UNISDR
The United Nations Office for Disaster Risk Reduction

UNISDR Scientific and Technical Advisory Group Case Studies - 2014

Linking Weather Forecasts to Disaster Preparedness Insights from Cyclone Phailin, India

The problem

Two thirds of India's coastline is estimated to be prone to cyclones and tsunamis.[i] Odisha, which has the lowest Human Development Index (HDI) in the country, [ii] and the other Bay of Bengal coastal states are the most at risk regions to cyclonic storms.[iii] The Orissa Super Cyclone (1999) had wind speed ranging between 260 to 270 kmph which ravaged the lives and livelihoods of more than 10 million people.[iv] The India Meteorological Department (IMD) was able to track the evolution of the storm and provide requisite alerts and warnings to the governments both at the federal, and provincial, levels. Warnings were issued more than 48 hours before the cyclone made landfall on the 29 October 1999.[v] The scale of the devastation was more than 10,000 casualties despite the warning.[vi]

The Orissa State Disaster Management Authority (OSDMA) was set up in the immediate aftermath of the cyclone. [vii] High storm tides experienced in the Bay of Bengal are the primary causes of death and destruction and as these types of storms are projected to increase in a changing climate[viii], the livelihoods of tens of thousands of communities and development gains are at greater risk. Coastal Odisha has large scale economic and technological investments, for development of its ports, and this has further increased the vulnerabilities of the social-ecological systems.[ix]

The science

The IMD monitored the development of this cyclonic system on a real-time basis, including its strength and projected path. IMD operationally runs two regional models; the Weather Research and Forecasting (WRF) and Quasi-Lagrangian Model (QLM) for short-range prediction and one Global model for medium range prediction (7 days). The Numerical Weather Prediction (NWP) comprises of five components, each of which in turn is based on a specific model (*Fig, 1*).[x] The Regional Specialized Meteorological Centre (RSMC) for tropical cyclones over North India Ocean based at the IMD is one of the six RSMCs. The RSMC at New Delhi provides Tropical Weather Outlooks and Tropical Cyclone Advisories for the countries bordering the Bay of Bengal and the Arabian Sea (Bangladesh, Maldives, Myanmar, Oman, Pakistan, Sri Lanka and Thailand).

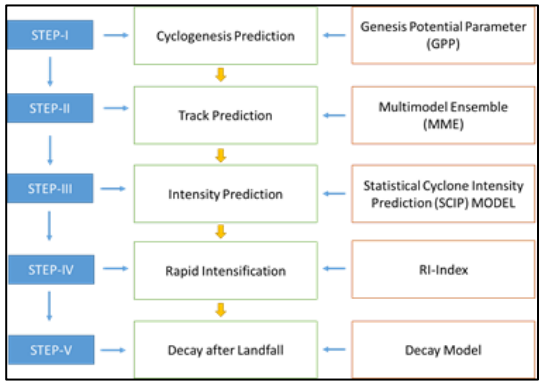

Figure 1: Numerical Weather Predictor based Objective Cyclone Prediction System

The application to policy and practice

Cyclone bulletins are issued for the Indian coast and provide: Pre-cyclone watch, Cyclone alert, Cyclone warning, Post landfall outlook and De-warning. In order to ensure ownership and real-time coordinated action, warnings are provided to a designated Control Room in the Ministry of Home Affairs. Guidelines for management of natural disasters [xi] are facilitated through two over-arching policy frameworks the National Disaster Management Act (2005) and the National Policy on Disaster Management (2009), which shape disaster management institutional mechanisms at various levels of governance in the country. These are streamlined at sub-national for coordination, monitoring and implementation. The vision of the national policy on Disaster Management is 'To build a safe and disaster resilient India by developing a holistic, proactive, multi-disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response'.

Did it make a difference?

This change reflects how science and technology could potentially contribute to the design and development of effective disaster management policies and practices. Real-time forecast and warnings during the Very Severe Cyclonic Storm (VSCS) *Phailin* over the Bay of Bengal, October 2013, averted more than one million at-risk in coastal communities.[xii] The reported mortality of 38 was far less than the 10,000 deaths in Super Cyclone (1999). IMD generated and provided the critical information on the impending cyclone in the most accessible and easy-to-understand format to various stakeholders. Accuracy and accessibility ensured greater disaster preparedness and response capacities of government authorities, NGOs and communities in the region. Cyclone forecasts and warnings were communicated through a well-established channel of media, both print and electronic, and other community-level systems such as HAM Radio, Disaster Management Committees (DMC) and a vast network of volunteers comprising of young men and women. Since cyclone forecasts and warnings are now available 72 hours before land-fall, this provided adequate time and opportunities for the authorities to mobilise the most appropriate preparedness and response plan. This contributed to multi-level communication and inter-agency coordination which was systematic and integrated. This case also illustrates the role of science-based information in bolstering the capacities and increasing the efficiency of existing institutions of disaster response and management, and the wider community. Decision making processes in a disaster situation have to encounter a series of uncertainties and complexities. IMD's forecast of *Phailin* (*Fig, 2*) was critical to building trust and confidence among decision-makers and the public at large on science and scientific institutions.

