Geophysical Research Abstracts
Vol. 21, EGU2019-12581, 2019
EGU General Assembly 2019


# The effects of dredging and disposal activity on the multi-channel estuary system

Maarten Kleinhans, Wout van Dijk, Jana Cox, and Jasper Leuven
Universiteit Utrecht, Faculty of Geosciences, Physical Geography, Utrecht, Netherlands (m.g.kleinhans@uu.nl)

Shipping fairways in estuaries are continuously dredged to maintain access for large ships to major ports located at river mouths, i.e. estuaries. However, several estuaries worldwide show adverse side effects to dredging activity, including a shift from a multi-channel system to a single-channel system and loss of ecologically-valuable intertidal areas. We used timeseries of bathymetry of the Western Scheldt Estuary (the Netherlands), morphodynamic model runs and physical scale-experiments (in the Metronome) to study the effects of dredging and dumping on the morphology of estuaries at a variety of spatial and temporal scales. The scale experiment was designed with a dredging and dumping protocol based on past and current practices in the Western Scheldt. Both scale experiment and morphodynamic model runs were compared to control runs without dredging and disposal. We quantify the effects in scale and topology using a novel and mathematically rigorous network extraction. This revealed that reaches of the main channel switched with the side channel in the past and that continuous disposal of sediment pushes the side channel out of equilibrium by net siltation. The experiment confirmed the processes observed in the Western Scheldt. Adverse effects of dredging may therefore generalise to other estuaries worldwide and lead to decreased intertidal area, increased high water levels, increased tidal range, loss of connecting channels, increased tidal penetration and a tendency for shoals in the main channel to silt up more quickly. All evidence shows that current dredging and disposal strategies are unsustainable for the multi-channel system because dredging increases the imbalance between high and lower bed levels of the estuary. Experiments show that effects persist much longer than the decades over which the estuary has been dredged. A new strategy where dredged sediment is disposed in the scours of the main channel is economically feasible and is better for the preservation of the multi-channel system and potentially its ecological value. Sea-level rise model scenarios demonstrate that increased mean sea level restores the multi-channel system if sufficient sediment is available in the system as to prevent drowning. However, this proposed sediment management may conflict with further increasing the channel depth, which may be required to keep pace with a more rapid increase in the shipping draft.