ERDF UOMARI – New technologies for channel and mine pool mapping

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Euroopan unionin osarahoittama

Uudistuva ja osaava Suomi 2021–2027

Työ- ja elinkeinoministeriö
Arbets- och näringsministeriet

UOMARI – Uudet teknologiat uomien ja kaivosaltaiden kartoitukseen

Project time
10/2023–03/2026

Budget
666 942 €

EU-funding
553 551 €

Geological Survey of Finland (GTK)

University of Oulu - The Unit of Measurement Technology (MITY)

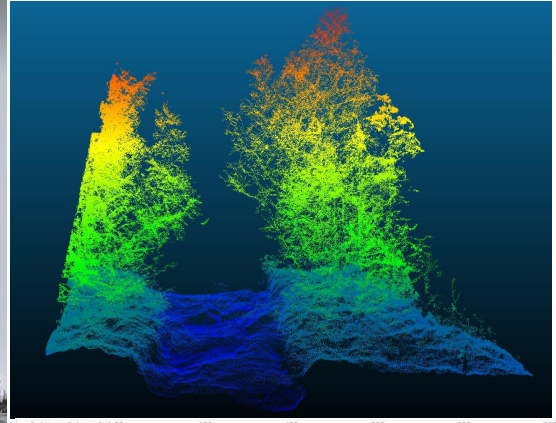
Finnish Environmental Institute (SYKE)

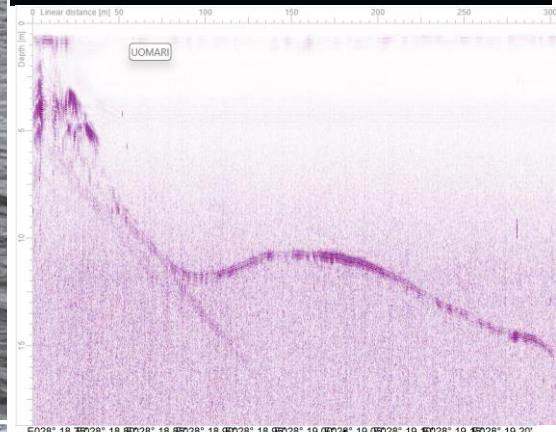
Finnish Geospatial Research Institute (MML)

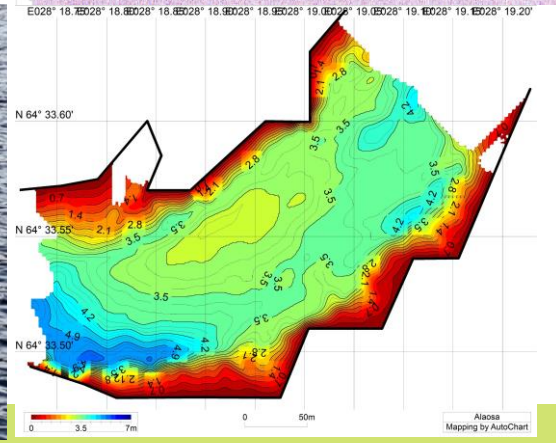
ERDF UOMARI

Project goals:

- Develop and pilot new cost-effective drone-integrated measurement- and imaging technogies for channel and mine pool mapping
  - Two wave lenght laserscanner drone-solution - MML
  - GPR-drone (GPR + drone) – OY MITY
  - Autonomous survey vessels for water - SYKE
- Develops data management for multiple imaging methods (LiDAR, GPR, FLIR, RGB)
- Compare developed imaging methods with traditional measurement methods







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UOMARI – New technologies for channel and mine pool mapping

- There are thousands of kilometers of channels in Finland that have been modified for various purposes.
  - Mapping is becoming more relevant as watercourse restoration and mire restoration increase.
  - The bottom shapes of riverbeds affect, among other things, the flow and thereby the mixing of industrial discharge waters.
- Pool structures consist of many different layers, the functionality and condition of which is challenging to determine in use.
  - The causes of recent environmental accidents have often been problems related to the bottom membrane and bottom structures.
  - In old mining areas there is often no information about thicknesses, materials, properties, etc.
- Mapping underwater bottom data is very labor-intensive and slow, and sometimes also risky.

