Mass evacuation in typhoon response in Wenzhou, China: a preliminary analysis of progress and challenges[1]

By

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Introduction

Mass evacuation is considered one of the most important measures to prevent loss caused by hurricane disasters (Lindell and Perry 1991). In a hurricane evacuation, large areas of costal vulnerable populations are evacuated to shelters. Most research on disaster evacuation responses focuses on the United States, such as studies on individual, family, and organization behavior of evacuation, governmental decision making, engineering models [including traffic model, logistic model et al.] and coordination and communication problems (Baker 1991; Bolin 1984; Dow and Cutter 2002; Fischer III et al. 1995; Kirschenbaum 1992; Wilmot and Mei 2004; Wolshon et al. 2005; Wolshon 2001). There is little empirical research exploring the progress and challenges of typhoon evacuation in China, and this paper seeks to bridge that gap.

China regularly suffers from severe typhoons in the southeast mainland region which is also the most developed area. About 9 typhoons target China every year (Wang et al. 2007). Some typhoons frequently cause many human deaths and economic loss. For example, the 1956 typhoon #12 is one of the deadliest tropical cyclones since 1949, killing more than 4629 people after striking the county Xiangshan in Zhejiang province; 1969 typhoon #03 killed 1554 people in Shandong city; 1994 typhoon #17 resulted in 1126 deaths and about 12.4 billion Chinese yuan loss; typhoon Rananim caused at least 164 deaths and direct economic loss of 15.33 billion Chinese yuan in Zhejiang province in 2004 (Xu and Bi 2005); Typhoon Saomai is the most intense typhoon to strike China in the latest 50 years, its landfall strength was stronger than that of hurricane Katrina, leaving at least 428 dead and causing more than 12.7 billion Chinese yuan economic loss in Zhejiang (China Meteorological Administration 2006).

Figure 1 Typhoon vulnerable provinces in China and location of Wenzhou City

Among the coastal cities, Wenzhou city is one of the most frequently affected areas [see the geographical position of Wenzhou and typhoon prone areas in China in Figure 1]. Wenzhou is a city located on a small plane with hills in its western and northern regions[2]. The population is 7.6 million [2007], of which the urban population is 1.4million [not including peasant workers 2.5million][3-4]. 16 typhoons landed in Wenzhou from 1949 to 2007. From 1990 to 2007, 219,000 houses were destroyed, 1,800 people were killed by typhoon or typhoon triggered flooding, and together they have caused 55.2 billion Chinese Yuan direct economic losses[5].

The total economic damage related to typhoons in Wenzhou has increased steadily, while the number of human deaths has decreased sharply[6]. Most of the increase is due to economic development in this vulnerable area. After opening up policy and reform in the

[2] Based on Wenzhou Municipal Manual for Flood Response, edited by Xue Zhigang in 2008.

[3] Based on official estimate http://news.xinhuanet.com/employment/2005-04/29/content_2894703.htm.

[4] http://www.wzstats.gov.cn/

[5] Based on the contents from *Wenzhou Municipal Manual for Flood Response*, edited by Xue Zhigang in 2008.

[6] Ibid.

late 1970s, people have engaged in a new commodity economy, household industries and specialized markets [For example Wenzhou is called “China’s capital of Shoes”]. The city created its own economic development model in China[7]. Like many other coastal cities in southeast China, the energetic economy attracts many investors and immigration peasant workers from other areas, which serve to further increase vulnerabilities during disaster response.

In China, evacuation did not assume an important position on the political agenda until the most recent two decades[8]. In the past, a strong emphasis on disaster prevention and community resilience[9] to prevent state property loss at any cost, motivated typhoon responses which led to some catastrophes.

With the development of China’s newly built emergency management institution, in the wake of Typhoon #9417[10], evacuation was introduced as a critical tool for typhoon response. Local governments set up typhoon emergency planning and identified many shelters, appointing specific officials to be responsible for evacuation[11](Deng 1999). These advancements in typhoon response demonstrate China’s effort in emergency management

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[7] For details, please see http://english.wenzhou.gov.cn/

[8] Interview #4, 8, 15 and 16.

[9] For example, if the dam burst under the weight of water, the Party member led other mobilized mass public jump into the river to stop the water rush into the properties. Many lives were lost because of this kind of stupid behavior in controlling the nature. This is reflected clearly in the newly produced disaster movie “super typhoon”, directed by Feng Xiaoning, which is based on typhoon response experience of China.

[10] Interview #4, #10, #11 and #12.

[11] Interview #1, #5, #6, #7 and #8.

In county level, 340 in 342 counties which were influenced by typhoons directly have finished typhoon emergency planning according to the statistics at the end of 1998.

these years[12]; however, there are still some problems left in typhoon response which are described in the following sections.

