A BALANCED APPROACH FOR URBAN FLOOD MANAGEMENT: A HO CHI MINH CITY CASE STUDY

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Content

- Urban flood Risk Uncertainties
- Balanced intervention approach with RDM
- Case study of Ho Chi Minh City
- Conclusions

Urban Flood Risk Uncertainties

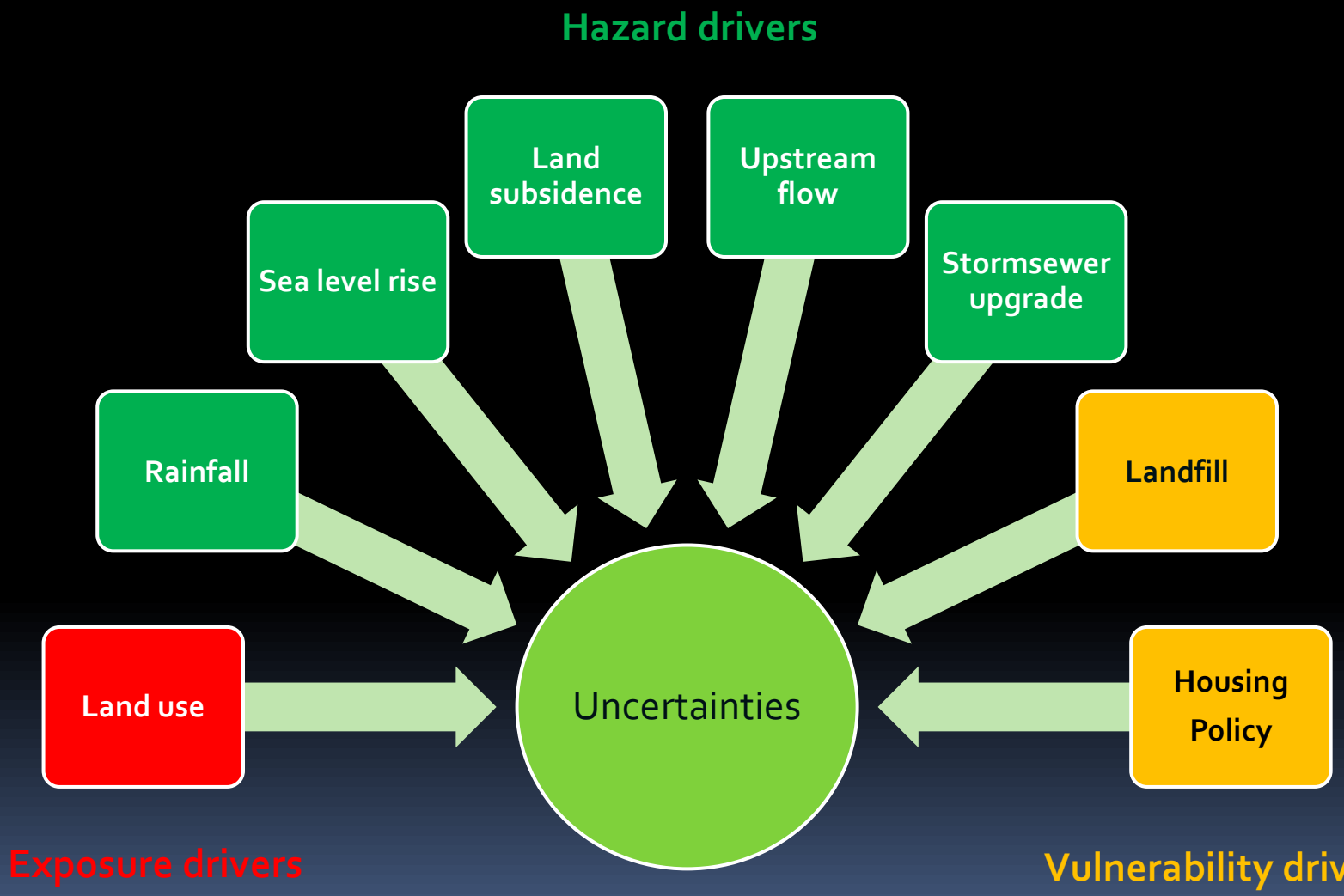
Risk Uncertainty Analysis

Risk is a Hazard-depending Spatio-temporal function:

Risk* = *Hazard Probability* * *Exposure* * *Vulnerability

- *Hazard Uncertainty resulted by both climatic and non-climatic impacts*
- *Exposure Uncertainty due to Urbanization*
- *Vulnerability Uncertainty due to Social policy and economical development*

