UAV TECHNOLGY IN FORESTRY

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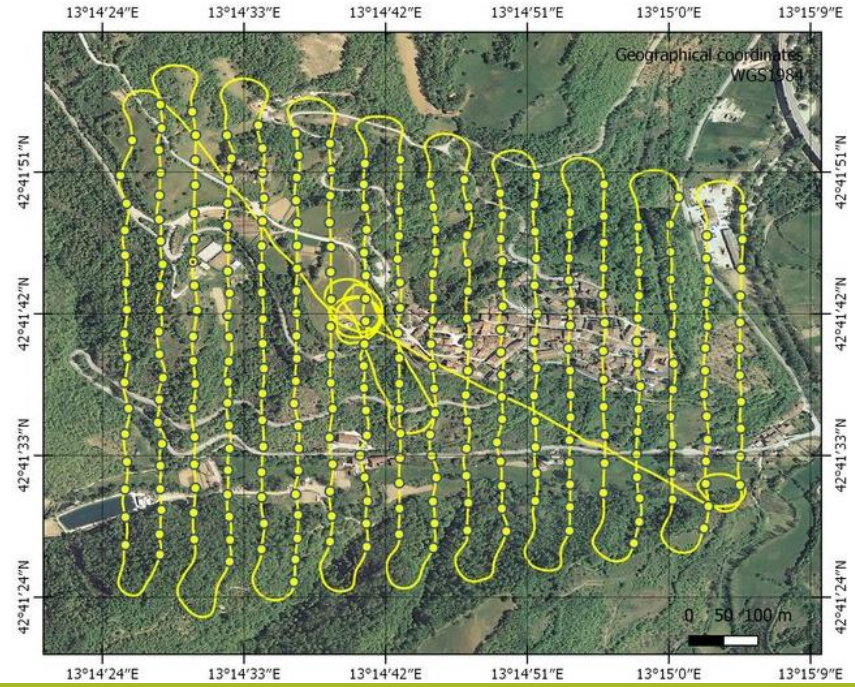
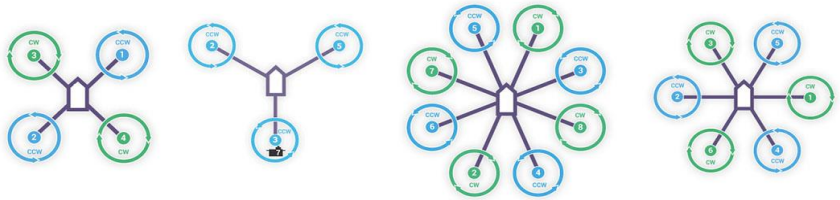
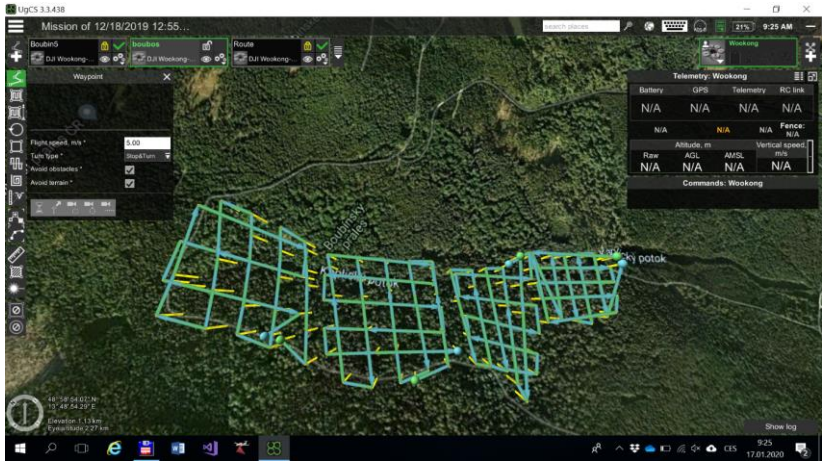
Fixed-wing vs. Copter







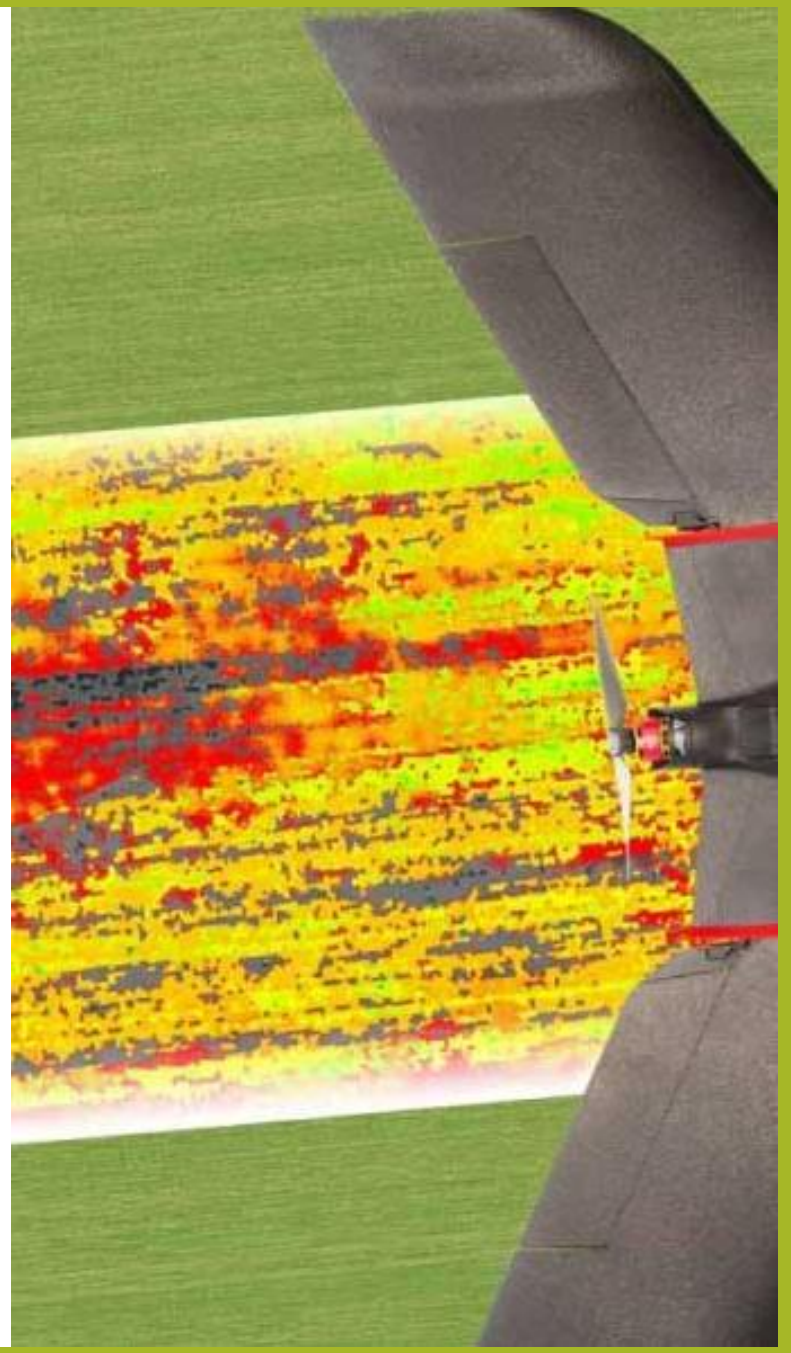
Fixed-wing

+ Longer fligth time

+ Faster data acquisition => optaining of larger area (100 of ha)

- Lover resolution
- Demanding on take-off and landing area
- Can cary only smaller sensor

• Mainly for larger areas with expected lower data resolution



Copter

+ Cheaper than fixed wing

+ Take-off and landing flaxibility

+ Possibility of cotroling the flight speed => high resolution and focussed images

+ Can cary heavy loads

- Shorter flight time => usable form smaller areas
- While discharged battery imediate fall down

- Usable for smaller areas with high data resolution

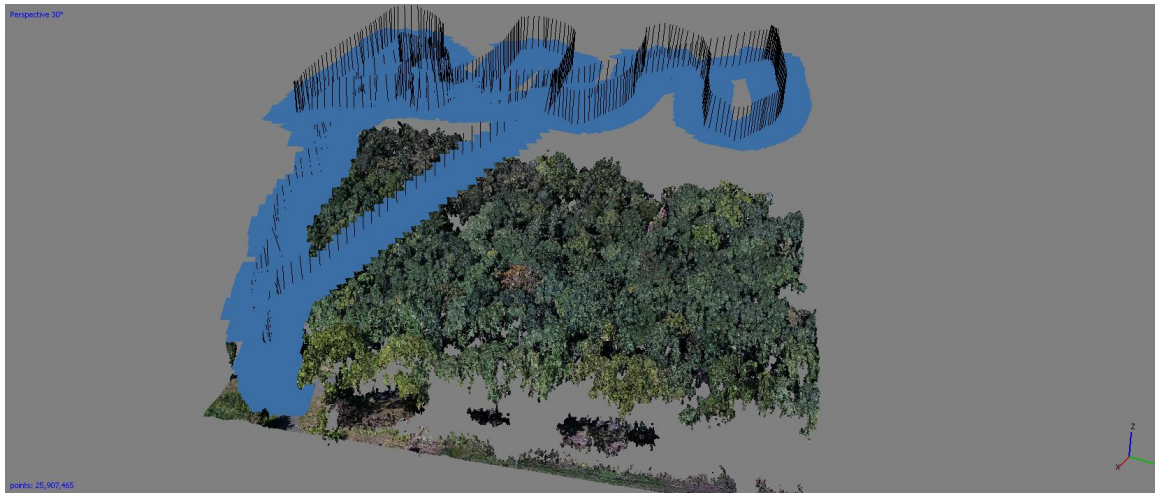
COMBINATION???

