BELAIR WORKSHOP 2016

08/11/2016

BRUGES (BE)

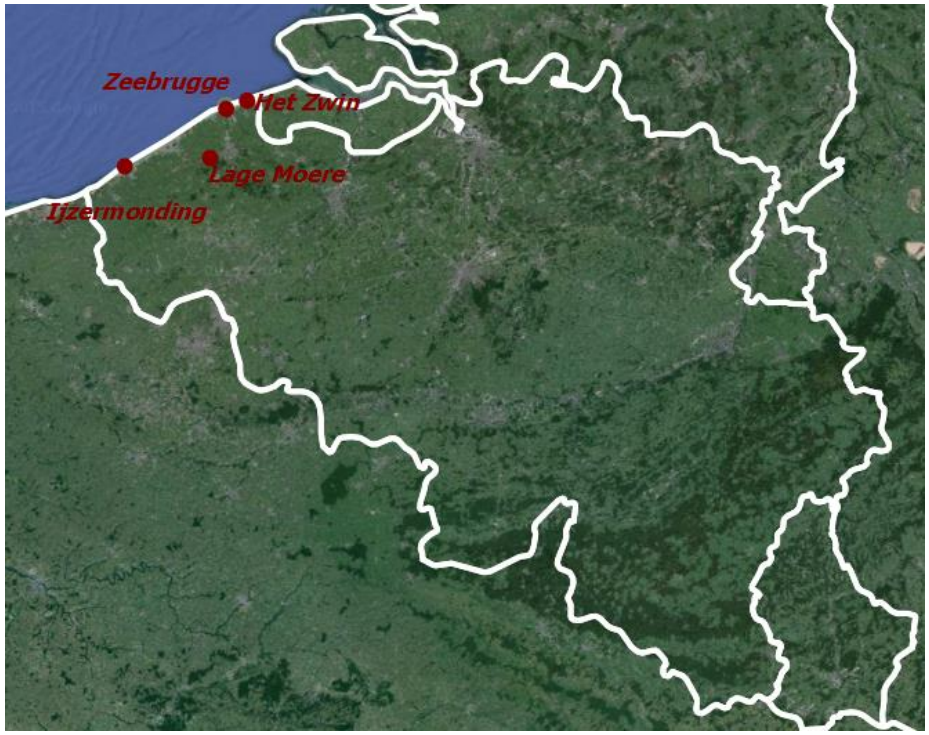
BELAIR-LITORA

COAST AND BIODIVERSITY

Nitin Bhatia, Liesbeth De Keukelaere, Caroline Echappé , Elsy Ibrahim, Els Knaeps, Jaak Monbalieu, Hana Ortega Yamamoto, Koen Sabbe, Ben Somers, Sindy Sterckx, Jeroen Vanden Borre, Laura Vanierschot

INTRODUCTION LITORA

- Ijzermonding - Presented by *Koen Sabbe*
- Zwin en Lage Moere - Presented by *Ben Somers*
- Zeebrugge – Presented by *Liesbeth De Keukelaere*



