

Universiteit Utrecht

Faculty of Geosciences
River and delta morphodynamics

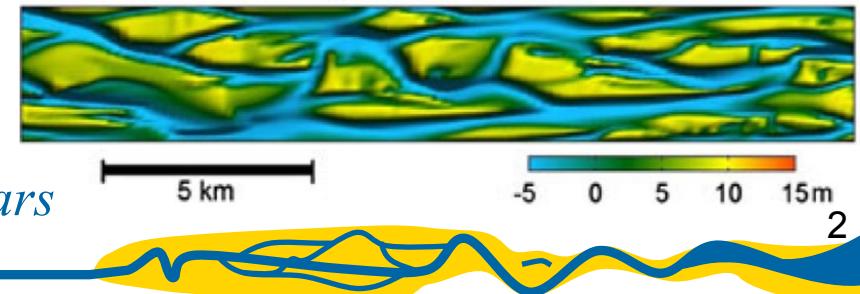
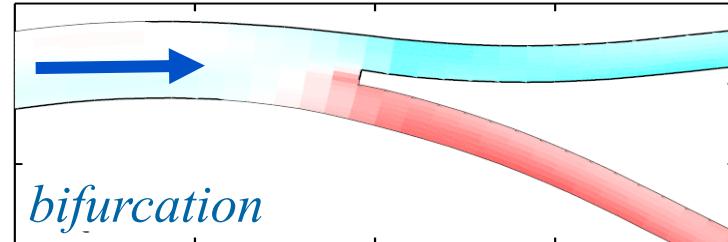
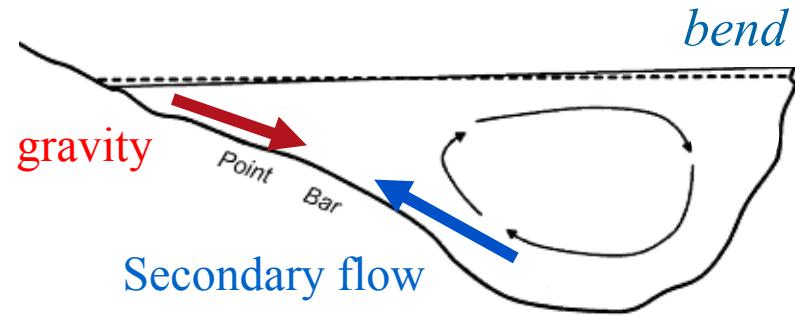
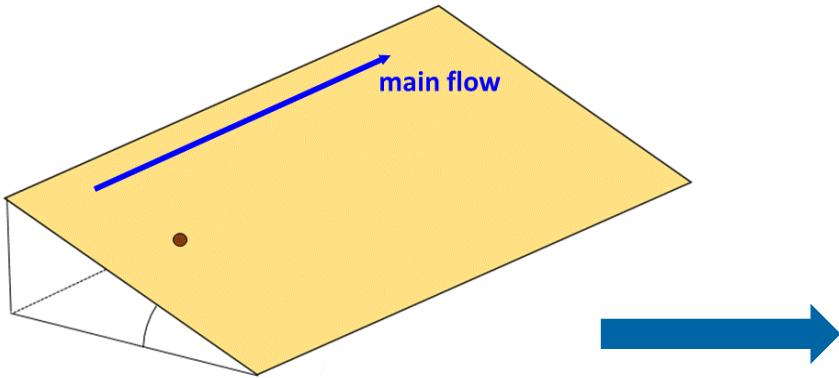


