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Morphological management in the Schelde-estuary: harmonizing ecosystem functions with sediment management

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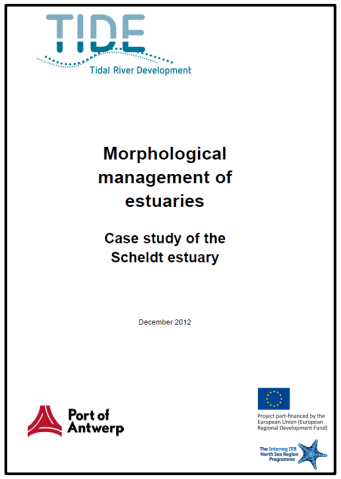
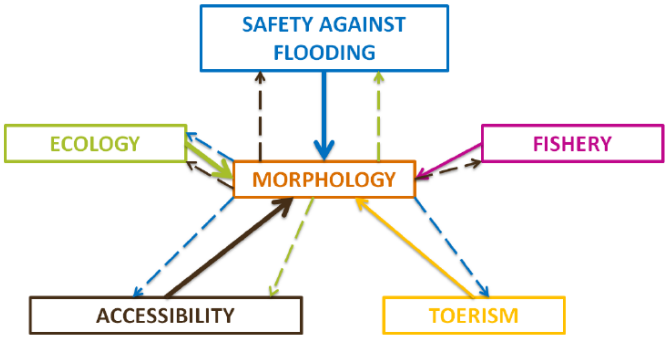
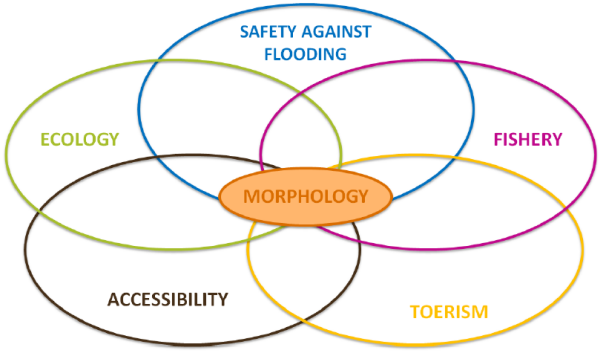
IMMERSE: TEEL #4 - Nov. 9th 2021

Morphological management



- Taking into account all estuarine functions
- Morphology as crucial element





- Not only supplying “solutions”, but focus on “diagnostic analysis” identifying causes for (negative) evolutions
- Importance of “multi-tool” research approach

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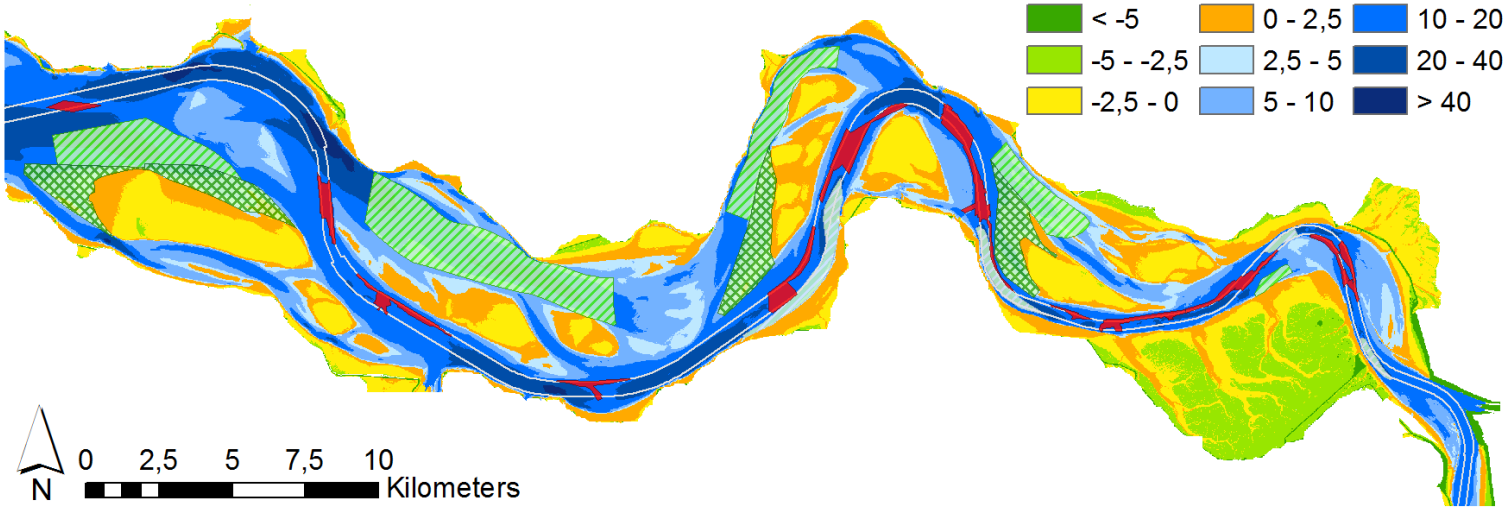
CASE 1 - Navigation channel enlargement

