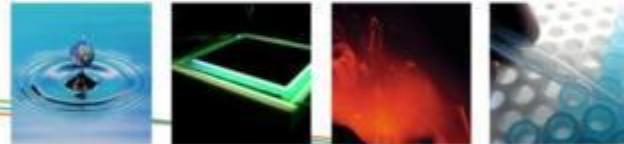




vision on technology



31/01/2013

A hyperspectral view of the coastal zone

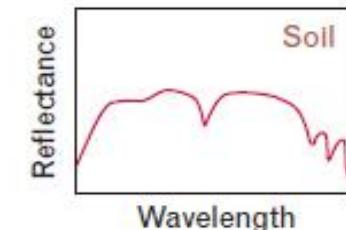
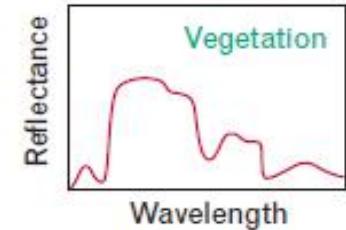
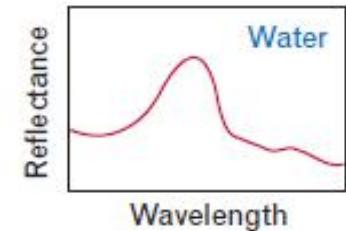
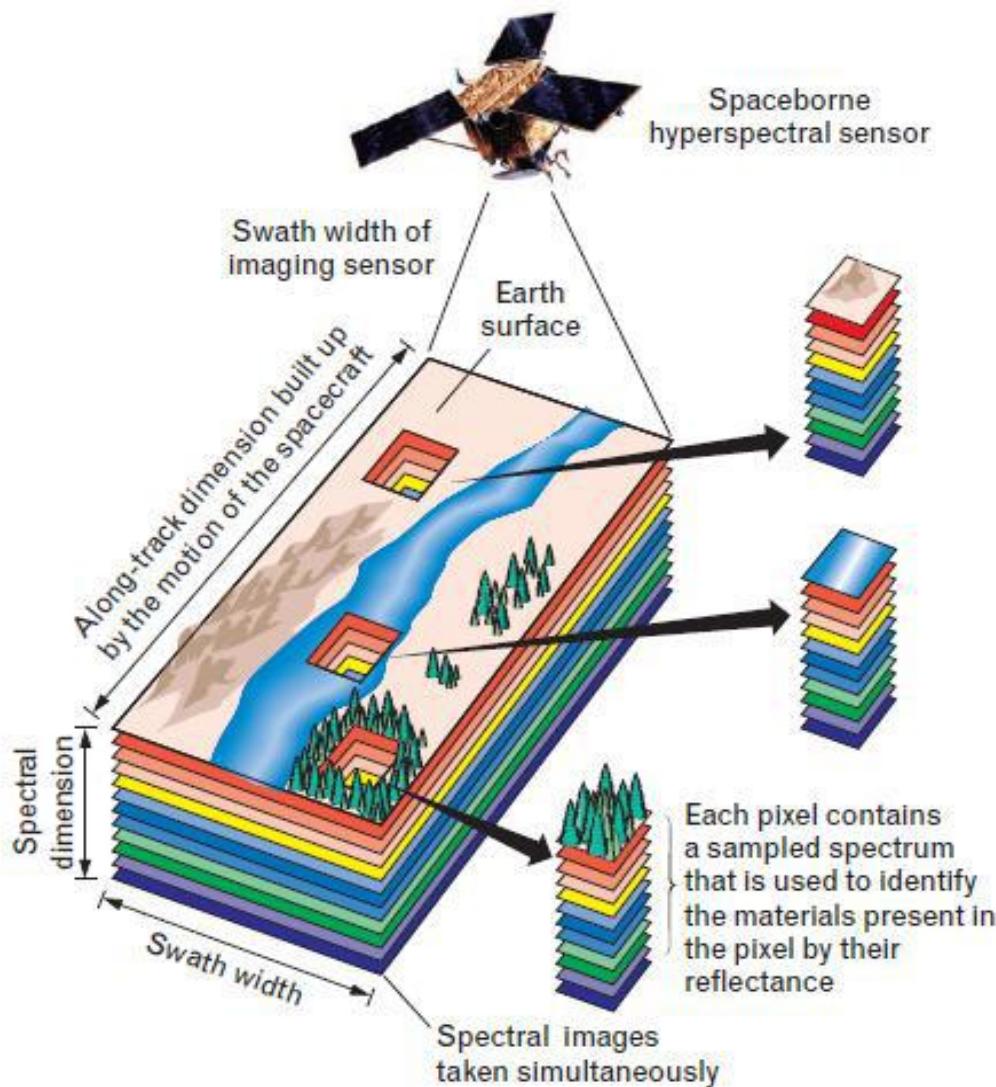
**Els Knaeps, Sindy Sterckx, Luc Bertels, Dries Raymaekers, Ben Somers,
Stephanie Delalieux, Bart Deronde, Koen Meuleman**

NCK theme day “Remote Sensing of the Coastal Zone” – 25/01/2013

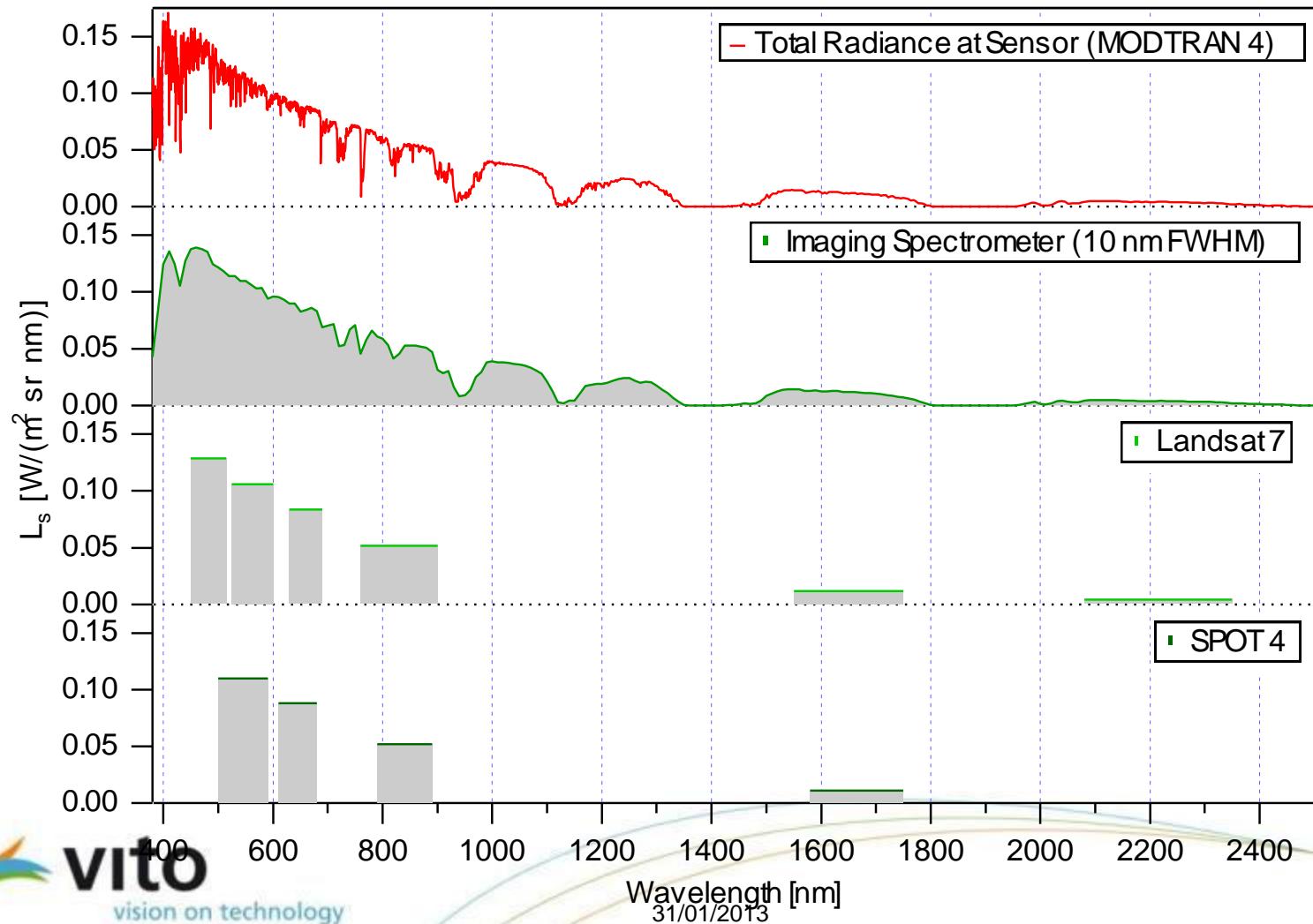
Overview

- » Image acquisitions
- » Applications
 - » Water quality retrieval
 - » Classification of salt marshes and tidal flats
 - » Dune vegetation classification

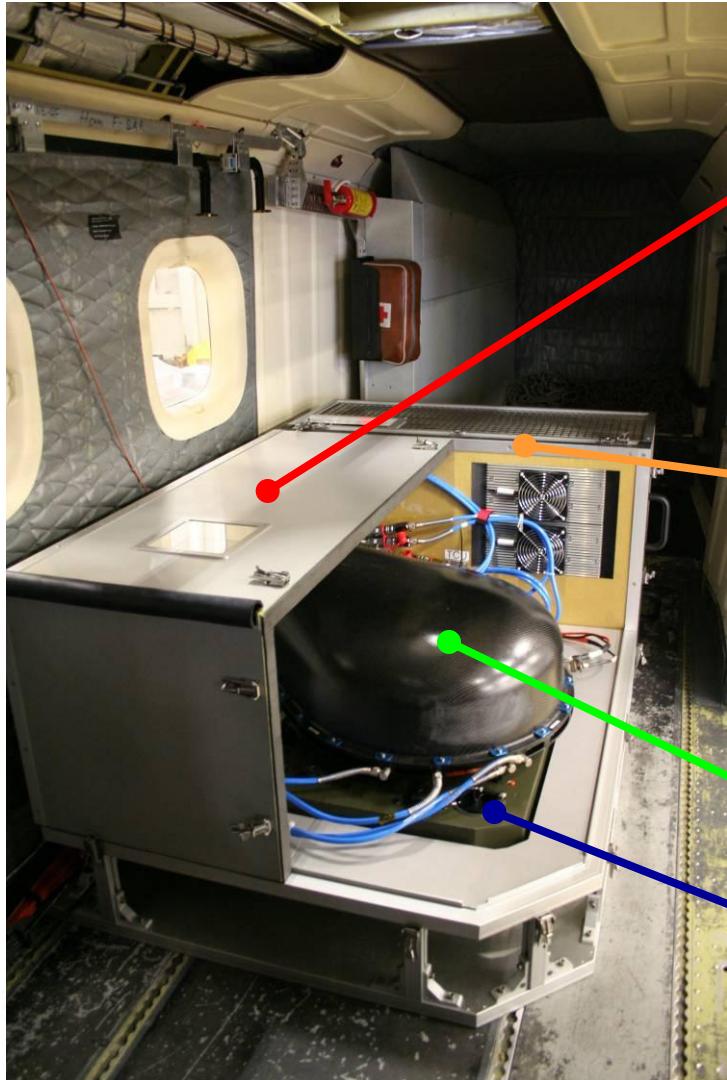
Hyperspectral imagery?



