HR Wallingford
Working with water

Dams and Levee Erosion Research: Context

Mark Morris

EWGOOE Webinar

28th March 2022

Context

Today we have four presentations – each on different aspects of dam and levee erosion research, but all connected with a common goal of improving our ability to predict, plan, design for better dam and levee performance

Climate change typically means increasingly more extremely load conditions (whether overflow or overtopping…)

Over the past decade the various speakers have collaborated or crossed paths on various research initiatives – in particular the review of research needs and priorities on this topic at the Aussois Workshop in Dec 2017.

Here's a chance to see how we are all progressing…

Research challenges…

Predicting dam and levee erosion and breach processes is not simple.

Combines soils, hydraulics and structures under conditions which are often rapidly changing and difficult to measure.

Many different pathways towards failure, requiring a clear understanding of many basic processes before considering how you may ‘flip’ from process to process as a failure progresses.

Research challenges…some key questions

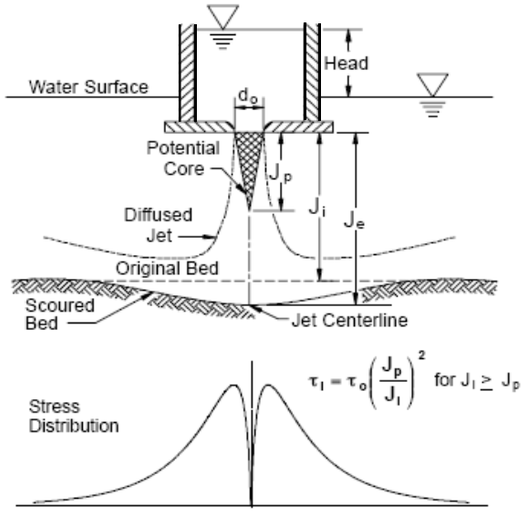
Some key questions include:

- What are the different macro and micro erosion processes? When, why and how do they occur?
- What is soil erodibility? How does it affect these processes? How do you measure it?
- How do processes measured in the laboratory translate to flood risk management in practice? How do we deal with scale effects?

Research challenges…JET Testing

Tony Wahl will talk about his work on Jet Testing:

- JET test equipment intended to allow measurement of soil erodibility and critical shear stress for a sample exposed to a jet
- Lab equipment – small scale field equipment – larger scale (EDF)
- How do results from the different scales correlate?
- How does this compare to Hole Erosion Test? What soils can be tested?
- What erosion conditions does this reflect?

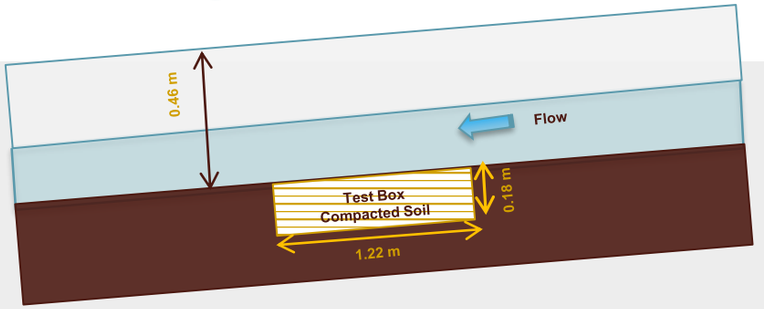


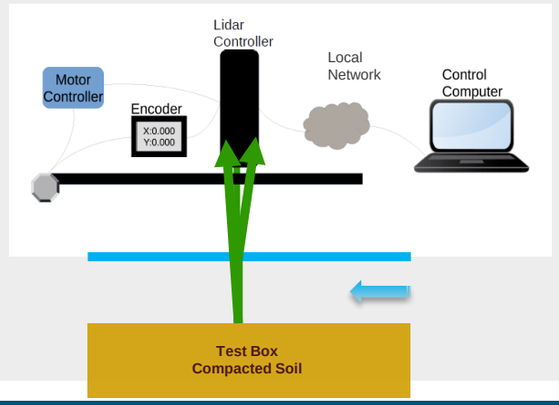
If we base breach prediction models on soil erodibility, we need to be able to understand and measure it!

