# Využití UAV v geomorfologii

# UAV

- UAV = unmanned ae letadlo
- Kvadrokoptéry
- Multikoptéry
- Křídla

EXAMPLE OF A QUADROTOR – DJI MAVIC PRO

EXAMPLE OF A HEXACOPTER – CUSTOM BUILT MODEL

Parametry:

- Výdrž baterie
- Rychlost a déll
- Nosnost

90 min

eBee X

Map without limits

55 min

eBee SQ

The advanced agricultural drone

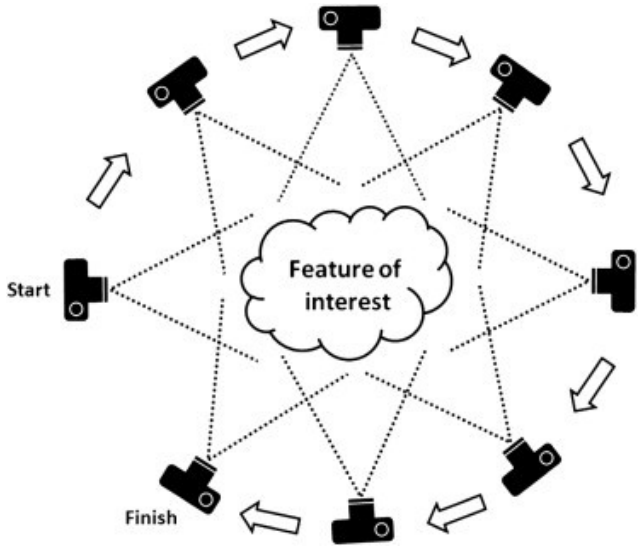
50 min

eBee Classic

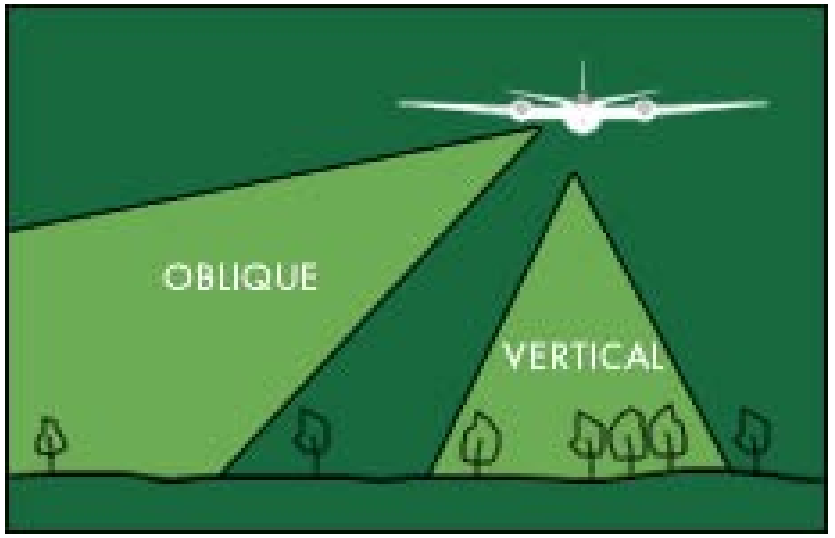
The professional mapping drone

# Structure-from-motion

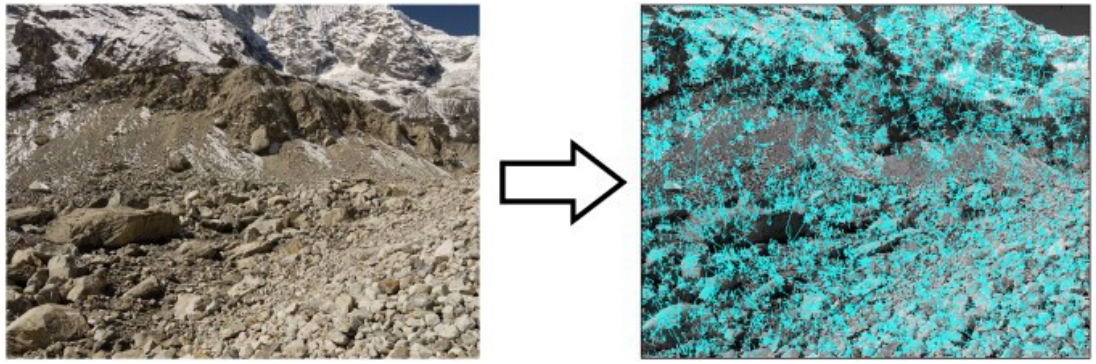
- Metoda vycházející z principů stereoskopické fotogrammetrie
- Vytvoření detailního 3D obrazu z 2D snímků
  -> vytvoření DEM
  -> ortofoto



