Benchmarking flood risk management practice in Chinese coastal megacities - the cases of Hong Kong and Ningbo

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Research aim and objectives 研究目的

1. To understand the generic concept and develop a conceptual template of sustainable flood risk management (SFRM) practice.
2. To understand if practice have any constraints and barriers to achieve SFRM through the Pearl River Delta (PRD) case in Hong Kong (first) and the Yangtze River Delta (YRD) case in Ningbo afterwards.
3. To contribute to the developing of sustainable flood risk assessment in these cases under dynamic conditions of changing:
   - Climate 气候
   - Demographic and development pressure人口与发展的压力

Growth – transformation转型

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The geographic favourite concentration of foreign investments

Open-door policy in China 门户开放政策

Growth – transformation

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The geographic favourite concentration of foreign investments

Open-door policy in China – Special Economic Zones (SEZs)

Shenzhen : Past and Present 深圳 ： 过去和现在

1950s 2010s Photos from the DSD

Urbanization in coastal megacities – the Pearl River Delta case 珠江三角洲的城市化进程

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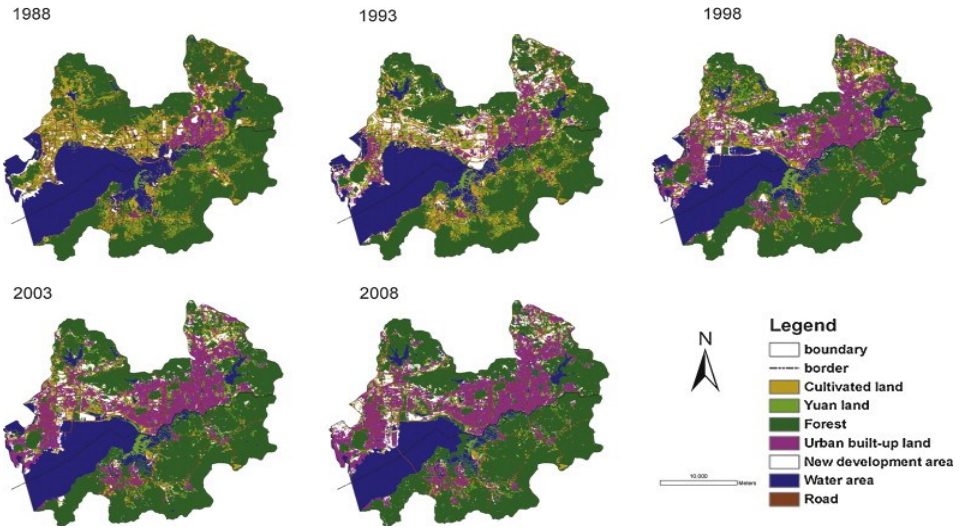
Shenzhen River catchment urbanization : 1998-2008 (Ng et al., 2011)



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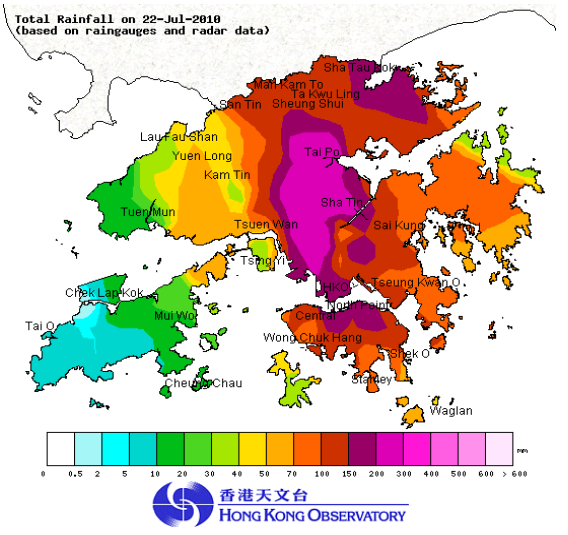
Flood background
- climate & rainfall

• Intensive precipitation in a short time

• 80% annual rainfall falls in the wet season (May – Sep.)

