International Journal of Multidisciplinary Research And Studies

Available online at www.ijmras.com

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND STUDIES
ISSN: 2640 7272
Volume:07; Issue:02 (2024)
Doi: 10.33826/ijmras/v07i02.23

Page no. 07/07

A case study of china's leading river in the face of water shortages, climate change, and urban reactions

ZHOU MINGWU[1], DR. AIMAN AL-ODAINI [2a], DR MOHAMMED SALEH NUSARI [3b]

[1]PhD Research Scholar in Engineering Lincoln University College, Malaysia.
[2, 3] Professor in Lincoln University College, Malaysia.
Contact Details:[a] aiman@lincoln.edu.my, [b] nusari@lincoln.edu.my

Abstract

Flood "Although loss assessment and flood adaptation are becoming more important areas of study, their relationship in flood management remains largely unexplored. The effectiveness of such preventative interventions is uncertain due to the lack of information on the effects of such an interaction (Kreibich et al., 2005). Losses that are hard to put a figure on include things like human life, disruption, emotional distress, and environmental degradation. These losses aren't often factored into predictions of how much a disaster will cost, but they're important enough to warrant investigation. It is also important to remember that it is impossible to get an accurate picture of the entire extent of the effects of a natural catastrophe if one only considers the expenses of immediate losses (Bouwer, 2013). As a result, it is crucial to conduct flood loss assessment studies using dynamic response simulations in order to provide a comprehensive understanding of flood damage processes and pinpoint the weak points in flood adaptation in order to better mitigate flood damage "management.

Methods now in use "have undoubtedly helped advance our understanding of flood damage and how to best respond to it. When socioeconomic and physical hydrological changes are taking place on a global scale, calculating flood losses and modifying response tactics may be a complex process. Loss assessment and adaptive management are both worthwhile pursuits, but a dynamic decision-making process requires more systematic tweaks (adaptive management). The people and places in this area need to be viewed as part of a system, with the help of organisations that facilitate cross-scale and cross-sectoral planning, so that they may better adapt to their changing environments (Eakin et al., 2010). A thorough flood risk assessment, which may include a representation of the individual characteristics of all potentially flooded goods, is required before any flooding is done. In this case, it is important to draw on both global consensus and local knowledge. Stakeholder preferences for risk assessment indicators and assessment deliverables are crucial in this "setting, but they are often disregarded.

Keyword: Adaptive Management, Decision Making process, environmental degradation

INTRODUCTION

Climate change is a major threat to the ecology, economy, and security of the globe today. Climate change is (Martens et al., 2009; Scheffran and Battaglini, 2011). When it comes to cities, climate change is unavoidable since they reflect the growth of human society in their entirety. The urban living environment is gradually degrading due to climate-related severe occurrences as drought, heat wave, flood, typhoon, and sea water intrusion in many places (WWF, 2009). The flip side is that wealth accumulates fast in cities and is vulnerable to climate-related calamities because of the direct exposure (Sanchez-Rodriguez, 2009). In light of the fact that disaster risk is either constant or even growing due to climate change, cities are increasingly vulnerable to the repercussions of a disaster. Furthermore, urbanization and population expansion are occurring rapidly in many parts of the world, particularly in emerging nations, which adds to the stress on cities and increases the risk of social unrest (Birkmann et al., 2010). To put it another way, metropolitan areas are among the most susceptible places to climate change.

There is evidence to suggest that developing nations, particularly those in Asia, Latin America, and Africa, are more sensitive to climate change (Mirzaa, 2003; IPCC, 2012). Adaptation to climate change depends on prior experience coping with comparable hazards because prevention and resilience are lacking. As a result, farmers, fishers, coastal people, and inhabitants of big cities will be able to do a lot of their adaptation work on their own, thanks to their own networks and resources (Adger et al., 2003). Individual experiences, on the other hand, are extremely constrained and disorganized. When you include the dangers of climate change in underdeveloped nations, the situation becomes much graver.

LITERATURE REVIEW

Water issues become increasingly significant as a result of climate change, particularly in cities where the population is growing (Muller, 2007). The melting of ice on land and thermal expansion of the ocean due to warming are two of these consequences, and as a result, many coastal communities will be submerged, coasts will erode, freshwater and soil will be salted, and so on. In light of the latest studies, climate change is expected to increase the frequency and scale of some extreme weather events and disasters like flooding and long-term drought, both of which place a significant strain on urban drainage and water supply systems (Schreider et al., 2000; Milly et al., 2002; Mirzaa, 2003). Given their rapidly expanding populations and wealth, coastal cities in the United States face the direst consequences from climatic extremes because of their high sensitivity to these events (IPCC, 2012).