The Uncertainties

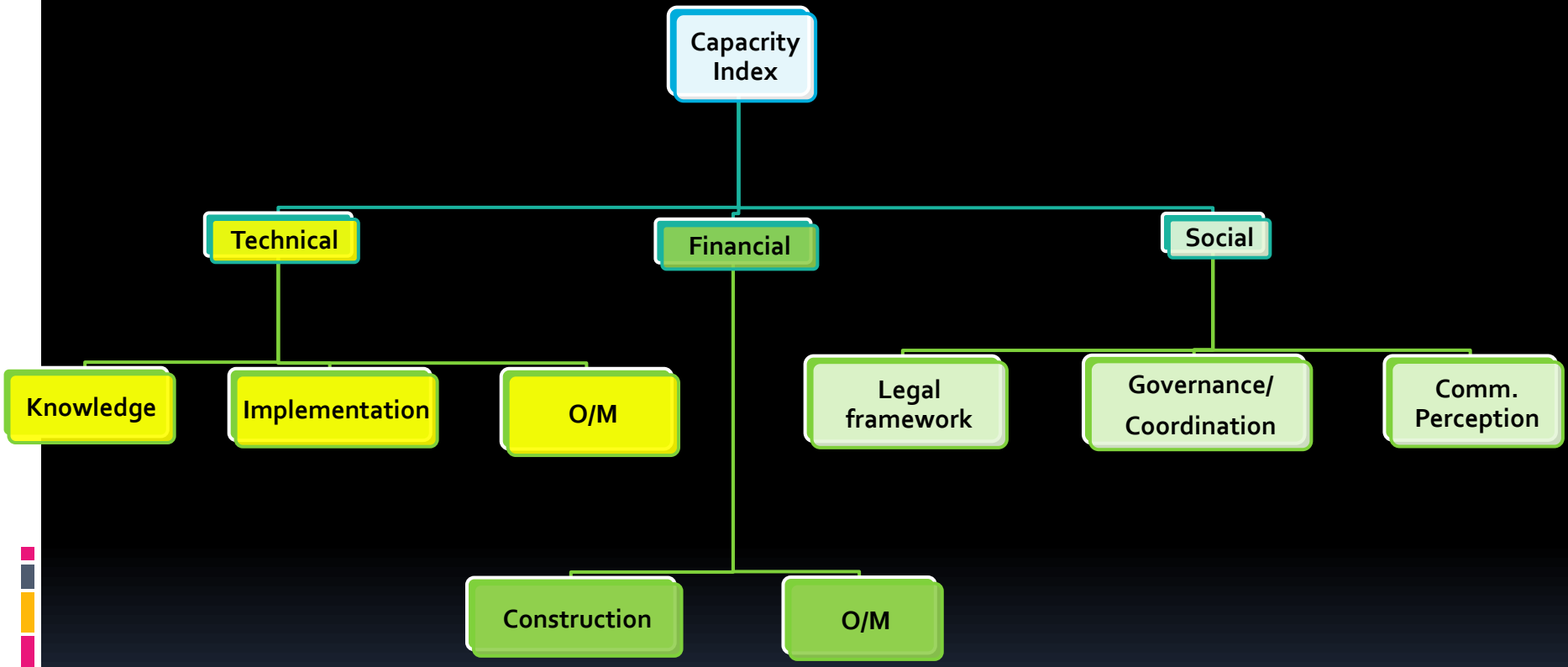


Remarks

- Urban flood risk control implies high level of Uncertainties resulted by both climatic- and non-climatic factors.
- Conventional approach focusing structural intervention may not be flexible to cope with such variations.
- 3 options of Flood Risk Management: Hazard-, Exposure- and Vulnerability reduction
- A spatially balanced intervention strategy decides the TIMING- and FRACTIONAL HARMONIZING of the H-E-V.

Balanced Intervention Approach

Capacity Analysis



Based Capacity analysis, the 3 adaptation components and intervention level may be determined.

Multi-leveled Integrated strategy

Mix measures to reduce flood damage under extremity

- Operation/Maintenance capacity, both technical and financial, decide intervention scale and sophisticated level of the measures.

- Social capacity determines the Adaptation level of strategy

Technical measures to alleviate flood risk within protection level (80-95%)

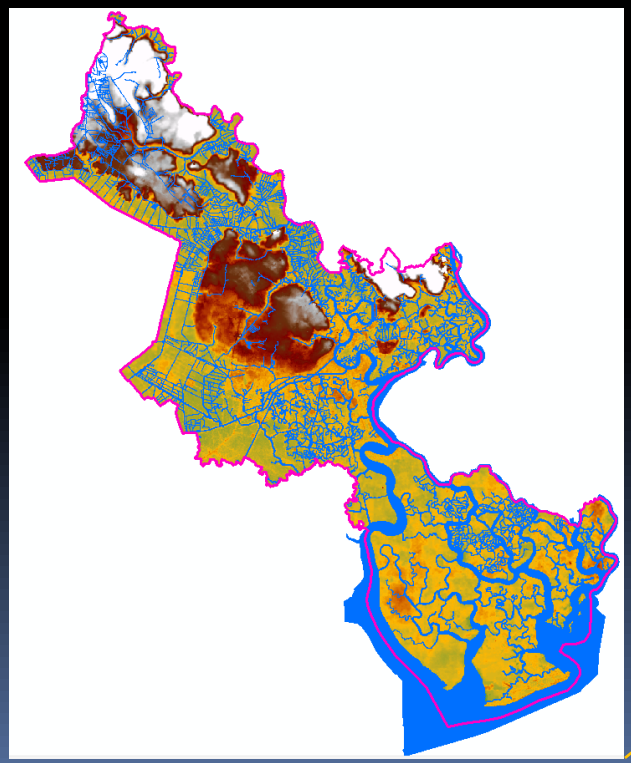
Integrated strategy and Social capacity

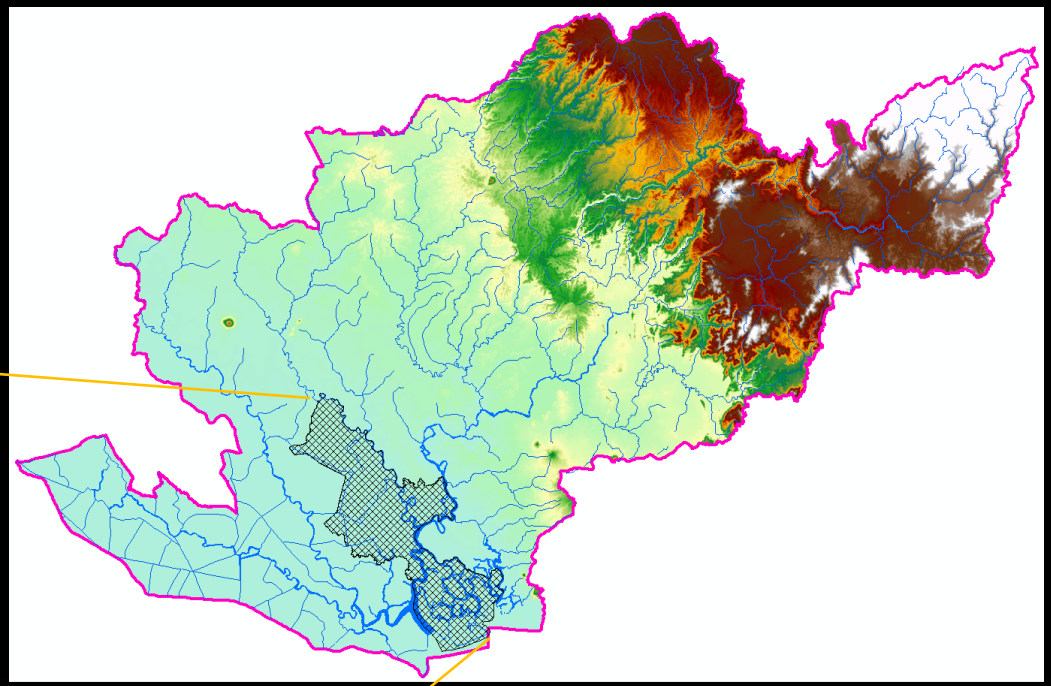
- Hazard control: common option for Low to Mid social capacity; requires less governance/coordination; Top-down strategy; highly vulnerable.
- Exposure control: requires higher governance/coordination; Mainstreamed by urban water space policy; Top-down strategy; low vulnerability.
- Vulnerability improvement: requires higher governance/coordination and perception; Mainstreamed by housing policy and Emergency response Plan; Mixed strategy,

