

2nd Delta Committee

Samen werken met water
Working together with water

Risico's en mogelijke maatregelen in de Rijndelta
Risks and possible measures in the Rhine Delta

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“Een land dat leeft, bouwt aan zijn toekomst”
“A country that is alive, builds on its future”

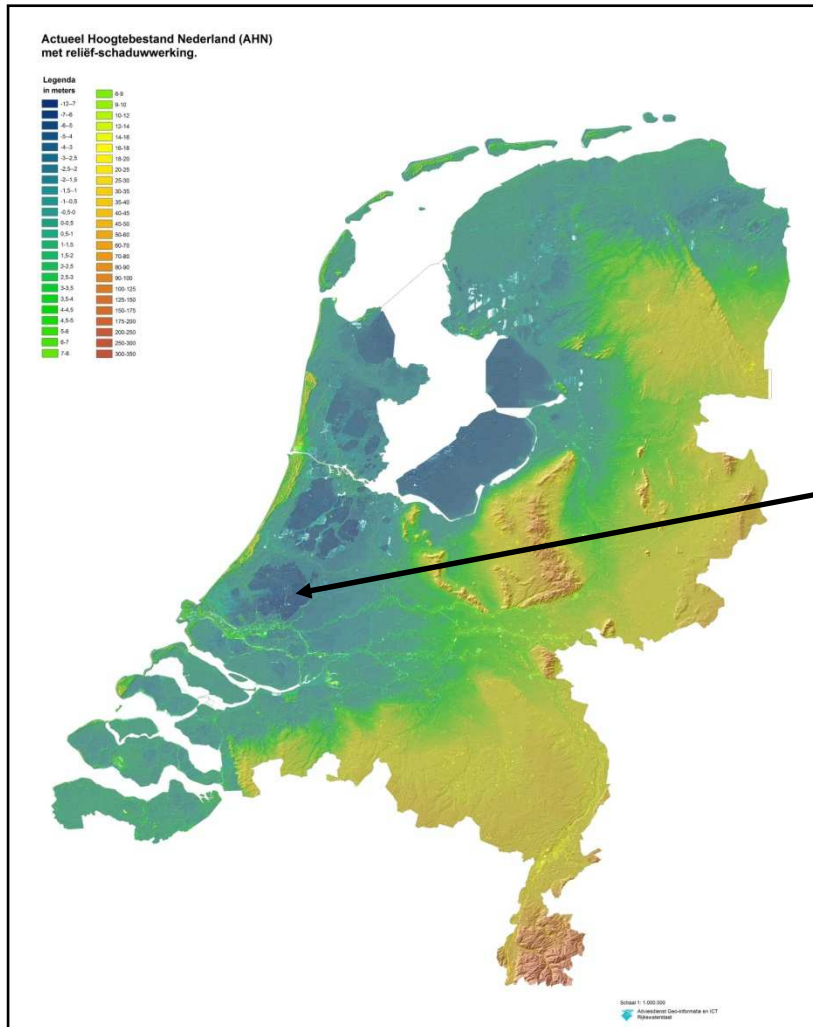
Dealing with uncertainties in climate scenarios

- Can we learn from the Dutch approach (2nd Delta Committee)?
- And what does this mean for inland navigation?

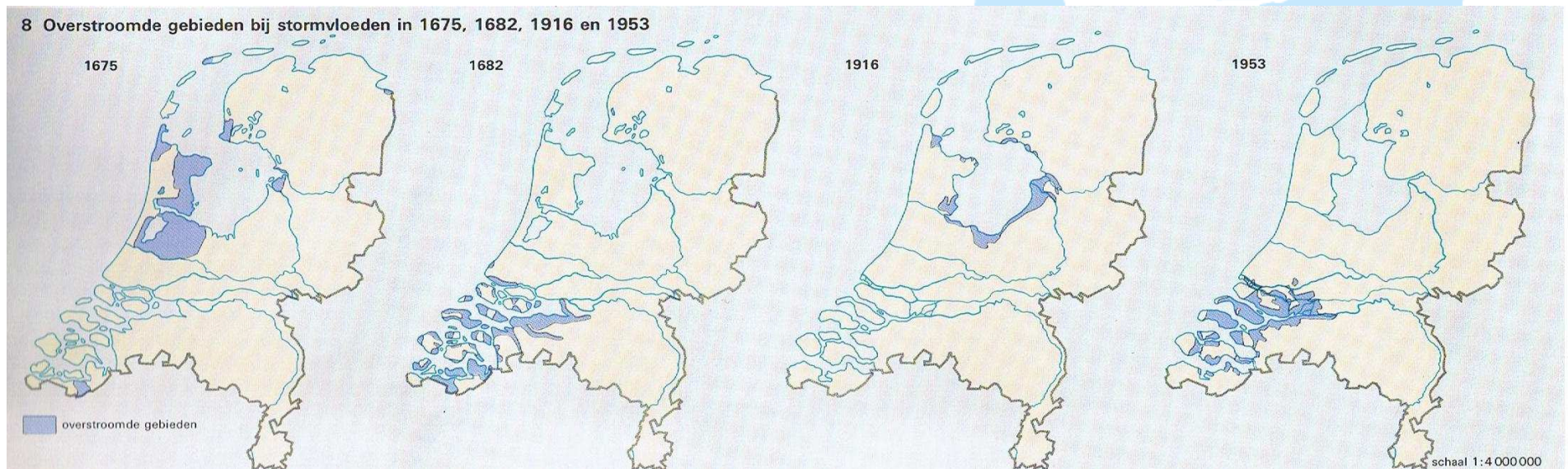


DELTA  **COMMISSIE**

Topography



Main flood events



1675

1682

1916

1953

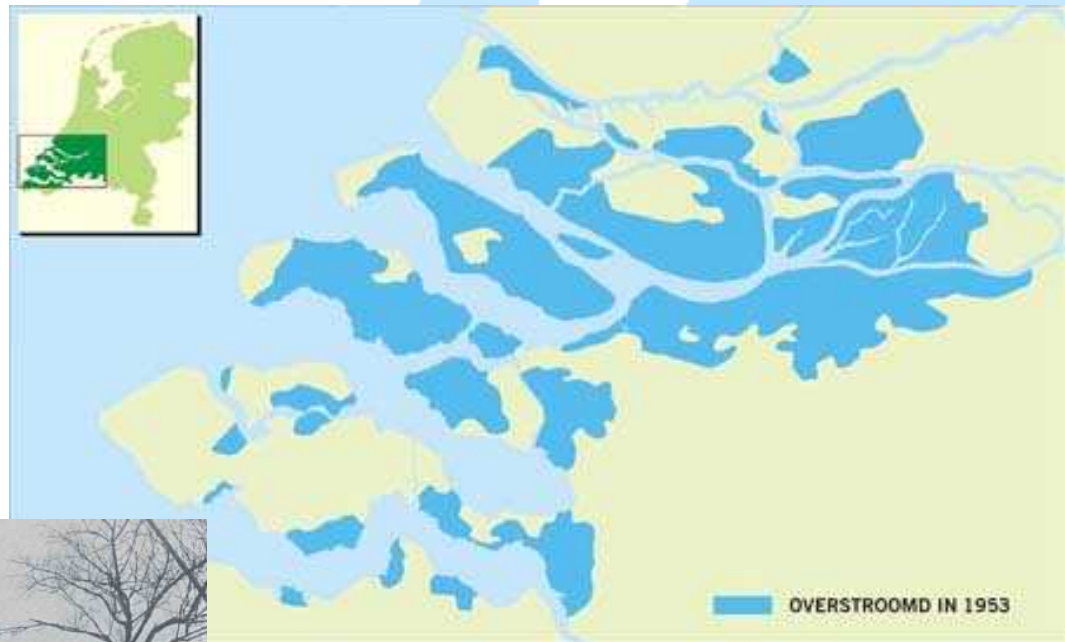
Following 1916

Creation of IJssel
Lake and polders



1953 flood

Flood disaster in
the SW Delta



The Delta works

Shoreline shortening by dikes and barriers



Without a flood disaster!