- Tide-independant draught up to 43’ to port of Antwerp
- 7.7 Mm³ (capital) + ca. 10 Mm³/year (maintenance)
- Uncertainties on potential long term effects
- Three-stage rocket approach



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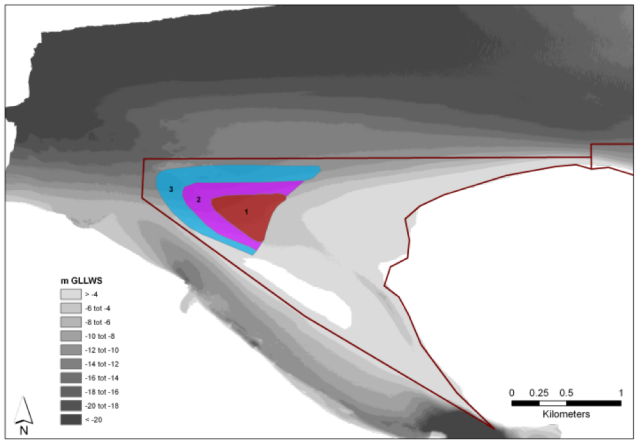
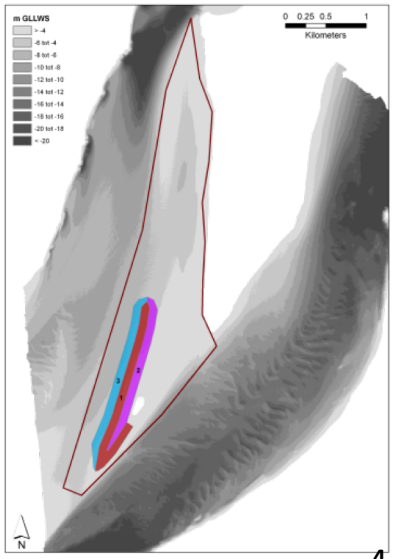
Stage 1 – New disposal strategy

- **EIA => material to reshape sandbars (~ pilot Walsoorden)**
- **Using dredged material to create new valuable areas for ecology (“working for nature”) => mitigate possible effects**
- **Increase low dynamic areas, by reducing flow velocities:**
  - Seaward tip of sandbar (PWA & HPW): megadune
  - Along sandbar (RvB & HPN): sand spit





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Stage 2: Monitoring and evaluation

- **Monthly meeting of experts => optimal disposal strategy**
- **Monitoring programme**
  - Multi-beam echo soundings
  - Flow measurements
  - RTK height measurements
  - Determination of grain size

- **Protocol flexible disposal strategy, several criteria:**
  - Stability of disposed sediment
  - Morphological changes of sand bars
  - Creation of ecological valuable habitats