Part I - Ijzermonding

Caroline Echappé, Elsy Ibrahim, Hana Ortega Yamamoto, Koen Sabbe, Jaak Monbaliu

KU LEUVEN

GHENT UNIVERSITY

Intertidal areas: seemingly barren but teeming with life

LITORA – IJZERMONDING 2015

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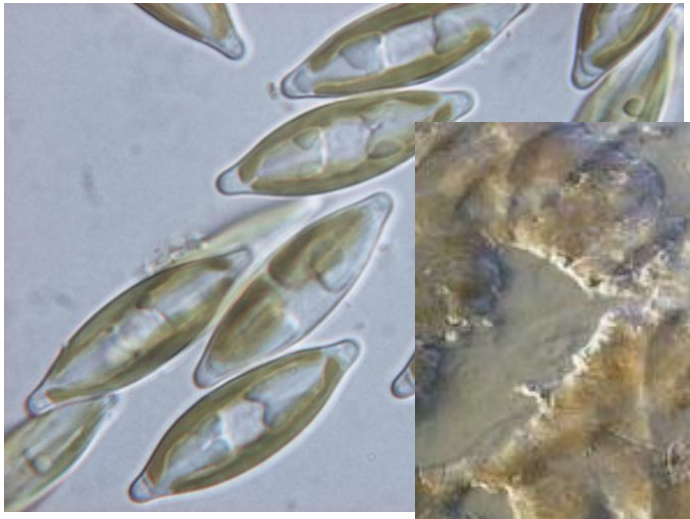
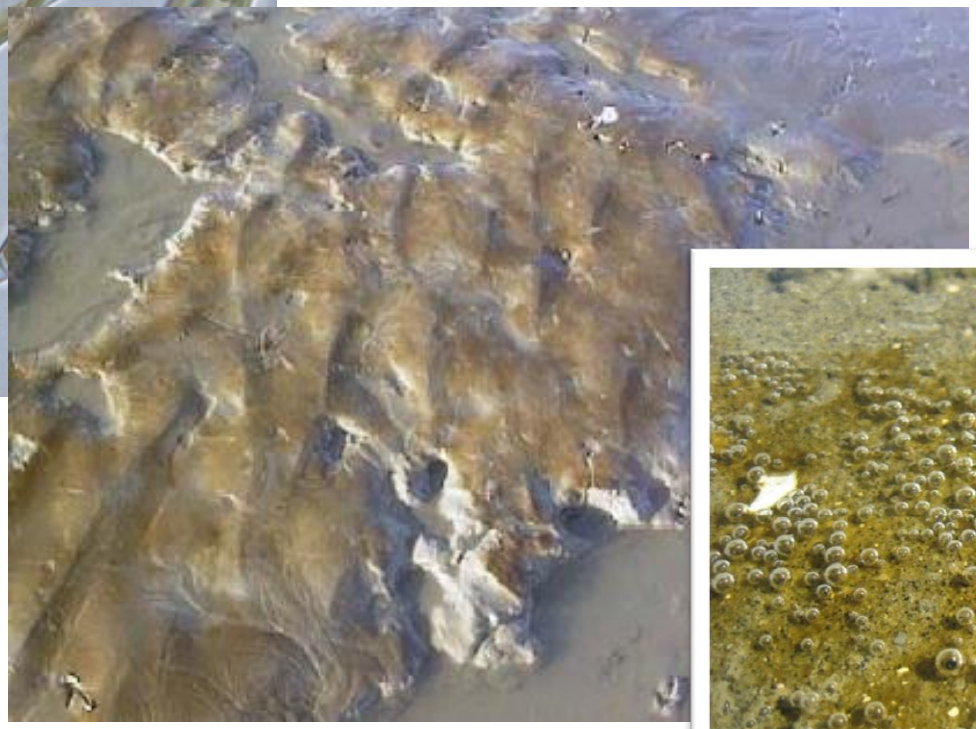
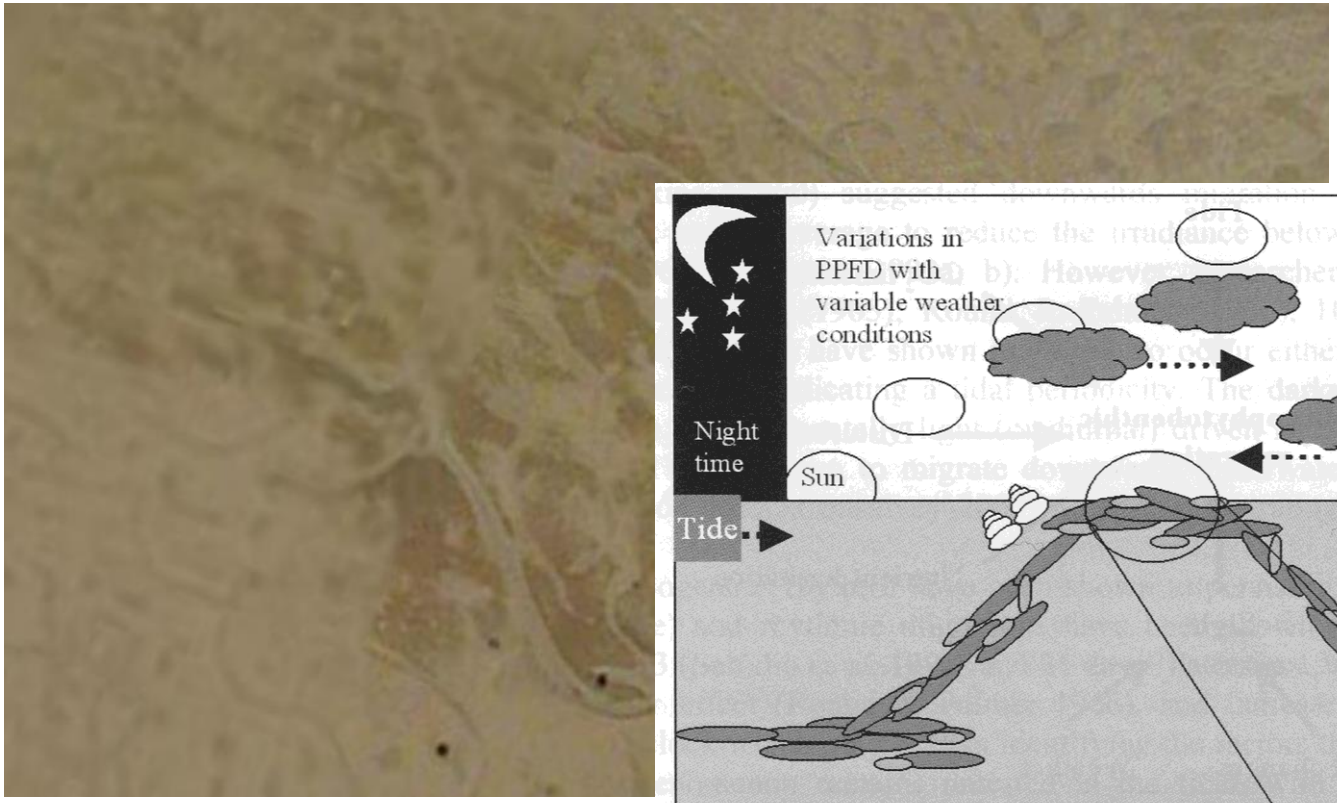
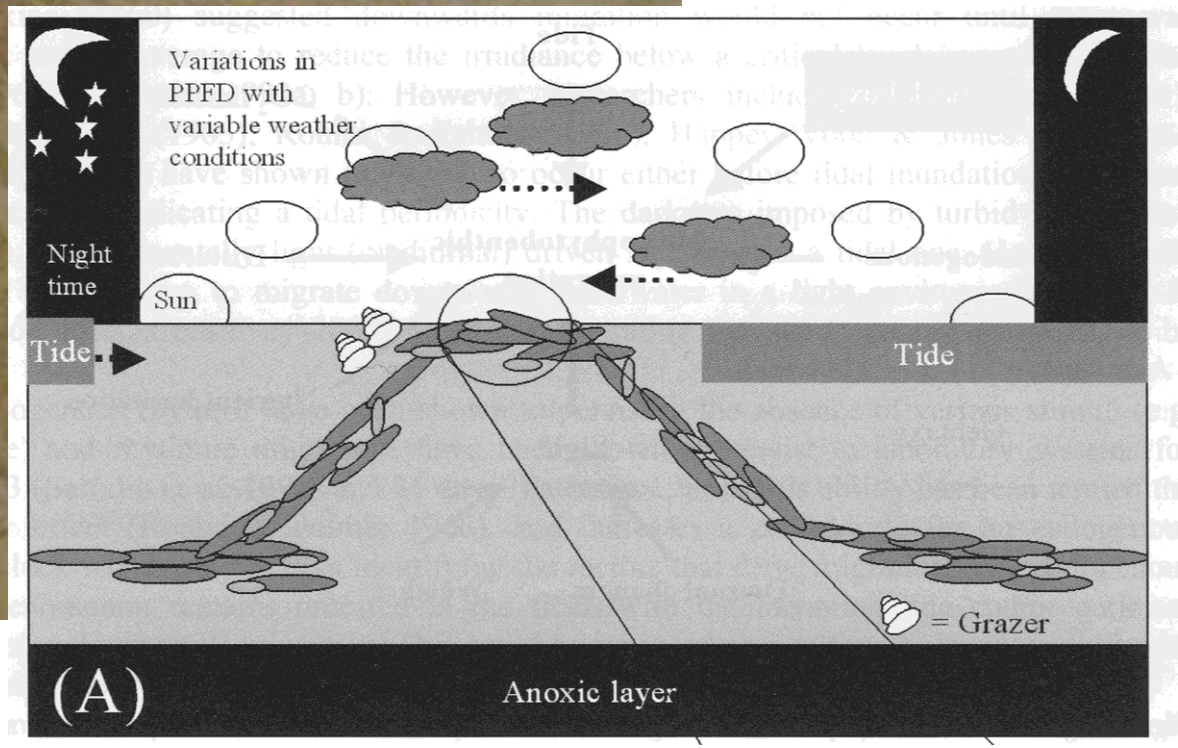
Primary production < microphytobenthic (MPB) algae (diatoms)





High spatial and temporal variability (a.o. due to vertical migration) → RS





LITORA – IJZERMONDING 2015

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In-situ campaign: Sensefly Ebee platform Multispec 4C camera (VITO)

