



MACQUARIE
University

A Comparison of China and Australia Flood Response Practices

Student Name: Haibin (Ray) Wu

Student ID:

Department: Computing

Faculty: Science and

Engineering **Supervisor:** Dr

Stephen Smith

Date Submitted: 24 May 2019

I certify that this work has been reviewed by my supervisor prior to its submission.

Declaration

I hereby submit my thesis for examination and declare that:

1. The thesis is my own composition, all sources have been acknowledged and my contribution is clearly identified in the thesis. Permission has been granted from all co-authors for any work in the thesis that has been co-published, and is specified in the thesis acknowledgments and/or relevant footnotes/endnotes; and
2. This work has not been submitted for a higher degree to any other university or institution.

Haibin Wu

Student ID

Abstract

China and Australia have a high incidence of flood disasters and the damage, loss of life that they cause. Both countries have successful flood management approaches underpinned by disaster management methodologies and resources. This research highlights different flood management practices in China and Australia to compare and contrast these approaches to develop cross-cultural “lessons learned”.

This research compares how both the countries plan for and respond to flood disasters, highlighting their operational differences. Our comparison focuses on their political systems as a background to their flood responses.

Analysis shows that China is more reliant on government and the military for flood management during disasters, with the central government leading the management effort. China’s approach is top down with minimal regional and local government interference. In Australia, state governments are responsible for flood control and local council coordination, and rarely use military resources. China has an operational advantage in large scale of floods, but Australia has an operational advantage when they are small scale.

This thesis concludes with a comparison of Chinese and Australian flood management practices. It is hoped that lessons can be learned by both countries from developing a better understanding of the flood management practices of both countries.

Keywords: Flood Management, Flood Response, Australia, China, Political System

Acknowledgements

First and foremost, I would like to express my sincere gratitude to my supervisor Professor Deborah Bunker who is the first person to guide me in stepping into the academic research. It has been an honour for me to be her student. Her continuous support, patience, motivation, and immense knowledge helped me in my research and writing of this thesis.

I would also like to thank Dr Stephen Smith for his insightful comments and encouragement, which inspired me to widen my research from different perspectives. I could not be more thankful for the resources he organized for me which offered me enough assistances in my research.

Besides Professor Deborah Bunker and Dr Stephen Smith, my sincere thanks goes to Adjunct Associate Professor Tony Sleight, who provided me precious suggestions and supported me in my research database.

In addition, I am grateful to Yaniv Rahav who is the ICT Manager in Legacy Club Service in providing me flexible working hours to work full time and conduct my research meanwhile. Also I thank my friend and colleague Mr Bruno Gortan, Mr Jason Levy and Ms Shuyang Ning in helping me with proofreading my manuscripts.

Last but not the least, I would like to thank my lovely family for their spiritual support throughout my research and my life in general.

Contents

1. Chapter 1 - Introduction	1
1.1 Introduction	1
1.2 Background	1
1.3 Research Problem and Objectives	1
1.4 Research Methodology	2
1.5 The Scope of The Research.....	2
2. Chapter 2 - Literature Review.....	2
2.1 Introduction	2
2.2 Flood Management	5
2.3 Flood Management Frameworks	7
2.4 Political Systems.....	8
2.4.1 Levels of Government Relationships.....	8
2.4.2 Military Use in Flood/Disaster Management	9
2.4.3 Volunteers in Disaster/Flood Management.....	10
2.5 Flood Response.....	11
2.5.1 General Response	12
2.5.2 Flood Dispersal/Storage Areas	15
2.6 Research Gap.....	16
2.7 Research Questions.....	16
2.8 Summary	16
3. Chapter 3 - Methodology.....	17
3.1 Introduction	17
3.2 Currently Research Methodology	17
3.3 Proposed Methodology	18
3.4 Summary	19
4. Chapter 4 – Analysis	19
4.1 Introduction	19

4.2	Political Systems.....	19
4.2.1	Leadership	20
4.2.2	Government Framework	20
4.2.3	Military Involvement in Flood Control.....	23
4.2.4	Volunteers in Flood Management	24
4.3	Flood Response.....	25
4.3.1	Warnings During Floods	25
4.3.2	Reporting.....	26
4.3.3	Flood Response Plans	26
4.3.4	Levels of Activation for Response Arrangements.....	27
4.3.5	Flood Dispersal/Storage Areas in Flood Response	27
4.3.6	Forced Relocation During Flood	28
4.3.7	Human Resource Deployment.....	29
4.4	Summary	29
5.	Chapter 5 - Discussion.....	30
5.1	Introduction	30
5.2	Culture in Flood Management.....	30
5.3	Political System Effect on Flood Management.....	32
5.4	Military and Volunteers in Flood Response.....	33
5.5	Flood Response Plans, Reporting and Warning	34
5.6	Flood Dispersal / Storage Areas	35
5.7	Forced Rescue	35
5.8	Resource Mobilization in Flood Management	36
5.9	Advantages and Disadvantages by Flood Scale	36
5.10	Summary	38
6.	Chapter 6 - Conclusion and Future Direction.....	39
6.1	Finding Research Questions	39
6.2	Conclusions	40

6.3	Future Direction.....	42
7.	Annexure.....	44
8.	References.....	52

List of Tables

<i>Table 1: Top (8) Information System Journals</i>	<i>3</i>
<i>Table 2: The Number of Relevant Articles.....</i>	<i>4</i>
<i>Table 3: Flood Management Approaches.....</i>	<i>6</i>
<i>Table 4: Frameworks of Flood Relief Plans</i>	<i>8</i>
<i>Table 5: Military Involvement in Flood Management.....</i>	<i>10</i>
<i>Table 6: Volunteers in Disasters.....</i>	<i>11</i>
<i>Table 7: Flood Response</i>	<i>13</i>
<i>Table 8: Flood Dispersal/Storage Areas.....</i>	<i>16</i>
<i>Table 9: Small Scale Floods versus Large Scale Floods.....</i>	<i>37</i>

List of Figures

<i>Figure 1 – Chinese Government Flood Management Framework</i>	<i>21</i>
<i>Figure 2 - Flood dispersal</i>	<i>28</i>

1. Chapter 1 - Introduction

1.1 Introduction

This chapter provides a brief research background about the cost of floods and flood management in Australia and China. The research problem and the reason why this research is important is explained in this chapter. This chapter also discusses an overview of research methodology and scope.

1.2 Background

Australia and China have multiple floods every year causing huge (financial and personal) losses. In 2016, China suffered flood (excluding typhoon) losses of 313.44 billion RMB or around AUD 62.68 billion (Ministry of Civil Affairs of the People's Republic of China, 2016) across several provinces. These losses exclude intangible costs such mental health impacts and resulting chronic diseases. In the same year, China's GDP was around 74.36 trillion RMB or around AUD 14.872 trillion. The cost of flood took around 0.42% of Chinese GDP. The situation is much the same in Australia. For instance, large floods impacted New South Wales, Victoria and Queensland respectively in 2011, which lead to more than AUD 2.7 billion in losses (Insurance Council of Australia, 2012) and more than 2.6 million people affected. In 2011, the flood cost is of more than 0.19% of GDP of AUD 1.4 trillion.

Australia and China have been successful at implementing flood management. Both countries have their own approaches and strategies in flood management especially in flood response, due to their different political systems, military systems, cultures, population distributions and resource mobilization.

1.3 Research Problem and Objectives

There are not many researches directly relevant to flood management and published study results are hard to find in top journals. The literature of flood management/response is very sparse. Very little literature focuses on political systems and flood response.

China, Australia, UK, and USA are typical countries with many floods, and also have more available resources compared with other countries. Therefore, this literature review is based on these four countries.

The systematic introduction to Australian or Chinese flood management/response has highlighted that it is hard to find any references in current literature. Furthermore, there is even fewer research topics about the comparison of flood management between these two countries.

Both (China and Australia) countries on average suffer many floods yearly and have very successful flood management understanding. The aim of this study is to compare both countries in order to reduce overall flood losses, and learn from each other to improve flood management efficiency.

This thesis therefore demonstrates the differences between China and Australia in flood management approaches and their impacts on flood response and seeks to find the potential reasons for these differences and the strengths of Australian and Chinese flood response.

1.4 Research Methodology

Secondary data is used to compare and analyse both countries' flood management practices. The discussion and findings are based on this analysis.

1.5 The Scope of the Research

Aspects of government leaderships, government frameworks, military and volunteer involvement are used to analyse and compare flood management approaches between Australia and China. In addition, the differences of flood response in these two countries have been highlighted in warning, reporting, flood response arrangements, flood disperse, resident's relocation and human resource deployment.

This research also seeks to investigate the reasons that lead to the variety of different flood management practices in Australia and China. The strengths of flood response in both countries have been highlighted in the last section of chapter 4.

Australia and China have mostly opposite flood management approaches. China has a top down (centralized) model but Australia has a decentralized model. The two different flood management approaches directly result in different flood response behaviours. China has an operational advantage in large scale of floods, but Australia has an operational advantage when they are small scale.

2. Chapter 2 - Literature Review

2.1 Introduction

In this chapter we review the current literature around the analyses of current flood management practices in different countries, in order to identify strengths, problems and issues (research gap) which will then be addressed in the latter sections of this thesis. Flood management, of course, is not a popular research topic in top information system journals. A research of the top (basket of) 8 information system journals using "flood" as the keyword (which included search title, subject, keywords and abstract), only highlighted a few articles (Table 1).

Table 1: Top (8) Information System Journals

Journal	Keyword	Relevant Articles
European Journal of Information Systems	Flood	0
Information Systems Journal	Flood	2
Information Systems Research	Flood	0
Journal of the Association for Information Systems	Flood	1
Journal of Information Technology	Flood	0
Journal of Management Information Systems	Flood	0
Journal of Strategic Information Systems	Flood	0
Management Information Systems Quarterly	Flood	0

Eight different keywords and different criterion are applied in Google Scholar to find relevant literature (table 2). The 8 keywords are “Australia Flood Management”, “Australia Flood Response”, “China Flood Management”, “China Flood Response”, “Australia and China Flood Management”, “China and Australia Flood Management”, “Australia and China Flood Response”, and “China and Australia Flood Response”. The criteria are “anywhere in the article”, “include patents” and “include citations”, which means one of keywords of the article title, keywords, subjects, abstract, context, parents and citations in the article will be highlighted. Therefore, most of articles come out by searching keywords. However, using search criteria in the articles’ title including the eight selected keywords was more productive. In the Google Scholar database, there are very few articles containing keywords in the title, and there are a total of eight published articles which are relevant to flood management in both countries at the government or whole country level.

In reviewing the literature, it is clear there is very little researcher in the area of flood management and flood response across China and Australia. Furthermore, there are very few articles linking flood management to government, and there are no articles relating to flood response in government level or a comparison between both countries.

Table 2: The Number of Relevant Articles

Keywords	Anywhere in the Articles	Title included keywords	Relevant Articles
Australia Flood Management	496,000	9	1
Australia Flood Response	533,000	4	0
China Flood Management	719,000	21	7
China Flood Response	611,000	5	0
Australia and China Flood Management	215,000	0	0
China and Australia Flood Management	196,000	0	0
Australia and China Flood Response	181,000	0	0
China and Australia Flood Response	171,000	0	0

Searching the literature in the domain of flood management and flood response, however, highlighted data which is relevant to the UK, the USA, Australia and China where these countries have suffered many floods in last 50 years. As I live in Australia and am from Chinese background, these four countries are highlighted and compared for this literature review in order to highlight the complexities of flood management and response across disparate cultures. Comparing with other countries, it is more accessible to get data from these four countries because more research has been conducted on these four countries.

There is very little published academic research on flood management and flood response in the top (8) information systems journals as well as normal academic journals, books and academic papers (search results from Google Scholar). In addition, currently there is no research to compare Australian and Chinese approaches on flood management and flood response although both countries frequently suffer from flood disasters. Consequently, this represents a gap in the literature and the driver for undertaking research into flood management and flood response in China and Australia.

This chapter introduces flood management theories and compare current flood management practices across all four countries (China, Australia, UK and USA). Current flood management frameworks, political systems and flood general response are also discussed.

2.2 Flood Management

This section describes the definition of flood management, identifies the stakeholders and the differences between developing countries and developed countries. China, Australia, the UK, the USA and other countries such as Germany and Netherlands have very successful structural and non-structural approaches in flood management. This section will primarily discuss the approaches in China, Australia, the UK and the USA.

Researchers such as Birkholz et al. (2014) and Bubeck, et al. (2017), consider flood management as a flood risk management problem. Other researchers like Meijerink & Dicke (2008) believe flood management can be considered through structural and non-structural management approaches. The structural approaches included dams and other civil engineering projects, and non-structural approaches are more akin “to working with nature” or “living with nature” (Meijerink & Dicke, 2008). Furthermore, flood mitigation generally focuses on mitigation structures only and overlooks environment and socio-economic factors (Shah et al, 2017). In recent times modern flood management approaches have changed from structural to non-structural, flood probability strategies to flood risk strategies, and development of prevention to evacuation and aftercare strategies (Meijerink & Dicke, 2008). While Chou et al (2014) believed natural disaster management including floods could be identified in five stages: general preparation (prepare and plan for the coming disaster including to educate or train stakeholders), preparation for a coming/predicted disaster (prepare for disaster response), disaster in progress (disaster response during disasters), recovery and learning (learn from current disasters to improve general preparation).

In terms of flood management stakeholders, Tingsanchali (2012) pointed out that flood management approaches have various stakeholders including urban planners, civil and water resources engineers, civil disaster defence authorities and health and social services. In developing countries, flood management relies on governments and very limited non-government agencies and private sectors involvement, while for economically developed countries, governments, non-governmental and private agencies, and the public are all involved in flood management. (Tingsanchali, 2012).

Different countries also have differing flood management practices (see Table 3). Netherlands flood management relies on technical engineering and innovation because the Dutch rivers systems safety standard is designed to withstand a once in 1250 years' flood (Aerts et al. 2008). In Germany, the federal states are responsible for flood risk management (Bubeck, et al., 2017). In addition, Germany has high safety standards and flood protection from 1 in (/)30 years to 1/1000 years, and insurance and policy development such as spatial planning polices and increasing responsibility of flood area damage prevention for flood management (Bubeck, et al., 2017). For the UK, the Department for

Environment, Food and Rural Affairs are responsible for making policies, and the Department for Communities and local governments are in charge of spatial planning (Bubeck, et al., 2017).

