



UNDERSTANDING RISK
GLOBAL FORUM 2024

TRADITION • INNOVATION • RESILIENCE

Improvements to Coastal Flood and Erosion Assessments in Bangladesh

Speaker:

Mathijs van Ledden



Improvements to Coastal Flood and Erosion Assessments in Bangladesh

- Floods and Erosion main hazards in coastal zone affecting communities and activities
- Improving understanding and modelling capabilities is key for future investment programs
- Technical assistance during CEIP-1 by (inter)national consultants with finance from the World Bank for Bangladesh Govt



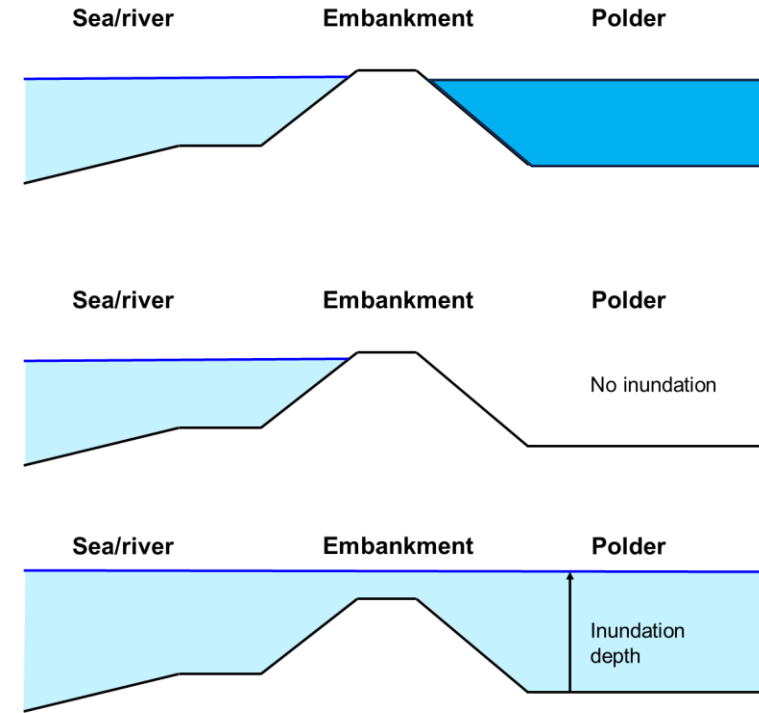
Challenge in coastal flood modeling

- Coastal floods during cyclones result in elevated (storm) water levels and waves
- Embankments provide perimeter protection for the communities
- Breaching of the embankment results in polder flooding but is uncertain (location, timing, characteristics)



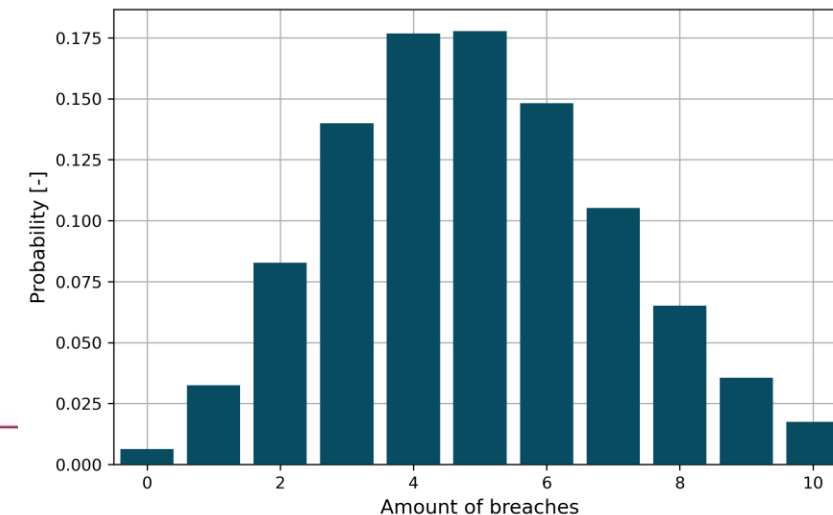
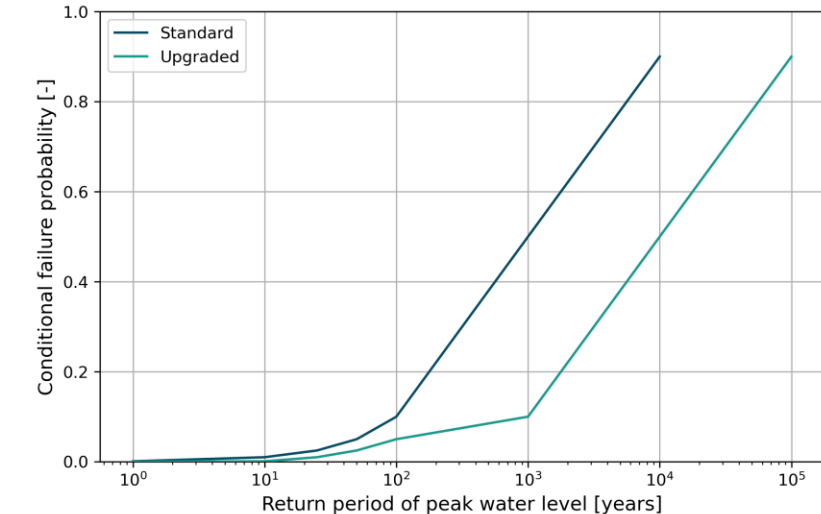
Classical “bathtub” approach

