PRESERVATION OF MUD LAYERS IN TIDAL BARS: SHOAL OF WALSOORDEN

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Aim

Mudflats and mud layers can have a large influence on the morphology of estuaries (Braat *et al.* 2017; e.g. confining the estuary width, higher intertidal bars), owing to different erosion and deposition characteristics of mud compared to sandy or silty sediments. Mud typically needs low velocities to settle, but has a high critical shear stress for erosion. On long timescales (decades to centuries) these mud-related effects on the morphology of estuaries are hard to predict. Reasons for this are that it is unclear where these mud layers are and under what conditions they are deposited and preserved. Even very thin mud layers can have large morphological effects and are therefore important to study. In this research we aim to determine when mudflats form and under which conditions they are preserved in the stratigraphy.

Methods

To achieve our aim, we compare numerical modelling results that include stratigraphy (Delft3D) with field data collected from the shoal of Walsoorden in the Western Scheldt. During fieldwork several cores up to 3 m depth were taken over a wide variety of environments on the shoal, including marsh, low- and high-energy tidal-flat environments. Four cores of 45-70 cm long collected near a big flood channel were brought back to the lab. Here, sand and mud layers were described in more detail, relying in part on screens for diatom assemblages and on lacquer peels (Figure 1).

We use a 2DH numerical morphological model to study different scenarios of the shoal of Walsoorden, which setup is based on the calibrated NeVla model. Scenarios that are tested include different concentrations of mud supply at the boundaries and absence versus presence of initial mud in the bed. Results of the modelling study are then compared with the field data to see if the model can accurately reproduce the mud deposits on the shoal. Lastly, the model is used to find if and when mud layers are preserved in the stratigraphy of the shoal.

Results

Preliminary results suggest that exceptional conditions are necessary to preserve mud layers in the stratigraphy. Even though the spatial extent of mudflats is large in the field, only limited mud is found in the stratigraphy. Diatom screening of the mud samples shows that several thin mud layers (2-10 mm) might be related to storm events, because high numbers of marine planktonic species were observed. Other mud layers can be correlated to the occurrence of vegetation, and some deposition angles suggest bedform migration. In line with the field data, it proves difficult to preserve mud layers in the model stratigraphy; even the few thin layers from the cores are not observed in the model. We hypothesise that this omission is due to the simplified conditions, as the model does not capture storm events or large dune or sandbar migration over the shoal.

Braat, L., van Kessel, T., Leuven, J.R.F.W., Kleinhans, M.G. (2017). Effects of mud supply on large-scale estuary morphology and development over centuries to millennia. *Earth Surface Dynamics*, 5 (4), 617-652.

Figure 1. Lacquer peels of four sediment cores. Darker layers are mud layers.