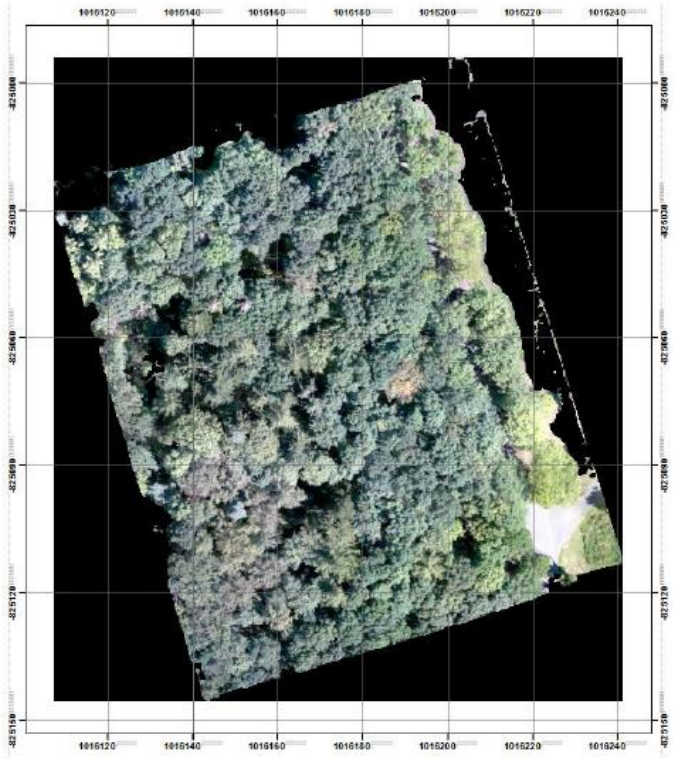
DJI Phantom 4 Pro (RTK)

- Max take-off mass 1388 g
- Max flight time 29 minut
- Operation temperature 0° to 40° C
- RTK module (1.5 cm V + 1 cm H)
- Max wind speed 10 m/s
- Sensor 20 Mpx (1 " CMOS)
- All DJI Phantom 4 versions have compatible bateries

Agisoft MetaShape

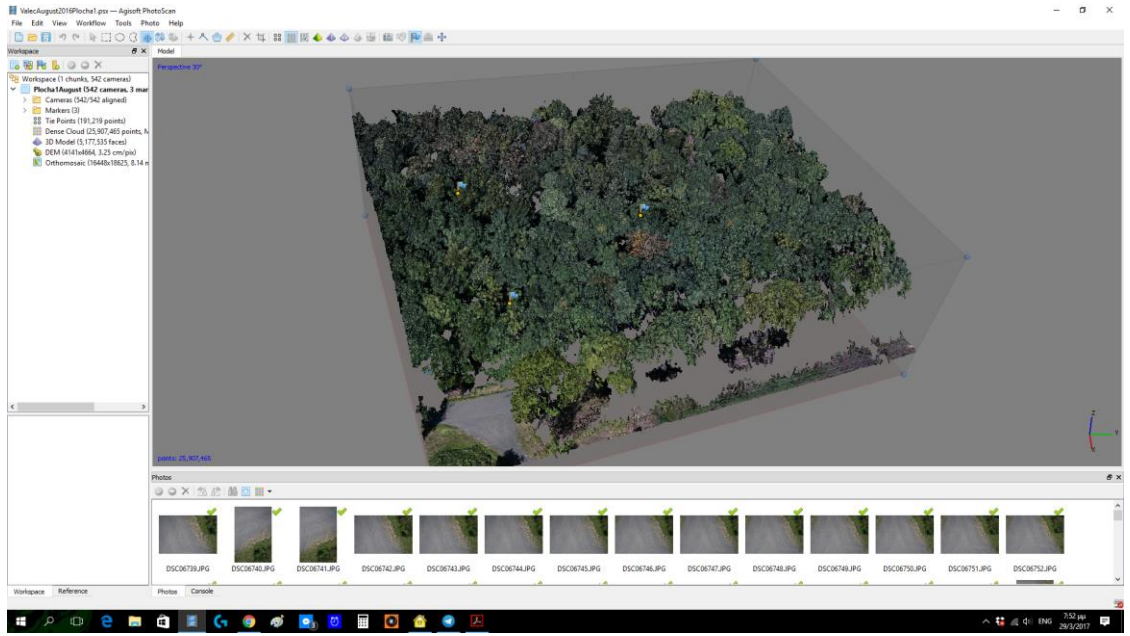
- UAV position
- Model -> ortophoto
- Georefferencing
- DEM -> DSM a DTM (rasters)

