SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

USE OF INEXPENSIVE UAV SYSTEMS FOR ENVIRONMENTAL APPLICATIONS (CASE STUDIES REVIEW)

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Content

- Overview of models and characteristics of various types of drones for photogrammetry
- Operating the drone – basics of image acquisition
- Case studies

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UAV/drones

- **UAV** – Unmanned aerial vehicle also known as **drone** (dynamic remotely operated navigation equipment)

- The flight of the drone is remotely operated by a drone operator or it can be done automatically by the drone software

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Parts of the UAV system

Software

Drone

Remote controller

GNSS base station

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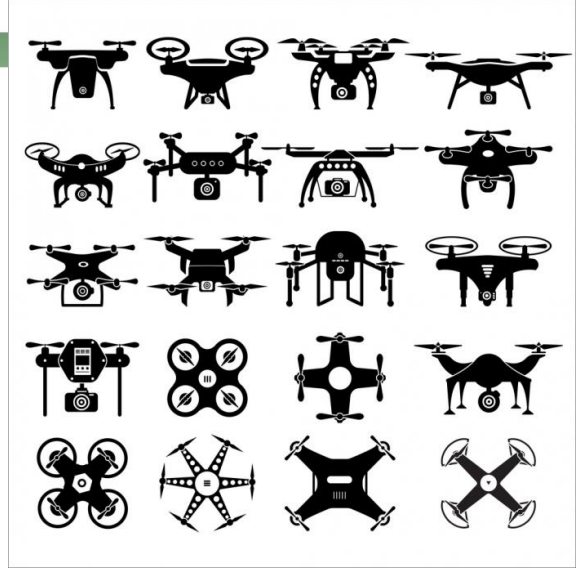
Overview of models and characteristics of various types of drones for photogrammetry



Bicopter

Tricopter

Quadcopter

Pentacopter

Hexacopter

Octocopter

1. Multi rotor drones

DJI MAVIC PRO

2. Fixed wing drones

senseFly eBee X

3. Single rotor drones

Vapor 55 UAV Helicpoter

4. Fixed wing hybrid VTOL (vertical take – off and land)

Falcon Vertigo

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DJI Phantom 4 RTK vs. WingtraOne

Although they are both marketed as survey and mapping drones, WingtraOne and Phantom 4 RTK have little in common. As a VTOL drone (vertical takeoff and landing), the WingtraOne is a hybrid between a fixed-wing and a multirotor. It lifts off and lands vertically, but for flight it transitions into a fixed-wing mode. Phantom 4 RTK is a typical multirotor, which behaves in the air like a helicopter. Because of this fundamental difference, WingtraOne delivers much broader coverage required by the majority of mapping projects, while multirotors like Phantom 4 RTK can only cover limited areas.

In fact, according to our test flights for coverage, on a full battery, WingtraOne can cover almost 14 times more than Phantom 4 RTK at the same 1.2 cm (0.5 in)/px GSD. Phantom 4 RTK covered 8 ha (20 ac) and the WingtraOne covered 110 ha (272 ac) in one flight.

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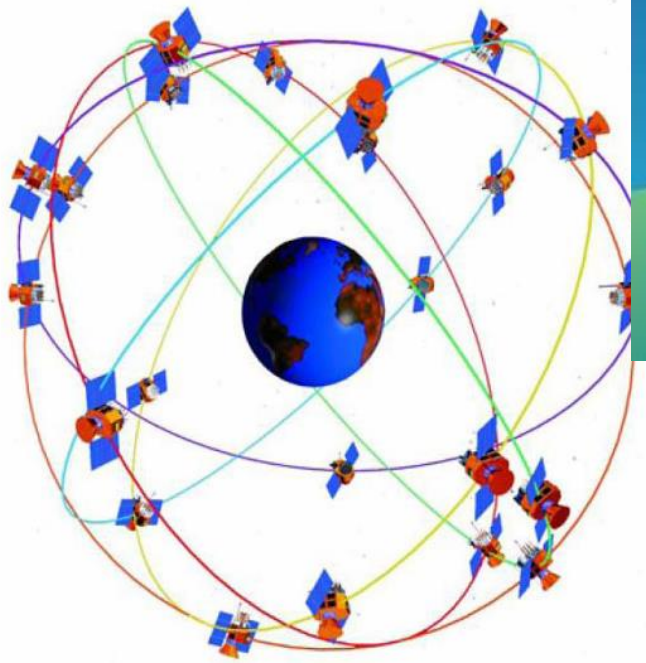
https://wingtra.com/best-drones-for-photogrammetry-wingtraone-comparison/phantom-4-rtk-vs-wingtra/

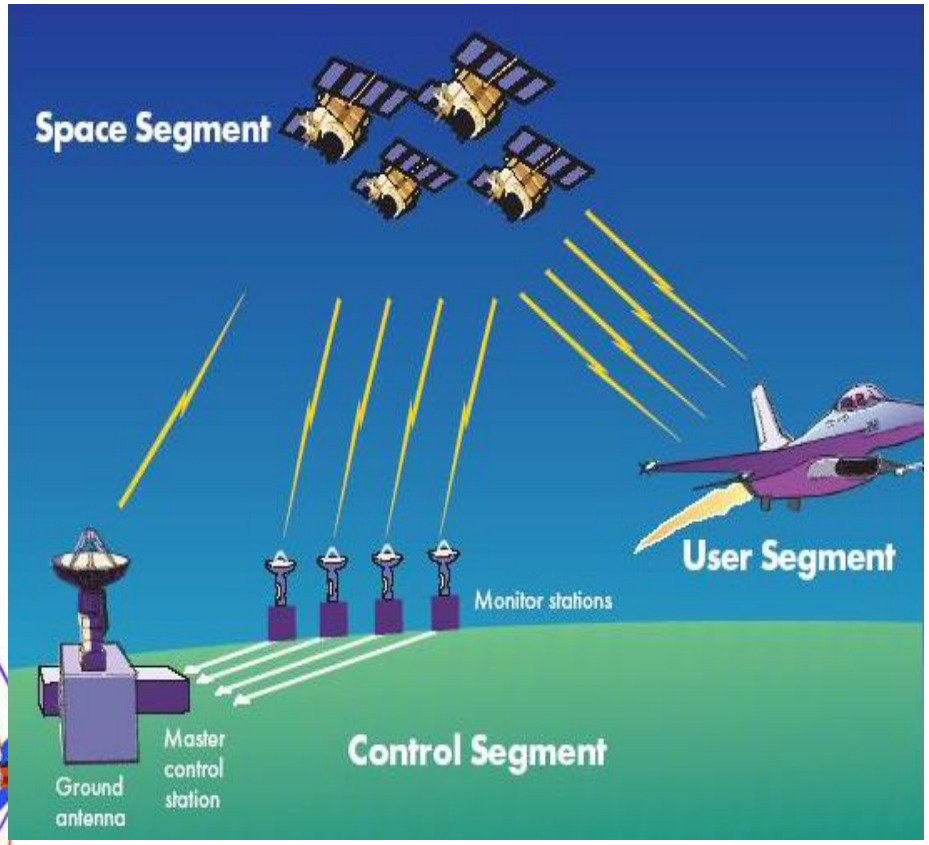
GNSS (Global Navigation Satellite System)

- It is constituted of 3 segments:
  - Control segment
  - Space segment
  - User segment (drone)

- The accuracy using this system varies from 3-10m

If we want to improve the quality we should introduce a ground base station (Differential GNSS/RTK)