New Delta Committee to advise on a sustainable future for the Dutch delta

Presentation, reflection and discussion

- Three steps towards a safer delta
- A new safety standard
- Plausible upper and lower boundaries SLR
- Delta dike
- Regional recommendations
- Navigational impacts

Acute? No, Urgent? Yes



The three steps:

- Water defences are not up to 1960 standards (following 1st Delta Committee)
- Current standards are inadequate (recommendation increase safety with a factor 10!)
- Climate change may accelerate

Safety check flooding

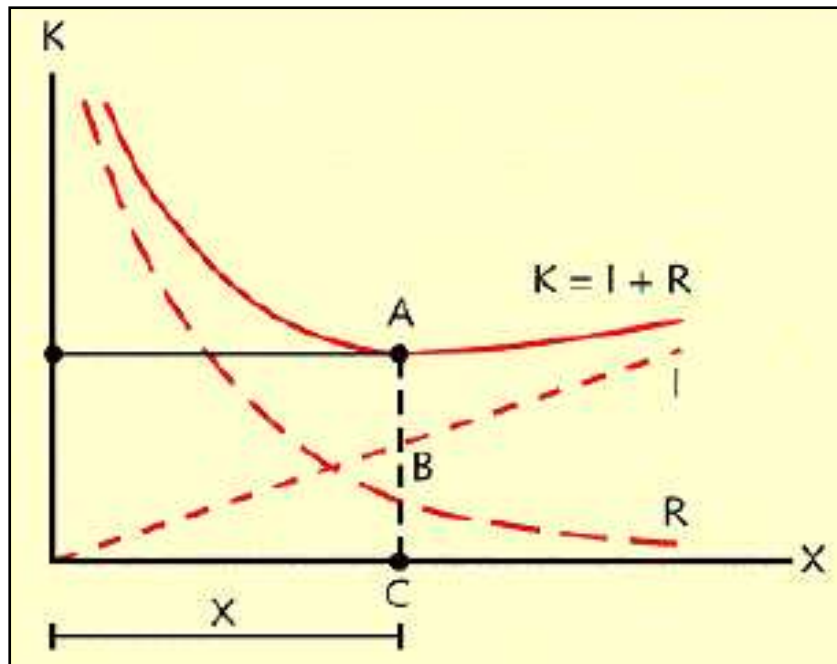


Results 2nd check
(2006) primary
defences:

- 24% no-pass
- 32% no check possible

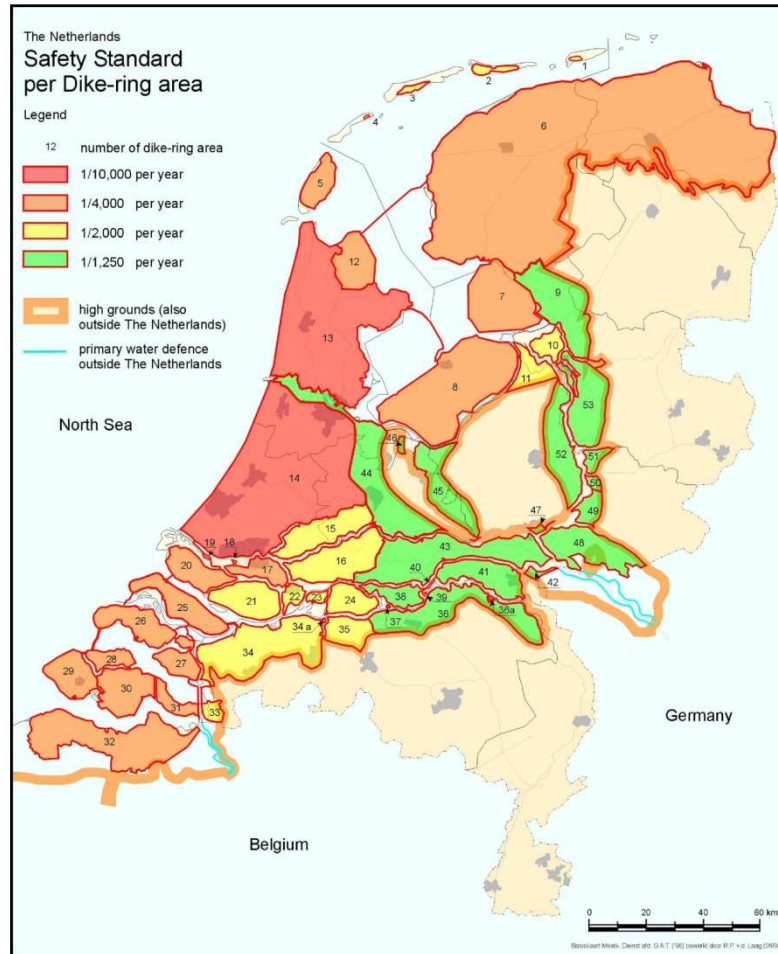
Risk approach

risk = (probability of failure) x (projected cost of damage)



The principle of economic optimisation (I – investments;
R – risk;
K – total costs;
X – optimal safety).

Safety standard for 53 dike-ring areas



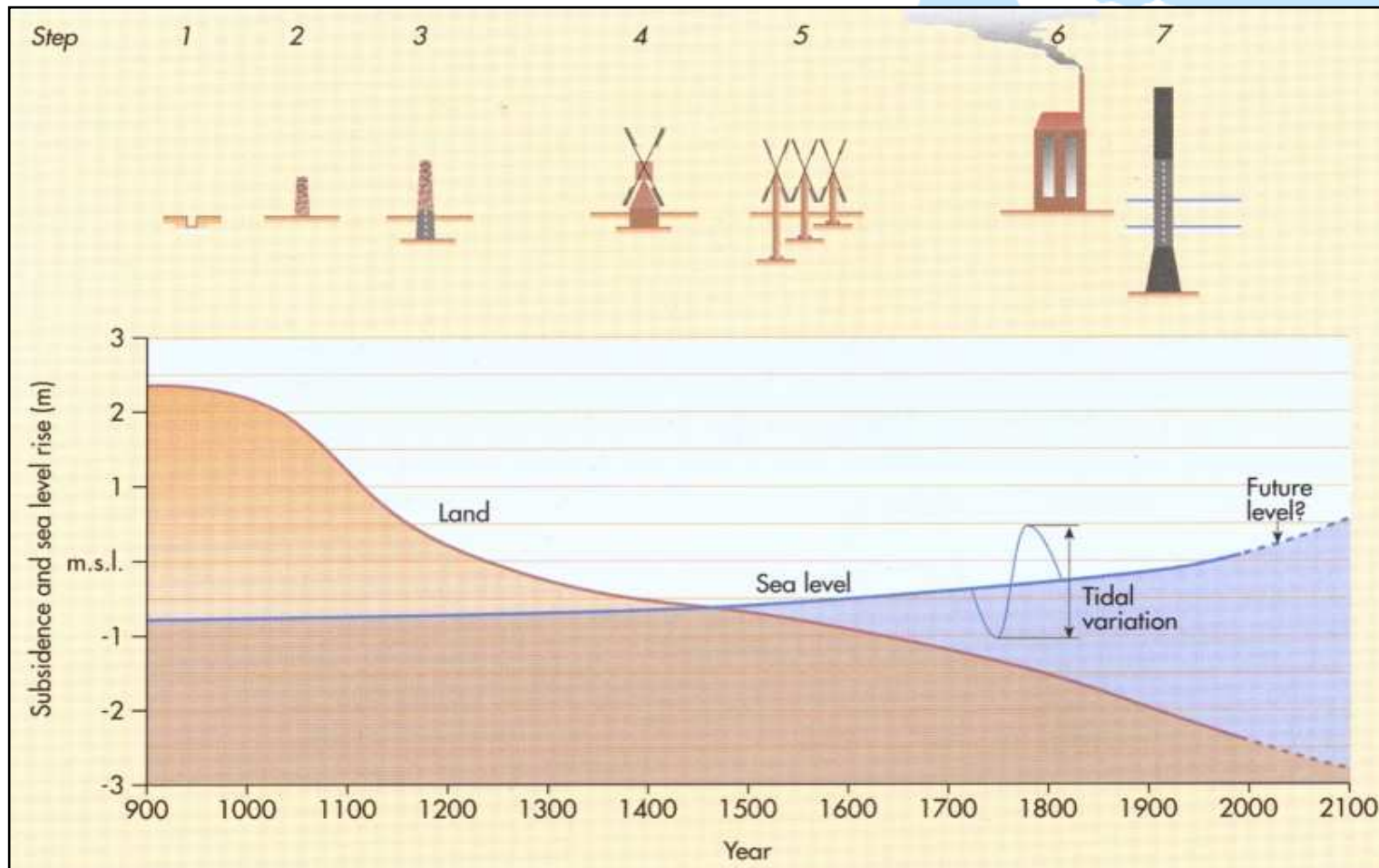
De facto a varying safety:

- NH and ZH 1/10.000 per year
- North and South 1/4.000 per year
- Yellow 1/2.000 per year
- Green: 1/1.250 per year

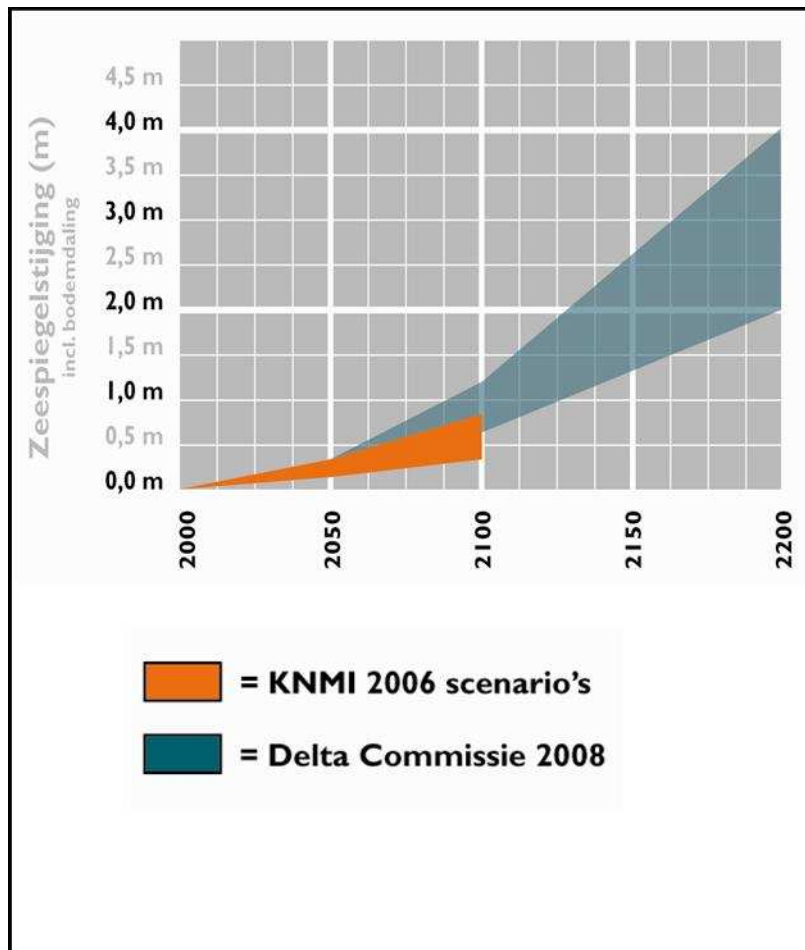
NB:

- Recommendation: increase with a factor of 10!

