

## Satellite Monitoring of Water Defense Systems

Freek van Leijen<sup>1</sup> and Ramon Hanssen<sup>2</sup>

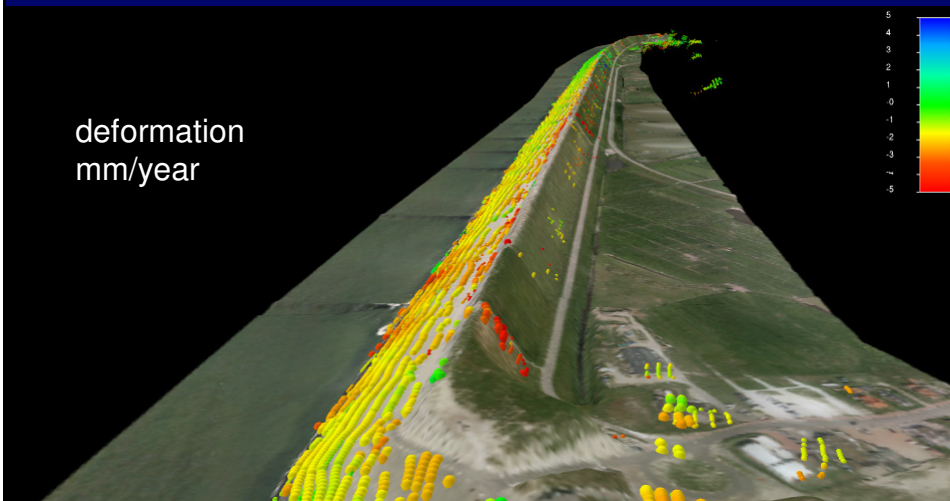
<sup>1</sup>Hansje Brinker B.V., The Netherlands

<sup>2</sup>Delft University of Technology, The Netherlands



## Stability by satellite

deformation  
mm/year



## Background

- Sea level rise
- Increase extreme weather conditions (IPCC, 2007)
- Dike failures (Wilnis, 2003; New Orleans, 2005)
- Increasing socio-economic consequences



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## Situation in The Netherlands

Resultaten tweede veiligheidstoetsing primaire waterkeringen, 1 januari 2006

Legenda

voldoet aan de norm  
geen oordeel  
voldoet niet aan de norm

dijkkringgebied  
hoge gronden

Source: RWS, Primaire waterkeringen getoetst, sep. 2006



17.000 km water defense structures (dikes, levees, dams)

24% of primary dikes not conform norm  
32% status unknown

Vulnerability stressed by Delta Committee  
→ advice on protection involving billions of Euros



