Deltares
Enabling Delta Life

DSD 2016: XBeach and Earth Observation course: Assessment of Nature-based Flood defenses

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XB-VEG

RISC-KIT
RESILIENCE-INCREASING STRATEGIES FOR COASTS - TOOLKIT
WWW.RISCKIT.EU

FAST
FORESHORE ASSESSMENT USING SPACE TECHNOLOGY

Program of today

Time	Type	Description
09:15	**Theory**	The different modes of XBeach (i.e. stationary, surfbeat, nonhydrostatic)
09:30	**Theory**	XBeach-VEG
09:45	**Hands-on**	Lovas (2000) by van Rooijen et al., 2016 – understanding the impact of vegetation on wave height and setup
11:00	**Theory**	Earth Observation – from image to info
11:15	**Hands-on**	Continue with the exercise Lovas (2000)
12:00	**Practical**	RISCKIT and FAST information
12:30	**Lunch**	
13:30	**Practical**	Nesting: XBeach to LISFLOOD
14:00	**Hands-on**	The vegetated foreshore of Tillingham, UK - from hazard to inundation with Xbeach and LISLFOOD
17:00	**Closure & drinks**	

Part 4a. Practical

NESTING: XBEACH TO LISFLOOD WITH DELFT DASHBOARD (DDB)

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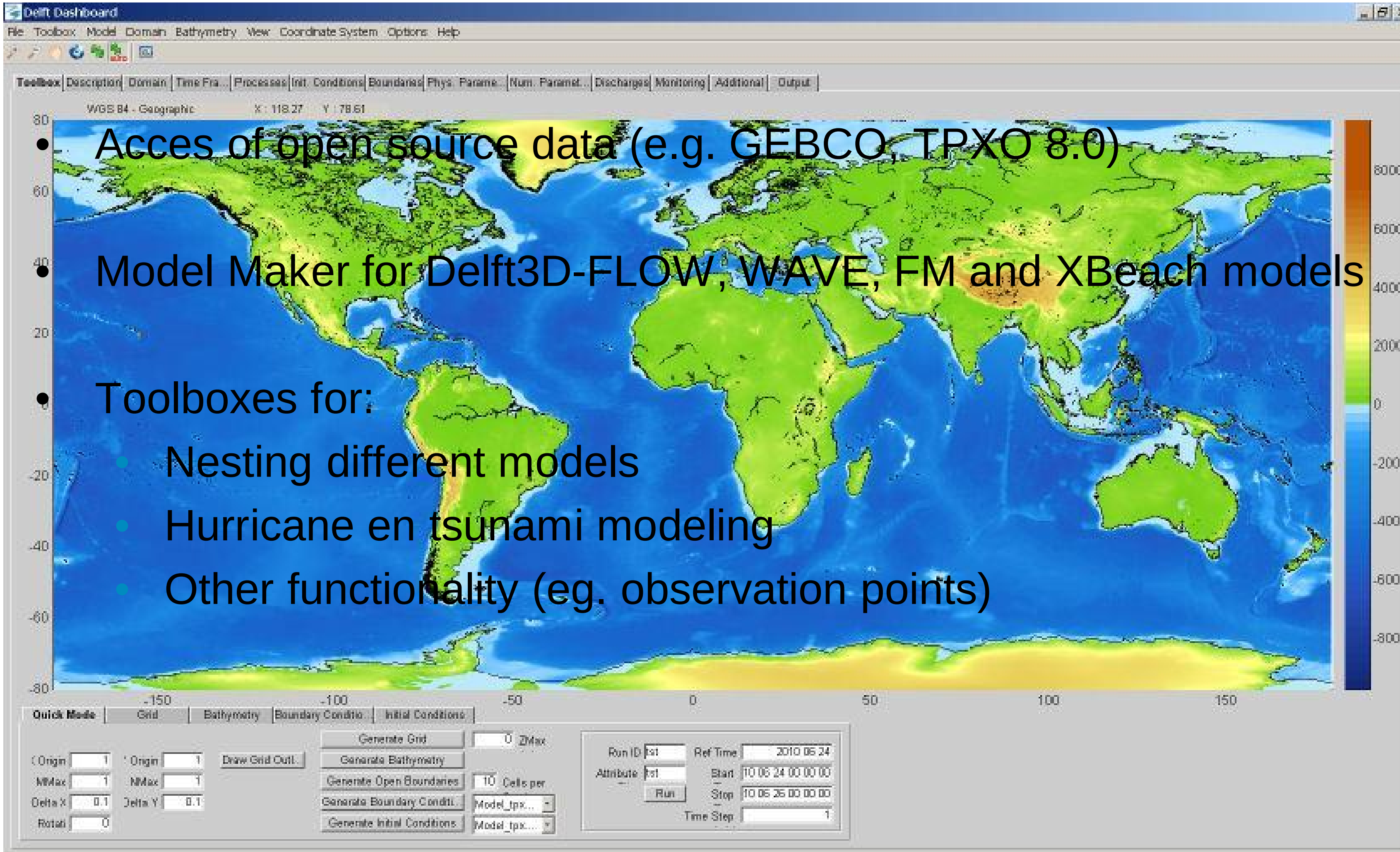
Delft Dashboard is a quick set-up tool for coastal and estuarine model



- Acces of open source data (e.g. GEBCO, TPXO 8.0)
- Model Maker for Delft3D-FLOW, WAVE, FM and XBeach models
- Toolboxes for:
  - Nesting different models
  - Hurricane en tsunami modeling
  - Other functionality (eg. observation points)