Rate of change ground elevation and SLR 900 -2100



Relative SLR



High-end scenarios:

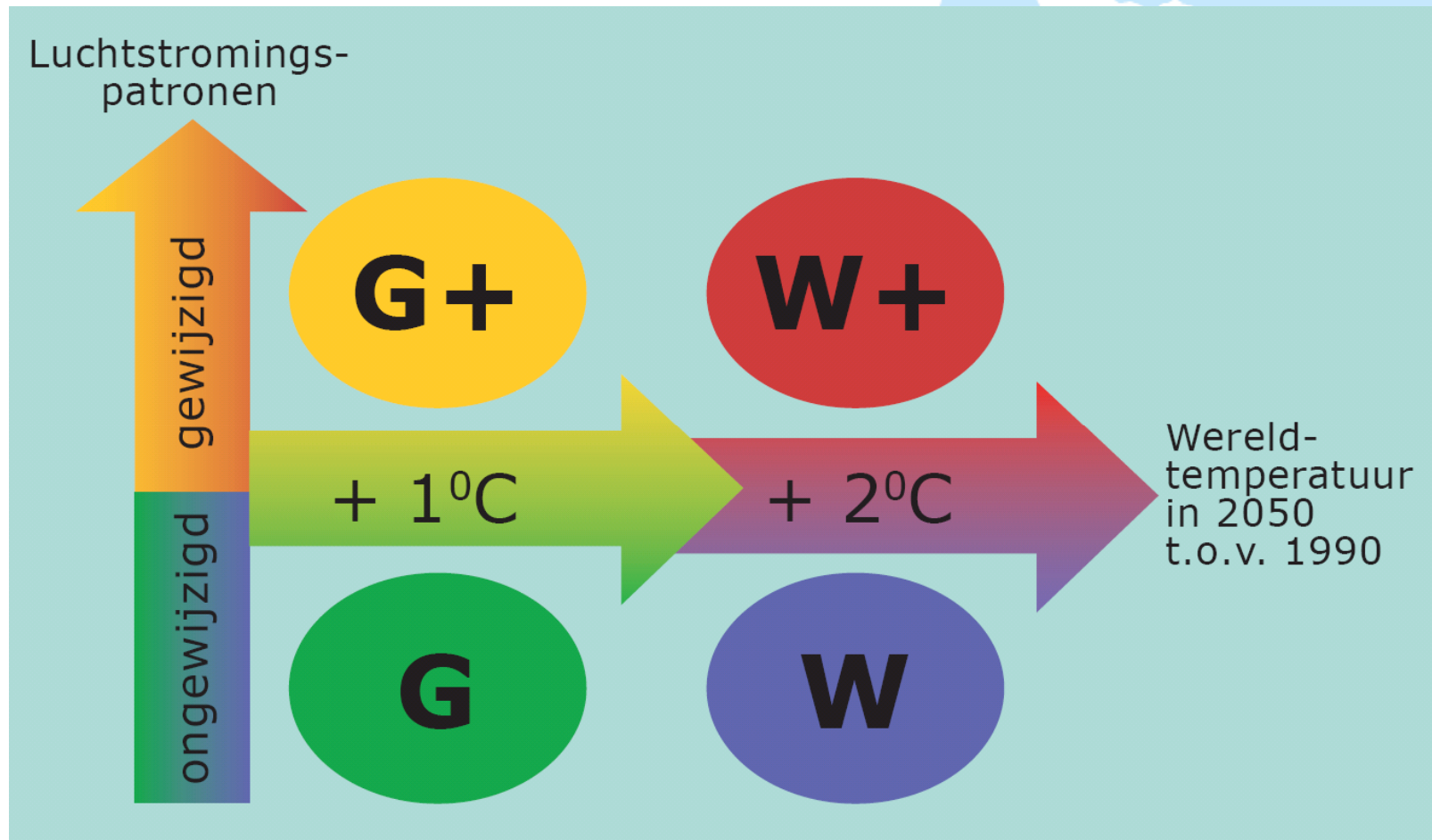
- Round 2050: 40 cm increase relative to 2000
- Round 2100: 65 to 130 increase relative to 2000
- Between 2100 and 2200: 1 to 3 m/century

NB: a bit confusing because KNMI are best estimates

Relative SLR

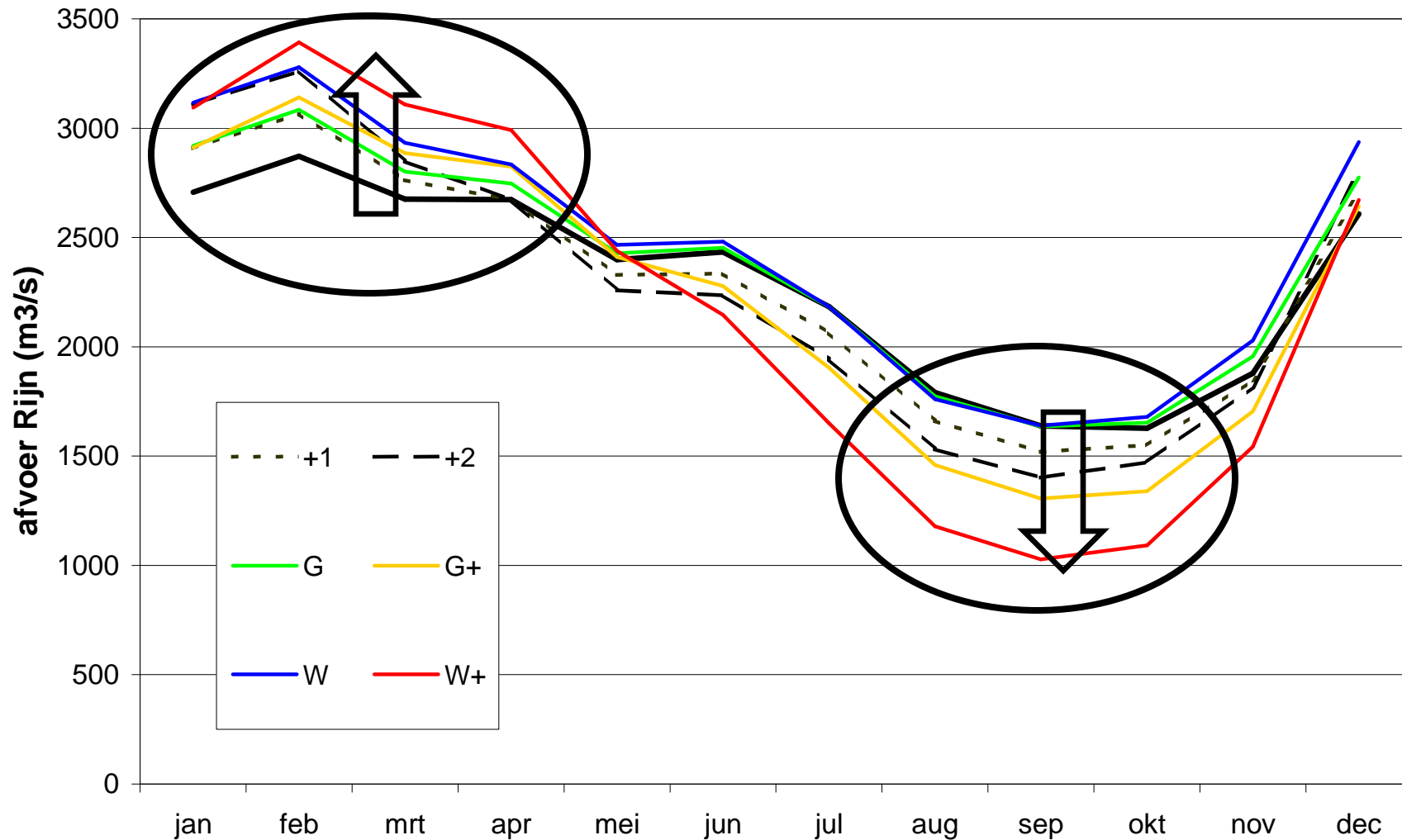
- Possible upper boundary necessary to conduct a test on robustness (give up dike rings or not?)
- Upper and lower boundaries necessary to make robust designs
- Probabilities are an issue!