Critical dependence of morphodynamic models on transverse slope effects

Anne Baar

Marcio Boechat Albernaz, Wout van Dijk, Maarten Kleinhans

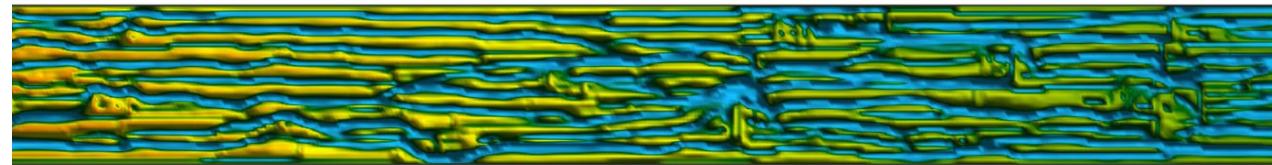
Transverse slope effect



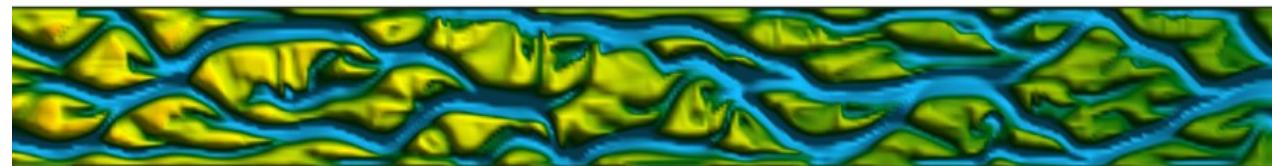
Transverse slope effect

- Major influence large-scale morphology

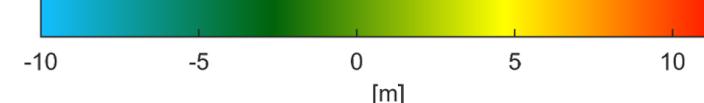
default value
weak
(physically correct)



strong
?



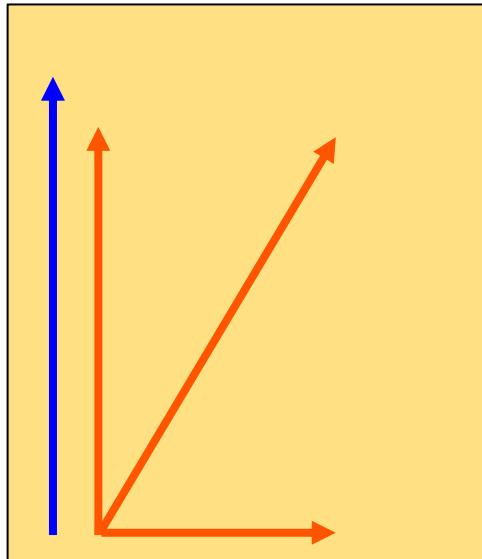
Flow direction →



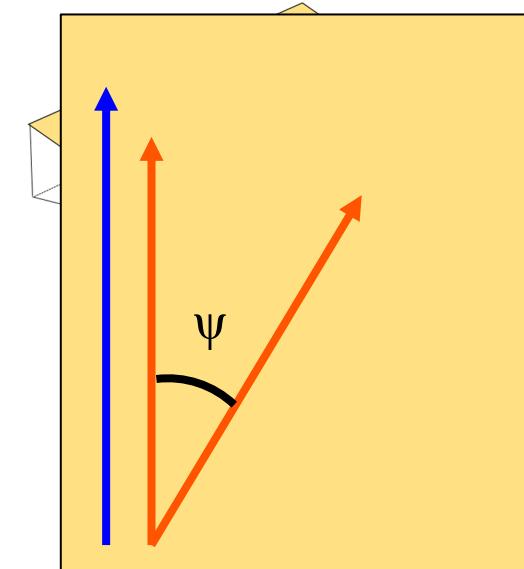
(Baar et al, 2018 WRR)

Slope effect in Delft3D

Ikeda



Koch & Flokstra

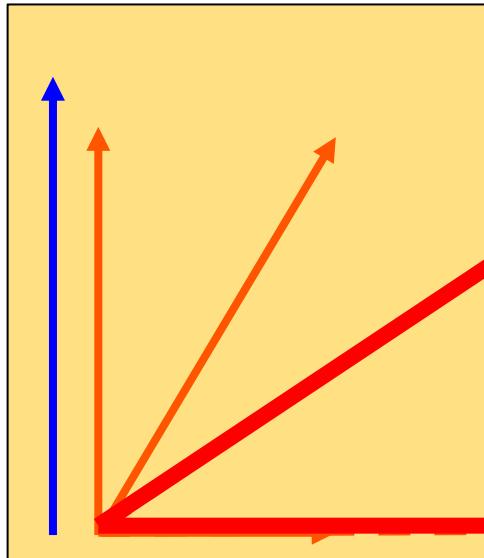


$$\blacksquare q_n = q_s \alpha_{bn} \sqrt{\frac{\theta_c}{\theta}} \frac{\delta z}{\delta y}$$

$$\blacksquare \tan \psi = \frac{1}{A_{sh} \sqrt{\theta}} \frac{\delta z}{\delta y}$$