Hyperspectral imagery?



APEX system overview



Environmental Thermal
Control (ETC) Box

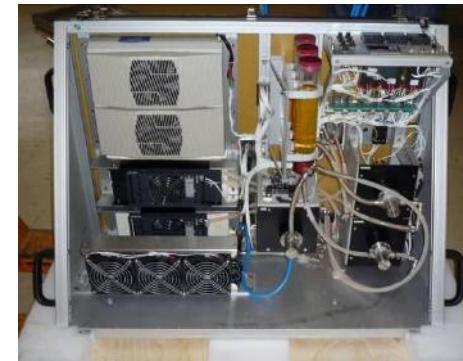
Thermal Control
Unit (TCU)

Optical Subsystem
Unit (OSU)

Stabilising Platform
(Leica PAV30)

31/01/2013

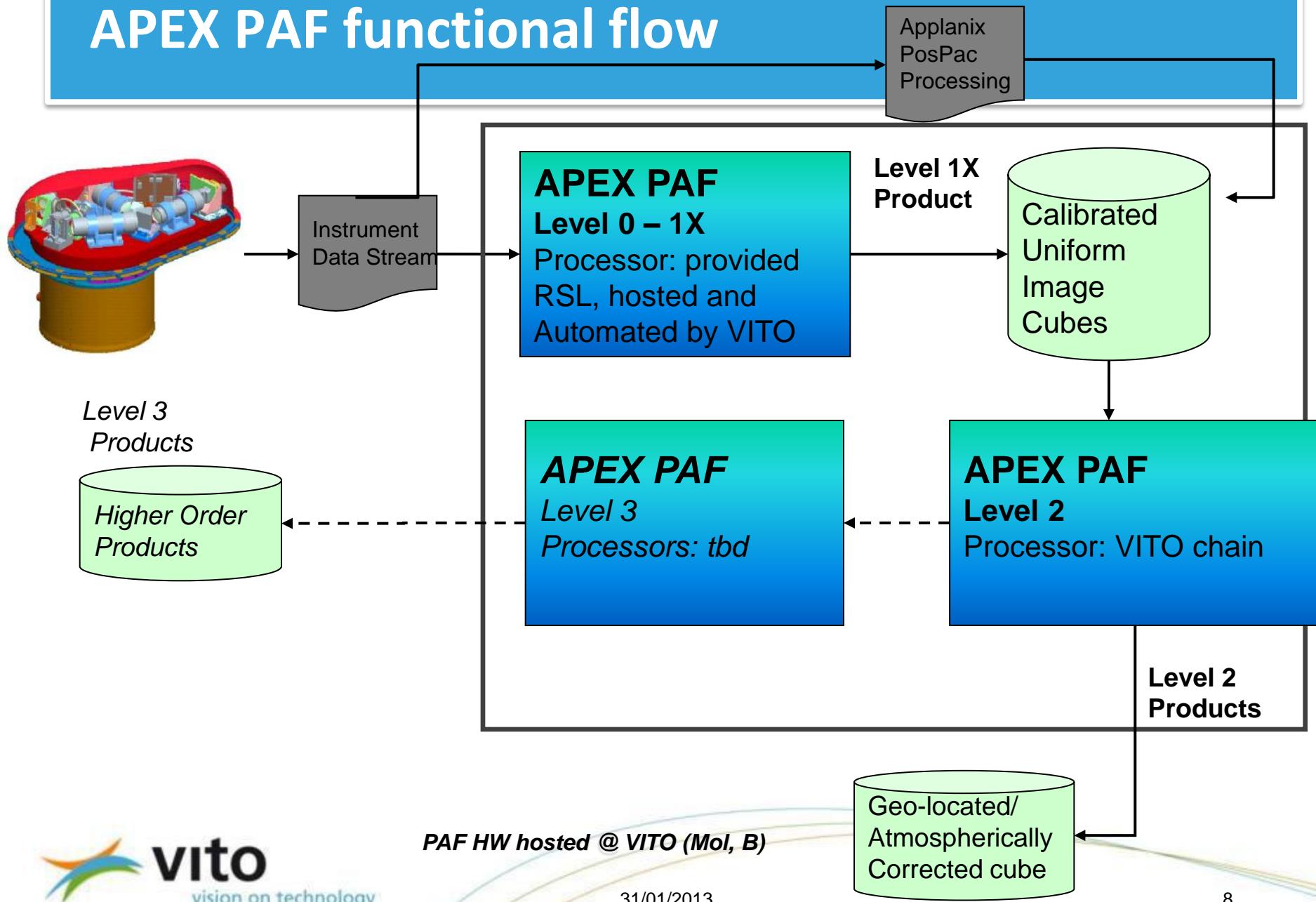
© 2010, VITO NV



APEX flights 2011



APEX PAF functional flow



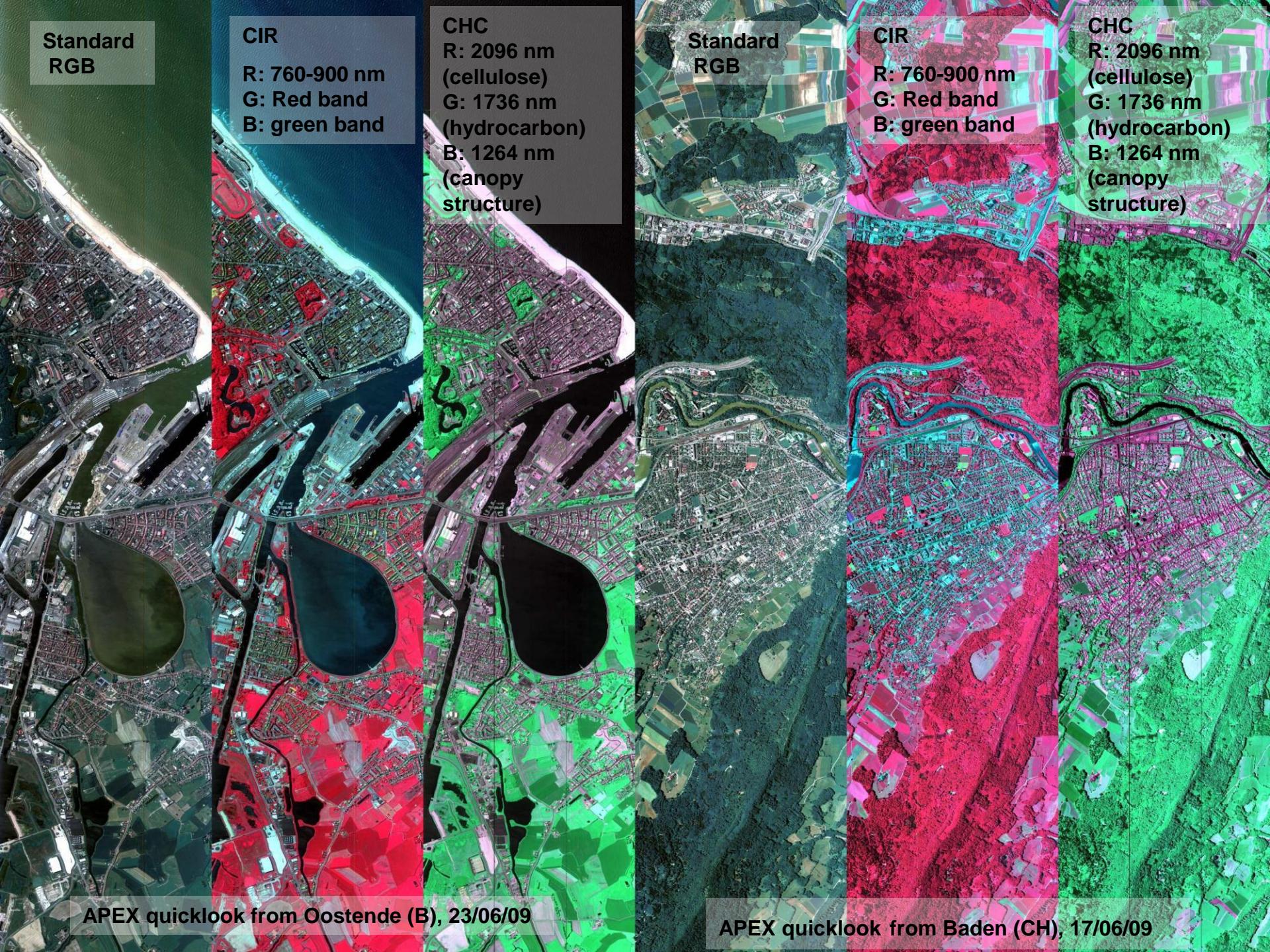
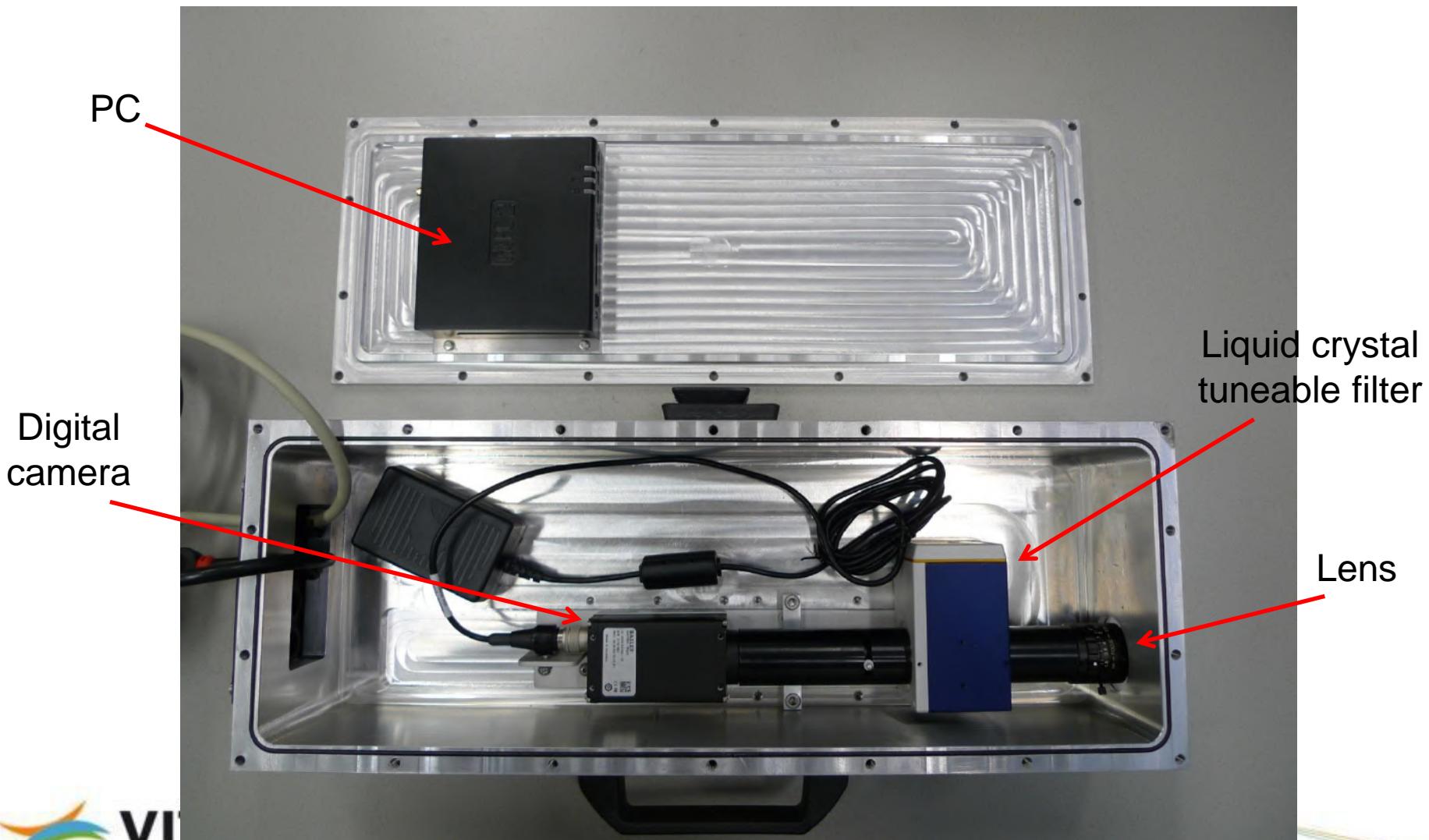
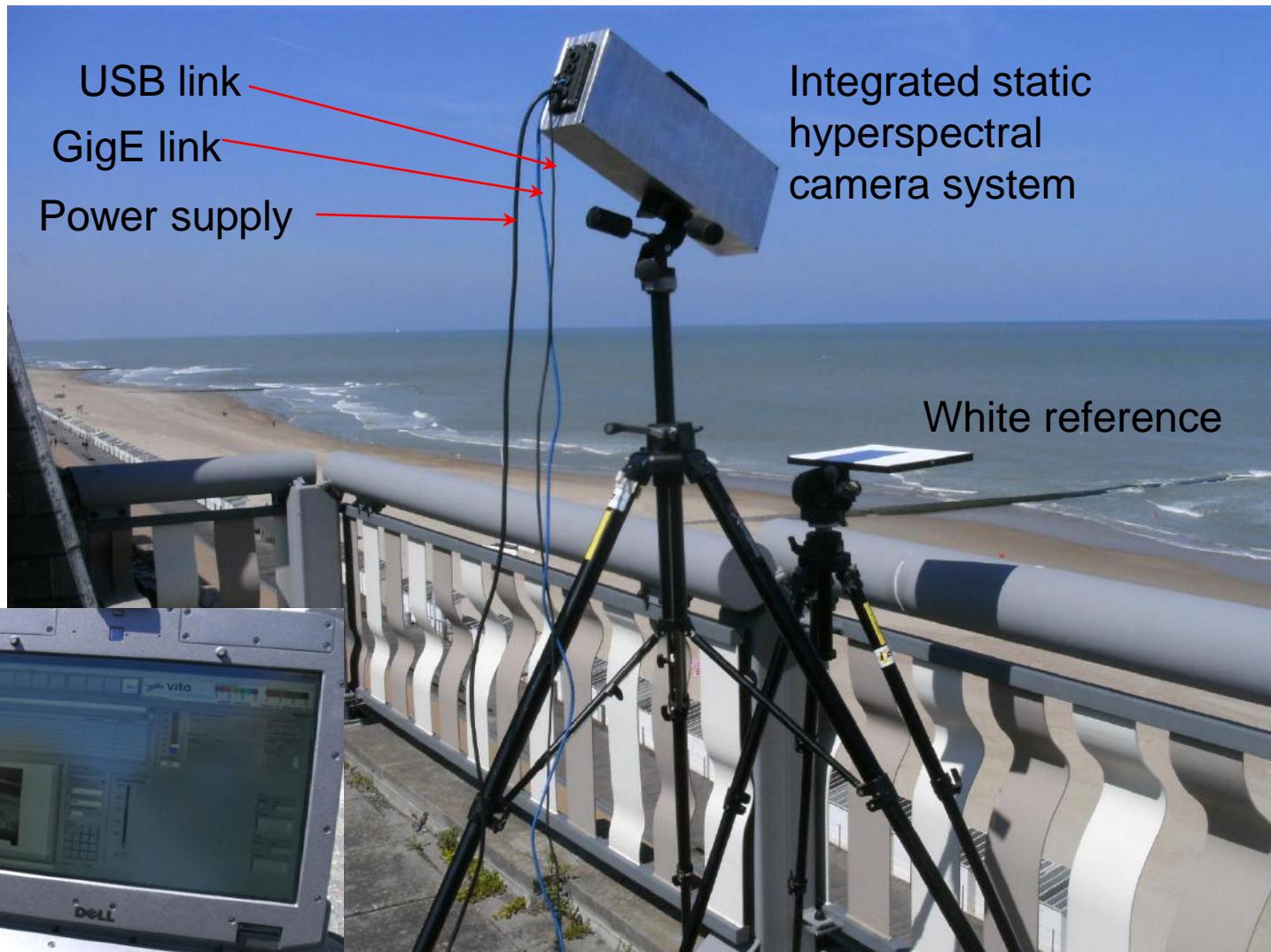


