

HyDroneS - Hydrosystem Drone Surveying

Tales from the field, state of the art and
future development

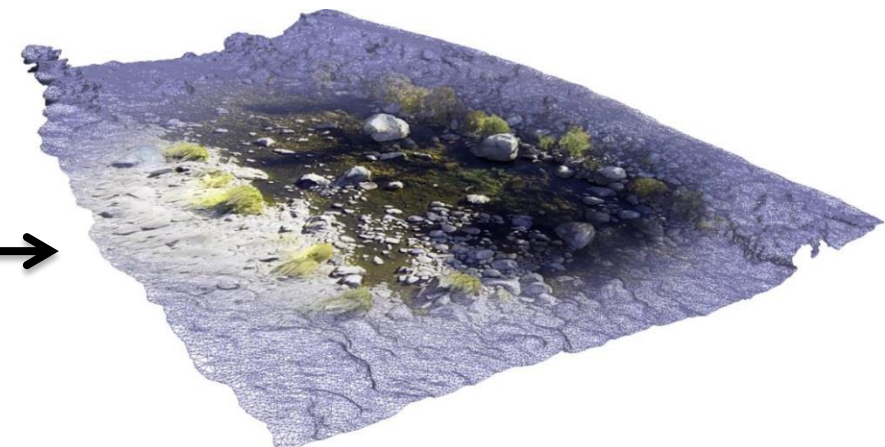
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1. The HyDroneS Project
 2. Technical aspects
 3. Applications
 4. Future

Aim: Application of UAV technology in the fields of:

- **Hydraulics**
- **River morphology**
- **Mapping** of rivers and surrounding
- **Holistic data collection** of hydrosystems (→ vegetation, land use, forestry)

→ **efficient for small and middle scale reaches**

HyDroneS combines different **optical sensors** (camera, 3D camera, multispectral camera, NIR camera etc.), position of photo shooting (**UAV**) and **post-processing methods**



Picture: Aibotix

2. Technical Aspects

Which information is needed?

- SfM model (accuracy?)
- aerial pictures (resolution?)
- orthophoto
- Substrate (grainsizes?)
- reach dimensions
- access?



2. Technical Aspects

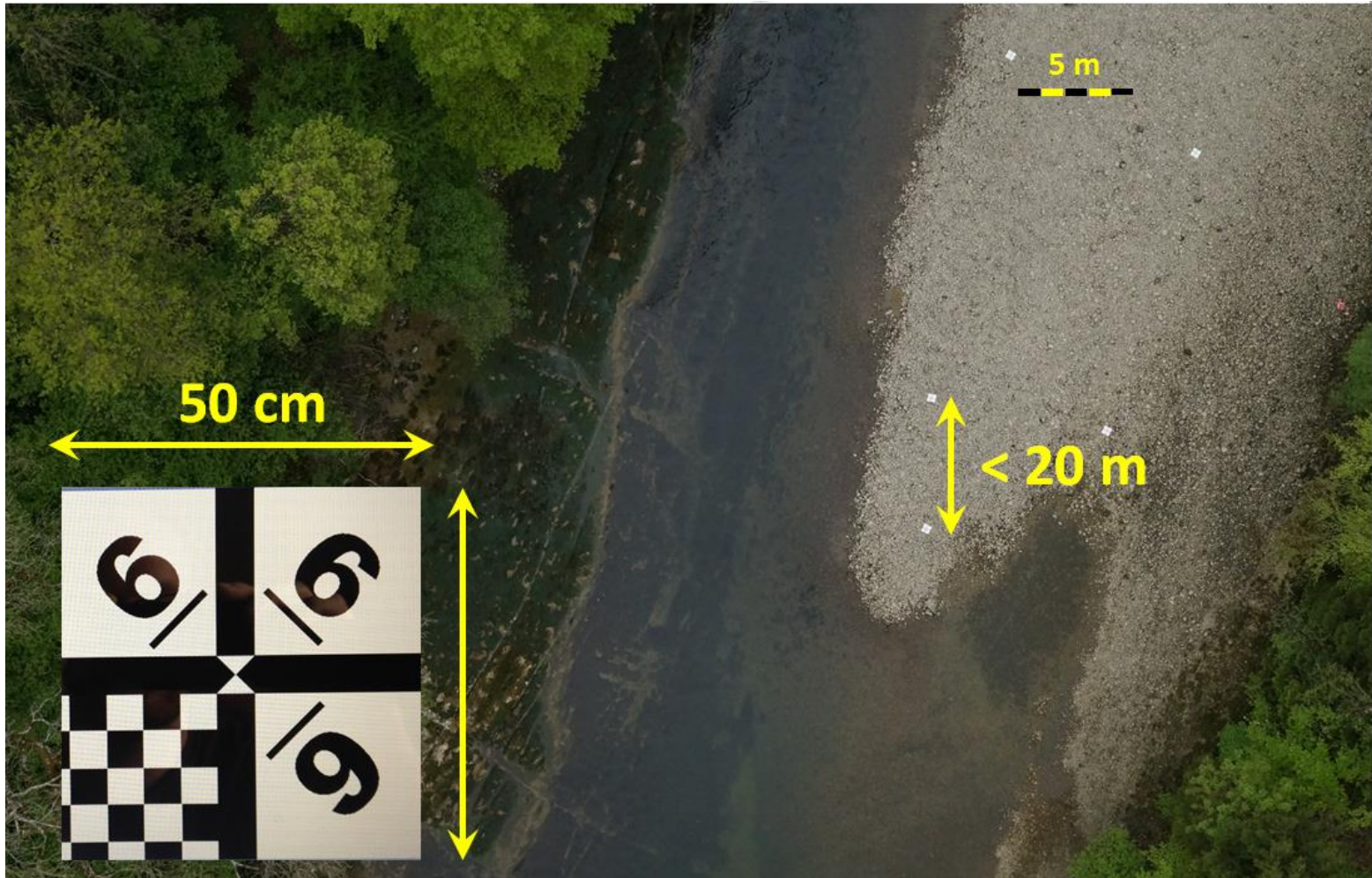
Field work



- **camera lens** 19mm, 30mm or 60mm
- **altitude** 40m, 80m, 100m, >100m
- **automated flight** for fast and precise data acquisition
- **data check** in field
- *technically possible*
≠ allowed!