- **Approach 1:** Ignore the presence of embankments (outside = inside)
- **Approach 2:** Assume no failure of embankments (except overflow)
- Both situations are two extremes (upper and lower limit)



Inclusion of embankment failure

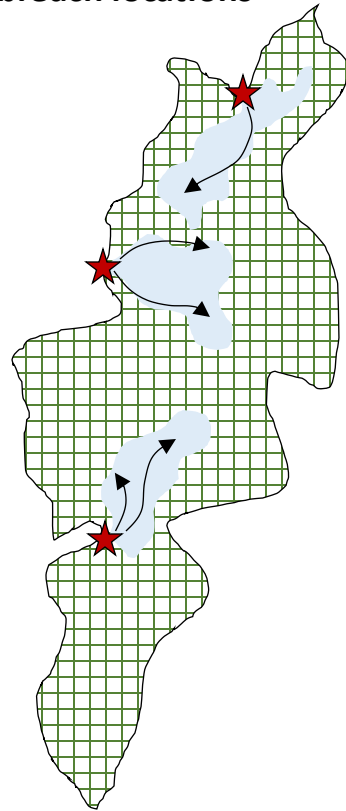
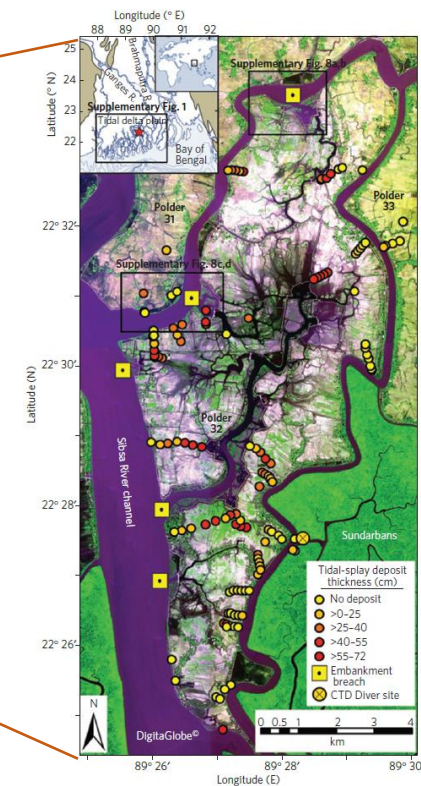
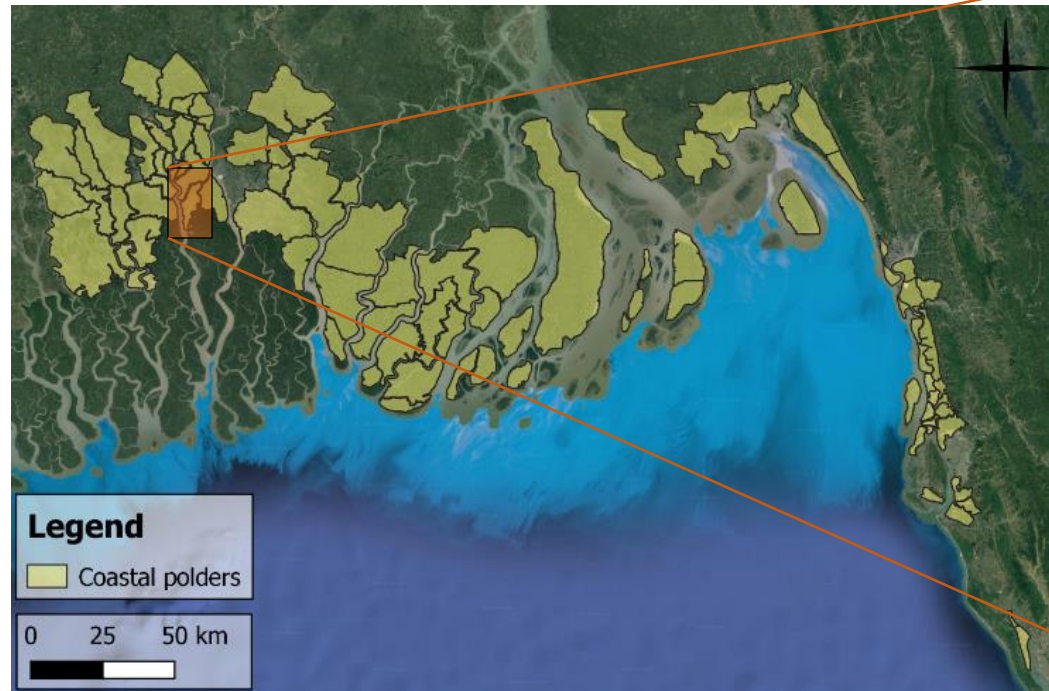
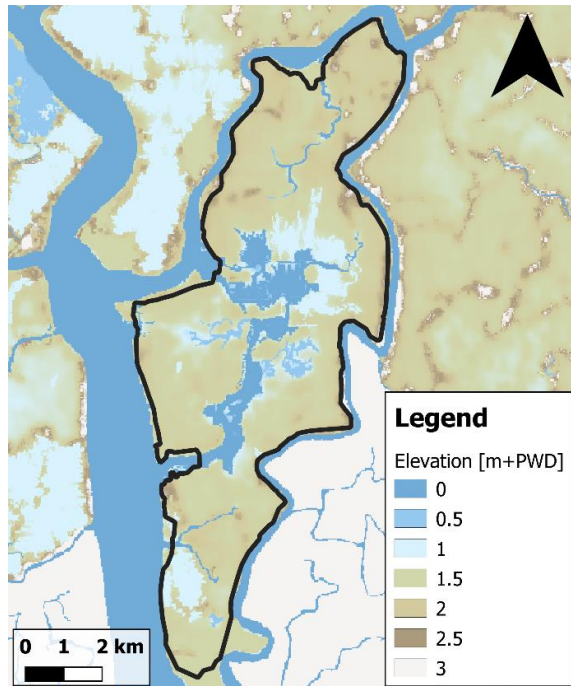
- **Probabilistic variables:**
 - Hydraulic conditions
 - Embankment performance
- **Embankment performance:**
 - Fragility curve
 - Breach dimensions
 - Number of breaches



