

Cyclone Risk Mitigation- India perspective

Sanjay K Sharma
Environment Specialist, NCRMP, NDMA

BACKGROUND

India is highly vulnerable to natural hazards particularly cyclones, floods, earthquakes, drought and landslides. A long coastline of about 7,516 km of flat coastal terrain, shallow continental shelf, high population density, geographical location and physiological features of its coastal areas makes India, in the North Indian Ocean (NIO) Basin, extremely vulnerable to cyclones and its associated hazards like storm tide (the combined effects of storm surge and astronomical tide), high velocity wind and heavy rains.

About 5,700 km of the India's coastline encompassing 84 Coastal districts (roughly 8% of the geographical area) in 13 Coastal States and Union Territories (UTs) are affected by severe tropical cyclones year after year. Approximately 40% of India's population is living within 100 km of the coastline.

Climate change is a major challenge for developing nations like India, threatening to enhance risks already elevated by high levels of social vulnerability and climate variability. As climate change and variability become more pronounced, hazard events are set to grow in frequency and intensity. The Climate change and its resultant sea-level rise are bound to increase the vulnerability of the coastal population. Economic losses due to disaster are also on the rise both from an increase in the number of disaster events and from an increase in the average loss associated with each disaster event, coupled with a greater concentration of exposed assets.

Though the frequency of Tropical Cyclones (TCs) in the North Indian Ocean(NIO) covering the Bay of Bengal and the Arabian Sea is the least in the world (7% of the global total), their impact on the east coast of India is relatively more devastating due to storm tidal effect in the area. This is evident from the fact that in the past, 21 of the 23 major cyclones (with a loss of about 10,000 lives or more) worldwide occurred over the area surrounding the Indian subcontinent.

The risks of coastal impacts related to cyclone and storm surge should be seen in the context of large projected growth in the population of India living in low elevation coastal zones. India's level of poverty, rapid urban infrastructure growth, high population density, and limited

community awareness, further increases the vulnerability of its people to the impacts of natural hazards and climate change. Poor living in peri-urban areas, and informal settlements concentrated in high risk zones are particularly vulnerable to natural hazards due to lack of adequate infrastructure, insufficient enforcement of building codes, a near absence of financial and insurance mechanisms that help transfer risk, and limited access to basic emergency services.

Losses due to Cyclone

Recurring cyclones account for large number of deaths, loss of livelihood opportunities, loss of public and private property and severe damage to infrastructure, thus seriously reversing developmental gains at regular intervals. The historical cyclones resulted in a catastrophic loss of lives, assets, and livelihoods, including the 1977 cyclone with a fatality of 10,000 people in Andhra Pradesh, the 1990 Super Cyclone with a fatality of 967 people in Andhra Pradesh, the 1996 Very Severe Cyclonic Storm with a fatality of 1,057 people in Andhra Pradesh, and the 1999 Super Cyclone in Odisha with a fatality of about 10,000 people, destroying 275,000 homes and leading to 1.67 million homeless.

On October 12 2013, Cyclone Phailin hit the states of Odisha and Andhra Pradesh with maximum sustained wind gusting up to 220 km per hour, heavy rains measuring up to 25 cm and storm surge over 3 m; the sea pushed in as much as 40 m along parts of the coast. It was the strongest cyclone to hit the Indian coast, similar to the Super Cyclone of 1999 which hit Odisha. The cyclone hit a densely populated area, with 4.5 million people within the hurricane force wind path and significant informal housing.

MITIGATION APPROACH

The approach to dealing with the cyclones had been predominantly response centric. This approach has limitation in the sense that Response is essentially post-disaster activity and we were not undertaking pre-disaster activities geared towards preparedness, capacity building of community/first responders, and mitigation activities. In other words, the concept of Community Based Disaster Risk Management (CBDRM) was lacking. Similarly, we did not have State-of-Art Early Warning Dissemination System (EWDS), which came in the way of timely evacuation to safe shelters (before the landfall of cyclones) and thereby saving precious lives. These lacunae necessitated adopting a holistic approach to disaster management focusing on both post and pre/ex-ante measures encompassing investments in EWDS, Risk Mitigation Infrastructure and

most importantly, capacity building of the community to manage the risk mitigation assets such as cyclone shelter, saline embankment, etc.