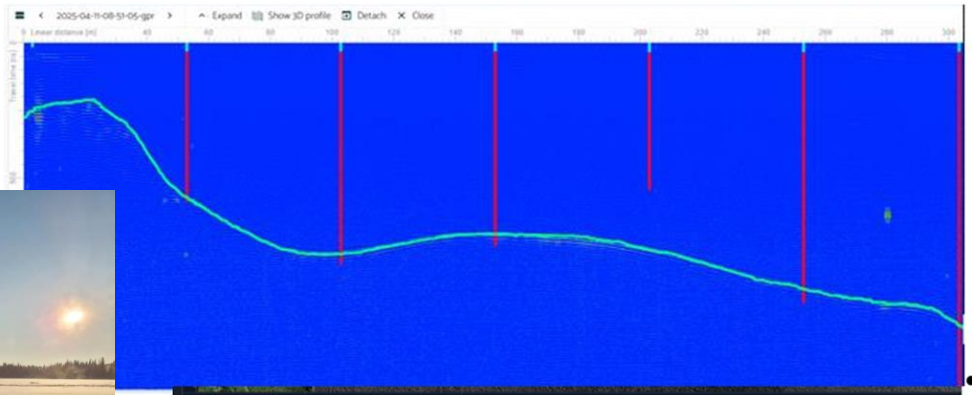
→ ***The need for new cost-effective measurement and imaging methods***

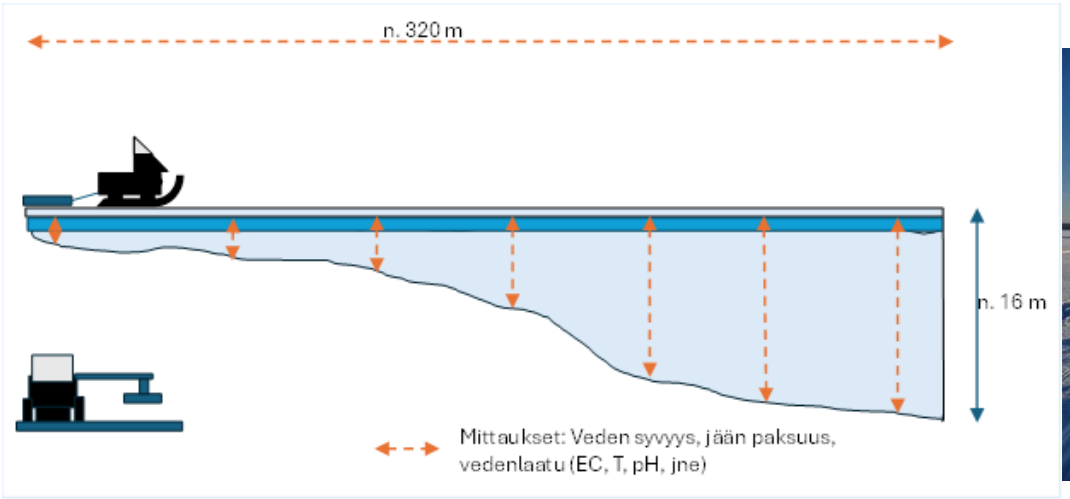
UOMARI – New technologies for channel and mine pool mapping

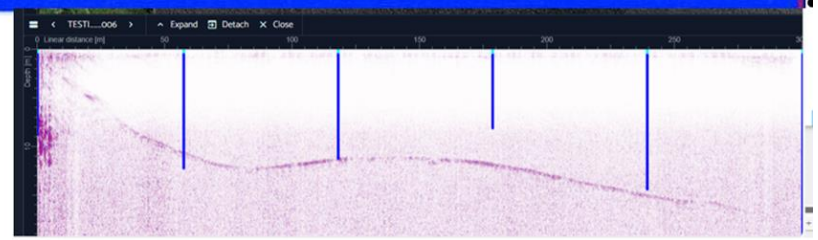
- Ease the planning of riverbed restoration projects and monitoring of impacts
- Ease the assessment of environmental impacts, e.g. in the planning of mine water discharge routes
- Reducing environmental harm and risks from business activities
- Increasing occupational safety and cost-efficiency
- Creating operating conditions and business opportunities for companies that rehabilitate and map the environment

Bottom shape with a GPR-drone and a sonar raft

- Comparing test data obtained with drone measurement systems and traditional measurement methods
  - ADCP-rafts, flow tracker, traditional GPR (on foot, snow mobile), GEM-2
- The usability of the developed methods for various types of applications, such as mixing models, ecological impact assessment, habitat models, etc., is being investigated.