• Cyclones and typhoons from the West Pacific, increase frequency of heavy rainstorms in South China



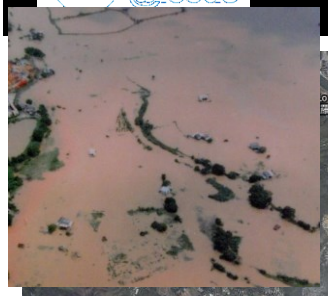
Total Rainfall on 22.07.2010 in Hong Kong (HKO)

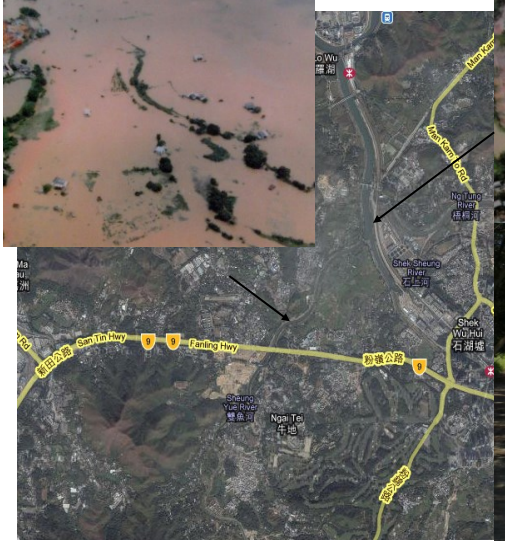
Flood background - Inland flooding (2010 flood)

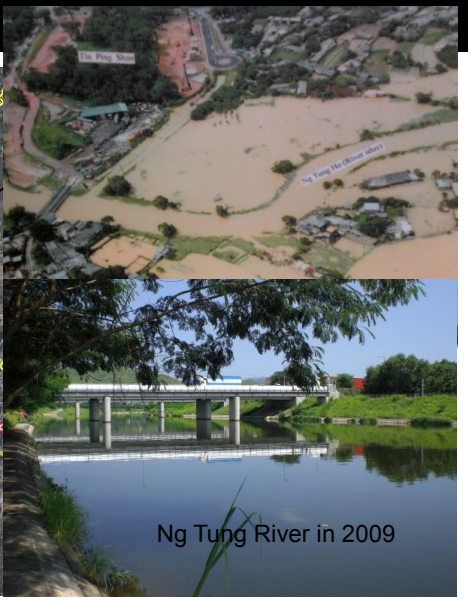
• Urban flooding on 22.07.2010 in Kowloon (the city centre) (Hong Kong Standard)

• A villager was swept away by the flash flood in the village on 23.07.2010 (China Daily)

Sheung Yue River flooding in 2001







Ng Tung River and other rivers in North West of the New Territories (Gogglemap, 2009)

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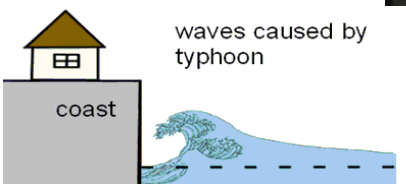
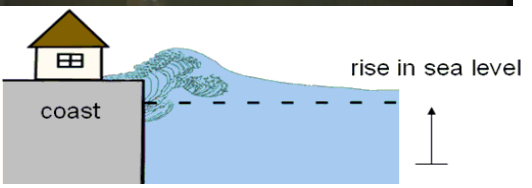
Flood background - Coastal flooding and storm surge

- Two sea floods in Tai O town in 2008-09.
- Low-lying areas may suffer flooding twice a month due to spring tide alone (HKO, 2010)
- **No obvious institutions responsible for sea flooding** in Hong Kong.





