NCK theme day OASE

Offshore Activities and seabed evolution
Opportunities & Challenges

Luitze Perk


PhD Sand wave dynamics
Eelgrass seed farm
Salt marsh development Terschelling
Hydro-morphological measurements
Prins Hendrikzanddijk
Underwater noise measurements (JOMOPANS)
Flushbasin Holwerd
Flushbasin Noordpolderzijl
Morphological review HKN
Breakwater Enkhuizen
Underwater noise measurements Medemblik
Underwater noise measurements Borssele
Burial depth assesment HKZ
Bird detection system
Studio Porpoise
Burial depth assesment Borssele
Sedimentation assesment Borssele

Trends

Offshore developments:

- Ongoing construction of Offshore Windfarms
- Related need for burial of Export- and infield cables
- Growing demand of sand for nourishments (from sand mining areas)

Questions from our Clients

Offshore Windfarms

Optimal locations of individual wind turbines?

Scour extend /magnitude at wind turbines & offshore constructions?

Seabed level > 40 years?

Cables

Minimum required burial depth cables > 40 years?

Maximum possible burial depth cables > 40 years?

Optimal cable routing with lowest CAPEX-OPEX?

Best landfall locations?

Maintenance dredging requirements of trenches/ dredged channels

Effect of sweeping (cut-off crests) sand waves

Most plausible location & depth of Uxo's 1940 => 2018?

Sand mining areas

Where to find optimal type of sand from borrow areas?

Infill rate of present sand mining areas

Location/ depth of hard geological layers (clay)

