

# Challenges of adaptation to the increasing flood risk in the PRD: implications for new towns and urban redevelopment

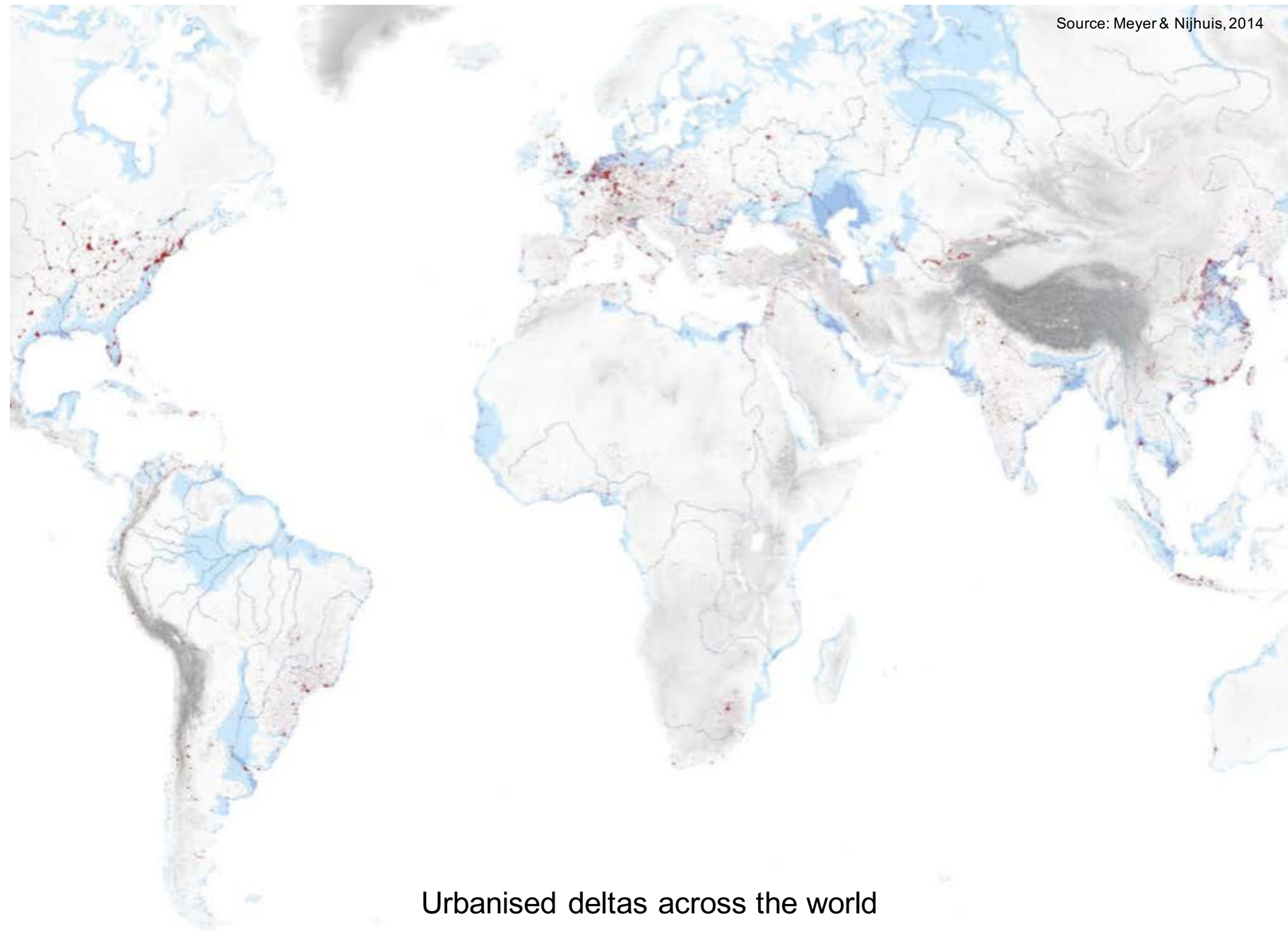
Marcin Dąbrowski, Dominic Stead, Yu Feng & He Jinghuan

SCUT-TU Delft Joint Research Centre  
'Urban Systems and Environments'  
24 November 2016, Guangzhou



