iWaGSS
INTEGRATED | WATER | GOVERNANCE

Use of Drones for River Monitoring

iWaGSS – Status Workshop 2019
05.11.-06.11.2019
Sefapane Lodge, Phalaborwa

Dipl.-Geogr. Ingo Nienhaus

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Agenda

1 Introduction

2 Digital Surface Model

3 River Cross Sections by ADCP / DSM

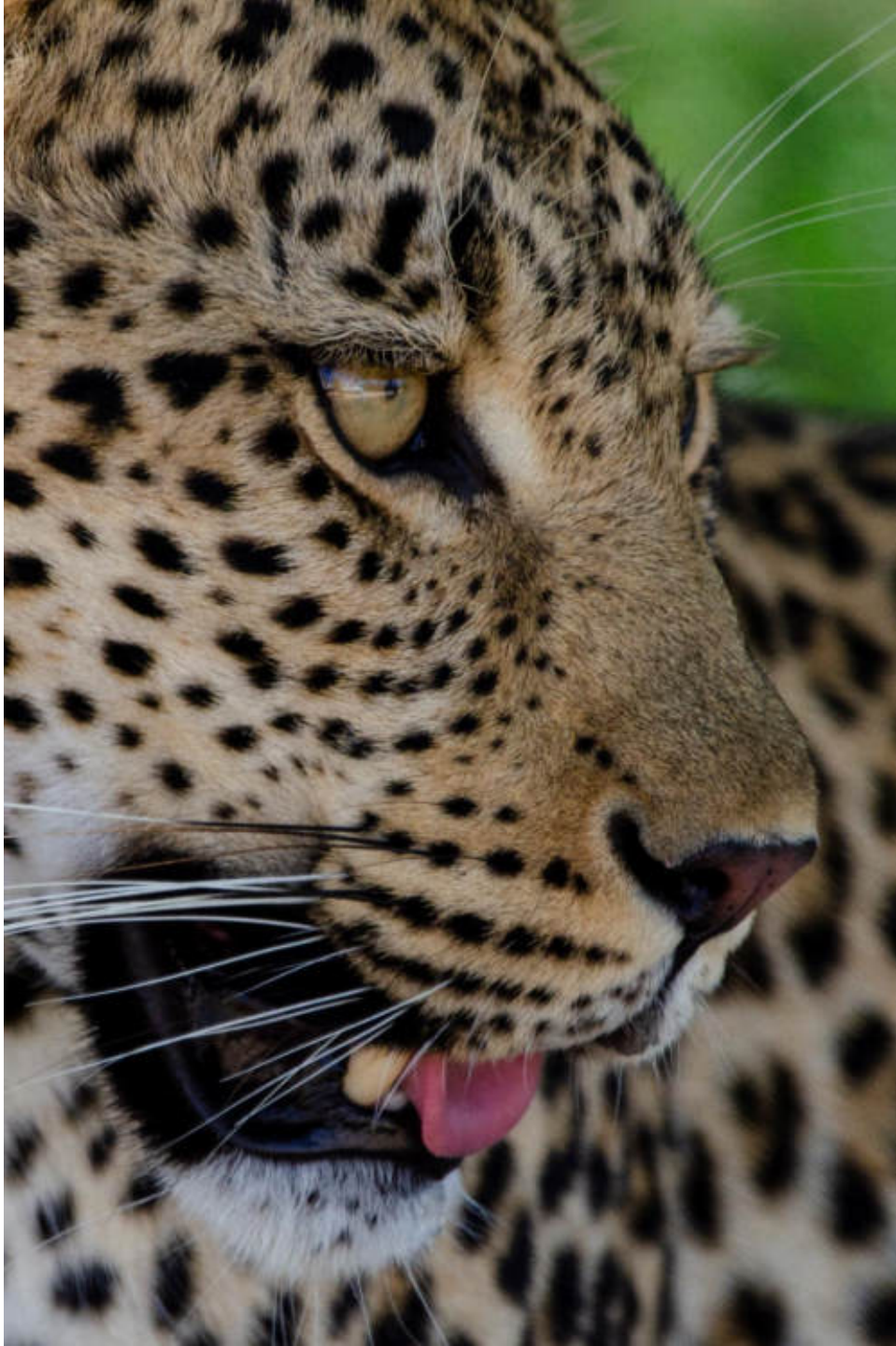
4 Vegetation Indices und Algae Monitoring with a Multispectral 5-channel Sensor

5 Experimental Fieldwork: Water Sampling by Drone

6 Experimental Fieldwork: Underwater Maps by Drone

7 Overview of Field Activities

8 Outlook



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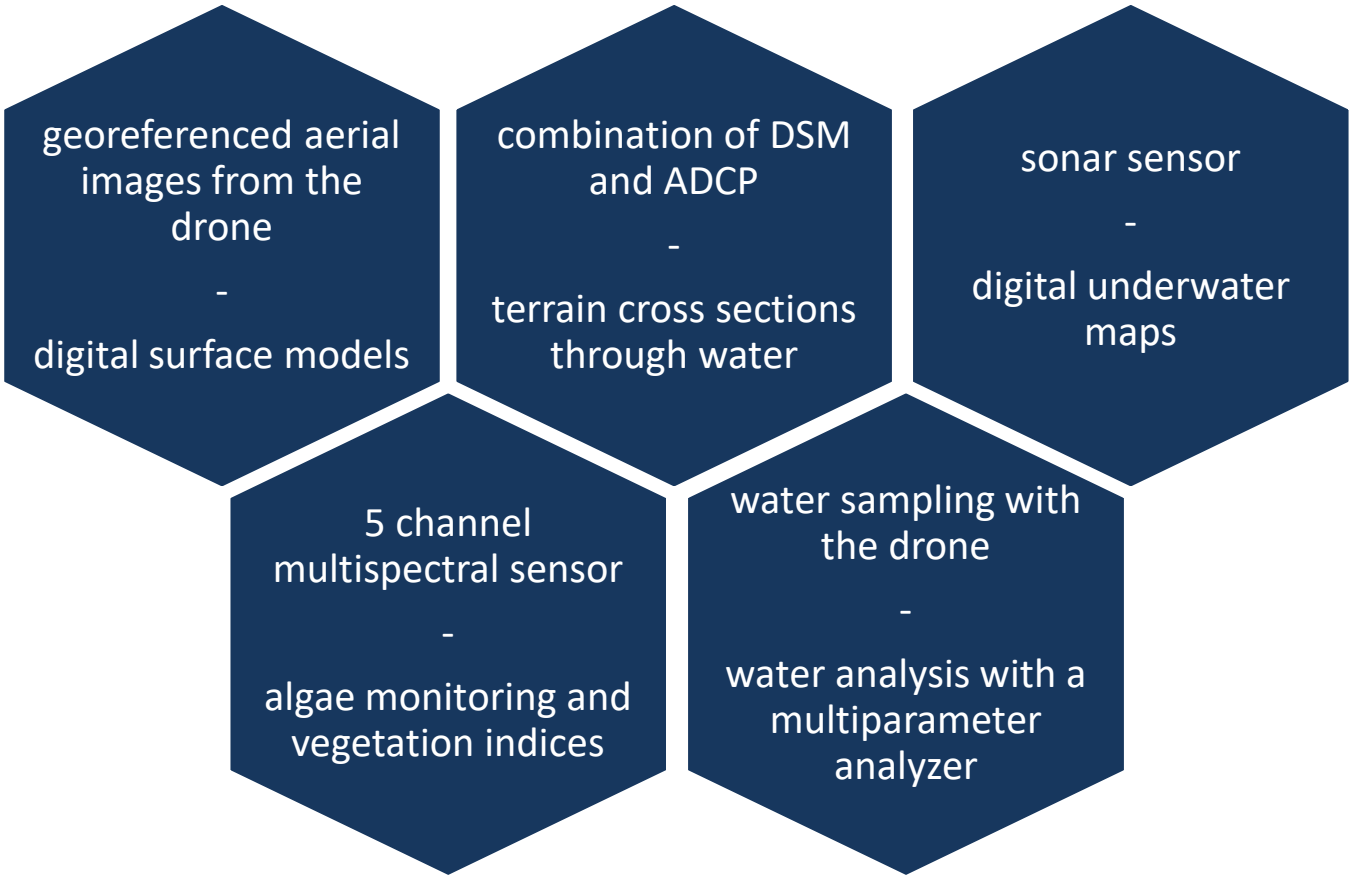
1. Introduction: Aim of Work Package 8 – Remote Sensing

Development of a multiparameter drone with several sensors for a broad, efficient and safe data collection to support river research and monitoring:



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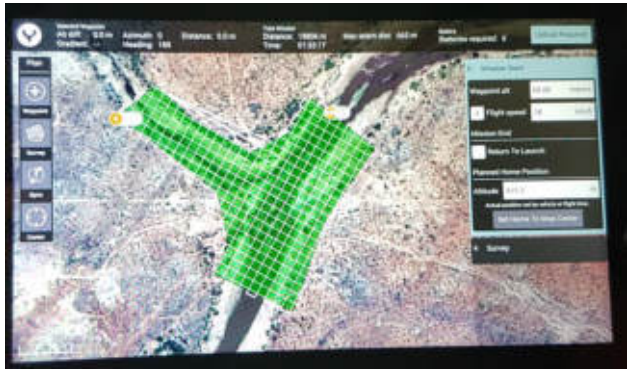
2. Digital Surface Model

Yuneec Typhoon H520

- Camera E90: 20 MP, 23 mm focal distance
- Autonomous flying of planned missions
- Accurate overlap
- Double grid
- Takes georeferenced aerial pictures

