

# Shifting Time Horizons in Urban Flood Risk Management

Opportunities and Challenges to Increase Resilience

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Chris Zevenbergen,  
Professor  
Water Science and Engineering Department  
IHE Delft -TuDelft



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## Some notions

We can expect fewer but larger disasters in the future

(Fundamental) changing patterns of the 'system'

Time horizons are shifting

Transformative change: long lead times



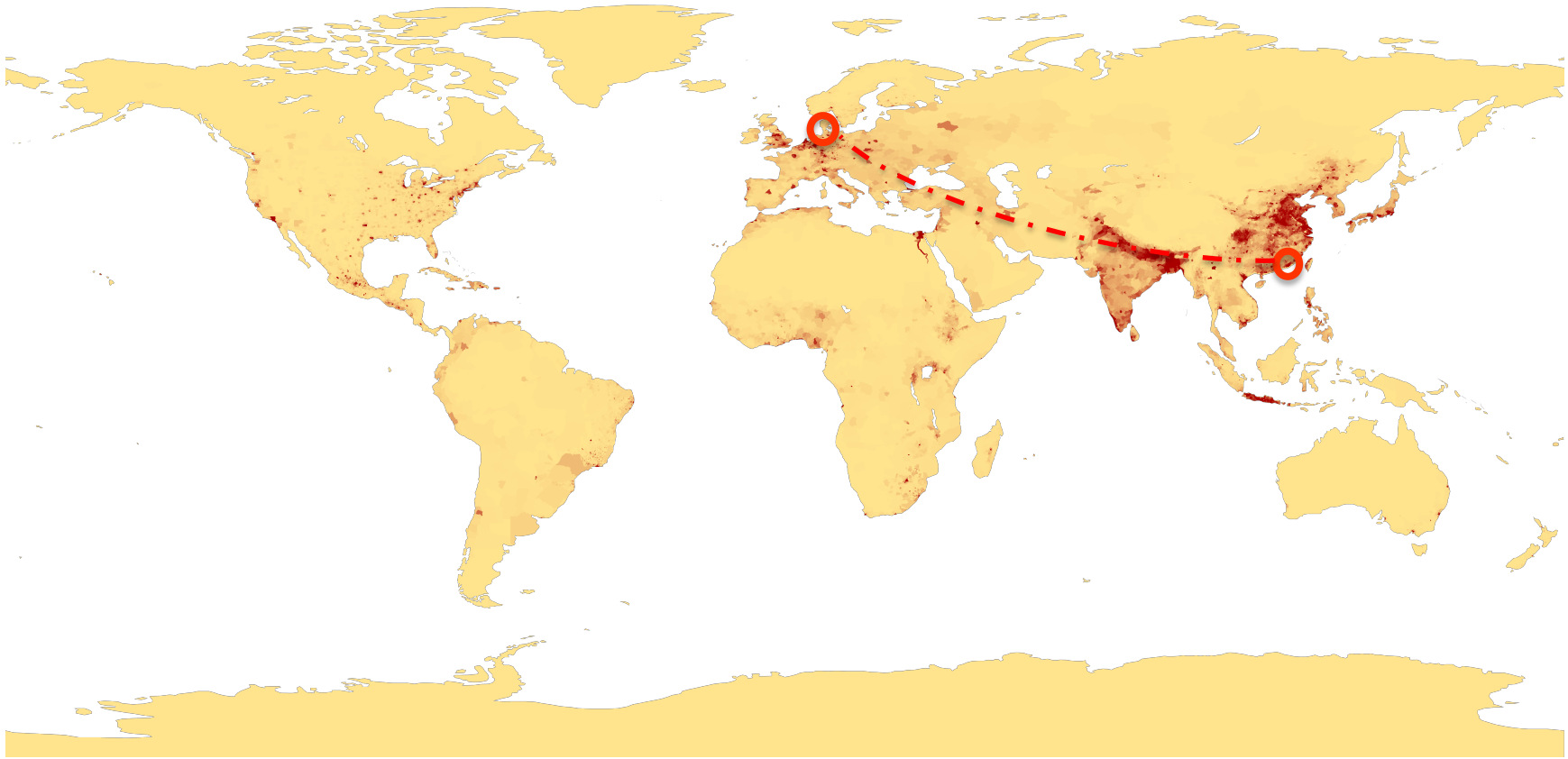
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# Hong Kong & The Netherlands





# The Netherlands





# What do we share?

Small country, vulnerable to natural hazards

High protection standards, huge investments in 'hard' flood infrastructure

Resources and time to **revisit current strategy**



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A 3D topographic map of Rotterdam, Netherlands, showing the city's layout and surrounding landscape. The map uses a color gradient where blue represents lower elevations (water and low-lying land) and brown/tan represents higher elevations. The city's built-up areas are shown in brown, while the surrounding fields and water bodies are in shades of blue. The Scheldt river is prominent, flowing through the city. The map is presented in a perspective view, giving it a three-dimensional appearance.