Image acquisitions – LiCrIS – liquid Crystal based Imaging Spectrometer



LiCrIS set-up



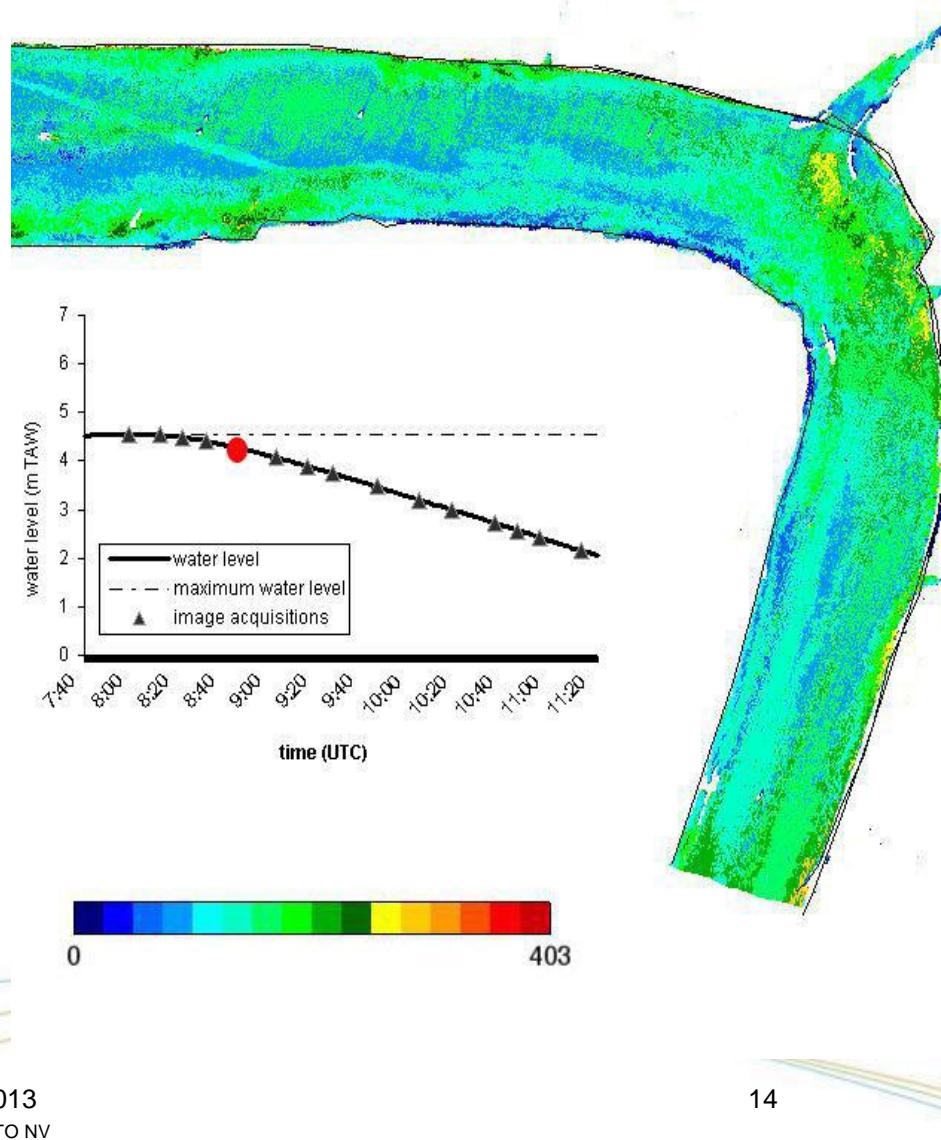
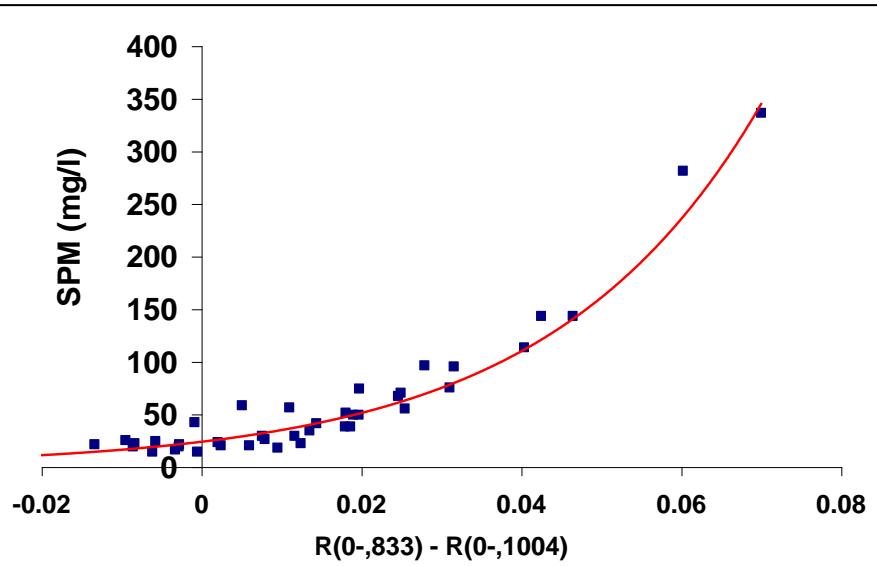
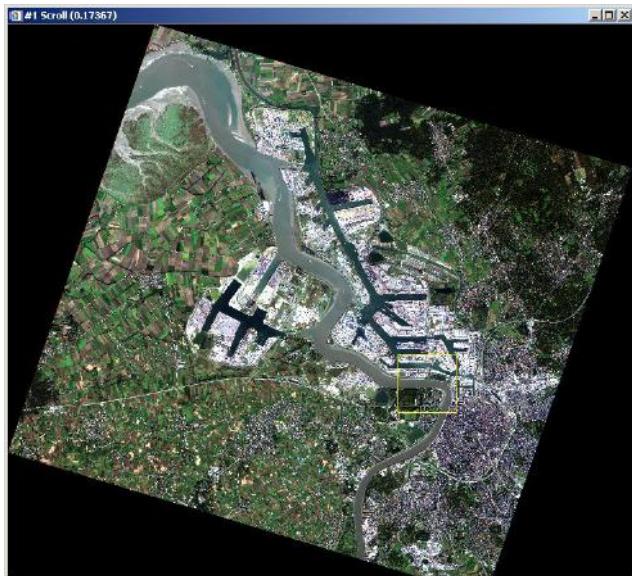
LiCrIS set-up



