

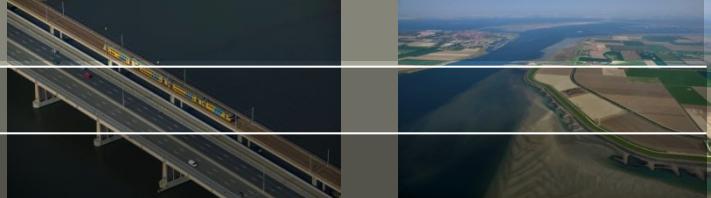


Modelling the deposition in deep channels of the Western Scheldt

*Bas Huisman, Thijs Lanckriet,
Reinier Schrijvershof, Jebbe van der Werf*

29 October 2018

Problem



Navigation channel to Antwerp

- Maintenance dredging → • Dredge disposal?



Historic strategy

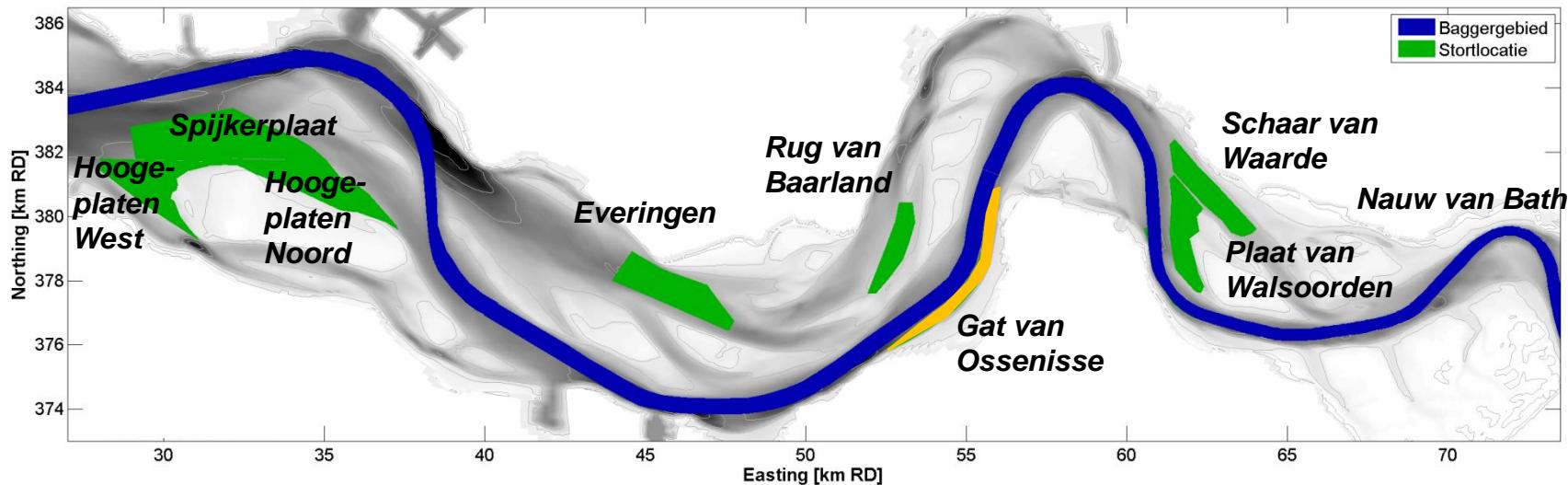


Strategy : 2011-2014

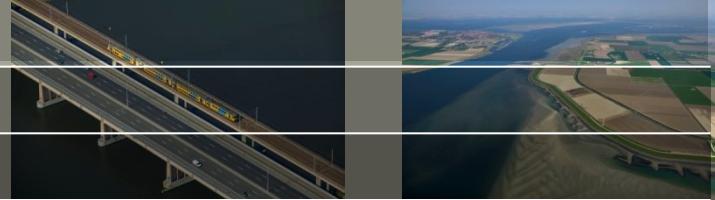
- Tidal flats
- Side channels

Inactive regions

(exception : Gat van Ossenisse)



