

Sharing lessons from the Netherlands

A country below sea level

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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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This presentation

A. Two key questions:

1. What are the challenges?
2. How do we respond and what are emerging strategies?

(from an international perspective)

B. Room for the River (Dutch approach)

The Netherlands



Flood disaster 1953



Emphasis on flood protection





A black and white photograph showing a flooded residential area. In the foreground, there is a large, rectangular concrete structure, possibly a foundation or a wall, partially submerged in water. The water is murky and reflects the sky. In the background, several houses with tiled roofs are visible. Some of the houses appear to be in various states of disrepair or destruction. One house on the left has a severely damaged roof, with wooden beams exposed. Another house in the middle has a partially collapsed roof. The overall scene suggests a significant flood event that has caused extensive damage to the buildings and infrastructure.

Delta Commission 1.0*

- **Predict and control regime;**
- Neglect of man;
- Top down;
- Delta works;
- Stringent safety standards based on fixed drivers.

*1970-2010

1995



River flood: 1993 and 1995 (narrow escape)



Delta Commission 2.0*

- **Integrated and adaptive regime;**
- **Changing drivers and deep uncertainty;**
- **Multi-level governance;**
- **Effective public participation;**
- **Long-term perspective and short term benefits**
- **Protection, prevention & preparedness.**

* 2014 - 2050

Adaptive delta management (ADM)

The background image shows a large dam structure with several tall chimneys or towers. In the foreground, a paved path runs alongside the dam. Several people are walking on the path, including a person in a dark jacket walking a dog. The scene is slightly hazy, suggesting a misty or overcast day.

- Connecting short-term decisions with long-term tasks (related to watersafety)
- Thinking in adaptation pathways instead of end-goals
- Tend to postpone large scale interventions
- Linking investment agendas (aging infrastructure, nature, recreation..)

Source: DP2015

A 3D topographic map of Rotterdam, Netherlands, showing the city's layout and surrounding terrain. The map uses a color gradient from light blue (low elevation) to dark brown (high elevation) to represent elevation. The city's main waterways, including the Nieuwe Waterweg and the Oude Waterweg, are clearly visible, along with the numerous canals and streets that form the city's grid. The surrounding landscape is relatively flat, with some higher ground visible in the north and east.

Rotterdam

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

Evolution flood risk management

reacting after events



preparing for events



adapting to slow changing
conditions



*anticipating trends in extreme
events and slow changing drivers*

past

present

future

What is anticipation?

“Action based on (existing) knowledge”

Knowledge:

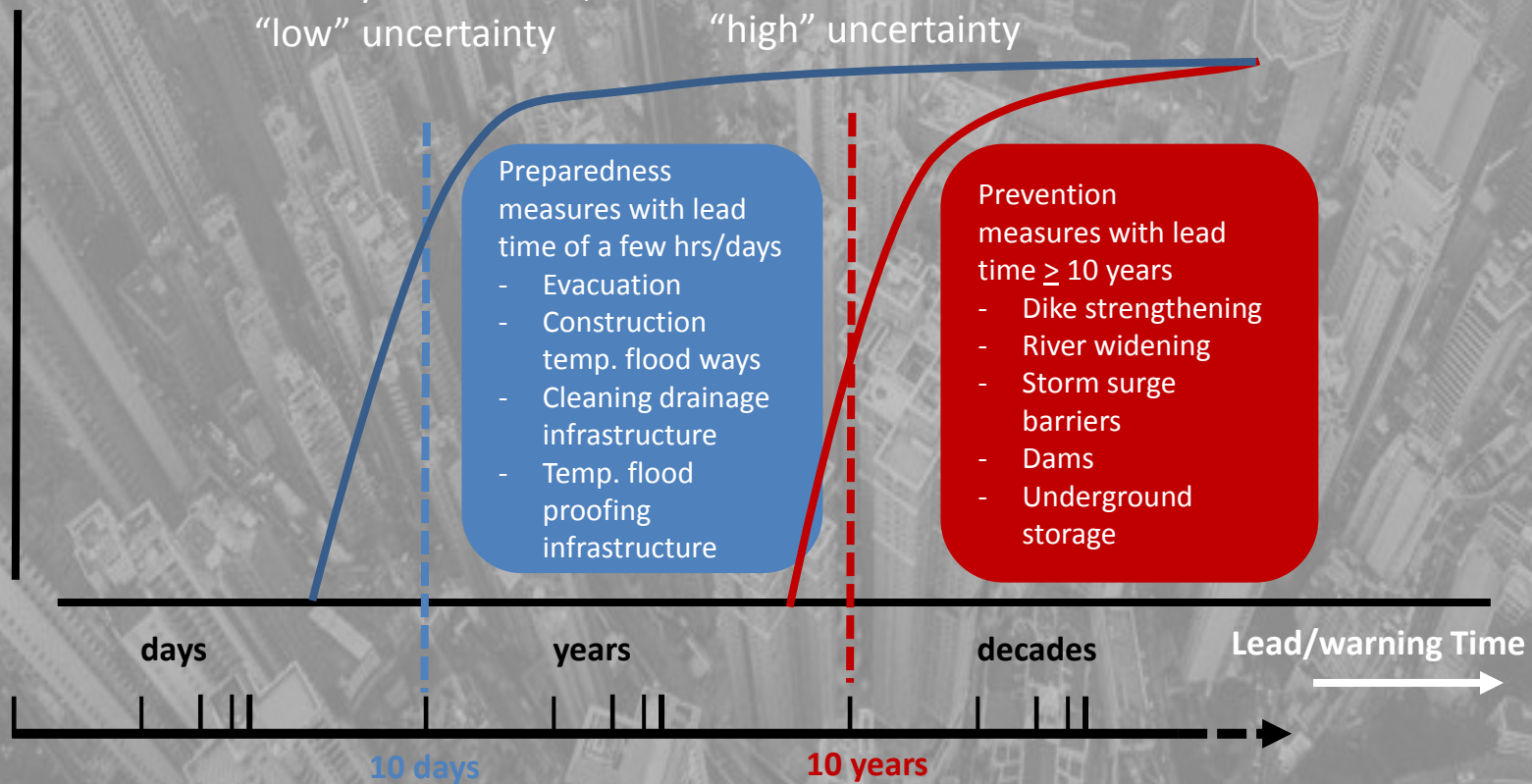
- Information that predicts events (forecasting) & possible routes into the future (projections)
- Information to signal changing system dynamics

What is anticipation?