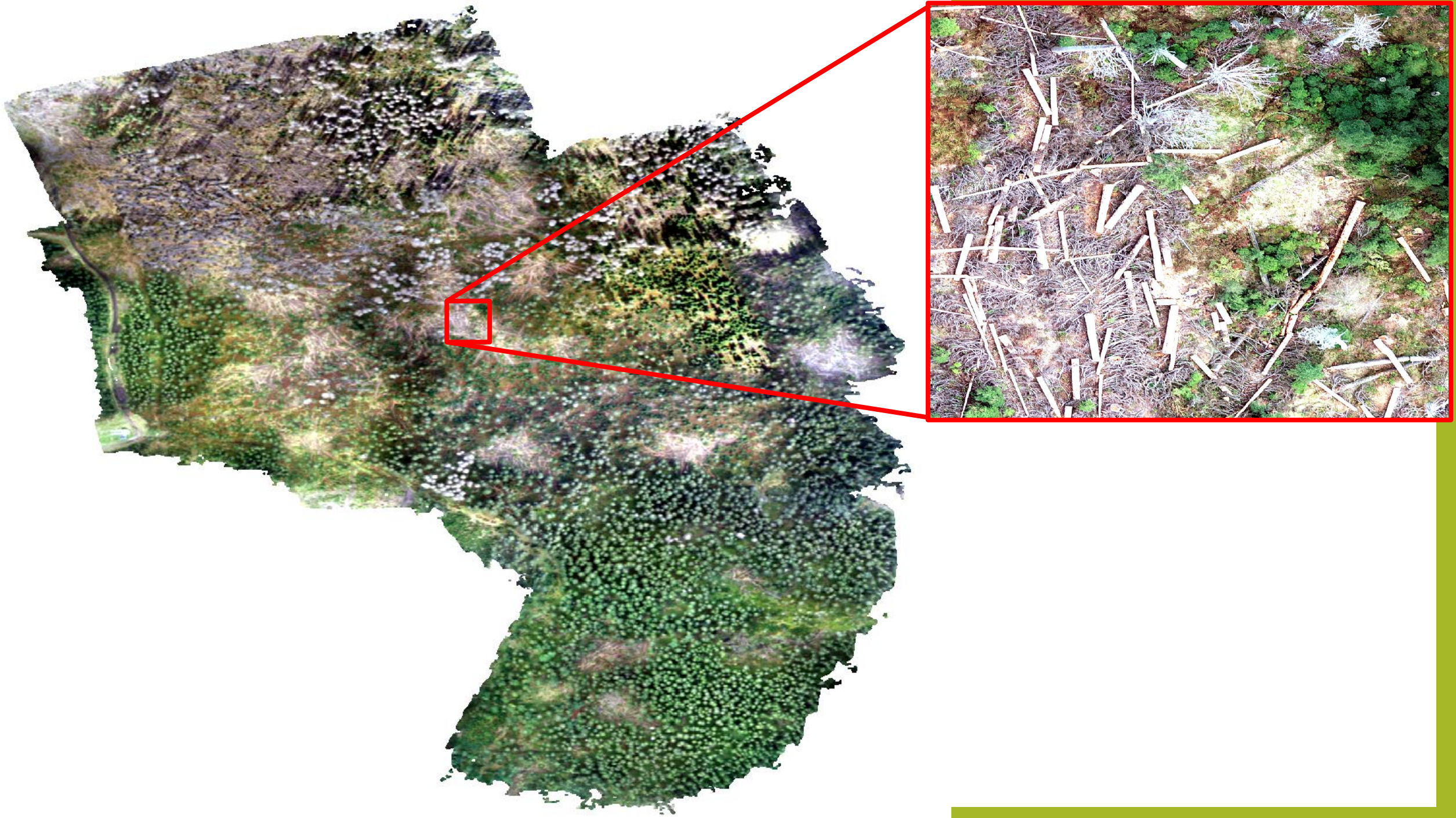




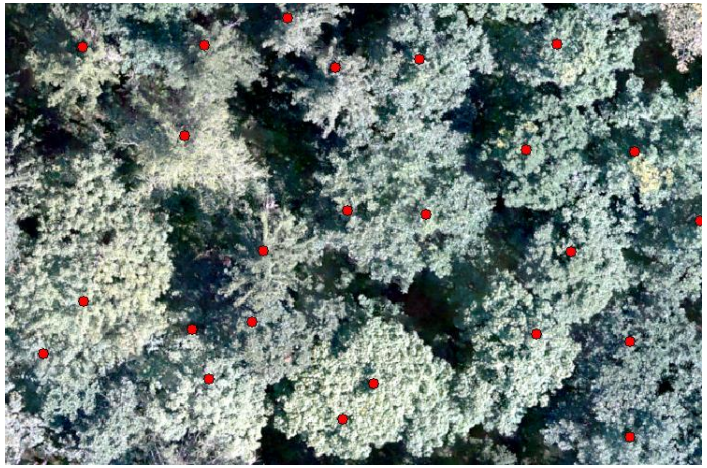
Algorithms

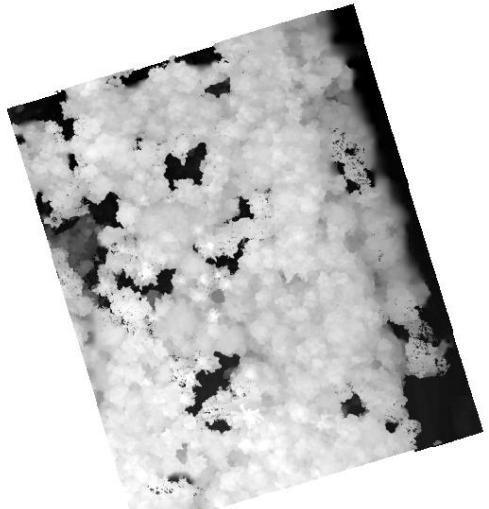
- SIFT
- SURF





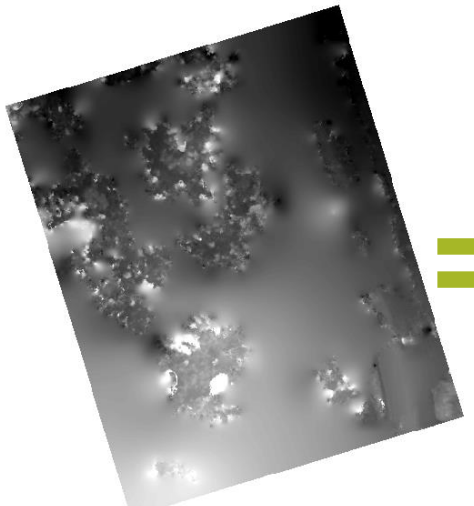
Height estimation





DSM

-

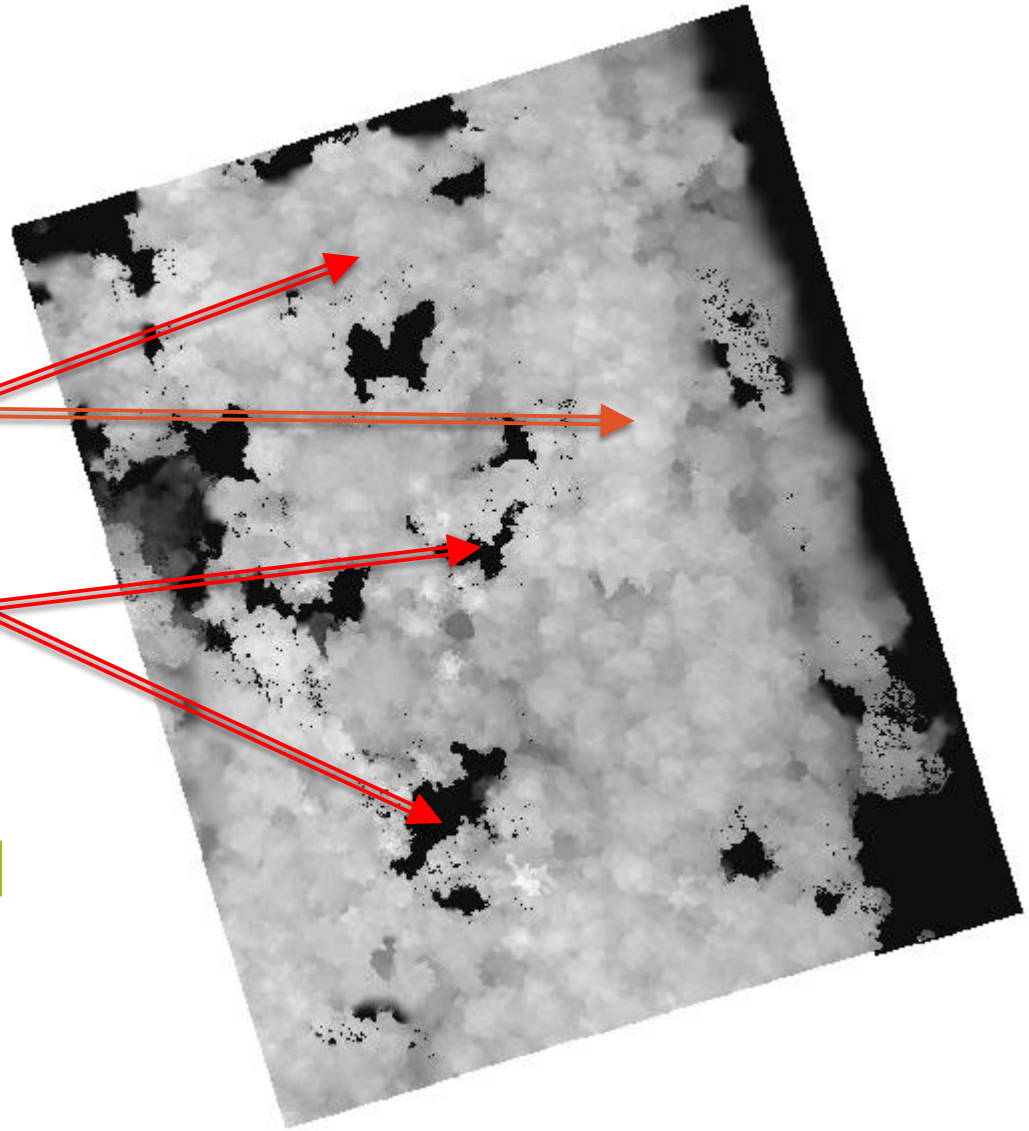


DTM

= nCHM