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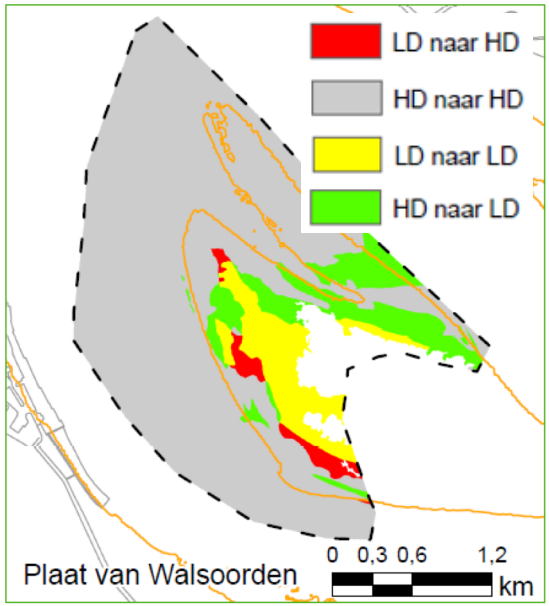
CASE 1 - Results

- **Different morphological behaviour at 4 disposal locations**
- **Continuing disposal strategy 2015-2021**
- **Increase of low dynamic habitats (2020):**
  - Hooge Platen: + 75.2 ha
  - Walsoorden: + 49.2 ha
  - *Rug van Baarland: + 152.1 ha*

=> Stage 3 – 'stopping works' not necessary!



- **Cause of past evolutions still exist**
  => need for morphological management

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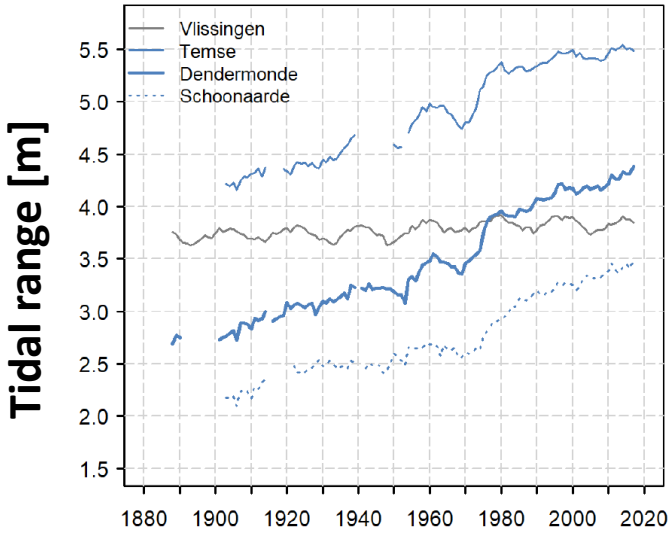
CASE 2 – tidal damping using sediment

- **Conceptual exploration possibility of reducing tidal propagation using sediment (infra projects)**
- **Reduction of cross-section along reaches of the Schelde-estuary**
- **Different (4) scenario's [IMDC, 2020]**
- **Potential effect on:**
  - Tidal propagation
  - Sediment dynamics
  - Ecology (primary production) [UAntwerpen, in prep.]



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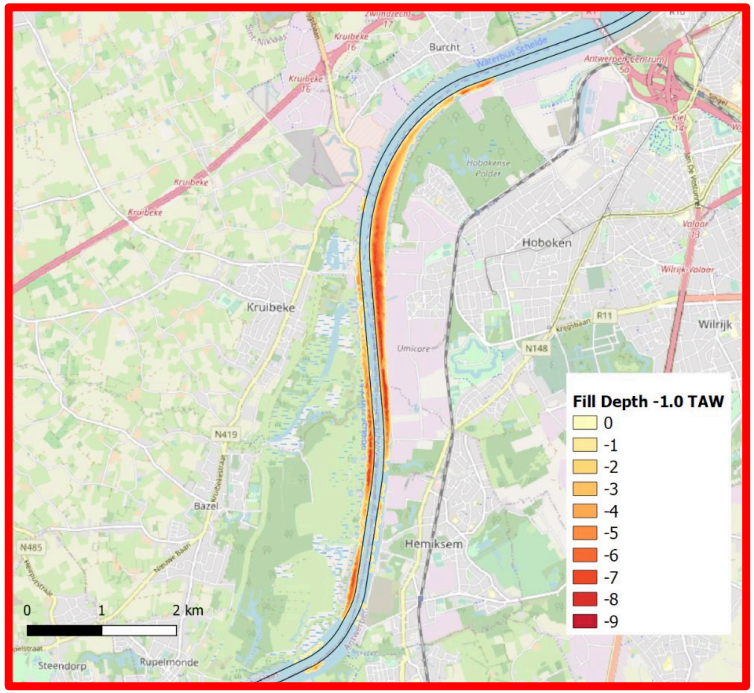
Scenario “Beneden-Zeeschelde”

