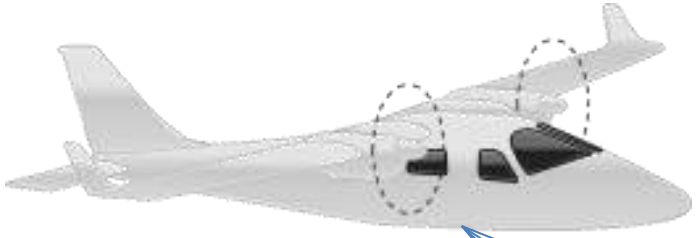


GREENSURVEY

AIRBORNE HYDRO MAPPING

AIRBORNE LAND MAPPING

AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

AirborneHydroMapping

New possibilities in bathymetric and topographic survey

Agenda

- University of Innsbruck
- Research project “green lidar” – the history and the future
- Fields of application:
  - **Hydro**Mapping:
    Near-shore - Baltic Sea
    Inland rivers – Rhine and Elbe
    Lakes – Lake Constance

  - **Ice&Snow** Mapping:
    Measuring snow and ice surfaces
    Laser induced assess of carbon contribution by glaciers
    Measuring snow depths

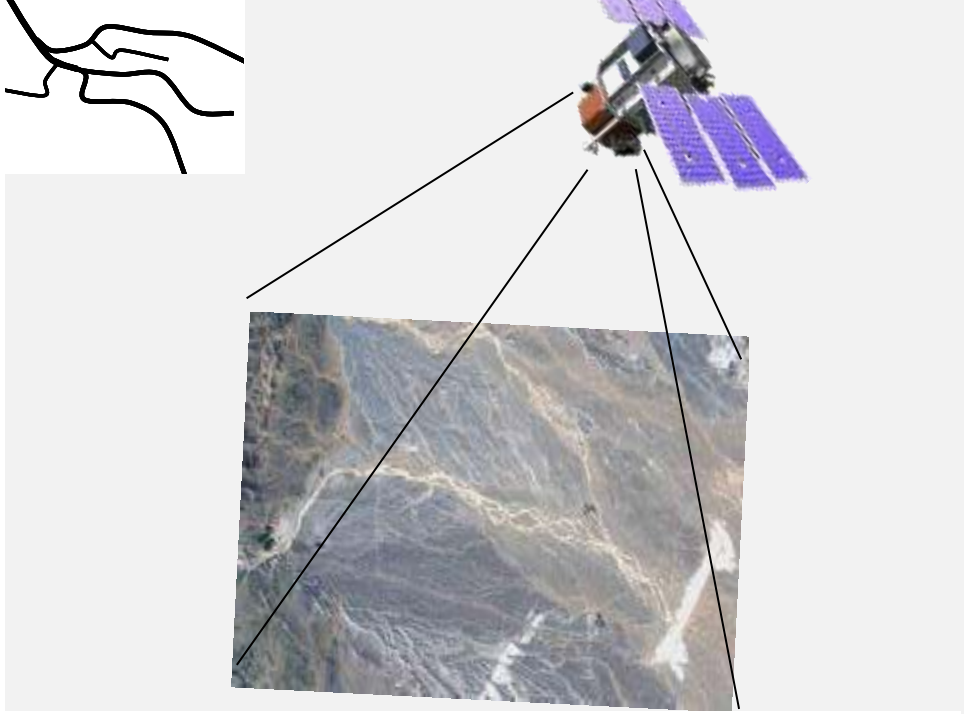
  - **Land**Mapping:
    Power line missions
    Steep slopes and mountainous areas
    Inner-city modeling and planning

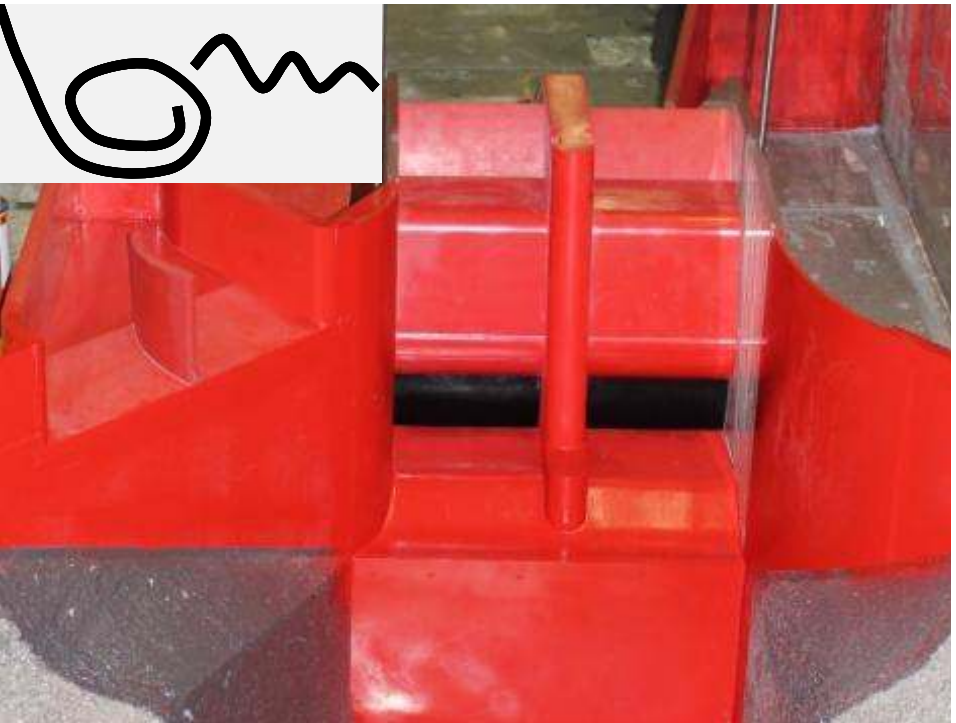
  - **Nature**Mapping:
    Automatic detection of vegetation distribution (roughness)
    Vitality check of forestry by combining green and red lidar

- AHM GmbH & AHM Software development GmbH – academic spin-off and company


Tirol


WASSERBAU
INNSBRUCK
IWI
Völs
1025 m
Image © 2011 GeoEye
© 2011 Google
© 2011 Tele Atlas
Image © 2011 GeoImage Austria
Google
Bildaufnahmedatum: 1 Jan 2000
Höhe 576 m
Sichthöhe 4.24 km



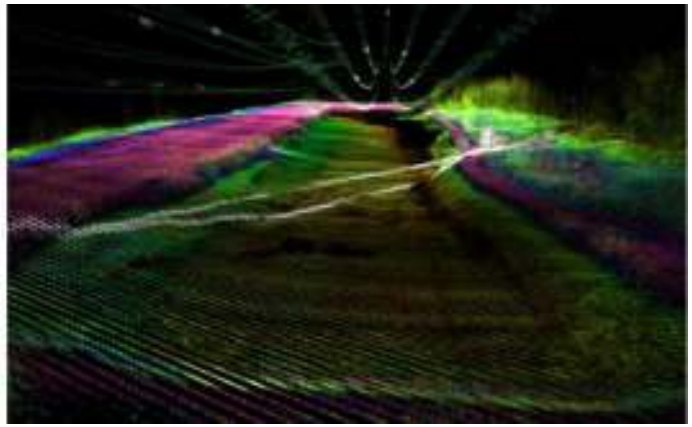


AIRBORNE HYDROMAPPING (2008 – 1011)

FFG-Project „Airborne Hydromapping“ 2008-2011

Projekttitel:	B2: Airborne Hydromapping
Projektnummer:	815483
Antragsteller:	Universität Innsbruck, Arbeitsbereich Wasserbau *RIEGL* Laser Measurement Systems GmbH
Förderzeitraum:	Februar 2008 – Februar 2011

Pictures of final report:



FFG-Project „Airborne Hydromapping“ 2008-2011

A lot of work .... :

Abbildung 1: Laseraufbau Fa. RIEGL, "Vor-Versuchsystem"

Agenda

- University of Innsbruck
- Research project “green lidar” – the history and the future
- Fields of application:
  - **Hydro**Mapping:
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Fields of application / description of technology

HydroMapping:
Near-shore - Baltic Sea
Inland rivers – Rhine and Elbe
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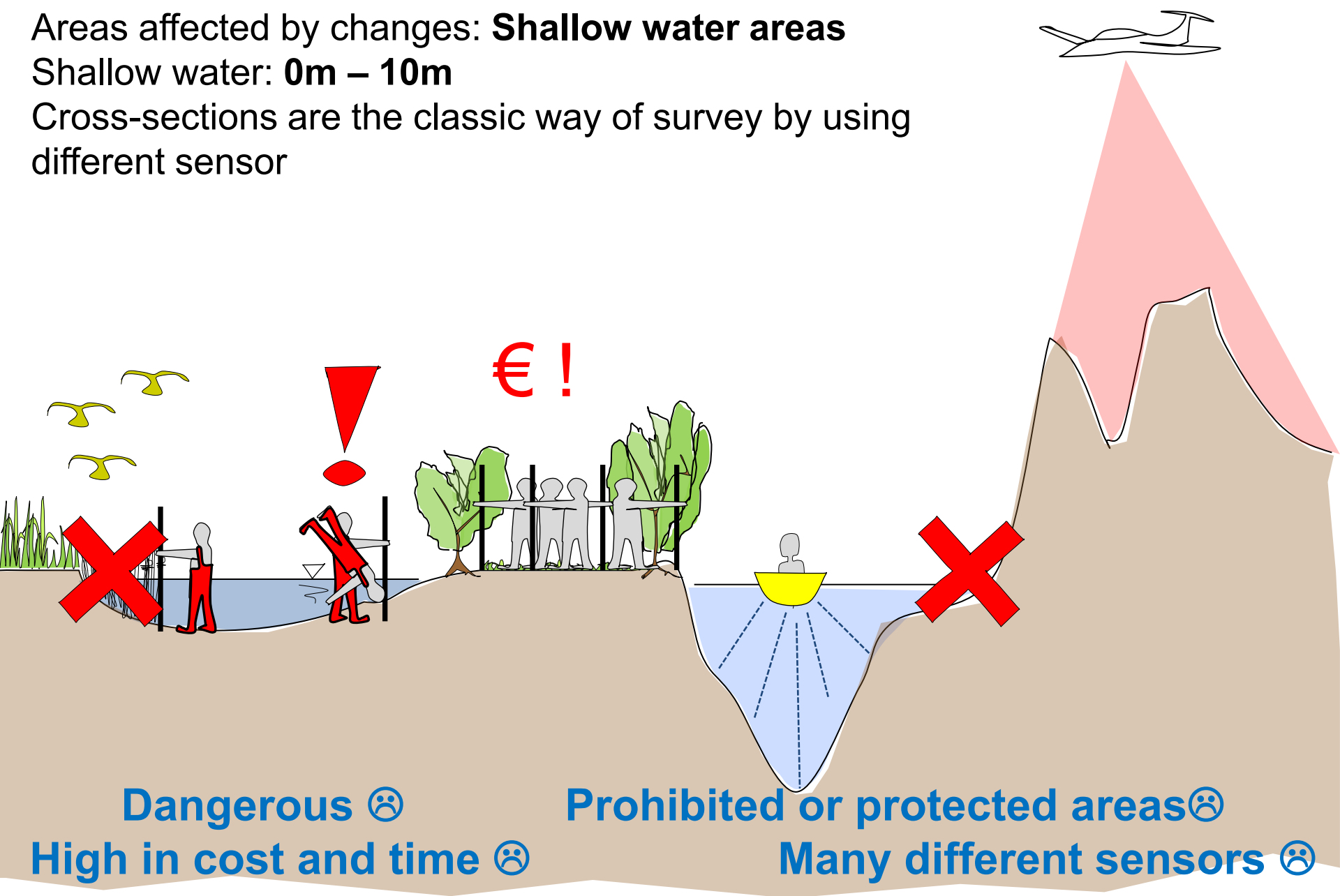
Areas affected by changes: **Shallow water areas**
Shallow water: **0m – 10m**
Cross-sections are the classic way of survey by using different sensor



Dangerous ☹
High in cost and time ☹

Prohibited or protected areas☹
Many different sensors ☹

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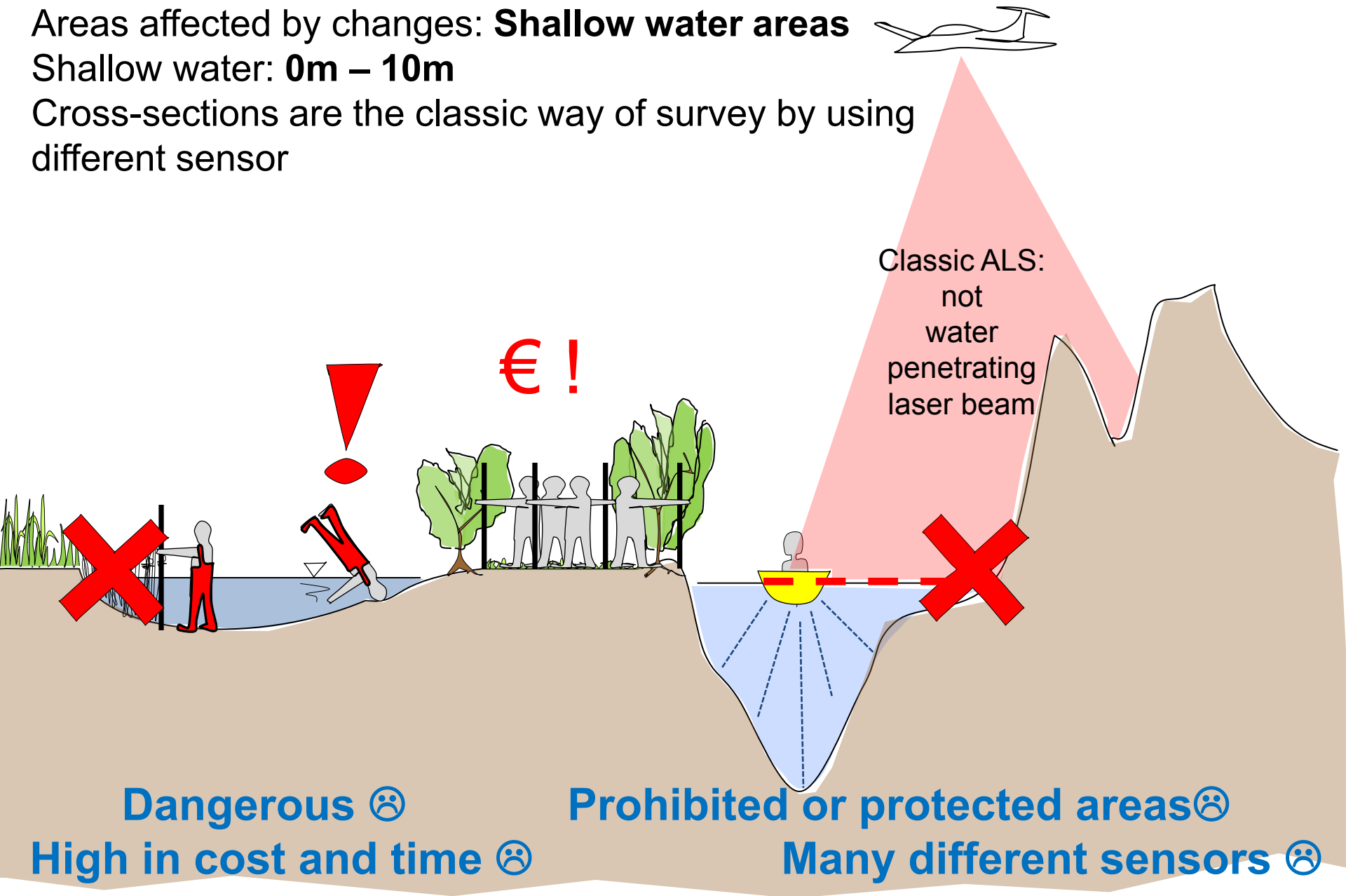
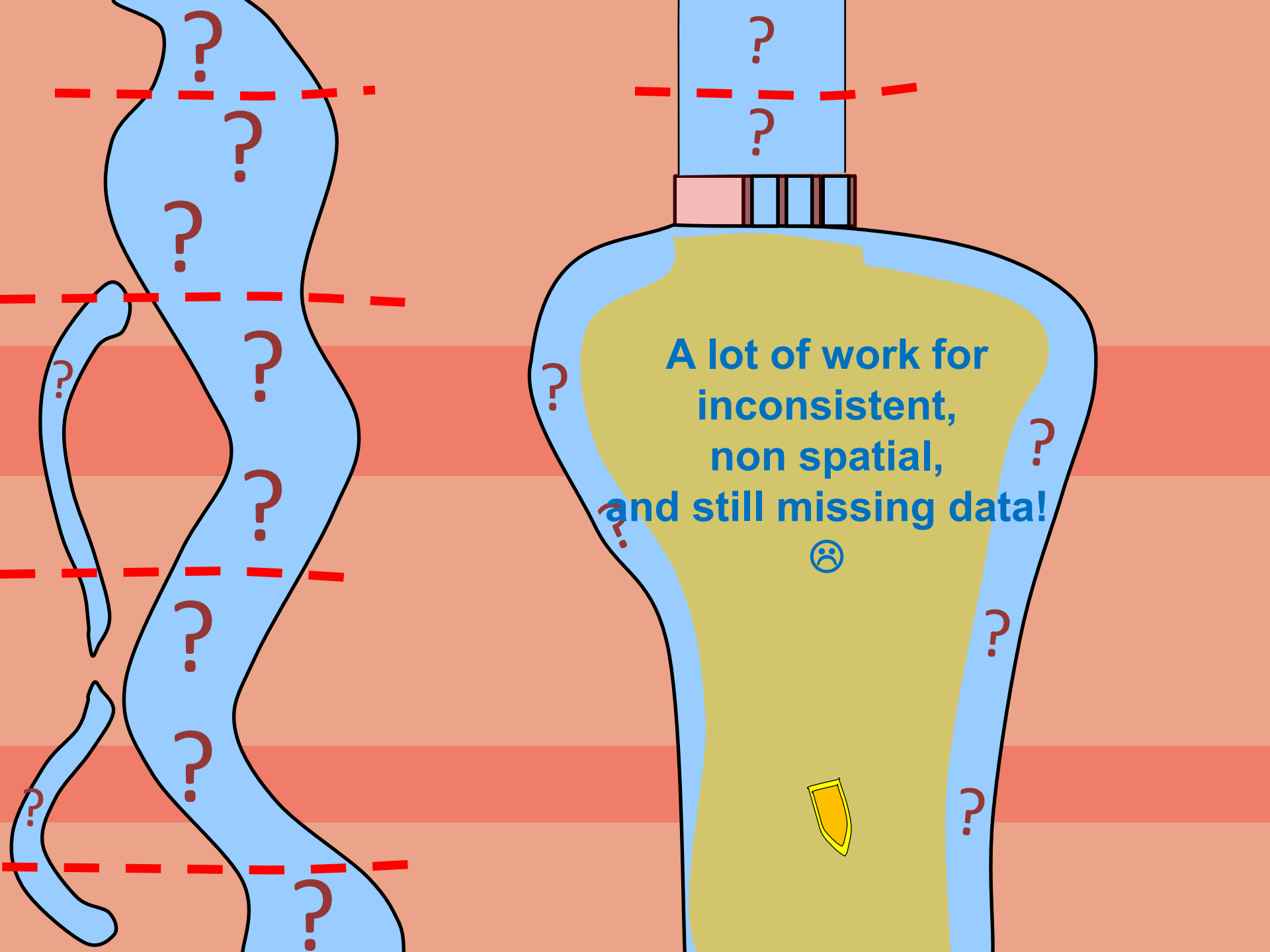
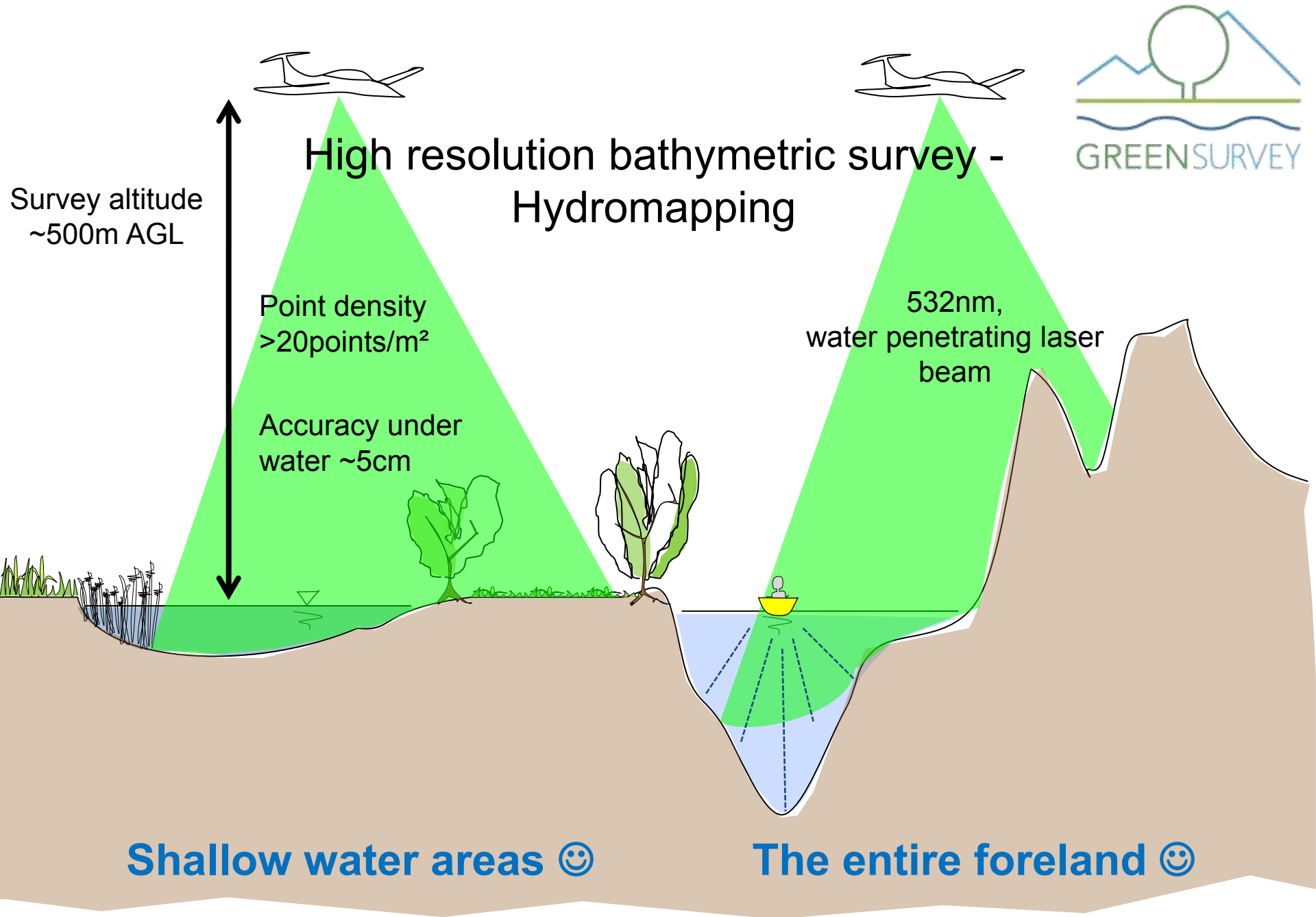