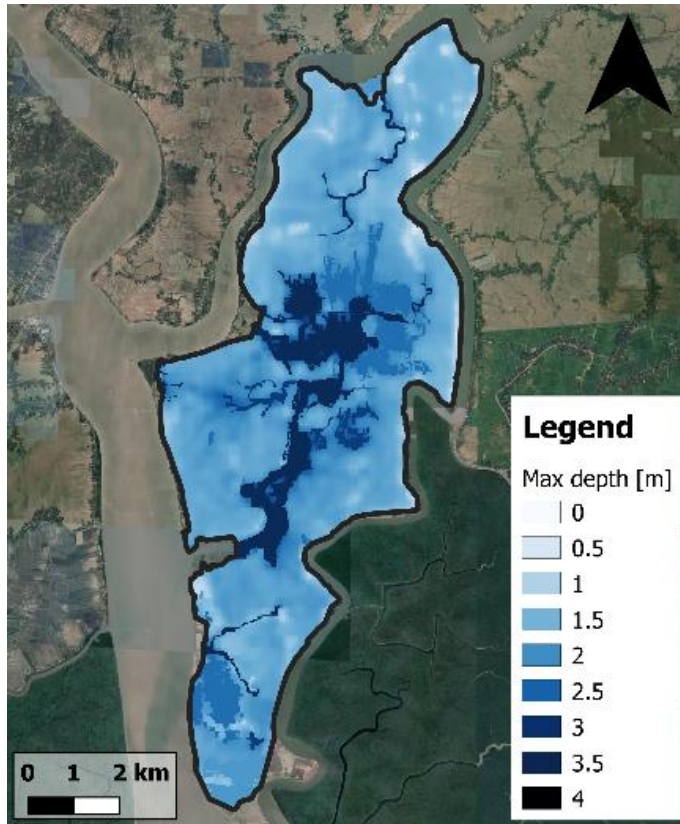
Numerical tests Polder 32 Bangladesh

★ breach locations

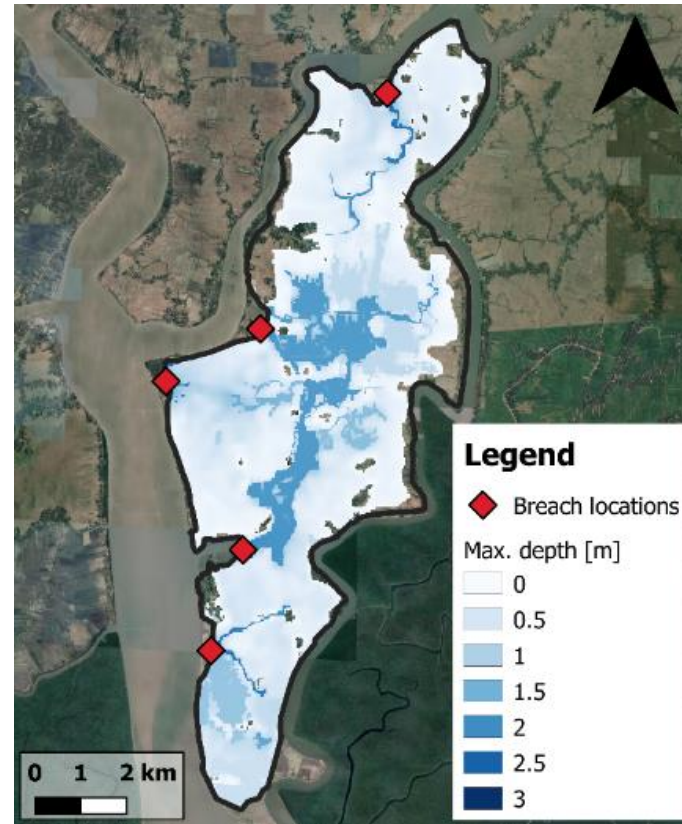
- Cyclone Aila 2009 flooded this polder



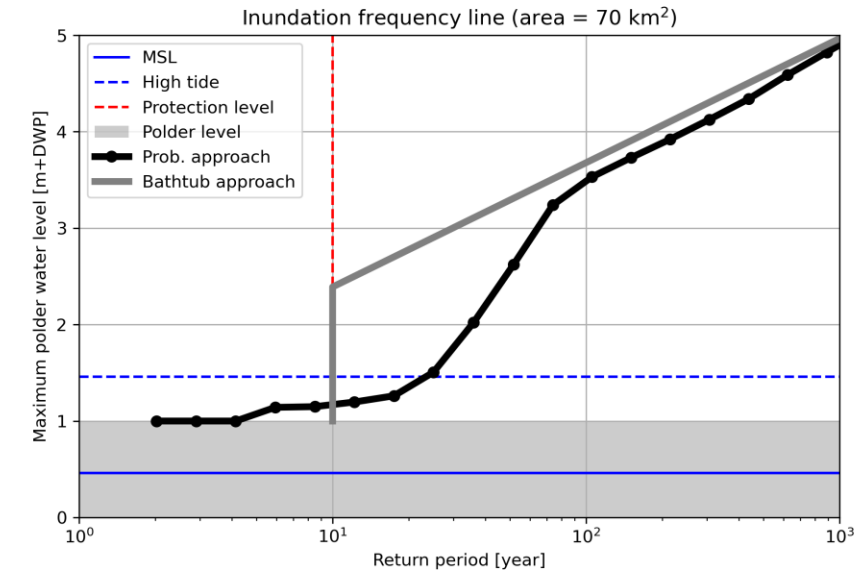
Significant differences in flood behavior



Bathtub approach



Probabilistic approach



Challenge in river bank erosion

- Bank erosion occurs in many places along the tidal river system
- Erosion undermines the perimeter protection and can result in breaching and loss of valuable land
- Uncertainties in bank erosion