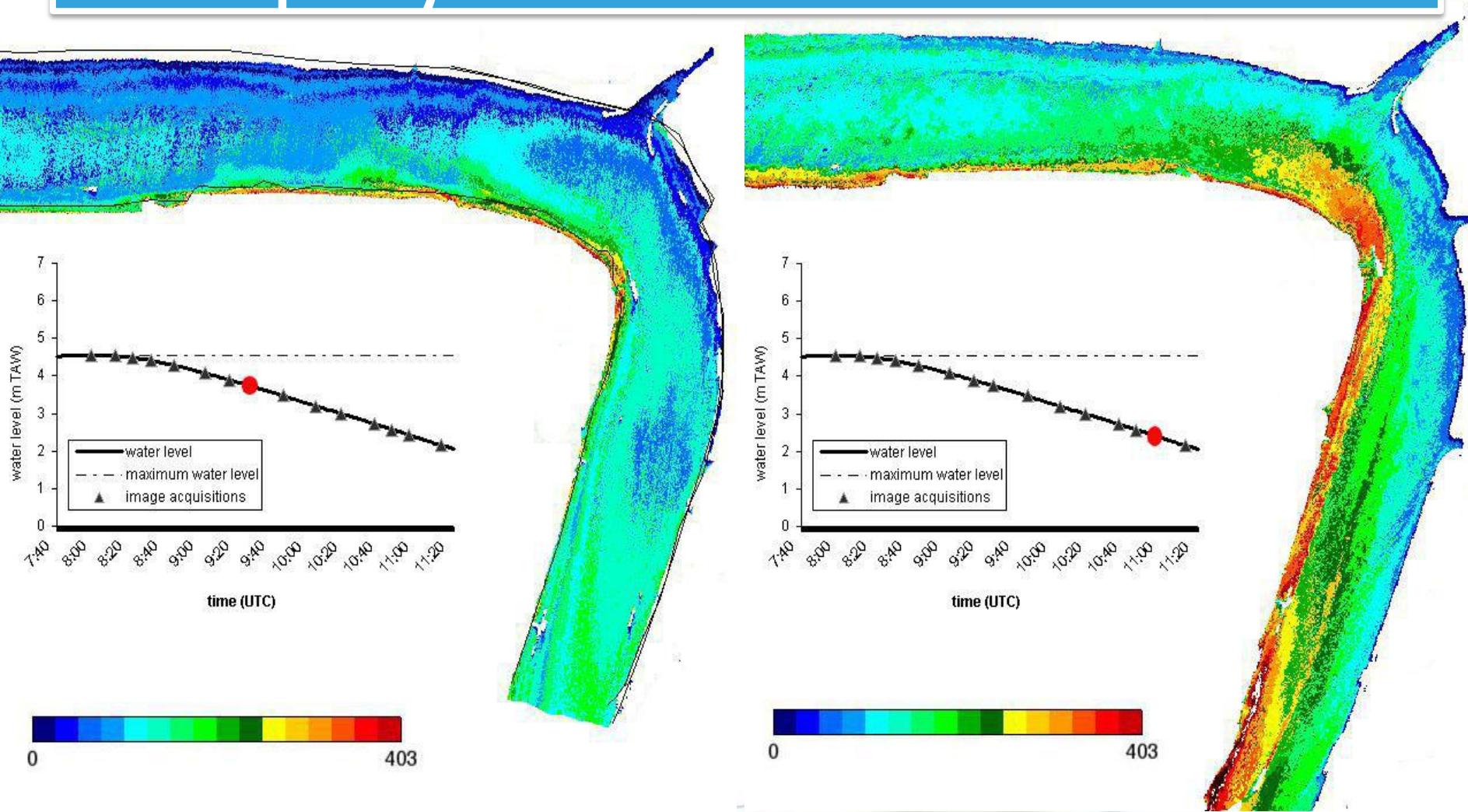
An aerial photograph showing a coastal landscape with a large, light-colored sandbank or barrier island curving into a dark blue body of water. The land is marked by numerous intricate, branching patterns of water channels and pools, characteristic of a tidal flat or deltaic system. In the bottom left corner, a white airplane wing is visible, indicating the photo was taken from an aircraft.

Water quality

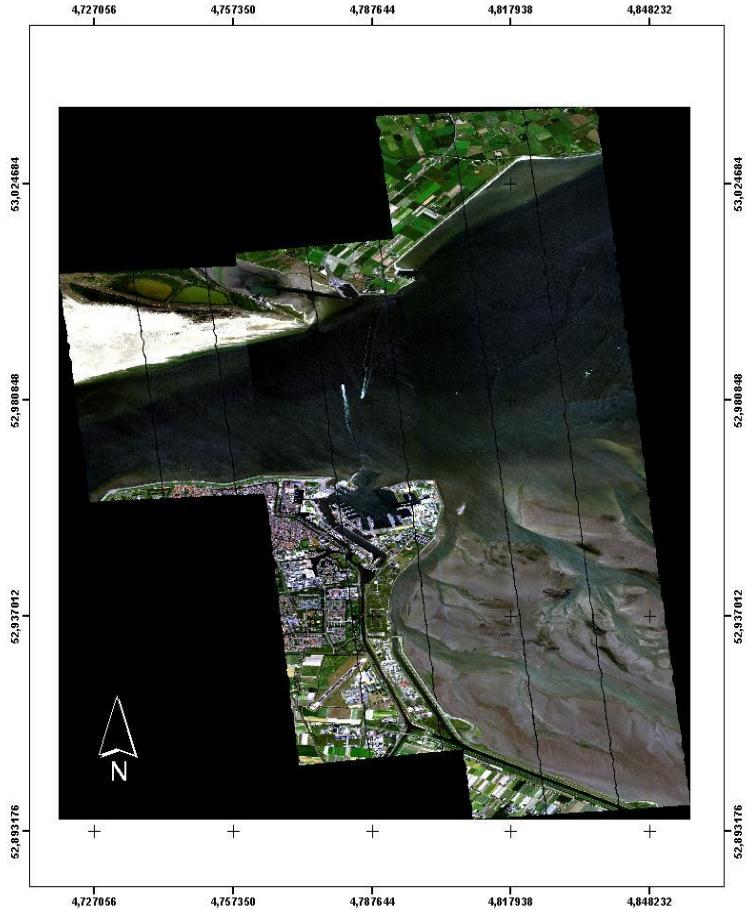
Hyperspectral flightcampaigns and water quality retrieval at the Scheldt river



Hyperspectral flightcampaigns and water quality retrieval at the Scheldt river

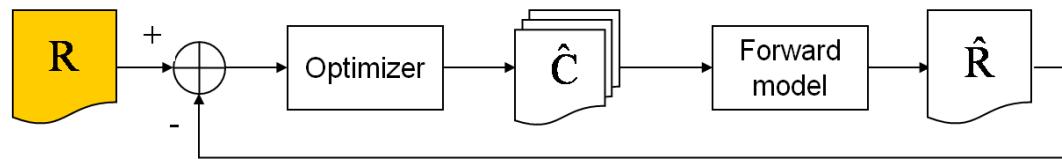


Hyperspectral flightcampaigns and water quality retrieval at The Wadden Sea

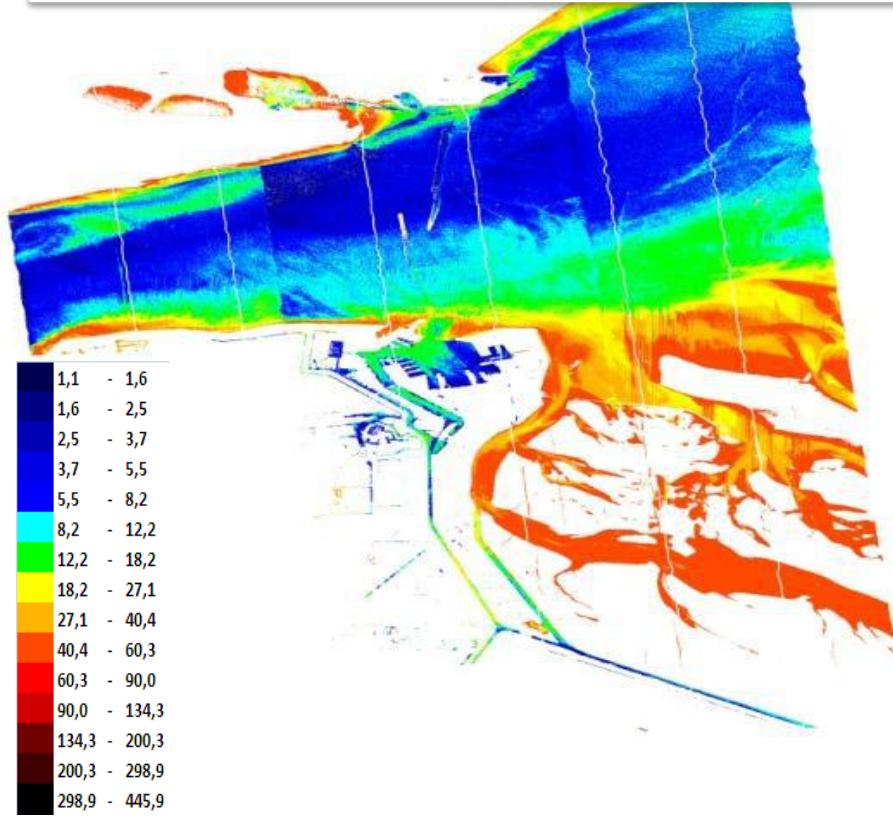


Mosaic of three APEX flightlines

Curve fitting procedure

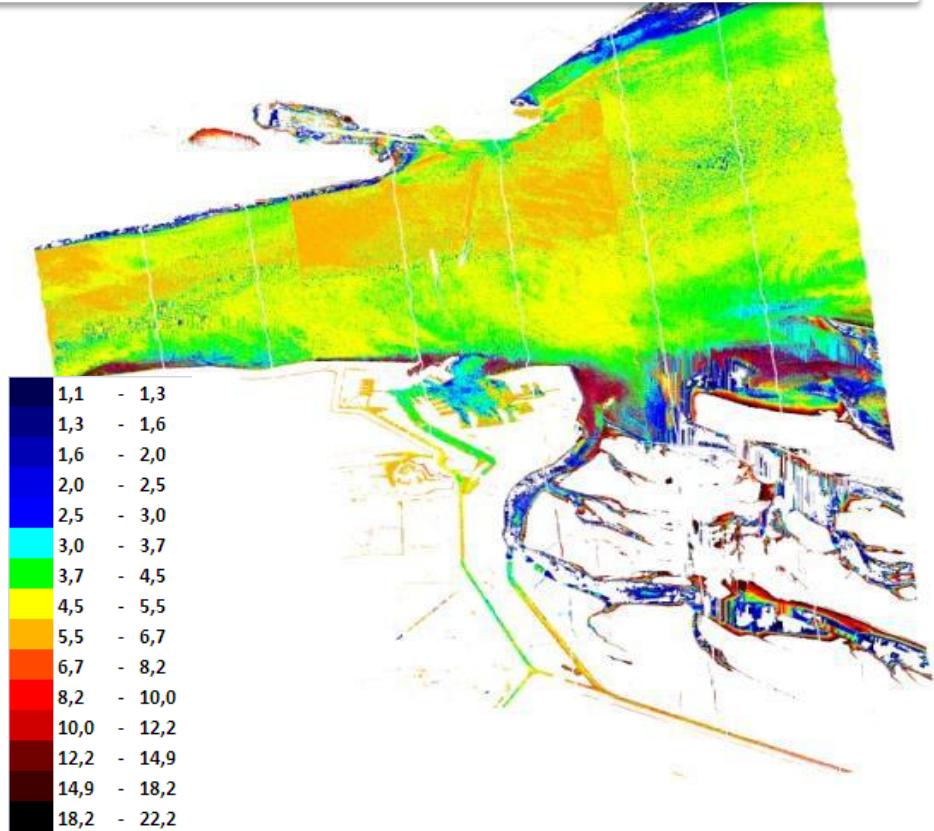


Hyperspectral flightcampaigns and water quality retrieval at The Wadden Sea



TSM concentrations in the Wadden Sea (in mg L^{-1}), mosaic of flight line 1, 2 and 3