# Rotterdam

Bron: Bobbink TU Delft i.o.v. gemeente Rotterdam



# Happy Valley Underground Stormwater Storage

- Add pic



# Introduction:

## Evolution flood risk management





# What is anticipation?

“Action based on (existing) knowledge”

Knowledge:

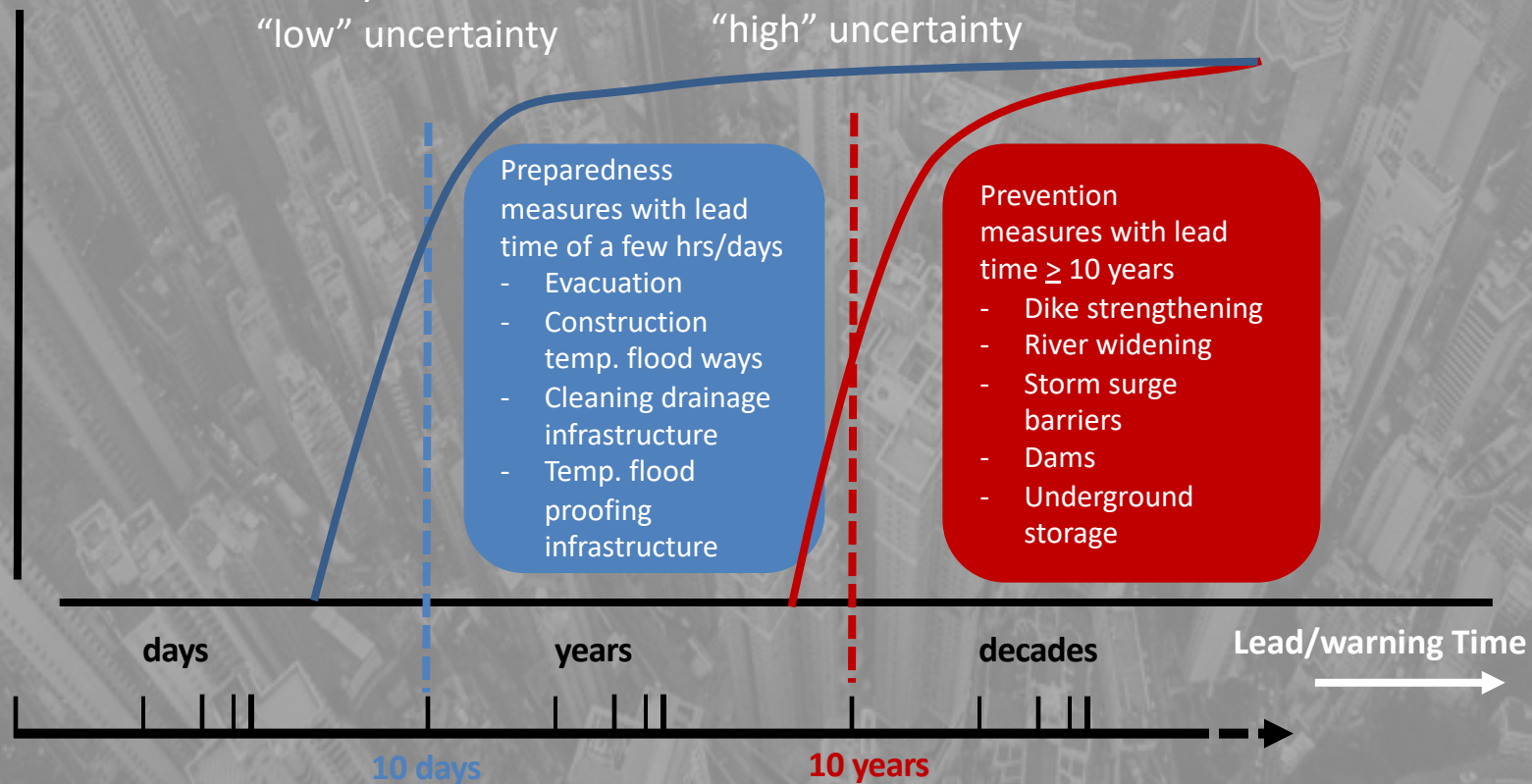
- Information that predicts events (forecasting) & possible routes into the future (projections)
- Information to signal changing system dynamics

# What is anticipation?

Decision **Anticipation / Preparedness**: lead time a few days in advance; “low” uncertainty

Decision **Anticipation / Prevention**: lead time  $\gg 10$  years in advance; “high” uncertainty

Freedom of choice:  
number of options ↑





An aerial photograph of a dense urban landscape, likely Hong Kong, showing a vast number of high-rise buildings packed closely together. The image is used as a background for the presentation text.

# This presentation

## **Two key questions:**

1. What are the challenges?
  2. How to respond?
- (from an international perspective)



# **Challenge nr 1.**

## **Coping with uncertainty in future predictions (1)**

### **Strategy 1: Prepare for the worst**

- Resource intensive;
- Might have strong impact (spatial, social);
- Residual risk

### **Strategy 2: Wait for scientific certainty/consensus**

- Maybe too late for timely readjustment (implementation period);
- Maybe new insights will NOT increase confidence bounds;
- Risk might be increasing due to anthropogenic changes

**Can we afford these strategies?**



# **Challenge nr 1.**

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### **Strategy 3: Adaptive planning, adaptive decision making**

- Dynamic plan, adaptive pathways (start with small steps)
- Monitoring, evaluation & corrective action
- Inclusive public participation

# **Challenge nr 1.**

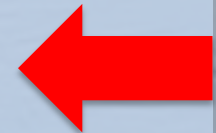
## **Coping with uncertainty in future predictions (2)**

