



“Field plant phenotyping using UAV LIDAR system: current state and first experiences.”

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Building field phenotyping from scratch

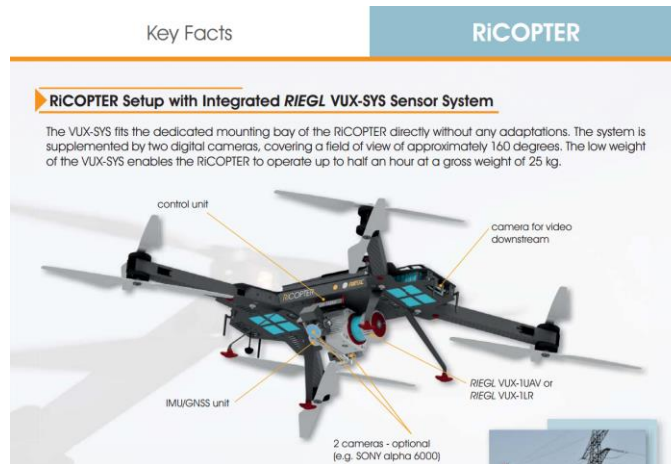
- 9/2018 – beginning of the project
- 10/2018 – sowing of winter rye (26 cultivars) and wheat (64 cv.) experiments
- 11/2018 – aquisition of the equipment (UAV LIDAR system)
- 12/2018 – sowing of garlic experiment (56 cv.)
- 2/2019 – documentation for Civil Aviation authorization for UAV LIDAR system (in progress...)



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Equipment

- What we would like to use...



3

Equipment

- What we would like to use... but we have to wait...

RIEGL VUX-SYS Sensor System Technical Data

System Components	<ul style="list-style-type: none"> • RIEGL VUX-1UAV • IMU/GNSS unit with antenna • control unit • up to 2 cameras (optional)
RIEGL VUX-1UAV Scanner Performance when integrated in RiCOPTER Field of View (FOV) max. effective measurement rate max. range @ target reflectivity 20 % minimum range range accuracy Laser Safety Class according to IEC 60825-1:2014	230° up to 350,000 meas./sec 550 m 3 m 10 mm Laser Class 1 (eye safe)
IMU/GNSS Unit accuracy Roll, Pitch / Heading IMU sampling rate position accuracy (typ.)	0.015° / 0.035° 200 Hz 0.05 m - 0.3 m
Camera Interfaces	2x trigger and event marker

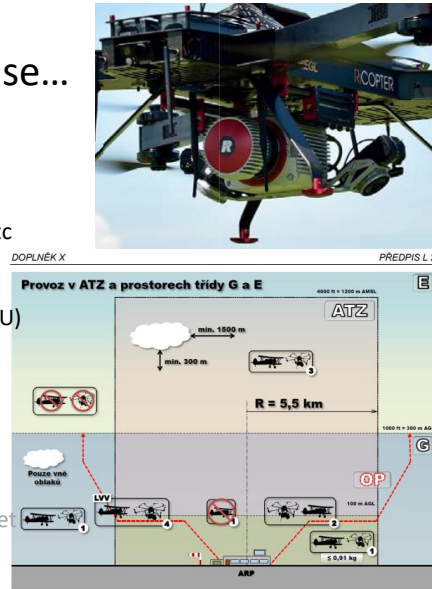
The VUX-SYS Sensor System can also be equipped with the RIEGL VUX-1LR (details on request).
Details to be found in the latest RIEGL VUX-1UAV, VUX-1LR & VUX-SYS data sheets.

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Equipment

• What we would like to use...