Table 3: Flood Management Approaches

Country	Structural approaches	Non-structural approaches
China	There are 1/10 years → 1/1000 years flood safety standards, but most of flood infrastructures are 1/10 → 1/100 years, and 88 % size reservoirs are 1/1000 years (Chen G., 1998)	National Flood and Drought Relief Plan including preparation and warning, response, response support, recovery and response activation conditions (The State Council of The People's Republic of China, 2006).
Australia	Flood infrastructure standards (levees) up to 1/100 year (Wenger, 2015), and the most of NSW urban levees are less than 1/100 year (Smith et al, 2014). But building in flood hazard areas are 1/100 year, 1/50 year and 1/25 year respectively in Australia (Australian Building Codes Board, 2012) Flood defences, dams, dyke, public and private rain gardens are flood management structural approaches (Meijerink & Dicke, 2008).	There are limited forms of flood insurance in Australia (Meijerink & Dicke, 2008). Emergency management framework.
UK	The UK has not flood protection standards, and its flood infrastructures included flood defences, watercourses, sluice gates, pumps, underway etc (Government of the United Kingdom, 2016).	National Flood Risk Management and Coastal Erosion Strategy (Government of the United Kingdom, 2016). Emergency management frameworks. Insurance is very commonly used in flood management (Meijerink & Dicke, 2008)
USA	National Flood Insurance Program which requires a 1/100 year flood protection standard such as Dykes and dams (Bubeck, et al., 2017)	Multiple emergency frameworks. Insurance is very commonly used in flood management (Meijerink & Dicke, 2008)

Moreover, in England and Wales, the Environment Agency is mainly responsible for implementation of flood risk management, however, in other areas, local authorities are in charge of emergency planning, spatial planning, and emergency response (Bubeck, et al., 2017). In America, the flood safety standard is 1/100 years (Aerts et al. 2008). Local governments and states governments are main responsible for flood management and the Federal Emergency Management Agency (FEMA) and other USA federal agencies are less directly involved in flood management in USA (Galloway, 2004).

2.3 Flood Management Frameworks

Many countries have published emergency frameworks, but they do not reference flood management frameworks. Following is a brief list and description of the published frameworks and flood relief plans for China, Australia, the UK and the USA.

The Australian emergency management framework highlights approaches to planning, preparation, response and recovery for emergencies, which is known as PPRR, and is used to benchmark emergency management including flood management (Rogers, 2011). Salter (1997) argued that PPRR improves disaster management efficiency because it highlights a linear and temporal relationship between each phase of a disaster. The UK's framework i.e. Integrated Emergency Management (IEM) includes anticipation, assessment, prevention, preparation, response and recovery (AA-PP-RR), and it widens the resilient and integrated approach to the disaster cycle (Rogers, 2011). AA-PP-RR creates a typology of risks at national, regional, and local levels and improves vulnerability identification, the targeting of risk assessment resources and resilience implementation (Rogers, 2011). The USA does not have a general flood management framework, but does have the following National Planning Framework, National Prevention Framework, National Response Framework, National Mitigation Framework, and National Disaster Recovery Framework (Federal Emergency Management Agency, 2018). China does not have any specific flood management or disaster management frameworks, but it has a National Flood and Drought Relief Plan (NFDRP). NFDRP is a full flood management plan and process standard for different levels of government to organize and cooperate as well as apply different resources to flood response (Chen T. , 2006). NFDRP details identify the flood management of each stage such as preparation and warning, response, response support and recovery, and identifies 4 different levels of active response (Chen T. , 2006).

Overall, China, Australia, UK and USA, have no flood management frameworks, but UK, USA and Australia use a general (overall) emergency framework instead of a specific flood management framework, and China has implemented a flood relief plan (see table 4).

Table 4: Frameworks of Flood Relief Plans

Country	Framework
China	National Flood and Drought Relief Plan (NFDRP) including preparation and warning, response, response support, recovery and response activation conditions
Australia	Preventing, Preparation, Response and Recovery (PPRR)
UK	Anticipation, Assessment, Prevention, Preparation, Response and Recovery (AA-PP-RR)
USA	National Planning Framework, National Prevention Framework, National Response Framework, National Mitigation Framework, and National Disaster Recovery Framework

Source: modified from Rogers(2011), Federal Emergency Management Agency (2018),Chen (2006)

2.4 Political Systems

The political systems directly impact on flood response approaches. In this section, the relationship especially leadership between the main countries such as China, Australia, the UK and the USA, will be introduced. In addition, this section will also introduce the roles and the benefits of the military and volunteers in flood/disaster management. There are different attitudes towards military and volunteers involving flood/disaster managements in these countries.

2.4.1 Levels of Government Relationships

In countries where government political power is centralised, the highest level of government such as the national government directly leads and manages lower level governments in flood management, for instance, their regional and local governments (Zhang H. , 2002). China is a unitary state country and has a distinctive political system which means that the Chinese Communist Party directly leads and manages different levels of governments and departments including central and local levels (Zhang H. , 2002). In other words, the same level Chinese Communist Party committee leads same level of government (Zhang H. , 2002), for example, the Shanghai Chinese Communist Party committee can lead the Shanghai government. In addition, Chinese local government power (from the province level to the county level) comes from the central government and the central government has power to remove or adjust a local government's authorization (Xue, 2007). In countries which have more political autonomy at a local level such as Australia, America and the UK, the central government and state/local governments are more independent (Yang & Xing, 1999). For example, in America, the central government and local governments cooperate and have an independent relationship under the law (Yang & Xing, 1999). In Australia, the national government and state governments are constitutionally independent of each other, and the Australian High Court's

interpretation of the constitution prevents the national government directly intervening in state government matters except where a state government requests assistance or where Federal law prescribes jurisdiction (Stilwell & Troy, 2000), such as some forms of taxation, financial support and allowances (Yang & Xing, 1999).

2.4.2 Military Use in Flood/Disaster Management

Normally, the military is not involved in natural disaster management except when a very large scale disaster occurs because its direct involvement in natural disaster response management may lead to misinterpretation by the general population (Anderson, 1970). However, the military can be a very important force in providing disaster support because they have a very strong logistical and well-established organizational structures, effective management, good skills and fast response (Heaslip, 2012). In addition, the military can move quickly into disaster areas and deliver large volumes of relief materials (Heaslip, 2012). Heaslip (2014) believed that the military's primary mission should be to establish a secure area as well as assisting disaster areas move back to normality, after the disaster period. The military response generally depends on bureaucratic rules and procedures during a disaster (Kapucu, 2011).

Each of the four countries detailed (in this thesis) have strict policies and requirements for involving the military in a disaster response (Table 5). For example, in the USA, the military play an assistance role to support different levels of governments, and local governments can request military assistance at a state government level via a request the National Guard (Kapucu, 2011). In the perspective of military service and non-government organizations, the UK military involvement in relief or natural disasters is a sensitive issue (Pettit & Beresford, 2005). Only when non-government organizations are not able to provide enough humanitarian aid because of the scale of the disaster then the that UK military can be involved and support relief agencies (Pettit & Beresford, 2005). In Australia, humanitarian aid primary actors are non-military government agencies and communities, and the Australian Defence Force (ADF) involvement in disaster response will be fused within military missions in the future (Greet, 2008) but this generally off shore in third party countries. China have a different approach to other countries, as it has a special military system where the Chinese Communist Party can directly lead a military response to be quickly involved with natural disasters (Tang, 2009). According to Tang (2009), compared with American military, the Chinese military primary mission is disaster mitigation instead of establishing a secure environment during disasters. For military involvement in international natural disaster response, US, UK and Australia directly provide humanitarian assistance for their citizens when overseas or to other countries citizens as a joint effort guided and managed by their governments (Kapucu 2011, Pettit & Beresford 2005, Greet 2008).

Table 5: Military Involvement in Flood Management

Country	
China	Chinese Communist Party can directly lead a military response be quickly involved with a natural disaster.
Australia	Australian Defence Force (ADF) is not responsible for humanitarian operations excepting when the scale of the disaster requires their intervention.
UK	Only when non-government organizations are not able to provide enough humanitarian aid.
USA	Different levels of governments can request military assistance by their state government's which in turn sends a request via the National Guard.

Sources: Kapucu (2011), Pettit & Beresford (2005), Tang (2009), Greet (2008)

2.4.3 Volunteers in Disaster/Flood Management

Volunteers do perform an important role in disaster management as they can provide varied skills that aid disasters management situations (Alexander, 2002). Alexander (2002) believed that volunteers can be classified into the following three types:

1. A volunteer/s who works regularly for an official agency and as well as within the ranks of emergency agencies during the disaster period,
2. Volunteer/s who works for specific charities or non-government organizations, and
3. The last type of volunteer is an individual volunteer/s that is attached to a small temporary group.

Whittaker, McLennan, & Handmer (2015) believed that there are formal volunteers and informal volunteers. Formal volunteers have training and qualifications, and also long term while Whittaker et al. (2015) believed that there are formal volunteers and informal volunteers. Formal volunteers have training and qualifications, and also a long-term employment for an emergency service/agency; informal volunteers work outside of formal emergencies or disaster management arrangements to help other people. They normally work as an individual or a small team. In most developed countries, many professionals have varying skill sets and the individuals that are affiliated with official agencies, have regular training and have good rescue skills (Whittaker et al., 2015). According to Bachner et al. (2016), volunteers involved in disaster management have tangible and intangible effects. The tangible effects include financial benefits for example provision of service hours. The intangible effects include health effects like the contribution to public health and safety; specialised qualifications where volunteers are able to obtain the necessary skills from engagement in disaster management; and social effects such as improving society trust, cohesion and solidarity (Bachner et

al., 2016). In addition, in comparing volunteers with emergency agencies or formal organizations, volunteers do not need to be constrained by bureaucratic rules, strategies and technologies, and can directly provide fast response to meet local needs (Fernandez, Barbera, & Van Dorp, 2006).

Volunteers play different roles in different countries (Table 6). In Australia, the US, the UK, Austria and Germany, there are a large number of professional and temporary volunteers who are engaged in flood pre-warming and flood response (Brennan, Barnett, & Flint, 2005, Khalili et al., 2015, Harris et al., 2017, Bachner et al., 2016). China has very few professional and trained volunteers, however, and most of these volunteers have not been organized properly during the disaster period (Zhang W. , 2011). Moreover, informal volunteers have the potential to increase the possible risks in physical and mental injuries when that are involved in a disaster, and emergency agencies may possibly be sued by volunteers or their families due to accidents, so they can be viewed as a nuisance to some agencies (Whittaker et al., 2015).

Table 6: Volunteers in Disasters

Country	Volunteer Involvements in Disaster/Flood Management
China	There are around 100 million volunteers and they have not been considered as having an important role in disasters (Wang & Li, 2017). Most of these volunteers are untrained and only doing basic jobs in disasters (Zhang W. , 2011).
Australia	Trained volunteers who play a very important role in disasters, e.g. In the NSW State Emergency Service, only 1% of their complement are paid staff but around 99% are volunteers (Khalili, Harre, & Morley, 2015)
UK	Trained volunteers embedded in governmental and nongovernmental organizations who join a disaster response (Harris et al., 2017).
USA	Trained and untrained volunteers who are essential for effective disaster response because they are first responders and have the opportunity to save peoples' lives (Brennan, Barnett, & Flint, 2005).

2.5 Flood Response

This section describes a variety of opinions on flood response from different researchers. Australia, the UK, the USA and China have individual national conditions leading to their different flood response approaches. These four countries have flood dispersal solutions and disperse flood into different areas.

2.5.1 General Response

The flood responses in various countries are very different because they are dealing with different situations, frameworks, policies, geographical characteristics, and experiences with flood disasters and human behavioural (Bubeck, et al., 2017). Floods like crime, disease and other disasters, require different institutions to work together to respond to a disaster through modern science and engineering methodologies (Wetmore, 2007). In other words, Wetmore (2007) believed flood mitigation needs to make full use of a whole countries resources to develop a large socio-technical system. In addition, responding to natural disasters, governments or agencies have time pressures, high uncertainty of the situation and high stakes outcomes (Smith & Dowell, 2000). The temporary organizations developed on “on the fly” by disaster management agencies cooperated to respond disasters are very important (Smith & Dowell, 2000). While engineering solutions such as dams, drainage channels and embankments are very common methods for flood response in industrialized countries (Head, 2014).

For flood response, engineering solutions are a first response. When engineering solutions cannot address flood or sanitation, flood warnings give people time to evacuate which is also very important. In developing countries such as Thailand, when the traditional disaster response systems fail, the official information may become slow and inaccurate, and new communication channel like social media can a new information source (Tim, Pan, Ractcham, & Kaewkitipon, 2017).

Different countries have different flood/disaster responses and have different levels of activation for response arrangements for example those as described on the above sections of this paper in Australia, the USA, the UK and China. The summary comparison of these four countries in flood response is shown in Table 7.

Table 7: Flood Response

Country	Infrastructure for flood response	Warning during flood	Main responders in flood	Levels of activation for response arrangements
China	Water stations, substations, dams and reservoirs.	Text message, Internet, TV, Radio, air defence alarm, landline, text message, social media	National government, province governments, local governments, military	Level 1, Level 2, Level 3, Level 4
Australia	Constructed channels, weirs, levee banks and wetlands.	Automatic Voice Messaging (AVM), social media, website, emails, landline, text message	States/local governments, authorities, various State Emergency Services, volunteers etc.	Alert, Learn Forward, Stand Up, Stand Down (e.g. Queensland State)
UK	Flood defences, sluice, gates, pumps, underway, watercourses.	Radar warning system, Automatic Voice Messaging (AVM), Sirens, Door-to-door, phone call, media (TV, radio, message, internet)	Local authorities, the police, fire services, ambulance operations, the Environment Agency, voluntary services, volunteers	Fire and Rescue Service command Structure: Gold, Silver, Pseudo Silver, Bronze
US	Levees, canals, weirs, wetland and locks.	Automatic Voice Messaging (AVM), Internet, Social media	State governments, local governments, Federal Emergency Management Agency, non-governmental organizations (volunteers)	Level 1, Level 2, Level 3, Level 4, Level 5 (e.g. North Carolina State)

Data source: Bond, et al. (2014), Queensland Fire and Emergency Services (2018), Government of the United Kingdom (2016), Penning-Rowse & Wilson (2006), Parker (2004), McMaster & Baber (2012), North Carolina Department of Public Safety (n.d.), Queensland Government (2016), The State Council of The People's Republic of China (2006), Cheng, Li, Wang, & Wang (2010), Tim et al. (2017)

China, Australia, UK and USA, each have well established flood prevention infrastructures such as water stations, substations, and dams, which are used for flood response during flooding (Head, 2014, Smith et al., 2013, McMaster & Baber, 2012, Zhang & Yuan, 2014, Wetmore, 2007). Moreover, in Australia, the USA and the UK, the local/state governments and agencies are initially responsible for flood response and national governments only provide help if they are needed (Head, 2014, Smith et al., 2013, McMaster & Baber, 2012, Wetmore, 2007). China however is different, as in China the national government is responsible for flood prevention/response, for example, in the 2013 flood rescue in the northeast of the country China (Zhang & Yuan, 2014). In addition, volunteers / non-government organizations also play an important role in flood response in Australia, the USA, the UK (Head, 2014, Smith et al., 2013, McMaster & Baber, 2012, Wetmore, 2007), but Chinese volunteers are not considered of importance during flood response (Zhang W. , 2011).