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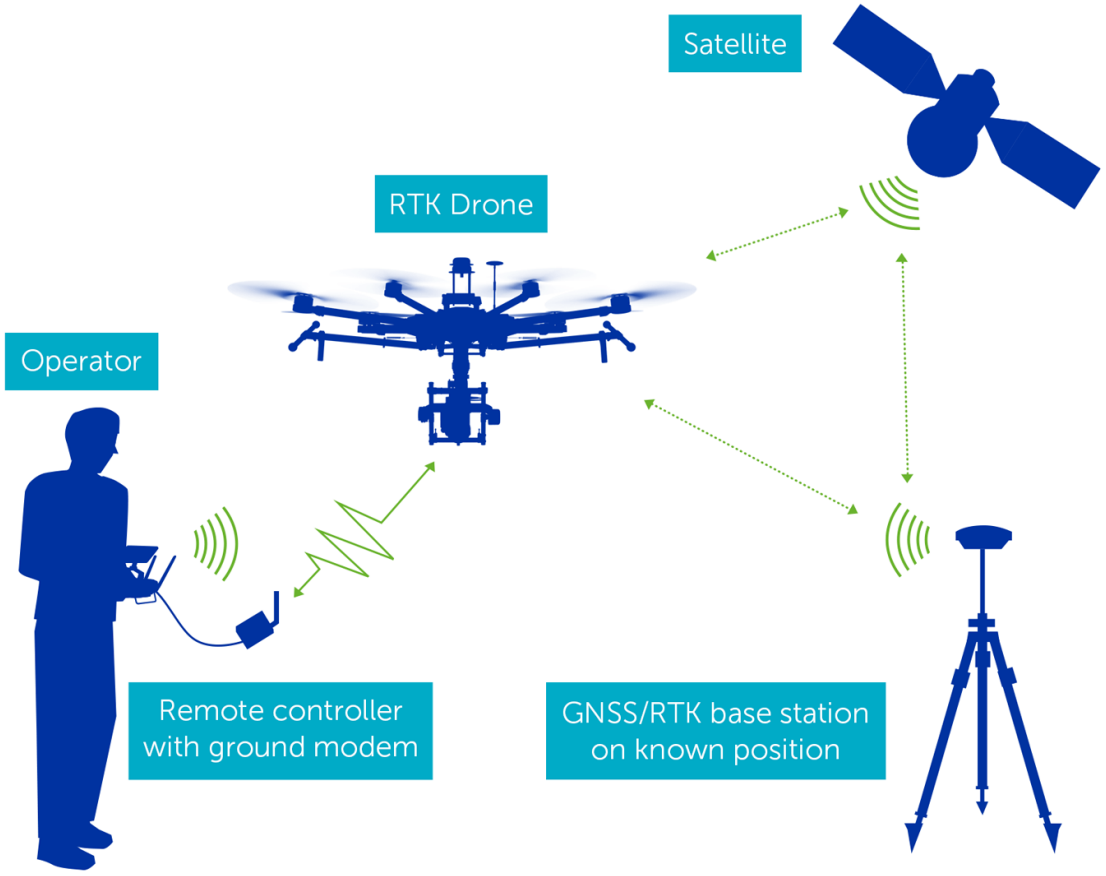
RTK – Real Time Kinematic

PPK – Post Processing Kinematic

Real-time kinematic positioning (**RTK**) is a satellite navigation technique used to enhance the precision of position data derived from satellite-based positioning systems (global navigation satellite systems, GNSS) such as GPS, BeiDou, GLONASS, Galileo and NavIC. It uses measurements of the phase



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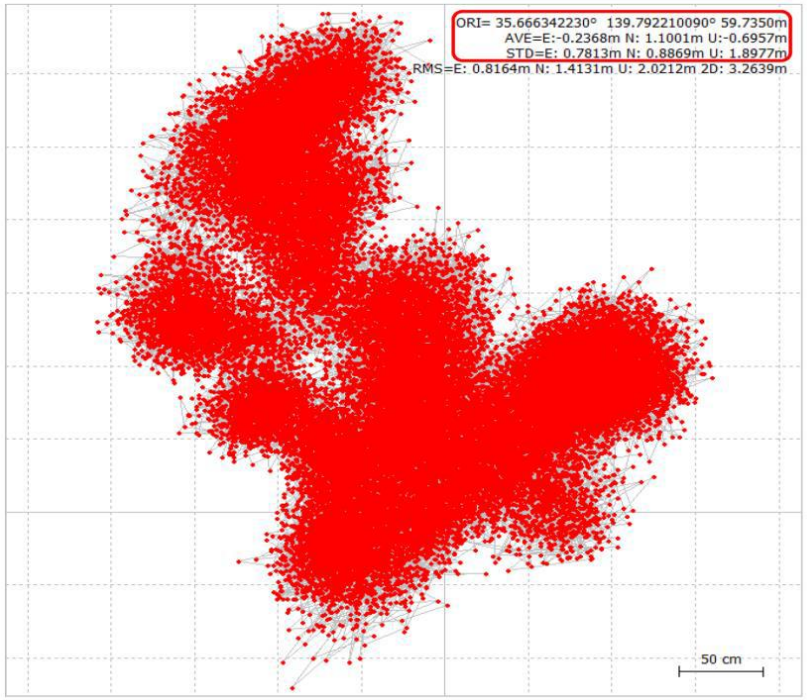
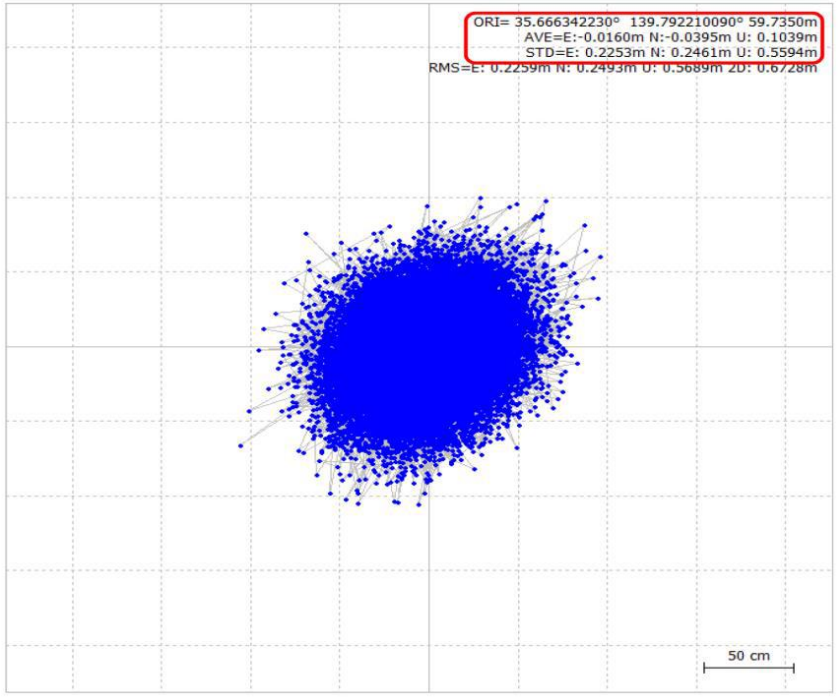
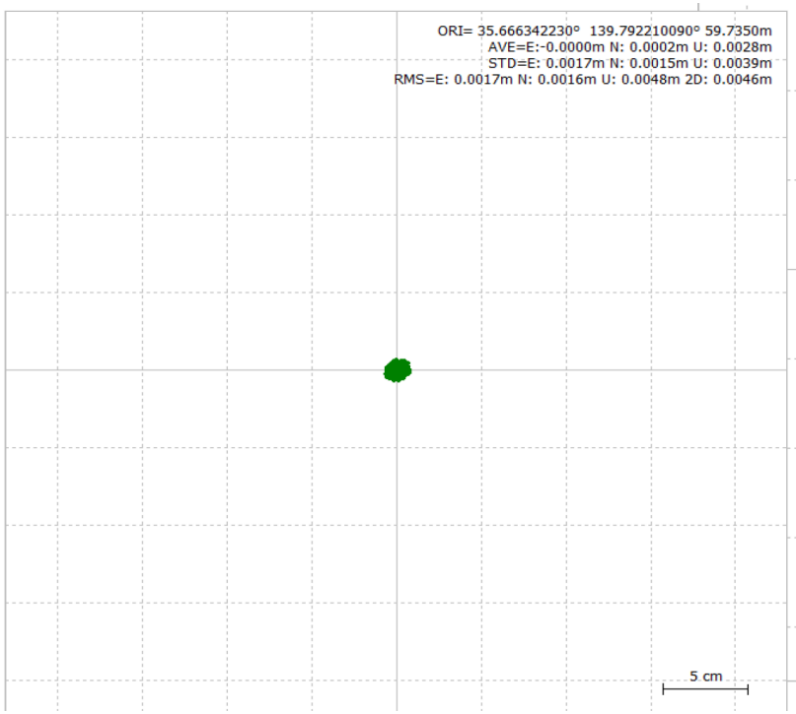
GNSS accuracy