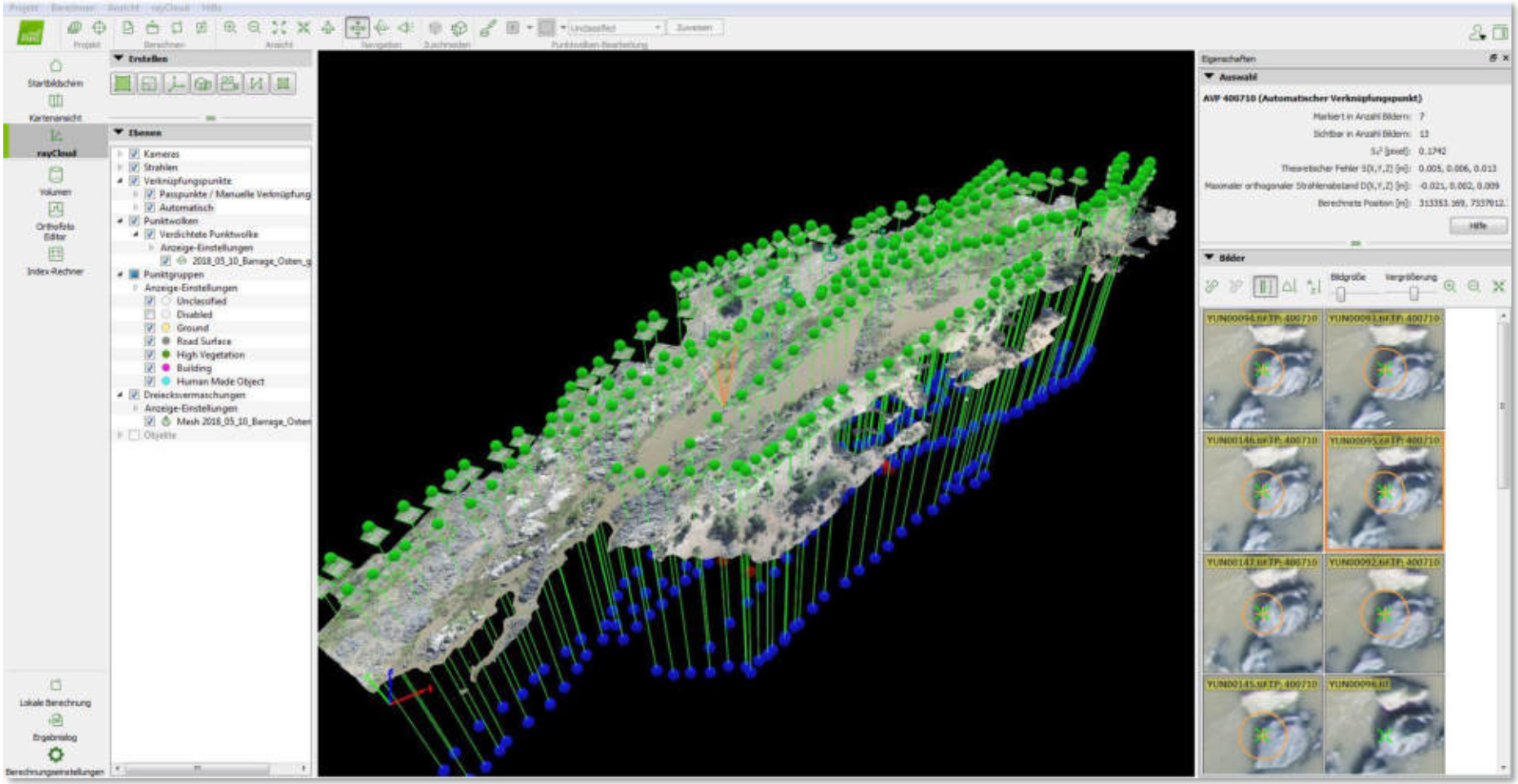


MagicMapper DGPS

- Tough and light hardware
- GNSS reciever, GPS / GLONASS (u-blox neo-M8N)
- Precission of 0,3 - 1 m, even in altitude
- Takes GPS coordinates of Ground Control Points (GCPs)

2. Digital Surface Model

Pix4D Mapper – Calculating DSM



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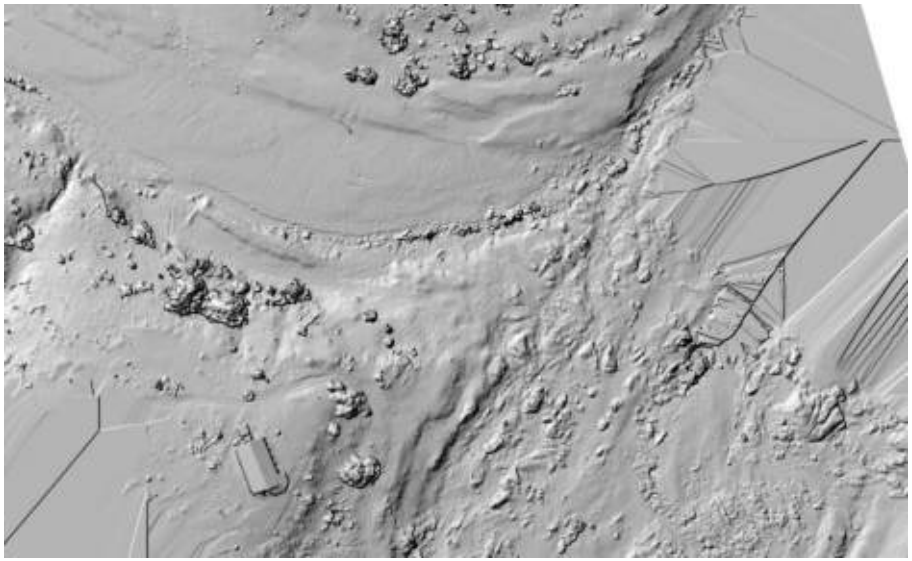
2. Digital Surface Model

Pix4D Mapper – calculated 3D-model

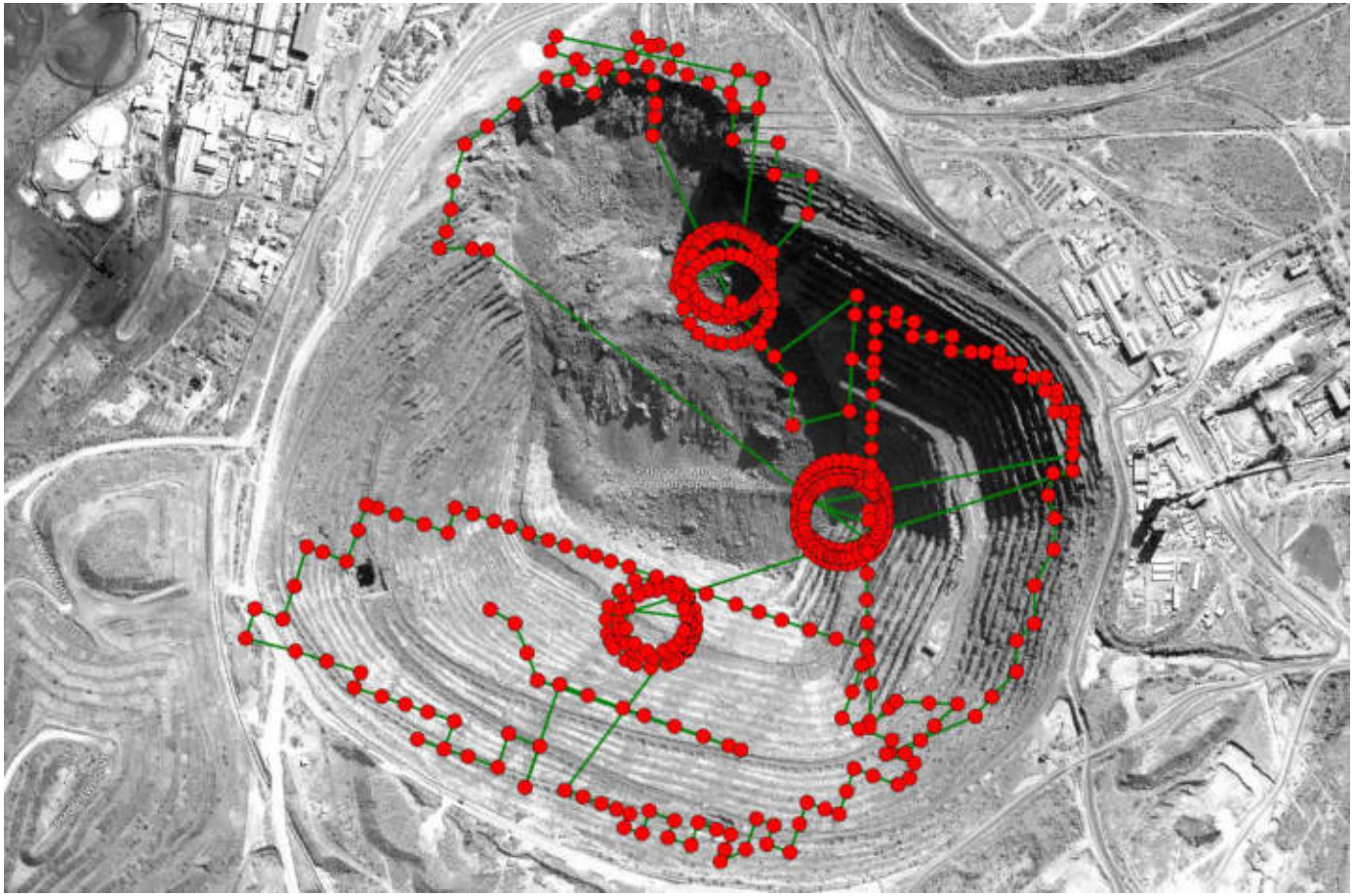
2. Digital Surface Model

Post processing in GIS:



2. Digital Surface Model – Example: Openpit Mine

Capture Photo Points:



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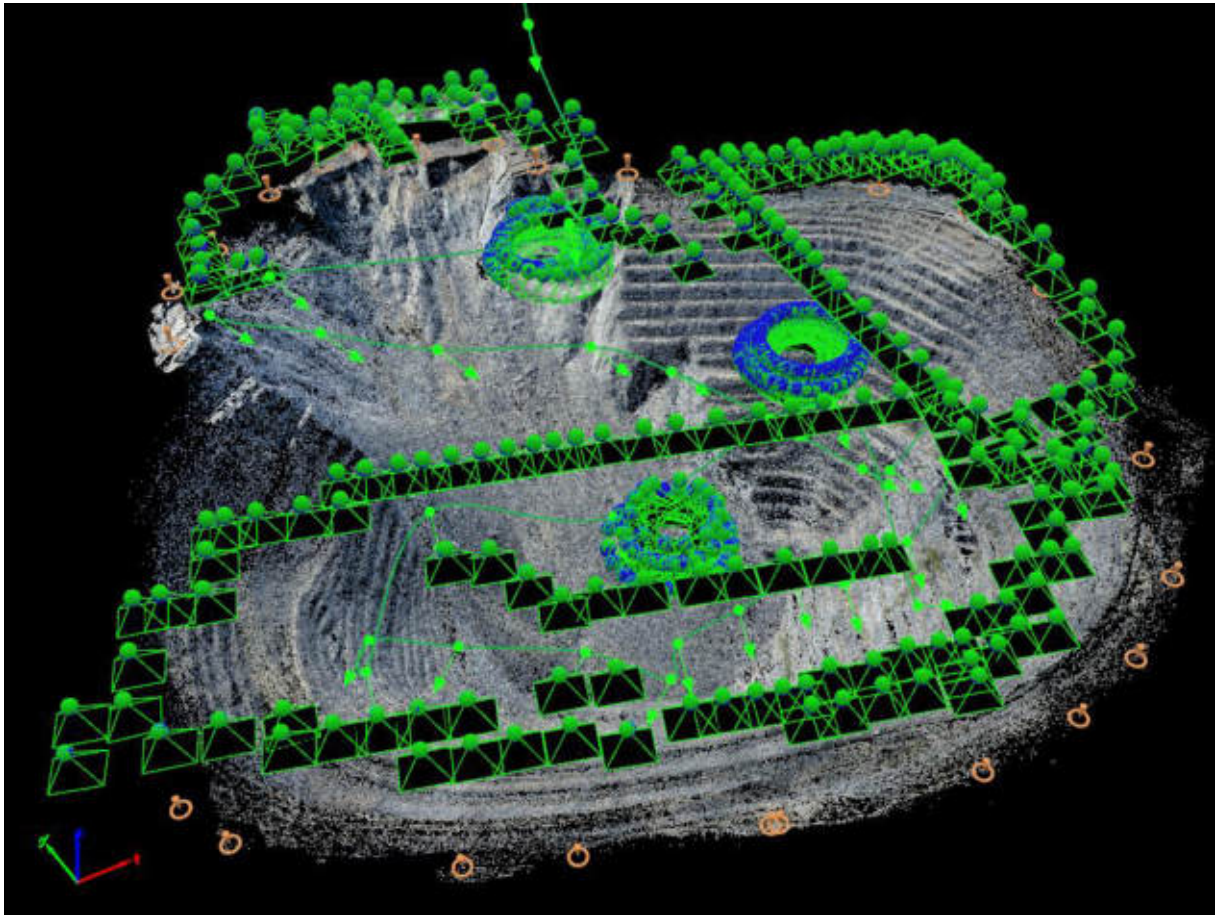
2. Digital Surface Model – Example: Openpit Mine