BELAIR

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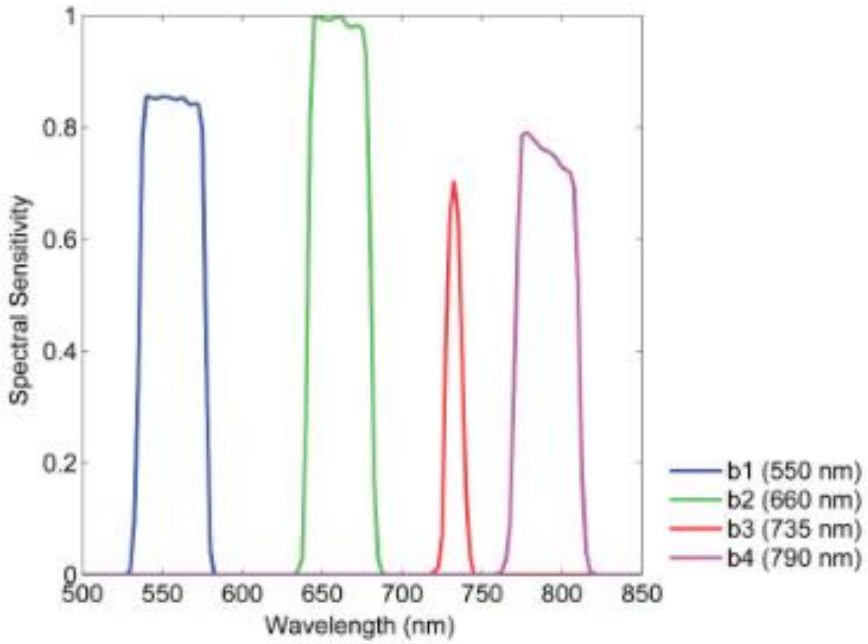
Sensefly Ebee platform Multispec 4C camera



LITORA – IJZERMONDING 2015

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- 6 Ebee flights
- No Apex image because of cloud conditions
- Limited number of field samples at pole 10 (only after flight to avoid interference)
- ASD measurements at pole 10 at the time of Ebee flight
- Main goal: investigate feasibility to capture spatial variability and temporal evolution of RS signal over a tidal cycle

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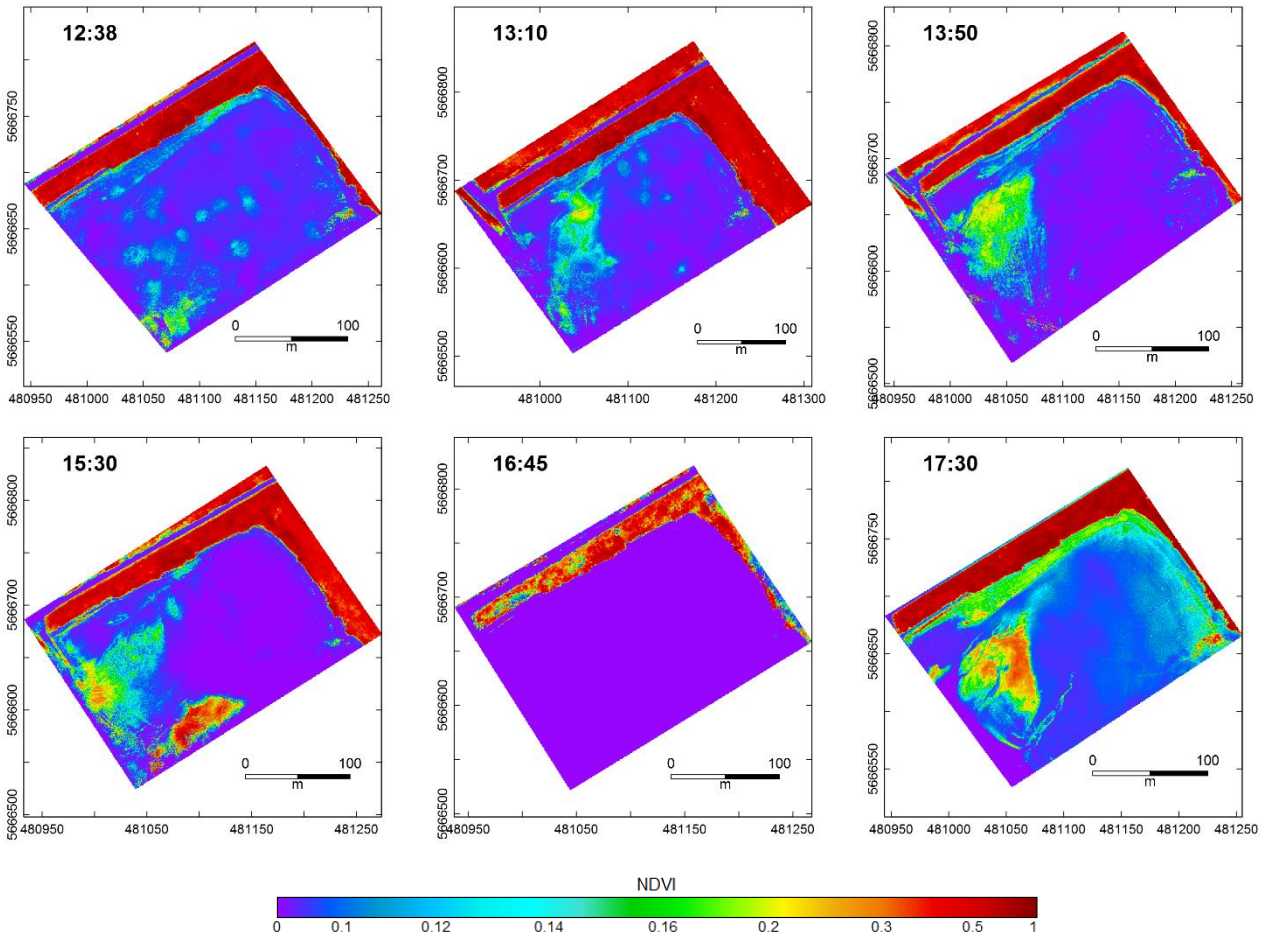
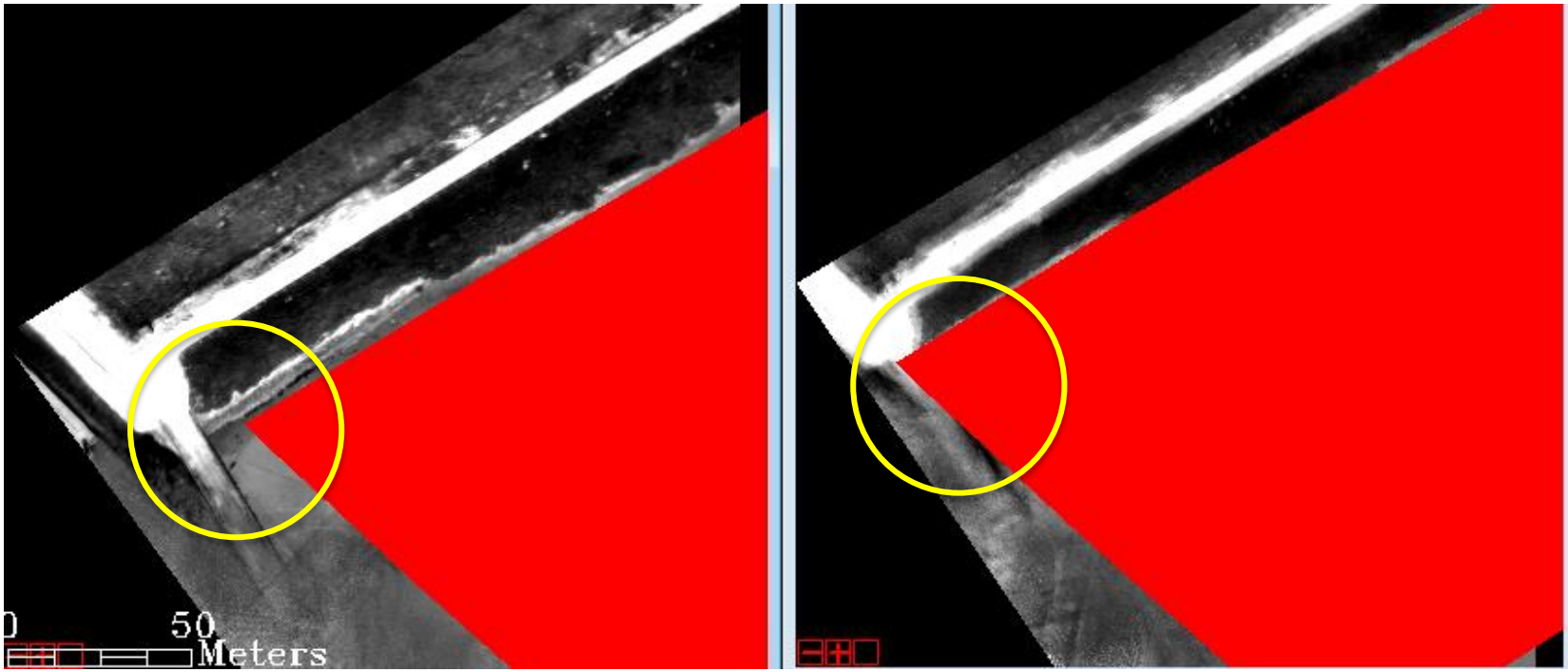
Preliminary results:

- NDVI maps from the images acquired during the flights
- Variations in spatial patterns can be observed along the tidal cycle (low tide at 15:05)



GEOMETRIC CORRECTION



There are issues with the geometric correction of the imagery. One cannot overlay them to carry out analysis of change detection

e.g. the images above show a section of the area in red obtained from flight 1 and overlaid on flight 2 (left) and flight 3 (right)

NDVI values

NDVI was calculated using the red-edge band and the NIR band for the drone data and using corresponding band in previous hyperspectral imagery

Maximum values of NDVI in the intertidal region covered by Belair are below

2013*	2005*	Belair 1	Belair 2	Belair 3	Belair 4	Belair 5	Belair 6
0.067	0.064	0.48	0.44	0.79	0.72	0.18	0.57

* Hyperspectral airborne acquisitions

FEED BACK: what was good, what could be improved

(+)

- 6 images by drone demonstrate it is feasible to get very detailed images over a tidal cycle => opens new possibilities for research related to ecology of intertidal areas

(-)

- No Apex flight (no overview image to extend hyperspectral image series).
- Multispectral only
- Insufficient resources to do image analysis?

Collaborations

BELAIR campaign partners

Hydraulics Lab, Dept. Civil Engineering, KU Leuven

Protistology & Aquatic Ecology Lab, Dept. Biology, UGent

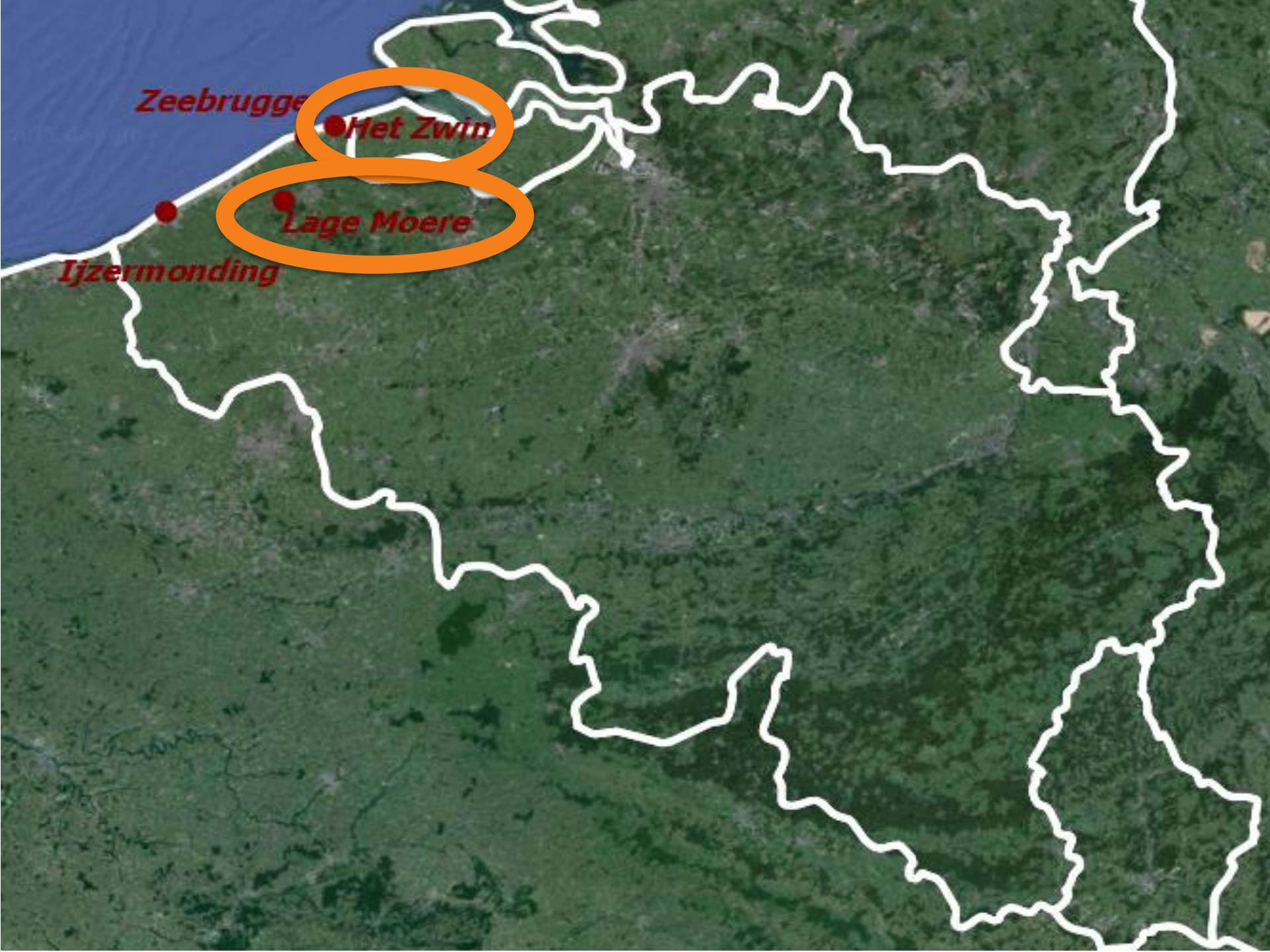
VITO

Joint PhD UGent – Univ. Nantes (France) – Caroline Echappé

Prof. Elsy Ibrahim, Dept. Civil & Env. Engineering, Notre Dame University, Beirut, Lebanon