Dangerous ☹
High in cost and time ☹

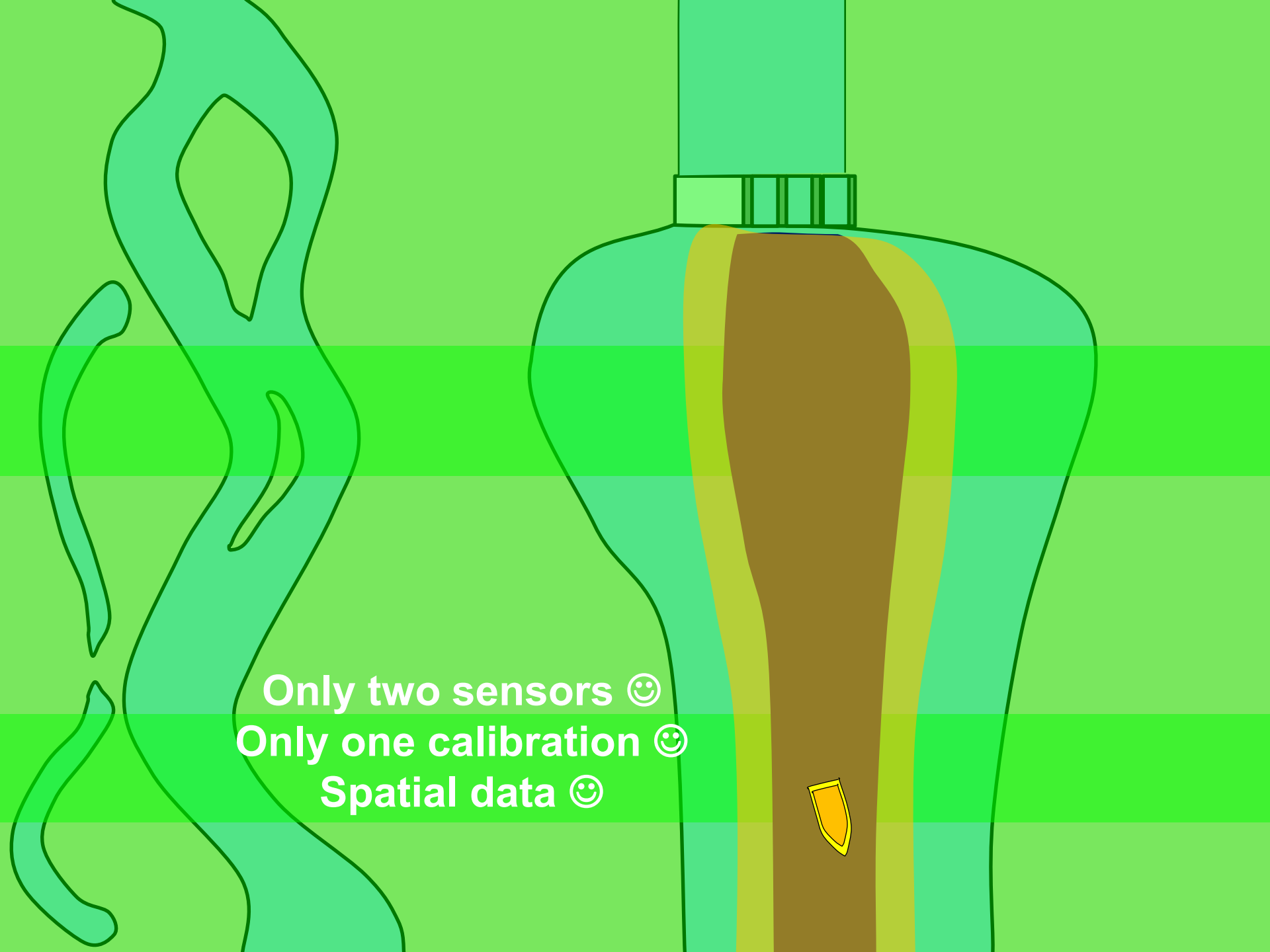
Prohibited or protected areas☹
Many different sensors ☹


A lot of work for
inconsistent,
non spatial,
and still missing data!
☹

High resolution bathymetric survey - Hydromapping



Only deeper areas need to be captured by echo sounders ☺


Only two sensors ☺
Only one calibration ☺
Spatial data ☺

Bathymetric survey: Baltic Sea coast, Germany

Hydromapping

July 2012

~387.000.000 points

Clear water conditions

Depth down to 8 m

Sonar

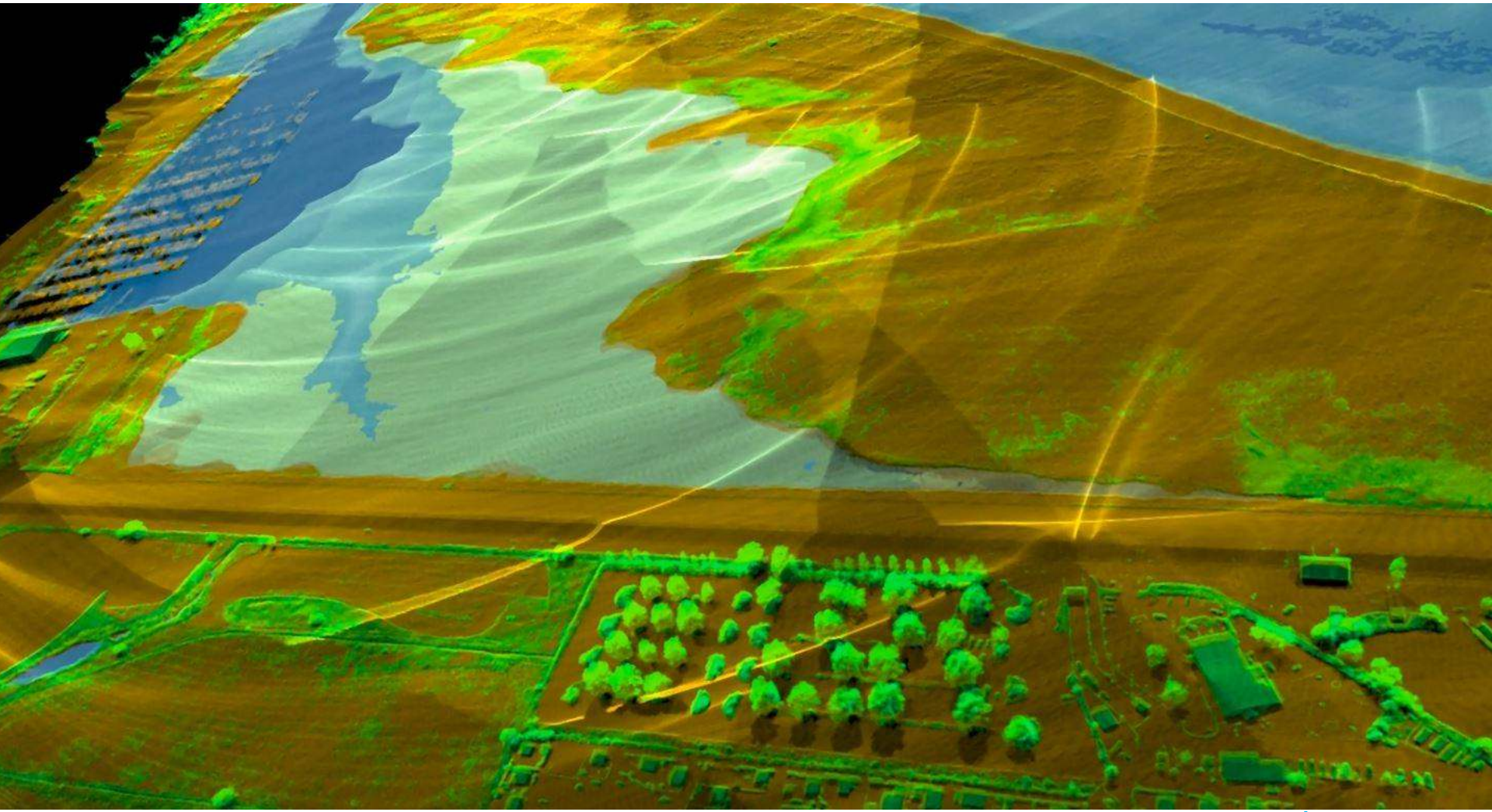
July 2012

Depth down to 10 m

HydroMapping:
Near-shore - Baltic Sea
Inland rivers – Rhine and Elbe
Lakes – Lake Constance

Bathymetric survey: Baltic Sea coast, Germany

Water surface & classified points

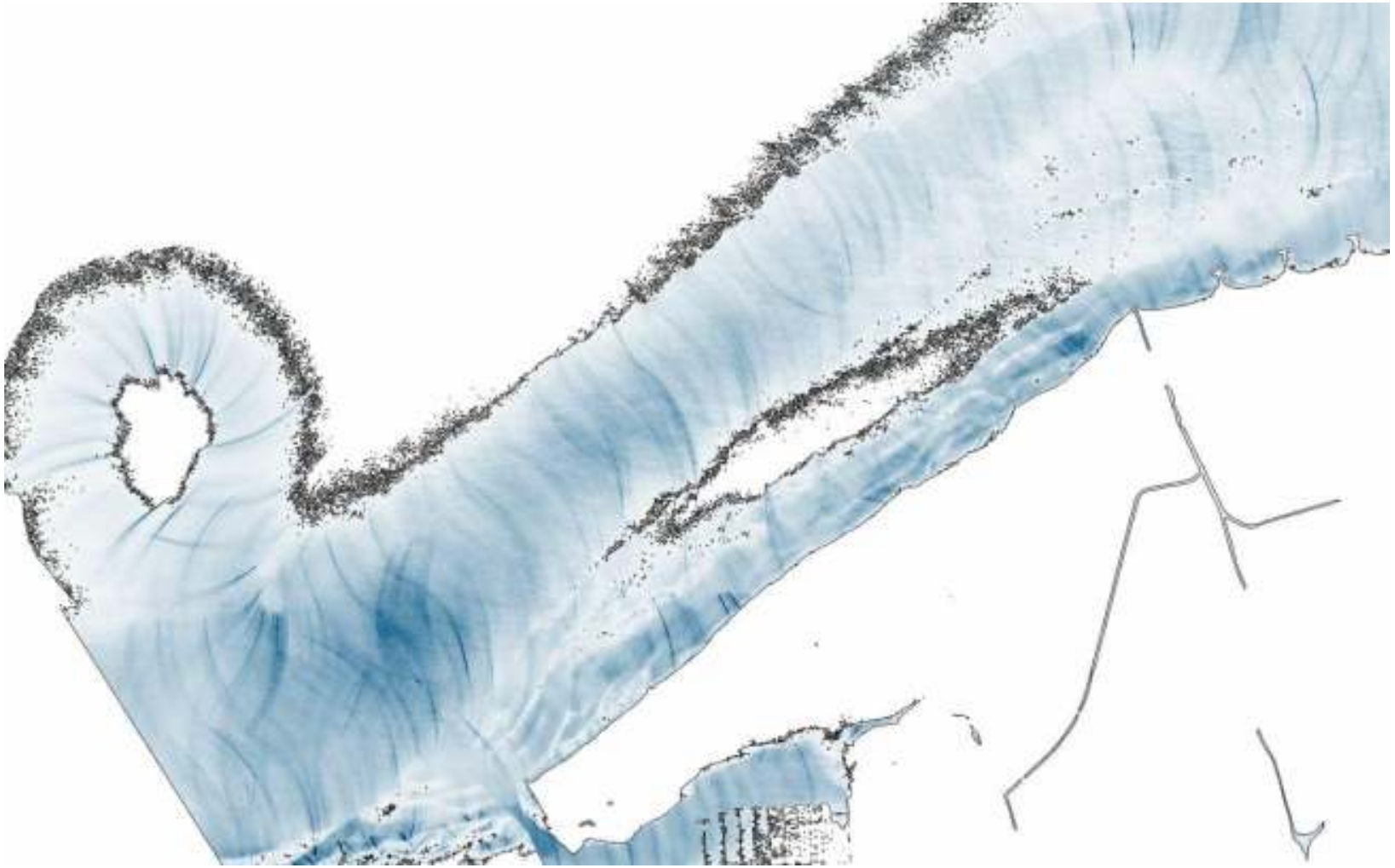


Bathymetric survey: Baltic Sea coast, Germany

Combined topographic and bathymetric map

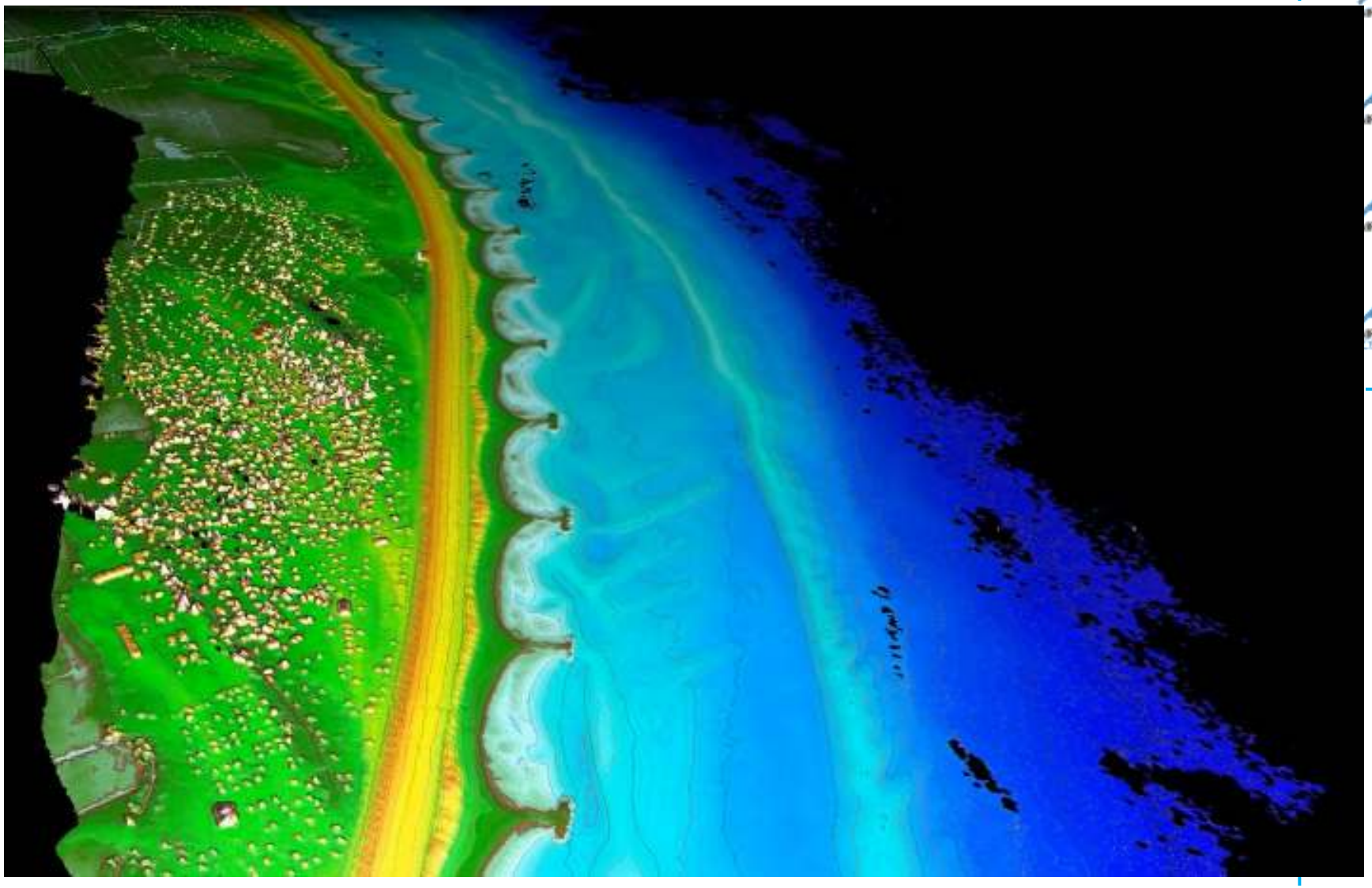
Bathymetric survey: Baltic Sea coast, Germany