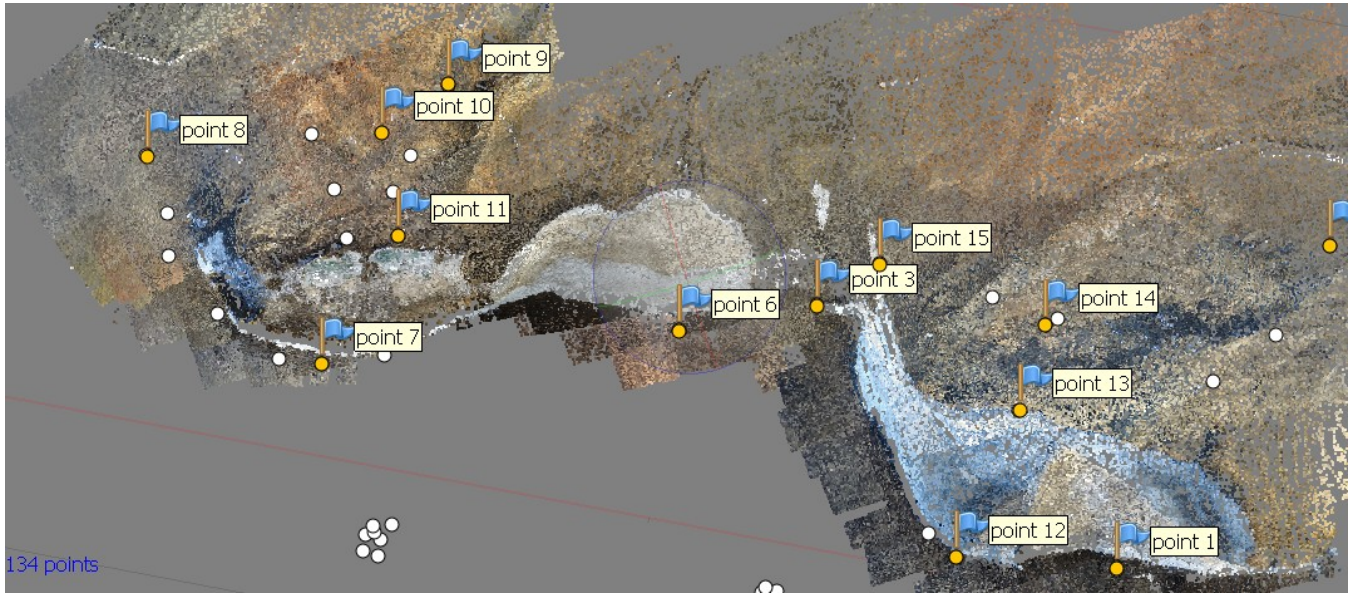

- Kolmé (vertical) i šikmé (oblique) snímkování




- Software
  - Metashape (dříve Photoscan)
  - Pix4D



Dekompozice obrazu na mrak bodů (Westoby et al., 2012)