- until now we have to solve:
- provide complete description of Ricopter system to CAA
 - technical parameters, standard procedures, emergency procedures...etc
 - more than 100 pages operation book
- train pilots (5 days in Riegl LMS, Horn, AU)
- train operators (5 days in Riegl LMS, Horn, AU)
- put request to CAA to get licence „student pilot“
- pay insurance
 - pass theoretical exam
 - pass practical exam of pilot skills
- provide documentation nad pay to CAA to get authorization for „aerial operations“



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Equipment

• In a meantime we use:



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Equipment

- Every experimental field block was georeferenced



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Data processing



Agisoft

- Align Photos - High
- Build Mesh
 - Surface Type: Height Field (2.5D)
 - Source Data: Sparse cloud
 - Face Count: High (90,000)
- Build Orthomosaic
 - Pixel size: 1 mm
- Export do TIFF



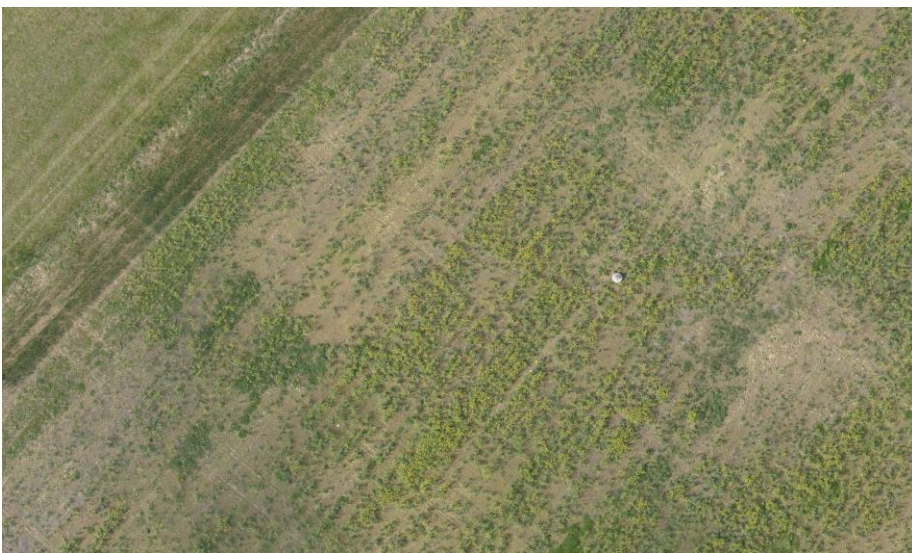
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example – canola



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example – canola



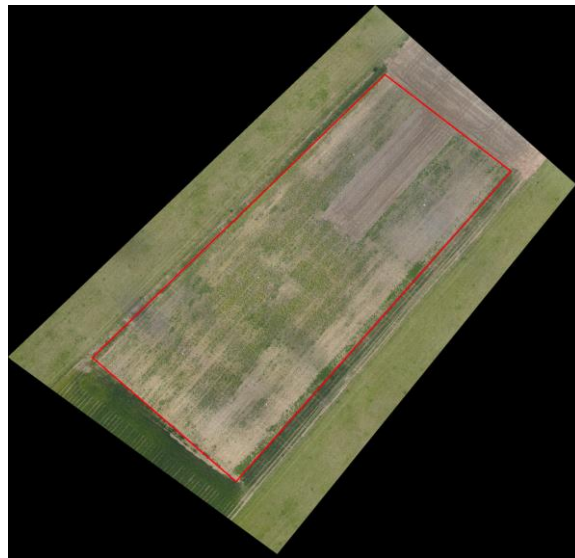
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example – canola



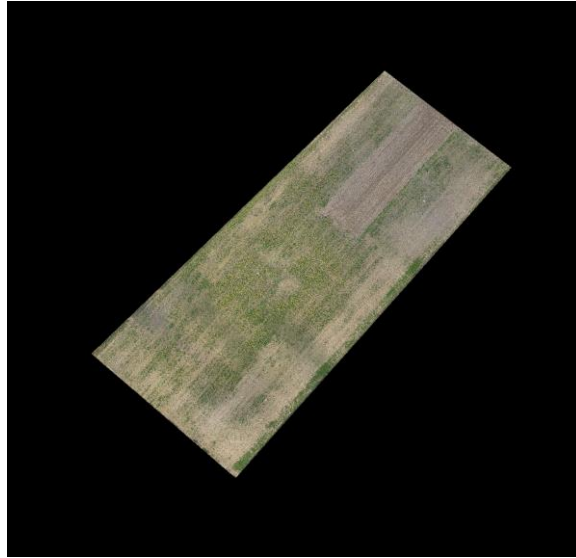
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Image analysis