Detecting and reconstruction the water surface



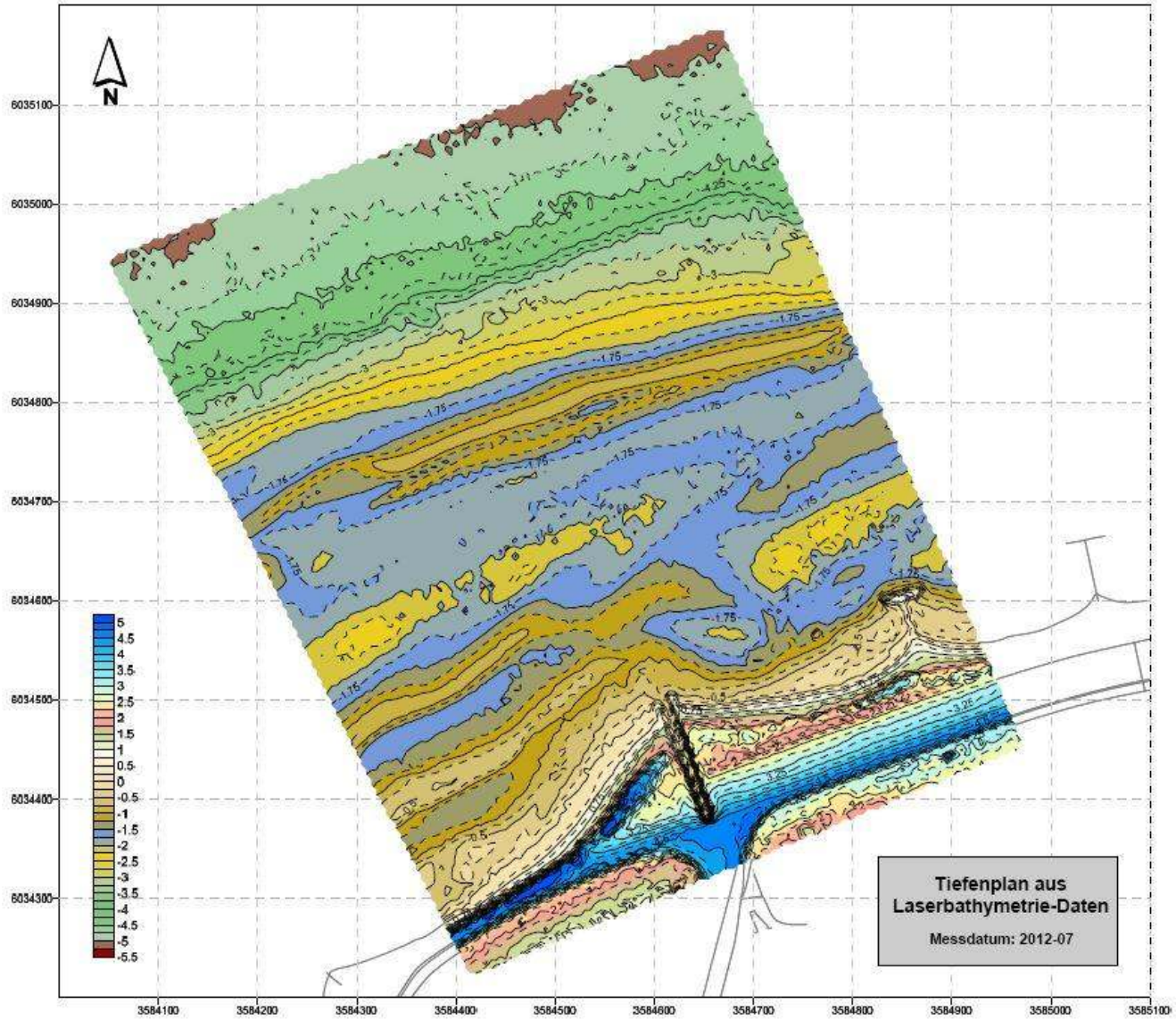
Bathymetric survey: Baltic Sea coast, Germany

Combined topographic and bathymetric surface model



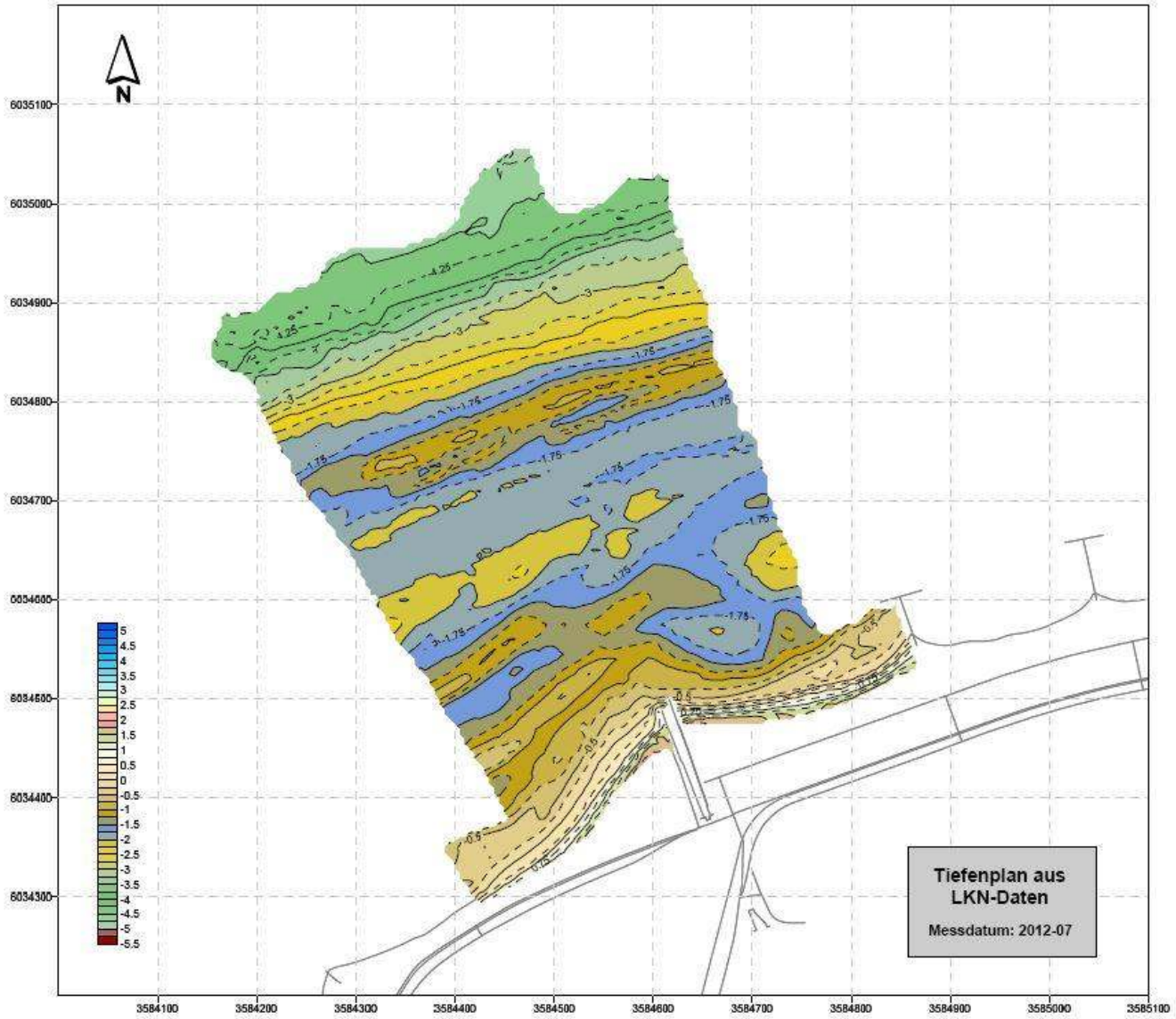
Bathymetric survey: Baltic Sea coast, Germany

Comparison **hydromapping** and sonar **data 2012**



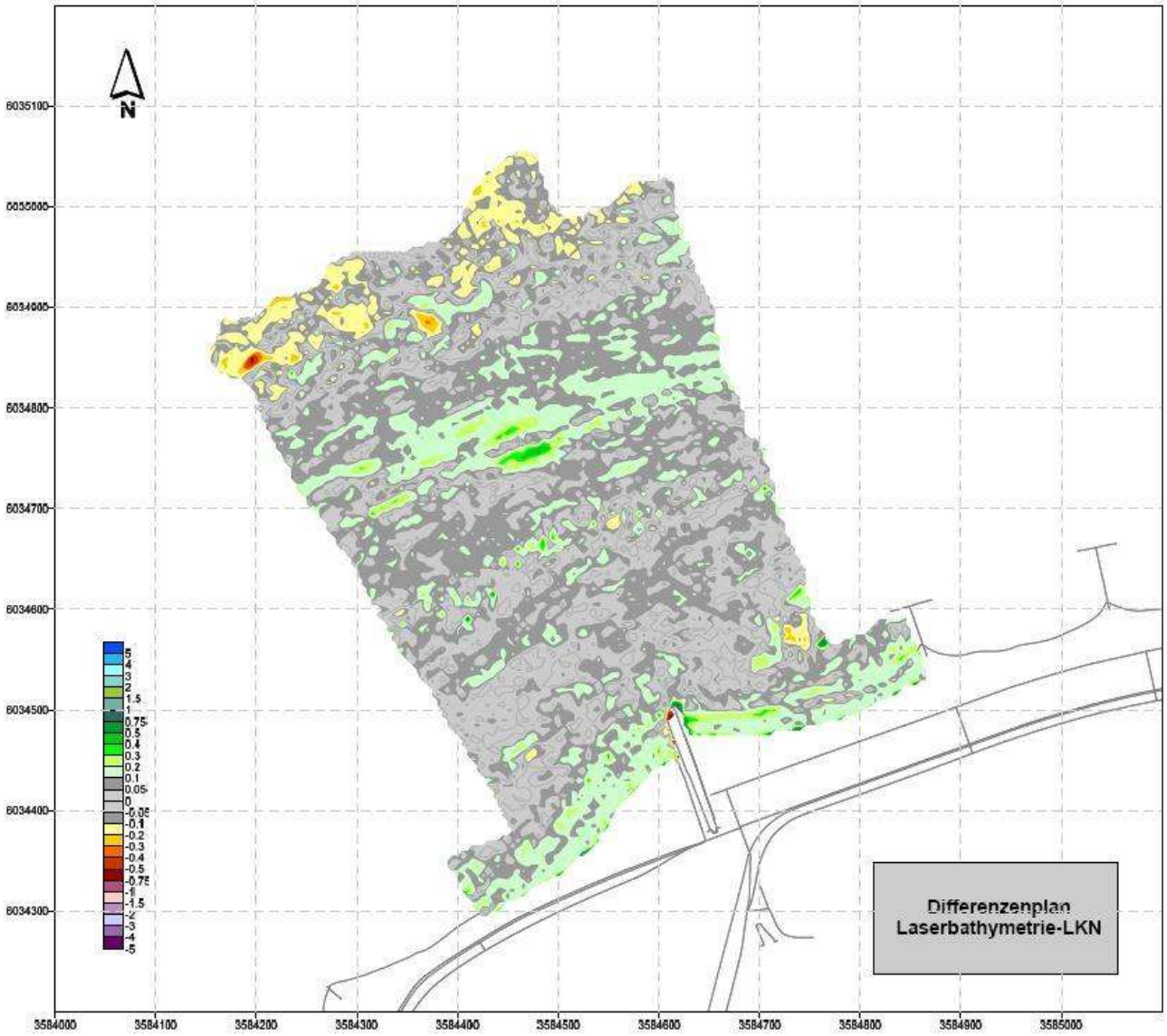
Bathymetric survey: Baltic Sea coast, Germany

Comparison hydromapping and sonar data 2012



Bathymetric survey: Baltic Sea coast, Germany

Comparison hydromapping and sonar data 2012



Bathymetric survey: Baltic Sea coast, Germany

Looking for underwater vegetation

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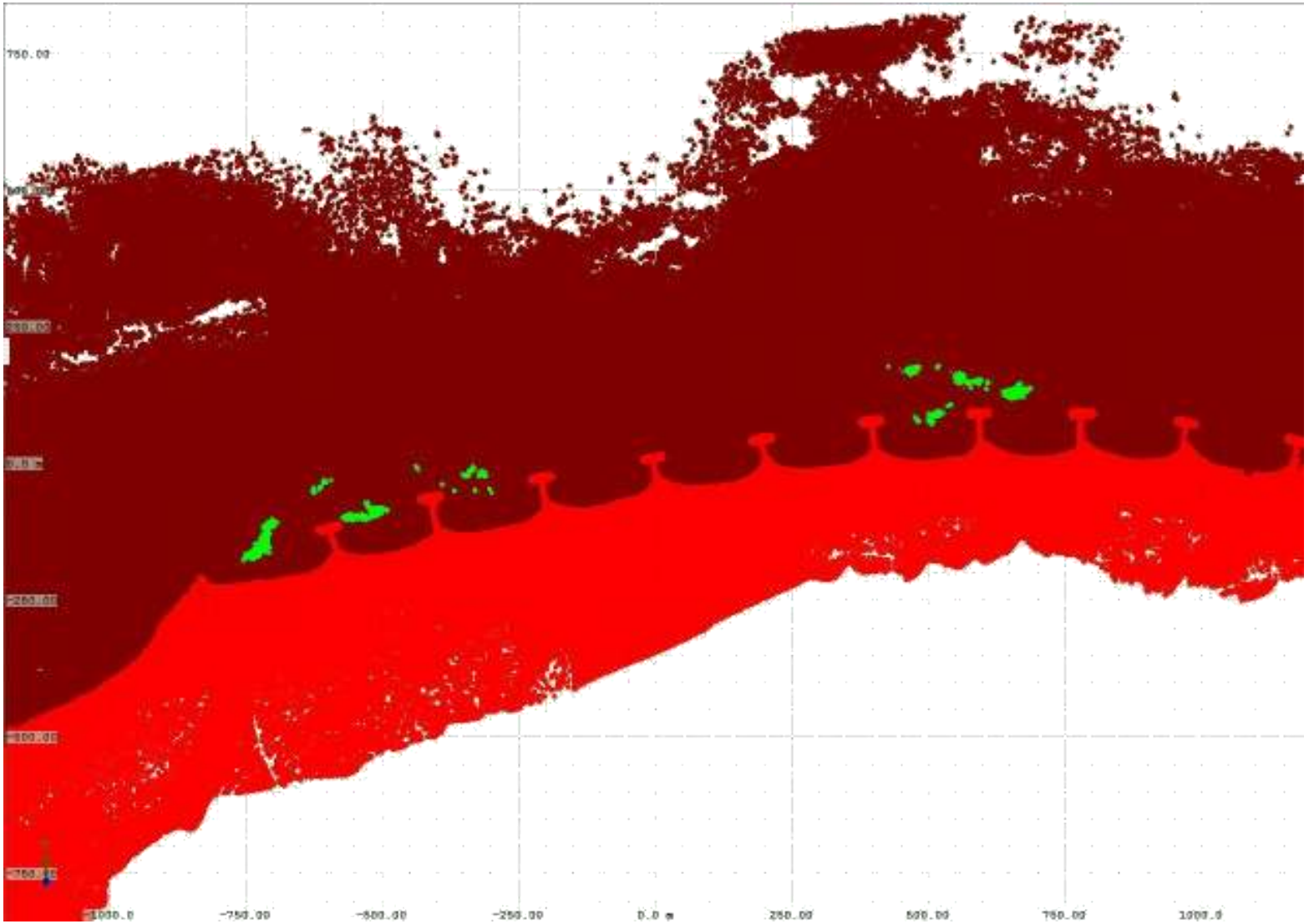
AIRBORNE ICE&SNOW MAPPING

Bathymetric survey: Baltic Sea coast, Germany

Looking for underwater vegetation



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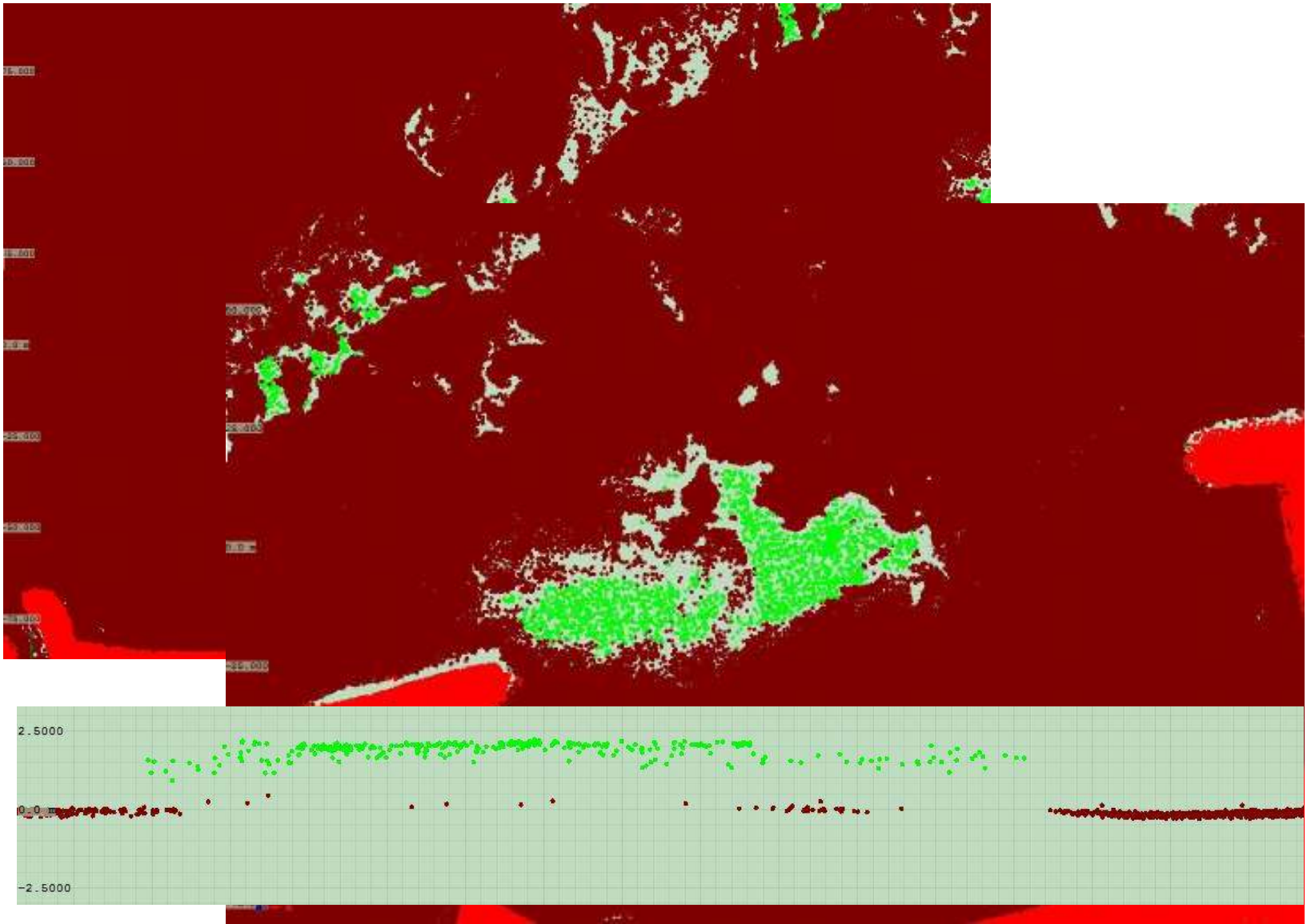