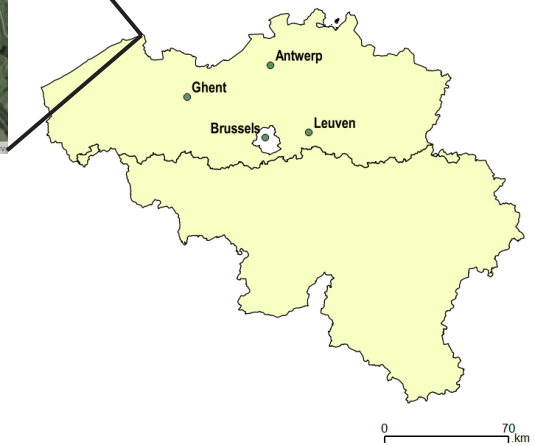
Part II - Zwin and Lage Moere

Ben Somers, Jeroen Vanden Borre, Laura Vanierschot


Zeebrugge
Het Zwin
Lage Moere
Ijzermonding

Zwin

Private reserve 1952-2006
Flemish government & province of W-Flanders – restoration!



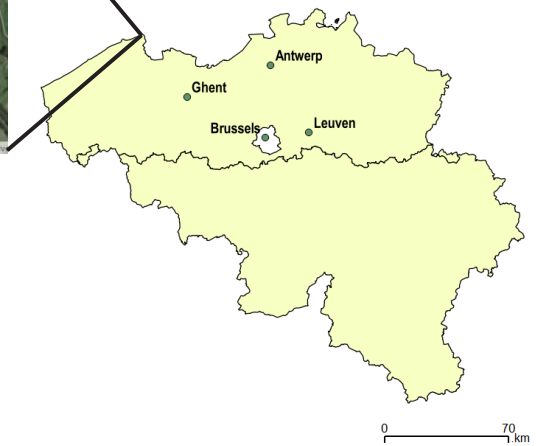
Total: ± 500 ha

Zwin

Zwin dunes

Zwin tidal plane

Biggest area of saltwater tidal marshes



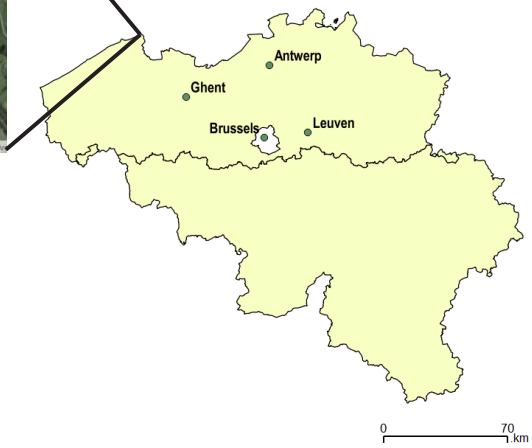
Zwin grasslands

A unique gradient from dune to polder grasslands

Total: ± 500 ha

Zwin

Zwin dunes



Zwin grasslands

Total: ± 500 ha

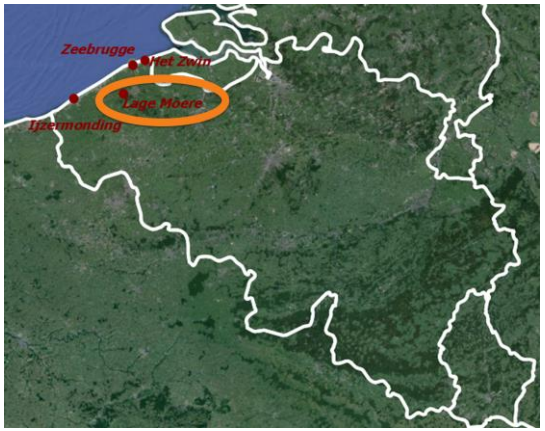
Zwin grasslands

A unique gradient from dune to polder grasslands

Total: ± 500 ha

Total: ± 5

Lage Moeren, Meetkerke

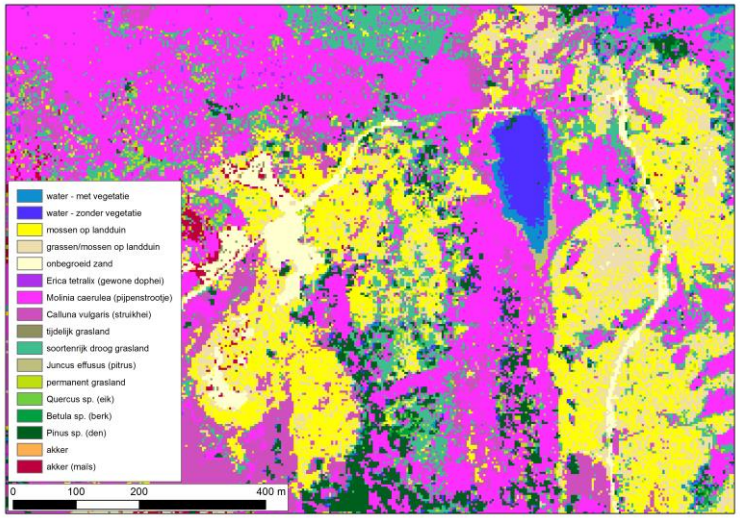


- Typical polder landscape: flat low-lying and wet, dominated by grasslands
- Polder grasslands are protected vegetation type in Flanders since 1998
- Now nature reserve
- Total: ± 420 ha

The potential of high resolution remote sensing for grassland conservation and management?

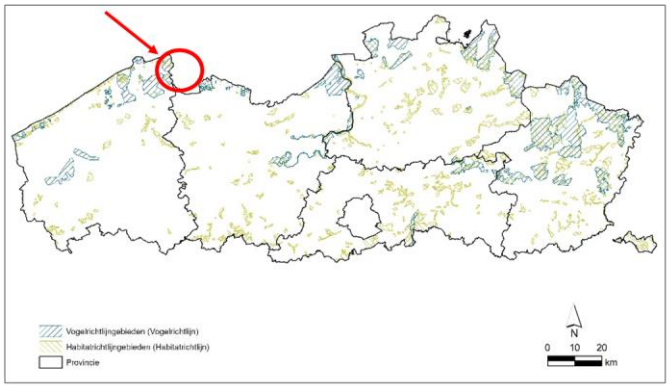
Objectives

The potential of high resolution remote sensing for grassland conservation and management?