# *Urban regions in deltas and climate change*

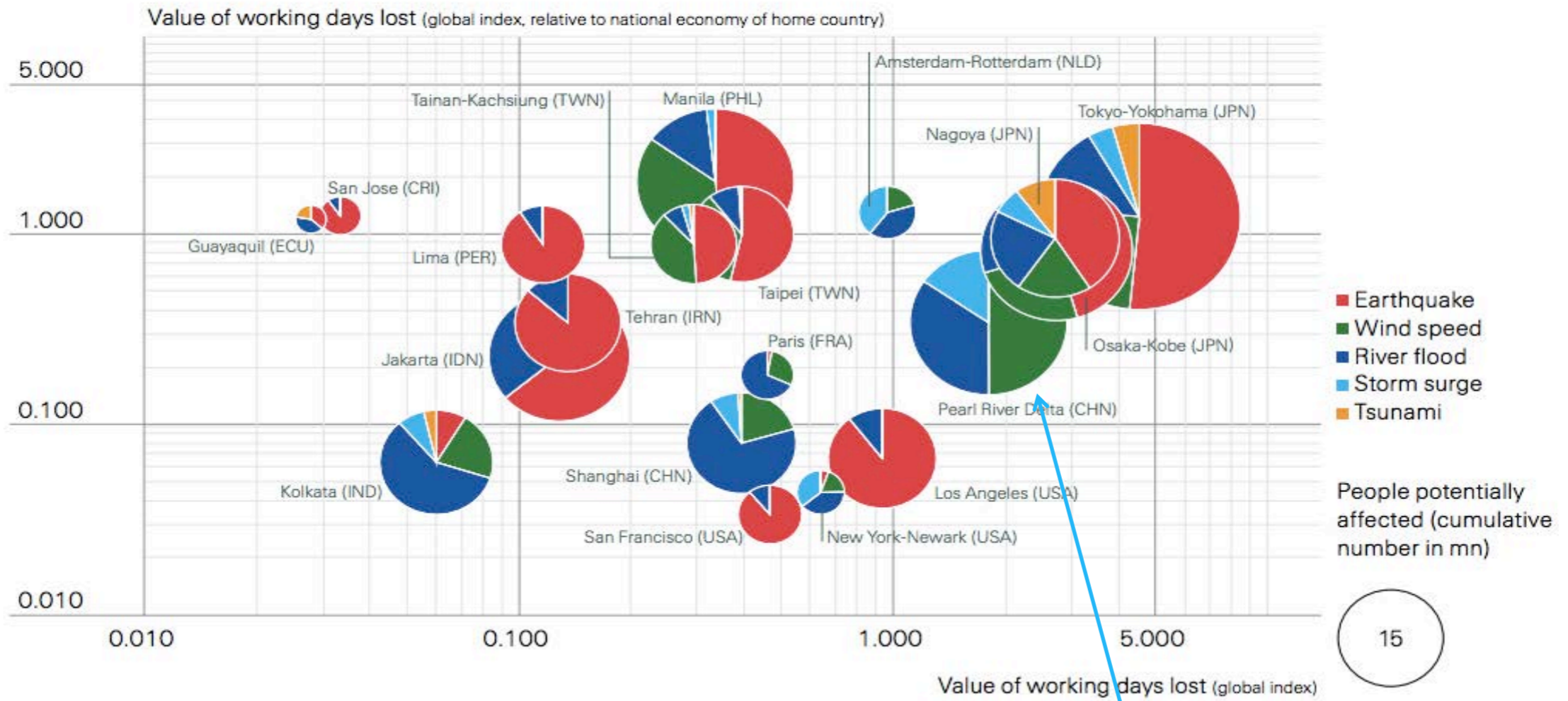
- Tension between the **natural environment** and intensive **urbanisation** – urbanisation increases vulnerability
- **Rising sea levels** particularly dangerous for **low-lying areas**
- Prone to flooding from the **river** and **rain**
- Land **subsidence** and **salinisation** of soil
- Damage of infrastructure and other physical assets from extreme weather events → costly and harmful for the **economic activity**, which tends to be concentrated in deltas
- Threat to the **dense population, heritage, economic assets**
- In some climates increased risk of **epidemics**



Urbanised deltas across the world

**Figure 8: Impact of all perils by metropolitan area – Top 10**

The chart includes the aggregate number of people potentially affected by all relevant perils (bubble size) and global rankings by the value of working days lost, in absolute terms (x-axis) and in relation to the country's national economy (y-axis). Residents are counted multiple times when affected by more than one peril because each peril is accounted for individually.