GREENSURVEY

AHM AIRBORNE HYDRO MAPPING

AHM AIRBORNE LAND MAPPING

AHM AIRBORNE NATURE MAPPING

AHM AIRBORNE ICE&SNOW MAPPING

Bathymetric survey: Rheinfelden, Germany

6 km long section of the Rhine river

Hydromapping

April 2012

~243.000.000 points

Increased turbidity due to construction work

Depth down to 3,5 m

Sonar

December 2011
January & May 2012

4.430.000 points

Depth 3-25 m

GREENSURVEY

AHM AIRBORNE HYDRO MAPPING

AHM AIRBORNE LAND MAPPING

AHM AIRBORNE NATURE MAPPING

AHM AIRBORNE ICE&SNOW MAPPING

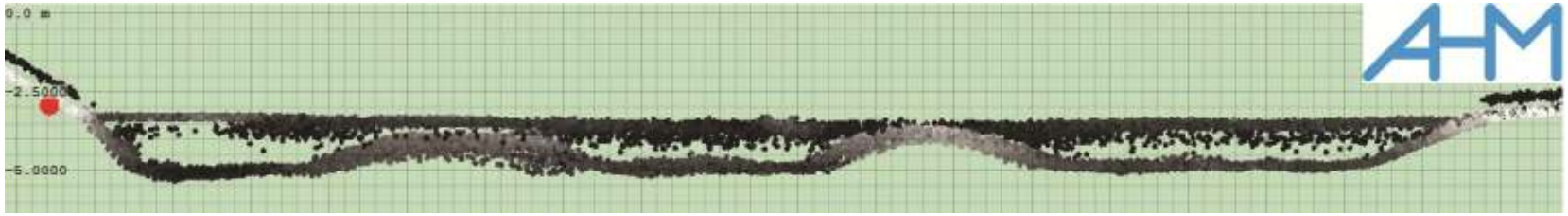
EnergieDienst

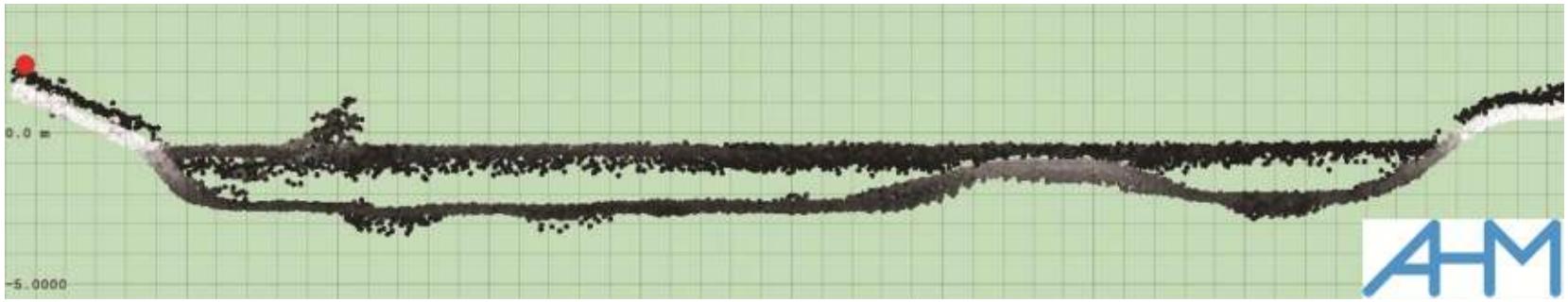
HydroMapping:

Near-shore - Baltic Sea

Inland rivers – Rhine and Elbe

Lakes – Lake Constance





HydroMapping:
Near-shore - Baltic Sea
Inland rivers – Rhine and Elbe
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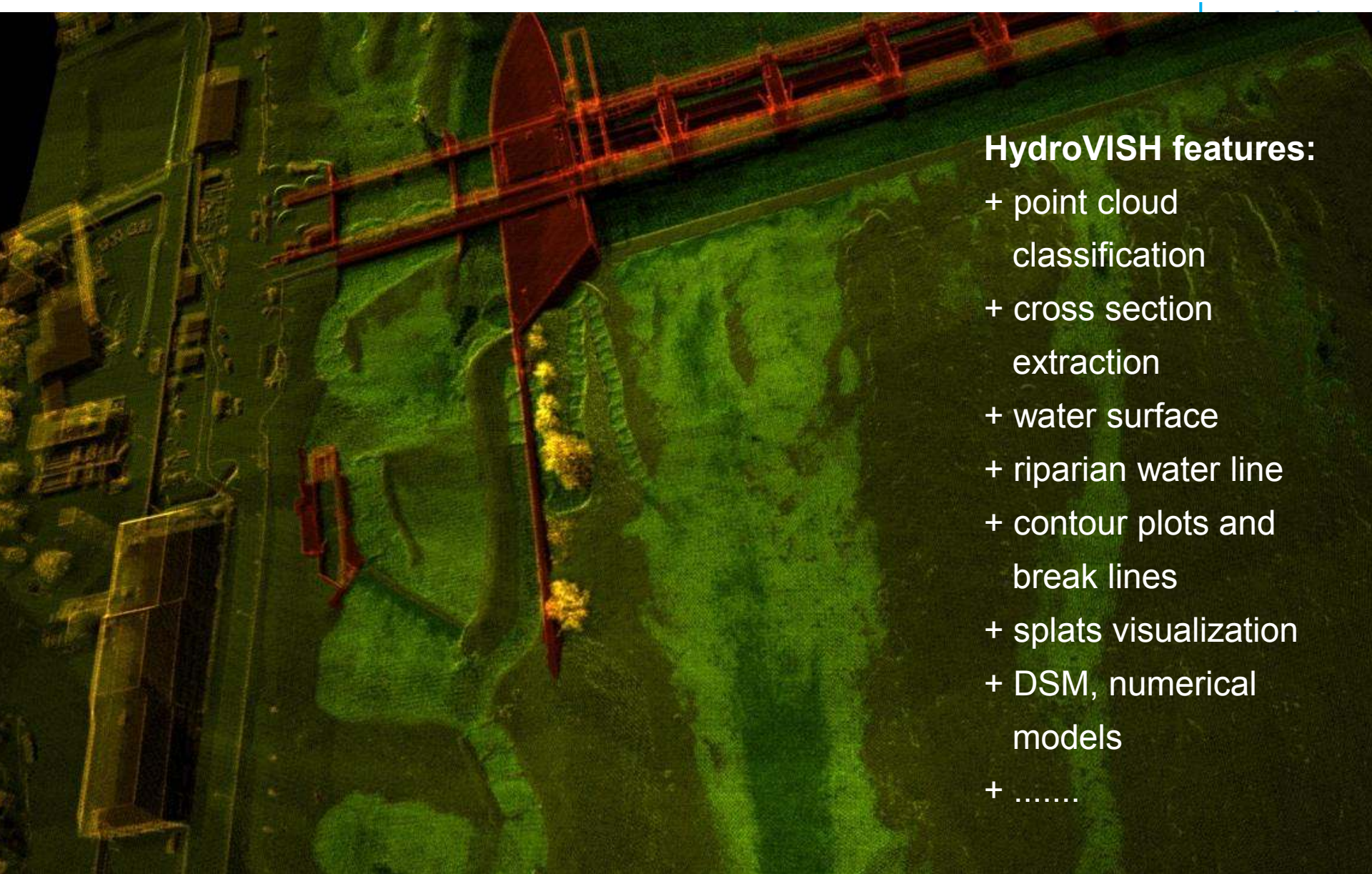

HydroVISH features:

+ point cloud classification
+ cross section extraction
+ water surface
+ riparian water line
+ contour plots and break lines
+ splats visualization
+ DSM, numerical models
+ .....

HydroMapping:

Near-shore - Baltic Sea

Inland rivers – Rhine and Elbe

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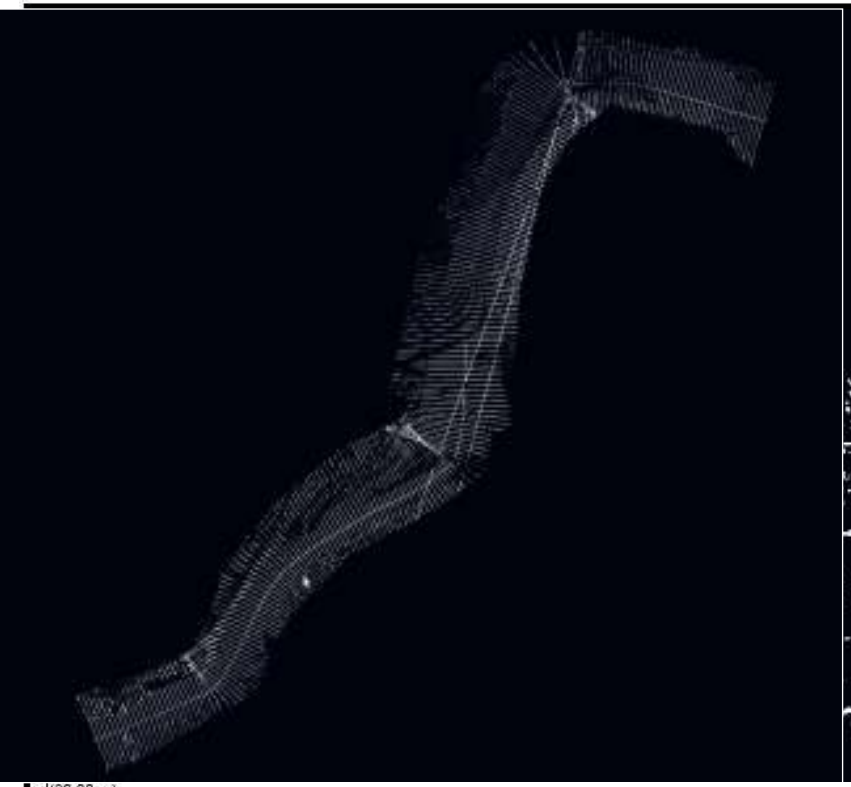

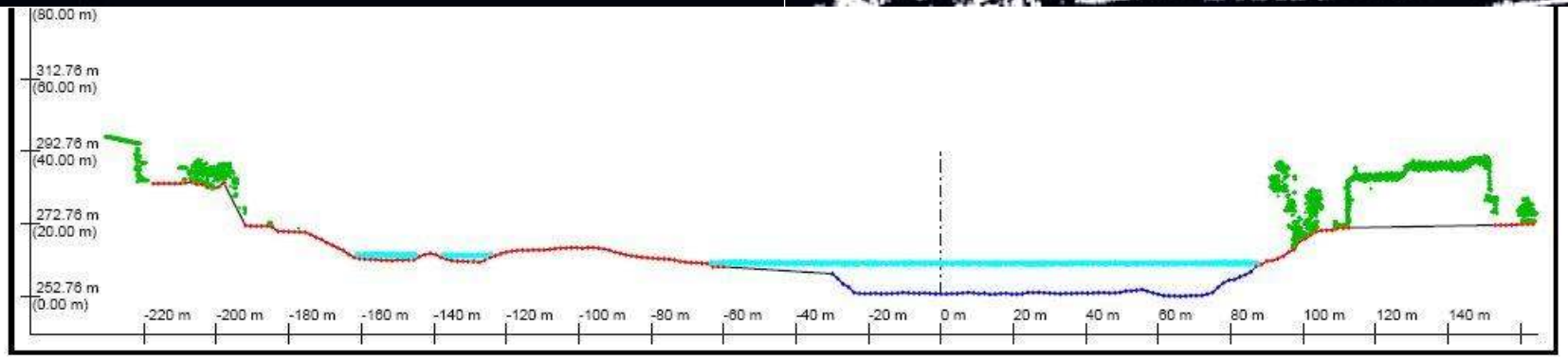

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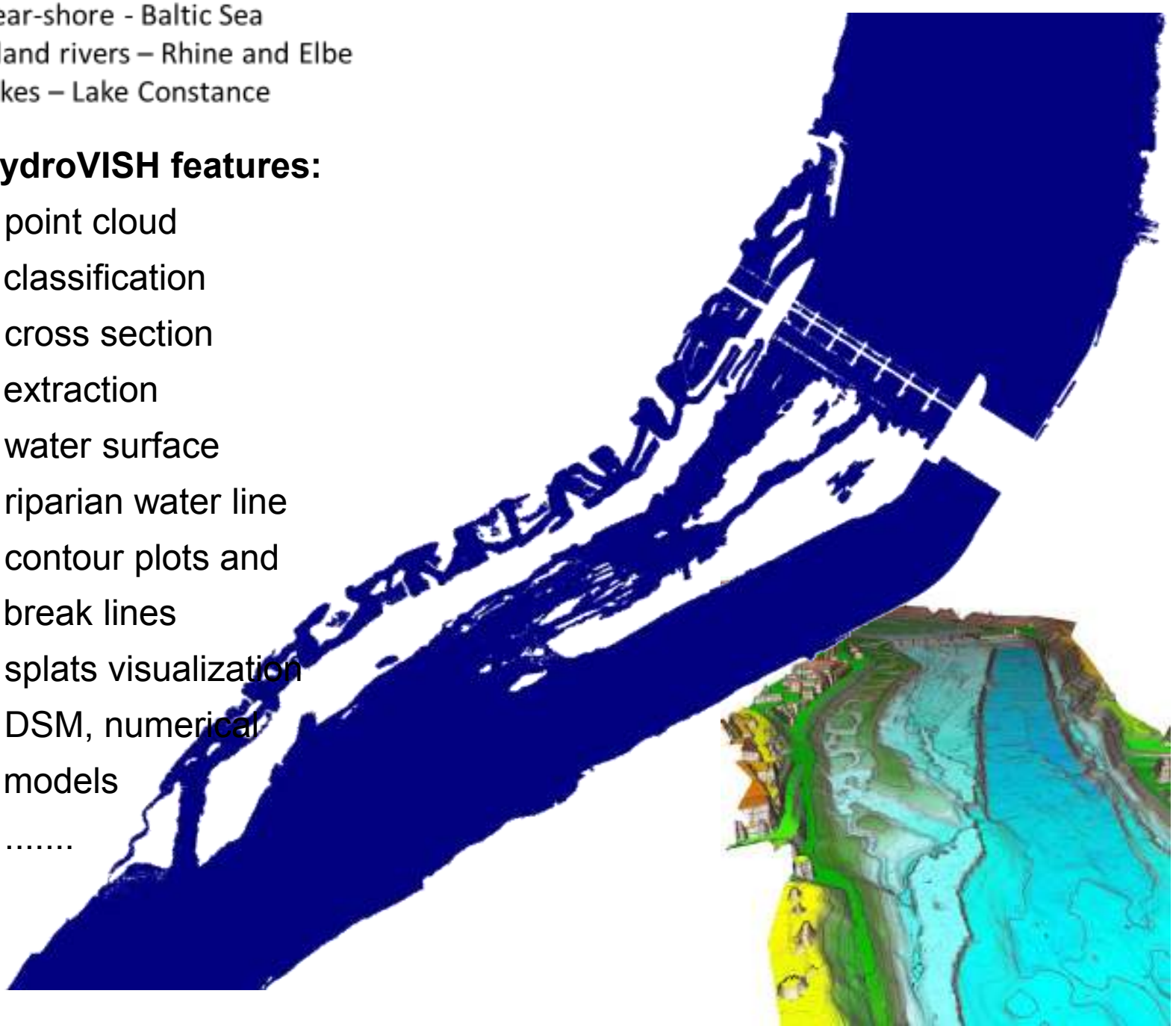

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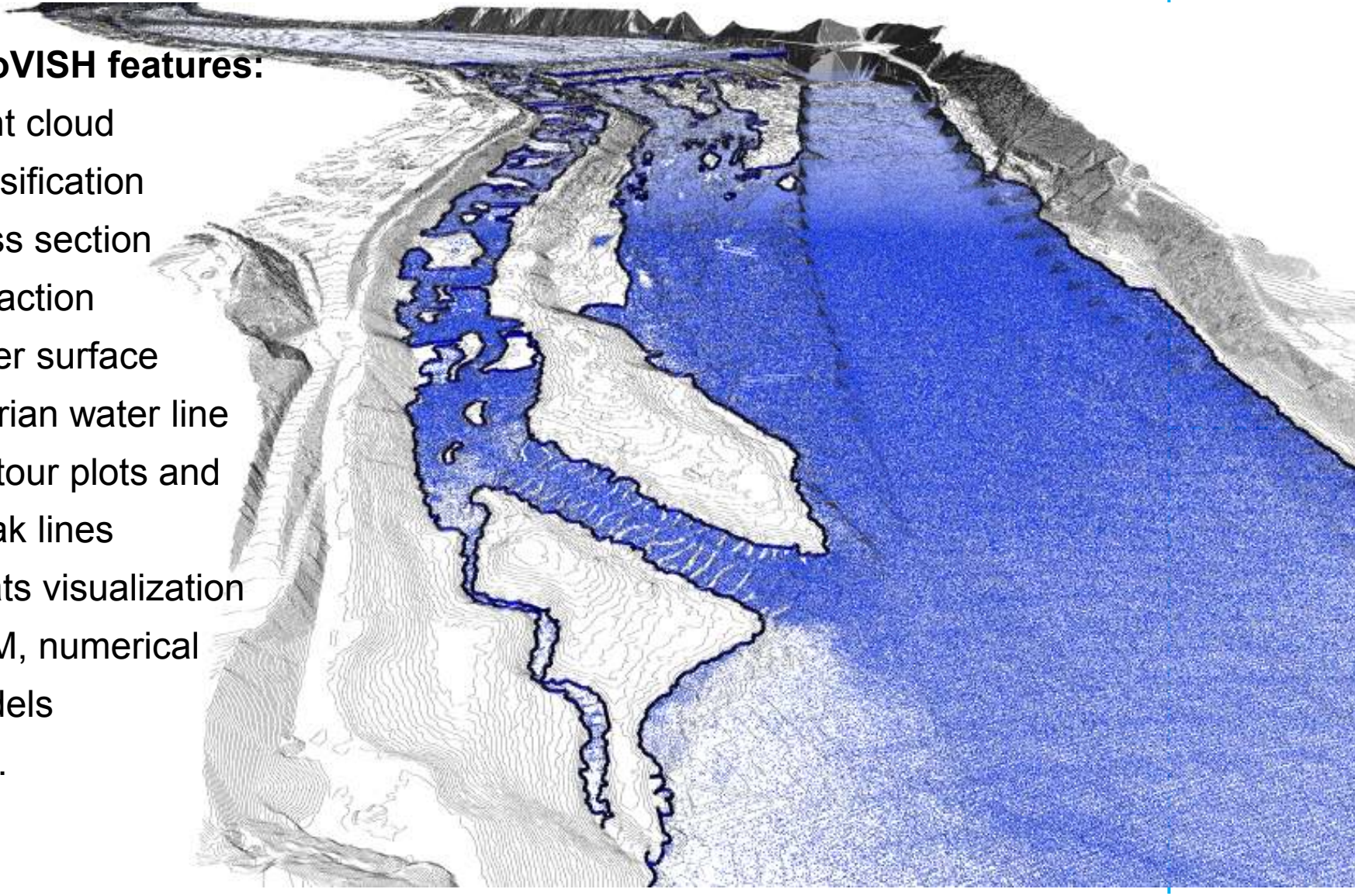

