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SMART & SUSTAINABLE INFRASTRUCTURE







Integrated Plan Upper Sea Scheldt

Turn The Tide: Scientific Research
Towards An Integrated Plan For The
Upper Sea Scheldt

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the Upper Sea Scheldt







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Towards an Integrated Plan for the Upper Sea Scheldt

- ▶ Scheldt Estuary plays important role
 - Reduce the impact of storm or flood events
 - International recognized nature conservation area
 - Economical development and navigation
- ▶ And faces several challenges at the same time
 - Recent insights on the functioning of the Estuary
 - Coexistence of several functions like safety, nature and economics

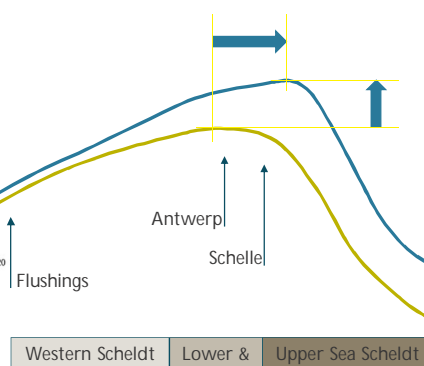
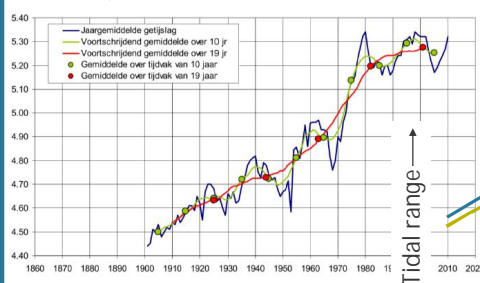
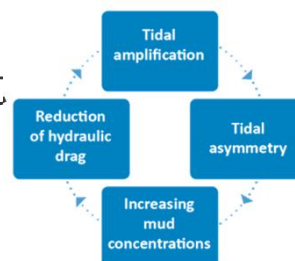


IP-Upper Sea Scheldt Themes

- ▶ Safety
 - North Sea tides are felt until far land inward on the Scheldt and its tributaries
 - The SIGMA-Plan protects Flanders against flooding from storm floods and peak discharges
- ▶ Nature
 - The Scheldt constitutes a unique ecosystem of international importance due to the tidal action
 - This ecosystem is under continuous pressure due to autonomous and anthropogenic changes: investigations on regime changes
- ▶ Navigability
 - Preceding: feasibility study W&Z to improve the navigability of the Upper Sea Scheldt
 - Build upon the results of this study and recommendations regarding the integration of navigability with other functions of the Upper Sea Scheldt

IP-Upper Sea Scheldt Challenges

- ▶ Climate Change and Sea Level Rise
- ▶ Increasing tidal range
- ▶ Sediment management
- ▶ Coordination with VNSC – Agenda for the Future



after K. Kuijper, 2012

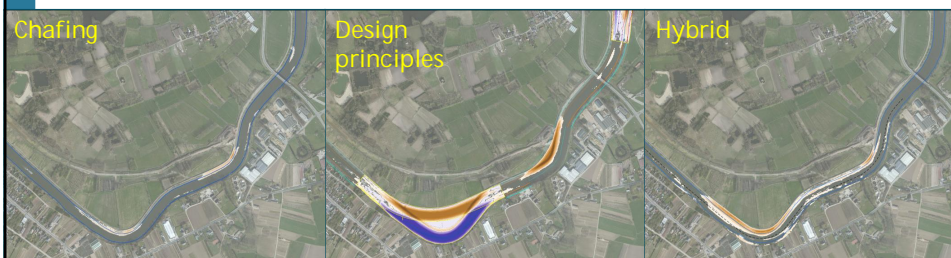
IP-Upper Sea Scheldt Study approach

- ▶ Goal:
 - Improve insight in the functioning of and processes in the Upper Sea Scheldt
 - In order to maximise the potentials of all functions of the river.
- ▶ Investigations of various themes:
 - Hydrodynamics
 - Sediment transport
 - Ecosystem functioning
 - Habitats and higher trophic levels (fish and birds)
- ▶ Team:
 - Waterwegen en Zeekanaal NV
 - Research teams:
 - × Flanders Hydraulics Research (Hydrodynamics & Sediment transport)
 - × University of Antwerp (Ecosystem, Primary Production)
 - × INBO (Habitats, Fish and Birds)
 - × IMDC (Hyper turbidity, Morphology, Coordination)
 - International expert panel
 - EIA & Communication (Technum)



