1997 Typhoon Linda Storm Surge and People's Awareness 20 Years Later: Uninvestigated Worst Storm Event in the Mekong Delta

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Abstract.

Typhoon Linda (1997) was the worst storm in the Mekong Delta. However, very little scientific information is available. Of the last 228 storms to make landfall in Vietnam, this tropical cyclone took the southernmost course,

10 and the estimated reoccurrence period is once in 150 years or longer. Our analysis reveals that the storm surge reached 1.5-m high along the eastern coast of the low-lying delta, and it even propagated until the regional capital of Can Tho, which is located 80-km inland from the river mouth. Despite the fact that local people in Can Tho still clearly remember Linda after almost 20 years, curiously all of the interviewees replied, '*I am not afraid of a typhoon*'. On the other hand, the islanders of Con Dao, which was directly impacted by Linda, acknowledged a

15 high degree of awareness of typhoon disasters. This study demonstrates that only a memory of the past significant event does not necessarily improve people's awareness. Because the delta was a nearly uninhabited mangrove jungle before the 20th century, this particular typhoon event needs to be better studied to envisage a future catastrophic '*gray swan*' event.

20 *Keywords*: 1997 Linda, Mekong Delta, Storm Surge, Typhoon, Awareness, Can Tho, Track Analysis

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1. INTRODUCTION

Although Vietnam is a typhoon-prone country, relatively little research has been conducted on typhoons and storm surges along its coast. Cyclones rarely form in a low-latitude oceanic basin due to smaller influence of the Earth's rotation. Consequently, the risk of a typhoon disaster in Southern Vietnam, which includes the Mekong

5 Delta (hereinafter MD), tends to be overlooked due to the low frequency compared to Northern and Central Vietnam. However, typhoons sometimes venture into the southern part of Vietnam (Takagi et al., 2015; Anh et al., 2017).

Typhoon Linda (meteorologically categorized as a severe tropical storm) in 1997 is considered to be the worst tropical cyclone ever to make landfall in southern Vietnam. Linda hit MD, killing over 3,000 people and causing

10 US$385 million of damage. Heavy rainfall induced flooding, which damaged or destroyed about 200,000 houses and left about 383,000 people homeless. The fatalities were mostly fishermen and sailors, who were caught at sea in its path and unable to escape (Nation, Nov 6 1997; UNDP, 2003). Linda also affected Cambodia where at least 23 people died and over 200 people are missing (Hong Kong Observatory, 1998) and Thailand where 12 died and an unknown number of fishermen are still missing (The Nation, Nov 15, 1997a). Winds from Linda fanned

15 flames from Indonesian peat fires and swept smog into neighboring Southeast Asian countries, causing serious air pollution (The Nation, Nov 6, 1997b). Some previous studies revealed that Linda generated a strong northeasterly wind. Consequently, the storm surge was up to 70 cm in the northwestern part of the Gulf of Thailand (Aschariyaphotha et al., 2011) and the wind waves were nearly 3 m (Wannawong et al., 2010).

Few studies have examined the damage Linda caused in Vietnam, despite extensive devastation. Particularly, the

20 physical impact due to storm surge has yet to be investigated. There may be some literature documented by governmental institutes or local authorities, but it is hard for ordinary researchers to access. This limited information about Linda differs from other recent major coastal disasters occurring in neighboring countries (e.g., 2004 Indian Ocean Tsunami, 2011 Tohoku Tsunami, and 2013 Typhoon Haiyan). These recent disasters have been extensively investigated by local and international researchers (Esteban et al., 2015a).

25 The most severely affected provinces such as Ca Mau and Bac Lieu were remote areas that remained inaccessible by roads for many weeks after the disaster (The Nation, Nov 15, 1997a). Additionally, Vietnam's bureaucracy at that time might have made it difficult for non-governmental organizations or researchers to investigate in the Mekong region. Nevertheless, it is worth noting that the deadliest 2008 Cyclone Nargis in Myanmar has been substantially investigated by at least several international research groups even under a military regime with a

30 strong closed-door policy, and has contributed to the general understanding of damage due to strong winds and storm surges (Shibayama et al., 2008; Fritz et al., 2009; Tasnim et al., 2015). To a lesser degree, the non-

availability of information in the case of Linda may be due to the limited mobility of international researchers because the internet environment in those days was insufficient to promptly conduct post-disaster surveys abroad. In this study, we revisit Typhoon Linda to understand the characteristics of its track and the extent of the storm surge caused by strong winds. A major disaster tends to rapidly raise awareness, but the awareness gradually

5 decays (Esteban et al., 2015b). To gage the state of people's awareness 20 years after Linda, we also conducted a series of field surveys to examine whether such a catastrophic event has changed people's mindset about typhoon disasters.