**IPCC AR6 new report in 2021:**

- **New climate scenario's**

**Dutch Delta Program:**

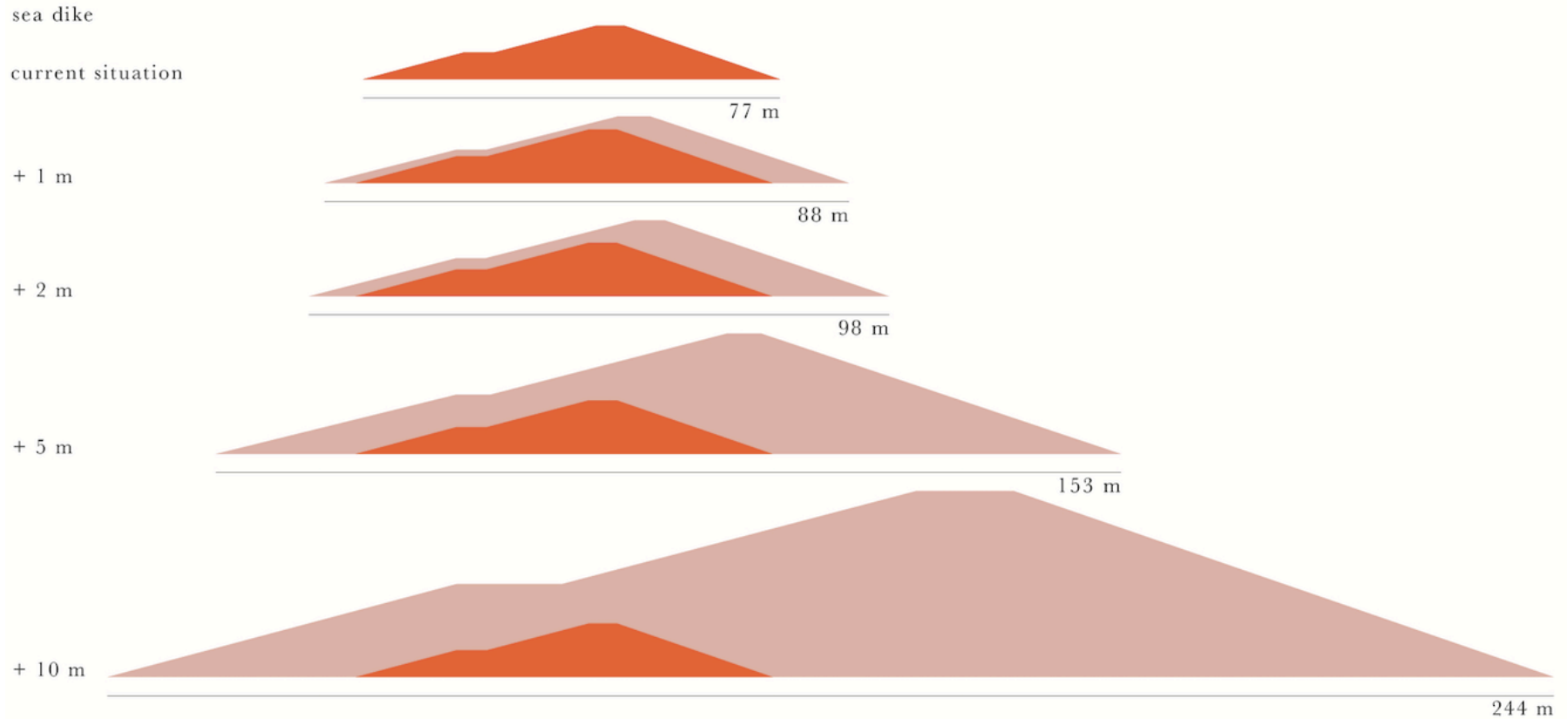
- **Present scenario (2100): 85 cm SLR**
- **New scenario (2100): 200 cm SLR**



