Overflow & overtopping in Flanders

Issues & Engineering needs

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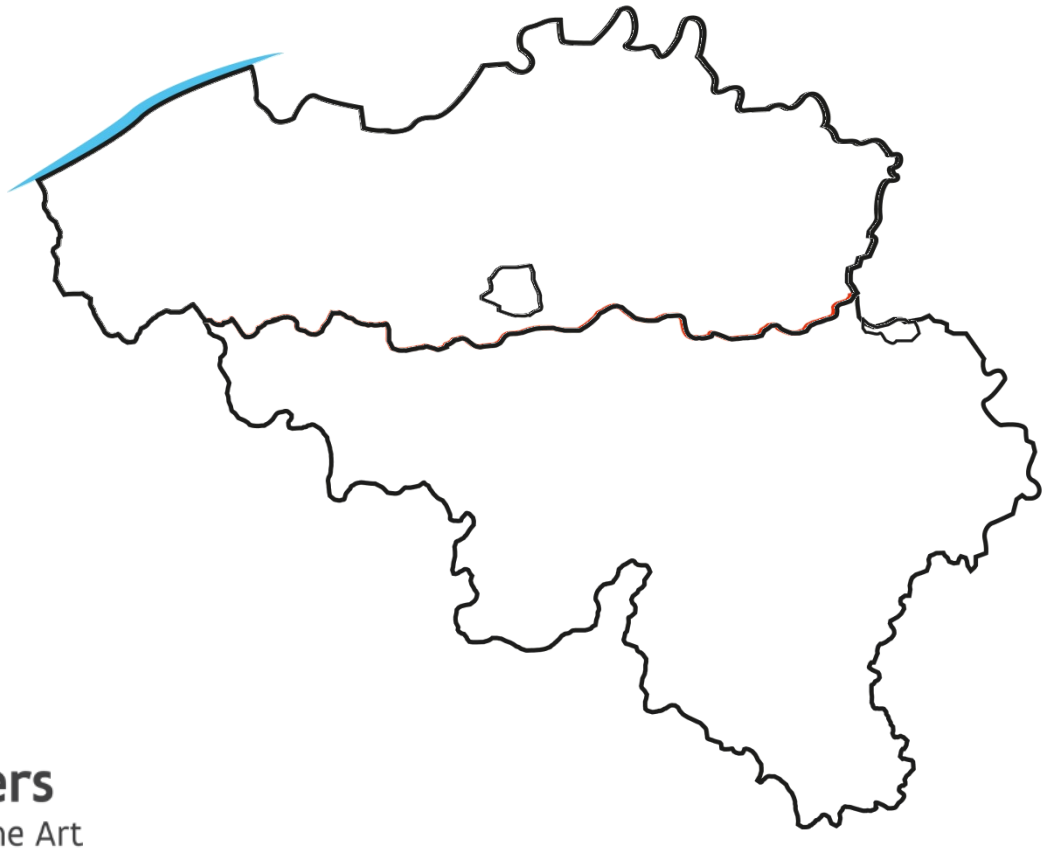
Who we are

Flanders Hydraulics Research

Flanders, the northern part of Belgium



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Flanders Hydraulics Research

- Founded in 1933
- Department of Mobility and Public Works (Flemish Government)
- Centre of expertise for research and advice on hydraulic, nautical, sediment-related and hydrological topics
- Provides consultancy services for
  - government of Flanders
  - other domestic and foreign government services
  - private sector