Climate change scenario's 2050 compared to 1990



Discharges of the river Rhine

2050 compared to 1990



How to deal with uncertainties in climate change?

- Flood protection along rivers: ‘high end’ scenario’s
- Other issues: ‘average’ or ‘low end’ scenario’s
 - Water distribution
 - Water quality and ecology
 - User functions (including inland navigation)
 - Dunes with nourishment
 -

Recommendations (1): A Delta Law and application of
“Building with nature”, multifunctional solutions and the “Delta dike”



A solid approach

- Steering committee on ministerial level led by MP
- Delta Director responsible for execution
- Mostly regional authorities responsible for elaboration and execution
- Delta Fund fed by gas revenues and long-term loans
 - At least 1 billion €/yr after 2020
- Delta Law to ensure the above

“Delta dikes”



Dikes that through height, width or internal structure are practically breach resilient. Requires local optimization.

Non-breaching dikes

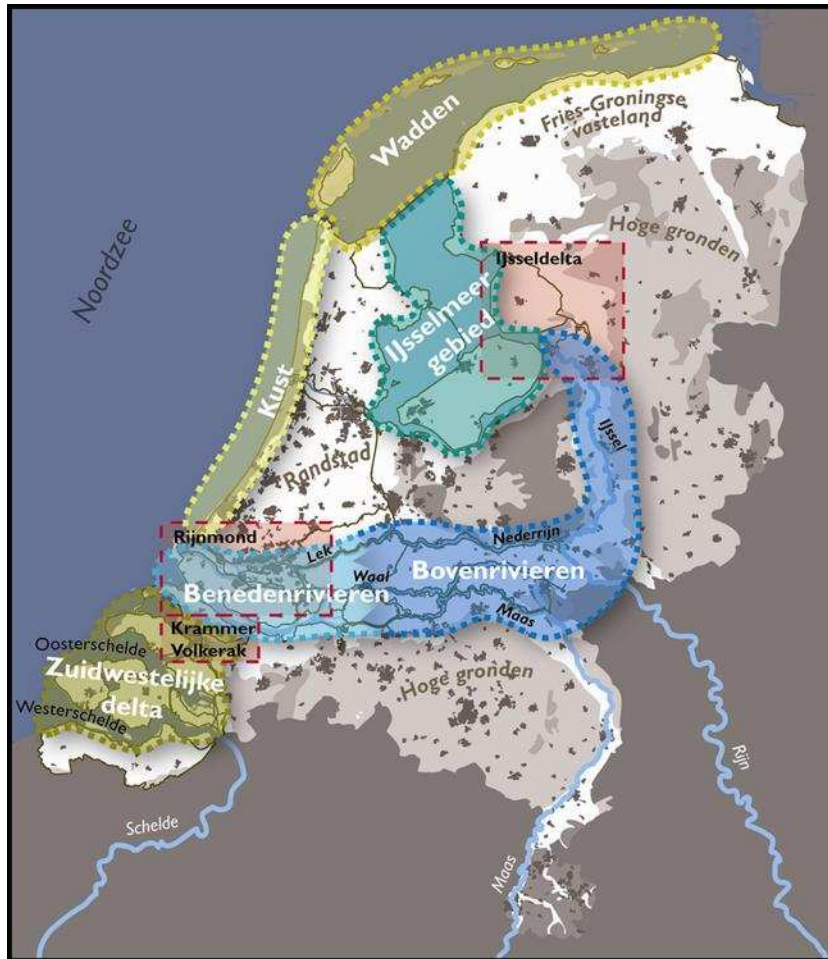
- Plea for broad non-breaching dikes is popular
- Is not THE solution
- Can be a solution, BUT (1) space availability is a problem and (2) all failure mechanisms need to have comparable risks
- A dike ring consists of a chain of structures (as strong as the weakest link!)
- NB: $\text{risk} = \text{probability} \times \text{damage}$ with the damage a function of the failure mechanism!

Building with nature



- Adapt to changing conditions and predictions
- In the long run the least costs
- Create opportunities for multifunctional and integral approach

Regional recommendations (2)

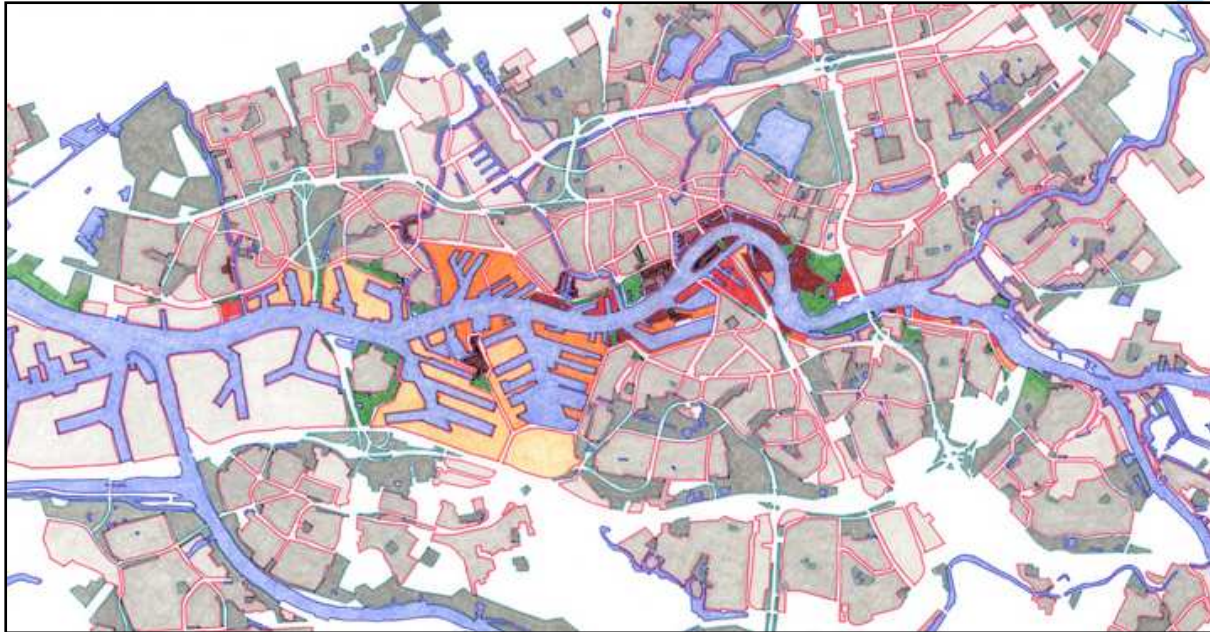


- North Sea coast
- Wadden region
- Rijnmond region
- Southwest delta
- River region
- IJssel Lake region

Nieuwe Maas at Rotterdam









Waterfronten Rotterdam



WATERFRONTEN

HERONTWIKKELING VAN WATERFRONTEN IS IN ROTTERDAM AL 40 JAAR GAADE – CRUCIAAL VOOR DE VITALITEIT VAN DE STAD
DOOR DE AFSLUITBAARHEID VAN DE RIVIER ZIJVEN DEZE WATERFRONTEN TIJDPAAK EN KUNNEN TOT IN LIGTE VAN JAAREN NIEUW VERDIEP ONTWIKKELD

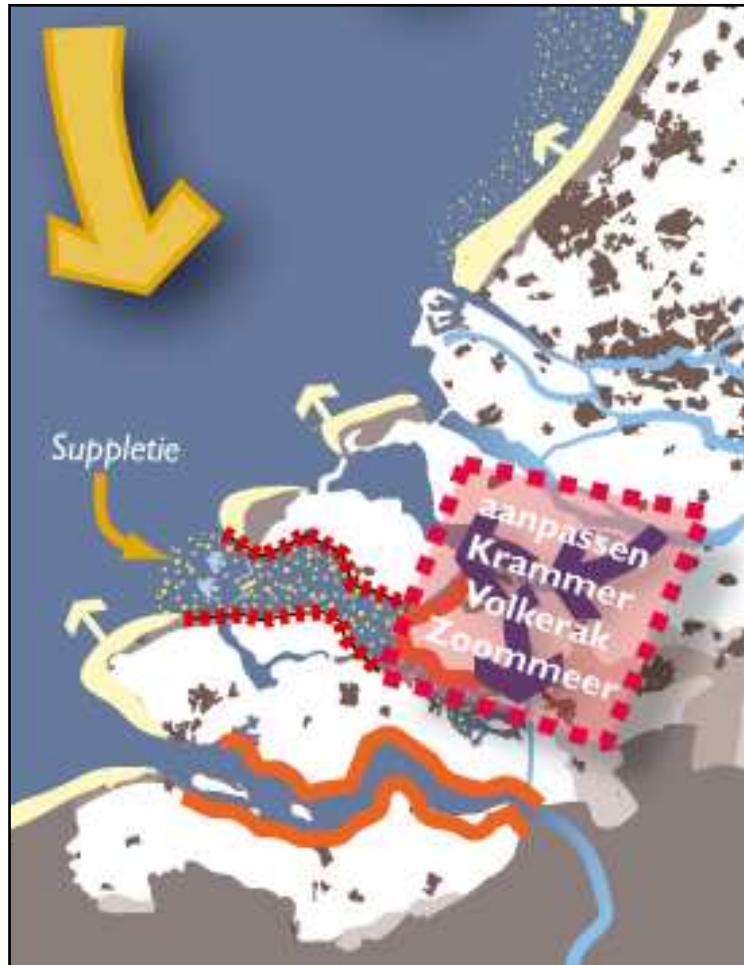
-  HISTORISCHE WATERFRONTEN EN WATERGEGELATERSDE OERTUIN
-  WATERFRONT(HER)ONTWIKKELING 1970-1990
overloopruimte voor de stadsovername
-  IDEM 1990-2010
brede functie voor de stedelijke vernieuwing – naast wonen en veel meer
-  IDEM 2010-2030
toekomstig accent op creatieve sector
-  IDEM 2030-2050 e.v.
afhankelijk van verdere westwaarts ontwikkeling van de haven
-  AAN WATER GEGELATERSDE PARKEN
DE RIVIER