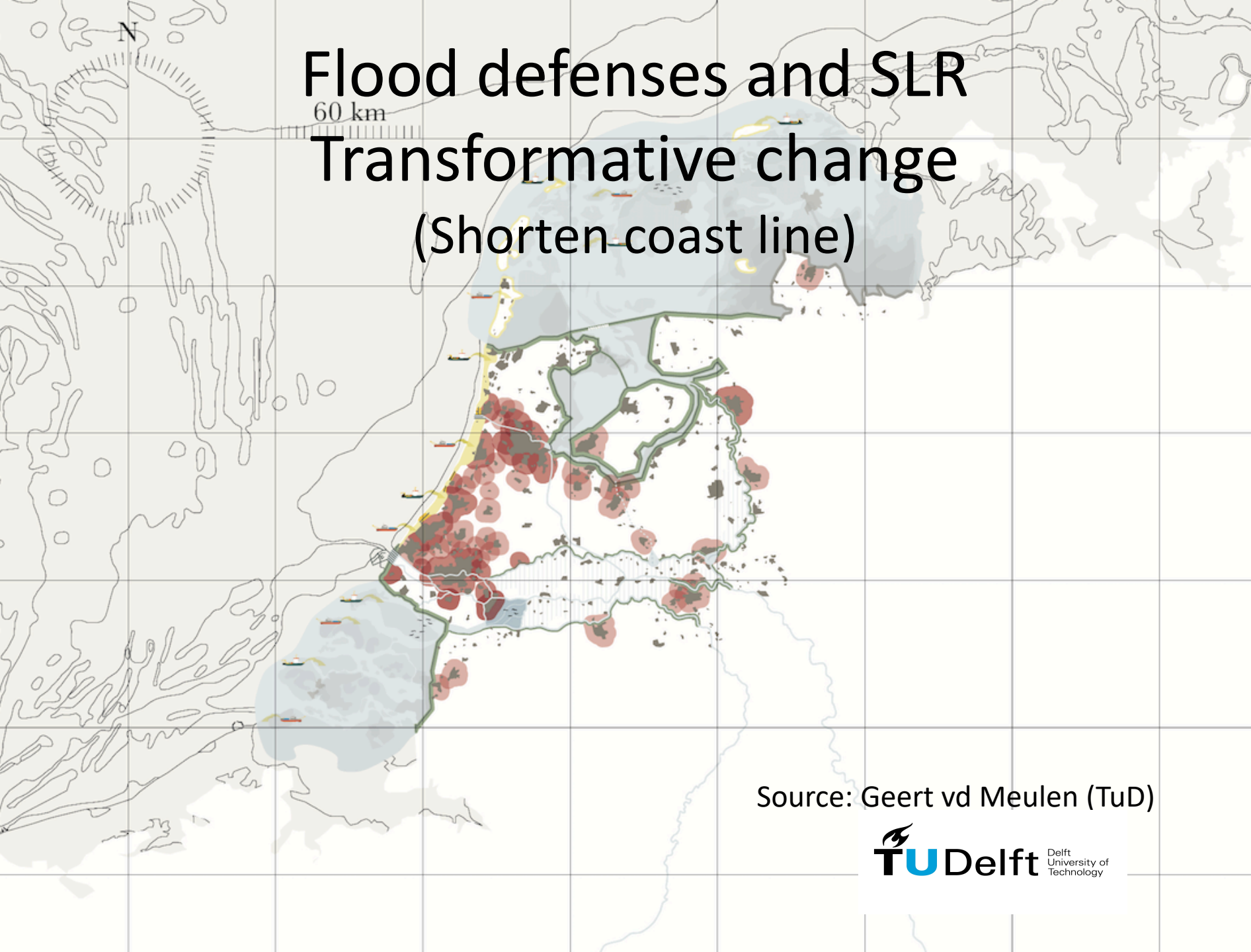


# Flood defenses and SLR

## Incremental change ?



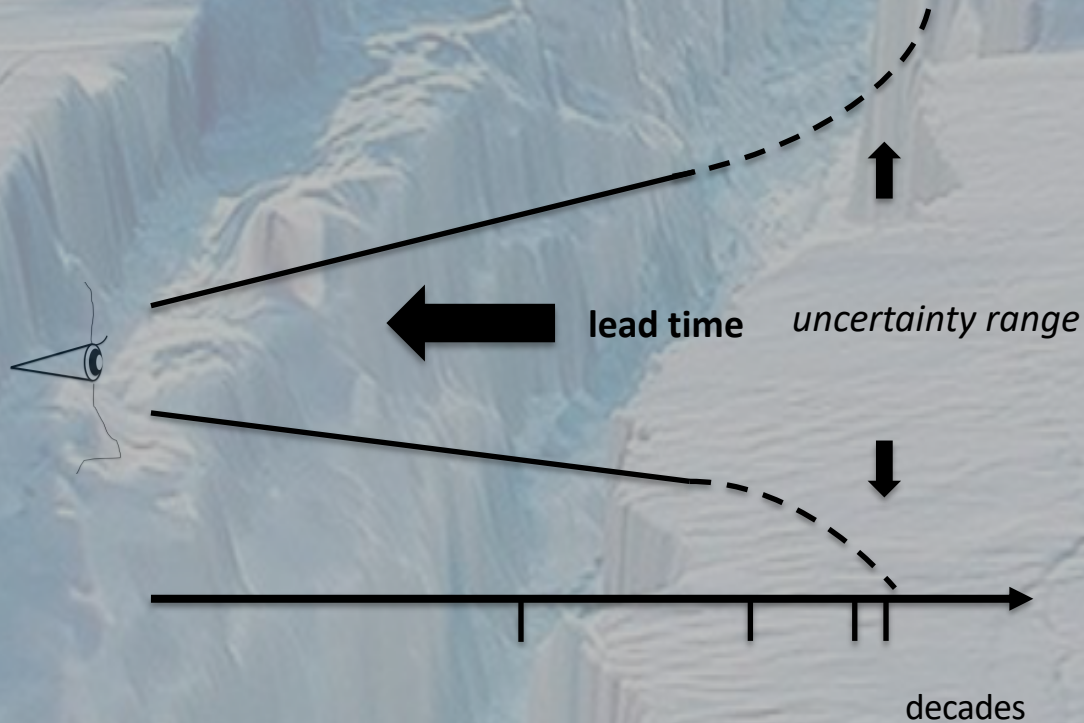
# Flood defenses and SLR Transformative change (Shorten coast line)



Source: Geert vd Meulen (TuD)



# Long-term projections: lead time of interventions is increasing





# Long-lifetime decisions

- Difficult to define performance criteria and risk margins
- Interventions decisions generally call for high investment costs, transformative change
- Increasing lead times
- **Calls for a shift from adaptive planning to planned adaptation ?**



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# Challenge nr 2: Extreme whether events







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# To deliver climate adaptation, we must invest in early warning systems





# Technological change: information systems

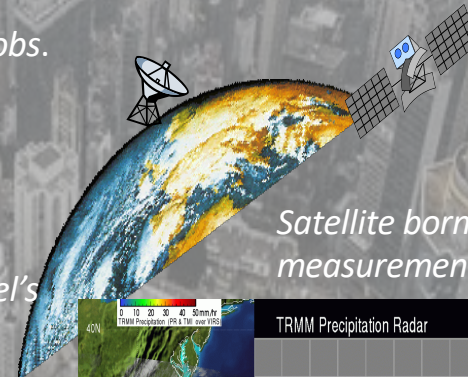
*In-situ sensors*



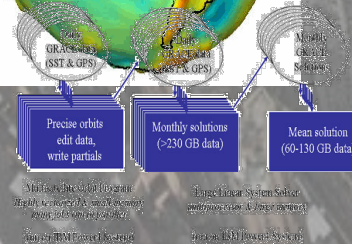
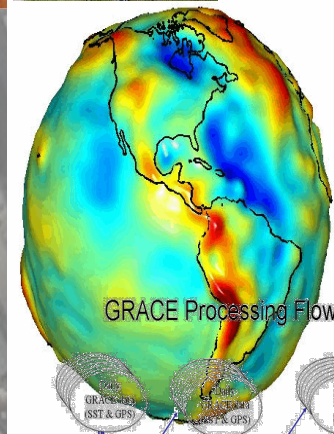
*Citizen obs.*