- Mapping of Natura 2000
- Monitoring habitat quality

Natura 2000

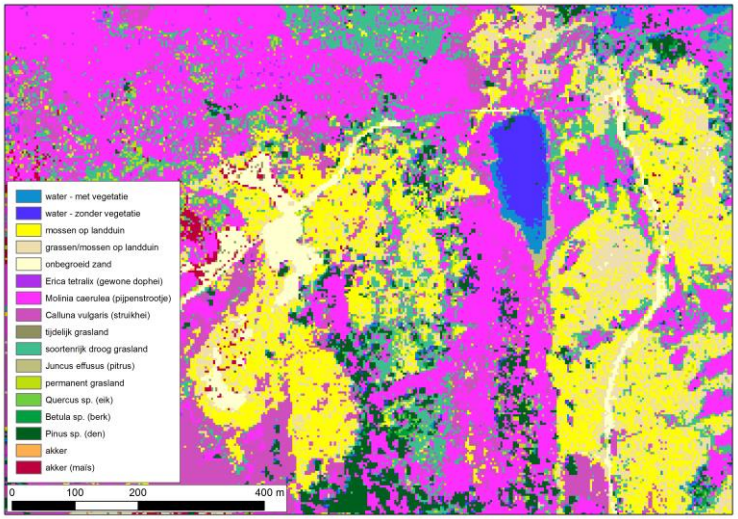


- Habitats Directive
- Monitoring habitat quality
- Follow-up report every 6 years

Objectives

The potential of high resolution remote sensing for grassland conservation and management?

- Mapping of Natura 2000
- Monitoring habitat quality



- Effects of daily nature management

Objectives

Potential of high resolution remote sensing

Ground measurements

APEX

Sentinel 2

Drone imagery – Gatewing X100 – July & October 2015

‘t Zwin (source: INBO)

Drone imagery – Gatewing X100 – July & October 2015

Zwin dunes (detail) (source: INBO)

Field campaign 2014, 2015, 2016

- **Vegetation surveys** (22 plots in 2015; 62 in 2014; 30 in 2016)- (Lage Moere 15 plots in 2015)

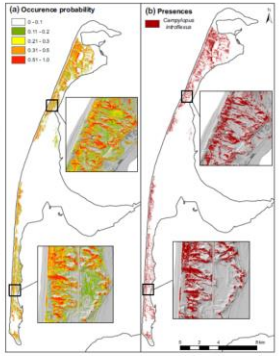
- **Hyperspectral data (2016)**

- **Functional traits (2016)**
  - Plant height
  - Biochemical analysis of leaves (C, N, P, chlorophyll, cellulose, lignin)
  - LEDA/TRY database

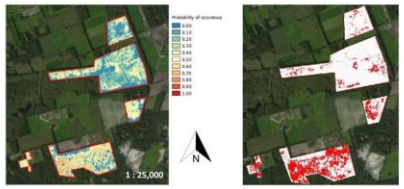
- **Ecosystem functioning (2016):**
  - Peak aboveground biomass
  - Biochemical stocks in soil (C, N, P)

BIODIVERSITY

Plant species mapping?



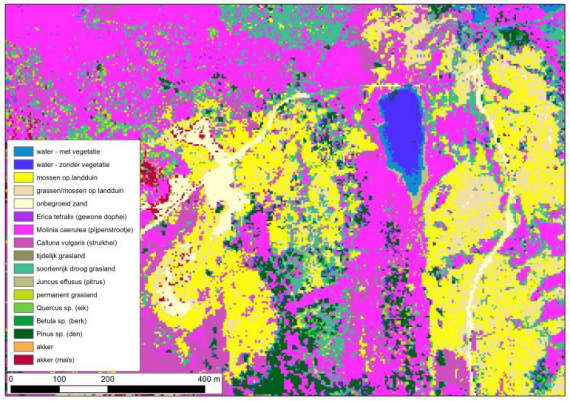
Skowronek et al. (2016). Biological Invasions



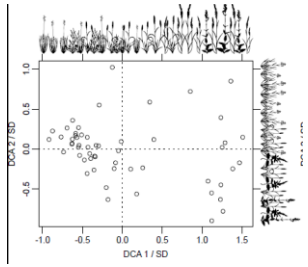
Rombouts et al. (2016). M.Sc. Thesis KU Leuven

Maxent modeling
Advanced image classification

Natura 2000 habitat mapping



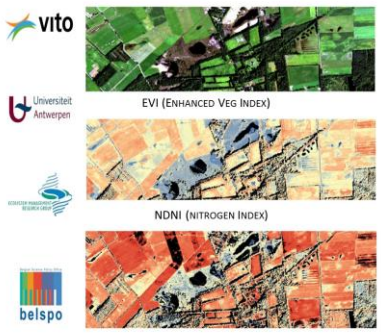
Floristic gradients

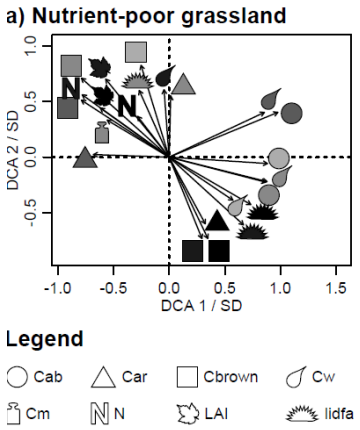


…

Ecosystem functioning?

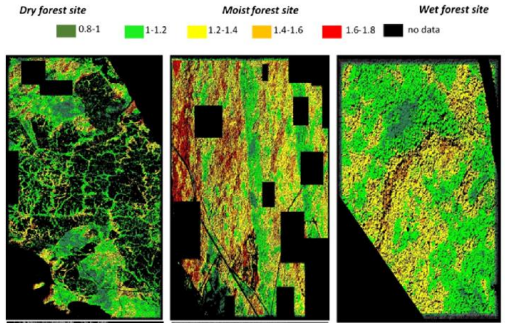
Plant optical types
Optical plant traits

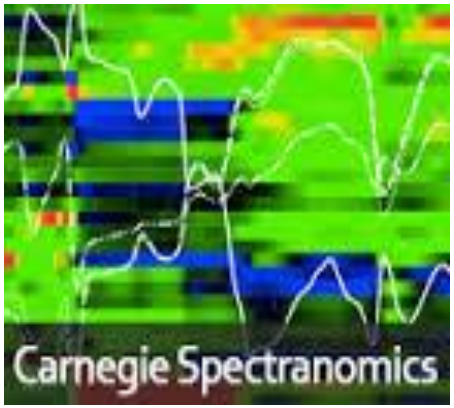




Species (taxonomic) diversity

Spectranomics
Spectral Variation Hypothesis





Results

Lack of human resources for data analysis … until this summer

Msc thesis

- Tessa Vanderborght: *Ecological and spectral assessment of different types of grasslands (2016-2017)*

- Sam Medart: *The potential of Sentinel 2 for monitoring habitat quality of Natura 2000 protected grasslan*ds*(2016-2017)*

PhD

- Laura Vanierschot*: The potential of high resolution remote sensing for grassland conservation and management? (2016-2020)*

FEED BACK: what was good, what could be improved

(+)

- Good data quality
- A lot of ideas and enthousiasm

(-)

- Insufficient resources to do image analysis?