Pearl River Delta

**Table 1 | City ranking by risk (AAL) and relative risk (AAL in percentage of GDP) for 2005.**

Ranking by AAL (US\$ million)				Ranking by relative AAL (percentage of city GDP)					
Urban agglomeration	100 year exposure	AAL, with protection (US\$ million)	AAL, with protection (percentage of GDP)	Urban agglomeration	100 year exposure	AAL, with protection (US\$ million)	AAL, with protection (percentage of GDP)		
1	Guangzhou	38,508	687	1.32%	1	Guangzhou	38,508	687	1.32%
2	Miami	366,421	672	0.30%	2	New Orleans	143,963	507	1.21%
3	New York—Newark	236,530	628	0.08%	3	Guayaquil	3,687	98	0.95%
4	New Orleans	143,963	507	1.21%	4	Ho Chi Minh City	18,708	104	0.74%
5	Mumbai	23,188	284	0.47%	5	Abidjan	1,786	38	0.72%
6	Nagoya	77,988	260	0.26%	6	Zhanjiang	2,780	46	0.50%
7	Tampa—St. Petersburg	49,593	244	0.26%	7	Mumbai	23,188	284	0.47%
8	Boston	55,445	237	0.13%	8	Khulna	2,073	13	0.43%
9	Shenzen	11,338	169	0.38%	9	Palembang	1,161	27	0.39%
10	Osaka—Kobe	149,935	120	0.03%	10	Shenzen	11,338	169	0.38%
11	Vancouver	33,456	107	0.14%	11	Hai Phòng	6,348	19	0.37%
12	Tianjin	11,408	104	0.24%	12	N'ampo	507	6	0.31%
13	Ho Chi Minh City	18,708	104	0.74%	13	Miami	366,421	672	0.30%
14	Kolkata	14,769	99	0.21%	14	Kochi	855	14	0.29%
15	Guayaquil	3,687	98	0.95%	15	Tampa—St. Petersburg	49,593	244	0.26%
16	Philadelphia	22,132	89	0.04%	16	Nagoya	77,988	260	0.26%
17	Virginia Beach	61,507	89	0.15%	17	Surat	3,288	30	0.25%
18	Fukuoka—Kitakyushu	39,096	82	0.09%	18	Tianjin	11,408	104	0.24%
19	Baltimore	14,042	76	0.08%	19	Grande_Vitória	6,738	32	0.23%
20	Jakarta	4,256	73	0.14%	20	Xiamen	4,486	33	0.22%

A comparison with a ranking by exposure is proposed in the Supplementary Information.