WATER PROOF

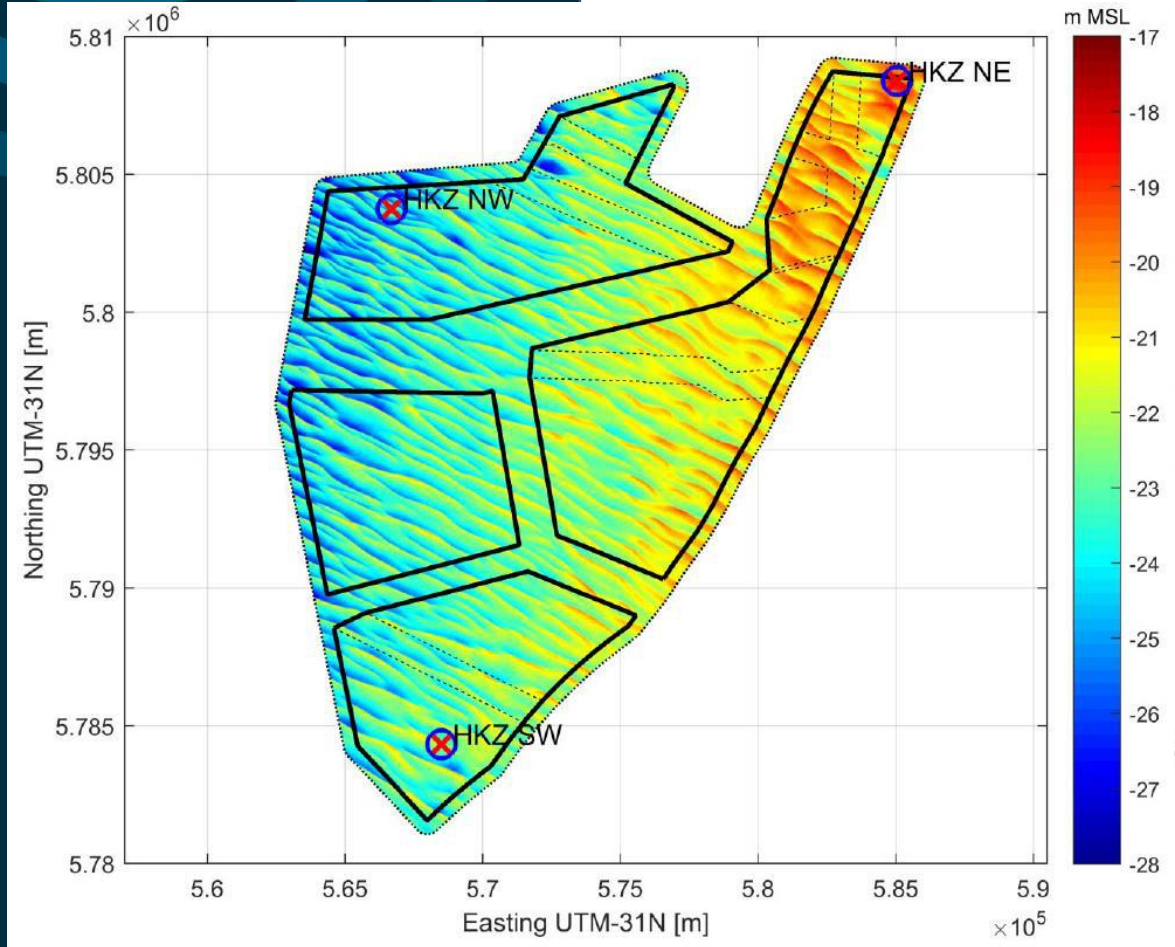
Questions from our Clients

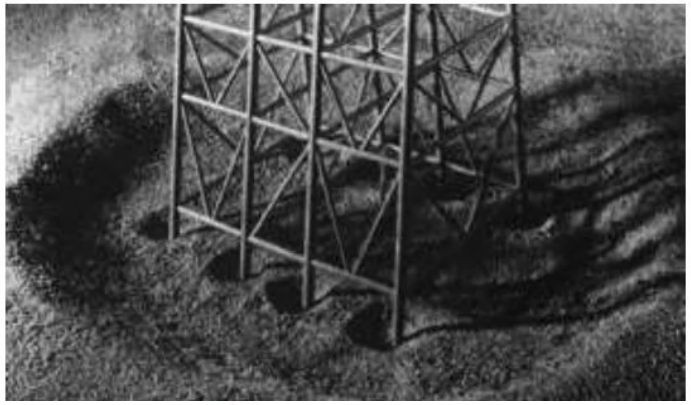
Offshore Windfarms

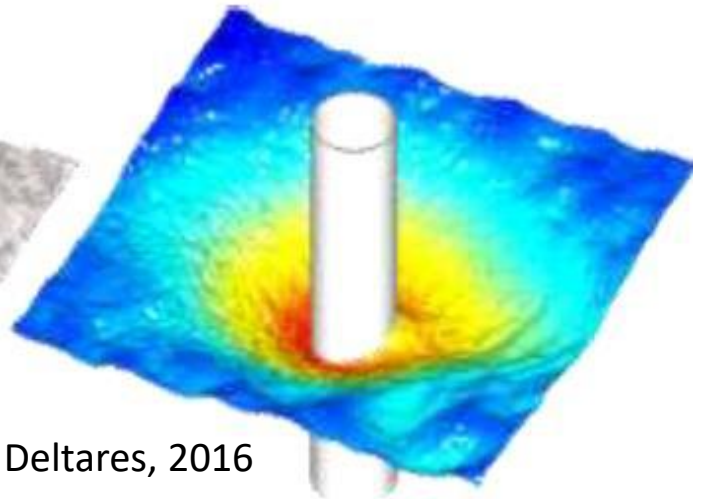
Optimal locations of individual wind turbines? Seabed lowering / raise?

Scour extend /magnitude at wind turbines & offshore constructions?

Seabed level > 40 years?







Deltares, 2016

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Offshore Windfarms

Optimal locations of individual wind turbines?

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Cables

Minimum required burial depth cables > 40 years? => exposure

Maximum possible burial depth cables > 40 years? => thermal radiation

Optimal cable routing with lowest CAPEX-OPEX?

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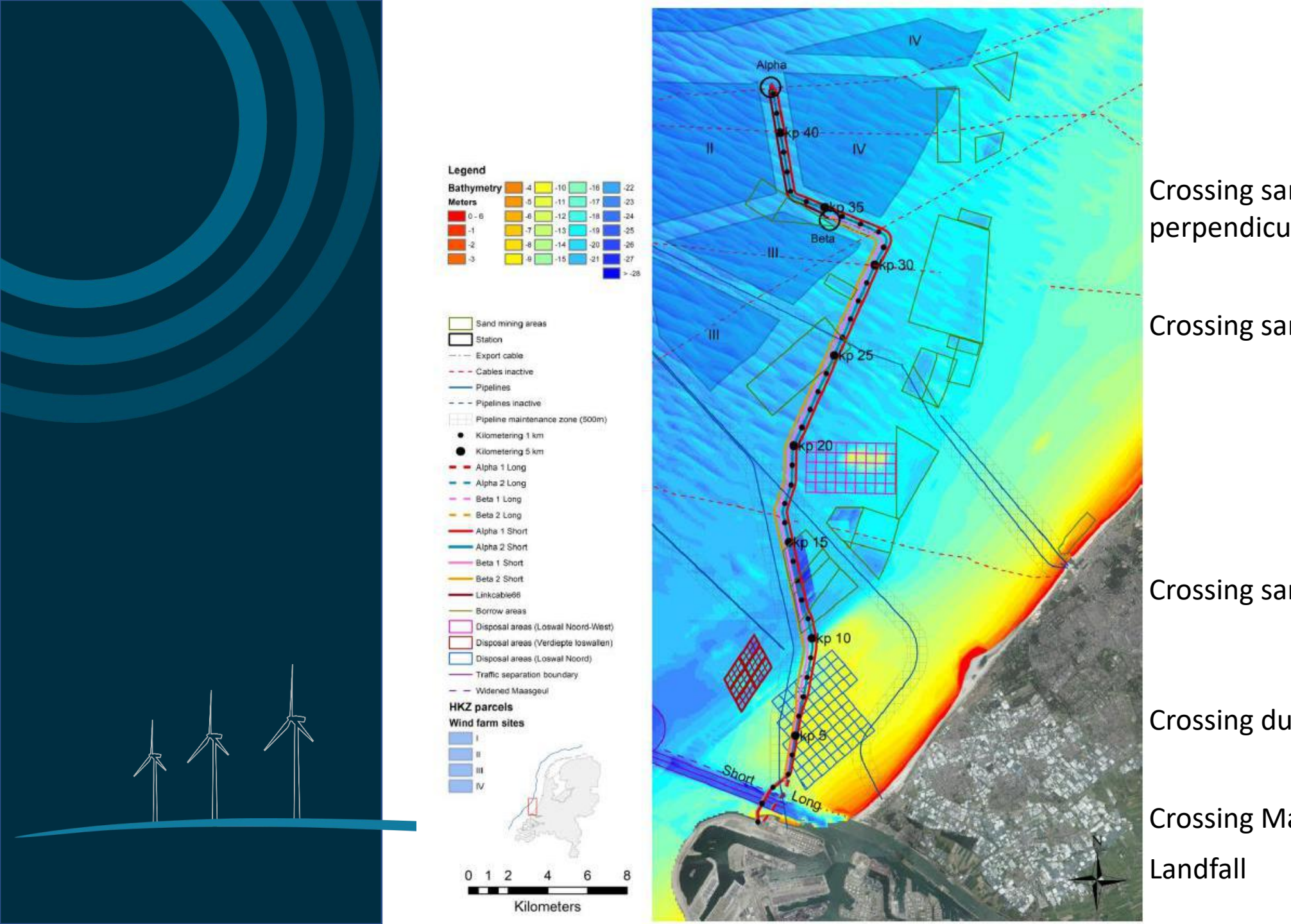