In this paper, decision structure for typhoon response in China will be described first. The second section aims to illustrate how China's evacuation decisions have become institutionalized. Third, I will describe a conservative decision making chain and evacuation politicaliztion. Finally, long-term disaster prevention and preparation problems are discussed.

Data and methods

All the data about typhoon response presented in this paper was collected through field research in the Wenzhou City Bureau of Water Resource during September, 2008, which includes [1] one interview with a NGO director and sixteen interviews with officials in the Bureau of Water Resource. Eight of which are from the city level, four are from county level and the others are from the town level; [2] Personal observation during response to the typhoon Sinlaku in Wenzhou City Flood Control and Drought Relief Headquarters [FCDRH]; [3] Evaluation reports of the typhoons; [4] Typhoon response command documents. Typhoon command documents are records of commands issued through facsimile[13] with signatures from leaders in charge. During the typhoon response process, a substantial

[12] For example, China's response in Spring festival ice storm is praised by western media and officials from United Nations, for details please visit http://www.unisdr.org/eng/media-room/press-release/2008/pr-2000-03-China-freak-snowstorm.pdf and also http://app2.dwnews.com/view-article.php?url=/gb/MainNews/SinoNews/Mainland/2008_2_13_12_5_39_307.html

[13] A way is widely used for sending commands specially designed for the government which is similar with fax machines.

amount of commands are transmitted to lower level FCDRH[14]. The contents of these faxes which were sent from Wenzhou City level to county levels in its jurisdiction include: [1] real-time information about rain and typhoon, and commands about evacuation and response; [2] requirement for real-time response information report (evacuation population statistical data); [3] coordination of the trans-county level response; [4] higher level instructions and governor's instructions; [5] instructions with regards to the prevention of certain engineering projects which have the casse potential danger to the community. In the response phase, administrators at the local level are responsible for everything which is relevant to typhoon response in his jurisdiction. If lower levels face unresolved problems, such as releasing water from city managed reservoirs in their counties jurisdiction in order to have enough space for the coming flood, they need to ask for permissions from a higher level at FCDRH.

The interviewees were selected using a snow-ball sampling[15]. The criterion for selection was that the potential candidates must have at least two years working experience in typhoon response. I also interviewed some retired professional staff of typhoon response to verify some of the interview questions, because these retired staff could comment on these issues more frankly.

[14] The amount depends on the situation of the hurricane, in total it is from ten to forty per hurricane [not including upstream communication from lower level to higher level]. Sometimes, these telephotographs are sent every ten minutes.

[15] Based on the recommendation of officials, the experienced decision makers and retired officials in different levels were selected for interview.

Decision making structure for typhoon response in China

Typhoon disasters are classified as a kind of natural disaster which is one of the four basic categories of emergencies in China[16-17]. State Floods Control and Drought Relief Headquarters [SFCDRH], which is led by the State Council, is responsible for all the tasks related to flood control and drought relief all over the country, including typhoon response[18]. Normally, a vice premier is the leader of SFCDRH and the members of this institution consist the minister of water resources and a few other vice ministers who are relevant to flood control and drought relief response[19]. There is also a standing body which is placed under the Ministry of Water Resource who works for this headquarters in daily crisis preparedness. The organization chart of typhoon response is shown in Figure 2. For the provinces which are run through by six main rivers, the governor also has to coordinate with specific River Basin Flood Control and Drought Relief Headquarters [FCDRH] for disaster response[20](Lu 2007; Ma, Xi and Wang 2009). There are three other levels of FCDRH, province level, city level, and county level. Each level is led by a direct superior and

[16] The public emergencies are classified into natural disasters, industrial accidents, public health crisis and social security crises. For details please visit http://www.gov.cn/yjgl/2006-01/08/content_21048.htm