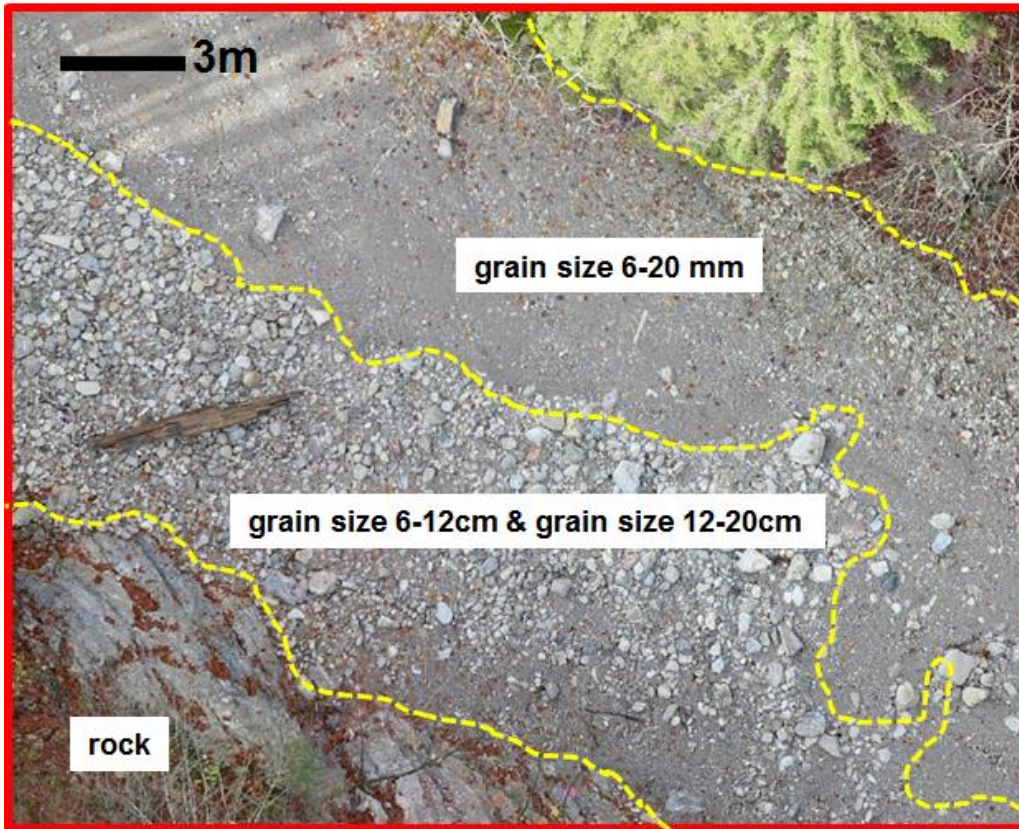


2. Technical Aspects
Surveying data



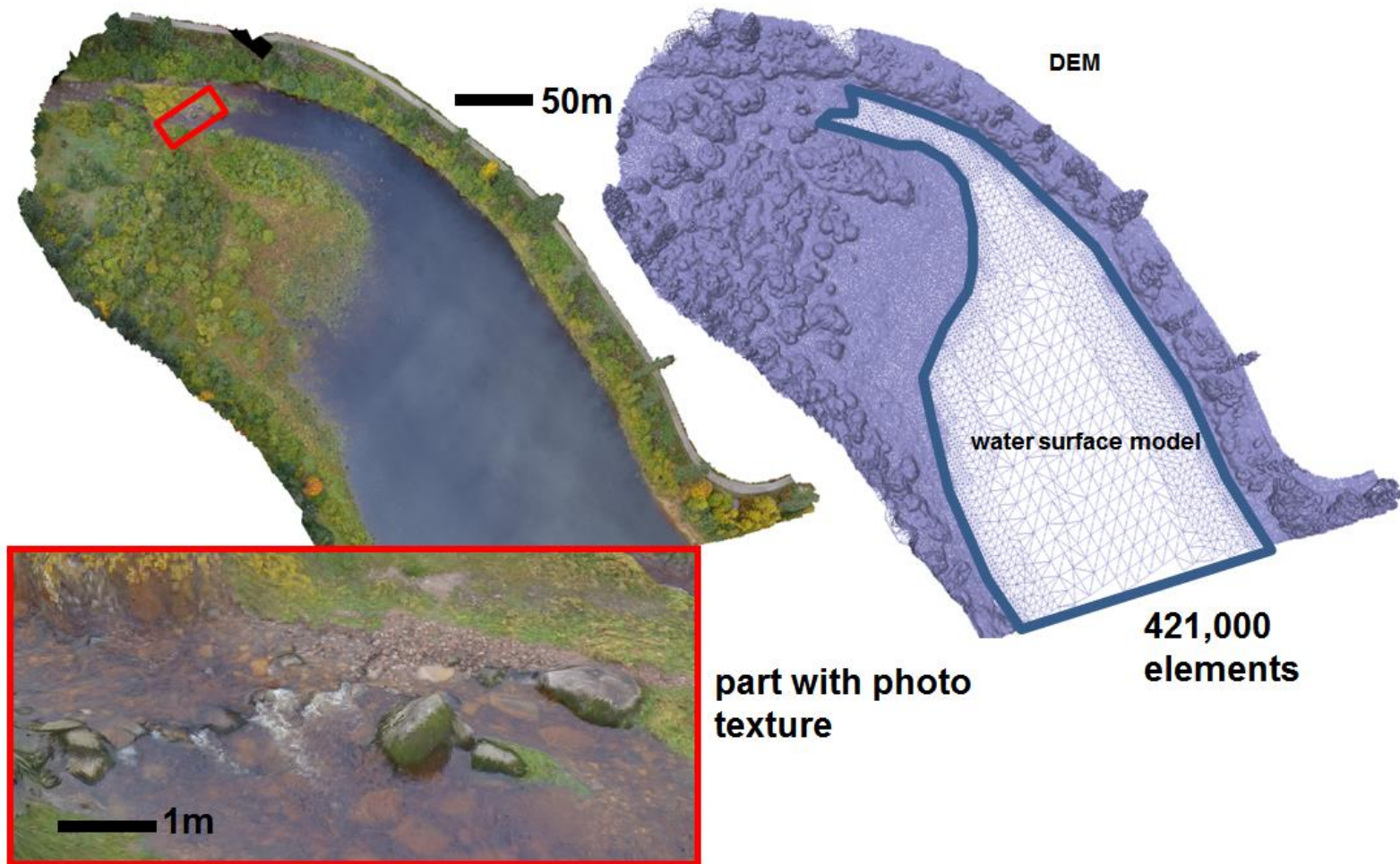
4. Applications Substrate Mapping

→ habitat modeling
→ changes in river morphology



4. Applications

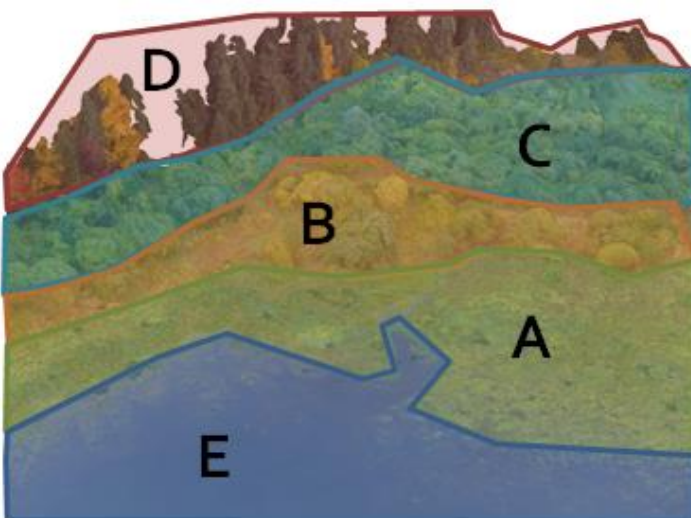
SfM model of beginning of backwater (250m x 420m) with 202 UAV photos. Model generation of topography (DEM) and water surface



2. Technical aspects
Accuracy