RMSE: 2.7 mg L^{-1} or 36% for the TSM concentration



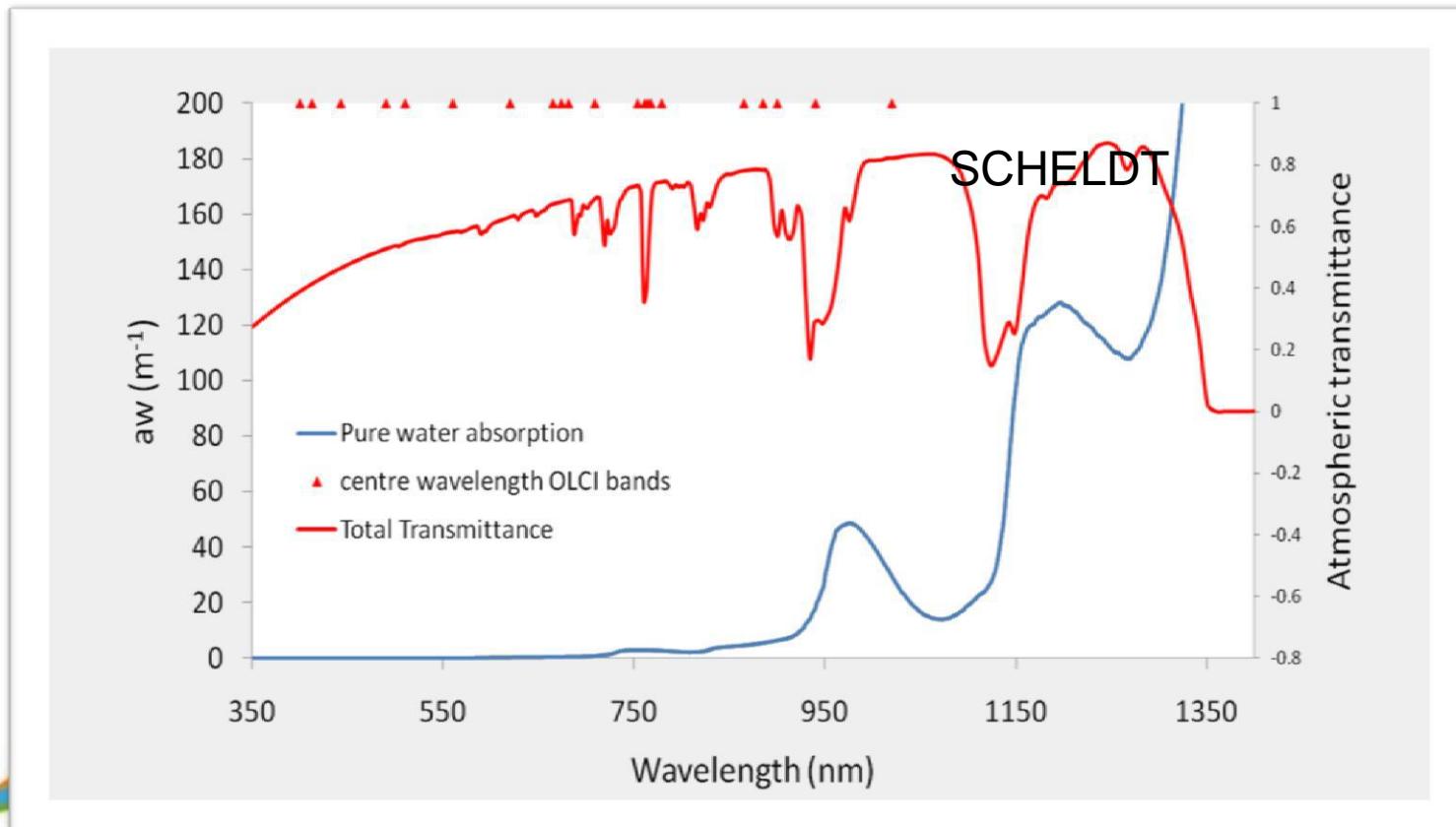
CHL concentrations in the Wadden Sea (in mg L^{-1}), mosaic of flight line 1, 2 and 3

a RMSE of 2.9 mg L^{-1} or 32% for the CHL concentration

Water leaving reflectance – SWIR?

SWIR is potentially interesting:

- Atmospheric transmission windows
- SWIR spectral bands available in future spaceborne sensors (e.g. Hypsir, OLCI)
- Local decrease in pure water absorption



Scheldt river

SeaSWIR



ASD

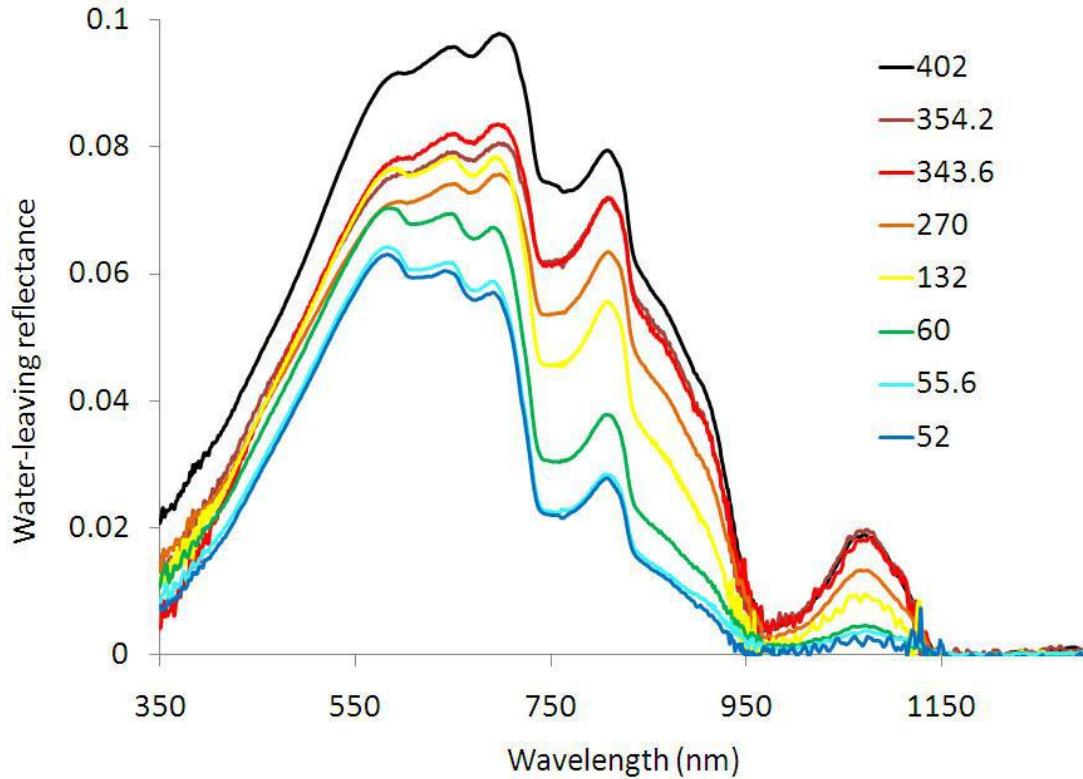
TRIOS

Water leaving reflectance – SWIR?

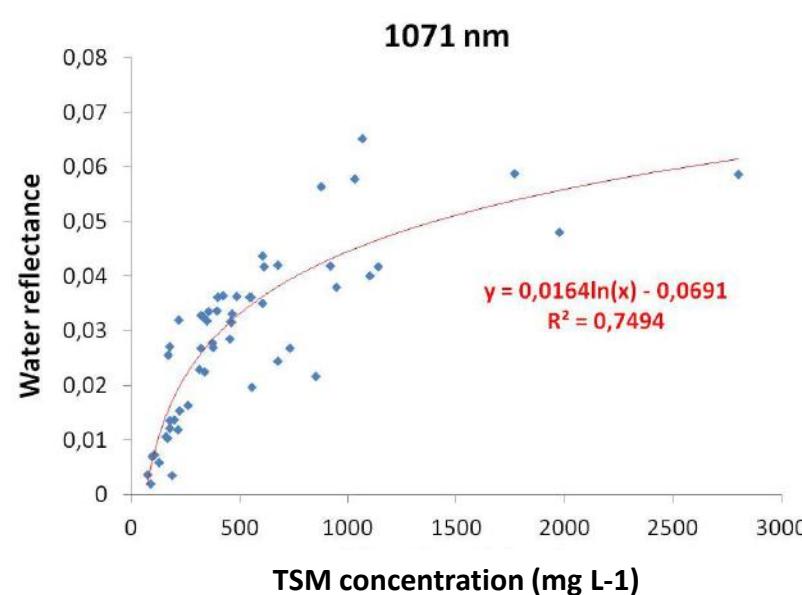
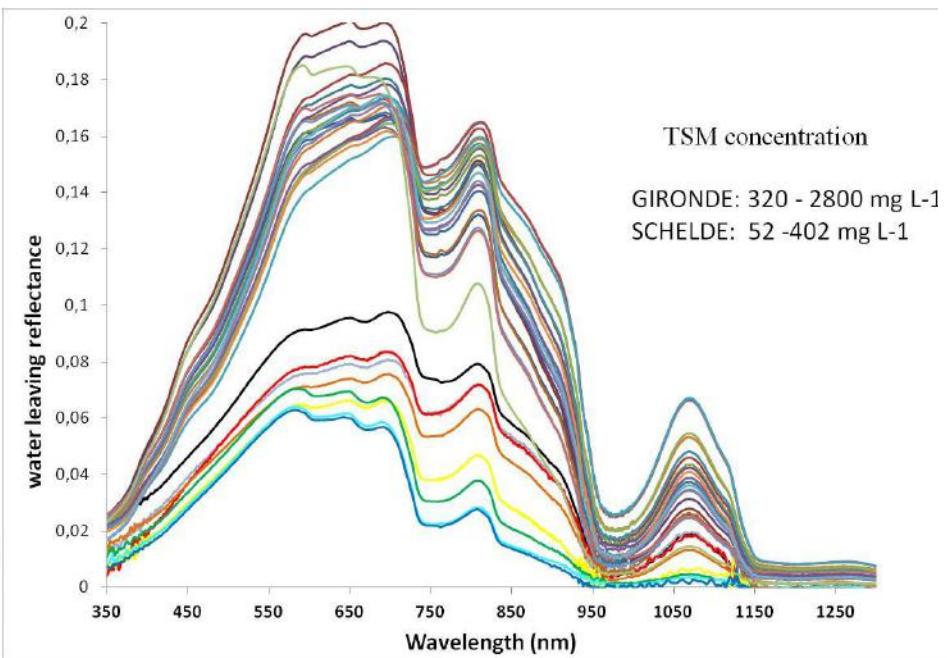
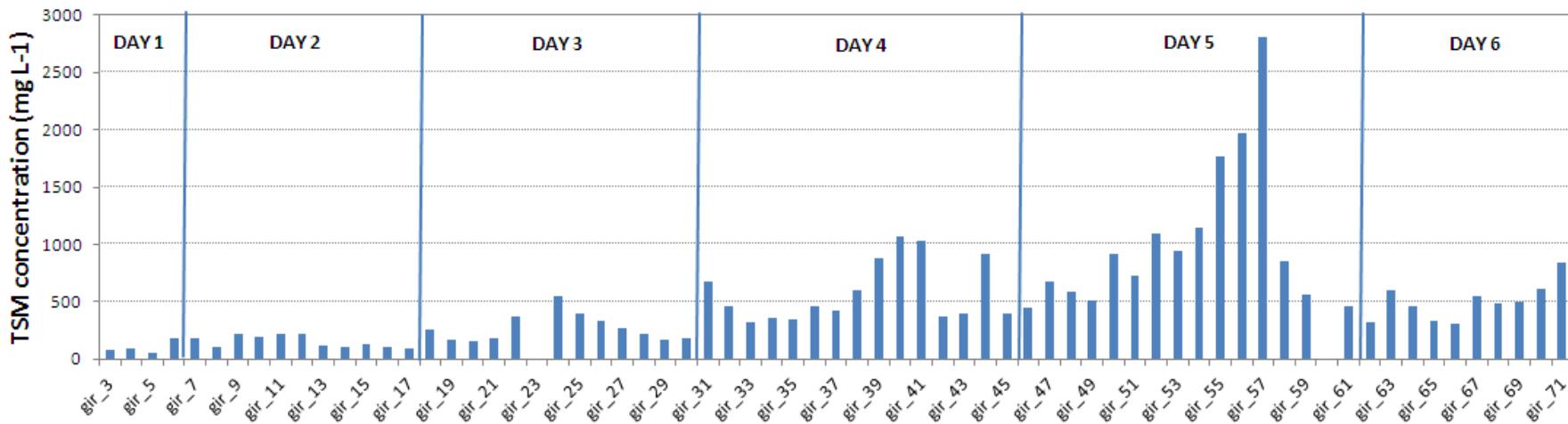
Knaeps, E., Raymaekers, D., Sterckx, S., Ruddick, K., Dogliotti, A.I.. 2012. In situ evidence of non-zero reflectance in the OLCI 1020nm band for a turbid estuary, *Remote Sensing of Environment*, *Sentinel special issue*, 112