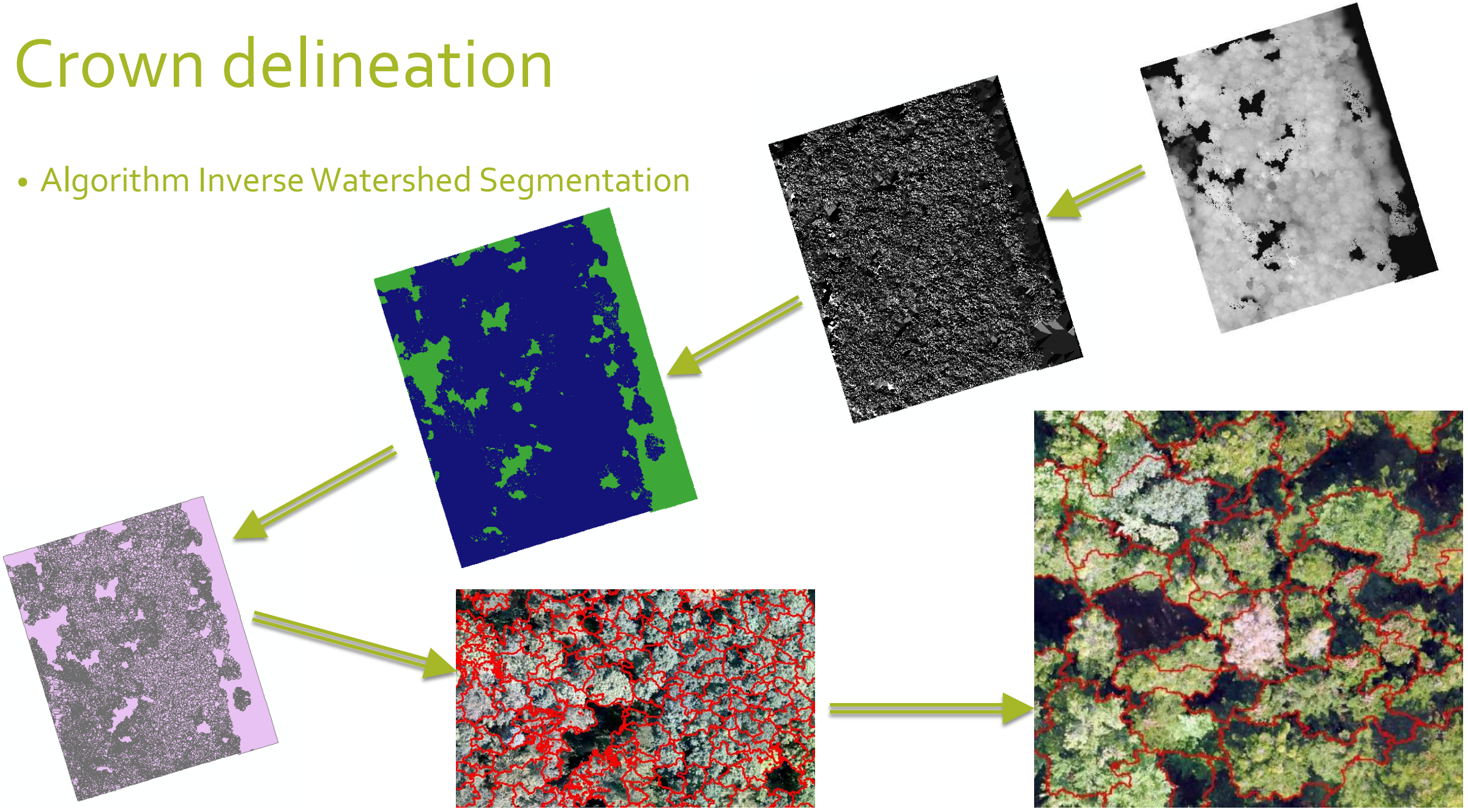
Trees

Gaps



Crown delineation

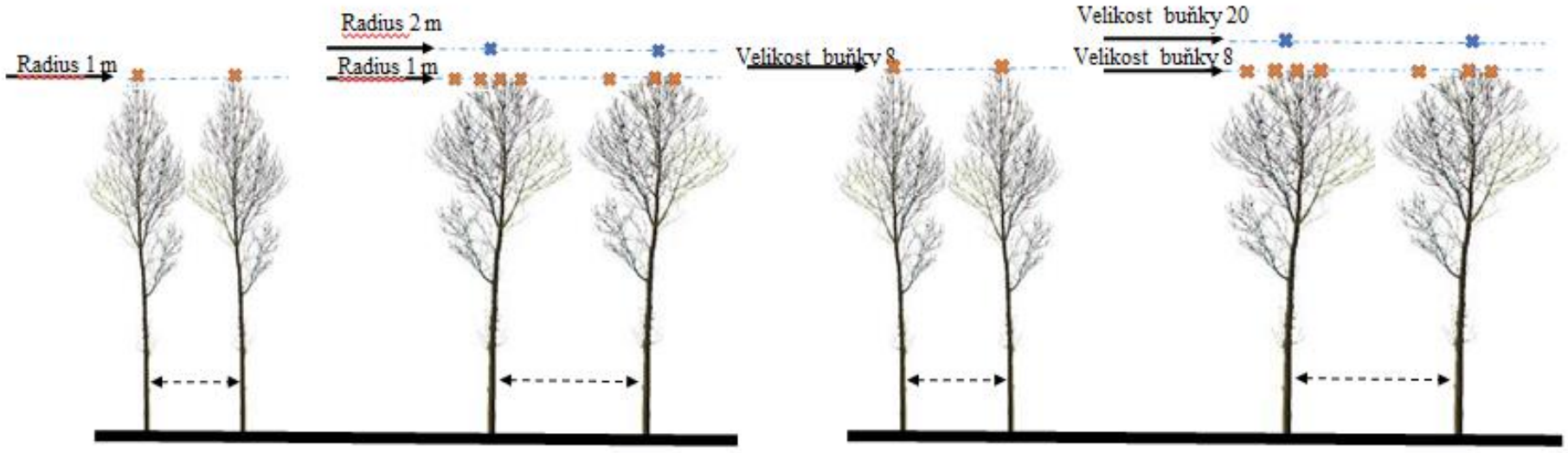
- Algorithm Inverse Watershed Segmentation



Tree detection

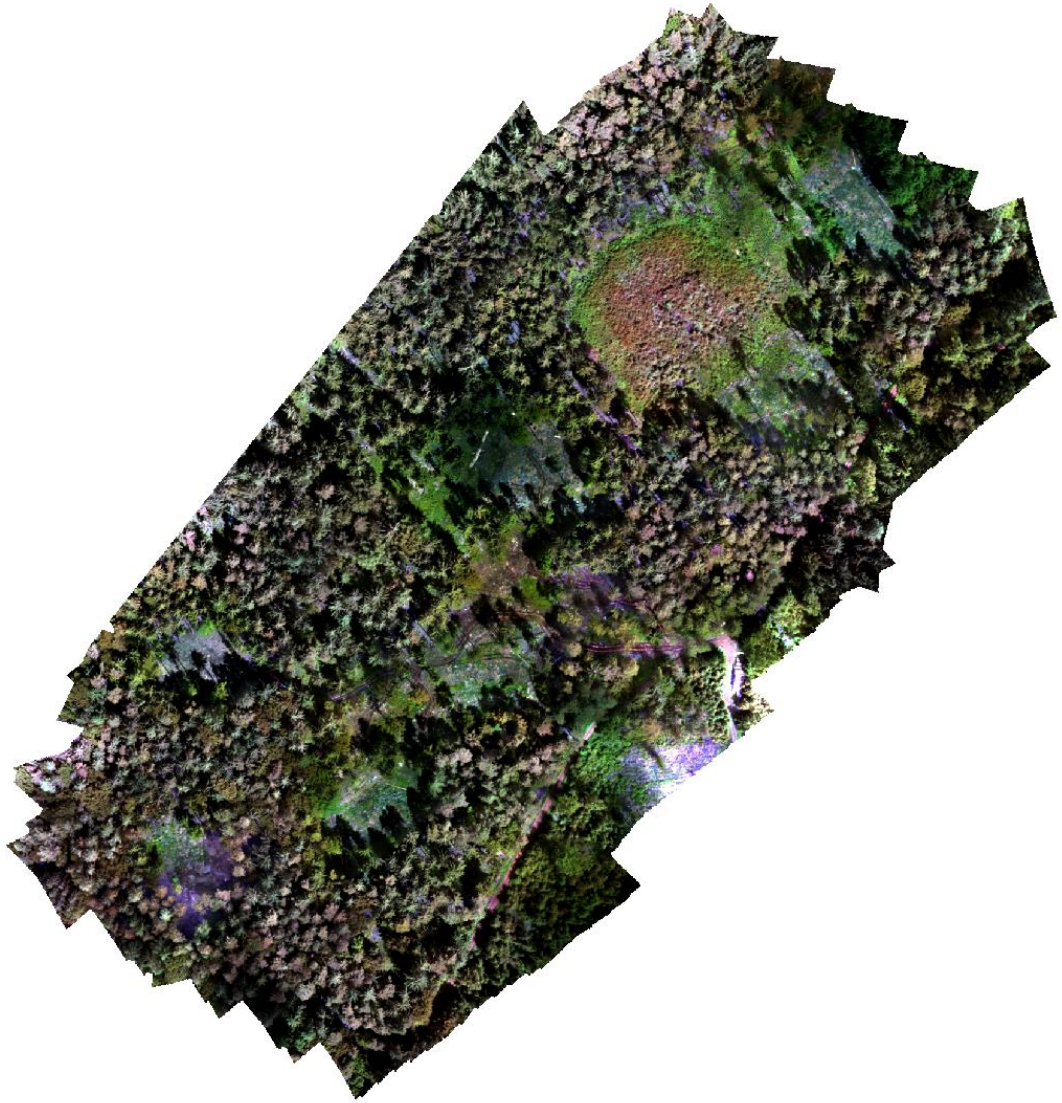
2 steps

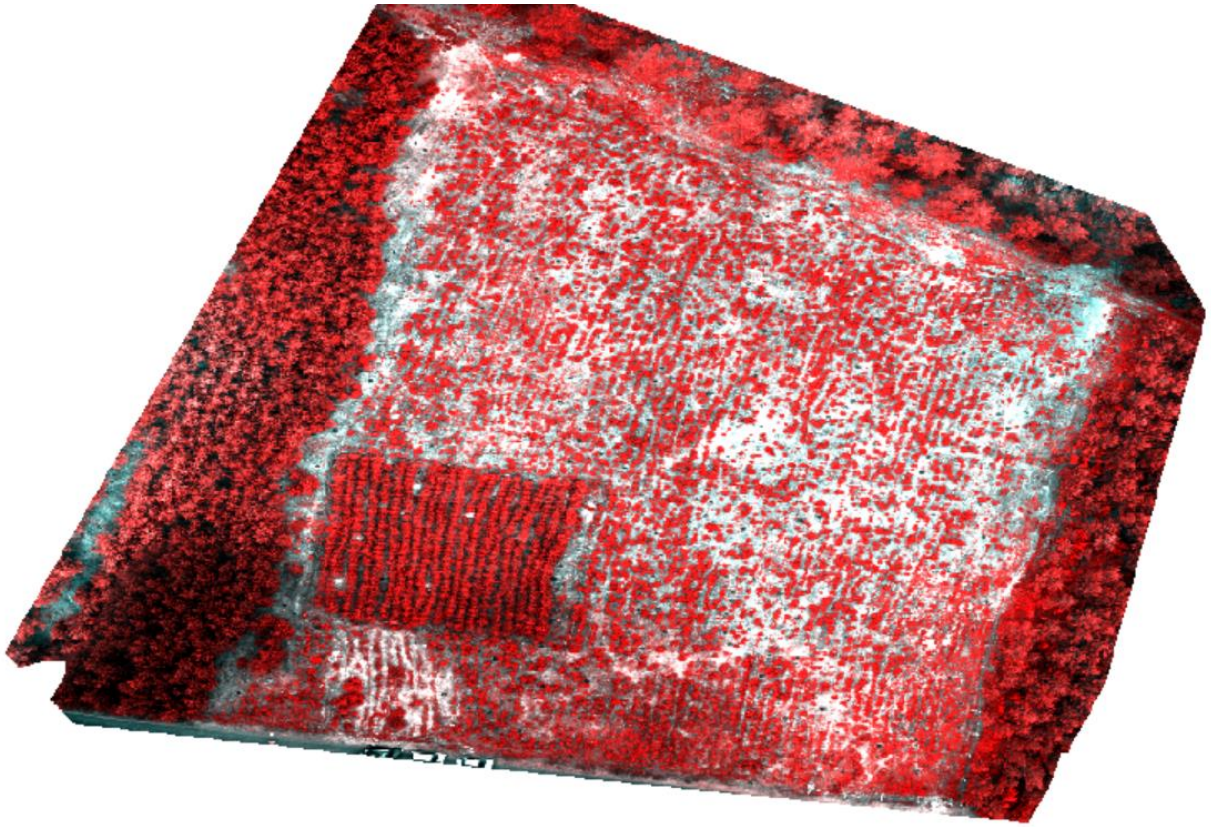
1. Local maxima detection
2. LM Interpretation