CCA is a social issue, not technical .

Ho Chi Minh City case study

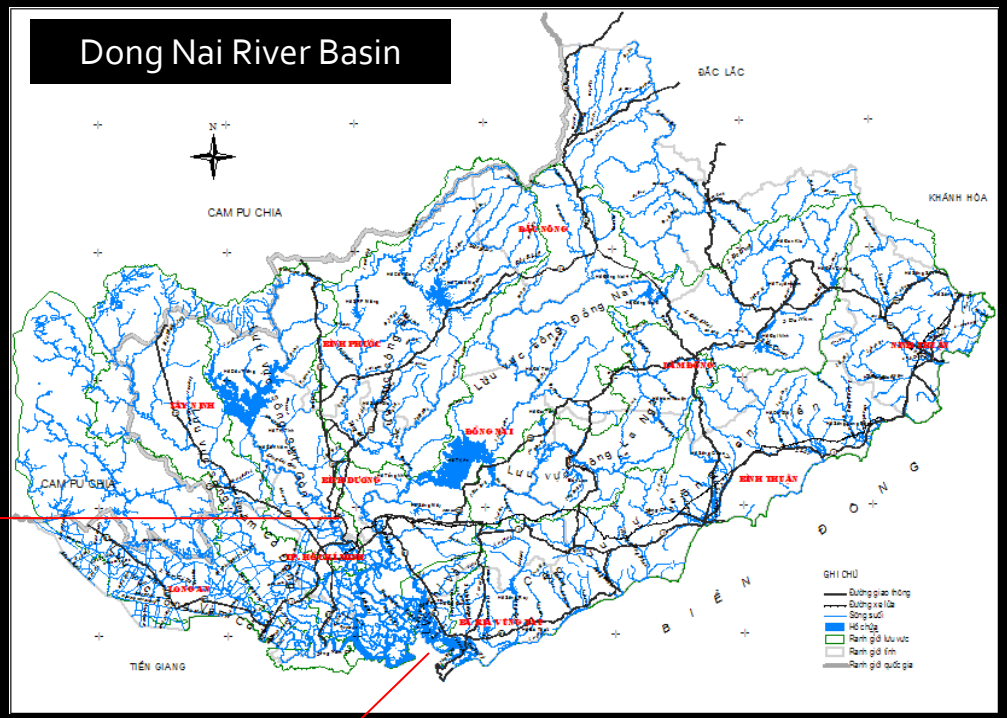
Ho Chi Minh City and the basin

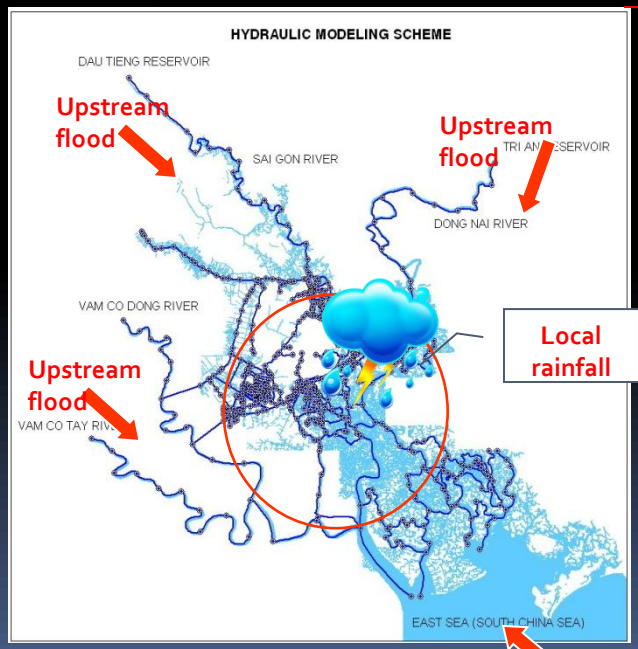




- HCMC is impacted directly by the sea and an upstream basin of 40,000 sqkm.