Pure water absorption coefficient (Pope & Fry,
1997: Kou et al.. 1993)



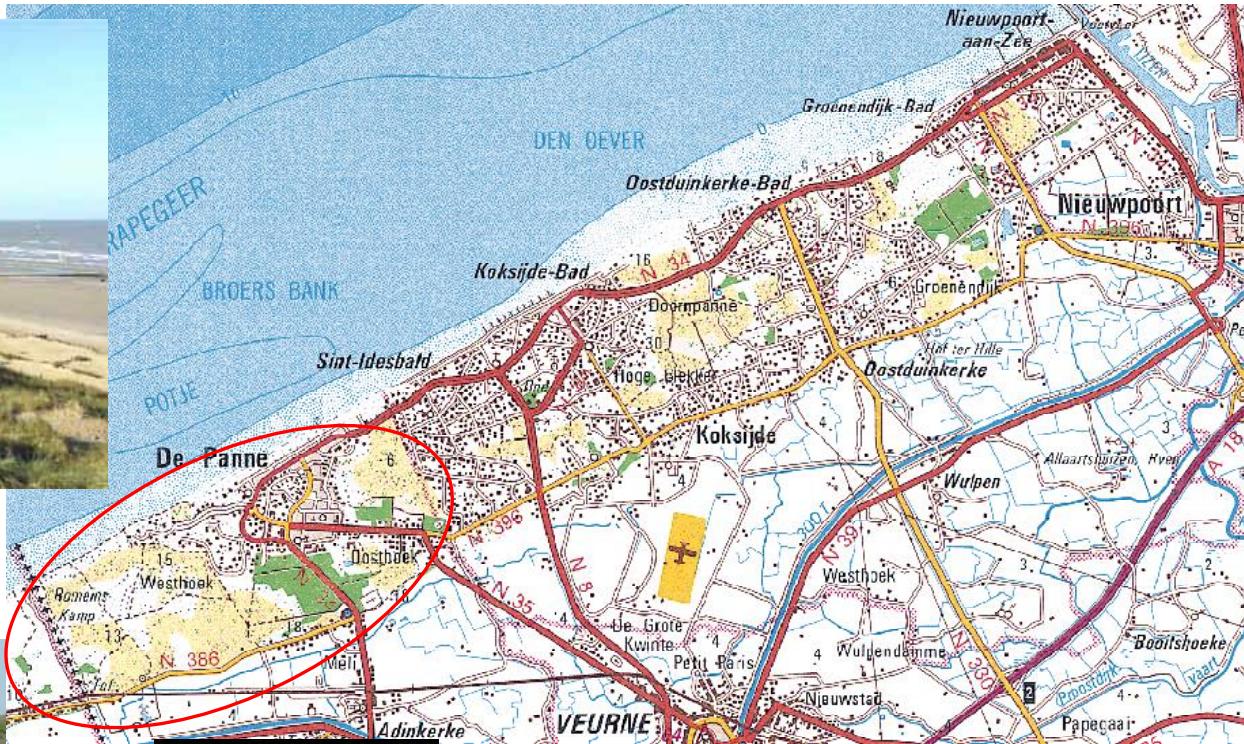
Gironde river



A photograph of a man in a field, crouching down and writing in a notebook. He is positioned between two pieces of surveying equipment: a yellow tripod with a GNSS antenna on top and a black tripod with a white rectangular sensor unit. The background shows a grassy hillside with dense green vegetation under a clear sky.

Hyperspectral Remote Sensing of vegetation in the dynamic dunes along the Belgian Coast

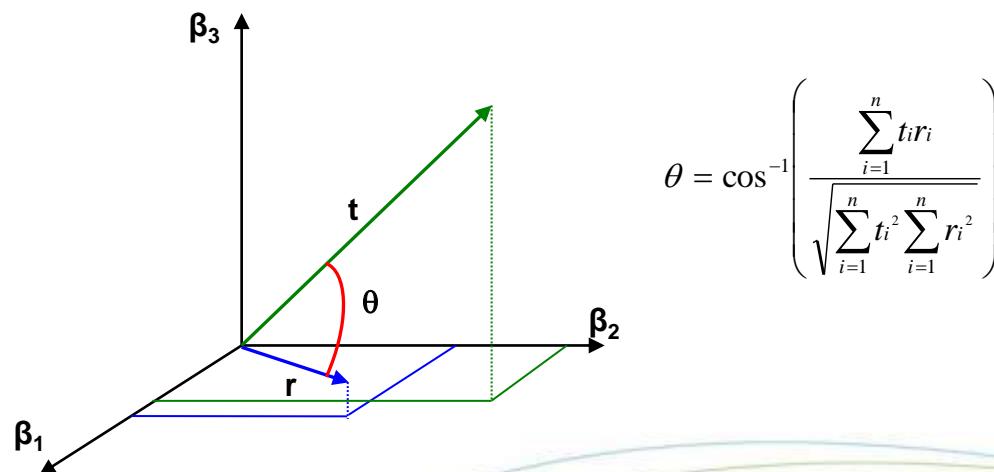
Situating the study area: “De Westhoek”



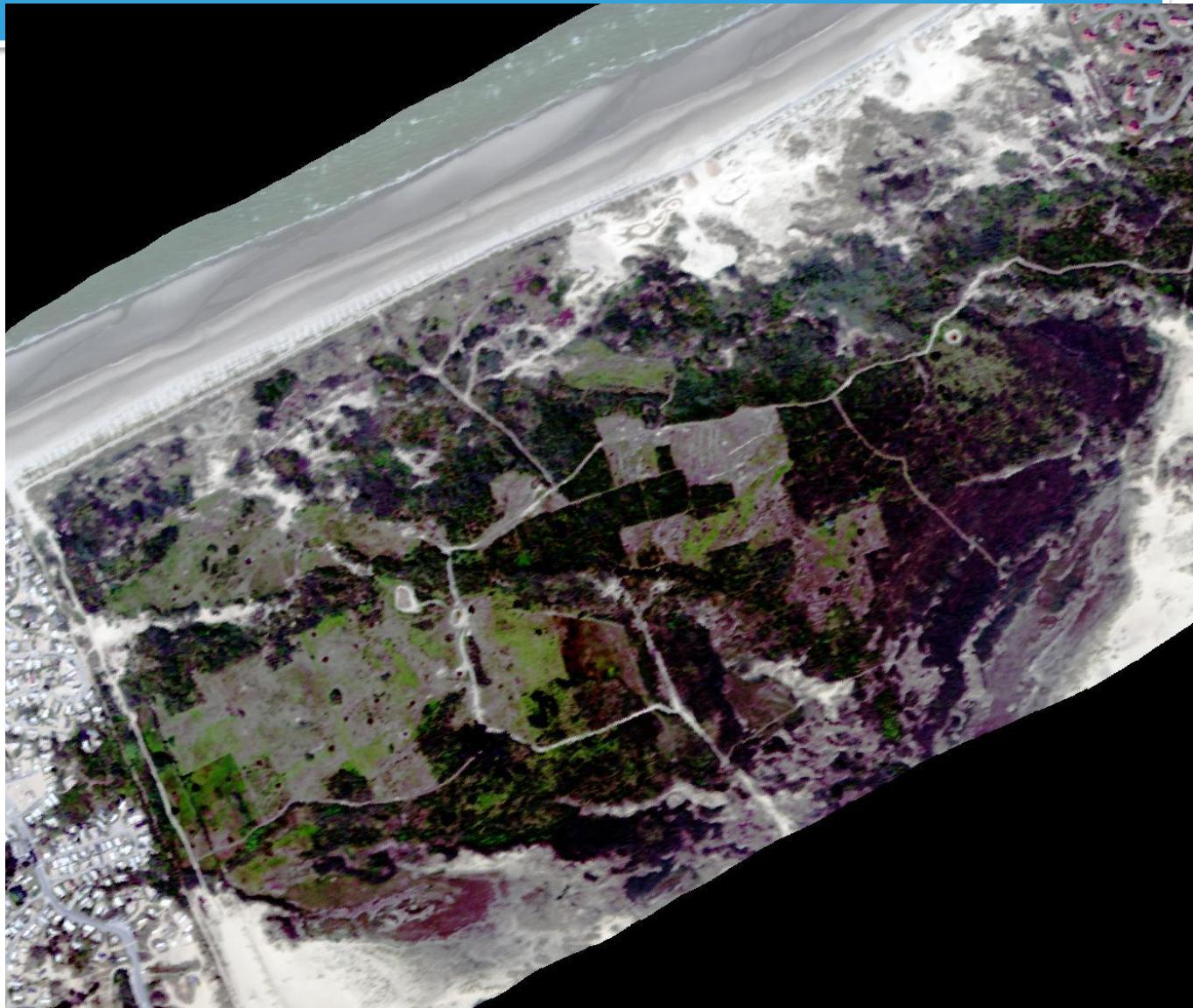
- 340 ha large nature reserve
- 400 species of vascular plants
→ 1/3 of the Flemish flora
- 20% extremely rare