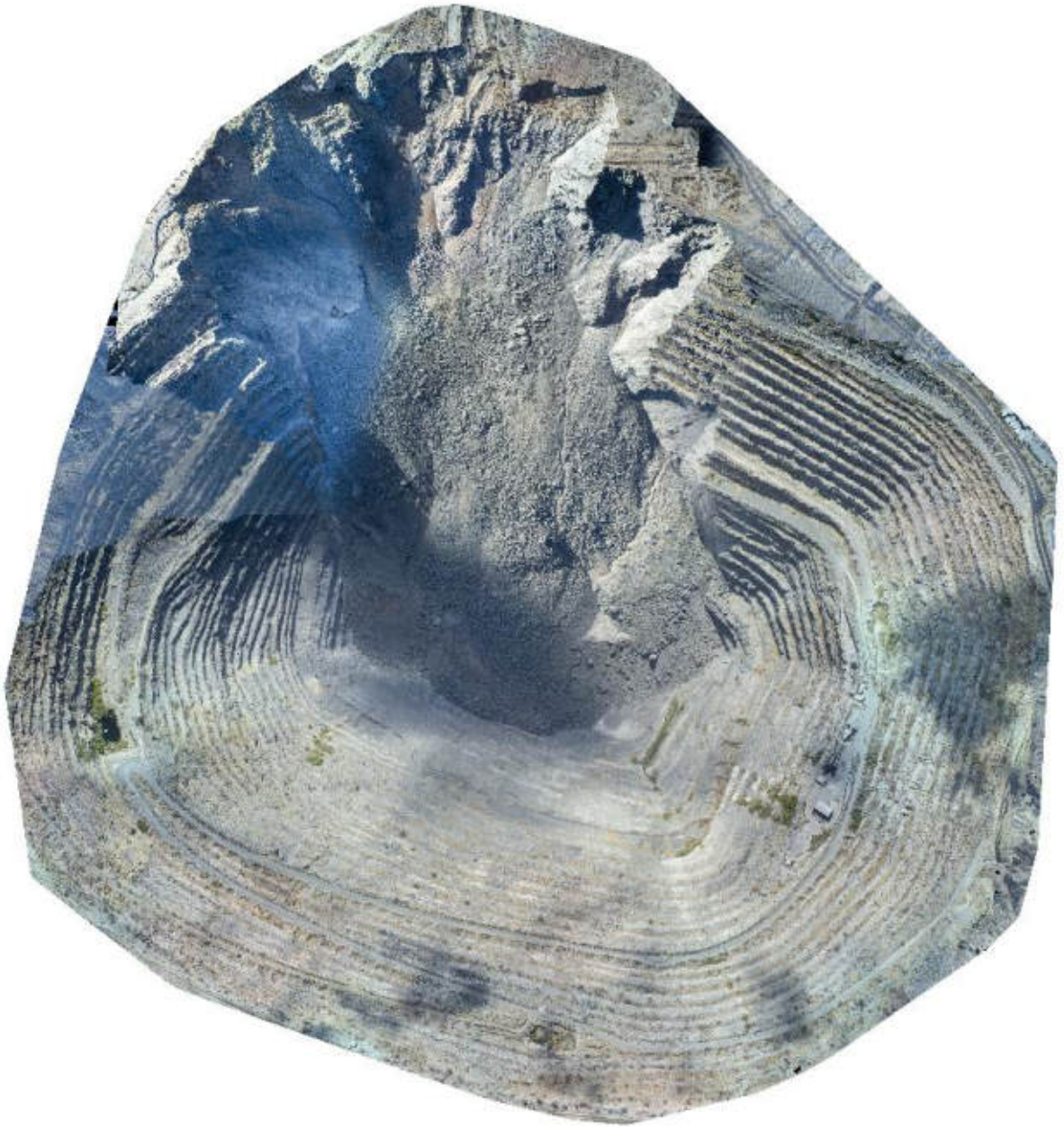
Capture Points

532 aerial pictures



2. Digital Surface Model – Example: Openpit Mine

Aerial Mosaic:



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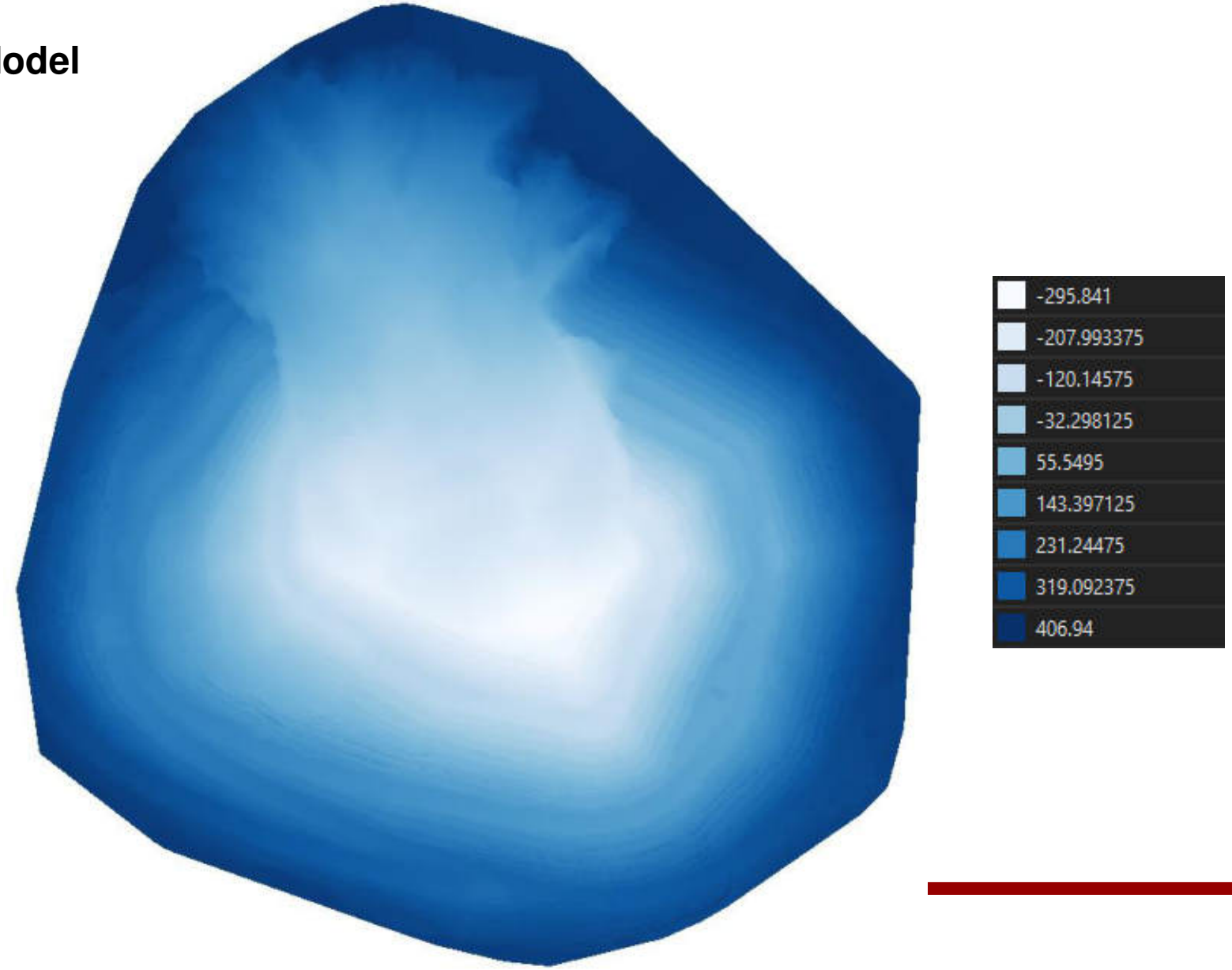
2. Digital Surface Model – Example: Openpit Mine

Elevation Model



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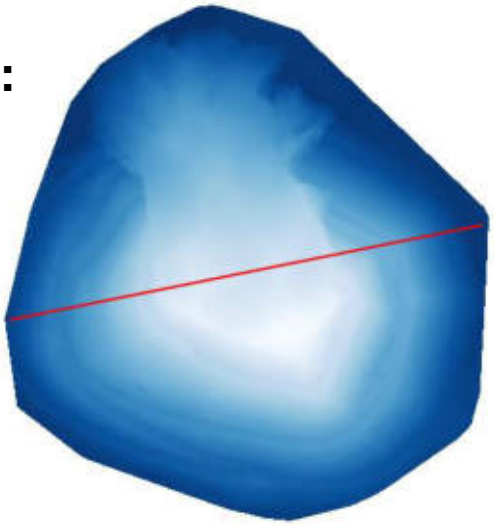
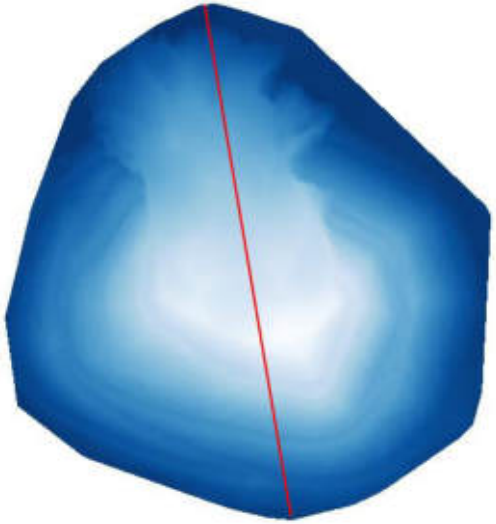
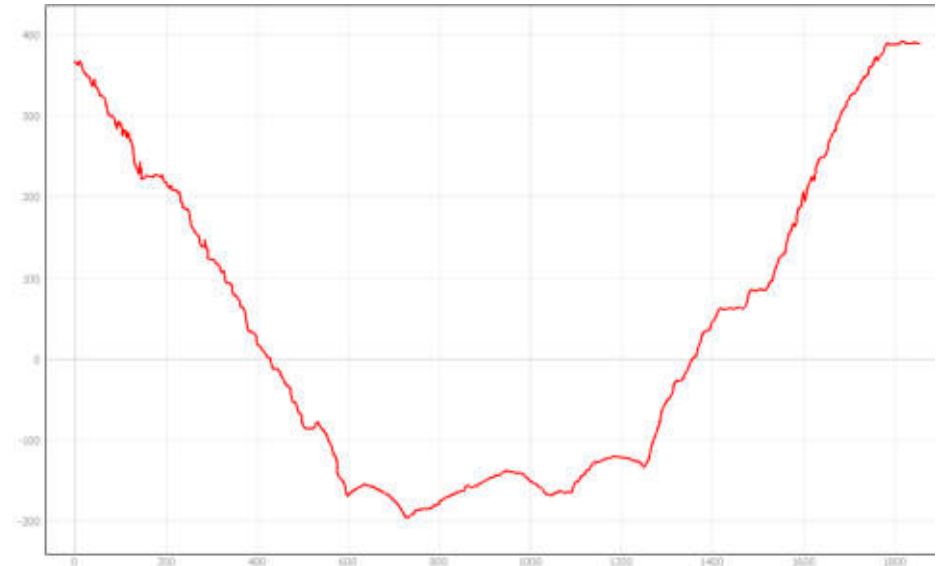
2. Digital Surface Model – Example: Openpit Mine

