Stability of river bifurcations from bedload to suspended load dominated conditions

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River and delta morphodynamics

Introduction

- Bifurcations unstable?
- Difference between gravel- and sand-bed rivers?


Braided River (Tagliamento River)

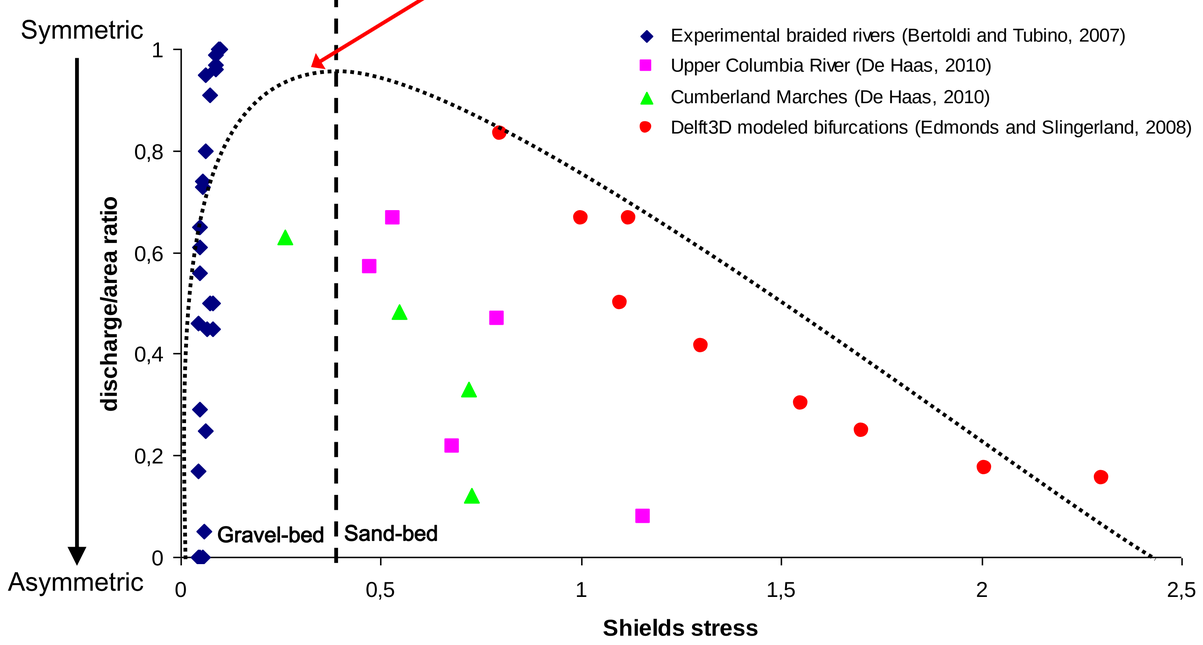

Meandering River (Rhine River)


Anastomosing River (Columbia River)


River delta (Cumberland Marshes)

