Hydrodynamic conditions on an accreting intertidal flat in the Western Scheldt

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Introduction

In this study, we compared spatial patterns and magnitudes of flows driven by tides and wind on a fast accreting tidal flat in the Western Scheldt. Furthermore, we established the relationship between the hydrodynamics and the sediment transport.

Field site





Time to local high water (minutes)



Located near the mouth of the Western Scheldt in the

- northern part of the tidal flat 'Hooge Platen'
- Current velocity was measured at 16 locations during 6 months
- Bed level along the transects was recorded during field visits



- Huge sedimentation on transect 01 in 2019
- Development of the channel on the north side of transect 05 and transect 06



Measured flow velocity (cm/s)

Cross-shore flow velocities: comparison of measured with calculated flow velocities for location on the tidal flat (Friedrichs)

- Calculated values are in good agreement with measurements on transect 03
- A different approach is needed for the other transects



Data analysis

- Flow velocity split up in cross-shore (u) and longshore (v) direction
- Local water level derived from location Vlissingen
- Transport of coarse sediment: data from lowest cell is used
- Cross-shore velocity compared with mass conservation model (Friedrichs)
- Longshore velocity: momentum balance is being analyzed • Proxy sediment transport:

• $Qs_{longshore} = (u^2 + v^2).v$ • $Qs_{cross_shore} = (u^2+v^2).u$

Rijkswaterstaat

Ministry of Infrastructure

and Water Management

References

C.T.Friedrichs and D.G. Aubrey. Uniform bottom shear stress and equilibrium hypsometry of intertidal flats. Coastal and Estuarine Studies Volume 50, pp 405-429, 1996

- Cross-shore transport decreases with increasing bed level
- Flood dominance: at transects 1 and 3 sediment is transported onto the tidal flat
- Eastern locations in the channel: ebb dominance, export of sediments

Conclusions

- At short distances large variations in ebb-flood dominance
- Storm causes increased flow velocities and sediment transport
- Flow velocities at transect 03, which is at the longshore uniform part of the tidal flat, agree with the model of Friedrichs
- More complicated flow and sediment transport patterns were observed in parts of the tidal flat with 3D morphology