Photo: AFPV



# Guangzhou

Photo: DFIC



# Shenzhen



Photo: Reuters



Photo: Reuters

Guangzhou, 10 May 2016



Photo: IC / China Daily



Guangzhou, 10 May 2016

Photos: China Daily

weibo.com/u/2111111111





*Qingyuan*  
清远市

*Guangzhou*  
广州市

*Dongguan*  
东莞市

*Zhongshan*  
中山市

*Shenzhen*  
深圳市

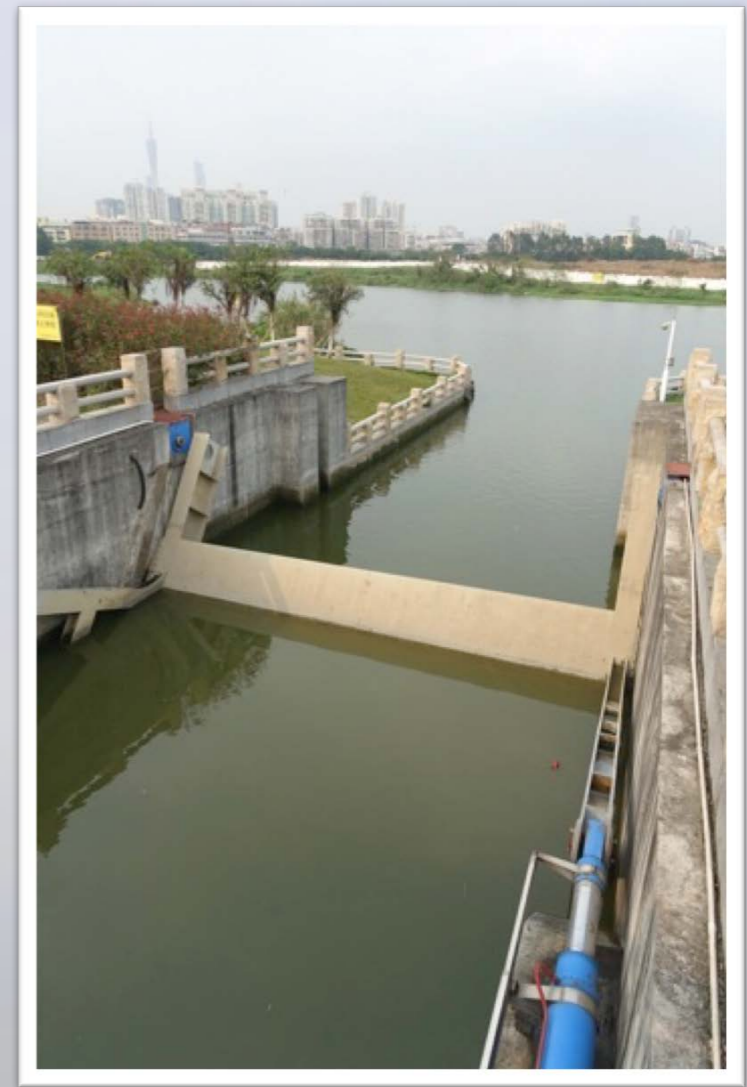
*Macau*  
澳門

*Hong Kong*  
香港

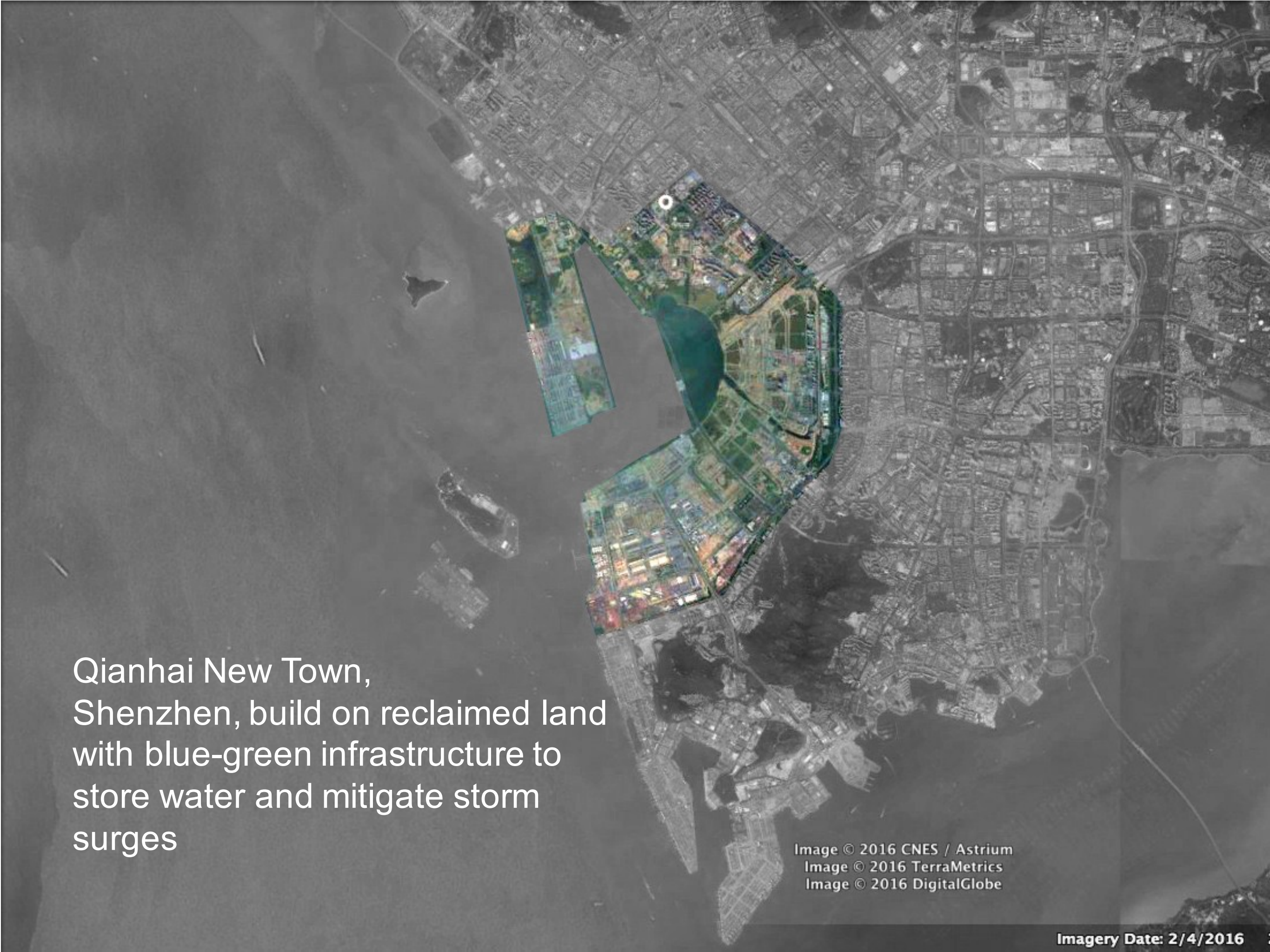


## *Climate change programmes and strategies in place*

- Recognition of the need to take adaptation measures at the national level, trickling down to the provincial level, but no local response:
  - **National Plan for Coping With Climate Change 2011-2020**
  - **Provincial Climate Change Adaptation Strategy, 2010** – not taken up by the cities