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

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

Freedom of choice:
number of options ↑



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

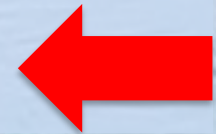
Challenge nr 1. Coping with uncertainty in future predictions (2)

IPCC AR6 new report in 2021:

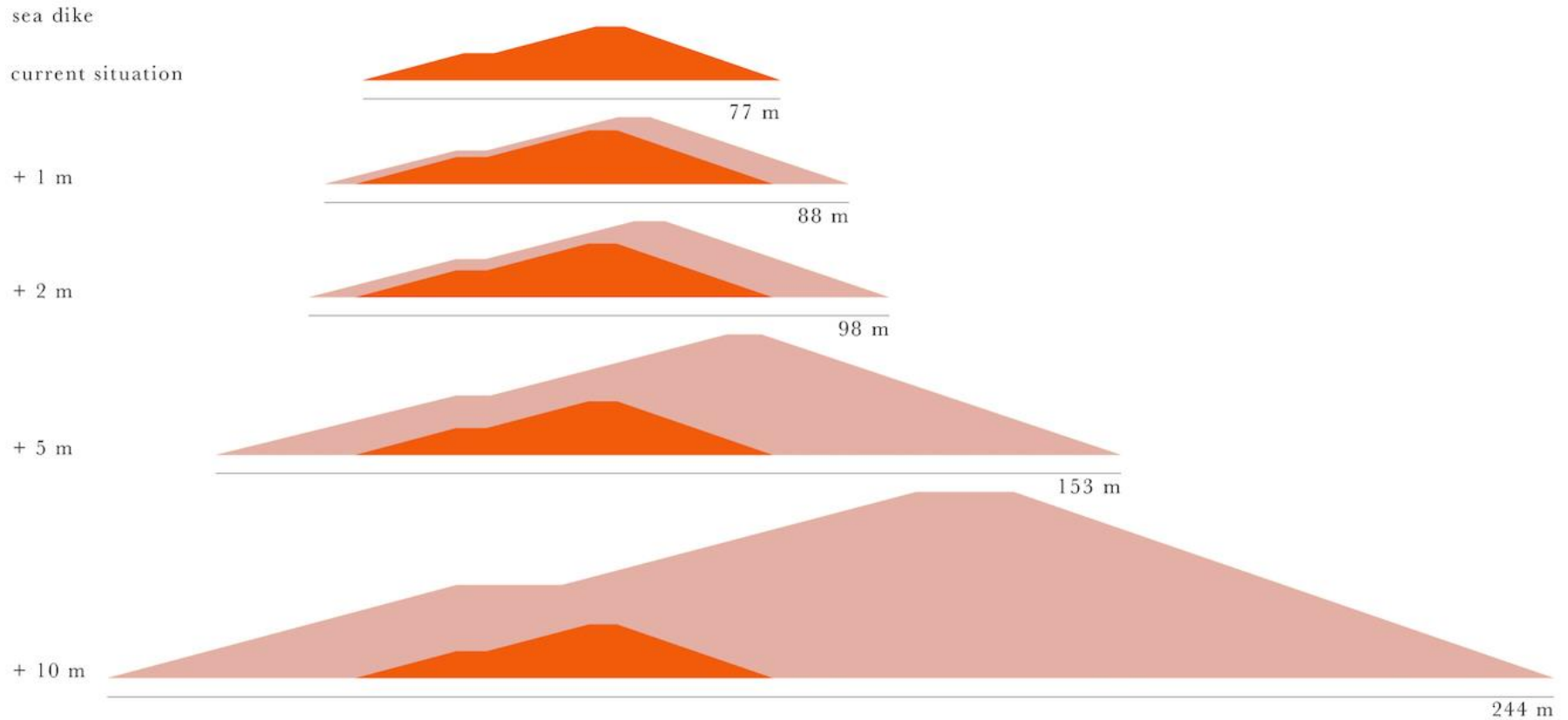
- **New climate scenario's**

Dutch Delta Program:

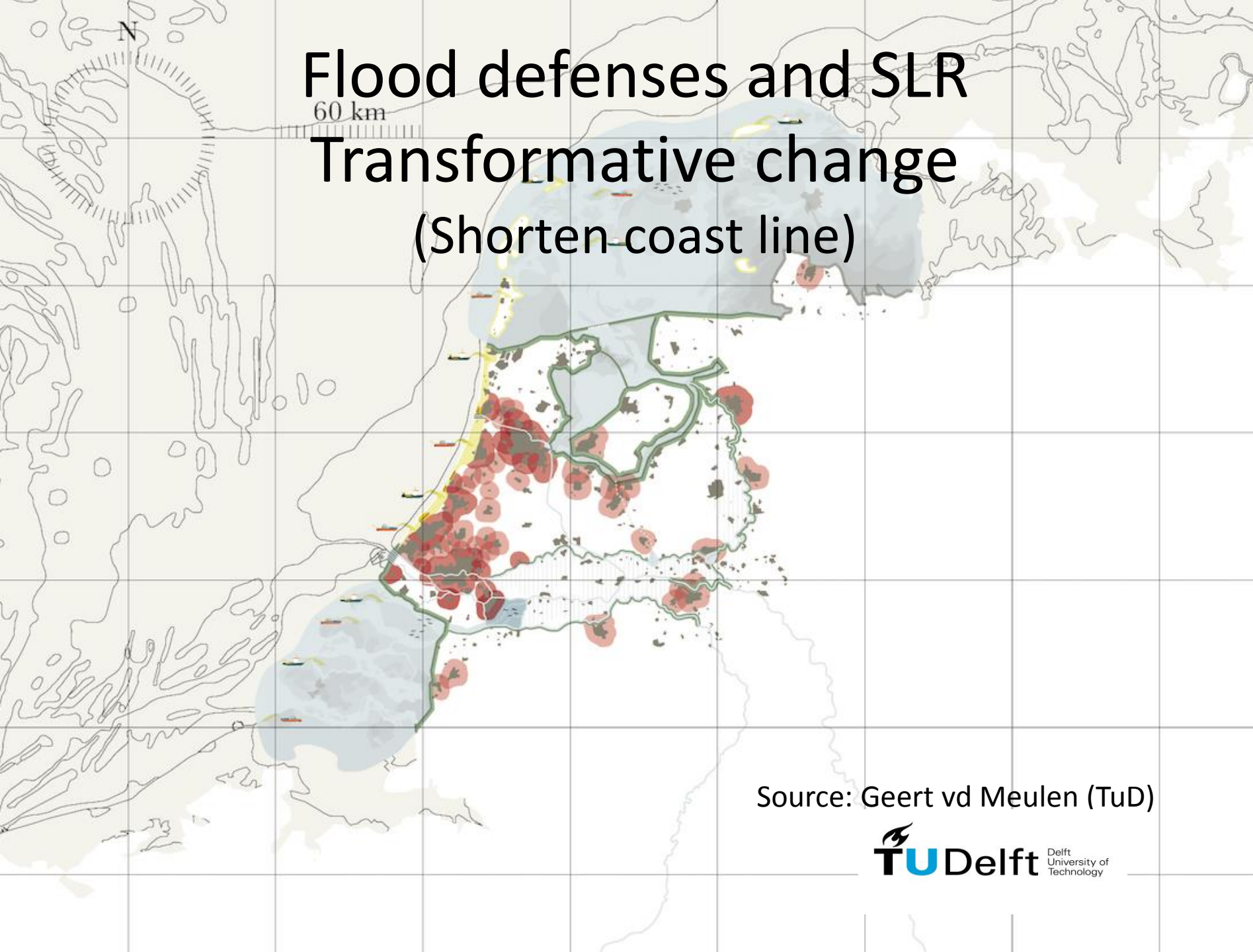
- **Present scenario (2100): 85 cm SLR**
- **New scenario (2100): 200 cm SLR**



Flood defenses and SLR Incremental change ?