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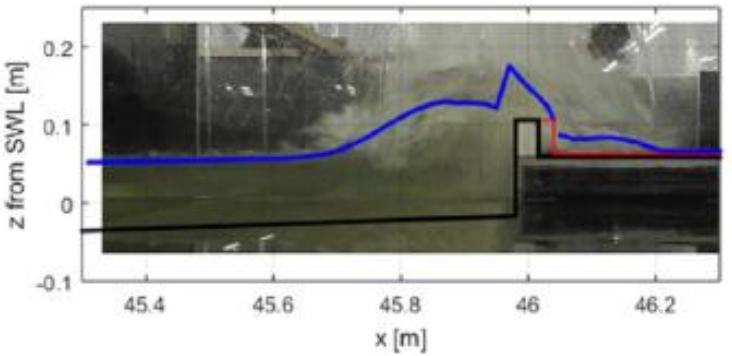
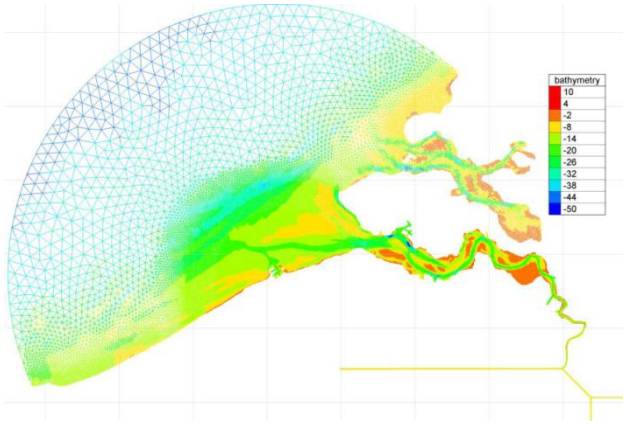
Research areas

- Harbours & waterways
- Hydraulic structures
- Water management
- Hydraulics & sediment





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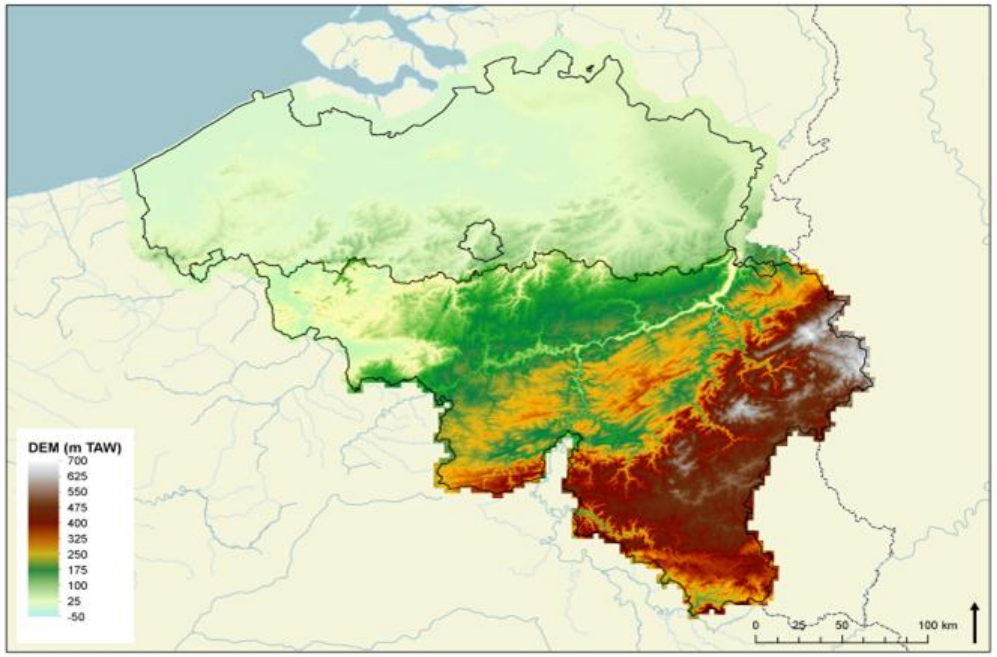
Levees in Flanders

River management in Belgium

- Wallonia
  - Narrow valleys
  - Large dams
- Flanders
  - Relatively flat
  - Dunes & levees