Research challenges…Understanding Erosion Rate

Ghada Elithy will talk about her work on soil erosion measurement:

- Flume box tests undertaken to study how coarser grained soil mixes eroded under lateral flow conditions
- Having overcome the challenge of measuring erosion through water (Shallow water lidar), the focus is on how the erosion process develops under different soil and load conditions.



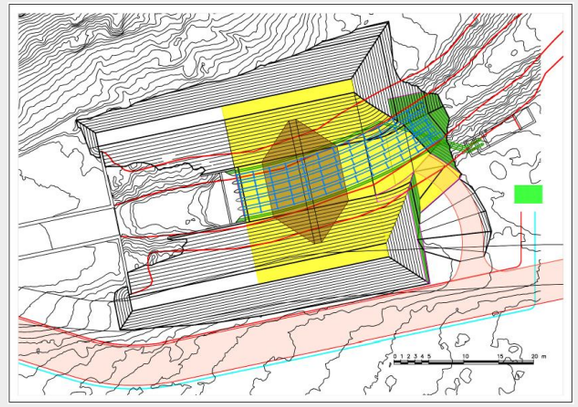


Erosion processes change according to soil mix, rate of change and magnitude of hydraulic loading, soil erodibility… many dimensions to consider.

Research challenges…Breach Prediction
The OVERCOME Project

The OVERCOME Project (EDF & CNR – UPM & HRW & INRAE):

- Overall goal is to improve breach prediction models for flood risk engineers by understanding both macro and micro erosion behaviour in relation to varying soils, permeability, erodibility and hydraulic load (absolute and rate of change).
- Understand the range of erosion behaviour – not just a snapshot of specific conditions - and the effects of scaling



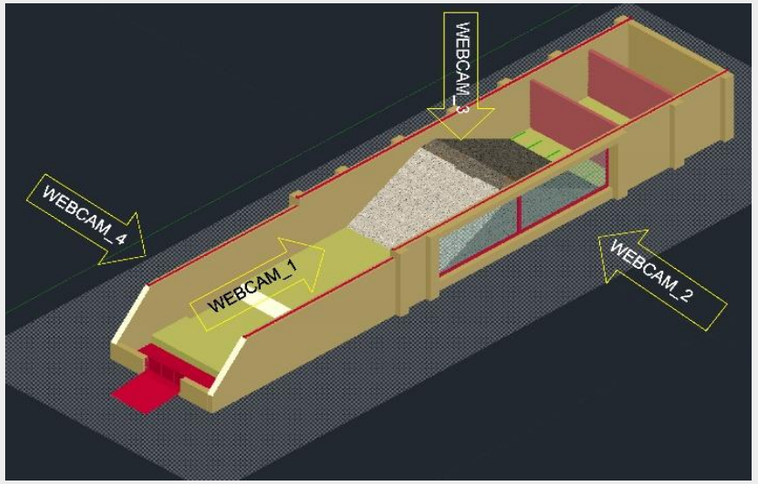
- Using a combined programme of:
  1. Small scale lab tests – levee sections 0.6m high
  2. Medium scale lab tests – levee sections 1.0m high
  3. Numerical models – breach and 3D flow simulations (shear stress distributions)
  4. Construction of field scale test facility + field tests – levee sections ~2m high, 10m wide
  5. In situ (Rhone levee) overflow erosion tests

Research challenges…Breach Prediction
The OVERCOME Project

Rafel Morán and **Ricardo Alves** will talk about the work at UPM on The OVERCOME Project undertaking the laboratory flume test programme:

Small (0.6m) and medium (1.0m) scale flume tests (UPM) with different coarser grained soils to understand both macro and micro erosion processes

- Varying soil grading using filtered and real levee soil samples – alignment with US research
- Changing hydraulic loading (absolute and rate of change)
- Sealing of upstream face – with and without effect on the breach erosion process
- When does headcut occur, surface erosion occur, slumping occur? Why & how?
- How does changing scale towards prototype affect the research results?