Crossing sandwave field perpendicular

Crossing sandwave field parallel

Crossing sand mining pit

Crossing dumping ground

Crossing Maasgeul

Landfall

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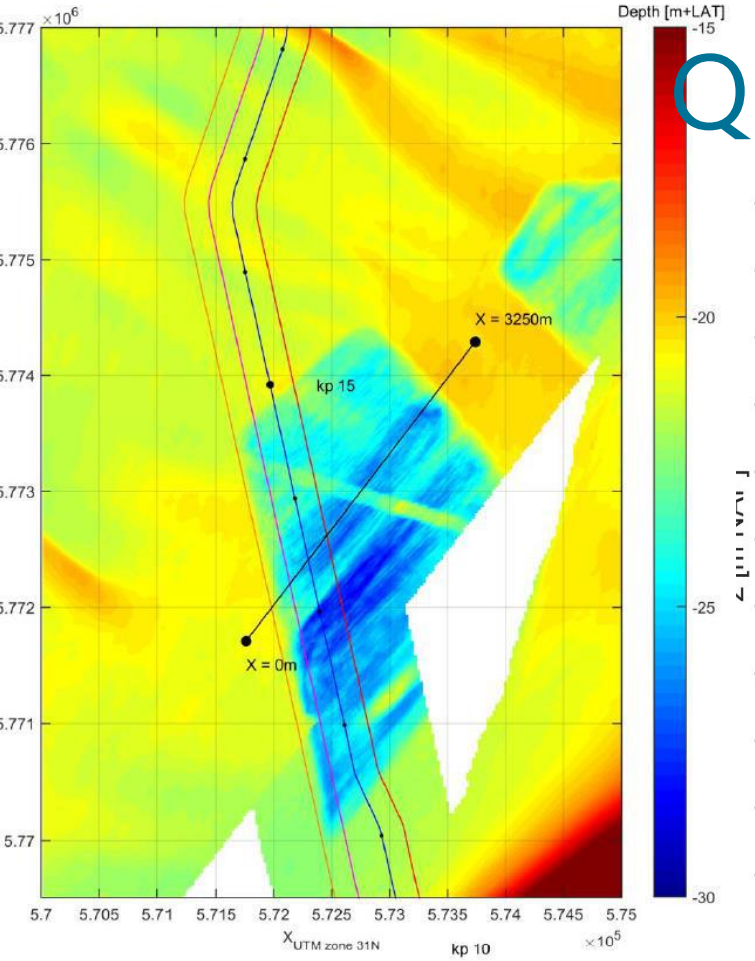

