

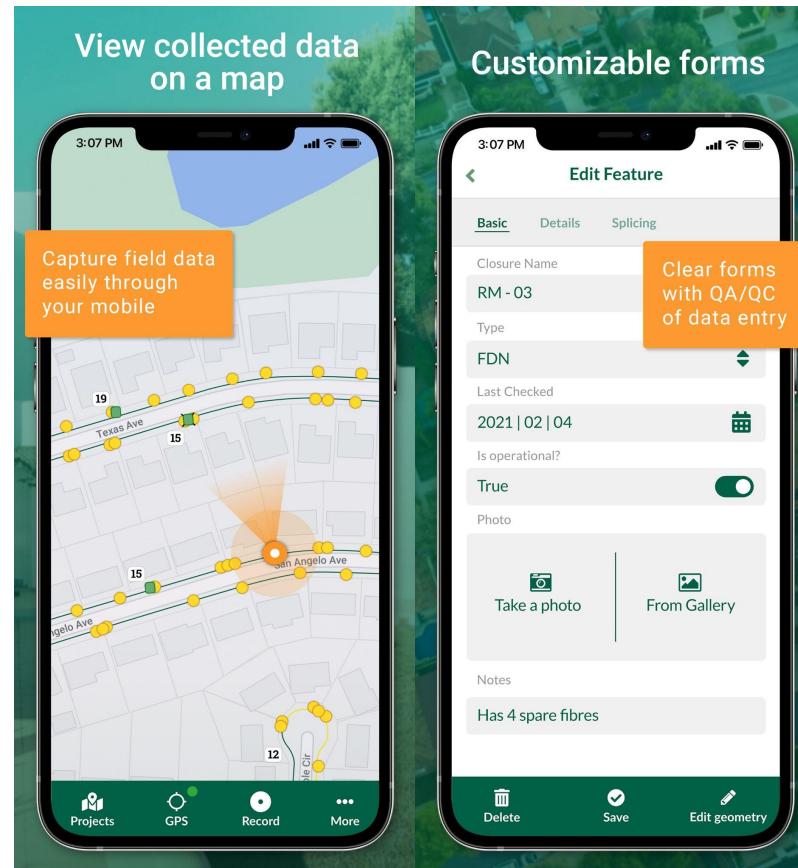
QGIS a mračná bodov: novinky

**Martin Dobiaš
Lutra Consulting**

GeoKARTO 2022

About Lutra Consulting

- Services around open source GIS
 - QGIS development
 - Development of custom QGIS plugins
 - Migration to open source GIS
 - Support and training
- Mergin Maps: Mobile data collection
 - Mobile app based on QGIS (Android/iOS)
 - Web service for synchronization
 - QGIS plugin for setup
 - Hosted SaaS, open source community edition
 - <https://merginmaps.com/>



Point clouds in QGIS

- Two crowdfunding campaigns - in 2020 and 2021

<https://www.lutraconsulting.co.uk/crowdfunding/pointcloud-qgis/>

<https://www.lutraconsulting.co.uk/crowdfunding/elevation-pointcloud-enhancements-qgis/>