2. METHODOLOGY

10 This section first describes the statistical analysis of landfall of tropical cyclones on Vietnam. The numerical model that simulates typhoon and storm surge is then briefly explained. Finally, field surveys conducted in the Mekong Delta and a remote island are described.

2.1 TC Landfall Analysis

15 The original data for the TC track analysis were retrieved from the database of the Joint Typhoon Warning Centre (JTWC) (http://www.usno.navy.mil/NOOC/nmfc-ph/RSS/jtwc/best_tracks/wpindex.php). We developed a program code to detect the landfall location at which a typhoon track intersects the coastline retrieved from Google Earth. Wind speeds at the time of landfall were also estimated by interpolating the best track data at two points before and after the landfall. In the extreme value analysis, many theoretical distribution functions were

20 employed to fit the samples. The Generalized Extreme Value (GEV) distribution, which combines the Gumbel, Fréchet, and Weibull families, is often used in the statistics of extreme events such as extreme rainfalls (Koutsoyiannis, 2004) and extreme wind speeds (Palutikof et al., 1999). Typhoon Linda made landfall on the southernmost coast of Vietnam over two decades ago. Here we employed GEV to estimate the return period of Linda in terms of landfall latitude. Among the many plotting rules proposed for the extreme value analysis (Goda,

25 2000), the Cunnane formula was applied as the plotting position in this study.

2.2 Typhoon and Storm Surge Simulation

We used the fluid dynamics model Delft3D-FLOW coupled with our parametric typhoon model developed to simulate the storm surge during the passage of Linda. The reliability of our model was verified for some strong

30 typhoons, such as 2013 Typhoon Haiyan (Takagi et al., 2017) and 2015 Typhoon Goni (Takagi and Wu, 2016). The typhoon model calculated both the pressure and wind fields using parameters obtained from the JMA TC

Best Track Data set (http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/trackarchives.html). That is, the central positions and pressures at every recording period were used as parameters. The maximum wind radius, which was not contained in the best track data, was estimated from the central pressure (Takagi and Wu, 2016). Figure 1 shows the time series of the sea surface pressure and wind speed at Con Dao close to the storm track, as

5   derived from the typhoon model.

Although the Delft3D model can be applied to three-dimensional phenomena, the present study used a two-dimensional horizontal grid. Thus, the code becomes a shallow-water wave model, which is commonly used to simulate a long wave such as storm surges, tsunamis, and tidal propagation. Oceanic bathymetry within the computational domain was obtained from the General Bathymetric Chart of the Oceans (GEBCO). The

10   computational domain encompassed a wide area that included MD between 5.44°N–105.97°E and 12.86°S–108.13°E (Fig. 1).

2.3 Tidal Analysis

We gathered water level data, encompassing the period of Linda, measured at three observatories (Can Tho, My

15   Thanh, and Ganh Hao). Ordinary tidal prediction techniques were applied to detect anomalies in the water levels induced by the typhoon storm surge of Linda. The main tidal constituents for two coastal stations (My Thanh and Ganh Hao) were derived from the TPXO 7.1 Global Inverse Tide Model (Egbert and Erofeeva, 2002), whereas those in Can Tho, which also contains fluvial influences, were assumed by the reference (Takagi *et al*., 2016a) (Table. 1).

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2.4 Field Survey

Con Dao Island is located off the southeastern tip of Vietnam about 230 km south of Ho Chi Minh City (HCM), while Can Tho City is situated 150 km southwest of HCM. We conducted a structured questionnaire survey among the local inhabitants of Can Tho and Con Dao in December 2015 and March 2017, respectively. Our

25   primary intent was to investigate the residents' memory of Typhoon Linda (1997) as well as to assess general awareness of typhoon disasters. We asked whether they remembered Linda. Specifically, we asked if they could recall the degree of wind intensity, inundation, and whether they evacuated during Linda. A total of 205 valid responses were collected in the two locations (Table 2).

Although we initial thought about visiting the coastal area directly hit by Linda, the location is very remote (Fig.

30   2). The lack of populated villages would prevent identifying a sufficient number of interviewees. Alternatively, we conducted interviews in Con Dao Island with the expectation that we could gather responses from people

directly impacted by Linda. Meanwhile, Can Tho was more than 100 km away from the track of Linda (Fig. 2). It was speculated that Can Thao sustained less damage, but there was not a published report describing the situation in Can Tho during Linda. For this reason and given the importance of this city as the regional capital, we also visited Can Tho. We administered the structured questionnaire based on the initial version drafted in English,
5   which was translated into Vietnamese. The questionnaire was distributed to individuals encountered on an opportunistic basis (Fig. 2).

