

# Shifting Time Horizons in Flood Risk Management

Chris Zevenbergen



## This presentation

- I. EU Floods 2021: some notions
- II. The three time domains of FRM
- III. Long-life time decisions vs short-life time decisions
- IV. How to increase (flood) resilience (capacity)?

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- I. EU Floods 2021: some notions
- II. The three time domains of FRM
- III. Long-life time decisions vs short-life time decisions
- IV. How to increase (flood) resilience (capacity)?

Key message:

**Need for (better) alignment preparedness & prevention**



# ICFM8 Webinar: Lowering Risk by Increasing Resilience

10 August, 2021 12:00-14:15 UTC 8:00 Eastern Daylight Time 20:00 China Standard Time 17:30 India Standard Time 16:00 Central European Time



## EU Floods July 2021

12 July  
Southern England  
(London)





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## EU Floods July 2021

15 July  
Belgium  
(Verviers)





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## EU Floods July 2021

15 July  
Germany  
(Schuld)





## EU Floods July 2021

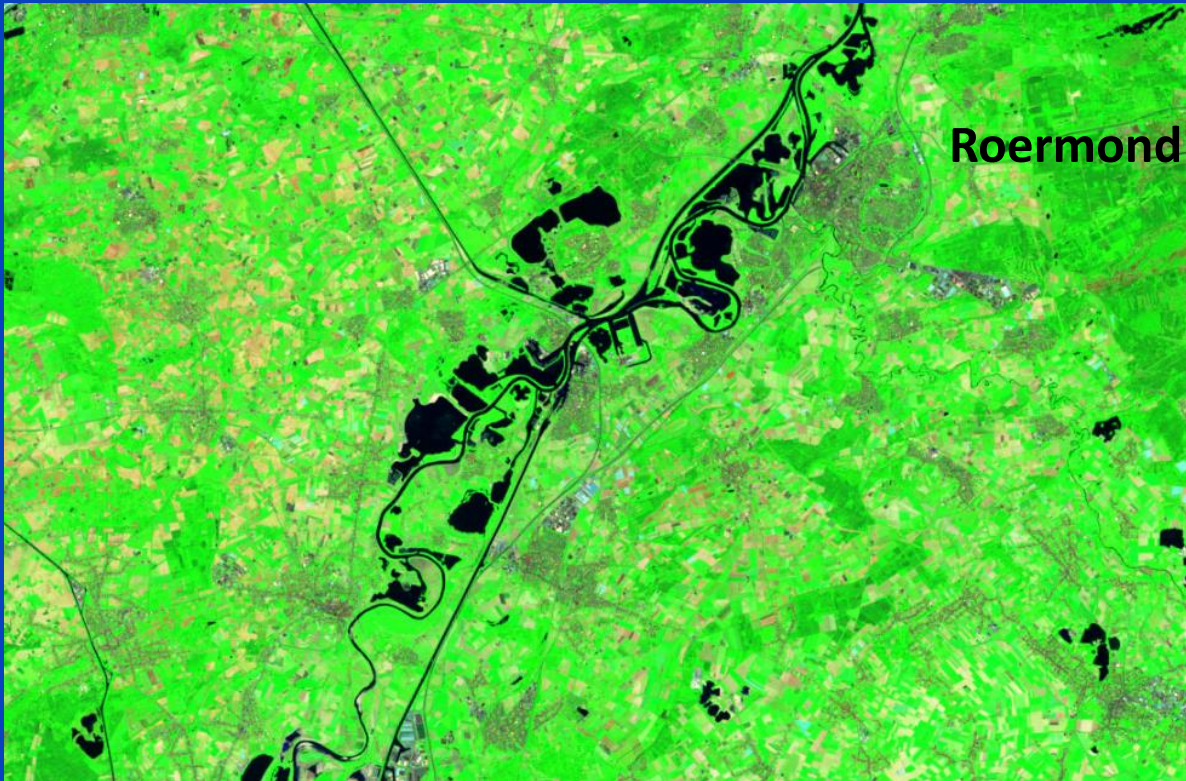
17 July  
The Netherlands  
(Well)





## EU Floods July 2021

### Roermond, The Netherlands



16 July



18 July



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## EU Floods July 2021

Evacuations Limburg  
15-16 July  
The Netherlands





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## EU Floods July 2021

More than:

- 229 flood fatalities
- 30 bln euros damage





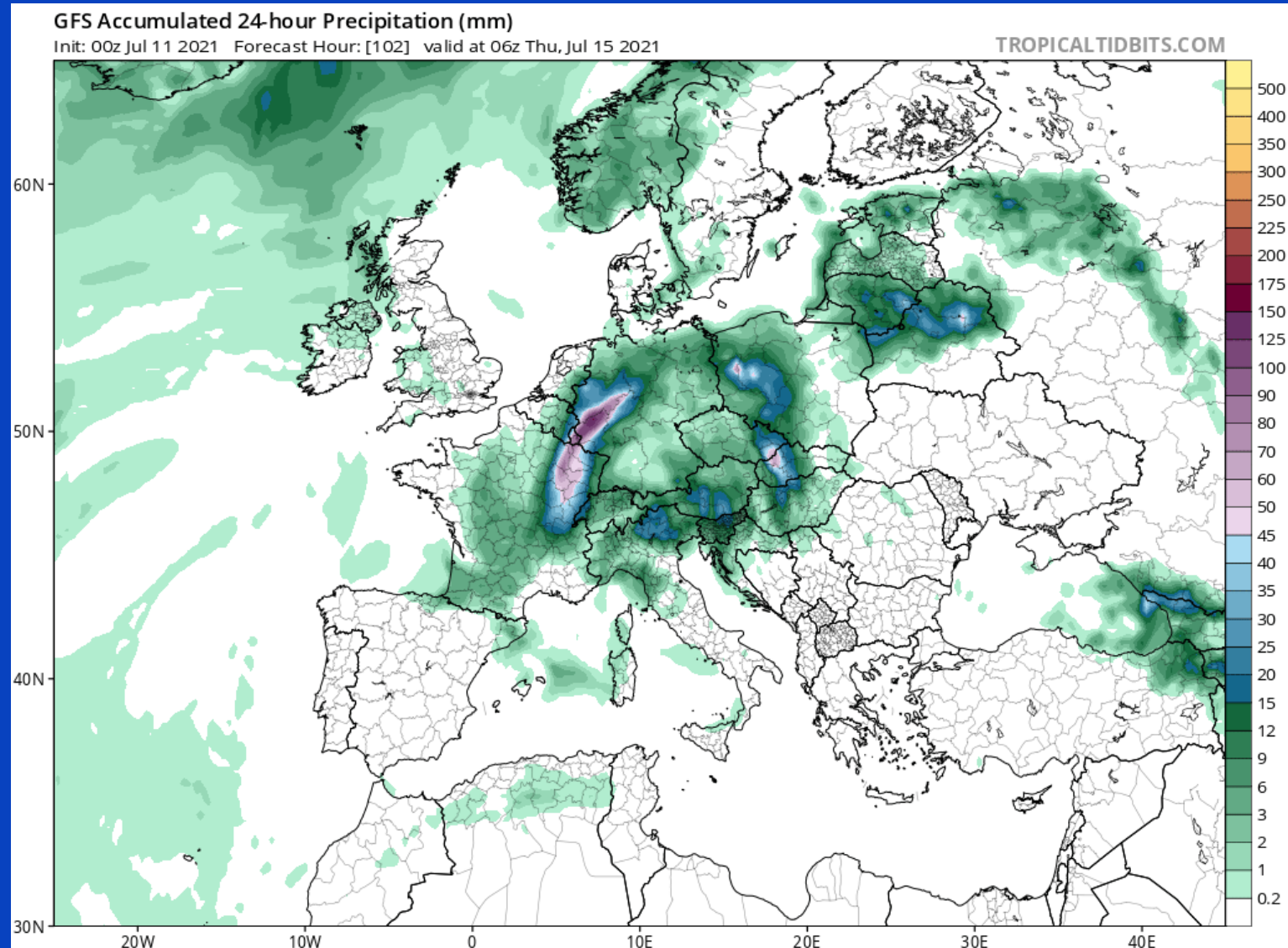
## Slow-moving extreme precipitation potential (SEPP)

