ShorelineS TKI

Bas Huisman & Dano Roelvink

Deltares

Deltares
Enabling Delta Life

UNESCO | IHE DELFT

TKI - ShorelineS

What it is?

- Develop long-term coastline model : "ShorelineS"
  - Sandy coastlines
  - Decadal time scales
  - Knowledge of the system / software

- Joint-Industry-Project
  - Deltares & IHE-Delft
  - 4 Dredgers
  - 9 Engineering firms
  - 2 International institutes

- Ministry of Economic affairs

Why?

- Efficient   (> 10years in minutes to hours)
- Easy to apply (low effort)
- include complex situations
  - Elongated sand spits
  - Coastline undulations / Headlands
  - Harbour breakwaters / Dunes
  - Coastal structures
  - Embayed beaches
  - Rocky headlands
  - Deltaic areas / Island heads
- Accurate (no wave-climate reduction)
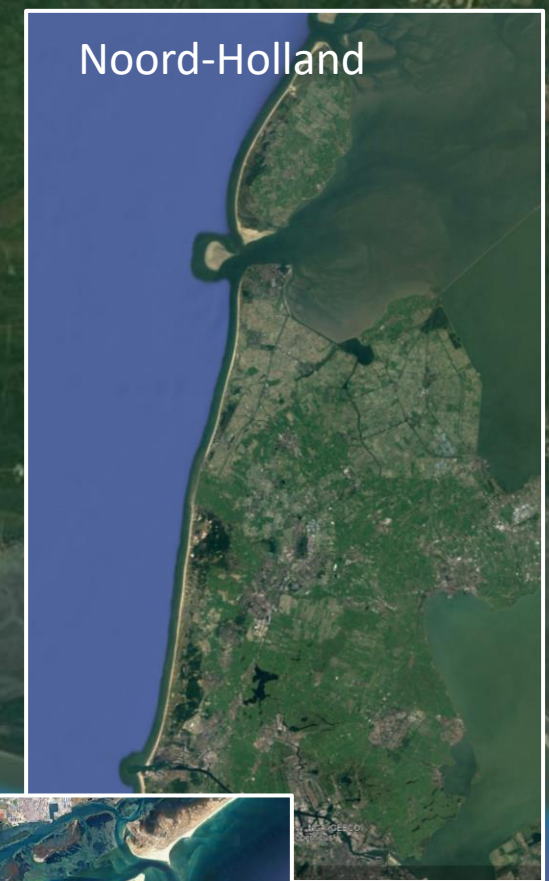

Charleston

IJmuiden
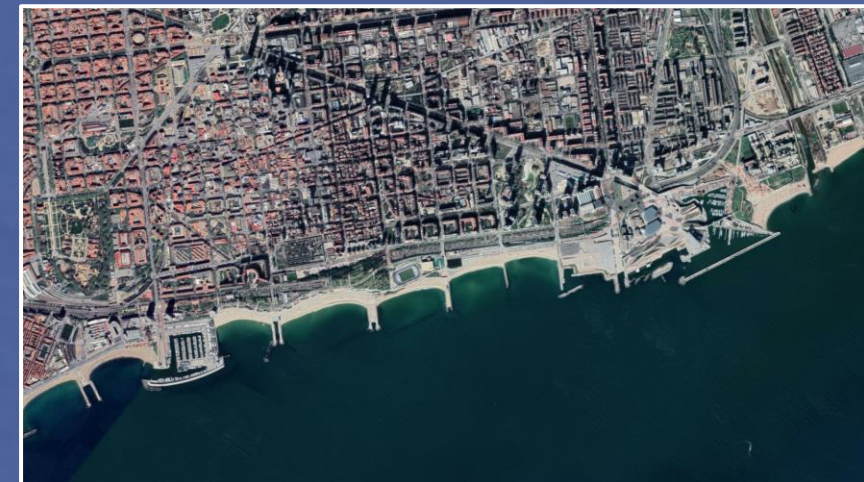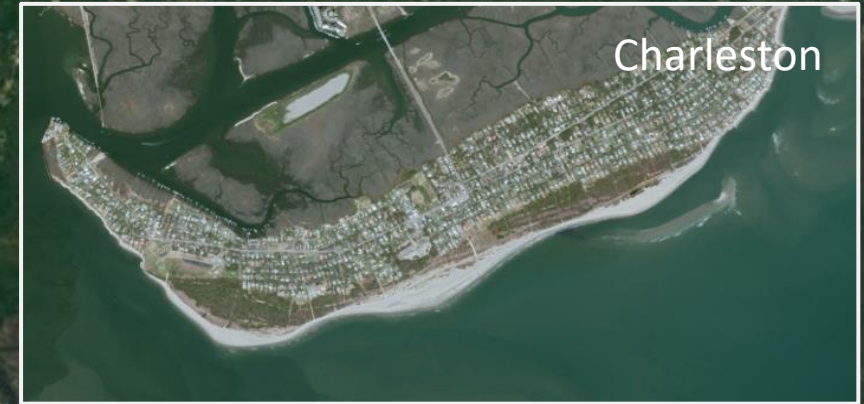
Applications?

