

AFTER PHAILIN: UNDERSTANDING CYCLONE RISK IN INDIA

In 2013, Phailin, the first major tropical cyclone to hit India since 1999, made landfall as a Category 4 storm near Gopalpur on India's east coast, killing more than 25 people and generating economic losses of an estimated USD 700 million to USD 4.5 billion (according to local governments and Swiss Re, respectively). While it was a very strong storm, Phailin fortunately made landfall in a relatively sparsely populated area. AIR conducted a study for the General Insurance Corporation of India (GIC Re), the sole reinsurance company in the Indian insurance market, to quantify potential losses had Phailin made landfall at different locations on India's east and west coasts, as well as potential impact of storms stronger than Phailin. AIR's analysis indicates that the industry should be prepared for significantly higher losses.

INTRODUCTION

Cyclone Phailin, the strongest cyclone to hit India in 14 years, made landfall on the eastern coast of India near Gopalpur in Orissa around 21:15 local time on Saturday, October 12. Phailin arrived as a Category 4 storm with maximum sustained 3-minute winds of 200–210 km/h at landfall, according to the Indian Meteorological Department (IMD). Phailin's high winds and heavy rain—up to 300 millimeters in some regions—flooded roads, uprooted trees, damaged crops, cut off electricity to millions of homes, and destroyed thousands of poorly constructed homes. Phailin also damaged infrastructure, including roads, bridges, and power and communications networks.

Before the storm arrived, India conducted its largest storm evacuation ever, relocating more than 900,000 people from the coast to shelters in schools and government offices. The evacuation effort was credited for the relatively low death toll. This was in stark contrast to the Orissa super cyclone of 1999, which claimed over 10,000 lives and had made landfall around 160 km north of where Phailin made landfall.

Due to the continental shelf being steeper and overland terrain being higher, the effect of storm surge flooding was limited. Phailin brought a storm surge of more than 3.5 meters (11 feet) to portions of the coast. The districts of Balasore, Mayurbhanj, Jajpur, and Bhadrak experienced inland flooding, which was triggered by the heavy rainfall that accompanied the cyclone. It has been estimated that the agricultural sector lost about 15% of their rice crop as a

"India's insurance industry was lucky to be left relatively unscathed with Cyclone Phailin. If Phailin were to make landfall at places with high exposure concentration, companies would have experienced huge losses."



—Dr. Praveen Sandri,
Managing Director and
Senior Vice President
AIR Worldwide – India

"When Phailin happened, I asked AIR to perform an analysis to assess the loss potential if Phailin or a stronger cyclone were to affect different parts of India. We suspected that the losses could be much higher, which was confirmed by AIR's study. Because the penetration of insurance is so low in India, a natural catastrophe pool may be a very welcome addition to the risk landscape."



—Mr. A. K. Roy, Chairman
and Managing Director
GIC Re

result of flooding. While crop insurance is offered for many crops, participation remains relatively low because challenges remain in the pricing and administration of insurance products and in effective risk diversification.

While economic losses due to Phailin are estimated at USD 700 million to USD 4.5 billion, the insured losses are only a fraction of this value. There was significant damage to crops and residential properties, but a high proportion of residential losses in the region are not insured. Residential structures are generally less resistant to wind and water damage than commercial/industrial buildings. India's diverse commercial/industrial building stock continues to change as older structures are replaced with ones that are engineered for wind and water resistance.

Insurance coverage in the affected area varies by line of business; overall take-up rates (insurance penetration) in the hardest hit regions are low.

MODELED LOSSES FOR PHAILIN

AIR began tracking Phailin as soon as it was classified as a cyclone. After landfall, AIR input available meteorological data from the India Meteorological Department and other national and international agencies parameters into the AIR Tropical Cyclone Model for India. Modeled parameters

include maximum sustained wind speed, central pressure, radius of maximum winds, maximum precipitation, and radius of precipitation, among others.

While the track of the storm is easy to ascertain using satellite imagery, there is considerable uncertainty in the reported intensity parameters. For this reason, AIR created several scenarios of Phailin with identical tracks, but different landfall parameters. These scenarios were run against the AIR Insurable Exposure Database (IED) for India, which is a comprehensive database of risk counts, replacement values, and vulnerability attributes of all insurable properties in India.

After applying insurance take-up rate assumptions, AIR's analysis resulted in insured loss estimates ranging from USD 22 million to USD 106 million (Table 1). In the AIR Loss Estimates in Real Time (ALERT™) posting on October 16, 2013, AIR indicated that insured losses in India were not expected to exceed USD 150 million.