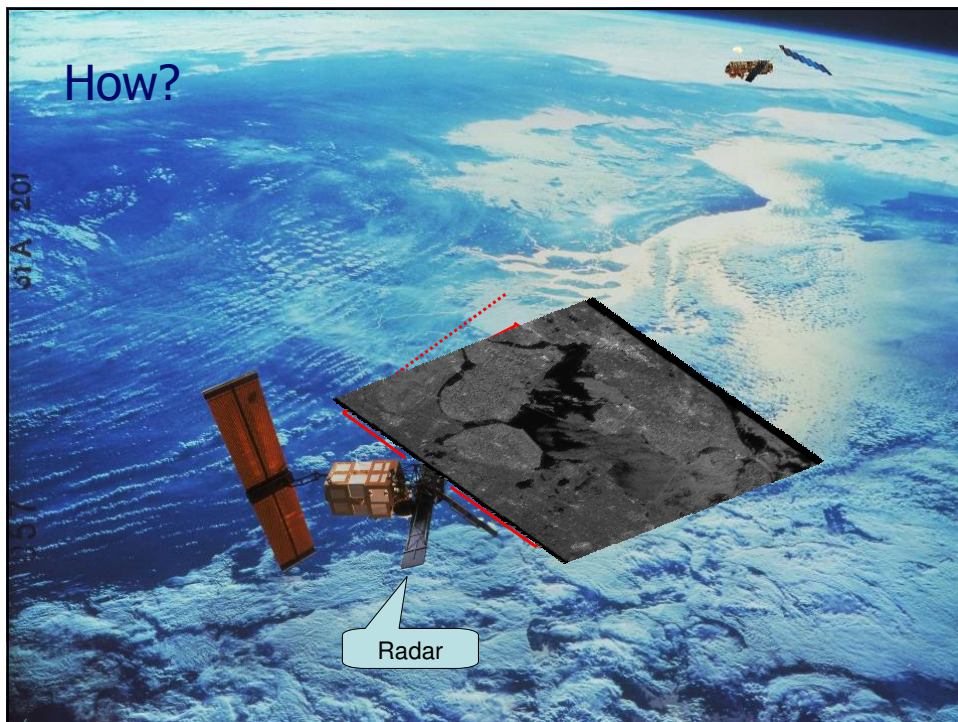
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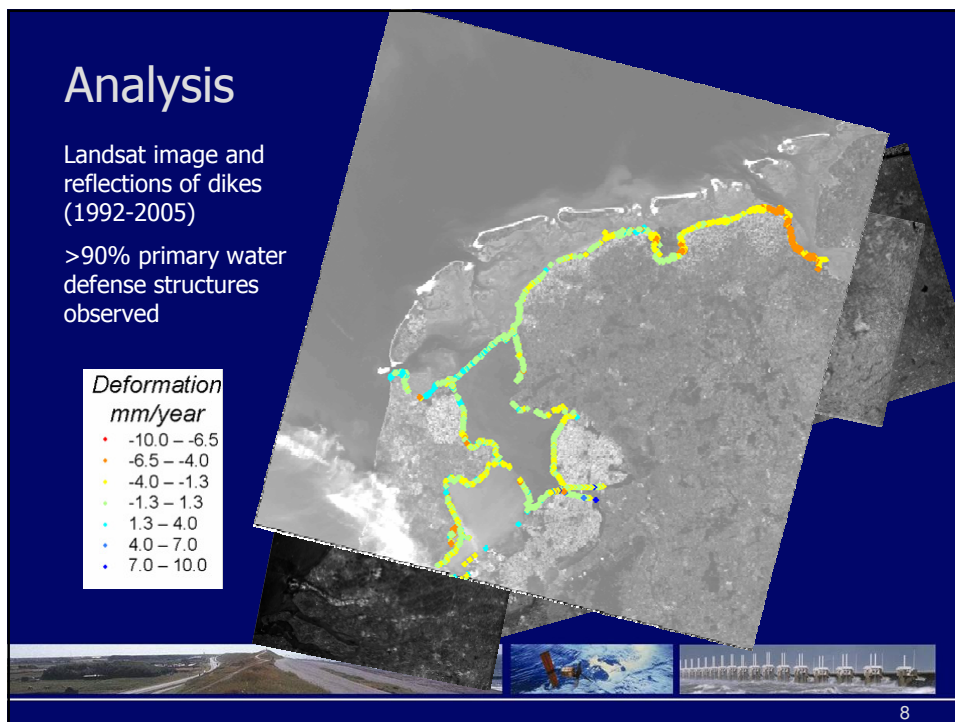
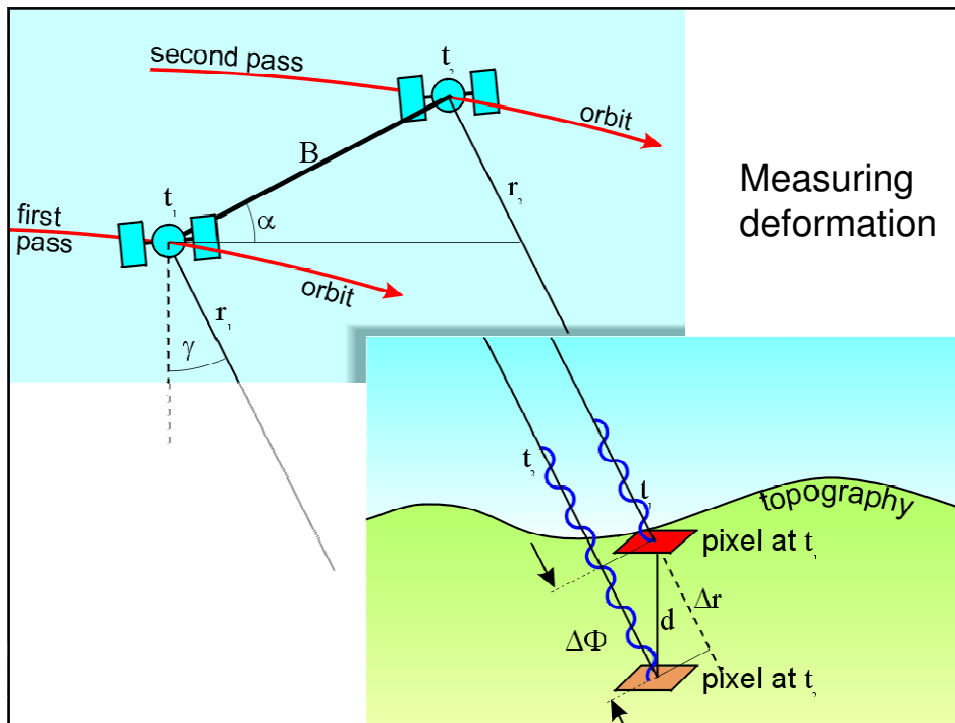
## Stability Monitoring by satellite radar data