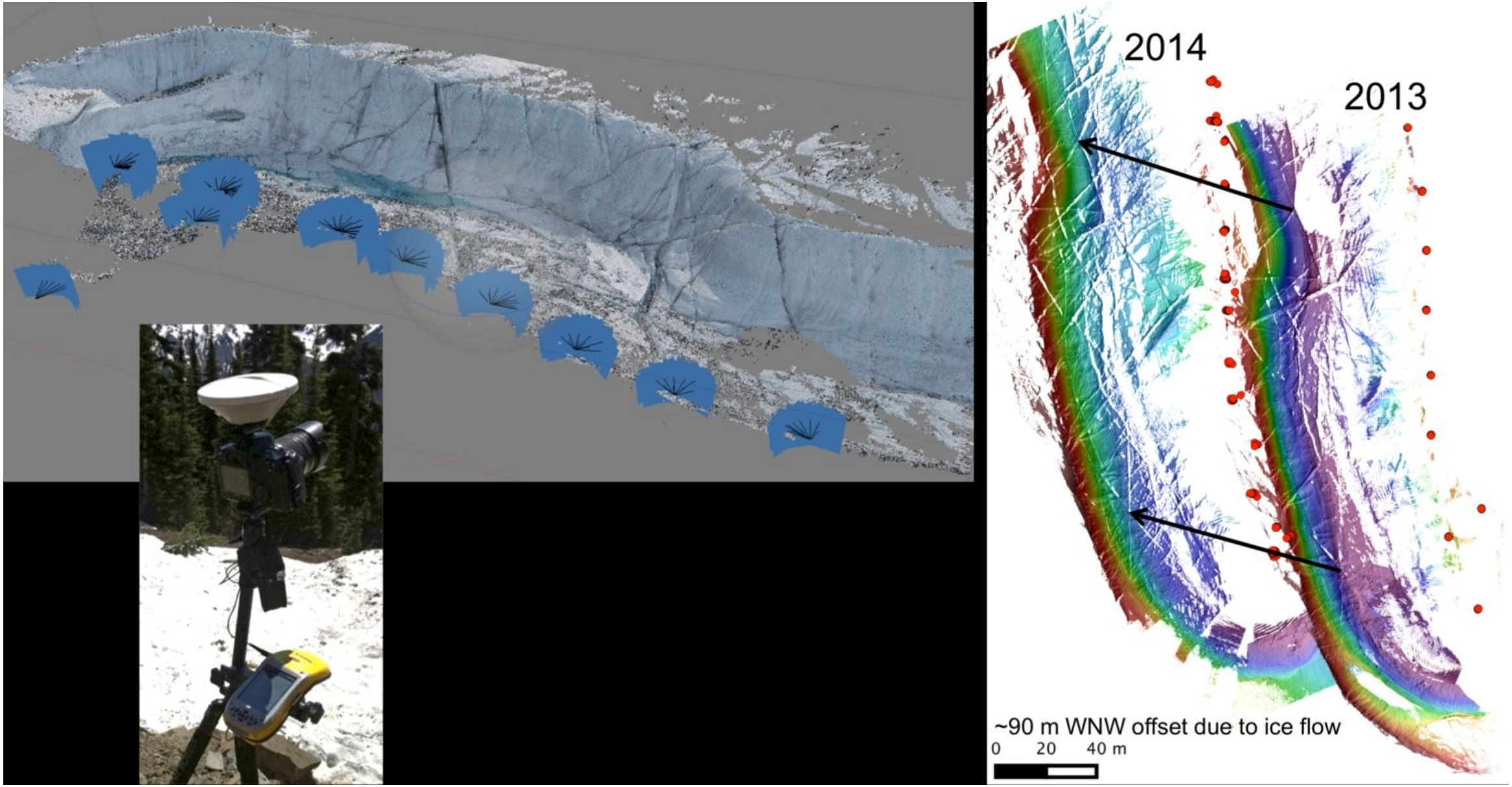


Šikmé snímkování

Kolmé snímkování


https://www.geos.ed.ac.uk/~mscgis/15-16/s1577970/

Příklad snímkování ze země (https://dshean.github.io/technology/sfm/)



- Příprava letové mise krok po kroku

## Operational framework for rapid mapping and monitoring of proglacial areas

**Stage 1 – Preparation and selection of the appropriate platform**

- Checking national and local regulations
- Selection of UAV platform
- Preparation of necessary documents
- Upgrading of software and firmware
- Planning of suryeys

**Stage 2 – Transport**

- Checking carrier's regulations
- Proper packing (e.g. hard case for checked-in luggage)
- Battery transport (always in hand-luggage)

**Stage 3 - Preliminary on-site activities**

- Contacting the local aviation authority and landowners
- Ground control point collection (optional):
  - use of natural features
  - distribution of artificial targets