z accuracy of a DEM (max difference between DEM and terrestrial surveying)

DEM accuracy \leftrightarrow point accuracy (3 cm)



Ground	Max error*	Region
sand, gravel, Blocks	10 cm	A
patchy vegetation	20 cm	B
dense vegetation	1 m	C
Forest	2 m +	D
underwater	<i>not possible**</i>	E

*altitude 100 m
** currently...

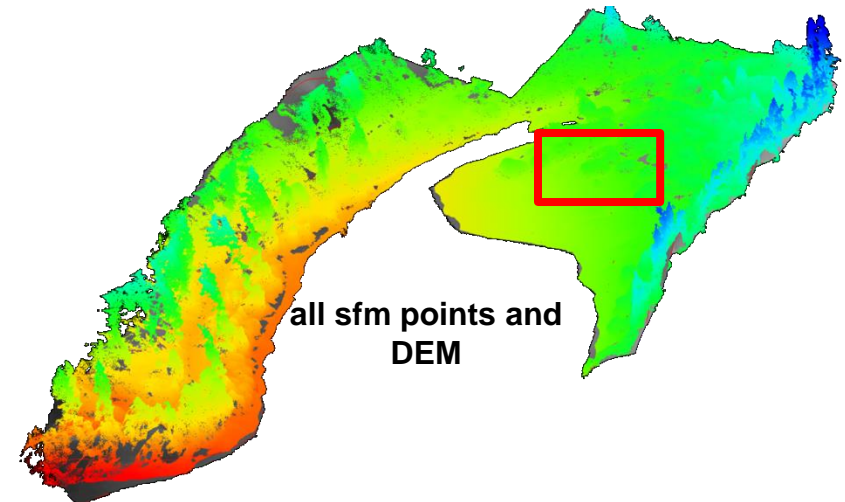
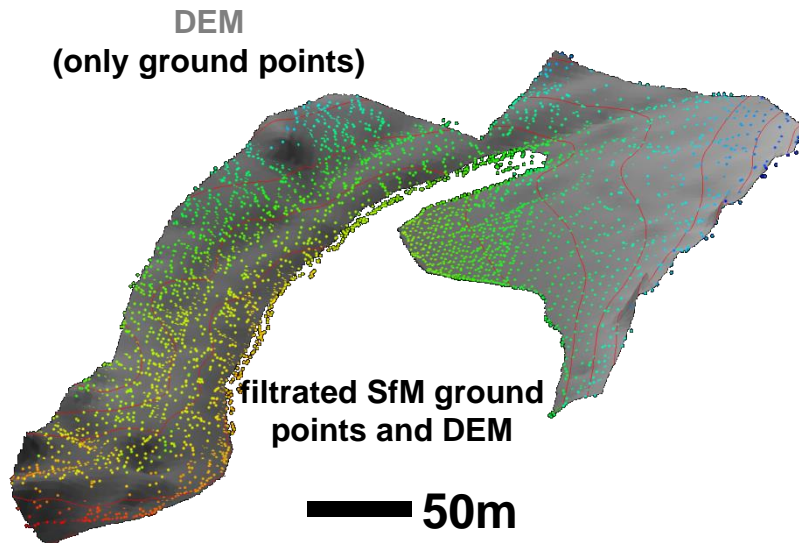
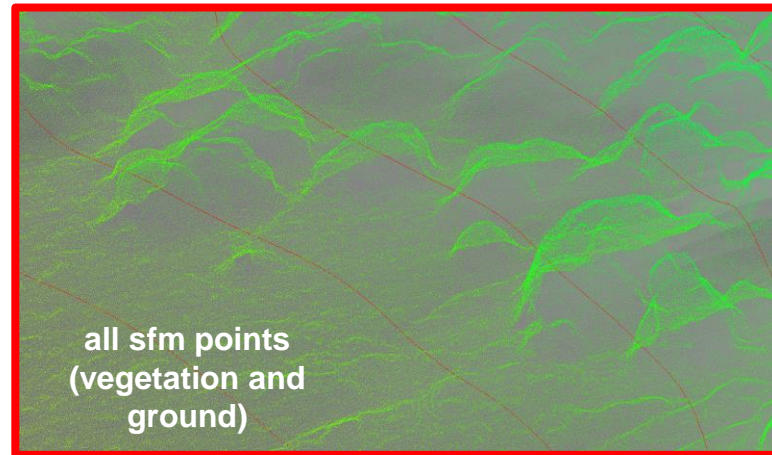
4. Applications