Alternatives

- ▶ From navigability study (B-alternatives)

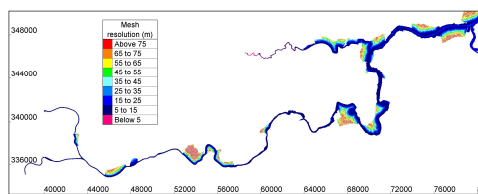


- ▶ Opportunity to mitigate adverse effects of deepening
 - Building Blocks
- ▶ C-alternatives



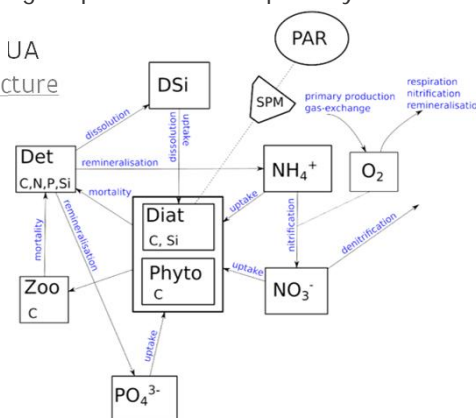
Hydrodynamics & sediment transport – Scaldis model

- ▶ Flanders Hydraulics Research => Presentation J. Vanlede
- ▶ High resolution, unstructured Telemac model
- ▶ Hybrid boundary conditions including extreme events
- ▶ Output
 - Hydrodynamic effect of measures, HW, LW, Extremes
 - Effect on sediment transport
 - Dispersion parameters, SSC for Ecosystem model
 - Residence time and flow velocities for fish model
 - Extreme HW, LW, flow & shear stresses for habitat model



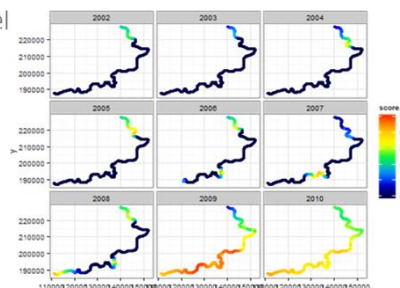
Ecosystem model

- ▶ University of Antwerp
- ▶ OMES (monitoring EIA Sigma-plan)
- ▶ 1D dispersion model for ecological parameters and primary production
- ▶ Research tool developed by UA
 - Ecosystem foodweb structure
- ▶ Model output
 - Primary production
 - T, O₂, Sal, SPM, Zoo for fish migr. model
 - + Nutrients, PP, BOD, O₂ for bird migr. Model
 - Retention times for habitat modelling



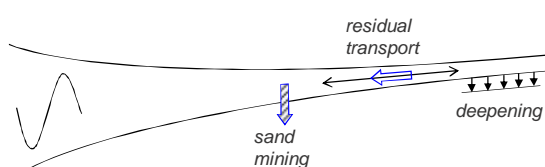
Fish and Bird models Habitat modelling

- ▶ Research Institute for Nature and Forest (INBO)
- ▶ OMES (monitoring EIA Sigma-plan)
- ▶ Habitat suitability for Twait Shad (NL: Fint)
 - Fuzzy logic model
 - based on T, O₂, S, SPM, Zoo, water depth, flow velocity, retention time
- ▶ Wintering water bird response
 - Multiple linear regression model
 - External, water quality, habitat quality
 - Bird abundance at 1.5km transects

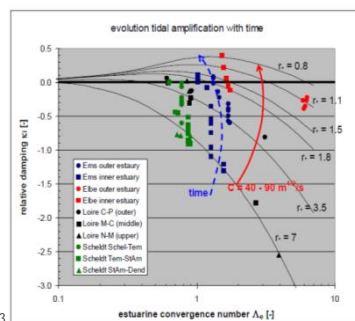


Morphology & hyper turbidity

- ▶ Long term morphological response
- ▶ Calibration 2000 – 2015, Hindcast 1970 – 2015
- ▶ Observed deepening
 - Response (deepening, sand mining, tidal amplification)
 - Result (of human interference)
- ▶ Increased risk to hyper turbidity?



from Winterwerp et al. 2013



Outlook

- ▶ Timing
 - Research and model development (2016)
 - Scenario analysis (2016)
 - Integrated plan (2017)