Rijnmond region



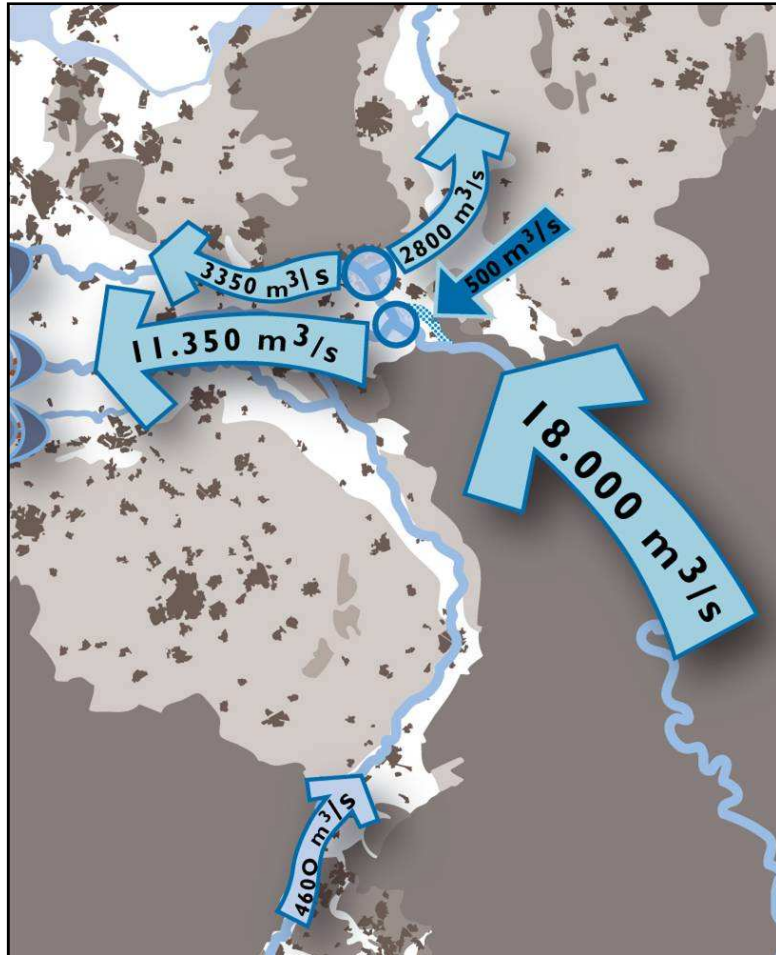
- Protection by a chain of open surge and discharge barriers
- Creation of potential for nature and urban development

Southwest Delta



- Oosterschelde end of century completely open!?
- Raise the dikes along Westerschelde
- Volkerak-Zoommeer from fresh to salt water!
- Fresh water storage (Kierbesluit!)
- Schelde-Rijn connection (Antwerpen)

River discharge extremes



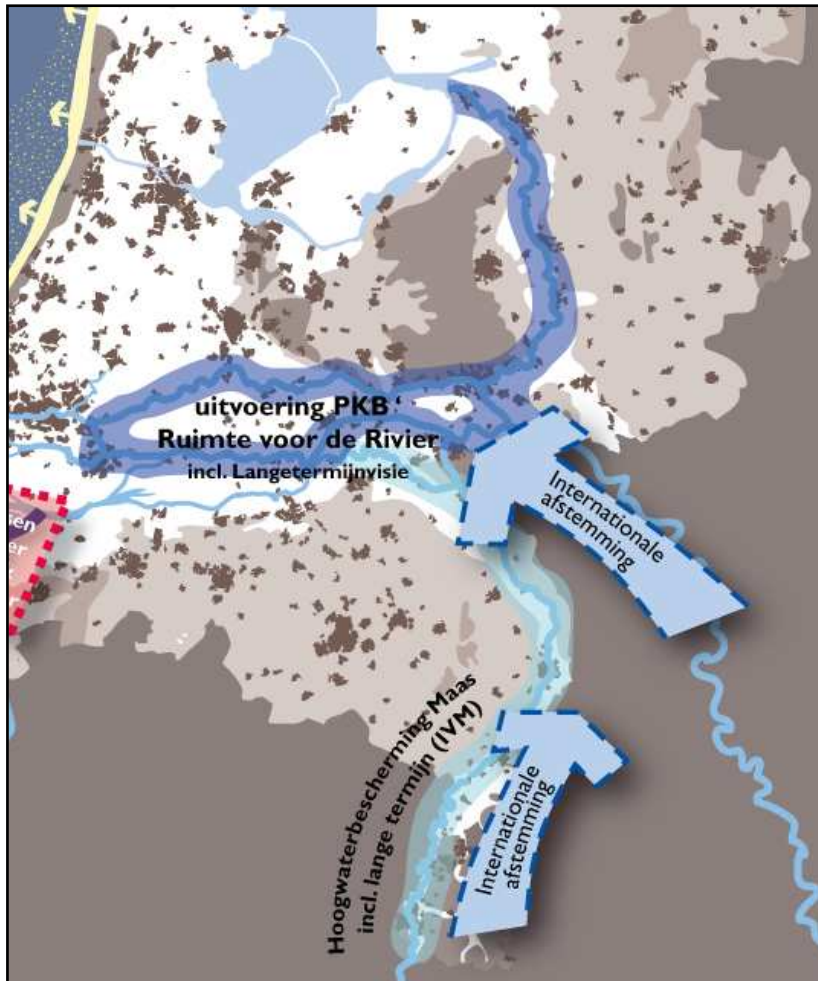
Summer:

from 1700 m³/s now to 700 m³/s in 2100

Winter:

from 16.000 m³/s now to 18.000 m³/s in 2100

Rivers



- Completion of project 'Space for the rivers'
- Execution of the Meuse project
- Acquire strategic ground positions

Space for the IJssel



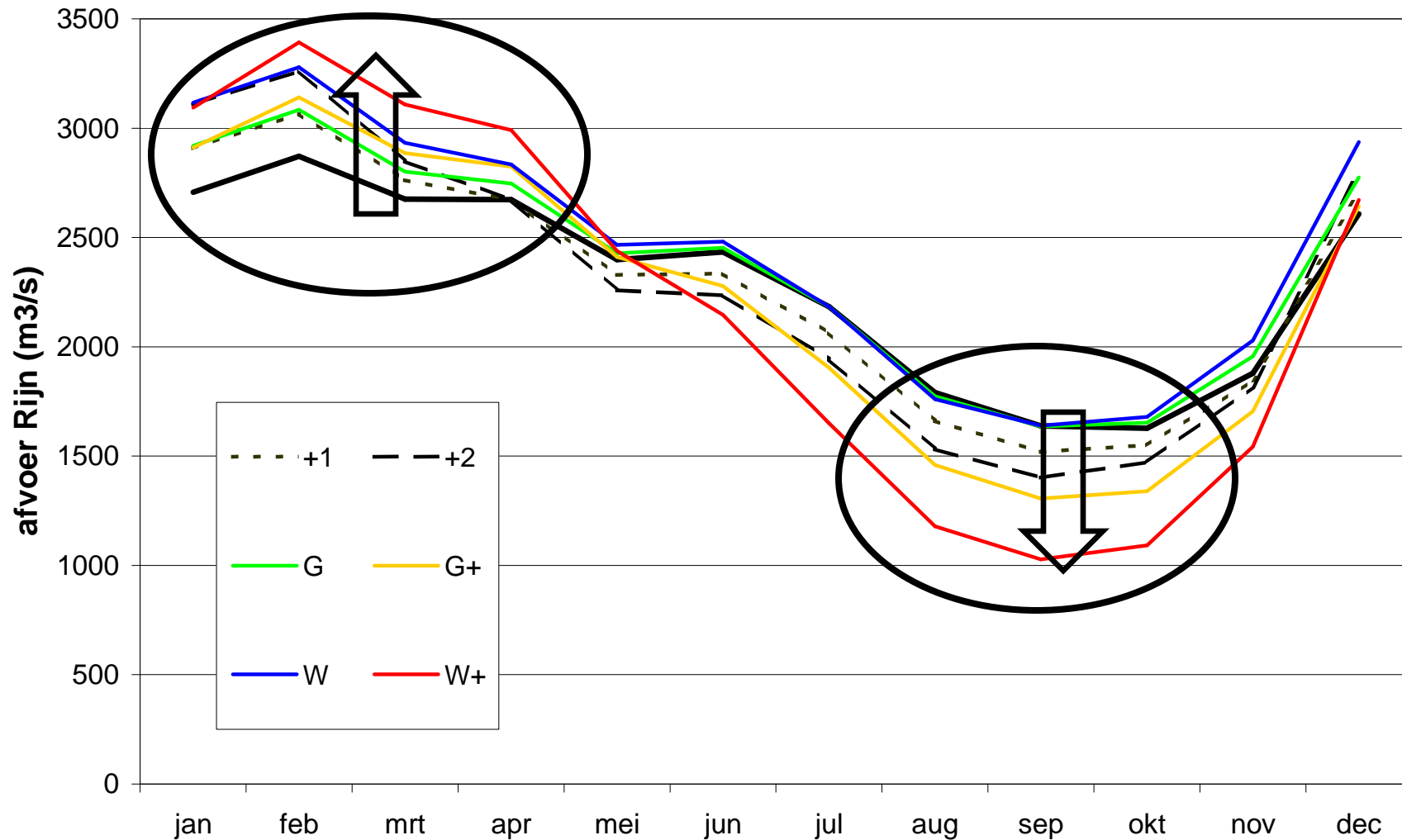
High riverbed enlargement along the IJssel between
Zwolle and Kampen



