

Functies van (potentiele) kwelders in ZW-Delta & Wadden

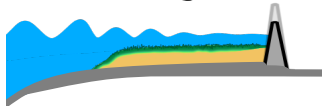
1) Nature based flood defense

- From concept towards implication
 - Effective? – novel insights from historic analyses
 - Optimal solution depending on space availability (WS vs Waddensea)

2) Double-dike systems with transitional polders



3) Latest insights in marsh establishment on bare tidal flats



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1

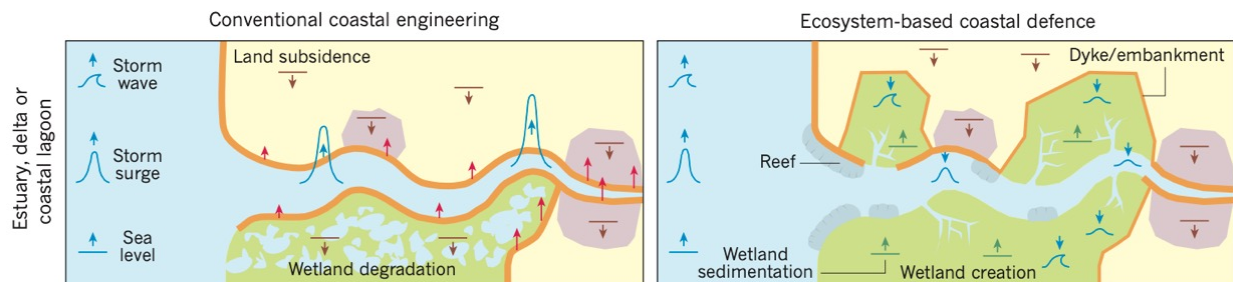
Nature based flood defense: from concept in 2013 → towards practice

PERSPECTIVE



Ecosystem-based coastal defence in the face of global change

Stijn Temmerman¹, Patrick Meire¹, Tjeerd J. Bouma², Peter M. J. Herman², Tom Ysebaert^{2,3} & Huib J. De Vriend⁴

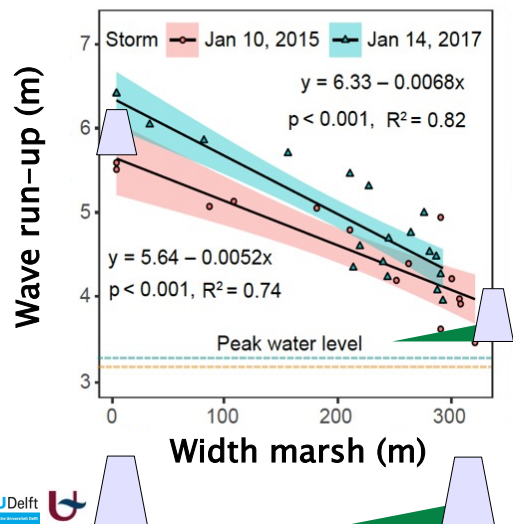


2

Wave attenuation works during 'extreme' storms



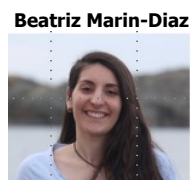
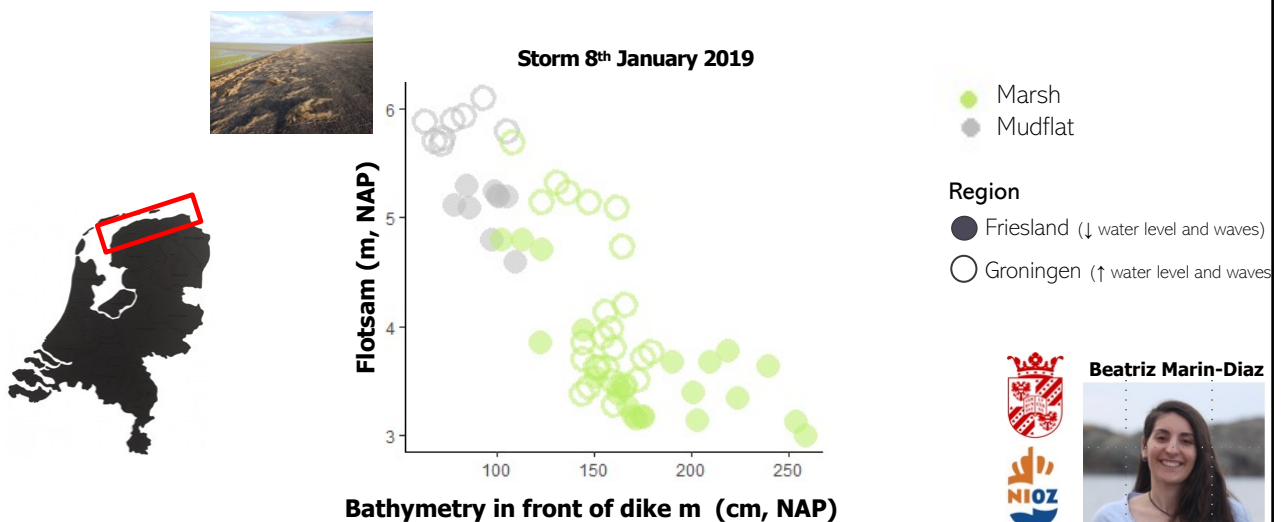
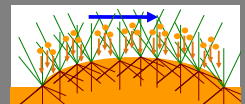
Moller et al. (Nature Geoscience 2014)