In Australia, state governments are mainly having responsibility of water governance and flood response (Head, 2014), managing dams to control flood volumes during a flood (Coates et al., 2014). The Australia Commonwealth Bureau of Meteorology will publish warning information, during a flood and states governments as well as the State Emergency Services will organize a flood response (Coates et al., 2014). Coates et al (2014) argued that the Australian military also involved response in Queensland floods in 2011 and citizen response (e.g. volunteers) made a large contribution to the Queensland flood response. In Australia, there is no national disaster response plan, but each state has their own emergency response strategies, but they required to collaborate and coordinate with each other during a multi-jurisdictional disaster. For example, Queensland state's emergency response divided into Alert, Learn Forward, Stand Up, Stand Down (Queensland Government, 2016).

In the USA, flood responses can be broken down into three components, which were used in New Orleans flood hazard mitigation (Wetmore, 2007). Wetmore (2007) believe first components are physical infrastructure, such as flood control levees, and flood buildings and reservoirs; The second component includes pre-catastrophe response like weather forecasting, organising resident evacuation though official agency rescues; and the last component is the post-flood response system, for instance, different levels governments and non-government organizations establish and return normalcy to flooded areas. Furthermore, the USA Federal Emergency Management Agency and the military especially the Corps of Engineers will be involved in flood response in major flood (Galloway, 2004). For response arrangement level, each state in USA have their own response plan, for instance, there are level 1 to 5 response levels in North Carolina (North Carolina Department of Public Safety, n.d.).

In the UK, flood response approach, involves various types of technologies that are used for flood warning such as the radar warning system, dam etc (Penning-Rowsell & Wilson, 2006). For non-

structure, the UK Fire and Rescue Service identifies Gold, Silver, Pseudo Silver, Bronze (McMaster & Baber, 2012) to coordinate disaster response and allocate resources (Penning-Rowell & Wilson, 2006). The main flood responders in UK are local authorities, the police, the fire services, ambulance operations, the Environment Agency, voluntary services and sometimes this military (Penning-Rowell & Wilson, 2006).

In China, the National Flood Control and Drought Relief Headquarter (NFCDR) provides flood warning, and for example, the reservoirs were used to control flood volumes in 2013 China northeast flood (Zhang & Yuan, 2014). In a major flood, like this one, the Chinese national government, province government and the military were directly involved in the flood response, and the military was the organizer of flood rescue (Zhang & Yuan, 2014). China has a national level flood response activation arrangement from level 1 to level 5 (The State Council of The People's Republic of China, 2006).

2.5.2 Flood Dispersal/Storage Areas

The flood dispersal/storage area is both a structural and non-structural solution (Ma, 2006). When large floods occur, the water is released to other areas to protect people and property. In countries where private ownership of land is the norm (e.g. Australia), there are not many flood dispersal/storage areas because the land is private and for governments to establish flood dispersal/storage areas is more difficult than countries where there is little land private ownership (Ma, 2006).

According to Acreman, et al. (2000), the UK releases their flood water to a floodplains system. Located in floodplains, are infrastructure and residents, but they are protected by flood infrastructure (Acreman, et al. 2000). In the USA, the floodwater can be dispersed into forest and farmland where there are no resident areas (Ma, 2006). In the USA, the government will pay for landowners to set up flood dispersal areas (Ma, 2006). However, in China the relevant agencies try to redirect excess water to designated flood zones. If the flood dispersal/storage areas have residents in the designated area the floodwater can be dispersed to these areas, but the residents will be evacuated before excess water is dispersed (Ma, 2006). Currently Australia can disperse flood water into controlled floodplains (NSW Environment & Heritage, 2018) where some infrastructure is located e.g. roads and railways (NSW State Emergency Service). The country comparison summary shown in Table 8.

Table 8: Flood Dispersal/Storage Areas

Country	Residents located within area	Dispersal flood area
China	Yes	Yes, residents land areas or sparsely populated areas
Australia	Yes	Floodplains
UK	Yes	Floodplains
USA	No	Forest, farmland

Source: Ma (2006), Acreman, et al. (2000), NSW Environment & Heritage (2018), NSW State Emergency Service(n.d.)

2.6 Research Gap

Some good researches have been done in flood management for China, Australia, UK and USA respectively. There is also some specific research on flood response for these four countries, such as flood framework plans, flood stakeholders, the response actions during floods etc.

Therefore, there are some gaps across research into flood management and flood response. Firstly, there is not a systematic introduction of flood management approaches and flood response during floods in Australia and China. Secondly, there is no detailed comparisons between Australia and China in flood management and flood response. Lastly, there remain some potential reasons of different approaches to cope with floods in Australia and China, which need to be sorted out in order to find the contributor in improving flood response efficiency.

2.7 Research Questions

- Question 1. What are the approaches of China and Australia (e.g. Queensland) for flood management?
- Question 2. How do Chinese and Australian (e.g. Queensland) flood management approaches impact flood response?
- Question 3. What lessons can be learned by comparing the impact of flood management approaches between the two jurisdictions and can this contribute to our knowledge of how to more effectively respond to floods?

2.8 Summary

This chapter reviewed current flood management and flood response literature based on different keywords. There is very little published academic literature. The research gap i.e. comparison of China and Australia in flood response and detailed research questions are identified in this chapter. There are many different flood management theories such as structural and non-structural flood

management approaches, five stages for flood management and flood stakeholders. Countries such as the China, Australia, UK, the USA, are discussed and structural and non-structural approaches are listed and described. These four countries do not have flood management frameworks, but they have their own plan or emergency frameworks instead. China has a large and different government leadership in comparison to the other three countries that directly impacts flood management practices. Furthermore, military and volunteers play an important role in flood/disaster management and are also very necessary in specific situations. The four countries reviewed have different conditions in terms of military involvement in disaster management. Volunteers involvement in flood/disaster management has many benefits, but China does not take them into consideration as a main force which is vastly different to other countries. Flood dispersal is a popular choice for these four countries, and only China can disperse floods to residents' areas (once they have already been relocated) in extreme situations.

3. Chapter 3 - Methodology

3.1 Introduction

This research focuses on a case data comparison analysis of Australian and Chinese flood management and flood response, highlighting some potential reasons why the two countries have different approaches to dealing with floods. China is a centralized country with different levels of governments, which take similar approaches to the central government in regards to flood management. Australia, on the other hand, is a decentralized country with huge differences in each State or Territory. For the purposes of addressing the research gap (as outlined at the end of Chapter 2), a typical Queensland flood response case is selected to compare with a typical Chinese flood response case.

3.2 Currently Research Methodology

Data used for this comparison comes from secondary sources, which includes government reports, academic papers, legislation documentation, government websites, published government plans, and new agency websites. Most data sources come from academic databases and government websites.

For the purposes of improving flood response efficiency, document analysis has been applied to this secondary data to produce a comparative dataset. For example, government documents, reports, law documents will be reviewed and comparison. Both countries' flood management practices have been categorized into two sections. The first one is related to political system influences and structures, which refers to government frameworks, military and so on. The political factors directly impact flood responders and in both China and Australia. The second one is flood response activities which

includes warning, reporting, response arrangements, flood disperse and human resource deployment. The comparative dataset is then used to discuss the pertinent attributes of both jurisdictions' flood management practices and their impact on flood response.

There are some limitations of the dataset, however, as it has been produced from secondary sources, and as a consequence, it may not be not be fully accurate, comprehensive or necessarily be based on standard flood management responses. For example, from the literature review, we know that there would be some differences between the two countries in flood management system design, and thus the data that individuals in a flood response would report. Besides, there is limited publicly available data in both countries. In China, flood response data is centrally reported and published by the government, whereas Australia's flood response data is reported on a state basis and is difficult to access.

3.3 Proposed Methodology

This master's thesis forms the basis of a PhD project which will come from this thesis where research gaps have been identified and research questions have been produced to bridge this gap (see Chapter 2).

To date, the knowledge domain has been studied via a detailed literature review and secondary data analysis (see Chapter 4).

In the PhD project, data collection will be extended to primary sources: firstly, via a questionnaire to elicit expert opinion on the flood management domain across the two jurisdictions; and then secondly via semi structured interviews to drill more deeply into the questionnaire responses. The structure and topics to be addressed in the questionnaire will be informed by the outcomes of this thesis. A draft structured questionnaire will be designed and sent to academic and industry experts for their comments and feedback including how to best deal with cross cultural issues within the questionnaire. As the researcher was born in China and is now living in Australia, it is hoped that these issues would be effectively addressed. The questionnaire will then be administered to a large number of flood response managers and first responders in China and Australia.

Questionnaires will then be analysed and form the basis of semi-structured interview questions to be administered to a smaller representative sample of study participants. Interviews would be conducted by face to face, phone, and WeChat / Skype. Other relevant questions may also be asked during interviews depending on how the respondent reacts.

The overall object of questionnaires and interviews would be to collected primary data about the flood response process, different levels of agency corporation during floods and other issue of importance

to both China and Australia, allowing for a “drill down” into a more detailed and comprehensive comparison.

In addition, secondary data, such as further flood management and response case studies, historical data and academic papers, will continue to be collected for this analysis and to provide further context for the study.

3.4 Summary

This chapter proposed a research methodology for this current thesis and for the future PhD project. The current research methodology (this thesis) focuses on secondary data which has some limitations in data access, accuracy and comprehension for China and Australia. The secondary data collection via questionnaires and interviews is introduced as part of the future PhD research methodology for flood management and response research.

The research gap and research questions for this Master of Research project have been identified from the literature. The next chapters will analyse this secondary data and discuss the research findings.

4. Chapter 4 – Analysis

4.1 Introduction

This chapter outlines and describes the analysis of the comparison between China and Australia’s political systems and flood response. The section describing political systems focuses on the differences of both countries’ leadership, government framework, military and volunteer involvement in terms of flood management. The section of flood response describes China and Australia taking action to respond to floods in different ways. The flood response approaches are also analysed and compared via flood warning, reporting, level of flood response arrangements, flood dispersal, forced relocation and human resource deployment in both countries. The political systems and flood response strategies directly effect on both countries flood management approaches.

4.2 Political Systems

The leadership is one of the most important factors for political systems in China and Australia flood response. Different leadership styles impact on government framework settings. China and Australia have different flood management organization settings and different conditions regarding to the military involvement in flood response. The volunteers involved in flood response are also different in both countries.

4.2.1 Leadership

China and Australia have totally different political systems and leadership styles. In China, the higher-level governments can directly lead and order their local governments in times of crisis. The lower level governments directly report their flood management situation to a higher level of governments, such as a county government directly reporting to municipal government, and municipal governments directly reporting to provincial governments. When local government cannot cope with a severe flood or higher-level governments including the central government feel they need to be involved in flood management practices, they can intervene without lower level government permission.

China's central government plays a leadership role, and different levels of governments and departments are responsible for the implementation of disaster response plans following central government decisions (Gao, 2008). In terms of flood management, the decision making is fully controlled by the central government but the central government grants rights local governments (from province to county levels) to implement central the government's decision and policies (Moore, 2018).

However, in Australia, the Australian federal government plays a support role in flood management. It provides flood warning via the Bureau of Meteorology and financial assistance under Natural Disaster Resilience Program (Flood Victoria, 2009). In addition, when state governments cannot cope with an emergency the federal government can provide physical assistance (Flood Victoria, 2009). State and local governments have a great deal of autonomy with each state having its own flood management committees and each branch of government supporting these committees, while working with local councils in flood management decision making.

4.2.2 Government Framework

China and Australia have a largely different organization and systems for flood control. In China, the flood management includes physical (statutory) organizations and virtual organizations.

Statutory organizations, at the national level, include the Ministry of Emergency Management (MEM), and the National Flood Control and Drought Relief Headquarter (NFCDRH). The Ministry of Emergency Management is responsible for management of all emergency events and disaster management which was established in March 2018. The different ministries of emergency management will be merged into the MEM such as the China Fire Service (now called China Fire and Rescue), NFCDRH, State Administration of Work Safety, and another 11 different departments. MEM is responsible for making national level emergency plans, leading and management of all emergency events and disasters including flood management (Wang Y. , 2018). It is also responsible for establishing a disaster reporting system, disaster response, management, and recovery. From early

in 2018, each level of governments will establish their own Department of Emergency Management which includes FCDRH. NFCDRH is a professional agency for flood management at the national level in China. NFCDRH has 23 different Ministries and military department members, each level of government Flood Control and Drought Relief Headquarter (FCDRH) as NFCDRH branches, and 7 different river basin FCDRHs (Annexure A). The structure is shown in Figure 1 (see below). NFCDRH main responsibilities are formulation of national level flood control policy, design of flood mitigation for main rivers and across the province flood control plan, and organizing and management of flood early warning, response, rescue, recovery (The State Council of The People's Republic of China, 2006).

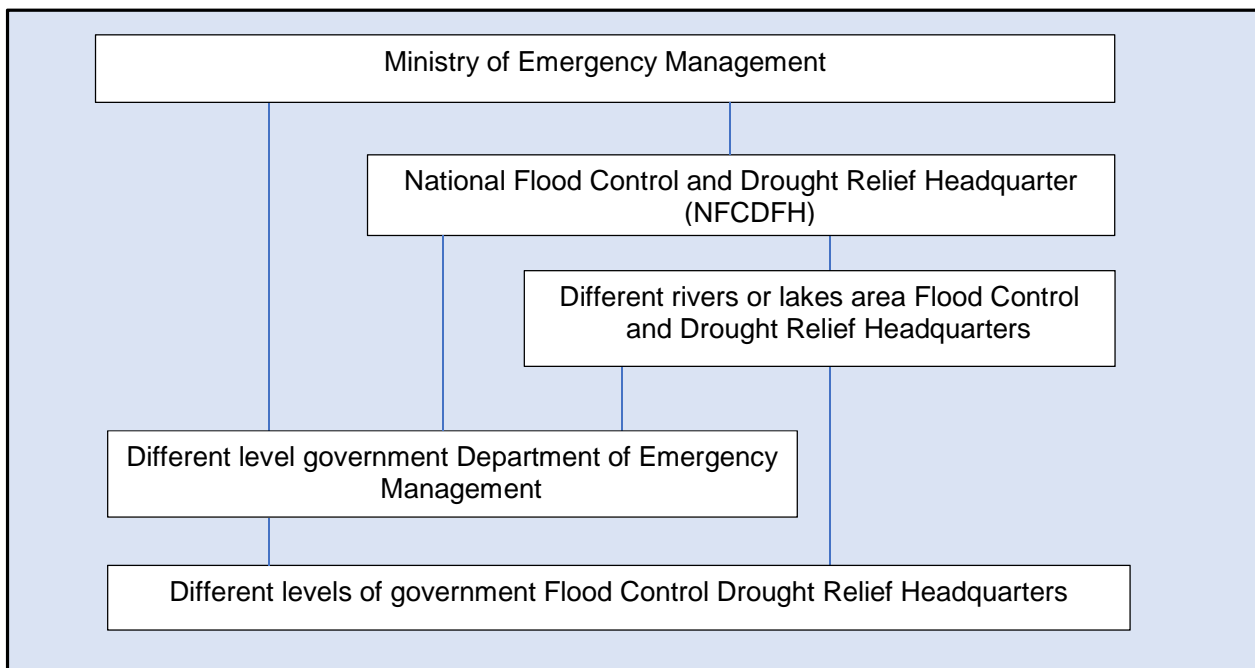


Figure 1 – Chinese Government Flood Management Framework

On local level, there are different FCDRHs for different levels of government which have almost the same function as NFCDRH in a local area. When crossing different provinces and areas flood control, there are flood control headquarters on river or lakes such as Yangtze River Flood Control and Drought Relief Headquarter, which is located between national level and local government level (The State Council of the People's Republic of China, 2005).