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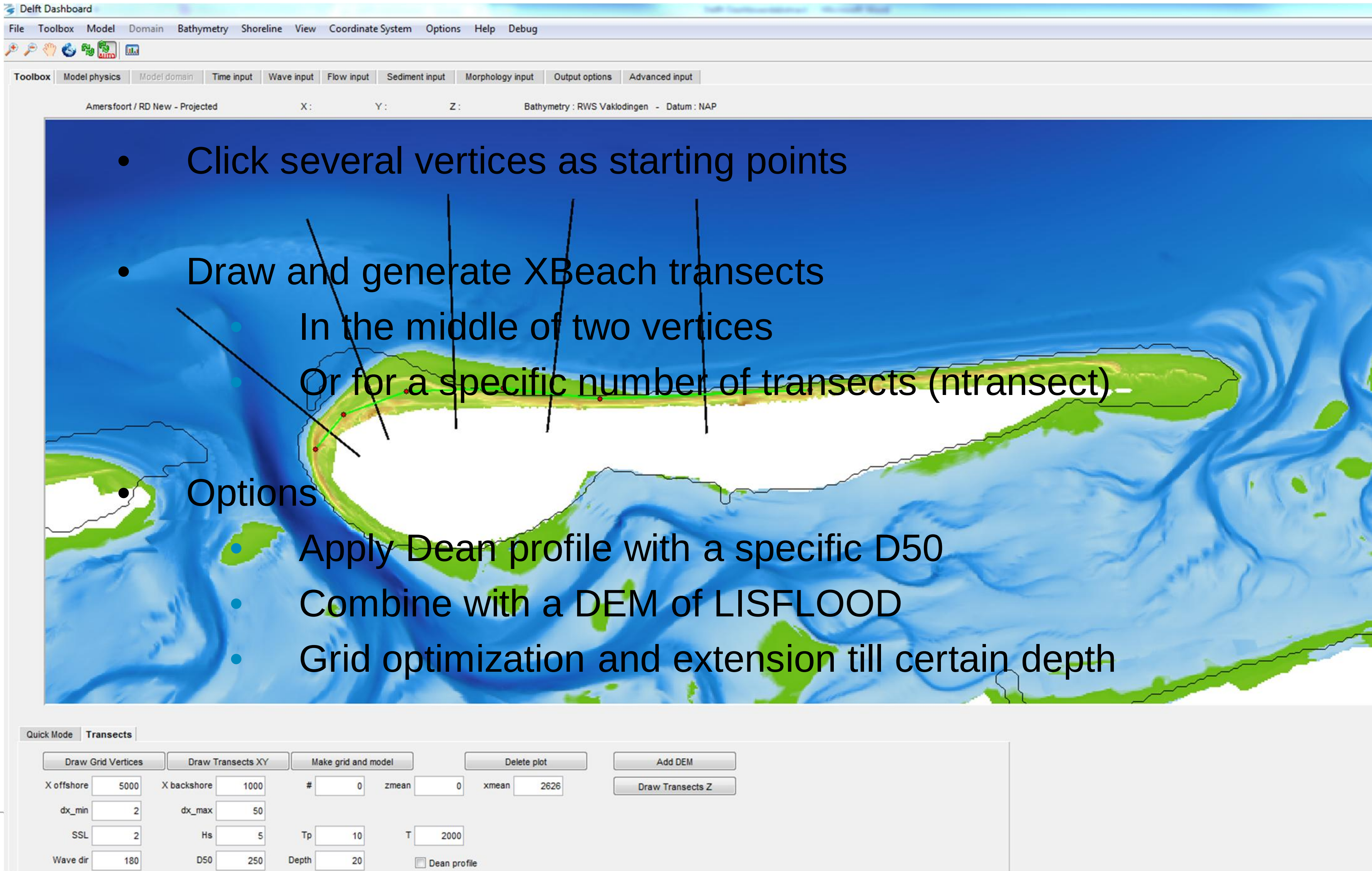
XBeach transect models can be created in less than 5 minutes with DDB

