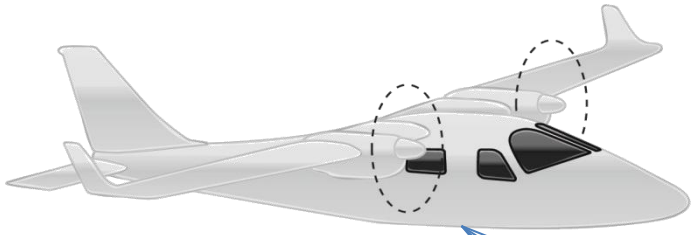


GREENSURVEY

AIRBORNE HYDRO MAPPING

AIRBORNE LAND MAPPING

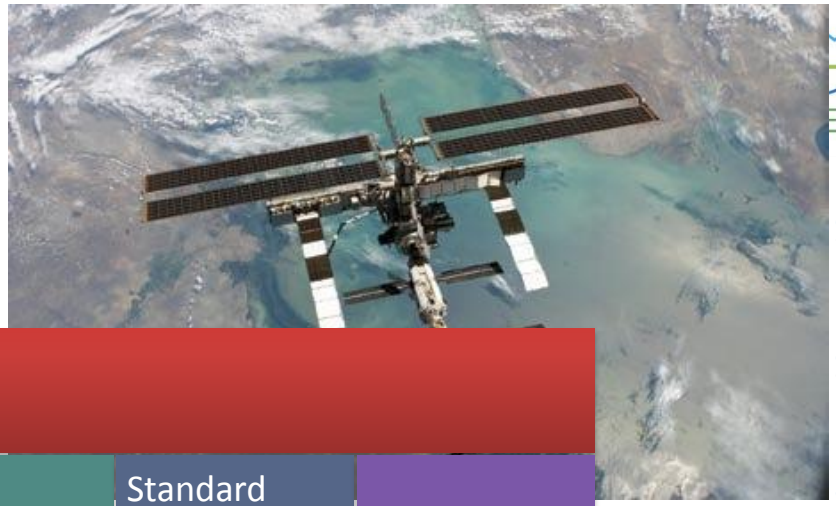
AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

Topobathymetric Data Processing with HydroVISH – Workflow

Dr. Ramona Baran
(in Vertretung Torsten Pöhler)

Data handling



EENSURVEY

AIRBORNE HYDRO MAPPING

AIRBORNE LAND MAPPING

AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

Diverse Data

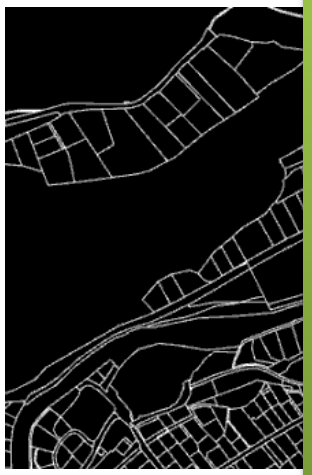
LIDAR

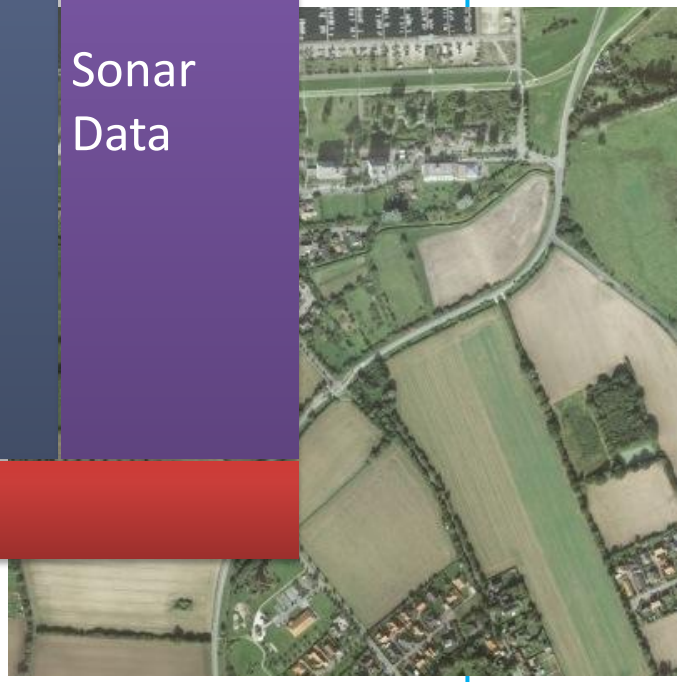
Satellite Images

Arial Images

Standard Surveys
- Cross Sections
- Cadastral Maps

Sonar Data

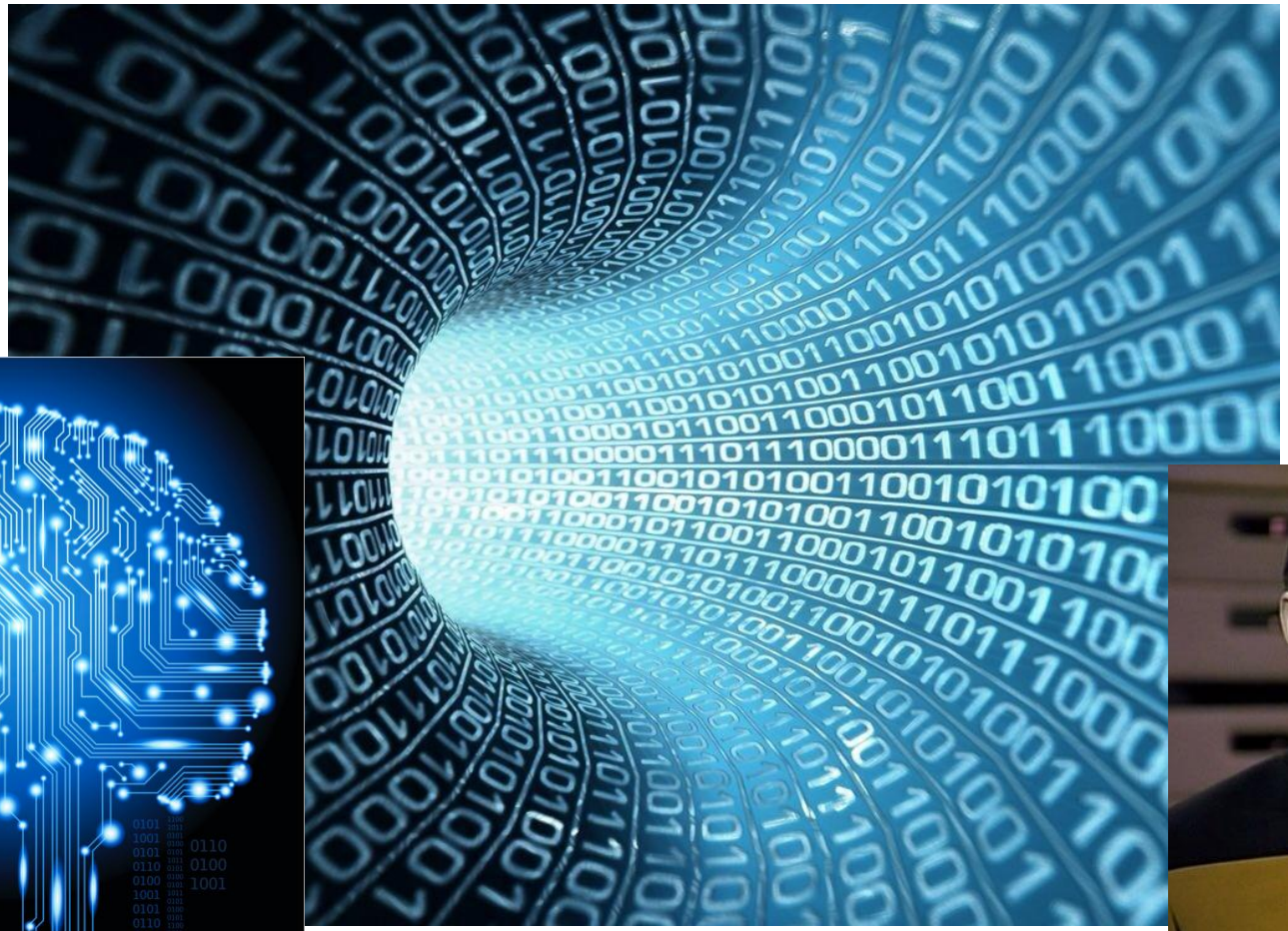


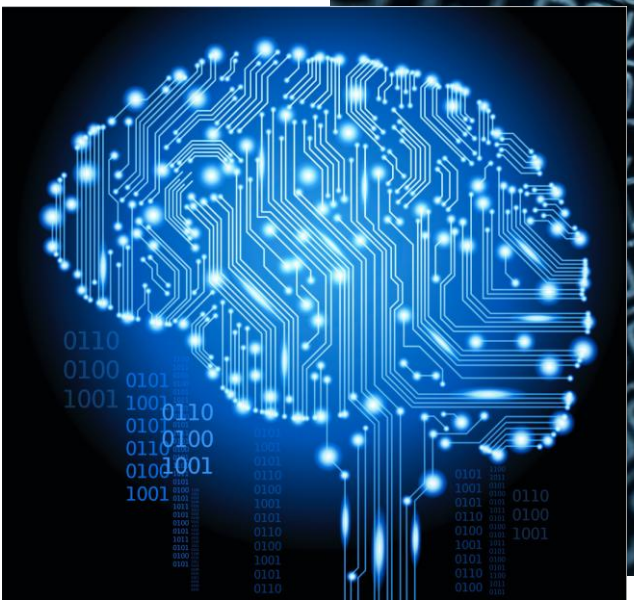


Data handling

- Before data processing and visualization one has to deal with data of many different kinds and many formats

- Data management and handling is crucial





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AIRBORNE HYDRO MAPPING

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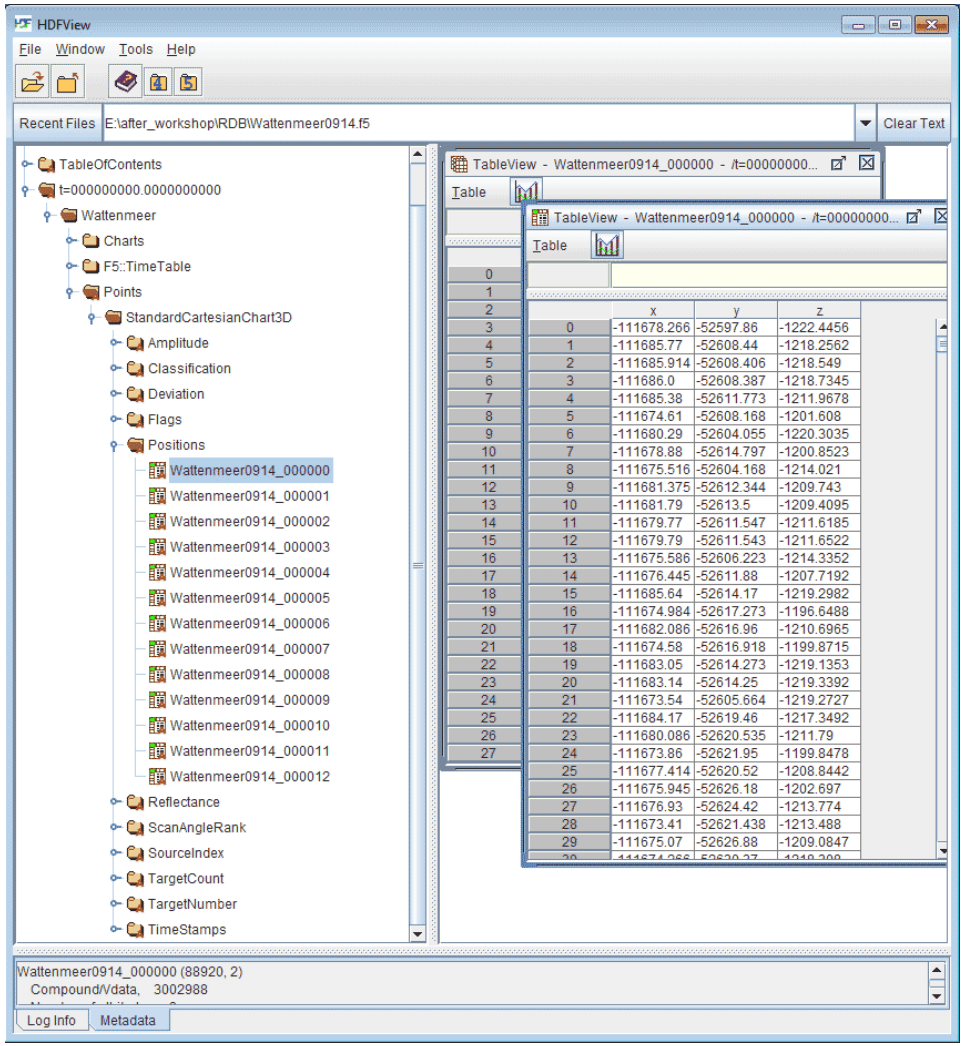
AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