point cloud filtration on different levels → with and without vegetation

z accuracy is direct correlated
with cloud density

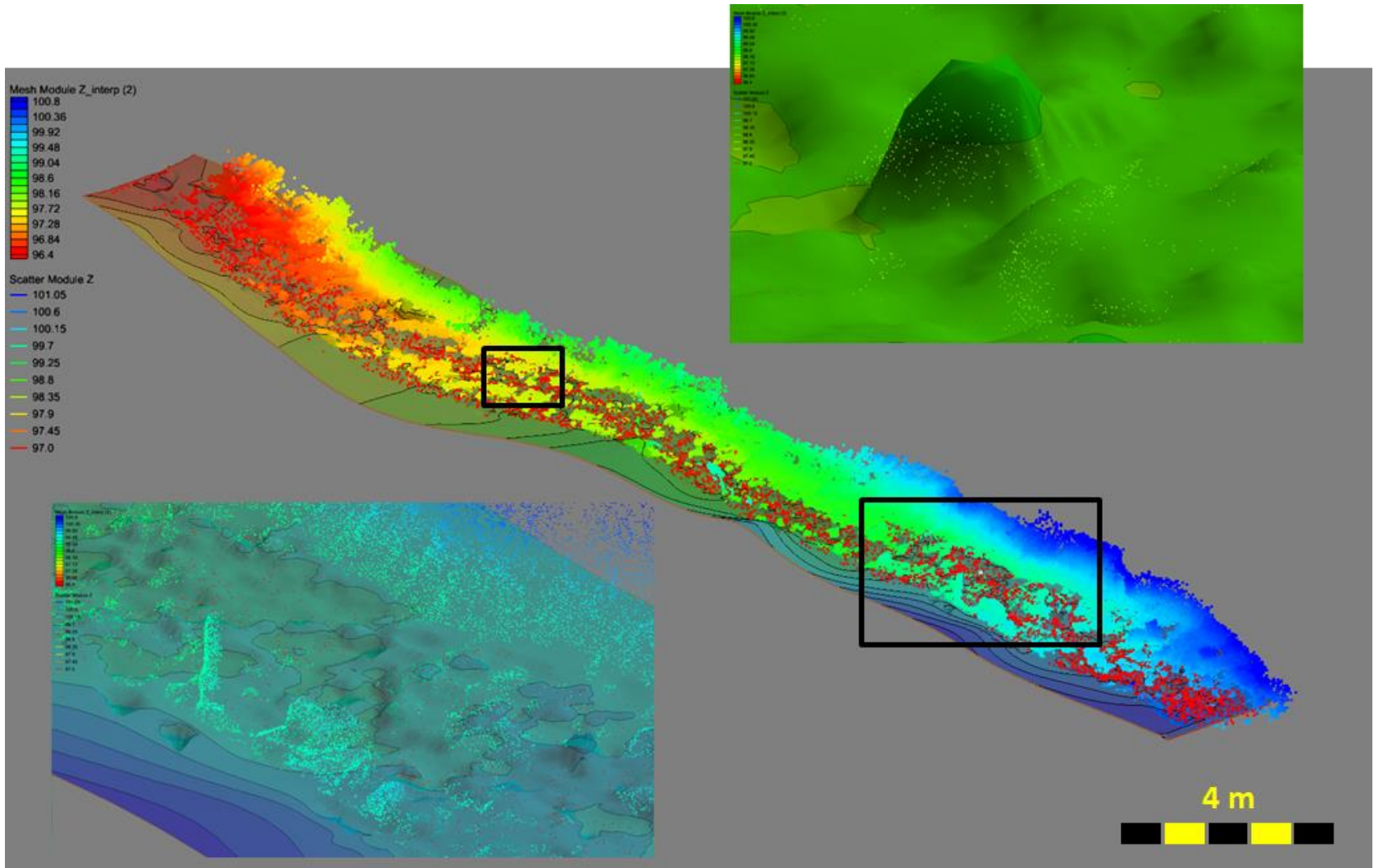
patchy vegetation → small
error

dense vegetation → large error

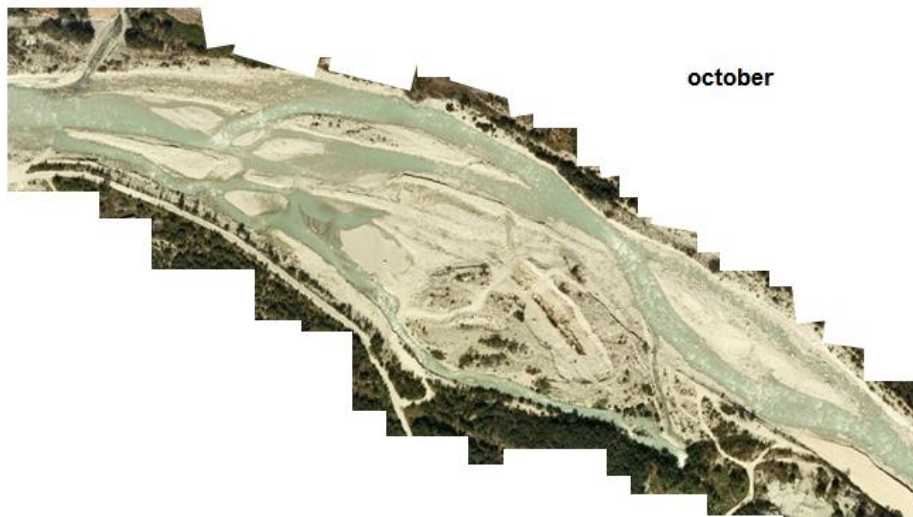


4. Applications

Additional information for mesh generation



4. Applications „Orthomotion“



„Orthomotion“

- morphologic changes and changes of water surface at different discharges
 - connection of side channels
 - conditions at dry periods and different water levels
- hydropeaking!