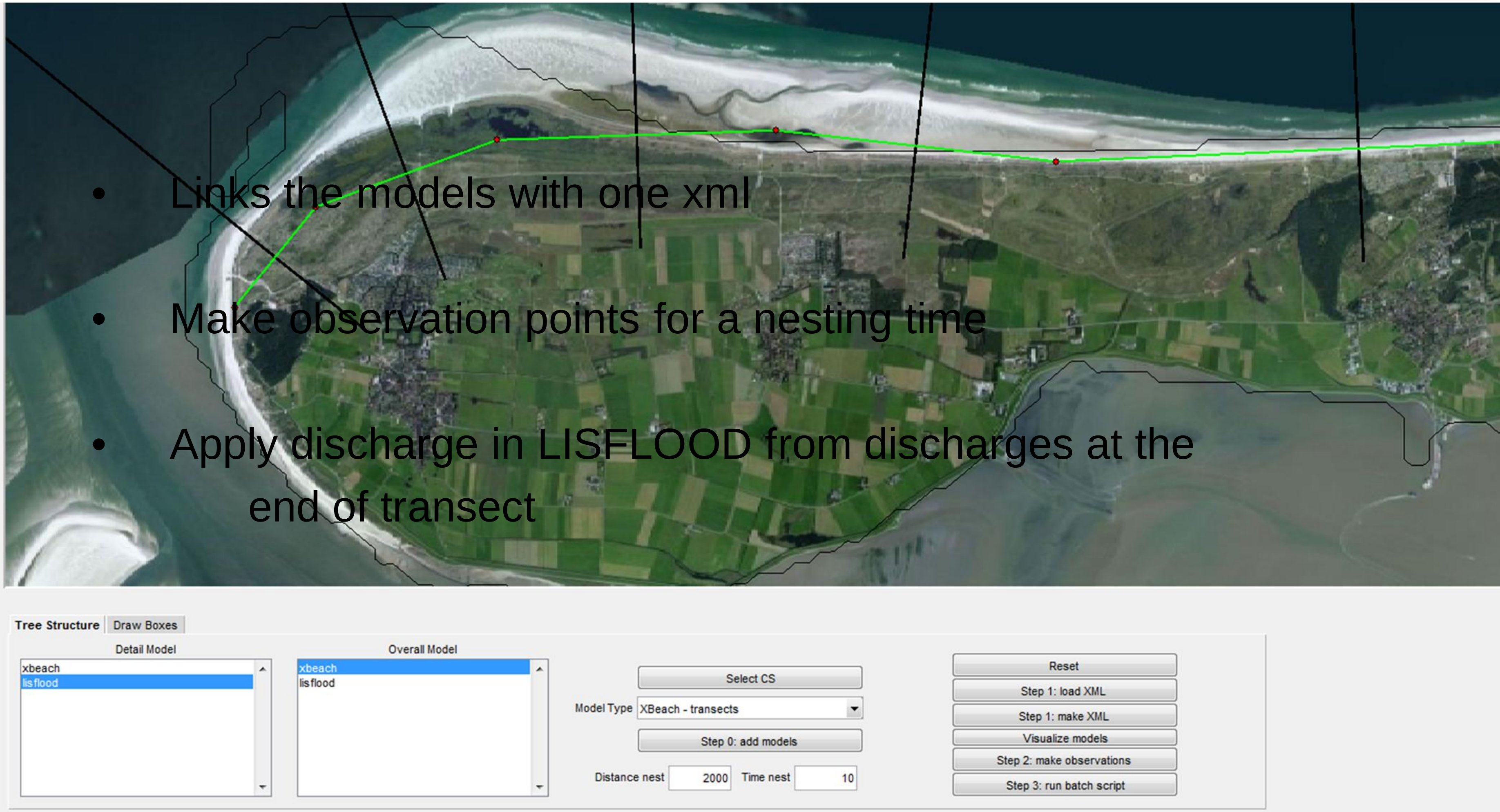
XB-VEG

- Click several vertices as starting points
- Draw and generate XBeach transects
  - In the middle of two vertices
  - Or for a specific number of transects (ntransect)
- Options
  - Apply Dean profile with a specific D50
  - Combine with a DEM of LISFLOOD
  - Grid optimization and extension till certain depth



Nesting: XBeach – LISFLOOD with a few mouse clicks

- Links the models with one xml
- Make observation points for a nesting time
- Apply discharge in LISFLOOD from discharges at the end of transect



Part 4b. Hands on

THE VEGETATED FORESHORE OF TILLINGHAM, UK - FROM HAZARD TO INUNDATION WITH XBEACH AND LISLFOOD

What do we need?

XB-VEG

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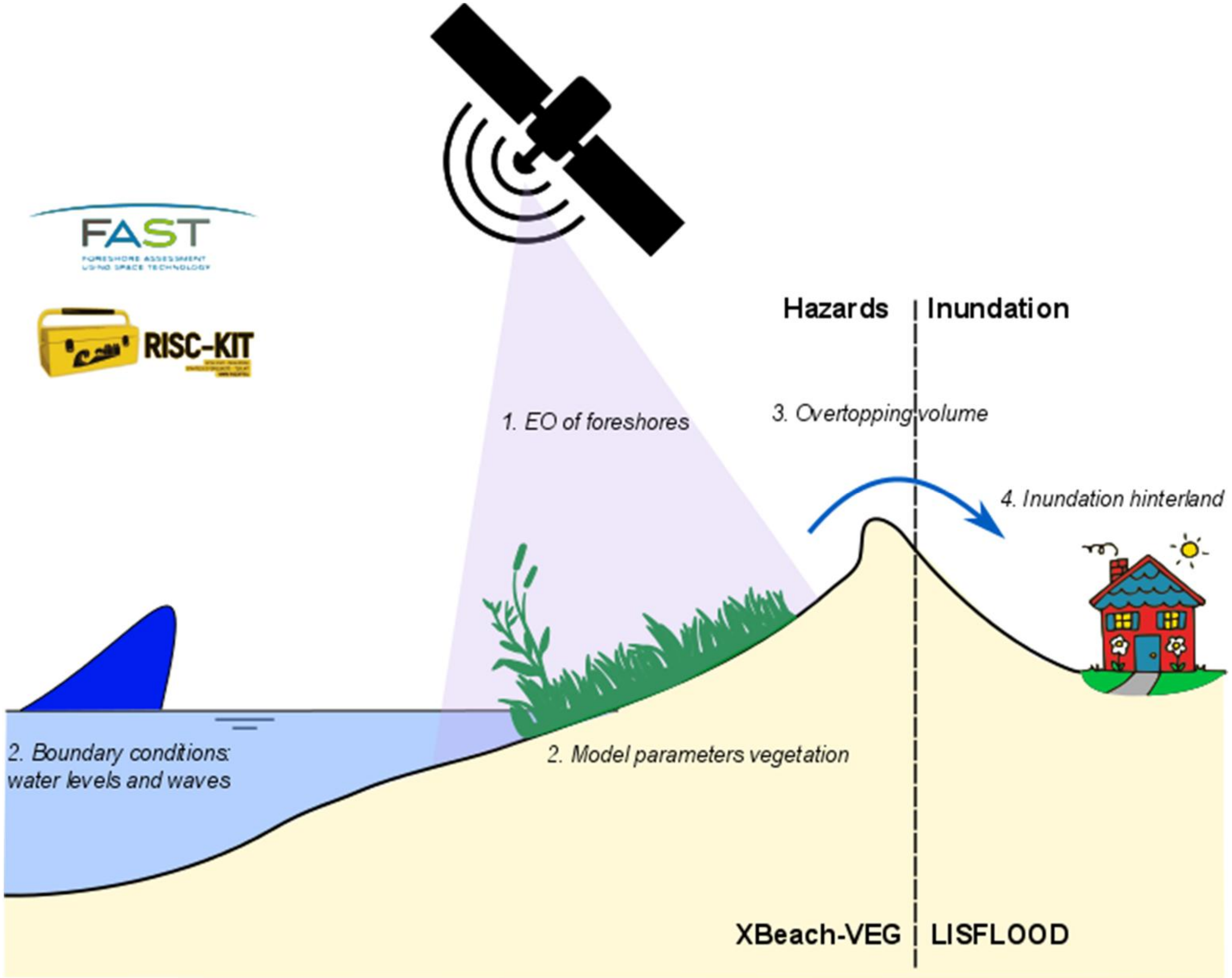
FORESHORE ASSESSMENT USING SPACE TECHNOLOGY