Climate change: increases in precipitation extremes:

- Higher moisture content & updraft velocities
- **Slower storm movement** (longer local duration)

By 2100 **11-14 times** more frequent

*Source: Karahman et al. 2020 Quasi-Stationary Intense Rainstorms Spread Across Europe Under Climate Change. EGU, Vol 48, Issue 13*





## The Dutch Room for the River program

New paradigm flood risk management main rivers

Long-term horizon

Dual objective:  
safety & spatial quality

Multi-level governance

Lead time: 40 years





# Room for the River: project Nijmegen (bypass)





# Room for the River: project Noordwaard (polder detention reservoir)





## What do we learn from recent flood disasters? (1)

Intensity & frequency extreme events are changing

(present (probabilistic) models not fit for purpose: compounding/clustering events, SEPP)

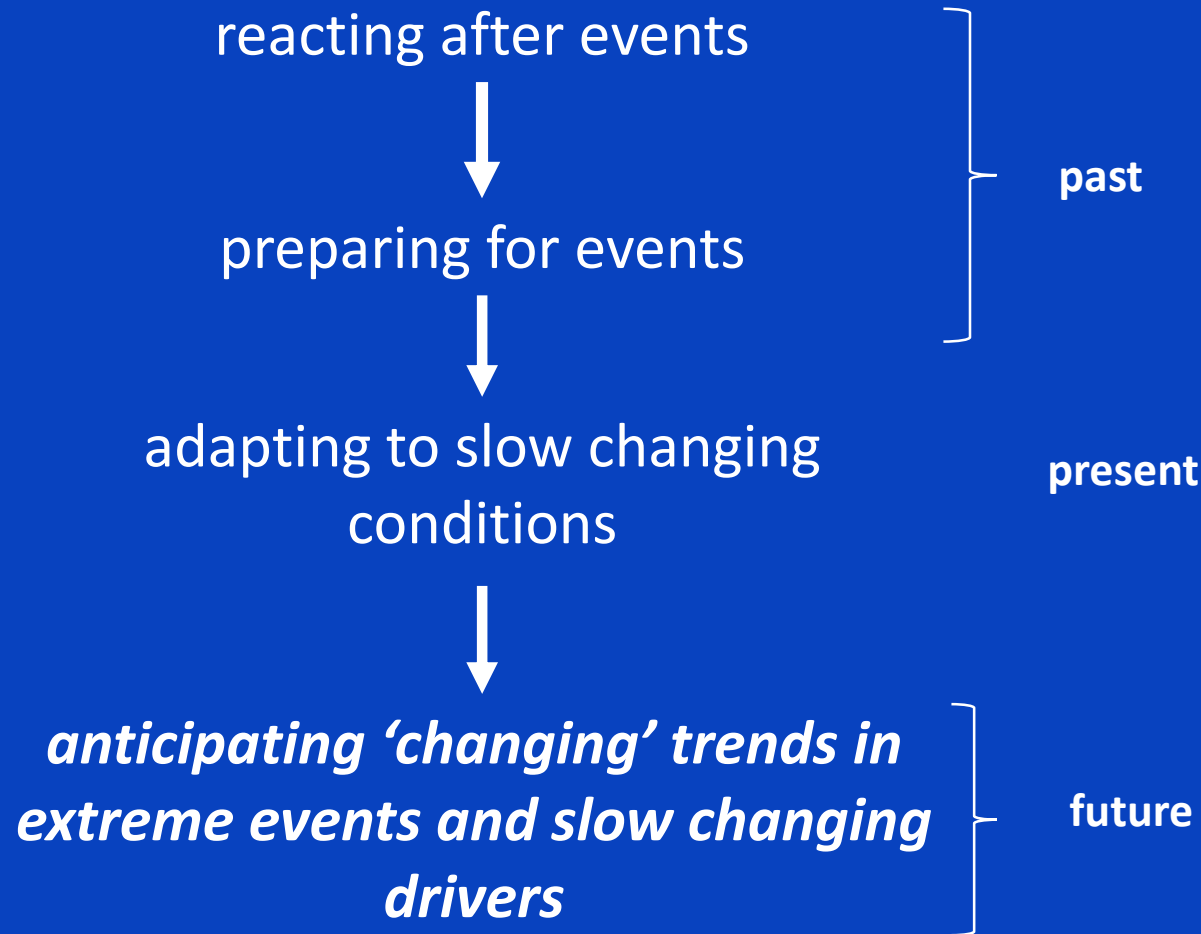
Preparedness & prevention fall short:

- inadequate early warning systems: "breaks in the chain" of preparation (European Flood Awareness System (EFAS) issued a flood notification a few days in advance)
- flood protection infrastructure not designed for these extremes (main rivers)
- backlog infrastructure maintenance, upgrading and replacement of existing infrastructure (small rivers/tributaries)