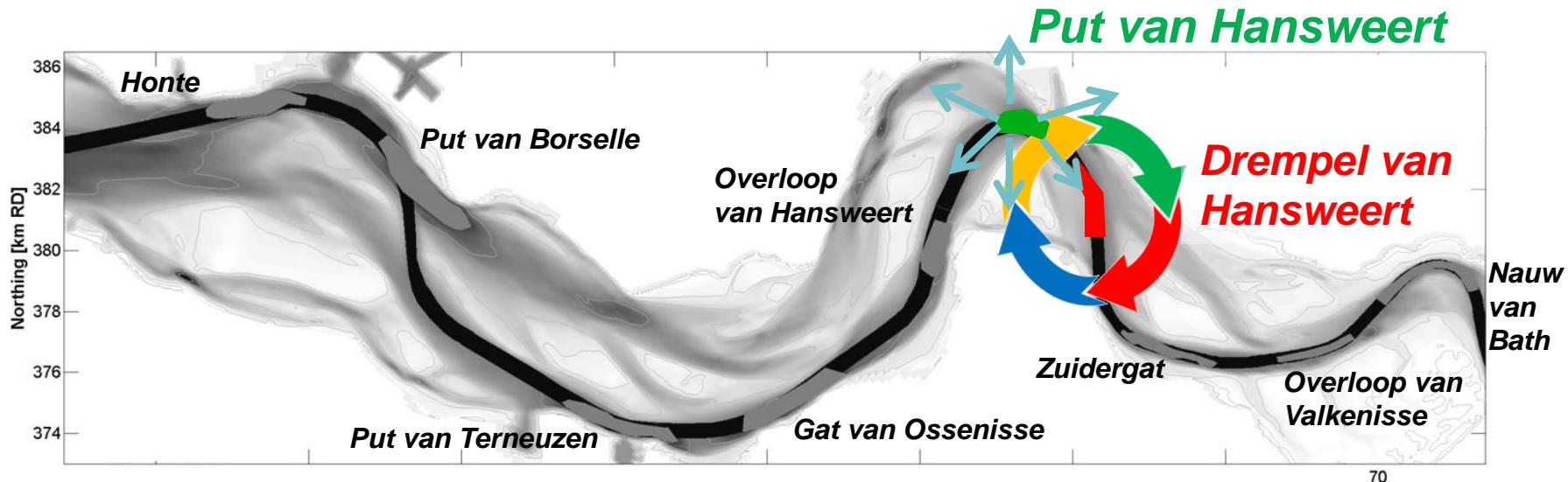
Proposed strategy



Strategy : deep pits in navigation channel

Active regions

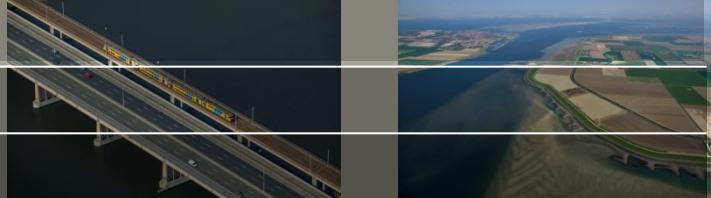
<< Impact environment



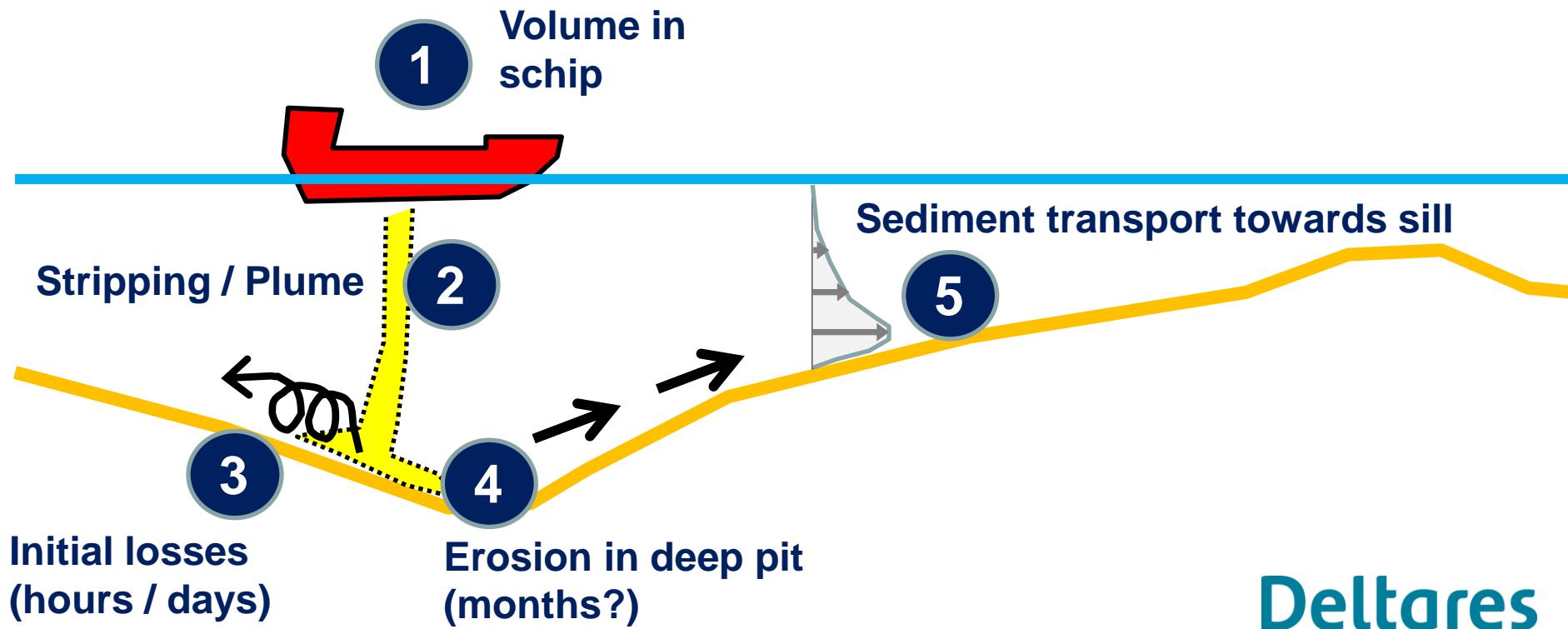
What happens with disposed sand?

Recirculation? (Drempel van Hansweert)