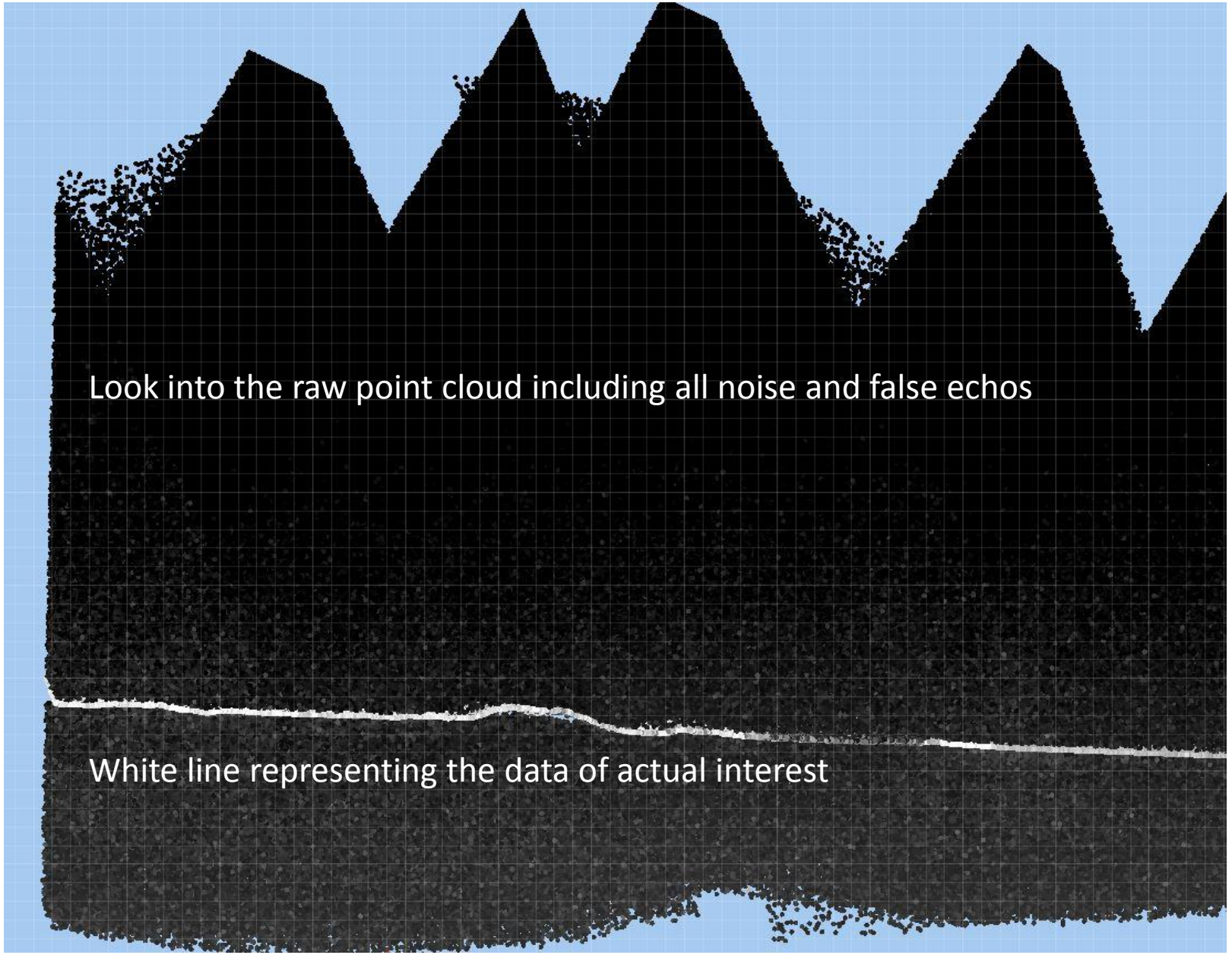
Data handling

- Raw data size coming from sensor: 26.3GB/km²
- Data format (f5): read out of Riegl file format rds & rdx

HDF5 & F5 file format open and free to document all data and manipulations executed on data → even after export (no more limitations due to file formats)



Raw data



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AIRBORNE HYDRO MAPPING

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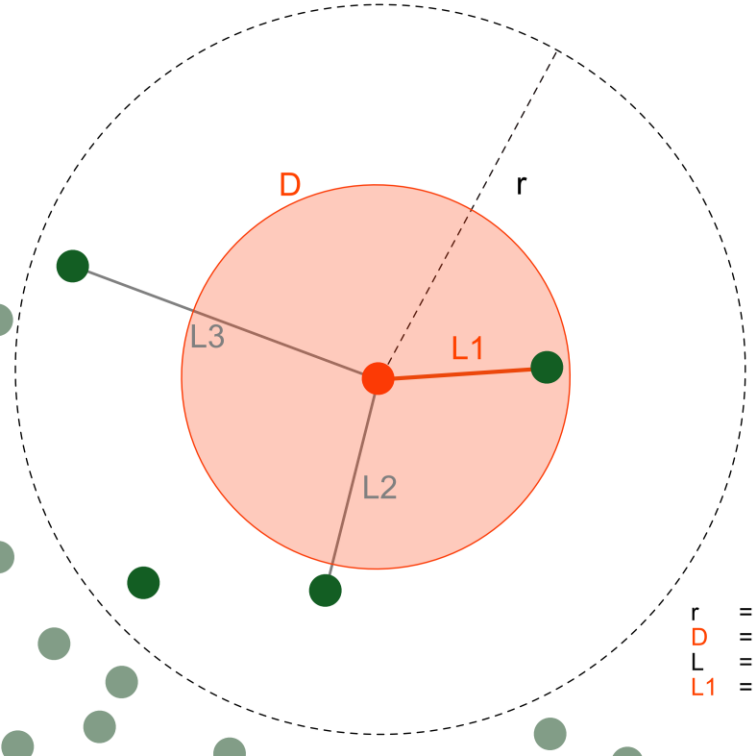
AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

Step 1) Removing flaw echos

Neighbourhood of points is investigated – detection of flaw echos according to:

1) Search radius r: radius for neighborhood analysis
2) Distance criteria D: distance, in which nearest point has to be located
3) Density criteria ρ: point density, which has to be given within search radius



Point is no flaw echo, if…

Point density within search radius r ≤ density criteria ρ

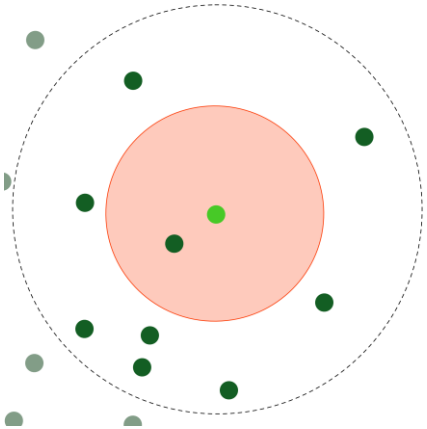
&

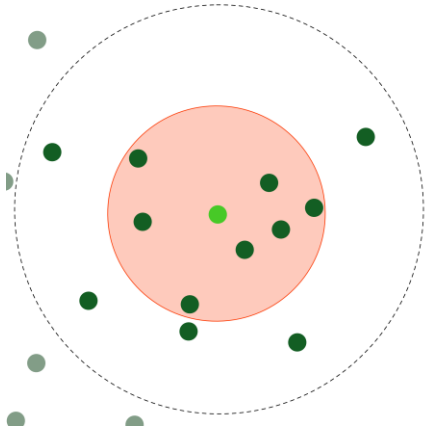
Distance to nearest neighboring point L1 ≤ Distance criteria D

r = search radius
D = distance criteria
L = distance to neighbouring piont
L1 = distance to neareast neighbouring point

Step 1) Removing flaw echos

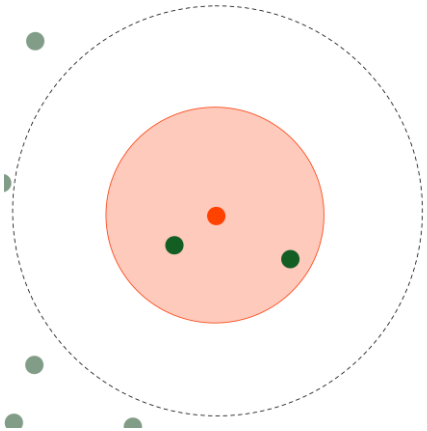
No flaw echos

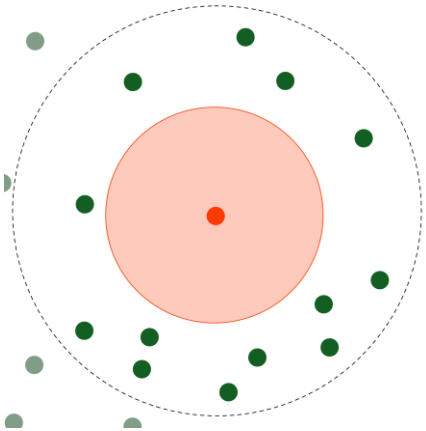


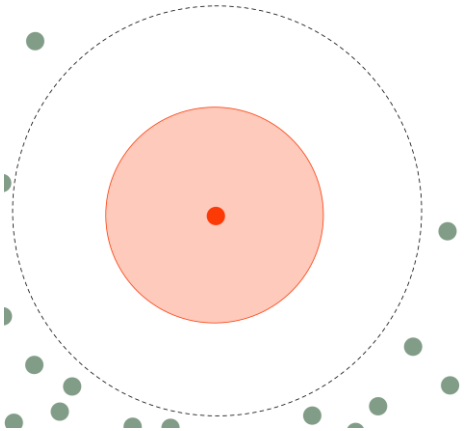


Filtering of flaw echos by factor of 10 faster, when GPU used for processing

Flaw echos







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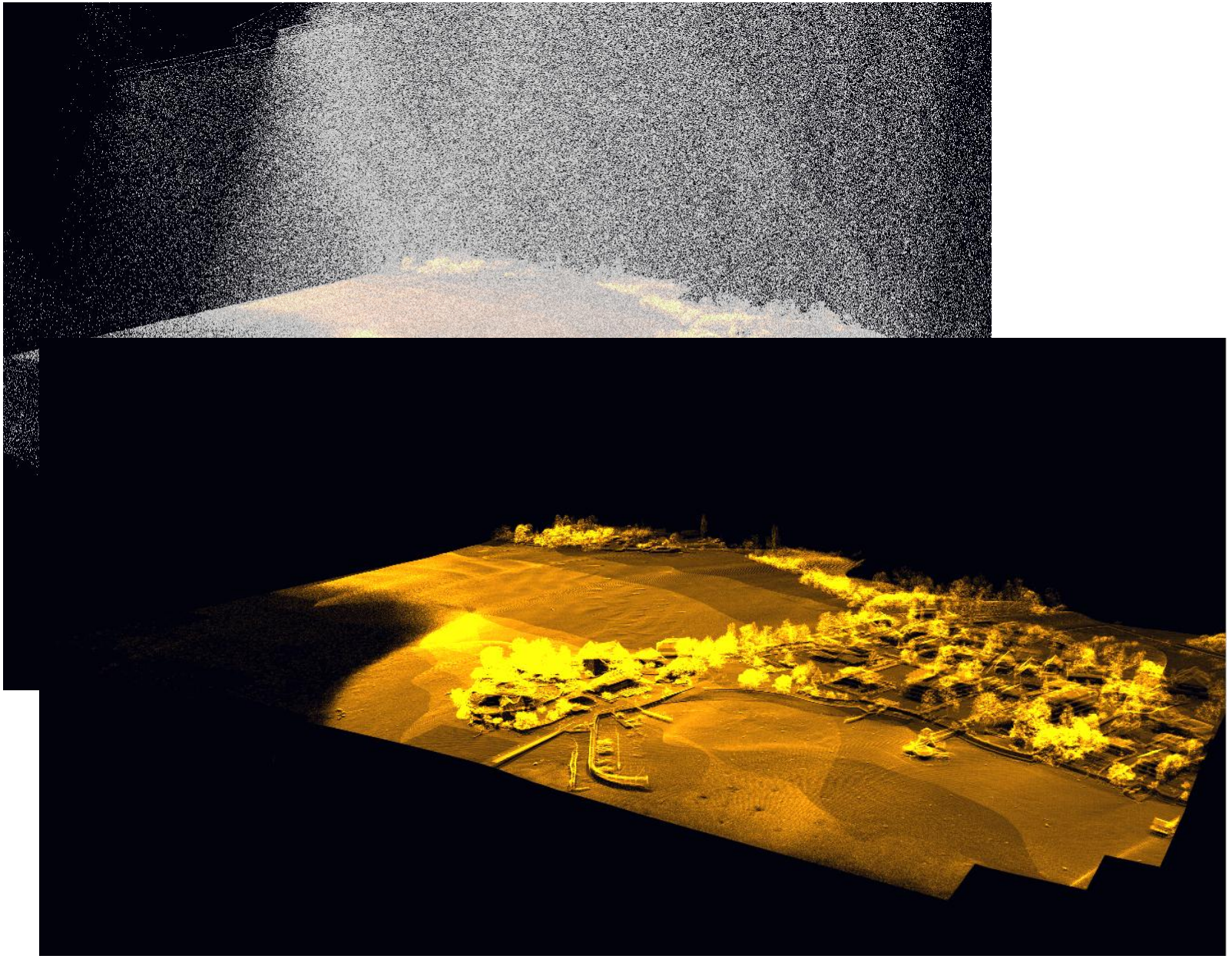
AIRBORNE HYDRO MAPPING