Collaborators

Part III - Zeebrugge

Liesbeth De Keukelaere, Els Knaeps, Sindy Sterckx, Nitin Bhatia

III - ZEEBRUGGE

Highly dynamic environment – tides

± 5-7 Mton dry material dredged yearly

Restricted area for UAVs (KB 25/04/2016)

Two AERONET-OC stations (RBINS)

- Thornton C-power
- Zeebrugge-MOW 1

Landsat-8 (17/01/2016)

Landsat-8 (09/05/2016)

BELAIR

S2VT

ACIX INTERCOMP

S3VT

- *14 A/C algo's intercompared*
- *19 sites all over the world incl Zeebrugge*

BELAIR

DRONESED

International Marine & Dredging Consultants (IMDC)

PV-Lac

ORSAT
(Flanders - Quebec cooporation)

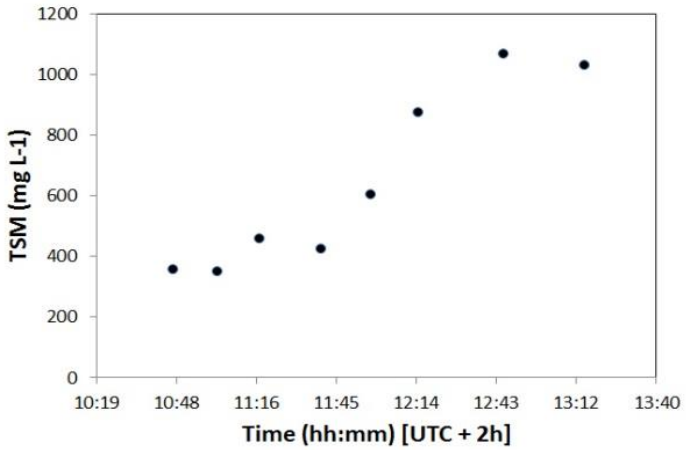
Martin A. Montes-Hugo Université du Québec à Rimouski (Canada)

Proba4Coast

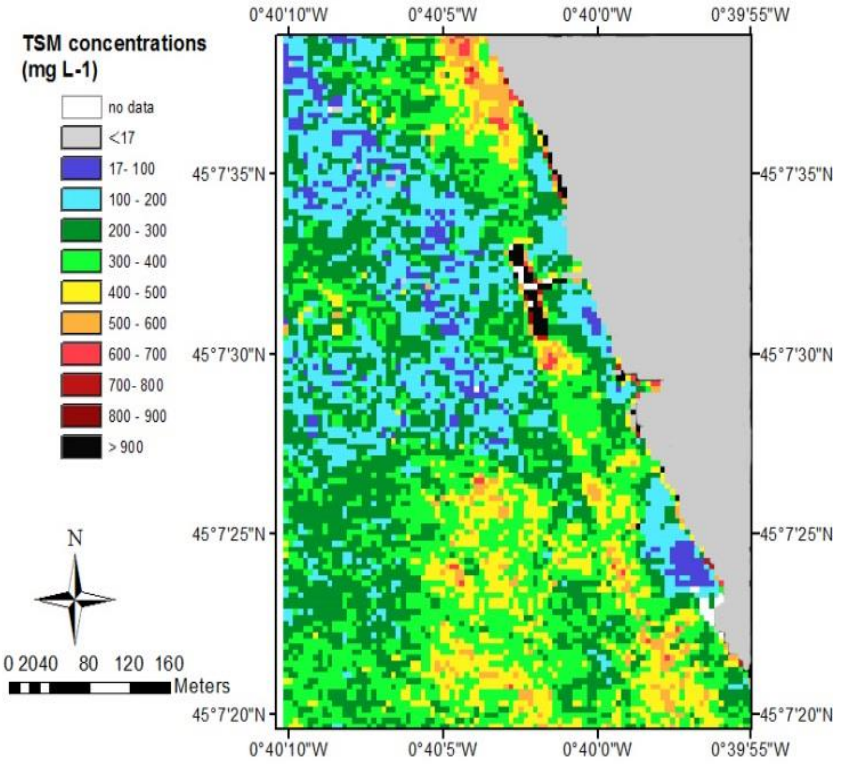
KU Leuven (Jaak Monbaliu)
Flanders Marine Institute (VLIZ)

International consortium (RBINS, BC, NIVA, UPMC, CEFAS, Uhull)
User Oriented (IMDC, …)

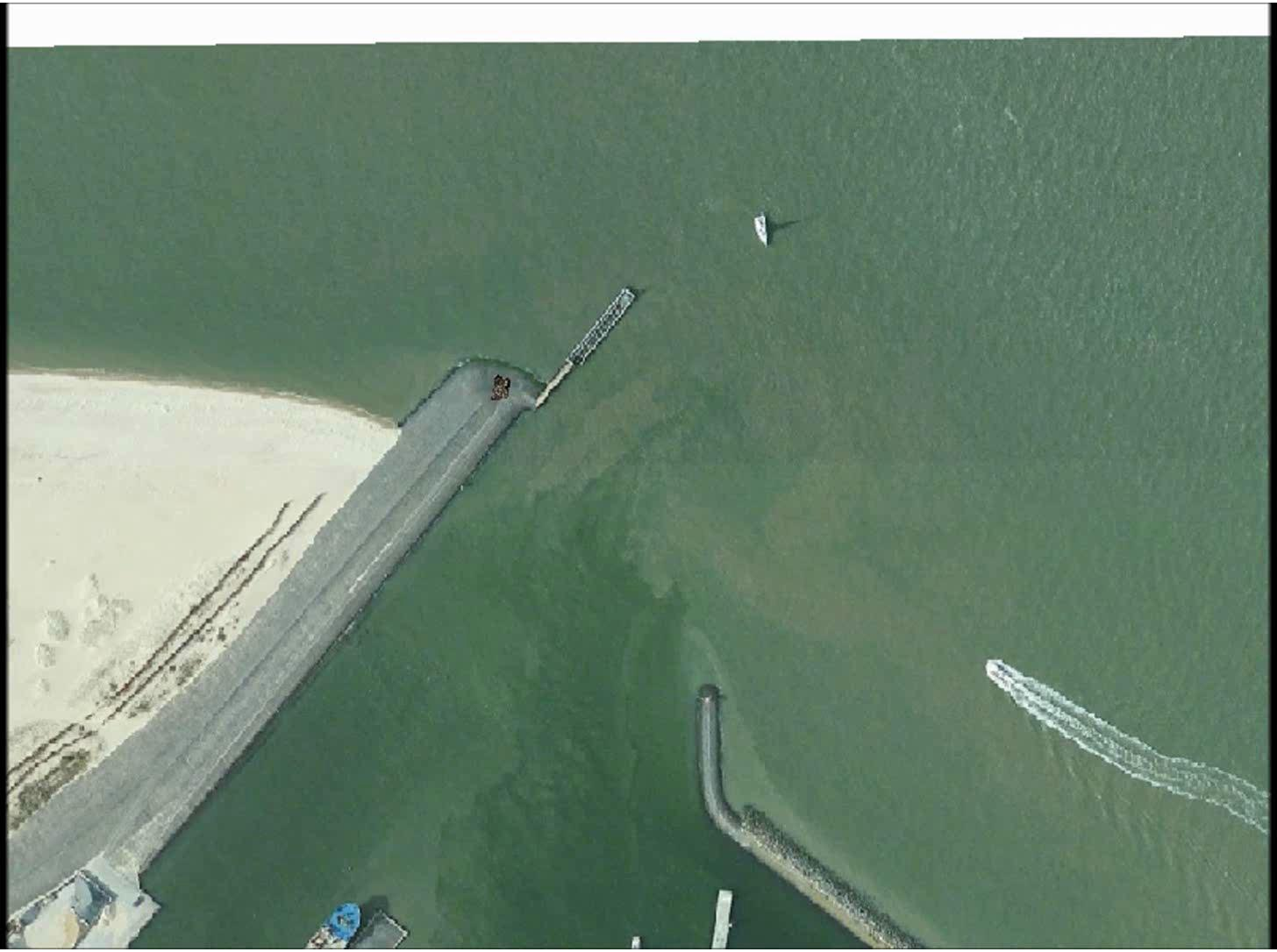
Sediment concentrations at Blaye pontoon (Gironde, France) (Knaeps et al., 2015).