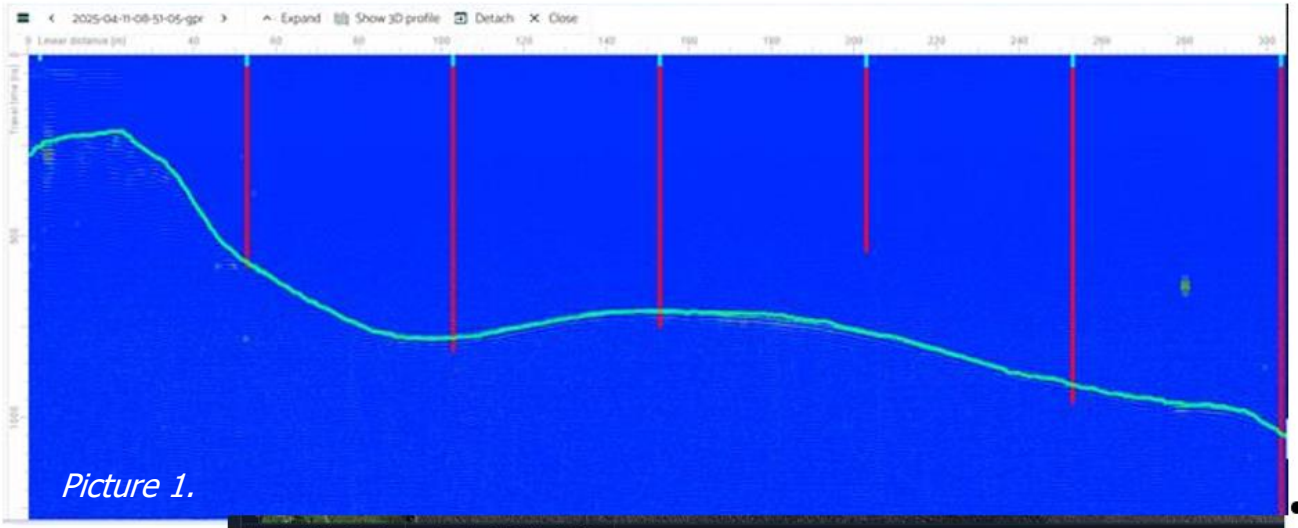




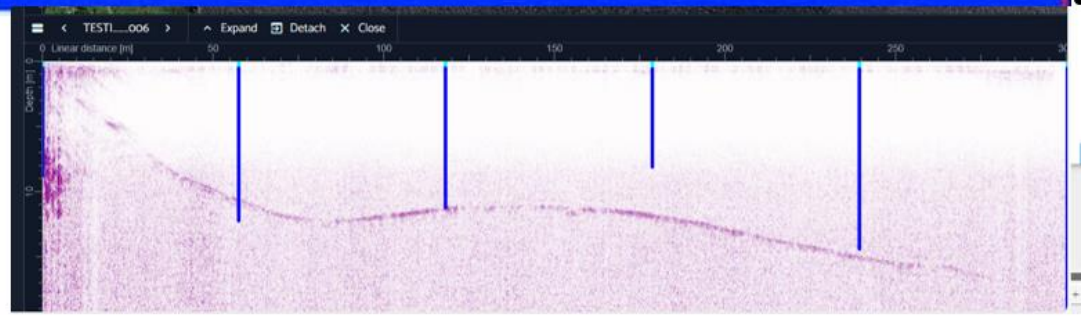


Testing and comparison measurements of GPR ground penetrating radars in Karankalahti (results)

