

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

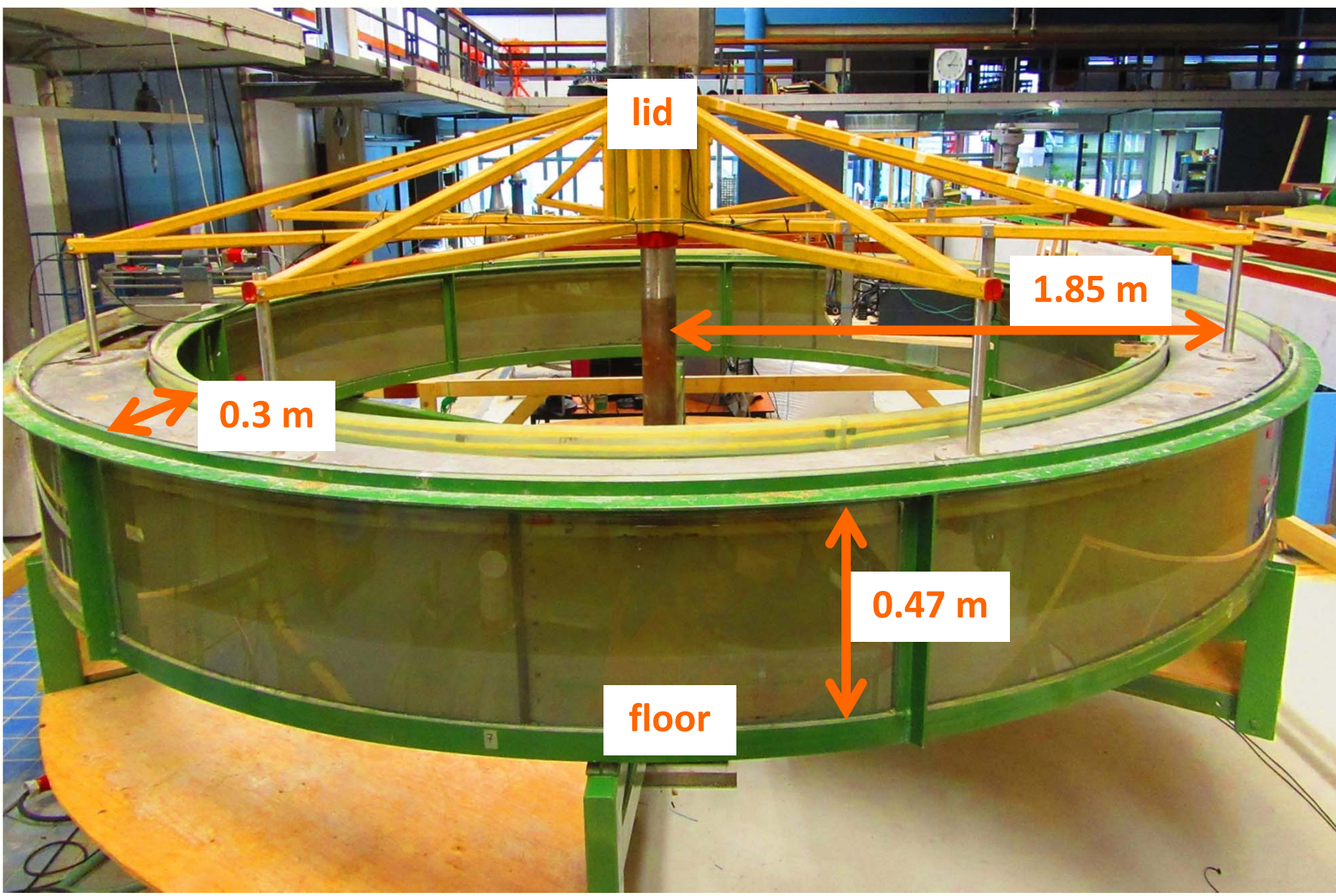
Experimentally determine the effect of transverse bed slope and sediment mobility on lateral and vertical sorting in meanders.

