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Influence of river pattern on estuary morphology

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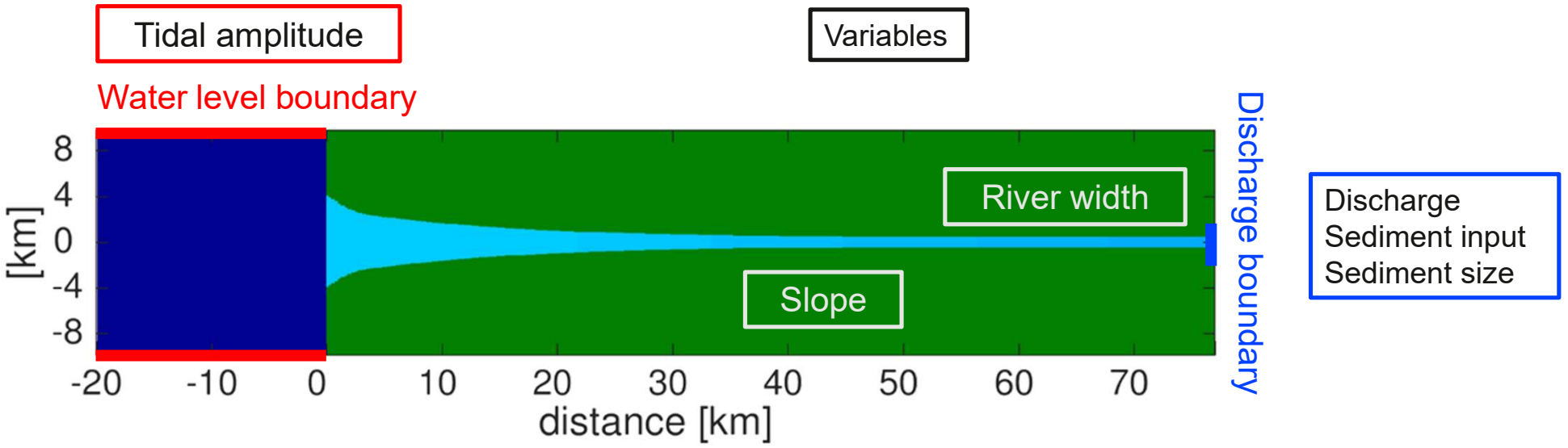
Objective:

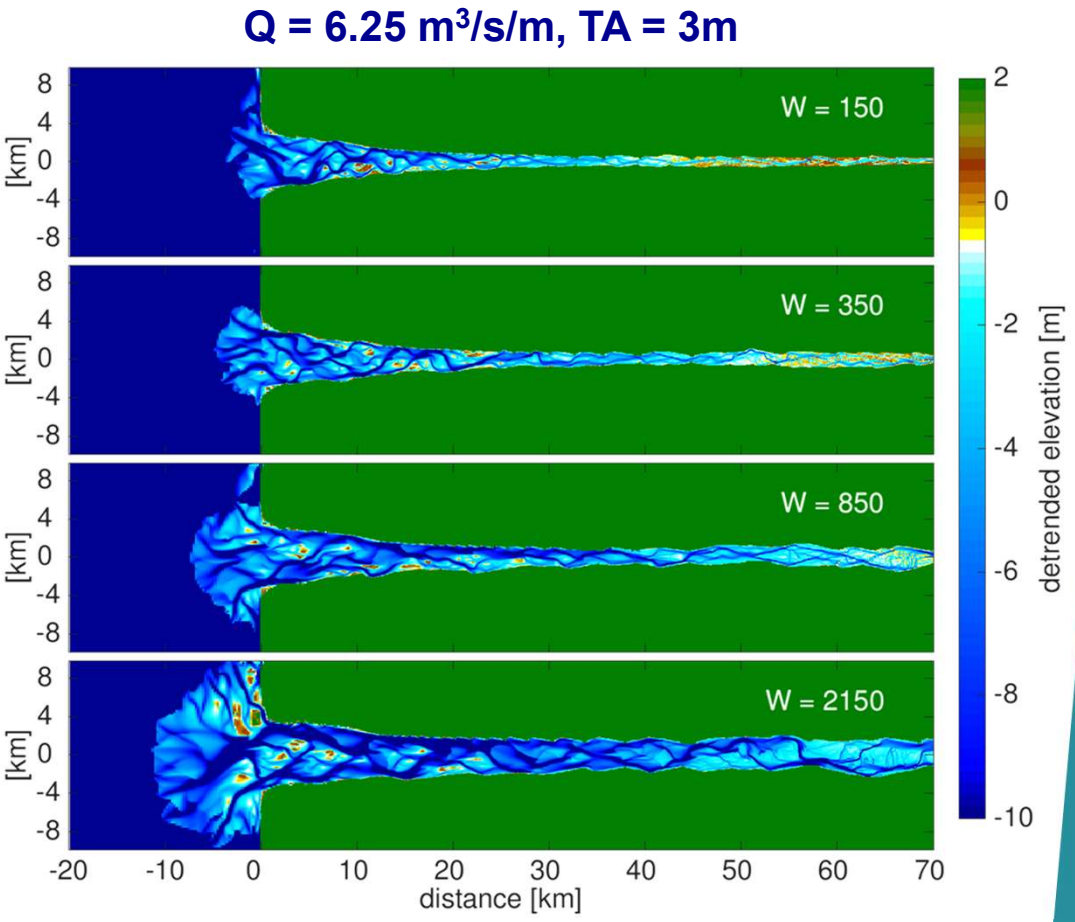
Study fundamental effects of river pattern and discharge on morphology and sediment transport in estuaries.