Technical questions



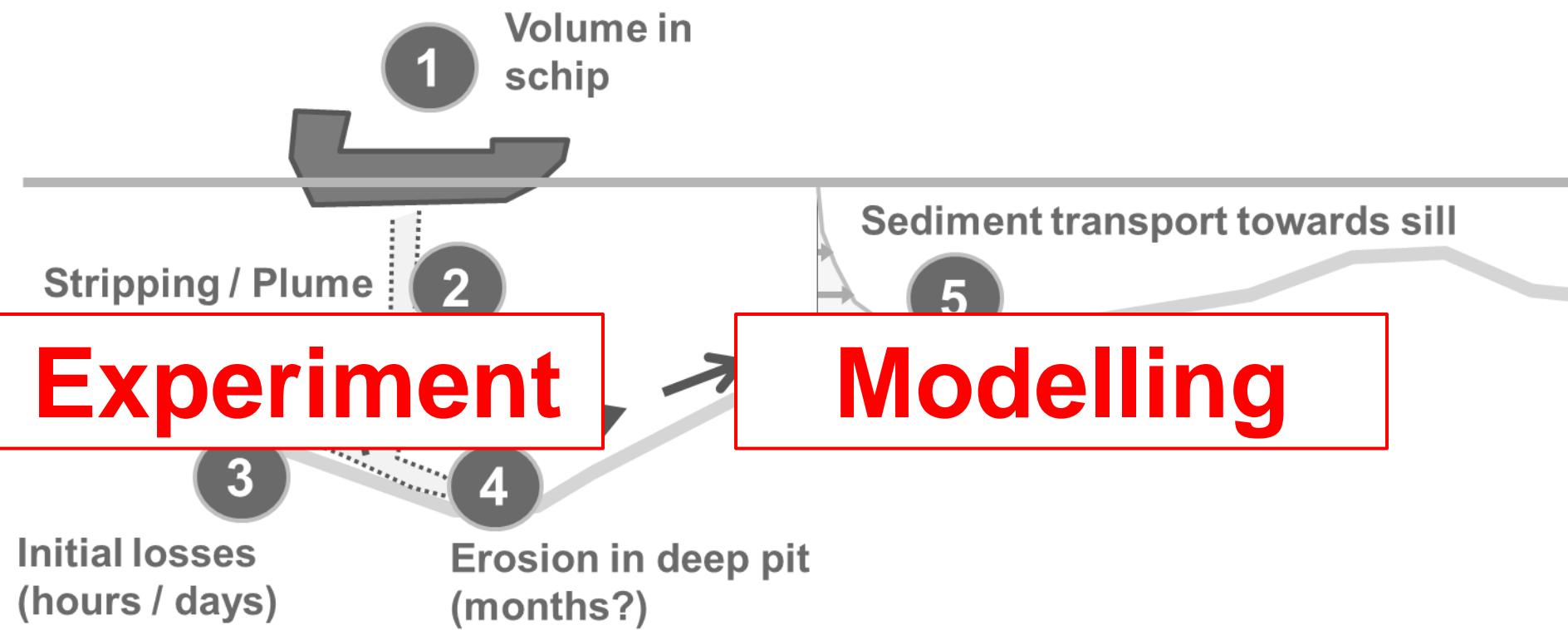
A. Spreading of nourished material? (recirculation)