For the most part, cities' water supplies are in jeopardy as a result of climate change, as well as developments in technology, infrastructure, and urban life that are unprecedented, particularly

ZHOU MINGWU: PhD Research Scholar in Engineering, Lincoln University College, Malaysia

in developing nations (Schellnhuber et al., 2006). Due to the complexity and political difficulty of developing comprehensive policies, those in charge of determining the future of cities must rely on the finest available expertise (Hunt et al., 2007). There is therefore an urgent requirement to comprehend the dangers posed by water and how cities will adapt to climate change.

STATEMENT OF THE PROBLEM

Greatest of China's population lives in the Pearl River Delta's cities, and the economy has grown the most there as well. These two factors have grown significantly faster in this area since the mid-1980s: industrialisation and urbanisation. Amplification of climatic conditions and other social and environmental impacts are caused by this process (Duan 2009). At the moment, climate security awareness in China is still developing domestically. Even today, environmental conservation and economic growth are viewed as mutually exclusive. While the general people is still concerned about the financial implications of urban environment improvement, they are also unaware of the potential long-term hazards (Chan et al., 2010). No comprehensive "climate response" plan that integrates urban society, the environment, and water risk has been developed to date. More and more experts and organisations want to do research on how cities might better adapt and mitigate the effects of climate change. These specific topics' research will not only add to the body of human knowledge, but it will also help advance sustainable urban development. That's why investigating the climate-water-city system's effect connections and coming up with appropriate reaction plans is a smart idea.

Objective of the Study

The Pearl River Delta (PRD) is a rapidly urbanising region on China's southeast coast, and this thesis "investigates the influence of climate change on water resources in the PRD" (including water shortages and floods).

- To recognize climate change impacts on local stakeholders and the related costs of water risk adaptation at both city and regional scales.

As a "as a consequence, it investigates how flood adaptation costs may be reduced in the PRD and how climate change adaptation can be included into Hong Kong's water supply planning. With this synopsis, I'd like to show how and why this study is crucial "in order to achieve the central goals of the thesis.

Research Questions

- In what ways are communities dealing with flooding and what does that mean for greater adaptation?

RESEARCH METHODOLOGY

The thesis uses a variety of approaches to investigate a wide range of issues, including an academic literature review, climate models, field research, empirical analysis, an indicator system, and agent-based simulations. These approaches are sometimes combined due to the variety of subtopics covered in the various chapters.

RESEARCH DESIGN

A review of academic literature will be provided throughout the thesis, with a focus on climate change aspects in the research area in the second chapter. Forecasts for the PRD area's future climate change trends are based on quantitative examination of the available models in various scenarios, such the Max Planck Institute for Meteorology's Earth Systems Model and the semi-empirical method to sea level prediction (Rahmstorf, 2007). To depict a long-term climate change trend that includes the past as well as the future, the National Centers for Environmental Prediction/National Center for Atmospheric Research Reanalysis (NCEP/NCAR) reanalysis dataset and modelling results are used combined.

DATA ANALYSIS

Numbers from "The MK-test, or the Man-Kendall test, is used to find patterns in all the climatic parameters, both present and past, that have been examined (Mandel, 1945; Kendall, 1975). Man-Kendall trend test is a non-parametric test that has been widely used to examine temporal trends in climate data (Chen et al., 2011a; Zhang et al., 2012; Fiener et al., 2013; Westra et al., 2013; Bawden et al., 2014). The MK-test technique has matured to the point where it can be implemented on a wide range of hardware. Microsoft XLSTAT 2013 will be used to run the MK-test, and the research will use a significance level of 5% for all tests. Finally, the data are integrated with that from other research to provide a complete picture of climate change in the "explore the area.

When working with "Agent-based modelling (ABM) is a useful tool for analysing the complex system of flood impacts and stakeholder responses. The field of flood studies (including vehicle relief systems) has made use of this method (Georgé et al., 2009; Dawson et al., 2011). (Scerri et al., 2012). In computer science, agents are independent programmes that can exchange information with one another; they may be designed and implemented to mimic the rule-based behaviours and interaction styles of real-world social entities (Monticino et al. 2007; Billari et al. 2006). To better understand how people's actions and reactions interact during a flood, agent-based modelling is a useful tool. This study seeks, using a bottom-up approach using ABM and complexity theory, to get a deeper comprehension of urban floods. Google Street View and other publicly-accessible aerial imagery are used to verify local circumstances "Internet.

