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A policy framing perspective

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Collaborative spatial planning in the face of flood risk in delta cities: A policy framing perspective

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ABSTRACT

Integration of flood risk in spatial planning is increasingly seen as a way to enhance cities' resilience to the growing flood hazards, albeit its operationalisation remains challenging. This study aims to explain the reasons for this difficulty through the case study of Guangzhou, a Chinese delta city that is highly vulnerable to coastal, fluvial and pluvial flooding, particularly in the context of a changing climate and rapid expansion of the urban fabric. It does so by investigating the recognition of flood risk in spatial planning and vice-versa, of spatial issues in the flood risk management field, using framing analysis. The paper reveals that the integration of flood risk concerns in spatial planning in Guangzhou remains an emerging process, gradually shifting from informal to formal activities grounded in legislation. This happens through percolation of framing discourse from the flood risk management policy to spatial planning, leading to changes in problem setting, action scripts and the prescribed governance arrangements in the planning discourse. The vagueness of governance arrangements, however, undermines the integration of flood risk management in spatial planning.

1. Introduction

Flood risk, substantially increased by climate change, is affecting cities across the world. The Inter-governmental Panel on Climate Change (IPCC) Fifth Assessment Report predicts the rise in temperature from 2 °C to 4 °C for the worst scenario (IPCC, 2013). The rising temperature may increase the frequency of storms, precipitations and the extent of ice cap's melting, contribute to the occurrence of pluvial, fluvial flooding and coastal flooding, and, finally, pose a considerable threat to the safety and social-economic development by causing significant losses.

Given those climate science predictions, a close collaboration across disciplines is needed to address cross-cutting flood issues (see e.g. Storbjörk, 2007; Sayers et al., 2013; Ward et al., 2013). Spatial planning is, in this context, drawn into the complex flood affairs governance to raise the cities' ability to face the impacts of climate change and avoid or reduce the hazards from potential floods, by, for instance, locating suitable types of land use, arranging activities across spatial scales and shaping the built environment (see e.g. White and Richards, 2007; Gersonius et al., 2008; Roggema, 2014). However, incorporating flood risk and climate change science insights into spatial planning is a challenging task, and, consequently, flood affairs tend to be underestimated by planners (e.g. Carter et al., 2005). Moreover, research has identified a range of institutional barriers to integrating climate adaptation into planning (Walker et al., 2015; Dąbrowski, 2018). To work, it requires mainstreaming those issues into national overarching policy framework and into local policies to mobilise commitment to the climate adaptation goals (White and Richards, 2007).

As a tool to influence planning practice, policy discourse stands out. It makes a difference by constructing policy problems, setting proposals for planning practice, and shaping subjective values, beliefs, perceptions and political concerns in a followed decision-making response (e.g. Bacchi, 2000). These reflections in policy discourse are named as a 'framing pattern' in brief in this research. We argue that this pattern matters for the mainstreaming. Until appropriate knowledge is clearly defined in formal documents, the problem of downplaying flood risk by planners will persist.

To elaborate on our contention, delta cities are selected as the main focus of this paper. They are engaged with a high possibility to be affected by floods due to their location in low-lying floodplains and dense

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watercourses (Meyer et al., 2010; Meyer, 2014). What is more, the potential loss could be further amplified by socio-economic activities in terms of high-value assets and densely concentrated population (see e.g. Hanson et al., 2011; Hallegatte et al., 2013). As for the studied Guangzhou case (Fig. 1), it is a deltaic city, ranking the second in global cities exposed to the flooding risk (Hallegatte et al., 2013, see more details in Section 2). However, climate change and growing flood risk has still been limited recognised in the local planning system, and flood affairs are normally left to the professionals in the flood risk management authorities[1] (Francesch-Huidobro et al., 2017). The newly launched National Sponge City Programme in 2014 are supposed to change such neglect of warning on climatic hazards and reluctant participation. As a major turning point, the programme aims to render Chinese cities more resilient to major pluvial floods through spatial planning working in close collaboration with other policy fields, for instance, the flood risk management, economic planning, or transportation (Meng et al., 2018). This paper is produced in this context at the time when the Guangzhou Sponge City Plan 2016–2030 (SCP), a local response to this national programme, has been launched in late 2017 (see Section 3.2).

To explore the changes in framing in the policy discourse between traditional planning policies, the Sponge City Plan (SCP) and flood risk management policies, three research questions are proposed. First, how are flood affairs acknowledged in the traditional spatial planning system? Second, how the SCP innovatively framed flood concerns? Third, how, if at all, do specific components of flood risk management policy discourse penetrate into spatial planning, and affect these new features in the SCP? Our findings, initially, add to the literature on the science-policy interface (e.g. G. Dunn et al., 2018, 2017), by investigating how the policy formulation process in spatial planning incorporates the insights derived from climate change science. Further, it responds to the calls made in previous studies for integrating spatial planning and flood risk management in flood-prone areas (Francesch-Huidobro et al., 2017), by pointing to ways in which coordination and interaction across these fields could be facilitated.

The next section outlines the flood risk in Guangzhou case, which is followed by a conceptual framework and methodology used for framing analysis in Section 3. Then Section 4 traces the changing discourse on flood affairs in spatial planning documents, and explains the underlying sources of these changes by comparing the innovations of spatial planning with external flood risk management discourse. The paper concludes with a summary of the main findings and implications for practice and future research.

2. Guangzhou: a deltaic city at risk

Guangzhou, with an area of 7434 km^2, is located at the confluence of the East and North branches of the Pearl River. As a metropolis in the Pearl River Delta (PRD), it is one of the first-tier cities in China, having administrative priority, significant international trade links and being a logistics hub for Guangdong province and the PRD region (Wong et al., 2006). In 2016, it boasted a GDP of 1960 billion RMB and a population of 14 million (Guangzhou Statistics Bureau, 2016).

Guangzhou is, however, extremely vulnerable to flooding. The thorniest problem is the pluvial flooding in the city centre. Fig. 2 (left) shows the latest reported locations of waterlogging 'black points' (Guangzhou Government, 2017). Apparently, they concentrate in the old city centre; high-density development in this area has brought too much paving surface, with 87.5% of the surface ground, on average, impervious (Li et al., 2015; Guangzhou Water Affairs Bureau, 2015). The paving surface hinders the infiltration of rainwater and contributes to the increase of the surface runoff at the source; this situation is even worsened by the low discharge ability of the outdated pipe system (Wu, 2010). As a result, it is difficult for Guangzhou' dense built environment to cope with the rainfalls in extreme weather, which happens increasingly frequent due to climate change (Wu, 2010).