Joint Venture of



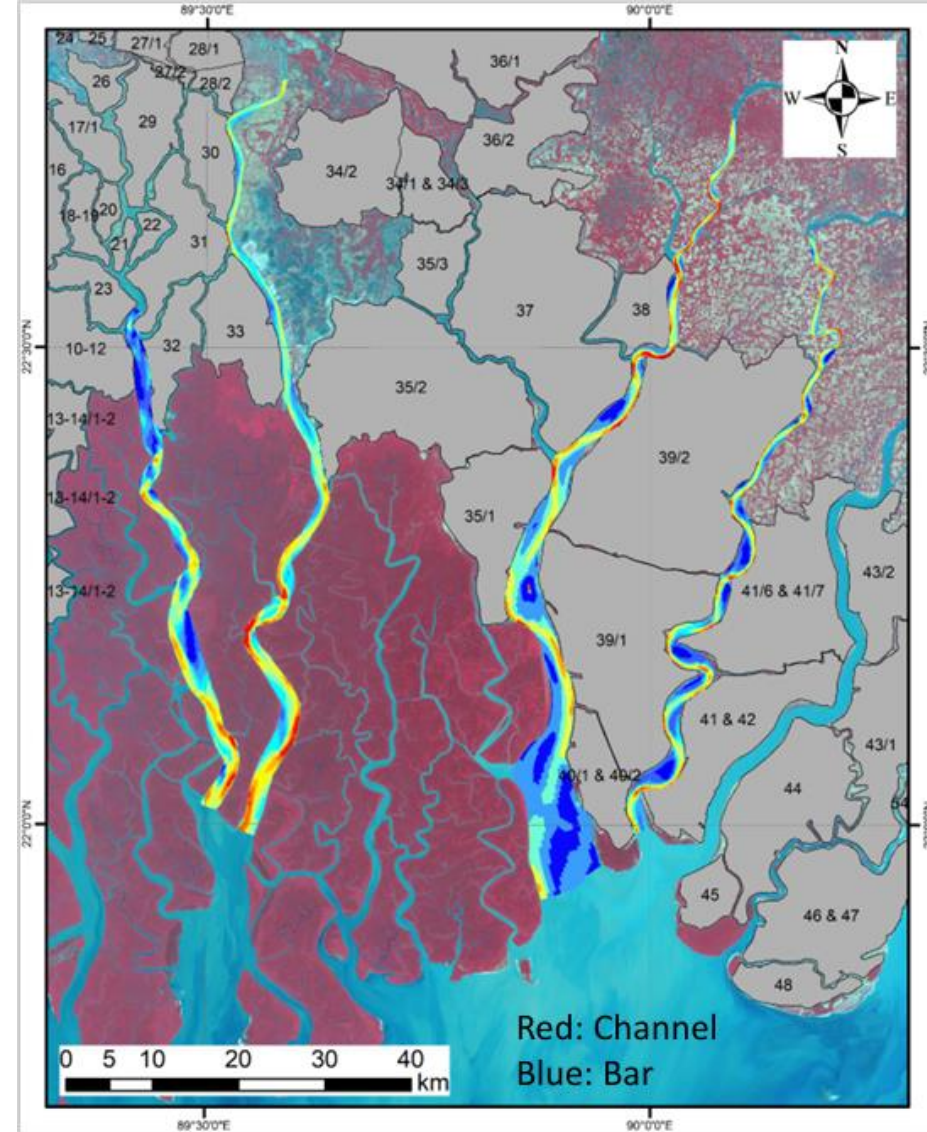
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Information sources

- Visual inspection
- Bathymetric surveys
- Use of Satellite imagery