SPP (Single Point Position) regular GNSS receiver



Differential GNSS



RTK (Real time kinematic)

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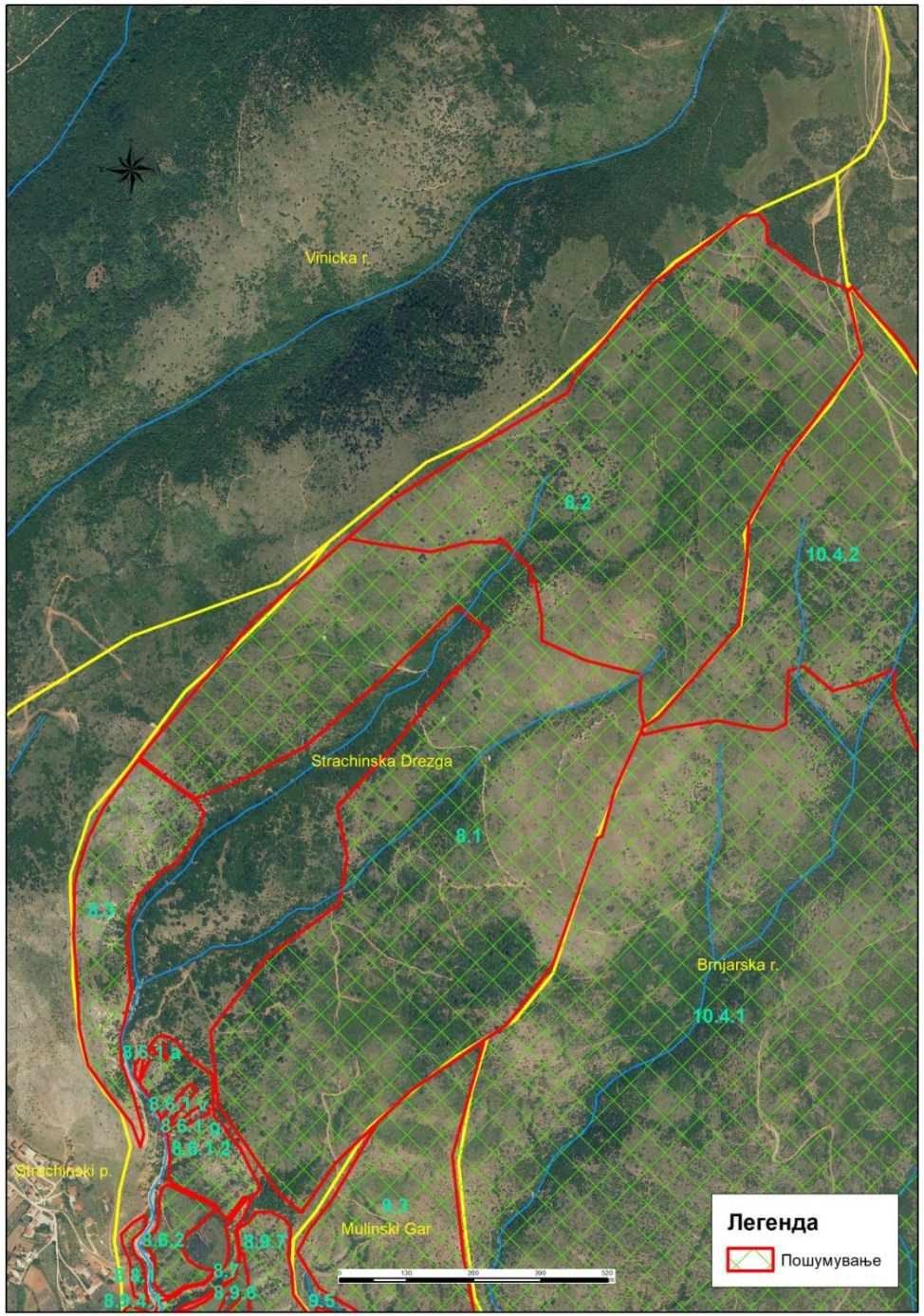
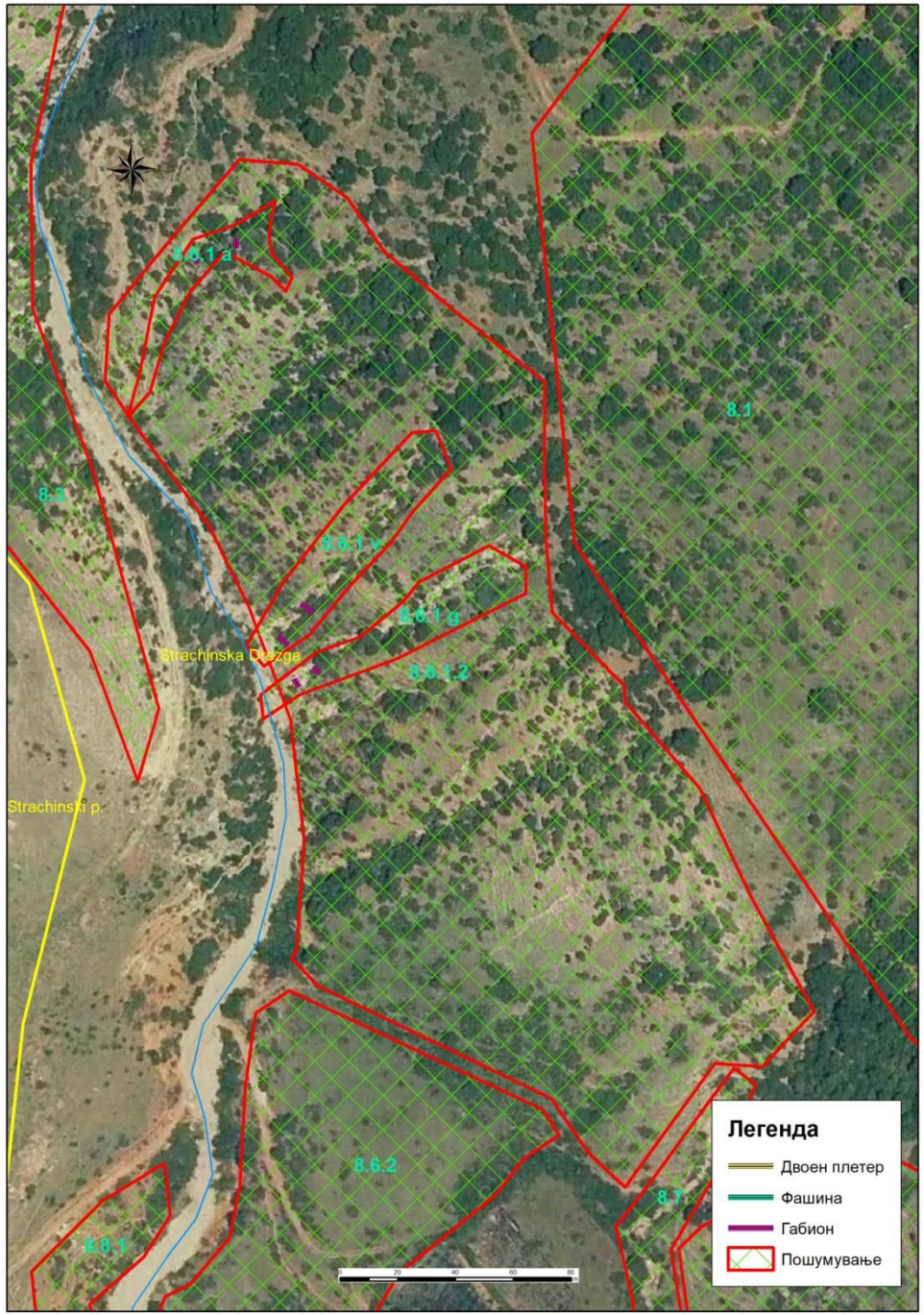
DJI Mavic pro (1st version)

