

Comparing Shanghai and South Holland

----- two regional multi-level flood risk analyses

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- Introduction
 - Storms surge and extreme river discharge
 - SLR and land subsidence
 - Advanced social-economic development
- Objective
 - To make a critical comparison between flood risk in Shanghai and South Holland and to further identify research issues
- Comparison
 - Geography
 - Demographics and Economics
 - Climate and Hydrology
 - Flood Threats and Safety Standards



		Shanghai City ⁽¹⁾	South-Holland ⁽²⁾
Geography			
Area		6,561 Sq.km	2,613 sq.km (Rotterdam 2001 sq.km)
Elevation(m)	Average	3-3.5 (Wangjiang Dam)	-4 (Rotterdam ⁽³⁾ (SLAP))
	Lowest point	2.2	-6.7
Demographics and Economics			
Population (Million)		19.21	3.57
	Densities	Shanghai 2932	Rotterdam 1357
Population Growth Rate (2009)		2.75%	3.95%
Population Density (2009)		3030	1227 (2830 in Rotterdam)
GDP Growth Rate (2009)		8.2% (2009)	3.1% (The Netherlands 2010)
GDP per capita		\$11,100	\$23,700
Ports ⁽⁴⁾ (Million TEU)	Cargo throughput	960	347
	Container throughput	25	9.74
Climate and Hydrology			
Average Precipitation (mm)			
	Projected sea level in 2100	1.05-1.5	740 (Rotterdam)
	Projected sea level in 2100	0.2-2.0m	65-130cm (Rotterdam)
Sea level ⁽⁵⁾	Average sea level rise (cm/year)	3-5mm/y	2 mm/y
	Land subsidence	4-10mm/y	10mm/year ⁽⁶⁾
Storm surge & level (m)	1/100000	6.90	5.1
	1/1000	5.10	3.00
Highest recorded water level (m)	Official Period	5.99 (Wangjiang Station)	3.8 (in Hook van Holland)
	Other critical Period	10.16-20.00	180-2009
Protection level for flooding per year	Floodwall	1/50 (approximate)	1/1000 - 1/10000 (Dike-ring)
	Sea dike	1/1000-1/2000	

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• **Conclusion**

Research Objective	Research Questions
Determination of the Natural Hazards	1. How do torrential rain peaks in the Huangpu catchment correlate with storm surges at the mouth of Yangtze River and the east China sea, and which probabilities match the extreme events? 2. Which existing gates and pumping stations can be operated to reduce correlation peaks?
Inundation Analysis	1. What are the water level characteristics in the Shanghai system, modeled by SOBEK? 2. With which probabilities could overflowing and overtopping occur in the Shanghai system; what are the weak points of the flood defense system in Shanghai area?
Vulnerability Assessment	1. How to estimate economic damage and loss of life in Shanghai under the extreme event?
Comparison Between Shanghai and South Holland	1. With what accuracy can the Shanghai data be compared to the Dutch data? 2. Which weak spots in the quantification of the two systems arise from the comparison? 3. Which policy recommendations arise from the analyses and the comparison?