Zhu et al. (Nature Sustainability 2020)

3

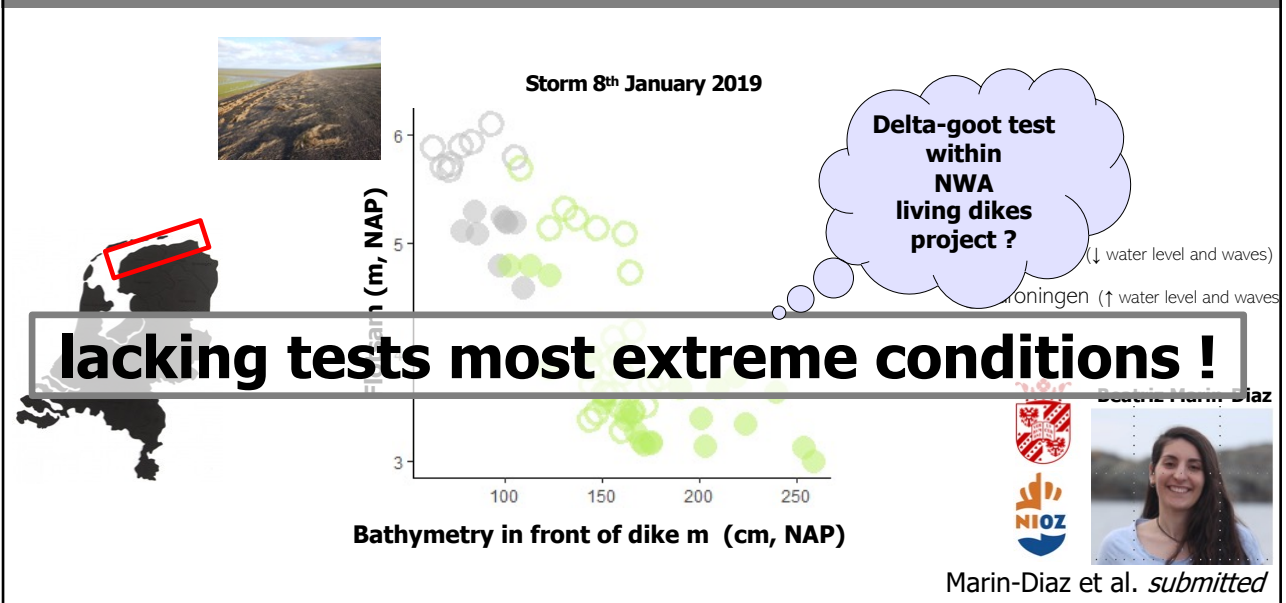
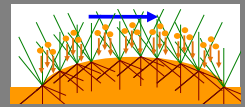
Wave attenuation mainly due to bathymetry