- Evaluate nourishment strategies & SLR impact
  - embayed coastlines (Africa, Australia, India)
  - Deltas (spits, tidal channels)
  - SLR impact on Metropolitan areas

- Effectiveness & lifetime of local measures
  - (large-scale) sand nourishments
  - Harbour breakwaters
  - Coastal schemes (groynes / breakwaters)
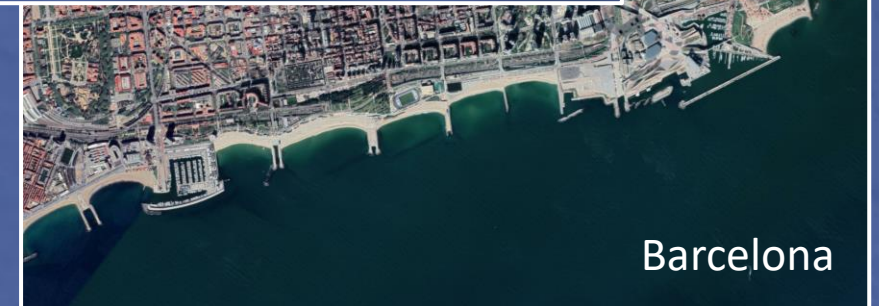
- Get a quick answer

India

Noord-Holland

Faro

Barcelona

Deltares - voettekst
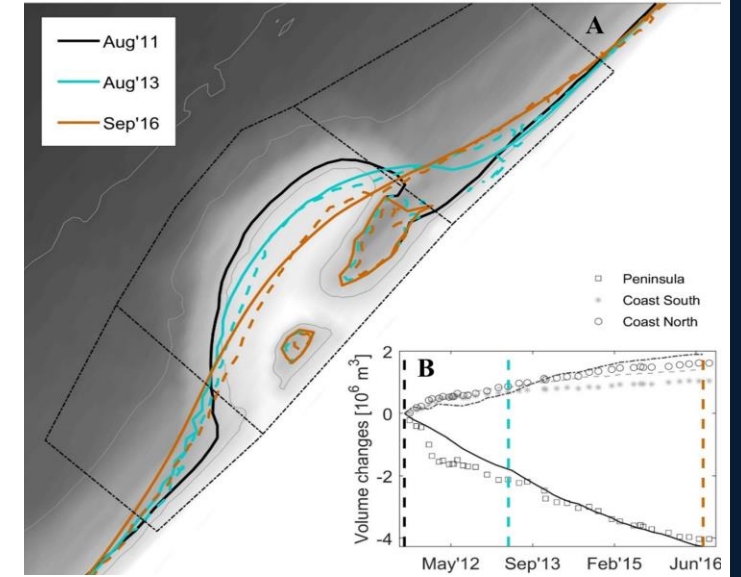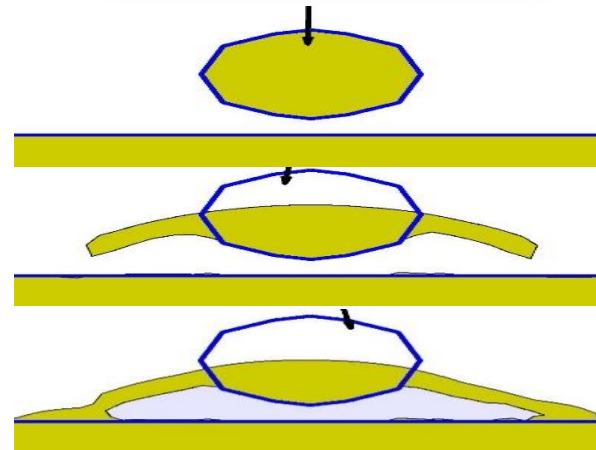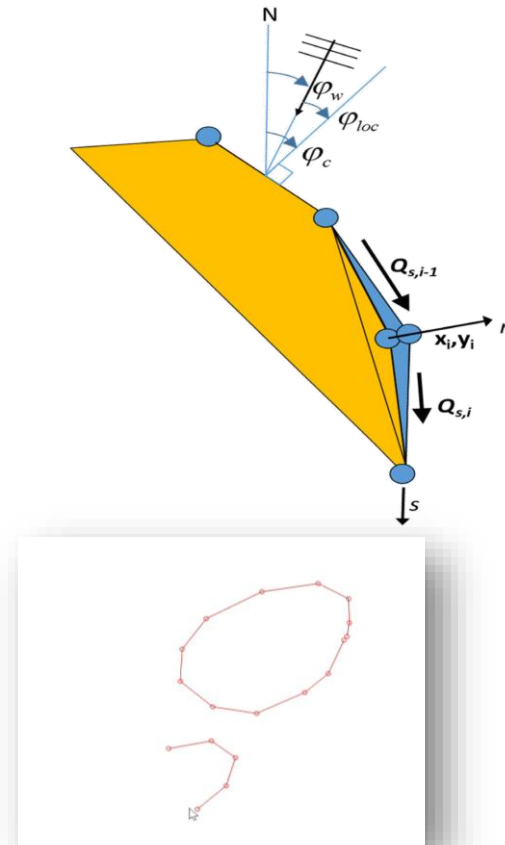
Applications

Technical features

- flexible grid generation
- merging and splitting
- high- and low angle waves
- combine complex processes