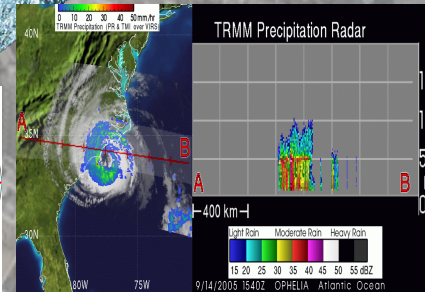
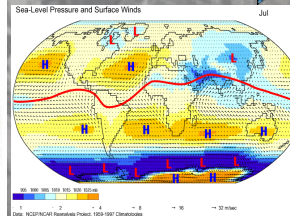
*Satellite borne measurements*



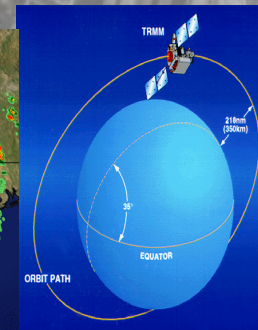
*Remote sensing*



*Numerical model's output*



*Weather radars*





# European Centre for Medium-Range Weather Forecasts (ECMWF)

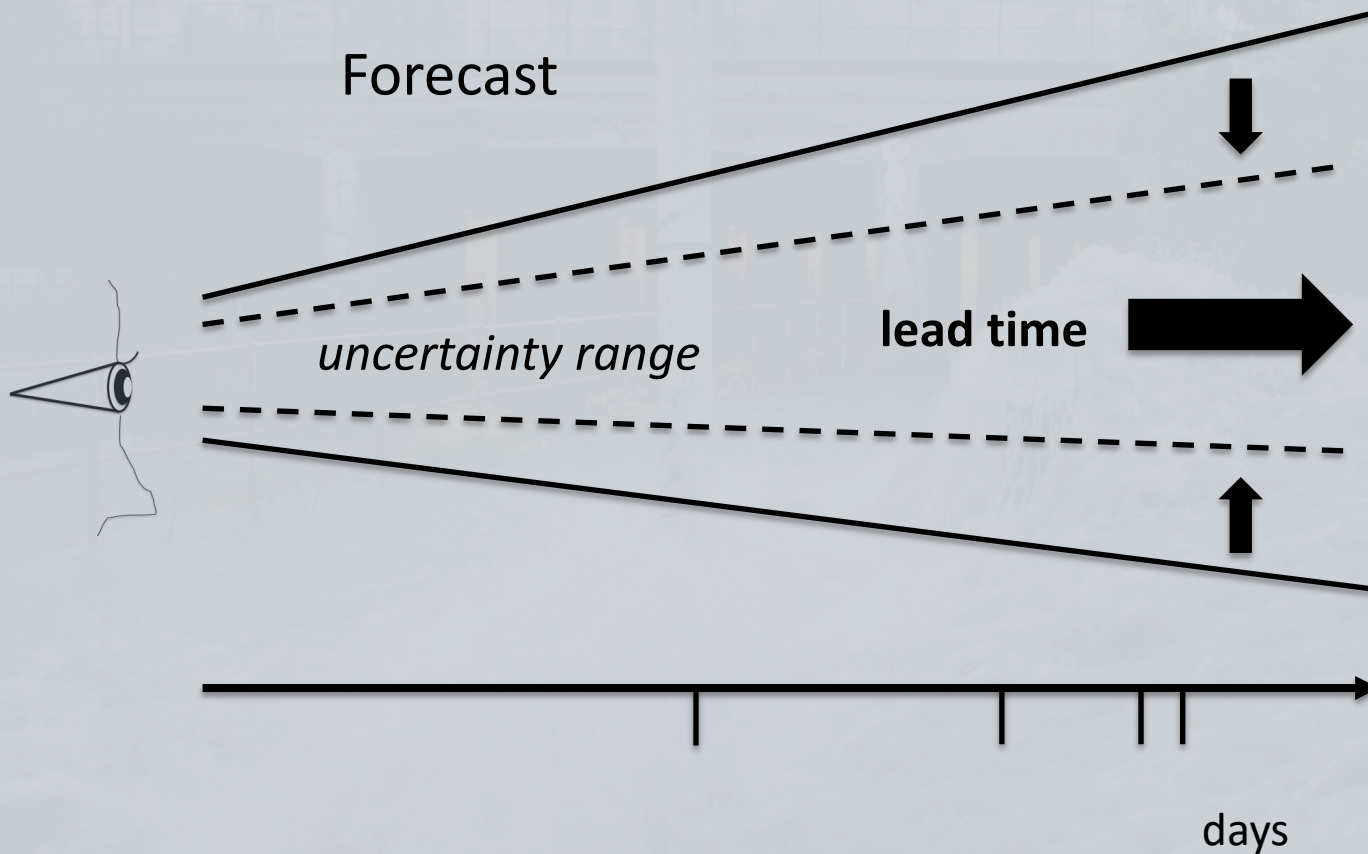
## Ambitious targets

“to make skillful (ensemble) forecasts of high-impact weather events up to **10 days** ahead”