RISC-KIT



The location: Tillingham

East coast of UK: considerable wave exposure

Tidal range 5.7 m

Eroding over past 50 years

Extensive gently sloping mudflat in front

Marsh plain 350-1000 m

see www.fast-space-project.eu for other field sites

see fast.openearth.eu/expert for available map layers

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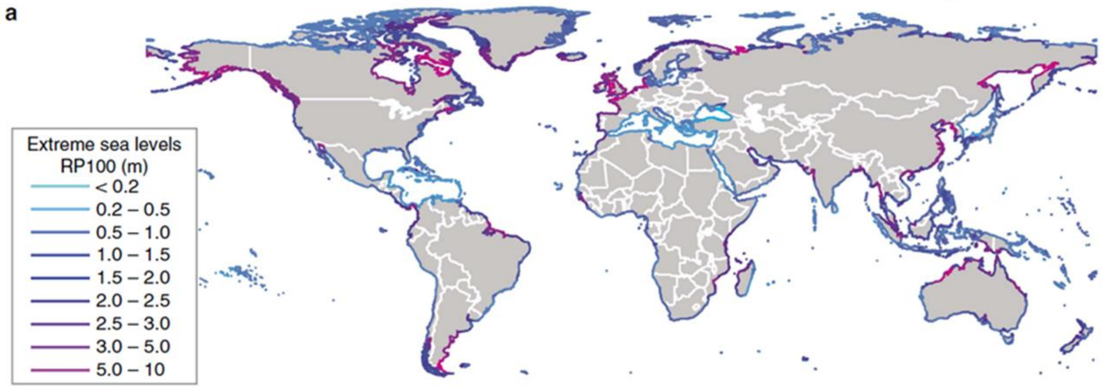
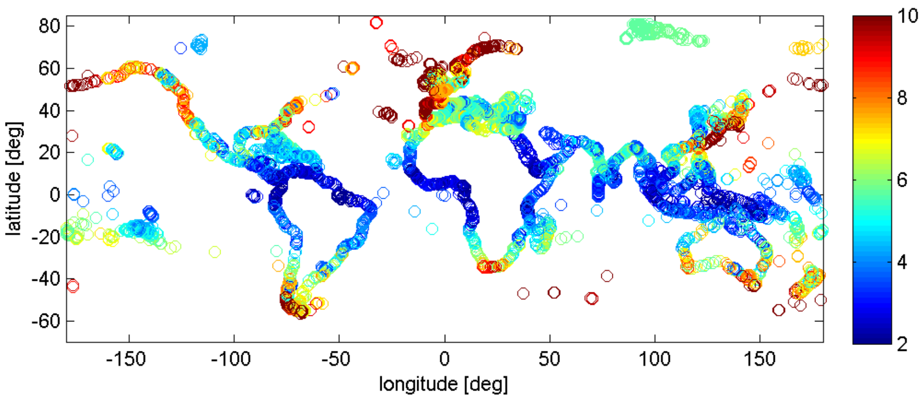
Global data sources

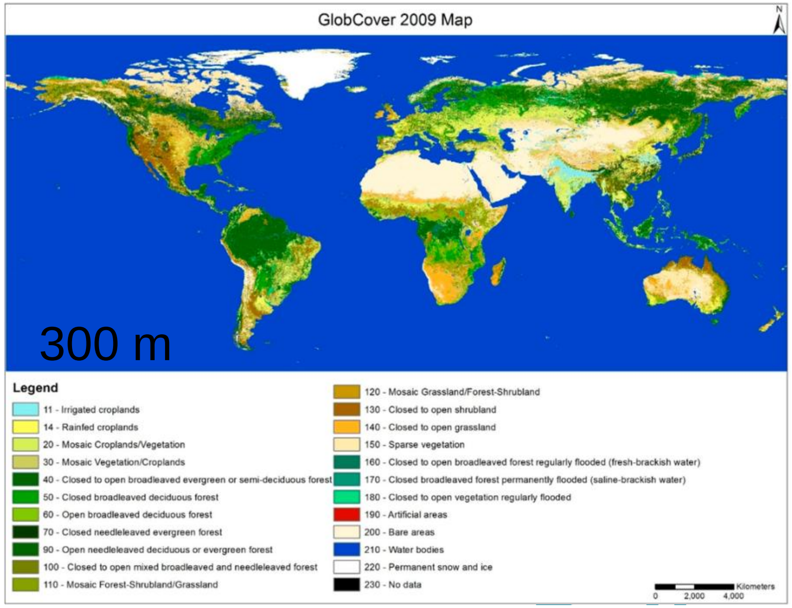
Global bathymetry and topography from SRTM and GEBCO.



Global extreme water levels (tide + surge) for a return period of 100 years. From Muis et al. (2016).