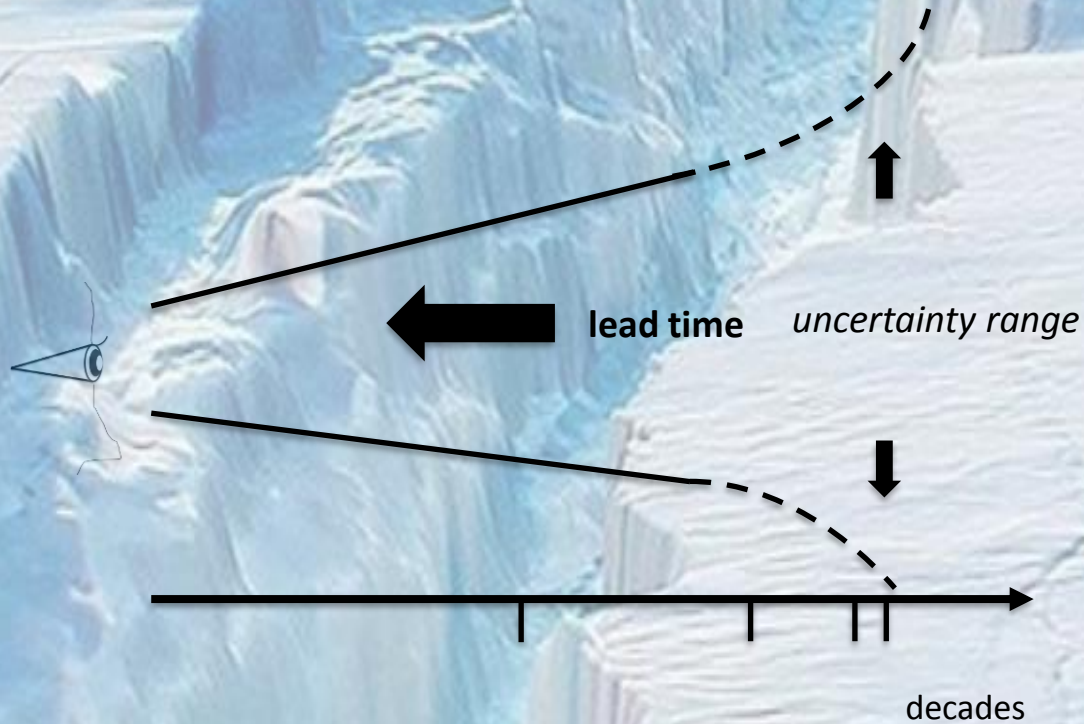


Flood defenses and SLR Transformative change (Shorten-coast line)



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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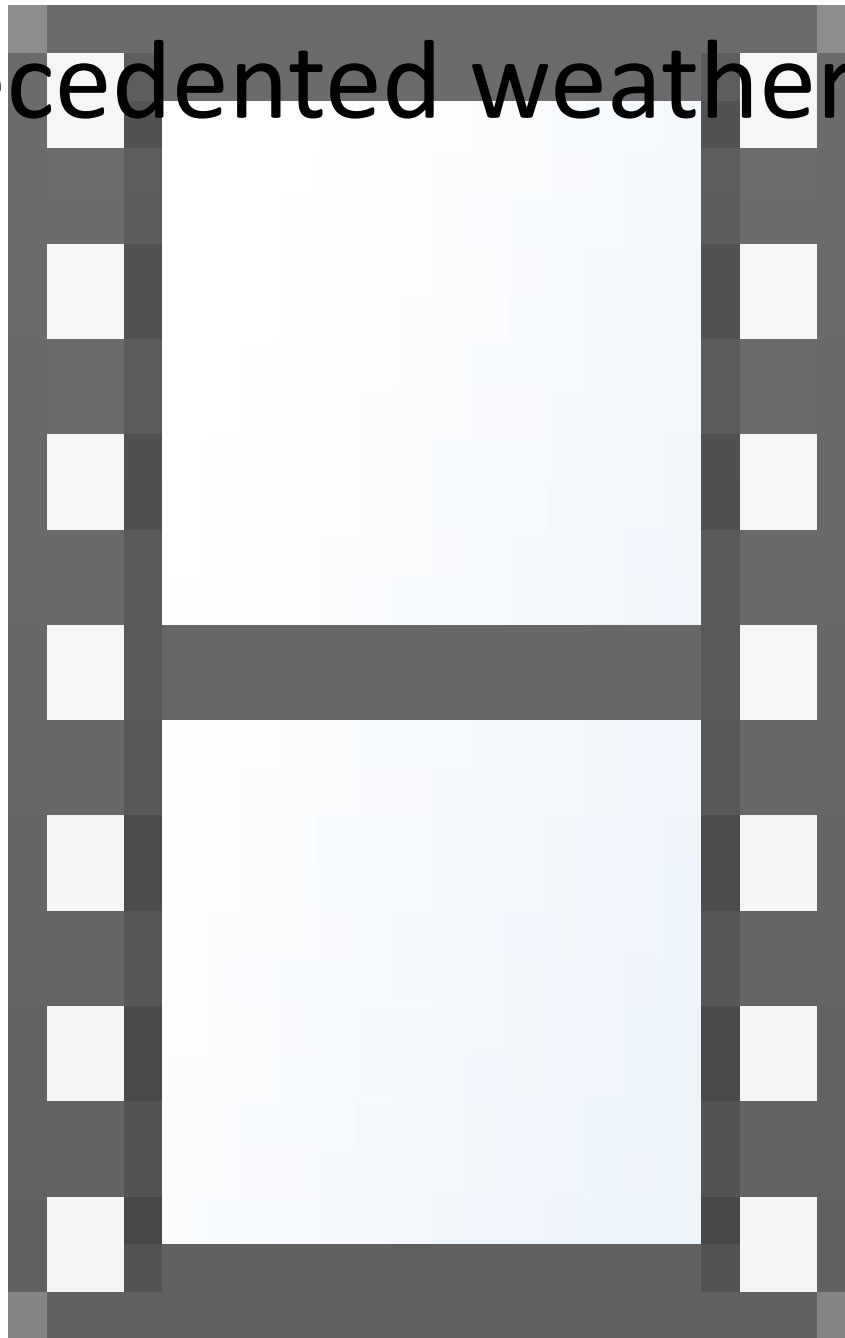


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Challenge nr 2: Extreme whether events



