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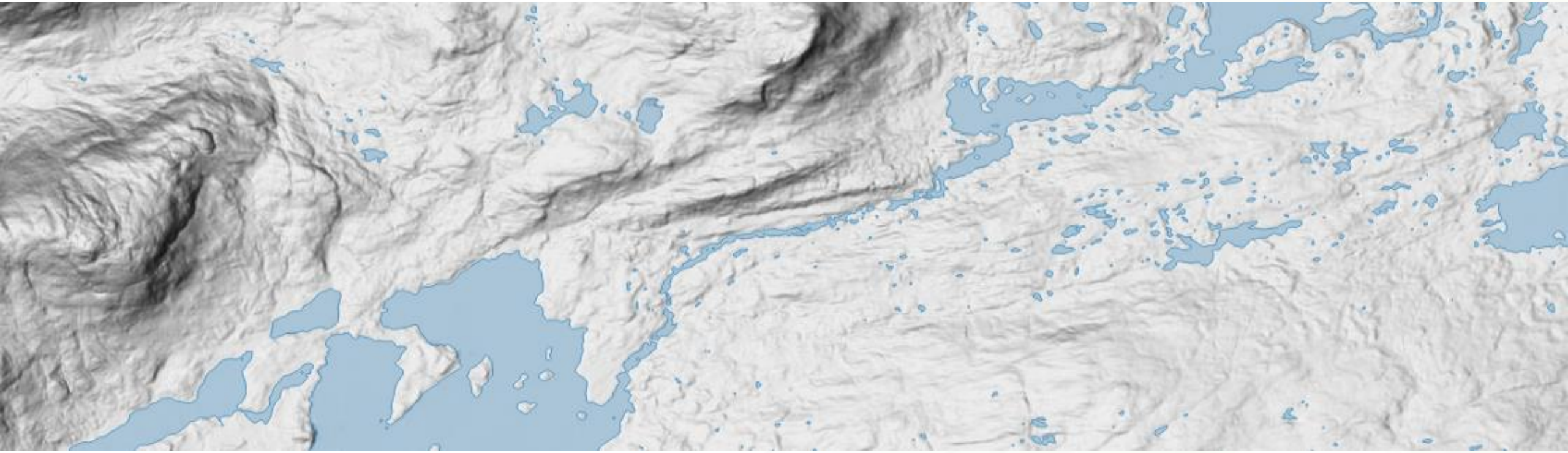
Detection of Waterbodies from Dense Point Clouds

EUROSDR – Use of algorithms on big DEM's
Jon Moe & Christian Malmquist

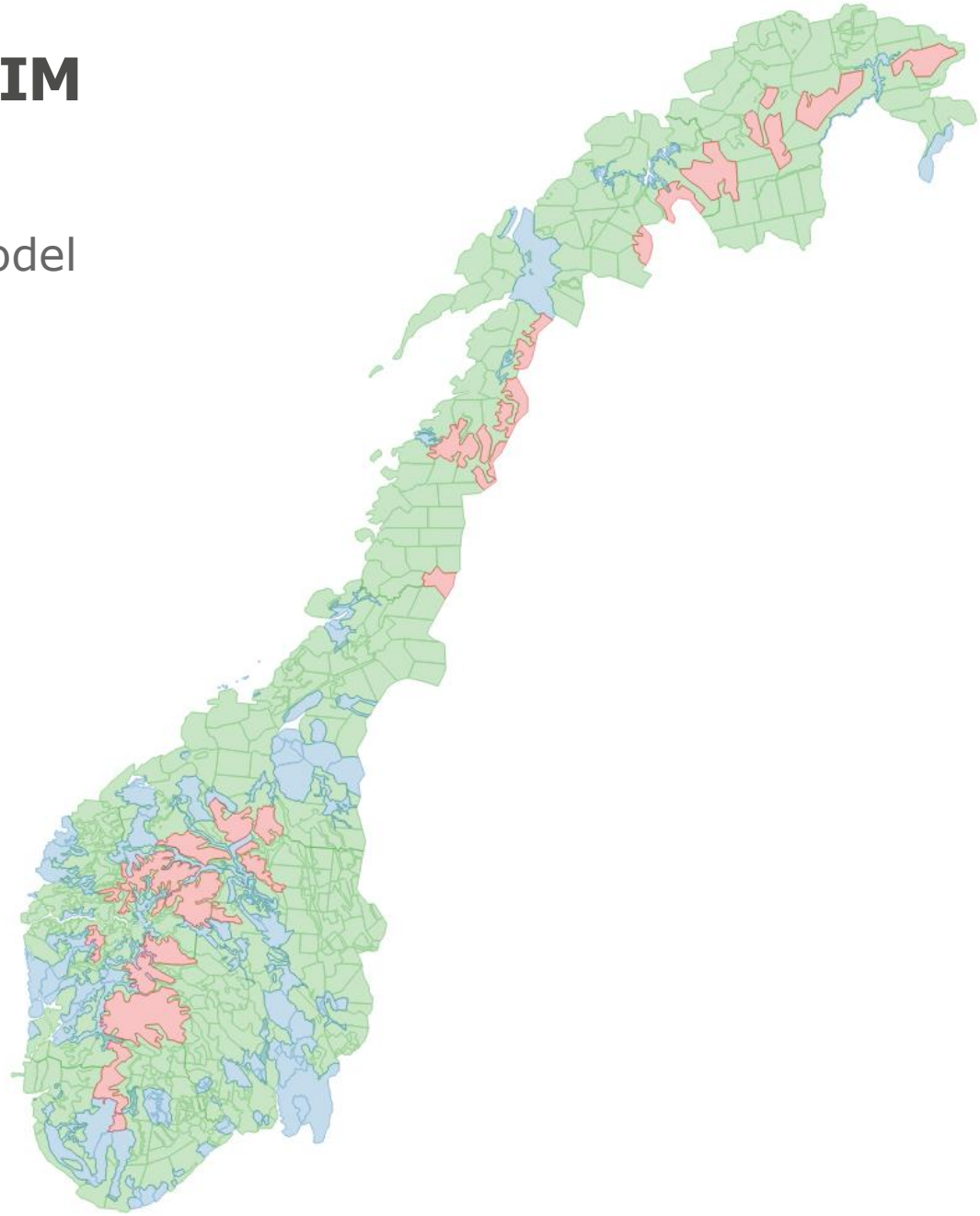


NATIONAL ELEVATION PROGRAM - DIM

- Establish a high resolution national elevation model
  - Existing LiDAR
  - LiDAR to be acquired
  - Dense Image Matching 39100km2

- LiDAR acquisition started 2016

- NMA decided to do the DIM in-house
  - No established specification for outsourcing
  - Mixed experience with previous outsourcing
  - Gain experience with the process
    - DIM Processing
    - DSM Classification
    - DSM Accuracy



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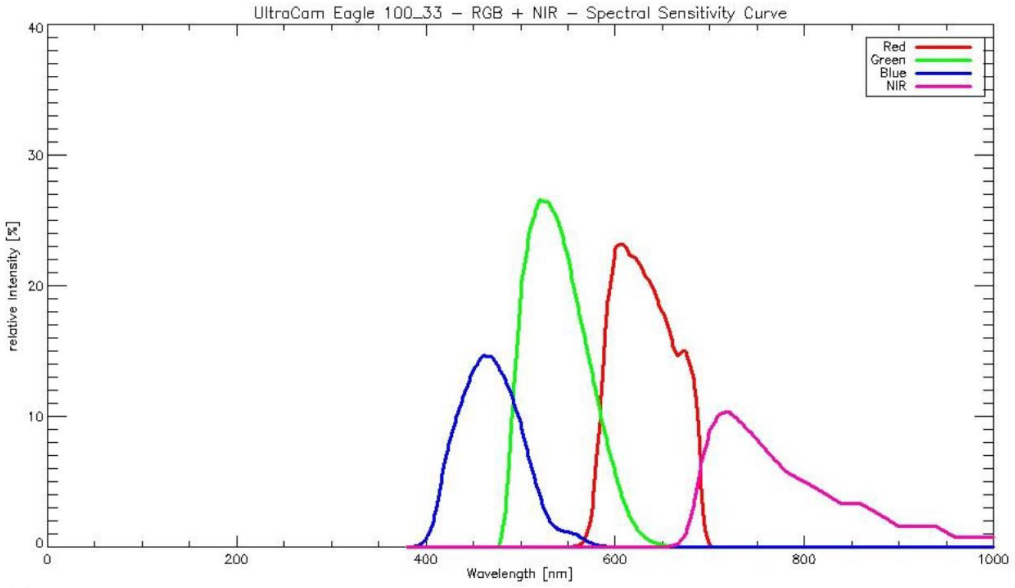
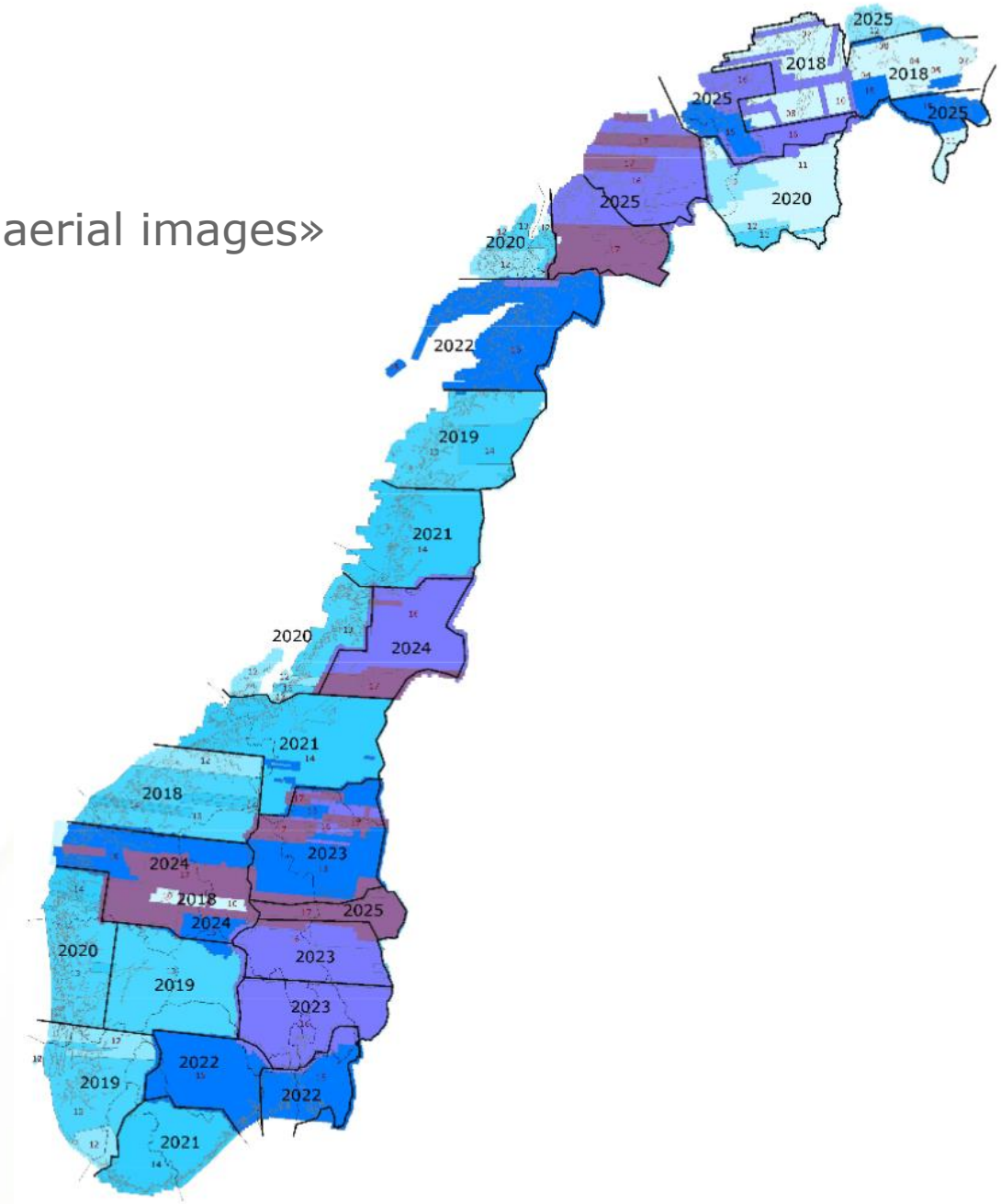
IMAGEMATCHING