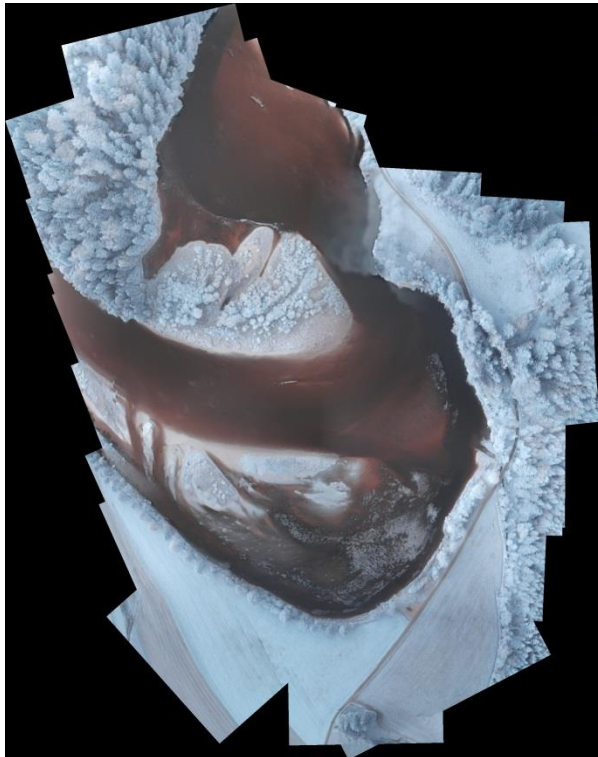
4. Applications „Orthomotion“



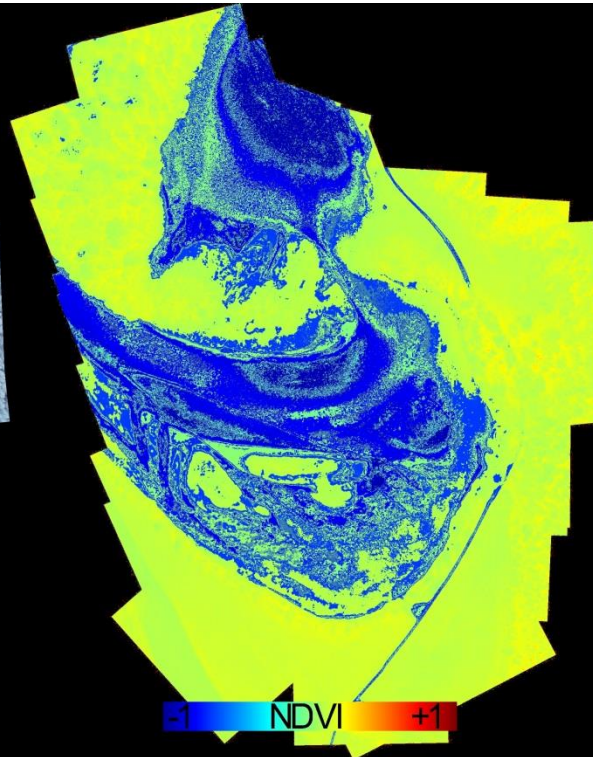
4. Applications

NDVI mapping, automated vegetation mapping

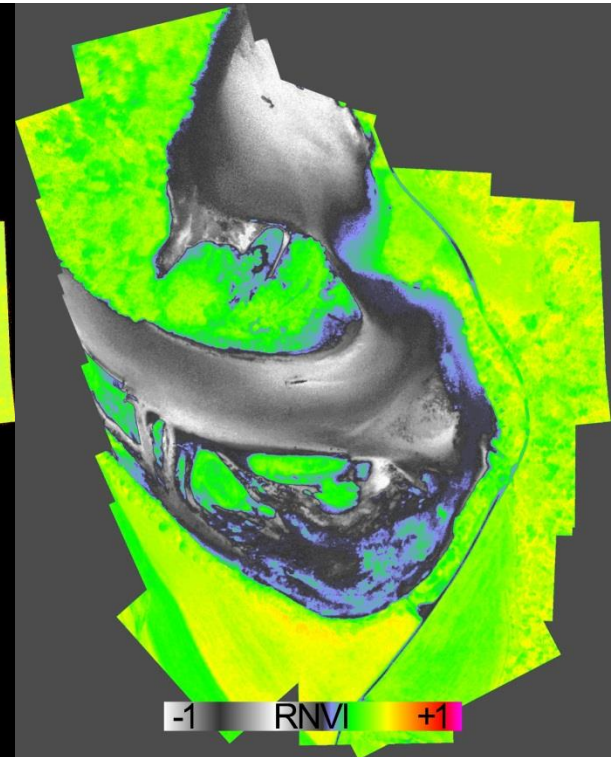
Near Infrared



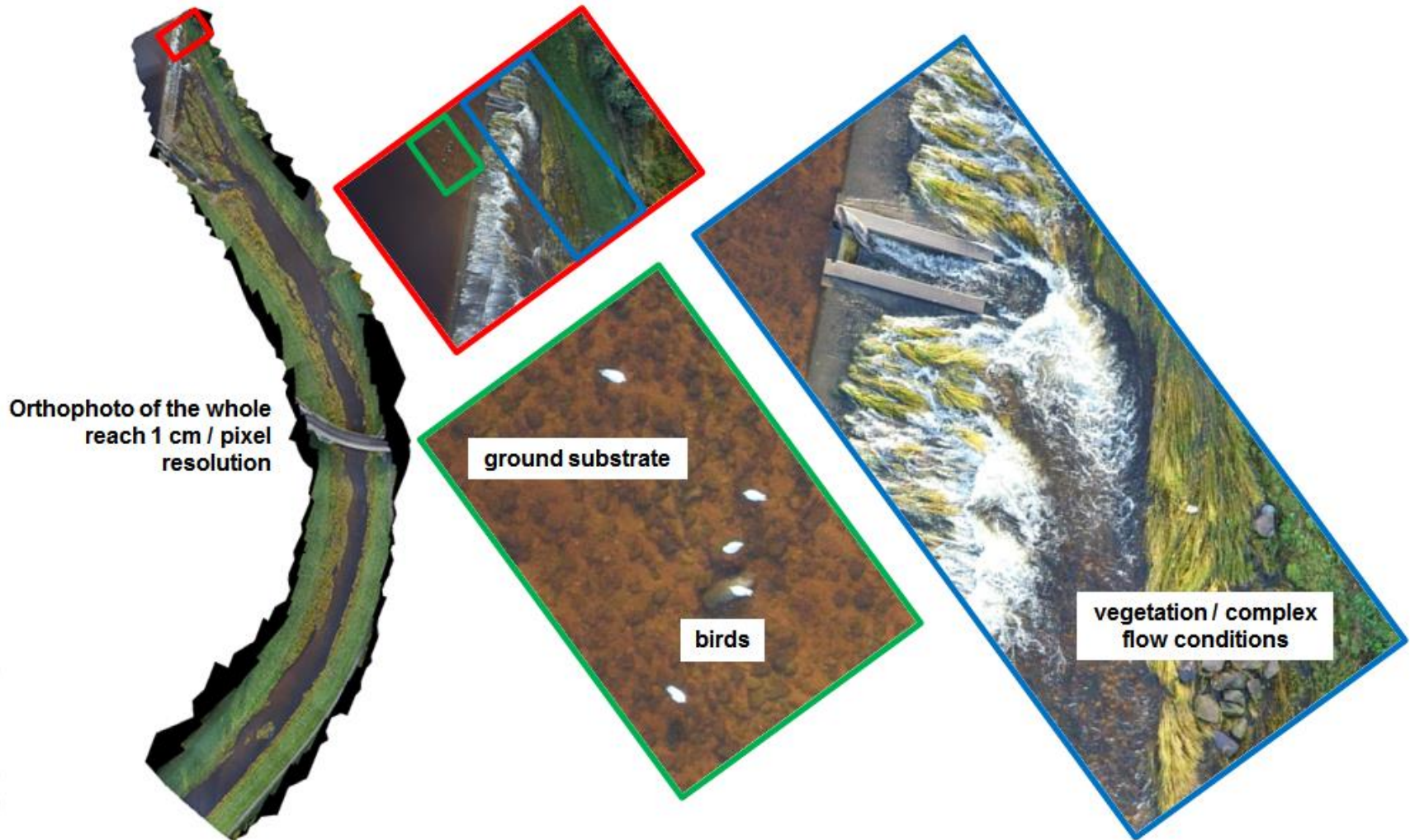
NDVI



RNVI (River Normalized)