- Raising of undeep water area between Burcht and Rupelmonde
- Increase of bed level to -1.0 mTAW (~ 0.5 m below low water)
- Disposal of ~2.7 Mm³ sand

- Abiotic effects simulated using Delft3D-NeVla-model
- Biotic effects simulated using OMES-PP-model



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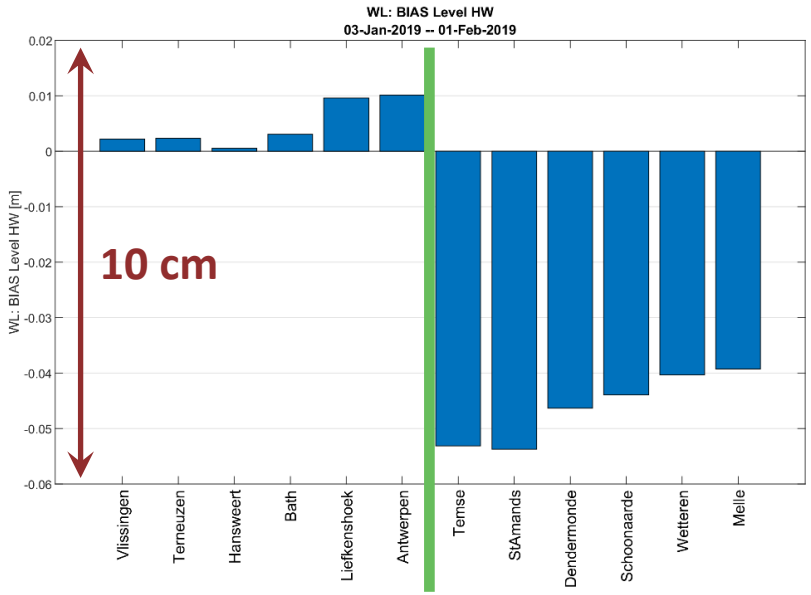
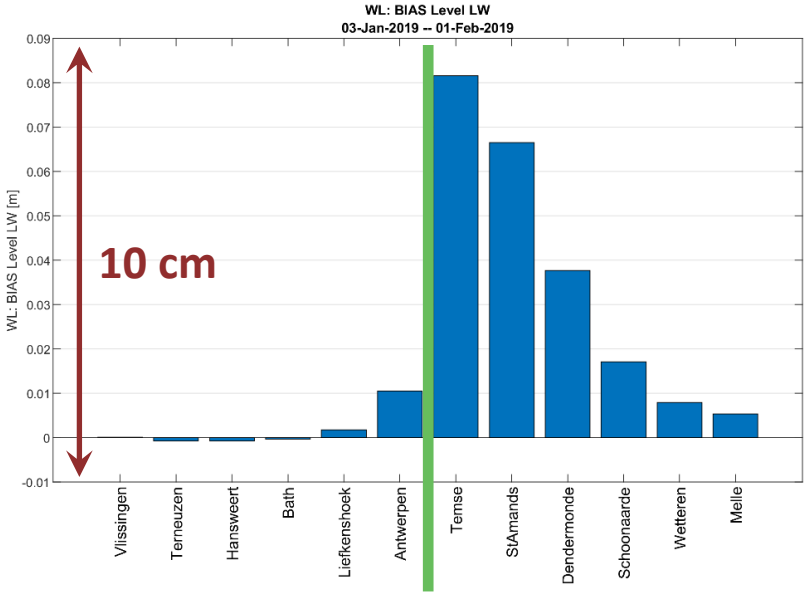
Tidal propagation