In addition, coastal and fluvial flooding will become another major threat if climate change impacts are not taken into account in the steering of future urban development. Even though the local authorities hold a positive view of the decent defence capacities of structural infrastructure (Interviews 7 & 8), like North and East River dykes, many research have warned the potential loss of Guangzhou due to its location at the estuaries of several rivers meeting in the South China Sea (e.g. Carmona et al., 2014). As early as 2002, the *China National Marine Basic Information Network Service System* elaborated four scenarios predicting the inundated areas due to the rising sea level. It indicated, in particular, that the Southern part of Guangzhou faces severe flooding risk in the future as a result of climate change (Chinese Academy of Science, 2002). A later study corroborated this by estimating a 30 cm sea level rise between 2000 and 2030 threatening the Southern part of Guangzhou (Huang et al., 2004), where major urban extensions are planned. Guangzhou, in fact, occupies the first position in terms of exposure to climate change related to the flood risk around the world in 2050, considering the population and assets at risk (Hallegate et al., 2013). The Sponge City Plan for Guangzhou does reconfirm those flood issues and indicates that a vulnerable area of 970 km^2, mainly located in the Southern districts (e.g. Nansha) (Guangzhou Government, 2017, see also Fig. 2 right).

3. Framing in policy discourse

3.1. The conceptual framework

This study borrows ideas from Hulst and Yanow's research on the framing analysis, which is used to understand policy interactions and controversies between two or more actors in the governance network (2016). Accordingly, framing concentrates on three major aspects. First, it is a problem-setting process, in which specific phenomena are defined and converted into explicit challenges to address into the political arena. Second, framing is also an interactive process, in which actors form their own action scripts by reacting to the choices made by others; by this, problem-setting is linked to problem-solving, enabling a leap from the sense-making of the present situation to what needs be done about it. Third, framing is also a reconceptualising process for the governance arrangement. By claiming the actors` identity, for instance, the scope of powers and responsibilities in a governance setting, it affects patterns of benefit-sharing and modes of interactions and communications.

This paper conceptualises policy framing along those three functions and explores them through the prism of six categories (Fig. 3): (1) the causes and (2) attitudes in problem-setting; (3) the goals and (4) proposed options in action scripts; (5) the roles of actors and (6) interaction patterns in the re-conceptualisation of flood governance. Admittedly, many other components are relevant for the framing process, such as the desirable ways to resolve conflicts, power construction and reconstruction, social orders of institutions and dependence on other participants (Goffman, 1981; Golec and Federico, 2004; Lewicki et al., 2003; Donohue, 2001; Dewulf et al., 2009). However, it is impossible to cover such a diverse range of components in one article, not to mention that many of those components cannot be traced easily in policy documents.

The discussion of problem setting tries to explore what foundations may affect the agenda setting in the policy-making process. On the one hand, the flood risk in delta cities is not merely a problem of natural or climate hazards but also related to the water system stemming from urbanisation, land-use patterns and hydraulic infrastructure construction (Meyer, 2014). Comprehensive problem setting might contribute to

[1] Flood risk management here refers to a process concerned with risk analysis, risk assessment and interventions for risk reduction aiming at mitigating and preventing the negative impact of flooding (see e.g. Schanze Jochen et al., 2007).

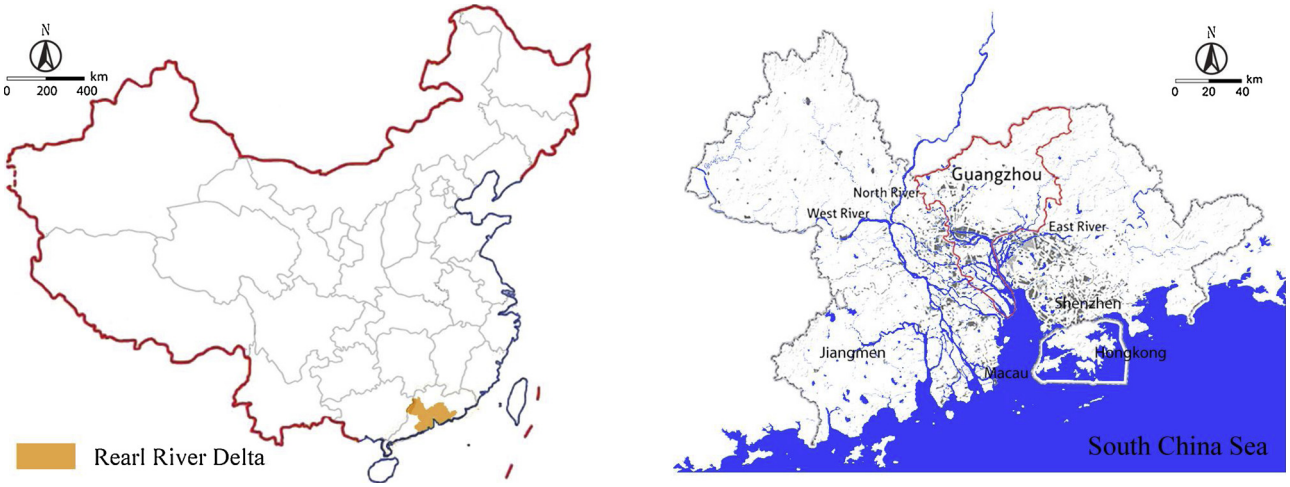

Fig. 1. The location of the Pearl River Delta (left) and Guangzhou (right).
Source: Author, based on Urban-Rural Integration Plan of the Pearl River Delta 2009–2020, Issued by the People`s Government of Guangdong Province