- Based on the «Norwegian national program for aerial images»
- Cameras used:
  - Different Ultracam Vexel Cameras
  - Ultracam Eagle
  - Leica DMC3
- RGB and NIR acquired for all blocks after 2012





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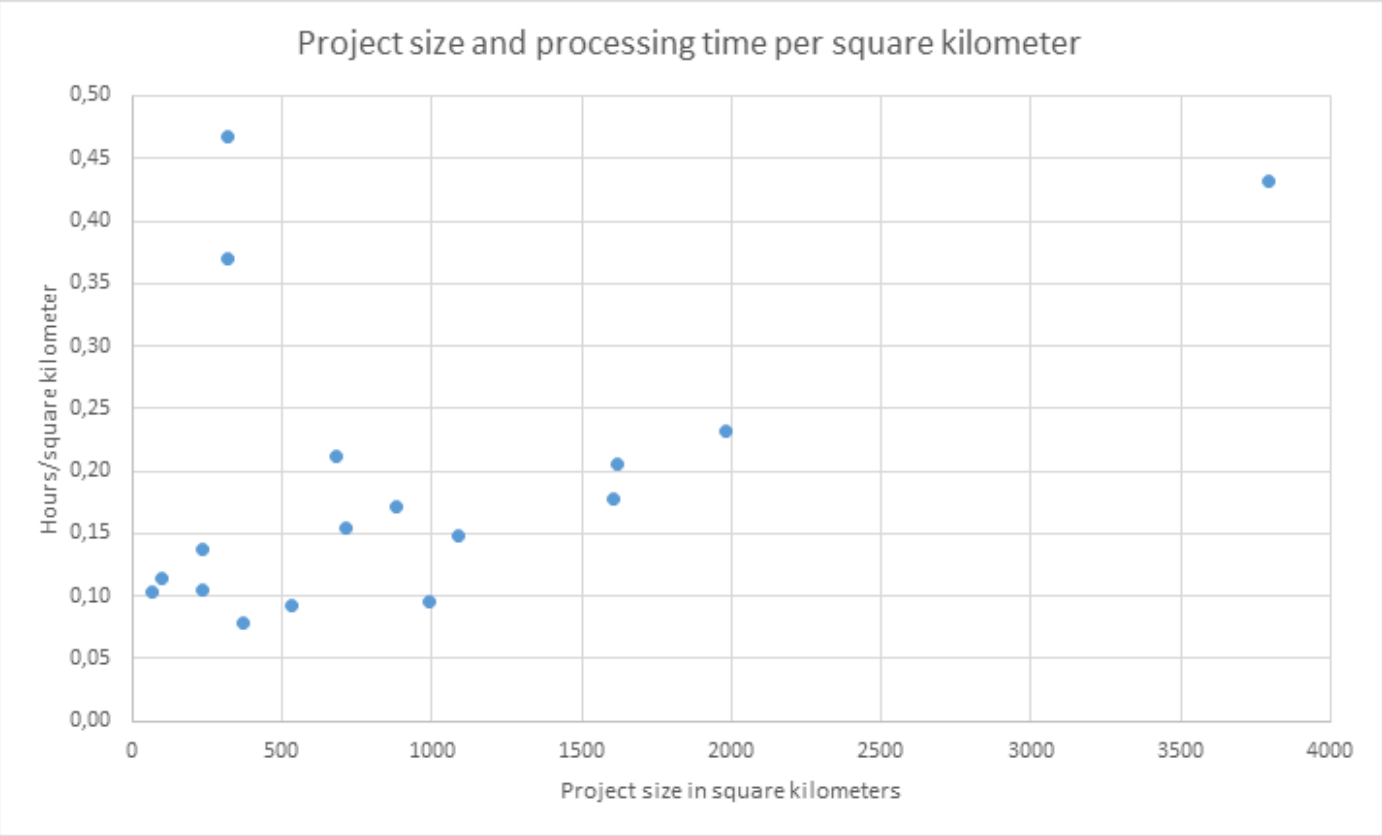
IMAGEMATCHING

- 25cm GSD and 80% Overlap (41%)
- Earlier projects 35cm/50cm GSD and 60% overlap

- 17 Areas processed
  - Avg 0.14H/km2
  - Max 0.47H/km2

- Trimble Inpho Match-T DSM
- High performing workstations
- NIR band written to LAZ as intensity



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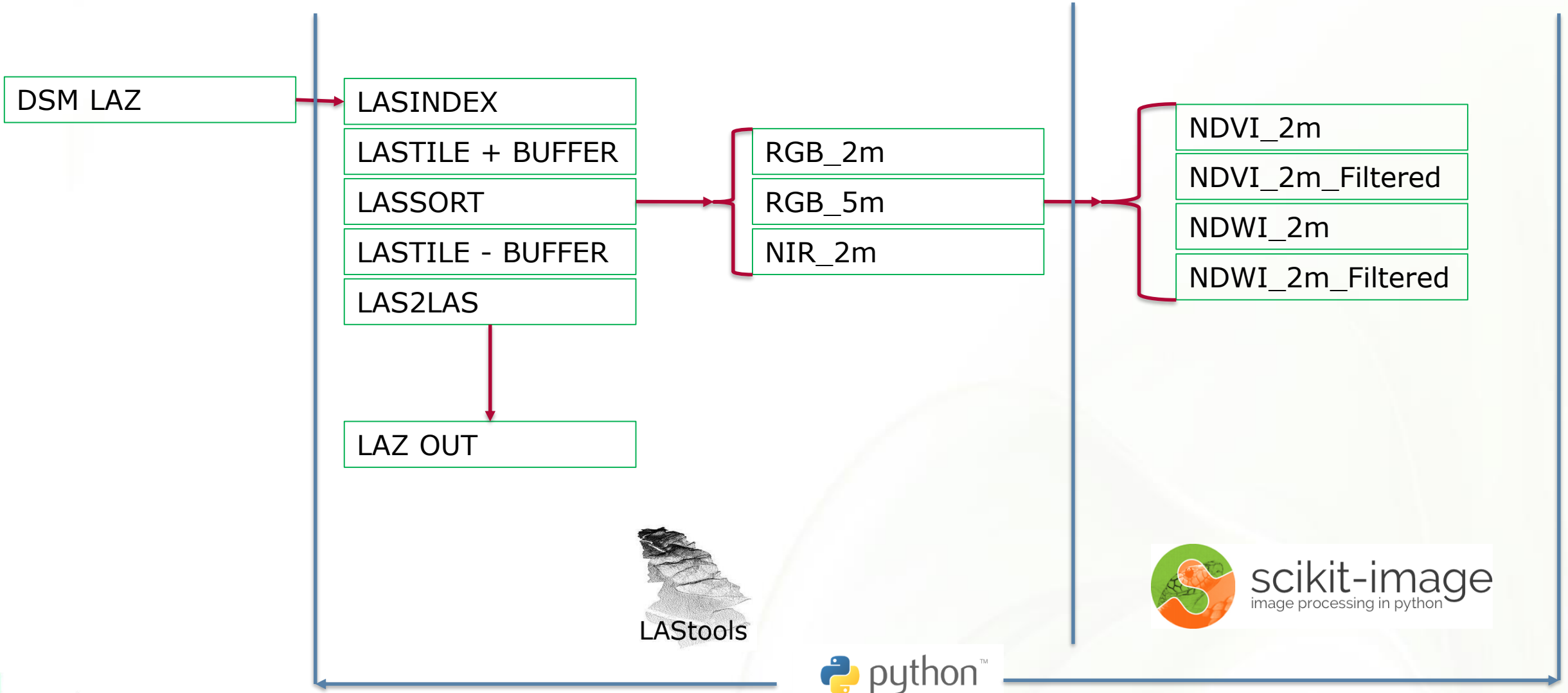
POINTCLOUD PROCESSING