  - **Guangzhou Water White Paper 2013** – climate change not mentioned and risks downplayed
  - **Sponge City Programme, 2014** – Shenzhen as a pilot city (Guangming), also in Guangzhou (e.g. Tianhe Wetland Park)
- **Growing flood risk resulting from climate change not recognised** by planners and urban designers in Guangzhou and Shenzhen – emphasis on rapid urban and economic development, increasingly on pollution
- However, at the local level, **some water management and urban development projects could tick the box of urban climate change adaptation**, but are not labeled as such



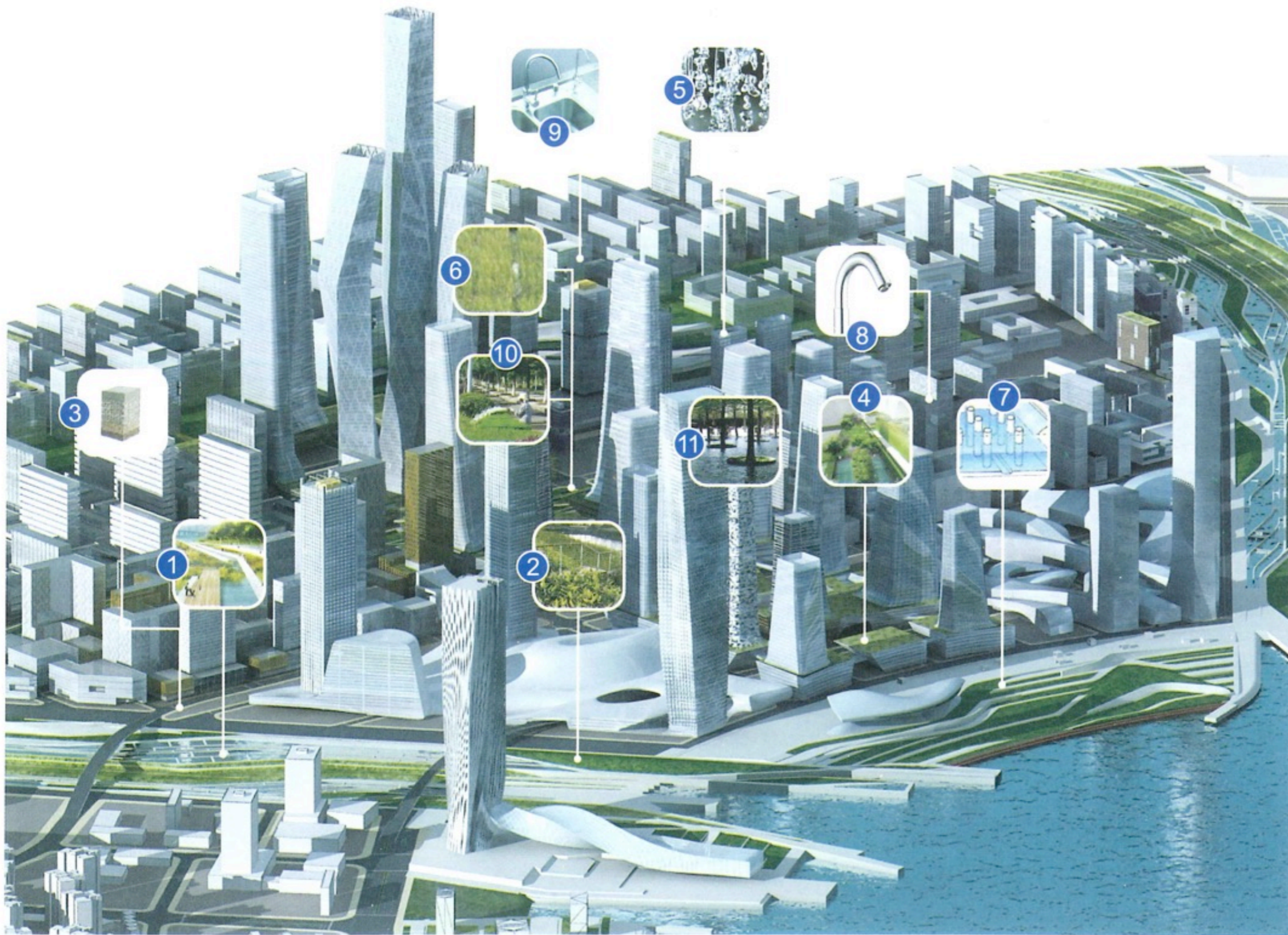
Haizhu lake – a (flawed) hydrological project with a key role in the future development of Guangzhou’s city centre (extension of the ‘Axis’)