Flood resilience requires both preparedness and prevention



## What do we learn from recent flood disasters? (2)



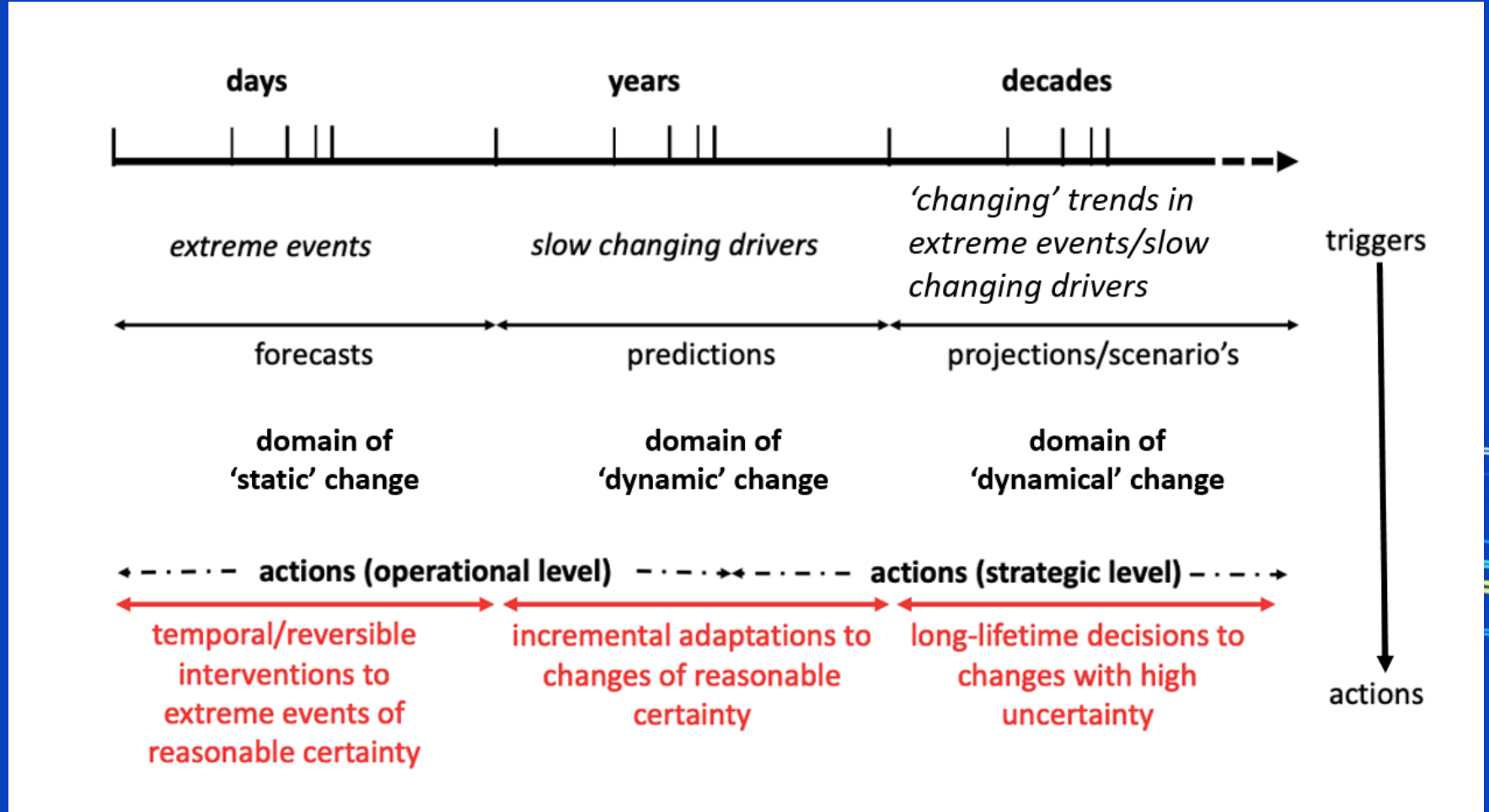


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## The three time domains of FRM



Terminology 'domains of change' adopted from Human System Dynamics

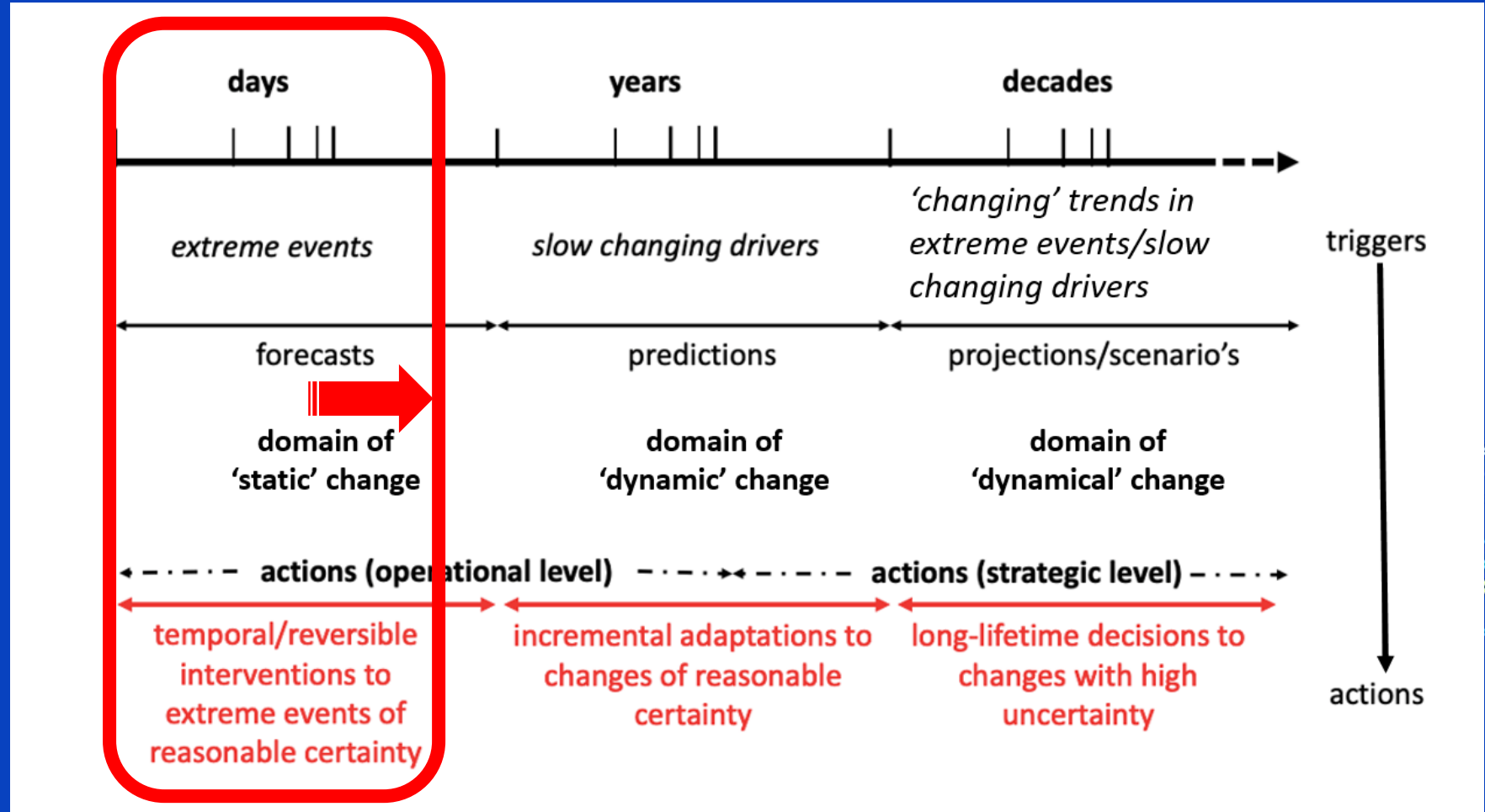


## Short-life time decisions:

- Interventions expected to have a **high benefit- cost ratio**;
- Longer warning (lead) time **increases options** to intervene