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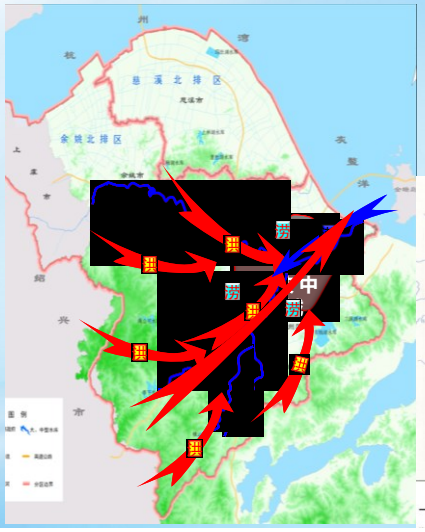
- **Urban flood characteristics**



Flood prone topography

- **Three Rivers connect the city ;**
- **The catchment is located at the mid-north part of the city ;**
- **Hills at the west/north west part flows to the city, Yong River connects with the sea ”**

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Typhoon Fitow 台风菲特 October 2013

Over 100,000 houses flooded in NGB (Yuyao district)

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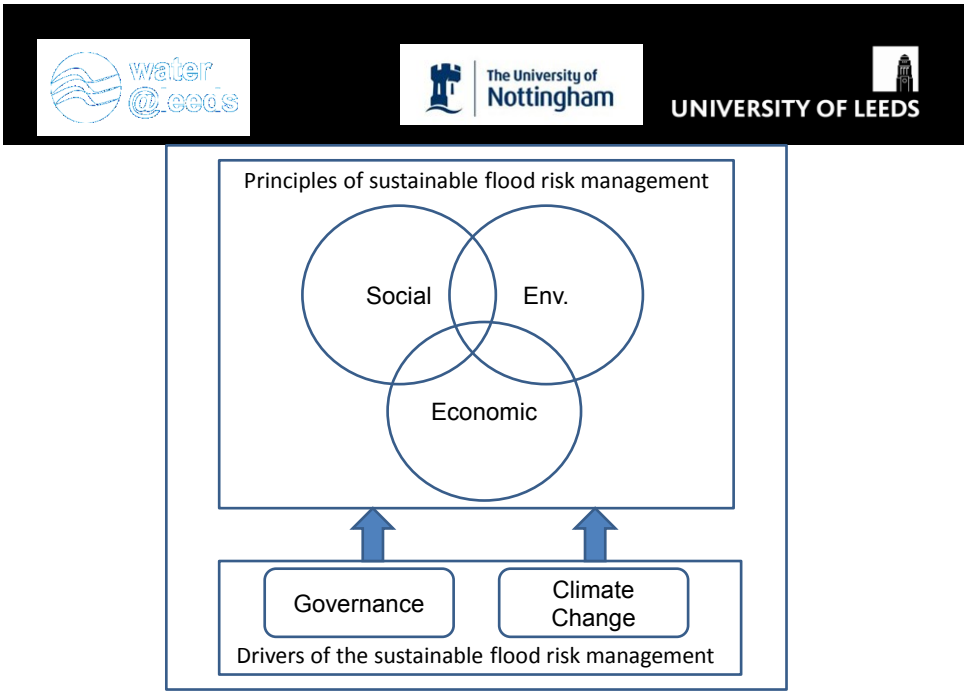
Future Flood exposure : Hong Kong and Ningbo– Top 20

Rank	Country	Urban Agglomeration	Exposed Assets Current ($Billion)	Exposed Assets Future ($Billion)
1	USA	Miami	416.29	3,513.04
2	CHINA	Guangzhou	84.17	3,357.72
3	USA	New York-Newark	320.20	2,147.35
4	INDIA	Kolkata (Calcutta)	31.99	1,961.44
5	CHINA	Shanghai	72.86	1,771.17
6	INDIA	Mumbai	46.20	1,598.05
7	CHINA	Tianjin	29.62	1,231.48
8	JAPAN	Tokyo	174.29	1,207.07
9	CHINA,	Hong Kong	35.94	1,163.89
10	THAILAND	Bangkok	38.72	1,117.54
11	CHINA	Ningbo	9.26	1,073.93
12	USA	New Orleans	233.69	1,013.45
13	JAPAN	Osaka-Kobe	215.62	968.96
14	NETHERLANDS	Amsterdam	128.33	843.70
15	NETHERLANDS	Rotterdam	114.89	825.68
16	VIETNAM	Ho Chi Minh City	26.86	652.82
17	JAPAN	Nagoya	109.22	623.42
18	CHINA	Qingdao	2.72	601.59
19	USA	Virginia Beach	84.64	581.69
20	EGYPT	Alexandria	28.46	563.28