Sensor	1/2.3" (CMOS), Effective pixels:12.35 M (Total pixels:12.71M)
Lens	FOV 78.8° 26 mm (35 mm format equivalent) f/2.2 Distortion < 1.5% Focus from 0.5 m to ∞
ISO Range	video: 100-3200 photo: 100-1600
Electronic Shutter Speed	8s -1/8000 s
Image Size	4000×3000


Vinicka r.
8.2
10.4.2
Strachinska Drezga
8.1
8.3
Brnjarska r.
10.4.1
8.6.1 a
8.6.1 g
8.6.1 d
8.6.1.2
Strachinski p.
9.3
Mulinski Gar
8.8.2
8.9.7
8.7
8.9.6
8.9.4.1
9.5
Легенда
Пошумување


8.6.1 a
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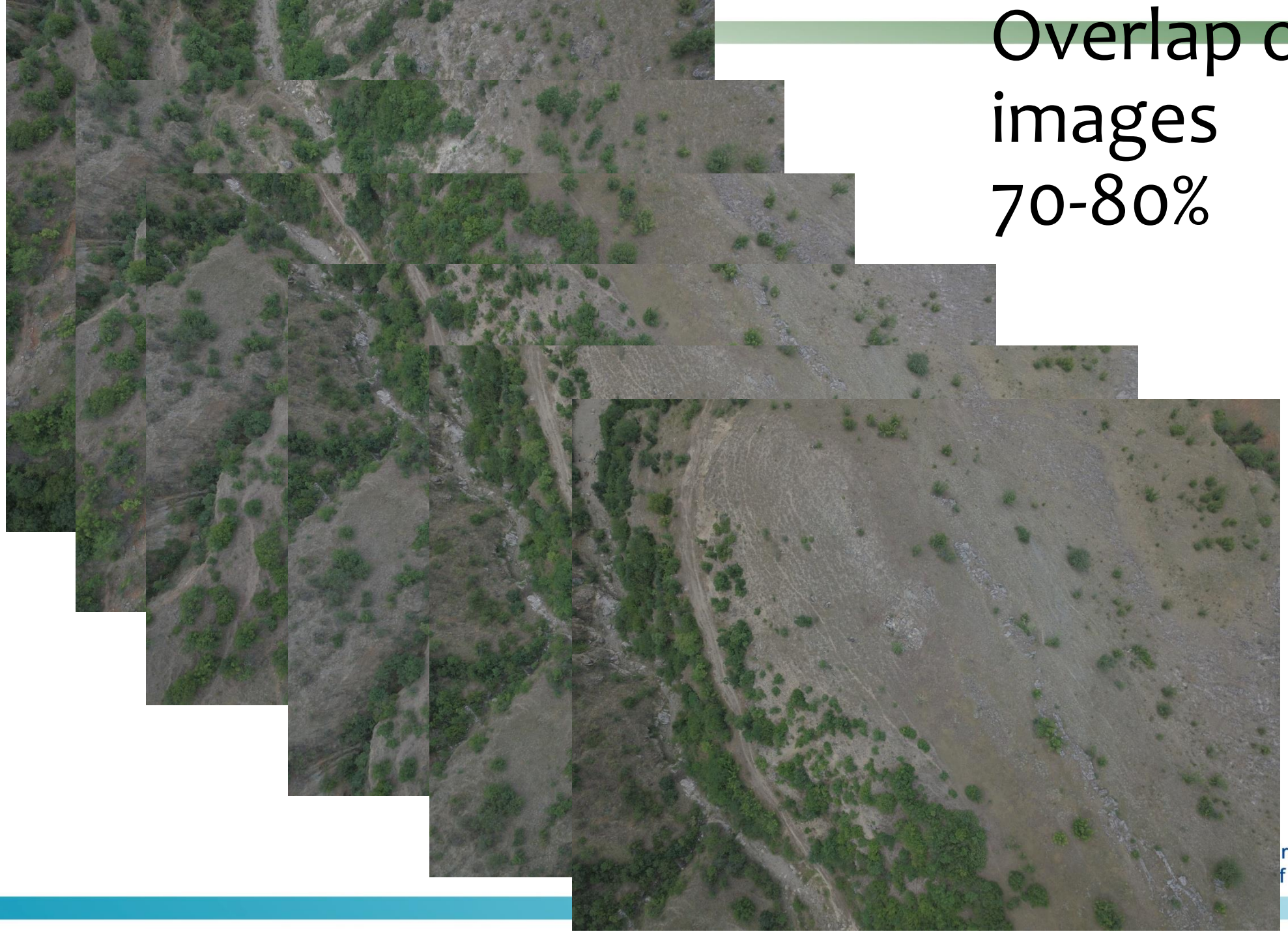
8.6.1 v
8.6.1 g
Strachinska Drezga
8.6.1.2
Strachinski p.
8.6.2
8.7
8.8.1
Легенда
Двоен плетер
Фашина
Габион
Пошумување