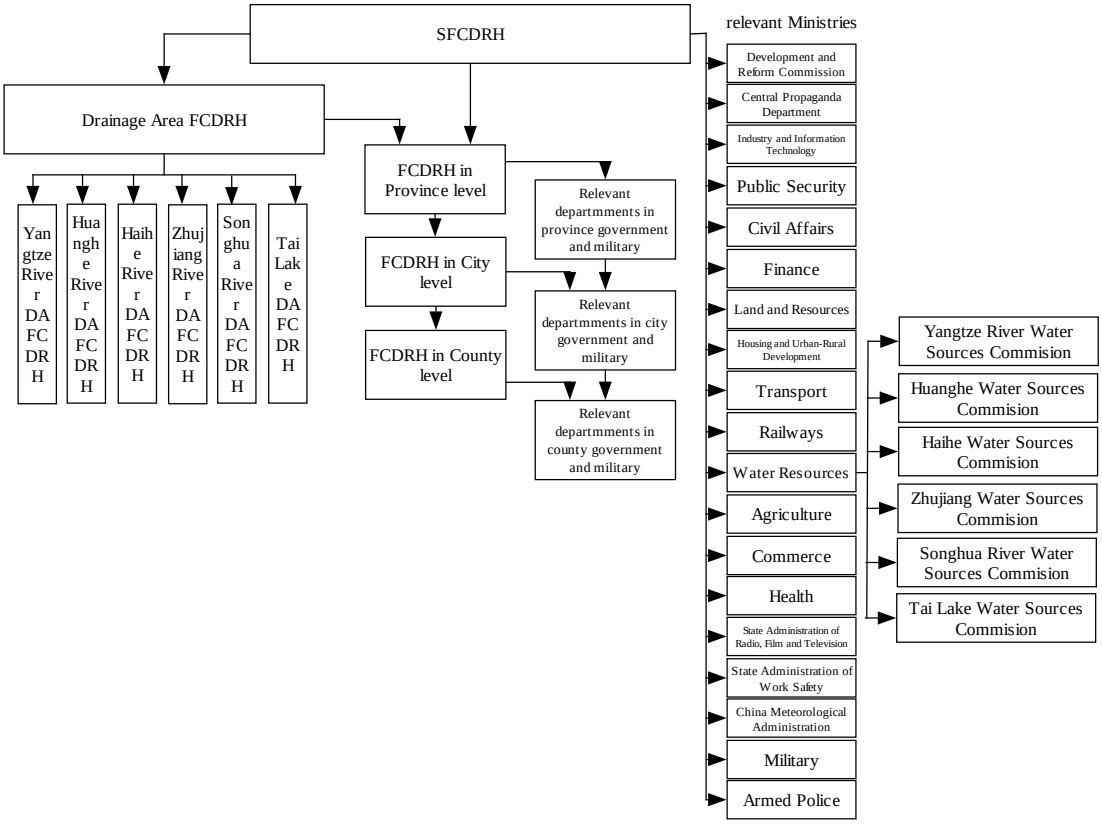
[17] State council is the leading agency of all types of disasters or emergencies in China. At least 21 headquarters which are led by the vice premiers and composed by many vice ministers from other related departments are specially designed and responsible for each specific type of emergency. An implementation office is set up in the ministry which is most relevant to this type of emergency, and is responsible for daily emergency prevention and preparation. In declared national scale emergency, the headquarter responses to the emergency.

[18] For details, please see http://sfdh.chinawater.com.cn/jgsz/jgsz.htm

[19] For which ministry is relevant to hurricane response, please see Figure 2.

[20] This will be a more complex coordination issue, especially in Songhua River pollution crisis. For more, please see Lu 2007; Ma et al. 2009

responsible for all the tasks of typhoon response in its jurisdiction. Some local daily working offices are placed in the departments of urban construction.



Source, the website of State Flood Control and Drought Relief Headquarters

Figure 2 Organization Structure Chart of Hurricane Response

When a typhoon threatens a city, FCDRH will hold videoconference with relevant governmental organizations to analyze the situation and preparedness. In this conference, some technical governmental organizations present their real-time and forecasted technical data on rain, tide and typhoon activity[21]. Additionally, other tertiary governmental organizations present what they have prepared in relation to response and expected difficulties. Then FCDRH leader makes the final decision on what category response will be

[21] Personal observation. In addition, all these forecast report, real time rain height information and emergency planning category are shared in the website for public. But there is no integrating website for these information.

initialized and delivers a mobilization speech. If it is necessary, this videoconference will be held frequently, from State level, province level, to city level and county level.

Coordination problems do not emerge as frequently in China's decision structure as they do in the US. All the interviewees agreed that once an evacuation decision is made, all involved governmental organizations tend to cooperate well in the response. There are two reasons for this level of cooperation:

[1] The variety of involved actors in typhoon response in China is not as broad as that in the US. Although ancestral halls or churches may serve as shelters during evacuation, the capacity of these shelters occupy only a fairly small part of all provided shelters. In China, non-governmental organizations have emerged in media reports recently, but they tend to participate in major catastrophe, like the Sichuan earthquake, but not in routine disasters, like typhoons[22]. In Wenzhou, only one volunteer organization which was founded in 2007 and composed by taxi drivers participated in typhoon evacuation[23]. This is also the first non-governmental organization related to typhoon disaster relief in China. Business sections seldom build up their own disaster supply chain or typhoon specific planning like Walmart, Chevron or Weyerhaeuser do in the US. Underdeveloped capacities for typhoon preparedness in non-public sectors reduce the chance of failure for cooperation with governments during the events, therefore, the government plays an absolutely dominant role in Chinese typhoon response.