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

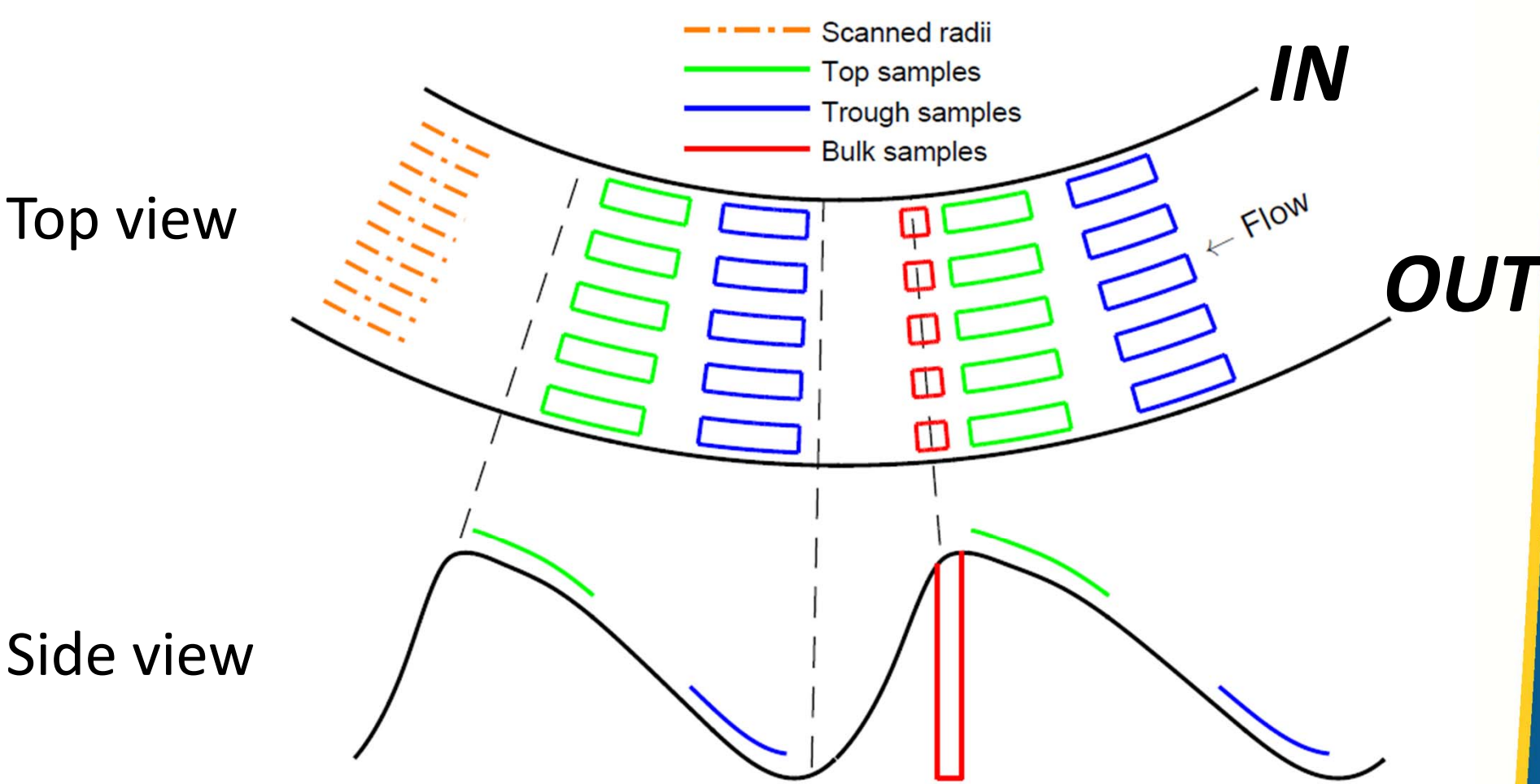
Methods

Annular flume experiments

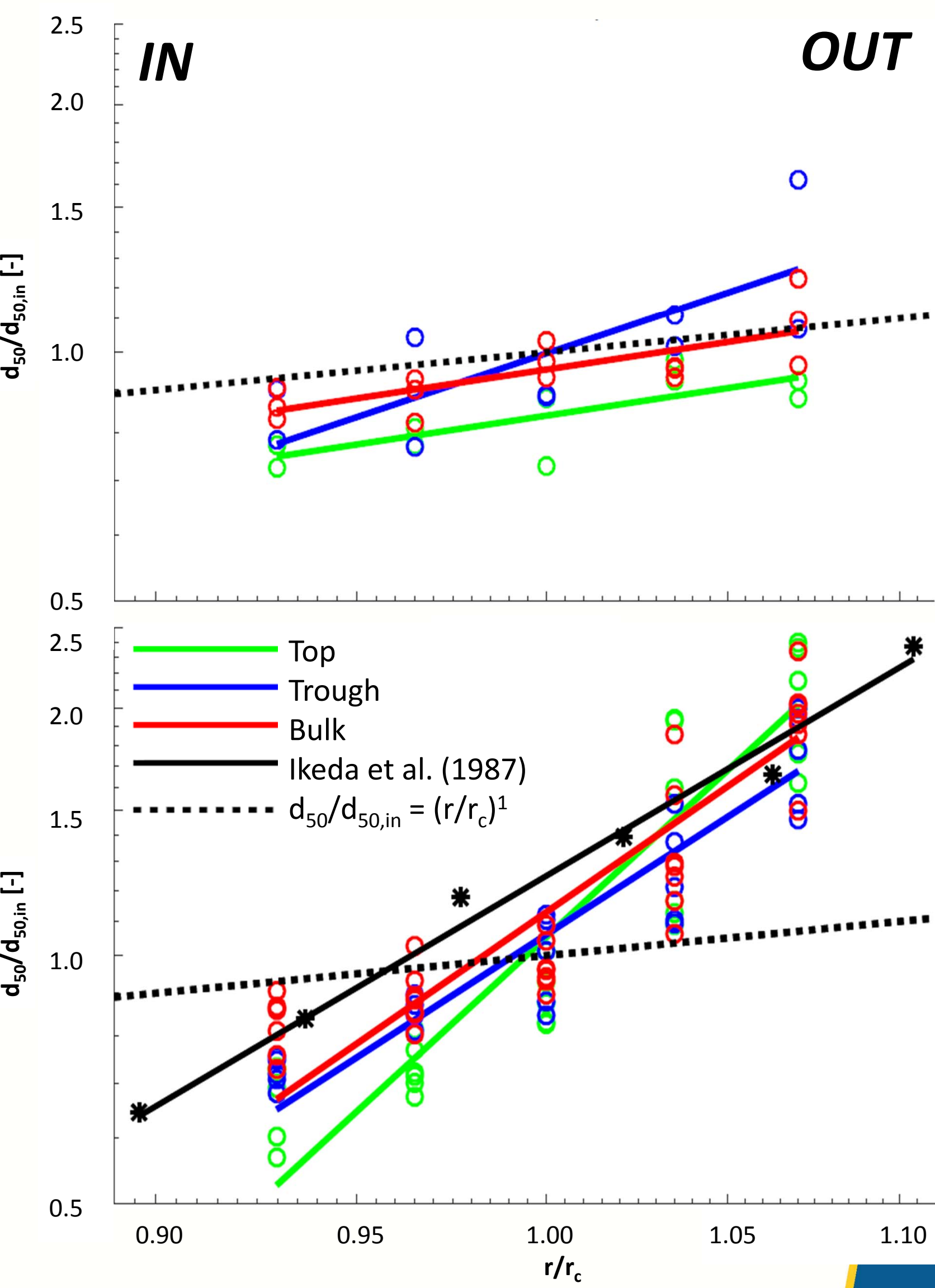
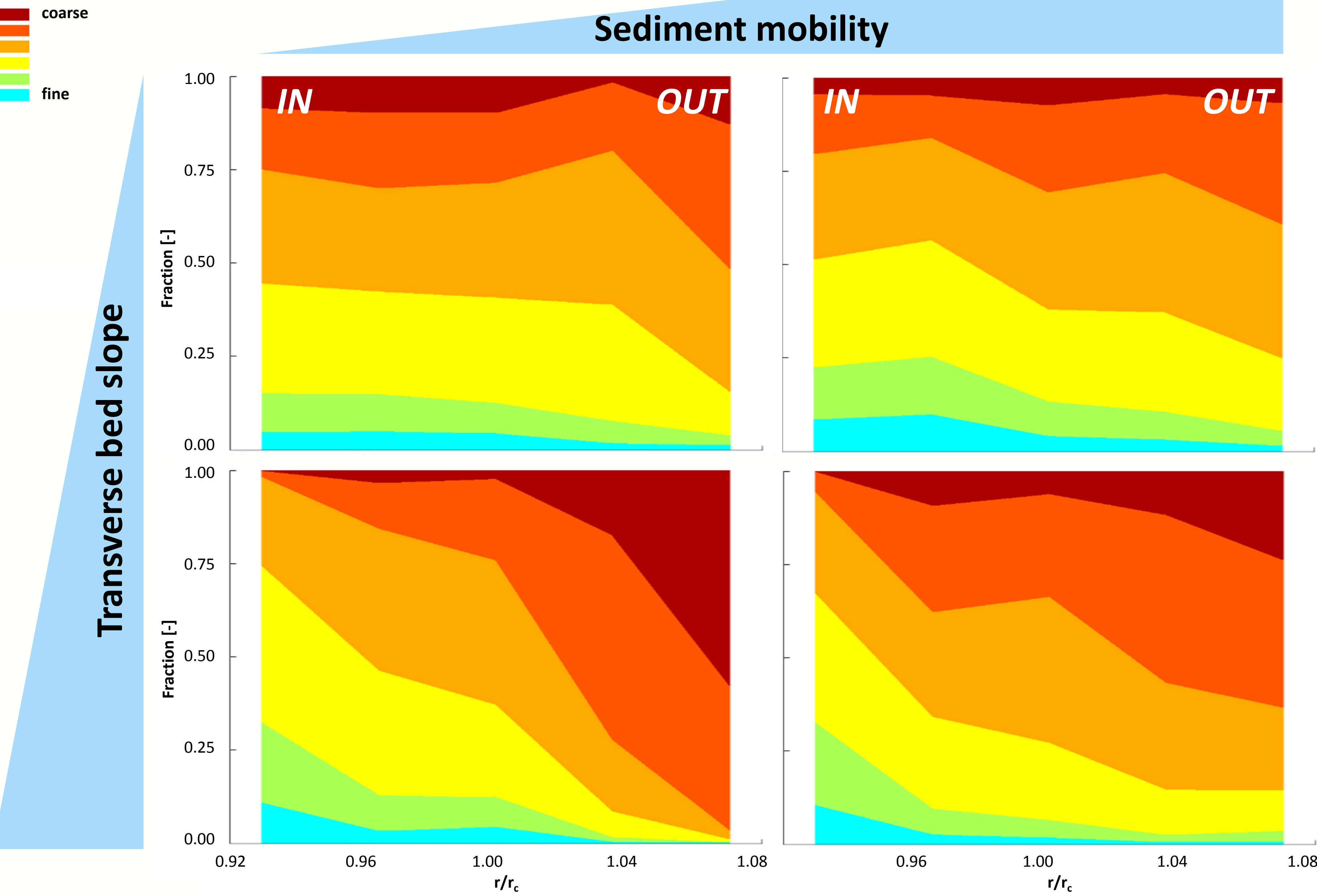
- Lid rotation steers flow → determines helical flow intensity and flow velocity
- Counter-rotation of flume itself → introduces a centrifugal force on lower part of the water column, weakening secondary flow intensity.
- Enables isolation of effect of transverse bed slope and sediment mobility
- A near-unimodal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