Overlap of images 70-80%



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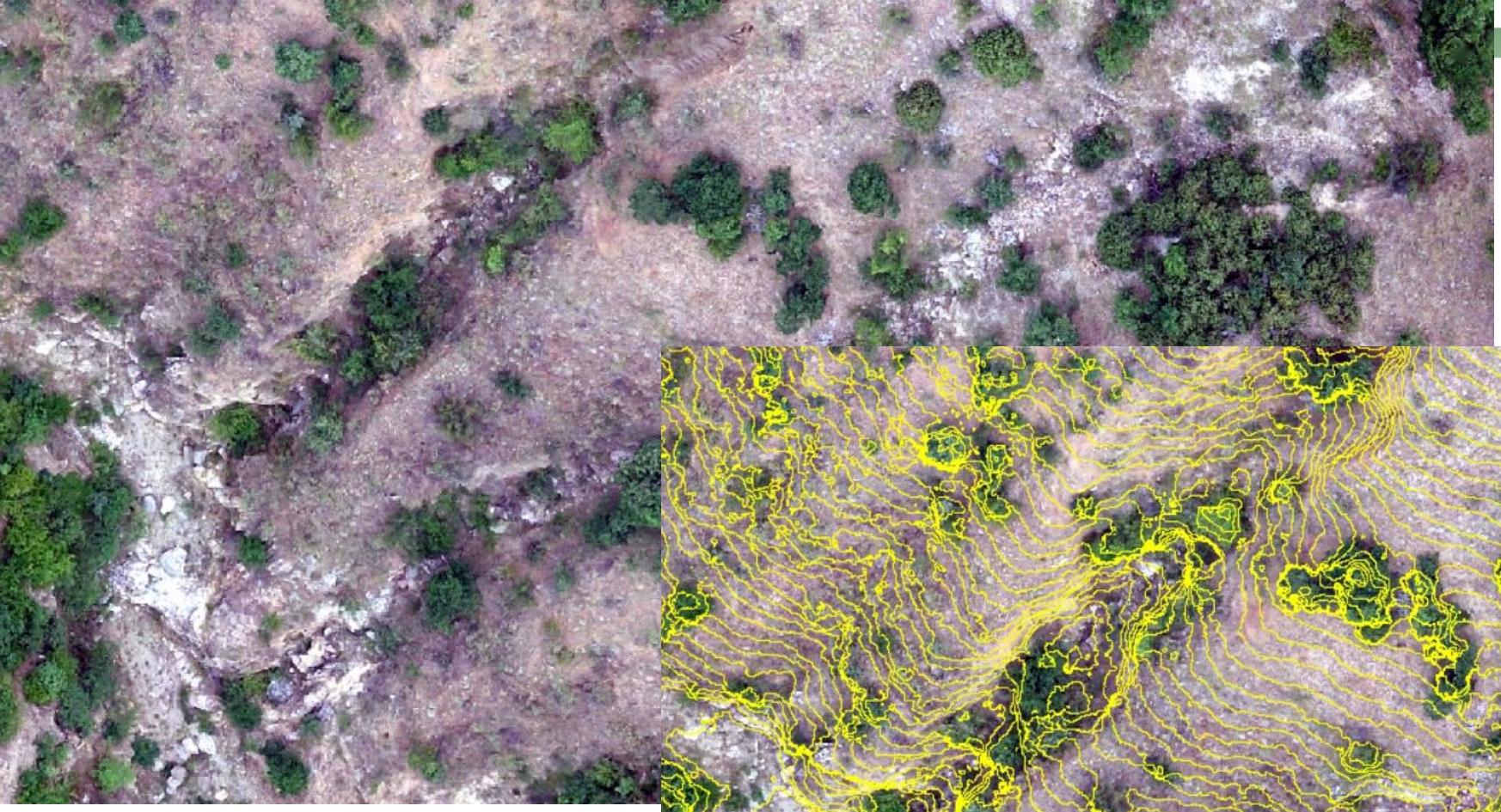

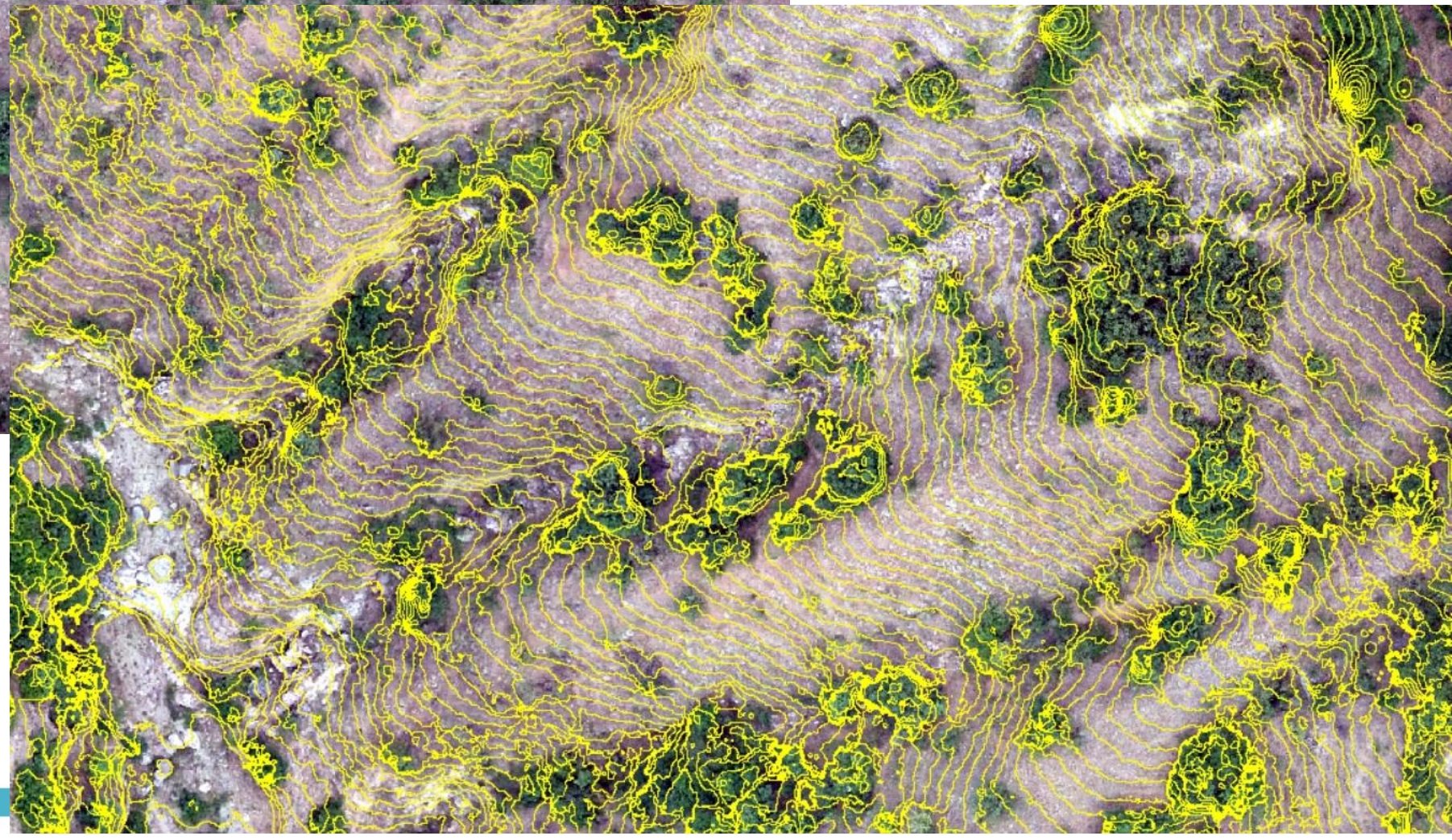

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DJI Phantom 4 RTK

Sensor	1" CMOS; Effective pixels: 20 M
Lens	FOV 84° ； 8.8 mm / 24 mm(35 mm format equivalent:24 mm)； f/2.8 - f/11, auto focus at 1 m - ∞
ISO Range	Video:100-3200(Auto) 100-6400(Manual)； Photo:100-3200(Auto) 100-12800(Manual)
Mechanical Shutter Speed	8 - 1/2000 s
Electronic Shutter Speed	8 - 1/8000 s
Accuracy	Positioning Accuracy: Vertical 1.5 cm + 1 ppm（RMS）； Horizontal 1 cm + 1 ppm（RMS） 1 ppm means the error has a 1mm increase for every 1 km of movement from the aircraft.