HydroMapping:
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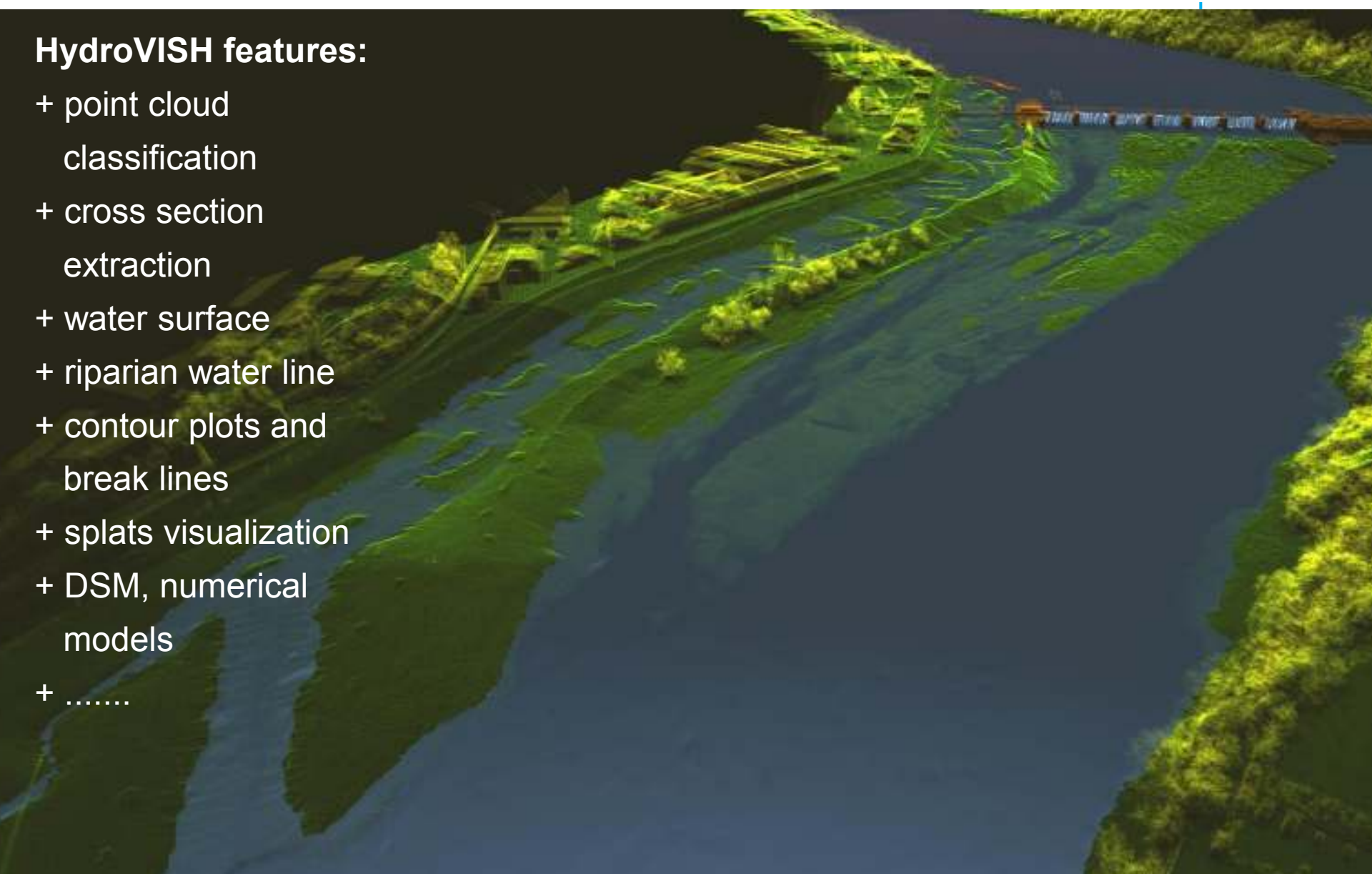

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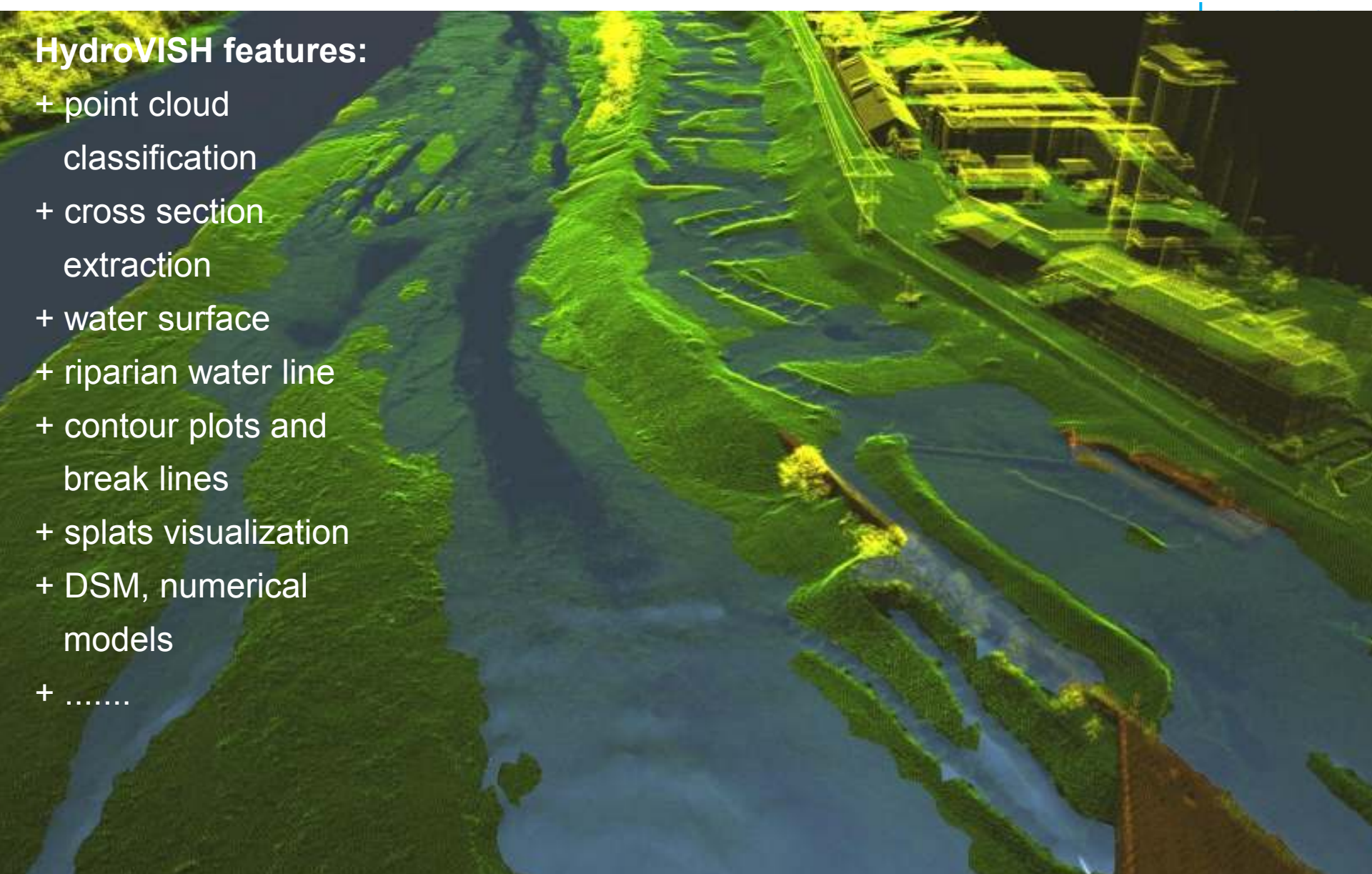

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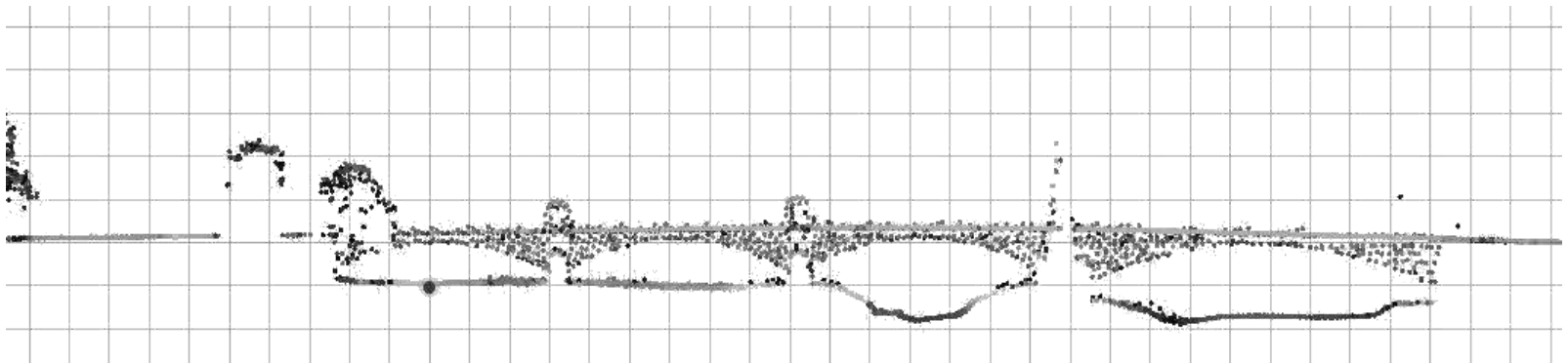
20° inclination



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HydroMapping:
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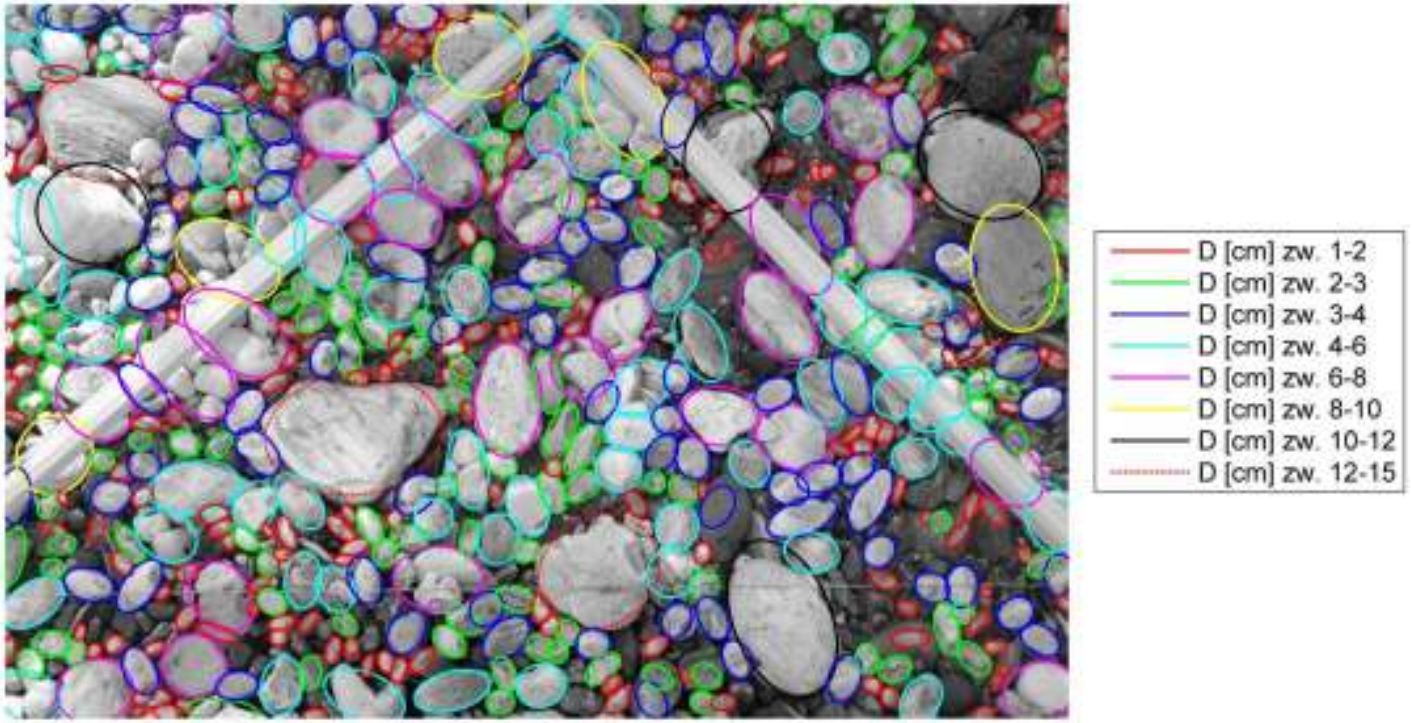
Data visualization and filtering

e.g. Shape Factors used for visualization and filtering
(forms like rocky structures within river bed)



HydroMapping:
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BfG / Elbe project

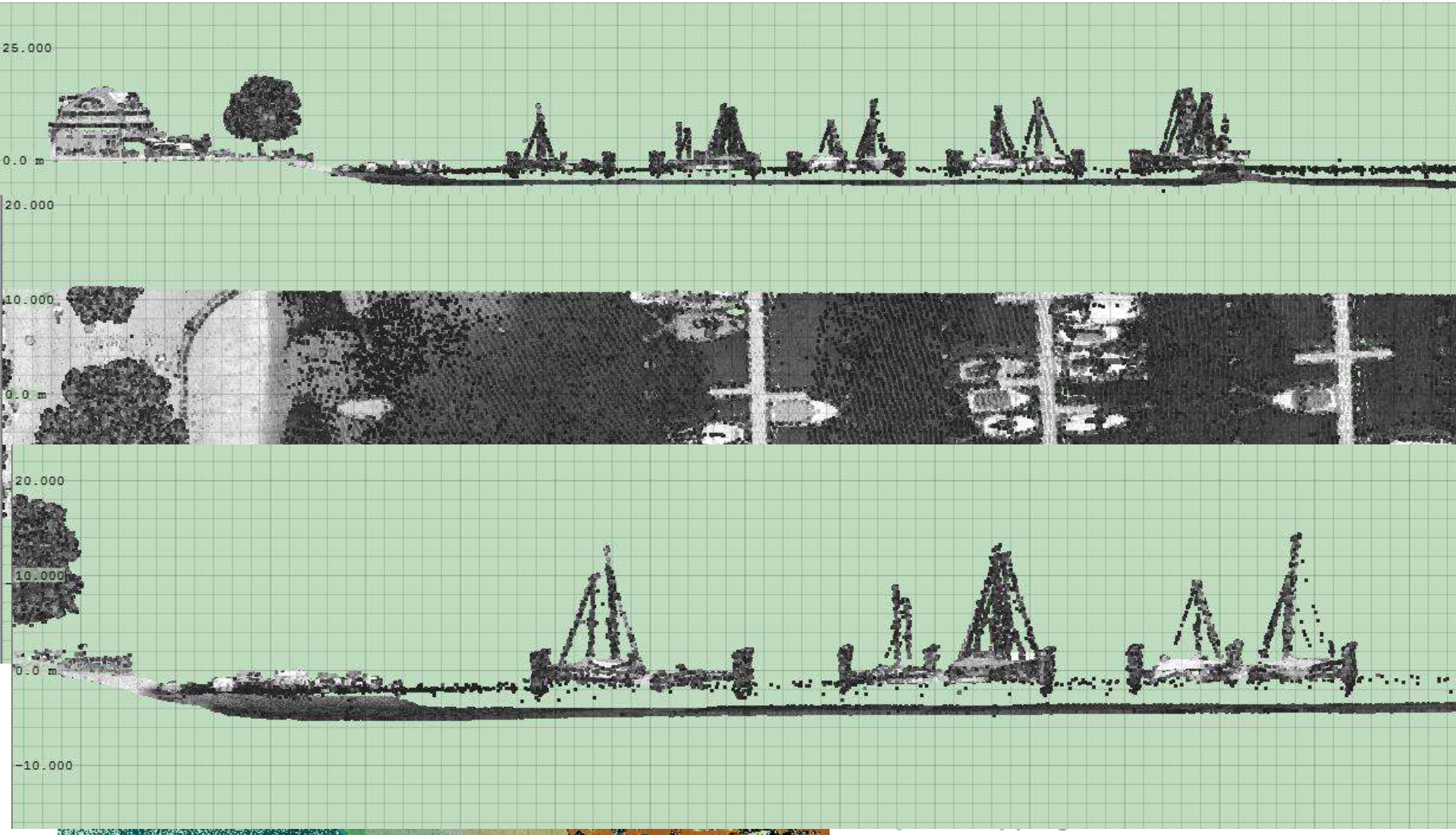
WSV.de
Wasser- und Schifffahrtsverwaltung des Bundes

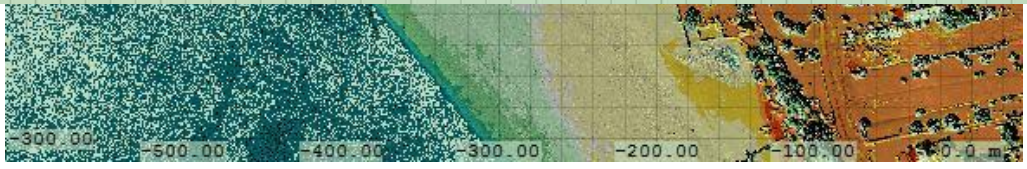
bfg Bundesanstalt für Gewässerkunde

BAW

2013/2014: Establishing a new standard in Germany for capturing and analyzing hydromapping data

Bathymetric survey: Lake Constance, Germany





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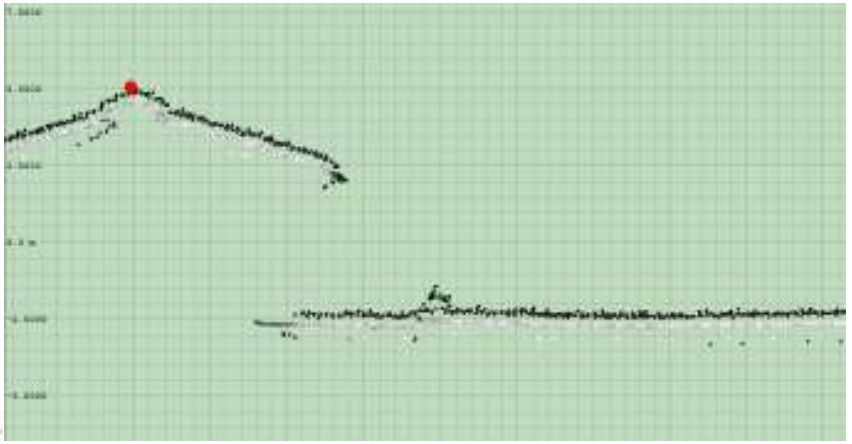
Ice&SnowMapping