- In collaboration with North Road & Hobu
- Initial support in QGIS 3.18



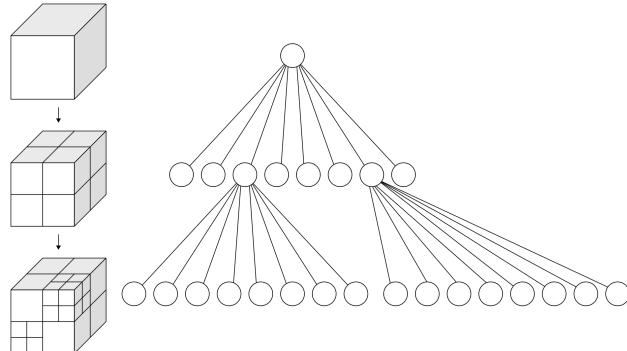
N O R T H
R O A D



Challenges of point cloud data

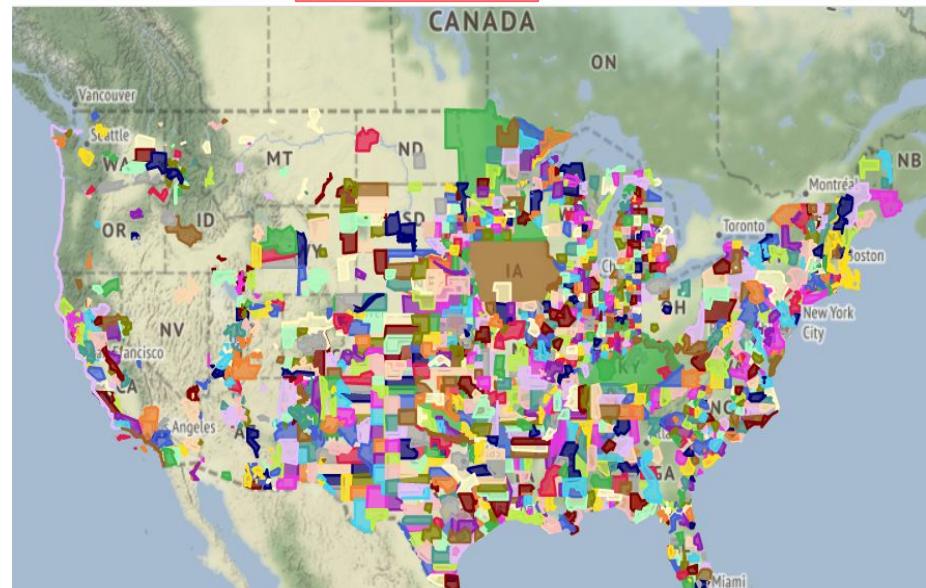
1. Massive amounts of points
2. Commonly used formats (LAS/LAZ)
not optimized for 2D/3D viewing

Data need to be organized (indexed) before rendering.



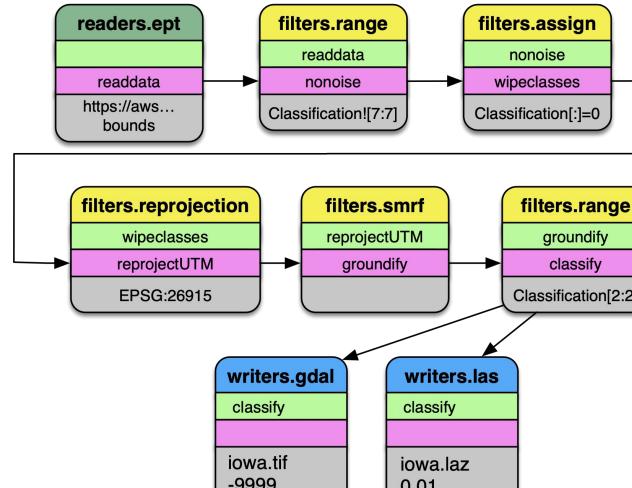
USGS / Entwine

31,318,193,285,666 points in 1,604 resources



PDAL - Point Data Abstraction Library

- “GDAL for point cloud data”
- Drivers to read/write multitude of formats
- Wide range of filters for manipulation of data
- Combine readers, writers and filters into pipelines