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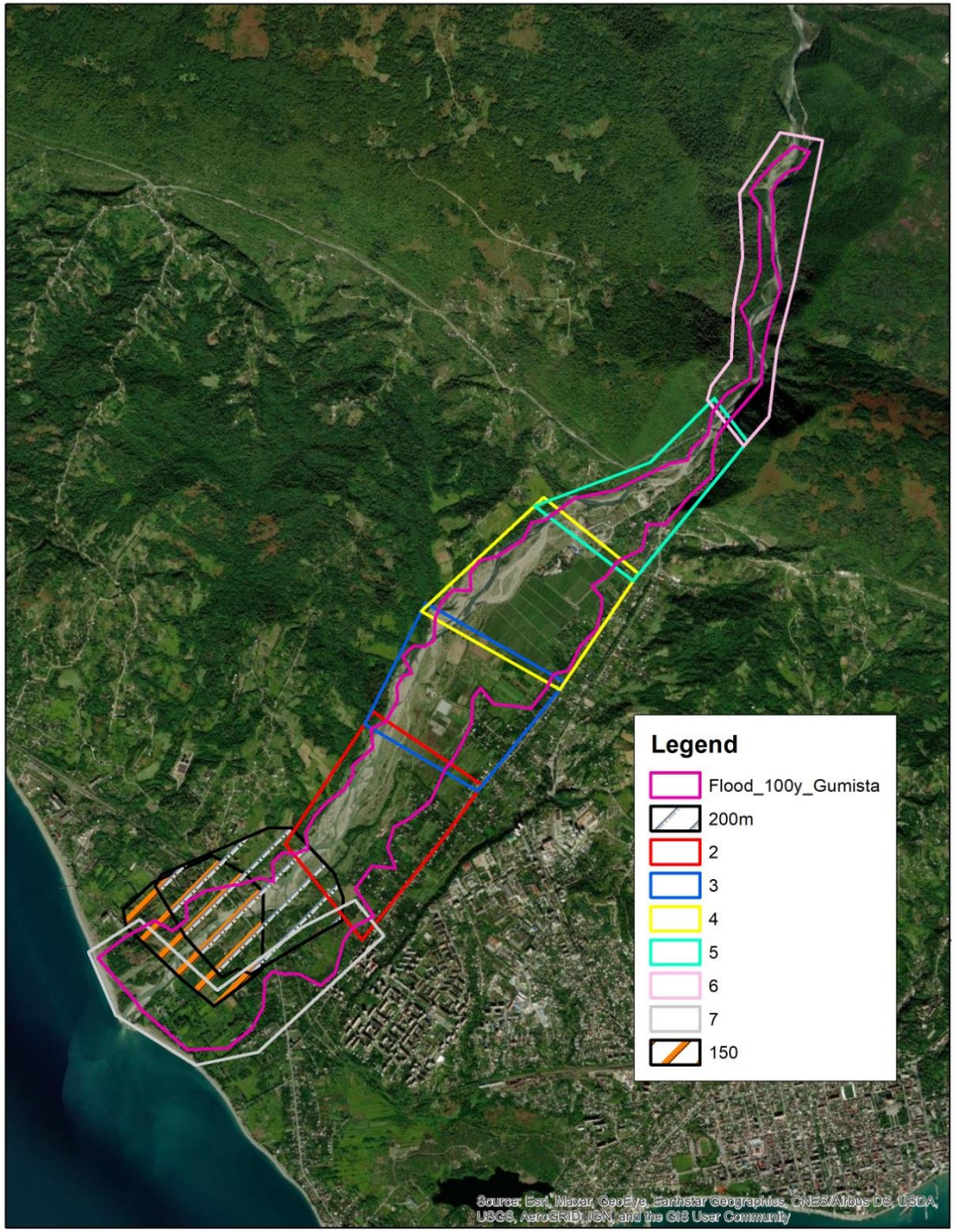
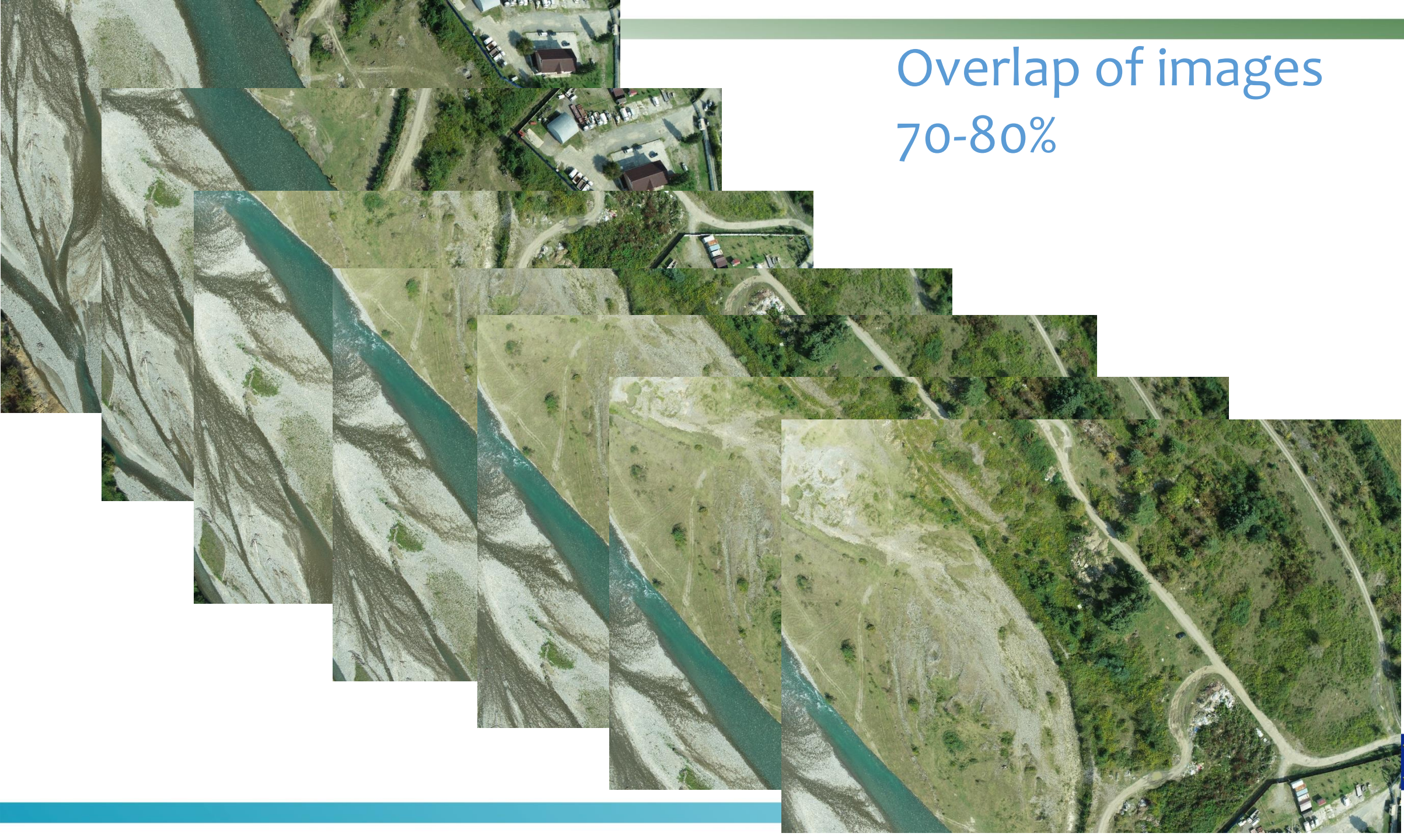