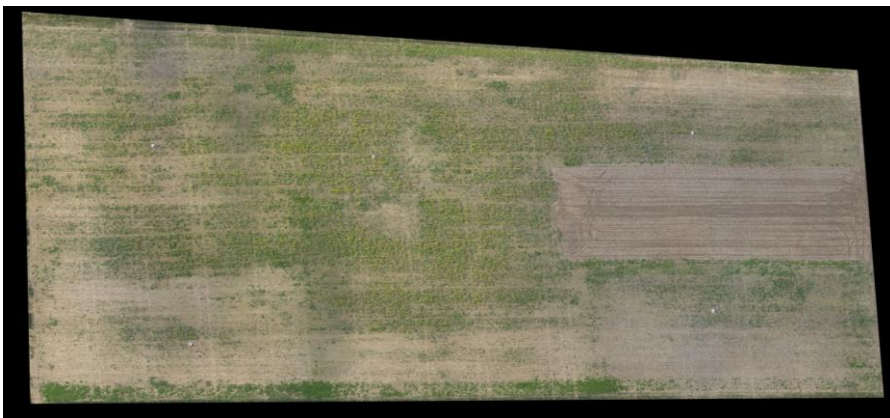
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Image analysis



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Image analysis



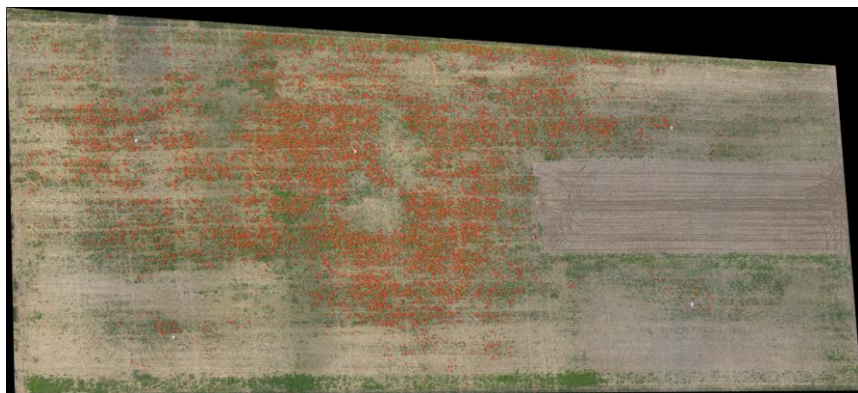
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Image analysis – green parts of plants



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Image analysis – canola flowers



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Image analysis – canola flowers



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example- LAI in winter wheat

March 22nd

4 %

April 15th

88 %

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example - winter rye 3D canopy model

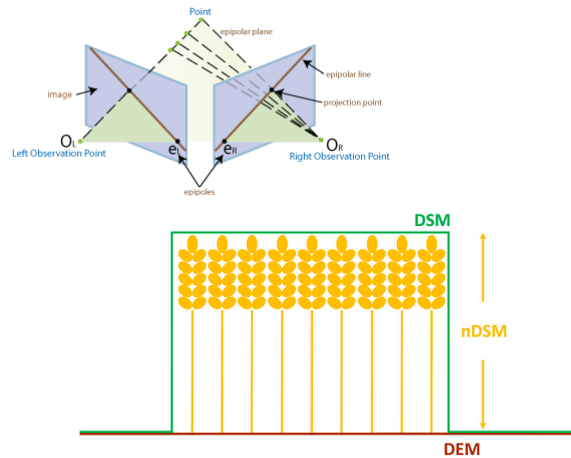


Figure 4. Visual representation of the Digital Surface Model (DSM), normalised Digital Surface Model (nDSM) and Digital Elevation Model (DEM).

