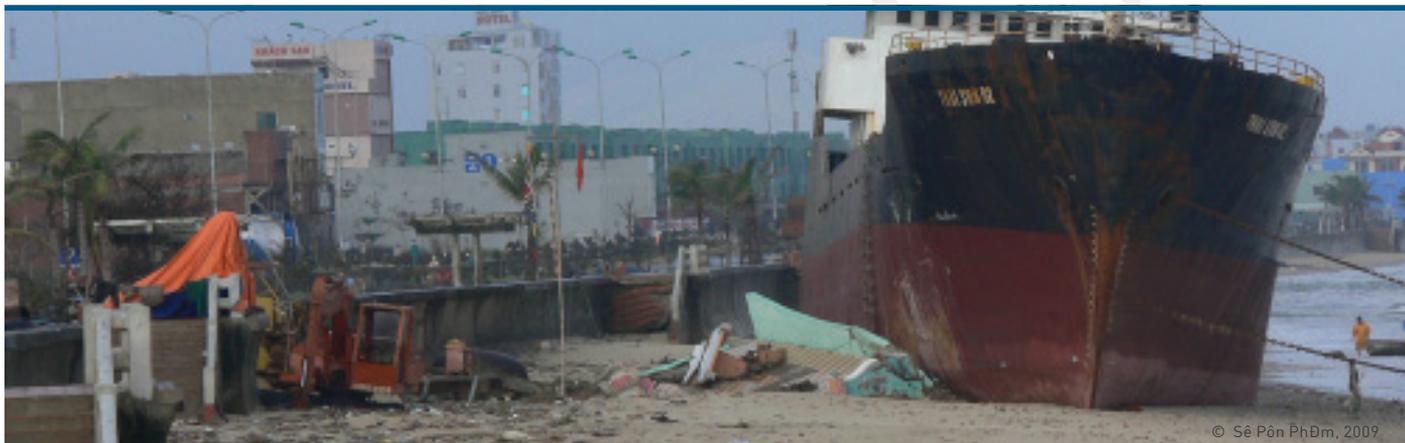


Da Nang, Vietnam

DA NANG: TYPHOON INTENSITY AND CLIMATE CHANGE

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KEY FINDINGS

- The overall number of typhoons forming in the East Sea decreased slightly between 1990–2008, as part of the natural, multi-decadal cycle.
- Projections from multiple climate models indicate that the total number of typhoons in the East Sea may continue to decrease in the future.
- It is still too early to tell whether the number of strong (winds 119–156 km/hr) to violent typhoons (winds greater than 194 km/hr) will decrease or increase in the future.
- Typhoon Xangsane was a strong typhoon when it made landfall in Da Nang in 2006. While we do not know how many storms like Xangsane might happen in the future, we do know that they will happen again.
- Infrastructure should be able to withstand storms like Xangsane with minimal damage, while protecting people and assets.

Da Nang's Context

Da Nang, located along the central Vietnamese coast, is experiencing rapid development in response to a growing population and diversifying economy. The city and the central Vietnam coastline experience tropical storms and typhoons. Significant damage to infrastructure, such as housing and office buildings, can occur during tropical storms due to high, sustained winds and post-storm due to flooding. As more people migrate to Da Nang, those who can afford to are constructing or purchasing new homes. Current housing, particularly homes built by the poor to middle income households, often cannot withstand tropical storms with winds higher than 89–102 km/hr, which are not even typhoon strength winds.