Classification approach

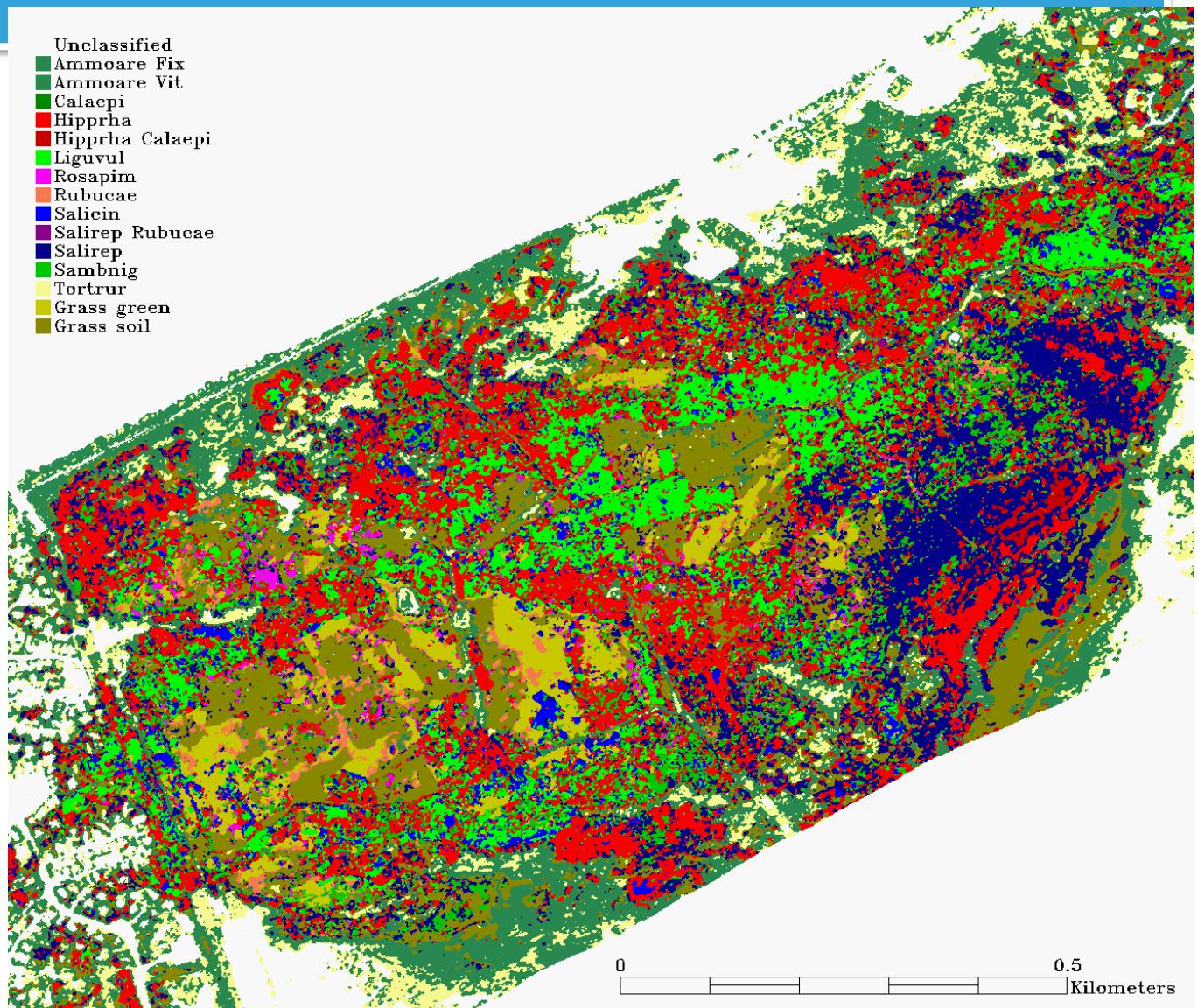
- The MNF reduces the dimensionality of the dataset and retains a small number of noise-free components.
- Compares image spectra to reference spectra of spectral libraries
- Two spectra are treated as vectors in N-d space (N = number of spectral bands)
- Similarity determined between two spectra by calculating spectral angle between both



The AISA-Eagle image



Classification result of the AISA image using SAM



What's in a pixel?

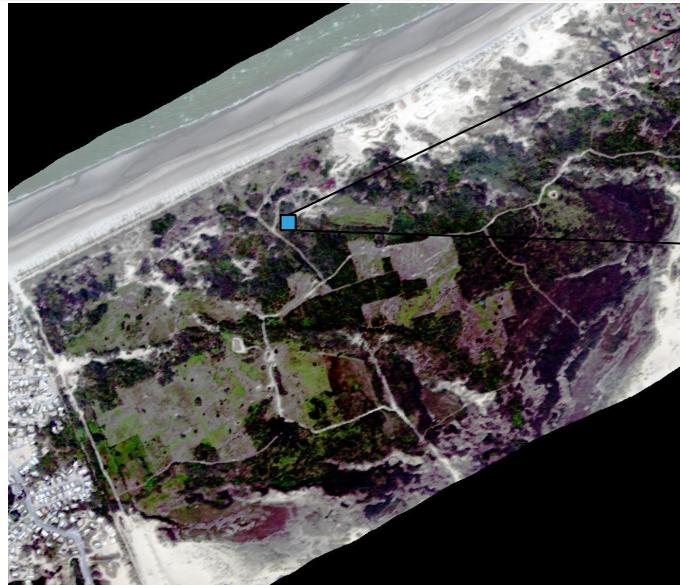
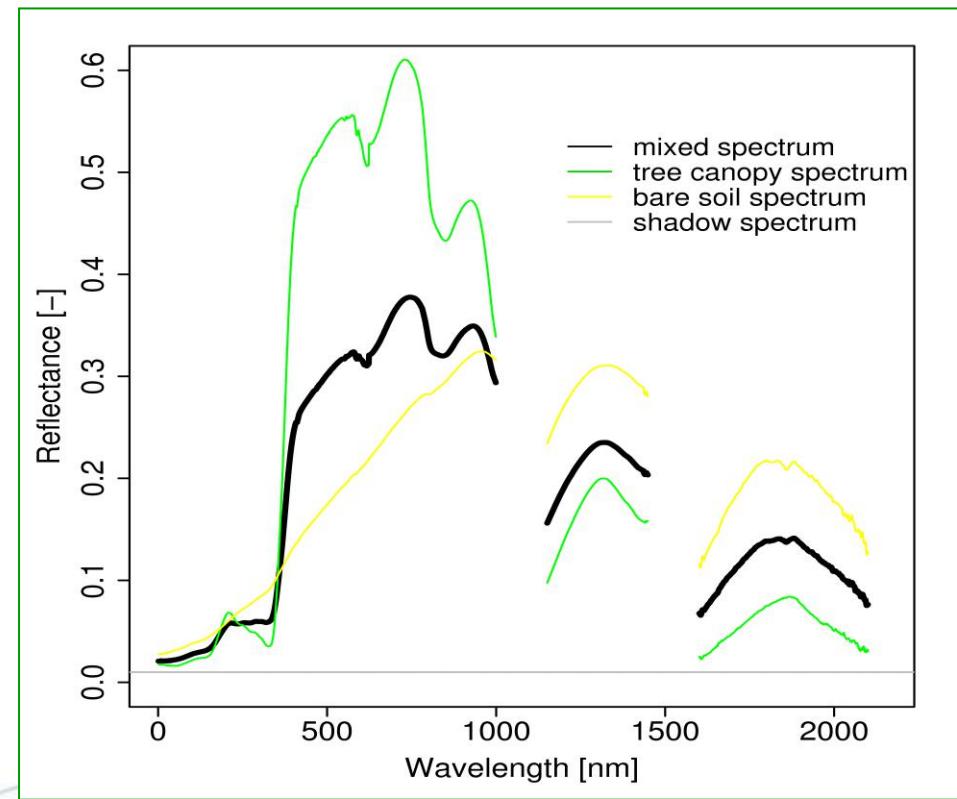
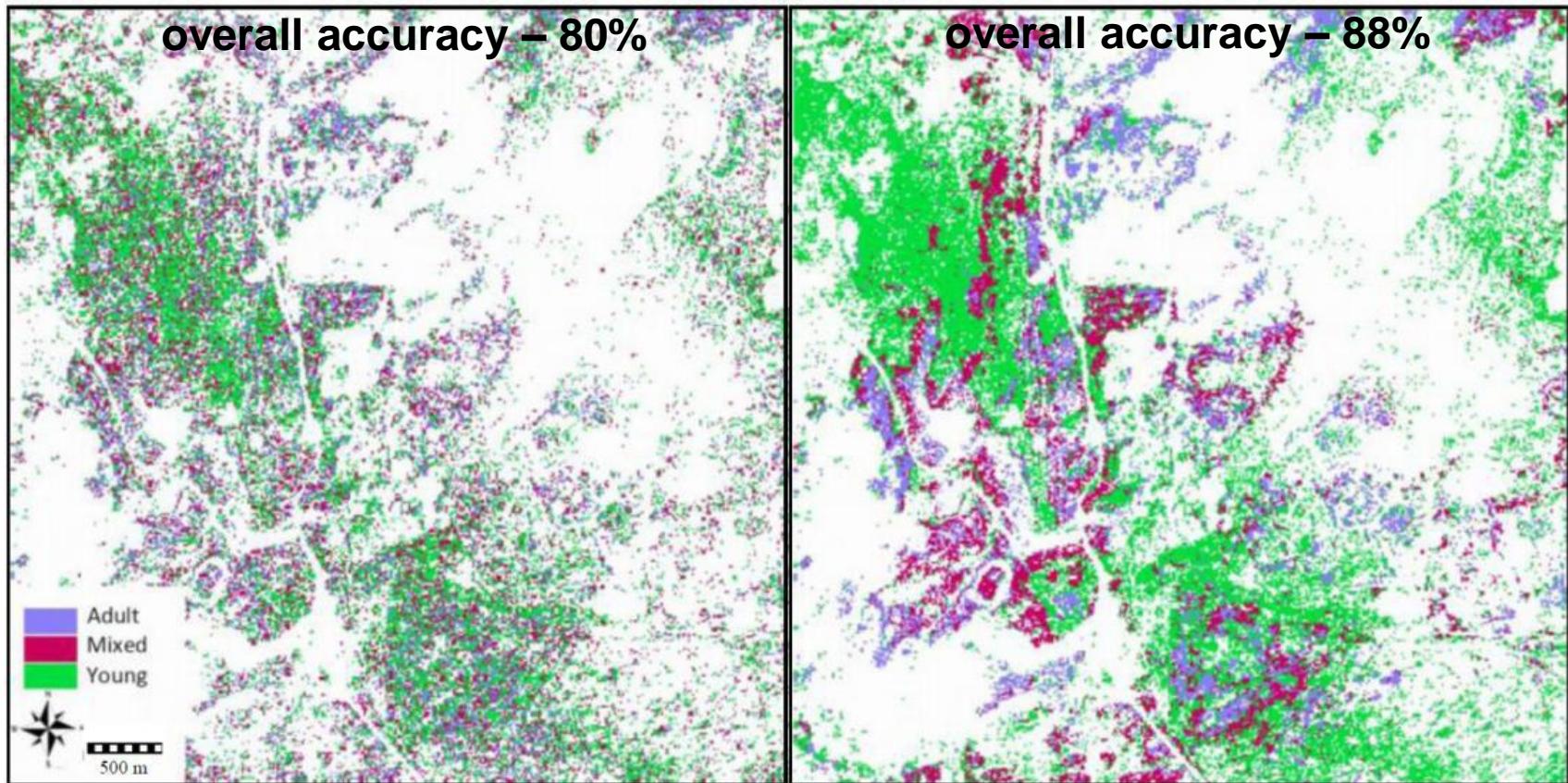


Image pixels often integrate the spectral information of different ground components (soil & vegetation, or different vegetation types). This mixing effect causes “spectral blurring” and can drastically reduce the quality of our classification



What's in a pixel?