3. RESULTS

10   **3.1 Statistics of tropical cyclones in Vietnam and uniqueness of Typhoon Linda**

The best-track data of the Joint Typhoon Warning Centre (JTWC) was used to analyze the frequency and spatial distribution of tropical cyclone (TC) landfalls between 1945 and 2014 in Vietnam (Fig. 3). In the past seven decades, 228 TCs have crossed the coastline, resulting in an average of 3.26 TCs per year. This frequency is smaller than that of the Philippines (5.9 times per year between 1945 and 2013, Takagi and Esteban, 2016) but is
15   similar   with   that   in   Japan   (2.9   times   per   year   between   1951-2016,   JMA, http://www.data.jma.go.jp/fcd/yoho/typhoon/statistics/landing/landing.html). The annual landfall frequency of TCs appears to increase with latitude, which can be adequately modeled with $F = 0.058\ Latitude - 0.36$ ($R^2 = 0.877$).

Linda formed as a tropical depression about 340 km south of the Spratly Islands on November 1st. It tracked
20   westwards and intensified into a severe tropical storm. The storm made landfall in MD on November 2nd (Hong Kong Observatory, 1998)[5]. The present study based on the best-track data indicates that Linda landed on the coast at 105.44°E–9.007°N with a forward speed of 25.6 km hr^{-1}. The maximum wind speed of 55 knots was not extremely strong, but still ranks in the 70th percentile of all TCs.

The southernmost latitude zone (9.0°N–11.0°N) included in Figure 3 has only encountered 11 TCs over the last
25   seven decades, which is a remarkably low frequency compared to the rest of Vietnam's coast. It should be noted that Linda took the lowest course, crossing almost the southern end of the delta. The extreme value statistics using the generalized extreme value (GEV) suggests that the return period of a typhoon with a similar course is once every 150 years or longer (Fig. 4).

30   **3.2 Storm Surge Induced by Linda**

We visited Ca Mau Cape in March 2014, which is on the south tip of Vietnam, to search for records of the storm surge during Linda. Although tidal records were not found, the estimated range of surge height in this area was 0.9–1.0 m through interviews with two local residents (Fig. 1). On the other hand, the time series of water levels around the passage of Linda was obtained from three observatories (Can Tho, My Thanh, and Ganh Hao). The

5 storm surge components were detected by subtracting the astronomical tidal levels from the observed water levels. The background map in Fig. 1 shows the distribution of the maximum surge heights generated by the typhoon – hydrodynamic coupling model. The analysis suggests that the abnormal water level reached 1.5 m at the Ganh Hao station, which is situated adjacent to the landfall point. The numerical simulation also shows that the seawater concentrated on the concave coast, resulting in an anomaly up to 1.8 m.

10 Regarding Can Tho City, the tidal analysis and numerical simulation both show that a substantial storm surge with the height of about 0.5 m occurred. Many local residents, who lived by the river, recalled that their houses were inundated with about 0.2–0.5 m (Table 2). On the other hand, the storm surge at My Thanh, which is located at the river mouth, was about 0.8 m. This was slightly higher than that at Can Tho. The reduction in amplitude between two locations implies that storm surge was attenuated during the course of propagation due to

15 bottom friction and counter river discharge.

These observations demonstrate that storm surge propagated in the main river over a long distance (about 80 km) and reached the largest city in MD. To the authors' best knowledge, the inundation caused by Linda has yet to be studied despite the fact that the storm surge led to the historical highest water level in Can Tho. In fact, a water level up to 1.84 m observed in 1997 was used as a design water level of the Can Tho Bridge (one of the longest

20 bridges in Southeast Asia), which is equivalent to a once-in-a-century flood event (JICA, 2000). However, it seems that this maximum water level was not properly analyzed as the storm surge height during the design procedure of the bridge due to the lack of scientific information on Typhoon Linda.

3.3 Memory of Linda and Awareness of Typhoon Disasters

25 We conducted questionnaire surveys in Con Dao Island and Can Tho. In all, we interviewed a total of 205 local people (Table 2). Although the interviewees were encountered on an opportunistic basis, the gender, age, and occupations were widely distributed. It is remarkable that 83.5% and 100% of the respondents in Con Dao and Can Tho, respectively, remembered Typhoon Linda, demonstrating how a single event can be imprinted as an unforgettable memory among the local population. The reason why not all recalled Typhoon Linda (16.5%) in

30 Con Dao is attributed to the young respondents, who were born after the event. Additionally, some had recently migrated from the main land and did not live on the island during Linda. However, awareness of typhoons

remarkably differed between the two regions. Interestingly, none of respondents in Can Tho were afraid of typhoon despite the fact that they all remembered Linda. Moreover, not all of them evacuated in the face of Linda. Many recalled flooded roads in Can Tho, and damaged houses due to strong winds or floods. Fortunately none of citizens in Can Tho died due to the direct impact of Linda. According to additional remarks from a couple of

5   respondents in Con Dao, none of the local people died on the island. However, many fishing boats, which departed from Con Dao and other parts of MD, including Can Tho, were lost offshore because they were unable to return to port. Many fishermen perished due to Linda. The wind appeared to be much stronger in Con Dao than Can Tho because the former was much closer to the typhoon's eye (see Fig.2). These results clearly demonstrate that a long memory of a specific disaster does not correlate to an increase in disaster awareness.