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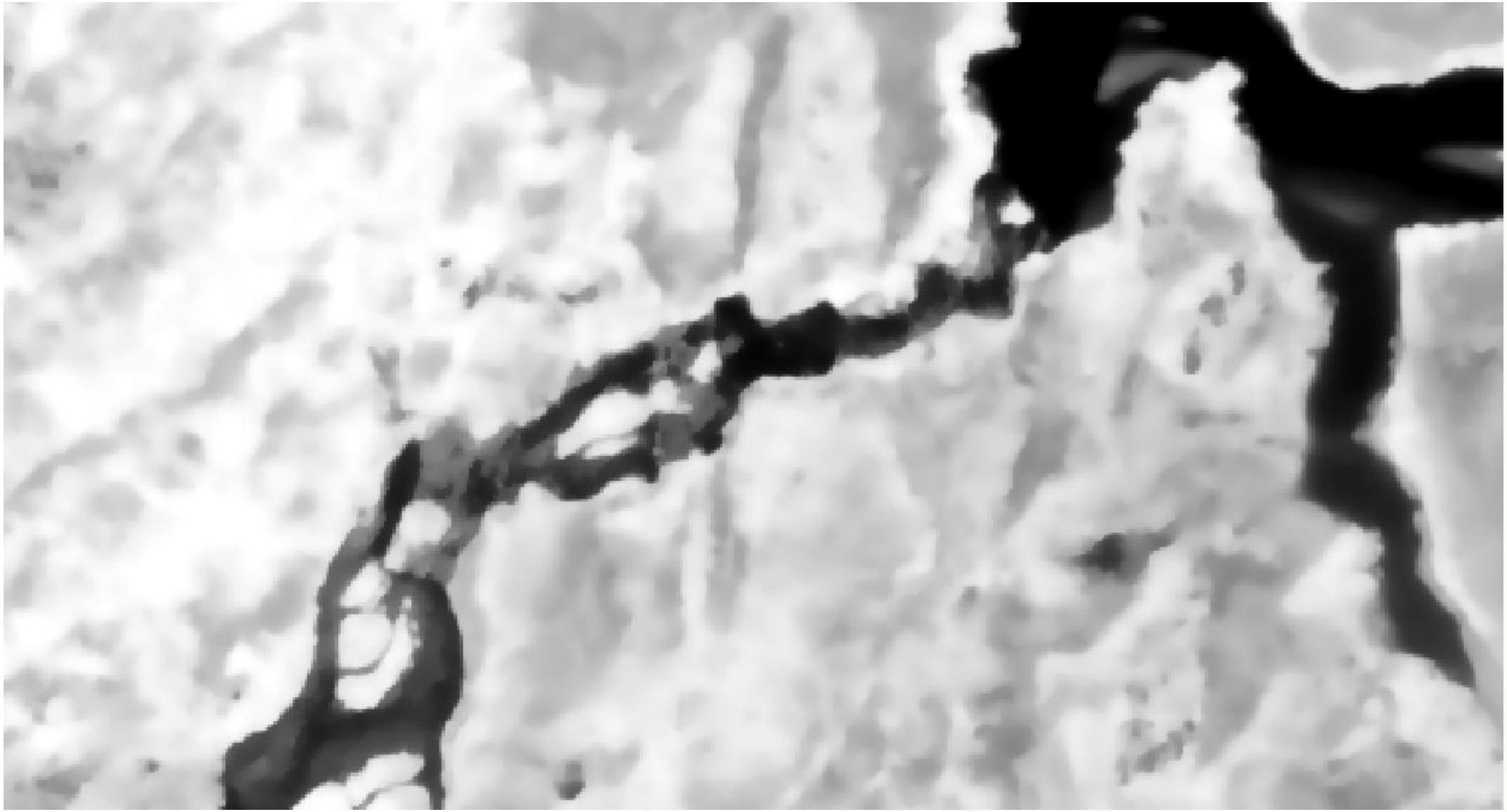

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POINTCLOUD PROCESSING

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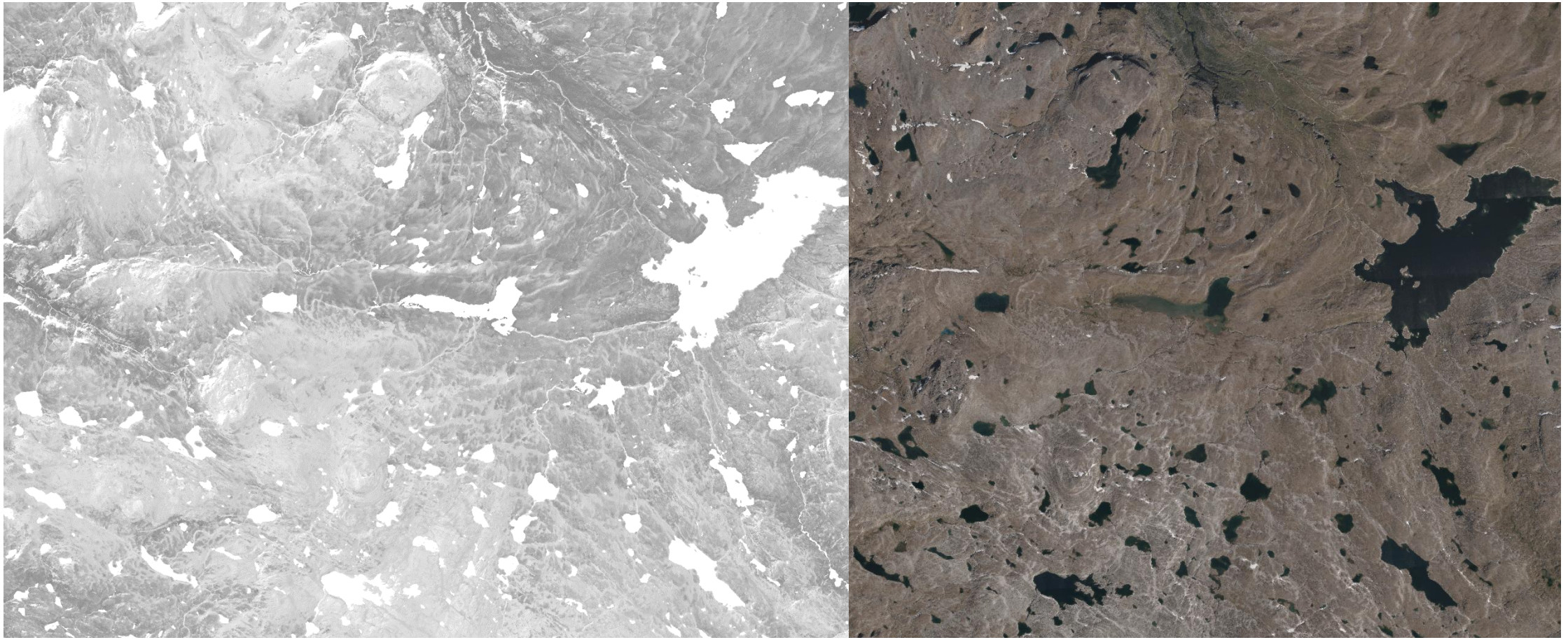
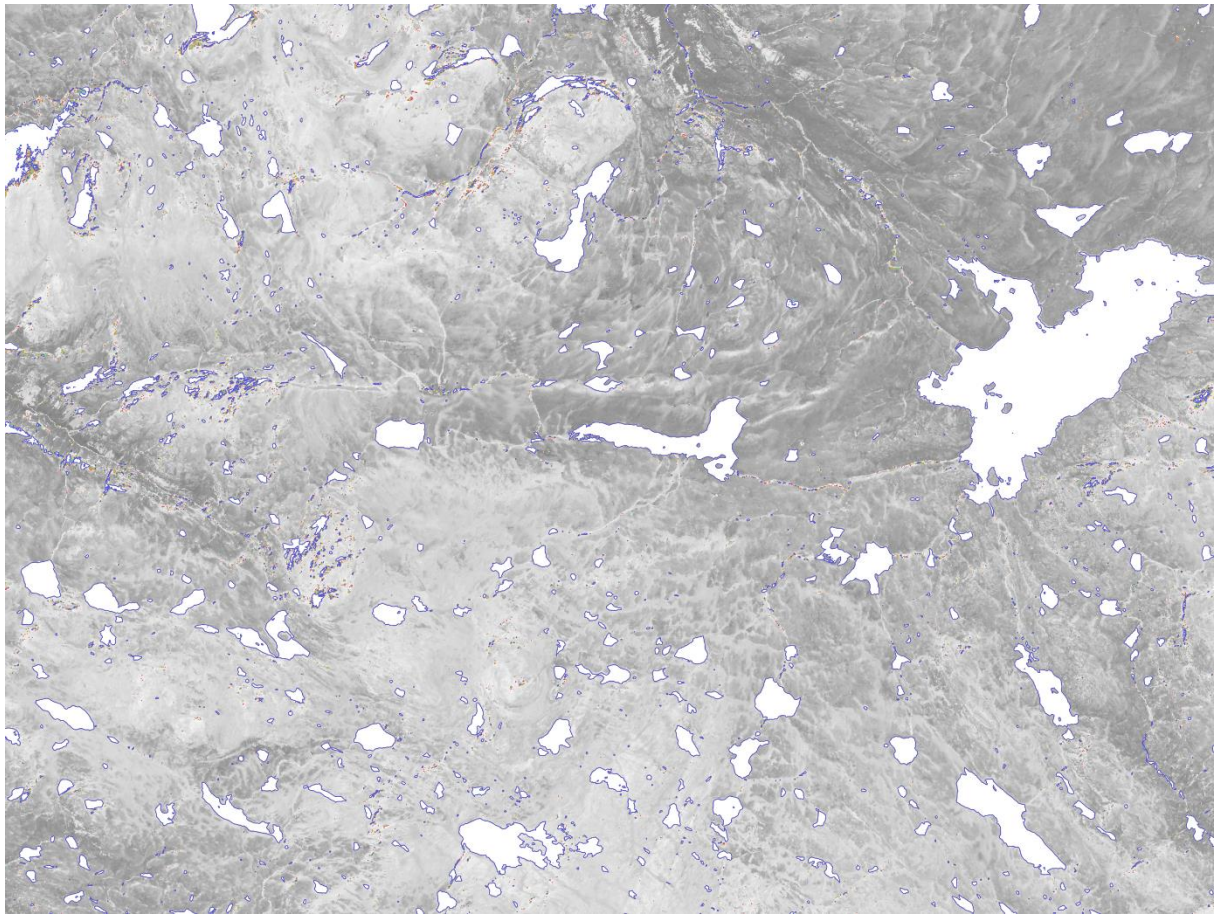
Good separation on water