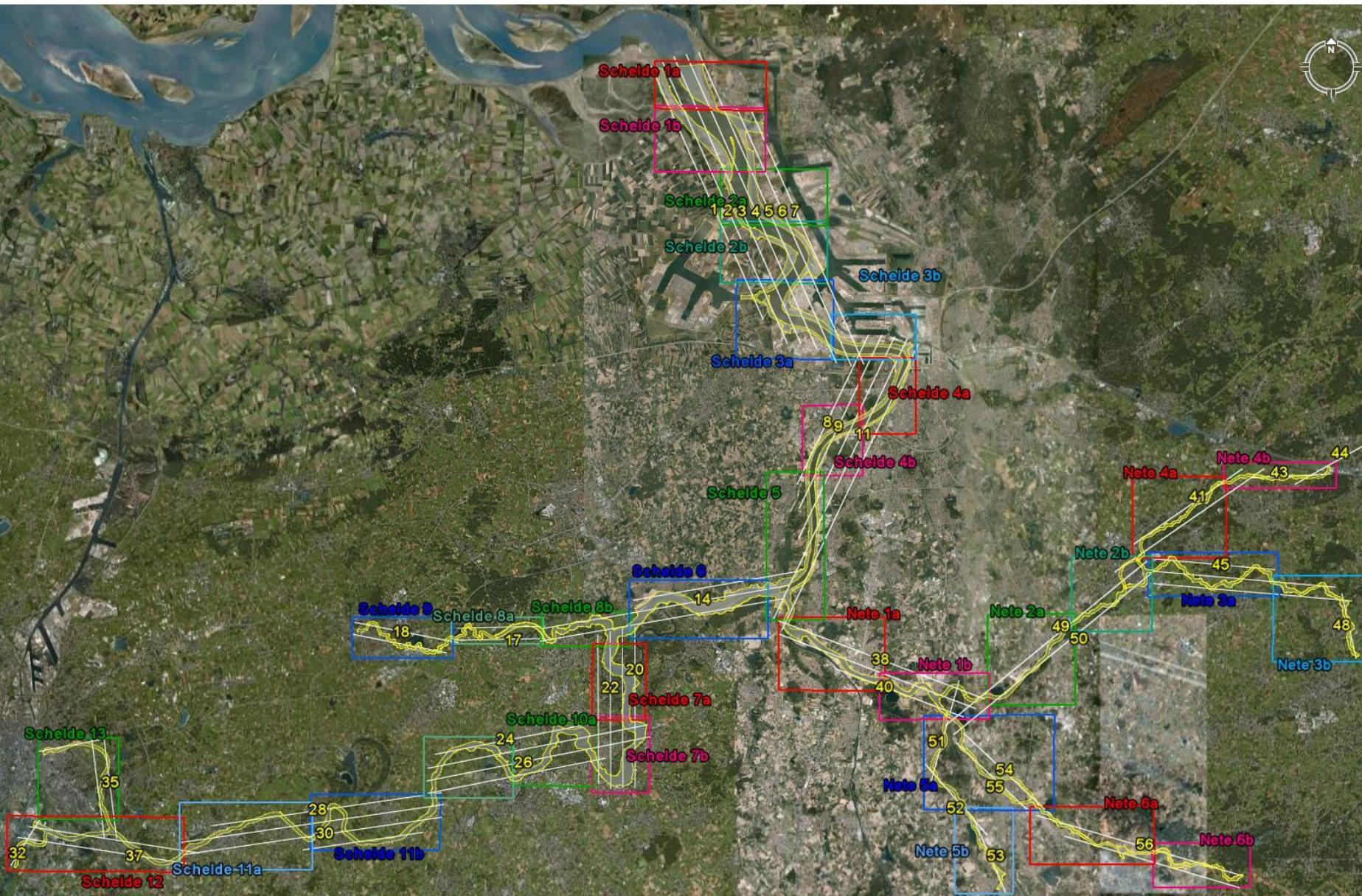


Left: Pixel-based classification of the heathland area in the Kalmthoutse Heide study area. Right: sub-pixel classification of the heathland area in the Kalmthoutse Heide with different age classes

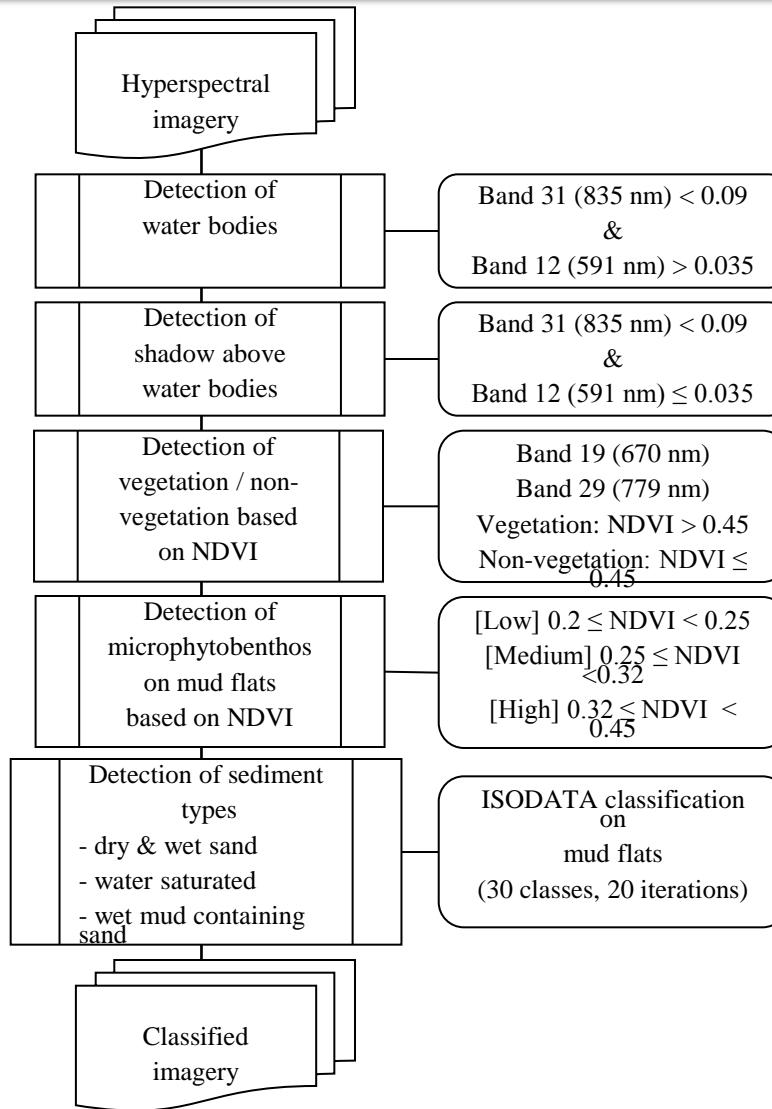
A photograph of a riverbank scene. In the foreground, there's a grassy area and a path made of large, rectangular concrete tiles. To the right, a body of water reflects the sky. In the background, there are more trees and a clear blue sky.

**Large-scale mapping of the riverbanks, mud flats and
tidal marshes
of the Scheldt basin,
based on airborne imaging spectroscopy and LiDAR**

LARGE-SCALE MAPPING OF THE RIVERBANKS, MUD FLATS AND SALT MARSHES OF THE SCHELDT BASIN, USING AIRBORNE IMAGING SPECTROSCOPY AND LIDAR



Classification; the expert system



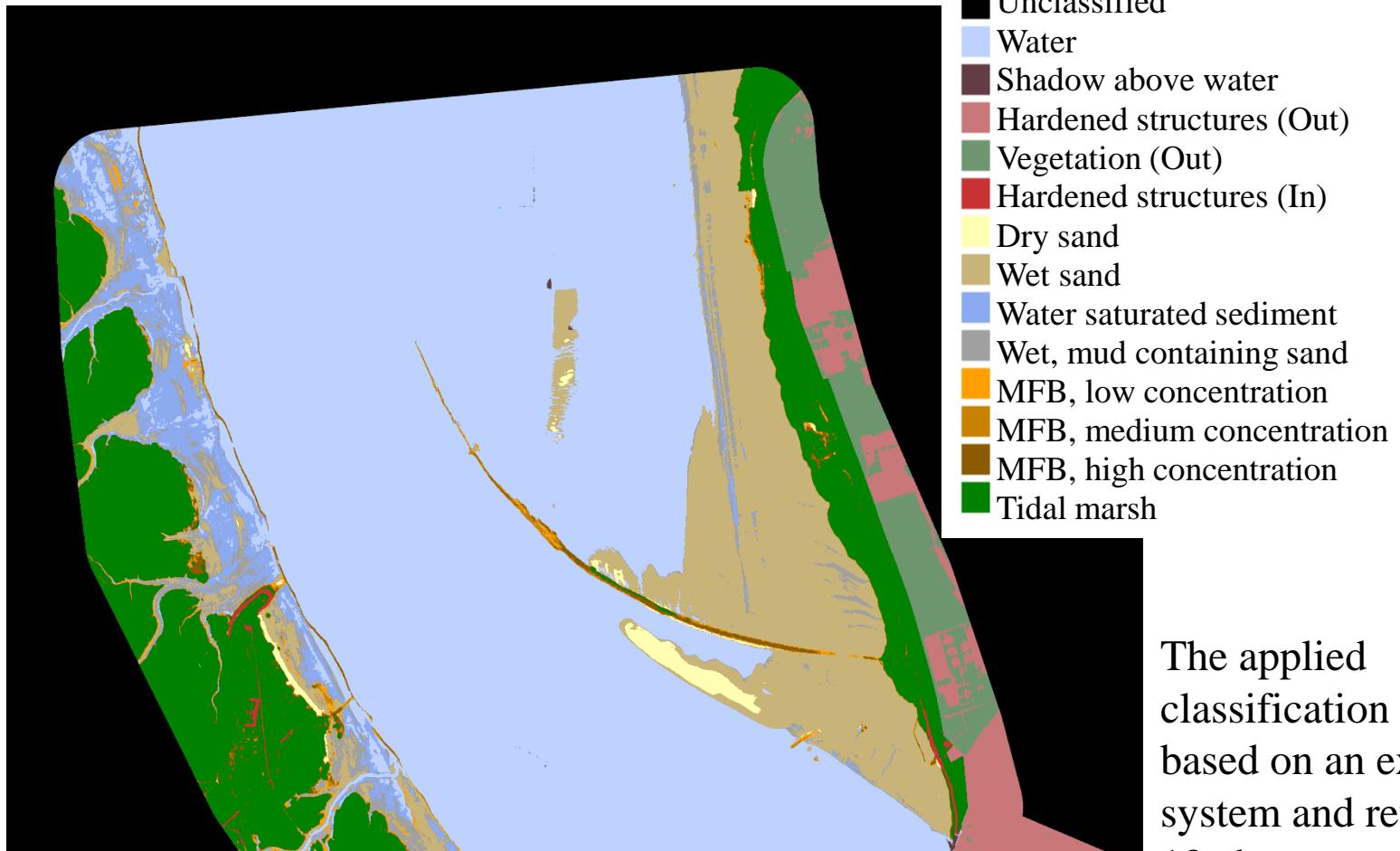
By using an expert system, 13 meaningful classes could be defined.

Classification; the unclassified composit



Sub-area:
Schelde_1a, a
composit of 5 flight
lines.

Classification; classified result by the expert system



The applied classification is based on an expert system and reveals 13 classes.

Thank you

- » els.knaeps@vito.be
- » APEX: www.apex-esa.org
- » Hyperspectral Research: <http://hyperspectral.vgt.vito.be>
- » Code library : Download available
at: <https://sourceforge.net/projects/enviidlcodelibr>