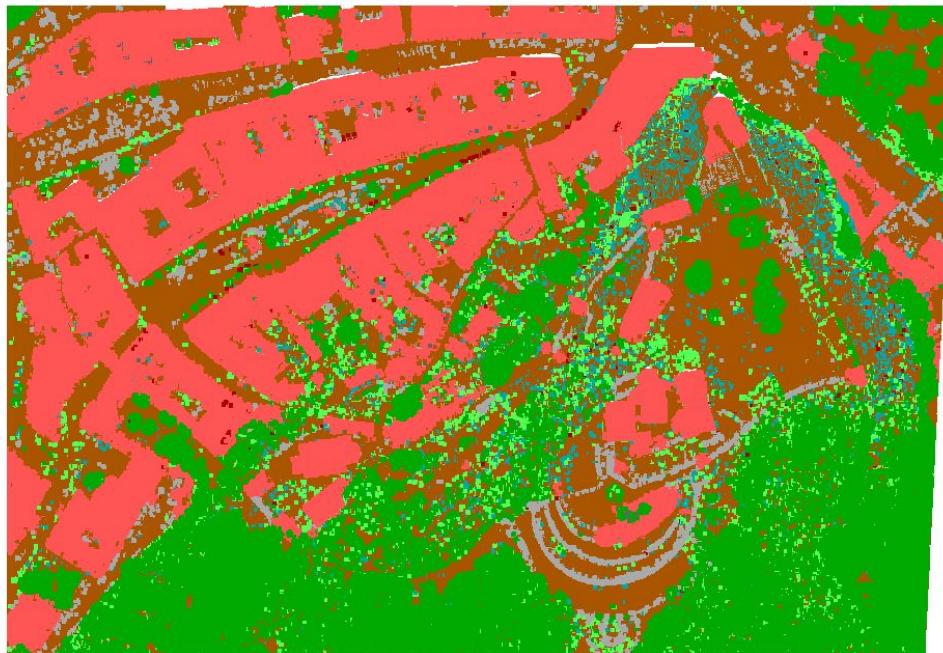


Browser

- ★ Favorites
 - /home/martin/tmp/3d
 - /home/martin/tmp/las
- Spatial Bookmarks
- Project Home
- Home
- /
- GeoPackage
- Spatialite
- PostGIS
- MSSQL
- DB2
- WMS/WMTS
- Vector Tiles

Layers

- entwine_tn-bin



Layer Styling

entwine_tn-bin

Classification

Attribute abc Classification

Color	Value	Legend
✓	1	Unclassified
✓	2	Ground
✓	3	Low Vegetation
✓	4	Medium Vegetation
✓	5	High Vegetation
✓	6	Building
✓	7	Low Point (Noise)
✓	8	Reserved
✓	9	Water
✓	10	Rail
✓	11	Road Surface

Classify

 Delete All

Point Symbol

Point size 1,000000 Millimeters

Style Square

Layer Rendering

Maximum error 0,300000 Millimeters

Opacity 100,0 %

Blending mode Normal

 Live update Apply

Processing T...

Debugging/Development...

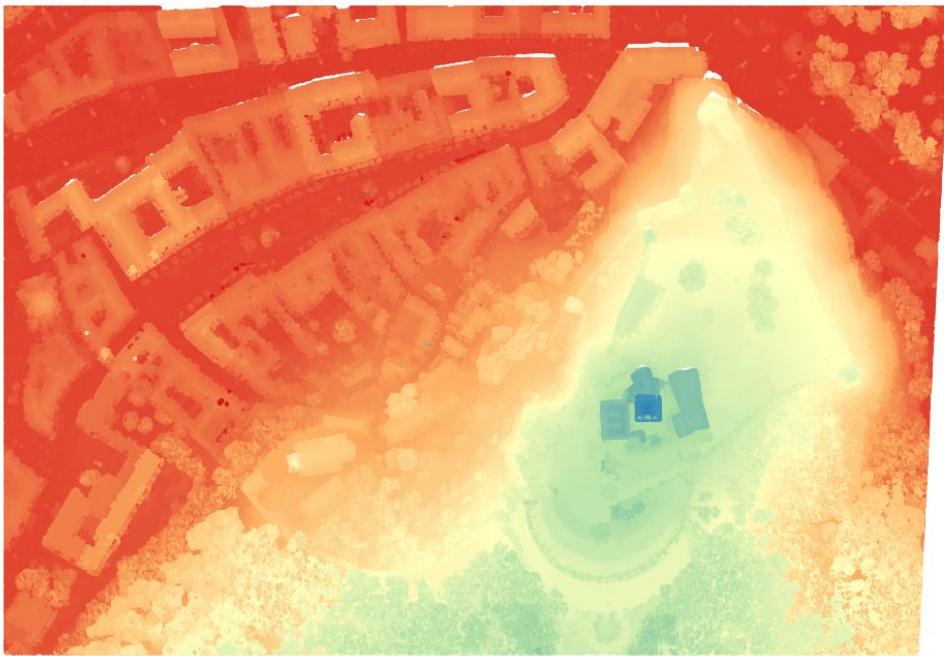
Layer ...