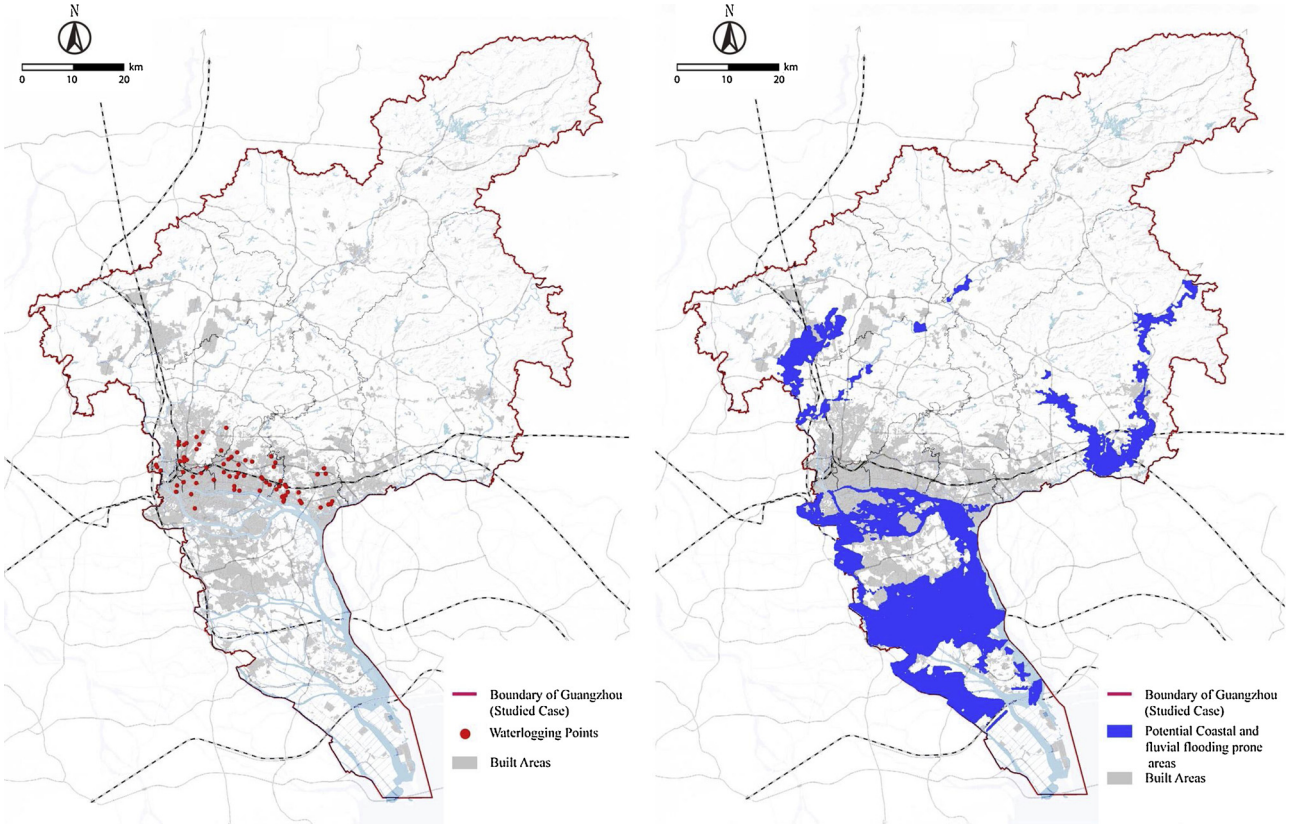

Fig. 2. The waterlogging points in Guangzhou (left), and the areas prone to potential coastal and fluvial flooding (right).
Source: Authors, based on Guangzhou Sponge City Plan 2016–2030

a corresponding response, while partial sense-making might lead to a biased reaction. On the other hand, gain or positive framing can contribute to an opportunity-seeking behaviour in the face of challenges and risks, while a loss or negative framing tends to relate to risk-seeking behaviours and reluctance to invest efforts in mitigating risk (Neale and Bazerman, 1985). Based on this, framing flooding affairs as opportunities (positive) might portray flood mitigation as a promising option and attract the interest from potential stakeholders, while a loss framing (negative) might lead to avoidance of responsibilities.

The dimension of action scripts aims to explore what goals are set and what options are stated. It is built on the notion that both structural and non-structural measures are crucial, while the latter brings opportunities for spatial planning. The flood control infrastructure (a structural option) is costly and might lead to a false impression of being well-protected with no need to prepare for the impacts of climate change (IPCC, 2007). When sudden inundation happens, inhabitants would encounter a great loss with little knowledge on how to handle it. Further, the traditional underground discharge-dependent system (a structural option) may be insufficient in the face of the increasing strength of thunderstorms and it is hard to update such a system in a built-up area as well. By contrast, non-structural options in spatial planning such as natural water storage, zoning, or building regulations

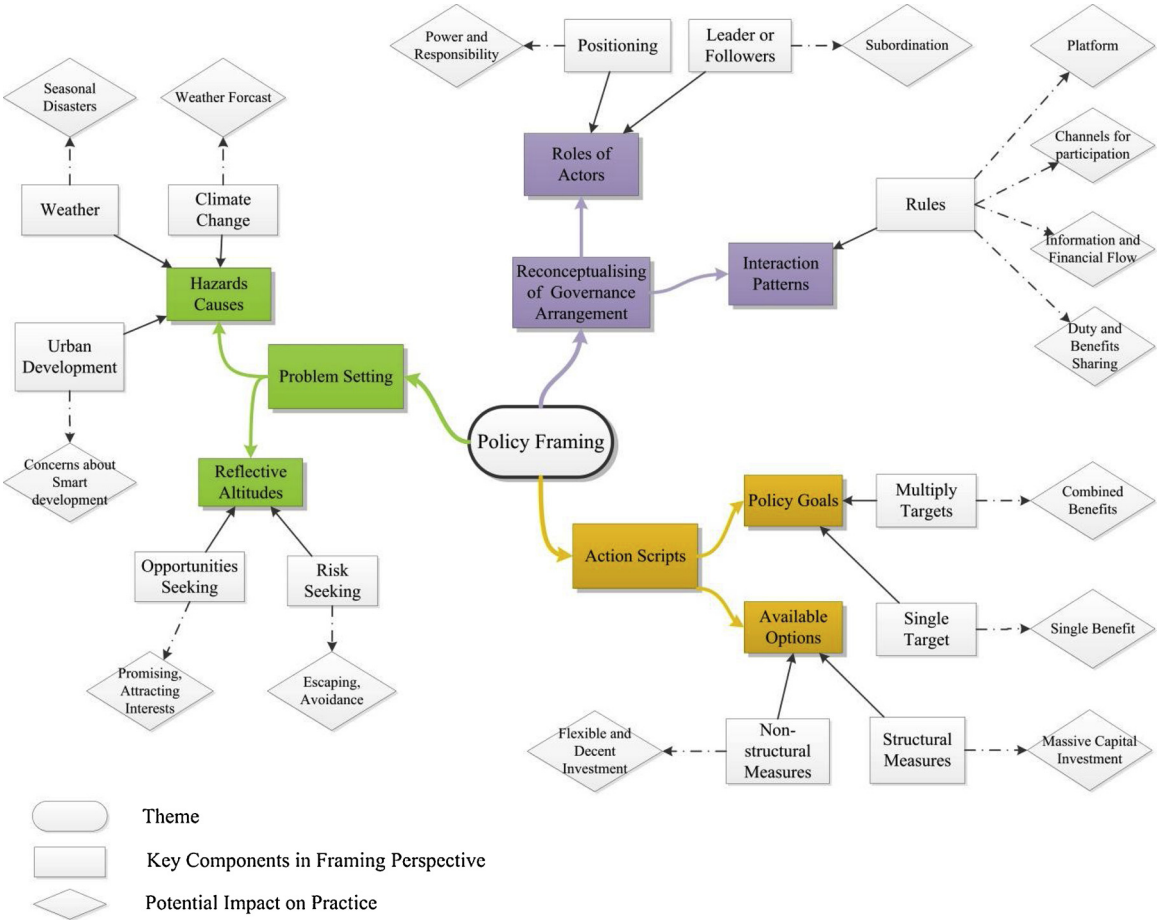

Fig. 3. Framework for the framing analysis of the spatial planning and flood risk management policy discourse, with key components shown in green, yellow and purple colours.
Source: Authors, based on (Hulst Van and Yanow, 2016)

can enhance the capacity to respond to flood risk with a relatively low cost and be operationalised more easily (Traver, 2014).