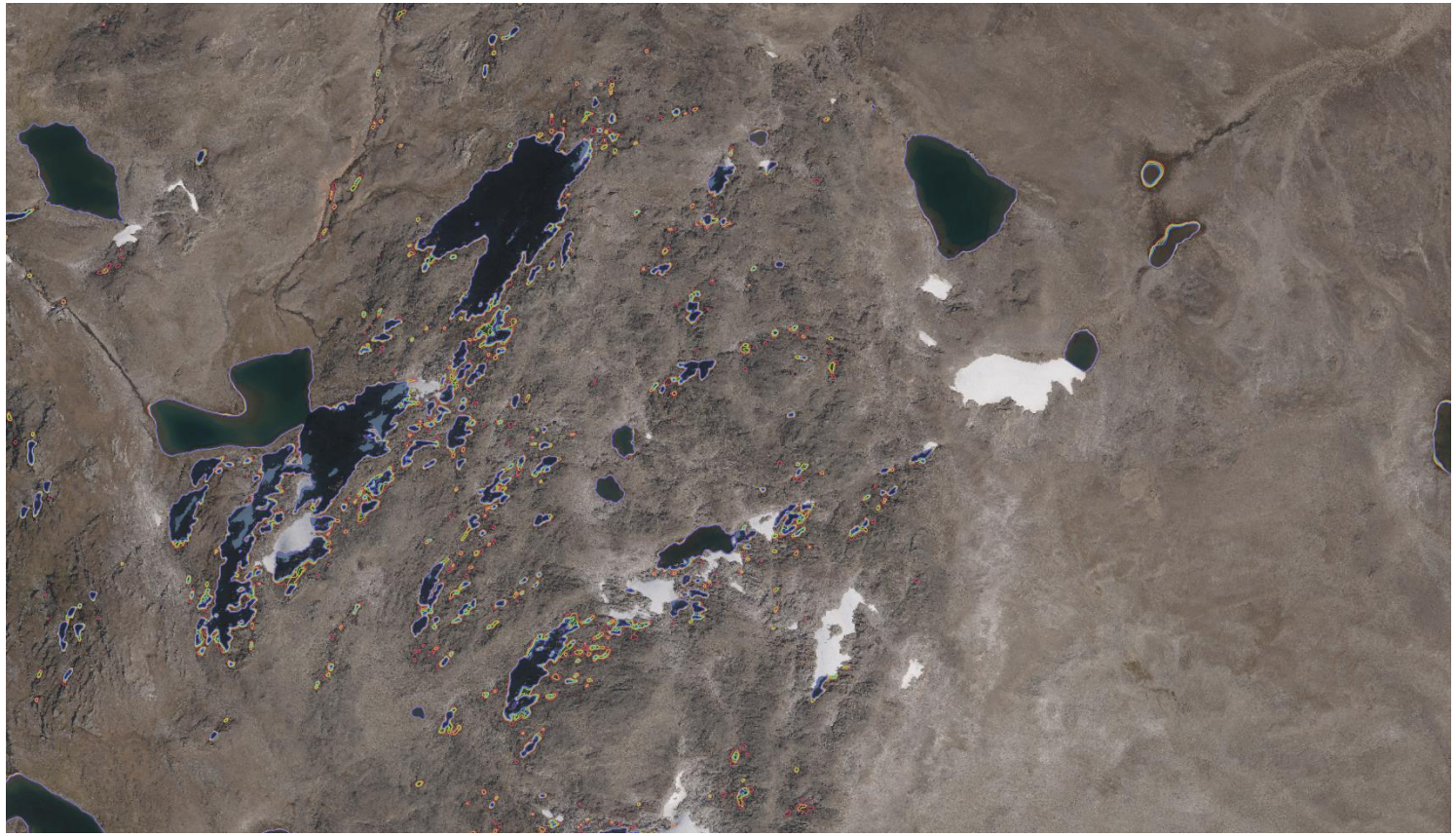
Contours

- Practical approach
- 0.41 seems to be a good threshold on our NDWI



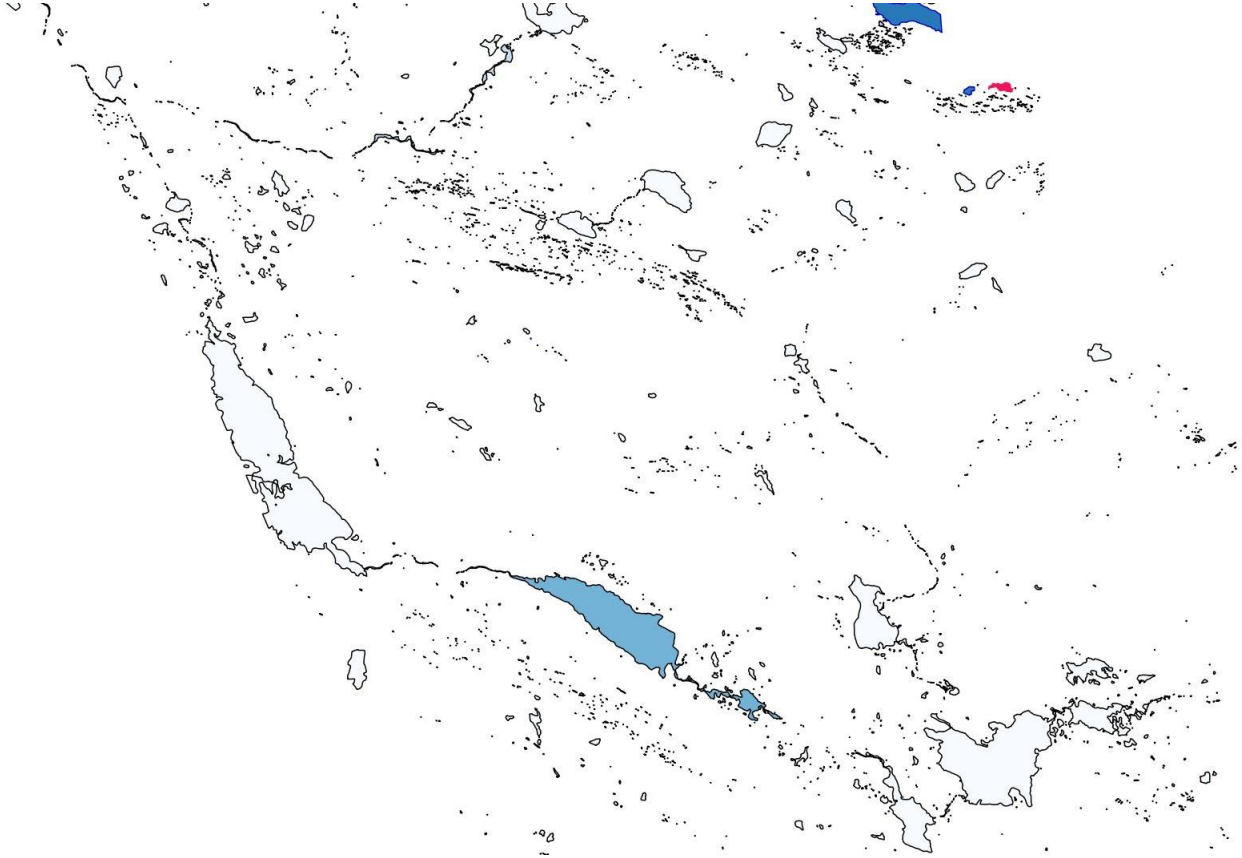
Shadows are problematic

- Shadows are defined as water.
- Remove small polygons



Std_dev and mean on contours

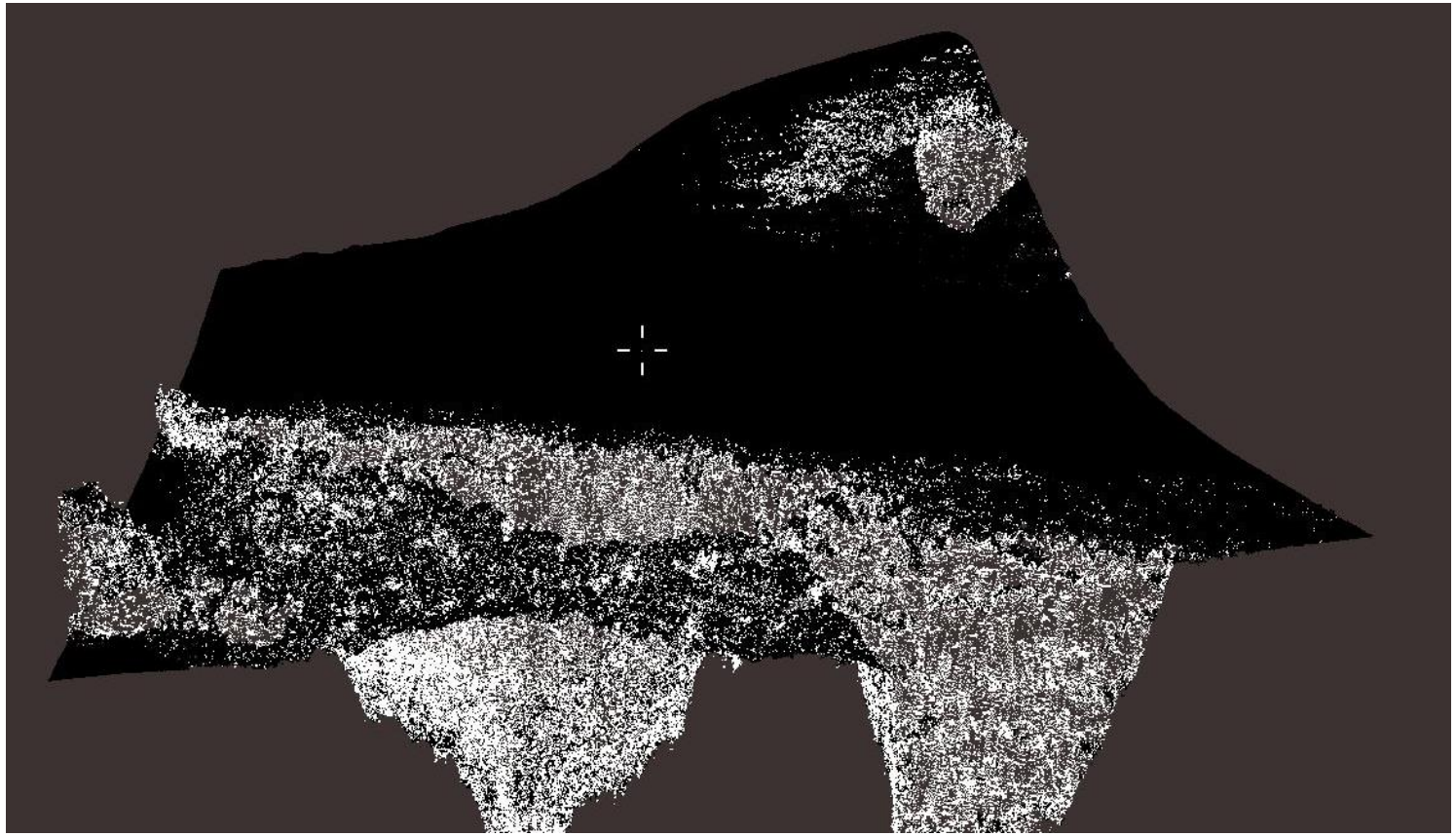
- Elevation along edge from laz
- Std_dev on z along the edge identifies shadow and water with problems.
- Manual edit of polygons to get final water.shp



