Challenges from a low-energy river in Bangladesh
Planform changes, stratigraphy, sharp bends and response to constriction (PPT)
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Challenges from a low-energy river in Bangladesh:

Planform changes, stratigraphy, sharp bends and response to constriction

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Symposium “Why river managers should care about the alluvial subsurface”
Wageningen

18 February 2020
Finding a low-energy river in Bangladesh

\[ P < 10 \text{ W/m}^2 \]

\[ \rho g \frac{Q}{B} i < 10 \text{ W/m}^2 \]

- \( \rho = 1000 \text{ kg/m}^3 \)
- \( g \approx 10 \text{ m/s}^2 \)
- \( i < 10^{-4} = 0.1 \text{ m/km} \)
Finding a low-energy river in Bangladesh

\[ i < 10^{-4} = 0.1 \text{ m/km} \quad i = 0.07 \text{ m/km} \]

\[ \frac{Q}{B} < 10 \text{ m}^2/\text{s} \quad Q = 50000 \text{ m}^3/\text{s} \]

\[ B = 10000 \text{ m} \]

Brahmaputra!

Deltares
this is not the other side of the river
Bank protection and river training
Stratigraphy
Stratigraphy
Sharp bends

- Result of river training
- Scour holes up to 30-40 m deep (15-storey building)
Bank stabilization and constriction

**Bank stabilization**
- Prevention of misery of people losing everything *(no other choice than to move to city slums)*
- Prevention of breaching of dikes by erosion *(the main benefit in cost-benefit analyses)*
- Stabilization of offtakes for water supply

**Constriction**
- Strong lobbies and agendas *(not justified by cost-benefit analyses)*
- Land reclamation *(for economic zones … and ecotourism)*
- Development of inland waterway by narrowing and deepening
- Dredging and sand mining
- ... Singapore offered to take out the sediment for free

**Deltas**

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Response to constriction

Theory: \[ i_{new} = i_{old} \left( \frac{B_{new}}{B_{old}} \right)^{1-3/b} \]

Morphological computations by Institute for Water Modelling:
- About 5 m bed degradation in 25 years

Yet … in Brahmaputra less extreme than in other rivers:
- Width taken away more from islands than from channels
- Formula relatively insensitive due to low \( b \):
  - common Engelund-Hansen: \( b = 5 \)
  - calibrated for Brahmaputra: \( b = 3.66 \)
    - (physically realistic: \( b > 3 \))
- More sinuous alignment for main channels

Deltareas
New approach to bank stabilization