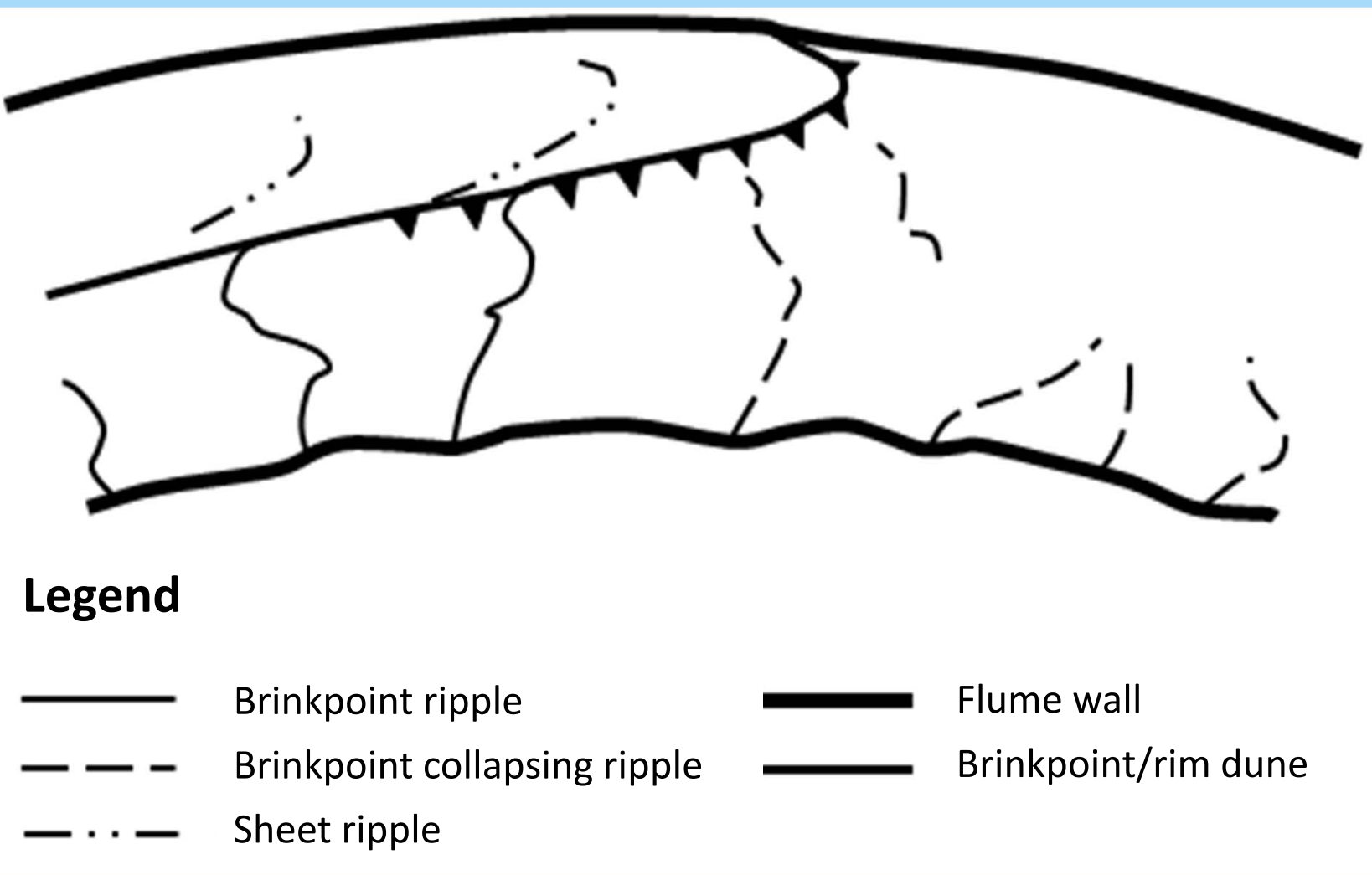
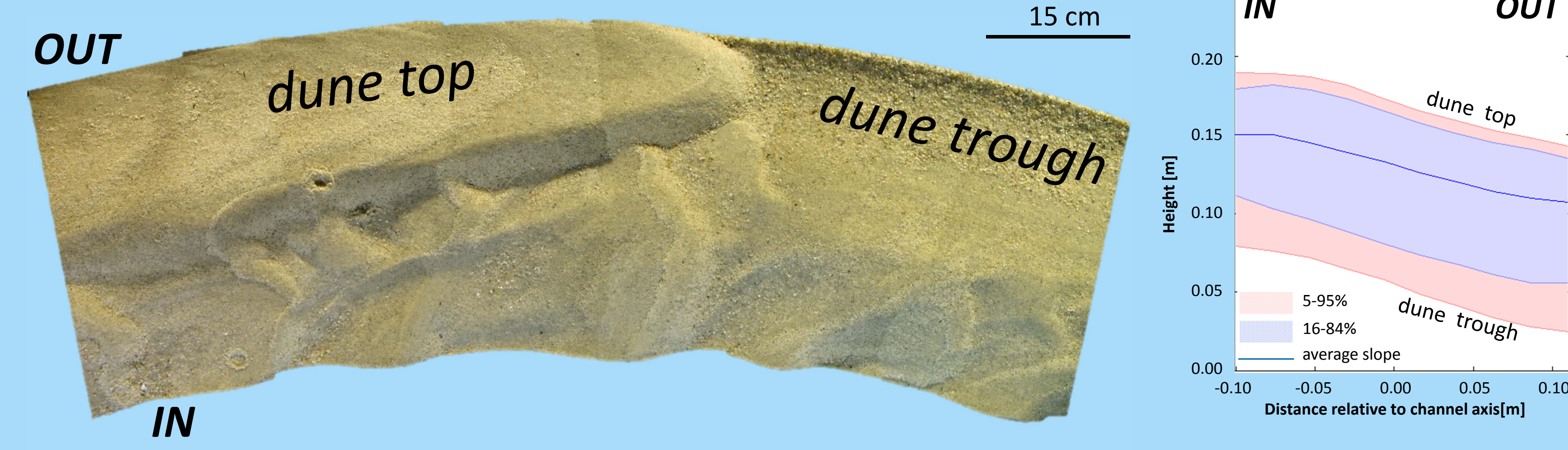
Sediment sampling