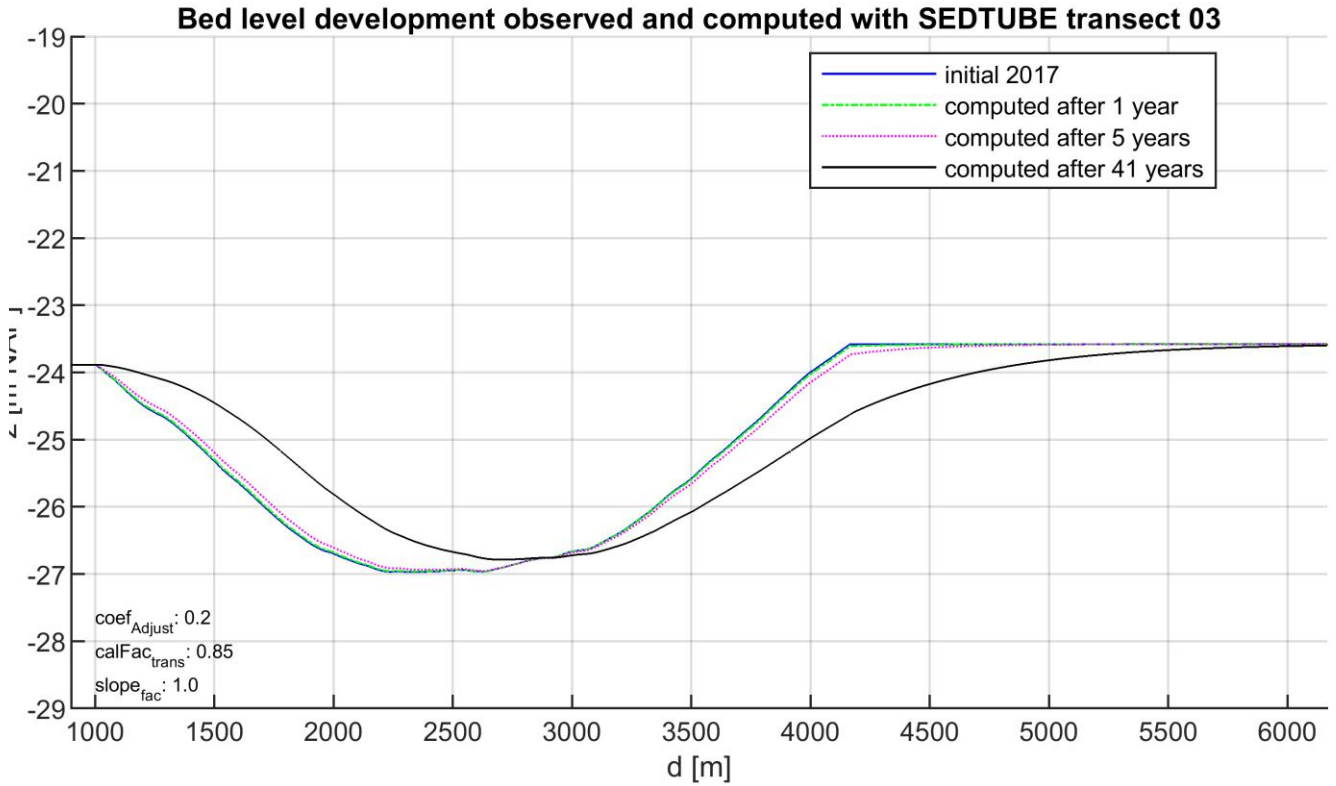

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WATER PROOF

Development of knowledge

Scour (Existing research programme and JIP's ongoing):

- Effect of type of structure
- Effect of sediment characteristics/ depth / environmental conditions

Long-term seabed dynamics:

- Decrease uncertainties seabed dynamics by:
  - High frequent bathymetrical surveys
  - 3D modelling of sand waves to better understand effects of parameters as: depth, tidal flow, waves, grain size, etc. on dynamics
  - Pilot projects (or monitor existing works) of sand wave dredging

Sediment transport & mega ripple dynamics and its effects on:

- sand wave migration
- sedimentation of trenches
- Long-term dynamics of present sand mining areas

Long-term foreshore dynamics:

- How will foreshore evolve in time:
  - given our management strategy not allowing regression of our coastline (steepening of coastline), and;
  - related nourishment strategy

Thermal resistivity of the subsoil:

- Improve the geological & thermal resistivity models
- In-situ measurements of heat dissipation from cables