- Alternative for reinforcement works (cheaper)
- Additional to visual inspection (more efficient)

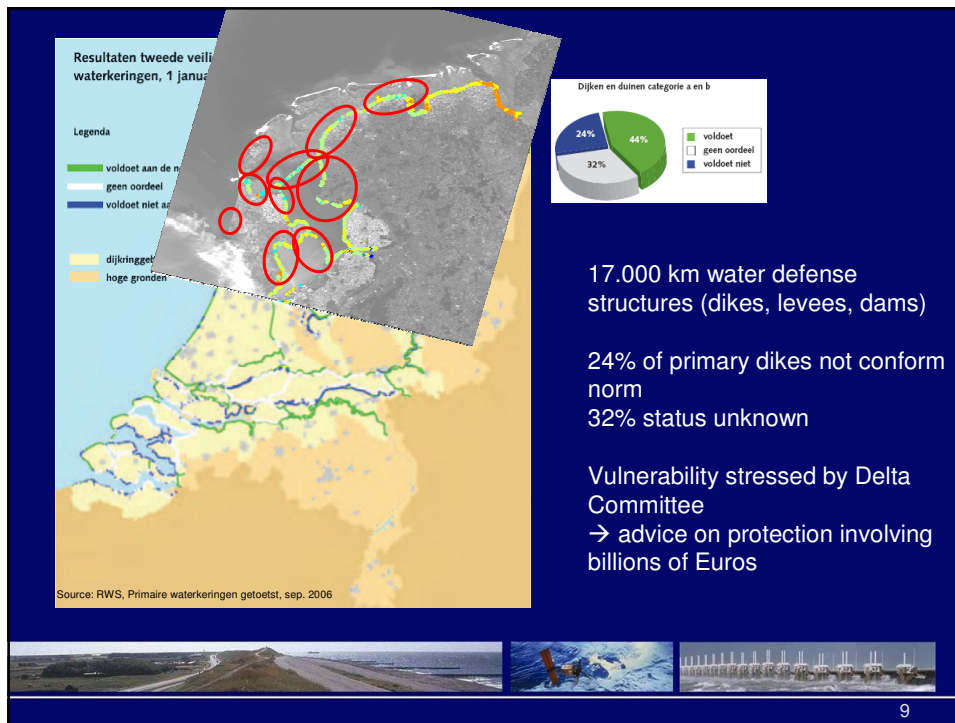


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## Satellite Monitoring

- Stability/deformation is the first indicator of weak spots (IJKdijk experiment, 2008)
- Dutch government indicated technique as an important added value (SBIR Digidijk, Agentschap.nl/RWS)



