Long term modeling of the Western Scheldt/shoal margin collapses
What are shoal margin collapses?

- Occurrence on the inner side of a bend
- Flow slides: liquefaction or breaching
- \(~1\text{M m}^3\) eroded sediment \(\Rightarrow\) perturbation
Objective

**Part 1** (Van Dijk et al., 2018, Earth Surface Processes & Landforms)
- Characterize shoal margin collapses in the Western Scheldt

**Part 2** (Van Dijk et al., 2nd review, JGR – Earth Surface)
- Implement universal parameterisations of collapses;
- Test effects of perturbations by collapses on the channel-shoal morphodynamics
Observed shoal margin collapses
Western Scheldt model setup

- Part from Delft3D-NeVla
- 2 years hydrodynamic simulation with MorFac of 20
  - Repeated hydrodynamic boundaries (two spring-neap tidal cycles)
- Tested 2 scenarios:
  - meteorite impact scenario (10 locations),
  - continuous yearly collapses
Automatic channel network extraction

Channel network at various scales:
1) main channel
2) secondary channels
3) connecting channels
Changes in the channel network

a. no collapses

b. yearly collapses

- Distance (km)
- Bed elevation (m)

- Main scale
- Secondary scale
- Connecting scale
Channel displacement over time

- Location:
  - Main
  - Side
  - Connecting

- Distance (km):
  - 0
  - 5
  - 10

- Morphological time (yrs):
  - 0
  - 40 yrs

- Fraction reworked area:
  - 0.02
  - 0.06
  - 0.1
  - 0.14
  - 0.18
  - 0.2

- Increase
Bed elevation differences against control run

tracer sediment (m$^3$)
- initial location
- 0.1
- 0.01

meteorite impact scenario

yearly collapses scenario
Changes in the bed elevation

Long-term response on the main channel

- a, main scale channel
  - no collapses
  - initial collapses
  - yearly collapses

- b, secondary scale channel
  - no collapses
  - initial collapses
  - yearly collapses

- c, connecting scale channel
  - no collapses
  - initial collapses
  - yearly collapses

channel depth (m)

years

10/11
In summary

Collapses affect:

- Changing the channel network, switching main and secondary channel
- Changes bed elevation; connecting channels => main channel
- Increase channel migration of the secondary channels

Collapses might explain differences between observations and model simulations

How does dredging and dumping affect the channel-shoal morphodynamics?