Reconceptualising of governance arrangement relates to the concern that whether spatial planners are self-believed or believed as a game player in flood governance, and how they are supposed to work with other players. Unlike a clear declaration of power and responsibility of an actor in official documents, a vague description may result in weak enforcement and leave a grey area for the potential participators to choose to be or not to be. In that case, spatial planning might be inclined to keep themselves out of water affairs, leaving them to the environmental or water management institutions (Herk Van et al., 2011). Likewise, a definite description of the interaction mechanism of participants in discourse clues the agreed rules about knowledge, benefit and responsibility sharing. Policy discourse is, thus, regarded a foundation in shaping the participants' values and common grounds (Rein and Schon, 1996; Forester, 2012).

3.2. Data sources and methods

Data for this study is drawn from a range of formal documents across spatial planning and flood risk management documents from 2000 to present (Table 1 shows the details). Two master plans, the 2000–2010 version (MP1) and 2010–2020 version (MP2), and the newly launched Sponge City Plan (SCP) are chosen for the analysis in the field of spatial planning. In the Chinese context, a master plan is produced by the municipal planning authorities under the supervision of local municipal governments. It is traditionally regarded as the most important document steering urban development in terms of population size, land use pattern, industrial programs, urban safety, flood affairs, etc. (Yu, 2014). The MP1 and MP2 are investigated as the reflection of traditional planning discourse in the face of flood risk. By contrast, the SCP is formulated in response to the National Sponge City Programme. As an 'alien' spatial plan, it is compiled by a joint work from the Urban Planning Bureau and Water Affairs Bureau, and specifically, put floods concerns to the first priority. Consequently, this document is a flood thematic spatial plan with detailed guidance on water affairs.

In parallel, three hydrological policies after the 2000s were studied as the supplementary materials (see the Table 1), including the Canals and Waterways Renovation Program 2005–2020 (CWR), Rainwater Discharge System Comprehensive Plan 2008–2020 (RDS) and Flood Defence and Rainwater Discharge Plan 2010–2020 (FDRD). They are the key reference policies directly related to water affairs and used by local authorities to formulate the local SCP in terms of pluvial, fluvial and coastal floods in past ages (interview 13).

The analysis firstly entailed coding the three framing components in the formal documents, including problem-setting, action scripts and reconceptualising of governance arrangement. Based on that, the traditional master plans (MP1 and MP2) and the Sponge City Plan (SCP) are compared to explore the distinctions, which reveal the innovations in the realm of spatial planning (see Sections 4.1.1 and 4.1.2). This is followed by a comparison between the innovative discourse in spatial planning and counter-part in flood risk management documents to seek the common ground between them (see Section 4.2.1). Here, similarity indicates a process of percolation of ideas from flood risk management to spatial planning. Section 4.2.2 points out the mismatch framing in the SCP, which indicates the current limits and potential future work.

Table 1
Relevant documents on spatial planning and Flood risk management in Guangzhou.
(sources: Guangzhou Government, 2005, 2016; Guangzhou Water Conservancy Bureau, 2007; Guangzhou Water Affairs Burea, 2012, 2013; Guangzhou Government, 2017)

Issued dates	Documents	Types of floods	Themes	Reviewed by (key actors)
Spatial plan policy documents (SP)				
2005	Guangzhou Master Plan 2000-2010 (MP1)	Fluvial, pluvial and coastal flooding	Overall rural and urban development, which concentrates on economic development, land uses, and infrastructure construction, etc	Urban Planning Bureau
2016	Guangzhou Master Plan 2010-2020 (MP2)	Fluvial, pluvial and coastal flooding		Urban Planning Bureau
2017	Guangzhou Sponge City Plan2016-2030 (SCP)	Fluvial, pluvial and coastal flooding	Integrated policy in terms of flood risk and urban development	Urban Planning Bureau (leader), Urban Water Affairs Bureau
Flood risk management policy documents (FRM)				
Issued dates	Documents	Types of floods	Themes	Reviewed by (key actors)
2007	Canals and Waterways Renovation Program 2005-2020 (CWR)	Fluvial and pluvial flooding	Canals dredging, environment Improvement and waterlogging discharge	Water Conservancy Bureau (predecessor of the Urban Water Affairs Bureau)
2012	Overall Plan of Guangzhou Rainwater Discharge System(2008-2020)(RDS)	Fluvial flooding	Rainwater discharge plan	Urban Water Affairs Bureau
2013	Flood Defence and Rainwater Discharge Plan (2010-2020) (FDRD)	Fluvial, pluvial and coastal flooding	Reinforcing flood defence infrastructure, preventing the loss of tide and rainwater discharge	Urban Water Affairs Bureau

Admittedly, due to the limited access to data, this study is unable to cover all official documents after 2000, which have a close association with the current planning system. Thus, it merely concentrates on the major documents that related to flood risk issues, spatial planning and the latest flagship policy SCP. In addition, there are typically some gaps between the glossy and positive discourse in the documents and the reality on the ground, when it comes to implementation. The framing analysis based on documents does not show how the frames in the documents are interpreted and understood by the local stakeholders. To address these issues, we conducted interviews to enrich and triangulate the insights of framing analysis, by providing first-hand accounts from a variety of stakeholders. Twelve semi-structured interviews (Appendix A), representing different policy sectors, researchers and societal groups, have been conducted to mitigate the typical limitation of interview as a research method, namely the bias related to subjective accounts given by the interviewees, including officials from Urban Land Resources and Urban Planning Committee, Urban Water Affairs Bureau, experts from state-owned spatial planning and flood risk management planning and design institutions, directly related to the policy formulation, and academic experts in the fields of spatial planning, urban design, hydrology and civil engineering.