AIR also provided several similar events from the stochastic catalog of the AIR Cyclone Model for India to help clients assess potential losses to their own portfolios. When run against the industry database, the stochastic events resulted in insured losses of USD 77 million, which was well within the range of what the industry actually paid.

Table 1. Simulated scenarios for Cyclone Phailin (Source: AIR)

Scenario	Central Pressure (mb)	Rmax (miles)	Forward Speed (mph)	Insurable Loss (USD Millions)	Insured Loss (USD Millions)
Scenario 1	946	7.5	10.20	255	22
Scenario 2	939	9	10.20	639	57
Scenario 3	942	8	10.20	395	35
Scenario 4	948	10	10.20	324	28
Scenario 5	951	11	10.20	287	25
Scenario 6	933	10	11.71	1,170	106

EXPLORING THE POTENTIAL IMPACT OF DIFFERENT SCENARIOS

From the time Phailin was categorized as a cyclone, there was a lot of interest and speculation in the Indian insurance market regarding potential losses. The industry was relieved when Phailin made landfall in an area with low insured exposures. In the aftermath of the storm, GIC Re wanted to understand the potential impact to the Indian insurance industry had Phailin made landfall in more populated areas in India, as well as the impact of an even stronger cyclone. For this purpose, AIR conducted a study to evaluate the impact of three storms (similar to Phailin, 1999's Orissa, and 2013's Haiyan) making landfall at 11 different locations in India. Table 2 shows the parameters for the three different variants and Figure 1 shows the map with potential landfall locations, with the AIR industry insurable exposure in the background.

Table 2. Parameters for the different scenarios (Source: AIR)

Variant	Central Pressure (mb)	Similar To	Wind Speed (km/h / mph)	Rmax (miles)
A	940	Phailin	210/130	9.0
B	912	Orissa	260/160	10.0
C	890	Haiyan	315/190	11.5

Each storm variant/track combination was simulated using the AIR Tropical Cyclone Model for India for a total of 33 modeled scenarios.

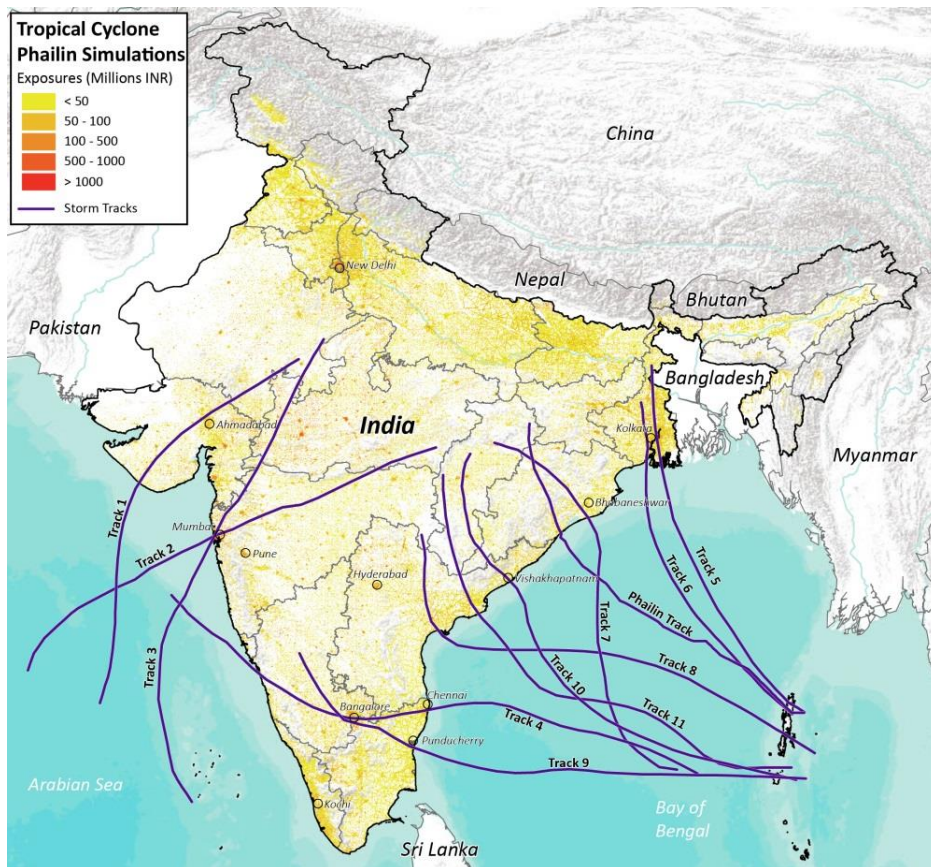


Figure 1. Simulated landfall locations (Source: AIR)

Wind field footprints for each scenario were modeled along the different landfall locations. Figure 3 shows the wind speeds at different locations for Variant C. Based on AIR's IED for India, insurable losses were estimated for each scenario (Figure 2).