Marin-Diaz et al. *submitted*

4

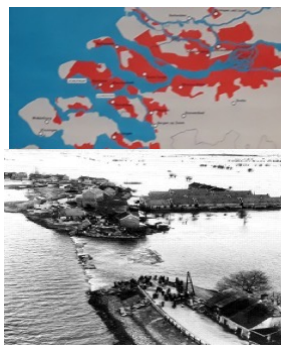
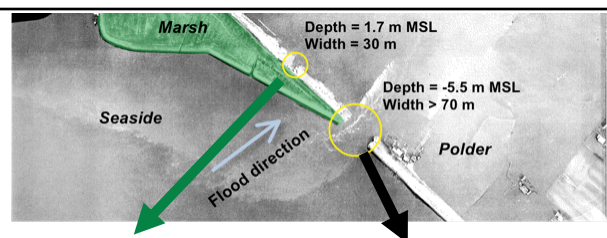
Wave attenuation mainly due to bathymetry



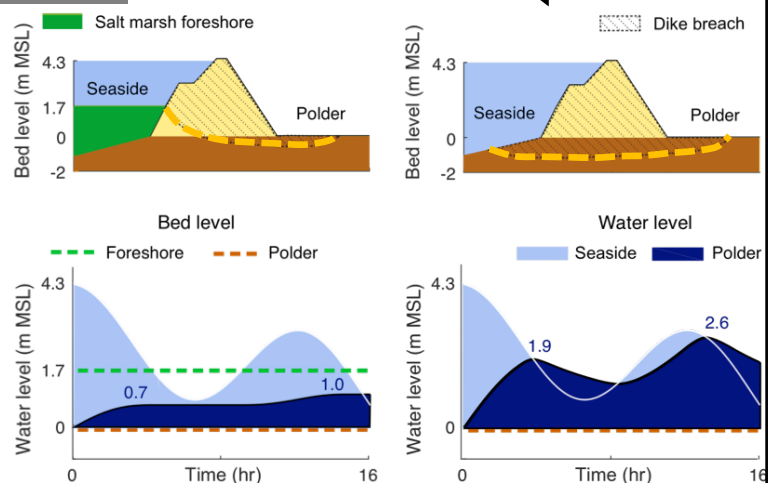
5

1953 storm:

marsh → smaller breach
= more evacuation time
= less fatalities



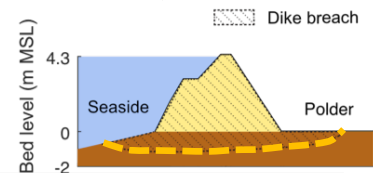
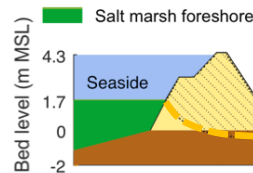
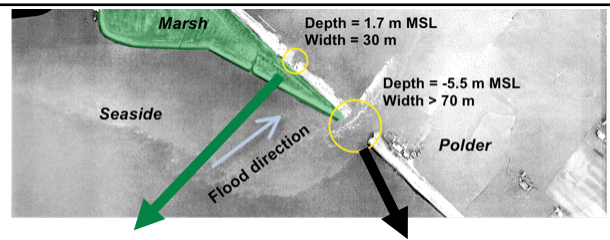
Zhu et al. (Nature Sustainability 2020)



6

1953 storm:

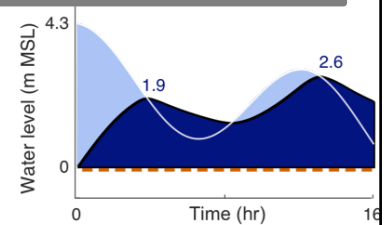
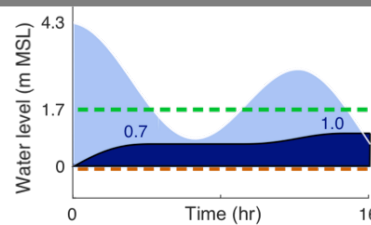
marsh → smaller breach
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protective effect → increases with SLR



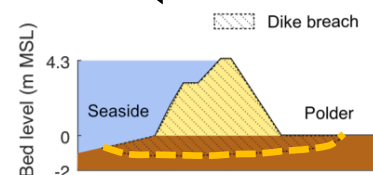
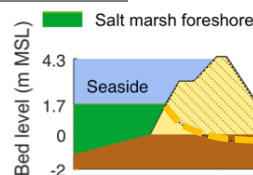
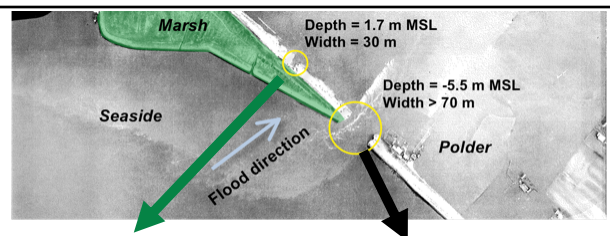
Zhu et al. (Nature Sustainability 2020)