For creating a virtual organization, when flood occurs, different level of governments (from provinces level to county level) will establish a temporary committee which includes different government departments and a military representative. In China, flood control is a chief local government responsibility, and each level of government departments and agencies are responsible to implement flood control (The National Peoples's Congress of the People's Republic of China, 2016) The chief

of the local government or local communist party will join and directly lead this temporary committee. This leads to the committee becoming the most powerful organization and main force within local area during a flood as it has the most power over resources. After a flood, this committee will be automatically dissolved. In addition, the senior officer who comes from a high level of government, department of emergency management or FCDRH, will directly join and lead this temporary committee, without local government or local temporary committee permission.

In Australia, national level disaster control is led by Emergency Management Australia (EMA) which is a division of the Attorney-General's Department (Attorney-General's Department, n.d.). EMA works through the Australia Government's Crisis Coordination (CCC) to monitor, inform and support the states and territories. EMA's main responsibilities are managing the CCC, providing funding to the disaster area, developing and maintaining the national emergency plan, providing suggestions to Australia's state emergency management officers, and providing education and knowledge services (An Australian Government Initiative, n.d.). There are representatives from a range of Australia government departments in the CCC, so it provides "whole of government" information for government decision makers. In addition, it can also directly coordinate different departments for disaster management. The states and territories have primary responsibility for disaster management, however, including policy, strategy, resource organization for disaster recovery and public messaging etc (Emergency Management Australia, 2010).

In Australia, different states have different flood control frameworks. In Queensland, the Queensland Disaster Management Committee (QDMC) is the disaster management organization at a state level which works via the State Disaster Coordination Group (SDCG) and State Disaster Coordination Centre (SDCC) for disaster management. Different relevant state departments have representatives in the QDMC and the SDCC is permanent facility. Both of organizations are directly accountable for disaster response operations.

Between state government and local government, there are District Disaster Management Groups (DDMGs) and District Disaster Coordination Centre (DDCC) which respond to district disasters including flood. When a disaster cover one district temporary district disaster management groups will be established to coordinate resources (Queensland Fire and Emergency Services, 2018). The temporary DDMGs are directed by QDMC.

In regarding to local flood control, local frameworks are same as state frameworks, and there are Local Disaster Management Groups (LDMG) and a Local Disaster Coordination Centre (LDCC). The LDCC is on behalf of LDMG to coordinate local resources and information to manage the

disaster. It can also escalate the disaster to DDCC for assistance. The DDCC organize states resources to support local government undertaking disaster management.

For floods across state borders, there are some river commissions and committees in Australia, for example, the Murray–Darling Basin Authority which assists different states governments for flood control via dams in Murray Darling Basin (Murray Darling Basin Authority, n.d.). However, it is not a flood control organization and only assists in organizing resources to control a flood.

4.2.3 Military Involvement in Flood Control

In terms of military involvement in flood control, China and Australia are very different in their approaches. The Chinese military plays a very important role in flood control. Interpreting the Flood Control Law of the People's Republic of China (2000) mentioned previously, the Chinese military is a main force in flood control, and it includes the People's Liberation Army (PLA), Chinese Armed Police Force and the Chinese Reserve Army. The Committee of the Communist Party at each level of jurisdiction are responsible for leading the same level of government. A military representative will join this committee. At each level of FCDRH there is also a military representative, so the military could very easily be involved in flood response. According to the Regulation on the Military Participation in Disaster Rescue (2005), when the military is involved in disaster rescue, the military should be directed by the same level of government. In other words, the rescue military will be led by the chief of the communist party or chief of government, but the rescue tasks would be managed by the military. During the disaster period, local government can directly request the local military station for assistance, and the military should immediately provide this and report to a high-level officer at the same time (The State Council and the Central Military Commission, 2005). The government prefect must invite the military directly to be involved in flood control, because they invite them without too much red tape, and the military can provide fast and effective response. The most common military involved in flood control or other disaster responses are the China Fire Service, Armed Police Force including Armed Police Forest Force and the Army Reserve. If Armed Police and the Reserve cannot deal with the disasters, then the PLA will be involved.

In terms of cost, if the military is invited by the central government, the cost will be paid by the central government in China. However, if the local government invites the military, then the local government is responsible for the military cost during the flood (The State Council and the Central Military Commission, 2005).

The military involvement in disaster response could be reduced in the future. From March 2018, in theory, China has a professional emergency response team which includes the China Fire Service, the Armed Police Forest Force, and safety production emergency rescue teams (Wang Y. , 2018). The

China Fire Service and the Armed Police Forest Force will be transferred to the professional response team (China Fire and Rescue) who are not military forces.

In Australia and China, the military plays a supporting government role in disaster response. However, Australian law allows governments to use the Australia Defence Force (ADF) to assist in natural disasters relief in a very limited way. The military and Police forces are not main forces in disaster response such as flood control and are generally the last choice for main disaster response in Australia. In Australia, there are liaison officers in emergency management authorities, which are similar to the military representatives at each level (committee) of the communist party in China.

Australia has identified 3 categories where military defence assistance to the civil community can be invoked such as local emergency assistance (category 1), significant emergency assistance (category 2), emergency recovery assistance (category 3). In category 1, district, regional or local emergency management authorities can directly request defence force assistance if a Senior Australian Defence Force Officer (SADFO) or Unit Commander approves. But the provision of assistance should not be in excess of 48 hours (Australian National Audit Office, 2014). For category 2 and category 3, state emergency management authorities can send requests through EMA and Minister for Defence/Chief of the Defence Force for their approval. Australia has a very detailed description of military involvement during a disaster response condition, while China is more flexible. When different level governments believe they need military assistance, they can directly request it.

For cost recovery, Australia is similar to China, with the cost recovery borne by central governments and local governments. In Australia, if the flood does not activate the COMDISPLAN, the state/territory or local governments have to pay for the Defence Force cost. In addition, even though the disaster might activate the COMDISPLAN, if the Defence tasks are not directly related to the saving of life or property then the state/territory or local government still need to pay their costs. Australia also has some large differences with China, for example, the state/local governments can apply for waiving the Defence Force costs. According to Australian National Audit Office (2014), the state or local government can also seek a cost waiver/variation from the Minister for Defence when the military tasks involve special circumstances such as significant public affairs, recruiting, or training value to Defence. If a task is a minor cost, the local government also can apply for a waiver of the cost.

4.2.4 Volunteers in Flood Management

According to the Regulation on Voluntary Services (2017), when the disasters occur and require assistance and rescue, the local governments should provide the required information and guide volunteers to voluntary service. In China, volunteers widely join in flood management, but they are

not considered as a main/important force. The volunteers normally are responsible for very basic and general tasks in disaster management including flood management in China. The volunteers will be led by flood area governments. Normally, the volunteers are called up by governments and come from companies/organizations and could be individual citizens. Most of volunteers are temporary, untrained, and do not have specialized rescue skills. In 2014 typhoon “Rammasun”, which killed to 25 people including 6 people that were lost, the Hainan province government’s response plans did not involve volunteers (Wang & Li, 2017). During the period, the Hainan Department of Civil Affairs suggested that the volunteers do not directly go to the disaster areas and that they were not organized enough to go to the disaster areas. In Australia, the state or territory governments rely on trained volunteers for flood management activities. According to Green Cross Australia (2019), there are more than 500,000 emergency management and response volunteers in Australia.

With disasters, including floods the main response force are usually volunteers, especially trained volunteers. In Australia, most of volunteers have had regularly training, of which is managed by state agencies. When floods occur, local volunteers are organized by relevant agencies into flood rescue teams to respond to local and surrounding floods. These agencies like to mix the skill level/set of individuals in these teams so that it gives an opportunity for all volunteers to learn my skills from the professional emergency staff. In addition, the volunteers normally live in the local areas; therefore, they are familiar with local environment and can provide fast and efficiency flood response.

4.3 Flood Response

China and Australia are largely different in flood response. The different flood response activities lead to different efficiencies during floods. There are seven (7) different aspects (warning, reporting, flood plans, response arrangement, flood disperse, forced relocation and human resource deployment) to analyse and compare the differences in both countries. The differences of each aspect will be highlighted and described in this section.

4.3.1 Warnings During Floods

Australia and China have very good warning systems during flood. Australian warning systems rely on technology. The traditional media like radio, TV and print are a popular way to provide information on floods. The social media, websites, emails, landlines and text messages are also used to warning residents and visitors (Queensland Fire and Emergency Services, 2018). With exception to the above warning channels, physical visiting to notice and the air defence alarm are also used for flood warning in the countryside and some cities in China. In some emergency situations, in China, the village committee have to visit the person to provide notice of the flood. In addition, in some

cities such as Jinan, the air defence alarm is used to give to flood warning because local government can easily introduce military resources for flood control.

4.3.2 Reporting

Australia has a different reporting system to China. In Australia, the flood sitrep (situation reports) does not need to report to a flood to the federal government. In China, except for small floods, all sitreps should report to the NFCDRH and national government. In Queensland, the sitrep will deliver a report to the DDCC from the LDMGs. The DDCC adopts a Disaster Incident Management System to record live information and the DDC determines the frequency of a sitrep to DDCC. The DDCC will deliver a situation report (sitrep) to the SDCC and the SCC will provide overall information to LDMGs or DDMGs. During floods, there is a 24/7 watch desk which provides monitoring, collecting, collating and analysing emergency information to Queensland government and other disaster management stakeholders.

However, China has stricter reporting requirements. Each level of government has a 24/7 watch desk during a flood. According to the Hubei Flood Control and Drought Relief Headquarters (2016), when more than 4 cities including 4 cities have a flood, the sitrep will report to the Hubei FCDRH and deliver a sitrep to the NCDRH. If there are only 3 or less than 3 cities that have a flood they will not report to the Hubei FCDRH. During the flood, the key flood monitor stations should report the flood status to NCDRH within 30 minutes, and the flood area should report a sitrep to the NCDRH within 2 hours (The State Council of The People's Republic of China, 2006). In addition, the main dams and river should report their information to the NFCDRH within 4 hours as well. In terms of reporting structure, in China, each level of the FCDRH will escalate their jurisdiction sitrep to higher level and the FCDRH and also the same level of government in a limited time period.

4.3.3 Flood Response Plans

China and Australia have different flood response plans. China has a flood response plan from the national level to local governments level, and each level of flood control plan is based on the central government flood plan. In other words, the local flood plans are similar to the central governments. Each level of flood plan is slightly different such as the flood response methodology which is based on local weather, landform and local flood control facilities. Australia does not have a national level flood response plan because the federal government is very limited in its involvement in flood control and the state/ territory governments take main responsibility for flood control. Australian flood plans are based on local government activity, even at a state/territory level, but even so some states/territories do not have a flood control plan, like the Queensland State Disaster Management Plan which includes flood control.

4.3.4 Levels of Activation for Response Arrangements

In Australia, the response arrangements are based on states/territories because the federal government does not have a flood plan at the national level. I have used Queensland as an example for comparison with China.

In Queensland, the action of response arrangements (Annexure B) at the state level are based on requests for assistance from local governments and districts. The Queensland response activation includes: Alert (before flood happens), Learn Forward (flood very likely happen), Stand Up (flood is happening), Stand Down (flood finished). Only the Stand Up level covers the response during a flood. In terms of activation triggers, the activation order come from the LDMGs to the QDMC in Queensland.

In China, when there is a flood across more than one jurisdiction, high level government is automatically in charge of flood control. In other words, higher level governments including the national government is involved in flood response without lower level government sending a request even though they could cope with the disaster. Each level of government has their own response arrangements which are very similar to the national response arrangements. China flood response is based on different levels and scales of flood. At the national level, China has four levels of activation response arrangements (Annexure C). All response arrangements focus on rescues during floods which is very different from Australia. The arrangements have detailed flood control actions. For instance, different levels of flood scale will require different levels of central government officers in charge of flood control. The arrangements also mention flood control from monitoring the flood, to support and rescue such as deployment of resources in a limited period.

4.3.5 Flood Dispersal/Storage Areas in Flood Response

The approach the Chinese government takes is more rigid in dealing with flood management, especially when direction is coming from the central or province level government. Alternatively, in Australia the approach is more flexible where there is more input by several organizations in addressing the water dispersal/storage.

Chinese laws allow governments to establish flood disperse/storage areas, but in Australia the government creates flood management plans. In China, only the central government or province level government can set up or approve flood disperse/storage areas. In emergencies, the flood disperse/storage areas can be activated, thus rising floodwaters can be diverted to this flood dispersal area. When the government decides to active a flood dispersal/storage area, no organization or individual can disrupt the implementation. If some individuals and organizations try to disrupt this implementation, the government will take action (The National Peoples's Congress of the People's

Republic of China, 2016). In other words, if they are in a flood dispersal/storage area, individuals will be forced to relocate even if they do not want too, even though their areas have not been currently threatened by flood.

For instance, (outlined below in Figure 2) there is A city which is a big city, and B is a village or small city. The flood direction would be from E to F, and it will directly threaten big city A. In China, the flood may disperse to flood dispersal area via dike C, to protect A in extreme situations. B is in the flood dispersal area which had been approved by the central government or province level governments. However, after the flood is over, the Chinese government will give them compensation for their loss and help them to rebuild or clean their property.