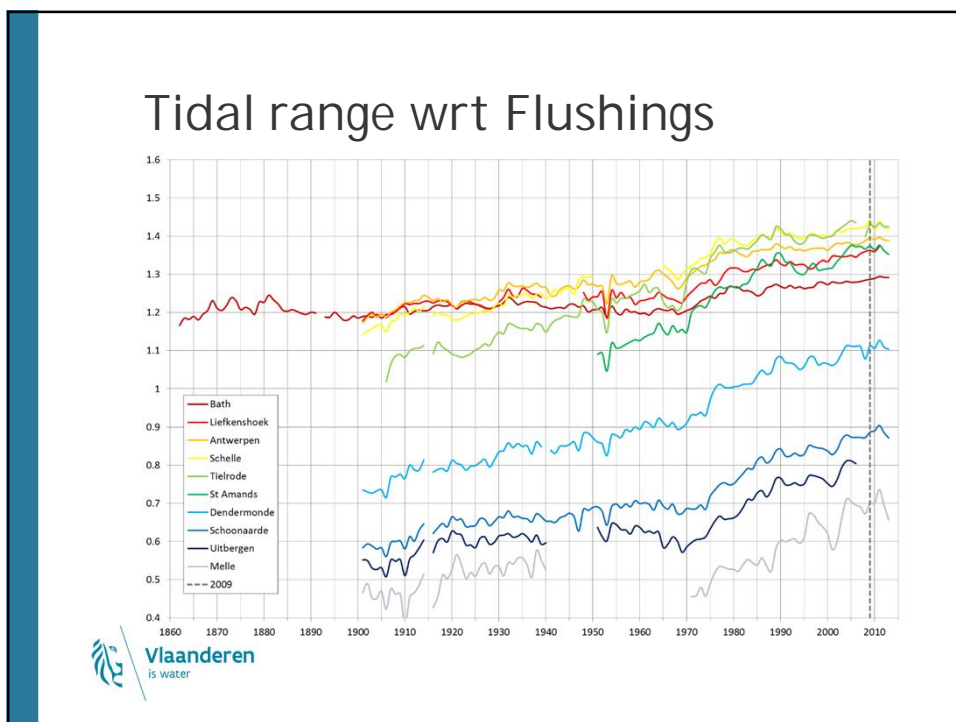
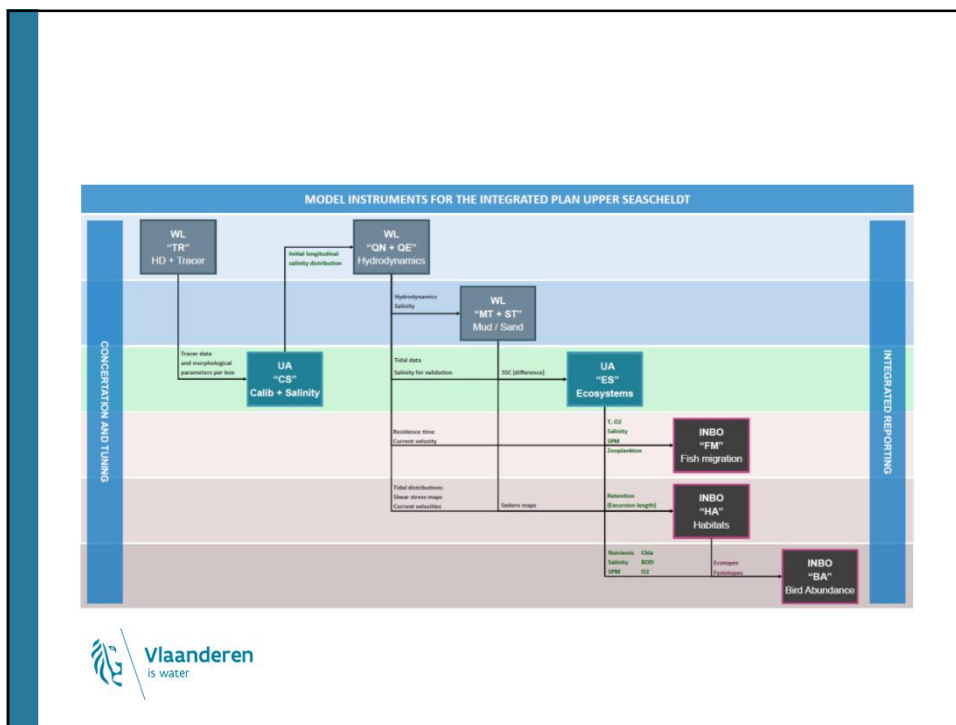


Thank you for your attention!

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Tidal range