Unprecedented weather extremes

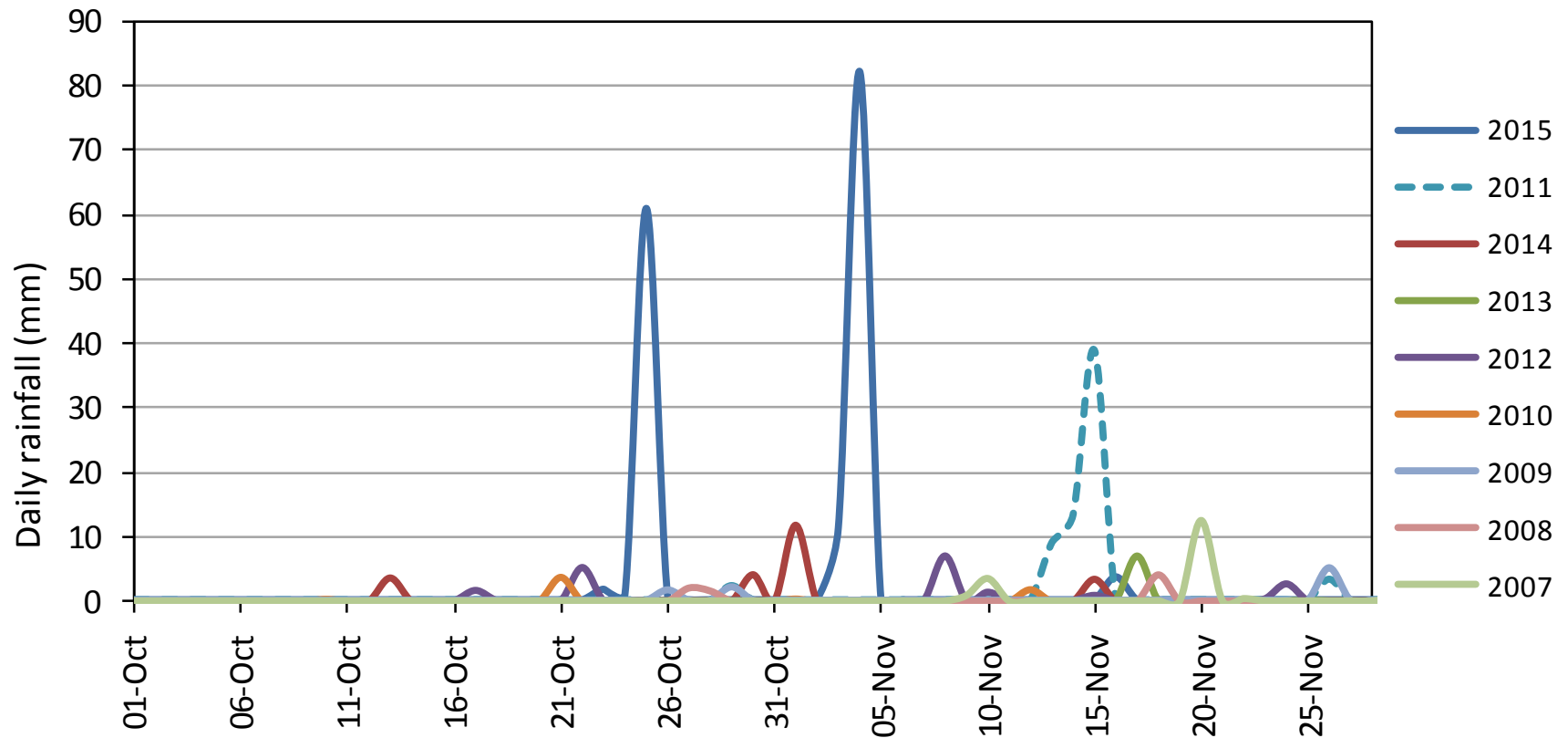




Alexandria,
2015

Daily rainfall: cluster of events

Alexandria, Egypt

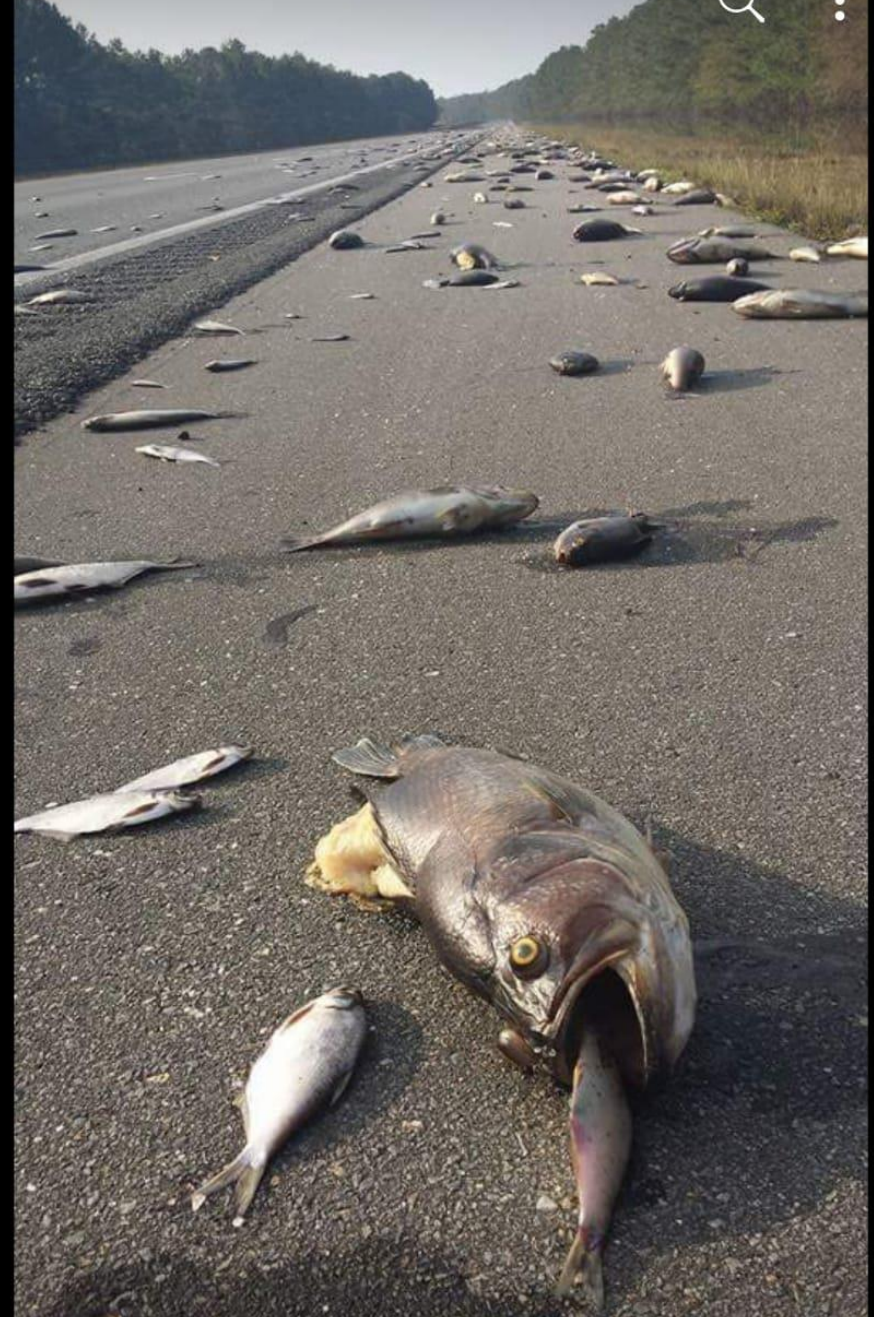


Hurricane Floren Caro



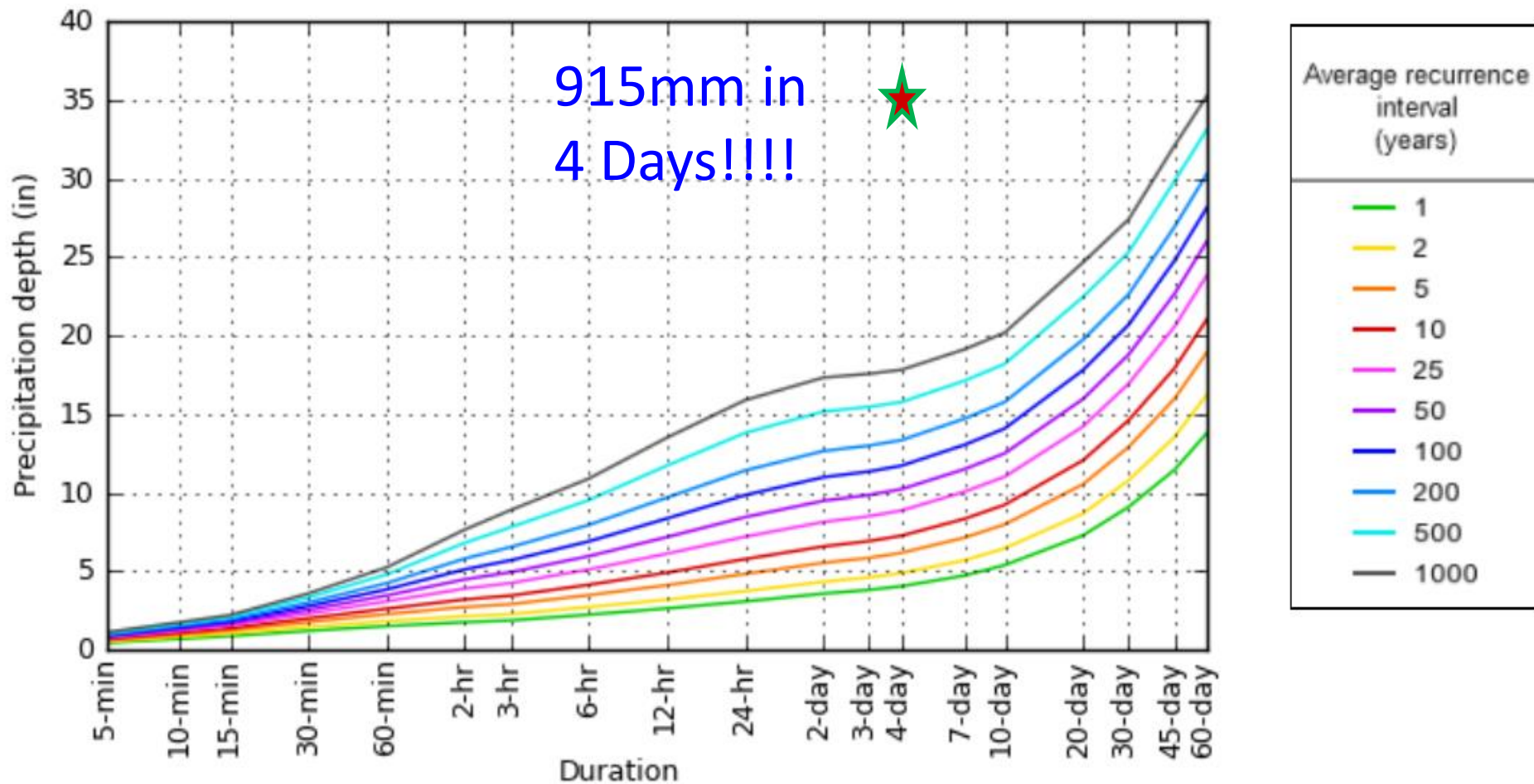
WILMIN

- 23.59" (IT'S S
WETTEST SINGLE
- 2018 RAINFA
86.79" SO FAR...
- BREAKS PRE
83.65" OF RAIN



Precipitation Frequency – ILM *Elizabethtown*

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.6267°, Longitude: -78.5783°





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



Technological change: information systems