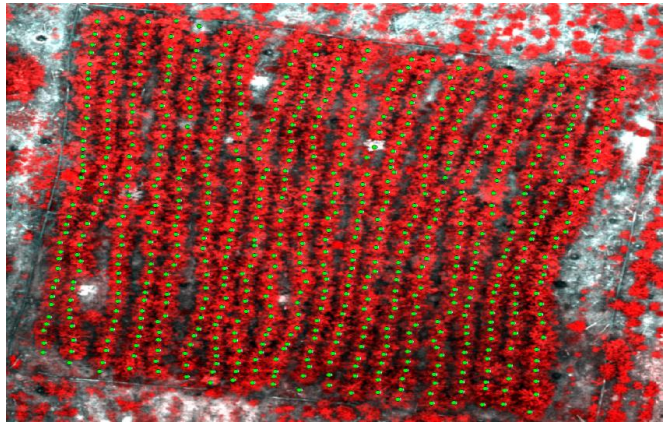
DJI Phantom 4 Multispectral

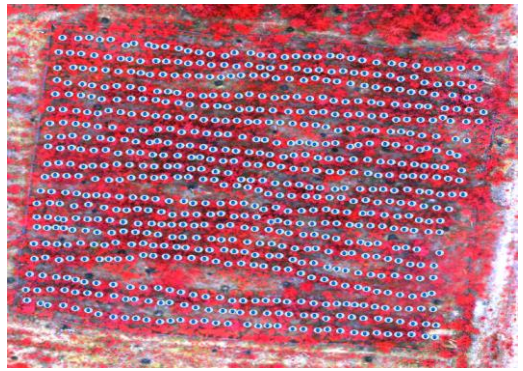
- Max take-off mass 1487 g
- Max flight time 27 minut
- Operation temperature 0° to 40° C
- Max wind speed 8 m/s
- RTK module (1.5 cm V + 1 cm H)
- Each sensor 2.08 MP (1/2.9" CMOS)
- Sensor resolution: Blue: 450 nm ± 16 nm; Green: 560 nm ± 16 nm; Red: 650 nm ± 16 nm; Red edge: 730 nm ± 16 nm; Near-infrared: 840 nm ± 26 nm





FALSE NEGATIVE PICTURE





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5	255	54	101	1
6	255	62	126	1
7	255	63	118	1
8	255	46	93	1
9	236	45	76	1
10	254	42	85	1
11	255	54	101	1
12	255	50	101	1
13	243	46	85	1
14	254	46	85	1
15	254	29	68	1
16	254	58	101	1
17	255	67	109	1
18	255	46	101	1
19	243	41	84	1
20	250	42	92	1
21	254	54	109	1
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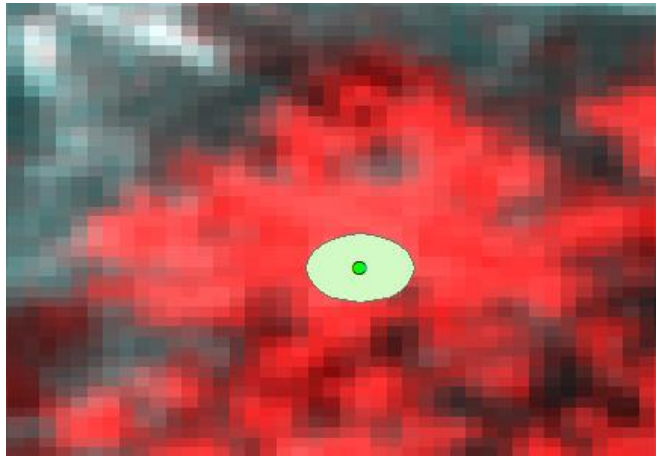
25	240	54	101	1
26	250	38	68	1



- Ortophoto derived in Agisoft Metashape
- Trainig data Arc GIS (pozice a Buffer)
- Data minig - Random Forest v R

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VUX-SYS

VUX-1UAV

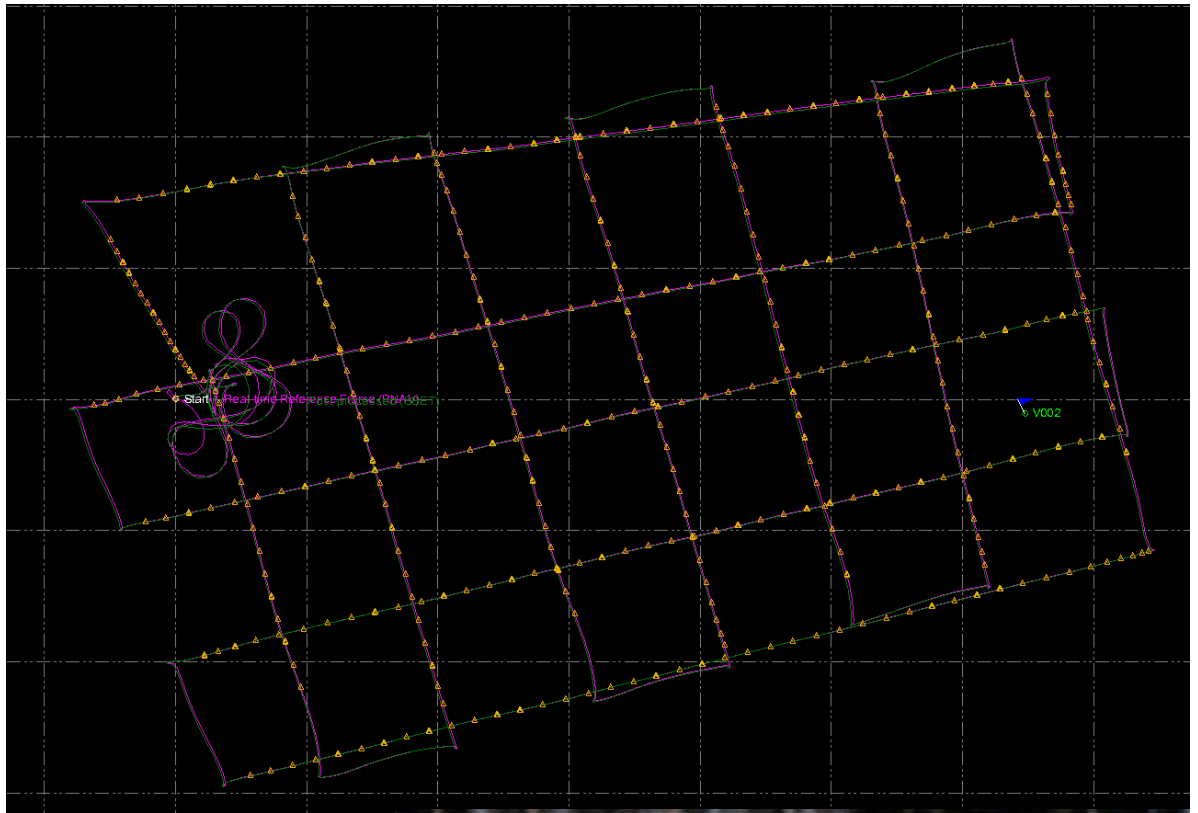
- 200 scans/s
- Frequency 550 kHz
- Range 920m
- 3,5 kg