WATER PROOF

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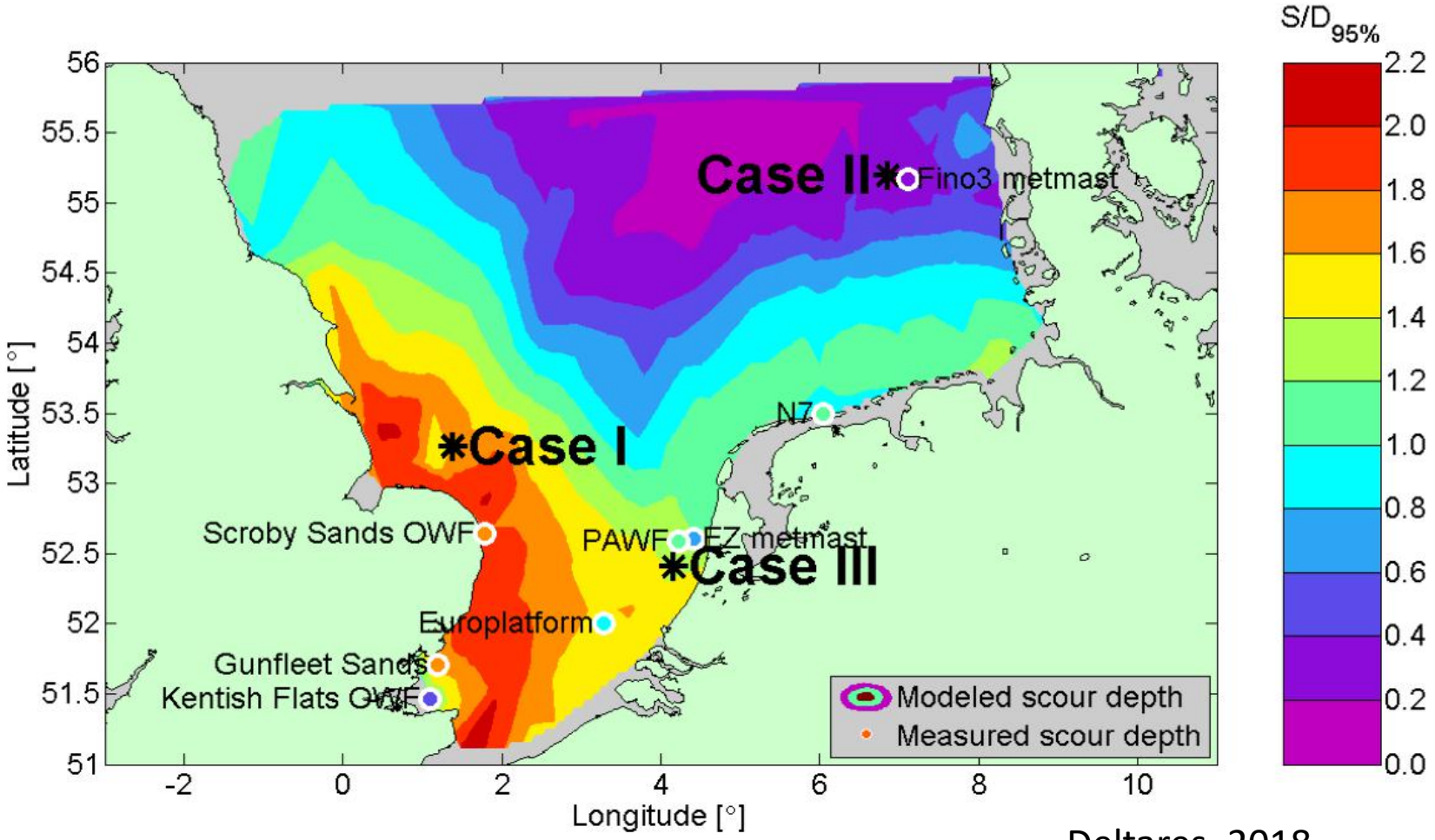
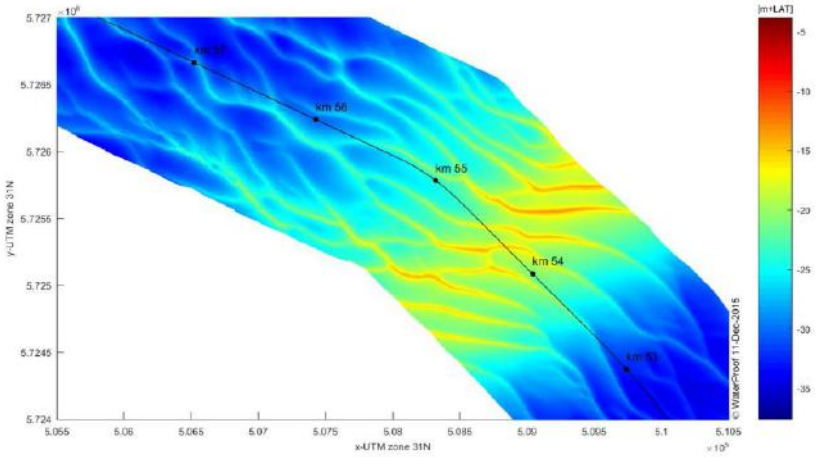