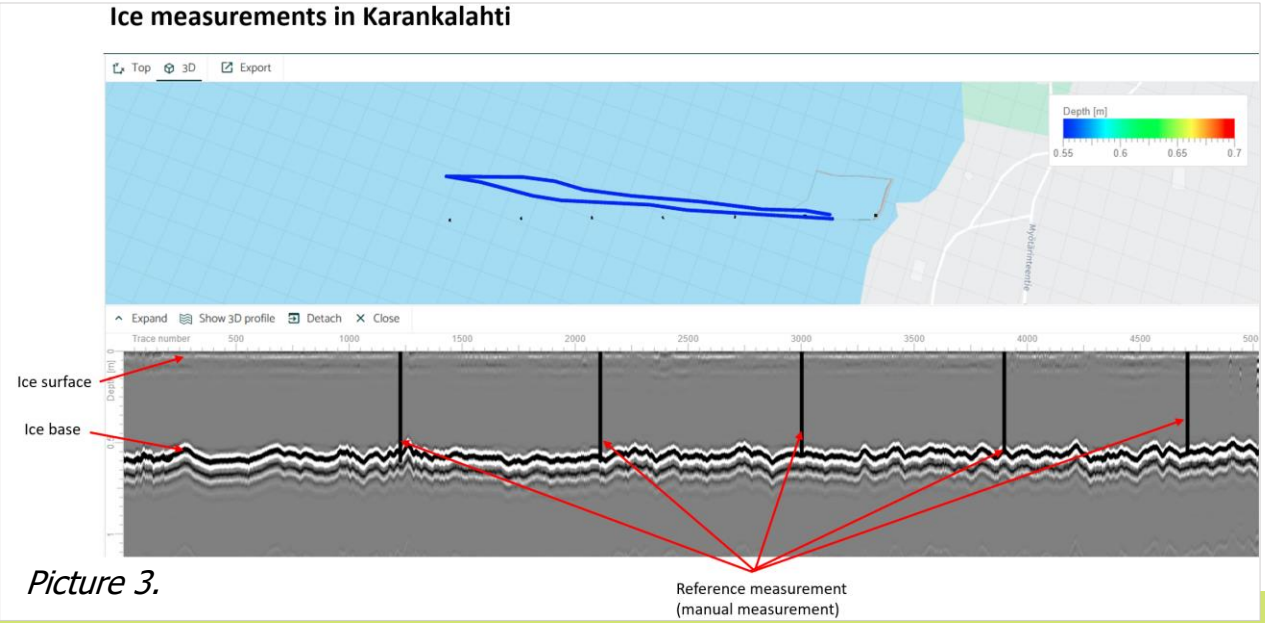
- Bottom shape with drone + GPR 100 MHz (Picture 1)
- Bottom shape with traditional 100 MHz GPR (Picture 2)
- Ice thickness with drone + GPR 1000 MHz (Picture 3)
- Results:
  - The acquired low-frequency radar shows the bottom shape well, although it differs at a few comparison points.
  - The acquired high-frequency radar clearly shows the ice thickness



Picture 1.



Picture 2.

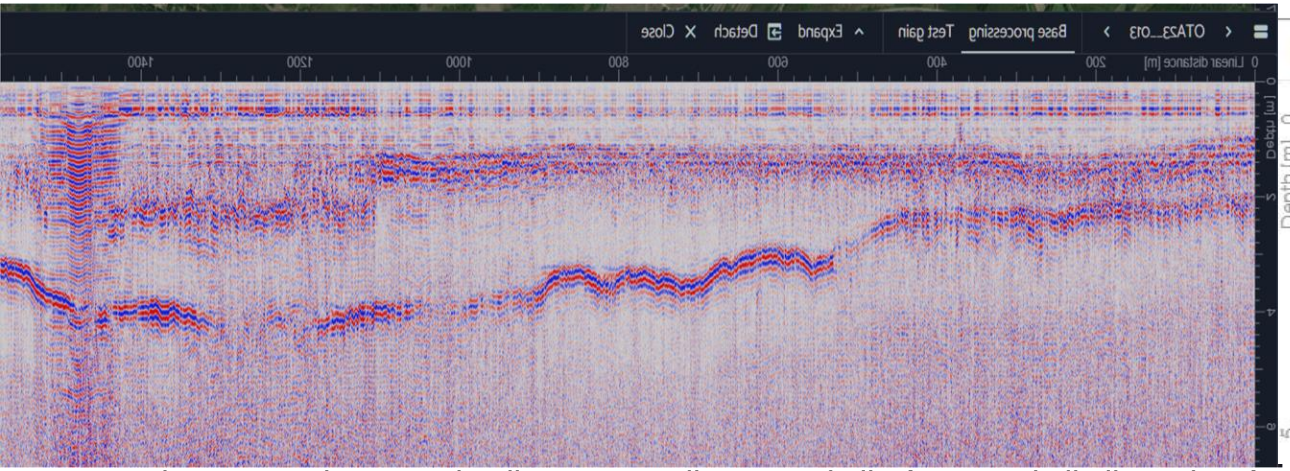


Picture 3.