The insurable loss from cyclone Phailin in Gopalpur, where the storm made landfall, is quite small. However if Phailin made landfall in areas with higher exposures like Chennai or Mumbai, losses could be in the range of USD 1 billion to USD 5 billion. A stronger storm like Orissa (Variant B) would result in even higher losses in these densely populated areas, with insurable losses on the order of USD 5 billion to USD 30 billion.

An event similar to Haiyan hitting India, while unlikely, cannot be ruled out. A Haiyan-like storm (Variant C) hitting Chennai could result in insurable losses exceeding USD 30 billion; Mumbai could experience losses of well over USD 100 billion.

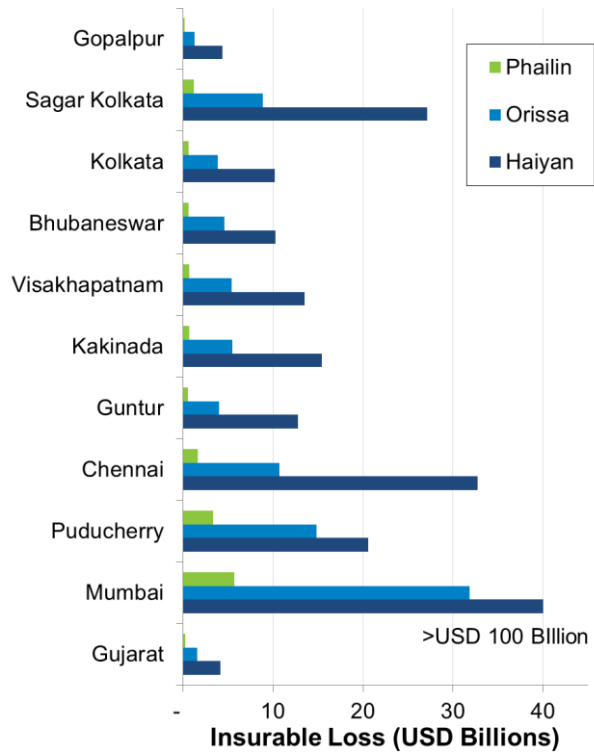


Figure 2. Insurable losses at different landfall locations (Source: AIR)