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Case 1:  
Analysis of large areas  
Friesland, The Netherlands



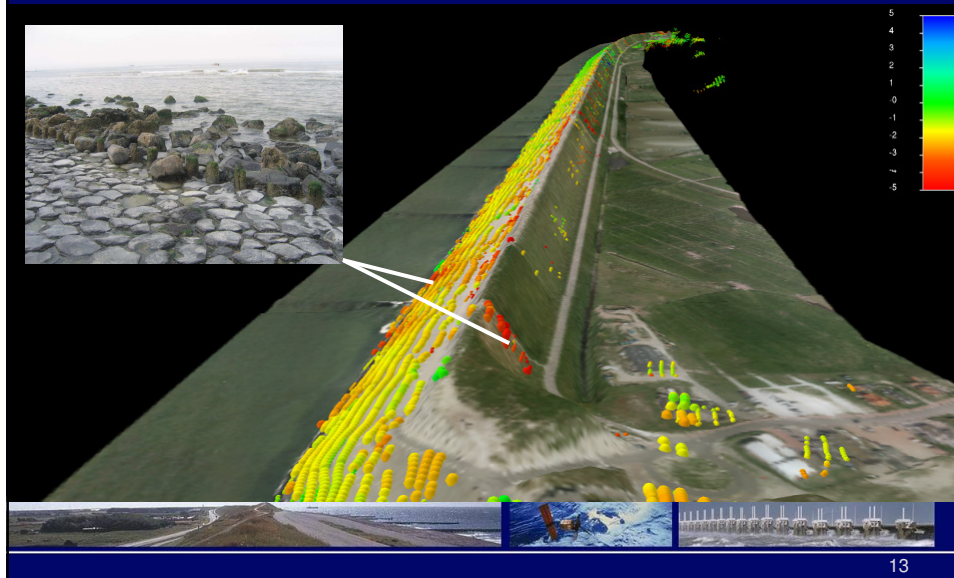
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Case 1:  
Analysis of large areas  
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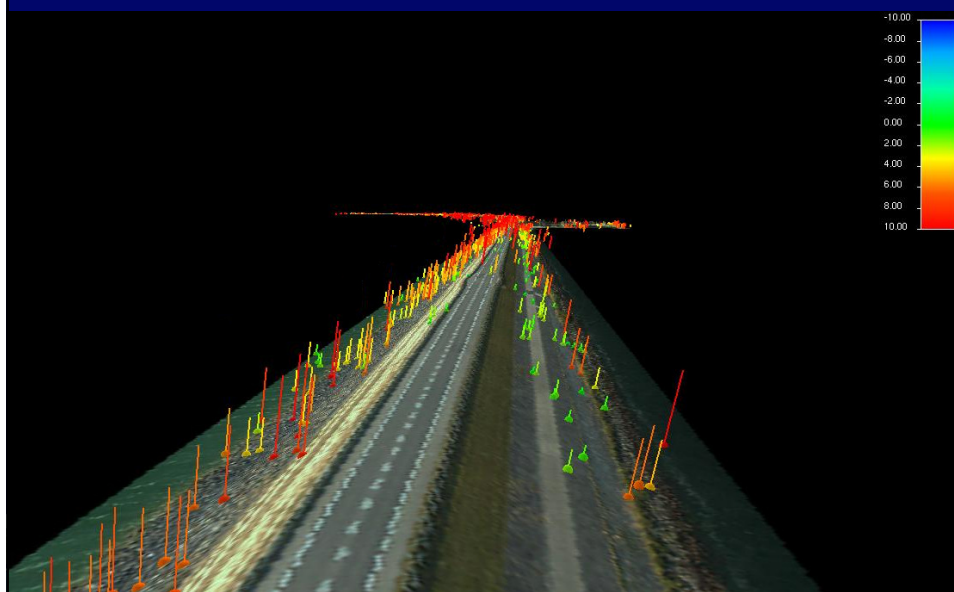
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Case 2:  
Hondsbossche and Pettemer zeewering, The Netherlands