: Top 20 cities ranked in terms of assets exposed to coastal flooding in the 2070s (including both climate change and socioeconomic change) and showing present-day exposure (Source: Nicholls et al (2007), OECD, Paris)



Conceptual framework of sustainable flood risk management

Sustainable Flood Risk Appraisal template – summary (cont.)

SFRA principle	Major themes	Indicators	Citations
Environmental	Nature	• Ecosystem health from flood event • Ecosystem health from FRM schemes/works	Hooijer et al. (2004)
	Landscape management	• Applications of sustainable flood management plans and practices (i.e. SUDs) • Pollution control of FRM schemes/works • Assess the landuse changes • Sustainable landuse planning	Mitchell (2005), Scholz (2011) Brouwer and van Ek (2004) Balica and Wright (2010)
Climate Change	Adaptation plans	• Resilience measures in the extreme climatic regimes (i.e. flood proofing, flood building codes) • Adaptive capacity modification (i.e. upgrade the flood protection standards) • Resilience in urban and rural planning system	De Bruijn (2004), McGranahan et al. (2007) Van Stokkom et al. (2005), Dawson et al.(2009)
Governance	Institutional arrangement	• Effectiveness of the FRM practice • Transparency of FRM information and process (e.g. flood risk mapping information)	Hutter (2006) Johnson and Penning-Rowsell (2009)
	Participation	• Public participation • Stakeholders engagement	Johnson and Penning-Rowsell (2009) ; McFadden et al. (2009)

Sustainable Flood Risk Appraisal template – Summary

SFRA principle	Major themes	Indicators	Citations
Social	Equity & Social Justice	• Flood protection to elderly, children, poor and unemployed people • Public participation • Flood risk perception, preparedness and awareness	Johnson et al. (2007); Kubal et al. (2009); Kenyon (2007) Hutter et al. (2007); Parker et al. (2011)
	Assess real/potential casualty risk	• Adequate flood protection standard • Population density and risk location • Fatalities and injuries from the past flood events	Middelkoop et al.(2004) Johnson et al. (2007) Hall & Solomatine (2008)
Economic	Economic risk	• Land, types of properties and value • Economic activities • Financial damages	Kubal et al. (2009) ; Brouwer and van Ek (2004)
	Implementation cost	• Cost and benefits of the FRM schemes	Johnson et al. (2007);
	Economic opportunities	• Flood insurance	Arnell et al. (1984)

Benchmarking with the SFRA framework – Environmental impact

Themes	Indicators	Green – achieved	Amber – partially achieved	Red – Not achieved
Nature自然	Loss of biodiversity and nature	Environmental issues have been considered in both cases		
	Potential pollution from FRM practice	Pollution control has been considered during the FRM projects		
	Landscape quality		Yes in the Shenzhen River case (e.g. SUDs), but not in the Tai O case	

Benchmarking with the SFRA framework – Social impact

Themes	Indicators	Green – achieved	Amber – partially achieved	Red – Not achieved
Casualty risk	Health (physical and mental) risk			Will start to consider
Equality and social justice	Elderly, children and poor people			No response
	Public area and infrastructure		Not in the private land areas	
	Flood risk awareness		Special warning system developed	
	Post flood aid and support		Shelters will be provided	
	Equality (e.g. minorities)			No Data
	Flood emergency plan	Yes (Tai O case only)		