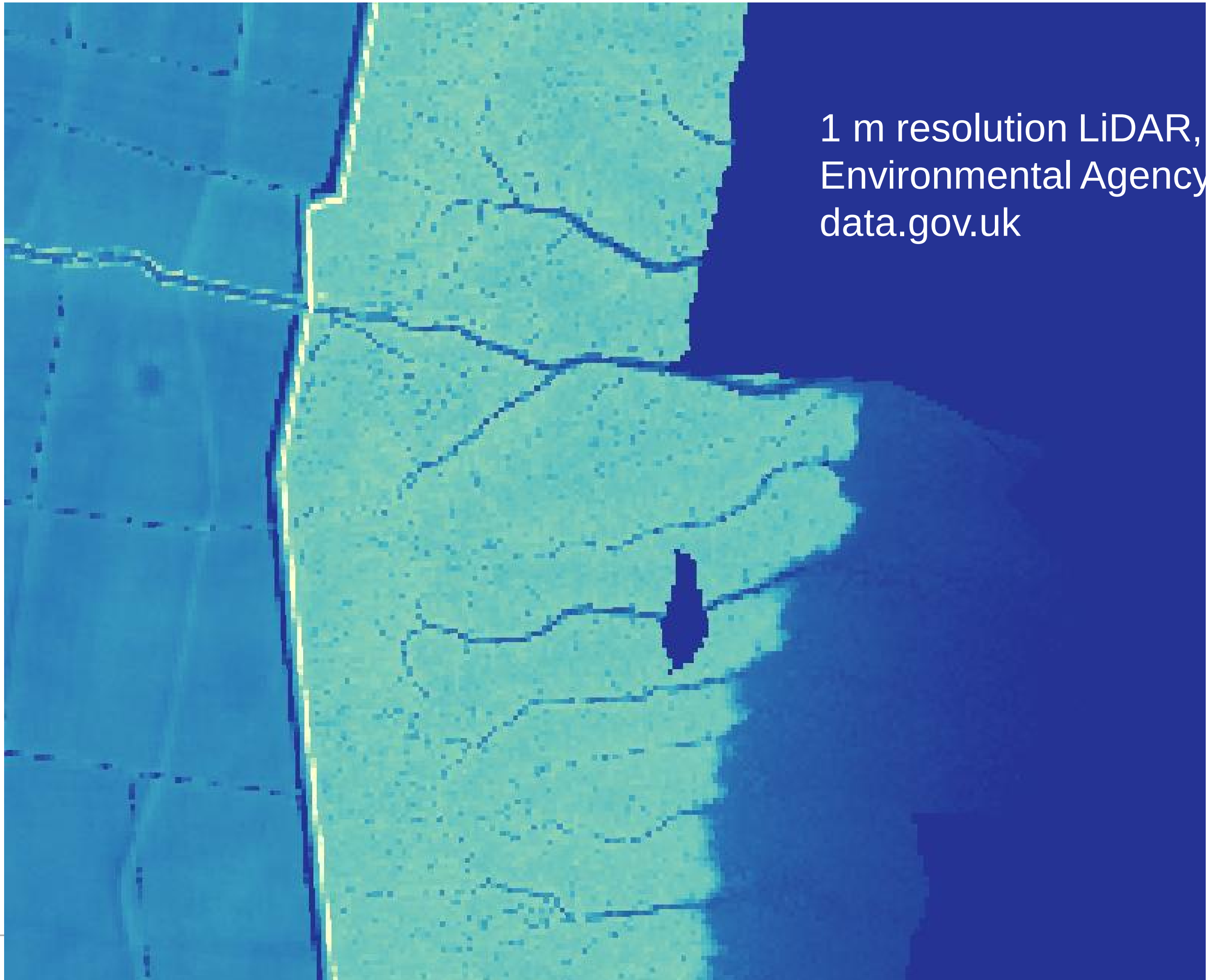
Global significant wave heights and periods from ERA-Interim.



Global levee heights?
Intertidal is problematic

Global vegetation cover: Globcover 2009.