Cross Sections:







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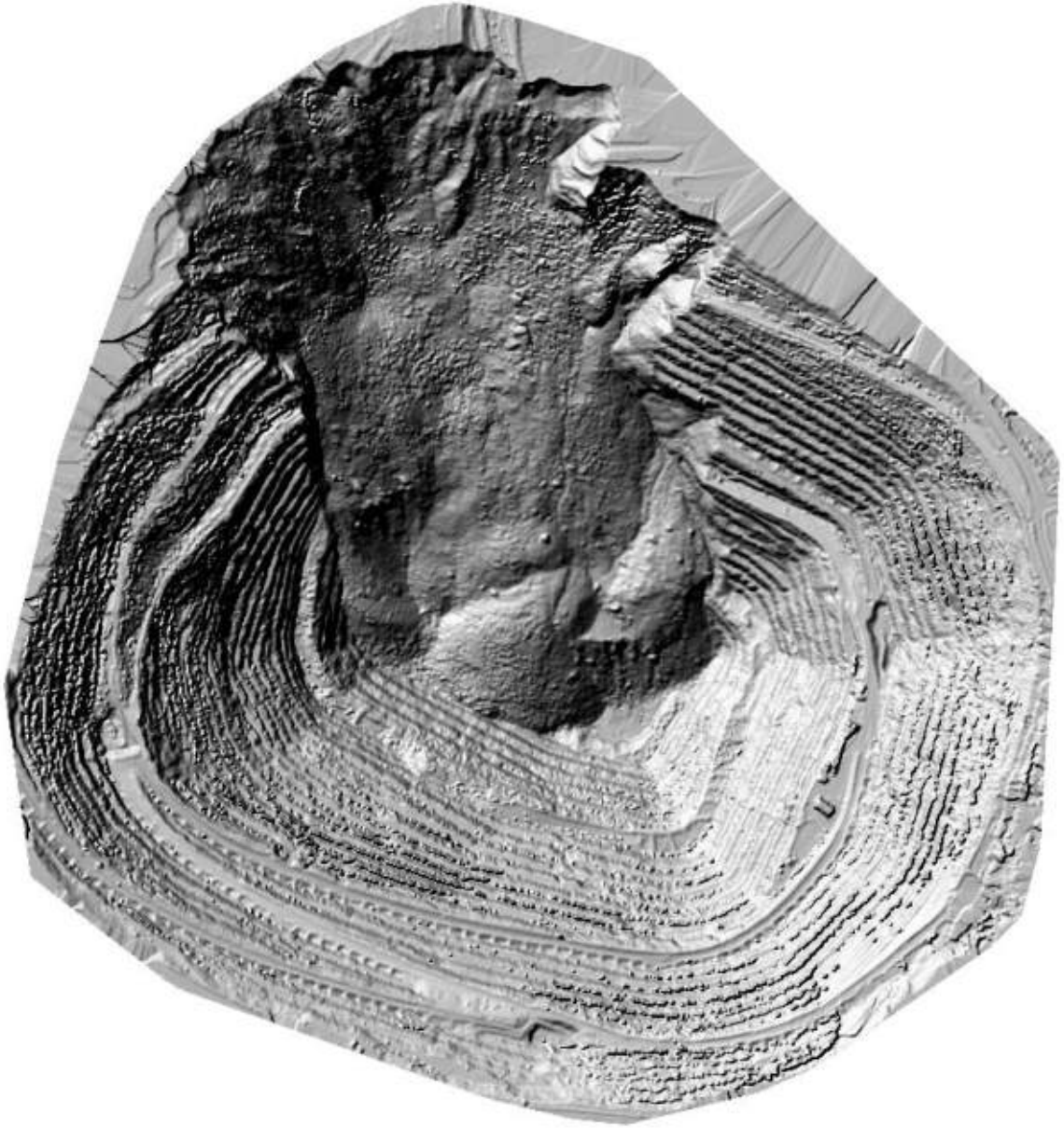
2. Digital Surface Model – Example: Openpit Mine

Hillshade:



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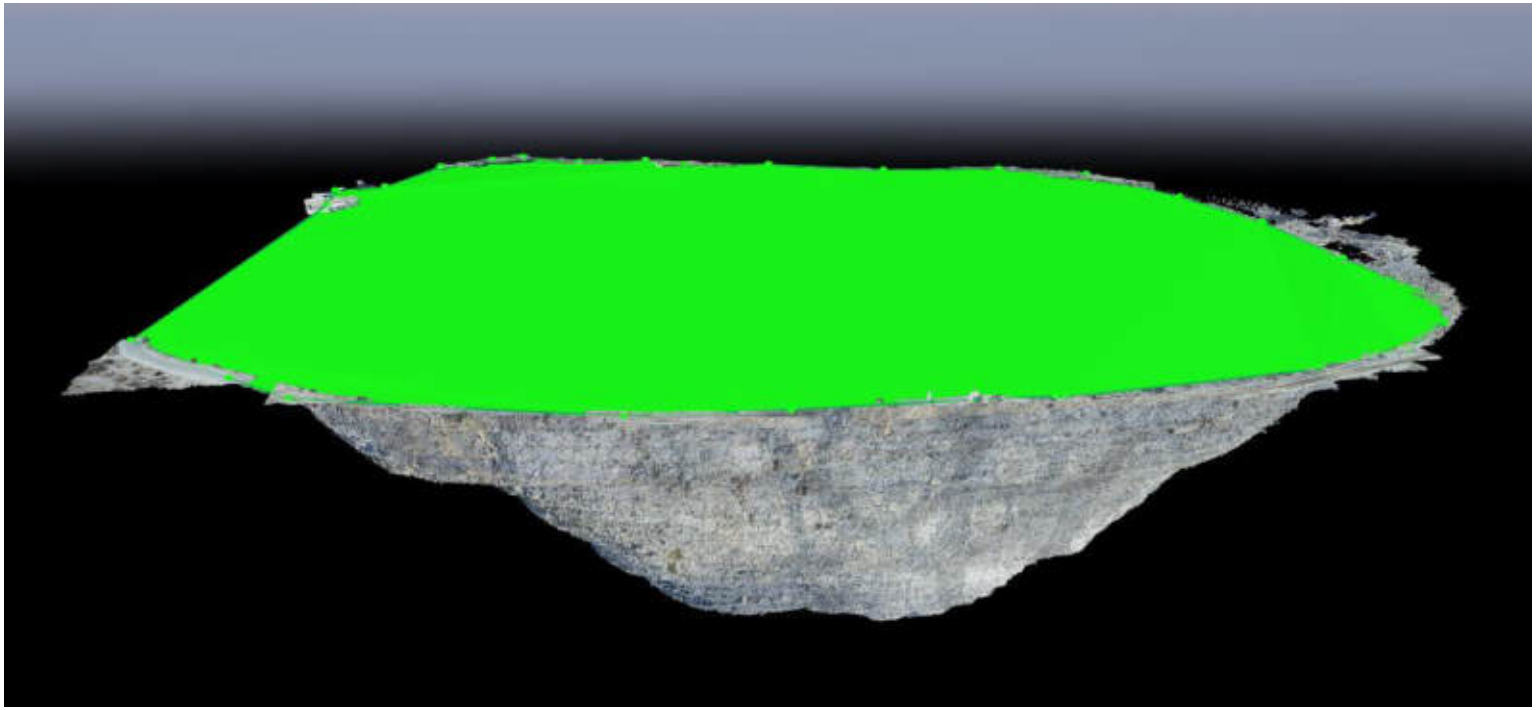
Video can also be found on: https://www.instagram.com/gewaesser_experten/

2. Digital Surface Model – Example: Openpit Mine



3D-surface: 4.644.850 m²
4,644 km²

Volume: 629.868.000 m³
0,629868 km³

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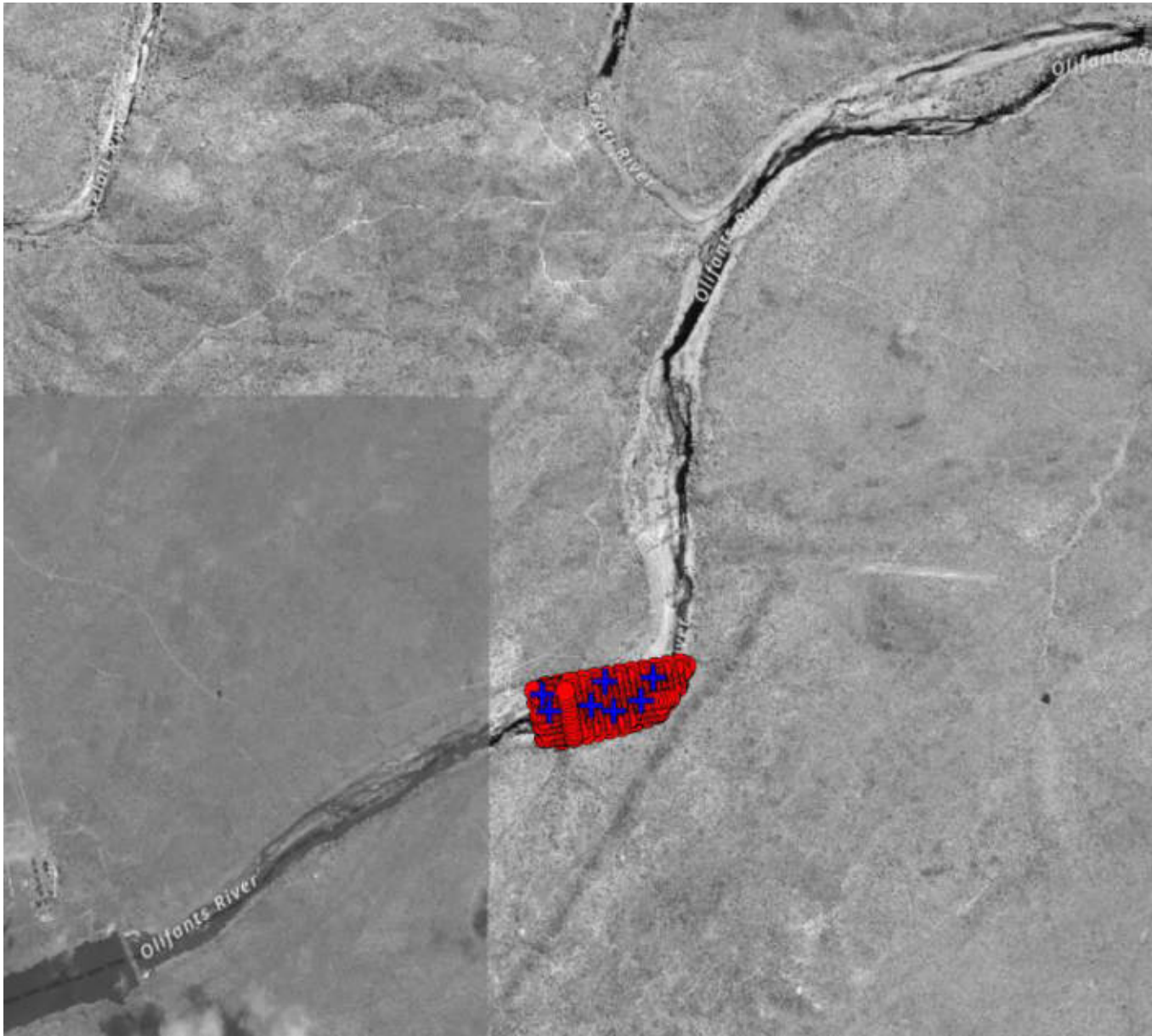
2. Digital Surface Model – Example: Sawong