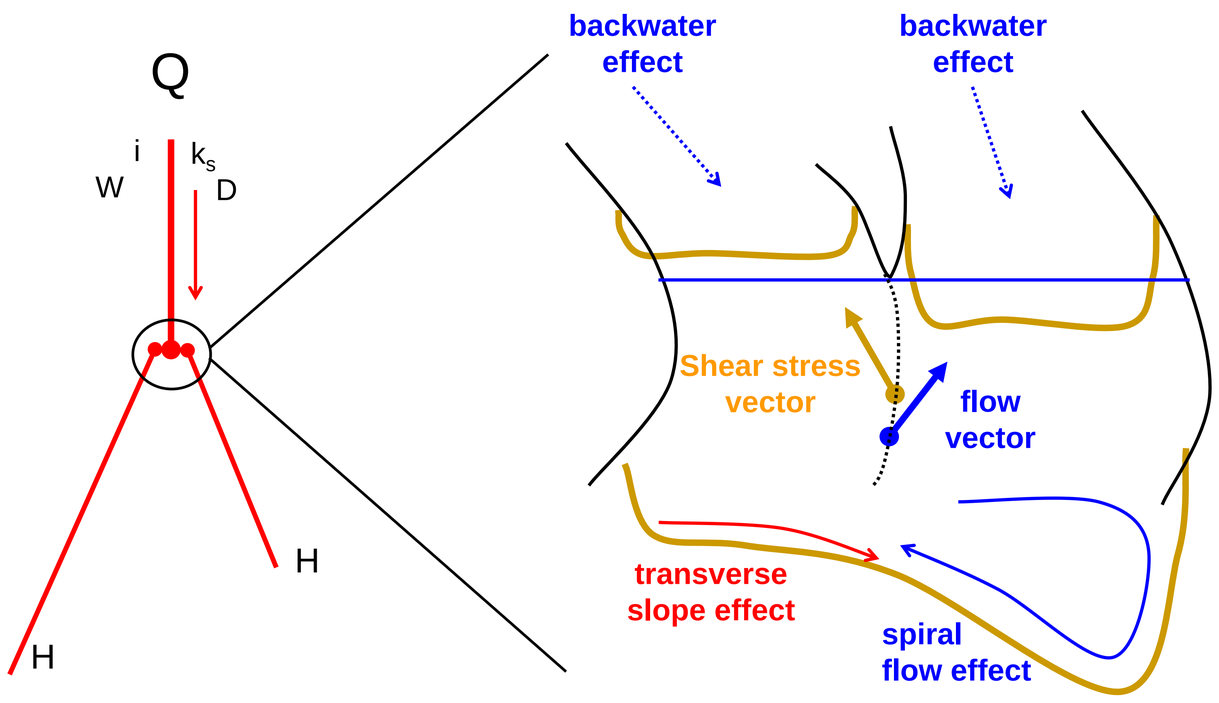
Problem definition

- Opposite trend gravel- and sand-bed rivers
- Hypothesis: connected by optimum?



Model

- 1D network model with Y-shaped bifurcation:
  - Gradually varied flow, bedload transport and morphological change
  - Width: *f*(Q), mass conserved
  - Flow and sediment division: transverse slope effect and spiral flow effect caused by bend