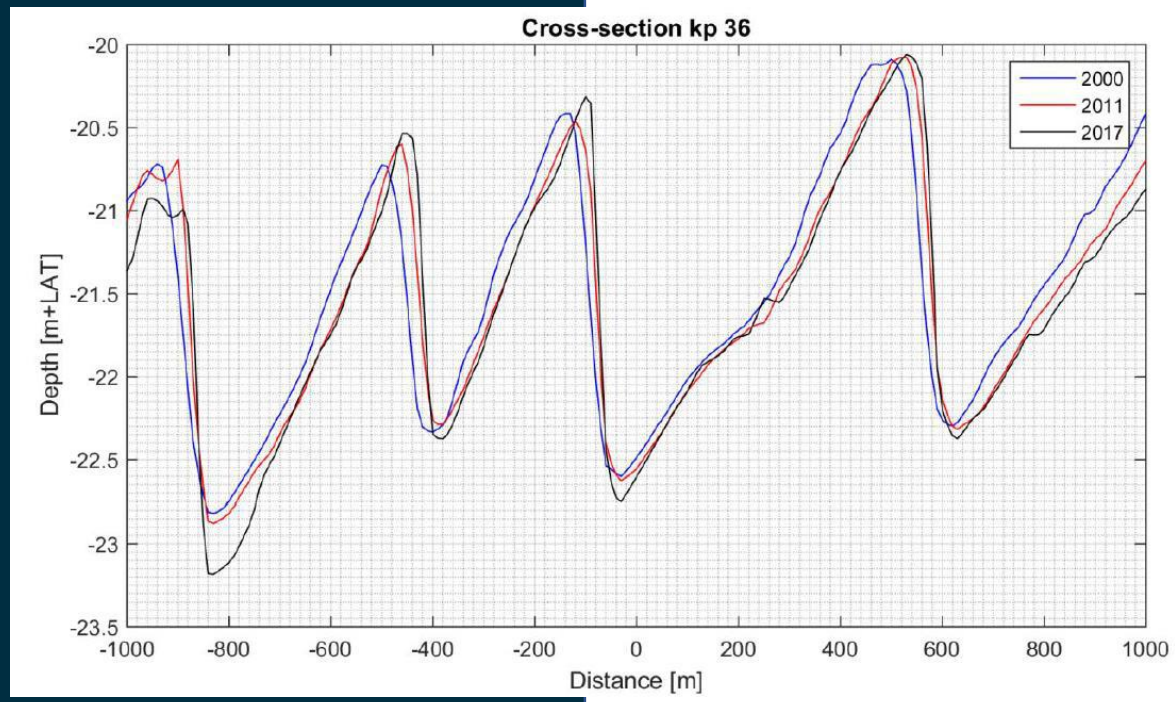
Deltares, 2018

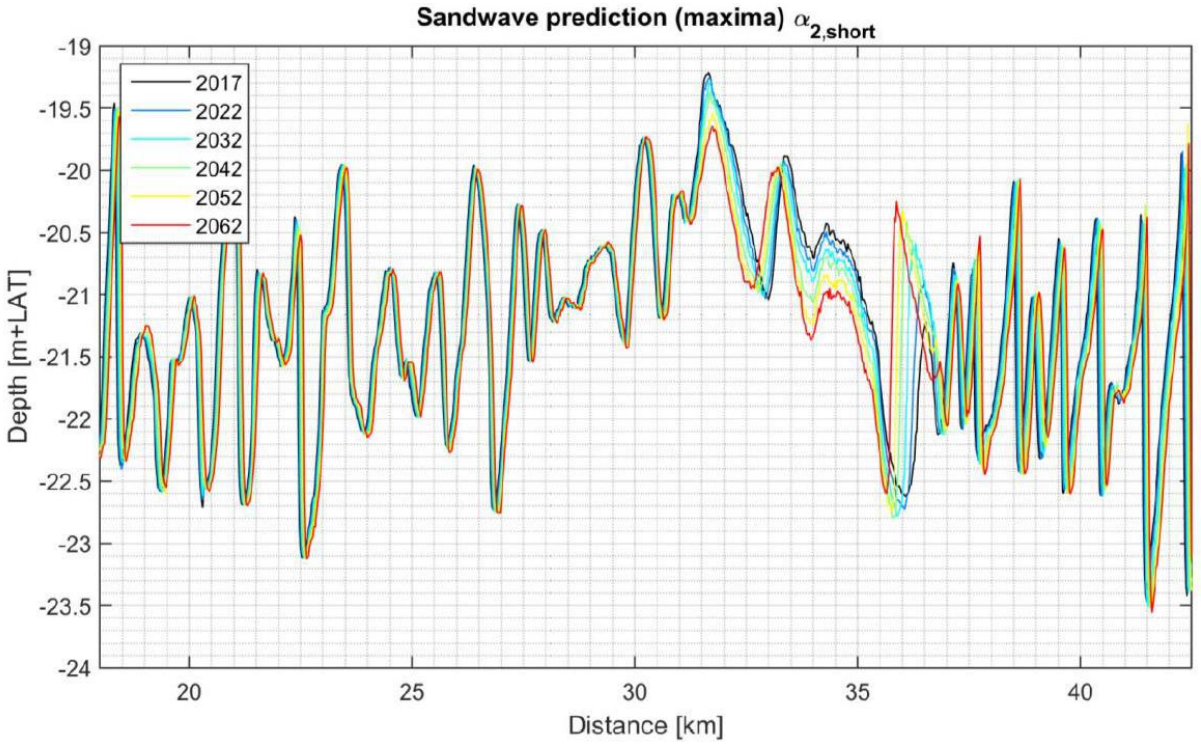
Development of know

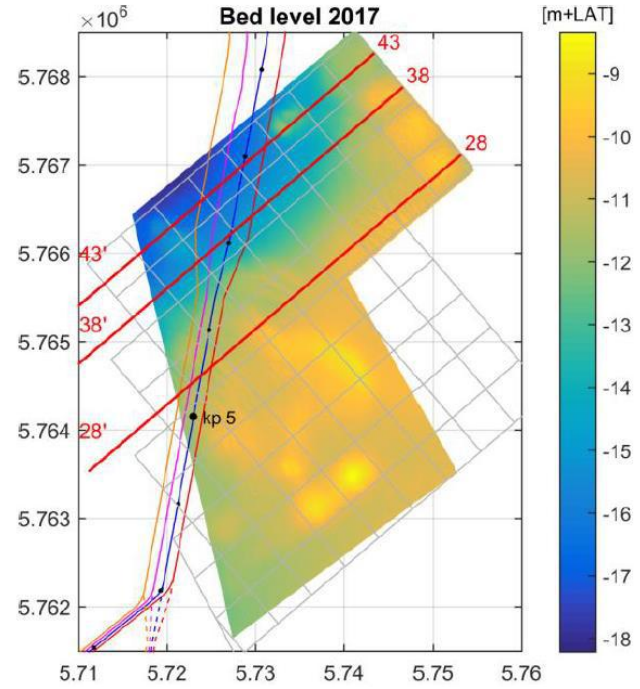


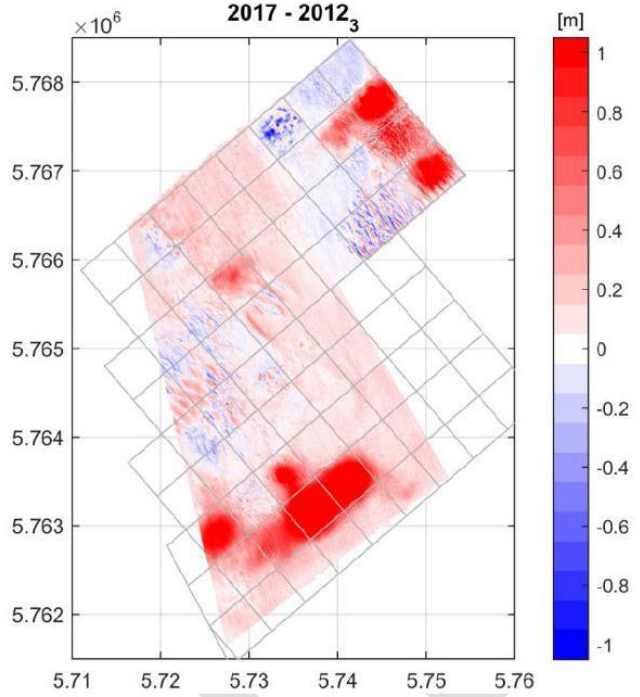
Long-term seabed dynamics:

- Decrease uncertainties seabed dynamics by:
  - More frequent bathymetrical surveys