4. DISCUSSION

Low frequency but high impact typhoon hazards

There are two disaster patterns that can result in catastrophic consequences. However, their impacts differ. The

15   first case is a catastrophe due to an unprecedented level of storm hitting an area where the population has a higher awareness because disaster events frequently occur. One such case may be Typhoon Haiyan in 2013, which made landfall in Leyte Island, the Philippines, and caused a maximum inundation height of up to 6–7 m (Takagi et al., 2016b; Mikami et al., 2016). The Philippines definitely suffers from frequent TCs. The return period of landfall of a Haiyan-class TC is estimated to be 200 years (Takagi and Esteban, 2016). Even local people familiar with

20   frequent typhoon disasters could have underestimated the intensity and subsequent storm surge during Haiyan as it resulted in over 6,000 deaths (Esteban et al., 2016).

The other scenario is the case where an area rarely suffers from TCs and consequently, the local population cannot perceive what would happen due to an unprecedented event. A typical case of this type of catastrophe is Cyclone Nargis in 2008, which was one of the worst storm surge disasters ever recorded. Cyclone Nargis claimed

25   nearly 140,000 lives in the Ayeyawady Delta, Myanmar due to the 4–6 m storm surge (Shibayama et al., 2008; Tasnim et al., 2015). Only a few cyclones have hit the southern coast of Myanmar in the last several decades (Shibayama et al., 2008). This situation is arguably different than that in neighboring Bangladesh, which has had at least 20 severe cyclonic storms make landfall since 1970 (Paul, 2009). Due to an almost complete lack of awareness of storm surges, many local inhabitants did not evacuated to safer areas during the course of Nargis

30   (Shibayama et al., 2008).

A '*black swan*' is a highly improbable event with three characteristics (Taleb, 2007): *it is unpredictable; it carries a massive impact; and, after the fact, an explanation can be concocted that makes it appear less random, and more predictable, than it was.* On the other hand, a *"gray" swan is a near-black swan, but it is somewhat trackable scientifically. Gray swan events are rare but expected.*

5 As mentioned earlier, the recurrence period of a Linda-like typhoon is estimated to be once every 150 years or longer, and it appears to be unusual. However, Linda should be categorized as a gray swan event. Thus, a future typhoon and storm surge in MD should be envisaged by examining only one past investigable typhoon, Linda.

Seasonal flood vs. storm surge

10 We demonstrated that Linda brought a substantial storm surge in Can Tho and caused a historical high water level about 80 km inland. Although it did not cause a devastating consequence, there are concerns that might decrease the abilities of local people to respond a future typhoon. Many citizens in Can Tho seem to adequately understand the general characteristics of disturbances triggered by typhoons such as strong winds, heavy precipitation, and flooding, based on their direct experience with Linda. However, they seem not to feel that a

15 similar event may have a life-threatening impact. People in MD have traditionally lived with floods. Thus, there is certain resilience among the residents in face of seasonal floods (Fig. 5). The seasonal inundation in Can Tho appears to be unavoidable. Flooding is estimated to occur 72 days per year (Takagi et al., 2016). It should be noted that such a tolerance to floods may adversely affect people's responses to real dangers. Although many respondents in Can Tho witnessed flooding around their houses, none of them evacuated during Linda (Table 2).

20 A gentle storm surge rising up to 50 cm might not have caused serious physical damage. However, they should have taken themselves to safer inland locations or higher buildings.

Population increase in MD

The current population of MD is 17 million, which is about 20% of the entire country (Central Population, 2010).

25 However, the delta was an undeveloped mangrove jungle prior to the 19th century, with a population density of only 10–20 persons/km². From the 19th to the early 20th century, the population density reached 100 persons/km² (Danh et al., 2011). In the 20th century, the population dramatically increased due to various factors such as agricultural, hydrological, geographical, and political benefits of the delta, which led to resettlement and construction of a new network of canals to exploit new land. Although the delta's population during undeveloped

30 periods was not well documented, the drastic population increase over the last two centuries (Biggs, 2012) and the combined population of three provinces (Tien Giang, Vinh Long, and An Giang) demonstrate a drastic

population rise from 49,645 in the 1802-19 to 522,473 in 1901-11 and 4,896,600 in 2004. Such a remarkable transition in population appears to lead to an increased vulnerability to typhoons and other disasters because the experience of a catastrophe, which rapidly raises awareness, may not be conveyed between generations.