Holman et al., *Remote Sens.* **2016**, *8*, 1031; doi:10.3390/rs8121031

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example - winter rye 3D canopy model



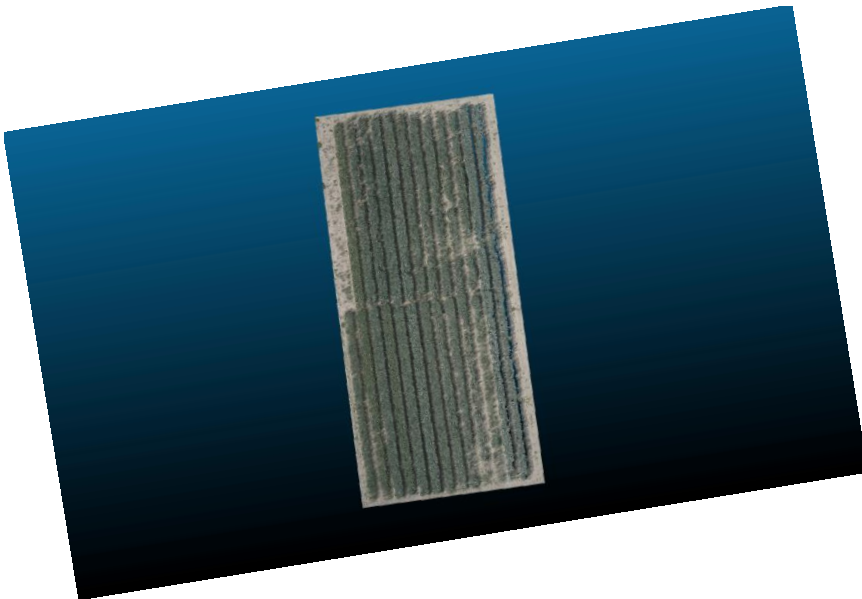
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example - winter rye 3D canopy model



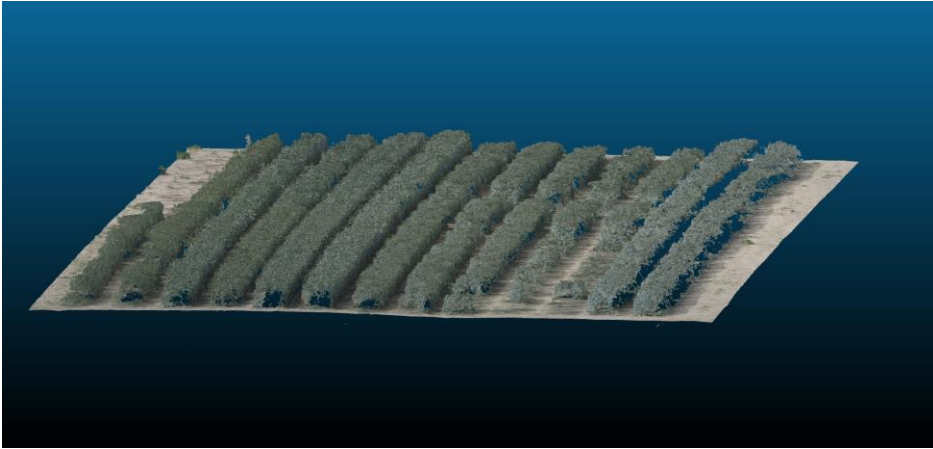
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example - winter rye 3D canopy model



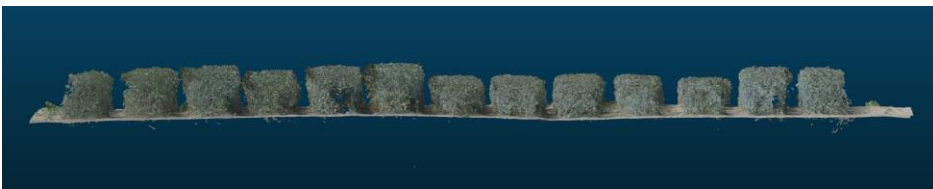
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example - winter rye 3D canopy model