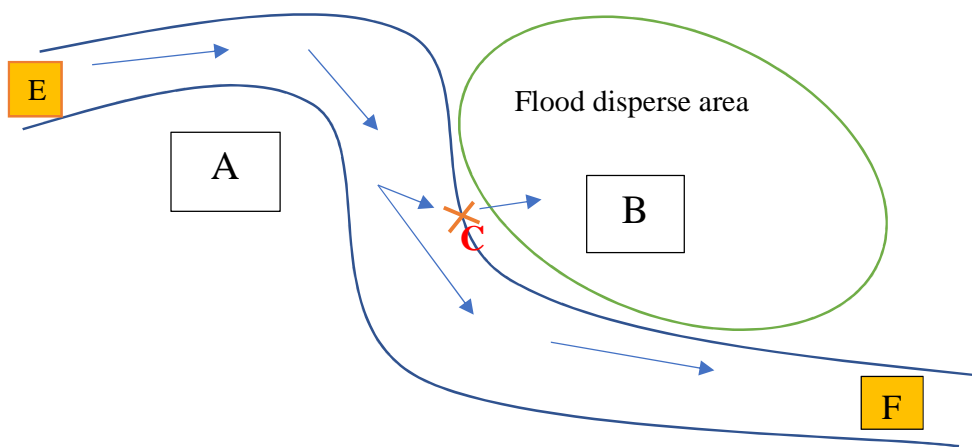


Figure 2 - Flood dispersal

Australia can disperse flood water into non-resident's floodplains and catchments during emergency situations. In extreme events, the local government/ LDMG, and state government / State Disaster Management Groups (SDMG) /SDCC will be in charge of flood response and can make decisions to release water. In addition, the flood water release information will be provided to the Minister for Natural Resources, Mines and Energy, and Premier (Queensland Floods Commission of Inquiry, 2011). Normally the flood water dispersal will not impact resident areas. However, in some extreme events, floodwater dispersal may impact the resident areas, and local governments or LDMGs are responsible for warning local residents (Seqwater, 2016), and organizing residents evacuation.

4.3.6 Forced Relocation During Flood

China and Australia have different practical approaches when the residents refuse to evacuate from flood areas or in emergency situations. In theory, the law in both countries have not mentioned that governments or the rescue teams can force residents to evacuate from flood areas if they have no impact on public interests. However, in practical, China rescue teams can force people to evacuate

from dangerous situations. For example, in 14th June 2008 around 3A.M., Guangdong province Yingde City Hanguang Town, Chinese militia forced one old woman to evacuate from her property because she refused to be rescued determinedly in the life-threatening condition. While she was saved and her house was crashed within few minutes by flood after forced rescue (Nanfang Daily, 2008). China rescue teams' behaviors are illegal in the view of law, but they are accepted by Chinese people as they saved people's life in most situations. In Australia, the rescue teams will not force residents to evacuate. The Rescue teams will encourage residents to leave during dangerous instances, but if they are unwilling to leave, they cannot be forcible removed. Rescue teams may give residents a warning of the danger and a disclaimer stating that they "have been warned", ensuring that they are fully aware of the possible outcomes of their actions. For instance, if some residents refused to evacuate they be required to sign a declaimer for their choices in Tropical Cyclone Debbie (Special Broadcasting Service, 2017).

4.3.7 Human Resource Deployment

In terms of deployment of personnel in Australia, there needs to be a request from the LDMGs to the SDCC which will coordinate deployments of Queensland resources. In China, local governments also can request assistance from higher level governments. Most of time, higher level governments such as the province or central government, have already taken charge of flood control according to activation arrangements, and can directly organize and deploy personnel in flood area.

4.4 Summary

There are different approaches to flood management and flood response for China and Australia to cope with floods. The different political systems in China and Australia primarily affect the different approaches to managing floods in the two countries, and different ways of flood response further differentiate these approaches on floods.

It is the political system that determines leadership style and government framework in a country, which will further affect the processes of dealing with emergencies, such as floods. Consequently, China and Australia are different in flood management leadership and flood management framework. China is a centralized country while Australia is a de-centralized country, therefore, it is understandable that China and Australia apply different approaches on flood control. As a centralized country, local governments need to follow the instructions from the central government on flood management in China. Besides, it is easy for the central government in China to get military involved in the flood rescue. However, each state/territory is empowered to manage floods individually in Australia. It is usually the trained volunteers, rather than the military involving in the flood management in the de-centralized political system.

In addition, China and Australia respond to flood in different ways. Firstly, China has a flood plan on a national level that local governments need to follow, while each state/territory has individualized flood plan in Australia. Similarly, there are levels of activation for flood response arrangements with detailed flood control actions in China, which is inexistent in Australia. Secondly, reporting patterns are different between Australia and China. Thirdly, unlike Australia, flood disperse areas are established in China to respond to floods if necessary. Lastly, forced evacuations is prevalent in Chinese flood response to save people's life. Whereas the Australia rescue team will not go against the will of people if they do not want to be rescued in floods. However, although there remain huge distinctions, China and Australia are similar in warning systems during floods.

5. Chapter 5 - Discussion

5.1 Introduction

This chapter will discuss the differences in flood response and the potential reasons for these differences in China and Australia. According to the analysis in Chapter 4, culture is a fundamental reason resulting in different flood response approaches. This chapter will highlight the cultural and political systems effects, military and volunteers, flood response, flood dispersal, forced rescues and mobilization and look at the potential different reasons for different flood response.

In addition, the advantages and disadvantages of flood responses for the different scale of floods in both countries will also be discussed in last section of this chapter.

5.2 Culture in Flood Management

Chinese and Australian cultures are different focusing either on individualism or collectivism (Casimir & Waldman, 2007). China is orientated towards collectivism, and Chinese traditional values reflect a situation where juniors show respect and obedience to seniors (or groups), and their contribution to groups overcomes their individuality (Hofstede & Bond, 1988). In addition, the value of Confucianism¹ and the value of Maoist² especially Confucian value plays a very important role in Chinese mainland society. There are thousands of years of Confucian culture and around 70 years of Chinese Communist education, that lead most of China interpersonal behaviours which are based on those two norms.

¹ The value of Confucius formed thousand years ago, referring to the relationships of people, the standard behaviours of people and the standards of the whole society

² Mao Zedong and his teams' opinion of China revolution, such as the supreme collectivism

Australia tends to have more focus on individual interests instead of group interests (Shanks, et al., 2000), which is apparently different from China. Even though legal personal property has been protected by the Chinese constitution, in some extreme situations, Chinese legislation states that governments may force people to sacrifice their own interests to protect the majority of people's interests. For example, forced resident relocations in flood disaster areas. In terms of acceptance in morality, in extreme situations, Chinese are more likely to accept the sacrifice of small group interests to protect the majorities' interests in the context of Chinese culture. For instance, in 2008, 15 Chinese airborne troops jumped from 4999 meters in an extremely dangerous situation with bad weather as well as complex and unknown geography, for the purpose of saving people in earthquake areas (Zhu, Ai, & Xi, 2008). Before attempting these high-risk operations, all Chinese troops have to prepare a testament for their families (Zhu, Ai, & Xi, 2008). However, in Australia this may not be accepted because each person is considered equally important in Australian culture.

Australia tends to have more concern regarding individual interests instead of group interest (Shanks, et al., 2000). In extreme situations, Chinese people are more likely to accept the group interest to protect the majority in the Chinese culture context. However, Australia may not accept this because each individual person is considered equally important in Australia culture.

According to Shanks et al (2000) research, China have a high power³ distance so its organizational structures have more hierarchical and more centralized authority. On the other hand, Australia has less centralized authority and power. In other words, Chinese culture and organizations are more dependent on leadership, but Australia does not. In flood management situations, people expect higher levels of government or more senior officers directly involved in flood response and follow their orders. The centralization of political culture leads to the Chinese government having a large influence and encouragement in the mobilization of Chinese citizens at any given time. In critical situations, the Chinese government can mobilize all of society's resources including military, requisitioning of personal property and individuals to the disaster area.

Furthermore, the Chinese military is considered as a member of Chinese families. Chinese citizens expect and believe the military are not only for military purpose, but they should be involved in disaster response including flood response. In terms of Chinese political culture, the military always belongs to a person or a party (excluding currently Taiwan) and this is backed by a few thousand years of history. Currently in China, the Chinese military belongs to the Chinese Communist Party, so it is not uncommon that the military is involved in disaster management and Chinese governments/Chinese Communist Party can easily invite the military for assistance. In Australia, the

³ It used to indicate dependence relationship in a particular country

military belongs to country instead of a particular party and the Australian military does not have easy access to disaster response because of complex disaster processes. At the same time, Australian citizens do not expect their military to take responsibility for emergency response including flood response. Comparing with China, the Australian military is rarely involved in flood management.

Casimir and Waldman (2007) highlight that Australian culture places more emphasis on egalitarianism and individualism but Chinese culture places emphasis on authority. That leads to China's disaster responses to rely on governments or organizations instead of individuals which is very different with western countries (Wang, Chi, & Chen, 2016). In China, government agencies or the military are mainly responsible for flood response, because Chinese citizens consider disaster management as the government agencies responsibilities. While in Australia, professional volunteers and government agencies both play an important role in flood response. For thanksgiving or pay back culture, China tends to directly return to the people or kinship who help them, but western countries tend to return society (Wang, Chi, & Chen, 2016). Under this cultural context, there are many Australian citizens who join professional volunteer teams in disaster response and volunteers are widely used in flood response. By contrast, there are not many volunteers involved or considered to be an important force in flood response in China.

5.3 Political System Effect on Flood Management

China and Australia have totally different political systems in each level of government. The Chinese Communist Party leads different levels of government, and higher levels of governments lead lower levels of governments. The Chinese central government has the most of resources such as financial resources and has a large effect on local governments, which results in flooding area residents preference for higher level of government involvement. In addition, there are ranks in the Chinese Communist Party or Chinese government officers which are similar to military ranks. The higher rank or senior officers have a large impact on lower governments, so the higher rank officers are more effective in organizing agencies and governments on flood response.

Australia has a three-tiered government system including national or commonwealth government, state governments and local governments (Stilwell & Troy, 2000). Furthermore, state governments have a large effect on local governments and local governments do not have formal constitutional status in terms of law (Stilwell & Troy, 2000). The national government has more resources such as financial resources and provides certain financial support to state governments if state governments need them. While local governments and state governments are mainly responsible for disaster management the Federal government will be involved in disaster management only when national major disasters occur or when a state government ask for assistance.

Compared with China, Australia has no specific established flood control organization. In China, there is the NFCDRH and its sub branches from national level to county levels. In addition, the NFCDRH is more powerful, and can directly and easily involve each level of flood control without local governments permission. During a flood, the temporary committee normally becomes the most powerful organization (automatically instead of the same level of the FCDRH), such as the state temporary committee instead of state level of the FCDRH. While Australian federal government can be involved in flood control normally they need to receive requests from local and state governments. The temporary disaster management groups are limited and established across regional flood control in Australia. The temporary disaster management groups areas also directed by state level disaster management centres, for example, the Queensland Disaster Management Committee.

5.4 Military and Volunteers in Flood Response

In China, the military has many resources which different levels of government do not have. For example, in early flood warning, Jinan City uses the air-defence warning to inform people. In addition, the military has more resources in the number of aircraft, satellites monitoring flood area and Big Dipper communication, which are very import resources in flood control. Regarding relief material, the military can fast deliver resources quickly to a flood area. They also can provide much more relief material than local governments because the military has a special supply chain and they have purchase agreements with suppliers. During emergency situations, the military can get nearly half price of the market to purchase relief material (Tang, 2009).

China has very few professional and permanent volunteers. There are less than 20% of volunteers have professional training (Zhang W. , 2011). The Chinese governments prefer to use military than volunteers, because the volunteers do not have the necessary rescue skills and governments have to allocate resources such as food and tents, to volunteers and protect their security during disasters. Most of temporary volunteers are untrained and normally they would be called up after a disaster occurs few days. The military is involved in the flood response in the fastest way to deploy the large number of human resources during the flood. Moreover, excluding the Chinese Armed Police Force, the Chinese People's Liberation Army has around 2 million full time active personnel (Ministry of National Defense of the Peoples's Republic of China, 2015), which can be deployed by the Chinese government for disaster response including flood response without adverse effects. Furthermore, China's population is more centralised, and the Chinese government have a large financial budget compared to the Australian government. Chinese governments/agencies can employ more emergency service staff for flood response. In other words, the emergency service staff can service more people/area in China.

However, Australia relies heavily on trained volunteers (McLennan & Birch, 2005), rather than government agencies' staffs and military. Australia has a limited emergency management budget because of the number of population and GDP. In addition, Australia's population status are sparse in regards to human settlement. These two facts lead to Australian agencies hard to employ staffs in each community, therefore they have to rely on local volunteers. In Australia, the government agencies have budget where they invests in volunteers training programs including training how to use equipment, that training will provide volunteers to have good skills for emergency response. Moreover, there are only has 59,574 Australia Defence Force personnel in 2018 (Church, n.d.), which limits the Australian government deploying the military for flood response to a large area. Overall, there is not always necessary for the military being involved for flood response in most situations because Australia has a large number of professional and permanent volunteers.

5.5 Flood Response Plans, Reporting and Warning

China and Australia differ in their flood response plans due to their political systems. China is a centralized country and local governments will follow central government policies and plans. Therefore, China has a national flood response plan, while each Australian state/territory is independent and will design their own plans based on their own interests, which will not be good for cross state cooperation if a national flood or disaster occurs.

Similarly, in China, higher level governments fully control lower level governments, so the flood status must be reported to higher level governments including central governments. In addition, local/lower level governments prefer to report the flood status to high level governments and hope they can be involved in flood response, because higher level governments have more resources and provide certain financial supports to flood areas governments such as relief stuff.

In China, there are remote areas with a lack of communication infrastructure, and there are some elderly people living alone who are not familiar with mobile phones and other modern communication tools. In addition, compared with Australia, the Chinese population is concentrated in small areas. Therefore, China informs residents by face-to-face notifications in terms of warning in some situations. As Australia has good infrastructure and population dispersion over large areas, it can take a couple of hours which means it may be too late to inform residents evacuating from danger by face-to-face notifications. The Chinese military and governments are led by the Chinese Communist Party, so governments are closely connected to the military via the Chinese Communist Party committee. China will also use their air defense warning system for flood warning, however, Australia is very sensitive about military involvement in disaster response including flood response, so military resources are very limited in flood response.

5.6 Flood Dispersal / Storage Areas

China and Australia have different approaches to flood management and flood dispersal. Compared to Australia, China has a limit on land because there is a huge population that directly impacts China's ability to establish flood dispersal areas. In addition, some flood dispersal areas already have residents in these areas which have been approved as flood dispersal / storage areas. Because of the huge number of people and the limited land that has been used to establish residents areas, the Chinese government has to sacrifice a small group of people's interest to protect the majority. Moreover, the Chinese government will provide large allowances, even rebuild the properties for flood dispersal area residents. The Chinese government implements this policy so that people can continue to live in the flood dispersal areas. Up to 2006, there were 16 million people living in 97 different flood dispersal / storage areas, which includes 30.6 thousand square kilometres in China (The Central People's Government of the People's Republic of China, 2006). Due to the large number of people living in flood prone areas the Chinese government cannot relocate everyone to other areas, they are forced to improve flood dispersal areas and flood control facilities.