Temporal variability (in-situ data)



Spatial variability (APEX)

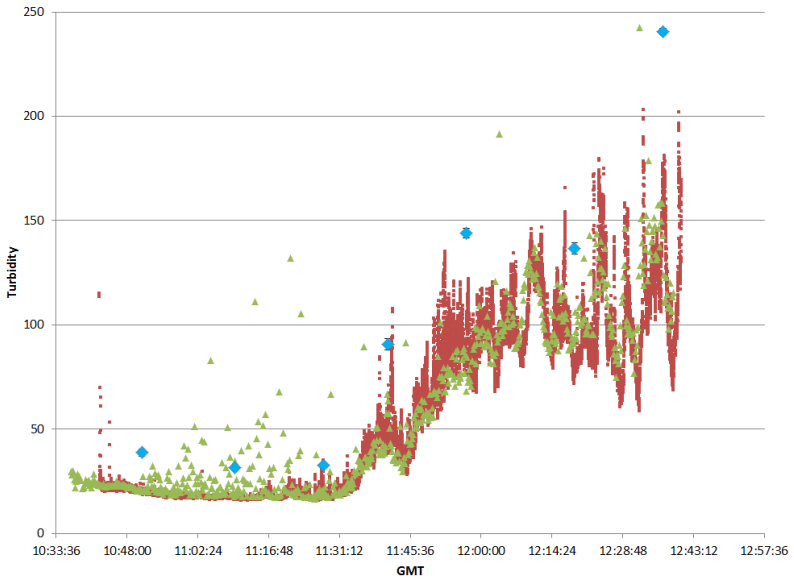


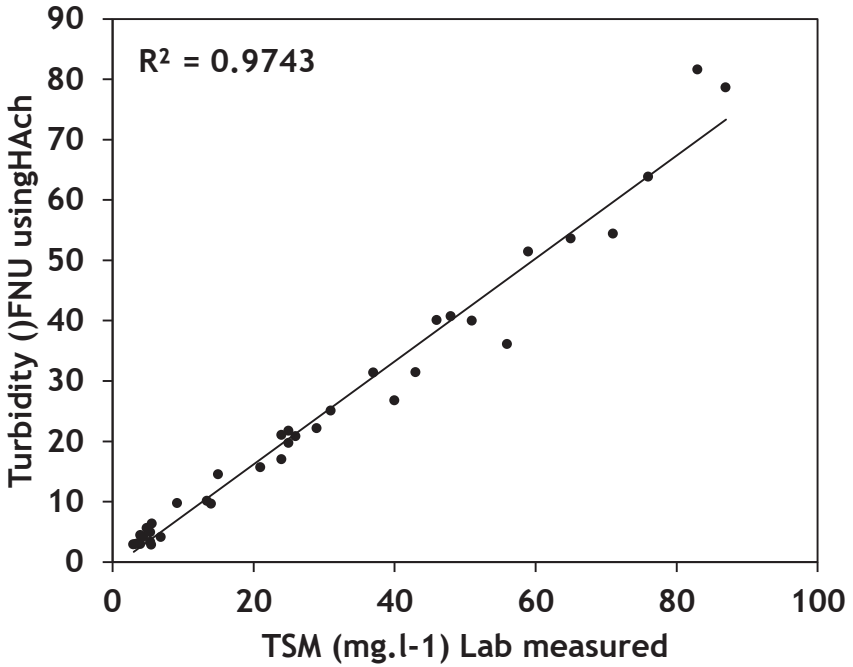
DEDICATED SAMPLING (VLIZ)

Date of sampling	Location	TSM mean ($mg \cdot l^{-1}$)	Turbidity mean (FNU)	Satellite overpass
04/05/16	**Nieuwpoort**	**$4.9 - 13.4$**	**$4.4 - 10.6$**	**S2, Proba-V, MODIS**
19/05/16	Zeebrugge	$26 - 76$	$21 - 69$	Proba-V, MODIS
20/07/16	**Zeebrugge**	**$24 - 29$**	**$23 - 30$**	**S2, Proba-V, MODIS**
17/08/16	Nieuwpoort	$15 - 17$	$19 - 22$	Proba-V, MODIS
25/08/16	Zeebrugge	$13 - 88$	10-82	Proba-V, MODIS
14/09/16	Nieuwpoort	3–7	3–5	Proba-V, MODIS
11/10/16	**Zeebrugge**	**…**	**…**	**S2, S3, Proba-V, MODIS**

INTERCOMPARISON (SCHELDT RIVER)

	HACH 2100Qis (VITO)	OBS 3A (IMDC)	OBS 3+ (VLIZ)
Wavelength	860 nm	850 nm/875 nm	850 ± 5 nm
Angle	90°	140 - 160°	90 - 165°
Unit	FNU	NTU	NTU





Feedback

Advantages

- Included in multiple projects
- Presence of two AERONET-OC stations (RBINS)

Disadvantages

- Special permission required for UAV
- Highly dynamic system
- Logistics: boat, accessibility

Recommendations

» No need to focus only on Zeebrugge

» Combine with existing projects, eg LifeWatch surveys (EU project) along the coastline

http://www.lifewatch.be/en/project-belgian-lifewatch-infrastructure

» Buoys (temporal) and remote sensing (spatial)


THANK
YOU !