AIRBORNE LAND MAPPING

AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

Step 1) Removing flaw echos



GREENSURVEY

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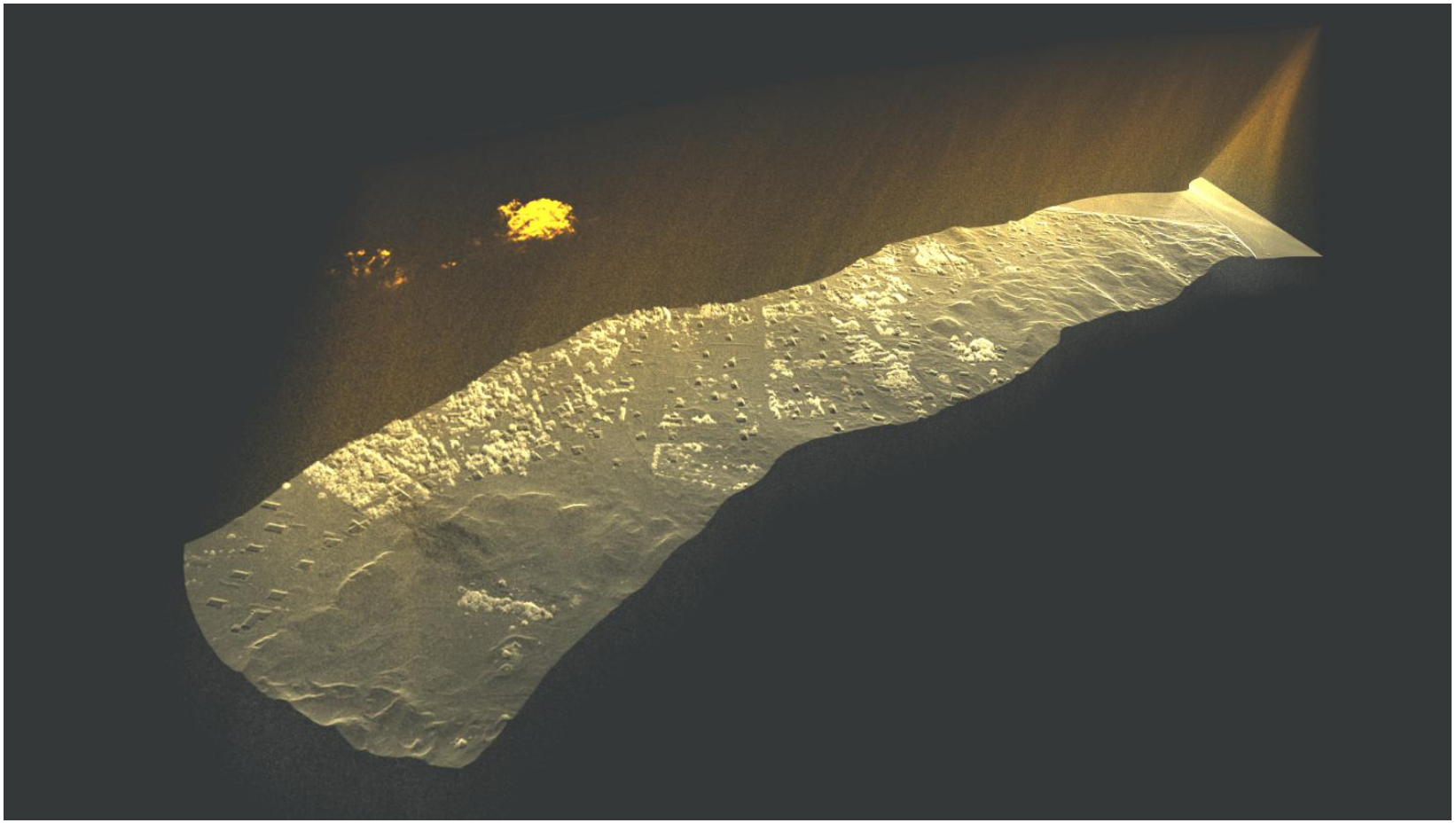
AIRBORNE ICE&SNOW MAPPING

Step 1) Removing flaw echos



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AIRBORNE HYDRO MAPPING

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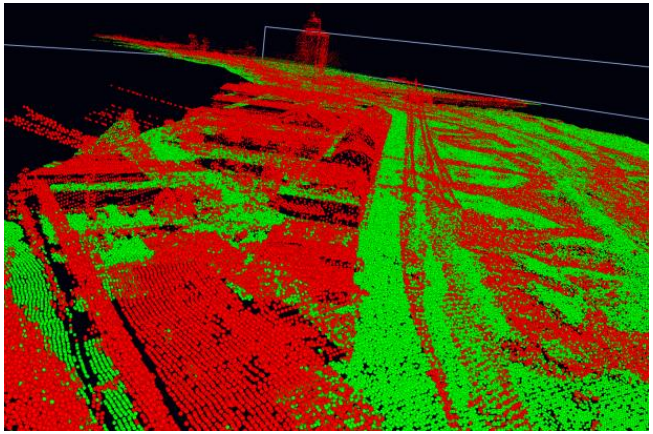
AIRBORNE NATURE MAPPING

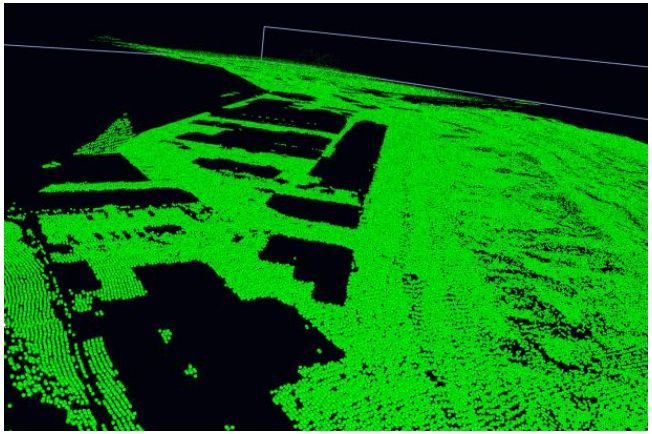
AIRBORNE ICE&SNOW MAPPING

Step 2) Point cloud classification

Terrain classification

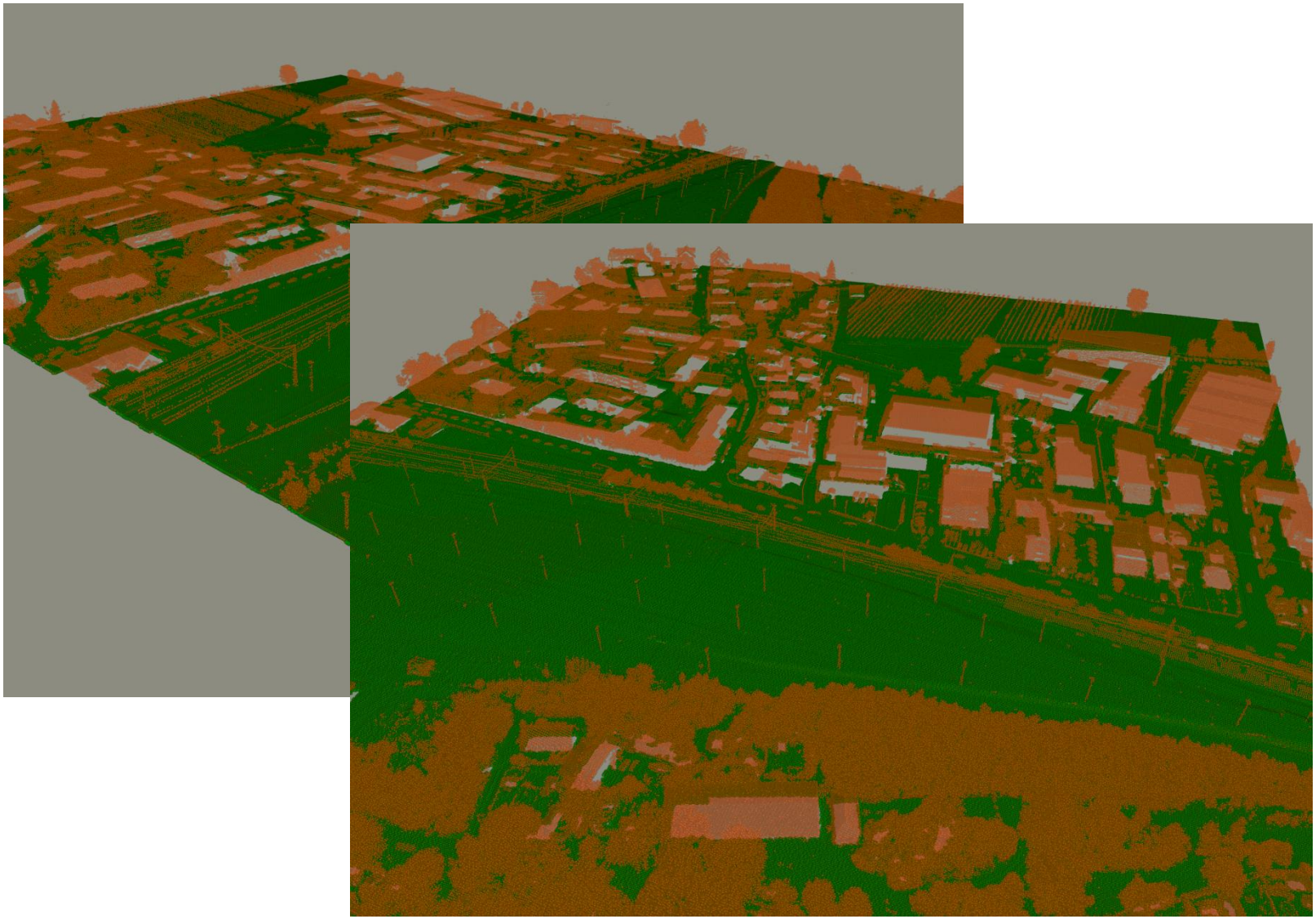
- Rasterization of point cloud: deepest point & average reflectance per raster cell
- Raster cells are marked, that do not fit a specific height criteria → remaining raster cells used as seed cells for terrain classification
- Based on seed cells remaining raster cells evaluated: raster cells classified as terrain, if height difference smaller than an arbitrary value & planarity of raster cell greater than an arbitrary value → remaining cells marked as unclassified
- Raster cell classification transferred to point cloud
- Manual correction of automated results





Step 2) Point cloud classification

Terrain classification



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AIRBORNE HYDRO MAPPING

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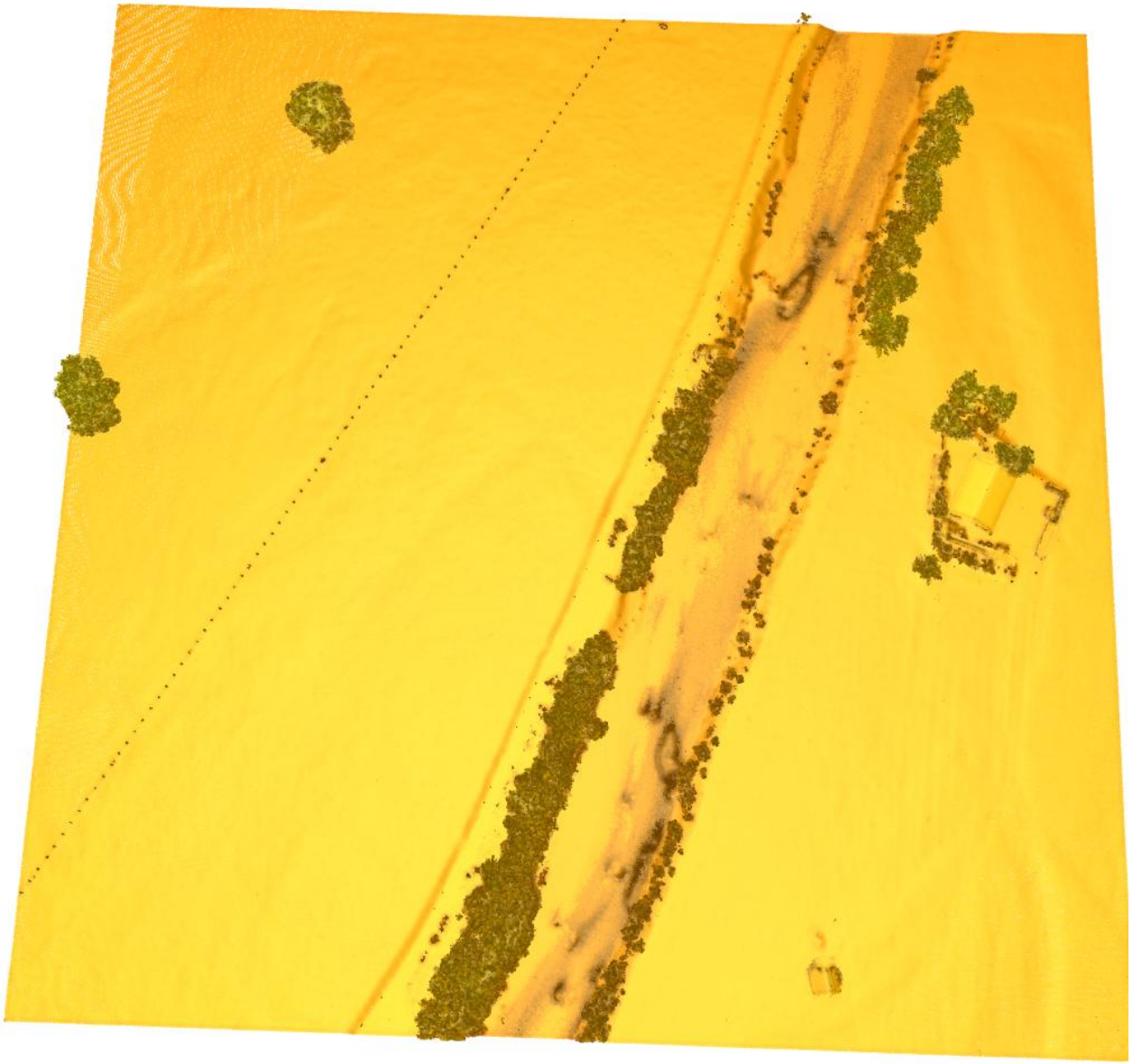
AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

Step 2) Point cloud classification

Terrain classification



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AIRBORNE HYDRO MAPPING

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AIRBORNE NATURE MAPPING

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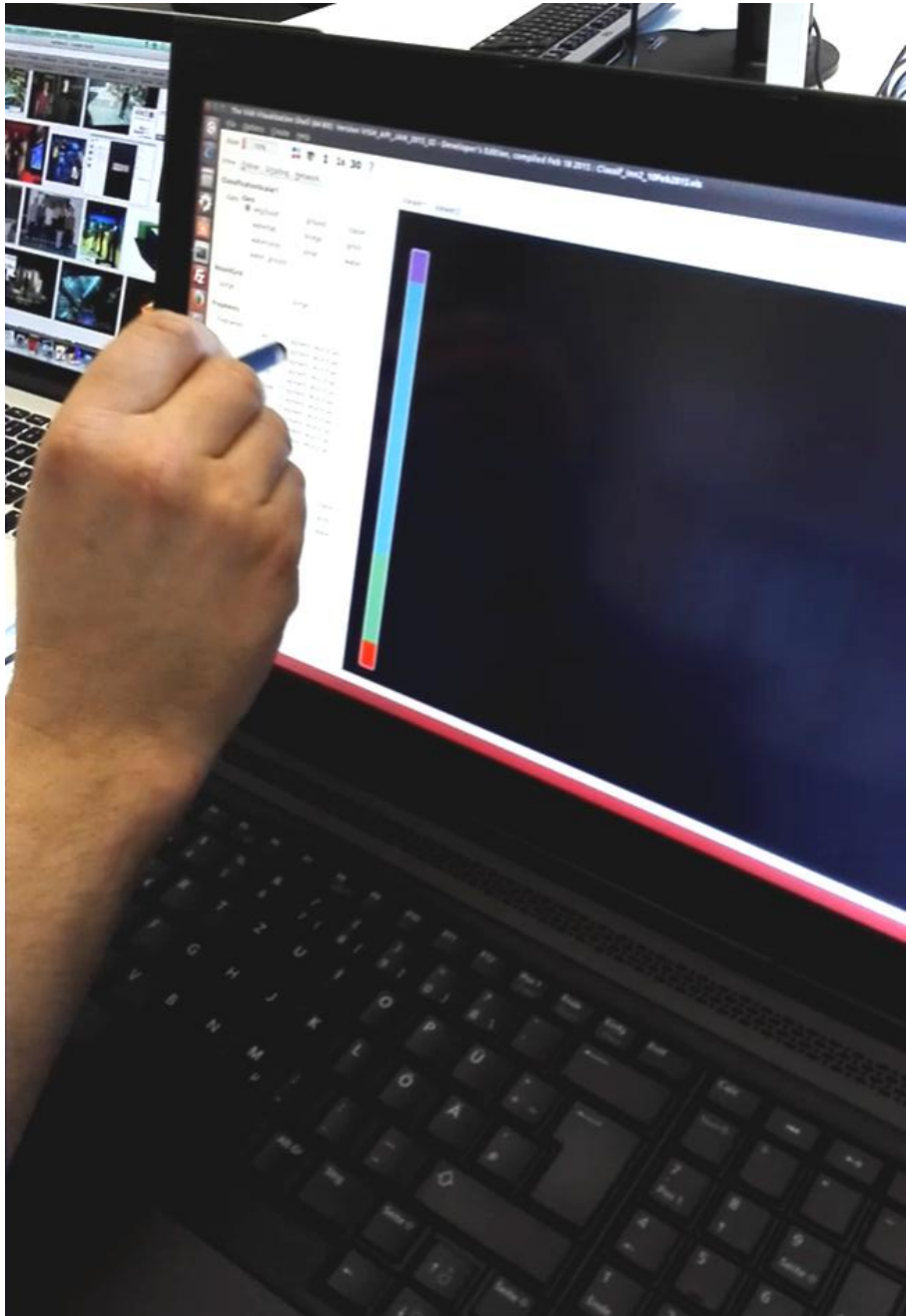
Step 2) Point cloud classification