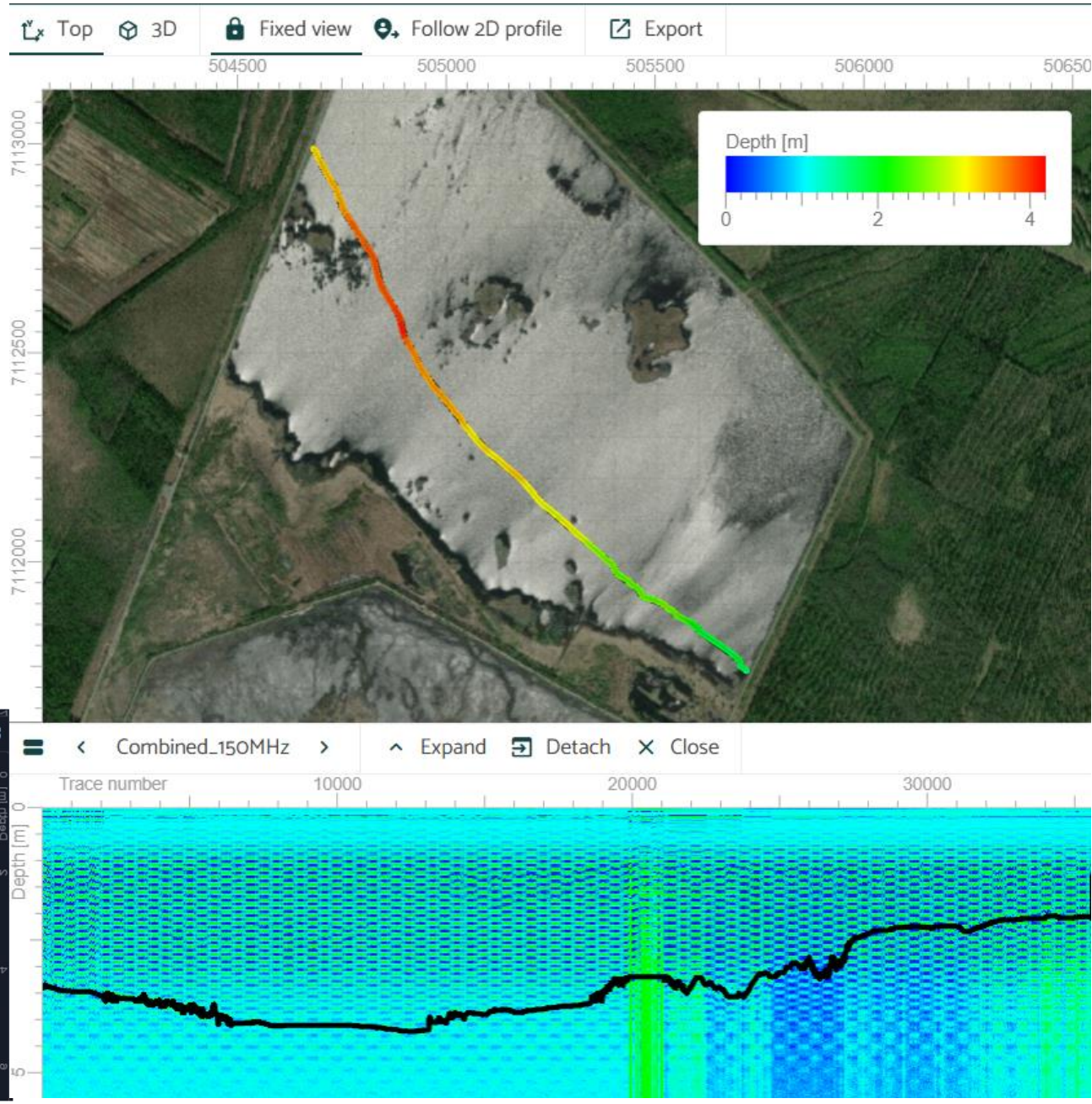
Piloting new technologies for mapping mine pools

Otanmäki mine drone measurements vs traditional GPR

- For comparison, the 2023 traditional ground-based radar measurement (100MHz, image flipped into a mirror image) matches each other very well