- Delft3D 2DH model: include effect of bars and channels (and compare results with 1D).
- Long-term development: use recent knowledge on morphological calibration with transverse bed slope effect and sediment transport predictor (Baar et al, 2019)



Methodology

- Systematically increase river width (W) to ensure a change in river pattern from a single-thread to braiding river
- 4 scenarios:
  - Tidal amplitude (TA) of 2m & 3m
  - River discharge (Q) of 6.25 m^3/s and 12.5 m^3/s per meter river width
- D_{50} = 0.3mm, S = 0.1 mm/m



Hydrodynamics

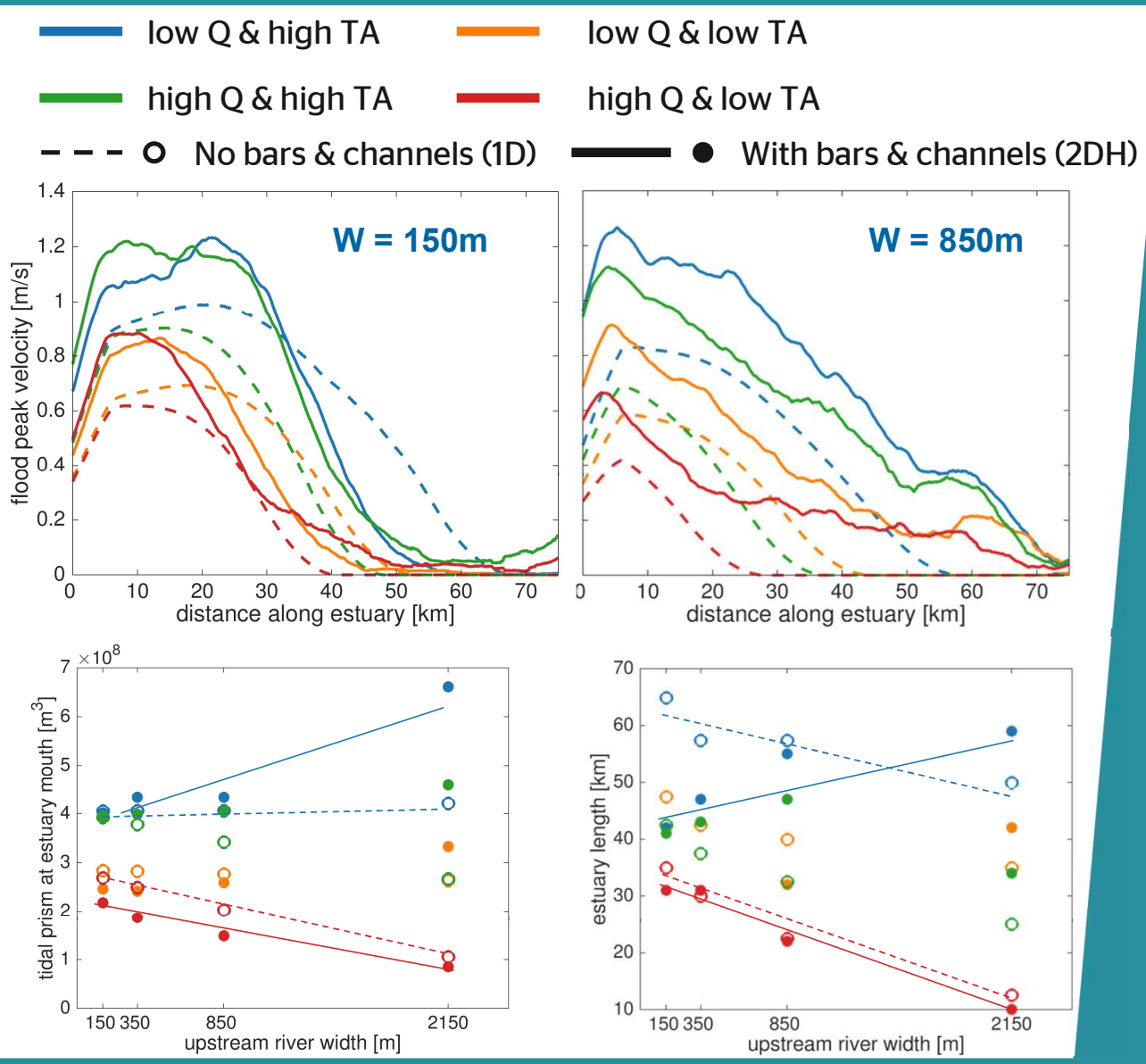
The balance between discharge and tides is significantly influenced by bar and channel formation