Advanced manual pointcloud correction (touch&gesture handling)



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AIRBORNE HYDRO MAPPING

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AIRBORNE NATURE MAPPING

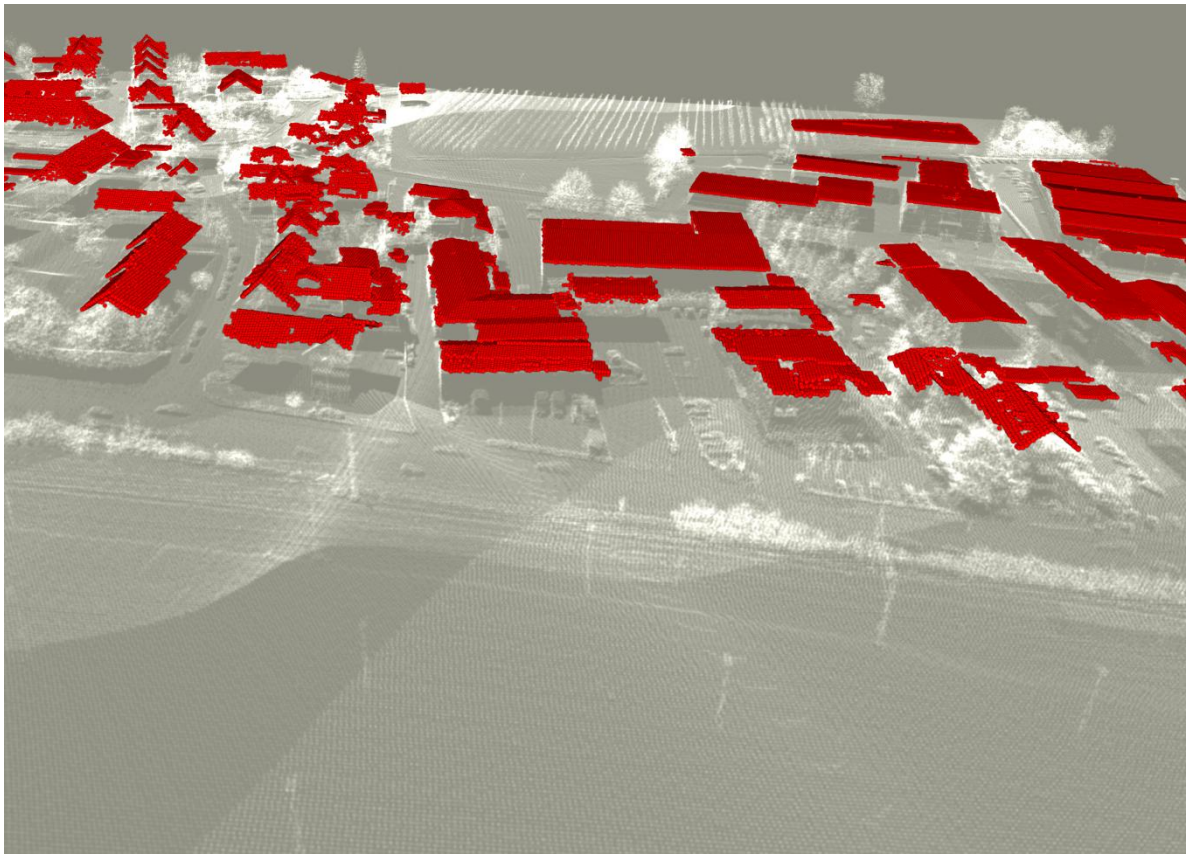
AIRBORNE ICE&SNOW MAPPING

Step 2) Point cloud classification

Building & roof classification (under continued development)

- Unclassified points left after terrain classification further analysed according to planarity characteristics

- Further separation into buildings and vegetation/rest



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AIRBORNE HYDRO MAPPING

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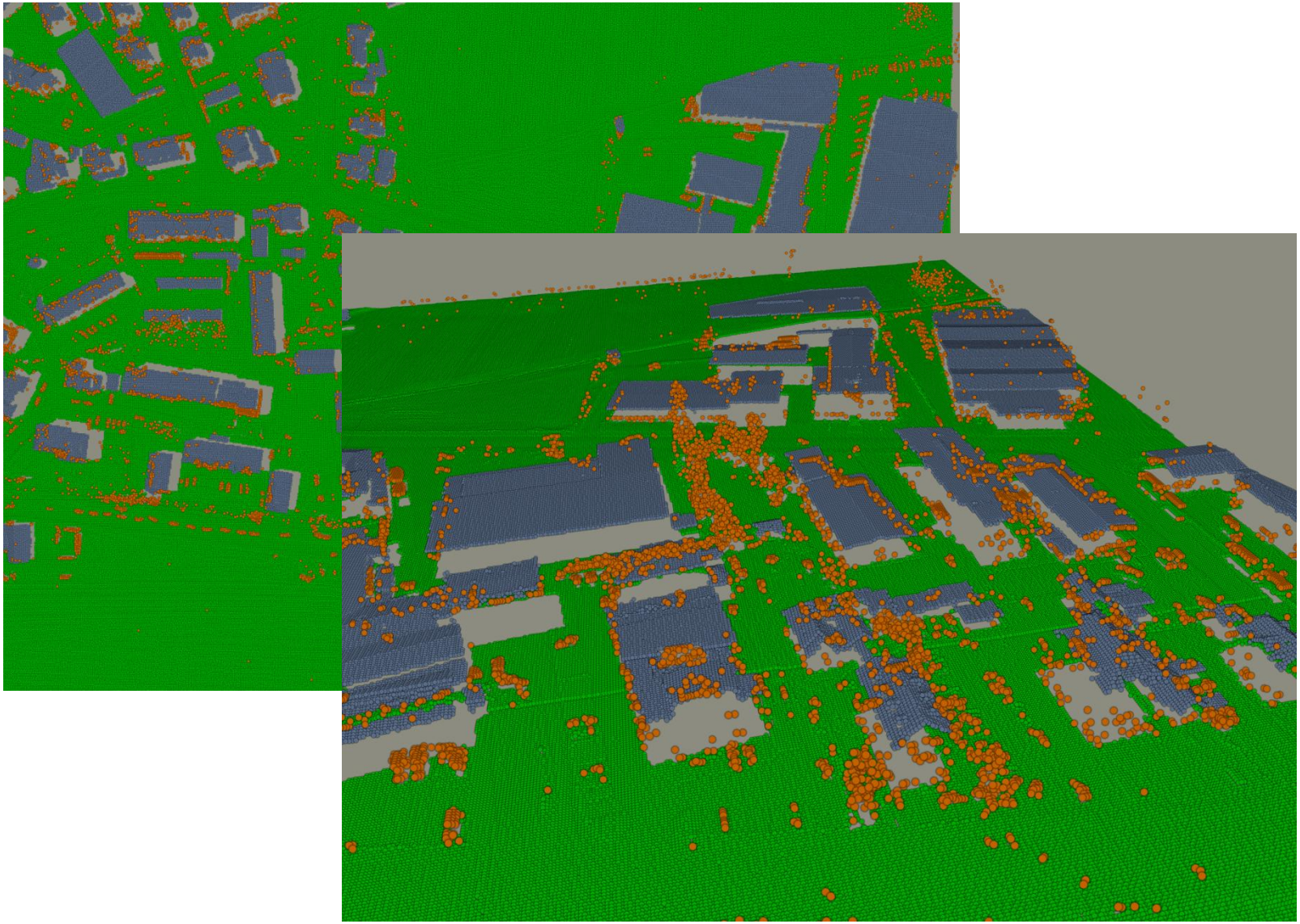
AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

Step 2) Point cloud classification

Building & roof classification



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AIRBORNE HYDRO MAPPING

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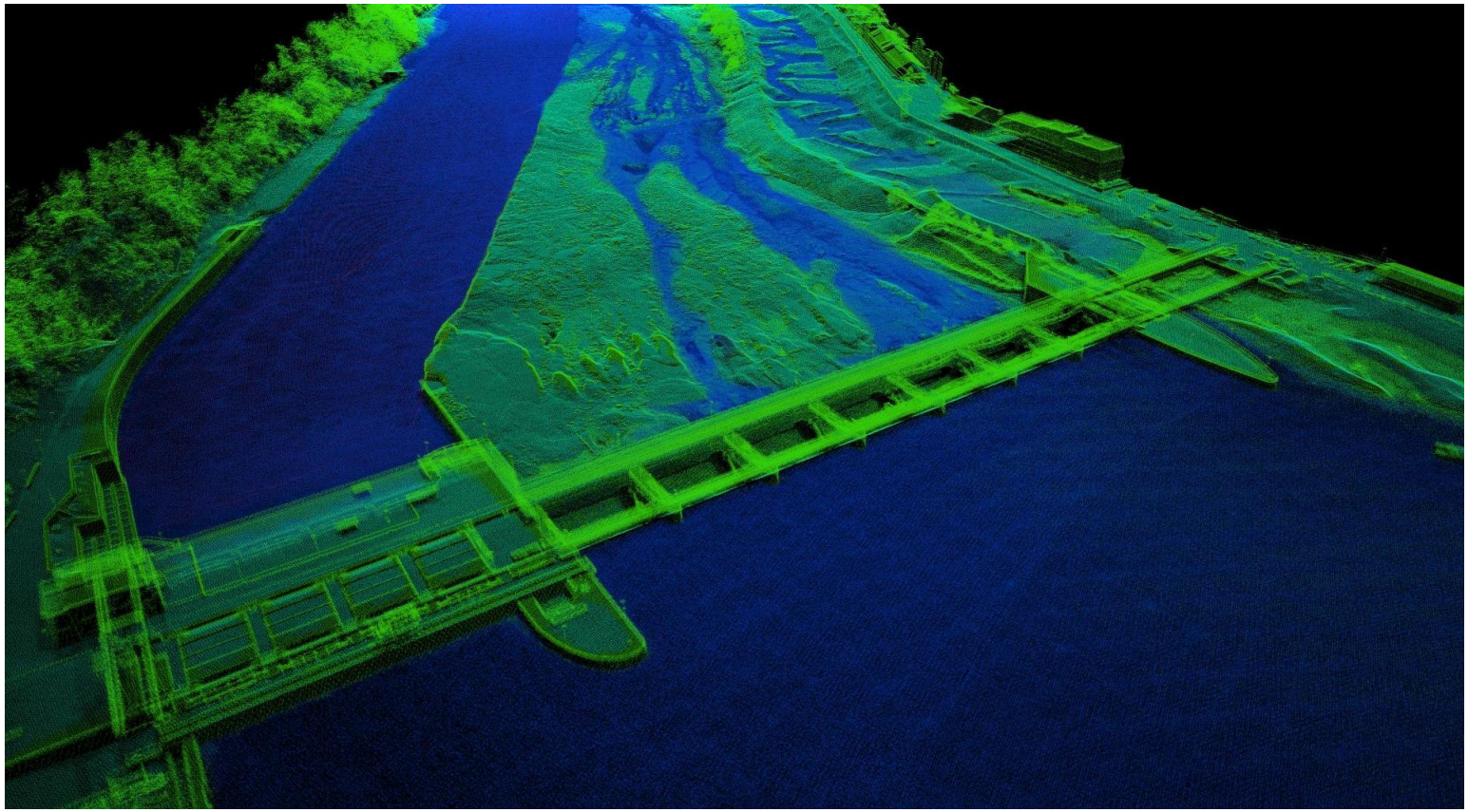
AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

Step 2) Point cloud classification

Water surface classification (under continued development)

- Rasterization of point cloud: deepest point & average reflectance per raster cell
- Average reflectance used to detect water surface together with planarity characteristics