“to predict large-scale patterns and regime transitions up to **4 weeks** ahead”



# Forecasts: lead (warning) time to intervene is increasing





Elbe, 2013







Alexandria,  
2015







## Short-life time decisions

- Interventions expected to have a high benefit cost ratio
- Uncertainties associated with 'preparedness' interventions are *relatively* low
- Increasing warning (lead) times expand the **deadline** for long-life time decisions (infrastructure investments)



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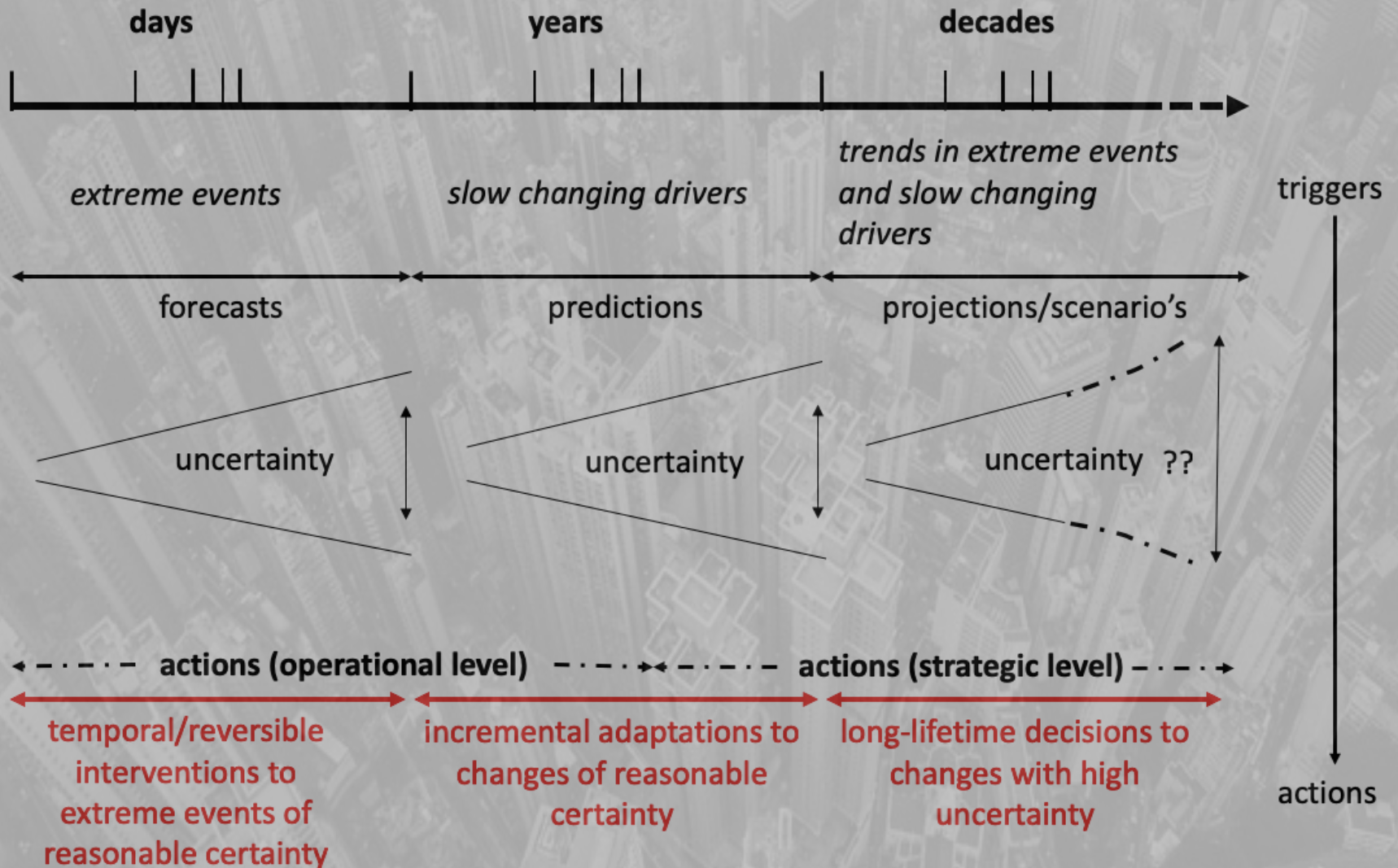


An aerial, high-angle photograph of a densely packed urban landscape, likely Hong Kong, showing a multitude of skyscrapers and high-rise buildings. The image is slightly desaturated, giving it a monochromatic feel. Overlaid on the upper portion of the image is a dark, semi-transparent rectangular box with rounded corners. Inside this box, the text "What are emerging strategies?" is written in a clean, white, sans-serif font.