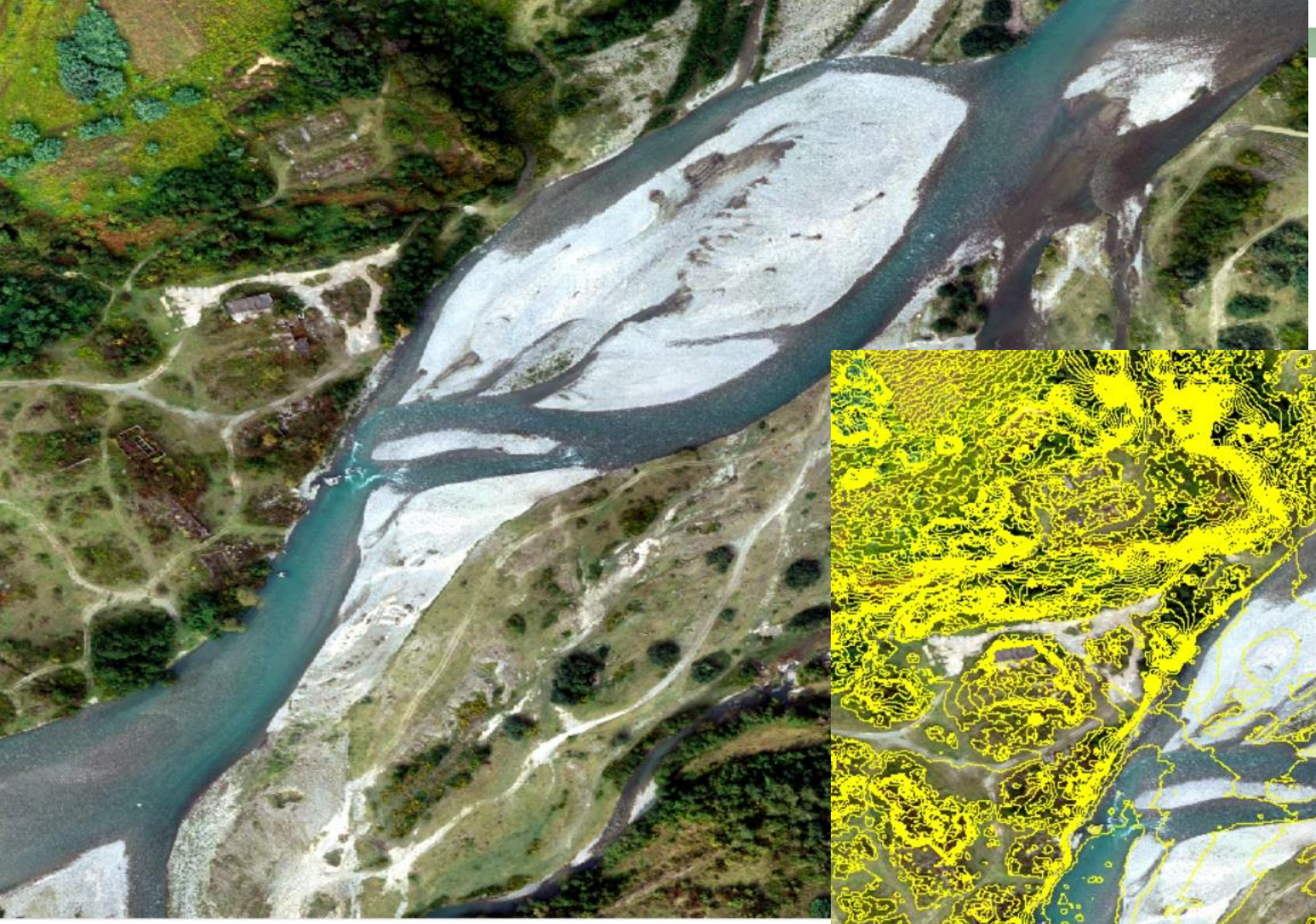
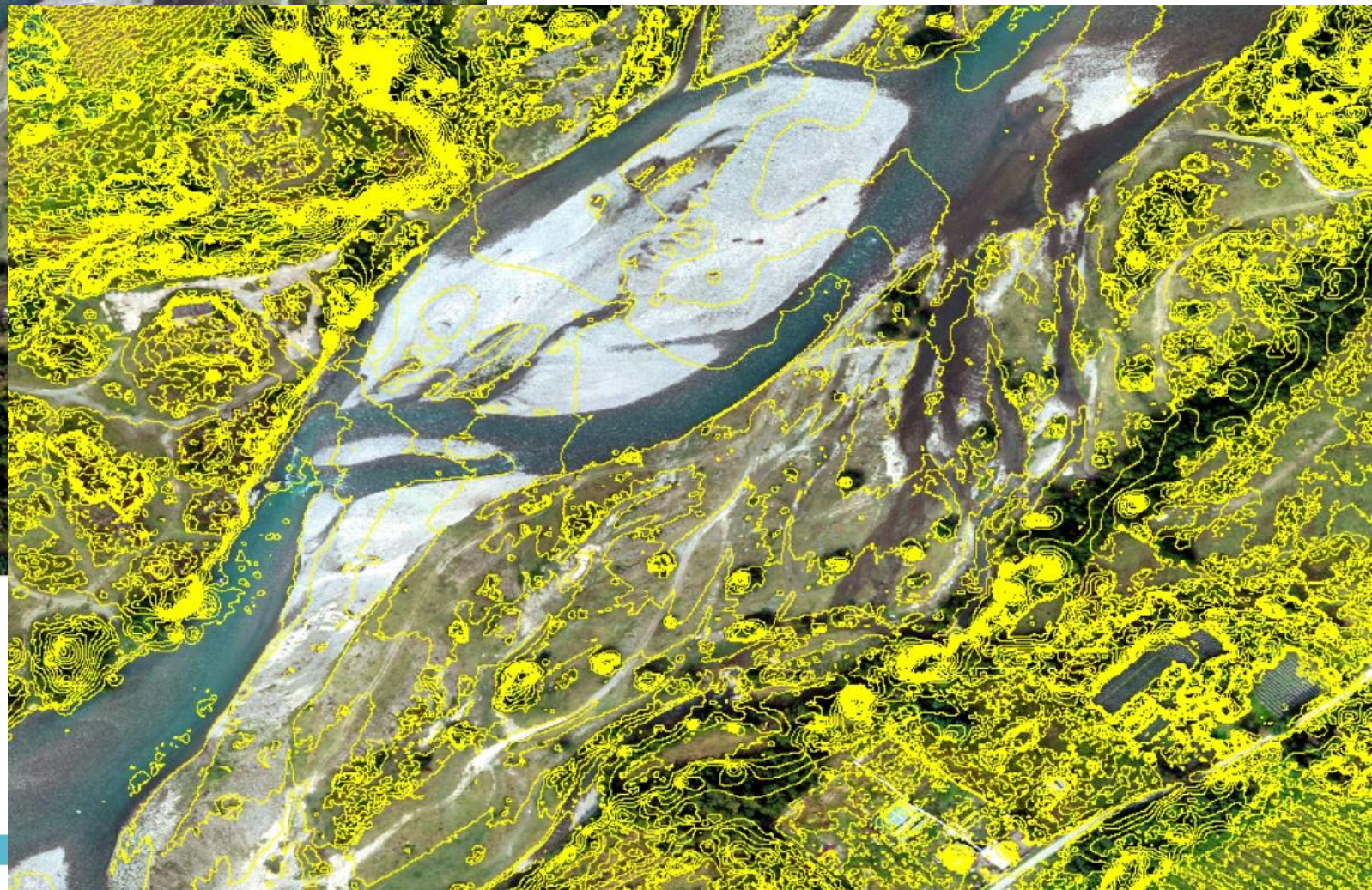
Gumista river
Georgia, Abkhazia