Overview:



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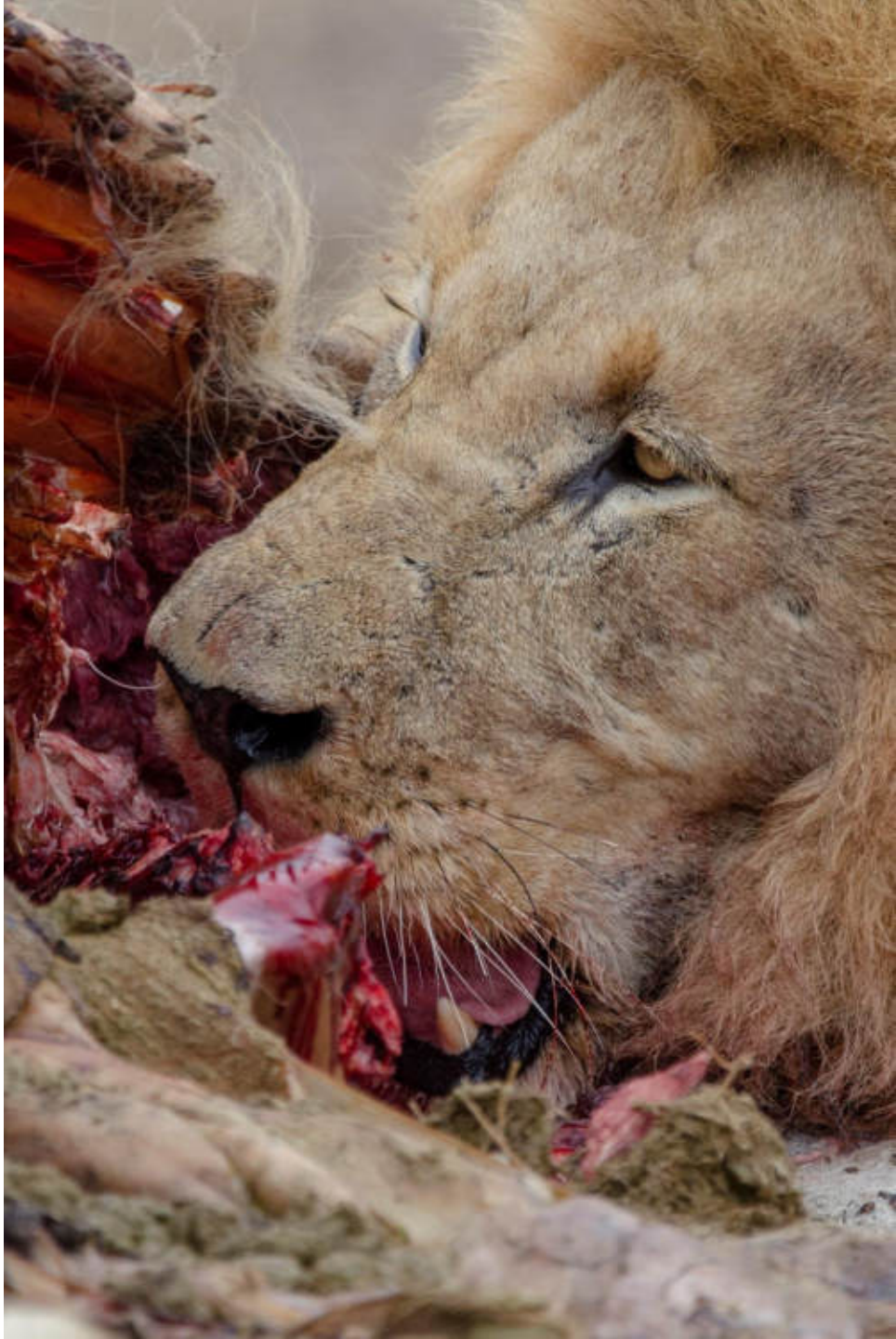

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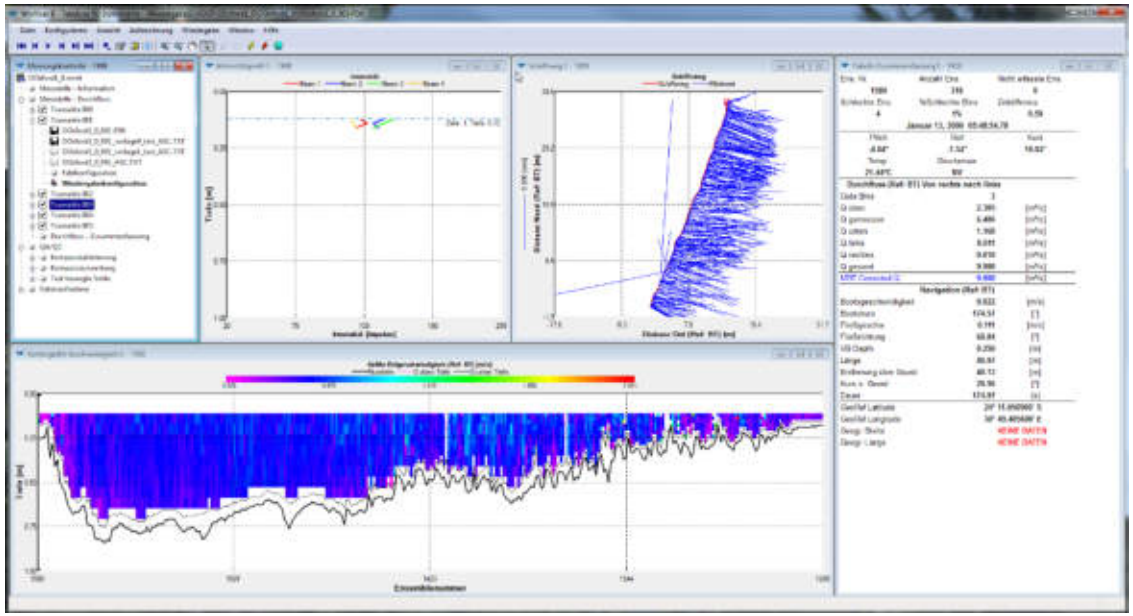
3. River Cross Sections by ADCP / DSM

5- Kanal ADCP (Acustic Doppler Current Profiler)

Software: WinRiverII



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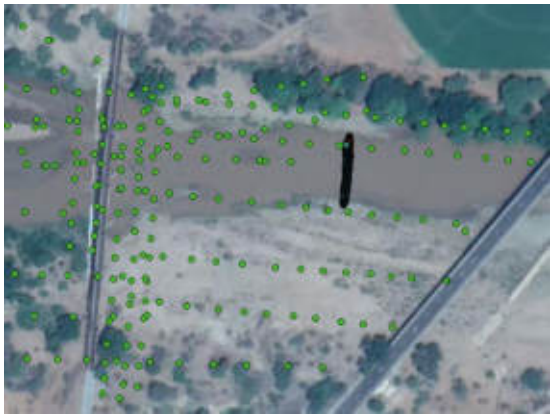

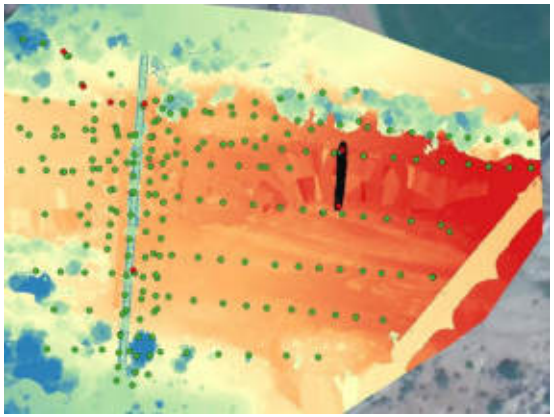

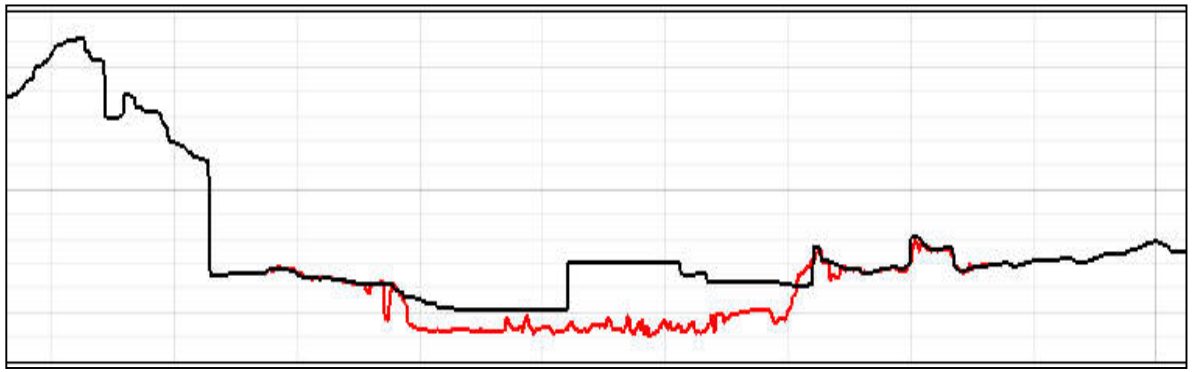

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4. Vegetation Indices + Algae Monitoring 5-channel Sensor

Micasense RedEdge MX

- 5-channel multi-spectral sensor (R, G, B, nIR, RedEdge)
- Vegetation indices
- Algae monitoring
- Evaluation and index calculation with Pix4D
- Post processing in GIS