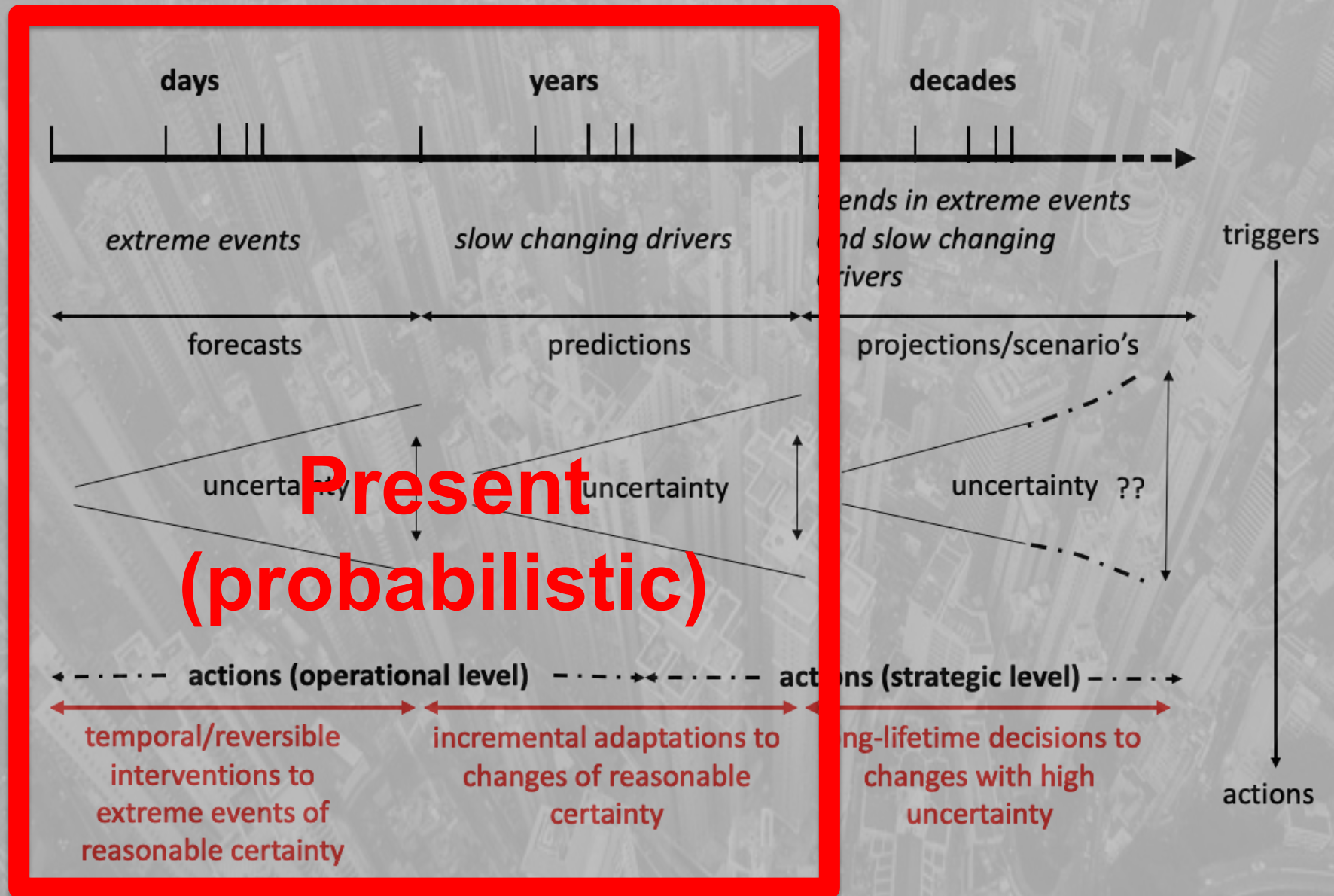
**What are emerging strategies?**



# Domain of anticipatory flood risk management

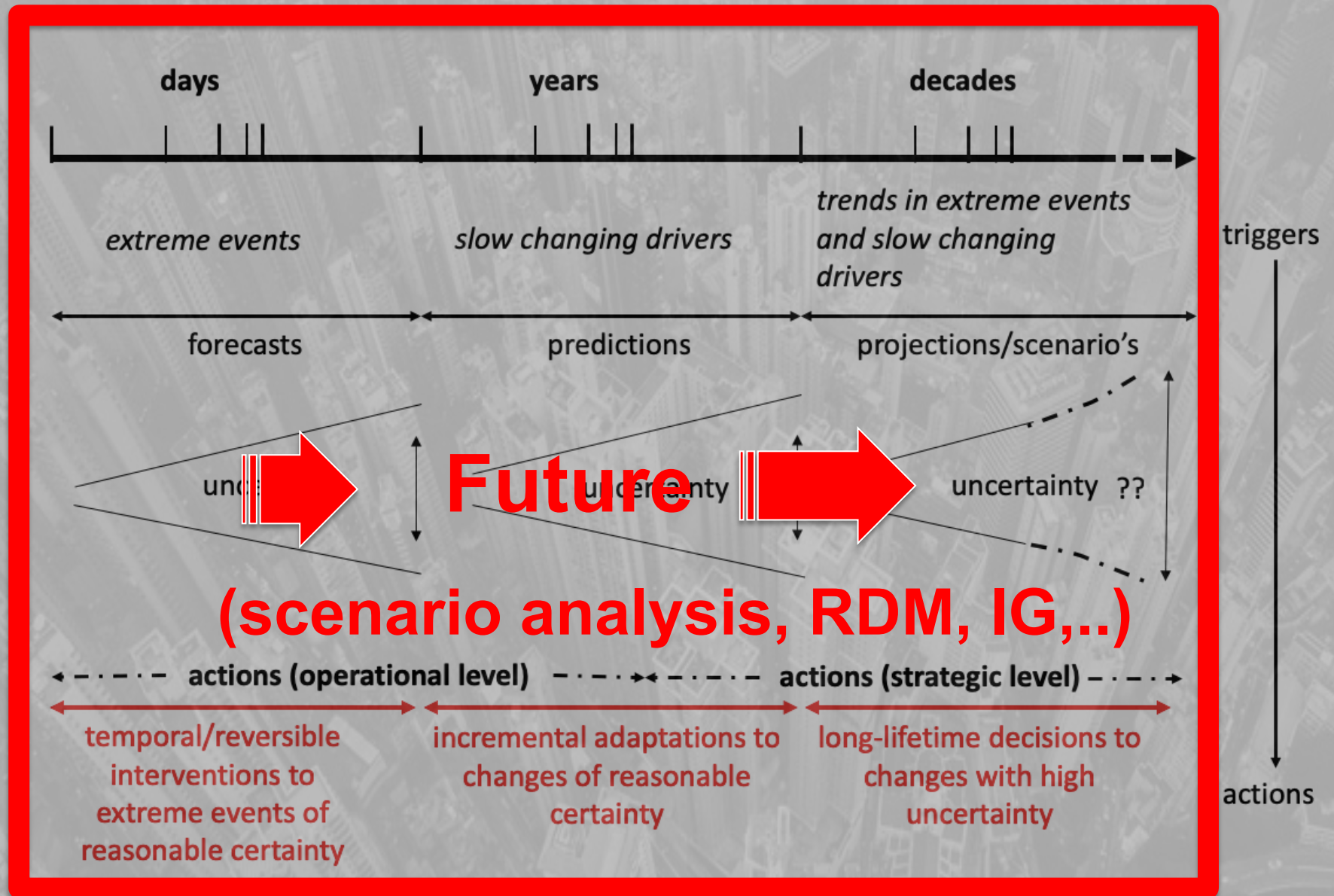


# Domain of anticipatory flood risk management





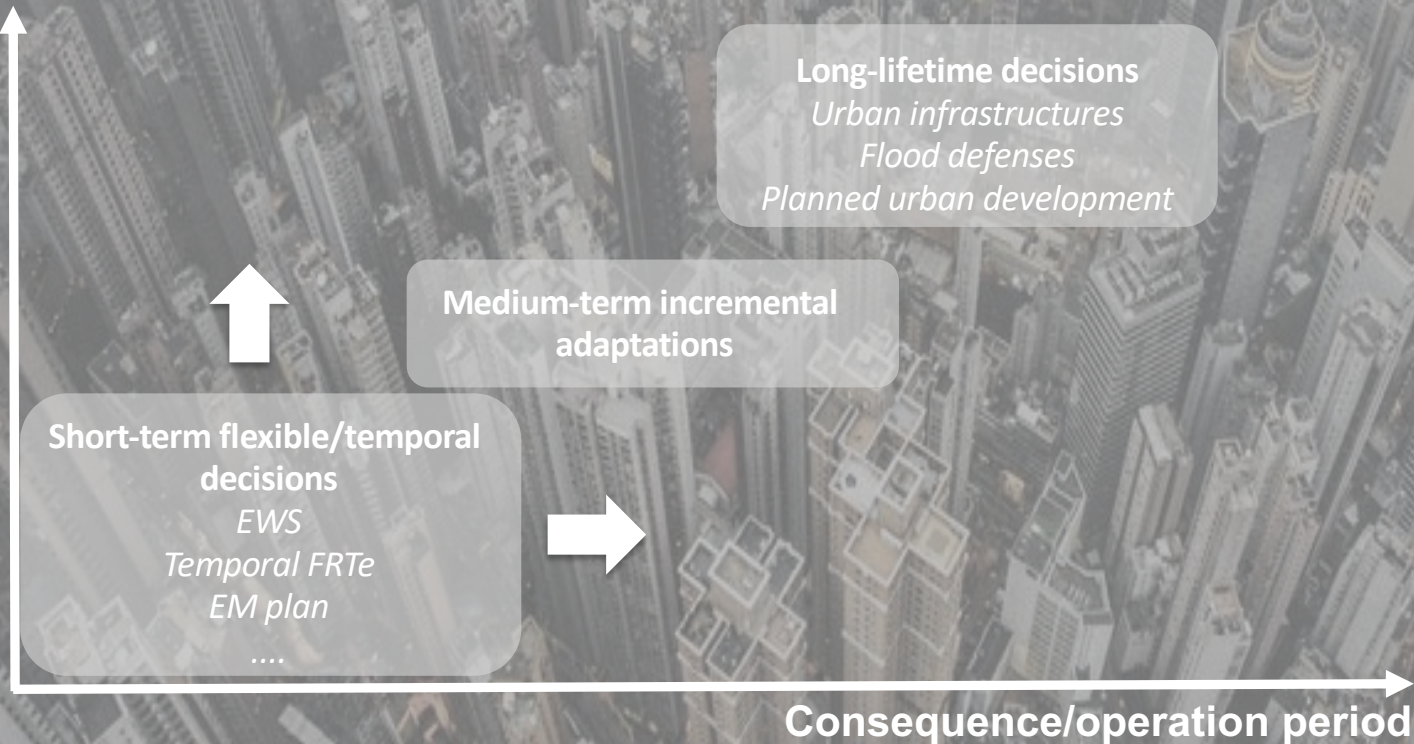
# Domain of anticipatory flood risk management





# Three types of decisions (based on lifetime)

Lead time





# Final remarks

1. Sense of urgency to act now
2. Preparedness and prevention still conceived as separate strategies
3. Climate change discussion drives:
  - setting longer time horizons LT strategies (lead times are increasing)
  - increasing “preparedness” (ST strategies) (expanding warning times)
  - shifting from adaptive planning to planned adaptation
4. Opportunities integration preparedness & prevention:
  - to maximize the value of existing assets
  - to increase flexibility in long-life time decisions (infrastructure projects)
  - to increase level of (flood) resilience