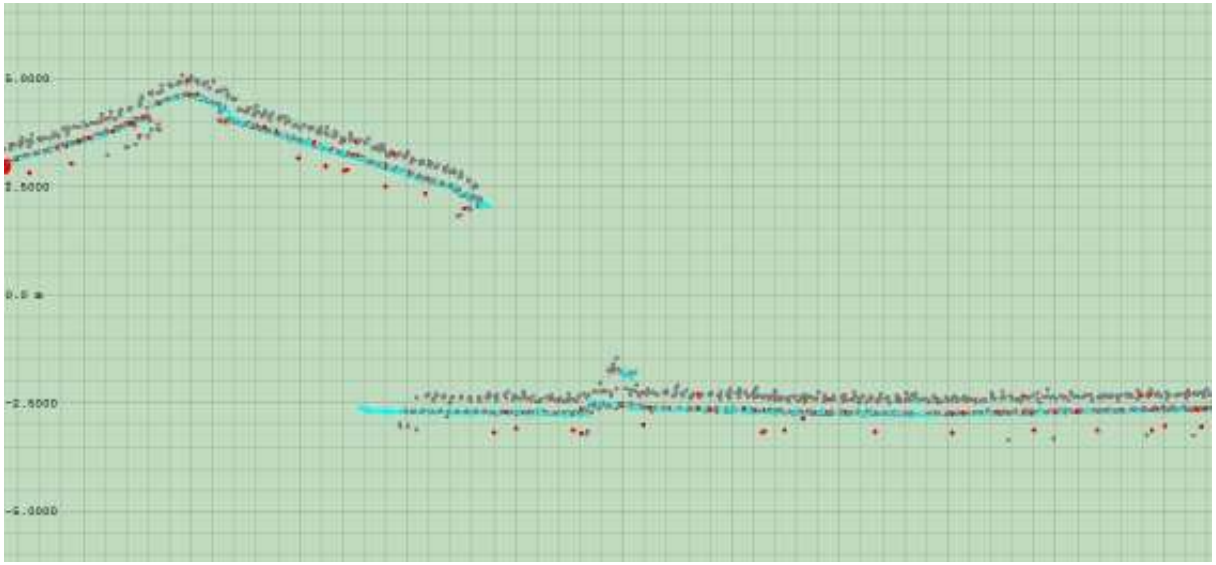


Ice&Snow Mapping:

Measuring snow and ice surfaces

Laser induced assess of carbon contribution by glaciers

Measuring snow depths



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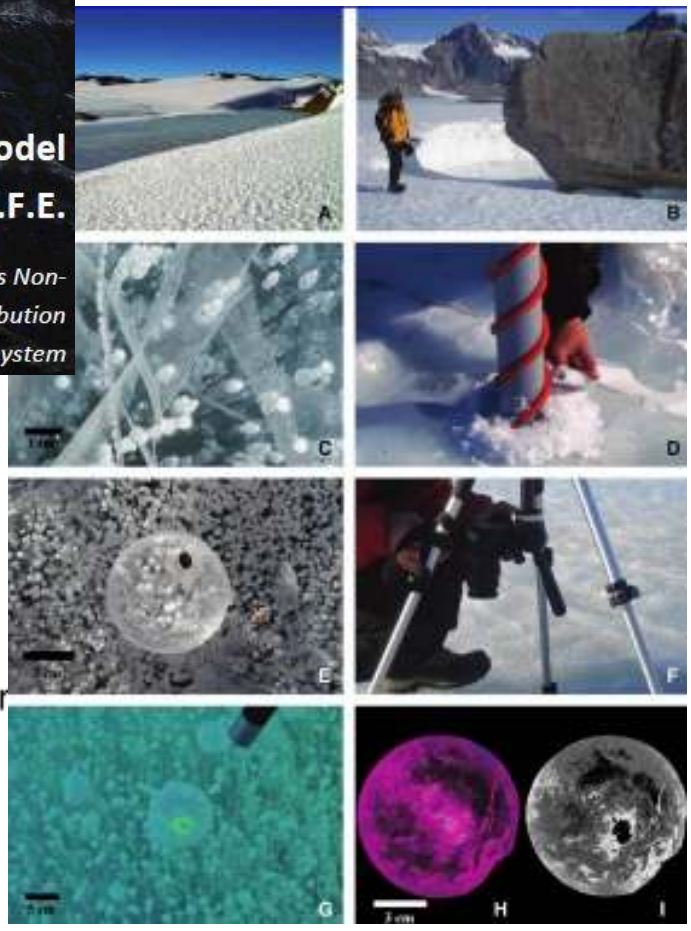

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LandMapping

LandMapping:
Power line missions
Steep slopes and mountainous areas
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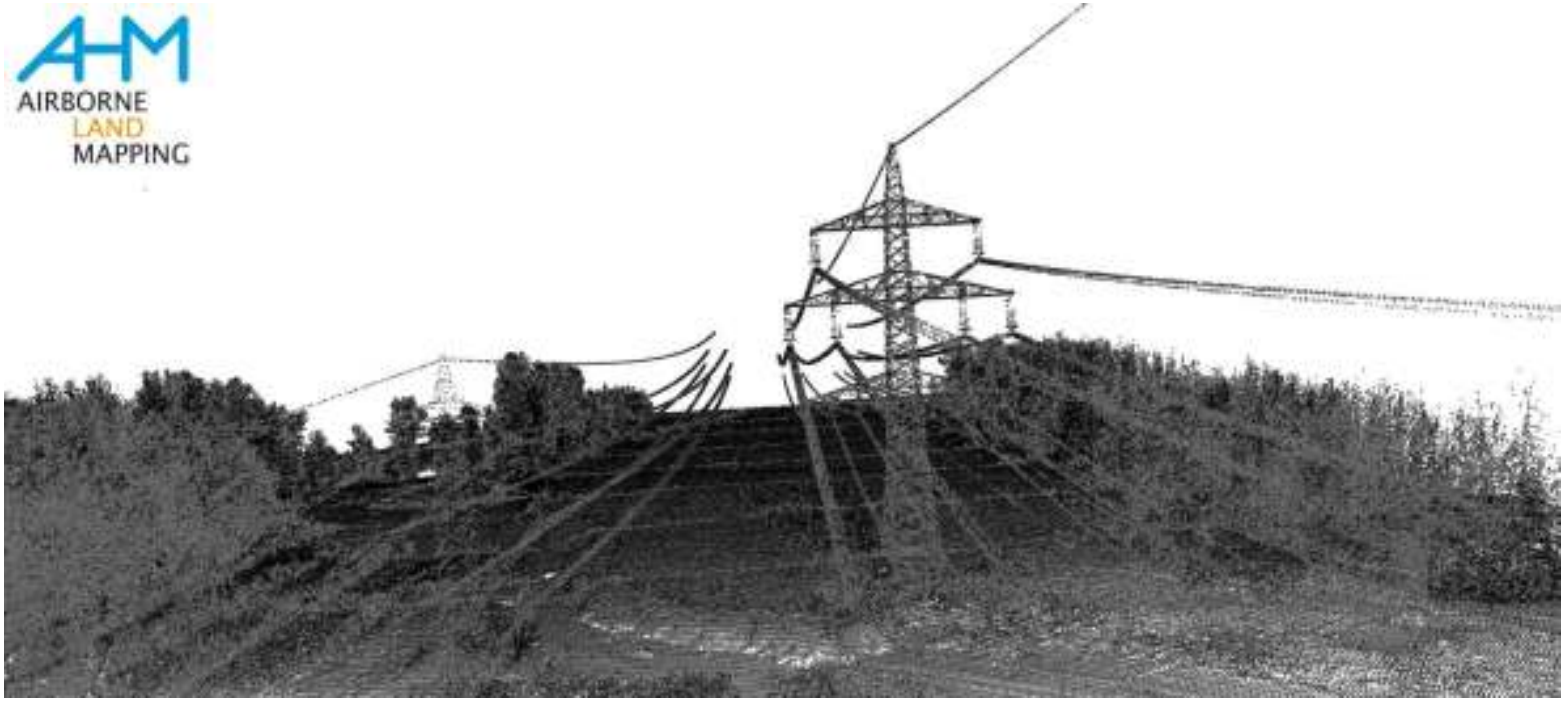
AIRBORNE LAND MAPPING



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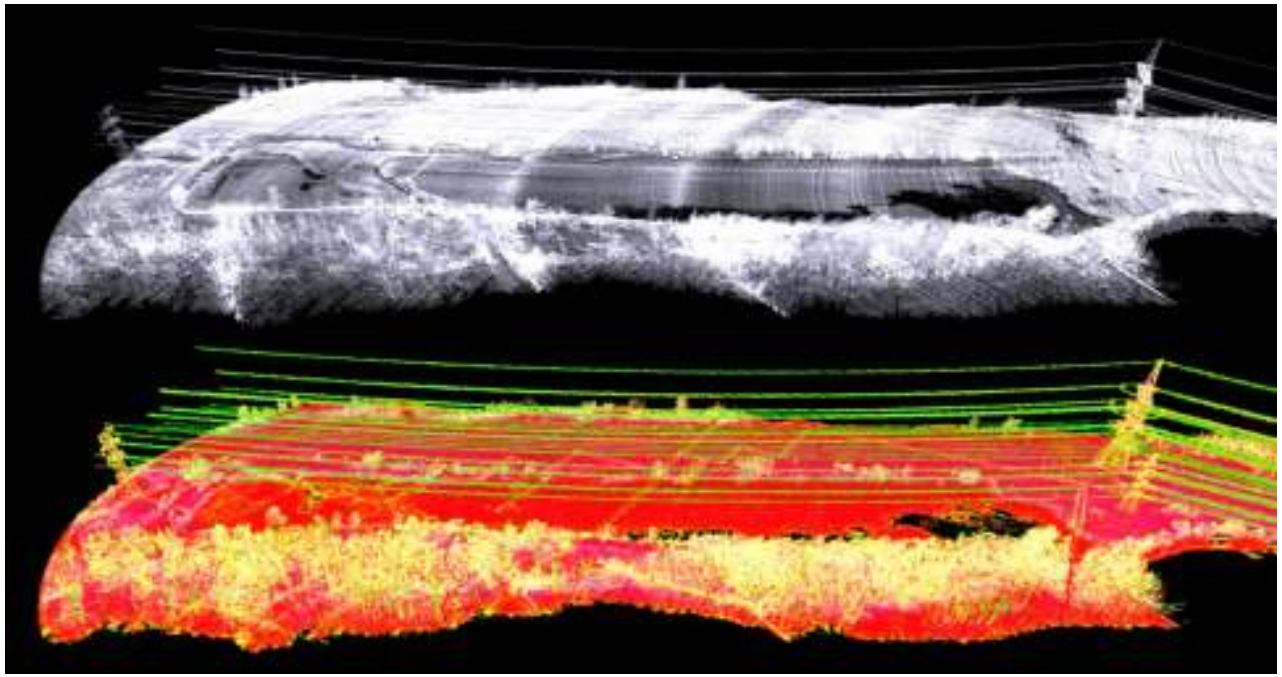

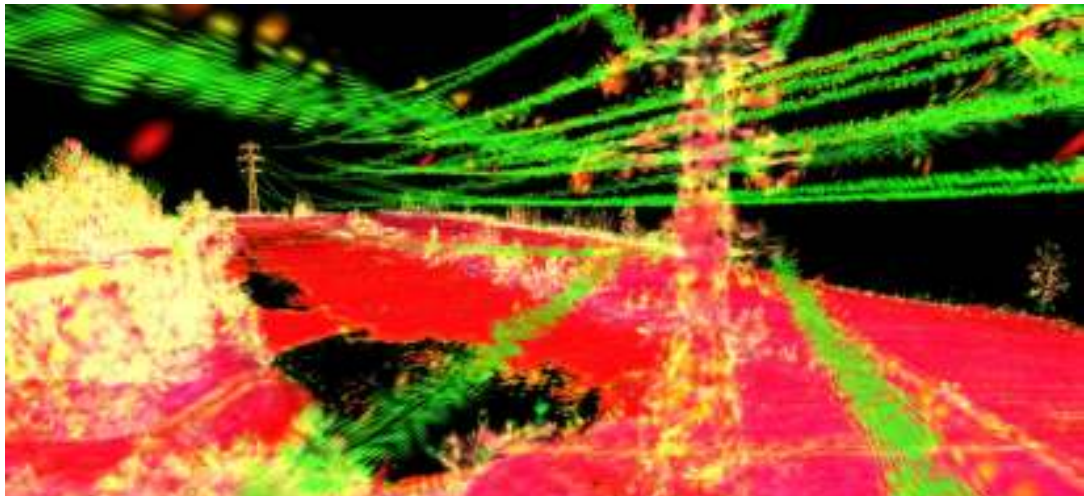

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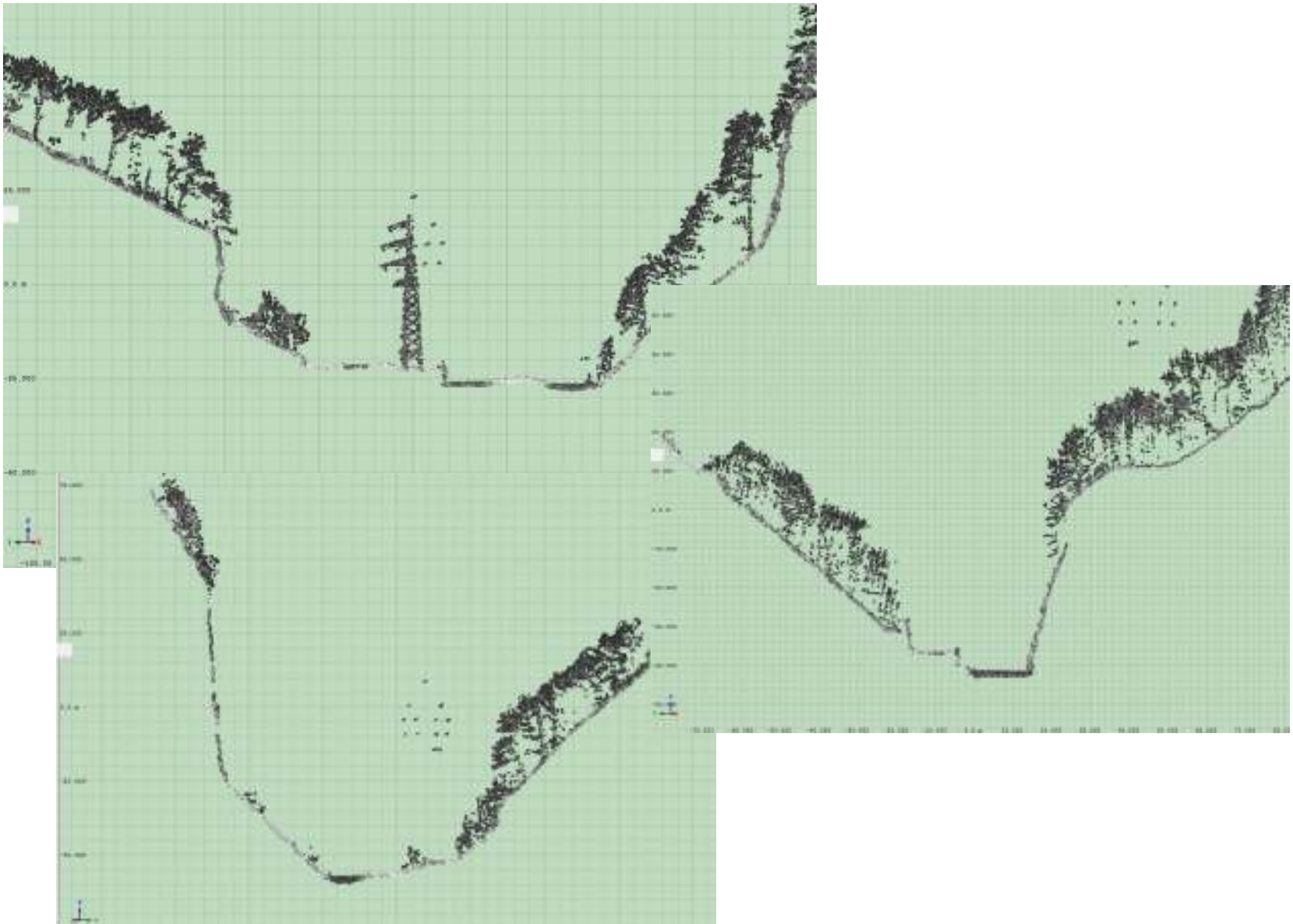

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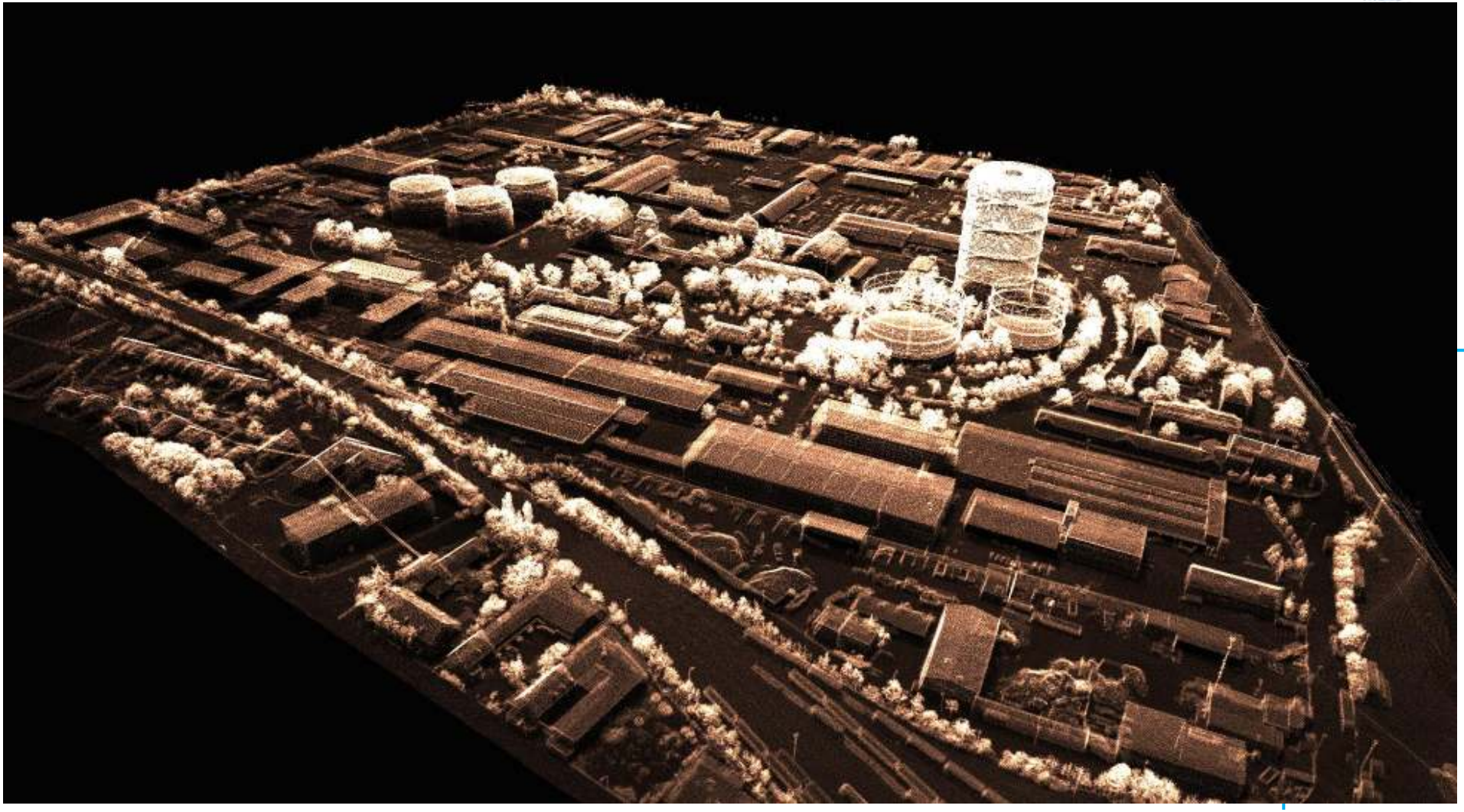