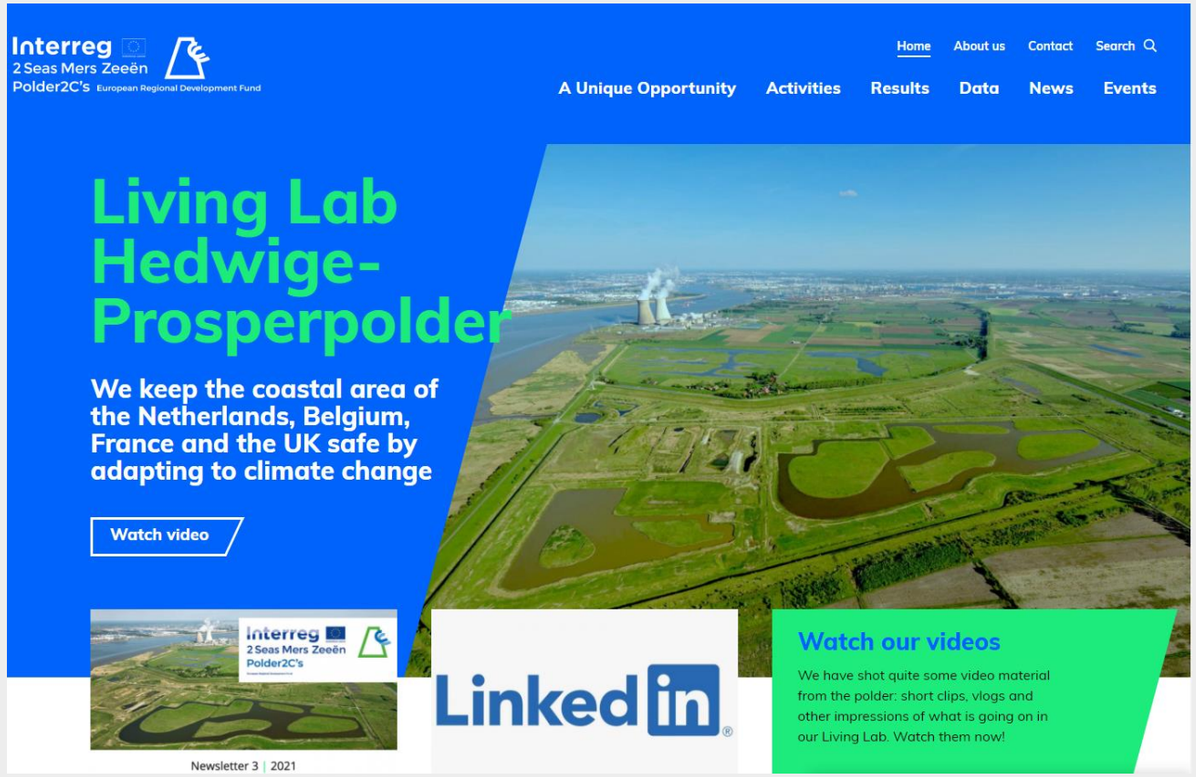
Research challenges…Research into Practice
The POLDERS2C's Project

Patrik Peeters will talk about the work currently underway on **The POLDERS2C's Project**

Aiming to improve levee flood resilience, the project is using redundant levees to test a wide variety of processes including overtopping and overflow erosion, effect of animal burrows, resistance to explosives, emergency repair solutions…

The list is very long!