Qianhai New Town,  
Shenzhen, build on reclaimed land  
with blue-green infrastructure to  
store water and mitigate storm  
surges

Image © 2016 CNES / Astrium  
Image © 2016 TerraMetrics  
Image © 2016 DigitalGlobe

Imagery Date: 2/4/2016



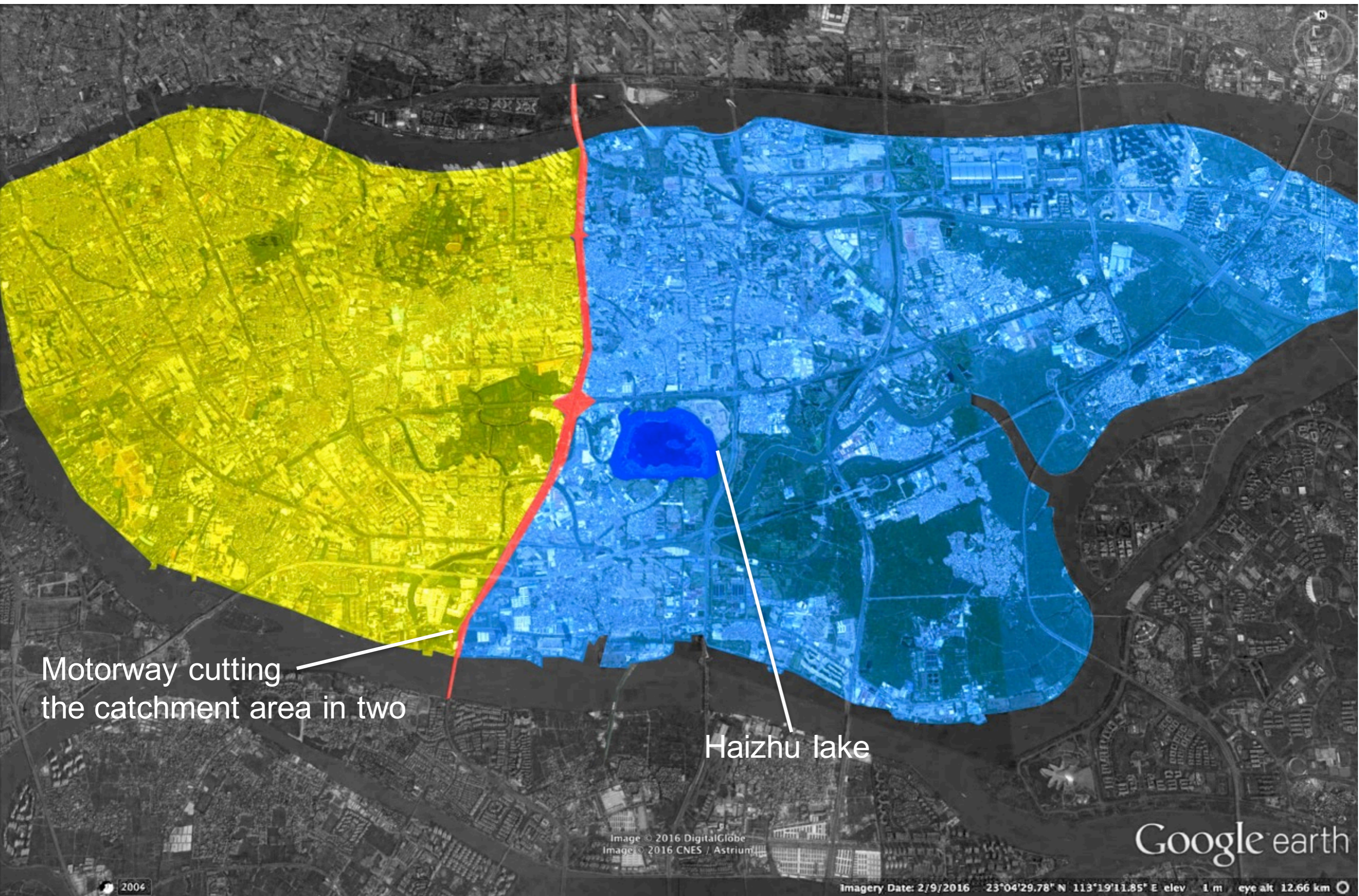
- 1 水廊道  
Water corridor
- 2 生态湿地  
Wet land
- 3 透水性地面  
Permeable pavements
- 4 绿色屋顶  
Green roofs
- 5 雨水收集  
Rainwater harvesting
- 6 雨水花园  
Rain garden
- 7 雨洪调节池  
Detention tank
- 8 节水装置  
Low flow fixtures
- 9 分质供水  
Dualwater supply
- 10 中水回用  
Grey water reuse
- 11 城市水景  
Water landscape