LandMapping

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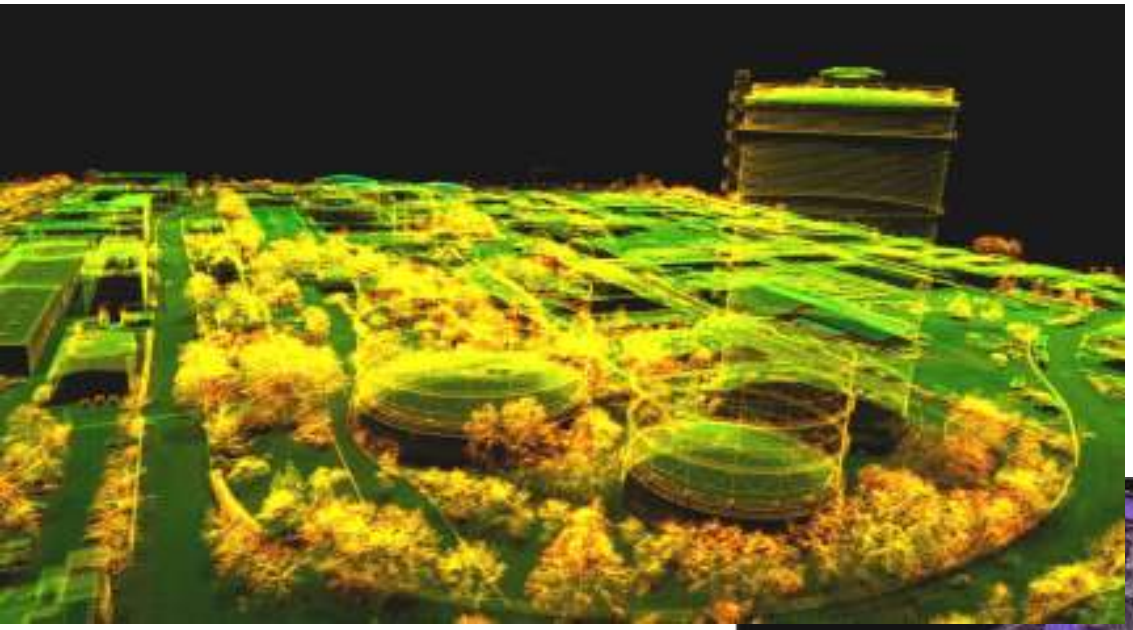
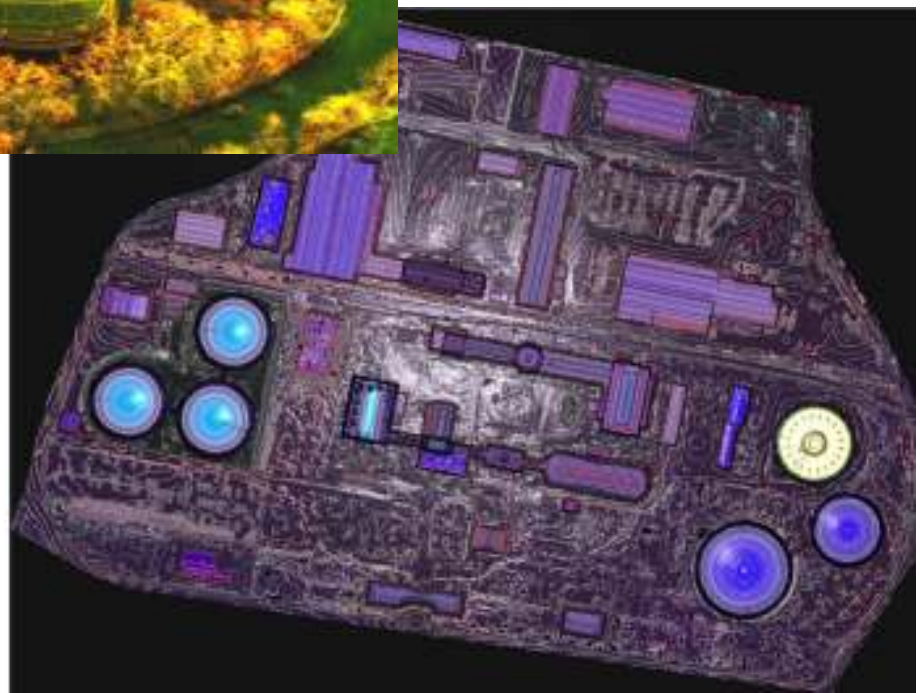
Inner-city modeling and planning





GREENSURVEY

AIRBORNE HYDRO MAPPING

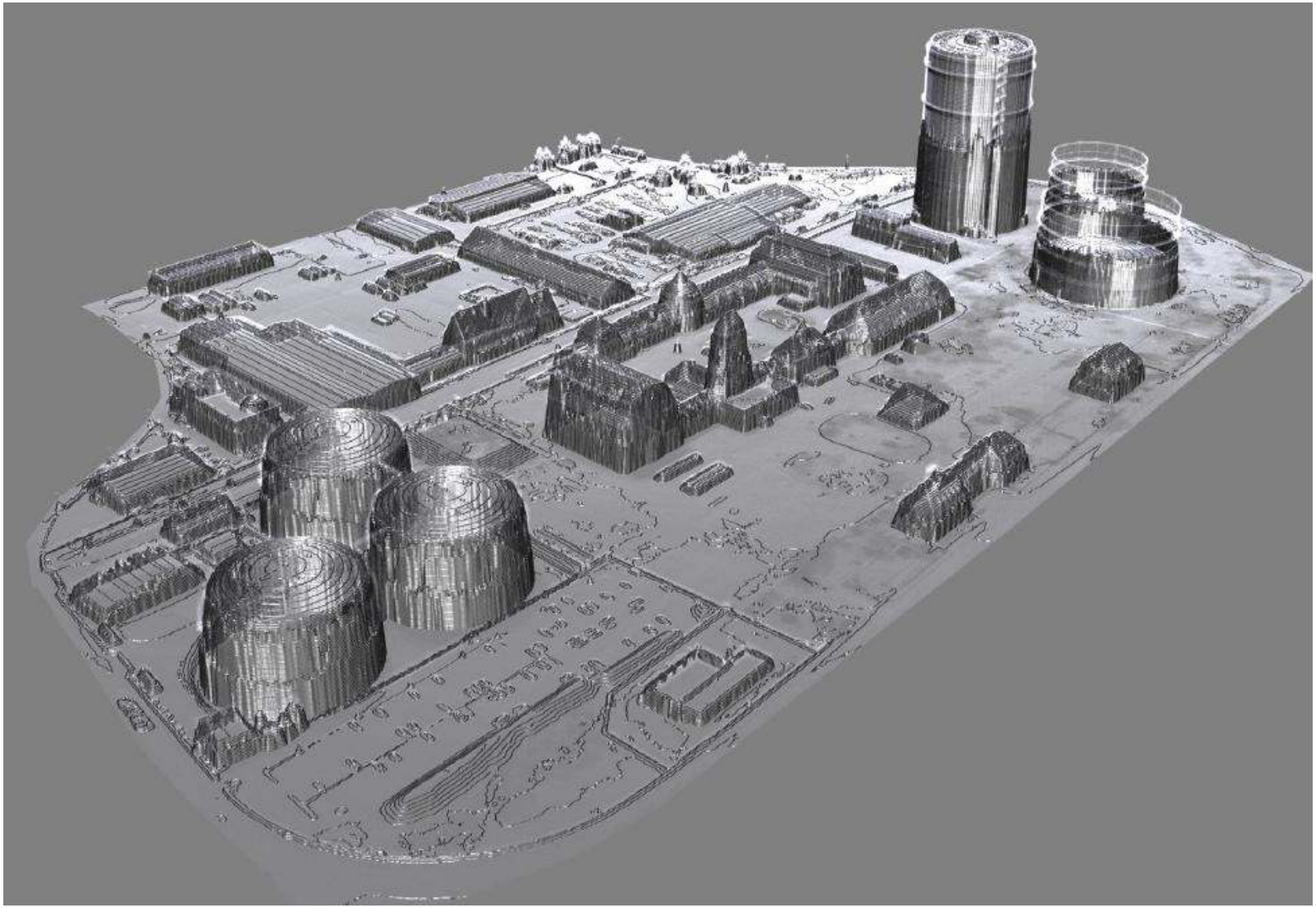
AIRBORNE LAND MAPPING

AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

LandMapping

LandMapping:
Power line missions
Steep slopes and mountainous areas
Inner-city modeling and planning



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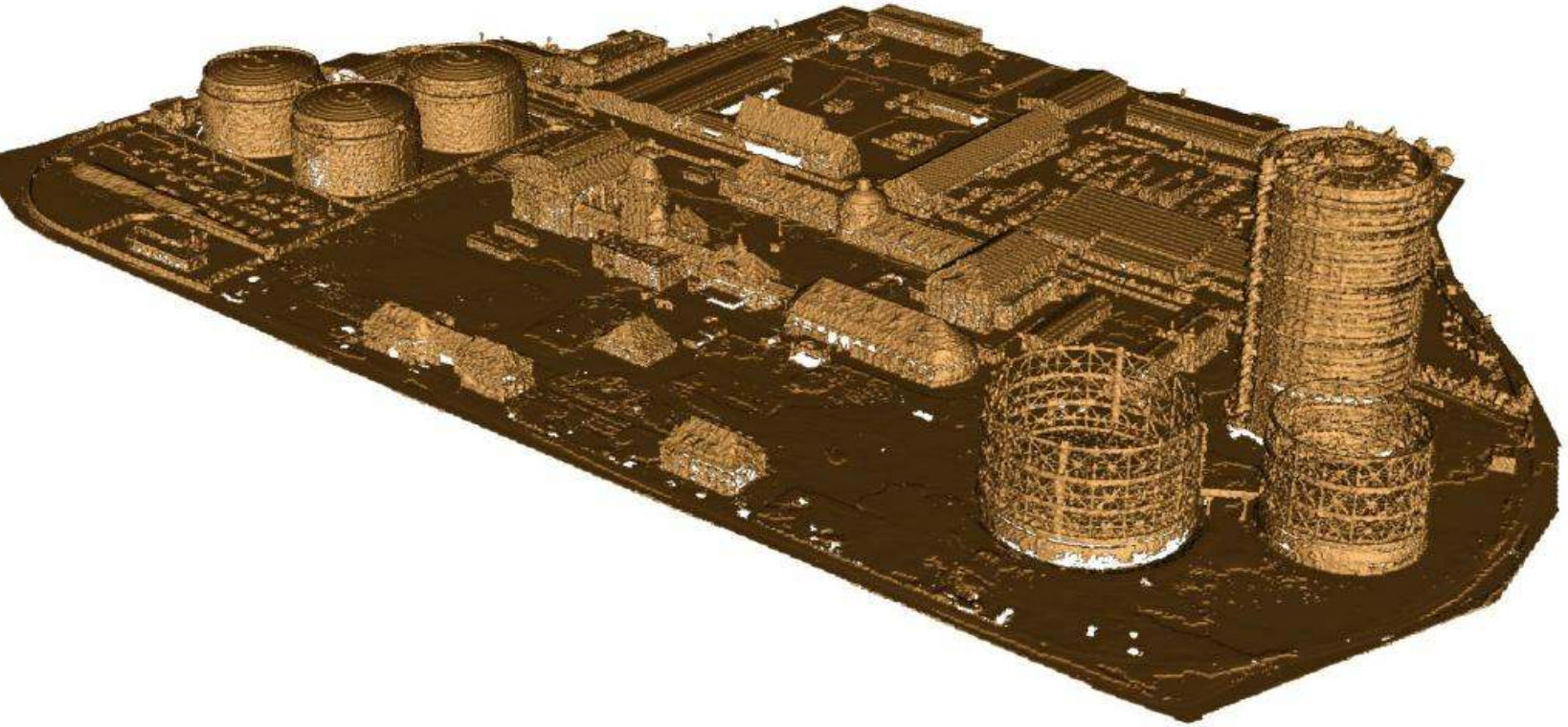

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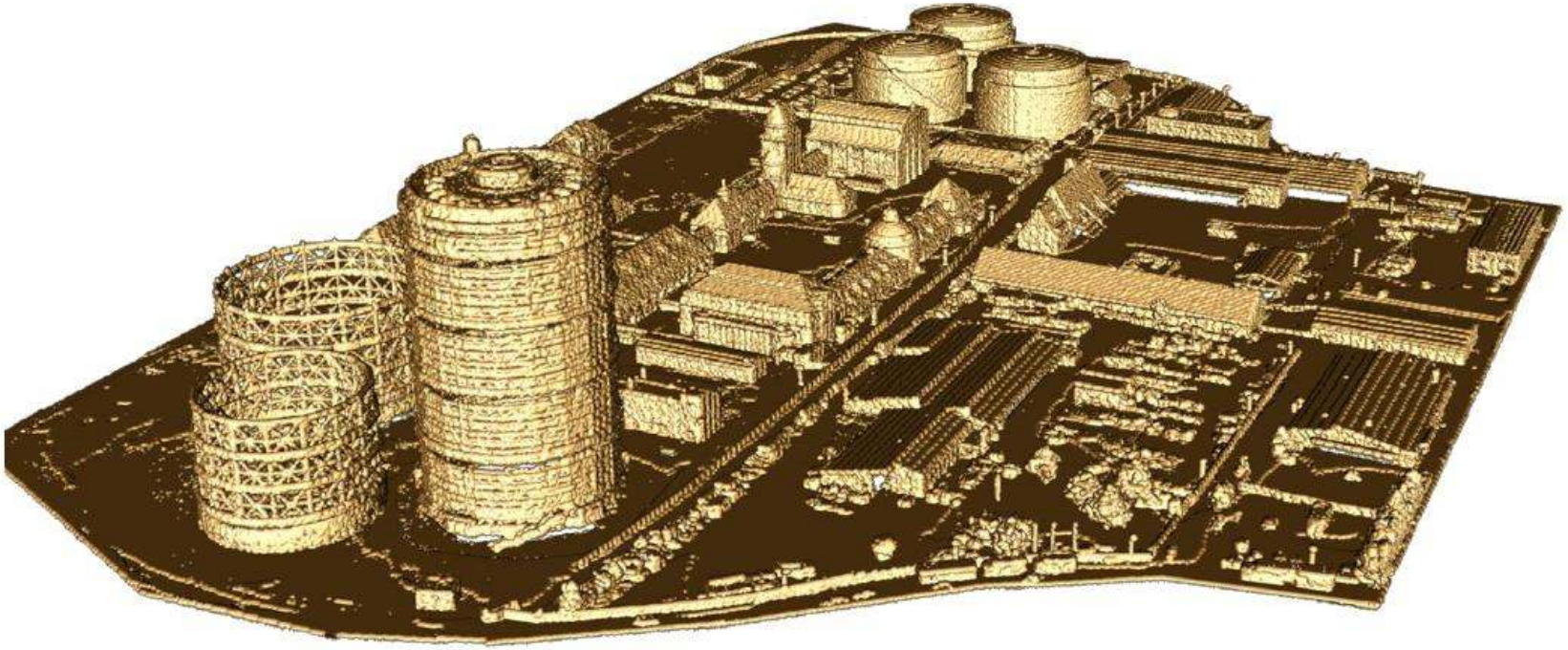

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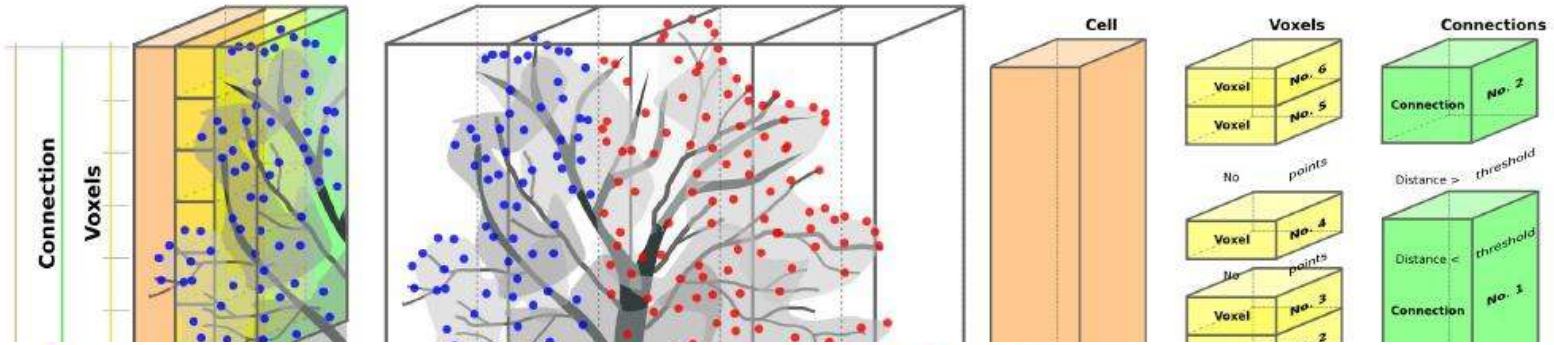
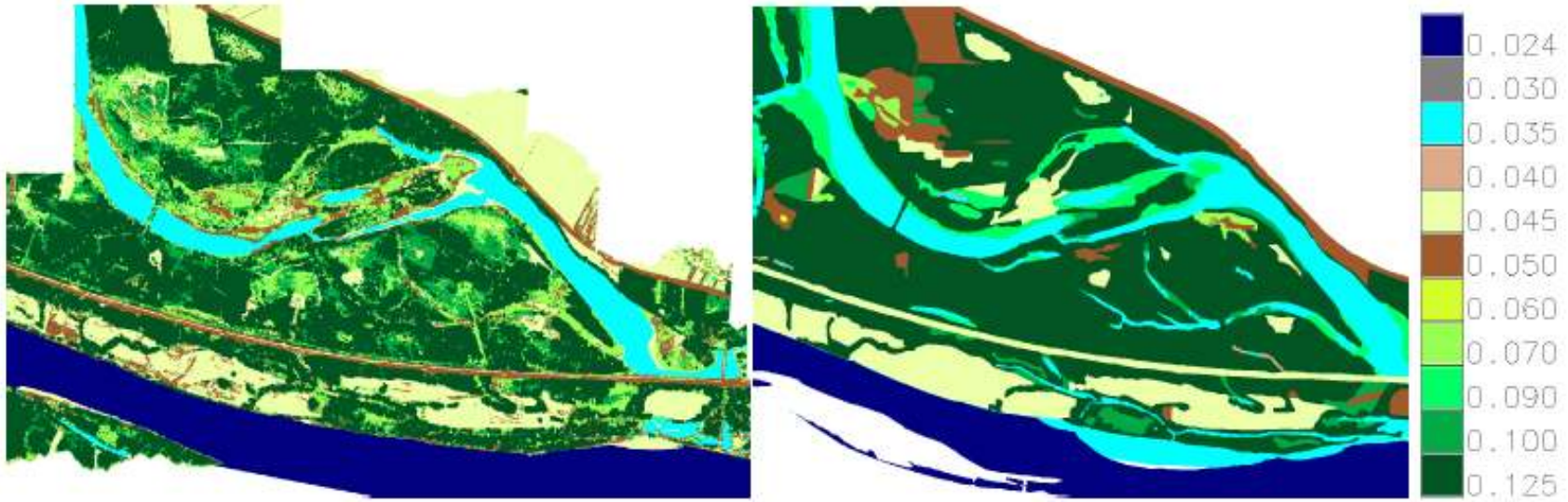
NatureMapping

NatureMapping:
Automatic detection of vegetation distribution (roughness)
Vitality check of forestry by combining green and red lidar