Sand Motor

- Forecast of lifetime
- Include lagoon

Lobito spit

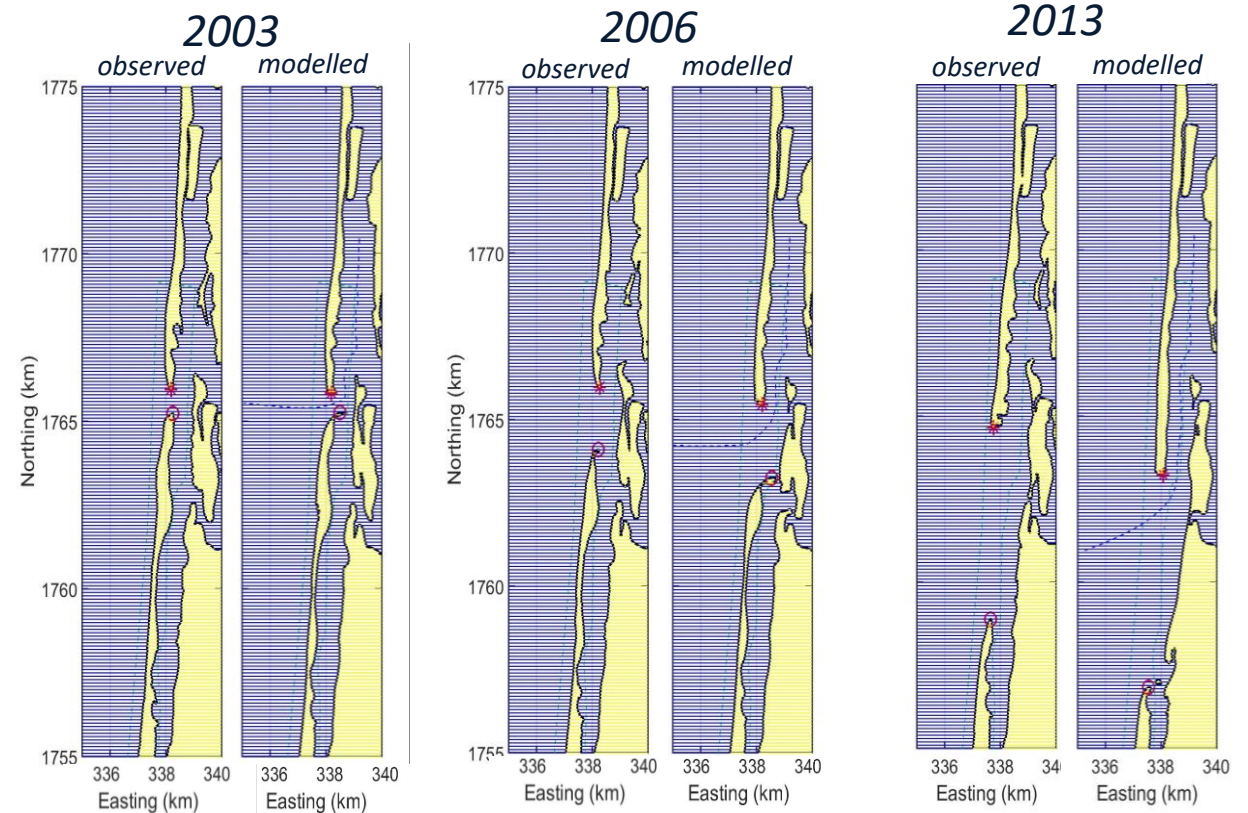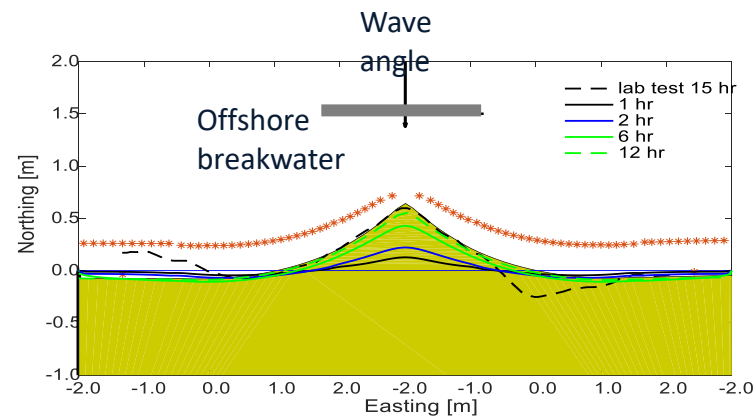- Complex coastal dynamics
- Structures

Applications

El Gamil (pilots)

- Scheme with coastal structures
- Infill with sand
- Shielding of waves

Senegal

- North-South sediment transport
- Erosion
- Sand spit (Senegal)
- Inlet migration
 (barrier island)

Project reference Ahmed Elghandour (IHE-Delft) : a.elghandour@un-ihe.org

Scope

T1 : Climate conditions	
	■ wave couplings
	■ tide conditions
	■ implement sea level rise
	■ multiple offshore breakwaters
T2 : Complex coastal features	
	■ groyne wave shielding
	■ rocky outcrops / revetments
	■ nourishments / sediment
T3 : Cross-shore shoreface	
	■ beach-dune coupling
	■ lower shoreface coupling / bar
T4 : Code efficiency & structure	■ code efficiency & software structure
T5 : Testbed / Version control	■ code validation algorithms & testbed
T6 : Case studies	■ interfaces & pre- and postprocessing
	■ pilot applications (e.g. North-Holland coastline)

|		
Deltares	**45%**	**Developer / management**
IHE	**15%**	**Developer / Publications**
Partners	**40%**	**Case studies focusing on T1 to T3, input in testbed**