4. Applications
advantage: 1 flight → various information!
example: 700m x 90m reach in Black Forest



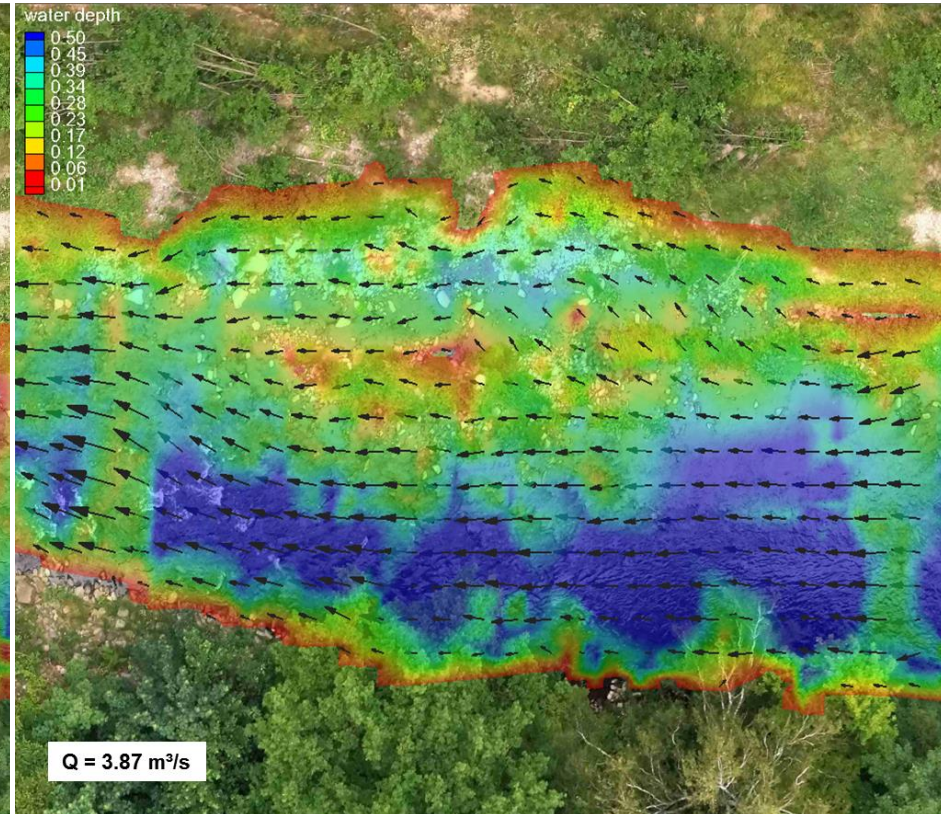
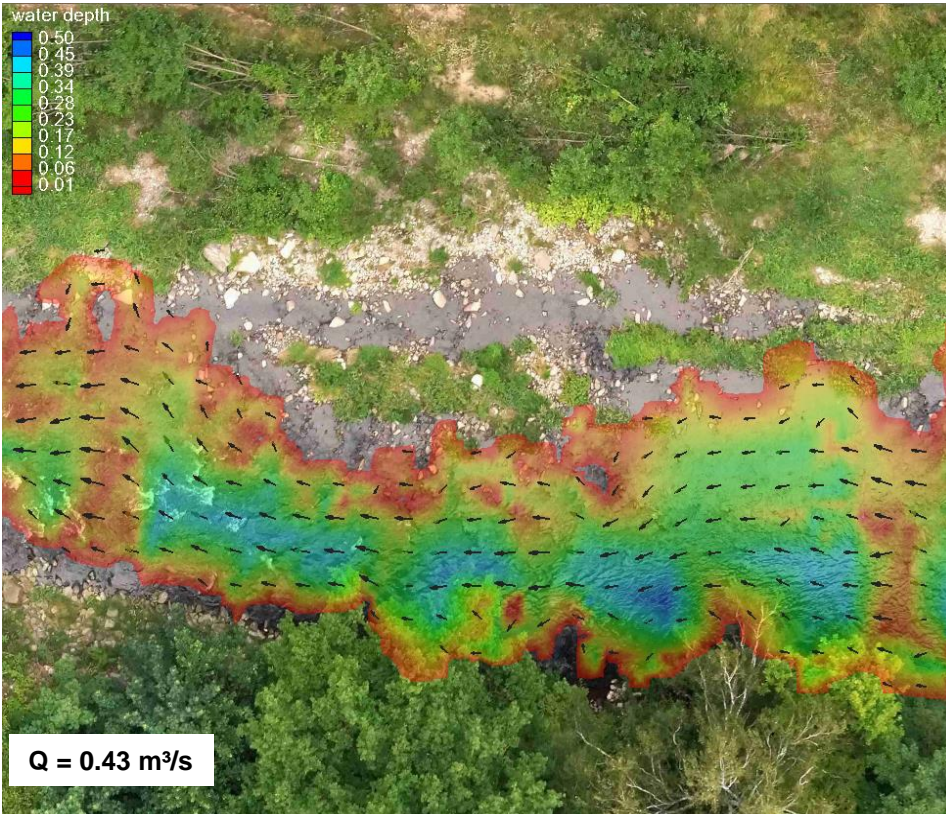
4. Applications