Slope effect in Delft3D

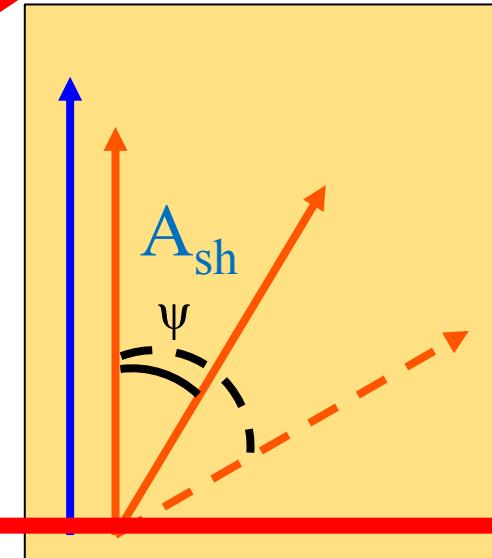
Ikeda



α_{bn}

$$\blacksquare q_n = q_s \alpha_{bn} \sqrt{\frac{\theta_c}{\theta}} \frac{\delta z}{\delta y}$$

Koch & Flokstra

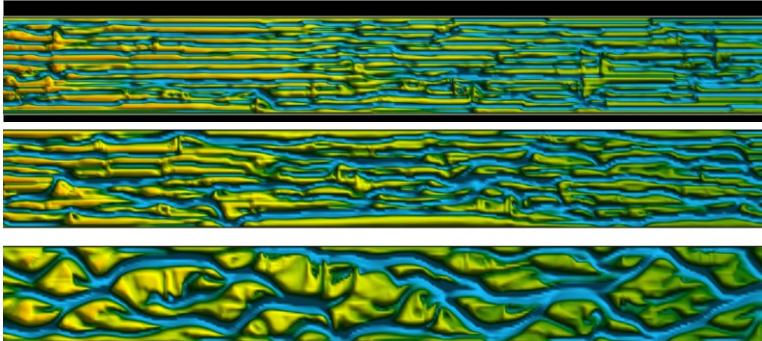


$$\blacksquare \tan \psi = \frac{1}{A_{sh} \sqrt{\theta}} \frac{\delta z}{\delta y}$$

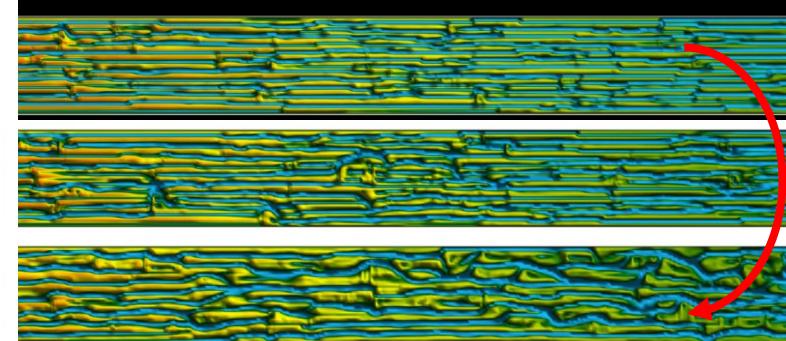
Different effect on morphology

Van Rijn

Ikeda (α_{bn})

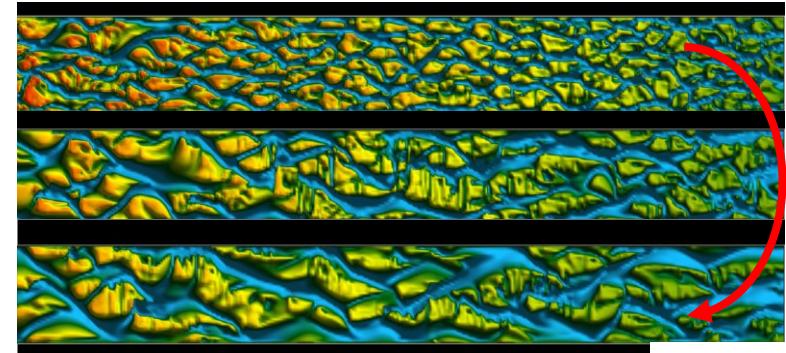
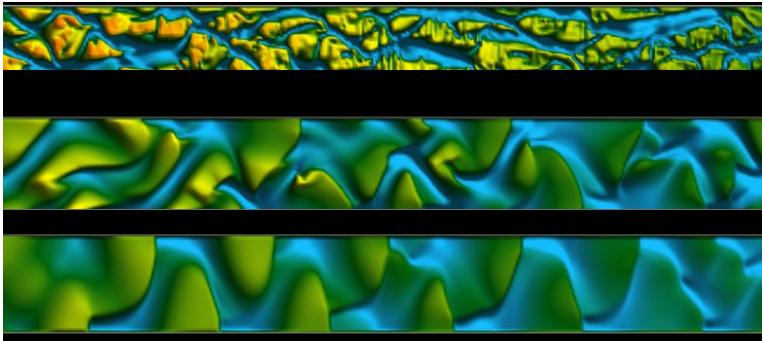