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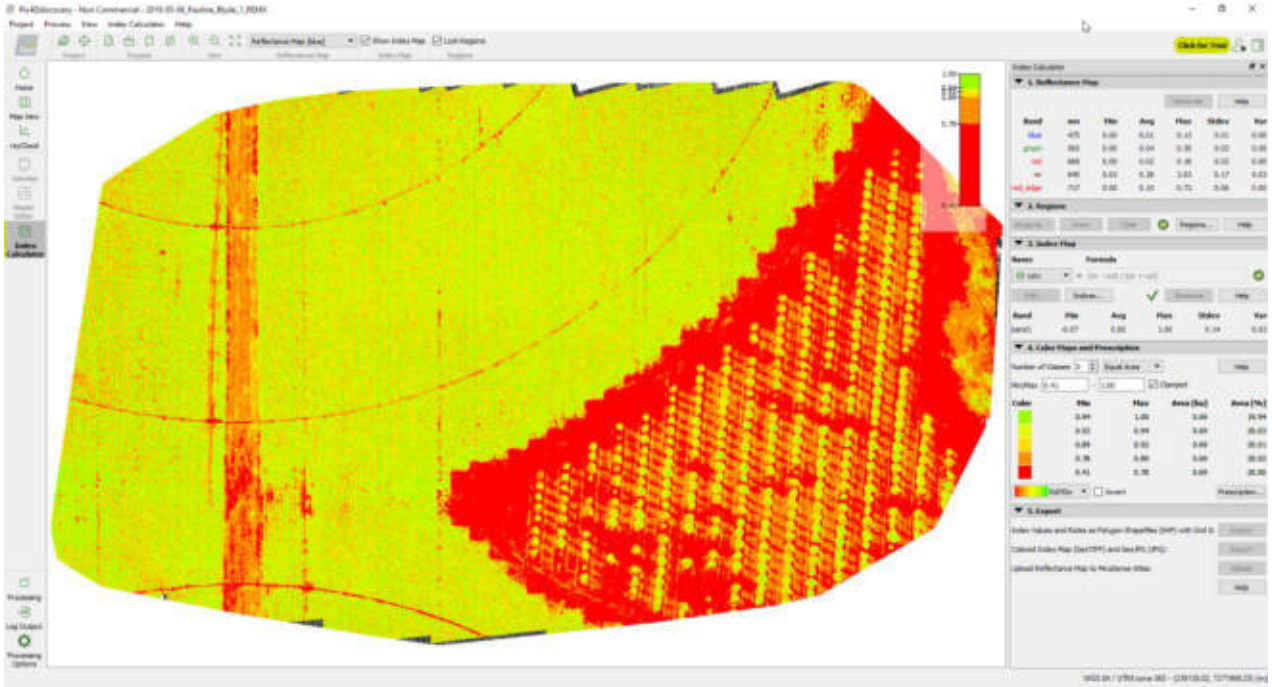
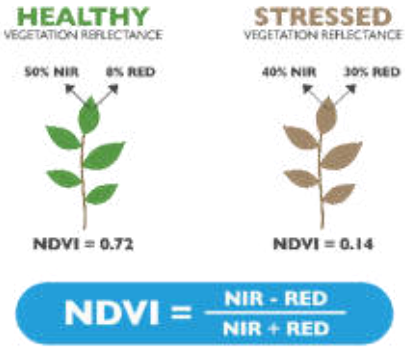
4. Vegetation Indices + Algae Monitoring 5-channel Sensor

Vegetation indices

- Significantly higher resolution than satellite data
- Detailed investigation of individual spots
- Large temporal flexibility, spontaneous aerial surveys
- Distribution and condition of plants
- Conclusions on drought stress, vitality, diseases

Quelle: www.agricolus.com





Quelle: www.agricolus.com

NDVI: Normalized Difference Vegetation Index

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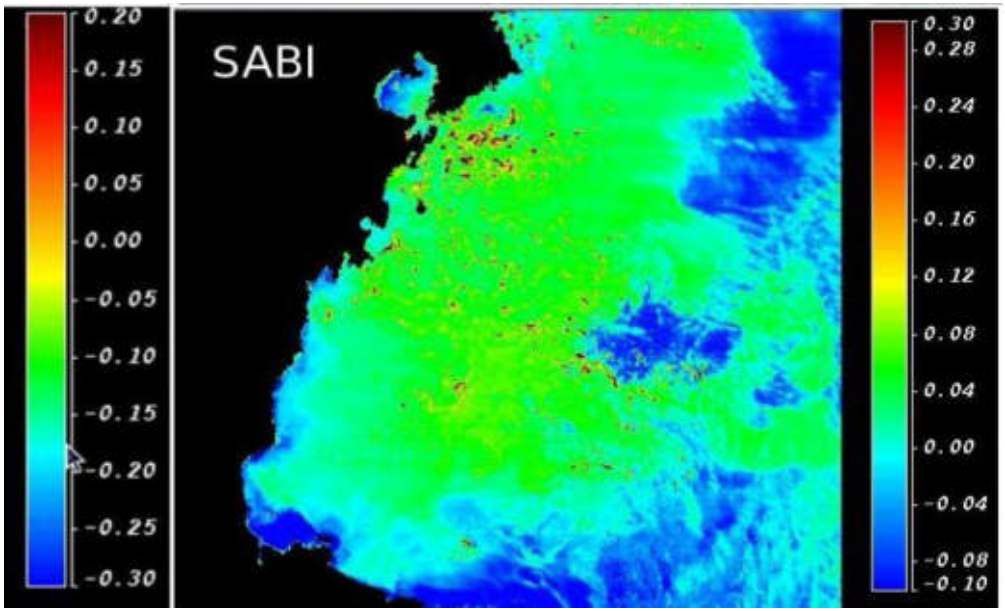
4. Vegetation Indices + Algae Monitoring 5-channel Sensor

Algae monitoring:

- Distribution and quantity of algae
- Chemical and physical parameters of the water possible
- Several indices, f.e. Surface Algal Bloom Index (SABI): Representation of plant biomass in the water



SABI=
(NIR-RED)/(BLUE-GREEN)

Quelle: Eprints.soton.ac.uk

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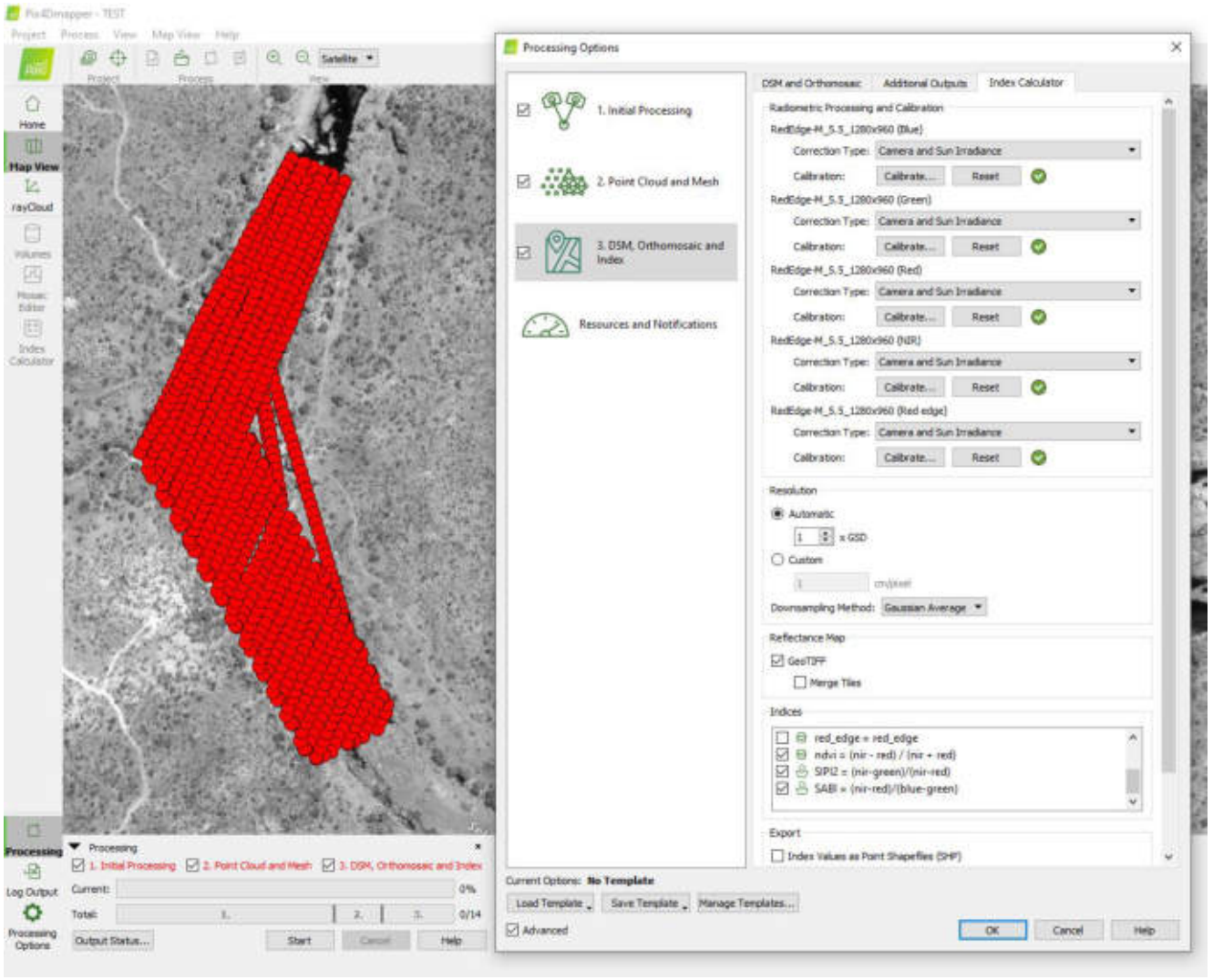
4. Vegetation Indices + Algae Monitoring 5-channel Sensor



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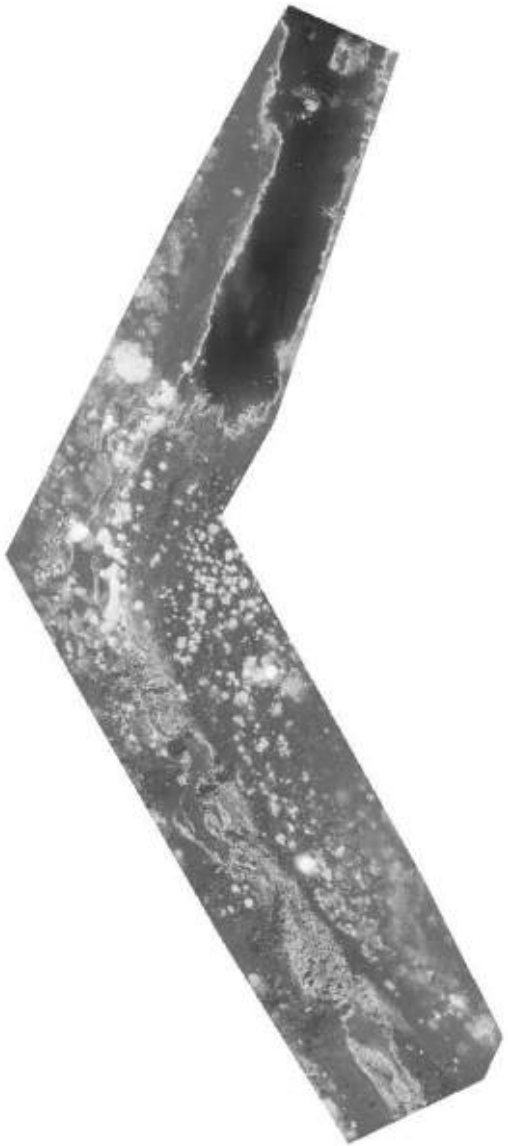