**Stage 4 – Pre-flight setup and checks**

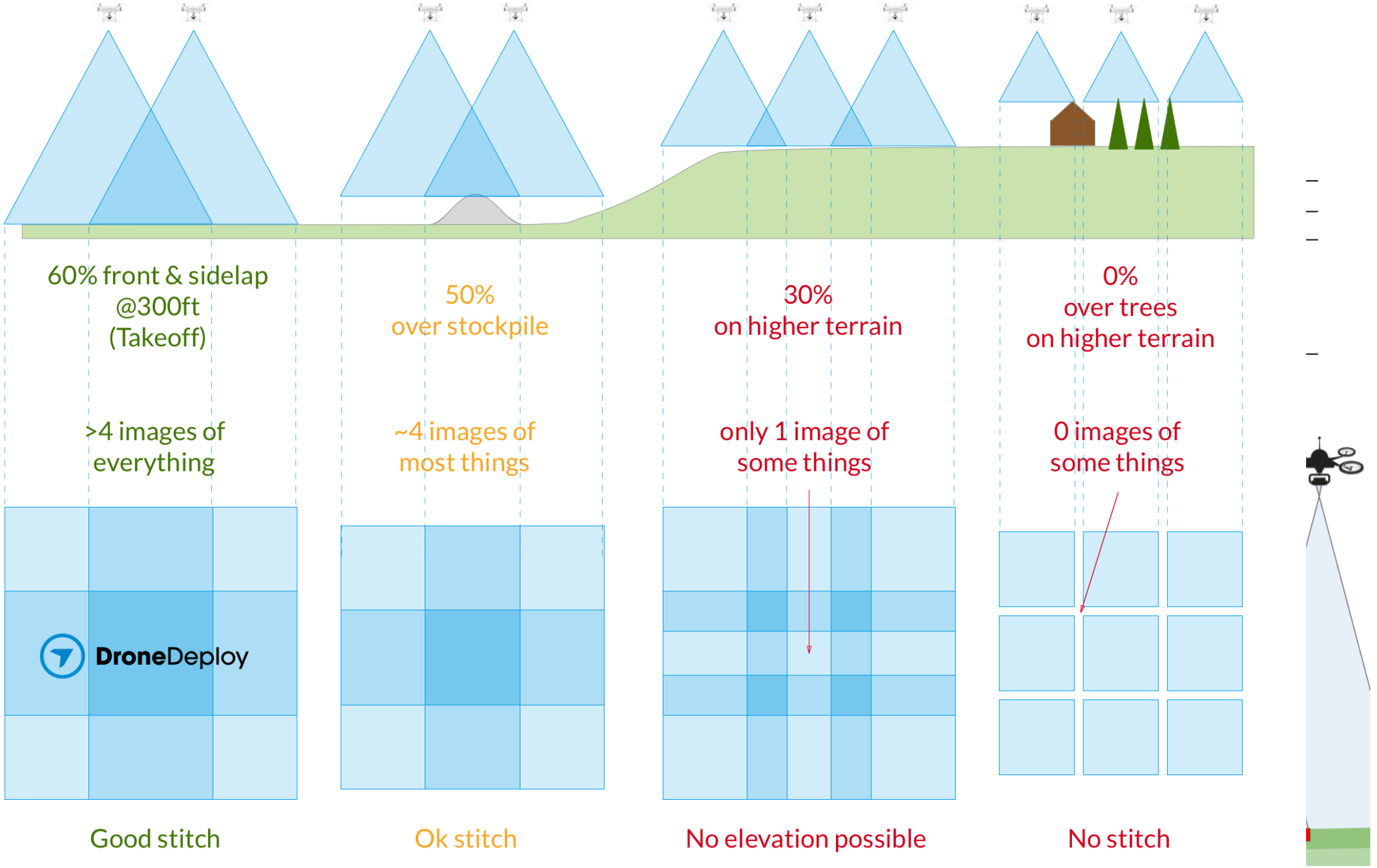
- Field reconnaissance:
  - visual scanning of obstacles (trees, electric wires)
  - selection of a take-off place
  - selection of primary and emergency landing spots
  - designing flying paths (manually or pre-programmed)
  - preliminary selection of flying altitude
- Preparation of equipment:
  - removing all transport protection elements
  - checking the condition of UAV (for any damage during transport)
  - preparation of UAV and connection RC and/or ground station
  - checking the sensors' reading and calibration (is necessary)
  - checking the camera settings (e.g. shutter speed; interval; ISO)
  - checking the fail-safe settings (e.g. RTH altitude)

**Stage 5 – Conducting the mission**

- Take-off, post-take-off flight checks, verification of home point location
- Mission flying (autonomous/manual)
- Return (if battery level < 30%) and landing