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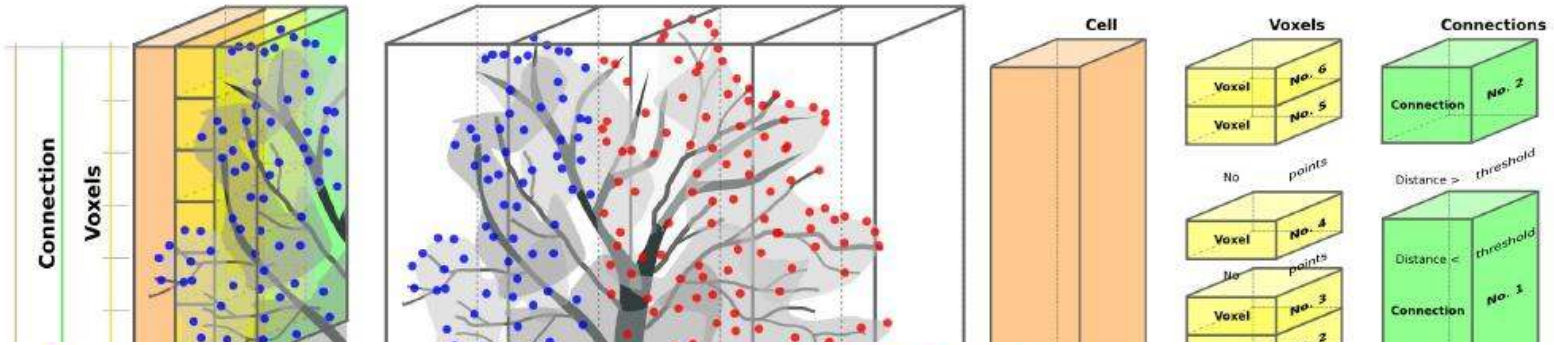

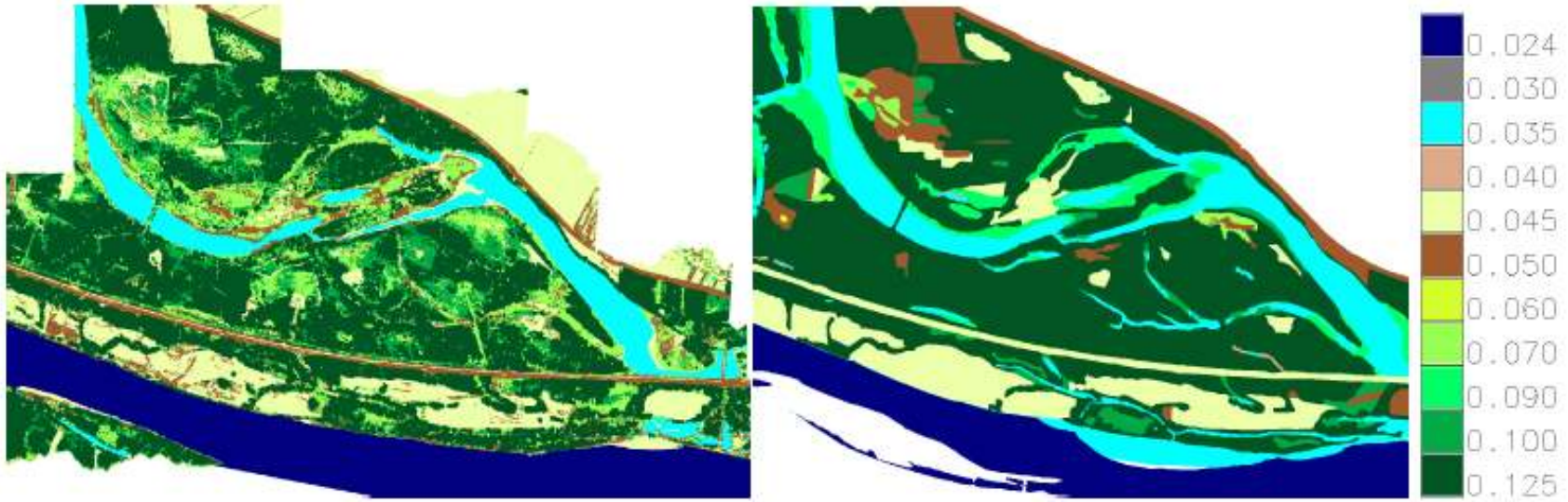

AHM GmbH &
AHM Software development GmbH –

academic spin-off and company

Foundation: November 2010
Head quarters: Innsbruck, Austria
Employees: 12 + students
Management: F. Steinbacher, M. Aufleger, University of Innsbruck

i2b-Award Winner Austria 2010: Best technical development and business concept

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AHM Software development GmbH

AHM *Research & Engineering*	· academic & private research co-operations · consultancy · scientific basic evaluation · civil and survey engineering · academic expertise
AHM *Software & Data Evaluation*	· raw data analysis · data processing · project oriented data handling · software development · numerical analysis
AHM *Sensing*	· scientific / project planning · flightplanning · survey · data / project management

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Data Capturing

- Speed/Performance
- Economic / Ecologic (small CO_2-footprint)
- Silent in operation
- No direct access to ecologic & protected areas
  - *Cut-outs for cross-sections*
  - *Walking in protected areas (even more than one time)*
  - *Protection of plants*
  - *No disturbance of animals/birds*
  - *No contact with water zones*

Data Captured

- High resolution survey
- Documentation (survey&picture)
- Multisensor concept for different research topics
  - *Turbidity*
  - *Morphology*
  - *Vegetation (land and under water)*
  - *Water detection (shallow water zones)*
  - *Habitat structures (insects, fish, small animals)*
  - *Floodplain structures*

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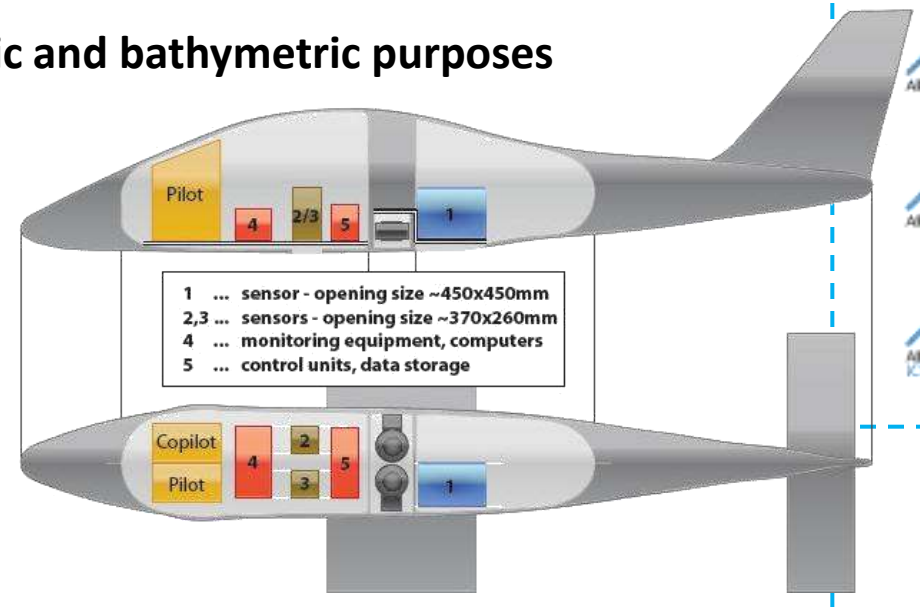
HydroVISH

Multisensor data survey for topographic and bathymetric purposes

- Green Lidar
  (entire topographic and bathy-
  metric dataset from one source)
- IR- Camera (groundwater datasets)
- Hyperspectral cameraset (foreland
  and vegetation datasets)
- RGB-Camera (Aerial pictures)



High-resolution laser pointclouds as basic and applicable dataset for further multisensor data handling

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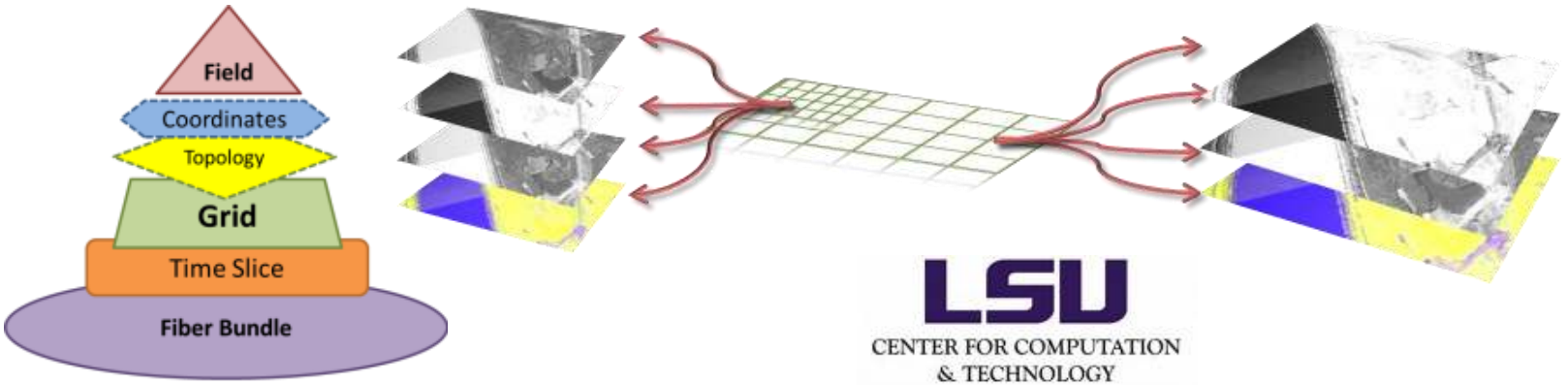
HydroVISH

Merging data – Building Complex Lidar Datsets (CLD) based on HDF5

1. Step: Merging multisensor information on the bathymetric and topographic pointcloud dataset
2. Step: Store processed information to pointcloud dataset (e.g. hydraulic results, filtering results, full-waveform analysis results)

→ a flexible and performing database (HDF5) and visualization and data processing shell (VISH) is needed managing the bottleneck of data handling, data processing and satisfying the still present classic needs of customer survey information (e.g. cross-sections)



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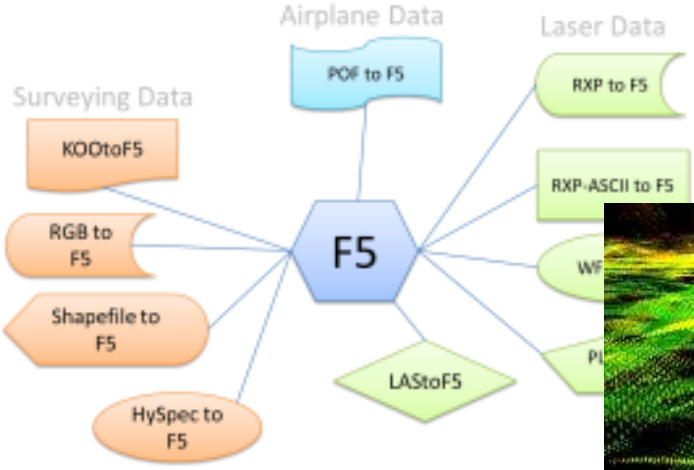
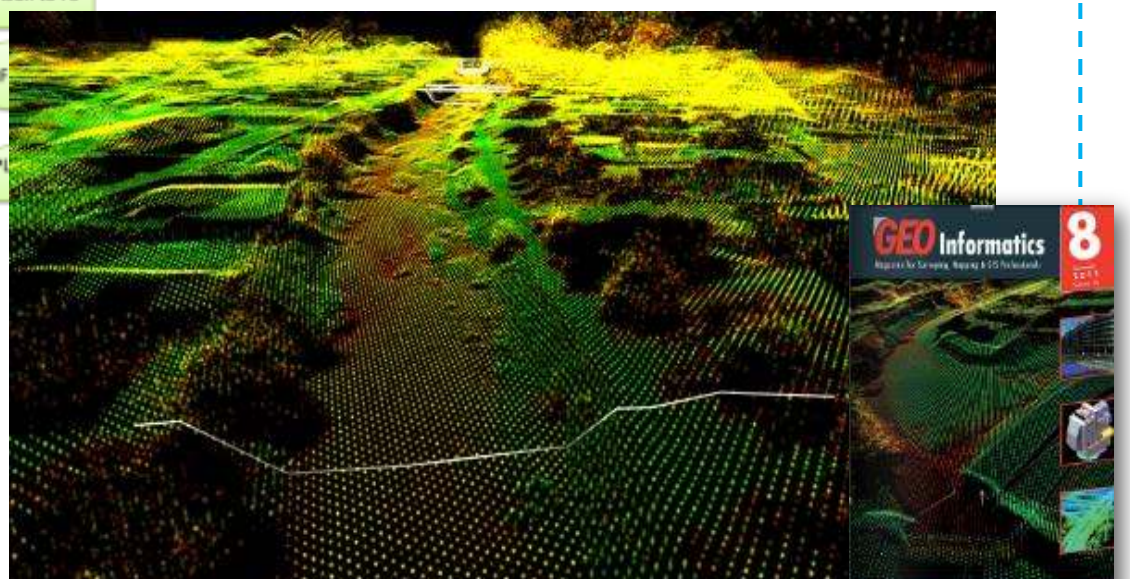
Data visualization and filtering

- Integrated data sources into HDF5 database
- OpenMP parallel code ~8 CPU threads for computation
- OpenCL parallel code ~1000 GPU threads for computation (work in progress)





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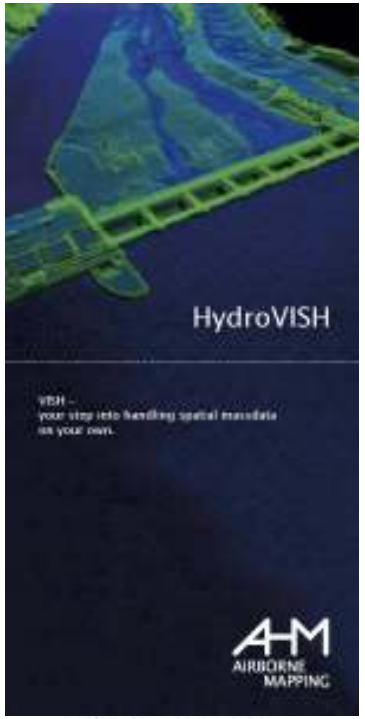

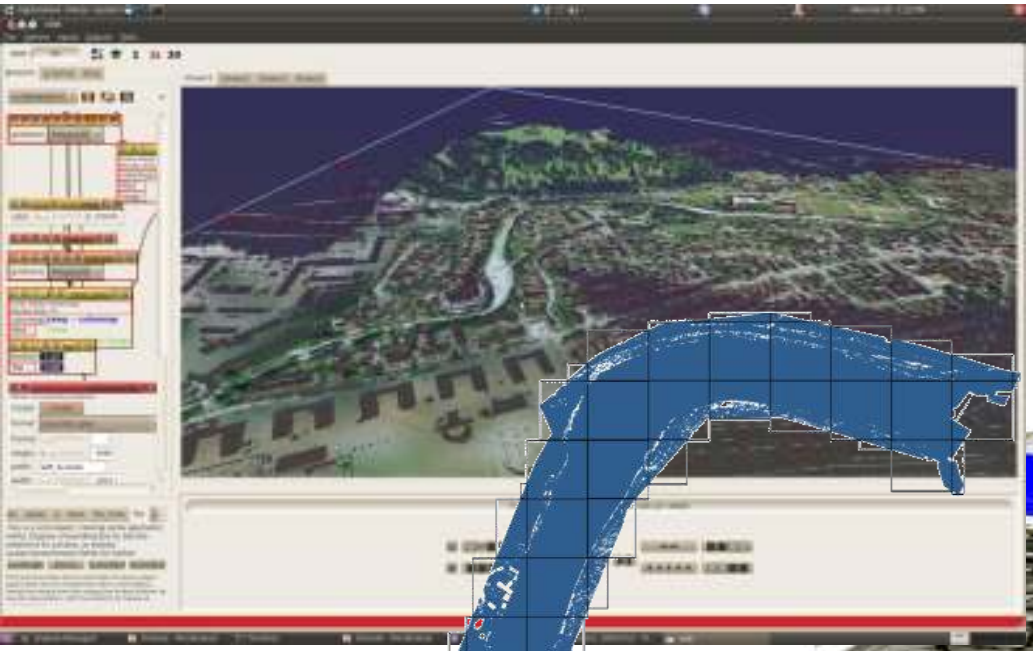

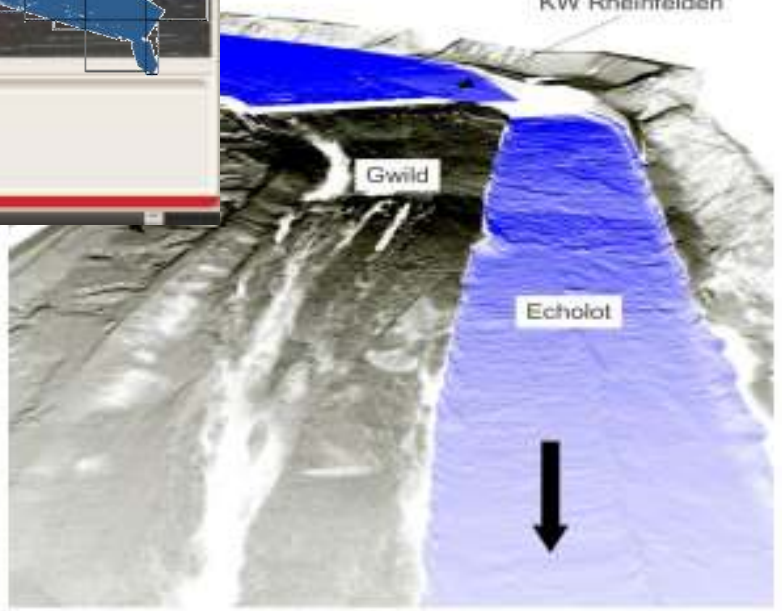

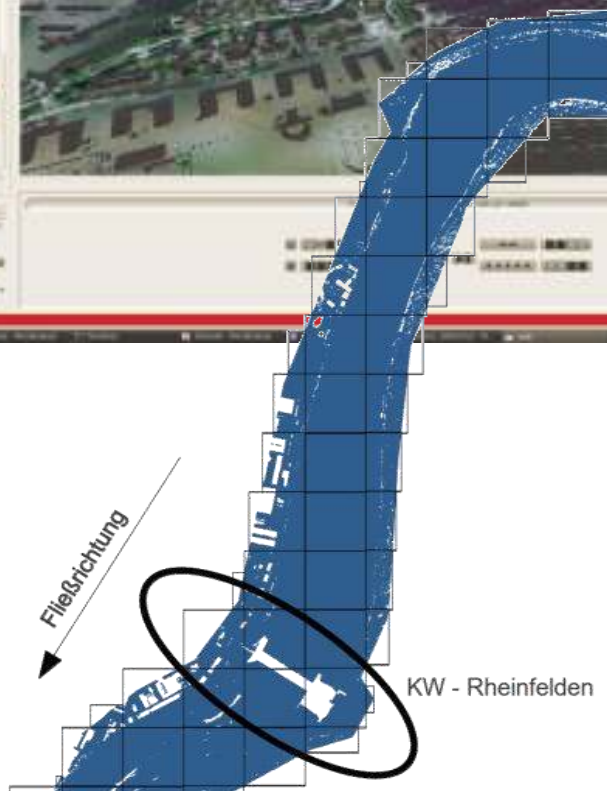

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