Model scenarios

- Bifurcations unbalanced:
  1. Bend at bifurcation
  2. Gradient advantage
- Mobility increased:
  a. Discharge
  b. Channel gradient
  c. Particle size
- Sediment transport
  — Including threshold for sediment motion
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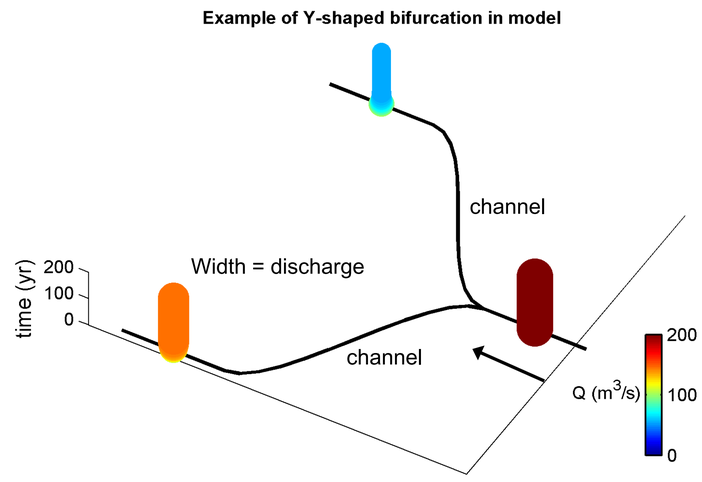
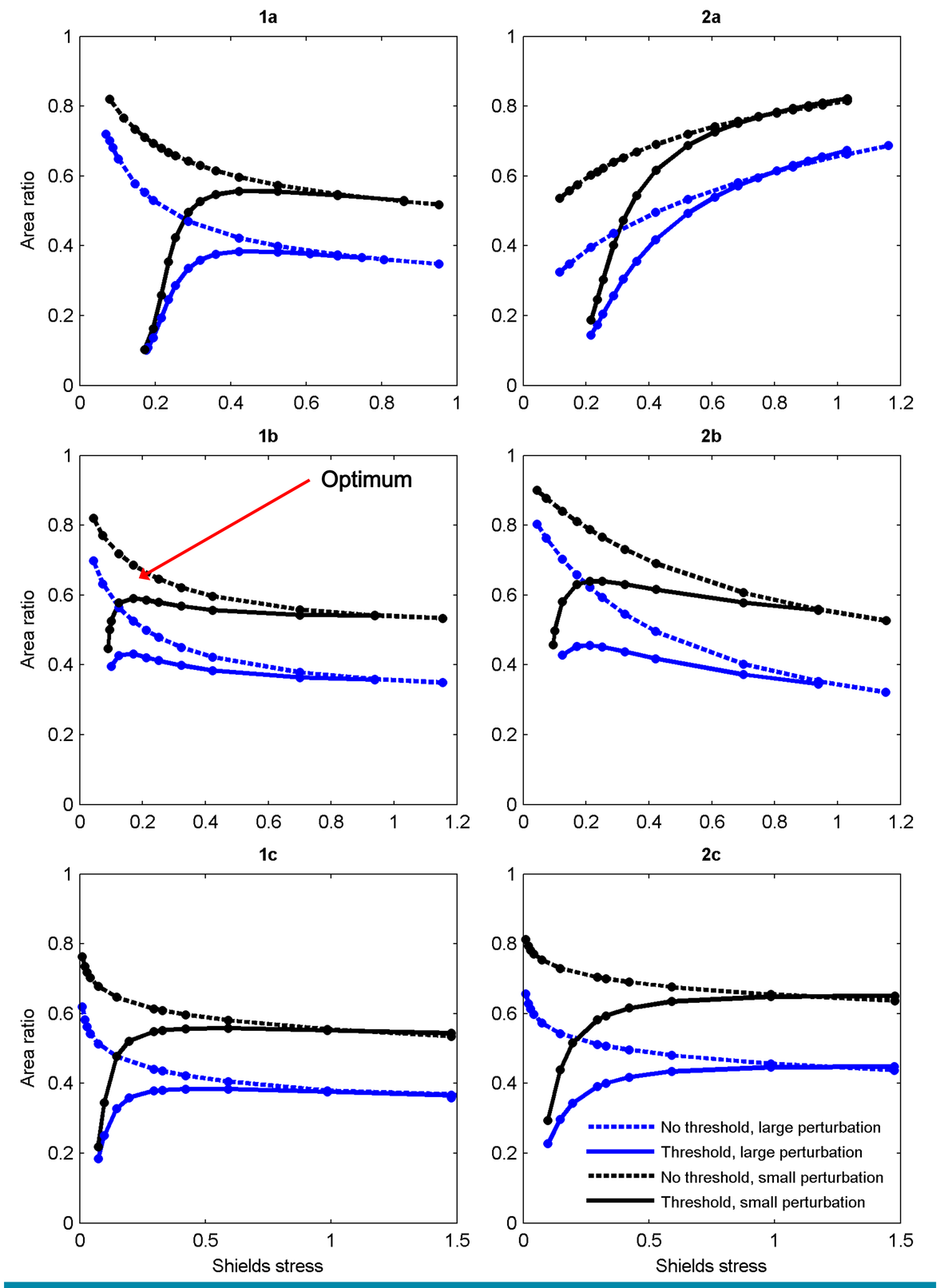


Results



Conclusions

- Threshold for motion → Optimum
  - Gravel-bed rivers → Shields stress lower than optimum
  - Sand-bed rivers → Shields stress higher than optimum
- Opposite trend explained!

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