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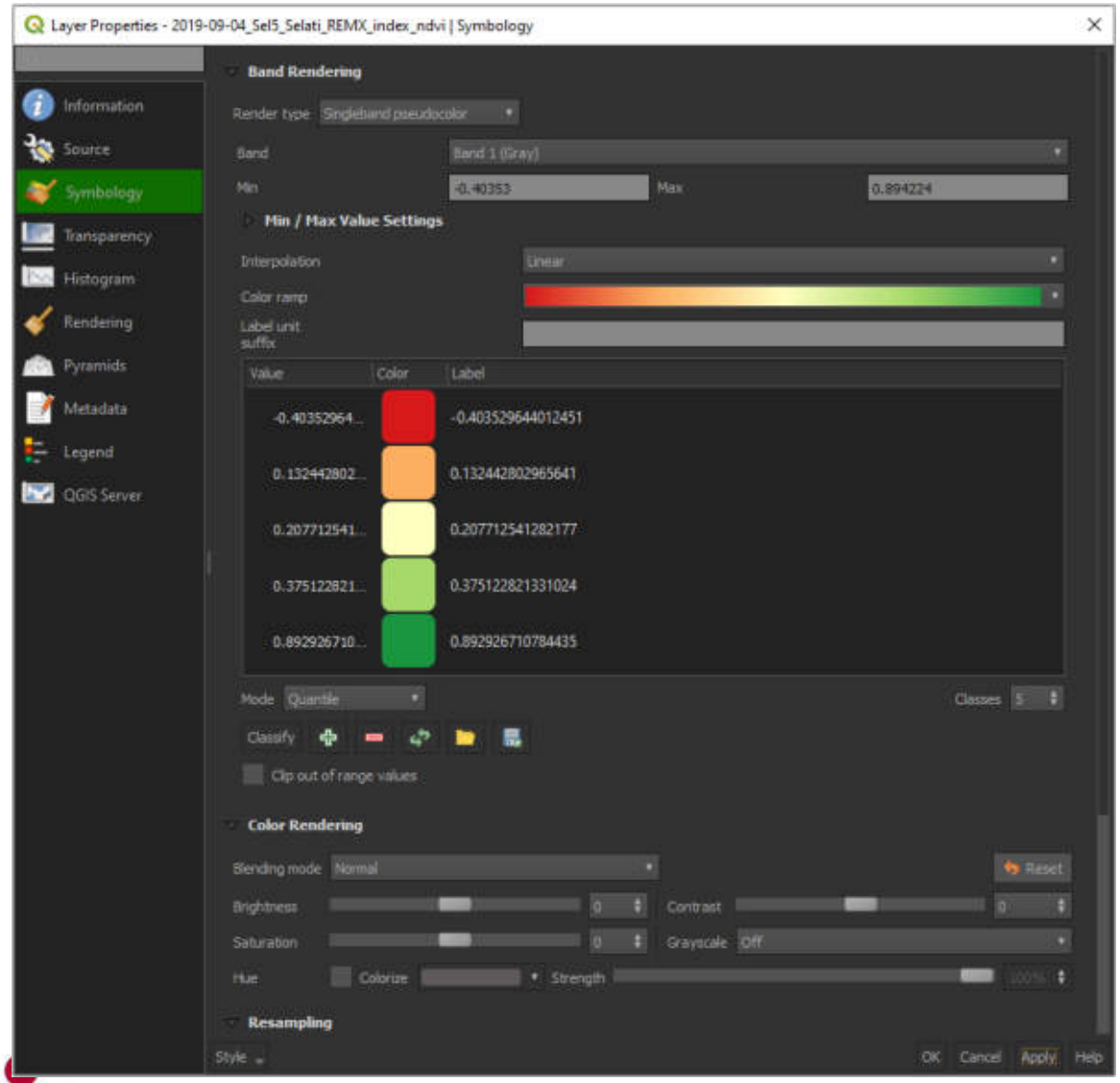

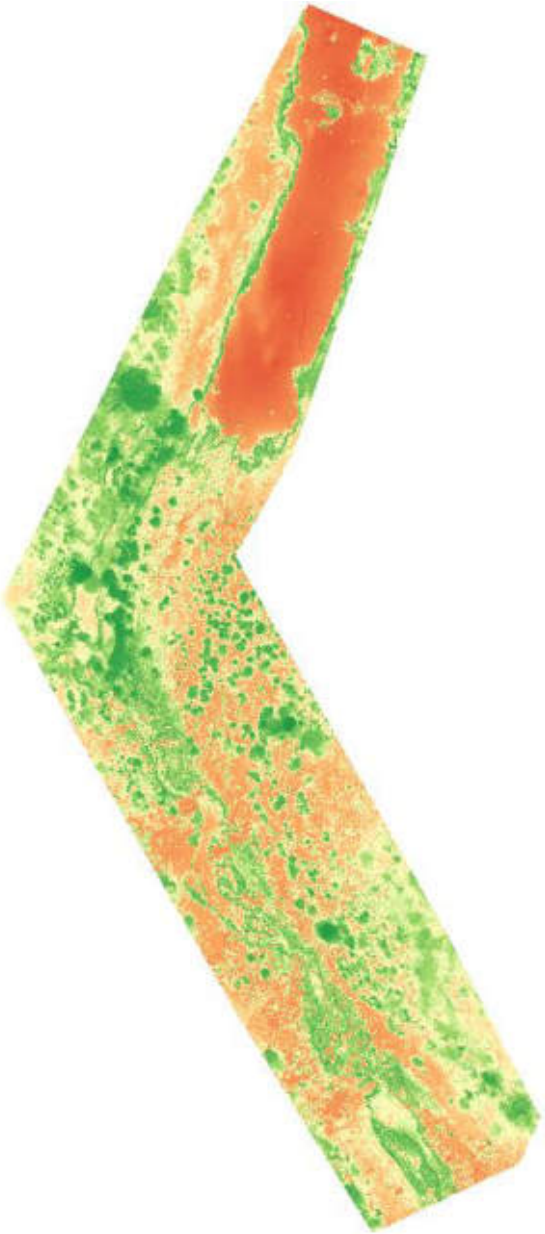

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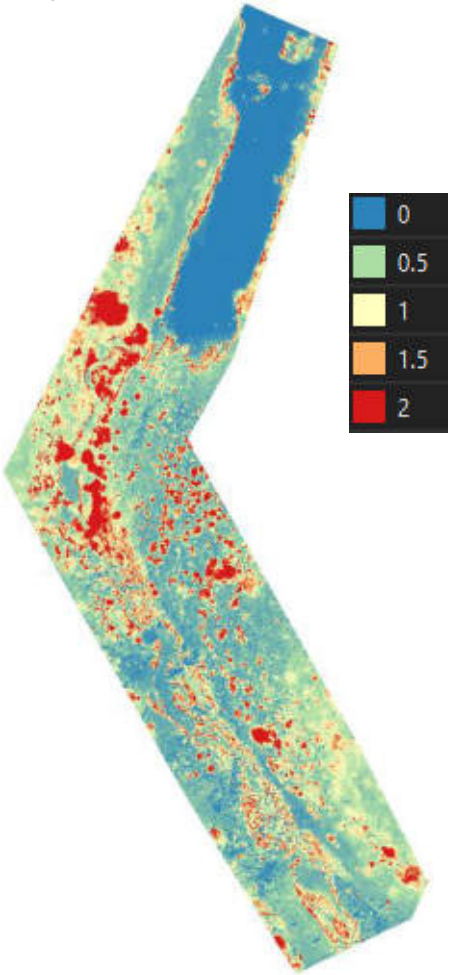
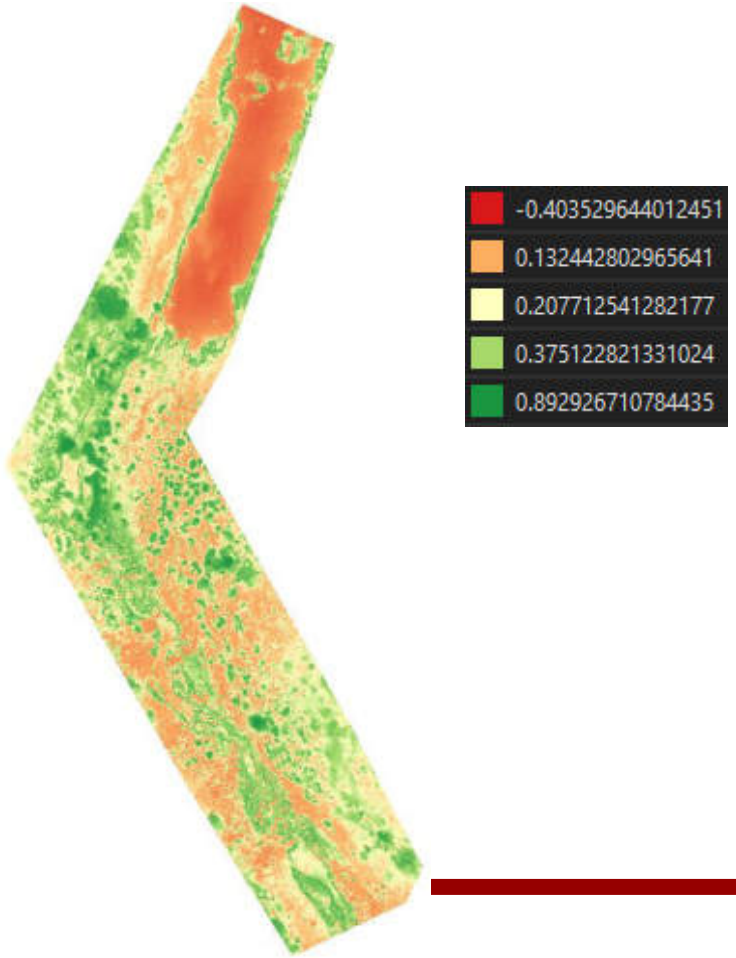
4. Vegetation Indices + Algae Monitoring 5-channel Sensor

SABI (Surface Algae Bloom Index)



NDVI (Normalized Difference Vegetation Index)