CONCLUSION

The whole picture "raises a number of critical concerns Increasing mean temperatures, fluctuating precipitation, rising sea levels, and a rise in the intensity and frequency of typhoons are only few of the elements that are contributing to climate change in the PRD.

Climate change, in addition to population growth, economic development, and the difficulties of responding to and controlling it, poses a threat to the PRD region's already precarious water supply. The effects of climate change in Hong Kong are examined, including the city's history of severe droughts, floods, sea level rise, water pollution, and societal management and policy failures. It suggests that the PRD towns put money towards strengthening water self-sufficiency, diversifying water sources, and boosting individual tolerance to predicted climate change consequences "for the sake of long-term survival.

LIMITATIONS OF THE STUDY

This research, however, raises some questions. Uncertainty in analytical procedures implies inadequate system information or limited hardware capability (e.g. computing capacity). The flood generation process is also fraught with uncertainty due to the interplay between human activity at every stage and unique geographical features across cities. In the framework of a river basin, city-level study will be conducted. If statistics are available at the district level, the findings may differ slightly from those obtained at the city level. Notably, the indicator system is extremely dependent on the indications selected as well as the data used. Uncertainty increases from the input data owing to the varied statistical criteria of the eleven cities, especially when they are compared in one indicator system. There is still some credence to these findings as the study focused on mean climatic conditions and dealt with relative hazards between cities rather than absolute dangers.

REFERENCES

1. Apel, H., Thieken, A.H., Merz, B., Bl¨oschl, G., 2004. Flood risk assessment and associated uncertainty. Nat Hazard Earth Sys 4, 295-308.
2. Balica, S., Wright, N.G., 2010. Reducing the complexity of the flood vulnerability index. Environ Hazards 9, 321-339.
3. Brun, J.C.A., 2007. Adapting to impacts of climate change on water supply in Mexico City In: Office, H.D.R. (Ed.), Human Development Report 2007/2008: Fighting climate change: Human solidarity in a divided world, p. 26.
4. Burke, S., 2011. Response and recovery after the floods. InPsych: The Bulletin of the Australian Psychological Society Ltd 2, 22-29.
5. Camarasa-Belmonte, A.M., Soriano-Garcia, J., 2012. Flood risk assessment and mapping in peri-urban Mediterranean environments using hydrogeomorphology. Application to ephemeral streams in the Valencia region (eastern Spain). Landscape and Urban Planning 104, 189-200.
6. Fan, J., 1994. Impacts of sea level rise to the water environment in Pearl River Delta (In Chinese). In: Sciences, G.-s.o.t.C.A.o. (Ed.), Impacts of and countermeasures to sea level rise in river deltas of China. Science Press, Beijing, pp. 194-201.