5   *Sea level rise and land subsidence*

In addition, MD, which extends over an extremely low-lying land, is vulnerable to a sea-level rise (SLR) and land subsidence (Takagi et al., 2016, Thanh, 2014). In particular, the subsidence rate is estimated to exceed SLR in the wider region of the delta (Takagi et al. 2016; Minderhoud et al., 2017). Groundwater exploitation is considered to be the primary cause of land subsidence. Given the increasing trends in groundwater demand in the delta,

10 subsidence will likely be exacerbated in the near future (Minderhoud et al., 2017). Future trends in the typhoon intensity and frequency under climate change remain uncertain (IPCC, 2013). Nevertheless, recent research based on state-of-the-art models suggests that socioeconomic damage by TCs may become more severe under global warming in the western north Pacific (WNP), while the frequency of TCs approaching coastal regions is projected to decrease (Murakami et al., 2012; Ying et al. 2012; Tsuboki et al., 2015).

  Knowledge on storm surge and sources for prompt evacuation

We suspected that the local people did not understand why the water level increases due to a typhoon. Although the local people were aware of a typhoon (84.5%), only 12% of the interviewees in Con Dao realized what storm surge is (Table 2). The perception of the possible danger of storm surge among local people appears to be low.

20 However, this result is not surprising. To understand how this has come about, the first author also conducted a similar questionnaire survey involving 39 sophomore to senior university students at his university (Fig 6). Only 35.9% realized the phenomenon of "storm surge", whereas all respondents understood a "tsunami". Even in the Philippines, which is the most typhoon prone country in the world, many local residents had not heard the vocabulary of a "storm surge" prior to the Category 5 Typhoon Haiyan in 2013 (Esteban et al., 2016). Although

25 an official typhoon warning adequately conveyed the prediction of a massive storm surge, many local inhabitants did not understand what would happen because it was the first time that they heard the term. Training and education for public awareness are effective particularly in developing countries, which may not be able to construct hard infrastructure. The effectiveness could be realized by reviewing the case of Bangladesh where the number of deaths directly related to storm surges has decreased in the past 25 years despite a 50% increase in the

30 number of people exposed to coastal hazards (Lumbroso, 2017).

Our interview survey revealed that TV and radio were the most effective media to convey disaster warnings to local population (Table 2). It is also interesting to note that a public address system such as fixed loudspeaker substantially contributed to getting people's attentions by providing a uniform and simultaneous announcement throughout the region. On the other hand, nobody in Con Dao and Can Tho answered that they obtained the

5 information from internet sources. Since typhoon rarely occurs, they may have only recalled the situation during Linda in 1997. In 1997, there was almost no internet environment in MD to access such information. However, if the same situation happens today, it is expected that many people will obtain information from the internet.

5. CONCLUSIONS

10 It appears that coastal hazards in the Mekong Delta, particularly storm surges and typhoons, have not received as much attention by local officers, NGO, and academics as they probably deserve. Even though Typhoon Linda was the worst storm in the Mekong Delta, few studies have examined the damage it caused in Vietnam. Of the last 228 storms to make landfall in Vietnam, this tropical cyclone took the southernmost course, and the estimated reoccurrence period is only once in 150 years or longer. However, we should recall that the delta was a

15 nearly uninhabited mangrove jungle before the 20th century. Therefore, Typhoon Linda needs to be better studied to envisage a future catastrophic event and enhance the education about typhoon and storm surge of the younger generation in the Mekong Delta and the rest of Vietnam.

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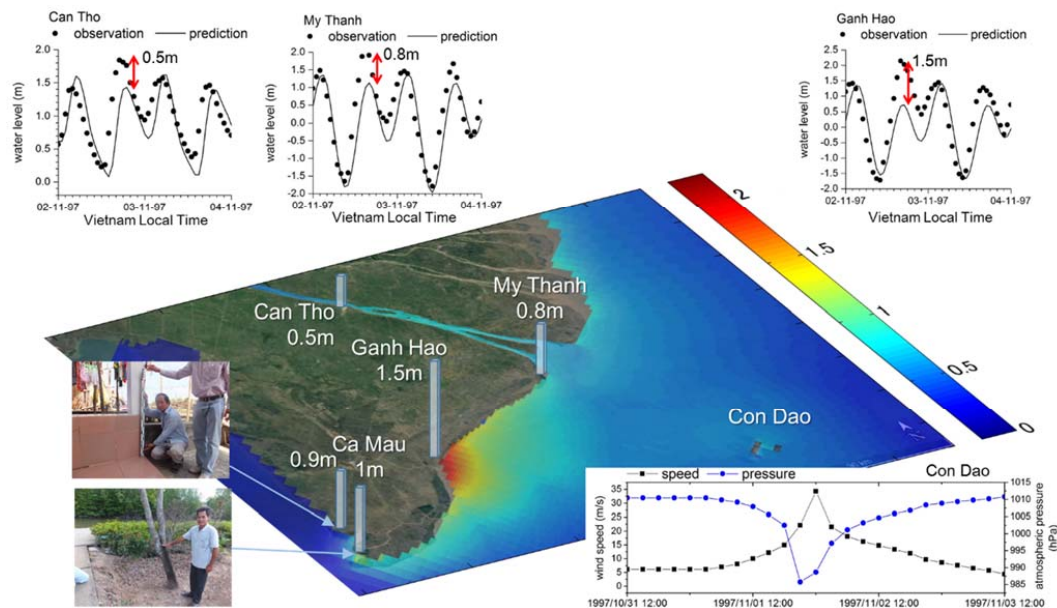