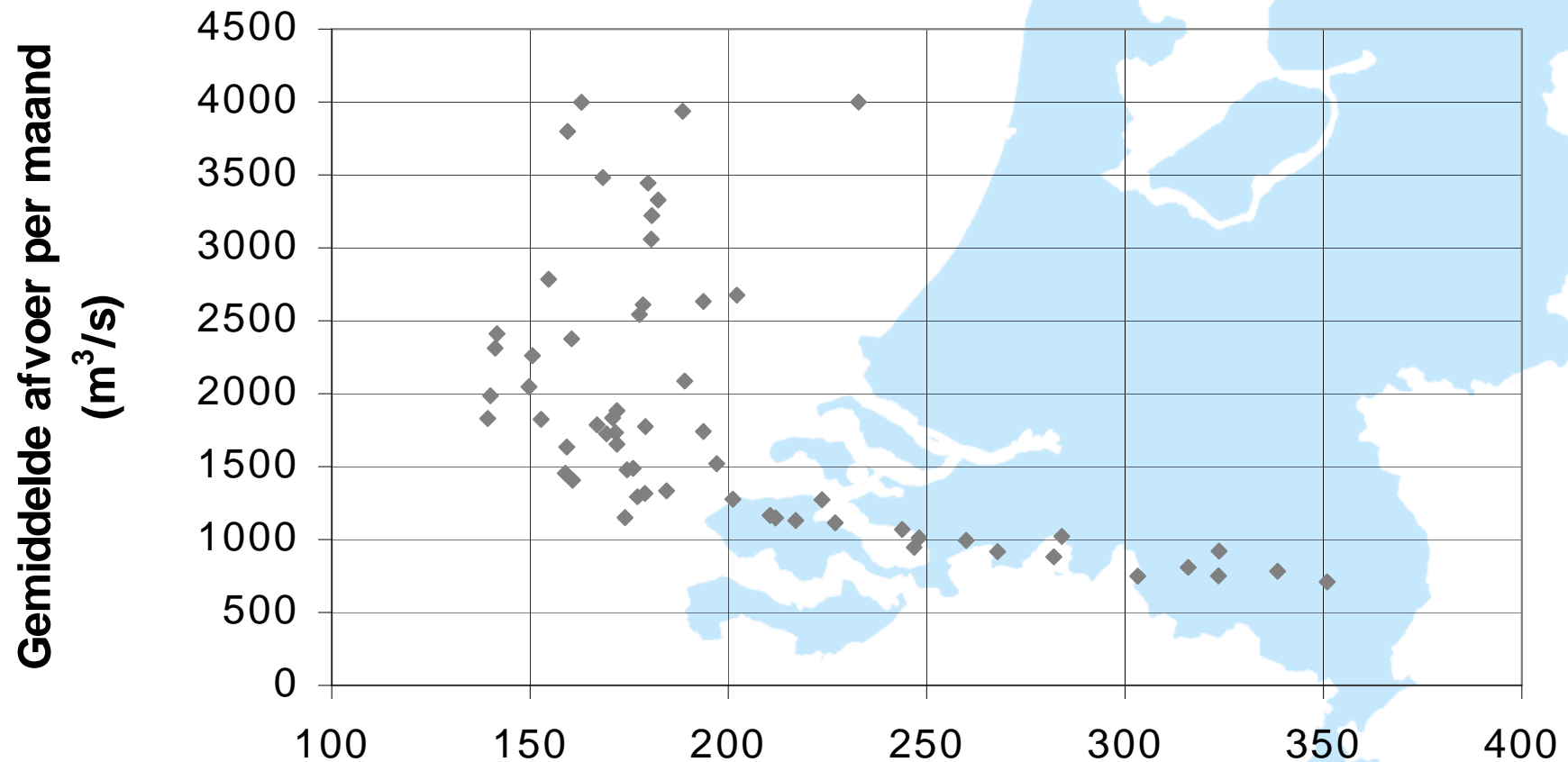
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Discharges of the river Rhine

2050 compared to 1990



Shipping on the Rhine river



Kosten per maand (Miljoen Euro)

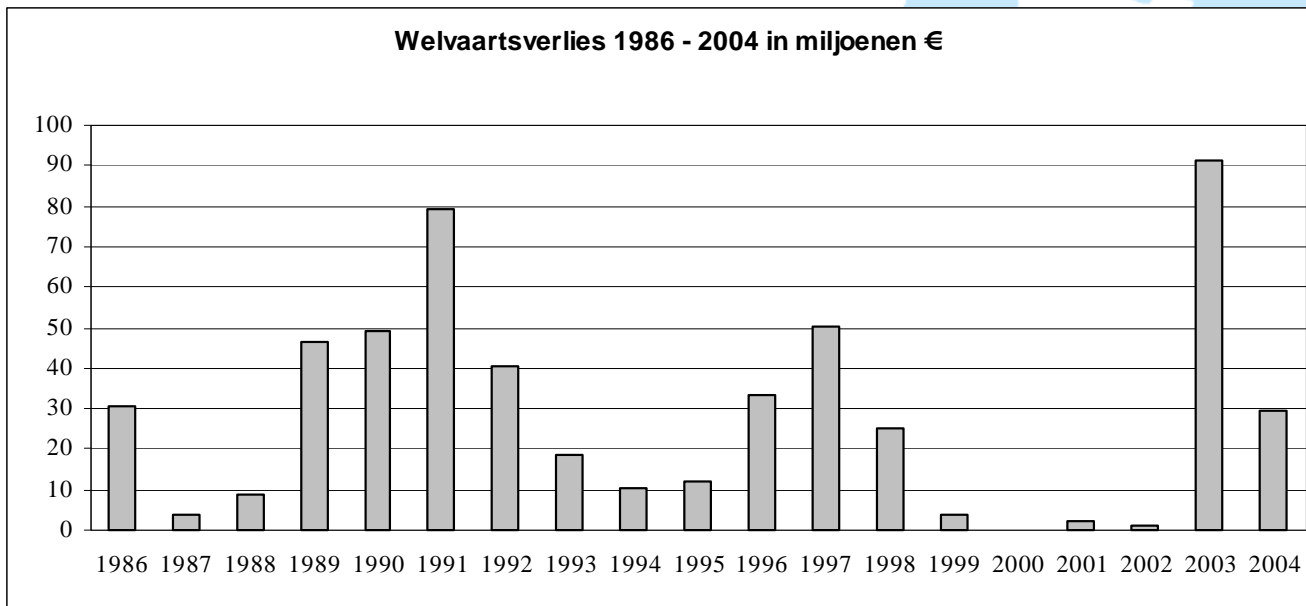
Price elasticity of the demand for inland shipping

Price elasticity of the demand = relative change of the demand due to a relative change of the price

Estimated elasticity: -0,60

Implying: a price increase of 10%, yields a demand decrease of 6%. Thus societal costs increase, i.e. loss of economic welfare