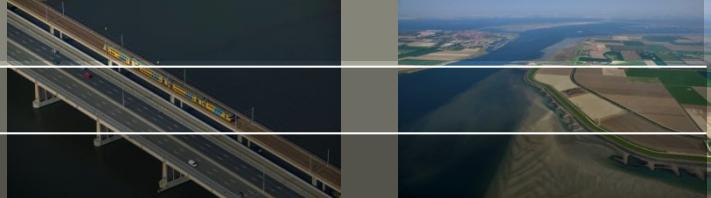
Approach



A. Spreading of nourished material? (recirculation)



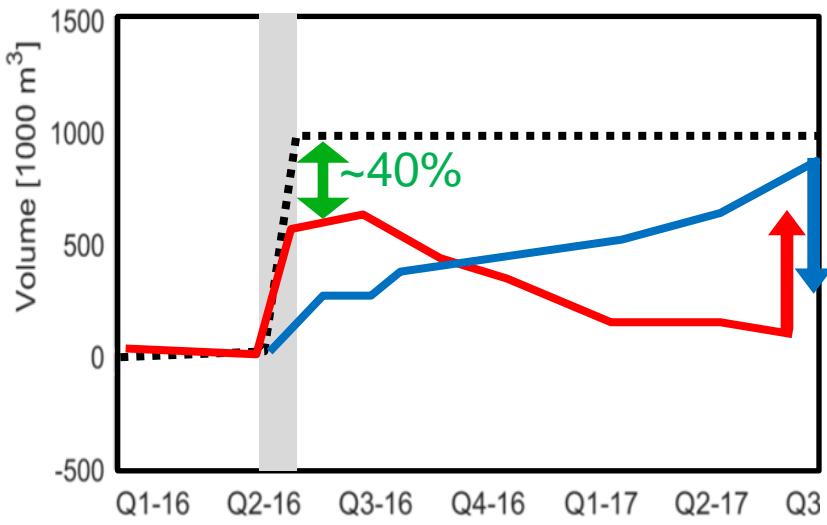
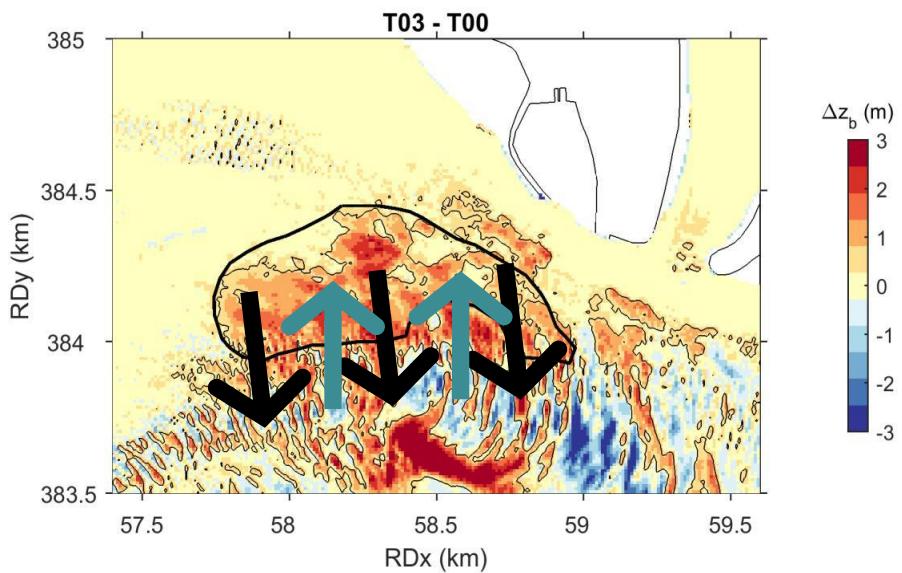
Experiment - Observations



Put van Hansweert-> 1 million m³

- Large initial losses (~40%)