Repertoire of adaptation solutions planned in Qianhai, Shenzhen

Source: Qianhai Authority

## ***Barriers: institutions***

- **No continuity of urban policies** – Mayors aim for being promoted to the provincial or national level - focus on the **short term and ‘prestige’ projects**
- **Vertical coordination** – in theory, a hierarchical policy transmission belt from central to local level, in practice the **central government has little means of enforcing implementation of national policies locally**
- **Horizontal coordination** - in theory, different municipal bureaus coordinate actions to ensure flood safety, in practice municipal bureaus (water resources, urban planning, urban construction, transport, etc.) **seldom coordinate** their policies and plans lack of coordination with counterproductive results



Motorway cutting the catchment area in two

Haizhu lake

Image © 2016 DigitalGlobe  
Image © 2016 CNES / Astrium

Google earth

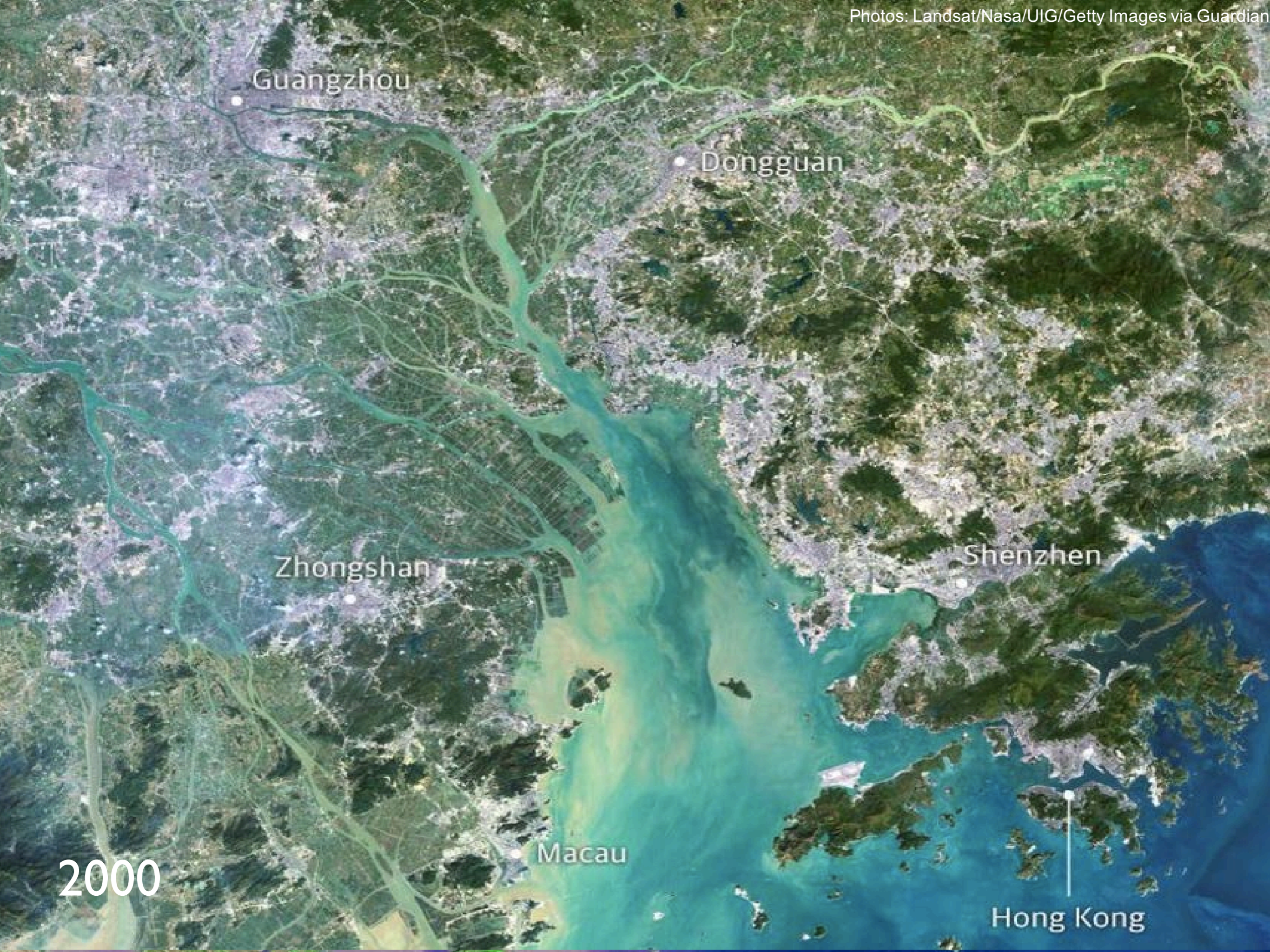
Imagery Date: 2/9/2016 23°04'29.78" N 113°19'11.85" E elev 1 m eye alt 12.66 km