Browser

- ▶ ★ Favorites
 - ▶ /home/martin/tmp/3d
 - ▶ /home/martin/tmp/las
- ▶ Spatial Bookmarks
- ▶ Project Home
- ▶ Home
- ▶ /
- ▶ GeoPackage
- ▶ SpatialLite
- ▶ PostGIS
- ▶ MSSQL
- ▶ DB2
- ▶ WMS/WMTS
- ▶ Vector Tiles

Layers



Layer Styling

entwine_tn-bin

Attribute by Ramp

Attribute 123 Z

Min 2,06000 Max 148,2000 Load

Interpolation Linear

Color ramp

Label unit suffix

Label precision 4

Value	Color	Label
2,06000...	Red	2,0600
38,59499...	Orange	38,5950
75,12999...	Yellow	75,1300
111,6649...	Green	111,6650
148,1999...	Blue	148,2000

Mode Continuous

Classes 5

Classify

Legend Settings...

 Clip out of range values

Point Symbol

 Live update Apply

Processing T...

Debugging/Development...

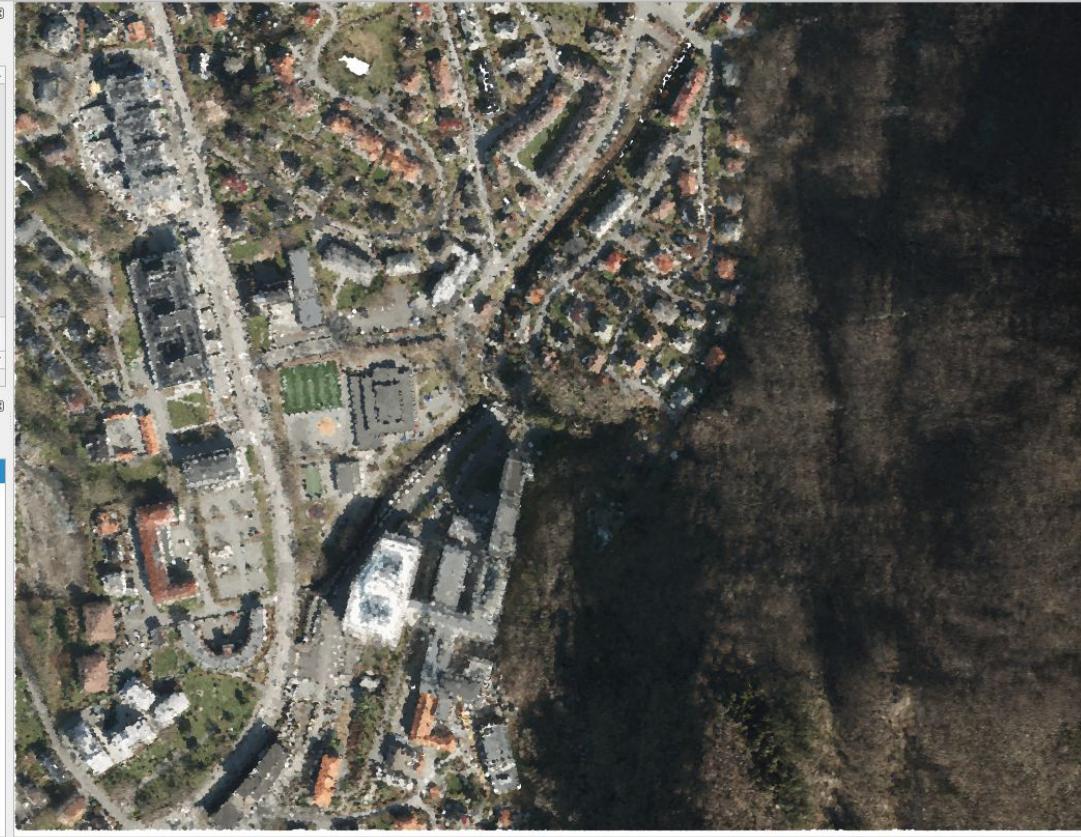
Layer ...