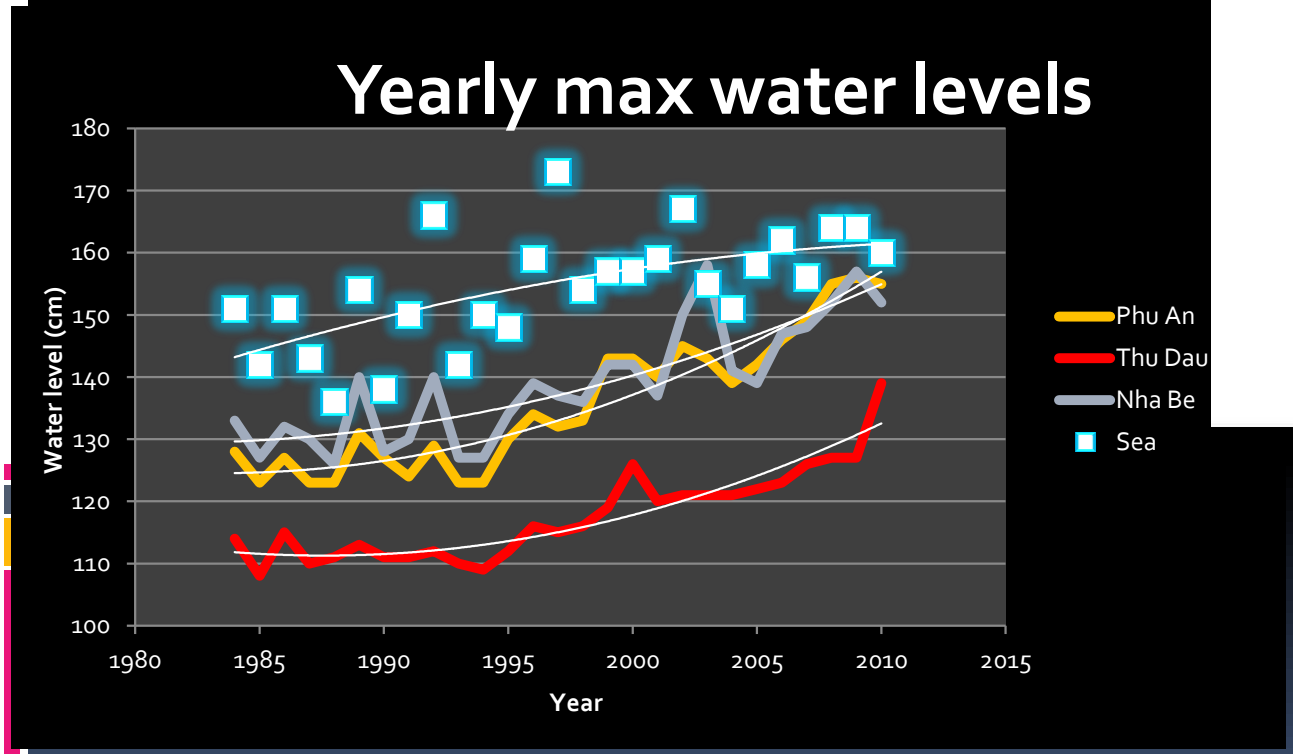
Hydrological impacts

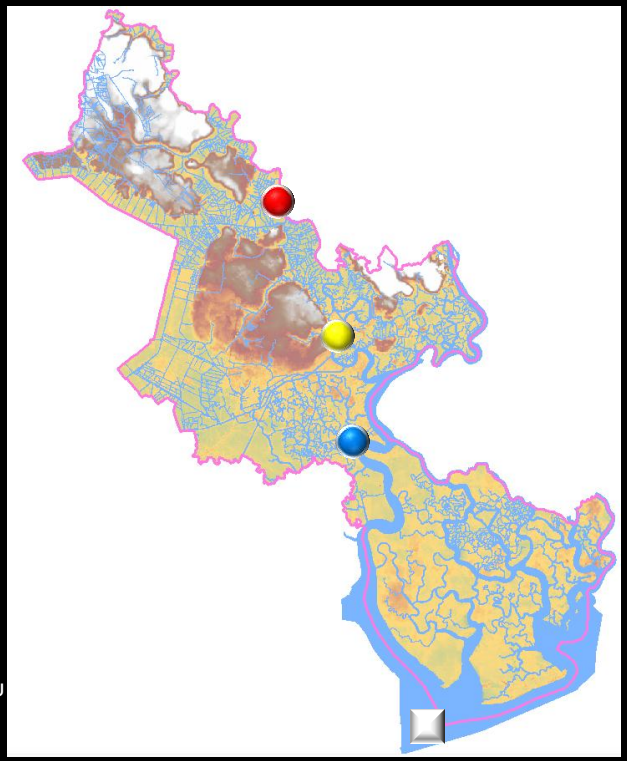




Tidal effect and sea level rise

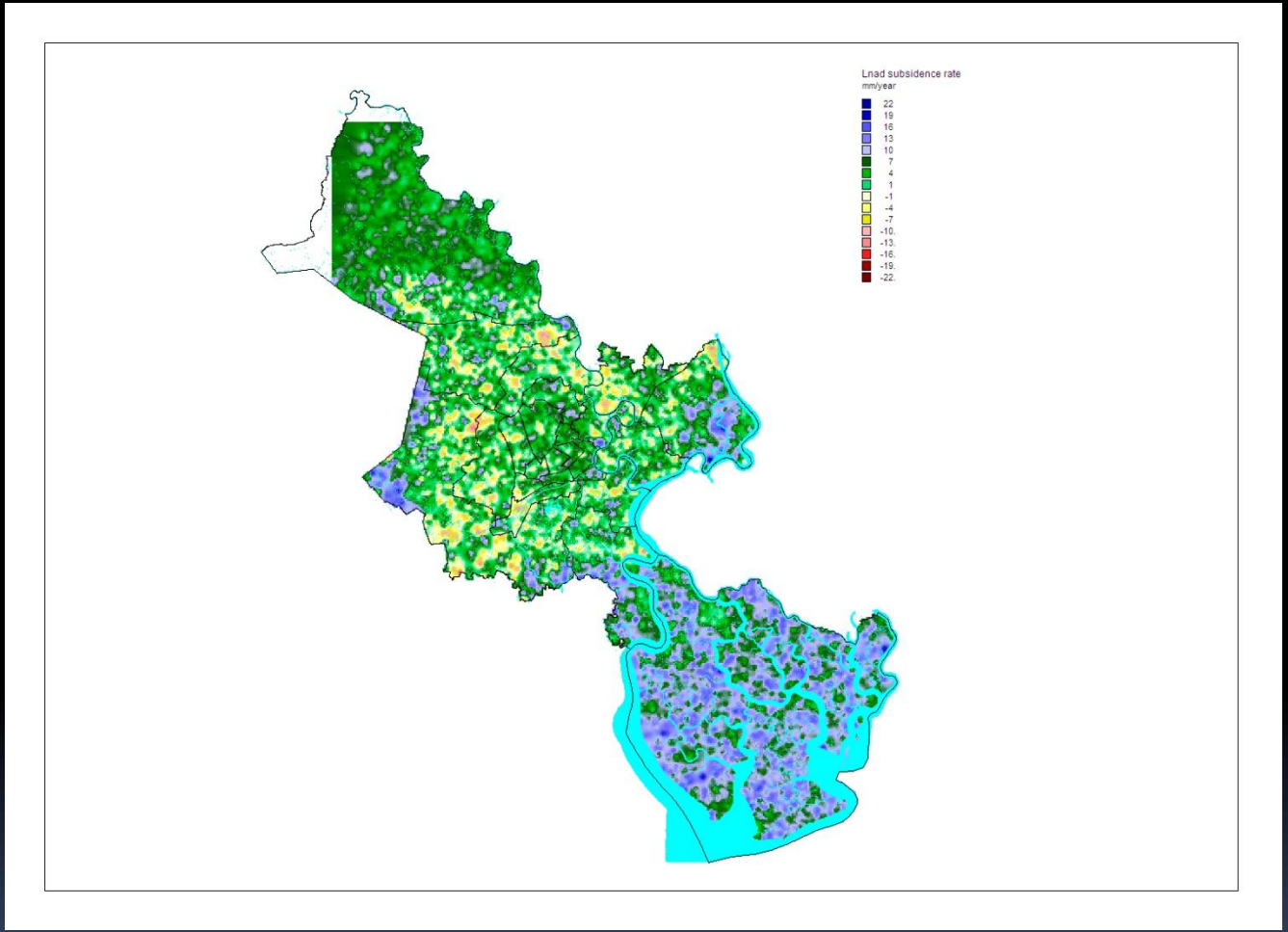
Hydrological anomaly





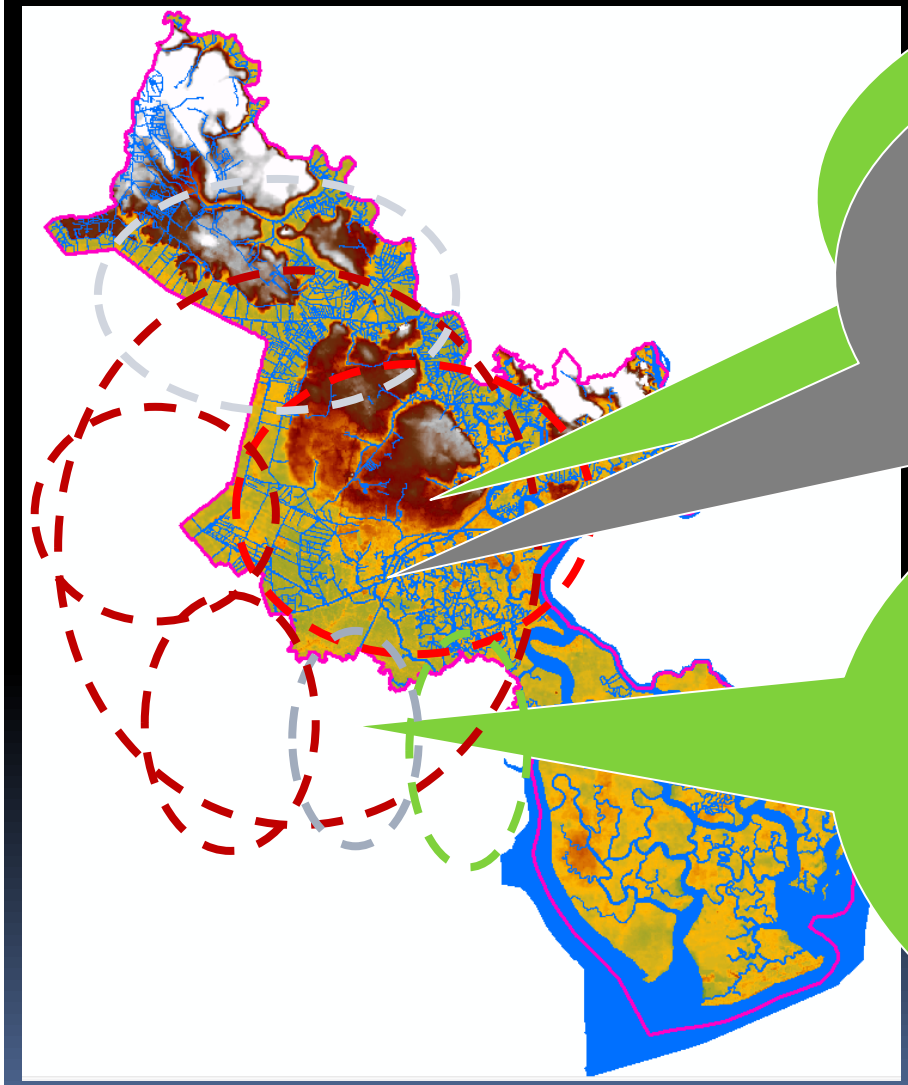
Hydrological anomalies have occurred since mid 1990s at all stations around Ho Chi Minh City

Land subsidence (1996 – 2010)



Land subsidence has occurred in large scale with highest rate of about 1 cm/year

Revised plan for more balance



- For both Urban and suburban areas with same protection level
- Unintentionally encourage urbanization.
- One basket for all eggs
- Exhausting resources for storm sewer system