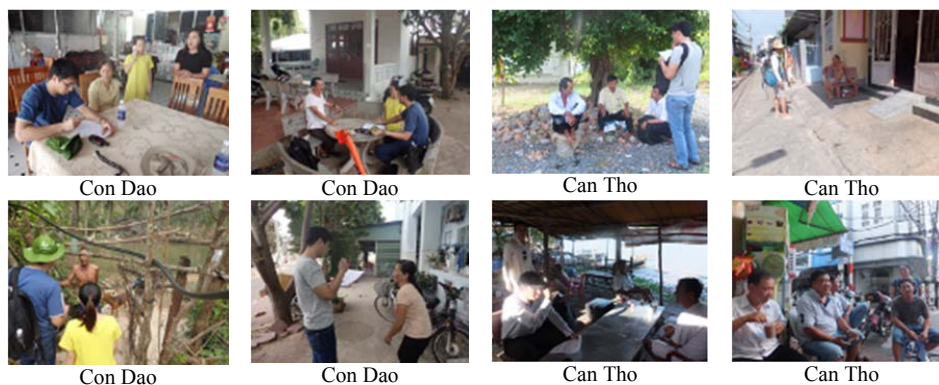
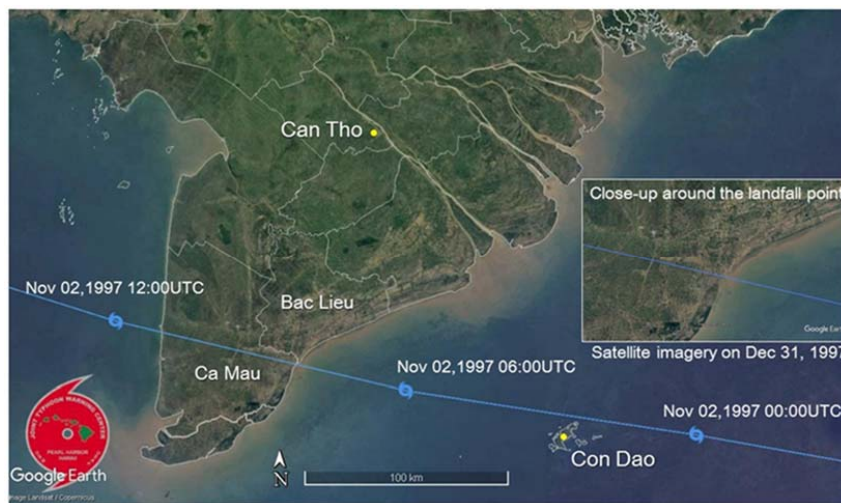
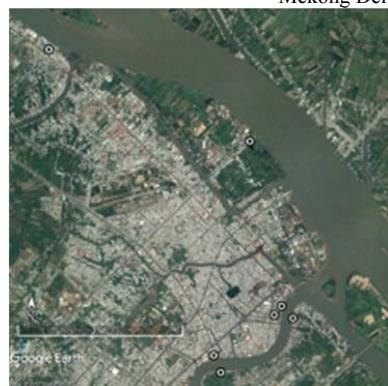
Figure 1. Storm surge induced by 1997 Typhoon Linda estimated by three methods (1. analysis with tidal constituents and observed data, 2. a typhoon-storm surge integrated model, and 3. interviews with local witnesses), showing that the overall range in MD is 0.5–1.8m high. Bottom right shows the simulated wind speed and atmospheric pressure at Con Dao.

Mekong Delta and Con Dao Island

Can Tho   Con Dao

Figure 2. Circular plots on satellite images indicate the towns where we conducted the interview surveys and collected a total of 205 questionnaires (Con Dao: n=103, Can Tho: n=102). Typhoon Linda struck near the border of the Bac Lieu and Ca Mau provinces, which was a low-populated coast with a vast area of shrimp farms. Can Tho, which is the most populous city in the Mekong Delta, has 1.2 million people and is the 4th largest municipality in Vietnam. Prior to the Vietnam War (1975), Con Dao was unpopulated except for political prisoners. Since then, residents have moved from the main land, leading to the present population of about 7,000.