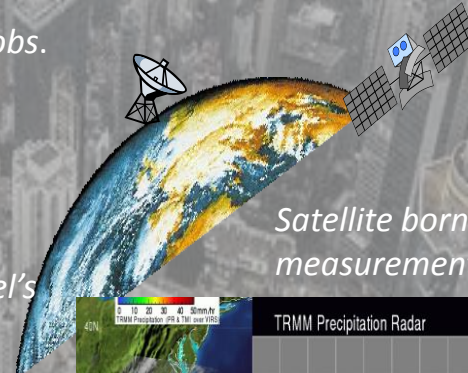
In-situ sensors



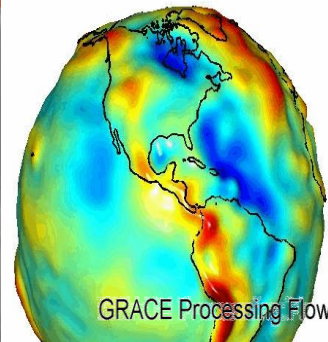
Citizen obs.



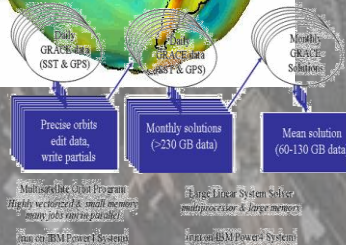
Satellite borne measurements



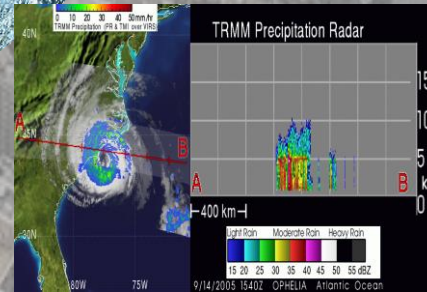
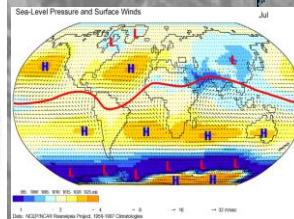
Remote sensing



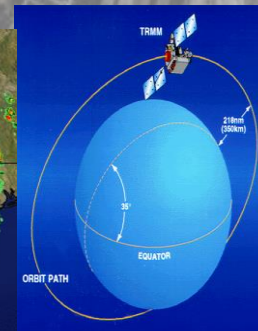
GRACE Processing Flow



Numerical model's output



Weather radars



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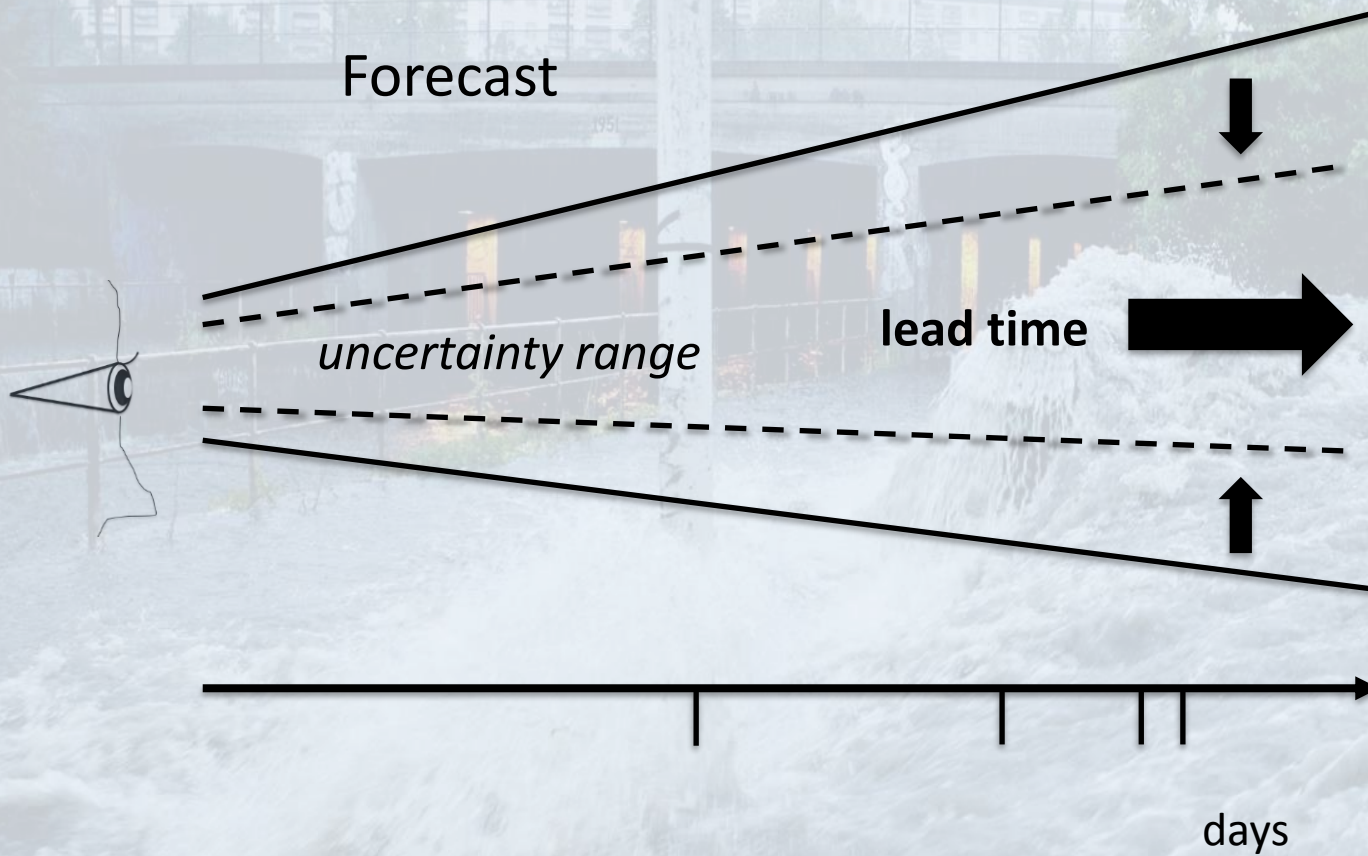
European Centre for Medium-Range Weather Forecasts (ECMWF)