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AHM AIRBORNE HYDRO MAPPING

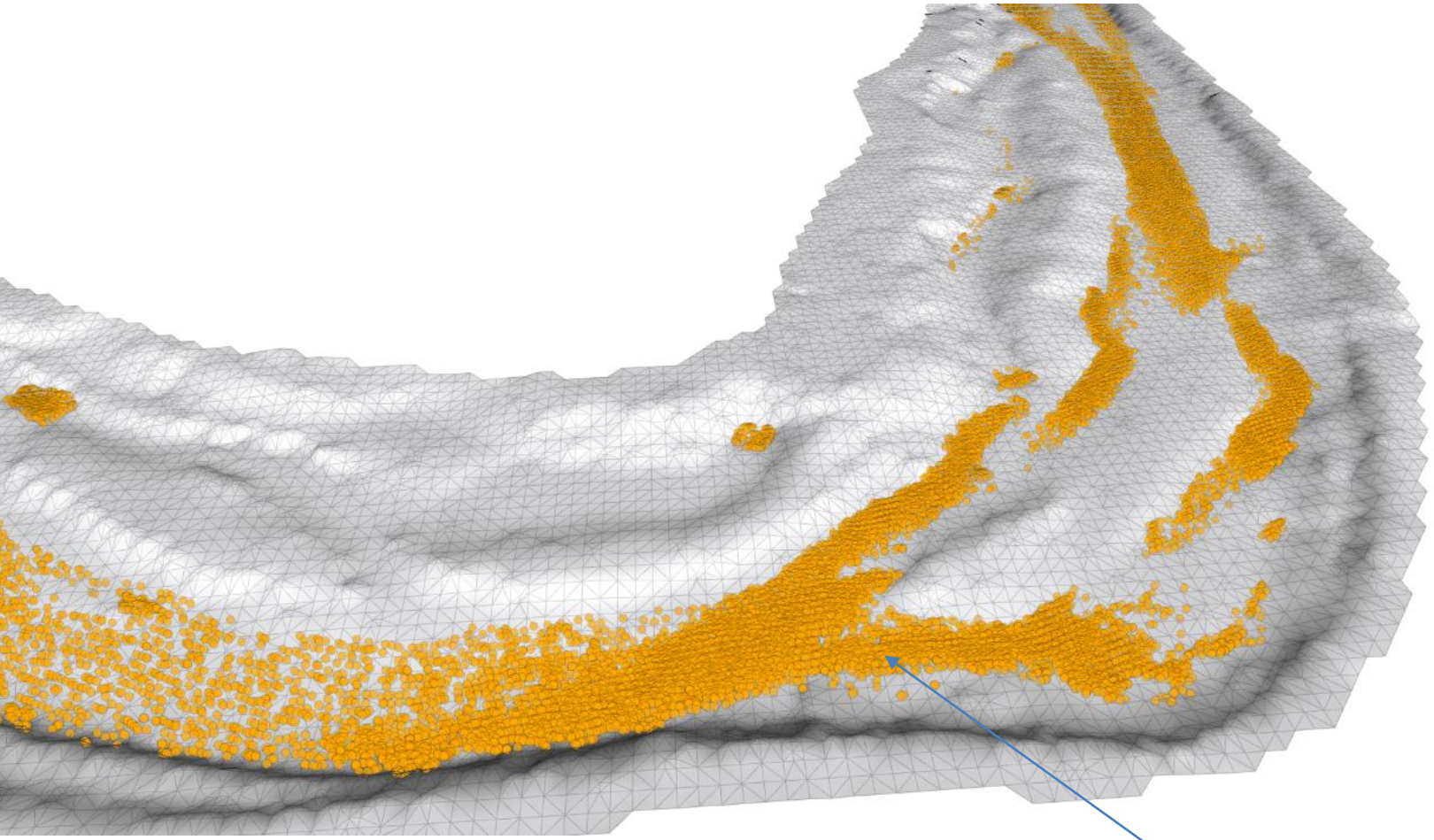
AHM AIRBORNE LAND MAPPING

AHM AIRBORNE NATURE MAPPING

AHM AIRBORNE ICE&SNOW MAPPING

Step 3) Water surface modelling

- Based on points classified as water surface



LiDAR points of water surface

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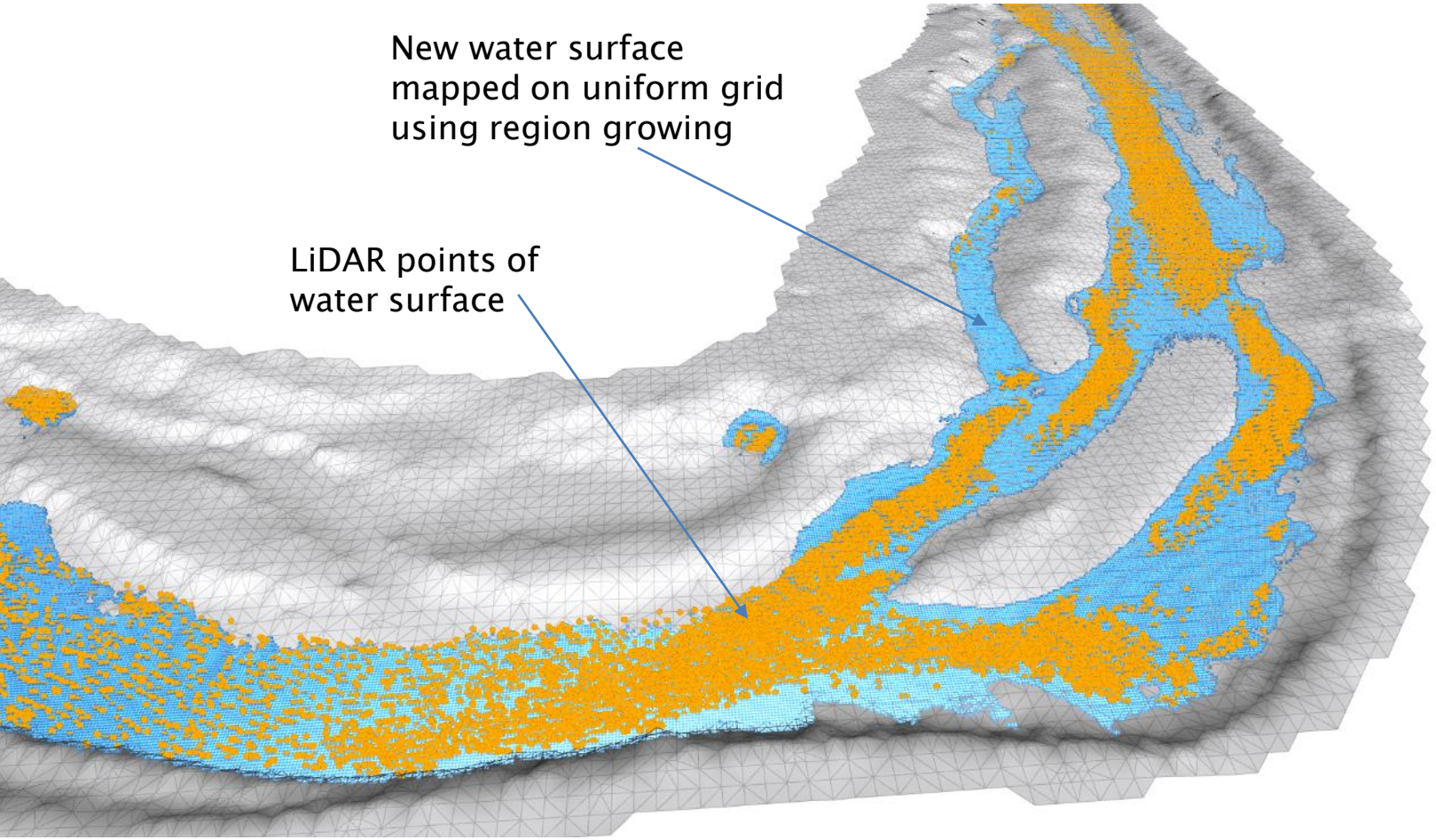
Step 3) Water surface modelling

- New water surface by region growing on raster until water-land boundary



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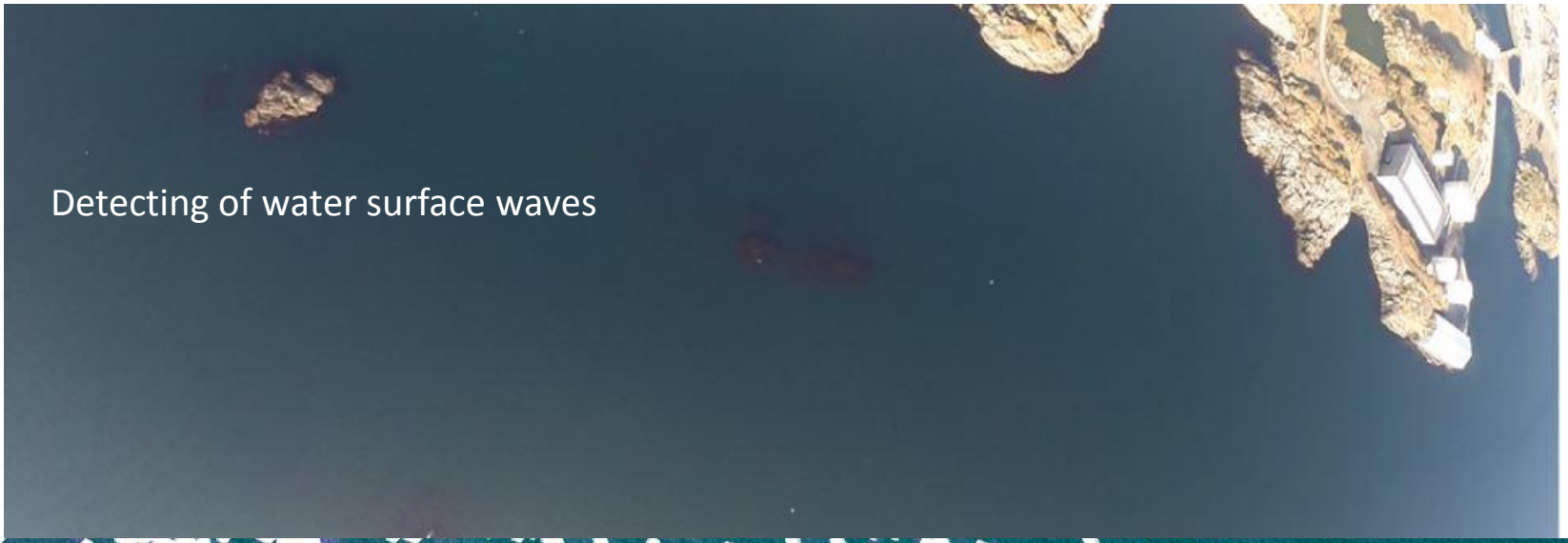
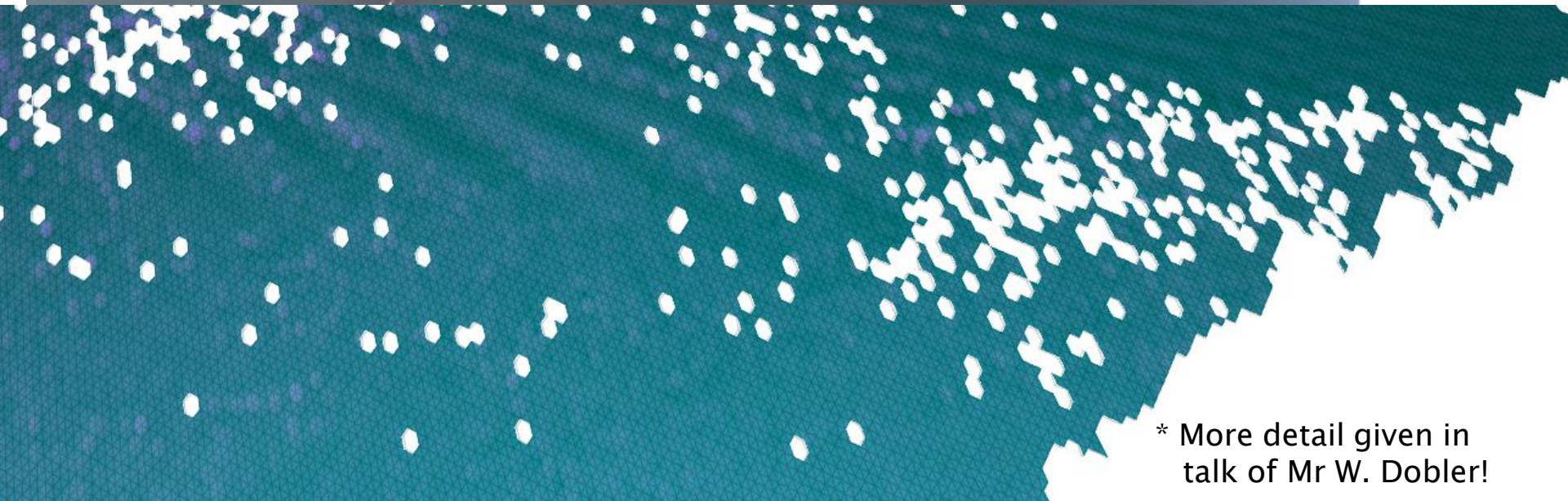
Step 3) Water surface modelling

- Waves need to be included in water surface model



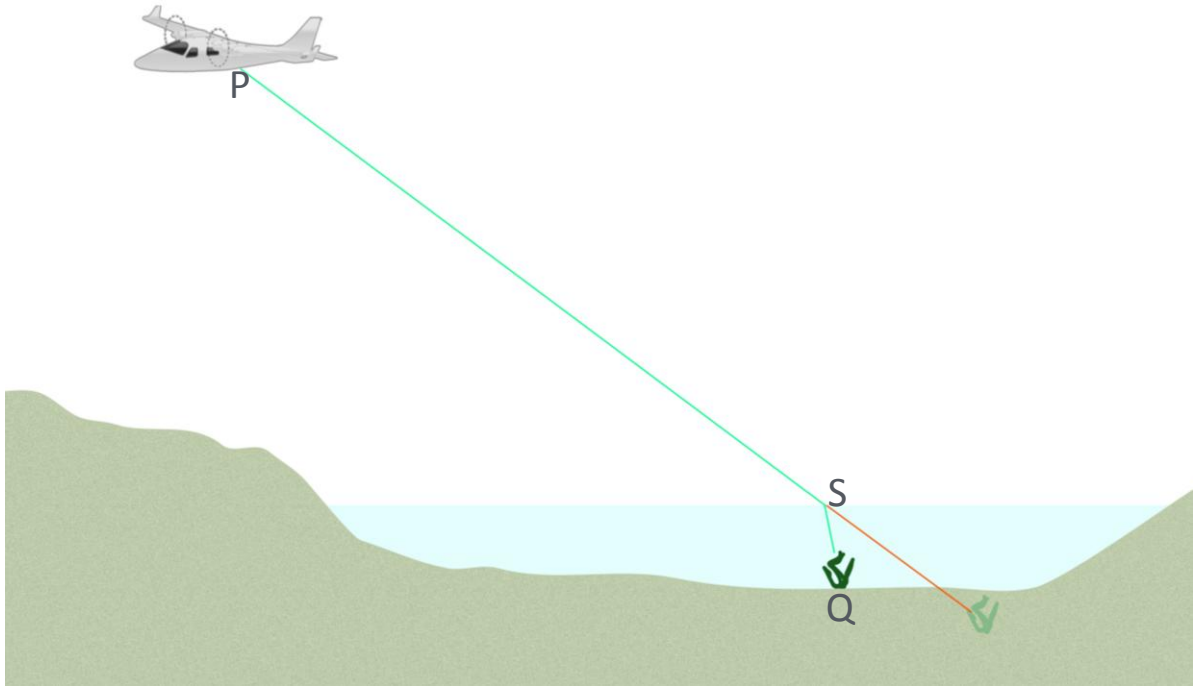


* More detail given in talk of Mr W. Dobler!