Koch & Flokstra (A_{sh})



X 100

Engelund-
Hansen



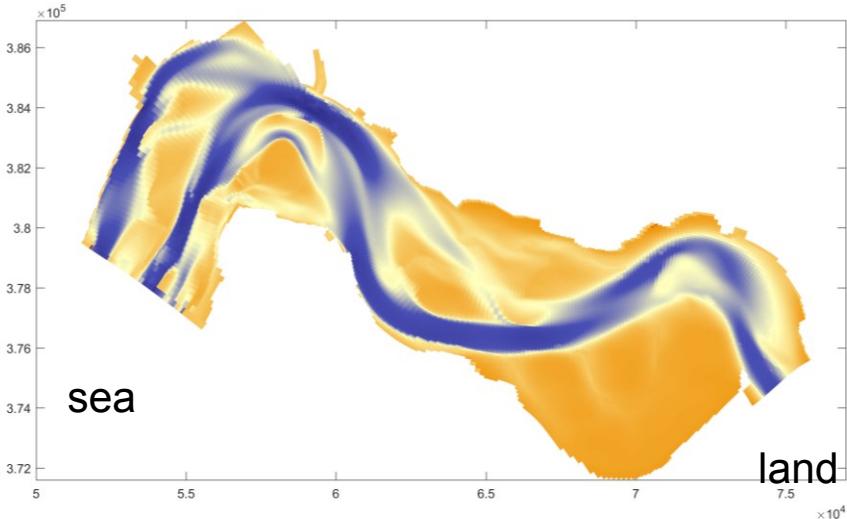
X 15

Calibrating with slope parameter

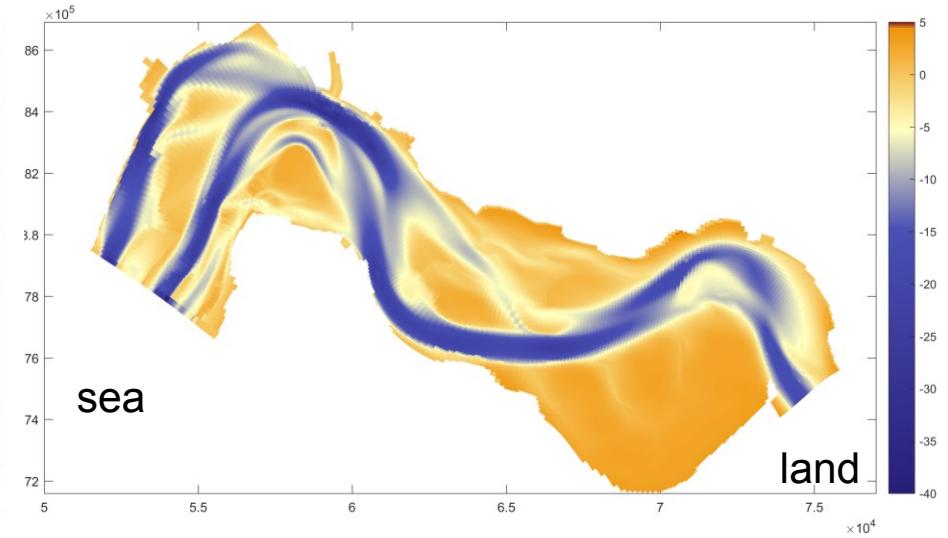
- Calibrating on sediment transport: effect morphology
 - Bed slopes
 - Dimensions bars/bends/bifurcations
- Calibrating on bed slopes: sensitivity sediment transport?

Calibration on bed slopes

Ikeda ($\alpha_{bn} = 30$)



Koch & Flokstra ($A_{sh} = 0.05$)



(Van Dijk et al., in prep.)

Difference in transport vector

- 19 million m³ difference in dredged volume over 20 years

Magnitude

Direction

Conclusions

- Calibrating with slope effects:
 - Either sediment fluxes or bed slopes calibrated
→ Change morphology & time scales
- Transport predictor determines tendency to incise
- Slope parameterization influences bar/channel stability