  - 3D modelling of sand waves to better understand effects of parameters as: depth, tidal flow, waves, grain size, etc. on dynamics
  - Pilot projects (or monitor existing works) of sand wave reformation after dredging









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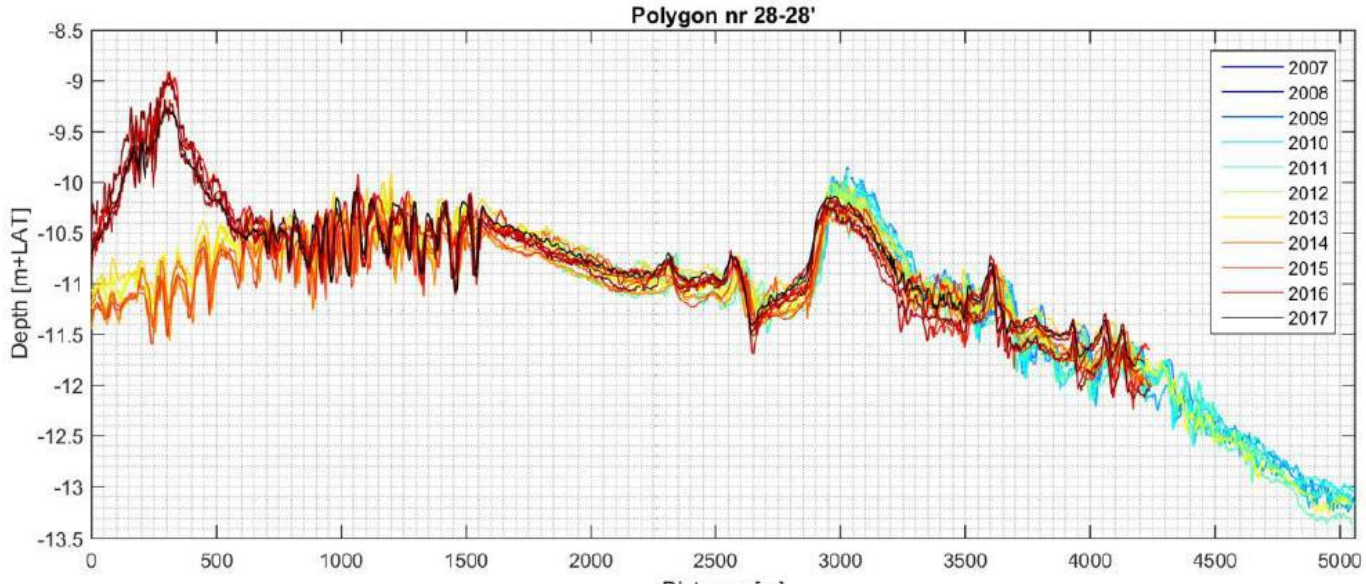