- For Lowland rural area
- Lower protection level
- Discouraging urbanization
- Sub[illegible] safety
- Stepwise scheme for limited resources
- Medium scale to fit with M/O capacity

High vulnerability

Resources exhausting

Less flexibility

Overkilled intervention

Scenarios generation

Optioned measures	
1	Levee
2	Sea barrier
3	Landfill
4	Retention space
5	Storm sewer upgrade
6	Housing/Infrastructure Improvement
7	Spatial plan

5 timings

Strategies	
S1:	1+3 +4 +5 +6
S2:	1+4+5+7
S3:	1+4+5+6
S4:	1+5+6
S5:	2+3+5

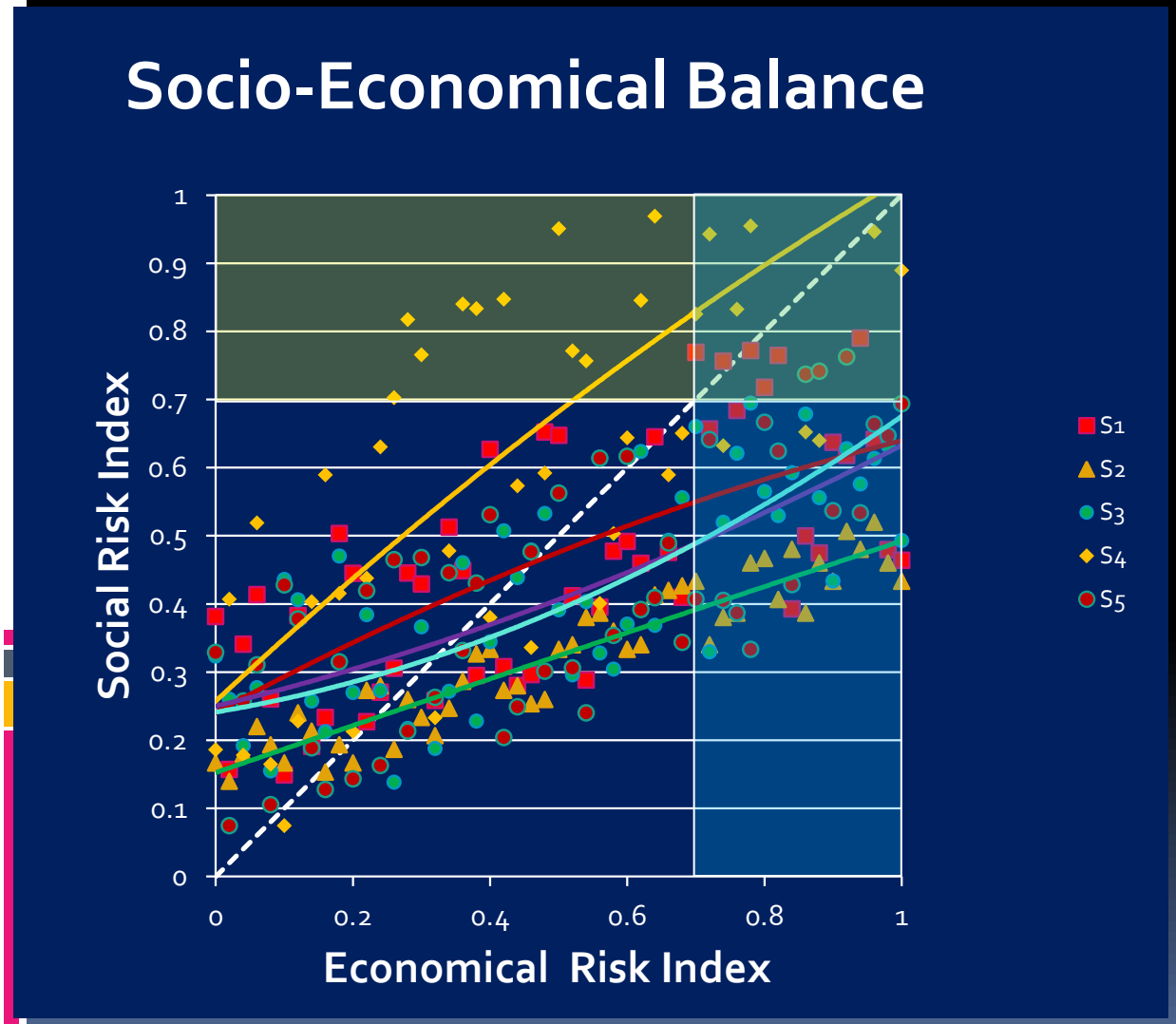
X

5 levels of variation

Variations
Sea level rise
Rainfall intensity
Land subsidence
Upstream flood
Exposure