Bed level



Boundary conditions - Waves

1/100 years

based ERA-Interim

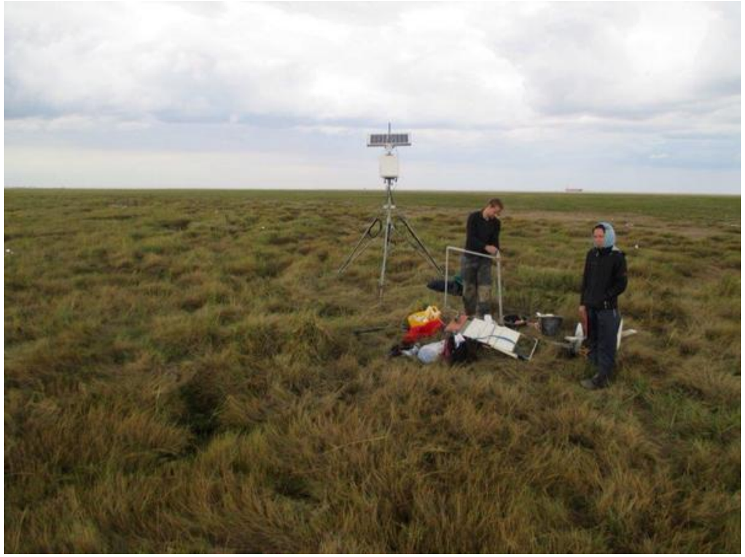
Boundary conditions – Water levels

1/100 years based on model results from Muis et al . 2016

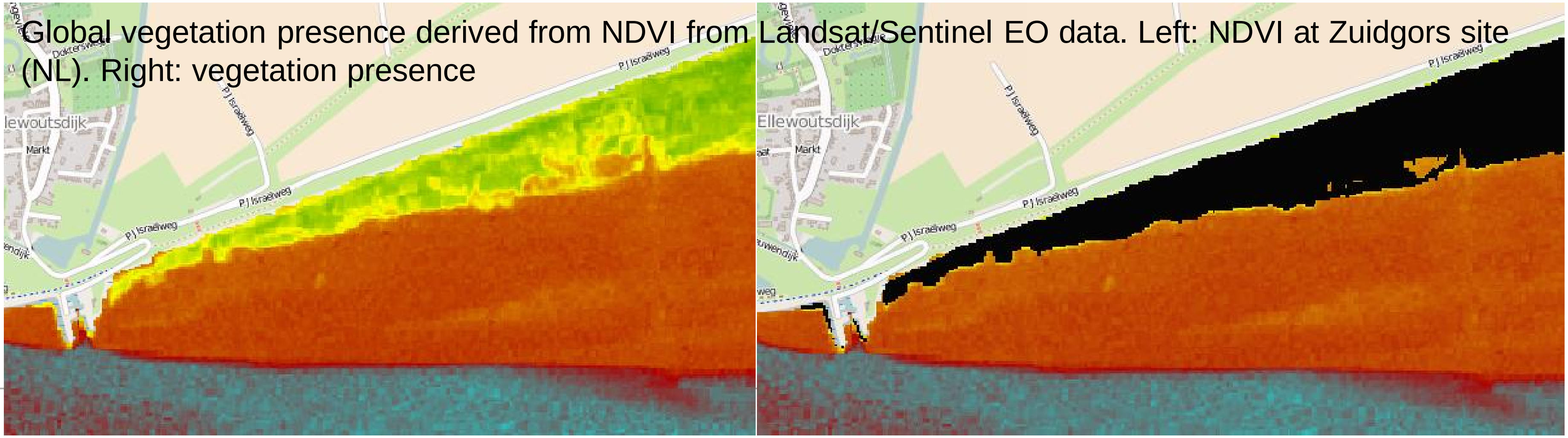
FAST Fieldsites

FP7 Space
607131

UNIVERSITY OF CAMBRIDGE
GeoEcoMar
NIOZ
UCA Universidad de Cádiz

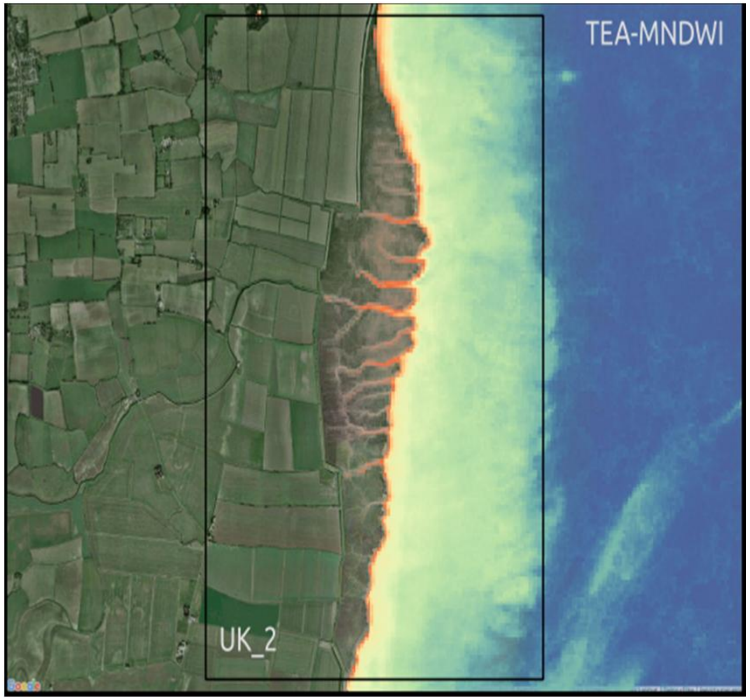


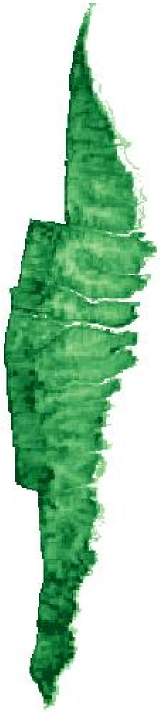
Measurements of in-situ spectra and vegetation dimensions at Romanian field site to link spectral EO data to local vegetation properties.



Global vegetation presence derived from NDVI from Landsat/Sentinel EO data. Left: NDVI at Zuidgors site (NL). Right: vegetation presence

FAST Fieldsites (2)

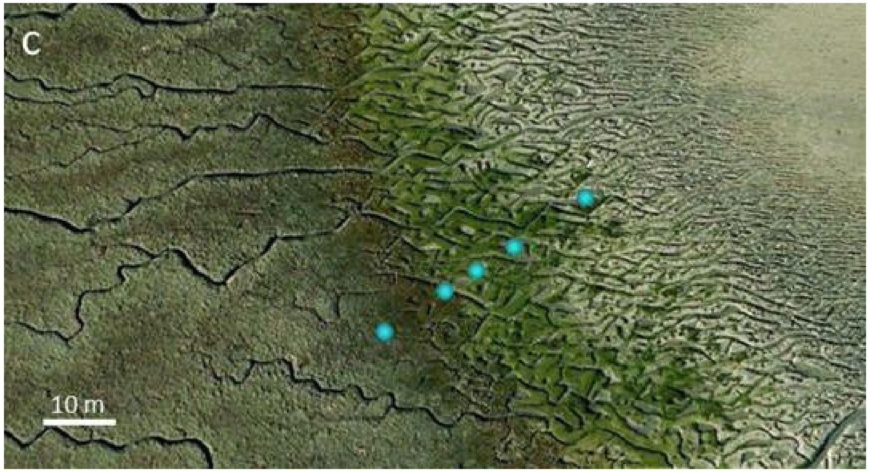




Time-ensemble average water indices for Tillingham (UK). Yellow to red represents reducing flooding frequency; a proxy for increasing elevation.

Leaf area index (LAI) for Tillingham (UK). Darker green represents higher leaf area per m^2; a proxy for increasing biomass.