4. Results and discussion

Table 2 is the result of the investigated documents in terms of six categories in policy framing. The followed Section 4.1 is the major findings directly presented by this table, which reveal an underplay of the flood risk in the Master Plan 2000–2010 (MP1) and Master Plan 2010–2020 (MP2) while a leap-forward of acknowledgement in the Sponge City Plan (SCP). Section 4.2 is a deduction based on Table 2, which explores, to what extent, if at all, there is any evidence of cross-fertilisation between flood risk management policies and the planning field.

4.1. Changing policy framing in spatial planning

4.1.1. Underestimation of flood risk in masterplans: Master Plan 2000–2010 (MP1) and Master Plan 2010–2020 (MP2)

In the traditional planning discourse in Guangzhou, flood affairs are not the main focus. They are normally given a low priority and merely discussed in general under the subtitle of ‘flooding prevention and rainfall discharge’, a section of the chapter ‘public safety and disaster prevention.’ The analysis of the Master Plan 2000–2010 (MP1) and Master Plan 2010–2020 (MP2) in this section illustrate such neglect among planning documents.

4.1.1.1. Problem setting. First of all, the agenda has not been fully set up. Causes of the flood risk have been limited discussed in initial master plans. The MP1 even lacks the acknowledgement; the policy discourse merely hints an uncontrolled natural hazards sense-making and entails the worries about pluvial, pluvial and coastal flood events. The MP2 enriches this topic by bringing the incapacity of hydrological infrastructure and overexpansion of urban size ahead of flood events (Guangzhou Government, 2016, p. 442–445); it reveals the insufficient protection by substandard dykes, riverbanks and outdated underground pipe system, and mentioned the degraded self-adjustment by open canals system and natural lakes during the urban erosion. Yet, the underlying reasons behind flood events, for instance, climate change and unsuitable urban development pattern are blank, still an elephant in a room.

Soon to come is the dominant negative altitude (albeit with some nuance in the MP2). In the MP1, floods are merely regarded as a natural threat impairing the safety of residents. Correspondingly, the construction of flood mitigation infrastructures is singled out as a way to reduce the potential damages. The MP2 makes an advance here by intentionally linking reducing flood risk to urban development

Table 2
Policy framing in spatial planning and flood risk management.
(sources: Guangzhou Government, 2005, 2016; Guangzhou Water Conservancy Bureau, 2007; Guangzhou Water Affairs Burea, 2012, 2013; Guangzhou Government, 2017)

	Issues in content	Spatial planning policies				Flood risk management policies	
		MP1	MP2	SCP	CWR	RDS	FDRD
Causes of flood risk	Natural hazards	○	●	●	●	●	●
	Ageing and weakness of structural hydrological infrastructure		●	●	●	●	●
	Erosion of the open water system in urban sprawl		●	●	●	●	●
	Increase in paving and decrease of infiltrating areas due to the high-density development			●			●
	Climate change			●			●
	Urban expansion into flood-prone areas						●
Attitudes towards flood issues	Loss / negative framing	●				●	
	Opportunity / positive framing		○	●	○		●
Goals setting of agendas	Raising the capacity of structural hydrological infrastructure for flood resilience	●	●	●	●	●	●
	Reducing the surface runoff by responsible development patterns concerning permeable land intensity			●		○	
	Good spatial quality, concern for environment and ecology	○		●	○		●
Responsive options	Reinforcing the dykes and sluices	●	●	●	●		●
	Retrofitting the underground pipe system	●	●	●		●	●
	Dredging open canals and constructing artificial lakes	●		●	●		●
	Raising the ground altitude in low-lying areas when necessary	●		●			
	Limiting encroachment on the existing waterways	●		●	●		●
	Protecting the green and blue infrastructures from the erosion by urban sprawl			●	○		●
	Regulating the density of permeable land (e.g. vegetative cover in public space and building roof, swales, grassed channel, permeable paving, detention ponds) and impermeable land (e.g. asphalt)			●		○	
Positions of involved actors	Spatial planning authority			●			
	Water affairs authority			●	●	●	●
	Other supporting authorities			●			
Interaction pattern between actors	Interaction between professions		○	○			
	Interaction within a profession				○	○	○

○ indicates that the notion or a similar one is merely proposed in passing with insufficient details, e.g. in one or two sentences.
● indicates that the notion or similar notion is covered extensively, e.g. described using examples with explanation on how to apply them.
blank space indicates that this notion or a similar notion is not mentioned in the document.

(Guangzhou Government, 2016). Apart from an emphasis on safety concerns from flooding defence infrastructure and water discharge system, it suggests in brief that implementing flood resolving projects 'should be bounded with developing urban areas' and simultaneously 'improving water quality […] enhancing ecological environment […] and shaping cultural identity' (p. 445). Such a description hints a subtle transition to a positive framing, which reappears remarkably in the SCP (see Section 4.1.2).

4.1.1.2. Action scripts. Further, the goals setting and responsive options in action scripts are unprepared. Single target setting is remarkable in the MP1, which strongly concentrates on engineering solutions to reduce flood loss. Even though the MP2 tends to frame flood reactions as a multi-objective issue, at best, linked to an improvement of ecological, environmental and social circumstances (Guangzhou Government, 2016, P 445), it seems more like a one-sentence slogan, with no further explanation.

When it comes to the stated options, structural options are privileged, with penny concerns for non-structural measures. The MP1 does not propose any systematic options to resolve flooding. Different options are merely mentioned in passing. The scattered content across the document discloses the attention to the structural measures such as dykes and pipe system, while mentioning in passing modest non-structural measures such as the rise of ground altitude for new building projects and the prevention of encroachment on waterways as a result of the urban sprawl (p. 51, 52, 99, 126). The options listed in the MP2 seems narrowly defined in comparison to the MP1. They focus on structural measures, while the previous non-structural options related to open waterways, lakes and water retention areas are neglected in this document (p. 442–447).

4.1.1.3. Reconceptualising of governance arrangements. The weakness in positioning and clarifying involved actors in governance arrangement is another reflection of the underestimated flood affairs. In fact, the definition of flood-relevant actors is totally missing in the MP1. A similar situation arises in the MP2, which merely cover one vague sentence claiming that "water administration institutions could contribute to enhancing water safety, water purification and waterfront environment improvement" (Guangzhou Government, 2016, p.445), without any mention of the role of spatial planners. This missing recognition of planners is underpinned by the planning convention that, in practice, flood affairs are left to water institutions (Interviews 4, 11), in terms of no instant economic returns in urban development which planning authorities give their priorities to.