7. Felsenstein, D., Lichter, M., 2013. Social and economic vulnerability of coastal communities to sea-level rise and extreme flooding. Nat Hazards, 1-29.
8. Füssel, H.-M., Klein, R., 2006. Climate Change Vulnerability Assessments: An Evolution of Conceptual Thinking. Clim Change 75, 301-329.
9. Gu, J., Yang, J., 2005. Features of climatic and environmental changes in the South China (In Chinese). Resources Science 27, 128-135.
10. Hallegatte, S., Green, C., Nicholls, R.J., Corfee-Morlot, J., 2013. Future flood losses in major coastal cities. Nature Clim. Change 3, 802-806.
11. Lamb, R., Keef, C., Tawn, J., Laeger, S., Meadowcroft, I., Surendran, S., Dunning, P., Batstone, C., 2010. A new method to assess the risk of local and widespread flooding on rivers and coasts. J Flood Risk Manag 3, 323-336.
12. Lawrence, J., Reisinger, A., Mullan, B., Jackson, B., 2013. Exploring climate change uncertainties to support adaptive management of changing flood-risk. Environmental Science & Policy 33, 133-142.
13. Lee, B.Y., Wong, W.T., Woo, W.C., 2010. Sea-level Rise and Storm Surge - Impacts of Climate Change on Hong Kong. HKIE Civil Division Conference 2010, Hong Kong.
14. Meinshausen, M., Smith, S.J., Calvin, K., Daniel, J.S., Kainuma, M.L.T., Lamarque, J.F., Matsumoto, K., Montzka, S.A., Raper, S.C.B., Riahi, K., Thomson, A., Velders, G.J.M., Vuuren, D.P.P., 2011. The RCP greenhouse gas concentrations and their extensions from 1765 to 2300. Clim Change 109, 213-241.
15. Merz, B., Hall, J., Disse, M., Schumann, A., 2010a. Fluvial flood risk management in a changing world. Nat Hazard Earth Sys 10, 509-527.
16. Merz, B., Kreibich, H., Schwarze, R., Thieken, A., 2010b. Review article "Assessment of economic flood damage". Nat. Hazards Earth Syst. Sci. 10, 1697-1724.
17. Peng, T., Chen, X., Liu, X., Wang, L., 2008. Flood Response to Changes of Flood Disaster Formative Environment in the Pearl River Delta (In Chinese). J China Hydrol 28, 343-351.
18. Ponce, V.M., 1989. Engineering Hydrology: Principles and Practices. Prentice Hall.
19. Priest, S.J., Parker, D.J., Tapsell, S.M., 2011. Modelling the potential damage-reducing benefits of flood warnings using European cases. Environ Hazards 10, 101-120.
20. PRWRC, 2011. Pearl River Water Resources Bulletin 2011. Pearl River Water Resources Commission. Pugh, D., 2004. Changing Sea Levels: Effects of Tides, Weather and Climate. Cambridge University Press.
21. Qu, X., Yan, M., Li, H., 2009. Community development of disaster prevention and Anti-vulnerability (In Chinese). Tianfu New Views 1, 94-97.
22. Shi, X., Chen, T., Yu, K., 2008. Sea level rise of the Preal River Estuary in the last 40 years (In Chinese). Marine Geology & Quaternary Geoiogy 28, 127-134.
23. SOA China, S.O.A.o.C., 2011. China Sea Level Communique 2011 (In Chinese). In: China, S.O.A.o. (Ed.), Beijing.
24. Stern, N., 2007. The Economics of Climate Change: The Stern Review. Cambridge University Press, Cambridge, UK.

25. Tai, Y., 2011. Water system and urban form of guangzhou in times of climate change. In: Abbate, A., Polakit, K., Kennedy, R. (Eds.), Subtropical Cities 2011: Beyond Climate Change, Florida, USA, pp. 109-123.
26. Xu., Y., Xu., J., Ding., J., Chen., Y., Yin., Y., Zhang., X., 2010. Impacts of urbanization on hydrology in the Yangtze River Delta, China. Water science and technology : a journal of the International Association on Water Pollution Research 62, 1221-1229.
27. Yang, L., Scheffran, J., Qin, H., You, Q., 2014. Climate-related Flood Risks and Urban Responses in the Pearl River Delta, China. Reg Environ Change.
28. Yang, T., Xu, C., Shao, Q., Chen, X., 2010. Regional flood frequency and spatial patterns analysis in the Pearl River Delta region using L-moments approach. StochEnv Res Risk A 24, 165-182.
29. Yang, Y., Ying, M., Chen, B., 2009. The climatic changes of landfall tropical cyclones in China over the past 58 years (In Chinese). ActaMeteorolSinica 67, 689-696.
30. Zhang, Q., Xu, C.-Y., Becker, S., Zhang, Z.X., Chen, Y.D., Coulibaly, M., 2009a. Trends and abrupt changes of precipitation maxima in the Pearl River basin, China. AtmosSciLett, 13.
31. Zhang, Q., Xu, C.-Y., Chen, Y.D., Jiang, J., 2009b. Abrupt behaviors of the streamflow of the Pearl River basin and implications for hydrological alterations across the Pearl River Delta, China. J Hydrol 377, 274-283.
32. Zhang, Q., Xu, C.-Y., Zhang, Z., 2009c. Observed changes of drought/wetness episodes in the Pearl River basin, China, using the standardized precipitation index and aridity index. Theoretical and Applied Climatology 98, 89-99.
33. Zhang, Q., Xu, C.-Y., Zhang, Z., Chen, Y.D., Liu, C.-L., 2009d. Spatial and temporal variability of precipitation over China, 1951-2005. Theoretical and Applied Climatology 95, 53-68