Rating Typhoon Intensity

The Institute of Meteorology, Hydrology, and Environment and the Central Committee for Flood and Storm Control uses the extended Beaufort scale with 17 levels to designate the severity of wind speeds accompanying storms and their infrastructure damage potential. Tropical storms have wind speeds of 62–117 km/hr (level 6–11). Typhoons are storms with wind speeds above 118 km/hr, or level 12 on the scale, and can cause significant damage to typical infrastructure found in Da Nang. Vietnam's categorization compares with international designations such as those of the Hong Kong Observatory in the following way:

TABLE 1

A TROPICAL CYCLONE INTENSITY SCALE

Extended Beaufort Scale Category	Wind Speed (km/hr)	Typhoon Category
12	118 KM/HR	TYPHOON
13-14	119-156 KM/HR	STRONG TYPHOON
15-16	157-193 KM/HR	VERY STRONG TYPHOON
17	>194 KM/HR	VIOLENT TYPHOON

RECENT TYPHOON TRENDS

Tropical storms tend to be larger and more intense in the Western North Pacific (WNP) basin than in any other ocean basin (Chavas and Emanuel, 2010). The typhoons that make landfall on the coasts of Vietnam or southern China originate near the Philippines in the East Sea. A number of different agencies, such as the Hong Kong Observatory and the Regional Specialized Meteorological Center in Tokyo, monitor the development, movement, and strength of typhoons in the WNP, and keep historical records of past typhoons. There are differences in the records—called best track data—between the agencies. Records only extend back to the 1950s, and early records are not as reliable as those from the more recent period.

Depending on which dataset is used, some researchers have detected a small decreasing trend in the overall number of tropical storms and typhoons between ~1990–2008 for central to south Vietnam, and no trend in storms making landfall in north to central Vietnam (Chen and Lin, 2013; Yokoi and Takayabu, 2013). However, this small decreasing trend is part of natural multi-decadal variability. There is no observable trend in the number of very strong or violent typhoons between 1977–2007 (Tong et al., 2010). Frequency analysis of tropical storm and typhoon data provided by the Vietnam Central Committee for Flood and Storm Control confirms that there is no trend in the number or severity of tropical storms and typhoons impacting Da Nang or the central Vietnam coastline near Da Nang.

Possible Future Changes in Typhoon Intensity

Preliminary studies project the following possible changes to typhoons impacting Vietnam:

- The overall number of typhoons forming in the East Sea and making landfall in Vietnam is likely to decrease according to multiple climate models (Yokoi, Takayabu, and Murakami, 2012; Tong et al., 2010).
- Climate models do not consistently project whether the number of very strong and violent typhoons will increase or decrease. Some multi-model studies show a potential increase in these types of typhoons, while others show a decrease (Tong et al., 2010).

General circulation models (GCMs) are used to project broad changes in a region's climate. Such models have a spatial resolution of approximately 90–300 km. The processes governing typhoon formation and movement occur at much smaller scales; GCMs have a difficult time reproducing typhoons, particularly very strong typhoons with wind speeds greater than 178 km/hr. Due to these difficulties, projections of future changes in typhoon frequency and wind intensity in the WNP should be interpreted with caution.

Broad Implications for Housing in Da Nang

Initial projections do show that the overall number of typhoons and tropical storms impacting Vietnam might decrease. However, it is still too early to tell whether the number of strong to violent typhoons will increase. Though there is the potential for fewer storms, it is important that the public, city planners, developers, and the department of construction do not relax building standards. Typhoons like Xangsane will still occur, some will be very strong or violent, and can cause significant damage if people are not prepared. While the models are not yet clear whether the intensity of wind speeds in typhoons in the WNP will decrease or increase, most models are showing an increase in the intensity of heavy rainfall events (due to tropical storm/typhoons or the monsoon) that contribute to flooding and infrastructure damage. It is therefore important that buildings adopt multi-hazard resilient construction, and offer homeowners and businesses safe places to store their assets. Improved early warning and communication systems can also help homeowners relocate their families and assets to safer locations (DiGregorio & Huynh, 2012).

Resilient Housing in Da Nang

To address these issues of typhoons, ISET–International and Hue University, with the support of the Climate Development and Knowledge Network, have announced a design competition specifically focused on climate resilient shelters that will be built to withstand typhoons with up to category 15 on the Beaufort scale, and that are also flood resistant. The design competition was launched March 1, 2013.

Further Reading

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