Step 4) Refraction

- Correcting positions of under water points

- Input: 1) point cloud with timestamp for each point
  2) water table as triangulated shape
  3) flight trajectory with timestamp for each point



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AIRBORNE HYDRO MAPPING

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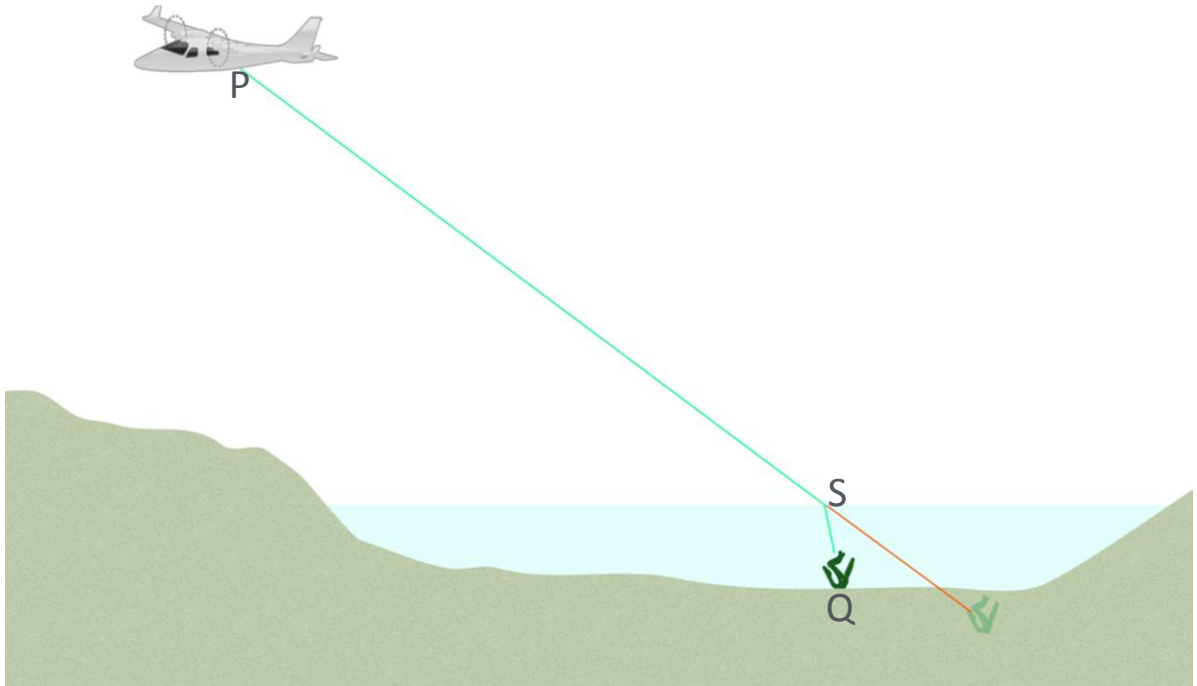
AIRBORNE NATURE MAPPING

AIRBORNE ICE&SNOW MAPPING

Step 4) Refraction

- Investigating a pair of points with matching timestamp (P of point cloud & Q of trajectory) & vector linking these two
- Calculation of point where beam P–Q intersects water table S (possible to adjust value by offset due to delay first echo)
- Calculation of beam's entry angle → correction of beam considering angle of refraction
- Calculation of beam length S–P under water → time delay correction of beam's running time considering refraction index



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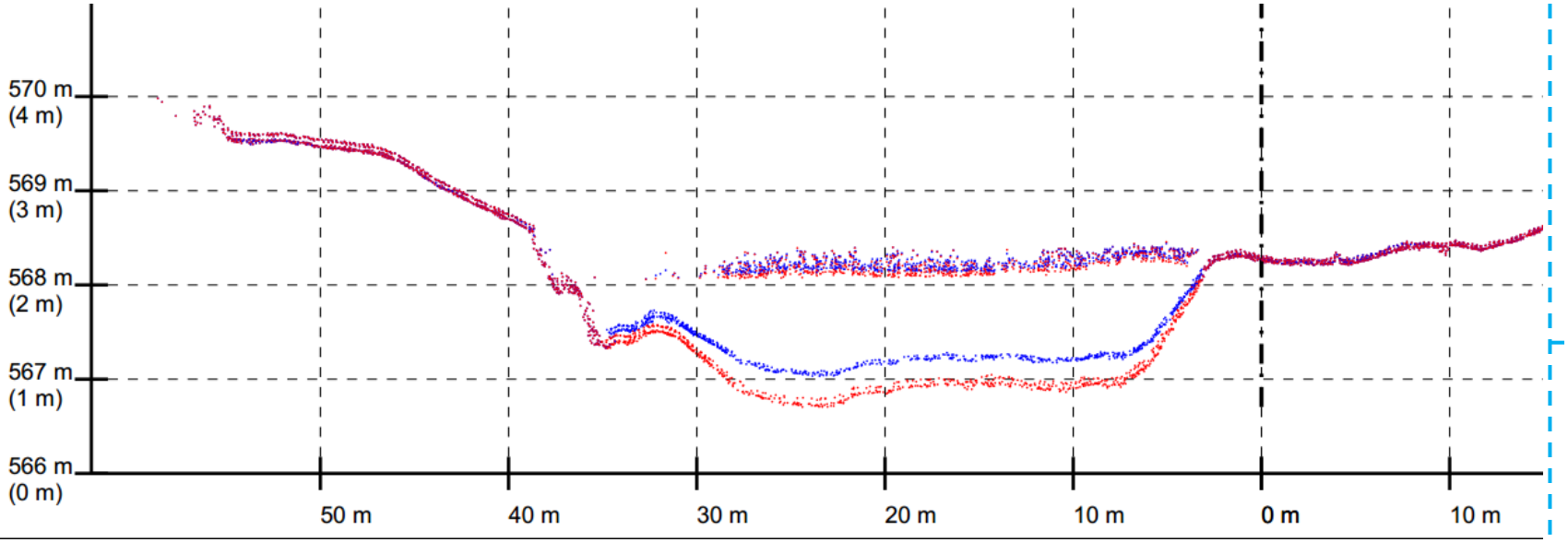
Step 4) Refraction



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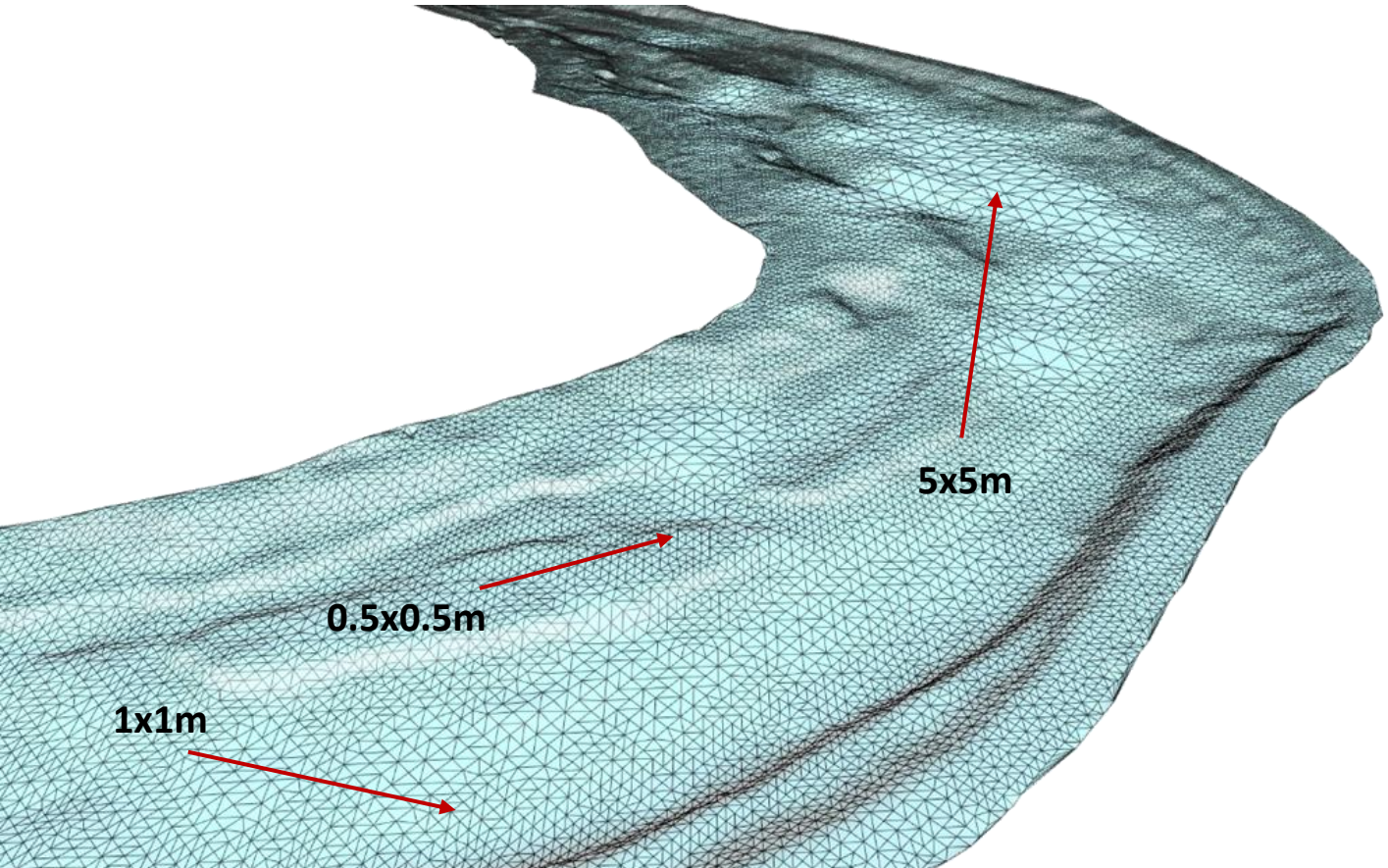
Step 5) Digital Models

Digital terrain models

- Triangulation based on variable grid size: reduce amount of data without loosing geometrical information
- Regular grids: 0.5 x 0.5 m, 1 x 1 m …



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AIRBORNE HYDRO MAPPING

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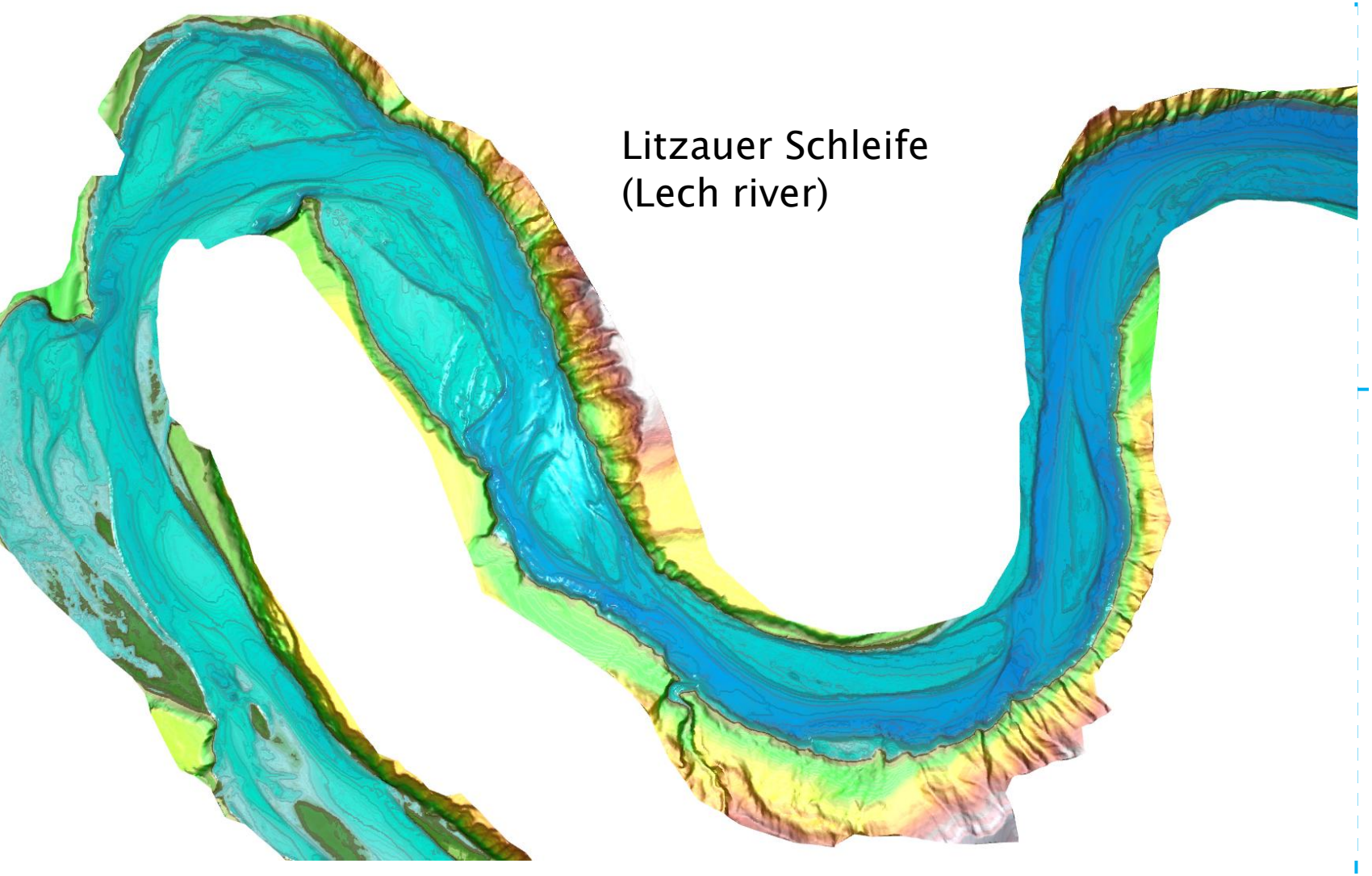
AIRBORNE ICE&SNOW MAPPING