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





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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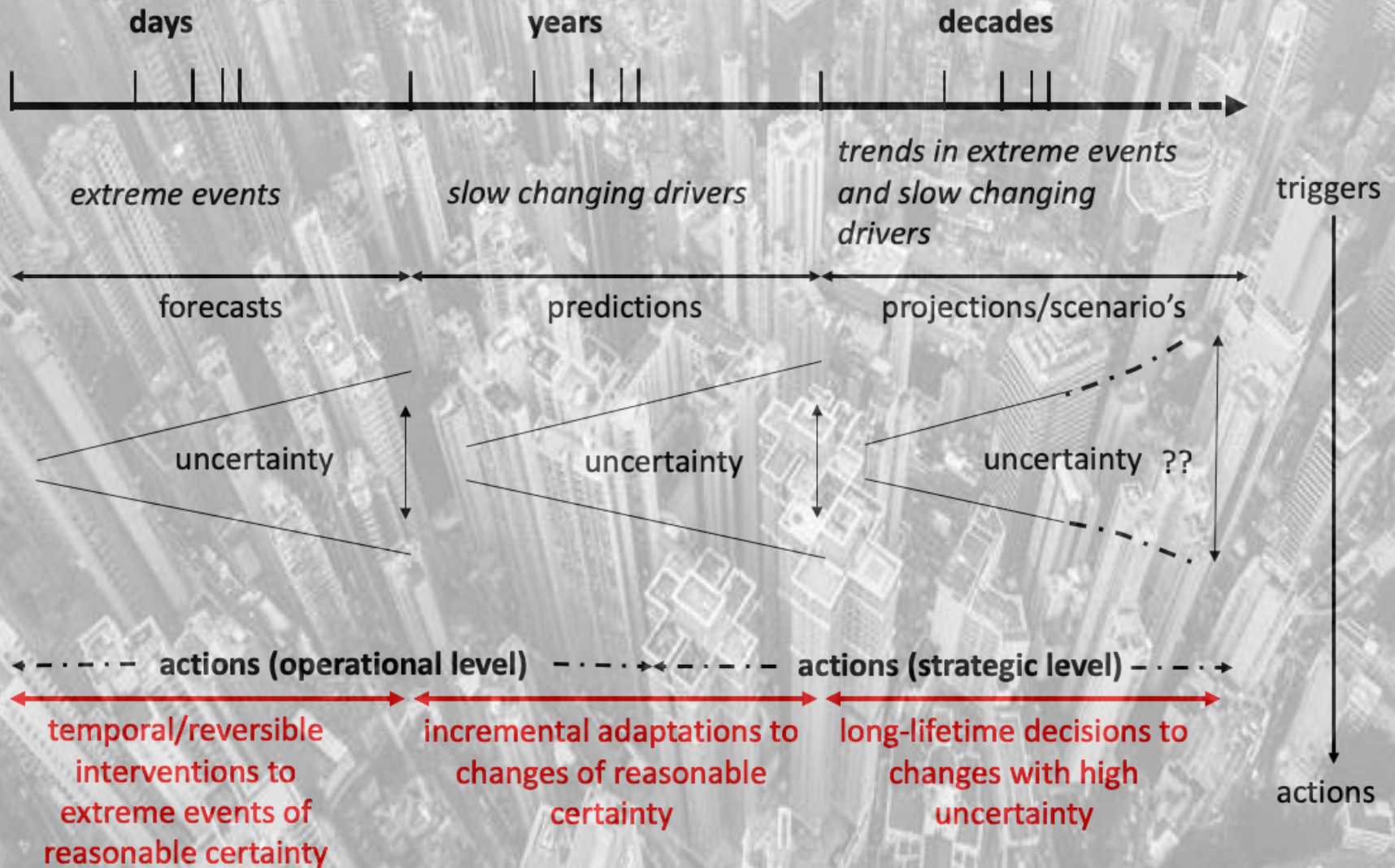