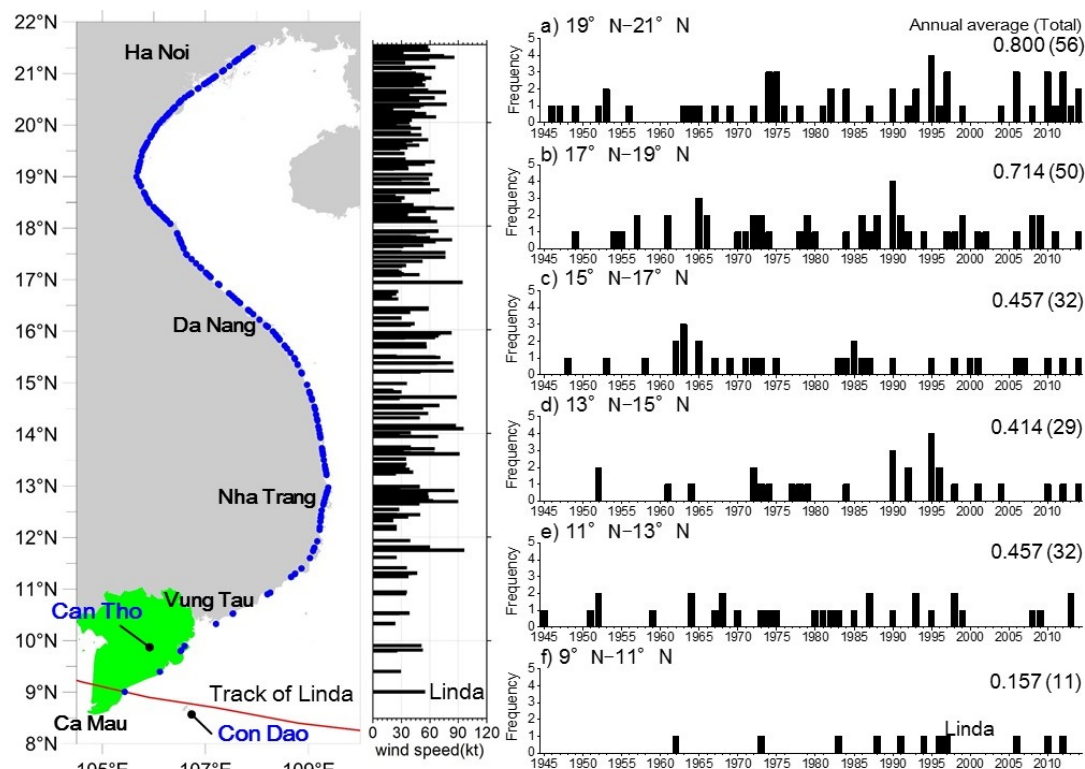



Figure 3. Landfall locations, frequency, and maximum wind speed of tropical cyclones between 1945 and 2014 estimated based on the best-track data of the Joint Typhoon Warning Centre. Area shown in green indicates MD, which is comprised of 12 provinces of Vietnam.

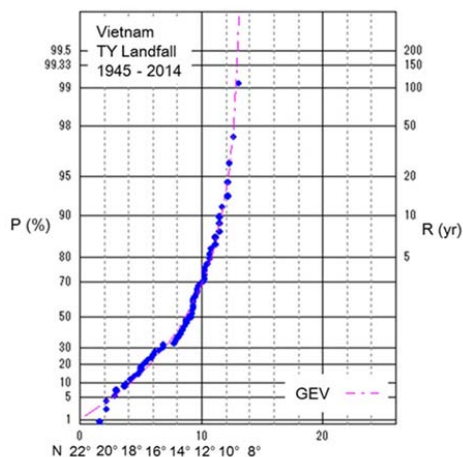



Figure 4. Extreme value statistics of Typhoon Landfall in Vietnam between 1945 and 2014 on a Gumbel probability graph. Cumulative distribution function is approximated with the generalized extreme value (GEV) distribution. P: non-exceedance probability (%), R: return period (year)

Figure 5. Scenery during an inundation in Can Tho, which is typically induced by a combination of a high tide and river discharge during flood season. Local people feel it is annoying but are not afraid of it (Photo taken by
10 the author in August 2014).