The same embarrassment comes to interaction patterns. Neither the MP1 nor MP2 provides guidance on how spatial planning could co-operate with the other actors to reduce flood risk. It partly reflects the function segregation shaped after the 2000s (interview 10), when Municipal Water Affair Bureau progressively took the leading position in municipal flood governance while planning authorities gradually lost their voice and concentrated on economic development.

4.1.2. Towards acknowledgement of flood risk as a planning issue: Sponge City Plan (SCP)

Unlike the traditional spatial planning discourse, the Sponge City Plan (SCP) breaks new ground by showing a tendency for a more scientific and detailed explanation of flood risk, a more comprehensive ways to resolve hazards, and more collaborative governance to enact initiatives. This section analyses the innovative discourse.

4.1.2.1. Problem setting. Initially, new perspectives are introduced to enrich the problem setting. It begins with a forward of climatic change

ahead of flood hazards; the term 'climate change' is officially stated to rationalize flood events. To support this, a series of flood vulnerability assessments are proposed which reveal, in the current climatic condition, the waterlogging areas and high-risk inundation areas concerning pluvial, fluvial and coastal floods (see Fig. 2, right). It is significant because it, for the first time, shows a clue for planners to know which area is more vulnerable in the official spatial planning document. As one of the planners engaged in compiling the SCP said, this effort would be a reminder for the local authorities to focus on flood resilience in the coming future (interview 5).

In the meanwhile, unsuitable land use patterns are blamed as another new source to shape an increasing flood frequency: limited permeable surface and too much paving brought by the high-density land use pattern are blamed for the difficulty in water infiltration, which pushes excessive waters to the overloaded discharge system. When the volume is beyond a threshold, the city has to face the inundation. Needless to say, this discussion lays seeds for options to regulate the density of impermeable surface during urban land exploitation (see 5.2 action scripts).

The progress is also reflected in the attitude to flood hazards. Opportunities framing is clearly shown in this document. Under this umbrella, the notion of 'bounded reaction' is emphasized. In comparison to the similar yet generalised idea 'linking urban development with flood risk reduction' flashing in the MP2, dealing with flood affairs, here, are mainstreamed into local concerns in terms of ecology, environment, water resource management and social welling-being. For instance,

> 'the protection of green spaces decreases the run-off volume and also brings ecological benefits; […] the dredging of canals enforces the capacity for water passaging and brings better sanitation; […] the retention and detention ponds act as buffers, storing excessive rainfall and create possibilities for water reuse; […] the reinforcement of river banks strengthens the flood defence capacity while bringing opportunities for renewal of the waterfront (Guangzhou Government, 2017, p. 70–115).'

4.1.2.2. Action scripts. Correspondingly, action scripts are upgraded. The SCP develops a multi-objective principle for goals setting. The single target safety concern in the Master Plan 2000–2010 (MP1) and inadequately expressed multi-function idea in the Master Plan 2010–2020 (MP2) are extended to three ambitions in a visionary language: to raise the capacity of structural hydrological infrastructure for flood resilience; to reducing the surface runoff by responsible development patterns with less paving and more infiltration; and to build an attractive, ecological and liveable water-related environment (Guangzhou Government, 2017, p.53–54). As an interviewee explained (Interview 9):

> "In practice, a project is given more priority when it takes two or more benefits into consideration. […] the 'softened' canal banks might act as a part of green-blue corridors which help drain the excess water […] while providing an attractive place for recreation."

The stated options follow this multi-objective principle. On the one hand, they confirm the significance of traditional structural measures, such as improving dyke system and pipe systems, proposed in the MP1 and MP2. On the other hand, non-structural measures are, significantly, enriched. First, the ever mentioned protection of canals and waterways in the MP1 is strengthened, backing on the contribution of green-blue networks in water flow passaging and waterfront landscape shaping (p. 70–115). Second, innovative options encourage sustainable land use with more permeable surfaces rather than the predominant untamed expansion of paved and densely built-up urban fabric. This idea is based on the notion of Low-Impact Development (LID), 'a land planning by hydrologic controls to replicate the pre-development hydrologic regime of watersheds through infiltrating, filtering, storing, evaporating, and detaining runoff close to its source' (Eslamian, 2014). By these, a prototype of three-layer options on defence, discharge and detention systems to deal with coastal, fluvial and pluvial floods is well-developed.

4.1.2.3. Reconceptualising of governance arrangements. More than anything else is a sea change in clarifying the position of planning authorities. As it claims, Guangzhou Land Resources and Urban Planning Committee (the local spatial planning sector) is supposed to be

> "a coordinator who negotiates the interests from different administrations such as Water Affairs Bureau, Transportation Bureau, Construction Bureau and etc.; a regulator who formulate the rules in zoning plan to carry out the ambitions of sponge city programme at municipal district and block level; an inspector who strictly reviews the implementation in following project-based plans" (Guangzhou Government, 2017, p.120).

Apparently, planners are pushed to a particular point of contention and nominated as one of the major actors, responsible for coordinating flood affairs.

Further, it makes a leapfrog development in interaction patterns by casting a light on collaborative planning for flood resilience and tries to build a new flood governance model through horizontal interactions between different professions, for instance, spatial planning, flood risk management, transportation planning, financial planning, etc. (Guangzhou Government, 2017, P.120). This interactive relationship is formalised by the position of fourteen governmental bureaus in implementation. For instance, the Municipal Water Affairs Bureau is responsible for the hydrology knowledge support, and the Finance Bureau has a duty to provide fundings for implementation (Guangzhou Government, 2017, p. 120–121).

Nevertheless, no further details about how the modalities of the cross-boundary interactions can be operated such as the channels for mutual knowledge learning, the platforms for information exchange or the sharing of costs and benefits. The proposed cooperation pattern, therefore, relies on an underlying tacit agreement in a black box (Interview 12). These concerns were highlighted by several spatial planning experts interviewed (interviews 1, 2 and 3). Past experience indicates it is not easy to reach such an ideal agreement: planners may be supposed to consider flood safety, but they tend to have different ideas on how to tackle it than water experts, which is likely to result in conflicts:

> "The governance system in China is complicated […] there is not enough integration between the various actors involved. Urban planners may suggest that dykes can be a dual system – one layer based on levies built for 1-in-50 years flood, and then the second layer can entail green space and landscape infrastructure. But the Water Affairs Bureau then want a concrete dyke, built the traditional way, safety first. Then the financial authorities look at what is cheaper. But the final decision is made by the mayor, who has a limited budget." (Interview 1, 2, 3)

4.2. Discussion

4.2.1. The influence on Sponge City Plan (SCP)'s framing from the flood risk management

The alterations in the Sponge City Plan (SCP) raises a question about what factors facilitate such a major transition. The following section offers an explanation by exploring how the framing in the flood risk policies if any, shapes the changes. The major reference documents for the SCP in relation to the flood risk management are coded, including the Canals and Waterways Renovation Program (CWR), Rainwater Discharge System Comprehensive Plan (RDS) and Flood Defence and Rainwater Discharge Plan (FDRD). Their similarity to the innovations, not rooted or visible in the traditional master plans, indicates the

potential knowledge penetrating or learning from one field to another. The point is, even so, it is still difficult to say such knowledge penetrating or learning is a spontaneous behaviour. After all, the SCP is a program led by the central government and imposed upon the cities. The municipal response, therefore, could be regarded as an answer to the national political movement (interview 6). That is to say, learning can still take place, but triggered by the national policy.