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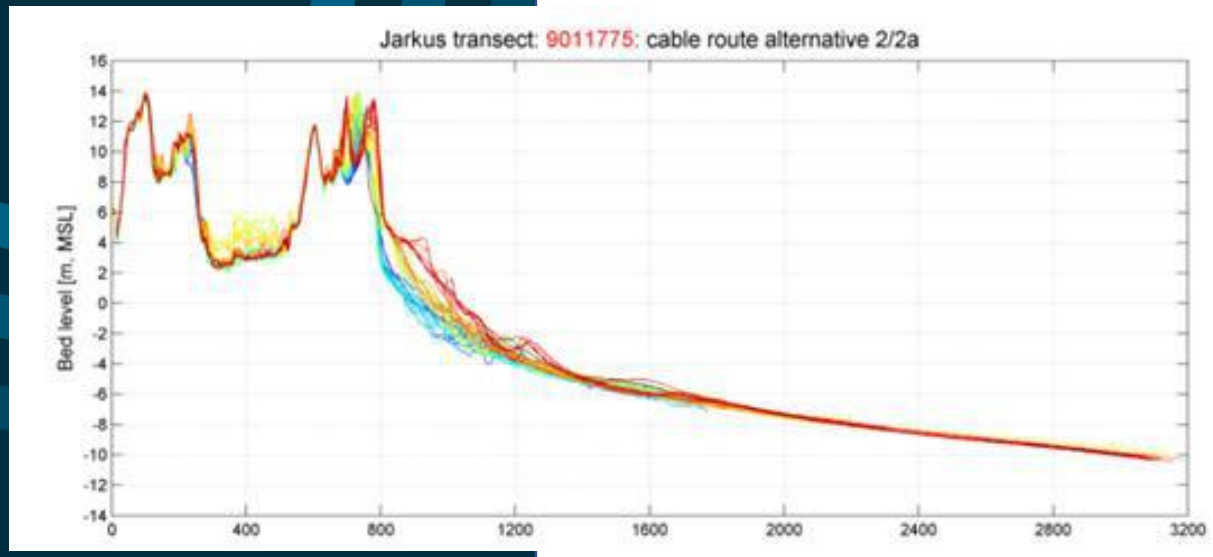

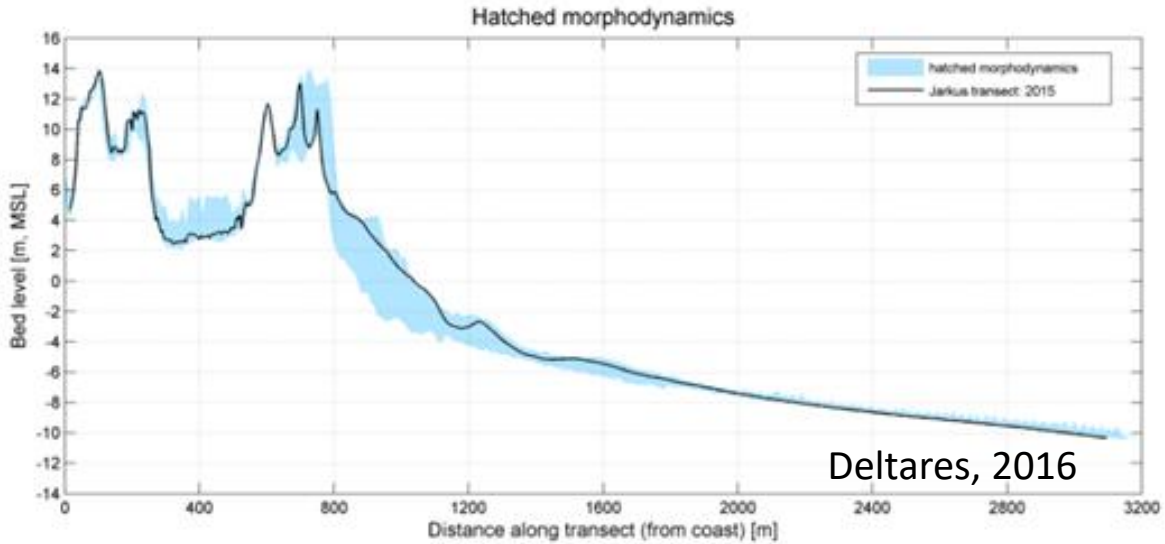

Deltares, 2016

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- How will the foreshore evolve in time:
  - given our management strategy not allowing regression of our coastline (steepening of coastline), and;
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  - Storms irt Climate change

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WATER PROOF

To fully understand the seabed dynamics and decrease the uncertainties in our designs, a combination of frequent measurements and 3D modelling is key