[2] The top down bureaucratic structure in China is powerful in mobilization during an emergency. China is a country with centralized state power (Lieberthal 2004). Leaders can

[22] Interview with director of Cangnan emergency rescue volunteer centre.

[23] For details, please see the website http://www.cnfxkt.com

mobilize different levels of governmental organizations to participate in response rapidly. Most of the officials are nominated by their superiors instead of by the citizens in their community (Zhong 2007), so they tend to respond well to top down orders in emergency situation[24]. Additionally, China also relies heavily on its military in disaster response, which promotes command and control models[25].

However, this model is not without problem in typhoon response. Centralization of state power in emergency management is accompanied by state authority fragmentation by horizontal and vertical power structures at the local level[26]. Typhoons or other disasters are local problems which need support from different agencies at the national level. Sometimes, local governmental departments need to balance orders from local administrators and national agencies.

Higher level authorities cannot gain accurate information about a crisis situation, so their commands tend to be vague and can be considered as a kind of guiding ideology. These vague commands could protect high level decision makers from taking responsibility for faulty commands. Sometimes, the contents of the commands are just repeating emergency plans or handing out the leaders' speech in the mobilization meetings, so they tend to be

[24] Although covering-up crisis information at the local level has been observed in other type of crisis, like public health incidents [SARS, Sanlu milk crisis], industrial incidents [Songhua River Pollution Crisis] and riots [Wengan riot], little evidence has been detected in typhoon response these years.

[25] Americans tend to worry about military offence citizens' rights, but this worry doesn't exist in China. 2005 issued military participating in disaster rescuing regulation specifies the role of military in disaster response. for details, please see http://slt.zj.gov.cn/pages/document/30/document_908.htm

[26] This issue is widely raised and recognized by many Chinese scholars during discussion and keynote speeches in INTERNATIONAL CONFERENCE ON RISK, CRISIS AND PUBLIC MANAGEMENT in September, in Nanjing China.

redundant which increase unnecessary commands will increase pressure for local officials to handle these documents[27].

Evacuation or not: critical decisions under uncertainty

Deciding upon evacuation is a critical task that must be undertaken under high uncertainty. Before landfall, predicting the area of potential typhoon landing is only one kind of uncertainty that creates a dilemma for decision makers: deciding not to evacuate may cause life and economic losses if typhoon strikes, while evacuation is costly in terms of capital and governmental credibility, particularly when the typhoon does not strike as expected. There are additional uncertainties which influence decision making, for example, a large number of vehicles are involved in evacuation which significantly exceeds the capacity of local road networks [recall Houston's evacuation during hurricane Rita], lots of people rush to a few shelters while there is still adequate space for evacuees in other places because of a lack of shared information between shelters. Some critical infrastructures [like highways, bridges] may be destroyed by floods or winds, which may also hamper the evacuation.

In practice, however, evacuation decisions are typically the outcome of an institutionalized process. This is because typhoons have become a kind of routine crisis in some areas, and governmental organizations learn from experience and lessons of multiple responses. Governmental decision makers institutionalize their decision making to reduce the dilemma caused by these decisions based on a combination of [1] emergency plans; [2] their accountability system; [3] preference of the public and media; [4] dominant ideology from upper level.

[27] Interview #7 and #13; personal observation, officials in county level just forwarded the official command documents to town level command centre.

Emergency plans and amendments

Emergency plans serve as restrictive institutions which routinize common factors in emergency based on historical experiences (Gao 2008). Chinese governments have generated more than 1.3 million emergency plans combined after the SARS crisis (Gao 2008). Every county level and town level formulated their own typhoon evacuation plans, invited experts to evaluate the plans, and update them regularly[28].

As indicated before, decision makers may fear the false outcome of a decision for evacuation because of the uncertainty of typhoon tracks. In order to reduce uncertainty in governmental decision making, typhoon plans clearly formulates which category typhoon preparedness should be issued. For example, if the city weather bureau releases an urgent typhoon warning, forecasts a severe cyclone or a typhoon will land in Wenzhou, or a Severe Typhoon or a super typhoon will hit between Ningde city, Fujian Province and Taizhou city, Zhejiang Province which may influence Wenzhou seriously, a category I warning is released[29].

Contrary to mainstream human right values [for example, self-government and individual choice], mandatory evacuation may violate the rights of citizens which may lead a local government into a lawsuit. Governmental organizations in Wenzhou pushed forward province level People's Congress for legislation of mandatory evacuation[30]. The 2007 updated article 30, Zhejiang regulations for flood control and typhoon prevention, clearly designates "government which is in charge of organizing evacuation and its relevant

[28] Based on interviewees #1-#14. In the field research, I also found a retired official was recruited as a part time employee to examine these town level emergency plans at Wenzhou FCDRH.