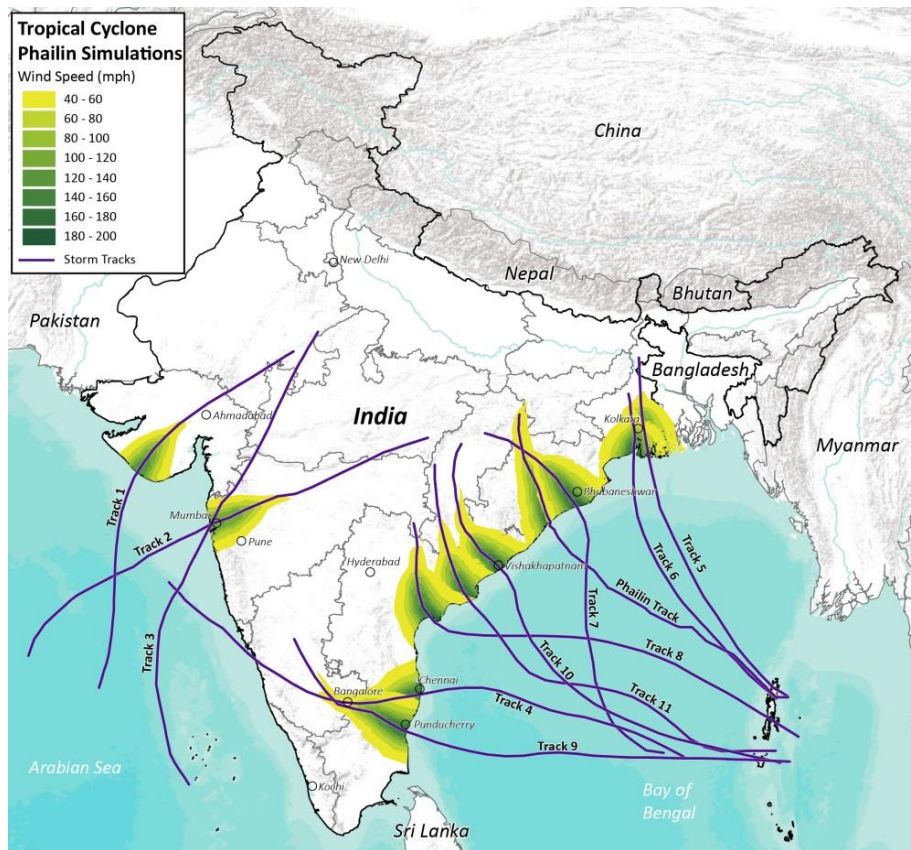


Figure 3. Wind field footprints for Variant C (Source: AIR)

As mentioned previously, the penetration of insurance in India is low. Figure 4 shows insured losses after region-specific take-up rates were applied to the insurable losses. The insured losses for populated areas like Chennai and Mumbai would be between USD 2 billion to USD 3 billion for a storm of Haiyan's strength.

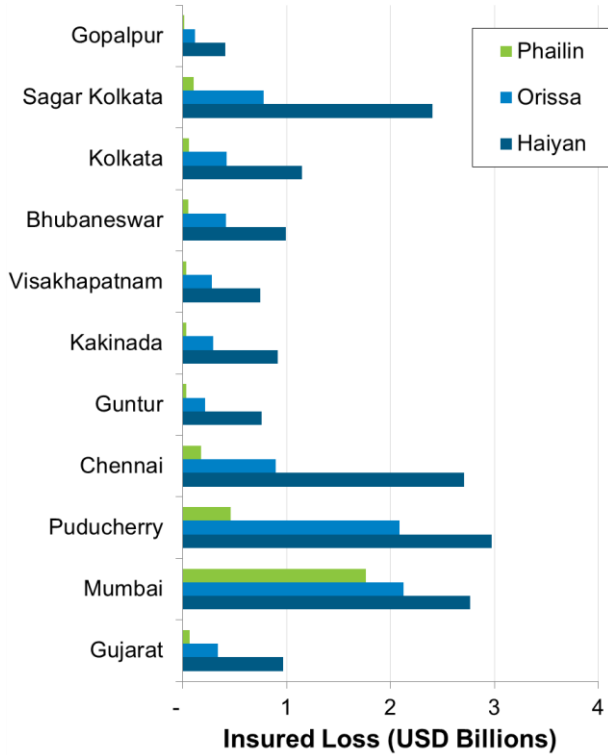


Figure 4. Insured losses at different landfall locations (Source: AIR)

CONCLUSION

After several years of low activity, Phailin in 2013 was the second strongest cyclone to make landfall in India in recorded history. Despite its strength, Phailin resulted in very low insured losses due to relatively few exposures in the landfall region and low insurance take-up rates. By analyzing events similar to Phailin, Haiyan, and Orissa at several landfall locations, AIR determined that insurable losses for India could be much higher, exceeding USD 30 billion to 50 billion for densely populated landfall regions and even exceeding USD 100 billion in some extreme scenarios. The AIR Cyclone Model for India can help the industry prepare for a full range of potential losses and to plan appropriate risk management and risk transfer strategies.

CONTACT

If you have any questions about the information in this white paper or about AIR's modeling solutions for natural catastrophes in India, please contact Prakash Agarwal at pagarwal@air-worldwide.com.

ABOUT AIR WORLDWIDE

AIR Worldwide (AIR) is the scientific leader and most respected provider of risk modeling software and consulting services. AIR founded the catastrophe modeling industry in 1987 and today models the risk from natural catastrophes and terrorism in more than 90 countries. More than 400 insurance, reinsurance, financial, corporate, and government clients rely on AIR software and services for catastrophe risk management, insurance-linked securities, detailed site-specific wind and seismic engineering analyses, and agricultural risk management. AIR is a member of the Verisk Insurance Solutions group at Verisk Analytics (NASDAQ:VRSK) and is headquartered in Boston with additional offices in North America, Europe, and Asia. For more information, visit www.air-worldwide.com.