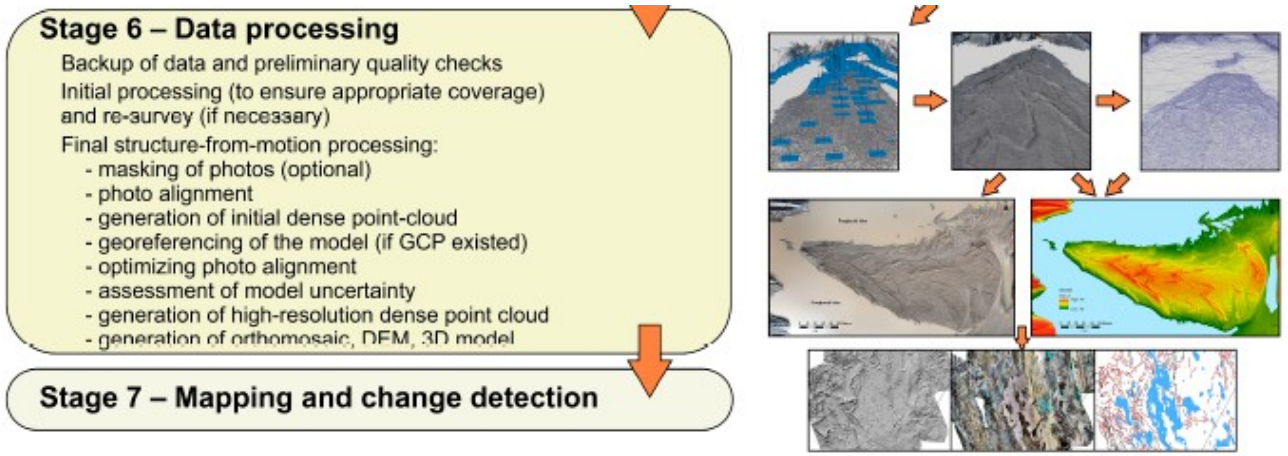
# P

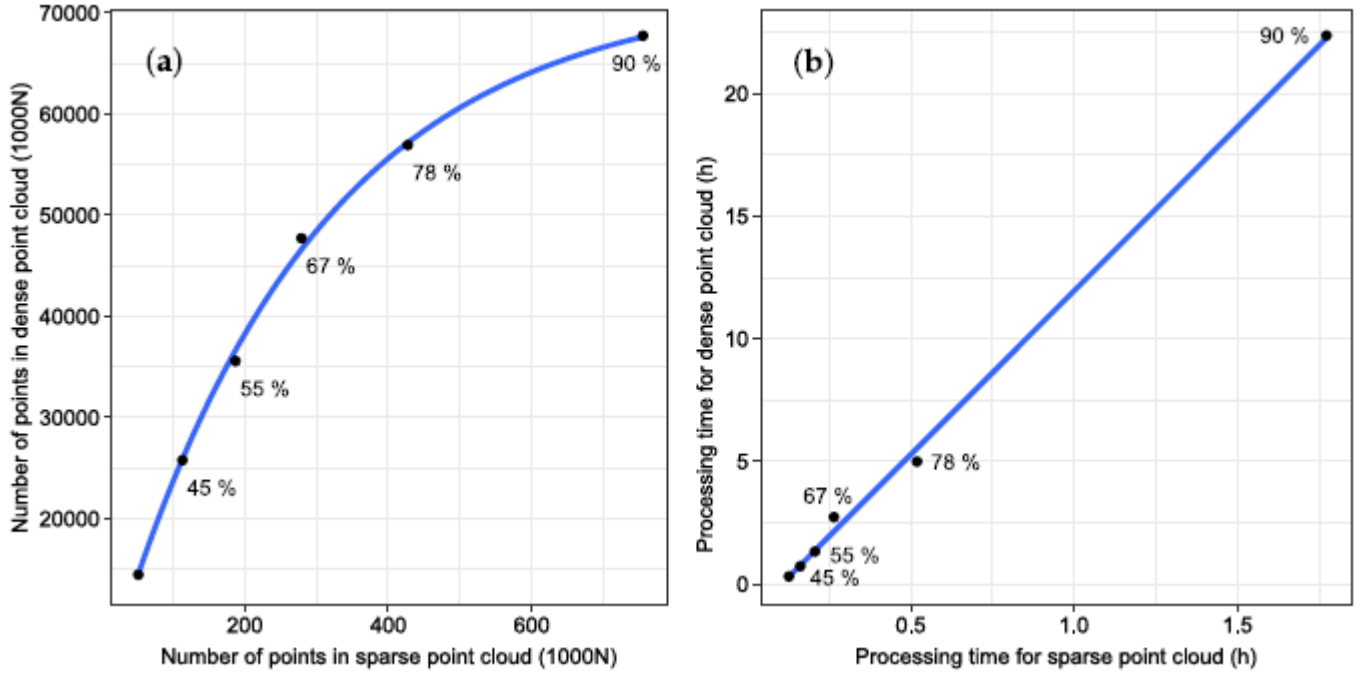
- V
- R
- P
- N


60% front & sidelap
@300ft
(Takeoff)
>4 images of
everything
Good stitch
50%
over stockpile
~4 images of
most things
Ok stitch
30%
on higher terrain
only 1 image of
some things
No elevation possible
0%
over trees
on higher terrain
0 images of
some things
No stitch
DroneDeploy

# Zpracování dat

- Časově a výpočetně velmi náročné
- Závisí na kvalitě snímků
  - Letových parametrech