[29] http://www.wzsl.gov.cn/wzsl/html/fxfhya/

[30] In China, people's congress in city level doesn't have legislation rights.

departments have the right to enforce mandatory evacuation for those who refuse to withdraw after being advised under following emergent circumstances: Flood, typhoon, landslide, rockslide, mud-rock flow or other geological disaster which directly threatens the lives of masses are likely to happen; The government has decided to carry out flood mitigation or flood discharge"[31].

Accountability system

All interviewees considered that decision makers need not to think about uncertainty caused by coordination between governmental organizations. If they cannot perform as instructed, they will be punished. More and more local leaders, even province leaders, have lost their positions because of under performance in crisis[32]. New regulations for the accountability of chief administrative officers have also been issued at the province and city levels. For example, Wenzhou Temporary Provision for Executive Accountability, which was issued in 2007, stipulates executives should take the responsibility if they cover up or not release in-time emergency information, take no action in organizing emergency rescue, or cannot execute the function of public management which causes mass public conflicts[33]. In social ethnics, governmental officials in China hold more responsibilities in evacuation mobilization, especially in operational level in the countryside. In US, governments will not take the responsibility of life lost caused by denying evacuation if government declares

[31] http://slt.zj.gov.cn/pages/document/47/document_537.htm

[32] This kind of accountability system begins with the resignation of Mr. Zhang Wenkang, the minister of Public Health, in SARS crisis. In these two yeas, a kind of so called "accountability storm" is blowing. In Sanlu milk powder crisis, Director General of General Administration of Quality Supervision, Inspection and Qurantine, Governor of Hebei Province resigned, the mayor and co-mayor of Shijiazhuang city were deposed. In Shanxi Miner crisis, Governor and vice governor of Shanxi province resigned. This also happened in Wongan public conflict crisis, Jiaoji Railway accident crisis et al.

[33] http://www.wzsl.gov.cn/wzsl/html/gfxwj/2007-6/13/11_14_14_614.html

mandatory evacuation. While this happened in China, governments have to take the moral responsibility, and blames from mass media and the public[34].

Preference of the public and media

The media and the public tend to forgive overreaction or false positive errors[35] [the "boy who cried wolf" syndrome][36] rather than passivity after 2006 super typhoon Saomai (Atwood and Major 1998; Breznitz 1984; Dow and Cutter 1998). Negative revisions or false negatives are measureable by human death or misery [for example, the suffering victims of New Orleans in the super dome after the 2005 hurricane Katrina] and visible to the media and public; Even small deficiencies will be amplified by the media in crisis.

The 2006 Typhoon Saomai changed attitudes of the public towards false positive errors in evacuation significantly. Because most of the permanent citizens in Wenzhou were born and raised there, flood and typhoon stories are part of their life. They formed their own normalized preparation procedures, such as consolidating their own houses, moving to higher place, detecting flood level [this is what we called "disaster subculture" (Anderson 1965; Hannigan and Kueneman 1978; Kueneman 1973)]. Before typhoon Saomai, some of them refused to evacuate relying on their own experience. Evacuation was often carried out only when the houses were flooded. Soldiers had to use kayaks to move people to higher

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[34] Interview #2, #3 and #4.

[35] False positive [also called "Type I error" or "α error"] and false negative [also called "type II error" or "β error"] are originally used to describe errors made in a statistical decision making process by Jerzy Neyman and Egon Pearson in 1928. False positive means error of rejecting the null hypothesis given that it is actually true; false negative means the error of failing to reject the null hypothesis given that the alternative hypothesis is actually true.

[36] What they called "cry wolf scenery" is that the public are less likely to evacuate in the future when fault evacuation orders were issued frequently but threatens don't materialize. For this issue, there is still some debate on this issue, for details please read Atwood and Major (1998), Breznitz (1984), and Dow and Cutter (1998).

place or rescue people from debris destroyed by typhoons. After typhoon Saomai, few cases were reported about refusing to evacuate[37], because the public realized how severe a super typhoon is.

In order to reduce economic costs caused by false positive errors, Wenzhou city FCDRH adopted a method called batchwise evacuation. Before typhoon landfall, citizens who live or work near the beach are required to evacuate first, then potential vulnerable houses which may be destroyed by the winds, community in the downstream of dams with potential safety problems, and people who live near potential geologic hazards [like debris flow] will be evacuated.

A Dominant ideology

In field research, all the interviewees suggested central government attached importance to crisis management, especially after the concepts of "human-centered" and "always put the demos first" were advanced by Communist Party of China[38]. All acknowledged that accountability system stimulated them not to violate the dominant ideology in a crisis.