- Application of numerical models



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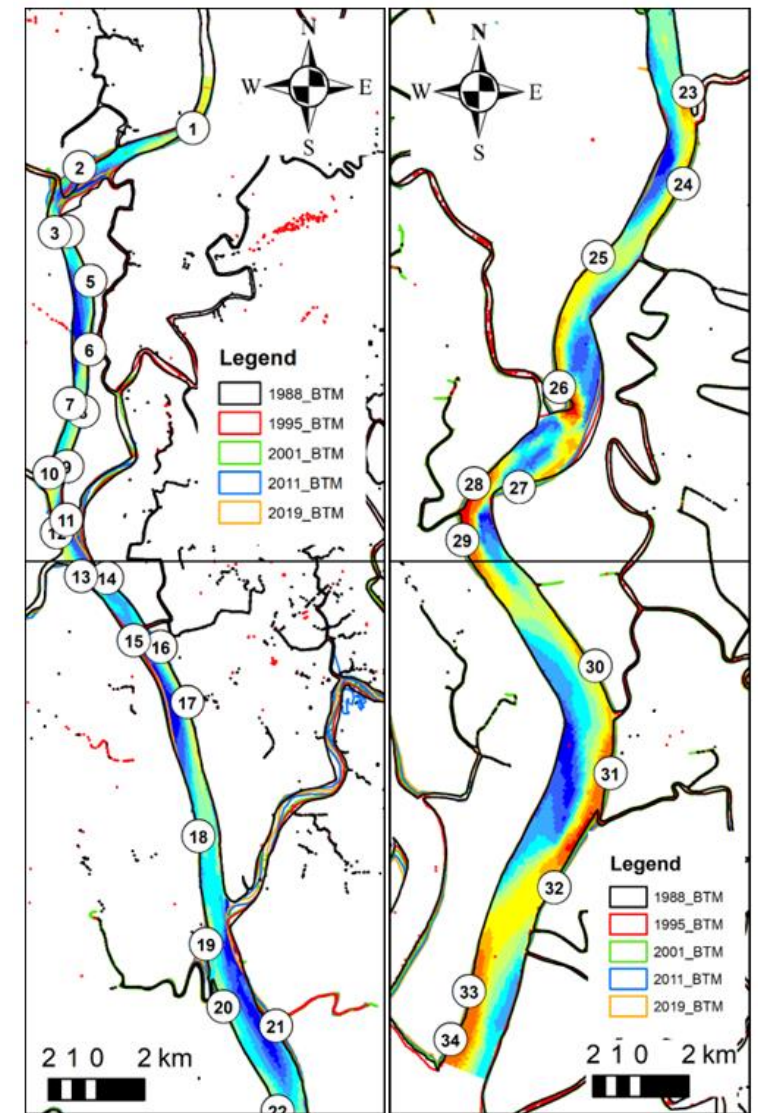
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Satellite imagery