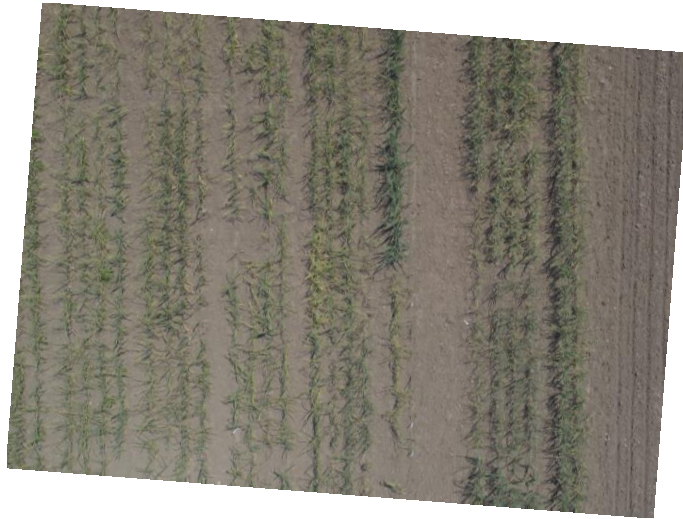
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example - winter rye 3D canopy model



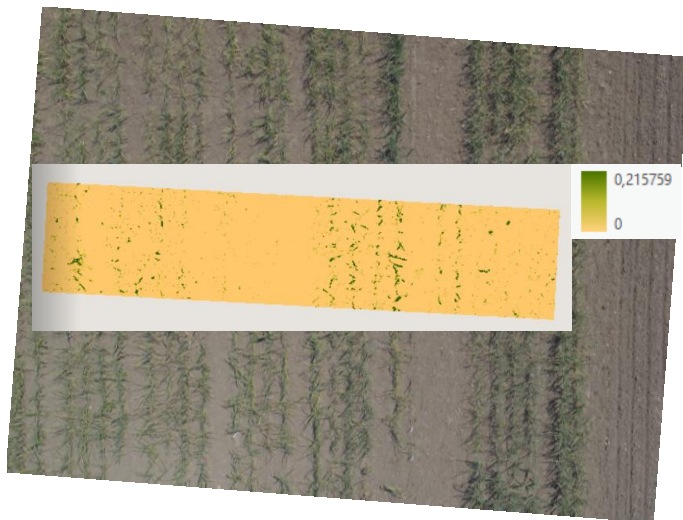
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example - garlic 3D canopy model



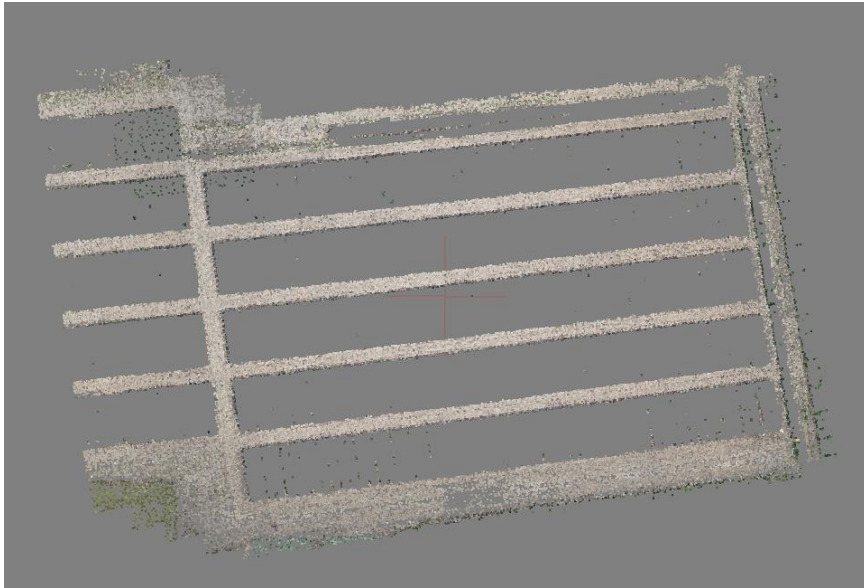
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example - garlic 3D canopy model



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example – 3D canopy model - problems



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Thank you for your attention!



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