Mr. Jinping Xi, formal Secretary of the Zhejiang Province Committee of the Communist Party of China, announced that they would rather evacuate without typhoon striking, instead of being hit without evacuation. This ideology also became the principal guideline of evacuation management[39]. This ideology was advanced in the historical context that local government should not just pay attention to protect economic property, but also the life of

[37] Based on interview #3, 4, 5, 10 and #11.

[38] After that, evacuation and shelter management has been invested much by the government. In the past, FCDRH cannot obtain so many budgets.

[39] Interview #2 and #3.

human. This ideology was partly misinterpreted by local officials as the basis of conservative decision.

These four factors have turned the typhoon evacuation process into an institutionalized process. In the following section, I will examine the effects of this institutionalized process: it consists of a conservative decision making chain, which promotes false positive errors.

Conservative decision making chain and evacuation politicalization

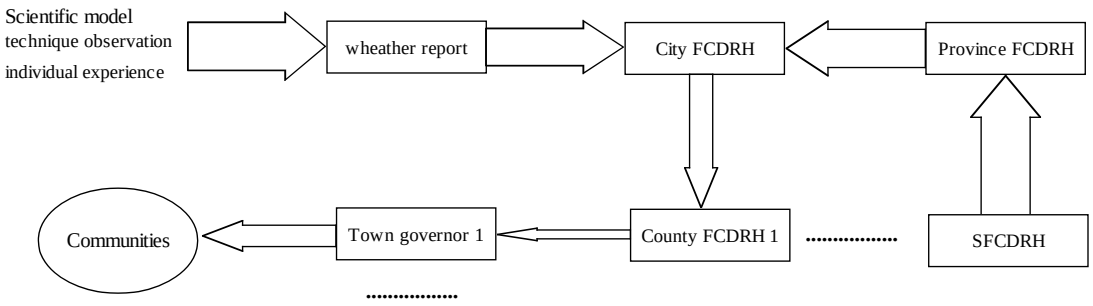

Figure 3 Conservative Decision Chain in City level

All the interviewees indicate that decision makers tend to err on the safe side of protecting the public in the face of cone uncertainty in typhoon evacuation [see for a similar observation in the US by Mileti and Sorenson (1990)]. When a typhoon threatens a certain number of coastal cities, central and local weather agencies will release their forecast report to what extent this area will be influenced by the typhoon. There is always a long list of threatened coastal cities. In general, this forecast tends to be more conservative when this information will be adopted by other departments or governors for decision making[40]. Once

[40] Interview #2, #3 and #4. Forecast report from local weather service authorities combine the forecast report from central and province weather and their own experience. Normally governor will adopt more from their local weather service. Based on interview #3, there happened some doubts from FCDRH about the vague information in the decision conference.

this forecast was adopted in decision making, weather service authorities are accountable for any failure caused by an inaccurate forecast. Therefore, weather service authorities try to exaggerate the potential threat and make the forecast vague.

After receiving information from the weather service, governmental decision makers have to determine if evacuation is required. Successful evacuation of the people in threatened areas will be considered as their duty; governmental officials will not acquire awards or social credibility[41]. It is not easy to measure to what extent successful evacuation is executed by the government. What is worse, if they are unable to evacuate people in the threatened areas, they will be criticized by the public, mass media and other interest groups. The criticism from a wrong decision not to evacuate when typhoon really strike is far more serious than an evacuation that was proven unnecessary. Therefore, the best choice is evacuate all the time even though the striking possibility is very low; this will cause economic loss and governmental credibility loss. However, this type of governmental credibility loss will not appear immediately, which means this may not cause trouble in the governor's term.

The commands which are issued from the higher to the lower level make up a conservative decision chain. Conservative decisions allow the potential evacuees time to evacuate. The cumulation of conservative decisions down the decision chain shifts problems to operational officials. The operational level [town level] must modify these decisions to solve practical problems. For example, if there is still sunshine, it is not easy to persuade citizens to evacuate. This conservative evacuation was also witnessed before hurricane Gustav in US. The governor of Louisiana could not afford a failure like Hurricane Katrina, so he decided to

[41] Interview #7

evacuate massively and at an early stage. The evacuation was successful, but mostly unnecessary in hindsight.