4.2.1.1. Problem setting. The problem setting in flood risk management is strongly related to the counterpart in the Sponge City Plan (SCP), especially the causes of land use pattern and climate change in the Flood Defence and Rainwater Discharge Plan (FDRD), which declares an increase in paved surface and decrease in wetland area are deemed to contribute to the excessive surface run-off and burden to the rainwater discharge system. In addition, it shares the contention with SCP that climate factor is an underlying yet influential reason for the aggravation of flood risk:

> 'Due to the climate change, the frequency of thunderstorms increases from 5.5 days per year in 1950 to 7.3 days in 1990. This number rises to 8.7 days from 2000 to 2009.' (p. 58)…in addition, 'sea level has increased by 90 mm in the latest 30 years, and the trend will continue due to the melting ice cap (p. 60).

Both of these two factors have not been shown in the traditional Master Plan 2000–2010 (MP1) and Master Plan 2010–2020 (MP2). Thus, it suggests a potential knowledge learning process.

The positive framing in flood risk management, another reflection of problem setting, is comparable to that in the SCP as well. In the Canals and Waterways Renovation Program (CWR), the reinforcement of the river banks or enlargement of the canals and waterways are supposed to open windows for improving waterfront environment and restoring the green-blue infrastructures (Guangzhou Water Conservancy Bureau, 2007, p.13); similarly, the FDRD alleges that flood mitigation projects can make a contribution to the restoration of the natural ecosystems, improvement of the living environment and re-creation on the waterfront (Guangzhou Water Affairs Burea, 2013, p. 25). Those gain-framed attitudes, which try to link water safety issue with urban benefits, later arise in the SCP.

4.2.1.2. Action scripts. High similarity in action scripts comes after the problem setting. As for policy goals, the ambitions, in the Canals and Waterways Renovation Program (CWR), Rainwater Discharge System Comprehensive Plan (RDS), Flood Defence and Rainwater Discharge Plan (FDRD), to raise the capacity of structural hydrological infrastructures, to reduce the surface runoff by increasing permeable land intensity and to pursue good spatial quality in flood mitigation with environmental and ecological concerns reappear as a combination in the Sponge City Plan (SCP).

This coincidence takes place again in the stated non-structural options. The way to deal with flood risk in the CWR, RDS and FDRD are analogous to the non-structural options outlined in the SCP. The CWR, for instance, has developed options, such as preserving the existing open water system for a smooth run-off passage, enlarging the natural lakes for large capacity in water storage, and broadening and softening the canals and lakes to provide more space for water discharge and ecological diversity (Guangzhou Water Conservancy Bureau, 2007). In the RDS, the application of Low-impact Development (LID) pattern is encouraged in urban development, in spite of engineering pipe systems as the major way in this document. Water retention and water detention examples are envisaged, such as swales, permeable paving, and green roofs (Guangzhou Water Affairs Bureau, 2008, 168–178). The FDRD agrees with this pattern and praises its positive function in collecting excess rainwater and relieving the pressure on the discharge system (Guangzhou Water Affairs Burea, 2013, p.119–120). As the interview 13 mentioned, the attention to the open water system, artificial lakes, bank softening and LID pattern in the CWR, RDS and FDRD inspired a similar discourse in the SCP.

4.2.1.3. Reconceptualising of governance arrangements. For the sake of reconceptualising of governance arrangements, however, one can hardly argue that the flood risk management documents directly affect the Sponge City Plan (SCP). Initially, positioning the relevant actors in the investigated flood risk policies merely cover water institutions; they do not foresee a clear place for spatial planning institutions in this endeavour. Urban Water Conservancy Bureau, its successor Urban Water affairs Bureau, and the subordinate actors like Canal Management Office, Pearl River Dike Office, etc., are claimed to be responsible for the inspection of changes of water level in canals, waterways, lakes, reservoirs, legislation of water affairs regulations, maintenance and construction of the hydrological infrastructures, and emergency response in flooding events (Guangzhou Water Conservancy Bureau, 2007, p. 77–80; Guangzhou Water Affairs Burea, 2008, p.182–189; Guangzhou Water Affairs Burea, 2013, 160–165). By contrast, planning authorities are totally neglected with no clues in the formal statement.

The discussion of interaction patterns between different professions is also limited. The Canals and Waterways Renovation Program (CWR), Rainwater Discharge System Comprehensive Plan (RDS) and Flood Defence and Rainwater Discharge Plan (FDRD) share an agreement on joint work in a narrow realm within the flood risk management. This notion is even more explicit in the FDRD, which calls for a platform to promote the cooperation within flood risk management within water affair sectors, for instance, Urban Water affairs Bureau, District Water affairs Bureaus and their subordinate departments. That is to say, no big pictures about the cross-span flood governance have been mentioned.

Nevertheless, considering the CWR, RDS and FDRD are the reference documents taken by the SCP (interview 13), it is hard to say the former has no impact on the governance framing, as outlined in the later. After all, positioning and collaboration have not been explicitly discussed in the planning arena until recently. Flood risk management, thus, could be regarded as a prototype for the discourse on governance arrangement in the SCP, even if the statement is originally discussed within one field.

4.2.2. Inconsistency in the policy framing

4.2.2.1. The difference in problem setting and action scripts: the local VS the national. The National Sponge City Programme has been launched in 2014 to deal with the increasingly frequent pluvial floods in Chinese inland cities since the early 2000s. One building block is a report released in 2010 by the Ministry of Housing & Urban-rural Development (MoHURD) (the initiator of the following National Sponge City Programme), which revealed that 231 out of 351 Chinese cities studied (62%) were affected by pluvial floods in the period from 2008 to 2010 (Hou et al., 2012). This background determines the main focus of the national Programme is to enhance urban flood resilience, especially with respect to pluvial floods.