Classification of pointcloud using lastools

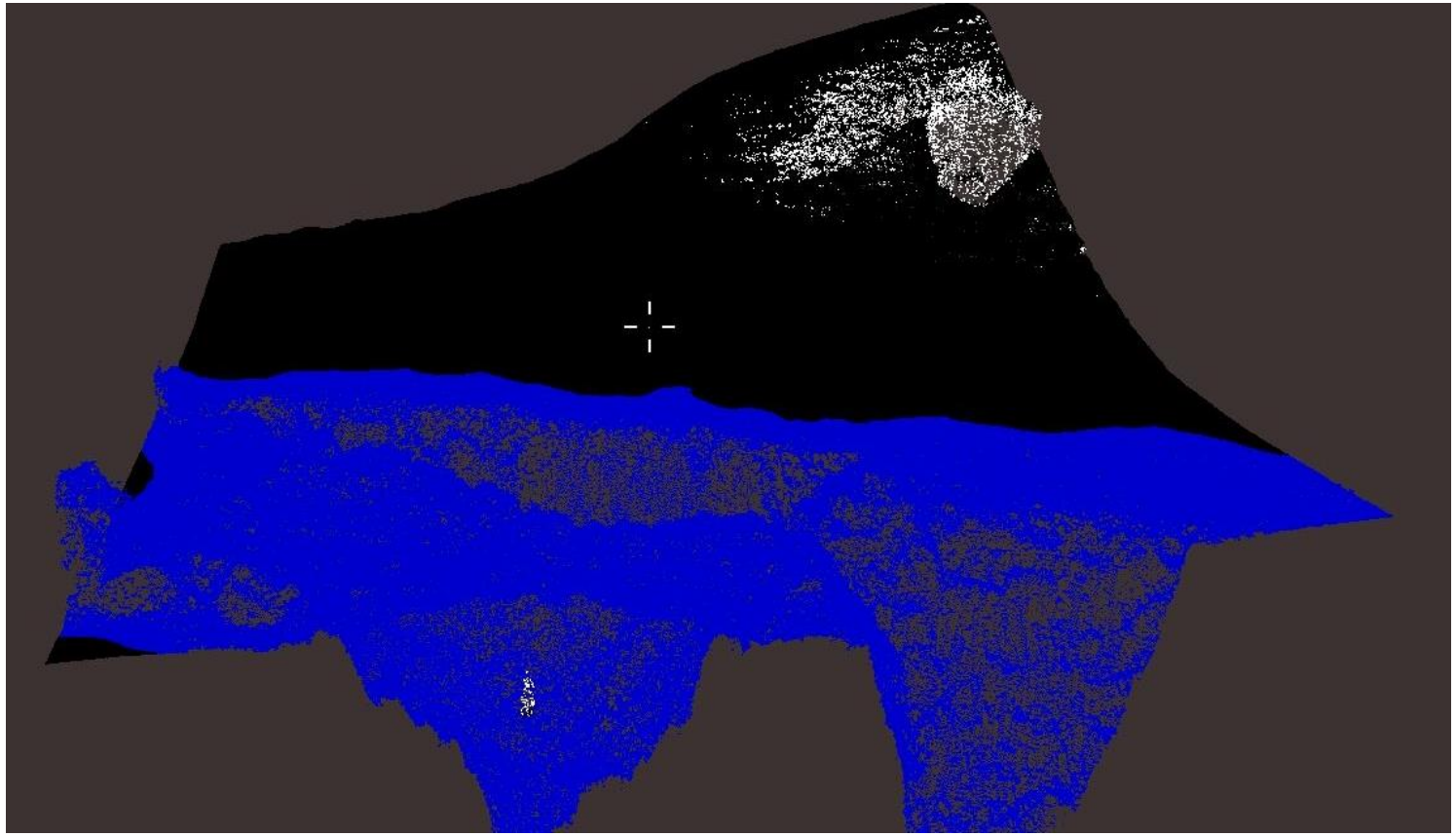
Raw pointcloud

- Unclassified
- Uncertain points



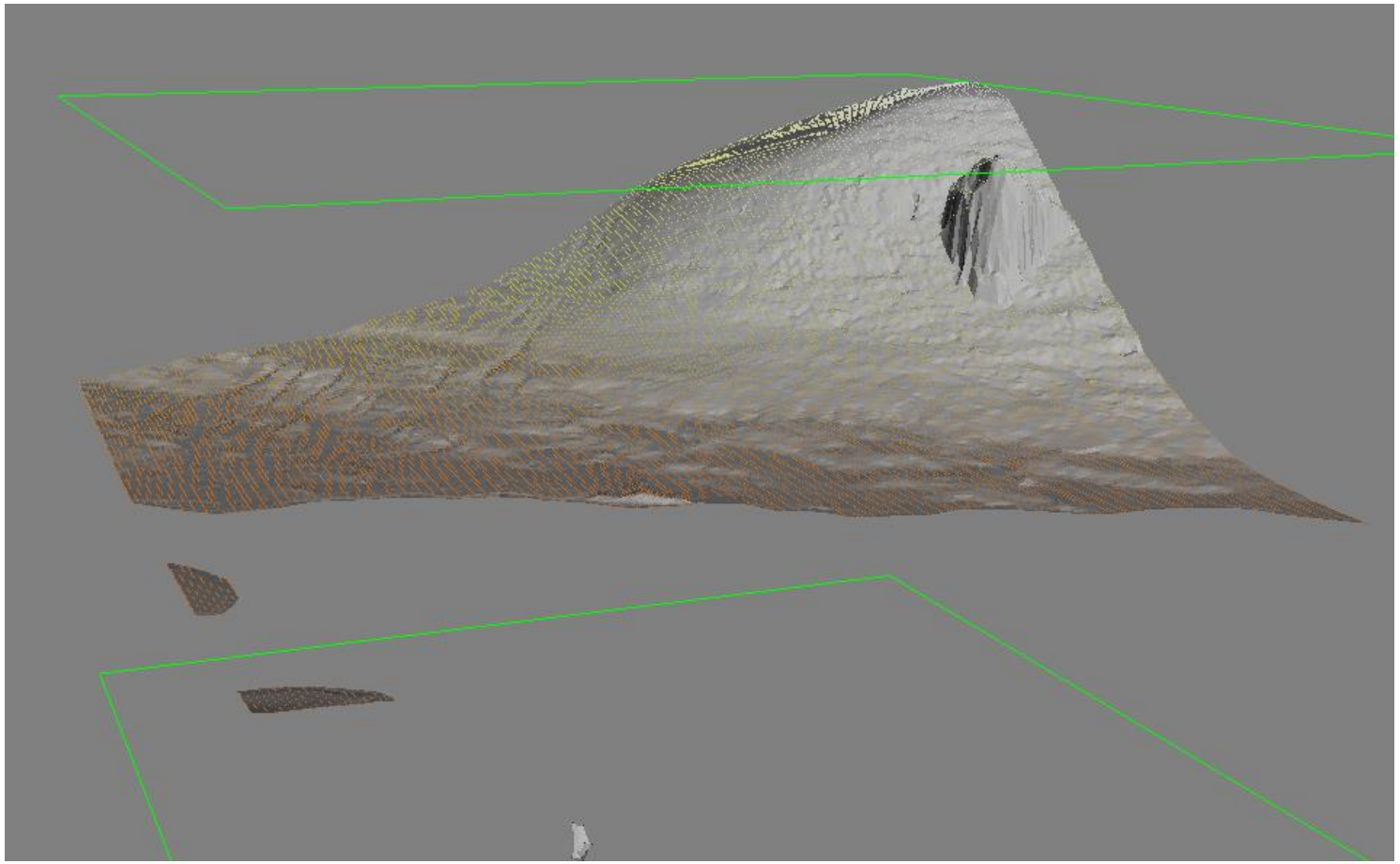
Classify water based on polygons

- lasclip -i *.laz -poly water.shp -olaz -classify 9 -interior -v -donuts



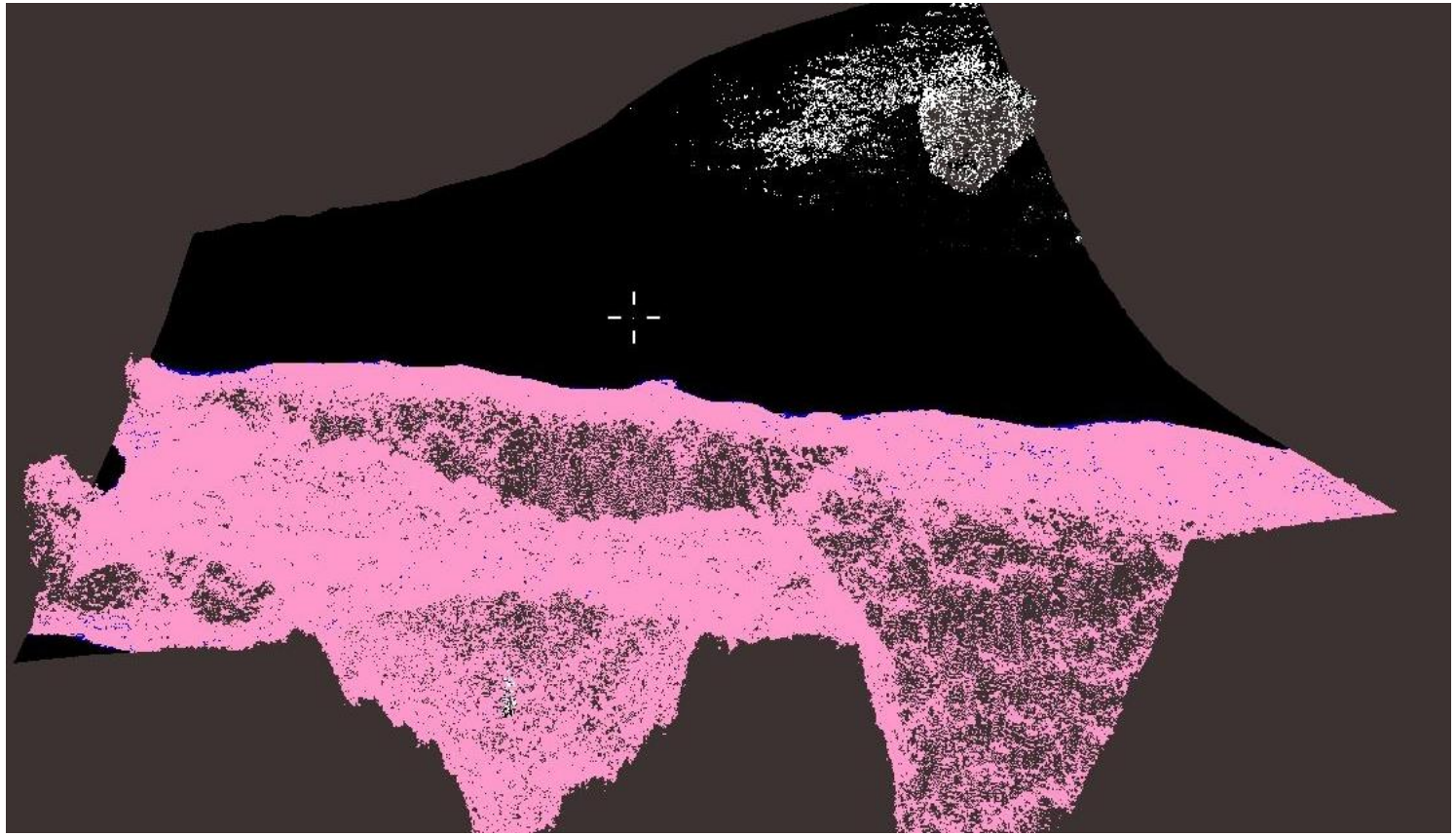
Create preliminary DTM