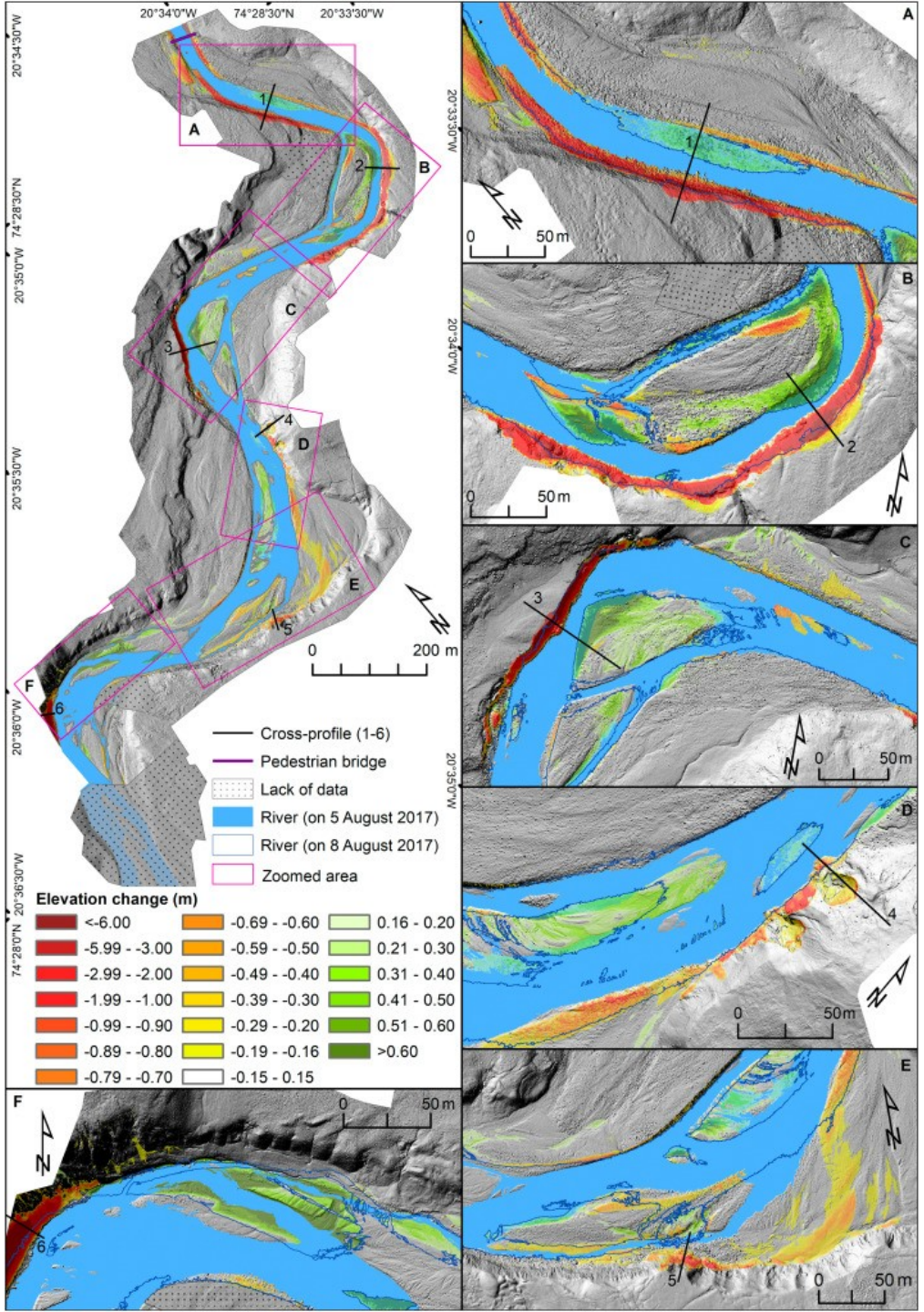
# Srovnání SfM s dalšími technikami (Voumard et al., 2018)

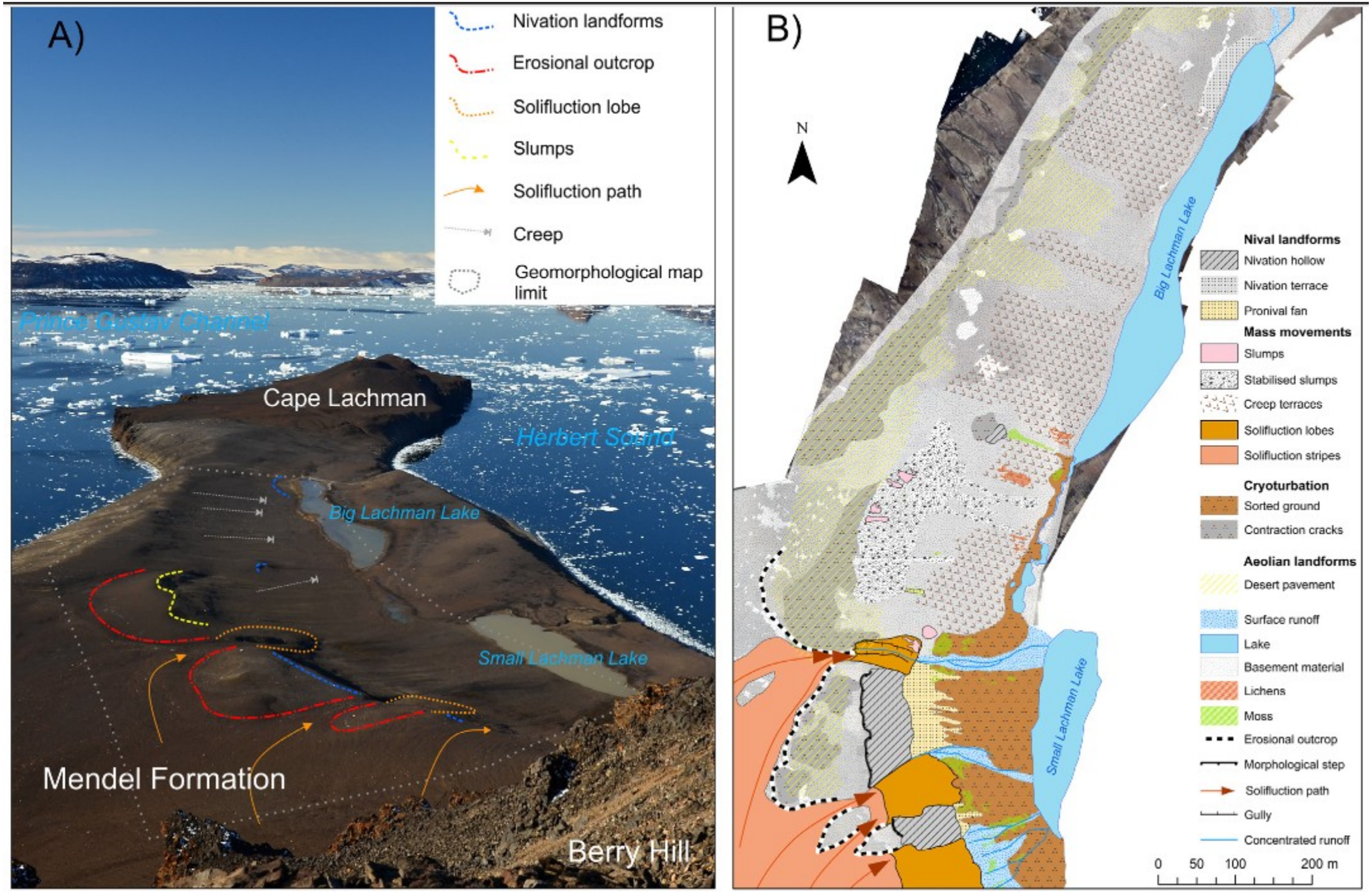
**Table 7.** Summary of the features of the different tested techniques. Point density, average acquisition velocity, precision and accuracy data originate from the test on the Agites cliff beside a small and winding Alpine road.