- 1988 - 2019 Landsat (30 m)
- Typical riverbank movements 5-10 meter per year
- Systematic and seemingly predictable



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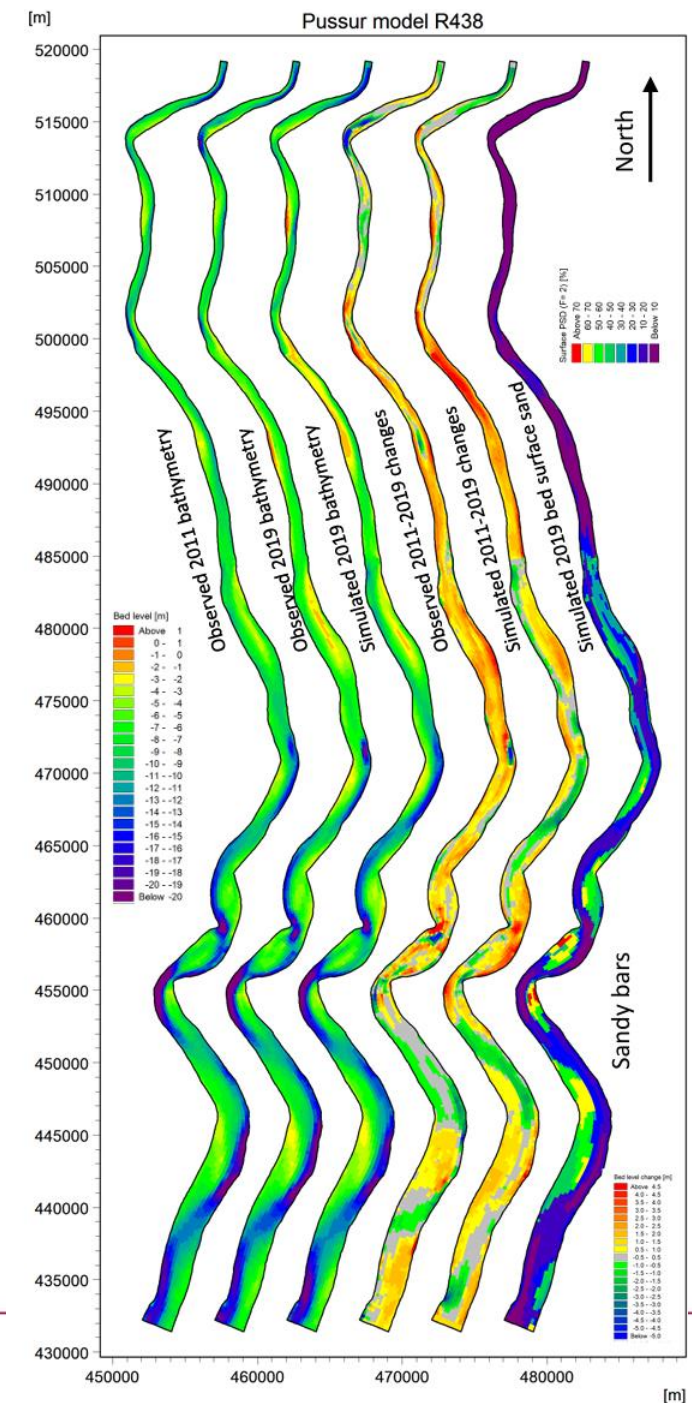
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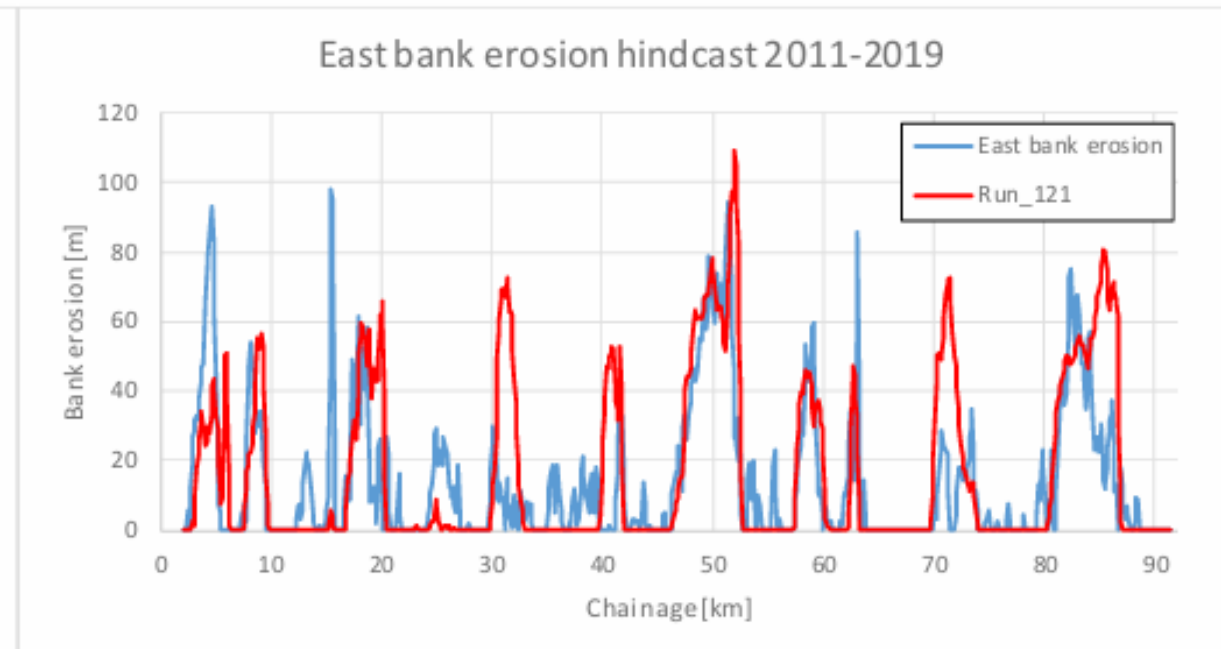