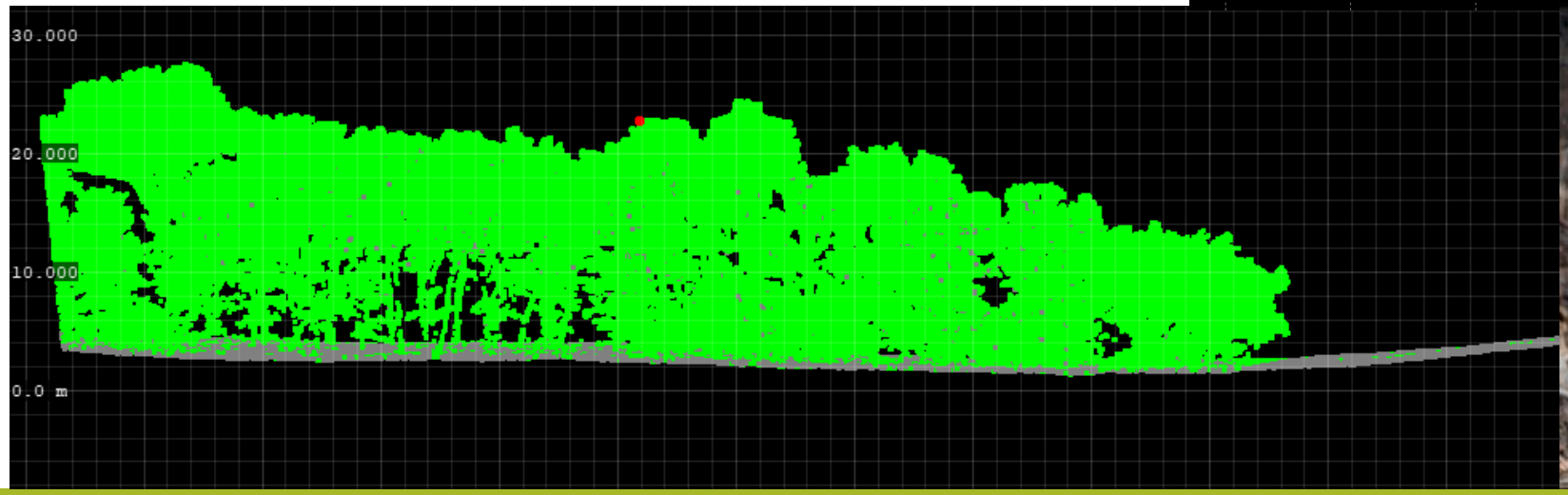
RiCOPTER

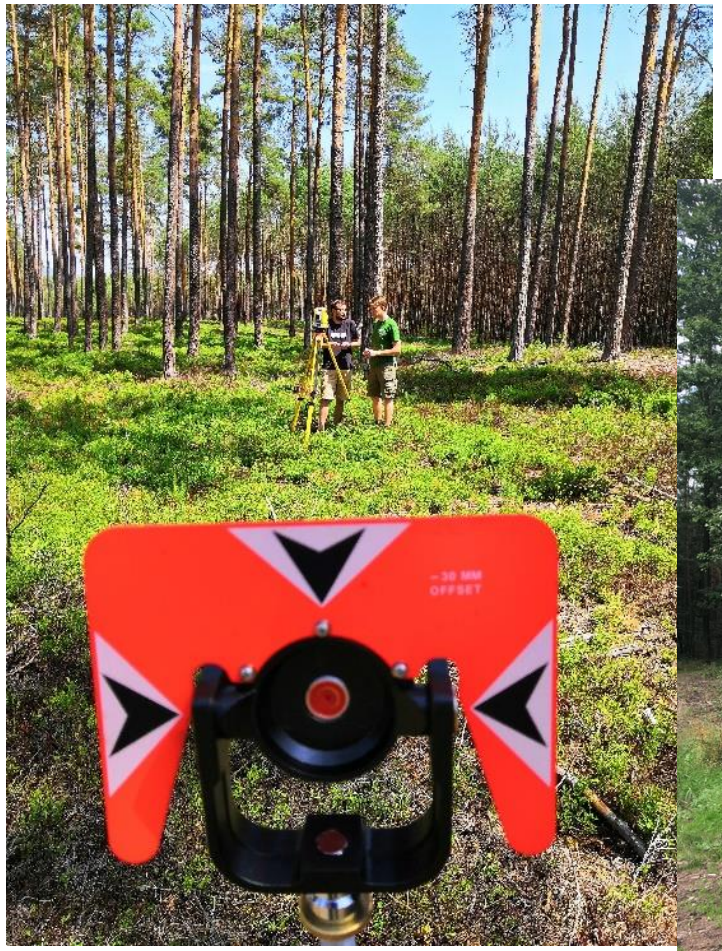
- Maximum take-off mass25 kg (11 kg)
  4 bateries 7,5 kg 29,6 V 12 500 mAh
  Sensors maximum 6,5 kg
- Max flight time28 minut
- Max speed rychlost 14 m/s
- Backup Controll Unit

Data pre - processing

- Trajectory calculations by POSPac MMS for SBET derivation
- Base Station PPK
- Trimble R2 RTK / VRS
- Initial point cloud derivation in RiPROCESS
- Basic filtering and classificaton (noise + ground)



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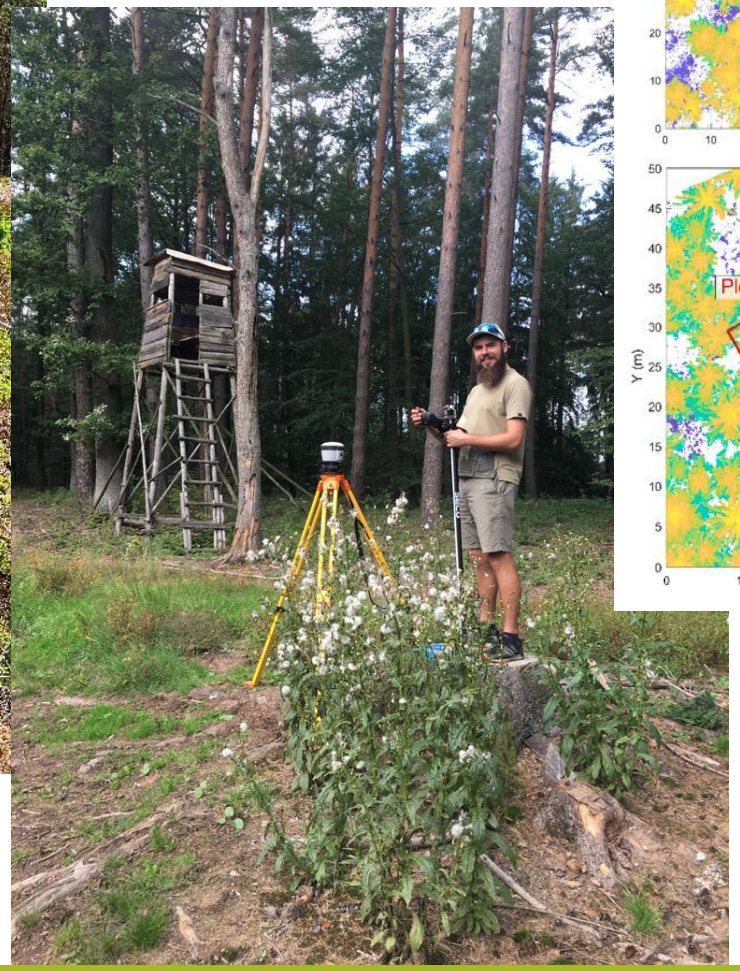
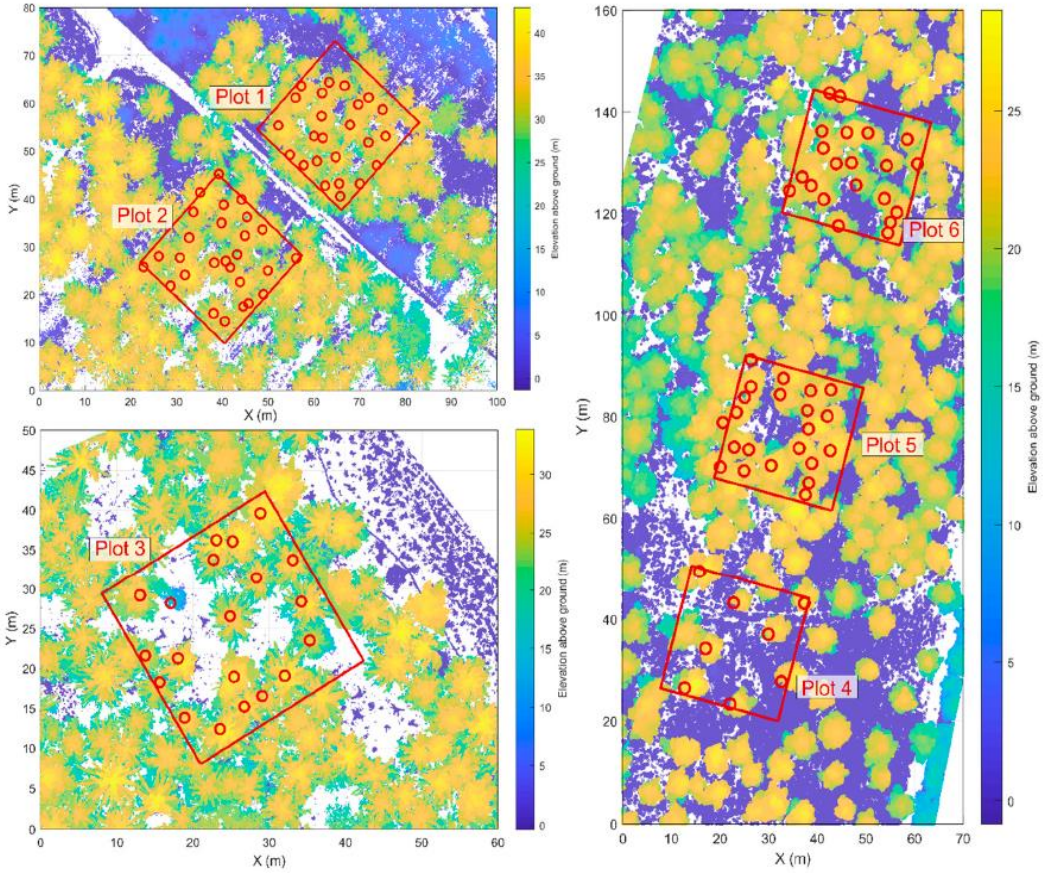
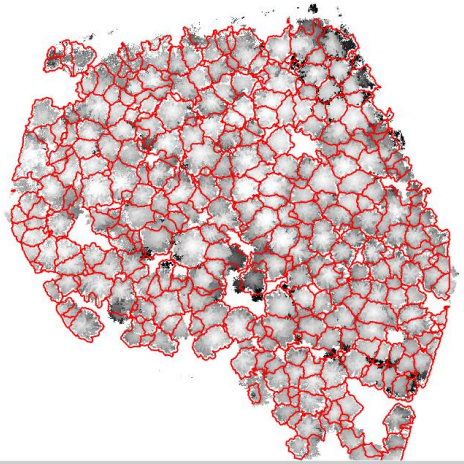
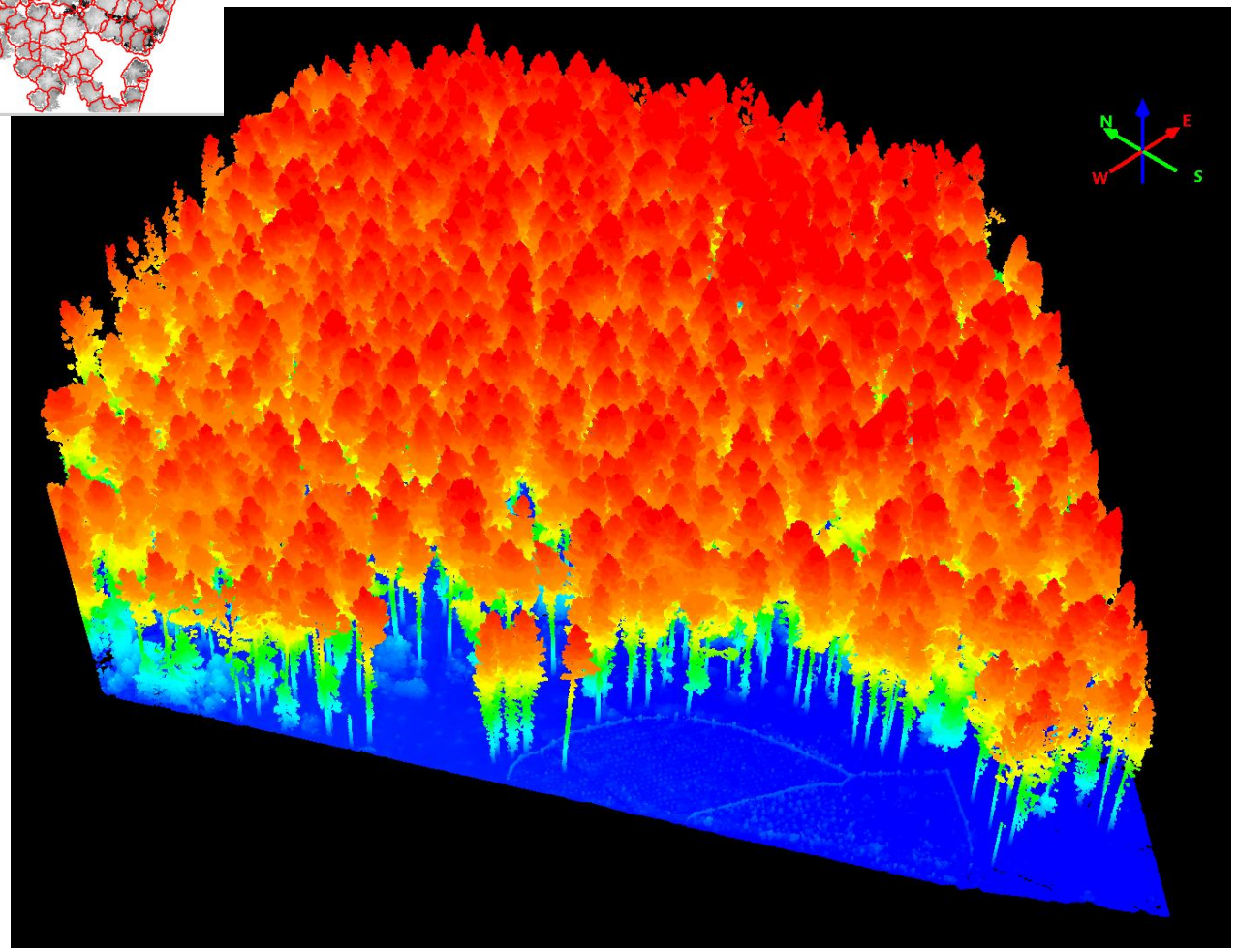
OFFSET