There has now been a paradigm shift in Government of India (GoI)'s approach to cyclone risk reduction. The approach shifted from a merely reactive emergency response to adopting a holistic approach to disaster management and being proactive in implementing disaster preparedness and risk reduction activities. This change has led to an increased focus on implementation of risk mitigation programs and strategies covering the entire disaster management cycle.

A National Cyclone Risk Mitigation Project (NCRMP) was launched in 2011 covering cyclone prone coastal States of the country with the objective to reduce vulnerability of the States to cyclone and other hydro-meteorological hazards of coastal communities, and increase the capacity of the State entities to effectively plan for and respond to disasters. The project (NCRMP) is being implemented in phases by NDMA. The project is part of a broader national multi-hazard mitigation program taken up by the NDMA that includes understanding hazards like seismic risk, floods, landslides and establishment of a National Disaster Management communication network. The project seeks to undertake suitable structural and non-structural measures to mitigate cyclone risks across the country.

The primary beneficiaries of the project are coastal communities, including the aged, differently abled, women and children in the target coastal states, benefitting from cyclone risk mitigation infrastructure such as cyclone shelters, connecting roads/bridges, Saline embankment & Underground Electrical Cabling, and Early Warning Dissemination Systems (EWDS).

In addition to implementation of cyclone risk mitigation infrastructure and EWDS including training & capacity building activities, Hazard, Vulnerability and Risk Assessment (HVRA) study was also conducted as part of NCRMP Phase I leading to development of a Web based Composite Risk Atlas (Web-CRA) using deterministic hazard and vulnerability analysis modelling based on historical cyclone events. The Web-CRA, having capability of identifying hotspots of high vulnerability coastal areas for communities at risk, was commissioned in the Coastal States/UTs in 2017. Taking forward the Web-CRA Application developed under NCRMP Phase I, a Web based Dynamic Composite Risk Atlas & Decision Support System (Web-DCRA & DSS) Tool for Cyclone impacts forecast covering all Coastal States/UTs of the

Country has been developed under NCRMP Phase II and hosted at IMD, HQ, New Delhi. The Impact-based forecast is an innovative approach to not only understand “*what the weather will be*” but go a step further to inform “*what the weather will do*”. The outputs of Web-DCRA & DSS Tool will be probabilistic and real-time hazard layers of cyclonic wind, storm surge and inundation/flooding. This information can be used by Disaster Management Authorities of the cyclone-prone States and Union Territories (UTs) of India in advance mitigation planning (evacuation planning, contingency planning, evacuation routing, etc) and placing of resources such as NDRF, SDRF, Fire & Emergency services, and community volunteers/task forces for dynamic response in real time as well during a cyclonic event. Using this Tool, dynamic and impact-based cyclone warnings will be release by IMD aiming to minimize economic losses and damage to property due to the intense weather system.

A Mobile App. compatible to both IOS and Android platforms is also being developed for faster outreach to population at risk. The Mobile App. will enable users to access features of Web-DCRA and cyclonic events specific to the area through location based technology. The features such as crowd-sourcing for feedback and SOS (I’M NOT SAFE) along with I’M SAFE feature are also provisioned in the Mobile App. Registered users can access all the forecast, warnings and advisories related to cyclonic event through the Mobile App. This application provides live updates features such as safe/emergency shelter, raised platforms, nearest evacuation routes, local weather forecast and near real-time risk reports of an impending cyclone. Thus the Web-DCRA & DSS Tool and the Mobile App. will be supplementary to the EWDS for last-mile connectivity in case of a cyclonic event.

Select photographs reflecting infrastructure/assets created under NCRMP



MPCS at Taranagar, West Bengal



EWDS (Alert Siren) at Basudevpur, Odisha