Typhoons are considered normal disasters in Chinese coastal cities by officers from various departments. What worried leaders in the past were that officials think every time of response for typhoon is similar and everything is under control[42]. However, chief administrators sometimes show overreaction and politicize the crisis response[43]. According to Wenzhou city typhoon response emergency planning, director of the FCDRH did not need to appear in the meeting of typhoon response when a Category III typhoon was declared, and either mayor or Secretary of the Municipal [Wenzhou City] Committee of the Communist Party of China did not need to participate in a Category I or II typhoon response. In reality, even in Category III, the mayor and Secretary of the Party attended this meeting for mobilization. This attendance demonstrates to the lower level officials that the leaders placed great emphasis on this disaster response[44]. Repeated unnecessary evacuation, historical success in evacuation and long time waiting could exhaust responders and make them too confident with the procedures about evacuation response which may result in losing any fears of problems [which was referred to as a "failure of success" by Pearson and Clair (1998)[45]]. This issue was referred to many times by leaders in video conference and can be found frequently in command documents.

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[42] Based on on-site notes of speech by Party Leader in Wenzhou, Shao Zhanwei, at the

[43] Interview #4, #5, #7 and #12.

[44] Interview #2, #3, #4, #5 and #8.

[45] "failure of success"means that they would think their organizations are no longer vulnerable to typhoon after repeating historical success

Other considerations about evacuation

Warning

Information dissemination changes significantly during a typhoon evacuation. Traditionally, door to door notification is the main channel for warning in China, especially in the rural villages. In the most recent typhoons, multiple channels were activated. Besides relying on top down official communication, governmental departments also released real-time information on their websites. For example, all real-time hydrologic information, satellite cloud pictures, tidal levels and typhoon forecasted routine pictures are updated hourly on the official websites[46]. A float window appeared in the main official website in order to attract internet users' attention. Live television announcements and cell phone instant messages were also used. Wenzhou government is proposing ADW, which was used in anti-aircraft defense in cold war, to warn the city for an impending typhoon evacuation. Additionally, China government adopted first nationwide open government information regulations on April 24, 2007, which marks a turning point away from a deeply ingrained culture of government secrecy toward making governmental information more transparent (Xinhua Reporter 2007a; Xinhua Reporter 2007b). Following deficiencies of information dissemination in emergencies, especially during the 2003 SARS crisis, this regulation stipulates that emergency plans, warning information and response should be made public. This regulation also makes timely warning an obligation for emergency response departments.

Evacuation of people with special needs

[46] http://www.wzsl.gov.cn/wzsl/html/fxfh/

http://www.zjwater.gov.cn/typhoneweb/

Migrating peasant workers and citizens in vulnerable houses received much attention at the town level. Wenzhou and other coastal cities which are affected by typhoons are economical developed areas and manufacture base for exportation. These areas attract large numbers of migrating peasant workers from western rural areas. But these peasant workers find it difficult to make sense of what happens during typhoon seasons, because these situations completely exceed their previous experience[47](Sellnow, Seeger and Ulmer 2002). Telephone numbers of their employers were listed in emergency planning of town levels, and these employers take the responsibility to evacuate their workers[48]. In batchwise evacuation, social security police and housing department officials are responsible for the final clearance of hazardous houses. Few specific plans, however, were speculated about the evacuation of special needs individuals [seniors, people need nursing care or people with disabilities].

Long-term typhoon disaster management

Successful evacuations are not just moving people to shelters for impending typhoons, but need systematic preparedness. However, preparedness still plays a secondary role in China's emergency management system. In this section, several problems are presented that are related to long term typhoon evacuation response might have been neglected by local governments.

Safety management of evacuation

[47] This lack of sense making has also been recorded in the 1997 Red River flood in Minnesota and North Dakota (Sellnow, Seeger et al. 2002).

[48] Based on interview and five town level emergency plans.

Safety issues of evacuation have great impacts upon well-being of citizens and governmental credibility. Historically, recorded cases release warning to governments in evacuation preparedness[49](ABC news reporter 2005; Moreno 2005; O'Driscoll, Wolf and Hampson 2005). Ill prepared evacuation, which neglects potential safety problems, may result in more deaths. It seems that Chinese governments haven't learnt much from foreign cases about safety issues of evacuation. Little evidence related to evacuation safety was referred to by interviewees.

Structural safety of public shelters lacks of scientific evaluation in China. The area of official registered shelters in Wenzhou city is 486847 square meters in 2008, which could settle down 162574 people[50]. Some of the interviewees said that there are official evaluations for the shelters in their jurisdiction, whereas some others said there is no evaluation, but they got the official labels for shelters. Most of the interviewees agreed that large amounts of the shelters are vulnerable to super typhoons, especially shelters in the rural areas. For example, a private household shelter collapsed in Heweiyang village, Wenzhou in 2006 typhoon Saomai[51].