2004

## **Barriers: ideas**

- **Living with water is in the local DNA**, however, the historical knowledge in water management has been lost in the context of super rapid urbanisation
- **Short-term thinking** – legacy of the rapid economic transformation of China; built environment not made to last
- **Typhoons and the related flooding seen as normal** - focus on draining the excess water and warning systems rather than on preventing storm surge flooding
- **No awareness or even dismissal of climate change impacts** - cities expand rapidly into extremely vulnerable areas (e.g. Nansha New Area, Qianhai)
- **‘Accidental’ climate adaptation measures** that are not framed as such and not based on assessment of future risks – the objective is to create a beautiful urban landscape (‘every Mayor wants a lake in his district’)





Guangzhou

Dongguan

Zhongshan

Shenzhen

Macau

Hong Kong

2000

## **Barriers: *interests***

- **Urbanisation at break-neck speed and at all cost - flood risk management is not a priority** (developing real estate is) and lags behind, resulting low level of flood protection
- **Limited availability of rural land** that can be converted in to urban justifies the **expansion of the cities onto reclaimed land**
- **‘Planning for growth’ (Wu, 2015) - interest in boosting the value of real estate** dictates the use of multi-functional flood-protections and Low Impact Development solutions rather than environmental or climate adaptation concerns (e.g. Qianhai)
- **GDP** as the main **indicator of performance** of local government leaders is a disincentive to pursue less tangible goals such as resilience

## *Implications for practice*

- Most **barriers** linked with the **characteristics of the Chinese governance system** → slow if not impossible to change
- Opportunities at the **local level**:
  1. **Raising awareness** of climate change impacts among planners and urban designers is critical to build support for investment in adaptation capacity
  2. Multi-functional solutions offer potential for **linking several agendas and interests**:
    - Blue-green infrastructures to store water + fighting air and water **pollution**, restoring natural **habitats**, restore elements of **traditional urban fabric** with canals and ponds, or even local **food production** (aquaculture)
    - Framing of adaptation measures as an **opportunity to improve spatial quality and liveability of the city** (see Qianhai, Lychee Bay) making it more attractive for investment → the question is **who benefits?**

## *Implications for practice*

- 3. Sponge City** programme makes resilience to rain water a national priority – opportunity for using the programme to promote **model solutions**
4. Limit to urban expansion and shift towards **urban redevelopment** – opportunity for **rethinking** urban development to reduce vulnerability of the city to flooding and **retrofitting** solutions for better drainage and water storage in the public and private space
- 5. Economic shift** away from manufacturing and emergence of the service and creative sectors will generate **vacant brownfields** – opportunities for developing multi-functional solutions

謝謝



m.m.dabrowski@tudelft.nl

Photo: Marcin Dąbrowski

The study was funded by:



华南理工大学  
South China University of Technology

ukna

URBAN KNOWLEDGE NETWORK ASIA