Step 5) Digital Models

Digital terrain models (with contour lines)



Litzauer Schleife
(Lech river)

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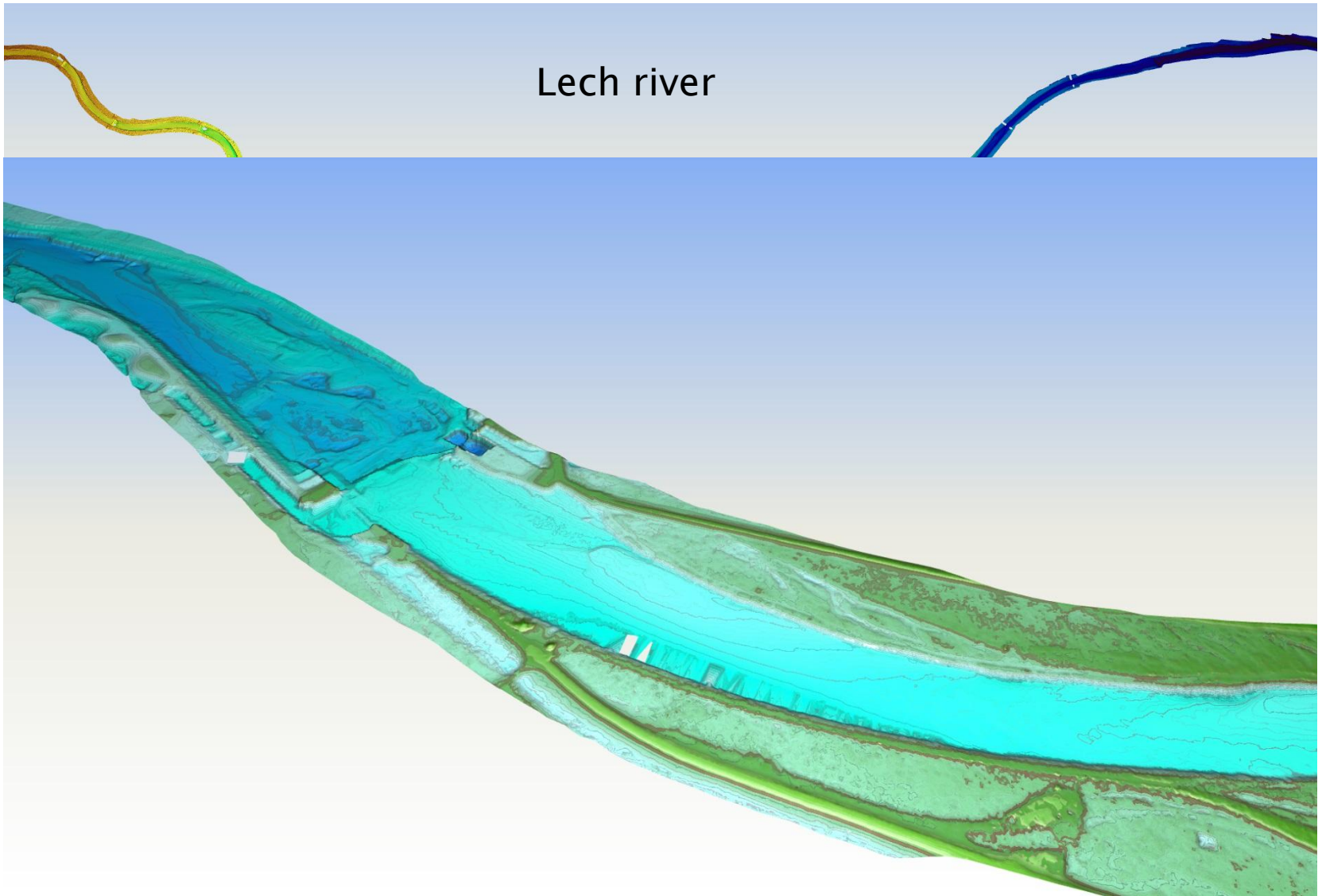
AIRBORNE ICE&SNOW MAPPING

Step 5) Digital Models

Digital terrain models (with contour lines)



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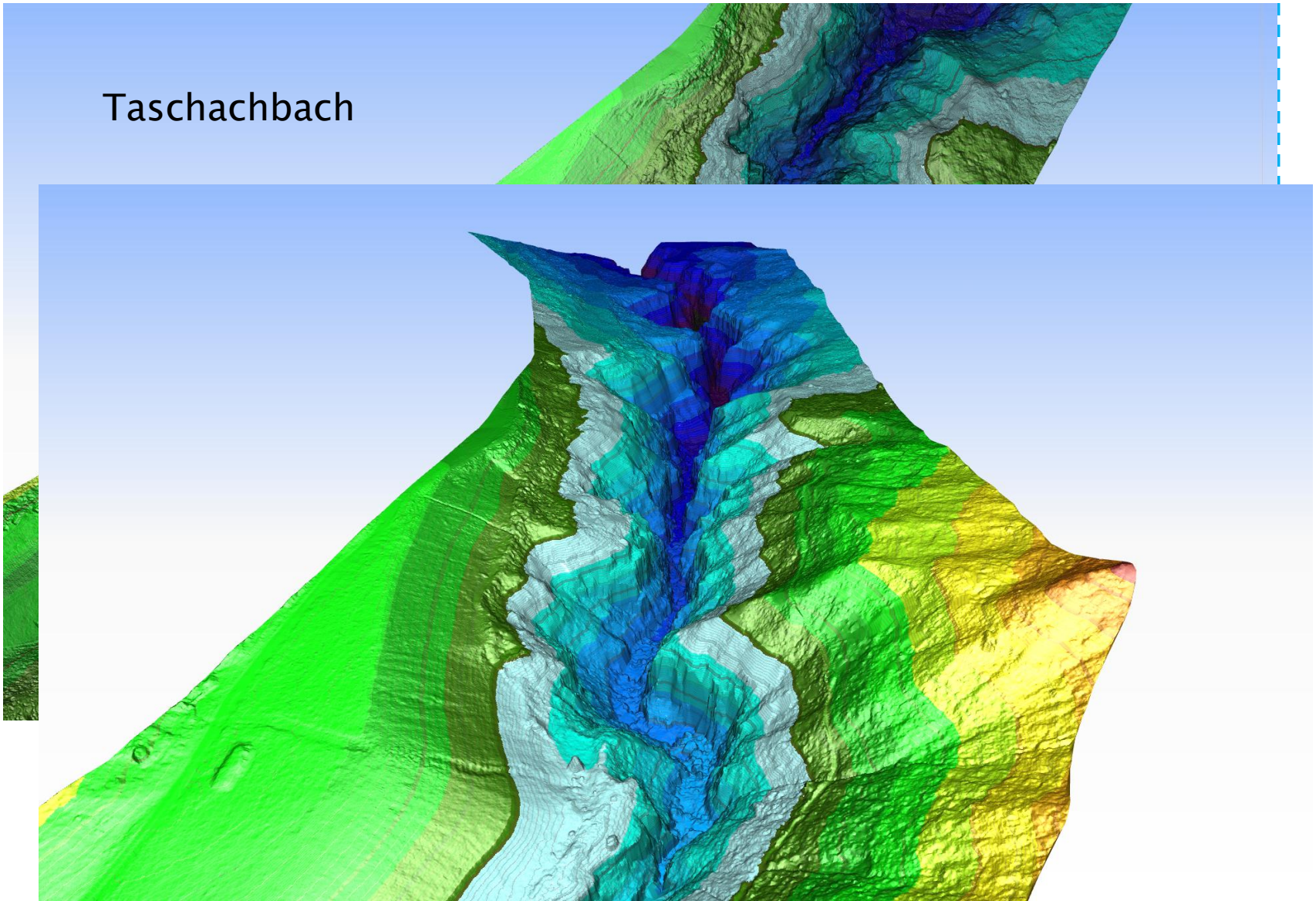
Step 5) Digital Models

Digital terrain models (with contour lines)

Taschachbach



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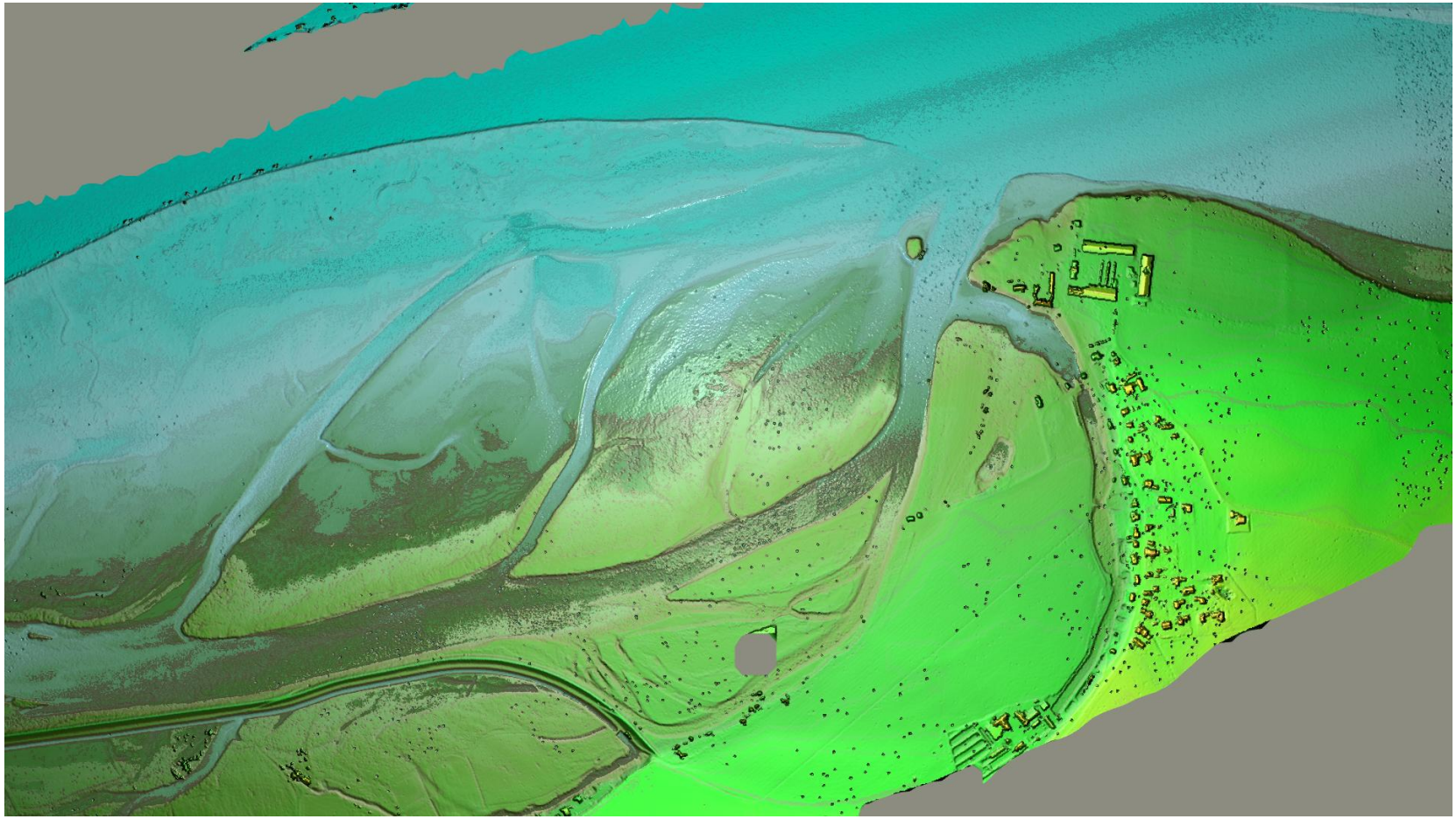
Step 5) Digital Models

Digital surface models

Hagenauer Bucht (Inn river)