Low river width:

Tidal amplitude determines flood flow velocity, tidal prism, estuary length

High river width:

- Q dampens flood velocity
- Estuary length depends on balance tidal amplitude and Q

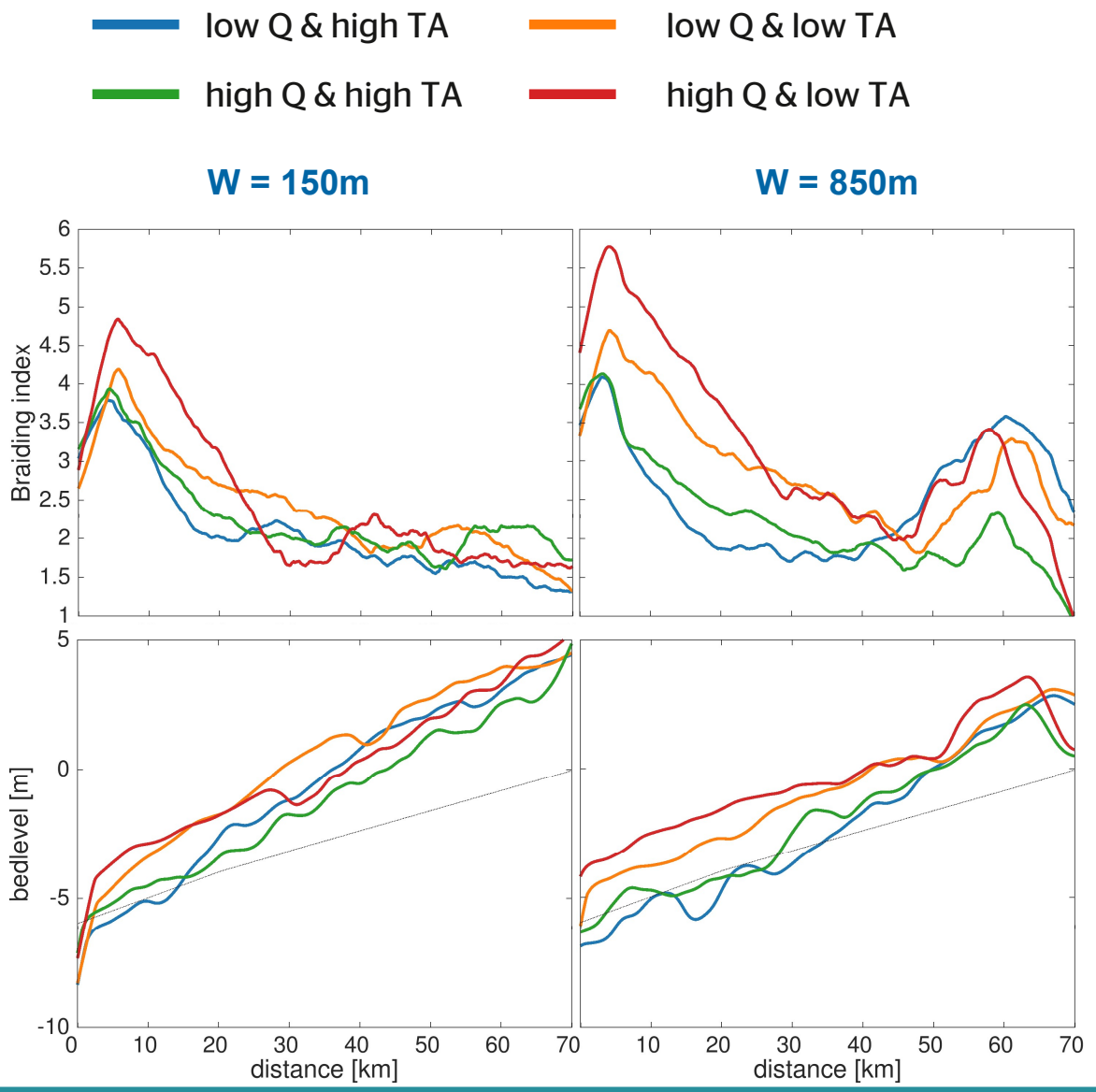


Morphodynamics

Low tidal amplitude:
River width & Q influences the braiding index and depth of the estuary

High tidal amplitude:
Morphology depends on tidal amplitude in estuary

- Average braiding index equal
- Average depth only depends on river width



Sediment transport during 1 tidal cycle

Large river discharge = hydrodynamically ebb-dominant system

Total sediment transport over 1 tidal cycle is not ebb-dominant in entire estuary when tidal amplitude is relatively high