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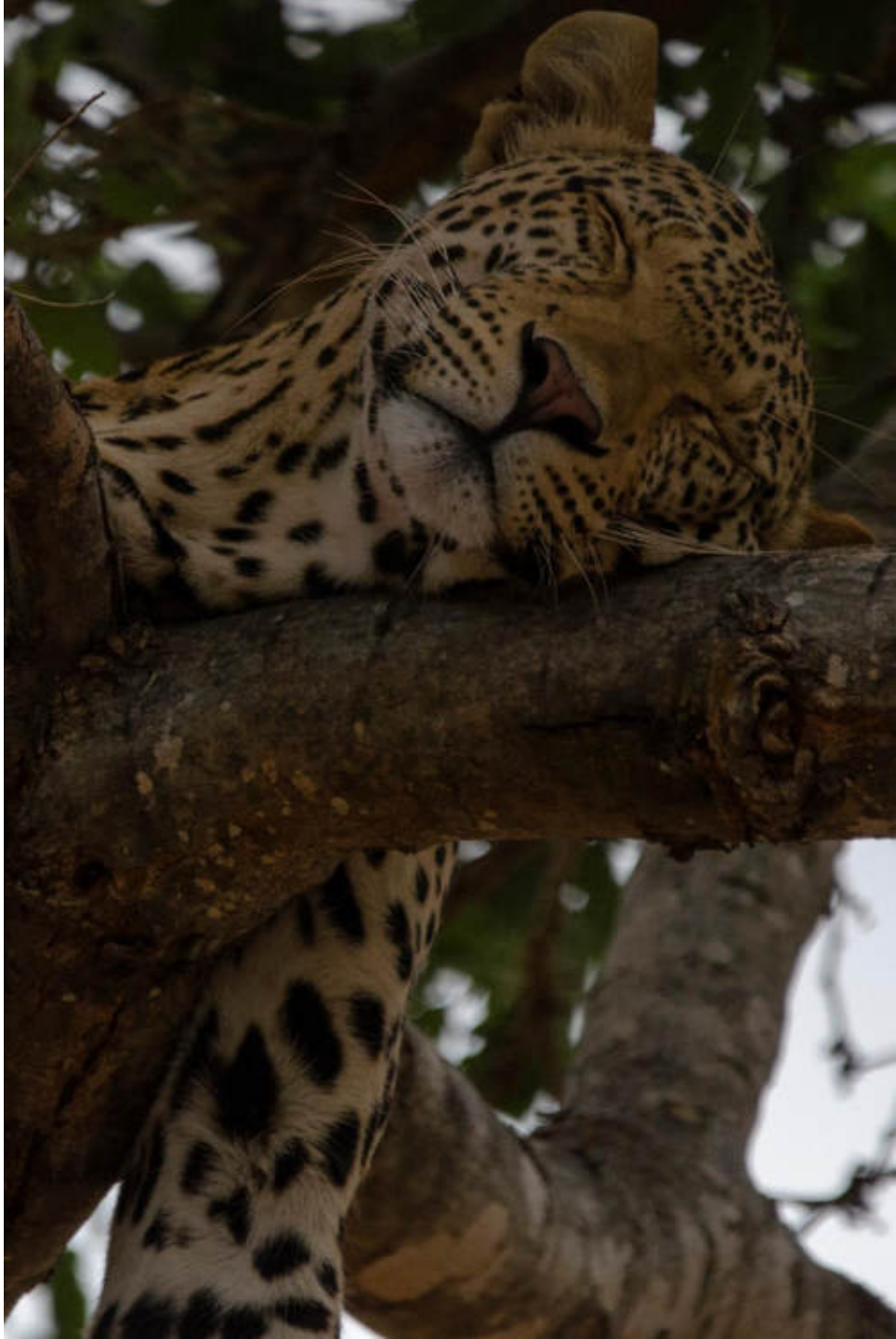

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5. Experimental Field Work – Water Sampling by Drone

Water sampling with drone

- Sampler „Dispo Dipper“
- Lightweight Pouch with long handle and closure
- Content: 250 ml
- Direct measurement or transfer to laboratory

Direktmessung vor Ort

- Measurements in the field directly from the sampler possible
- Measurement device: WTW Multi 3630 IDS
- Parameters: Temperature, pH value, oxygen content, conductivity
- Data transmission from the sensor to the handheld device via Bluetooth

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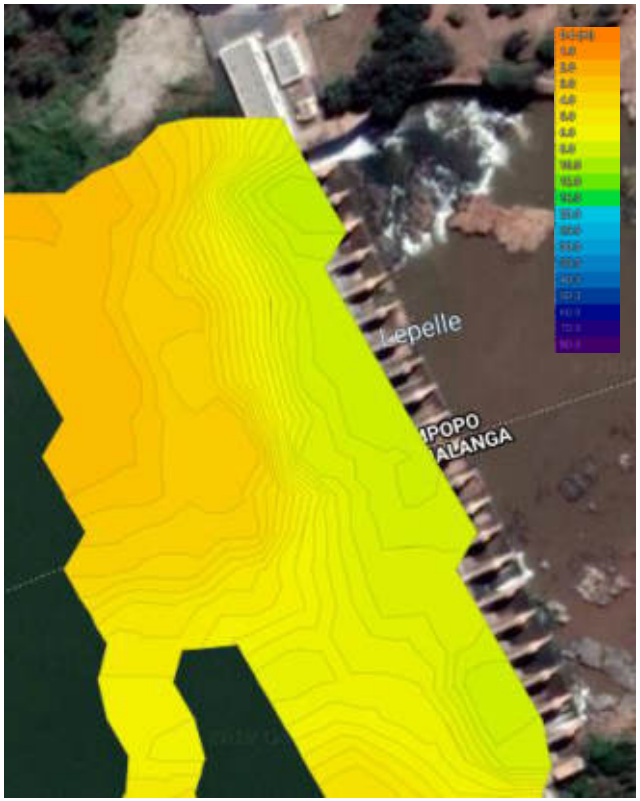
6. Experimental Fieldwork - Underwater Maps by drone

- Deeper Smart Sonar Pro +
- Kompaktes drahtloses Sonargerät
- Genauigkeit: 0,1 m, Mindesttiefe: 0,7 m
- Erstellung von Tiefenkarten, Bearbeitung in GIS möglich



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7. Overview of Field Activities

2. Fieldtrip: 05.2018 **Yuneec Typhoon H (old drone)**

Spot	River	Description	Flugdatum	UAV	GCPs	ADCP
Confluence Olifants_Selati	Olifants River, Ga-Selati River	Confluence of the two rivers	03.05.2018	X	X	-
Oxford_Three Bridges	Olifants River	southwest of Phalaborwa (40 km as the crow flies), between a railway bridge and an expressway bridge (R40)	07.05.2018	X	/	X
Blyde	Blyde River	south-southwest of Phalaborwa (70 km as the crow flies), near the Blyde River Canyon at Selati River Lodge	08.05.2018	/	X	X
Selati	Ga-Selat River	west of Phalaborwa (33km as the crow flies) on the Barrage	09.05.2018	X	X	-
Barrage	Olifants River	south of Phalaborwa (33km as the crow flies, directly on the dam east of the Barrage	10.05.2018	-	-	X
Sawong	Olifants River	south of the Confluence of Ga-Selati and Olifants, adjacent to a military area	10.05.2018	X	X	-

3. Fieldtrip: 10.2018 **Yuneec Typhoon H 520 (new drone)**

Spot	River	Description	Flugdatum	UAV	GCPs
Barrage westlich	Olifants River	just west of the Barrage Dam, near the water reservoir	17.10.2018	X	X
Barrage oestlich	Olifants River	immediately east of the Barrage Dam, below the dam	17.10.2018	X	X
Sawong	Olifants River	east of the Barrage, south of the Confluence of Ga-Selati and Olifants, adjacent to a military area	16.10.2018	X	X
Mine	-	open pit of the Phalaborwa Mining Company	05.10.2018	X	X
Selati River Lodge	Ga-Selati River	at the Selati River Lodge, west of Phalaborwa (33km as the crow flies)	18.10.2018	X	X
Ngwabitsi	Ngwabitsi, Ga-Selati River	west of Phalaborwa (79km as the crow flies), immediately adjacent to the bridge over the Ngwabitsi and Ga-Selati rivers, the rivers run side by side at this point, the R36	07.10.2018	X	X
Confluence	Olifants River, Ga-Selati River	confluence of the two rivers that continue as the Olifants River flow	17.10.2018	X	X
Mulati	Mulati	along a bridge, the R71, which leads over the Mulati. 24 km west of Phalaborwa (linear distance)	11.10.2018	X	X
Selati Baluale Reserve	Ga-Selati River	West-southwest from Phalaborwa (63 km straight line), just east of the spot the Baluale Reserve	11.10.2018	X	X
Oxford	Olifants River	adjoins to the southwest of Phalaborwa (40 km as the crow flies), between a railway bridge and an expressway bridge (R40)	13.10.2018	X	X

7. Overview of Field Activities

4. Fieldtrip: 05.2019 **Yuneec Typhoon H 520 (new drone) + MicaSense RedEdge MX (5 Channel)**

Spot			Flugdatum	UAV	GCPs	MicaSense
Oxford	Olifants River	Southwest of Phalaborwa (40 km as the crow flies), between a railway bridge and an expressway bridge (R40)	**14.05.2019**	X	X	
Sawong	Olifants River	east of the Barrage, south of the Confluence of Ga-Selati and Olifants, adjacent to a military area	**17.05.2019**	X	X	
Confluence	Olifants River, Ga-Selati River	confluence of the two rivers that continue to flow as Olifants River	**15.05.2019**	X	X	
Barragev2	Olifants River	west of the dam Barrage	**07.05.2015**	X	X	
GaSelati	Ga-Selati River	west of Phalaborwa, south of Leydsdorp	**05.05.2019**	X	X	
Timbawati 1	Timbavati	north of the city of Acornhoek, adjacent to road R531	**09.05.2019**	X	X	
Timbawati 2	Timbavati	northeast of the city of Acornhoek, on road R531	**09.05.2019**	X	X	
Blyde River 2	agriculture area	adjacent to road R36, north of Kroonkop	**08.05.2019**	X	X	X
Steelport 2	agriculture area	south of Burgersfort, west of Kroonkop, on road R37	**06.05.2019**	X	X	X
Blyde River 1	agriculture area	115 km (as the crow flies) south-southwest of Phalaborwa, on road R36, just south of Kroonkop	**06.05.2019**	X	X	X

5. Fieldtrip: 09.2019 **Yuneec Typhoon H 520 (new drone) + MicaSense RedEdge MX (5 Channel)**

Spot			Flugdatum	UAV	GCPs	MicaSense
Mine_Open_Pit		Phalaborwa Mining Company open pit	**03.09.2019**	X	X	X
Sel1_Feld	Ga-Selati River	west of Phalaborwa, just north of the R71	**04.09.2019**	X	X	X
Sel1_Teich	Ga-Selati River	road west of Phalaborwa, just north of the R71 road, just north of the Sel1_Feld	**04.09.2019**	X	X	X
Sel1_Selati	Ga-Selati River	less than 100 meters above the confluence of Ga-Selati and Olifant's	**04.09.2019**	X	X	X
Sel1_Confluence	Olifants River, Ga-Selati River	confluence of the two rivers as Olifants River continues to flow	**04.09.2019**	X	X	X

8. Outlook

Further (last) Steps:

- The technical development is done, there will not be produced more applications.
- The workflow and post-processing of the 5-channel-data and vegetaion indices is in process
- A training will be planned for 2020
- If it works: 3D-model of the Olifants Canyon in cooperation with SAEON and SanParks

Data

- We divide our produced data in „experimental data“ and „excelent data“ – the „excelent data“ will be made available
- There will be data sets with (1) only aerial mosaic, (2) aerial mosaic and 3D-model and (3) aerial mosaic, 3D-model and sets with vegetation indices
- The data will also be available in the Application produced by DISY

Thanks for your interest!

contact:
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www.gewaesser-experten.de

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