Plot 1
Plot 2
Plot 3
Plot 4
Plot 5
Plot 6
X (m)
Y (m)
Elevation above ground (m)




N
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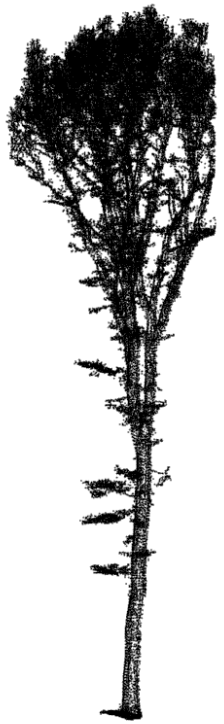

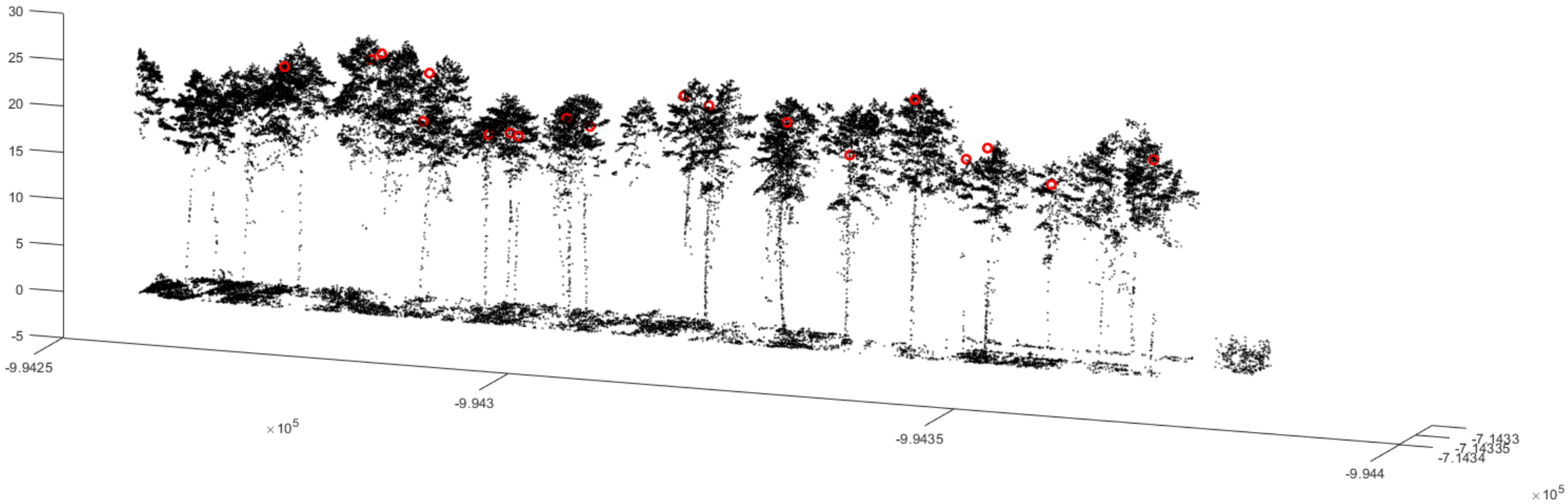
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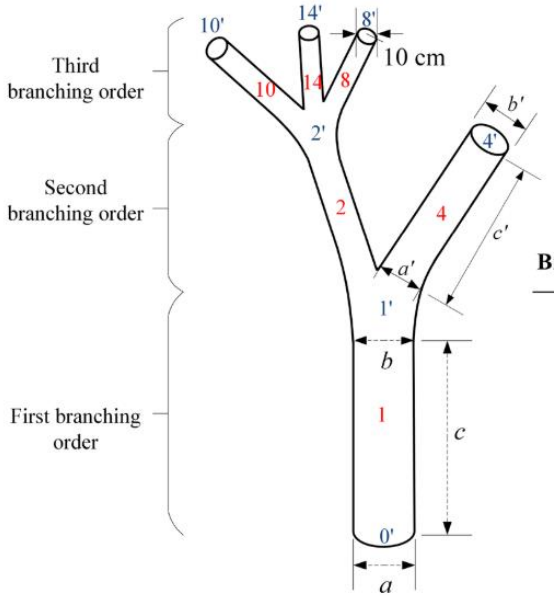
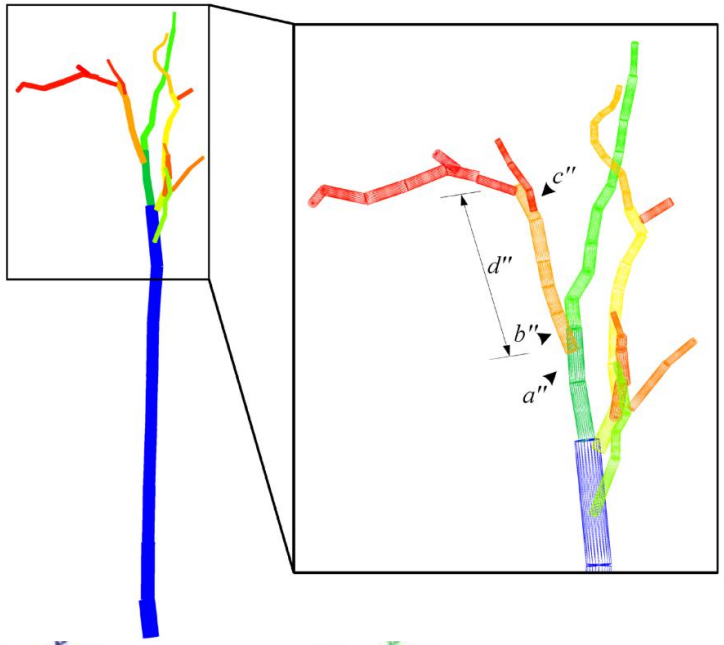
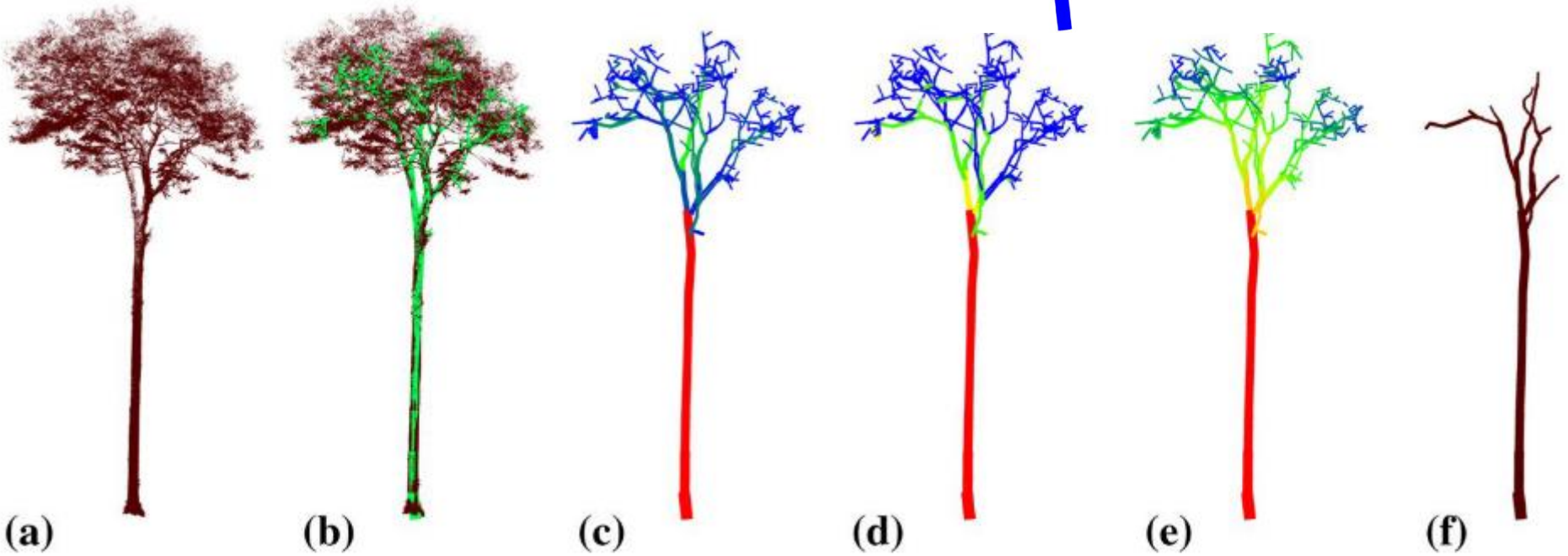
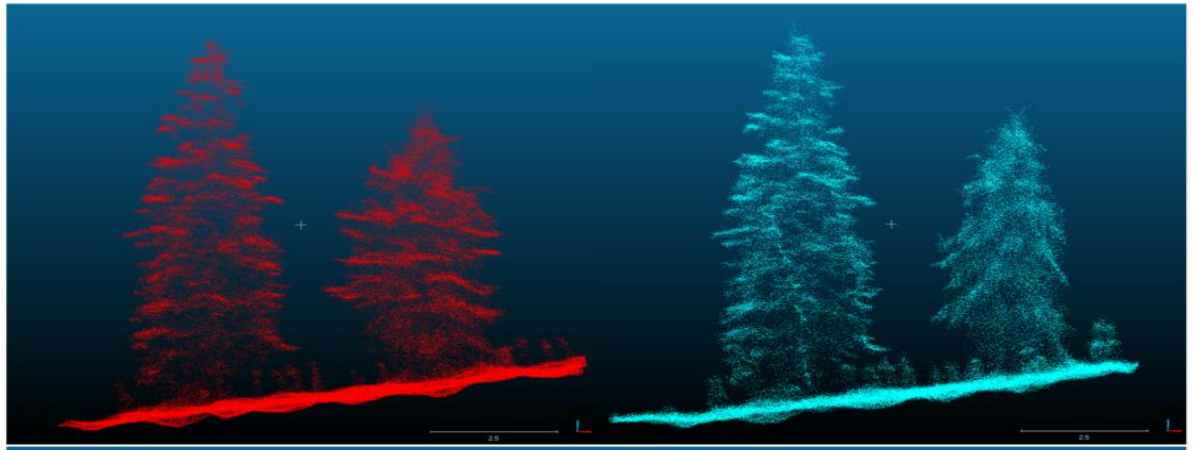
-9.943
-9.9435
-9.944
×10^5
-7.1433
-7.14335
-7.1434
×10^5