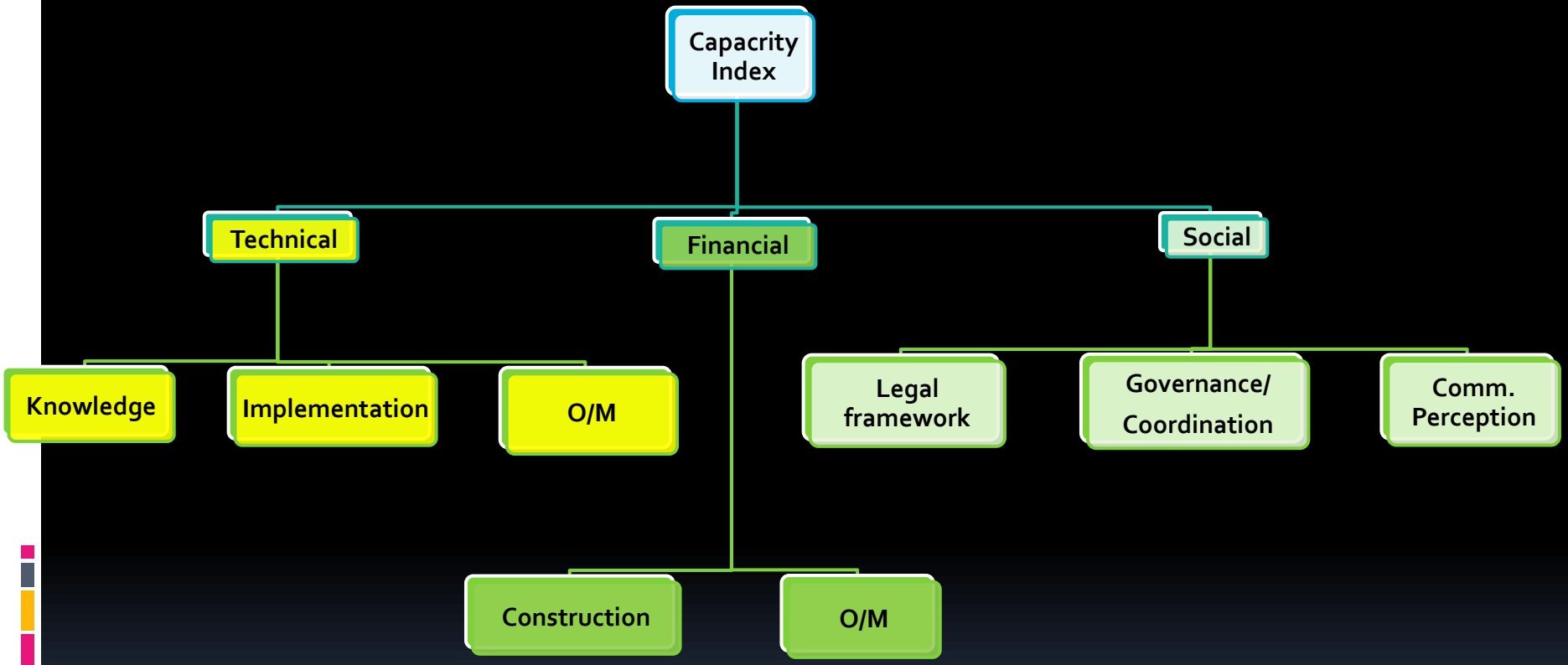
Analyzed scenarios = 5 strategies x 5 times x 5 variations x 5 levels = **625 tests**

Risk uncertainty analysis



- S4 is the Econ-favored.
- S2 is the Social-favored
- S1 and S3 were selected candidates for capacity analysis and CBA.

Capacity Analysis



Based on Capacity Analysis, the most feasible candidate and/or staged intervention can be determined.