Deltares

North-Holland coast

- **Hindcast / Forecast**
  Long-term
  nourishment strategy

- **Hondsbossche dunes**
  Longshore spreading

- **Supply to dunes**
  Aeolian transport

- **Shoreface nourishments**
  Interaction with
  middle-shoreface
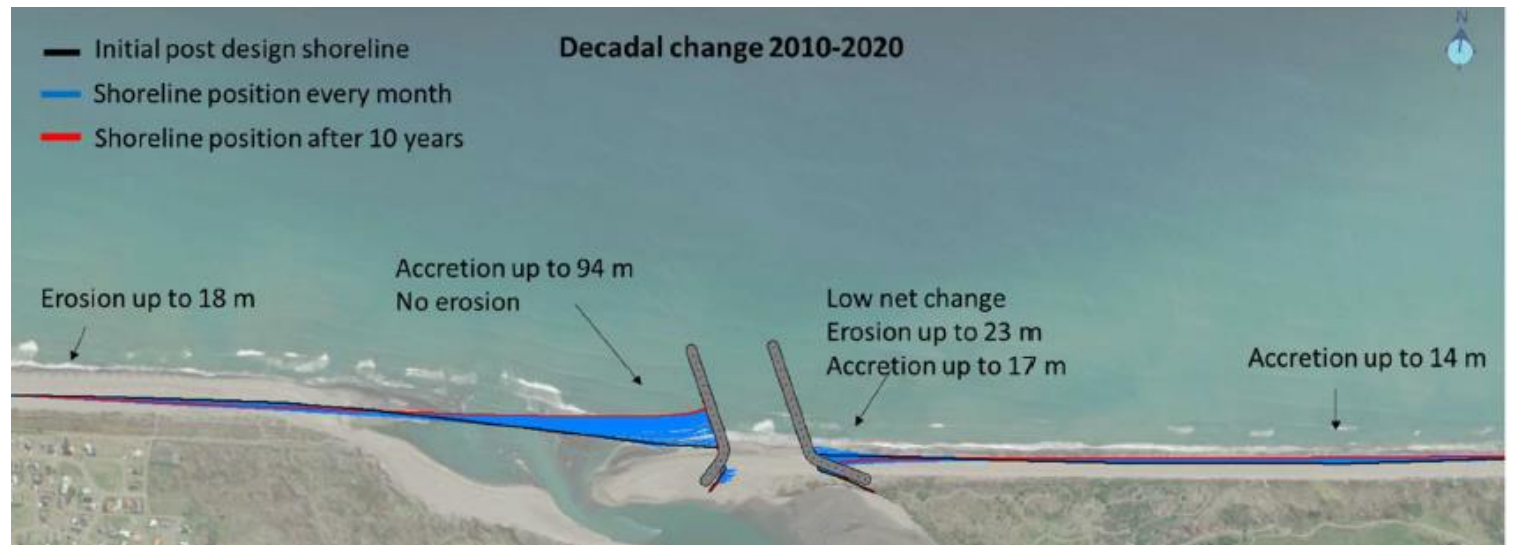
- **Climate impact**
  wave conditions & SLR
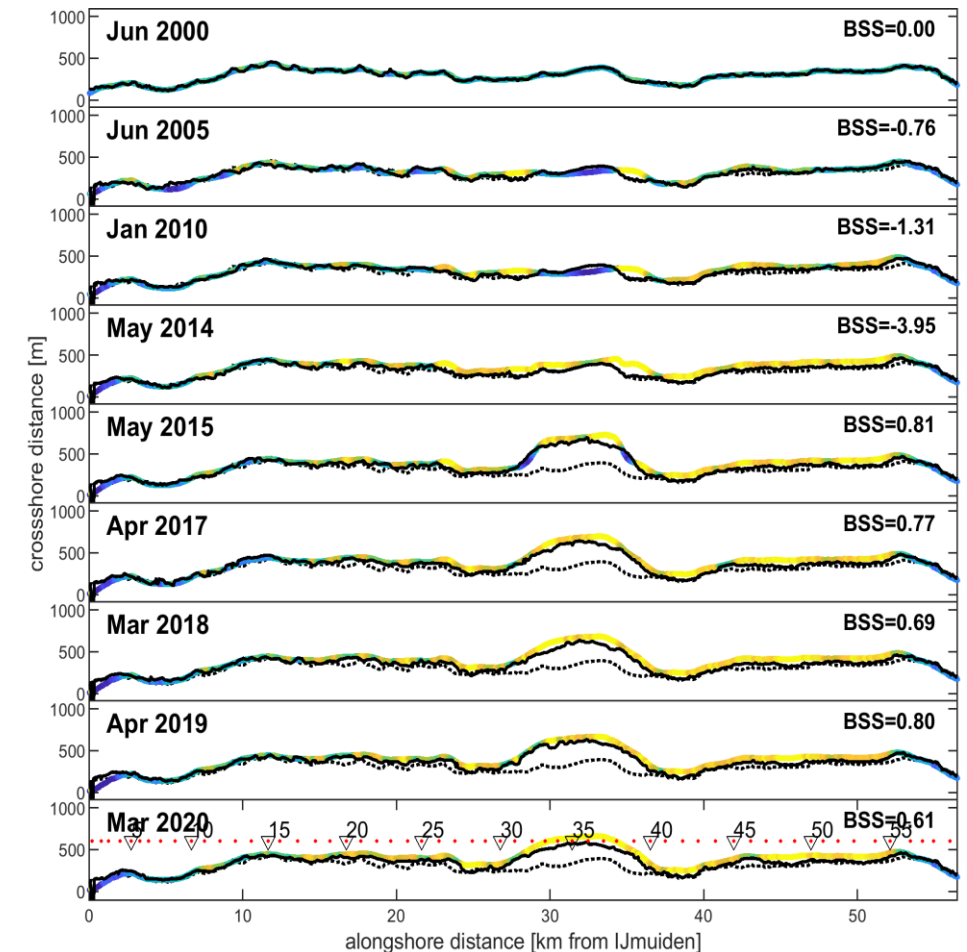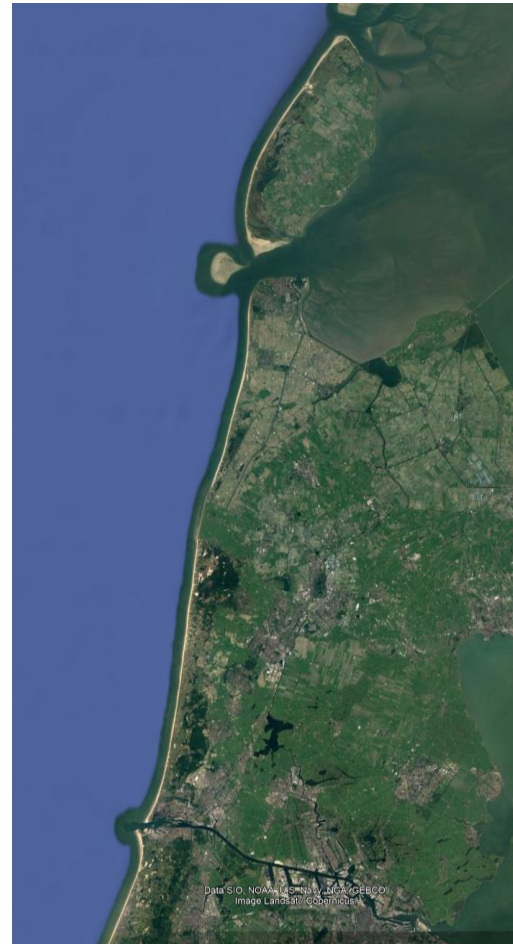
Flemish coast (WL-Borgerhout)