→ transport to inner bend
- Slope instability (>1 year)
→ sediment back to channel

— PvH volume deep pit
— PvH inner bend
- - - Official disposal volume

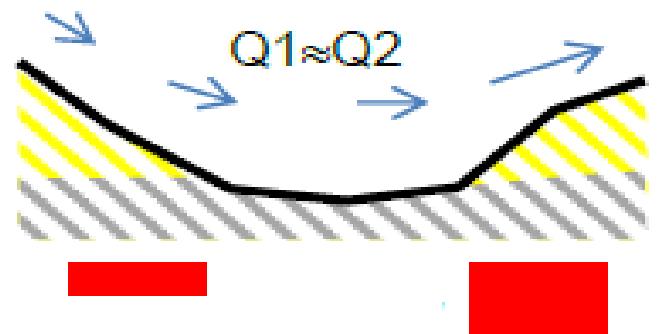
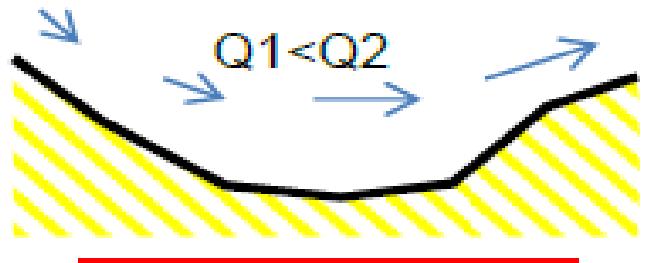
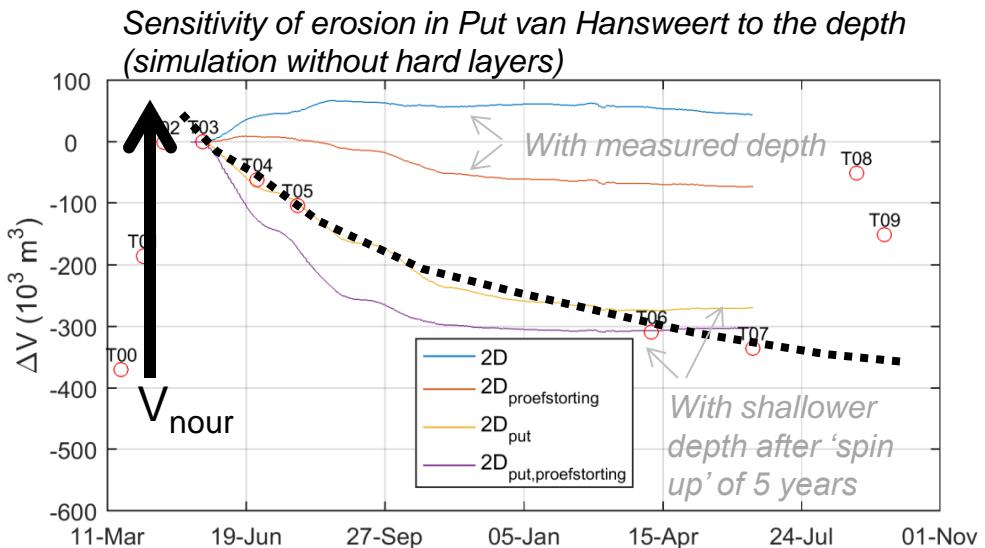