## Target ECMWF:

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





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Alexandria (Egypt),  
Oct-Nov 2015





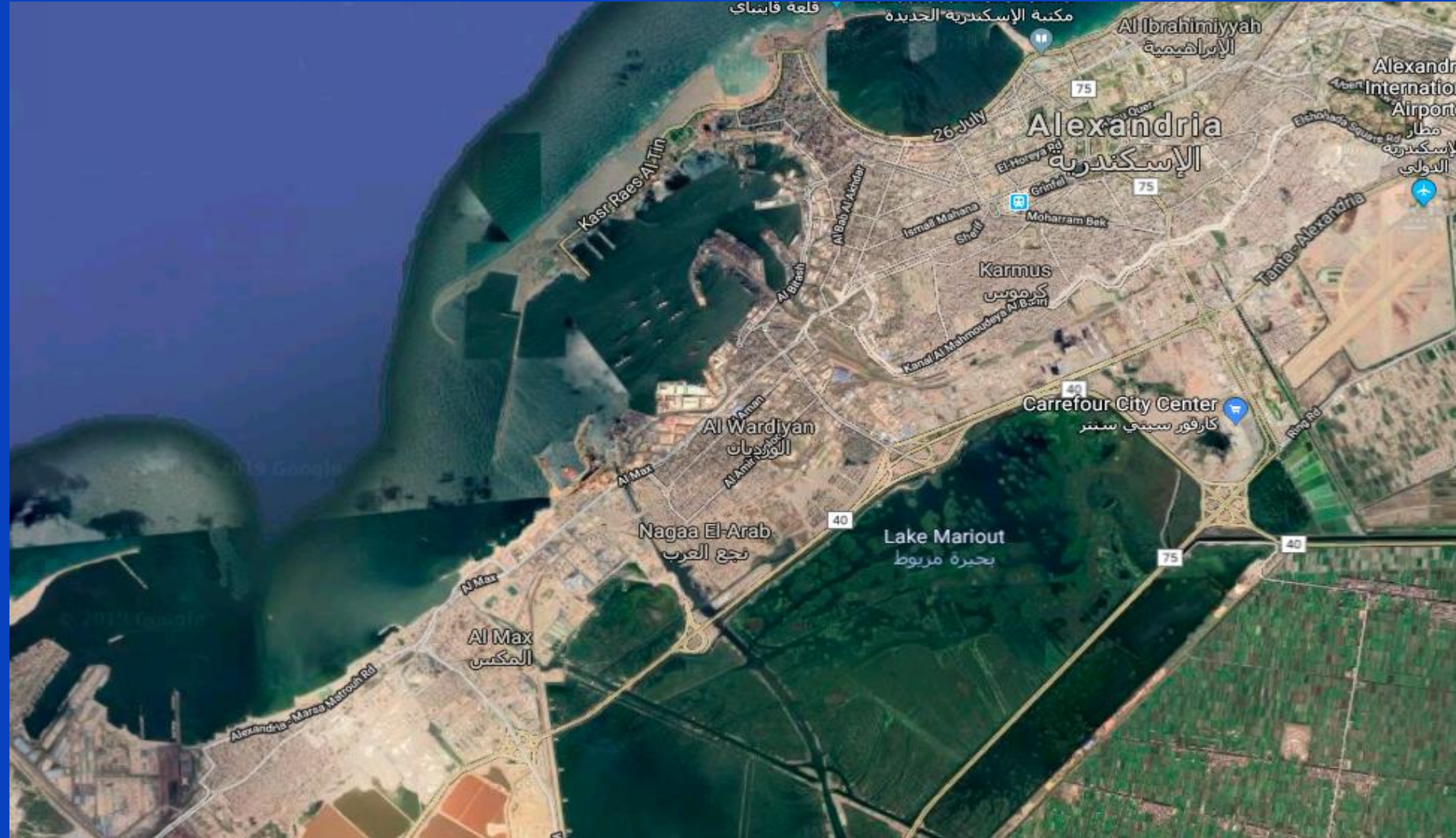
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## Alexandria (Egypt), Nov 2020

Early warning:  
Cleaning drains  
Lowering water level lake Mariout  
Rescue teams





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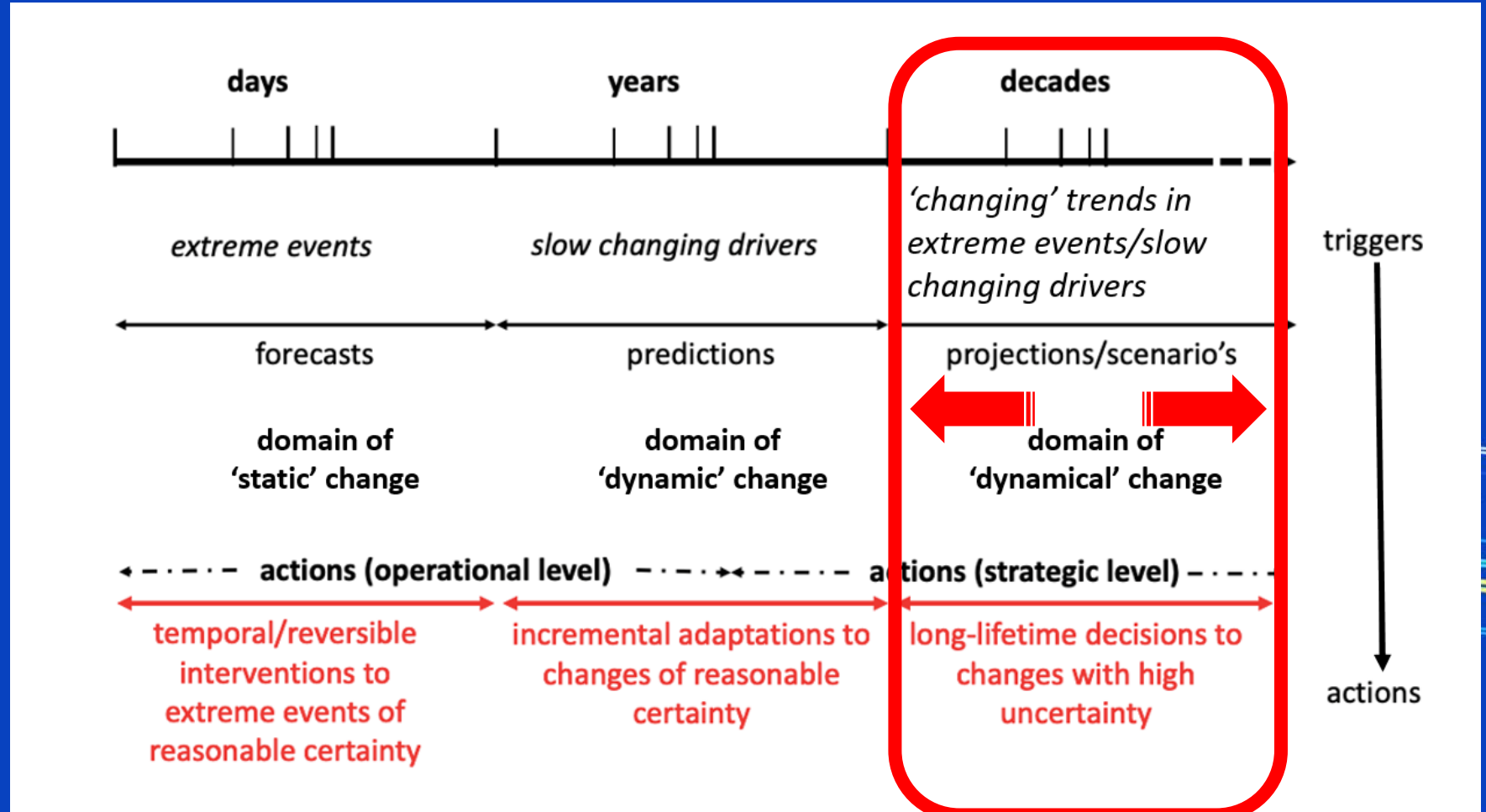
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## Long-life time decisions:

- difficult to define performance criteria and risk margins
- interventions decisions generally call for high investment costs
- changing (lowering) **warning time/lead time ratios**: complexity increases (transformation)

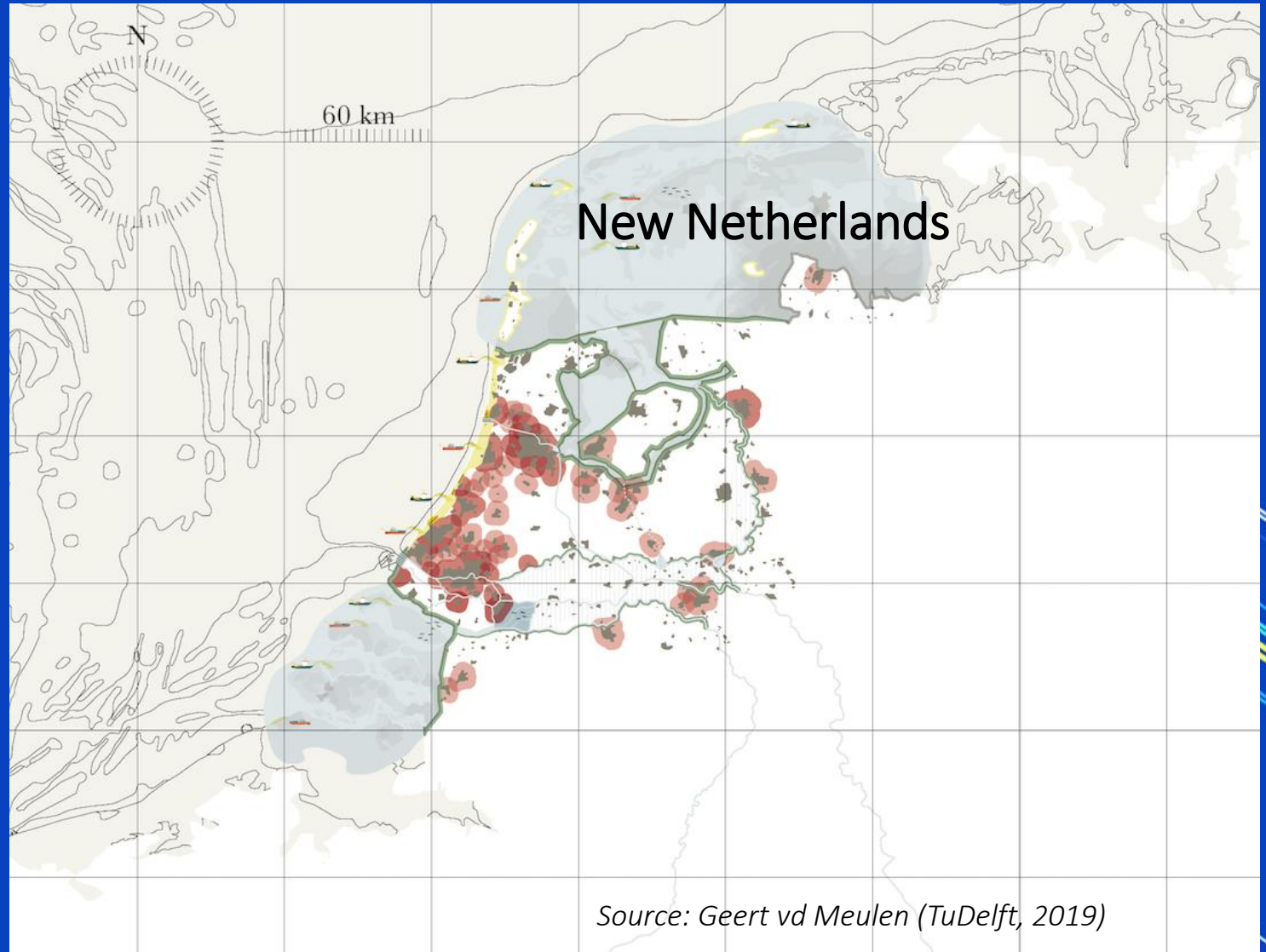
Shift needed from adaptive planning to planned adaptation & start preparing for a transformative change ?



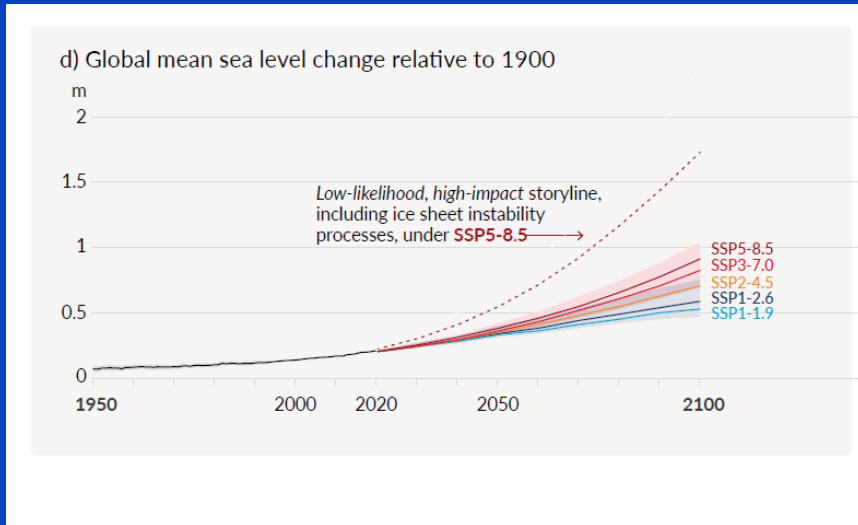


Flood defenses and extreme SLR scenario

Long-life time decision:  
Shorten coast line  
(transformative change)