Overlap of images
70-80%







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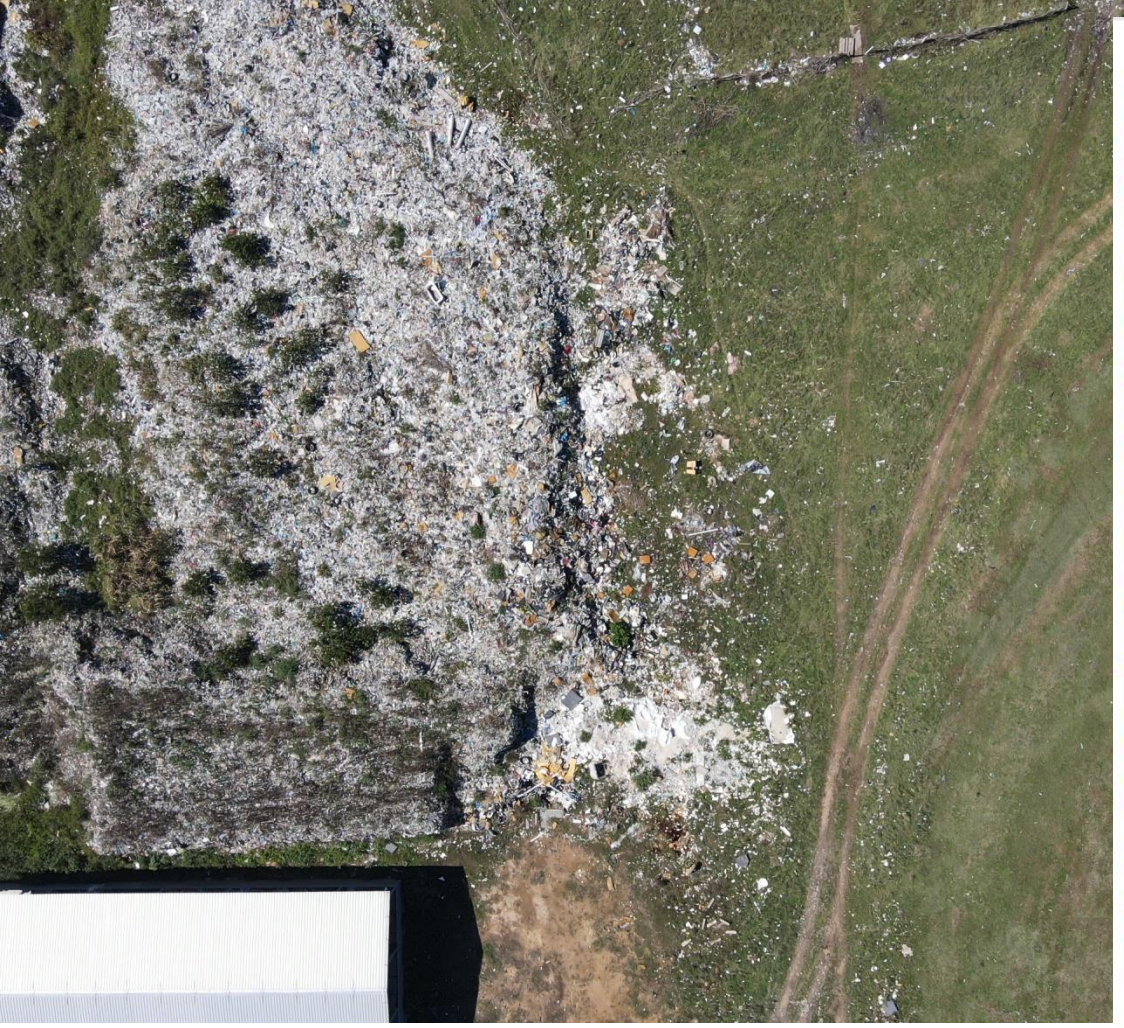
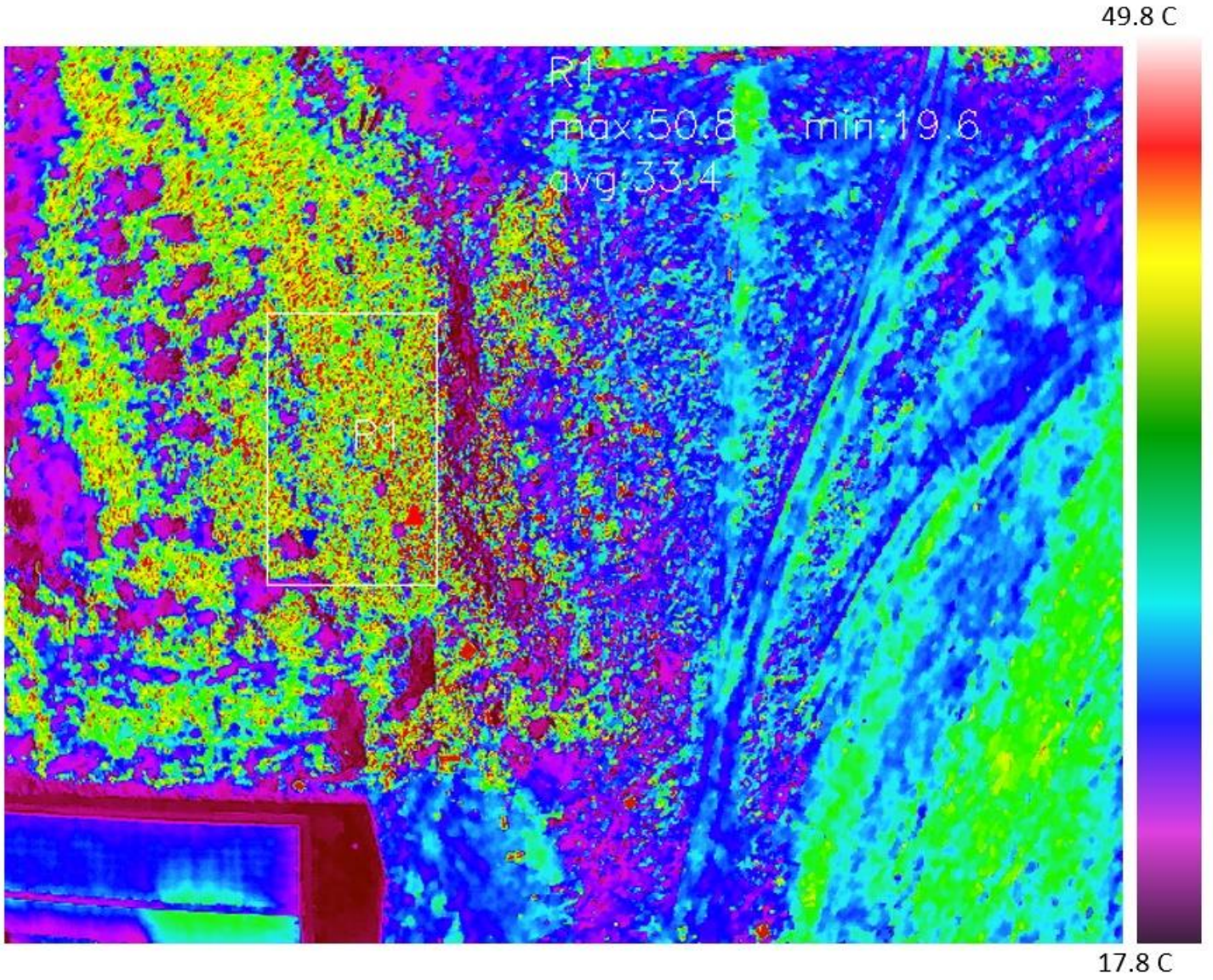
DJI Mavic enterprise 2 advanced + RTK

M2EA Thermal Camera

Sensor	Uncooled VOx Microbolometer
Focal Length	Approx. 9mm 35 mm format equivalent: Approx. 38mm
Sensor Resolution	640×512 @30Hz
Accuracy of Thermal Temperature	Measurement: ±2°C or ±2%, whichever is greater.
Scene Range	-40 °C to 150 °C (High Gain) -40 °C to 550 °C (Low Gain)
Digital Zoom	16 ×
Pixel Pitch	12 µm
Spectral Band	8-14 µm





Test Image

Region	Max	Avg	Min	Emiss	Distance
Rectang:1	50.80 C	33.42 C	19.60 C	0.95	5.00

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Thank you for your attention

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