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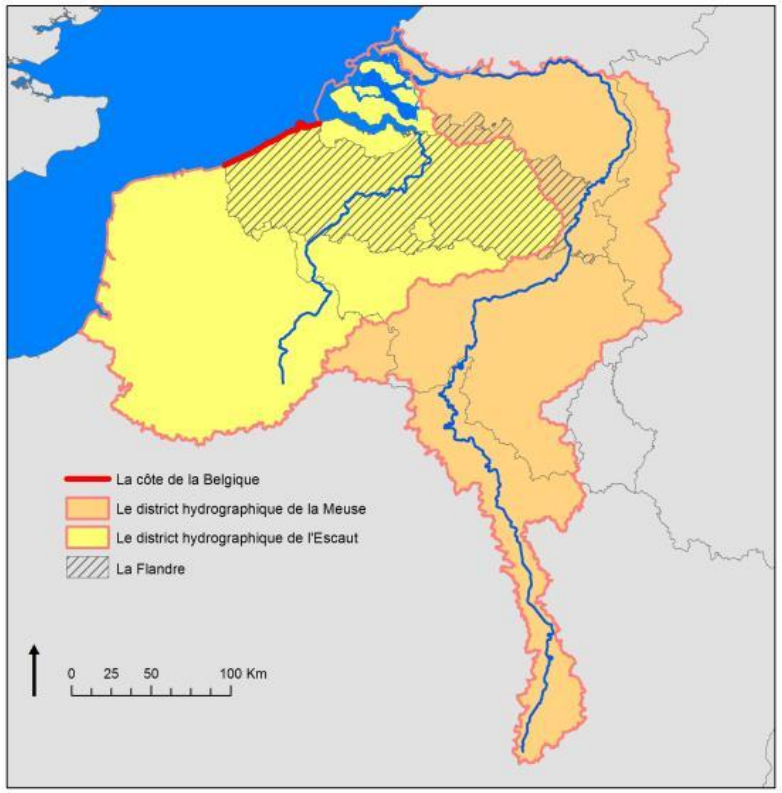
River management in Flanders

- Belgian coast (70 km)
- Two river basin districts
  - catchment of the Scheldt
  - catchment of the Meuse



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Levee management in Flanders

- Coastal levee

- River levee

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Knowledge Network Dikes (KND)

- All Flemish levee managers together
- Enhancing knowledge exchange
- Universal therminology
- Uniform inspection methodology
- 1 asset management tool under construction

- *Real-time free board maps*

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Issues with respect to external erosion

Along the coast

- Erosion of the foreshore during storm surges
  - following wave action

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Scheldt estuary

- Erosion of the landward slope
  - following wave overtopping

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Along rivers and canals

- Scour of the flood plain
- Erosion of un(der)protected landward slope
  - following overflow (limited water level above crest)

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Climate change

- Crest levels are more or less fixed.
- Frequency of wave overtopping & low overflow events expected to rise
- Increased cracking of cover layer following more intense wetting/drying cycli
  - Higher permeability of cover layer
  - Possibly in combination with an impermeable cohesive core

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Engineering needs with respect to external erosion

Research activities

- Study of hydraulic jump near the toe (using CFD)
- Prototype overflow experiments with Open Stone Asphalt
- Lime treatment of cover material
- *Geophysical detection of cavities*
- *Hyperspectral images of grass cover*
- In situ breach experiments