Tillingham vegetation



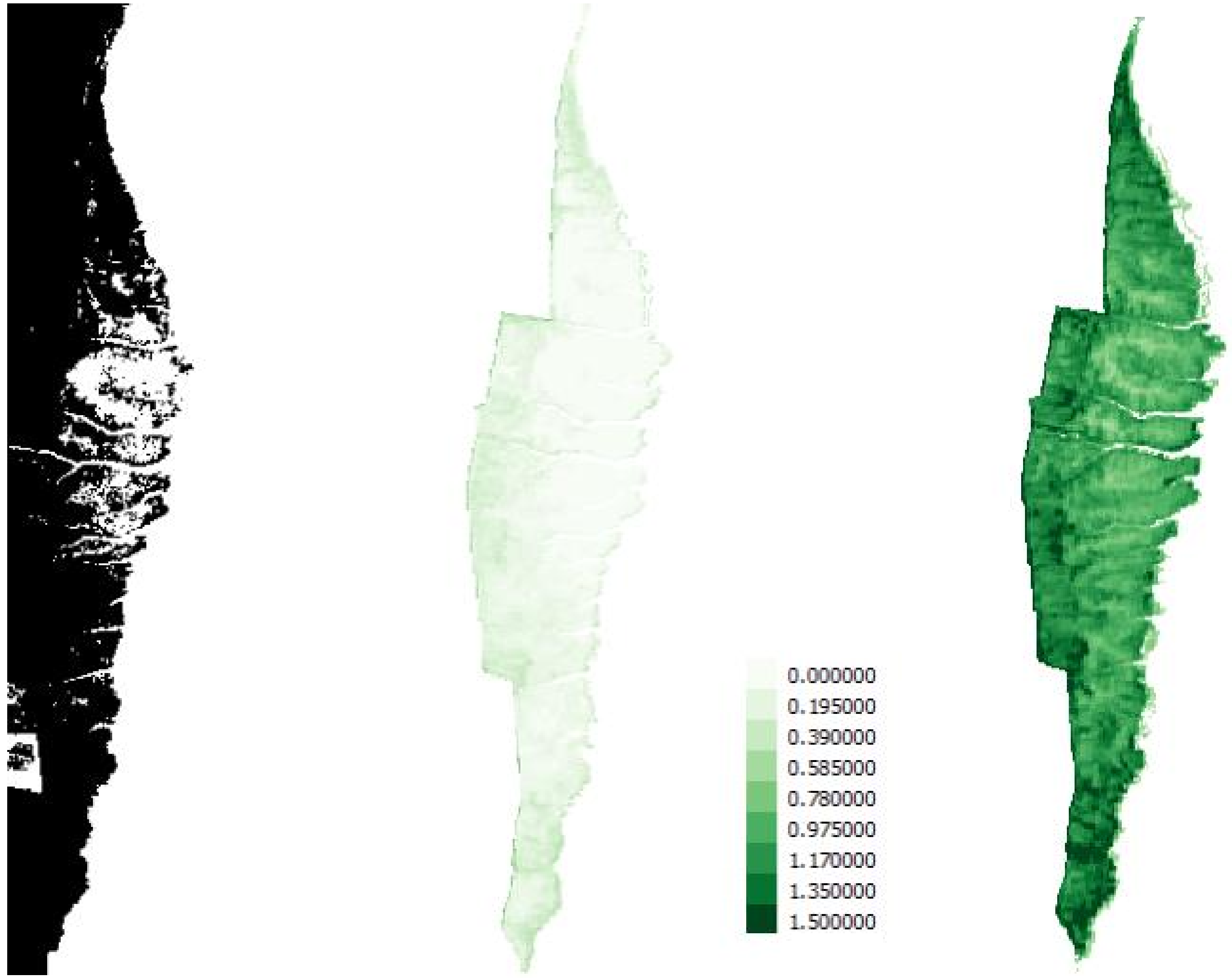
location	Average vegetation height (mm)	Average vegetation diameter (mm)	Average density (m^{-2})	Average LAI (m^2/m^2)
UK_2_VND1	327	4.0	275	0.36
UK_2_VND2	329	3.5	200	0.23
UK_2_VND3	290	3.5	367	0.37
UK_2_VNDSD1	209	3.4	317	0.22
UK_2_VNDSD2	224	3.3	292	0.22

Copernicus Sentinel data

Copernicus is the worlds largest single earth observation programme. It aims at achieving a global, continuous, high quality, wide range Earth observation capacity to improve the management of the environment, understand and mitigate the effects of climate change and ensure civil security. It follows and greatly expands on the work of the previous European Envisat program.

Satellite	Sensor	Resolution	Purpose
Sentinel 1	SAR	5 m	Land/ice surface
Sentinel 2	Multi-spectral	10-60 m	Vegetation indices
Sentinel 3	Color, Temperature, Altimeter	300-1000m	