Experiment – Modelling (local)



Delft3D model P.v.H.

- shows transport to inner bend
- Erosion in model << observed
- Spin-up of model : erosion ↑↑ (i.e. provides infill of deep pit)
- In addition : Hard layers!



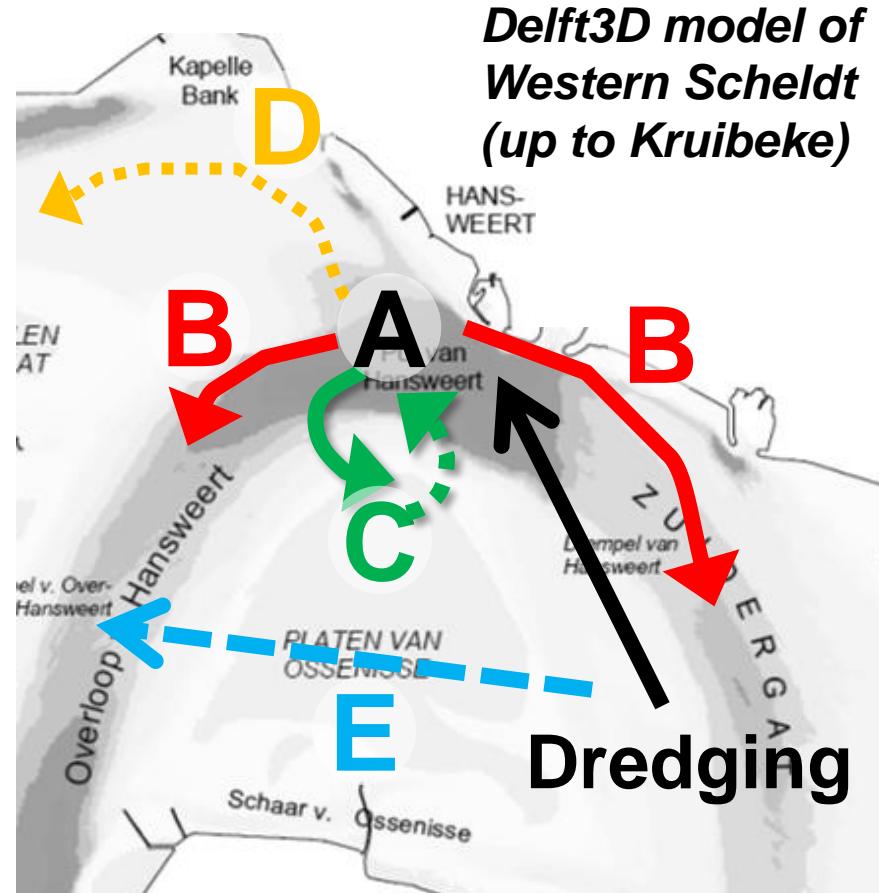
Spatial distribution of sediment on hard layer!