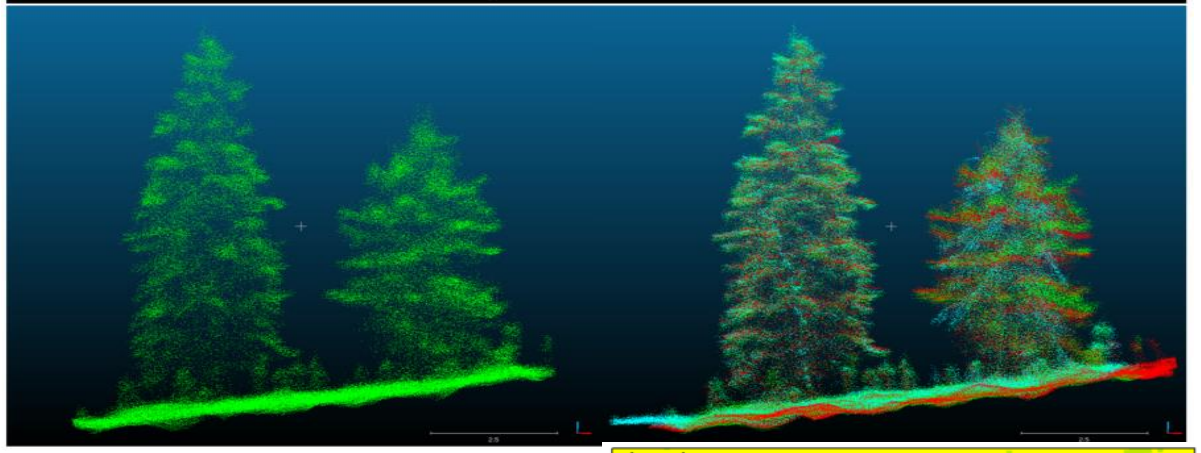


BranchID	Node	Parent branch	Branching order
1	0'	0	1
2	1'	1	2
4	1'	1	2
8	2'	2	3
10	2'	2	3
14	2'	2	3



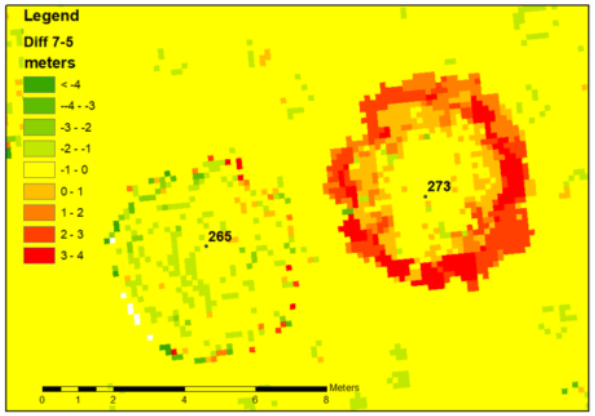


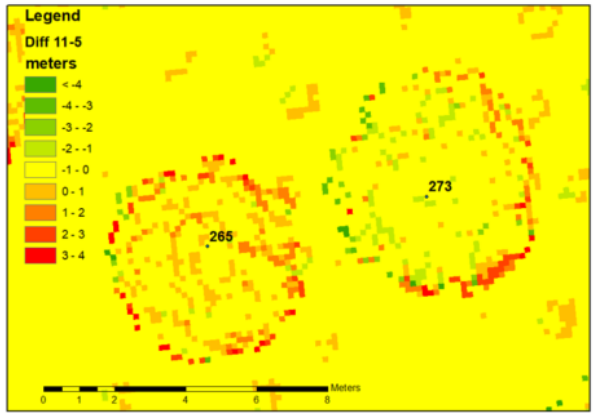




	Estimate	SE	tStat	*p*-Value
Intercept	32.884	22.659	1.451	0.1467
A1	43.728	30.725	1.423	0.1547
A2	6.350	4.130	1.538	0.1241
A5	−53.701	26.340	−2.039	0.0415
A6	−28.857	15.987	−1.805	0.0711
A9	−15.078	8.609	−1.752	0.0798

Dataset	Trees	Change	False Negative	False Positive	Correct
Training	204	29	1	2	28
Validation	204	14	2	5	12





DJI Mavic 2 Enterprise

- Max take-off mass 1100 g
- Max flight time 31 minutes
- Operation temperature -20° to 40° C
- Max wind speed 8 m/s
- RTK module (1.5 cm V + 1 cm H)
- Thermal sensor 640 x 512 pixel 16 x ZOOM
- RGB sensor 48 MP (1/2" CMOS) 32 x ZOOM
- **https://www.youtube.com/watch?v=pt-2vg1FVt8**

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