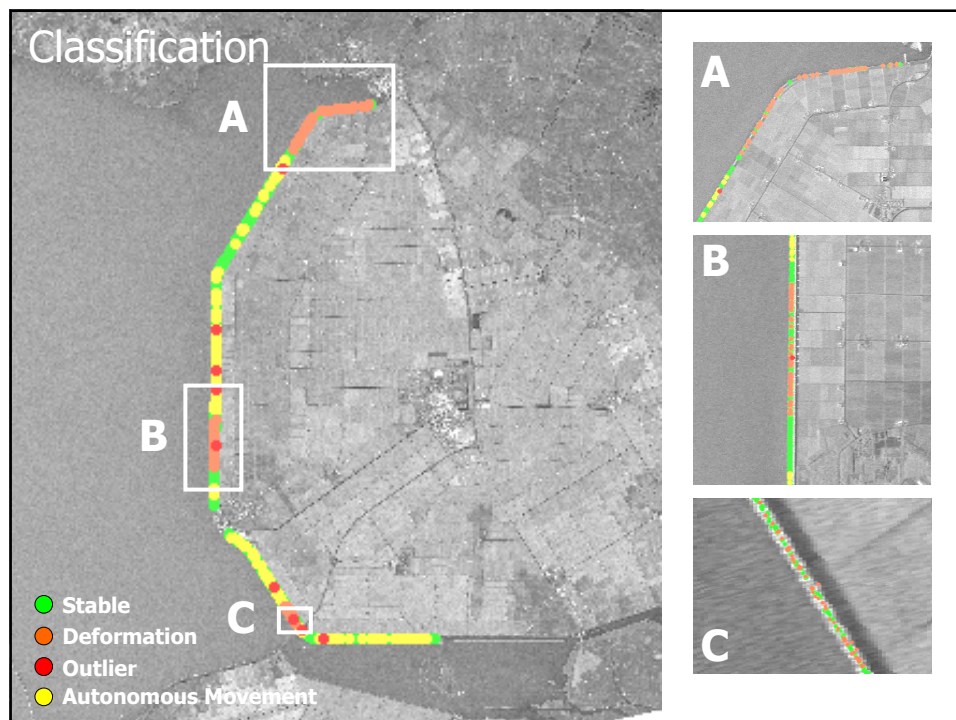
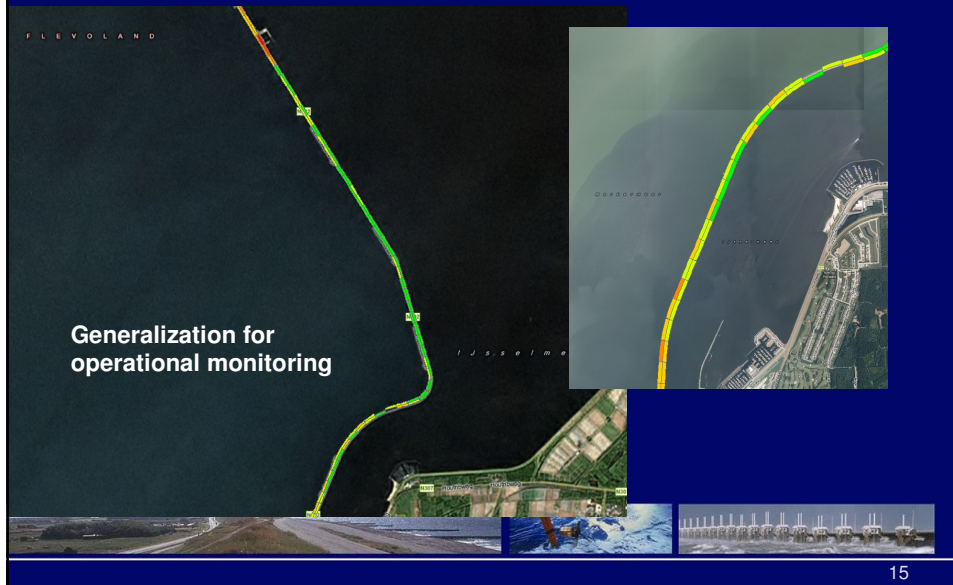
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Case 3:  
Houtribdijk, The Netherlands