- Create DTM without points classified as water
- lascanopy -i *.laz -height_cutoff -2500 -drop_class 9 -buffered 25 -step 5 -p 10 -obil



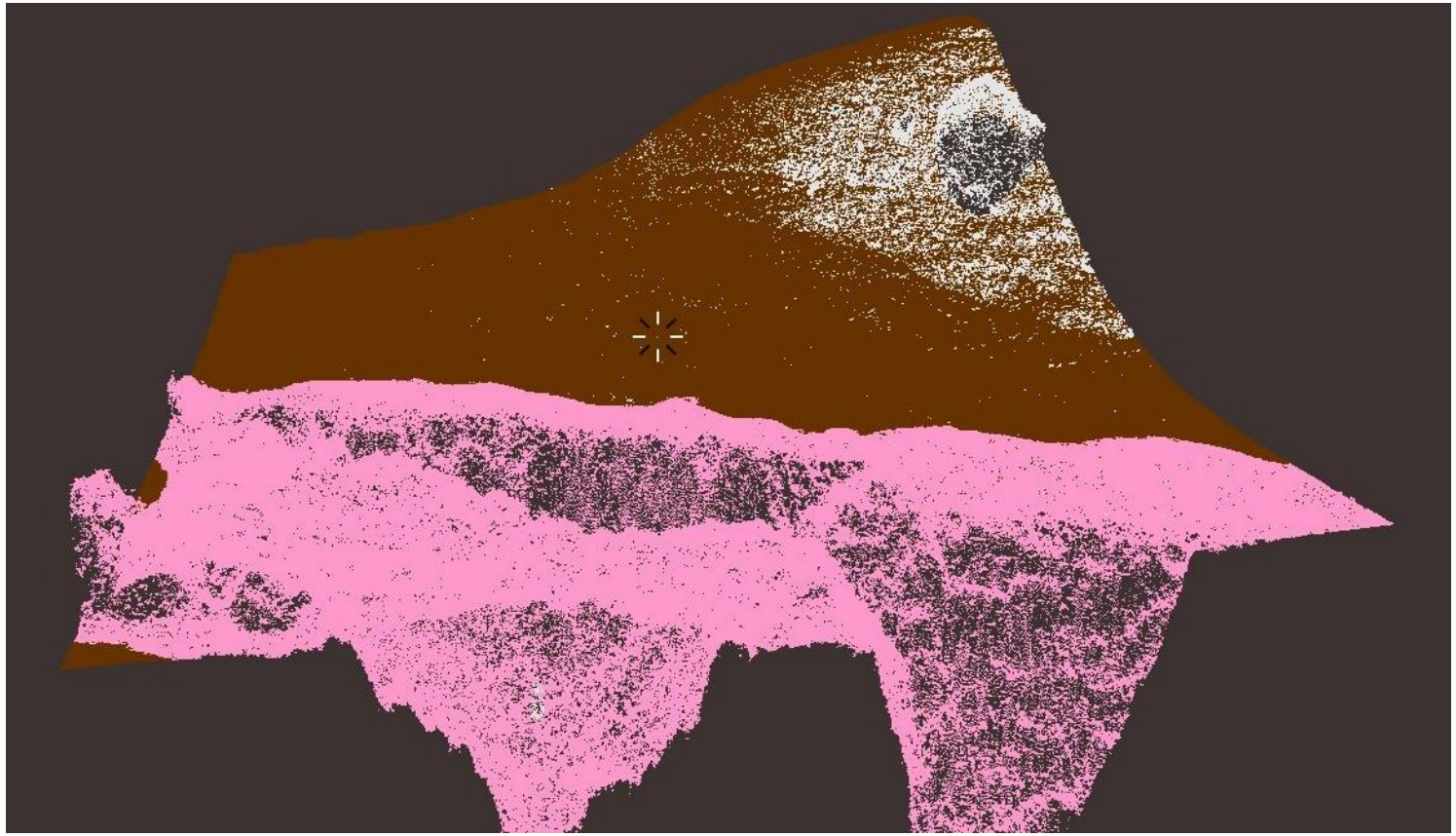
Classify water to noise

- lasheight -i «file».laz
  -ground_points
  «file»_p10.bil
  -ignore_class 0 13 14
  -classify_below -0.1 7
  -classify_above 0.1 7