By contrast, in Australia, almost no residents live within flooding floodplains or catchments areas. Firstly, there is enough land for individuals to relocated to safe places. Secondly, there is considerable private (unused) land where the Australia government cannot set up flood dispersal / storage areas, compared with China where land is belong to government. Thirdly, the Australian government is not willing to provide and allowance or rebuild property for flood dispersal area residents. Lastly, in Australia, the residents are responsible for their loss during floods and normally purchase insurance to mitigate this risk. In floodplains or catchment areas property insurance is expensive compared to non-floodplains or catchment area, and this can encourage floodplains residents to relocate to other safer places.

5.7 Forced Rescue

China is more likely to voluntarily accept a forced relocation or evacuation for lots of reasons. Firstly, compared with Australia, China does not have very good disaster or flood education for citizens. Some Chinese residents may not realize that they are in danger under the circumstances of emergency. While the Chinese rescue teams are well trained and are able to identify dangerous situations. In most cases the government has approved that the rescue teams force flood residents to evacuate and save people's life. Secondly, Chinese people respect authority or collectivism and individual interests or decision will be ignored in emergency situations as part of Chinese culture. Lastly, to some extent, if one disaster like a flood leads to a large number of people's deaths, the government especially the chief of (local) governments will suffer huge political pressure from higher level governments and

local residents. In some extreme situations, the chief of (local) government will be forced to resign because they are not efficient in organizing rescues, which is normally based on the number of deceased people. Consequently, the rescue teams are motivated to force residents to evacuate by the chief of (local) governments.

In contrast, Australia is more likely to focus on individual needs and respect individual decisions even though the decision may be harmful for individuals. The rescue teams may give up requesting flood residents to evacuate if they refuse to leave. Concurrently rescue personnel cannot spend too much time on persuading residents to leave a dangerous area, because they themselves may be in danger (in turn), consequently a disclaimer will be required to be signed from residents (Australia Broadcasting Corporation, 2015; Special Broadcasting Service, 2017).

5.8 Resource Mobilization in Flood Management

China can mobilize the whole countries' resources such as human resources, financial resources and relief staff in a short period due to the Chinese political system such as power centralization, and Chinese collectivism (culture). Australia needs to communicate and negotiate with different states/territories to organize resources and that would be less efficient than China to some extent.

In addition, in extremely risky situations and national floods, the Chinese central government could sacrifice some provinces' interests to protect the interests of the majority of people, because the central government fully controls lower level governments. In similar situations, Australia cannot sacrifice one state's interest and needs to negotiate among different states to reach an agreement.

Australia often has more international support than China. Australia has many allies such as the USA, the UK, New Zealand etc. which can provide assistance if the Australian government requires it. In theory, China does not have any allies which makes it hard for China (compared with Australia) to get other countries help during a catastrophe because of trust and legislation between countries (Zhan, 2008; Jiang, 2013).

5.9 Advantages and Disadvantages by Flood Scale

China and Australia have different advantages in flood response practice during flood disasters. It can be seen the handling of small scale floods (State/Territory government can handle) and large scale floods (national focus or co-ordination over a State/Territory government's ability). There are 13 items to compare between China and Australia (Table 9). There activities are highlighted as (☒) for "yes", and ☐ for "no" across small scale and large scale floods. ☒ stands for strength in the relevant areas, while ☐ represents weakness in the relevant areas.

Table 9: Small Scale Floods versus Large Scale Floods

Scale	Small scale flood		Large scale flood	
	China	Australia	China	Australia
State and central government relationship	✓	✓	✓	✗
Government Framework	✓	✓	✓	✗
Power of local/state/province governments	✗	✓	✗	✓
Military involvement	✗	✓	✓	✗
Volunteers involvement	✗	✓	✗	✓
Flood response plans	✓	✓	✓	✗
Flood warning	✓	✓	✓	✓
Flood reporting	✓	✓	✓	✓
Flood arrangement	✓	✓	✓	✓
Flood disperse	✓	✓	✓	✓
Forced evacuation	✓	✗	✓	✗
Mobilization	✓	✓	✓	✗
International assistances	N/A	N/A	✗	✓

In terms of small scale floods, compared to Australia, China has disadvantages in military and volunteer involvements regarding flood response. The Chinese local/province governments have relatively less power and resources in comparison with Australia, thus Chinese local/province governments are not effective in responding to small scale floods. Chinese governments (from the province level to local level) may directly call up the Chinese military for flood response which may not be necessary in small scale of floods. Australian professional volunteers are widely involved in flood response, but China has less professional volunteers to work with during flood emergencies. In

emergency situations, China allows forced evacuation for rescuing flood residents, but Australia does not, so China has the advantage in saving people's life in this way.

While relating to large scale floods, China's top-down leadership and centralization of power have advantages in flood response. Because China is faster to organize the whole country's resources for flood response the Chinese military can be quicker and more easily involved for flood rescue. Australia is very sensitive about using military for disaster response so their response may be slower than that of China's. For flood response plans, China has a national plan to organize and coordinate different provinces, but Australia does not. In large scale floods, China has the advantage in their government frameworks because the central government and local governments are strongly connected via the Flood Control and Drought Relief Headquarters that prompts flood response activities throughout the whole country. Due to a larger population, China is better in mobilizing more human resources including the military compared with Australia however, as far as international mobilization goes, Australia is dominated as it has many allies which makes it easier to source international assistance.

5.10 Summary

China and Australia have huge differences in culture: China has a more collective culture and Australia is more individualistic. The cultural difference is one of the main reasons that China and Australia are largely different in political systems, for instance, their flood management government frameworks. In addition, because of cultural differences, China and Australia hold totally different attitudes towards the military and volunteer involvement in flood response.

Furthermore, Chinese are more accepting of forcing population relocation/rescue and flood water dispersal, but takes a different cultural and political approach. Due to the centralized political systems, China has national flood plans and local governments have to report flood status to the central government. The similar flood response action in both countries focusses on flood warning but the Chinese government sometimes needs to use face-to-face notification during floods.

In terms of mobilization, China can mobilize more resources in a shorter time period than Australia because of centralized political systems. But Australia can get more international assistance if catastrophe occurs as it develops good relationships with other countries.

China has the advantage in large scale floods, but Australia has advantages in small scale of floods, as we have seen through the analysis and comparison of flood management and flood response in both countries.

6. Chapter 6 - Conclusion and Future Direction

6.1 Finding Research Questions

Floods are common natural disaster scenarios in China and Australia. The aim of the research is to answer the following research questions

What are the approaches of China and Australia (e.g. Queensland) for flood management?

There are few similarities and lots of differences in terms of the approaches China and Australia (e.g. Queensland) take for flood management. China and Australia are similar in their approaches to virtual organization structure during floods, as well as volunteer involvement, flood dispersal and response arrangements. There are differences, however, in the areas of political systems such as leadership, main flood responder type and flood response strategies. Queensland flood response is used as an example to compare with China.

Contrary to Australia, the leadership and political system is centralized in China where the main decisions are made by the central government. Consequently, the Chinese Communist Party plays a vital role in flood management while Australian political parties are not involved in flood management.

China has flood management agencies from the central government to local governments levels, while Australia has disaster / emergency management agencies rather than flood management agencies. Therefore, most floods need to be reported to the central government within a limited time in China to elicit a response.

The military is frequently involved in flood response in China as volunteers are not trained in flood management, while vast numbers of trained volunteers primarily engage in flood response in Australia.

The flood response plan is applied at the national level in China, while Australia only has the emergency management plan at the state level.

The level of arrangements is different between China and Australia because of these different flood response plans. China can utilize forced relocation to protect the interests of the majority of the population.

Detailed analysis supporting these points is discussed in Chapter 4.

How do Chinese and Australian (e.g. Queensland) flood management approaches impact flood response?

Cultural differences are major factors which impact the flood response approaches of the two countries. The Chinese mainland has strong collectivism, Confucianism and Maoism views so that China's flood management approaches are top down, diluting the interests of small groups. While Australia has a strong individual and independent culture where each state is an independent entity for individual response and is unable to force residents to relocate. Moreover, both countries hold different attitudes towards the military and volunteers being involved in flood response because of different cultural and political systems. Conditions and status in both countries directly impact on their mobilization for flood response as well, such as the economy, population, geography, cultural and political systems.

What lessons can be learned by comparing the impact of flood management approaches between the two jurisdictions, can this contribute to our knowledge of how to more effectively respond to floods?

China and Australia have different advantages in flood management. Australia is dominant in short-term and small scale flood management because of powerful local/state governments and a large number of professional volunteers, while China is accomplished in large scale flood management due to the centralized political system, early central government involvement and their ability to mobilize population. China should provide more resources for local governments in flood response because they are the first responders, and China needs to learn from Australia about the professional volunteer involvement in flood response which could reduce government cost and improve flood response efficiency. Australia has shown that volunteers can be well trained for dealing with a disaster situation when comparing them to the military. Furthermore, though volunteer involvement and training China could improve international cooperation among countries that would be helpful to get more international assistance for response to catastrophes.

Australia may also learn from China about flood response cooperation at the national level. Although Australian political systems and legislation do not allow the federal government to become excessively involved in state government matters, it is still necessary for the federal government to be involved in flood response at an early stage to organize the resources for the whole country without being the potential flood response leader. There is also a need for Australia to establish a national flood response/management plan which will contribute to coordinating the resources of the whole country when coping with cross jurisdictional floods.

6.2 Conclusions

This research has highlighted many differences in flood management practices between China and Australia. The main differences result from their cultures, political systems, military systems, flood

management plans, population distribution and resource mobilization. Australia has advantages in small scale of floods response which normally occurs within a state/territory or when a state/territory government can handle the response, but China has advantages in large scale of flood response.

In regards to flood management, China prefers a top down approach with regional and local governments which are led by higher levels of governments or the central government. Australia prefers the decentralized approach for flood management that each state/territory is independent to flood response. China has strong collectivistic culture and centralized political systems. The government leaderships and government frameworks in different levels are also in a top down structure in flood management. In China, most of resources are centralized in higher levels of governments so that local governments may not be capable of small scale of flood response. Australia is a more individualised country and each state/territory is very independent and has powerful political systems. Each state/territory's government frameworks in Australia are slightly different in flood management, while local government frameworks are consistent with the central government in China. In Australia, the state/territory governments have enough resources for flood response and do not allow the federal government to be involved in state/territory matters except by invitation. Unlike Australia, the higher levels of governments in China can be involved in local governments' flood management without permission. For a large scale flood, Australia may be less efficient than China because they need to communicate with other states or the federal government to cooperate for multi-jurisdictional flood response. Thus, China has strength in cooperation and communication because central governments or higher levels of governments are already involved, led and coordinated in flood area governments for flood response.

In terms of flood planning and arrangements, there are national flood management plans and arrangements in China because of the centralized political systems. China's local governments make their own flood management plans and arrangements which are very similar to the national plans and arrangements. In other words, different levels of governments flood management plans and arrangements are more likely to be the national government's sub-plans or sub-arrangements in each jurisdiction. However, in Australia each state/territory has individual flood plans and arrangements because there exists individual government frameworks in Australia. Australian plans and arrangements do not mention that the flood status should be reported to the federal government within a limited time, but China's plans and arrangements strictly prescribe the period of reporting to higher levels of governments, particularly the central government.

In relation to flood management, the military is frequently involved in flood responses in China which is vastly different from Australia, which results from political systems, military systems and cultural differences. Australia is less inclined to allow the military to be involved in flood response and

management, however, all jurisdictions have large contingents of trained permanent volunteers to call upon in their State Emergency Services. The China Fire Service and Armed Police Forest Force play a primary role in flood response, and used to be part of the Chinese military systems. As they have dropped out from military power, the Chinese military is considered to be less frequently involved in flood response.

In extreme situations, the Chinese law allows the government to force people to sacrifice their own interests to protect the interests of the majority of citizens in order to minimize the loss caused by the disaster. In addition, Chinese citizens also accept forced evacuation from Chinese rescue teams to save people's lives because residents in flood areas may misjudge their situations. In the same situation, Australian rescue teams normally provide strong warnings but residents still choose whether to evacuate an area.

In short period and extreme situations, China has more powerful population mobilization than Australia because Chinese laws empower the Chinese government to forcefully mobilize their citizen's assets and human resources. However, for long period mobilization, Australia will be more powerful because Australia is more concerned about individuals' interests. When a very large scale of flood occurs, Australia is more likely to get international assistance than China because Australia has many allies in the world.

China and Australia do have successful flood management experiences; however, lessons can be learned from each other's strengths in their flood management practices. Both countries have their own national situations and strategies in flood response. China may learn from Australia and pay more attention to the training of volunteers in flood response, give more authority to local governments and develop international cooperation in flood management. Australia may learn from China about military involvement as well as cooperation and communication among states or between states and the federal government.

6.3 Future Direction

Flood response plays a very important role in flood management because its efficiency will directly impact flood management performance and results. The current literature has highlighted a particular part of flood management in Australia, USA, UK and China. The current research gap highlights the lack of systematic research in China and Australia that specifically focusses on flood management approaches for both countries with a systematic comparison of their differences.

This research discusses and highlights flood management approaches in both countries and its impact on flood response. Different investment in flood response will lead to various of flood response results. Flood management not only includes flood response but also includes flood prevention, flood

preparation and flood recovery. These different factors will directly impact flood management performance. China and Australia have obvious differences in flood response investment and outcomes, as well as flood prevention, preparation and after flood recovery. Investigation of these area will be covered in further research for my PhD.

7. Annexure

Annexure A: China National Flood Control and Drought Relief Headquarter member list

(Office of National Flood Control and Drought Relief Headquarters, n.d.)