See https://polder2cs.eu



Research challenges…

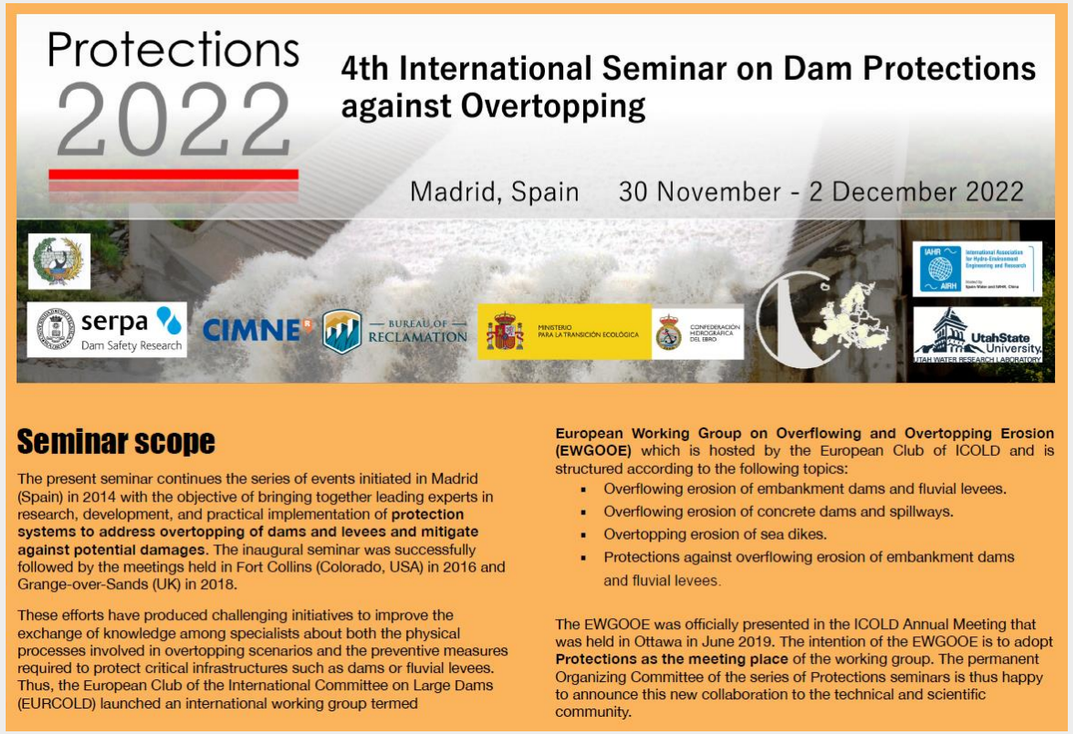
Opportunity for more detail later in the year:

See Protections 2022!

Madrid – 30th Nov – 2nd Dec 2022)

http://www.protections2022.com/

[Extended abstract submission to 4th April]



Technical matters…

1. The event will be recorded for later sharing online

- If you do not want to be recorded please mute and turn off your video

2. If your internet connection drops, please try to reconnect to the meeting.

- Someone will be monitoring the waiting room at all times to assist with any problems.

3. If our internet connection drops, please bear with us.

- We have co-hosts allocated to help manage such issues!
- Speakers will be presenting through sharing their screens. If there are repeated problems, we will move to the next speaker and come back to the original speaker later on (time permitting)
  - If a speaker prefers, the host can share slides whilst they commentate

Technical matters…

4. Please leave your microphone muted unless you are invited to speak.

- However, we encourage everyone to leave their video on so that we can all see the participants (unless you experience internet bandwidth / connection difficulties)

5. During the discussion session please ask questions by either:

- Typing your question into the chat window – await for the chairs to respond to your point
- Raising your hand – either emoji or real – await for the chairs to respond
- We will have brief Q&A sessions after each presentation

Programme

Ref	Item	Time	Speaker / Action
S1	**Welcome** EWGOOE Chairman	16:00	**Jean-Robert Courivaud** (EDF, France)
S2	**Programme Context / Overview**	16:05	**Mark Morris** (HR Wallingford, France)
S3	**Submerged Jet Erodibility Test Methods Research** - Overview of research (20 mins) - Q&A (5 mins)	16:15	**Tony Wahl** (USBR, Denver)
S4	**Using Machine Learning in Estimating Erosion Rate of Coarse-Grained Soil Mixes** - Overview of research (20 mins) - Q&A (5 mins)	16:40	**Ghada Elithy** (ERAU, Florida)
S5	**The OVERCOME Project** - UPM laboratory tests (20 mins) - Q&A (5 mins)	17:05	**Rafael Morán & Ricardo Alves** (UPM, Madrid)
S6	**The POLDER2C'S Project** - Overview (20 mins) - Q&A (5 mins)	17:30	**Patrik Peeters** (Flanders Hydraulics Research, Belgium)
S7	**Concluding observations**	17:55	**Jean-Robert Courivaud** (EDF, France)
	Close	18:00	