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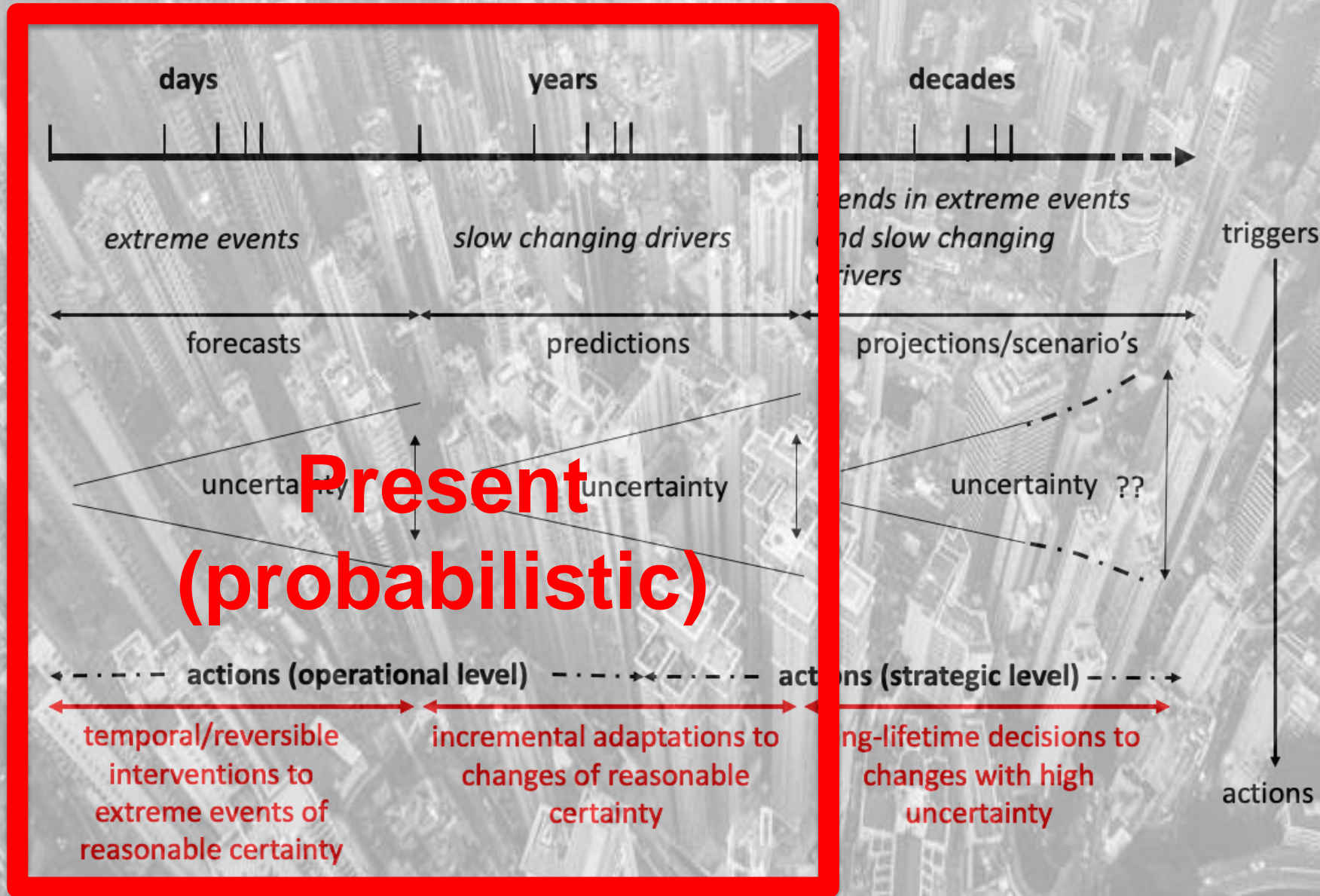
An aerial, high-angle photograph of a densely packed urban skyline, likely a major financial hub. The image is filled with numerous skyscrapers and high-rise buildings of varying heights and architectural styles. The buildings are tightly clustered together, creating a complex, textured pattern of grey, white, and brown tones. In the lower right, a multi-level highway interchange is visible. A semi-transparent, dark grey rounded rectangle is overlaid on the upper portion of the image, containing the text "What are emerging strategies?".

What are emerging strategies?

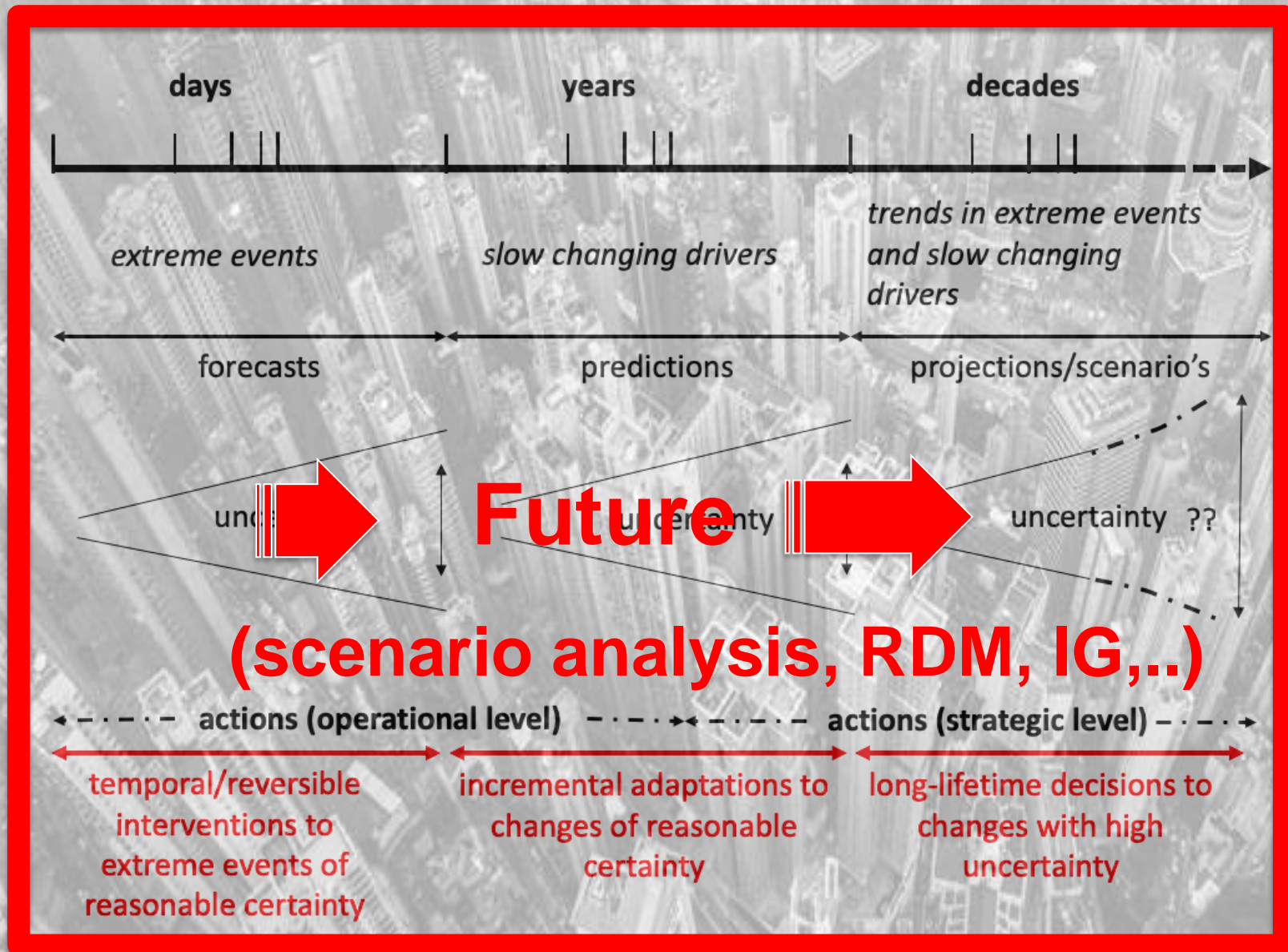
Domain of anticipatory flood risk management