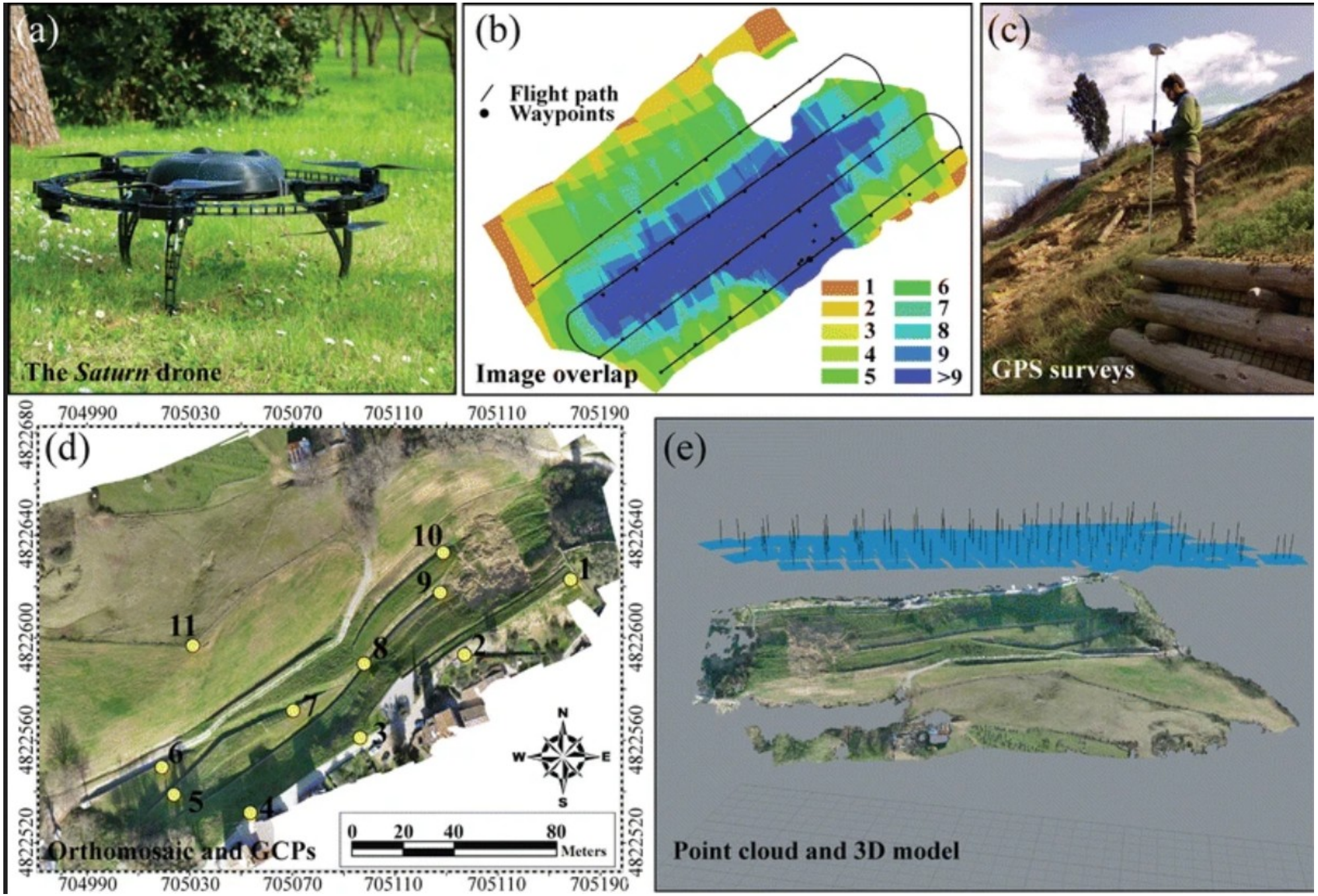
| Technique | Point Density [pts/m$^2$] | Range [m] | Average Acquisition Velocity [m/h] | Precision [cm] | Georeferencing [m] | Topographic Influence (Steep Slope, Gorges) | Setup Time [min] | Processing Time [h] | Price EUR (Hard and Software) | Advantages | Disadvantages |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SfM-EV | 20,000 | 25 | 15,000 | 3 | 3 | Loss of georeferencing | 15 | 24 | 2000 | Low-cost, acquisition speed, colourized point cloud, georeferencing, many support | Accuracy, processing time |
| UAV SfM | 1500 | 50 | 10,000 | 5 | 5 | Loss of georeferencing | 5 | 18 | 2500 | Low-cost, acquisition speed, colourized point cloud, georeferencing | Accuracy, processing time |
| Handheld LiDAR | 4500 | 10 | 2000 | 3 | No | No | 5 | 0.25 | 50,000 | Installation and processing time, acquisition speed, easy to use | No colourized point cloud |
| Mobile LiDAR | 5000 | 2000 | 20,000 | 3 | 0.5 | Loss of georeferencing | 90 | 4 | 300,000 | Acquisition speed, accuracy, georeferencing | Cost, installation and processing time |
| Scanning total station | 38,500 | 600 | 200 | 0.5 | 0.1 | Any | 15 | 1 | 70,000 | Accuracy, georeferencing | Acquisition speed |
| Static long-range LiDAR | 47,000 | 1500 | 100 | 2 | No | No | 15 | 2 | 100,000 | Accuracy, point density | Cost, acquisition time, georeferencing |
| Static LiDAR | 24,000 | 300 | 100 | 1 | No | No | 20 | 2 | 150,000 | Accuracy, point density | Cost, acquisition time, georeferencing |
| Airborne LiDAR | 2.5 | - | 100,000 | 5 | 0.2 | Loss of point density | - | - | 10/km$^2$ | Acquisition speed, georeferencing | Accuracy, point density, depends of a third party |