Kuva 1. Pohjanmuoto lintuvesialtaalla perinteisellä maatutkalla (moottorikelkalla vedetty)

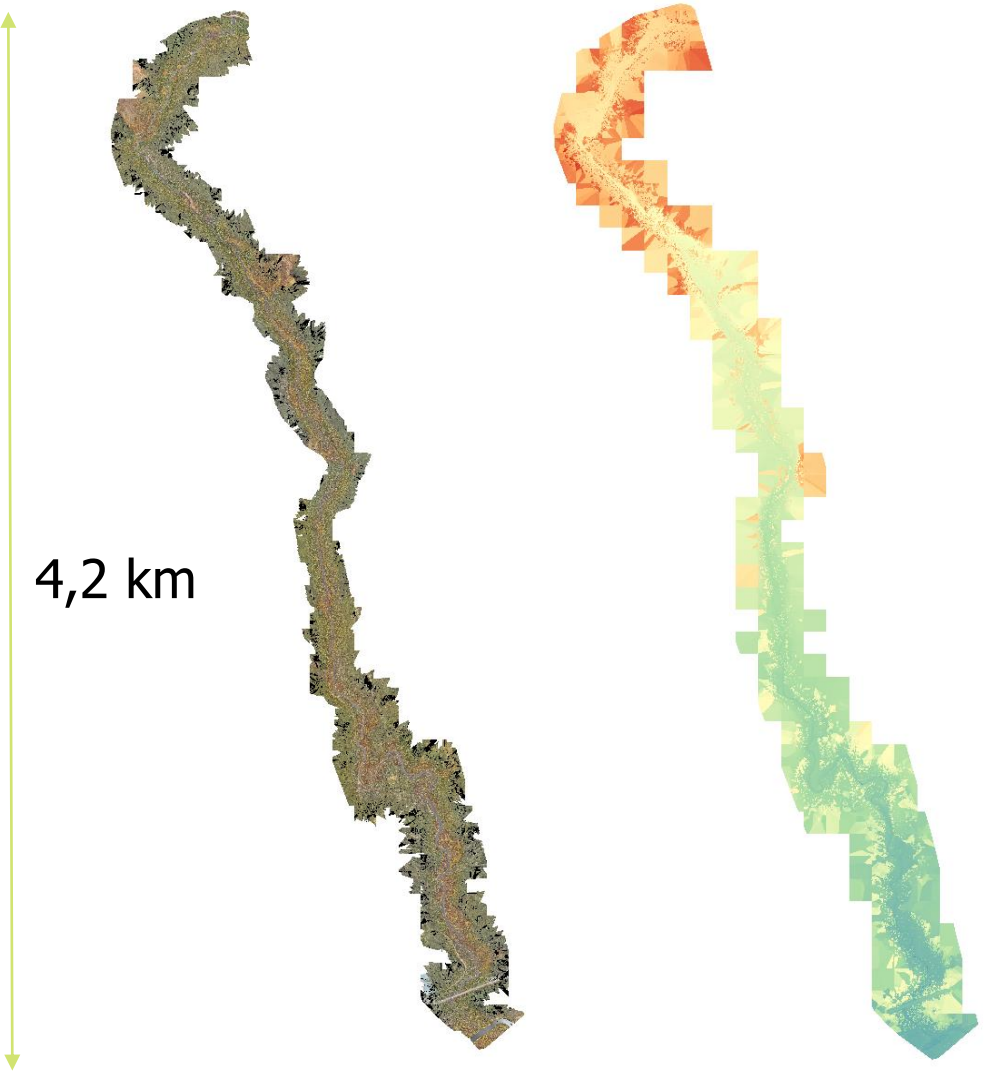


Kuva 2. Pohjanmuoto lintuvesialtaalla dronemittauslinjalta

Piloting new technologies for riverbed mapping

Hannukainen, Kolari

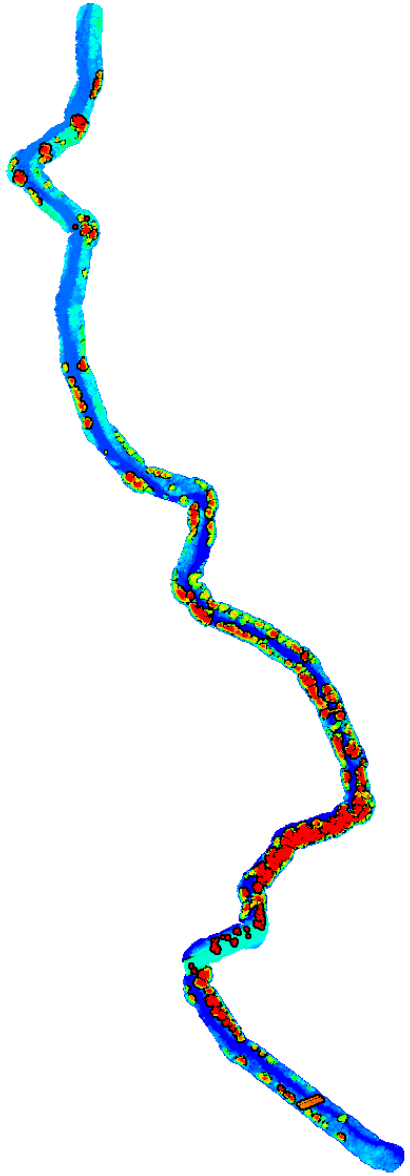
- Fieldwork during may and september 2024
  - RGB+IR imaging
  - 2 wavelenght laser scanning
  - Traditional measurements