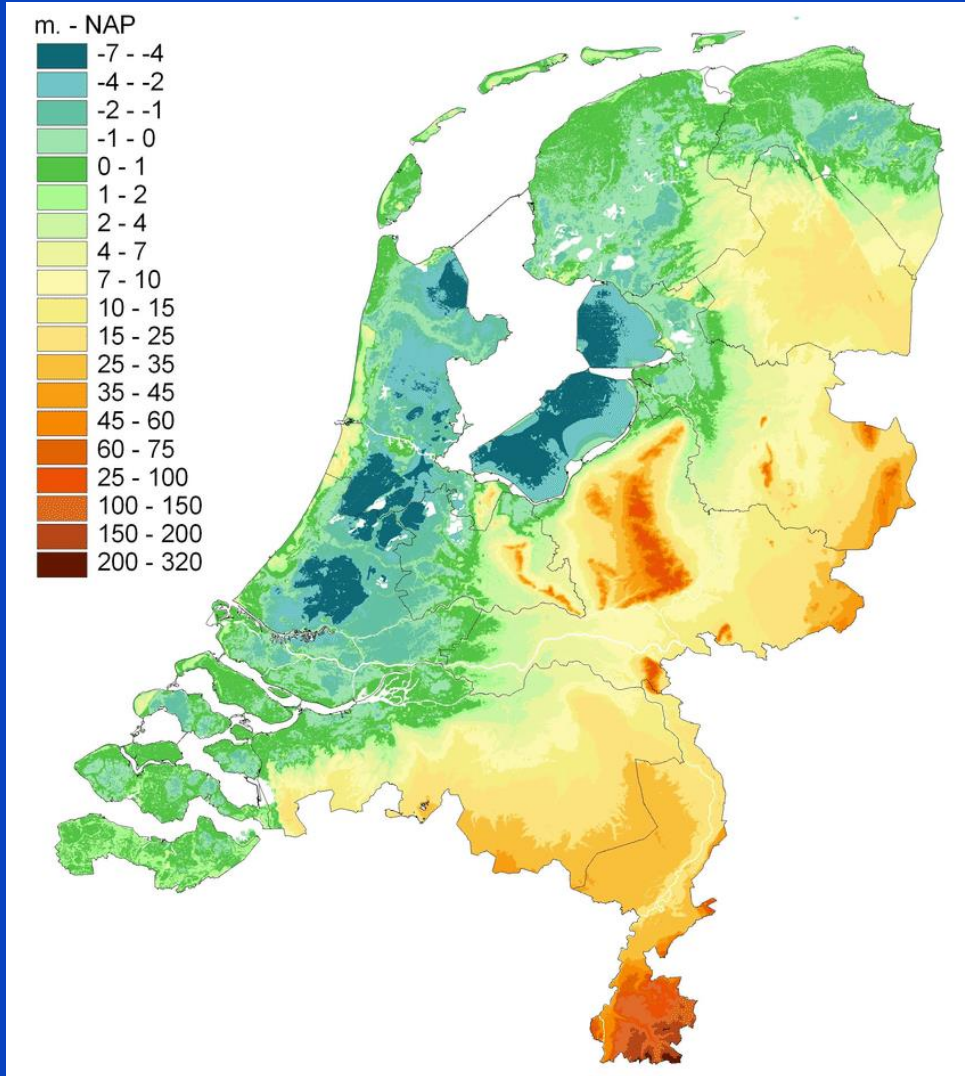
Source: Geert vd Meulen (TuDelft, 2019)



