 2018 (26 deaths in Oman), Chapala in 2015 (5 deaths in Yemen), MEGH in 2015 (18 deaths in Yemen), HUDHUD in 2014 (64 deaths in India), PHAILIN in 2013 (21 deaths in India), VIYARU in 2013 (64 deaths in Bangladesh, Sri Lanka & Myanmar) etc.

**4. Is it correct that the intensity of the recent cyclones have increased? If Yes, what could be the cause of it? Does climate change play a role in the frequency/intensity and impact of cyclones?**

**Reply:** Being a member of the international committee constituted by WMO for the study of impact of climate change on tropical cyclones, we have analysed the long term data of various characteristics of tropical cyclones like its frequency, intensity, life period, associated adverse weather etc. over different ocean basins. The results have been published in the form of two research papers in Bulletins of American Meteorological Society. We have analysed the aspects of detecting the changes in characteristics of cyclones and possible attribution to climate change over different ocean basins. This study also covers the impact of climate change over the BoB and AS. We found that

there is no significant change in the frequency and intensity of cyclones over the BoB. However, the frequency of severe/intense cyclones are found to show an increasing trend since 1990 over the AS.

There are many factors which contribute towards the genesis and intensification of tropical cyclones including (i) sea surface temperature (SST) & Ocean heat content (OHC), (ii) vertical wind shear (difference in wind at upper level (12km) and lower level (1.5km)) of the atmosphere, (iii) moist static instability in atmosphere, (iv) higher relative humidity upto mid-tropospheric levels (5-6 km), (v) Coriolis force (force due to rotation of earth about its axis), (vi) positive relative vorticity in lower level (1.5 km) (measure of anti-clockwise rotation of winds about its own axis). In addition, lower level convergence (measure of inflow of winds) and upper level divergence (measure of outflow at the top of tropical cyclone) also help in genesis and intensification

Among all these the SST has increased over these years due to climate change. Some studies also attribute the lower vertical wind shear to increase in the frequency of intense cyclones over the Arabian Sea. In recent cases of Amphan and Nisarga, the intensification of these cyclones occurred mainly because of higher SST (OHC) and lower vertical wind shear. Considering, the long term data, however, the expert team of WMO concluded that there is a low confidence in attributing the recent increase in intense cyclones over the AS to the climate change.



# The Five FAQs – Urban Floods



## 1. What is an Urban Flood?

Flood is an overflow of a large body of water over areas not usually inundated. Urban flooding is intense and/or prolonged rainfall, which overwhelms the capacity of the drainage system.

## 2. How are Urban Floods different from Rural Floods?

Unlike Rural Floods, flooding in urban areas is more intense and quick – because of density of population and lesser space for water to flow.



## 3. What factors cause Urban Floods?

- Meteorological Factors such as Heavy Rainfall, Cyclonic Storms, etc.
- Hydrological Factors such as occurrence of high tides;
- Anthropogenic Factors such as Unplanned urbanization, Poor waste management system, Ill maintenance of drainage systems, etc.

## 4. What are the impacts of Urban Flooding?

- Loss of Human lives;
- Loss of livelihoods;
- Loss of pets and animals;
- Increased risk of Disease outbreak because of contamination of water and rise in mosquito borne diseases;
- Infrastructural loss such as – damaged buildings, roads, heritage sites, etc.;
- Economical Loss such as – disruptions in industrial output, utility services, loss of small businesses, disruption in education curriculums, and response and relief measures put additional burden on the economy



## 5. What preparations can people living in risk-prone urban centres make in advance to tackle an urban flooding?

People should take simple measures such as installing the gas connection, water heater, and electric panels high above the ground to brace themselves against flooding incidents. They should also put check valves in sewer traps to prevent floodwater from backing up into the drain. They should also seal the walls in their basements to avoid seepage.

# What will you do ? when lightning strikes ?

## When you are Indoors



Unplug all electrical equipment before the storm arrives.  
Don't use corded telephones

Stay away from window and doors and stay off verandas



Don't touch plumbing and metal pipes.  
Do not use running water

## When you are Outdoors



Don't take shelter near/under trees.  
Spread out; don't stand in a crowd

Get inside a home, building. Stay  
away from structures with tin roofs/ metal sheeting



Don't use metallic objects; stay away from  
power/telephone lines

Get out of water - pools, lakes, small boats on water bodies



If caught under open sky, crouch.  
Don't lie down or place your hands on the ground

Stay put if you are inside a car/bus/covered vehicle



## What to do after a Lightning Strikes



Administer CPR (Cardio Pulmonary Resuscitation),  
if needed. Seek medical attention immediately.



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