Domain of anticipatory flood risk management

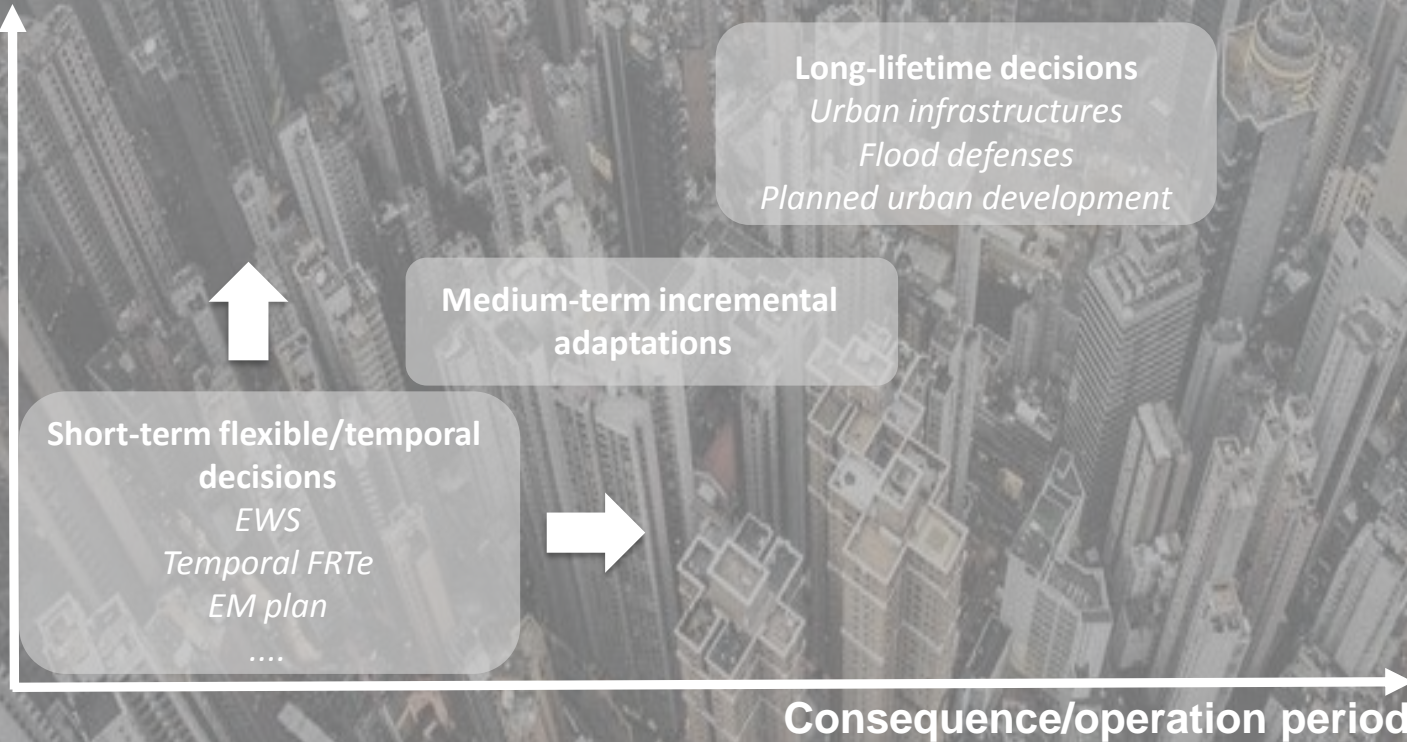


Domain of anticipatory flood risk management



Three types of decisions (based on lifetime)

Lead time



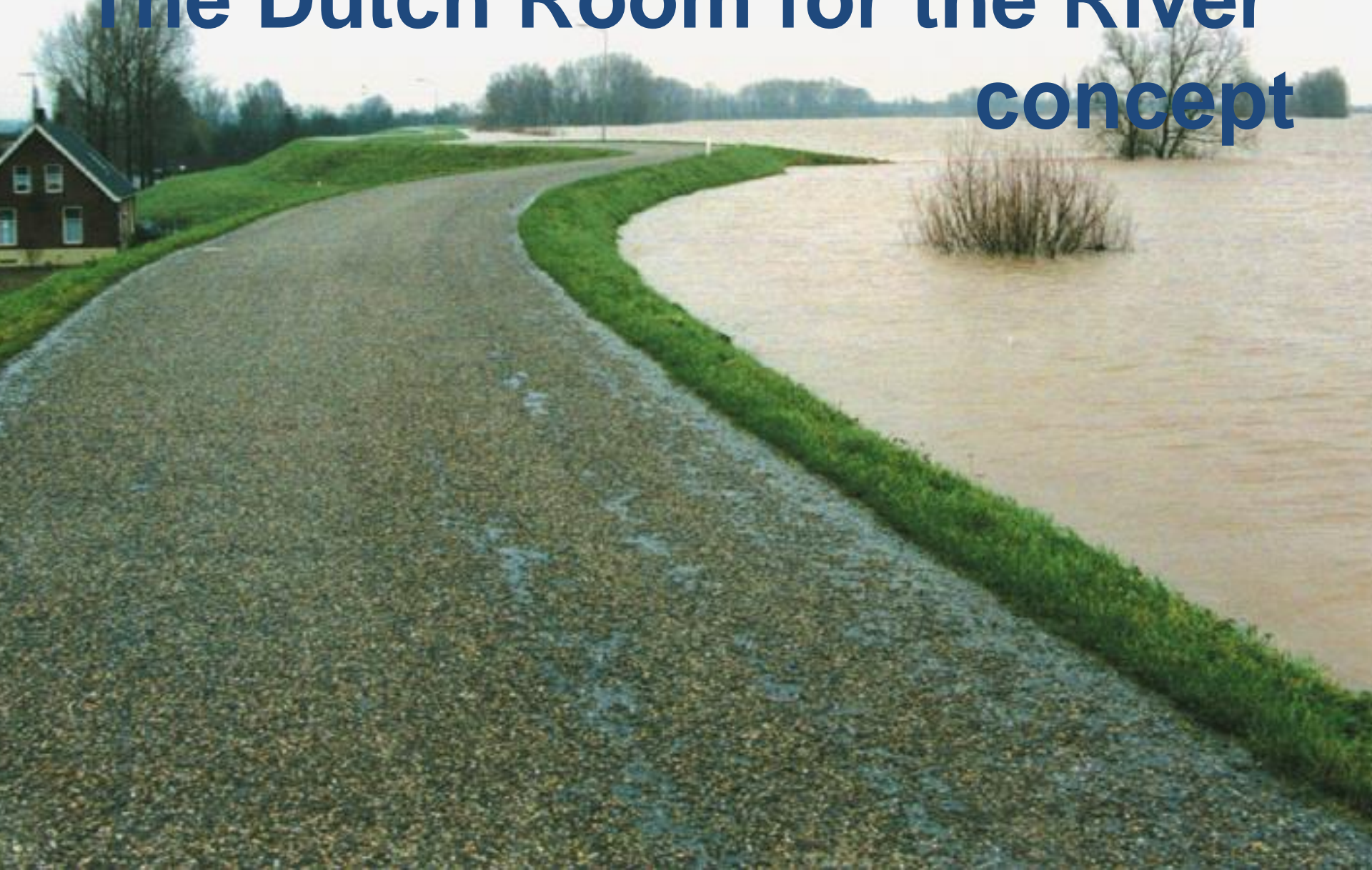
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1995 Waal

The Dutch Room for the River concept



Room for the River: 39 projects



Room for the River: features

A map of the Netherlands showing the Room for the River program. The map highlights the main river corridors: the IJsselmeergebied (IJsselmeer), the Rijn (Rhine) from Amsterdam to Rotterdam, and the Waal (Waal) from Nijmegen to the North Sea. Numerous project locations are marked with red dots and connected to text labels. These labels describe various types of interventions such as 'dikverbetering' (dike improvement), 'uiterwaardvergraving' (outer dike excavation), 'kribverlaging' (weir lowering), and 'overtakelverwijdering' (overbank removal). Major cities like Amsterdam, Almere, Utrecht, Nijmegen, and Rotterdam are also labeled on the map.

- dealing with uncertainty
- new analytical methods to facilitate discourse
- strategic flood risk management
- dual objective: safety & spatial quality





Normal situation



January 18, 2018

Room for the River Programme

Transition to more sustainable flood management: from “fighting against water” towards “living with water”

Key components:

1. Long term lens (climate change, population, ...)
2. Stronger integration with other disciplines such as spatial planning
3. Decentralized planning and execution

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