# Využití UAV

- Periglaciální geomorfologie
  - Horské oblasti
  - Polární oblasti
- Fluviální geomorfologie
- Svahové procesy




A)
Nivation landforms
Erosional outcrop
Solifluction lobe
Slumps
Solifluction path
Creep
Geomorphological map limit
Prince Gustav Channel
Cape Lachman
Herbert Sound
Big Lachman Lake
Small Lachman Lake
Mendel Formation
Berry Hill
B)
N
Big Lachman Lake
Small Lachman Lake
Nival landforms
Nivation hollow
Nivation terrace
Pronival fan
Mass movements
Slumps
Stabilised slumps
Creep terraces
Solifluction lobes
Solifluction stripes
Cryoturbation
Sorted ground
Contraction cracks
Aeolian landforms
Desert pavement
Surface runoff
Lake
Basement material
Lichens
Moss
Erosional outcrop
Morphological step
Solifluction path
Gully
Concentrated runoff
0 50 100 200 m


(a)
The *Saturn* drone
(b)
Flight path
Waypoints
Image overlap
1
2
3
4
5
6
7
8
9
>9
(c)
GPS surveys
(d)
704990
705030
705070
705110
705110
705190
4822680
4822640
4822600
4822560
4822520
10
9
1
11
8
2
7
3
6
5
4
N
W
E
S
0
20
40
80
Meters
Orthomosaic and GCPs
(e)
Point cloud and 3D model

- Voumard, J., et al., 2018. Pros and Cons of Structure for Motion Embarked on a Vehicle to Survey Slopes along Transportation Lines Using 3D Georeferenced and Coloured Point Clouds. Remote Sensing, 10, 1732
- Westoby et al., 2012. ‘Structure-from-Motion’ photogrammetry: A low-cost, effective tool for geoscience applications. Geomorphology, 179, 300–314.

- Publikace od Marka Ewertowskiho, Jonathana Carrivicka
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