Lateral and vertical sorting in an annular flume

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Problem description
Spatial sorting is observed on transverse slopes in natural meanders where the outer bend is coarser than the inner bend. Well developed lateral sorting just upstream of a bifurcation can have major consequences for large-scale morphology of the downstream branches. This is, since the grain size dependent transverse bed slope effect influences e.g. the degree of braiding and meander wavelength. Yet, previous research focused mainly on transverse slope development using uniform sediment. So, there is a demand for better understanding of how spatial sorting in river bends comes about.

Objective
Experimentally determine the effect of transverse bed slope and sediment mobility on lateral and vertical sorting in meanders.

We hypothesise that spatial sorting becomes more pronounced with steeper transverse slopes and lower sediment mobility.

Methods
Annular flume experiments

- Lid rotation steers flow → determines helical flow intensity and flow velocity
- Counter-rotation of flume itself → introduces a centrifugal force on lower part of the water column, weakening secondary flow intensity.
- Enables isolation of effect of transverse bed slope and sediment mobility
- A near-unimodal mixture with $d_{50, in} = 0.75$ mm. → close to equimobility.

Results – lateral sorting

Impression of the bed

- Sediment mobility

Results – vertical sorting

- Gentle transverse slope
- Steep transverse slope

Conclusions
- More distinct bend sorting with steeper transverse slope
- Mobility effect is insignificant
- Longitudinal variability bend sorting due to dunes

References


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