Difference in high water



Difference in low water

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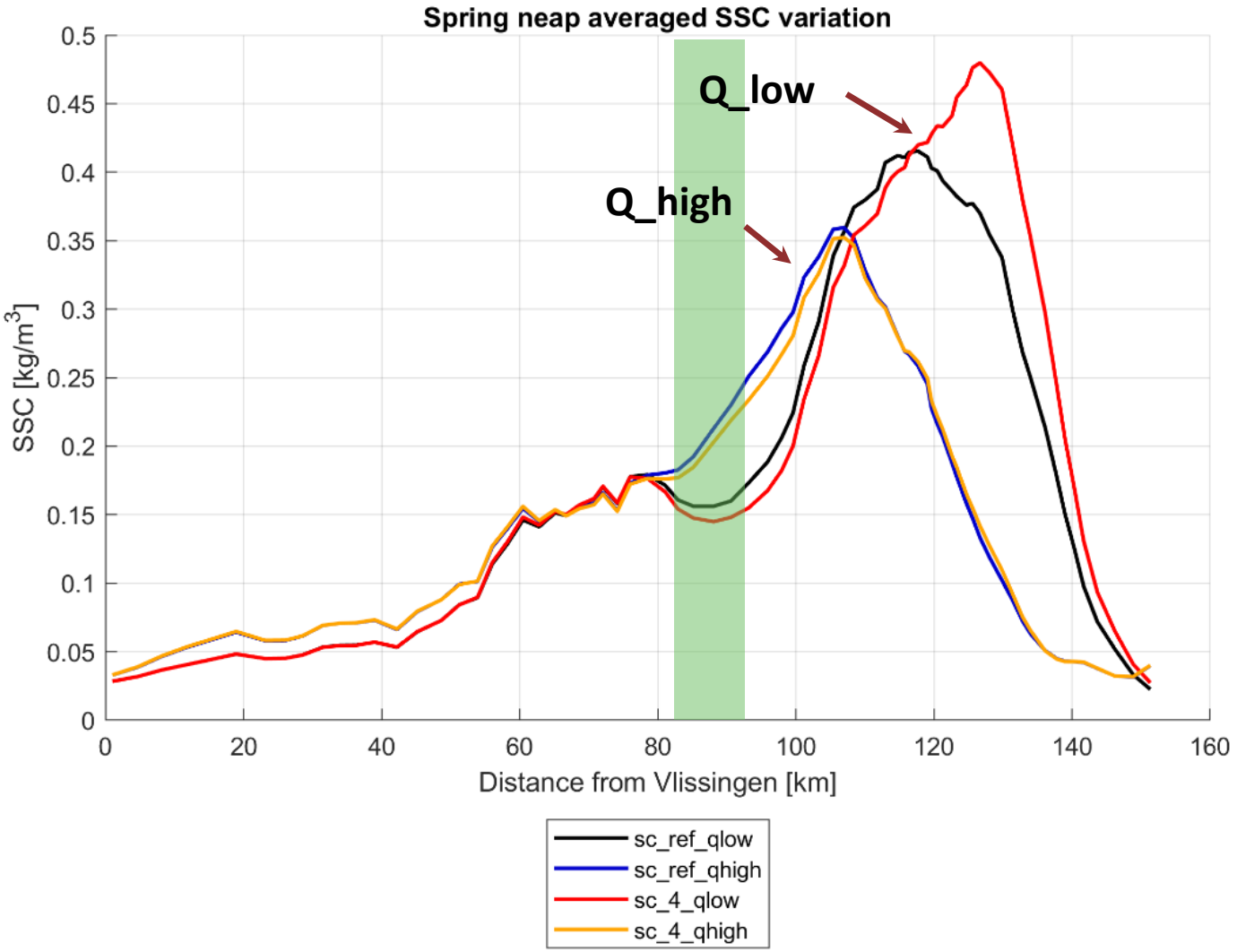
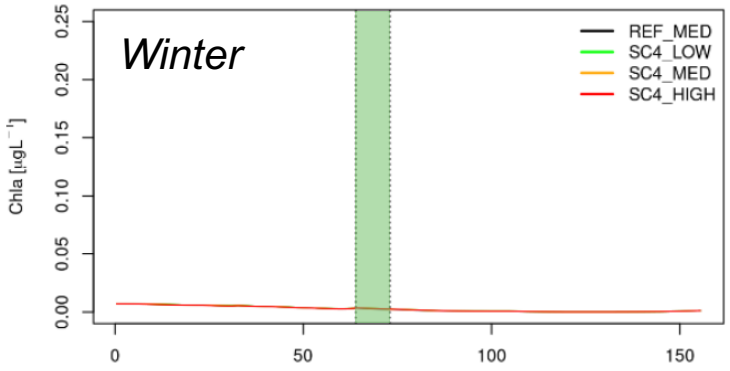
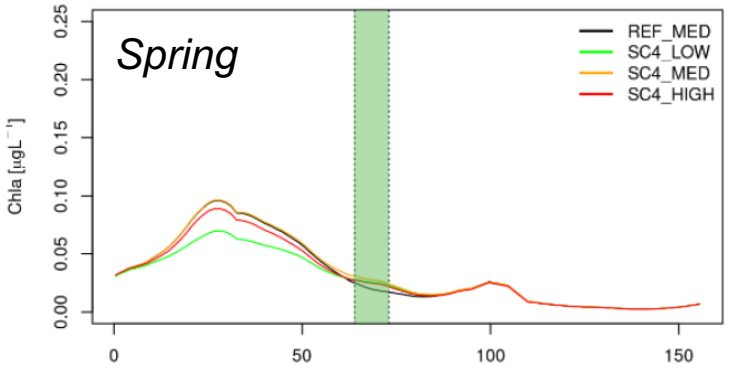
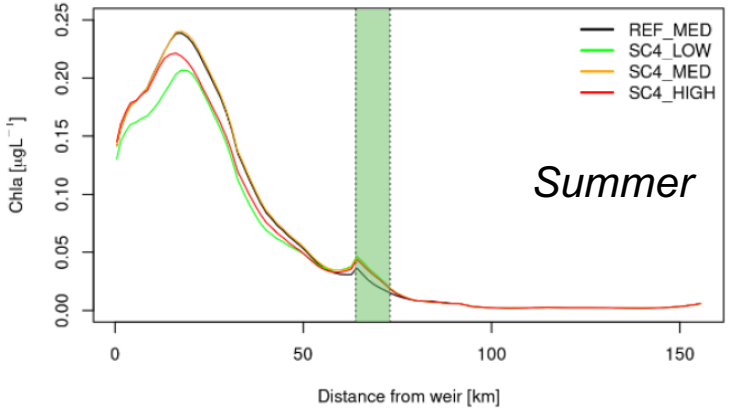
Sediment dynamics