7

1953 storm:

marsh → smaller breach
= more evacuation time
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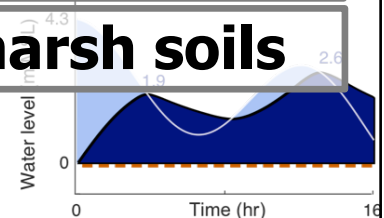
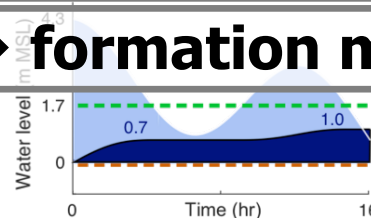


protective effect → increases with SLR

ongoing PhD → formation marsh soils



Zhu et al. (Nature Sustainability 2020)



8

Marshes protect – both in front & behind dike

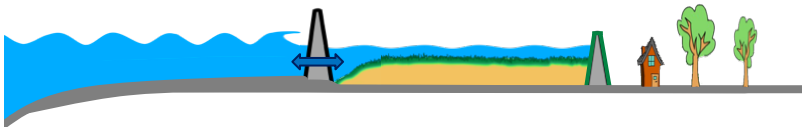
Traditionele dijk



Dijk met schor / kwelder



Dubbele dijk met Wisselpolder



VOOR de dijk:

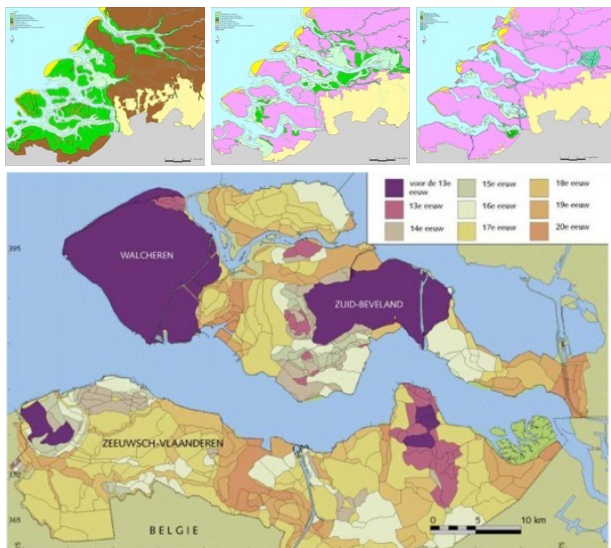
- Golf demping
- Beperken diepte bres
- Buitendijkse ruimte

WISSELPOLDER

- Ophogen diepe polders
- Beperken diepte bres
- Binnendijks ruimte, maar 'TIJDELIJK'

9

Western Scheldt → narrowing subsiding estuary due to land reclamation since 1200 !!!