Technologies HyDroneS has developed

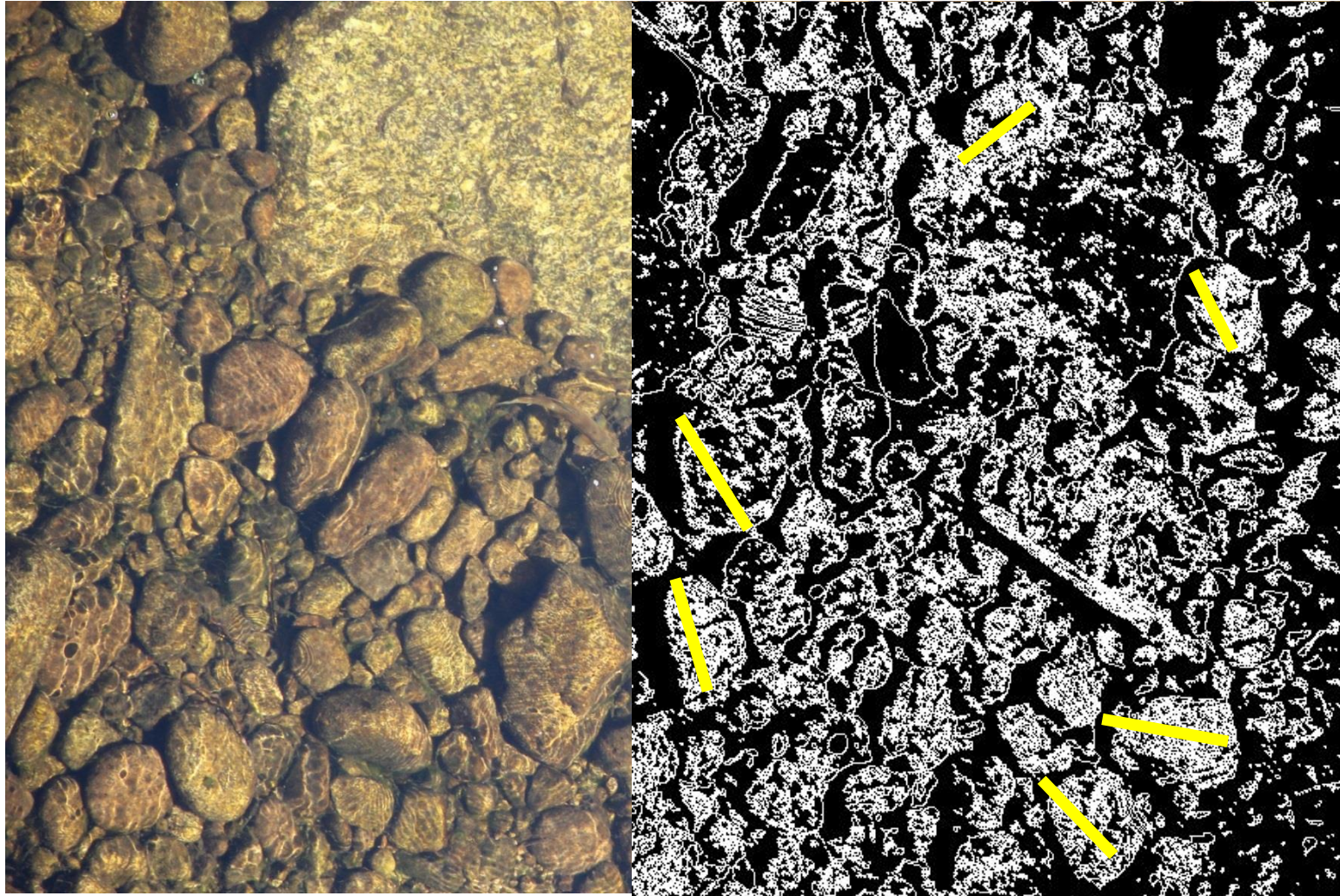


- **NDVI and RNVI calculator** for individual images or orthomosaics
- **Multi-band image calculator** for analysis of R,G,B,NIR data sets
- **Rapid assessment of local morphological changes** using difference of DEM
- **4D structure-from-motion (SfM)** showing changes in the surface model in both space and in time
- **Separate water surface and elevation models (WEM and DEM)**

5. Future 2D surface velocity



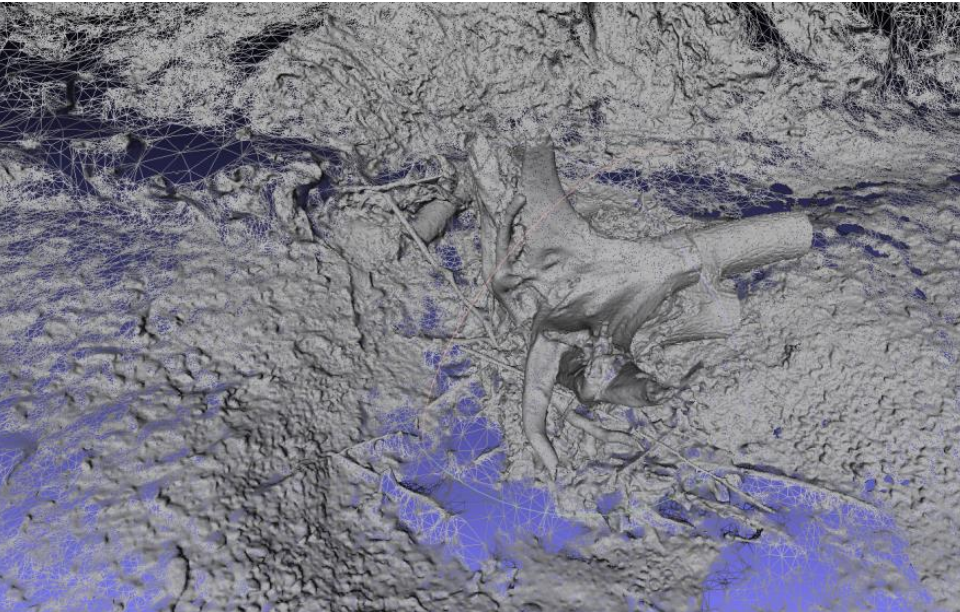
5. Future
automated grain size determination



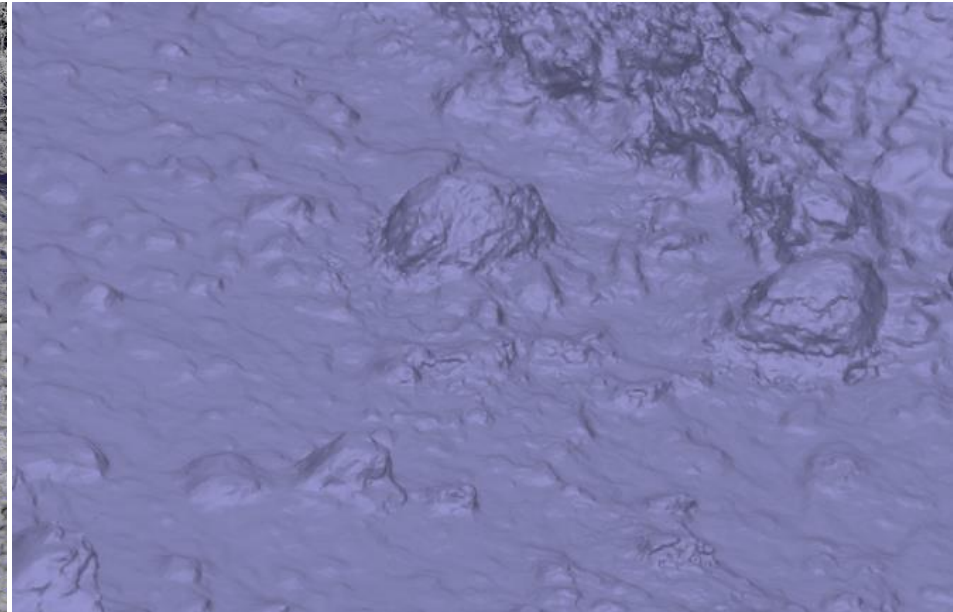
5. Future

Determination of roughness and resistance

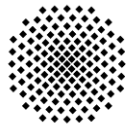
... of vegetation and disturbing
objects for hydraulic models



... of plant population (e.g.
forest) for wind models



... of arbitrary objects (e.g. train tunnel for optimization of
aerodynamic resistance)



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sje

HyDrone
HYDROSYSTEM DRONE SURVEYING



we want you
**...to become a member of HyDroneS international
research group**

A black quadcopter drone with a white sensor pod is flying in the air. Below it, a person wearing a white helmet and dark clothing is wading in a river, holding a long pole. The background consists of a rocky cliff face and green vegetation.

Takk for at du lyttet!

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