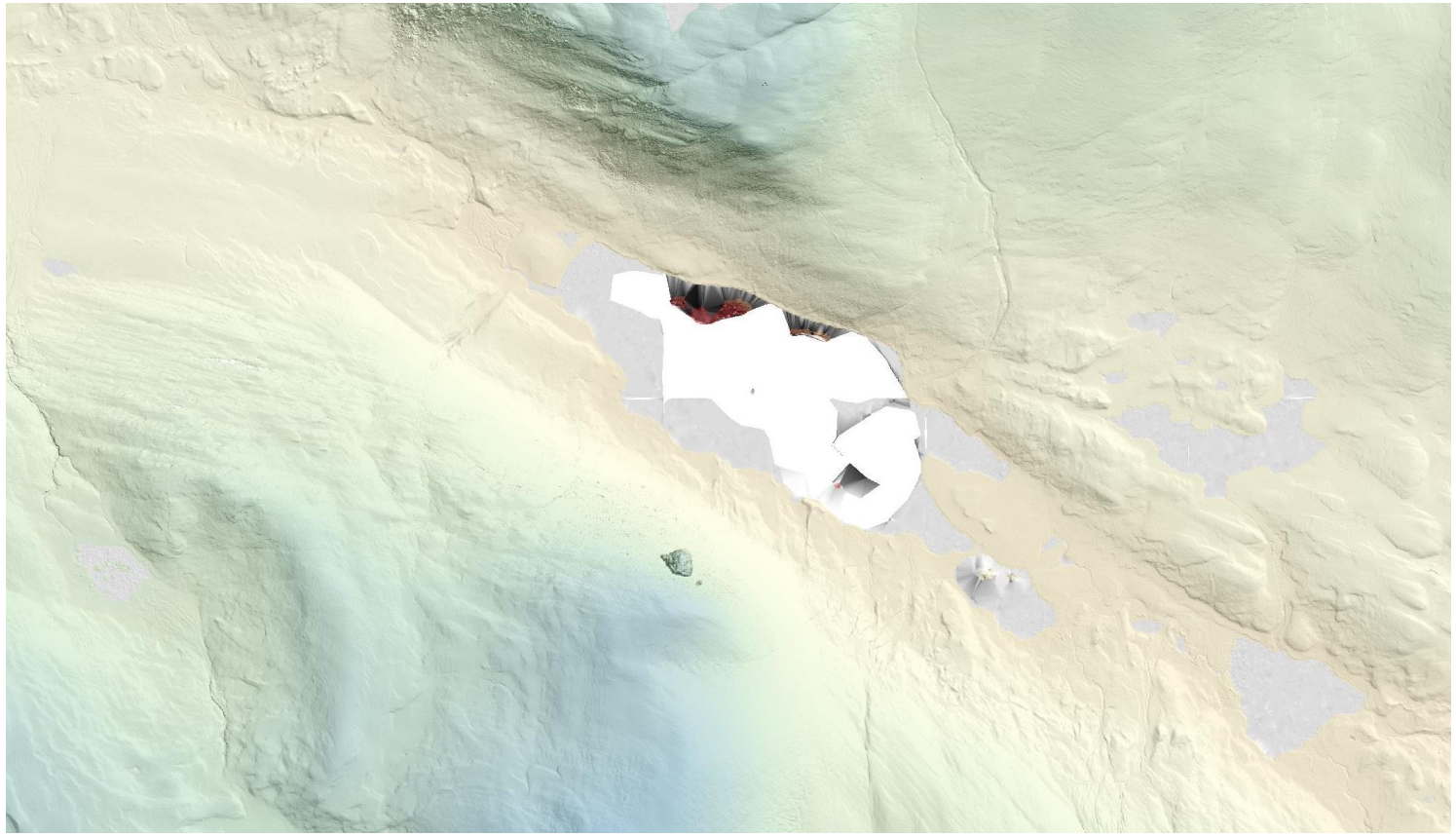
Classify ground points

- lasground_new -i *.laz
  -all_returns
  -ignore_class 7
  -step 10 -buffered 25