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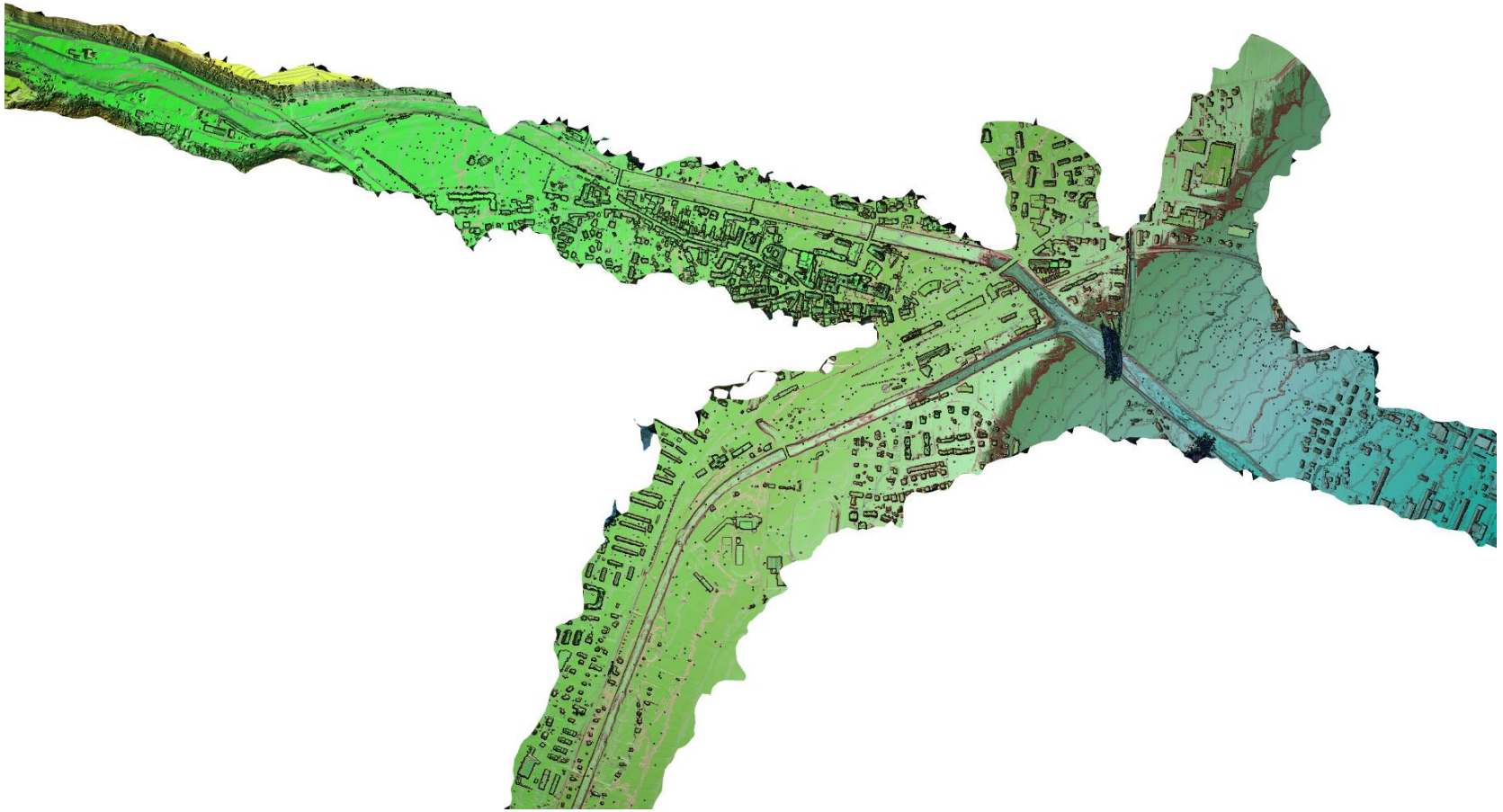
Step 5) Digital Models

Digital surface models

Drau river



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AIRBORNE HYDRO MAPPING

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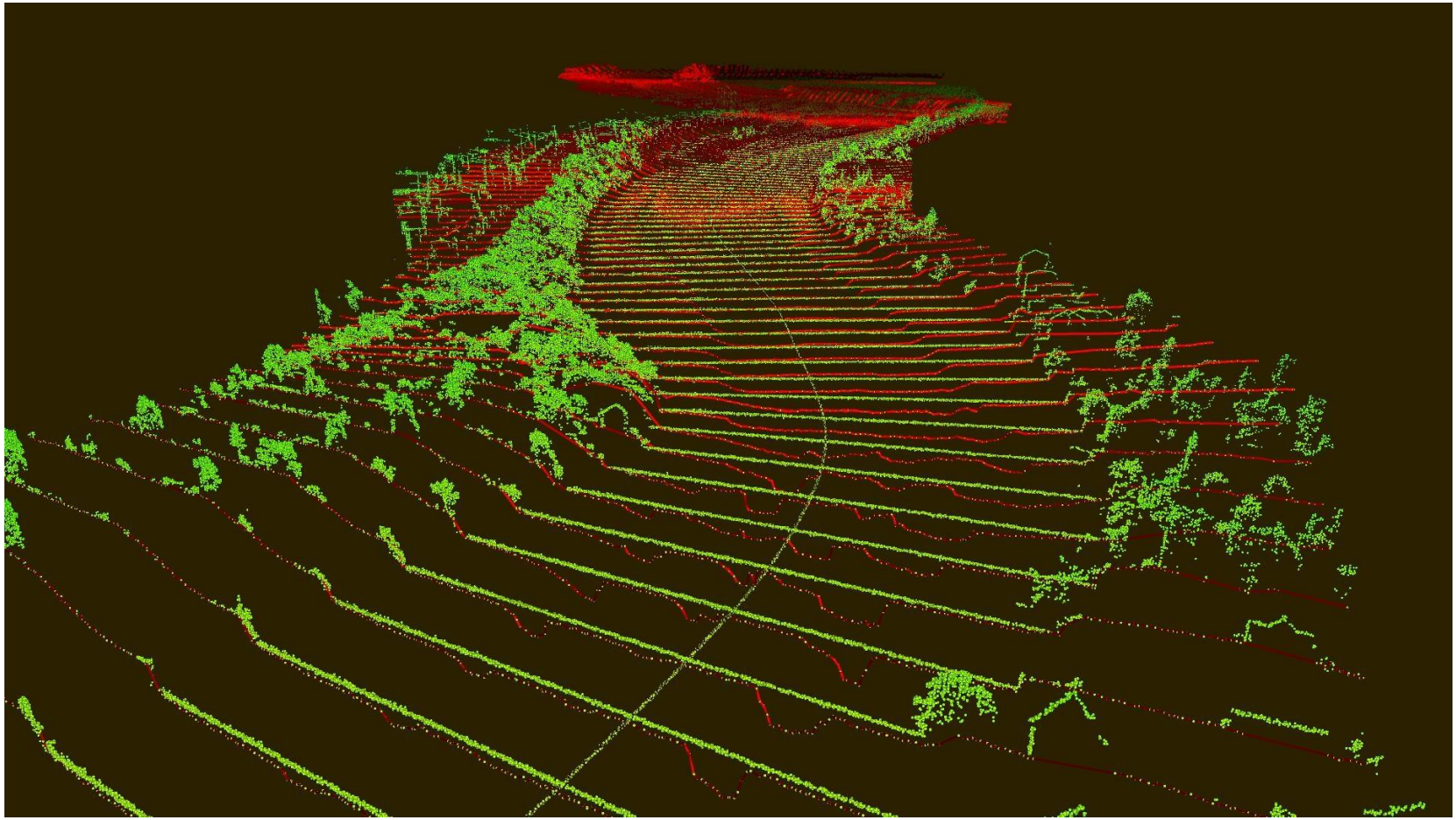
AIRBORNE ICE&SNOW MAPPING

Step 6) Cross-sections

- Defining river axis and computation of cross-sections



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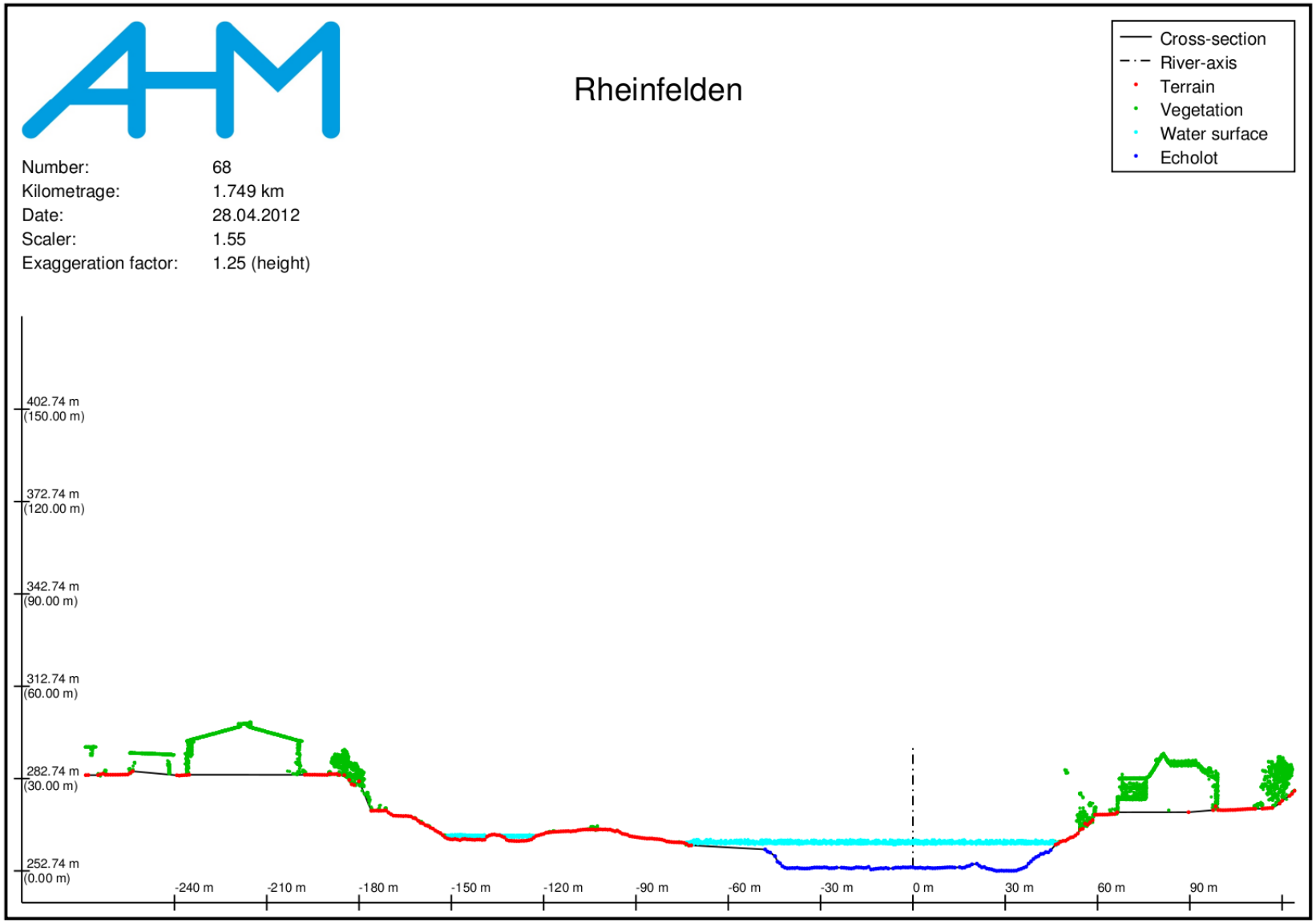
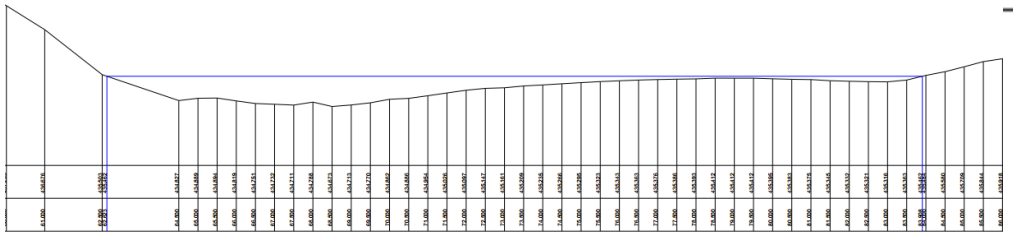
Step 6) Cross-sections

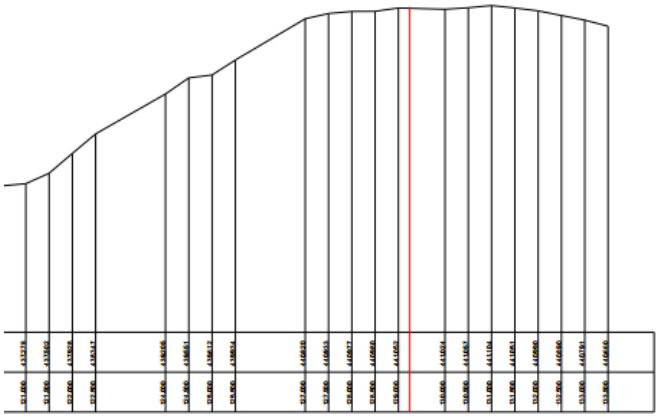
- Different types of cross-sections: points from point cloud

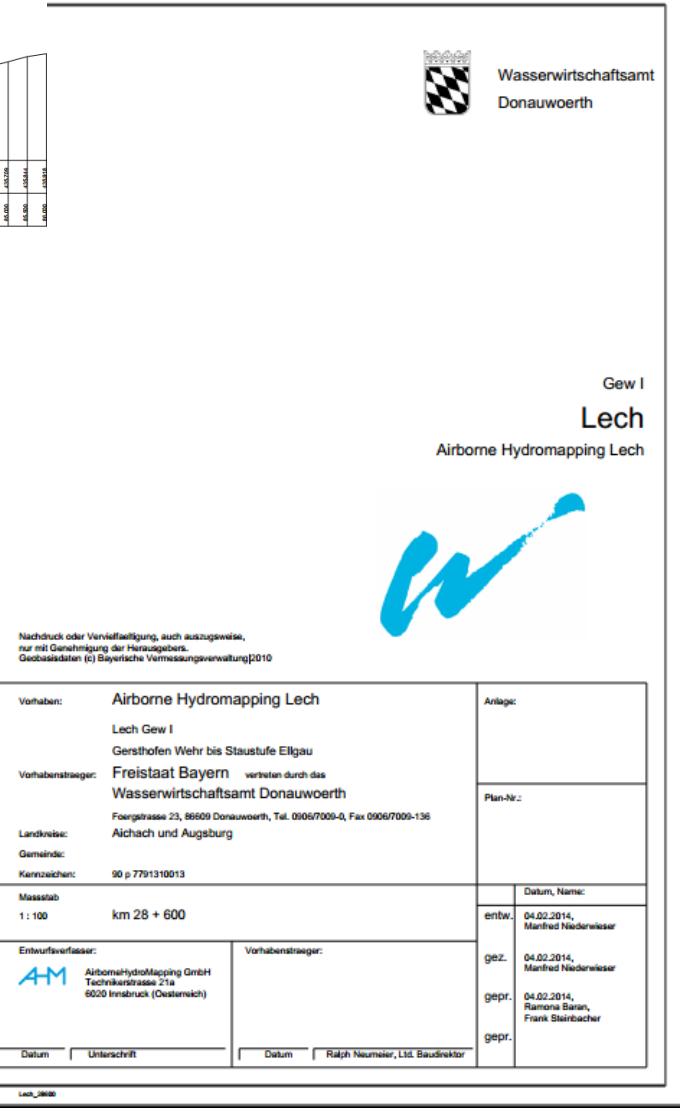


Step 6) Cross-sections

- Different types of cross-sections: vectorized profiles







Export of profile data
as ascii, pdf, dwg

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