

EXTRA INFORMATION

PhD candidate: Modelling the Holocene development of estuaries (1 fte)

Tidal systems such as the Ems and Scheldt estuaries and the Wadden Sea have perpetually changing channels and shoals of sand, mud and vegetation. Understanding these dynamic patterns is scientifically interesting, and highly important for management. Our current understanding and predictive capabilities remain limited regarding A) large-scale effects of internal biomorphodynamics of tidal flats, bars, marshes and banks with ecosystem engineering species, and B) externally imposed effects such as antecedent landscape, size of feeding rivers, sealevel change and historic human interference.

The ERC Consolidator project ‘Estuaries shaped by biomorphodynamics, inherited landscape conditions and human interference’ supervised by Prof. dr. M.G. Kleinhans (see www.geo.uu.nl/fg/mkleinhans for more information) consists of a team of 3 post-docs and 3 PhD students and is connected to a similar-sized project on estuarine morphodynamics. The overall objectives are to develop numerical and analogue (‘sand box’) models for large-scale planform shape and size of sandy estuaries and predict past and future, large-scale effects of biomorphological interactions and inherited conditions. Within this project-team we look for a multidisciplinary model user and experimenter to do a fully funded 4-year PhD thesis.

The general objective of this PhD project is firstly to assess how large-scale, long-term biogeomorphodynamics of estuaries lead to the morphology, patterns and stratigraphy that we observe in Holocene systems, and secondly to test hypotheses for how inherited conditions such as valley dimensions determined estuary planform development and its large-scale sedimentary architecture. To what degree did the inherited valley and substrate or the self-formed mud flats and marshes with eco-engineering species confine estuaries in width and depth? The tasks for this PhD project will be to employ the in-house paleogeographical reconstructions of a series of contrasting, middle and late Holocene systems of the Netherlands and perhaps Germany and Belgium, and to let complete estuaries form in our novel facility, the Metronome (www.uu.nl/metronome). We already successfully created estuaries in the laboratory with mudflats and with saltmarsh using seedlings of several plant species. At present, other team members are developing numerical models with ecoengineering species (our novel model) and sand-mud interaction (Delft3D), and quantitative analyses methods and code for comparing experiments, models and reality. Specifically, the PhD candidate will:

- experimentally and perhaps numerically test alternative interpretations for contrasting Holocene estuaries in NW Europe, in particular how specific aspects of estuary planforms are attributable to externally imposed constraints (and timing where relevant) as opposed to biomorphological development:
 - valley geometry and dimensions, partly determined by human interference in the floodbasins (peat mining and drainage for agriculture),
 - estuarine margin stability imposed by substrate, either inherited or by self-formed mud flats, tidal marsh and riparian vegetation,
 - river water and sediment supply, accounting for delays in clay and sand delivery due to avulsion,
 - coastal sand supply in the context of the entire embayed coast and sea level rise
- explore whether large-scale equilibrium exists as a result of balanced marsh development and channel migration plus wave attack
- collaborate closely with the team for comparisons with numerical model results, field data analyses and geological reconstructions of Holocene estuaries
- publish the synthesised knowledge in exciting papers for high ranking journals
- actively participate in academic discussions in the group and in field site visits and meetings with collaborators

This PhD study is part of a larger group effort and close interaction with the PI, PhDs, other postdocs and external collaborators is expected. The graduate school offers courses for writing and presentation skills. This also offers opportunities for BSc and MSc co-supervision, academic and professional network building. **Additional information can be obtained from Maarten Kleinhans at m.g.kleinhans@uu.nl.**