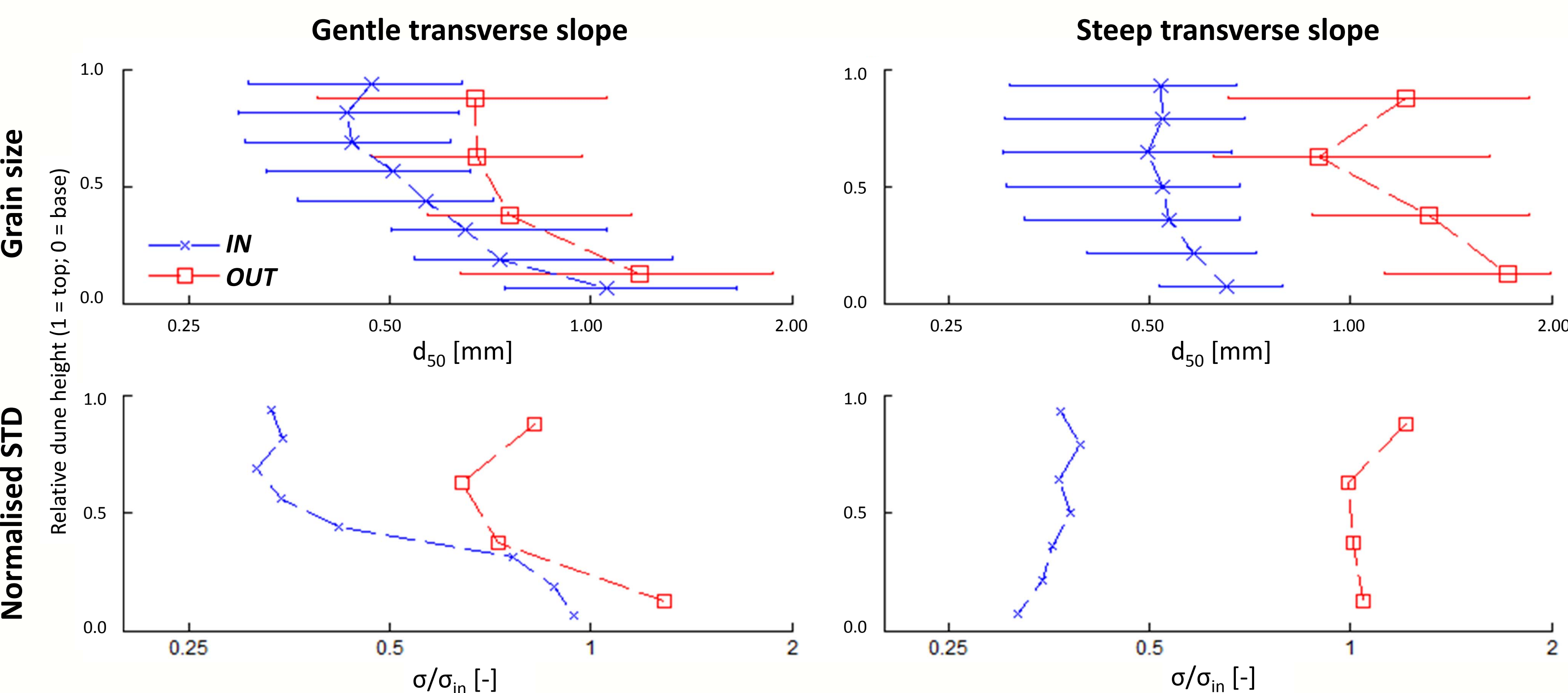
Results – lateral sorting



Impression of the bed



Results – vertical sorting



Conclusions

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

References

Booij, R., & Uijtewaal, W. S. (1999). Modelling of the flow in rotating annular flumes. Ikeda, S., Yamasaka, M., & Chiyoda, M. (1987). Bed topography and sorting in bends. *Journal of Hydraulic Engineering*, 113(2), 190-204.

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