Geophysical Research Abstracts
Vol. 18, EGU2016-2506, 2016
EGU General Assembly 2016
© Author(s) 2016. CC Attribution 3.0 License.

Turning the tide: effects of river inflow and tidal amplitude on sandy estuaries in laboratory landscape experiments

Maarten Kleinhans, Lisanne Braat, Jasper Leuven, Anne Baar, Maarten van der Vegt, Marcel van Maarseveen, Henk Markies, Chris Roosendaal, and Arjan van Eijk

Universiteit Utrecht, Faculty of Geosciences, Physical Geography, Utrecht, Netherlands (m.g.kleinhans@uu.nl)

Many estuaries formed over the Holocene through a combination of fluvial and coastal influxes, but how estuary planform shape and size depend on tides, wave climate and river influxes remains unclear. Here we use a novel tidal flume setup of 20 m length by 3 m width, the Metronome (http://www.uu.nl/metronome), to create estuaries and explore a parameter space for the simple initial condition of a straight river in sandy substrate. Tidal currents capable of transporting sediment in both the ebb and flood phase because they are caused by periodic tilting of the flume rather than the classic method of water level fluctuation. Particle imaging velocimetry and a 1D shallow flow model demonstrate that this principle leads to similar sediment mobility as in nature. Ten landscape experiments recorded by timelapse overhead imaging and AGIsoft DEMs of the final bed elevation show that absence of river inflow leads to short tidal basins whereas even a minor discharge leads to long convergent estuaries. Estuary width and length as well as morphological time scale over thousands of tidal cycles strongly depend on tidal current amplitude. Paddle-generated waves subdue the ebb delta causing stronger tidal currents in the basin. Bar length-width ratios in estuaries are slightly larger to those in braided rivers in experiments and nature. Mutually evasive ebb- and flood-dominated channels are ubiquitous and appear to be formed by an instability mechanism with growing bar and bifurcation asymmetry. Future experiments will include mud flats and live vegetation.