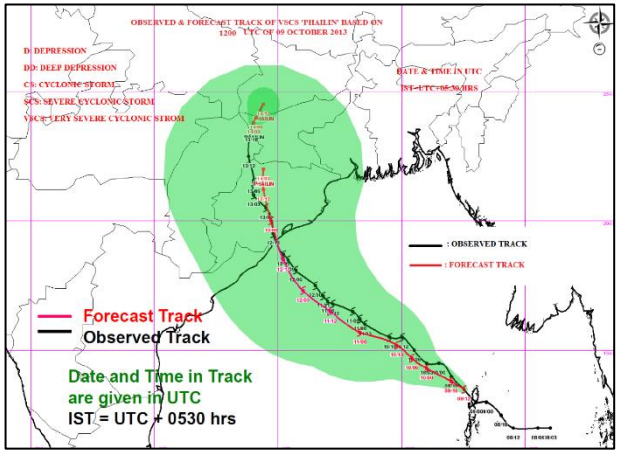

Figure 2, Forecast Performance Verification of Cyclone Phailin Source. Source: L. S. Rathore, 2014 , http://www.agrophysics.in/file/LecturePresentation.pdf

References

[i] National Disaster Management Authority (NDMA), 2009, National Policy on Disaster Management, Government of India. http://www.ndma.gov.in/images/guidelines/national-dm-policy2009.pdf

[ii] Planning and Coordination Department, Government of Orissa, 2004, Human Development Report-2004. http://www.odisha.gov.in/pc/humandevelopment/summary/Summary.pdf

[iii] Odisha State Disaster Management Authority (OSDMA), 2014, Odisha Vulnerability to Different Disasters, Government of Odisha. http://www.osdma.org/ViewDetails.aspx?vchglinkid=GL001&vchplinkid=PL003

[iv] Natural Disaster Management Division, Ministry of Agriculture, Government of India, 1999, India Country Report, 1999. http://www.adrc.asia/countryreport/IND/INDeng99/India99.htm#_Toc494259024

[v] Kalsi, S. R., 2006, Orissa super cyclone : A Synopsis, *MAUSAM*, 57, 1, 1-20. http://metnet.imd.gov.in/mausamdocs/15711_F.pdf

[vi] Thomalla, F and Schmuch, H., 2004, " We all knew that a cyclone was coming': disaster preparedness and the cyclone of 1999 in Orissa, India, *Disasters*, 28 (4): 373-387.

[vii] Nayak, A. K., 2009, Post Super Cyclone Orissa: An Overview, *Orissa Review*. http://orissa.gov.in/e-magazine/Orissareview/2009/October/engpdf/Pages98-104.pdf

[viii] Unnikrishnan, A. S., Ramesh Kumar, M.R., and Sindhu, B, 2011, Tropical cyclones in the Bay of Bengal and extreme sea-level projections along the east coast of India in a future climate scenario, *Current Science*, 101 (3): 327-331. http://www.currentscience.ac.in/Volumes/101/03/0327.pdf

Authors: Jyotiraj Patra (International Development Research Centre) and Komal Kantariya (Gujarat State Disaster Management Authority), *The views expressed here are personal and do not reflect those of the organizations in which the authors are based.*

[ix] Patra, J, 2013, Coasts, Ports and Communities: The Emerging Dynamics of Investment-Risk Interactions in Odisha, India, Background Paper for the 2013 Global Assessment Report (GAR) on Disaster Risk Reduction, UNISDR.
http://www.preventionweb.net/english/hyogo/gar/2013/en/bgdocs/Patra,%202012.pdf
[x] Roy Bhowmik, S.K. and Kotal S.D., 2010, A dynamical statistical model for prediction of a tropical cyclone, *Marine Geodesy*, 33, 412-425.
[xi] http://www.ndma.gov.in/images/guidelines/cyclones.pdf
[xii] World Bank, 2013, India Averts Devastation from Cyclone Phailin.
http://www.worldbank.org/en/results/2014/04/10/india-averts-cyclone-phailin-devastation

Authors: Jyotiraj Patra (International Development Research Centre) and Komal Kantariya (Gujarat State Disaster Management Authority), *The views expressed here are personal and do not reflect those of the organizations in which the authors are based.*