Large public transportation system

Every city or village in Wenzhou has a hill or foothill nearby. Therefore, the citizens are not afraid of the potential flood and other secondary disasters like debris flow or mud-rock flow

[49] For example, a bus carrying evacuees crashed and four people were killed, of which three from abroad in Cuba during 2005 hurricane Wilma; a bus fire during 2005 hurricane Rita killed 24 elderly nursing home evacuees from Brighton Gardens in Bellaire, Texas; Houston's traffic jam during Rita evacuation compelled evacuees run out of gas or experience breakdown in high temperature.

[50] Based on Wenzhou Municipal Manual for Flood Response, edited by Xue Zhigang in 2008.

[51] This is a shelter widely used the people in this village, but not officially verified. There are still protests in the website to criticize governmental ill preparedness.

caused by typhoon. Thus, the evacuations are relatively simple: just to move to a relatively safer and higher place nearby. However, many shelters cannot withstand super typhoons. Most families in China, especially in the rural areas, do not have the necessary vehicles to evacuate from coastal areas to far away shelters[52]. If a super typhoon[53] makes land in China, this kind of nearby evacuation may fail[54]. Large scale public transportation system for evacuation needs will be bottlenecked in this situation. Successful small area governmental provided public transportation may inspire further design of large scale evacuation public transportation system[55].

Coordination in daily preparedness and learning

The typhoon response capacity does not just depend on smooth coordination and decision implementation but also on sufficient preparation. Traditionally, governmental efforts concentrated on rescuing after a typhoon made landfall or the flood reached public properties. China improved in prevention and preparedness, but there still are some shortcomings. China's mobilization ability demonstrates strength during typhoon emergencies, but in the daily preparation for disasters, the director of FCDRH sets their agenda back to other issues and the office for FCDRH cannot coordinate other governmental organizations easily[56]. Crises are known as low probability-high impact events which do not

[52] There are more people living in the rural areas. The construction structures are usually weaker than that in the city.

[53] For the comparison of the categories of hurricane between China and US, please see Appendix 1.

[54] Interview #2, #4, #6, #7 and #16.

[55] Interview #5. they provide the case of Lingkun Island. The local government evacuate all the citizens in the island to continent in using public transportation.

[56] Interview #2, #3 and #4.

always compete successfully for resources in preparedness[57] (Falkenrath 2000). Most leaders do not have such foresight to invest in planning and preparedness. For example, reconstruction or maintenance of dangerous shelters could improve typhoon response and reduce vulnerability, but it is not easy to get this on the agenda or get budgets for this[58]; There is hardly enough funding for compiling, evaluating or revising the emergency operational plans, especially at the town level[59].

After major typhoons, governmental officers from various departments become active in typhoon preparation, mitigation and relief rapidly, which are driven either by their confounded performance or by the focus of news media [which is referred to "focused event" by Birkland (1996)]. This interest in typhoon preparation for the next typhoon fades rather quickly, however[60].

Most officials in FCDRH are trained as engineers in water resource related areas. However, there are almost no officials with a background of social science, especially management, or public administration. They rely much on engineering measures and experience, they are less able to coordinate, plan disaster response as a system. When I interviewed in Wenzhou, most of interviewees tend to talk much about engineering measure for typhoon response, for example building more dams, flood control projects, storm gates, breakwaters, and groins, detecting the potential debris flow site, assigning patrolmen for warning in big storm etc.[61], Vehicle Synchronous Orbiting Satellite Mobile Communication System will be sent to

[57] Similar situation with that in US based on interview with #7, #8 (Falkenrath 2000)

[58] Interview #3 and #4.

[59] Interview #2, #3, #11, #12 and #13

[60] Interview #3, and #5.

[61] Interview #2, #3, #4 and #5.

potential islands whose communication system may be destroyed by typhoon. When I referred to non engineering measures, most of them would indicate typhoon emergency plans. At the town level, response officials are volunteers and unprofessional without any disaster response training.

Conclusions

China is making rapid progress in local typhoon evacuation response. In two decades, China has changed its guiding ideology towards disaster response, formulated typhoon emergency plans and built basic dual shelters, introduced legislatic to support evacuation, set up multiple warning channels, and made specific policies for migrating peasant workers. However, some problems still exist. A conservative decision chain was identified. Moreover, evacuation to some extent has become politicized. Long term prevention, especially soft measures, does not receive enough attention.

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Table 1 Comparison of hurricane category between China and US

	speed	
	low	high
PRC		
Tropical Depression	10.8	17.1
Tropical Cyclone	17.2	24.4
Severe Tropical Cyclone	24.5	32.6
Typhoon	32.7	41.4
Severe Typhoon	41.5	50.9
Super Typhoon	>=51	
US		
I	32.8	42.5
II	42.8	49.2
III	49.4	58.1
IV	58.3	69.2

V	>=69.2	