The Propaganda Department of the Central Committee of the Communist Party of China	National Energy Administration of the People's Republic of China
National Development and Reform Commission of the People's Republic of China	State Oceanic Administration of the People's Republic of China
Ministry of Industry and Information Technology of the People's Republic of China	National Railway Administration of the People's Republic of China
Ministry of Public Security of the People's Republic of China	Office of the three gorges construction committee of the state council
Ministry of Civil Affairs of the People's Republic of China	South-to-north water diversion project construction office of the state council
Ministry of Finance of the People's Republic of China	the Headquarters of the General Staff of the Chinese People's Liberation Army
Ministry of Land and Resources of the People's Republic of China	People's Armed Police
Ministry of housing and urban-rural development of the People's Republic of China	Changjiang Water Resources Commission of the Ministry of Water Resources
Ministry of Communications of the People's Republic of China	Yellow River Water Resources Commission of the Ministry of Water Resources
Ministry of Water Resources of the People's Republic of China	Huaihe River Water Resources Commission of the Ministry of Water Resources
Ministry of Agriculture of the People's Republic of China	Haihe River Water Resources Commission of the Ministry of Water Resources
Ministry of Commerce of the People's Republic of China	Songliao Water Resources Commission of the Ministry of Water Resources
National health and family planning commission	Pearl River Water Resources Commission of the Ministry of Water Resources
State Administration of Radio, Film and Television of the People's Republic of China	Taihu Water Resources Commission of the Ministry of Water Resources
State Administration of Work Safety of the People's Republic of China	Each Province Flood Control and Drought Relief Headquarter
China Meteorological Administration of the People's Republic of China	

Annexure B: Levels of Activation for State Response Arrangements (Queensland Government, 2016)

QDMA Activations Table									
	QDMC			DDMG			LDMG		
	Triggers	Actions	Communication	Triggers	Actions	Communication	Triggers	Actions	Communication
Alert	<ul style="list-style-type: none"> • Advice from warning authority • Operational • advice from DDC • Staged activation of LDMG/S and/or DDMG/S 	<ul style="list-style-type: none"> • Hazard identified & risks analysed • Notify stakeholders via matrix in SDCC SOPs • SDCC staff on stand by • Conduct appreciation and prepare operations plan • SDC begins to coordinate/oversee preparations for disaster response operations • Recovery agencies placed on Alert 	<ul style="list-style-type: none"> • SDCC contact through Watch Desk • State Duty Manager on mobile 	<ul style="list-style-type: none"> • One or more LDMGs operational • Awareness that threat may be widespread 	<ul style="list-style-type: none"> • XO brief DDC on activation level of LDMG/s • Analysis of threat • Contact LDC/s 	<ul style="list-style-type: none"> • DDC and XO are communicating with each other and monitoring the need for DDMG activation. 	<ul style="list-style-type: none"> • Awareness of a hazard that has the potential to affect the local government area 	<ul style="list-style-type: none"> • Hazard & risks identified • Information sharing with warning agency • LDC contacts QFES • Initial advice to all stakeholders 	<ul style="list-style-type: none"> • Chair and LDC on mobile remotely

QDMA Activations Table									
	QDMC			DDMG			LDMG		
	Triggers	Actions	Communication	Triggers	Actions	Communication	Triggers	Actions	Communication
Lean Forward	<ul style="list-style-type: none"> Staged activation of LDMG/s and/or DDMG/s 	<ul style="list-style-type: none"> SDCC staff on stand by Rosters promulgated Conduct appreciation & prepare operations plan SDCC Liaison Officers identified22 Watch Desk supported by State Duty Manager Recovery agencies placed on Alert 	<ul style="list-style-type: none"> SDCC contact through Watch Desk supported by State Duty Manager, present at SDCC State agencies on mobile & monitor email Ad-hoc reporting 	<ul style="list-style-type: none"> Potential requirement for DDMG to coordinate disaster operations or provide support because of threat level or resource requirements 	<ul style="list-style-type: none"> Maintain contact with LDC/s Communication procedures established Planning commenced for support to DDCC Advise State regarding status of DDMG Establish contacts & set up communication systems Receipt of Sitreps from LDMG/s Brief DDMG core members Warning orders given to DDMG Planning for potential support to LDMG/s DDC support staff briefed 	<ul style="list-style-type: none"> DDC and / or XO contact DDMG members as per district level arrangements. The DDMG monitors the situation and may take some action to prepare for 'stand-up' level of activation Ad-hoc reporting 	<ul style="list-style-type: none"> There is a likelihood that threat may affect local government area Threat is quantified but may not yet be imminent Need for public awareness LDMG is now to manage the event 	<ul style="list-style-type: none"> QFES and LDC conduct analysis of predictions Chair and LDC on watching brief Confirm level & potential of threat Check all contact details Commence cost capturing Conduct meeting with available LDMG Council staff prepare for operations Determine trigger point to stand up Prepare LDCC for operations Establish regular communications with warning agency First briefing core members of LDMG LDC advises DDC of lean forward & establishes regular contact Warning orders to response agencies Public information & warning initiated 	<ul style="list-style-type: none"> Chair, LDC and LDMG members on mobile and monitoring email remotely Ad-hoc reporting

QDMA Activations Table

	QDMC			DDMG			LDMG		
			Communication			Communication			
Stand Up	Significant activations of LDMG/s and/or DDMG/s State wide hazard Significant BoM warnings Prolonged operations Cross agency coordination of tasks required Collation of information & intelligence requirements	SDCC activated Operations plan implemented SITREPS initiated for QDMC Critical Incident Directive activated Appointment of State Recovery Coordinator considered by QDMC	SDCC through land lines & generic email addresses State agencies present at SDCC, on landlines and/or mobiles, monitoring email and producing agency SITREPS	Request for support received from LDCC/s Large threat is imminent with impact in District Coordinated support required Significant State resources committed	Develop situational awareness Pass on urgent warnings Initial Sitrep to SDCC DDCC activated with required staff Roster developed and commenced for DDCC Forward planning commenced SDCC advised DDMG stood up Regular Sitreps provided to SDCC Logistics, operations, planning and administrative cells in place	DDCC contact through established land lines and generic email addresses DDC, XO and DDMG members may present at DDCC (dependant on local arrangements), contact is through established land lines and/or mobiles/ emails	Threat is imminent Community will be or has been impacted Need for coordination in LDCC Requests for support received by LDMG agencies or to the LDCC The response requires coordination	Meeting of LDMG Core Group LDCC activated Rosters for LDCC planned & implemented Commence operational plans Local government shifts to disaster operations LDMG takes full control SOPs activated Core group of LDMG located in LDCC Commence SITREPs to DDMG Distribute contact details DDMG advised of potential requests for support	LDCC contact through established land lines and generic email addresses Chair, LDC and LDMG members present at LDCC, on established land lines and/or mobiles, monitoring emails

QDMA Activations Table									
	QDMC			DDMG			LDMG		
	Triggers	Actions	Communication	Triggers	Actions	Communication	Triggers	Actions	Communication
Stand Down	<ul style="list-style-type: none"> Response activities are concluded 	<ul style="list-style-type: none"> Final Sitrep to QDMC Debrief of SDCC staff Transition from response and recovery to recovery Financial reconciliation 	<ul style="list-style-type: none"> Watch Desk resumes watching brief Agencies not involved in recovery resume standard business & contact arrangements 	<ul style="list-style-type: none"> LDMG/s stood down from response Recovery arrangements functioning 	<ul style="list-style-type: none"> Final checks for outstanding requests Assist LDMG/s to transition to recovery Debrief of staff in DDCC & DDMG members Consolidate financial records Final situation report sent to SDCC Hand over to Recovery Coordinator (If appointed) Return to core business 	<ul style="list-style-type: none"> DDMG members not involved in recovery operations resume standard business and after hours contact arrangements Recovery updates provided to DDMG members 	<ul style="list-style-type: none"> No requirement for coordinated response Community has returned to normal function Recovery taking place 	<ul style="list-style-type: none"> Final checks for outstanding requests Implement plan to transition to recovery Debrief of staff in LDCC Debrief with LDMG members Consolidate financial records Hand over to Recovery Coordinator for reporting Return to local government core business Final situation report sent to DDMG 	<ul style="list-style-type: none"> LDMG members not involved in recovery operations resume standard business and after hours contact arrangements

Annexure C: Levels of Emergency Response (The State Council of The People's Republic of China, 2006)

Level of Alert	Description	Response
I	<ol style="list-style-type: none"> 1. Severe flood occurs in one river basin; 2. Floods occur in multiple river basins simultaneously; 3. Levee breach occurs in the mainstream of big rivers; 4. Collapse of dams occur in key large reservoirs; 5. Extraordinary droughts occur in many provinces (autonomous regions and municipalities); 6. Extremely severe droughts occur in many large cities. 	<ol style="list-style-type: none"> 1. The commander of National Flood Control and Drought Relief Headquarters (NFCDRH) in charge of this disaster, and immediately report to The Party Central Committee, The State Council and other member of NFCDRH. 2. Rescue team and expert team will be sent to disaster areas in 24 hours from NFCDRH and monitor flood in 7 X 24 hours. 3. Ministry of Finance, Ministry of Health, Ministry of Transportation, Ministry of Civil Affairs and other member of NFCDRH provide directly supports such as financial support, health support, transportation support. <p>Each level of Flood Control and Drought Relief Headquarters (FCDRH) report to local government and NFCDRH and organize local resource for flood control.</p>
II	<ol style="list-style-type: none"> 1. Flood occurs in one river basin; 2. Levee breach occurs in the general stream of big rivers; 3. Serious floods occur in several cities (regions) or provinces (autonomous regions and municipalities); 4. Collapse of dams occur in medium-sized reservoirs; 	<ol style="list-style-type: none"> 1. The deputy commander of (NFCDRH) in charge of this disaster, and report to The State Council and other member of NFCDRH in 2 hours. 2. Rescue team and expert team will be sent to disaster areas in 24 hours from NFCDRH and monitor flood in 7 X 24 hours.

	<ol style="list-style-type: none"> 5. A severe drought occurs in several cities (regions, cities) in several provinces (autonomous regions, municipalities) or a major drought occurs in one province (autonomous region, municipality); 6. Serious droughts occur in many large cities, or extreme droughts occur in large and medium-sized cities. 	<ol style="list-style-type: none"> 3. Ministry of Civil Affairs and Ministry of Health provide directly support to disaster area, and other members of NFCDRH provide supports as requests. Each level of Flood Control and Drought Relief Headquarters (FCDRH) report to local government and NFCDRH and organize local resource for flood control.
III	<ol style="list-style-type: none"> 1. Floods occur in several provinces (autonomous regions and municipalities) simultaneously; 2. Flood occurs in one province (district or city); 3. Danger occurs in the mainstream of the big rivers; 4. Large and medium-sized reservoirs are in danger or collapse of dams occur in small reservoirs; 5. Several provinces (autonomous regions and municipalities) have simultaneous moderate drought disasters; 6. Moderate droughts occur in several large cities; 7. A severe drought occurs in one large city. 	<ol style="list-style-type: none"> 1. The secretary general of (NFCDRH) in charge of this disaster, and report to The State Council and other member of NFCDRH in 2 hours. 2. Rescue team and expert team will be sent to disaster areas in 24 hours from NFCDRH and monitor flood in 7 X 24 hours. 3. Each level of Flood Control and Drought Relief Headquarters (FCDRH) report to local government and NFCDRH and organize local resource for flood control.
IV	<ol style="list-style-type: none"> 1. Mild floods occur simultaneously in several provinces (autonomous regions and municipalities); 2. Several provinces (autonomous regions and municipalities) have mild drought at the same time; 3. Danger occurs in the mainstream of big rivers; 	<ol style="list-style-type: none"> 1. The deputy secretary general of (NFCDRH) in charge of this disaster, and report to The State Council and other member of NFCDRH 2. Monitor flood and report to office of NFCDRH

	<p>4. Danger occurs in medium-sized reservoirs;</p> <p>5. Many large cities do not have normal water supply due to drought</p>	<p>3. Each level of Flood Control and Drought Relief Headquarters (FCDRH) report to local government and NFCDRH and organize local resource for flood control.</p>
--	--	--

8. References

- Acreman, M., Farquharson, F., McCartney, M., Sullivan, C., Campbell, K., Hodgson, N., & Lazenby, J. (2000). *Managed flood releases from reservoirs: issues and guidance*. Wallingford: Centre for Ecology and Hydrology.
- Aerts, J. C., Botzen, W., Veen, A., Krywkow, J., & Werners, S. (2008). Dealing with Uncertainty in Flood Management Through Diversification. *Ecology and Society*, 13(1).
- Alexander, D. E. (2002). *Principles of Emergency Planning and Management*. Oxford University Press.
- An Australian Government Initiative. (n.d.). *About us*. Retrieved from An Australian Government Initiative: <https://www.disasterassist.gov.au/Pages/about-us.aspx>
- Anderson, W. A. (1970). Military organizations in natural disaster: established and emergent norms. *American Behavioral Scientist*, 13(3), 415-422.
- Attorney-General's Department. (n.d.). *Emergency Management Australia*. Retrieved from Attorney-General's Department: <https://www.ag.gov.au/EmergencyManagement/Emergency-Management-Australia/Pages/default.aspx>
- Australia Broadcasting Corporation. (2015, February 5). *ABC News*. Retrieved from WA bushfires: Residents refusing to evacuate told crews will not risk their lives for them: <https://www.abc.net.au/news/2015-02-04/house-destroyed-northcliffe-windy-harbour-evacuated-bushfire/6068256>
- Australian Building Codes Board. (2012, February). *Construction of Buildings in Flood Hazard Areas*. Retrieved from Australian Building Codes Board: <http://www.hpw.qld.gov.au/SiteCollectionDocuments/ABCBFloodStandard.pdf>
- Australian National Audit Office. (2014). *Emergency Defence Assistance to the Civil Community*. Canberra.
- Bachner, G., Seebauer, S., Pfurtscheller, C., & Brucker, A. (2016). Assessing the benefits of organized voluntary emergency services: Concepts and evidence from flood protection in Austria. *Disaster Prevention and Management*, 25(3), 298-313.