Vegetation cover



Simple Y/N LAI Winter LAI Summer

Vegetation characteristics

LAI $[m^2/m^2]$ = N x b x h_v $[m^{-2}$ x m x m] = vegfactor in Xbeach

b = 4 mm

typical for marsh vegetation: Songy, 2016, FAST field data

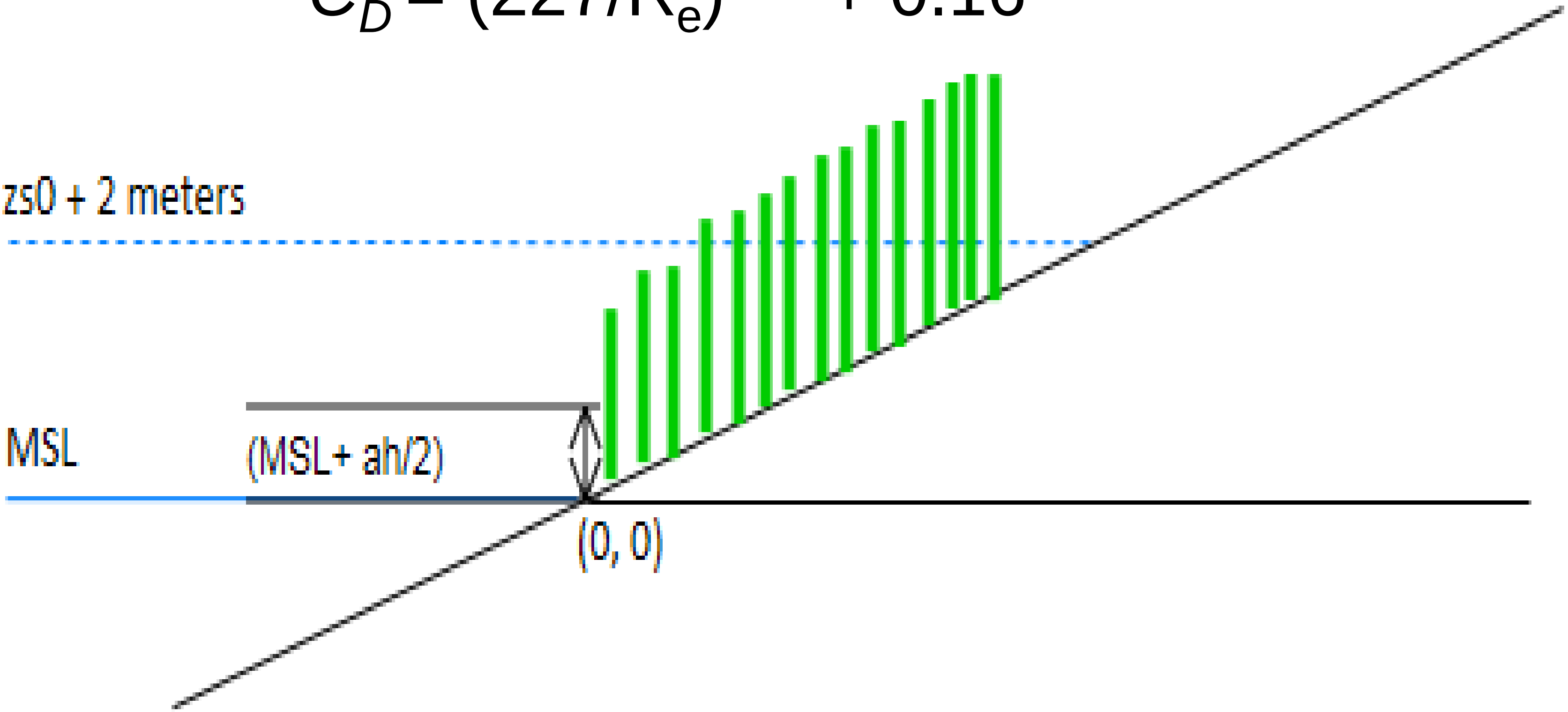
h_v = 30 cm

N = LAI/(b x h_v)

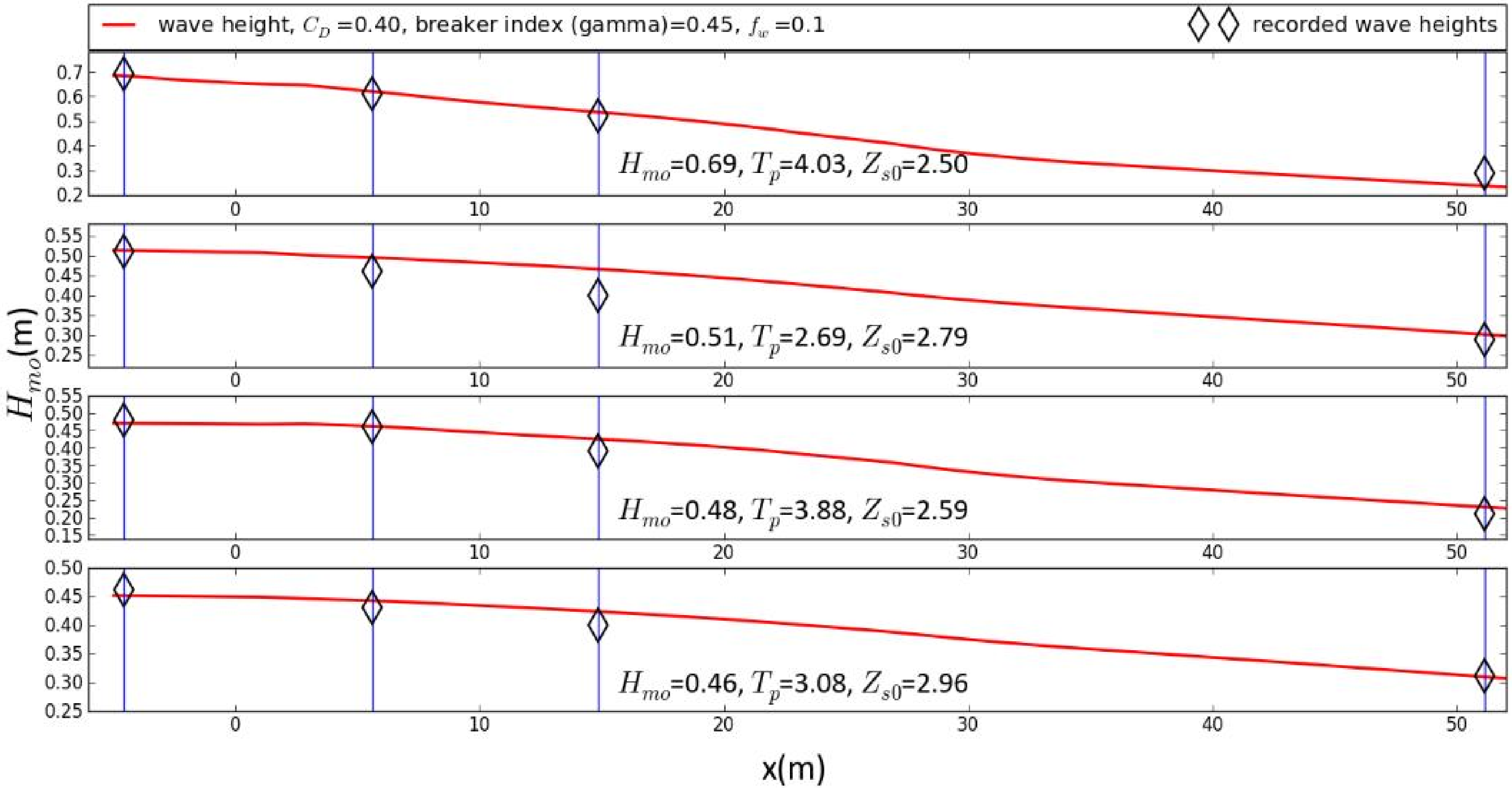
Drag coefficient – comparison to measurement

Cd calculation using Möller *et al*. (2014) equation

$$C_D = (227/R_e)^{1.62} + 0.16$$



Drag coefficient – comparison to measurements



Comparison: Songy, 2016
Measurements: Hellegat, Westerschelde (NL), Vuik et al. 2016

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