Benchmarking with the SFRA framework – Economic impact

Themes	Indicators	Green – achieved	Amber – partially achieved	Red – Not achieved
Economic risk 经济风险	Property value			Flood victims worry about it
	Economic losses			No Data
	Damages of public infrastructure			No assessment
	Agricultural productivity			No Data
Implementation costs 实施成本	FRM scenario comparison		Legislative Council to approve the cost	
	Flood insurance			No flood insurance available
	Cost-benefit analysis on FRM			Not consider in Tai O case

Benchmarking with the SFRA framework – Climate change and governance

Themes	Indicators	Green – achieved	Amber – partially achieved	Red – Not achieved
Adaptation plans适应计划	Resilience of FRM infrastructure	River channelisation and flood wall constructed – improve the resilience		
	Adaptations practice		Both cities using techno fix approach	
	Resilience and adaptations in planning practice			Not consider at the moment, will start to consider now
Participation 参与	Public participation		Have found the public consultations in both sites	
	Stakeholders engagement			No information
Institutional arrangement制度	Effectiveness and transparency			Not found in both cases in this research

Conclusion 结论

Anything they can do more to achieve long term liveable FRM practice ?

- Better SFRM practices i.e. restoration of urban channelized drainage, soft engineering practice and openness of flood risk information (e.g. flood mapping) to the public;
- In the techno aspect, both cases are doing well – e.g. smart weather tools, using science for the FRM practice, etc.
- However, still need to implement climate change adaptation plans in coastal and inland FRM practice ;
- Improving to understand on social science perspectives

Now - Soft flood protection measures in Shenzhen River
深圳河软防洪措施

Shenzhen River Regulation Works Stage IV – (now to 2014)

Urban flood management in Ningbo

River restoration & urban water front design

The change from "traditional water conservancy" to "modern water conservancy"

Flood wall in Tai O town – Prepare for the climate extremes on SLR

Tai O town, Hong Kong (CEDD, 2009)

Environmental

Coastal flood contingency plan in Tai O town

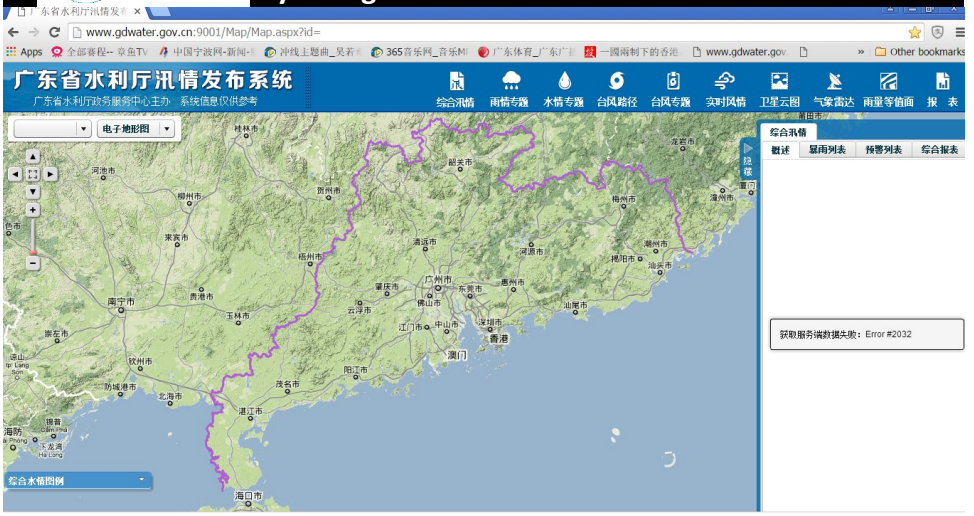
Urban flood management in Ningbo

Urban flood management

The change from "managing by experience" to "managing by science"

- The system of decision making and supply in flood control and drought resisting

Look ahead: Guangdong Water Bureau – hydrological information web



http://www.gdwater.gov.cn:9001/Map/Map.aspx?id=

Ningbo Smart Water system

The management system of the dynamic risk, warning and forecasting in Ningbo