Source: IPCC, 2021



## City of Dordrecht: building flood resilience (capacity)



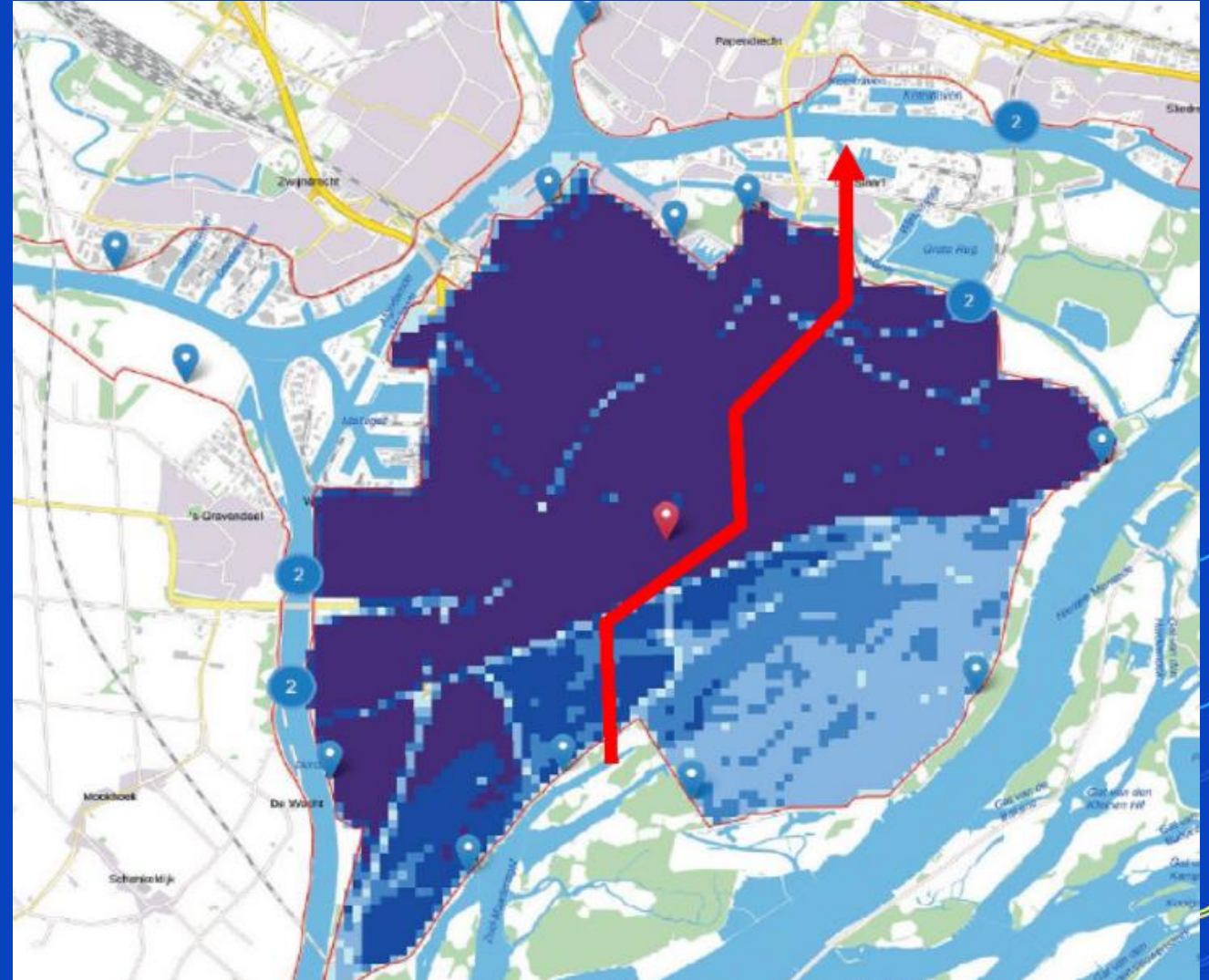
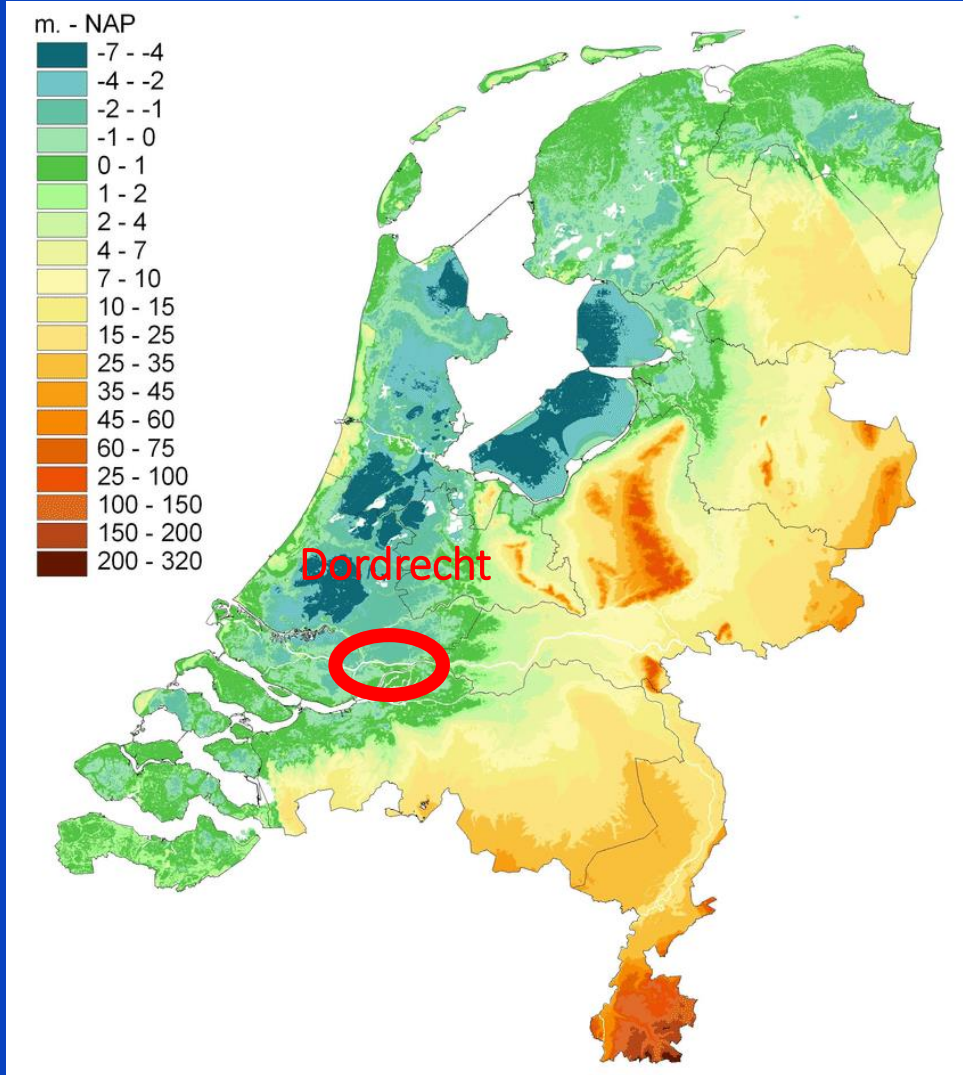