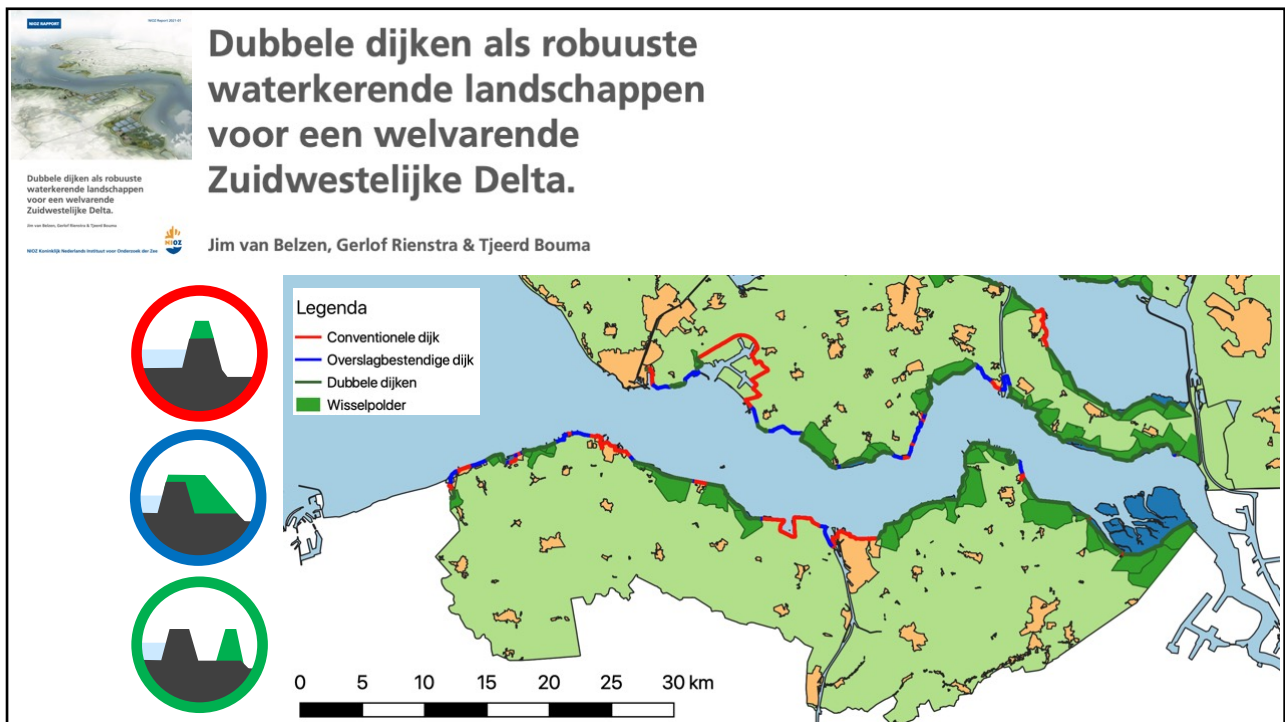


Figuur 2.2: Historische inpolderingen (Schelde Atlas, 1999)

Dijkenkaart



10



11

debate on double dike with transitional polders

'Polders tijdelijk onder water'
om Zeeland veilig te houden!

Ontpolderen is niet dé oplossing'
Het idee polders tijdelijk onder water te zetten is bij het kabinet in Zeeland niet dé oplossing.

Minister serveert idee wisselpolders niet af
Lusten en lasten Westerschelde

'Laat water zelf land opbouwen'
Wisselpolders: goed idee of schrikbeeld?

Waterschap werkt niet mee aan tijdelijk onder water zetten polders

Wisselpolders in Zeeland zijn het onderzoeken waard

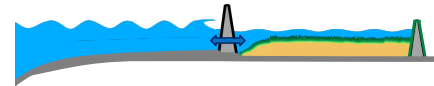
12

Starting 2022 → “Waterkerende landschappen”



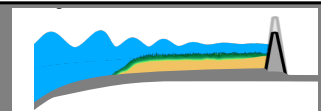
Double dikes with transitional polders:

- Optimal design?
- Flood safety?
- Salinization?
- What do people really think?
- Social innovation !



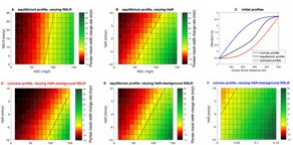
13

Latest insight in marsh establishment



Geophysical Research Letters

RESEARCH LETTER
10.1029/2021GL095596



Mechanistic Modeling of Marsh Seedling Establishment Provides a **Positive Outlook** for Coastal Wetland Restoration Under Global Climate Change *Hu et al. (2021)*

Zhan Hu^{1,2,3}, Bas W. Borsje⁴, Jim van Belzen⁵, Pim W. J. M. Willemsen⁴, Heng Wang⁶, Yisheng Peng⁷, Lin Yuan⁸, Michela De Dominicis⁹, Judith Wolf⁹, Stijn Temmerman¹⁰, and Tjeerd J. Bouma^{5,11,12}



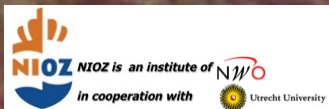
Fivash et al. (subm.)
identified mechanistically **early indicators** for state shifts in estuaries across Europe



14

Thank you for your attention 😊

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generating FUNdamental knowledge for Application*



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