Guangzhou being a deltaic city, however, faces a combination of coastal, fluvial, and pluvial floods. This complex situation brings a requirement for expanding the flood concerns of the national Programme. That is what has happened in the Sponge City Plan (SCP), which calls for integrated options to enhance urban-rural defence, discharge and detention capacities (see Section 4.1.2). Such a localisation process shows planning authorities' attempts to build comprehensive solutions based on the local settings, even if it mismatches the national call.

4.2.2.2. The mismatch between action scripts and governance arrangement in the Sponge City Plan (SCP). The explicit description of action scripts and governance arrangement in the Sponge City Plan (SCP) indicates the attention to formalising the duties and approaches of potential stakeholders in the flood governance. For instance, Water Affair Bureau is appointed to take charge of canals and pipe systems, Urban Planning Bureau can intervene on the land use pattern. By this, integrated

options are linked with a collaborative network.

Even so, there is still a mismatch: the role of Pearl River Commission (PRC) and their cooperation with the other actors are not included in the discourse. This regional institution is, in reality, responsible for the reinforcement of dyke systems that mentioned in action scripts. Our interviews (7 and 8) in this institution confirm their lack of involvement in the formulation of the local SCP. It could be partly due to the fact that national or sub-national discourse neglect to position them in the new Sponge City Programme. Consequently, when the municipality implements this national programme, there is no legislative base for municipal authorities to order or even mobilise a regional sector to participate in the local responses. Such a mismatch between action scripts and governance arrangement might limit the scope for facilitating collaborative planning needed to tackle the multi-faceted flood risk in Guangzhou because the role of the actual actor is vague, beyond the claimed institutional network.

4.2.2.3. A major omission: urban expansion into flood-prone areas. While the Sponge City Plan (SCP) brings flood risk into spatial planning discourse it misses one important issue: the encroachment of urban expansion into flood-prone areas, one cause of floods mentioned in the Flood Defence and Rainwater Discharge Plan (FDRD). This issue might lead to future tensions considering the ambitious plans for the urban sprawl in the Southern part of Guangzhou, for instance, in the case of Nansha District. This area has been officially acknowledged as a state-level Special Economic Zone in 2012 (Ma, 2012). In the coming years, a fast urban expansion is expected. Ironically, the new development zones in Nansha district including the port areas are located in a flood-prone low-lying reclaimed land, directly exposed to coastal flooding (Liu et al., 2013). If the development follows a similarly rapid path as elsewhere in the Pearl River Delta (PRD), this expansion would definitely weaken the hydrological system and raise the flood risk, especially concerning the climate change and rising sea level in the coming decades.

5. Conclusions

While previous research acknowledged the difficulties in considering flood risk in spatial planning (e.g. Carter et al., 2014), this study explores one underlying reason in relation to this challenge: the framing pattern of flood risk in the policy discourse. It did so by tracing the latest spatial planning and flood risk management documents in the case of Guangzhou, a Chinese delta city that is extremely and increasingly vulnerable to flood risk. The findings reveal the changing framing pattern, and underscore the percolation of knowledge from flood risk management to planning.

One lesson from the Guangzhou case is that traditional spatial planning policy, like the Master Plan 2000–2010 (MP1) and Master Plan 2010–2020 (MP2), do not consider flood risk extensively. Firstly, the understanding of the flood causes is limited, concentrating on the uncontrolled natural hazard while restricted to the negative impacts from the urban sprawl. Furthermore, a negative framing of flooding is dominant, narrowed down to a safety concern. Flood resilience, in this context, relies on the major structural options, mostly ignoring non-structural measures. Under this umbrella, the specification of the role of planners in flood governance is vague. In short, traditional spatial planning failed to address the growing flood risk in the official discourse, which has negative repercussions for the current and future flood vulnerability of Guangzhou.

The Sponge City Plan (SCP), by contrast, does incorporate flood risk in the spatial planning discourse. This shift is reflected in the spatial plans: (1) by recognising that both urban development patterns and climate change result in growing flood risk; (2) by promoting opportunity framing of the nexus between flood affairs and urban development; (3) by connecting the multiple objectives of enhancing safety, attractiveness, ecological diversity, environmental quality and social well-being, (4) by proposing integration between non-structural and structural measures; and (5) by clarifying the role of the planning sector in a cross-sectoral collaboration between a wide range of municipal institutions. By this, the SCP innovatively strengthens the linkages between planning and flood risk management and pushing planners to the frontline of efforts to increase flood resilience.

While the above findings are context-specific, the methodology for framing analysis used in this paper could be applied in research on other delta cities or other flood-prone urban areas. It can be used to highlight the role of discourse in the tensions within flood governance and the difficulties in considering flood risk in spatial planning, while pointing towards ways to avoid them. One limitation of this research, and more generally of framing analysis, is that it traces the change in discourse, however, it cannot explain fully explain the reasons behind it. Future research could thus explore how planning discourse and frames change in relation to the wider context such as shifting economic, political and even the increasingly frequent flooding events. Moreover, there is a need to study further the implementation of the SCP and explore how this new framing of flood risk in Guangzhou is interpreted by the relevant policy actors and how it affects the ways in which they collaborate with each other.

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Appendix A. Interviews' logbook (2014–2017)*

Code	Date	Interviewees
1	Nov 18 2014	Senior Official, Guangzhou Water Affairs Bureau
2	Nov 18 2014	Senior official specialised in urban redevelopment, Liwan District Bureau of Urban Construction and Landscape, Guangzhou
3	Nov 18 2014	Official specialised in water resources, Liwan District Bureau of Urban Construction and Landscape, Guangzhou
4	Oct 25 2016	Academic involved in planning in the PRD, South China University of Technology
5	Nov 29 2016	Planner, involved in the formulation of Guangzhou Sponge City Plan, Guangzhou urban planning design & survey research institute
6	Nov 30 2016	Senior Engineer, Design and Research Institute of Guangdong province
7	Nov 30 2016	Senior Official, Pearl River Committee
8	Nov 30 2016	Senior Official, Pearl River Committee
9	Dec 6 2016	Senior Official, Guangzhou urban planning Bureau- urban drainage Department
10	Dec 9 2016	Ex-senior planner, Guangzhou urban planning design & survey research institute
11	Dec 17 2016	Senior Official, Guangzhou Municipal Water Resources Bureau
12	Jun 23 2017	Landscape Planners, involved in the formulation of Guangzhou Sponge City Plan, Turenscape Planning and Design Company
13	Dec 8 2017	Senior Engineer, involved in the formulation of Guangzhou Sponge City Plan, Guangzhou Water Affairs Investigation, Planning & Research Institute

*Semi-structured face-to-face interviews

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