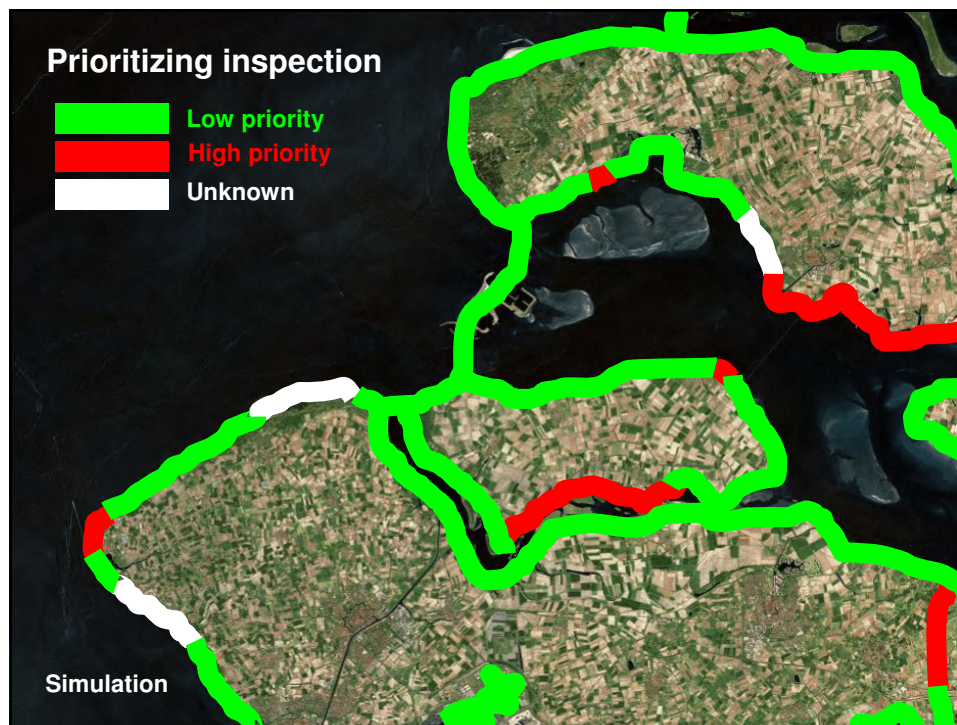




### Case 3: Houtribdijk, The Netherlands







## Conclusions

- Satellite monitoring is an alternative for reinforcements
- Indicator function for visual inspection and dedicated reinforcements
- Applicable world wide and for large areas
- Non-invasive
- Cost-efficient



## Integration in European projects

- Terrafirma



*Pan-European Ground Motion Hazard Information Service*

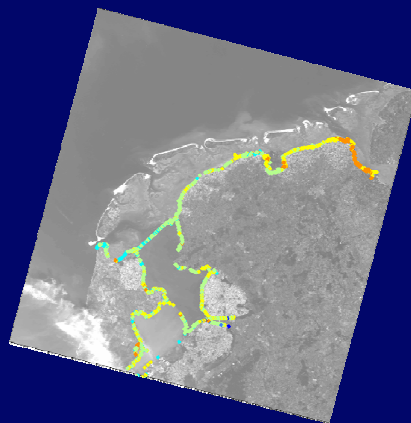
- Subcoast



*developing an European service for monitoring and forecasting subsidence hazards in coastal areas*



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