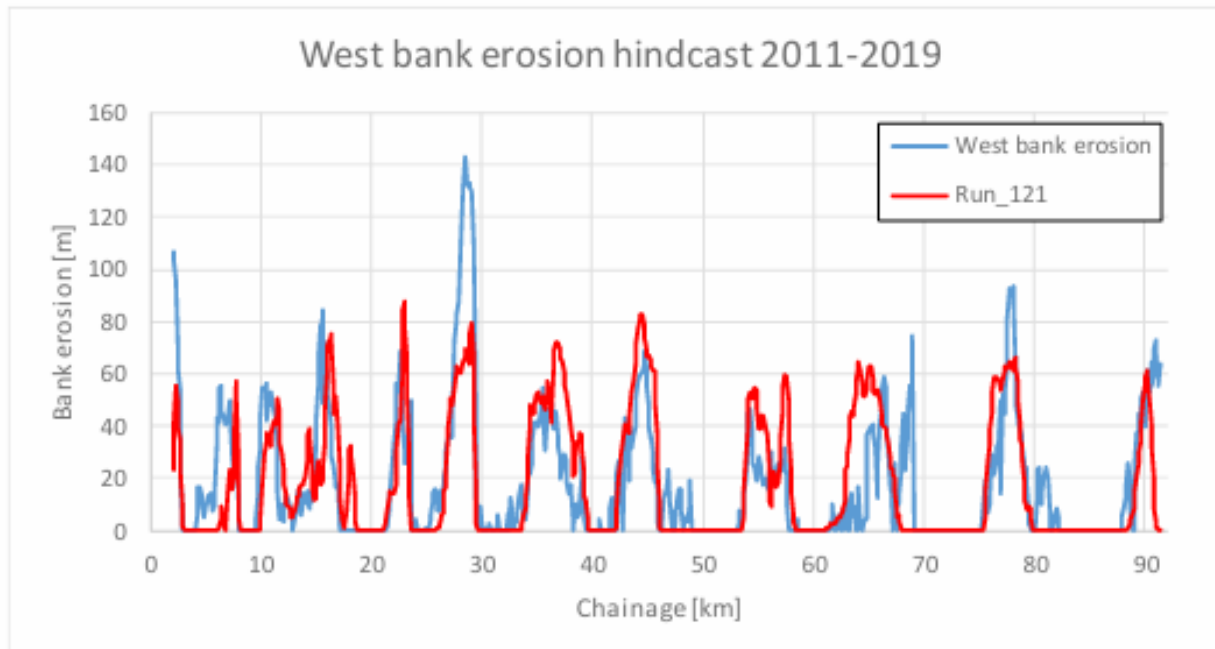
Numerical modeling

- 2DH modeling approach with MIKE software
- Sediments (silt and sand)
- Bank erosion based on near-bank excess velocity
- Lagrangian approach adopted for bank erosion (numerical grid is moving)