- Birkholz, S., Muro, M., Jeffrey, P., & Smith, H. (2014). Rethinking the relationship between flood risk perception and flood management. *Science of the Total Environment*, 478, 12-20.
- Bond, N., Costelloe, J., King, A., Warfe, D., Reich, P., & Balcombe, S. (2014). Ecological risks and opportunities from engineered artificial flooding as a means of achieving environmental flow objectives. *Frontiers in Ecology and the Environment*, 12(7), 386-394.
- Brennan, M., Barnett, R. V., & Flint, C. G. (2005). Community Volunteers: The Front Line of Disaster Response. *The International Journal of Volunteer Administration*, 23(4), 52.
- Bubeck, P., Kreibich, H., Penning-Rowsell, E., Botzen, W., Moel, H., & Klijin, F. (2017). Explaining differences in flood management approaches in Europe and in the USA—a comparative analysis. *Journal of Flood Risk Management*, 10(4), 436-445.
- Casimir, G., & Waldman, D. A. (2007). A Cross Cultural Comparison of the Importance of Leadership Traits for Effective Low-level and High-level Leaders: Australia and China. *International Journal of Cross Cultural Management*, 7(1), 47-60.
- Chen, G. (1998). China and Other Countries Flood Control Standards and Measures. *Technical Supervision in Water Resources*, 5, 10-12.
- Chen, T. (2006). The Meaning of Implementation of National Flood and Drought Relief Plan- Interpretation National Flood and Drought Relief Plan 1. *China Flood & Drought Management*, 2, 12-13.
- Cheng, X., Li, N., Wang, Y., & Wang, J. (2010). The Research of Criteria Comparison of Flood warning and Classification. *China Flood Drought Management*, 20(3).
- Chou, C.-H., Zahedi, F. M., & Zhao, H. (2014). Ontology-Based Evaluation of Natural Disaster Management Websites: A Multistakeholder Perspective. *MIS Quarterly*, 38(4), 997-1016.
- Church, N. (n.d.). *Parliament of Australia*. Retrieved from Defence Personnel: https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/BudgetReview201415/DefencePersonnel

- Coates, L., Haynes, K., Gissing, A., & Radford, D. (2014). The Australian experience and the Queensland Floods of 2010–2011. In *Drowning* (pp. 1075-1084). Berlin, Heidelberg: Springer.
- Emergency Management Australia. (2010, September). *NATIONAL CATASTROPHIC NATURAL DISASTER PLAN*. Retrieved from Attorney-General's Department: http://www.aph.gov.au/~media/Estimates/Live/legcon_ctte/estimates/sup_1011/ag/052_EMA_Attachment.ashx
- Federal Emergency Management Agency. (2018, March 26). *Resources & Documents Collections*. Retrieved from Federal Emergency Management Agency: <https://www.fema.gov/media-library/resources-documents/collections>
- Fernandez, L., Barbera, J., & Van Dorp, J. (2006). Spontaneous volunteer response to disasters: The benefits and consequences of good intentions. *Journal of Emergency Management*, 4(5), 57-68.
- Flood Victoria. (2009, October 27th). *Role of Australian Government*. Retrieved from Flood Victoria: <https://www.floodvictoria.vic.gov.au/prepare-prevent/government-and-related-agencies-roles/role-of-australian-government>
- Galloway, G. (2004). *USA: flood management–Mississippi River*. WMO/GWP Associated Programme on Flood Management.
- Gao, X. (2008). The Achievements of Chinese distinctive emergency management system developments. *Chinese Public Administration*, 11, 18-24.
- Government of the United Kingdom. (2016). *National Flood Resilience Review*. United Kingdom Government.
- Green Cross Australia. (2019). *Emergency volunteering – Harden Up - Protecting Queensland*. Retrieved from Green Cross Australia: <http://hardenup.org/help-others/become-a-volunteer/emergency-volunteering.aspx>
- Greet, N. (2008). ADF Experience on Humanitarian Operations: A New Idea? *Security Challenges*, 4(2), 45-61.
- Harris, M., Shaw, D., Smith, C. M., & Hieke, G. (2017). The Involvement/Exclusion Paradox of Spontaneous Volunteering: New Lessons and Theory From Winter Flood Episodes in England. *Nonprofit and voluntary sector quarterly*, 46(2), 352-371.

- Head, B. W. (2014). Managing urban water crises: adaptive policy responses to drought and flood in Southeast Queensland, Australia. *Ecology and Society*, 19(2).
- Heaslip, G. (2012). Challenges of Civil Military Cooperation / Coordination in Humanitarian Relief. In G. Heaslip, *Relief Supply Chain Management for Disasters: Humanitarian, Aid and Emergency Logistics* (pp. 147-172). IGI Global.
- Heaslip, G. (2014). Using the military in disaster relief: systemising challenges and opportunities. *Journal of Humanitarian Logistics and Supply Chain Management*, 4(1), 60-81.
- Hofstede, G., & Bond, M. H. (1988). The Confucius connection: From cultural roots to economic growth. *Organizational dynamics*, 16(4), 5-21.
- Hubei Flood Control and Drought Relief Headquarter. (2016). *Hubei Flood Control and Drought Relief Pland*. Wuhan: Hubei Flood Control and Drought Relief Headquarter.
- Insurance Council of Australia. (2012). *current and historical disaster statistics*. Insurance Council of Australia.
- Jiang, S. (2013). Conflict and Coordination between the Humanitarian Principle and the Sovereignty in International Disaster R esponse Law. *Science Economy Society*, 31(132), 126-132.
- Kapucu, N. (2011). The Role of the Military in Disaster Response in the US. *European Journal of Economic & Political Studies*, 4(2).
- Khalili, S., Harre, M., & Morley, P. (2015). A temporal framework of social resilience indicators of communities to flood, case studies: Wagga wagga and Kempsey, NSW, Australia. *International Journal of Disaster Risk Reduction*, 13, 248-254.
- Ma, Z. (2006). Status and Characteristic of Flood disperse and storage area in China and Other Countries. *Heilongjiang Science and Technology of Water Conservancy*, 34(6), 90-91.
- McLennan, J., & Birch, A. (2005). A potential crisis in wildfire emergency response capability? Australia's volunteer firefighters. *Environmental Hazards*, 6(2), 101-107.
- McMaster, R., & Baber, C. (2012). Multi-agency operations: Cooperation during flooding. *Applied Ergonomics*, 43(1), 38-47.

- Meijerink, S., & Dicke, W. (2008). Shifts in the Public–Private Divide in Flood Management. *Water Resources Development*, 24(4), 449-512.
- Ministry of Civil Affairs of the People's Republic of China. (2016, January 1). *2016 National Natural Disaster Basic Information from China National Office for Disaster Reduction*. Retrieved from Ministry of Civil Affairs of the People's Republic of China: <http://www.mca.gov.cn/article/zwgk/mzyw/201701/20170100002965.shtml>
- Ministry of National Defense of the People's Republic of China. (2015, September 11). *China receives complimentary from worldwide by disarmament 300,000*. Retrieved from Ministry of National Defense of the People's Republic of China: http://www.mod.gov.cn/intl/2015-09/11/content_4619049.htm
- Moore, S. (2018). The political economy of flood management reform in China. *International Journal of Water Resources Development*, 34(4), 566-577.
- Murray Darling Basin Authority. (n.d.). *Running the River Murray*. Retrieved from Murray Darling Basin Authority: <https://www.mdba.gov.au/river-information/running-river-murray>
- Nanfang Daily. (2008, June 17). *Guangdong Facing the challenge of Flood-Pearl River Delta 1/50 years Flood*. Retrieved from People's Daily Online: <http://society.people.com.cn/GB/8217/120914/120915/7390586.html>
- North Carolina Department of Public Safety. (n.d.). *State EOC Activation Levels*. Retrieved from North Carolina Department of Public Safety: <https://www.ncdps.gov/our-organization/emergency-management/em-operations/state-eoc-activation-levels>
- NSW Environment & Heritage. (2018, August 17). *Hunter Valley Flood Mitigation Scheme*. Retrieved from Office of Environment & Heritage: <https://www.environment.nsw.gov.au/topics/water/floodplains/hunter-valley-flood-mitigation-scheme>
- NSW State Emergency Service. (n.d.). *Lower Hunter Flood Mitigation Scheme*. Retrieved from NSW State Emergency Service: http://archive.ils.nsw.gov.au/__data/assets/pdf_file/0009/496566/archive_factsheet_3_lower-hunter-flood-mitigation-scheme.pdf

- Office of National Flood Control and Drought Relief Headquarters. (n.d.). *Office of National Flood Control and Drought Relief Headquarters*. Retrieved from Office of National Flood Control and Drought Relief Headquarters: <http://fxkh.mwr.gov.cn/>
- Parker, D. J. (2004). Designing Flood Forecasting, Warning and Response Systems from a Societal Perspective. *Meteorologische Zeitschrift*, 13(1), 5-11.
- Penning-Rowsell, E., & Wilson, T. (2006). Gauging the impact of natural hazards: the pattern and cost of emergency response during flood events. *Transactions of the Institute of British Geographers*, 31(2), 99-115.
- Pettit, S., & Beresford, A. (2005). Emergency relief logistics: an evaluation of military, non-military and composite response models. *International Journal of Logistics: Research and Applications*, 8(4), 313-331.
- Queensland Fire and Emergency Services. (2018, January). *Prevention Preparedness, Response and Recovery Disaster Management Guideline*. Retrieved from Disaster Management: <http://www.disaster.qld.gov.au/dmg/Documents/QLD-Disaster-Management-Guideline.pdf>
- Queensland Floods Commission of Inquiry. (2011). *Protocol for the Communication of Flooding Information for the Brisbane River Catchment - including Floodwater Releases from Wivenhoe and Somerset Dams*. Retrieved from Queensland Floods Commission of Inquiry: http://www.floodcommission.qld.gov.au/__data/assets/file/0019/3880/Morris_Kennet_h_BCC_KJM-02.PDF
- Queensland Government. (2016, September). *Queensland State Disaster Management Plan*. Retrieved from Disaster management: <http://www.disaster.qld.gov.au/Disaster-Resources/Documents/Queensland-State-Disaster-Management-Plan-2016.pdf>
- Rogers, P. (2011). Development of resilient Australia: enhancing the PPRR approach with anticipation, assessment and registration of risks. *Australian Journal of Emergency Management*, 26(1), 54.
- Salter, J. (1997). Risk management in a disaster management context. *Journal of Contingencies and Crisis Management*, 5(1), 60-65.

- Seqwater. (2016, October 14). *Wivenhoe Dam and Somerset Dam Mannual of Operational Procedures for Flood Mitigation*. Retrieved from Seqwater: <https://www.seqwater.com.au/s3fs-public/PDF%20Documents/Flood%20reports%20and%20manuals/22%2011%202016%20Manual%20WivSom%20-%20Rev14%20-%20Final.pdf>
- Shah, M. A., Rahman, A., & Chowdhury, S. H. (2017). Sustainability assessment of flood mitigation projects: An innovative decision support framework. *International Journal of Disaster Risk Reduction*, 23, 53-61.
- Shanks, G., Parr, A., Hu, B., Corbitt, B., Thanasankit, T., & Seddon, P. (2000). Differences in critical success factors in ERP systems implementation in Australia and China: a cultural analysis. *ECIS 2000 Proceedings* (p. 53). Association for Information Systems.
- Smith, J., Baeck, M. L., Villarini, G., Wright, D. B., & Krajewski, W. (2013). Extreme Flood Response: The June 2008 Flooding in Iowa. *Journal of Hydrometeorology*, 14(6), 1810-1825.
- Smith, P., McLuckie, D., & Spliethoff, C. (2014). *Adapting International Best Practice to the Design of Australian Levees*. Retrieved from Floodplain Management Australia: <https://www.floodplainconference.com/papers2014/Philip%20Smith.pdf>
- Smith, W., & Dowell, J. (2000). A case study of co-ordinative decision-making in disaster management. *Ergonomics*, 43(8), 1153-1166.
- Special Broadcasting Service. (2017, March 26). *Qld residents refuse to evacuate*. Retrieved from SBS News: <https://www.sbs.com.au/news/qld-residents-refuse-to-evacuate>
- Stilwell, F., & Troy, P. (2000). Multilevel Governance and Urban Development in Australia. *Urban Studies*, 37(5-6), 909-930.
- Tang, c. (2009). The comparison of China and America military participate emergency management case analysis. *China Emergency Rescue*, 36-40.
- The Central People's Government of the People's Republic of China. (2006, July 27). *Strengthen Flood Disperse Areas Management and Construction*. Retrieved from The Central People's Government of the People's Republic of China: http://www.gov.cn/ztl/2006-07/27/content_347176.htm

- The National People's Congress of the People's Republic of China. (2000, November 25). *Interpretation of Flood Control Law of the People's Republic of China*. Retrieved from The National People's Congress of the People's Republic of China: http://www.npc.gov.cn/npc/flsyywd/xingzheng/2000-11/25/content_8417.htm
- The National Peoples's Congress of the People's Republic of China. (2016). *Flood Control Law of the People's Republic of China (Revised in 2016)*. Retrieved from The National Peoples's Congress of the People's Republic of China: http://www.npc.gov.cn/wxzl/gongbao/2016-08/22/content_1995691.htm
- The State Council and the Central Military Commission. (2005, July 1). *Regulation on the Military Participation in Disaster Rescue*. Retrieved from The Central People's Government of the People's Republic of China: http://www.gov.cn/zwgk/2005-06/24/content_9347.htm
- The State Council of the People's Republic of China. (2005, 09 27). *Flood Control Regulations People's Republic of China*. Retrieved from The State Council of the People's Republic of China: http://www.gov.cn/flfg/2005-09/27/content_70634.htm
- The State Council of The People's Republic of China. (2006, January 1). *National Flood and Drought Relief Plan*. Retrieved from The Control People's Government of the People's Republic of China: http://www.gov.cn/yjgl/2006-01/11/content_155475.htm
- The State Council of the People's Republic of China. (2017, September 06). *Regulation on Voluntary Services*. Retrieved from The State Council of The People's Republic of China: http://www.gov.cn/zhengce/content/2017-09/06/content_5223028.htm
- Tim, Y., Pan, S. L., Ractcham, P., & Kaewkitipon, L. (2017). Digitally enabled disaster response: the emergence of social media as boundary objects in a flooding disaster. *Information Systems Journal*, 27(2), 197-232.
- Tingsanchali, T. (2012). Urban flood disaster management. *Procedia engineering*, 32, 25-37.
- Wang, J., & Li, H. (2017). The obligation of cooperation between disaster area government and volunteers . *Journal of Southwest University for Nationalities*, 96-101.
- Wang, Y. (2018, March). *The Statement of The State Council Reform Plan* . Retrieved from The State Council of The People's Republic of China: http://www.chinasafety.gov.cn/sykp wz/201803/t20180313_179477.shtml

- Wang, Y., Chi, F., & Chen, A. (2016). Difference of Emergency Cultures between China and Some Foreign Countries. *Journal of Catastrophology*, 31(4), 226-234.
- Wenger, C. (2015). Building walls around flood problems: The place of levees in Australia flood management. *Australasian Journal of Water Resources*, 19(1), 3-30.
- Wetmore, J. M. (2007). Distributing risks and responsibilities: Flood hazard mitigation in New Orleans. *Social Studies of Science*, 37(1), 119-126.
- Whittaker, J., McLennan, B., & Handmer, J. (2015). A review of informal volunteerism in emergencies and disasters: Definition, opportunities and challenges. *International journal of disaster risk reduction*, 13, 358-368.
- Xue, L. (2007). Authorization system-an explanation of the relationship between central government and local governments in contemporary China. *Social Sciences in Yunnan*(5), 18-22.
- Yang, X., & Xing, C. (1999). The Enlightenment and the Relationship of Central and Local Governments in Western Countries. *Journal of Political Science*, 2, 30-39.
- Zhan, Y. (2008). International Aid for Disaster Rescue: controversy and thinking. *Disaster Reduction in China*(6), 42-43.
- Zhang, H. (2002). Central-local Relationship as Two Classifications under Unitary State System-on developing balance under China's centralized central-local relationship. *Hebei Law Science*, 20(1), 12-16.
- Zhang, W. (2011). An Empirical Analysis on Volunteer Management in Contemporary China and its Problems. *Journal of Graduate School of Chinese Academy of Social Sciences*, 26-32.
- Zhang, Z., & Yuan, P. (2014). A case study of flood rescue in northeast China in 2013. *China Emergency Rescue*, 3, 35-38.
- Zhu, Y., Ai, X., & Xi, X. (2008, May 23rd). *The first warrior Li Zhenbo who jumped from 4999 meters high during Wenchuan Earthquake Rescue returned to Chengdu*. Retrieved from The Central People's Government of the People's Republic of China: http://www.gov.cn/gzdt/2008-05/23/content_989693.htm