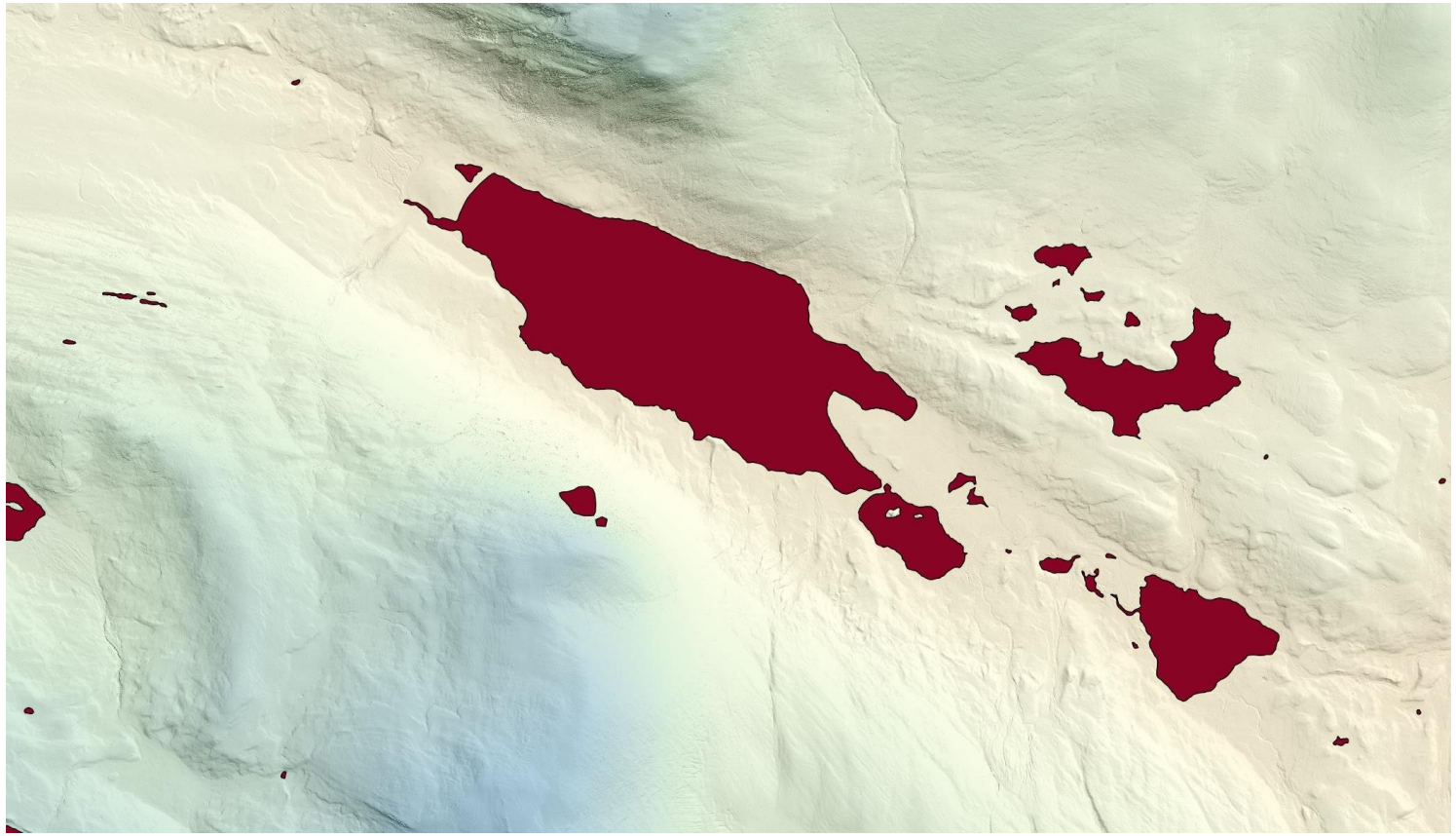
QC and edit

- create dtm to verify results
- Edit water polygons based on result



Re-run classification-run

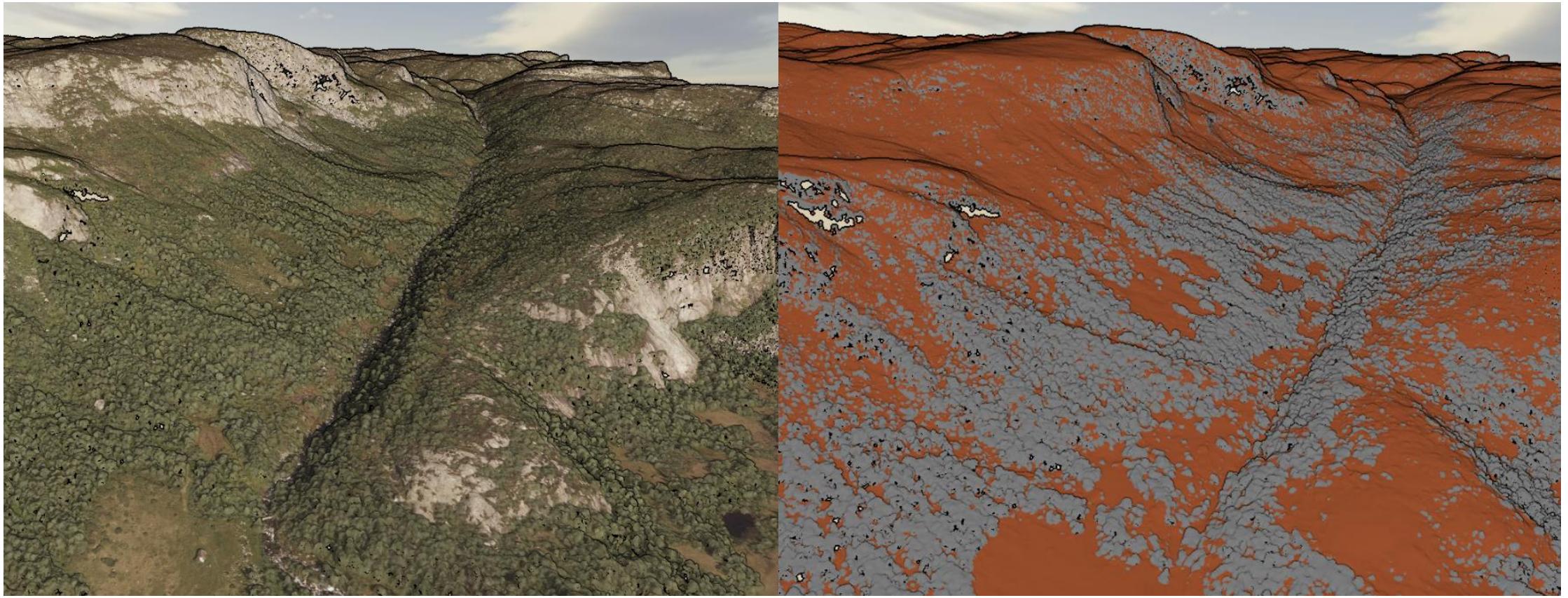
- Lastools workflow will also handle problems in shadows
- Alternative: create edits.shp and classify all points within polygons to noise



Inaccuracies

- Low shrubs will be classifed as ground
- Terrain will be «softened»

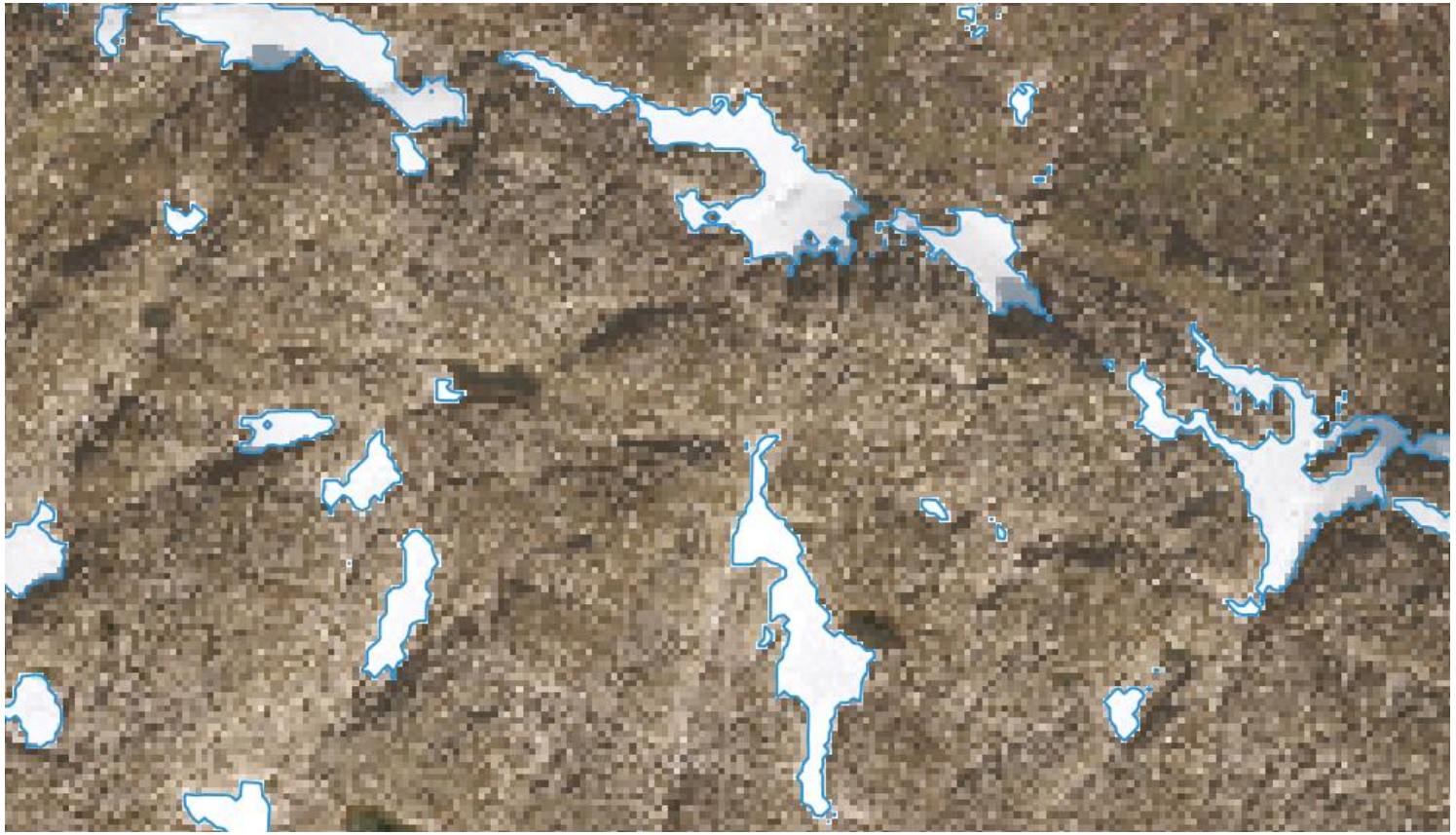
Forrests

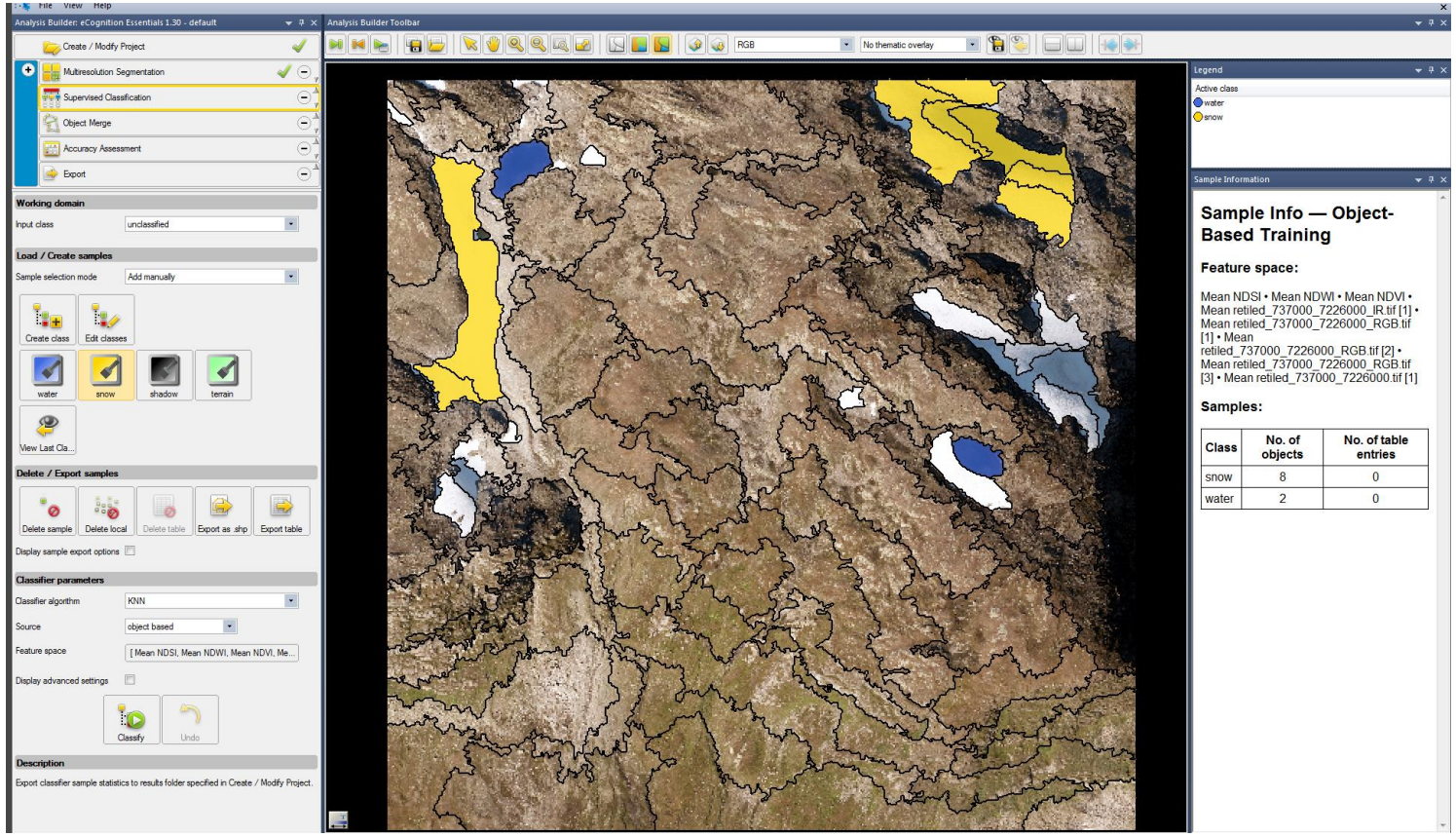


Challenges

- Snow
- Bridges
- Shadows

- Communicating that this is something else than lidar…



Breakout Session Question

- Efficient tool for semi-auto classification routine
- Must adapt to variations throughout the block