- **Influence of wave & tidal currents**
  Implement tide transport

- **Blockage by groyne system**
  Cross-shore distribution of the sediment transport

Deltares

Ōpōtiki Harbour Development (Tonkin & Taylor)

- West-> East longshore transport

- **Shielding of the waves** Parameterization of shielded conditions

- **Bypassing of structure** Parameterization of cross-shore distribution of the longshore current

— Initial post design shoreline
— Shoreline position every month
— Shoreline position after 10 years

Decadal change 2010-2020

Erosion up to 18 m

Accretion up to 94 m
No erosion

Low net change
Erosion up to 23 m
Accretion up to 17 m

Accretion up to 14 m
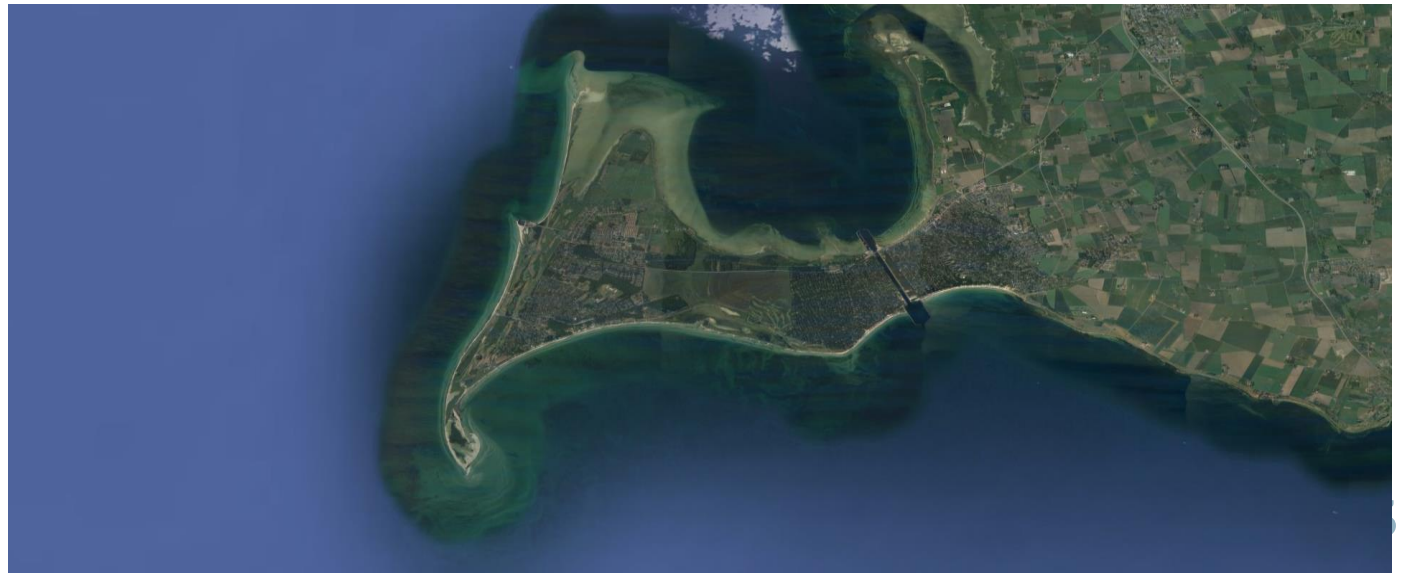
Ystad (Sweco)

- Ystad

  - Low energy beach (Ystad)
    Nourishments
    Time-lag of supply
    Dune growth
    Cross-shore interactions

- Falsterbo peninsula
  (optional)

  - Spit type coast
    Curvature of spit

  - Dune system / Port

Failaka island (KISR)

- East-> West longshore transport

- **Rocky bed features** blockage of transport

- **Reef / hard shoreface** Effect on wave transformation ->2D wave model

- **Infill in marina** Verification of transport

Conclusions

- Momentum in developing a long-term / efficient model

- Opportunity to enhance knowledge on coastal systems

- First assessment of climate impacts of nourishment strategies

- Blends in with other projects:

  Dutch coastline challenge -> extends time horizon

  KPP-ZSS -> relevant for phase 2 (market research)

  International work with World Bank

  Research on (shoreface) nourishments

  Market projects (e.g. impacts of harbours / windparks)

Deltares