Yearly welfare loss

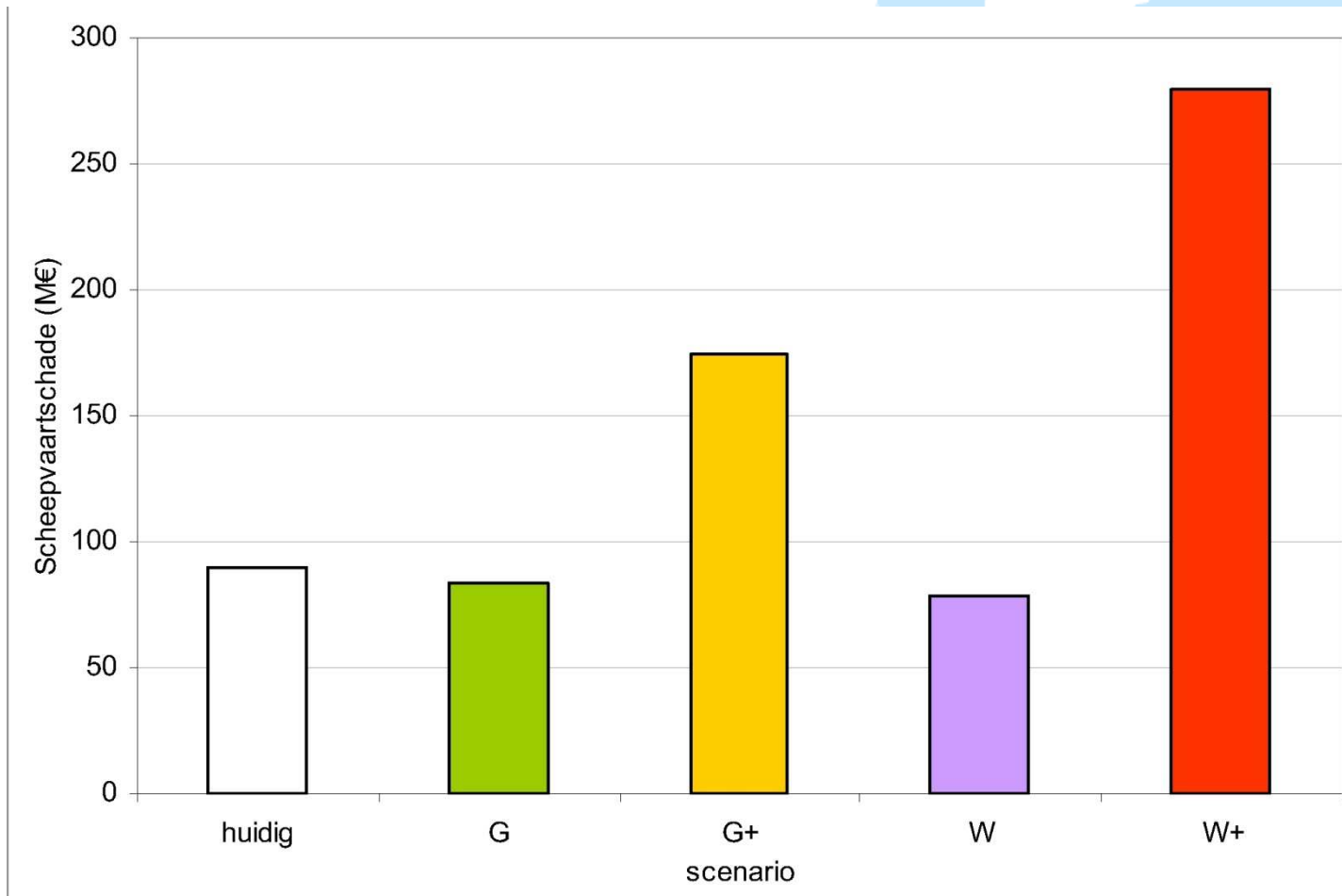


2003: € 90 million

Average: € 28 million

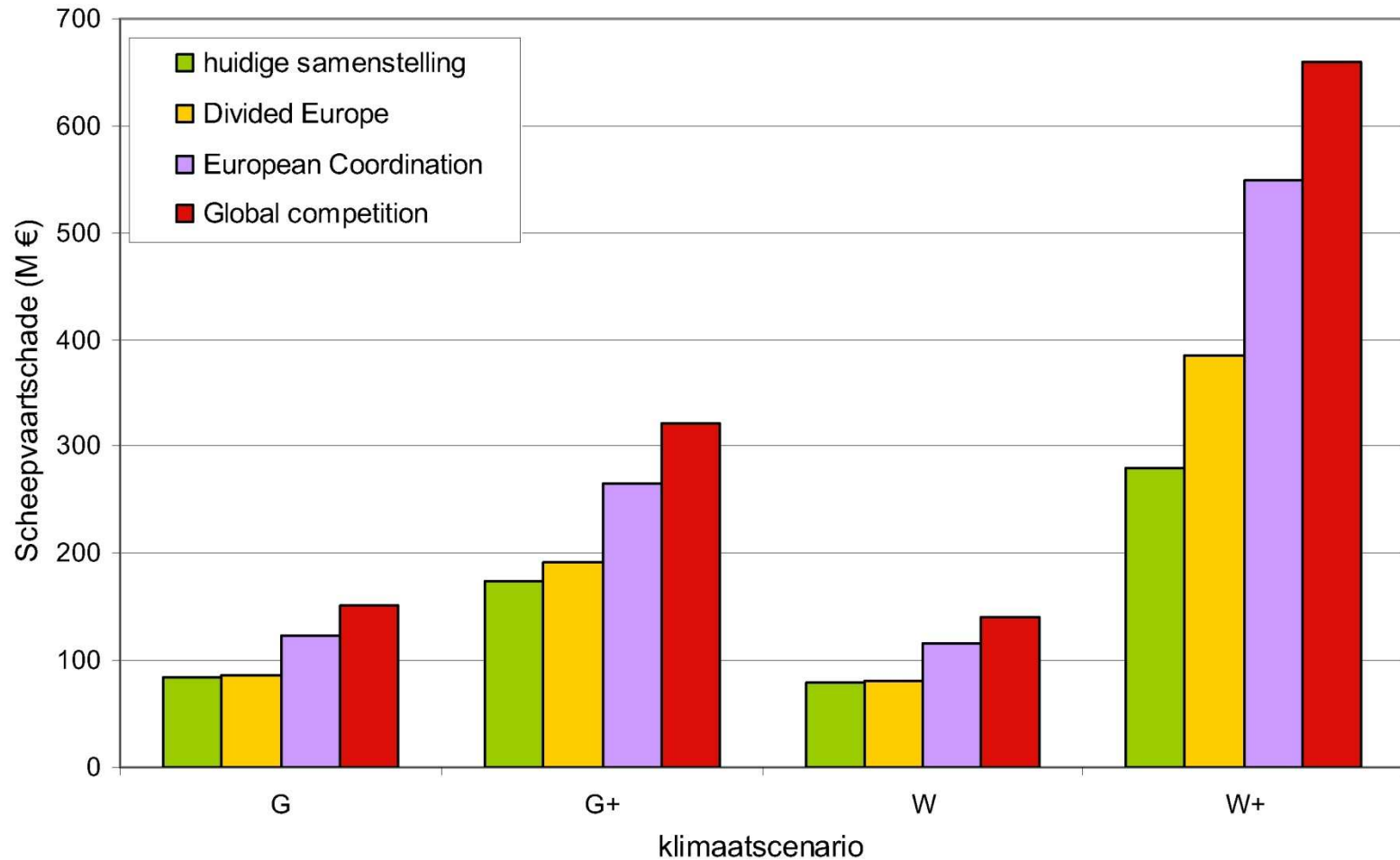
Net present value

present situation and climate scenario's



Net present value

climate change and economic scenarios



Shipping



- Impact of future climate scenarios for 2 of 4 scenarios costs are limited
 - Risk too small for large investments now
 - Risk high enough to prepare measures:
 - Infrastructure
 - Logistics
 - Shipbuilding
- Impact 'economic' future scenarios larger

Conclusion ‘scenario’s’

- If we know how to deal with economic scenarios, we also know how to deal with climate change scenarios
- Scenarios must span a wide probable range to be of use
- Objective: testing robustness of measures

Conclusions



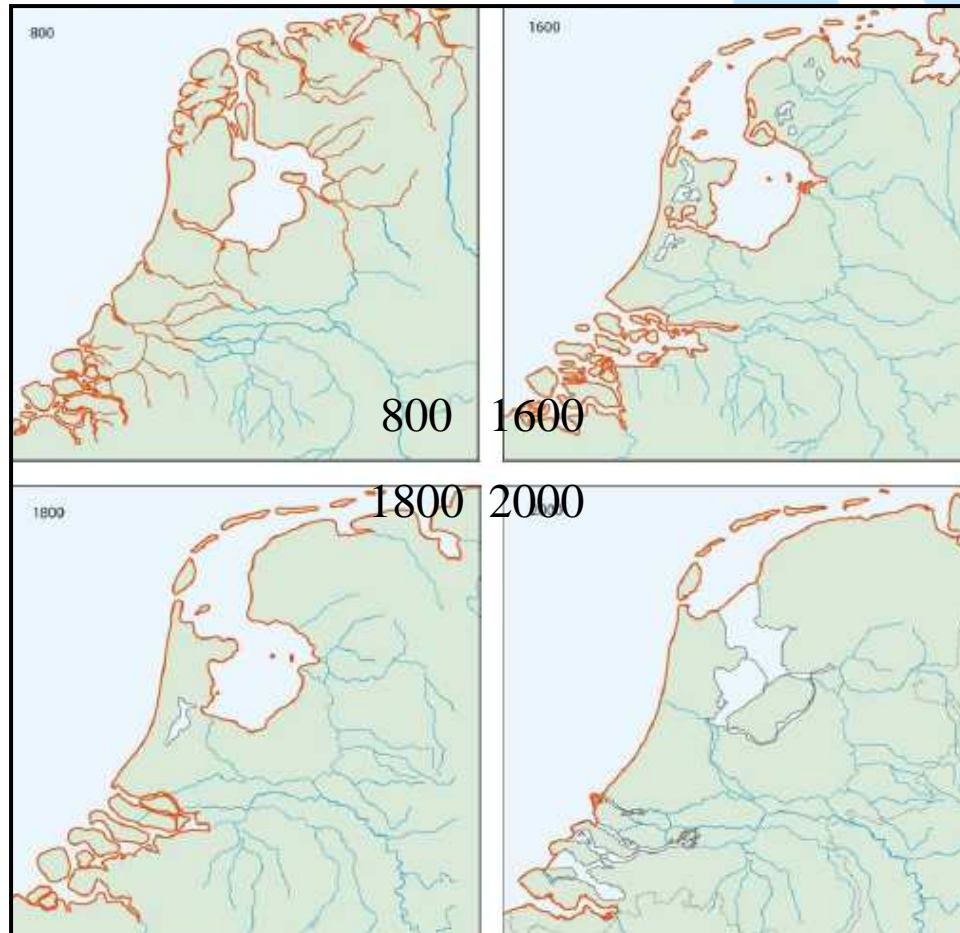
Risks and possible measures in the Rhine Delta:

- Include uncertainties to improve decision making
- Climate change clearly forces to take measures to increase safety against flooding
- Climate change does not yet force measures for inland shipping, just anticipation
- No matter how fast climate changes: shipping on the Rhine remains of large importance in the Netherlands in the next 100 years
- With additional measures navigability remains possible in the next 100 years, even for high-end climate scenarios



Samen *werken*
met water

Kustlijnverkorting



Coastal extension



SW Delta





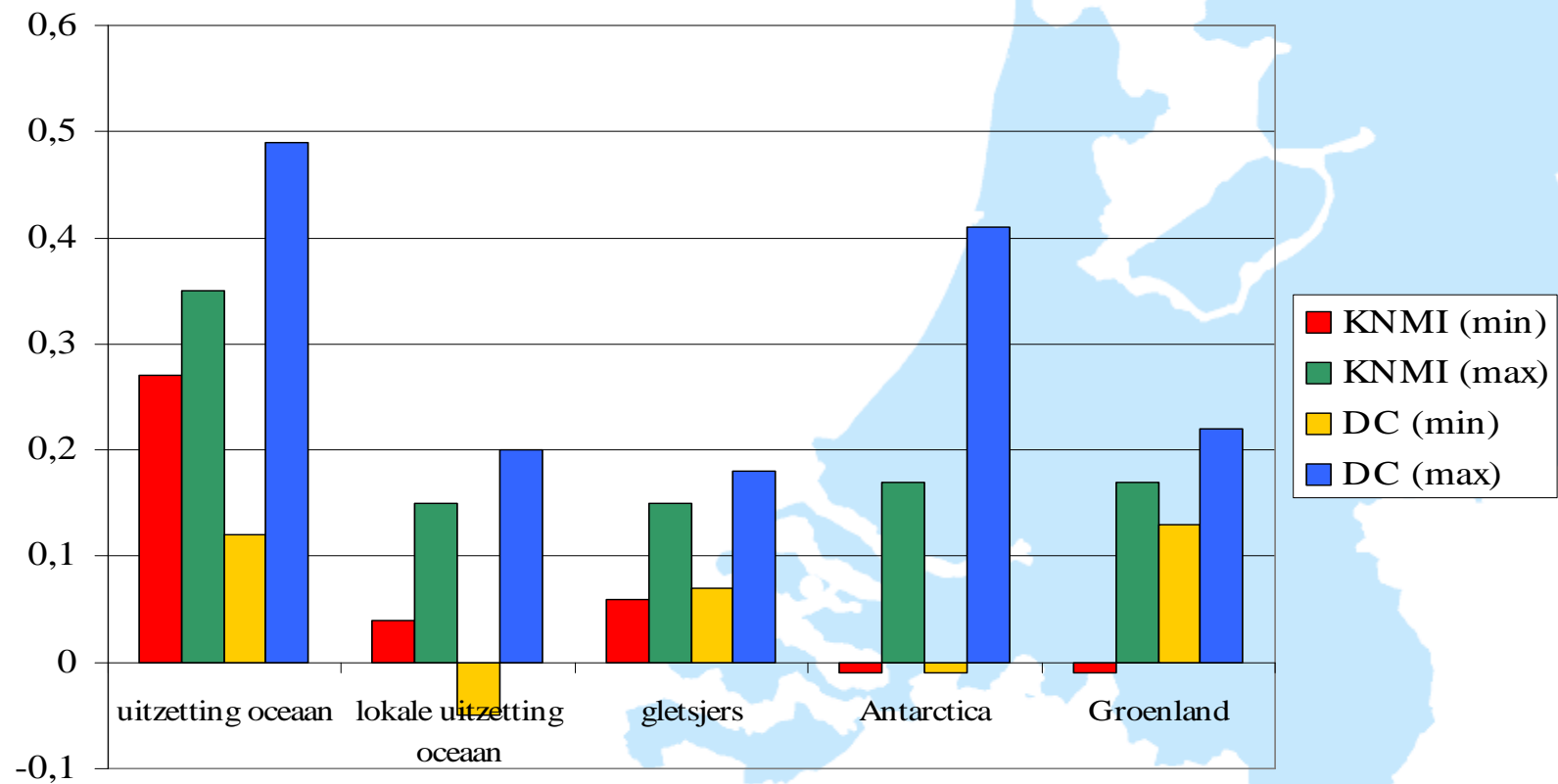


IJssel lake

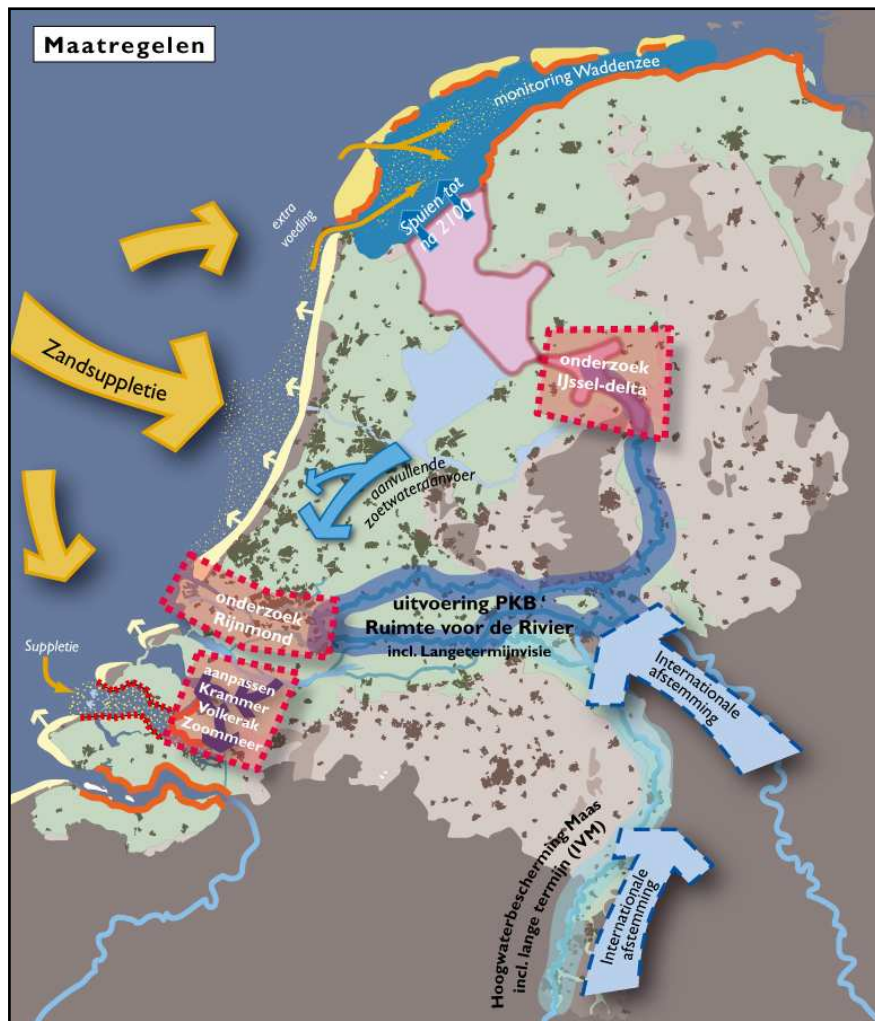


- Mean level of IJsselmeer follows SLR (1.5 m is upper boundary!)
- IJsselmeer remains THE freshwater basin, available for drought periods
- Level of Markermeer unchanged

Relative contributions to SLR 2100



Costs



- 1,2 to 1,6 billion euro per year until 2050
- 0,9 to 1,5 billion per year for the period 2050-2100
- exclusive costs for coastal extension

Noordzee coast



- Sand nourishment as the most optimal form of BwN
- Natural adaptation to sea-level
- Optional coastal extension

Coastal extension



Waddensea



- Sufficient sand nourishment along the coast will not constrain the availability of sediment for the Waddensea