Problem definition
No descriptive taxonomy and forecasting model for perpetually changing and interacting channels and shoals formed by ebb and flood currents in estuaries.
• Are bar dimensions explained by width-depth ratio as river bars?
• Is the apparent stability of ebb- and flood channels explained by the inherent instability of symmetrical channel bifurcations as in rivers?

Ebb- and flood-dominated channels
• Mutually evasive channels
• Channels often end in shoals
• Periodic behaviour?

Measured bar dimensions
• Bar length/width has universal ratio in rivers and estuaries
• Complex bars are amalgamated elongated bars with ebb/flood-dominated channels

Bar theory compared to measurements
• Theories: Schramkowski & al. (2002), Seminara & Tubino (2001), and Struiksma et al. (1985) for rivers
• Their hypotheses: bar braiding scales best with width/depth ratio; bar length determined by tidal excursion length (peak velocity)
• Our findings: bar length scales best by estuary width; braiding index also depends on width/depth ratio; secondary effect of tidal flow velocity
• Bar height from bathymetries approximates average water depth

Pilot scale-experiments
By tilting the flume, ebb and flood flows move the sand all along the experimental estuary, just like in nature.
• System width determines braiding index
• Flood channels form U-shaped bars; more so when sourced by scouring channels
• Some flood channels are chute cutoffs
• U-shaped bars are channel termini; direction depends on / causes flood/ebb dominance?

Channel-shoal interactions
• Mutually evasive ebb- or flood-dominated channels ubiquitous in all conditions with mobile sediment
• Two styles of formation:
1. Channel cutoff through ebb-dominated bend
2. Channel forms U-shaped bar, which is sharpened by the opposite current bifurcating around it

Numerical modelling
From idealised scenarios in Delft3D (3m amplitude):
• System width determines braiding index
• Flood channels form U-shaped bars; more so when sourced by scouring channels
• Some flood channels are chute cutoffs
• U-shaped bars are channel termini; direction depends on / causes flood/ebb dominance?

A look forward
• How do bar patterns relate to estuary shape?
• How can we predict bar dimensions?
• Scale bar dimensions with estuary dimensions and/or tidal properties?
• Are similar results found for experiments and models as for natural systems?
• What drives the dynamics of channels and shoals, such as the occurrence of mutually evasive ebb- or flood-dominated channels?