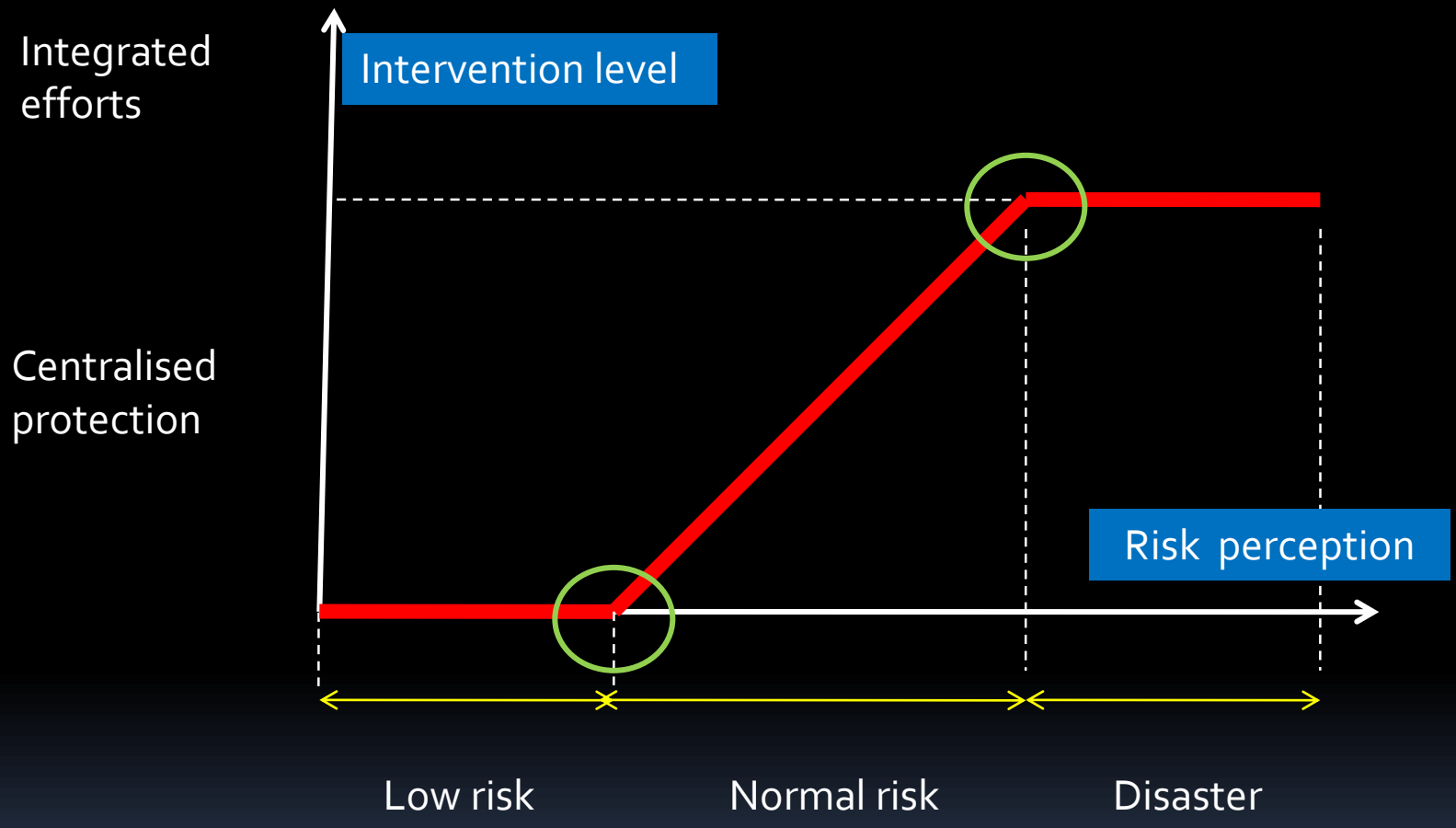
Capacity checking

Ex: Retention pond in residential area

Issue	Score (1 to 10)	Remark
Technical	**6.4**	
Data availability	7	Missing some
Knowledge Uncertainty	6	Environmental issue
Consultant	6	No technical code
Construction	8	
Operation and maintenance	5	Mosquito, pollution
Financial	**7.5**	
Construction	7	Higher cost appartment
Operation and Maintenance	5	O/M cost monthly
Social	**2.7**	
Legal frame work	0	No regulation
Governance/Management	3	No experience
Stake holder's perception	5	Why we need it?

The measures can be applied with local stakeholder's aggreement.
Good timing is essential.

Intervention options



- Risk perception may be very different among individuals/communities
- Intervention level should be appropriate response
- Long-term vision vs . short term measures

Integrated strategy and Social capacity

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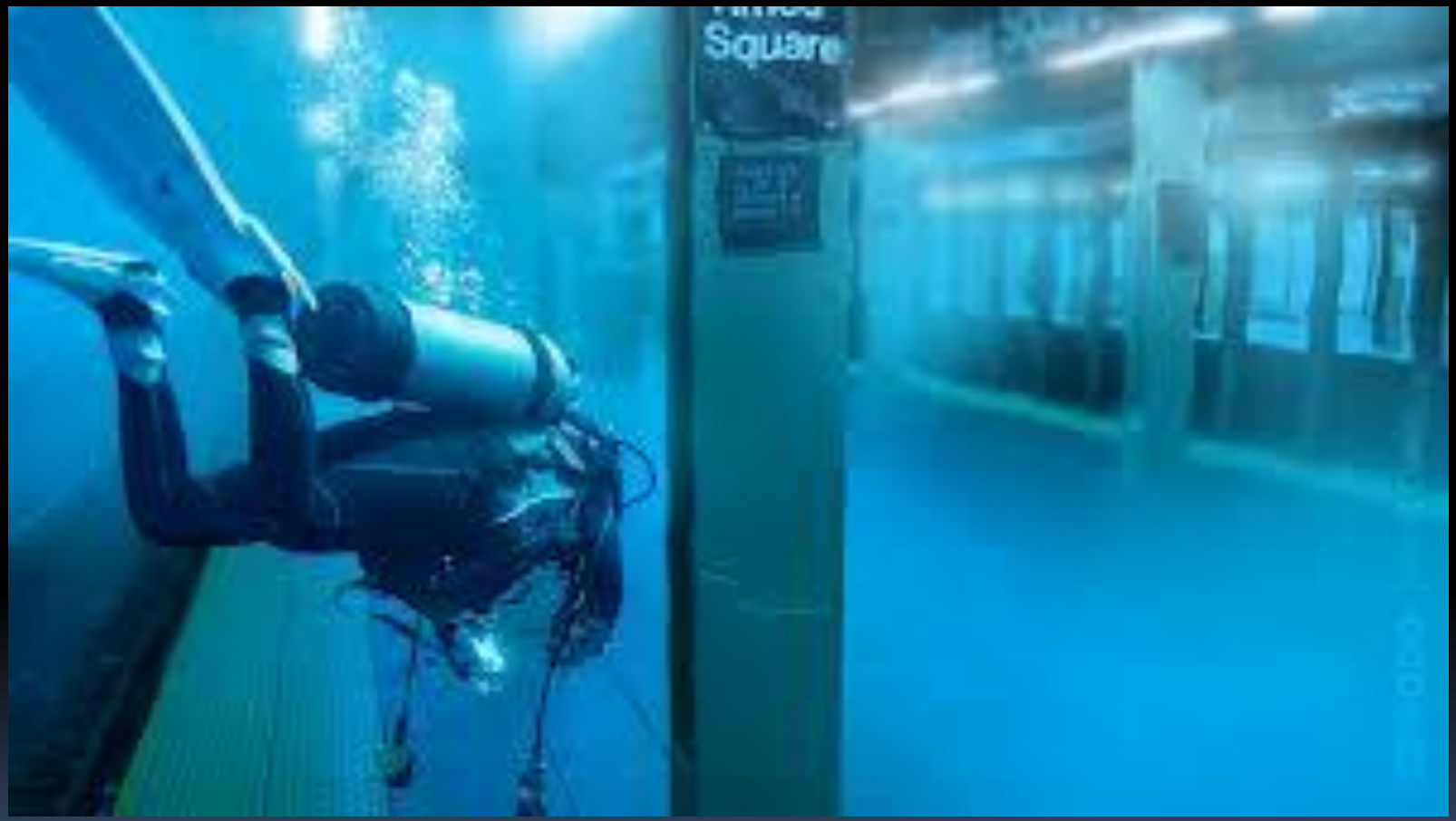
Conclusions

- The complexity of Climate Change Adaptation strategy depends on uncertainties of both climatic and anthropogenic.
- To cope with uncertainty, Bigger or Earlier interventions maybe not usually preferable.
- RDM may be helpful to explore the Risk Uncertainties and also the balance of CCA strategy.
- An effective and convenient tool package required for RDM.
- Data availability may limit the upscaling of RDM.
- RDM for Risk Uncertainty analysis, Capacity analysis for Feasibility and Timing.

Can we be protected?



Newyork City (Sandy, 2012)

Could we predict the extreme?

Groningen- the Netherlands (Jan, 2013)

Be resilient yourself

Dordrecht – the Netherlands (2012)


Thank you for your attention