Modelling - Morphological impact (large scale)



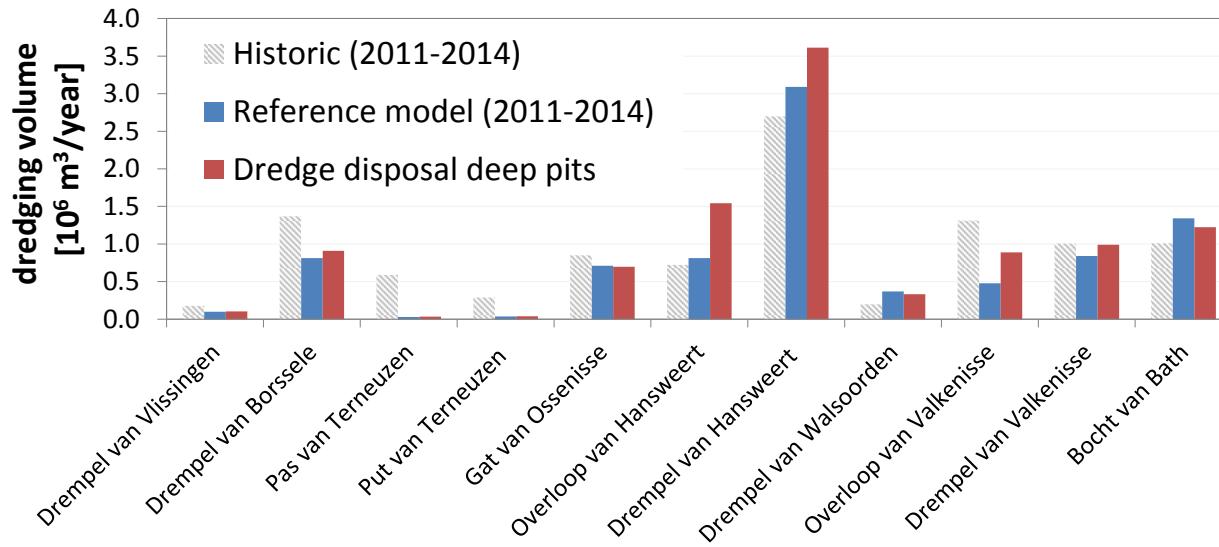
- A : Filling up deep pits (>5 yr; not unlimited!)
- B : Redistribution in channels (spread 1 to 5 km in 5 yr)
- C : Recycling with inner bend (occasional instabilities)
- D : Small quantity to Middelgat
- E : Macrocel 5 --> Macrocel 4
Sand balance = f(nourishment locations)



Modelling - Impact on dredging (large scale)



- Dredging volume 2011 – 2014 ➔ well represented (using the ‘spin-up’ bathymetry)
- Dredge volume ‘Dredge disposal deep pits’
10 ➔ 12 million m³/yr (+20%)



- > Without initial losses when dumping!
- > Under-estimation Terneuzen (Macrocel 3) -> high % fines

Recommendations



- **Dredging management**
 - **Adaptive** management / disposal strategies (i.e. ability to switch)
 - Initially high frequency **monitoring** at disposal sites (deep pits):
 - Check sediment **properties of disposed sand**
(with respect to site characteristics)
- **Knowledge**
 - **Experimental** dumps in deep pits
-> check bathymetry, concentrations, currents, sediment
 - Causes for **discrepancy in mobility** of sediment in deep pits
(i.e. density driven currents, turbulence/eddies due to hard layers and steep slope, 3D currents due to bend)
 - Geology of Western Scheldt (**Hard layers**)
 - Allow **long-term modelling** of morphodynamics (numerics/physics)