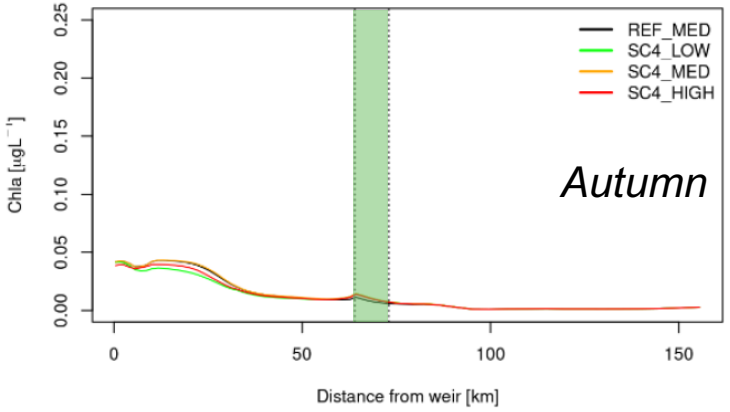


Primary production (UAntwerpen)









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Distances are inverted w.r.t. previous figures!

CASE 2 - Results

- **Reduction (up to 15 cm) of tidal range in Boven-Zeeschelde using sediment**
- **Changes in hydrodynamics => differences in sediment transport => differences in ecological functioning**

- **Only initial effect is estimated, sediment stability is a potential issue => initial impact will probably be reduced**

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Conclusions

- **Sediment management = succesfull creating ecological benefits**
- **Sand ⇔ mud: different challenges = different strategy**
- **Morphological management is important for estuaries trying to cope with future challenges (e.g. sea level rise, drought):**
  - **Understanding** of system functioning
  - **Holistic** approach (HD, sediment, ecology, …)
  - Each system is **unique** …but there are similarities
  - **Multi-tool** approach in research
  - **Soft** (reversible) measures should be preferred (not against nature)
  - **More strategies** to be explored (e.g. adaptation hard bordering)

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