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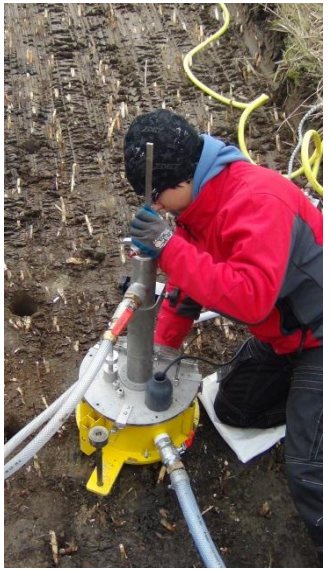
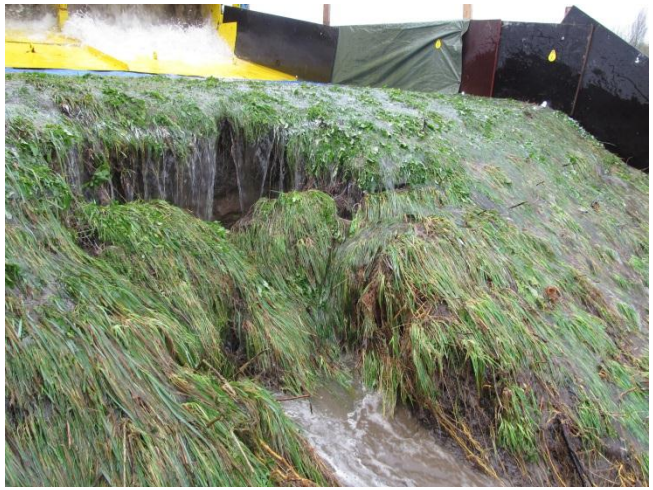
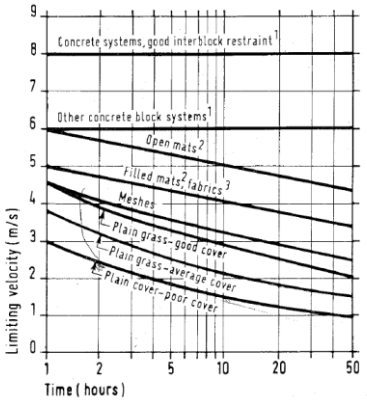
Assessing erosion resistance

- Qualitative strength assessment
- (In situ) JET
- Wave overtopping/overflow tests
- Velocity duration curves
  (Hewlett *et al.*, 1987)







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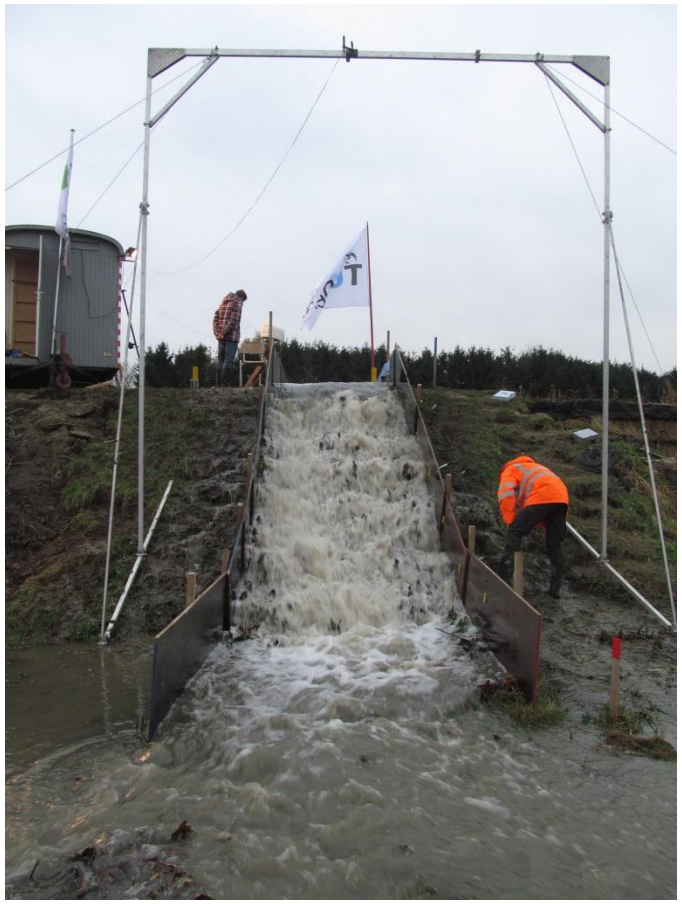
Flow over landward slope

- Uniform flow conditions apply?
- How to account for aeration of flow when calculating shear stress?
- Skimming flow or nappe flow? Which one do you prefer?

- *How to prevent breach initiation in your design?*
  (in case structural maintenance is lacking)



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Overflow dikes covered with Open Stone Asphalt

- Behaviour under design conditions?
- Effect of hydraulic jump on the slope?

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Animal activity

- Detection of cavities
- *Prevention through smart design?*
  (in case structural maintenance is lacking)

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Preventig breach growth in width

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Emergency measures

- No time for trial & error
- Need for best practices: do’s & don’ts

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Thank you for your attention!

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