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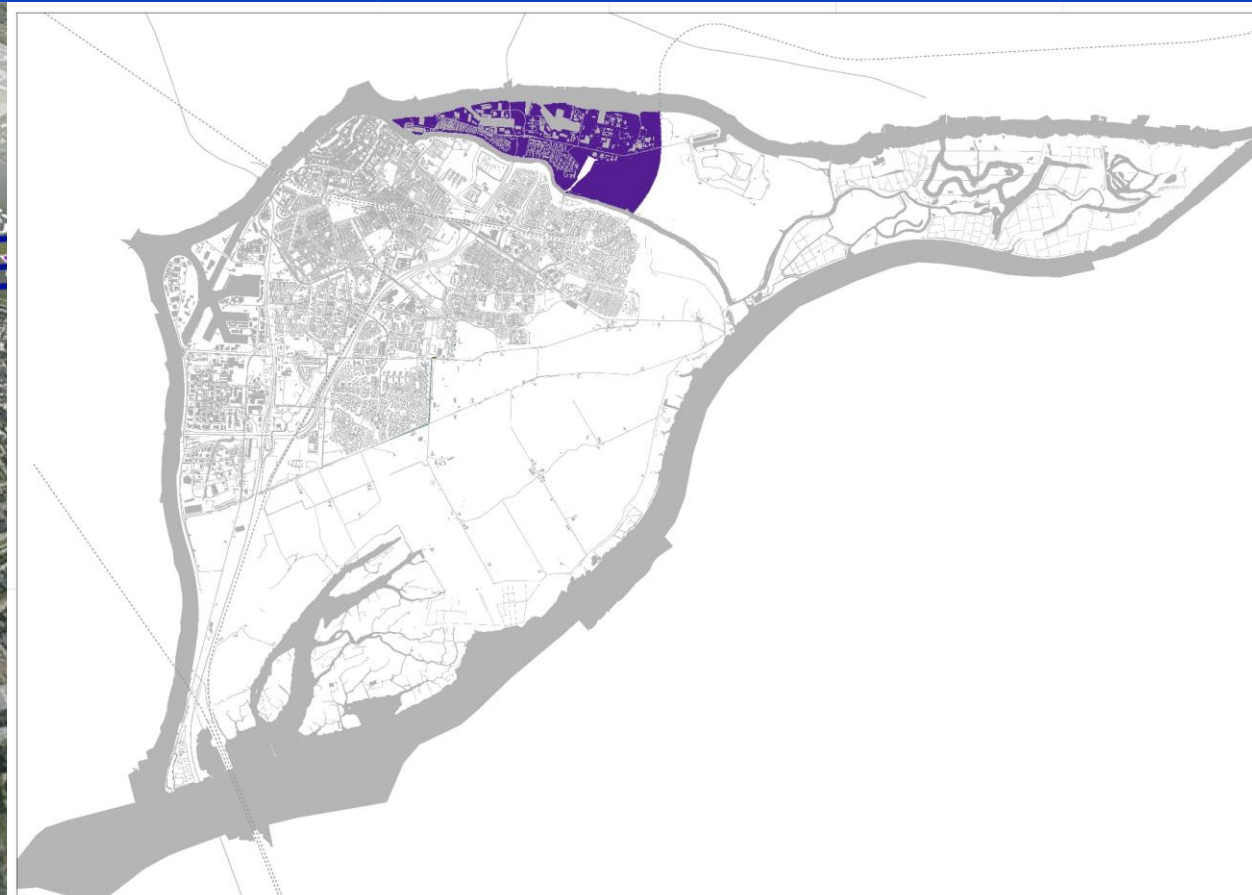
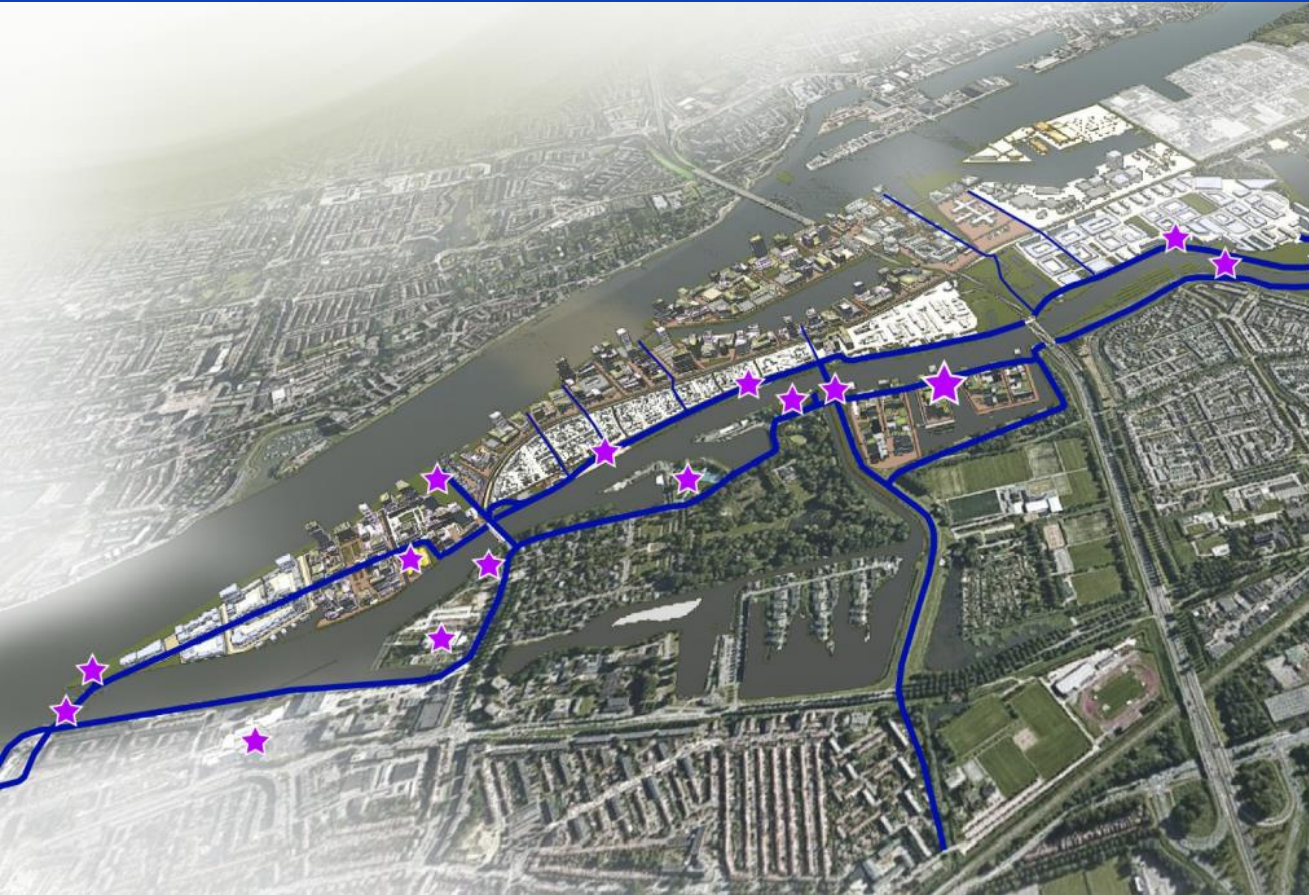
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## City of Dordrecht: preparedness as leverage





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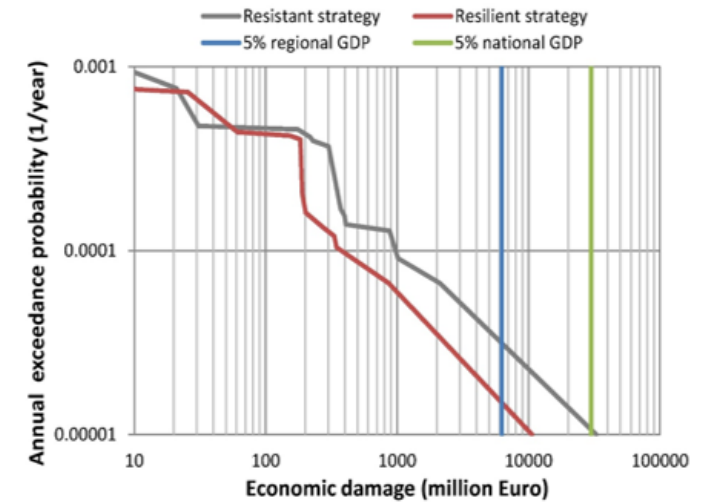
## Increasing resilience: alignment of preparedness & prevention



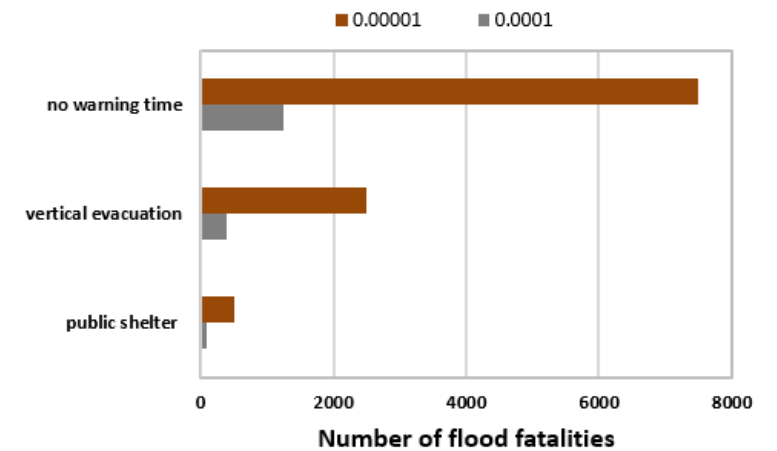
### Dordrecht

Economic damage

Source: Gersonius et al., 2016



Fatalities



Source: HKV, 2020



## Concluding remarks

Preparedness and prevention still conceived as separate strategies:

=> opportunities to align and leverage (other domains)

Climate change discussion drives:

=> to set longer time horizons LT decisions (feeling of unease: lead time > warning time)

=> longer warning times “preparedness” (ST decisions) (expand options to intervene)

=> to reconsider adaptive planning approaches in FRM