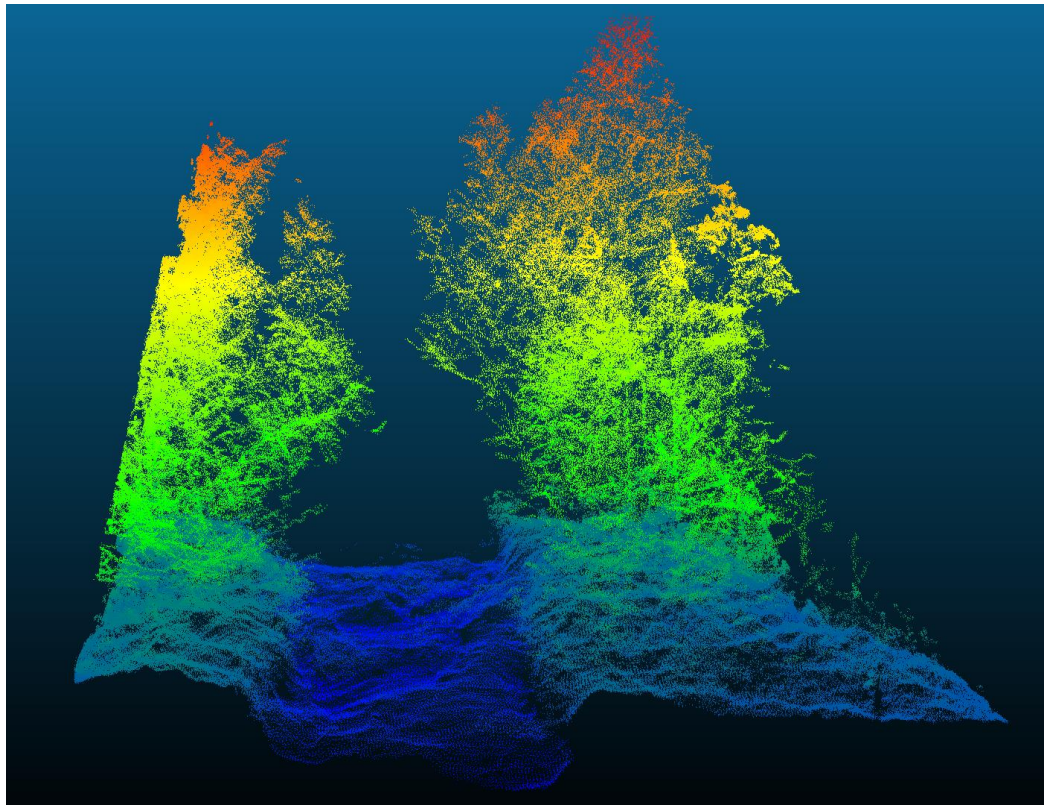


Two wavelenght laser scanning

Hannukainen, Kolari

- Two wavelength laser data from river Valkeajoki

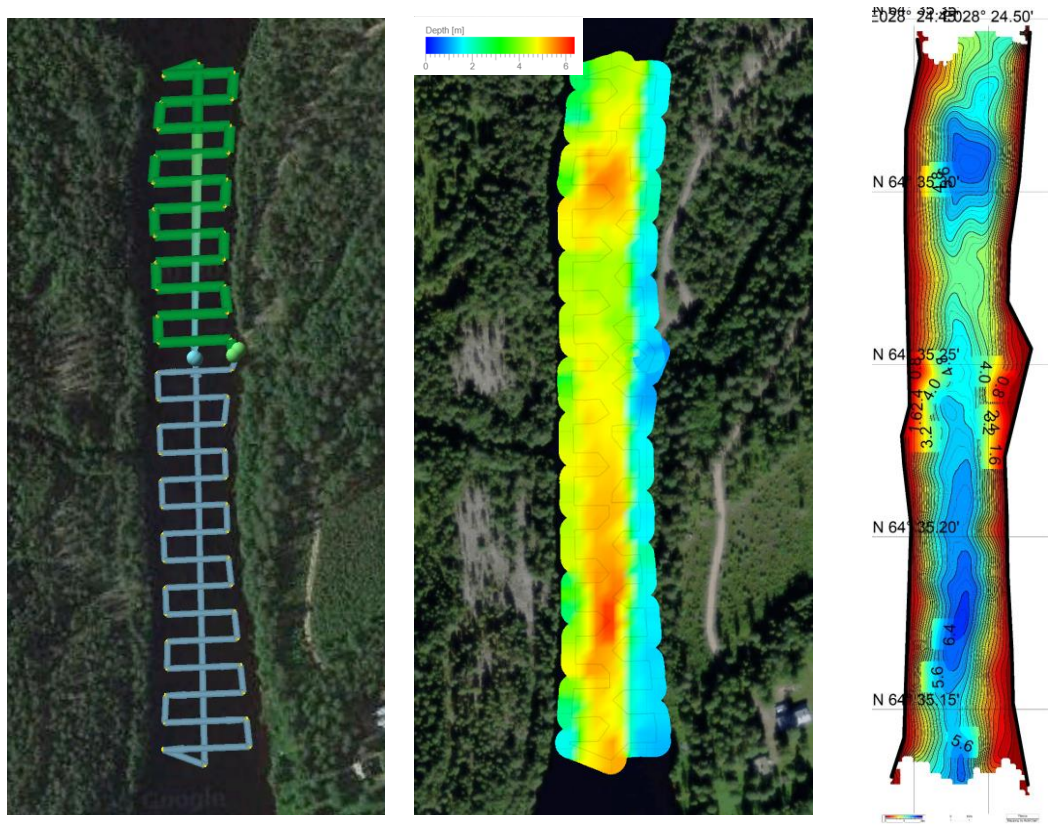




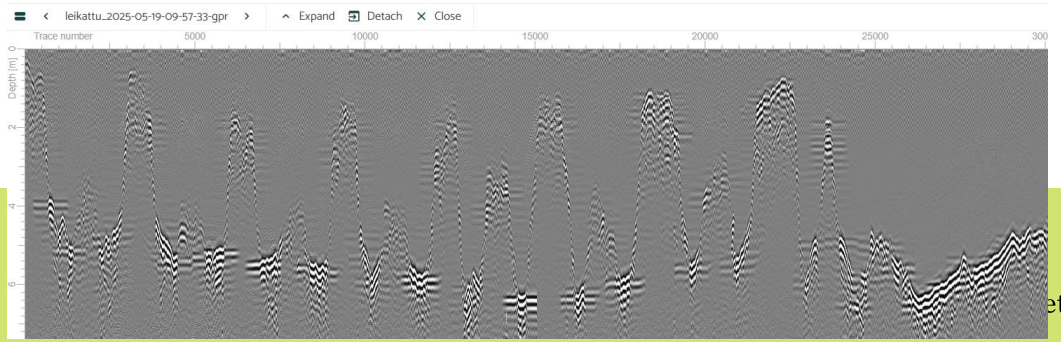
Channel and mine pool mapping - UOMARI

Emäjoki, Ristijärvi

- Drone 350 RTK + GPR LF flights 19.5.2025
- Flight route (Picture 1, left)
- Depth map from GPR-data (Picture 1, middle)
- Depth map by Finnish Environment Institute with an autonomous raft's sonar (Picture 1, right)
- Picture 2: example of GPR signal



Picture 1



Picture 2.

Kiitos!

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