Results Bank Erosion Modeling

- Good agreement between modeling and observations



Example Pussur River

Conclusions

- Embankments and their potential failure must be accounted for in the flood hazard characteristics of the protected hinterland;
- Tidal riverbank erosion can be much better predicted with a mix of local and satellite data in combination with numerical modelling;

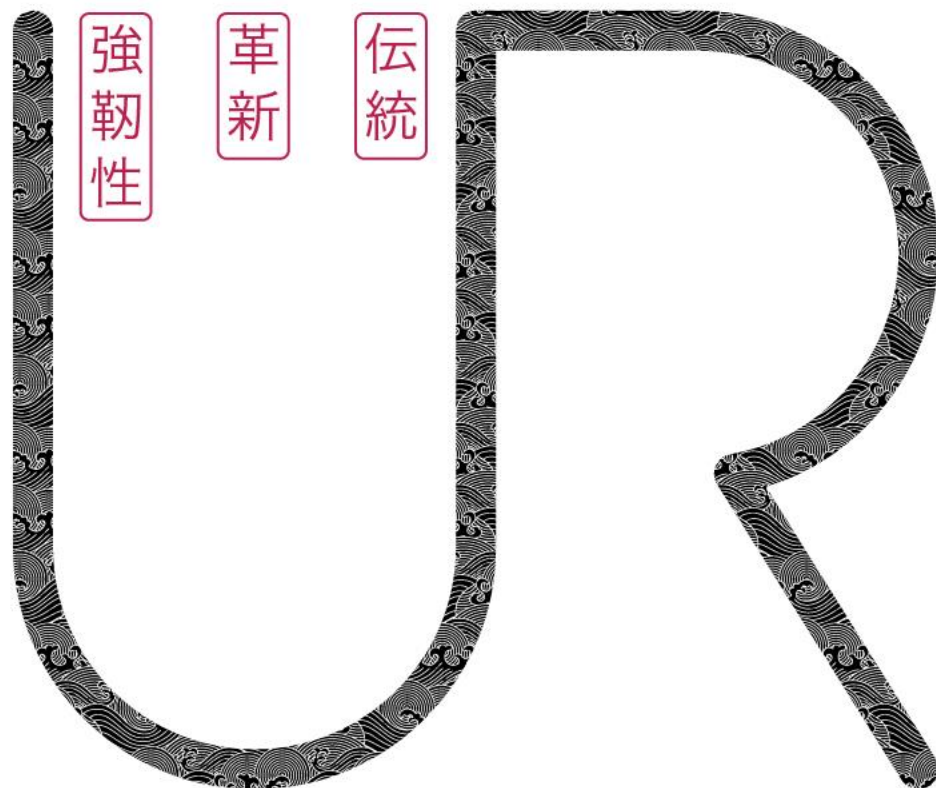




Journal of Coastal and Riverine Flood Risk

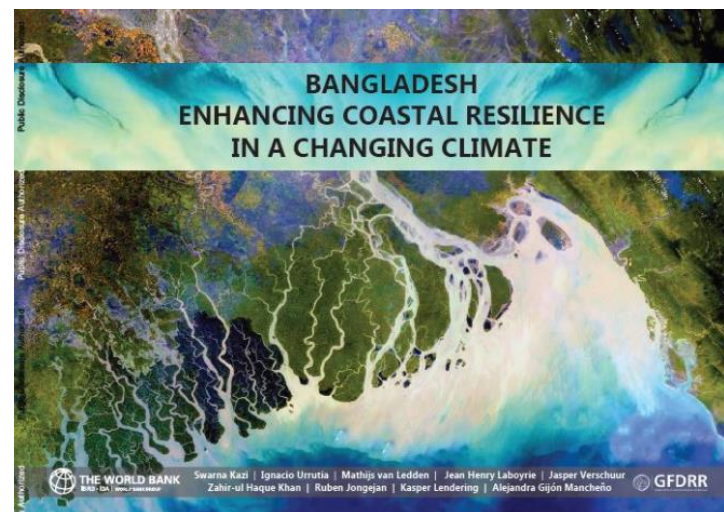


- high level multidisciplinary journal dedicated to all aspects of flooding
- focus on risk management and disaster mitigation, climate adaptation strategies, the forecasting of events, flood emergency response and post-disaster surveys, and reconstruction and planning.
- papers openly available online for everyone:
<https://journals.open.tudelft.nl/JCRFR>
- completely free, no processing or submission charges
- community-based: 15 international editors
- objective, double-blind reviews
- high-quality content welcomed from academia, industry, and government



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Thank you !



See: <https://openknowledge.worldbank.org/handle/10986/38004>