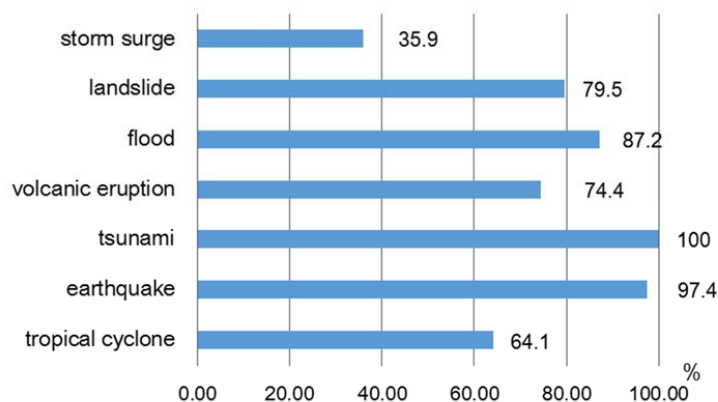



Figure 6. Questionnaire survey about the recognition of various types of natural disasters, involving 39 sophomore to senior university students (*n*=39, nationality: Japanese=21, Chinese=16, Korean=1, and Vietnamese=1)

Table 1. Primary six tidal constituents, represented by amplitude η (cm) and phase φ (degree)

Station	M2		N2		S2		K1		O1		P1	
	η	φ	η	φ	η	φ	η	φ	η	φ	η	φ
Can Tho	51.9	152.4	9.7	118.7	17.7	198.0	35.1	18.2	21.3	324.3	8.9	20.6
My Thanh	93.1	214.9	18.9	194.9	33.6	254.4	61.1	226.6	43.2	182.9	8.0	179.3
Ganh Hao	80.9	234.9	16.1	209.3	26.8	271.6	59.2	252.1	39.5	214.0	17.5	251.5

Table 2. Questionnaire survey about the memory of 1997 Typhoon Linda and people's awareness of typhoon disaster conducted on Con Dao Island and Can Tho City.

Items			Con Dao (*n*=103)	Can Tho (*n*=102)
Gender	Male		49	44
	Female		54	58
Age	15 to 19:		1	0
		20 to 29:	7	0
		30 to 39:	38	9
		40 to 49:	29	27
		50 to 59:	11	41
		60 to 69:	12	20
		70 to 70:	5	4
		Over 80:	0	1
Occupation	Fishing/Fisheries		14	0
		Office worker	10	1
		Village leader	3	0
		Driver	3	4
		Service worker	33	0
		Domestic worker/maid	2	7

Housewife	6	23
Student	3	0
Retired	6	32
Farmer	2	2
Self-employed	21	25
Boat owner	0	6
Laborer	0	2
Q1. Do you remember Linda? [a]	*n=103*	*n=102*
Yes	86 (83.5%)	102 (100%)
No	17 (16.5%)	0
Q2. Are you afraid of typhoons? [b]	*n=103*	*n=102*
Yes	87 (84.5%)	0
No	16 (15.5%)	102 (100%)
Q3. Did you evacuate due to Linda? [c]	*n=86*	*n=102*
Yes	38 (44.2%)	0
No	48 (55.8%)	102 (100%)
Q4. How strong was the wind caused by Linda?	*n=84*	*n=95*
wind was weak	0	0
wind was moderate	0	41 (43.2%)
wind was strong	57 (67.9%)	35 (36.8%)
wind was very strong	27 (32.1%)	19 (20.0%)
Q5. Did Linda inundate your house? How deep was it?	*n=86*	*n=102*
no inundation	85 (98.8%)	38 (37.3%)
less than 20 cm	1 (1.2%)	44 (43.1%)
more than 20 cm and less than 50 cm	0	19 (18.6%)
more than 50 cm and less than 100 cm	0	1 (1.0%)
more than 100 cm	0	0
Q6. Did your location suffer severe damage due to Linda?	(Multiple choices)	
No, my location did NOT suffer severe damage	2	32
People died and/or injured	0	0
Ships in the river were overturned	66	2
Roads were flooded	0	34
Cars and/or motor bicycles were washed away	0	0
Houses and/or facilities were damaged	67	51
Q7. Where did you get information on typhoon? [d]	(Multiple choices)	
TV, Radio	86	82
Print Media [e]	1	1
Public Address System [f]	55	30
Internet	0	0
Family, relatives	6	1
Neighbors	4	37
Authority Figures [g]	32	27
NGOs and other aid organizations	0	0
Self-taught or understood by observation	0	2
Q8. Do you know what a typhoon storm surge is? [h]	*n=103*	—
Yes	12 (11.7%)	—
No	91 (88.3%)	—

[a, b, c] Chi-Square test, $p < 0.001$, [d] Here, we asked typhoons in general, not necessarily only during Linda, [e] Newspapers, Pamphlets, and Brochures, [f] Fixed Loudspeakers, Mobile Loudspeakers, etc., [g] Village Leaders, Police, Firefighters, etc., [h] This question was only asked in Con Dao.