Browser

- SpatialLite
- PostGIS
- MSSQL
- Oracle
- WMS/WMTS
- Vector Tiles
- XYZ Tiles
- WCS
- WFS / OGC API - Features
- ArcGIS REST Servers
- GeoNode
- Mergin

Layers



Layer Styling

Bergen

RGB

Red band	123 Red
Min	0
Max	65535
Green band	123 Green
Min	0
Max	65535
Blue band	123 Blue
Min	0
Max	65535
Contrast enhancement	Stretch to MinMax

Point Symbol

Point size 1,000000 Millimeters
Style Circle

Layer Rendering

Maximum error 0,300000 Millimeters
Opacity 100,0 %
Blending mode Normal

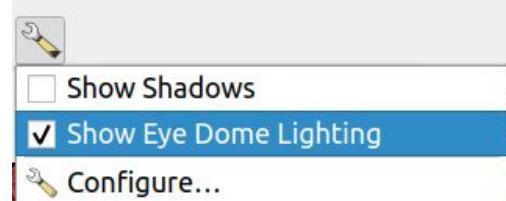
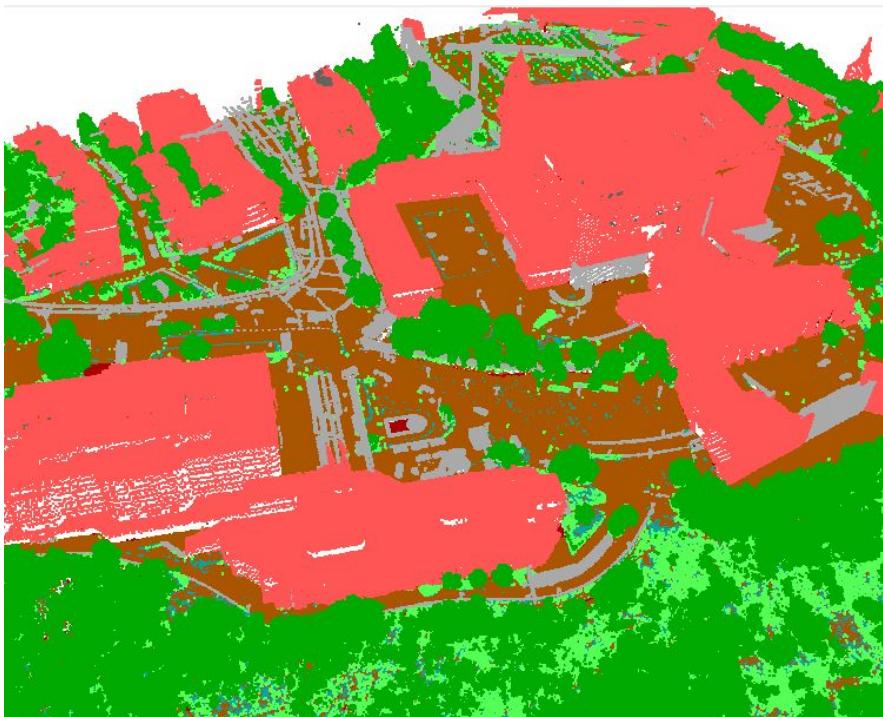
Live update Apply

Debugging/Development... Identify R... Layer ...

3D Map 1

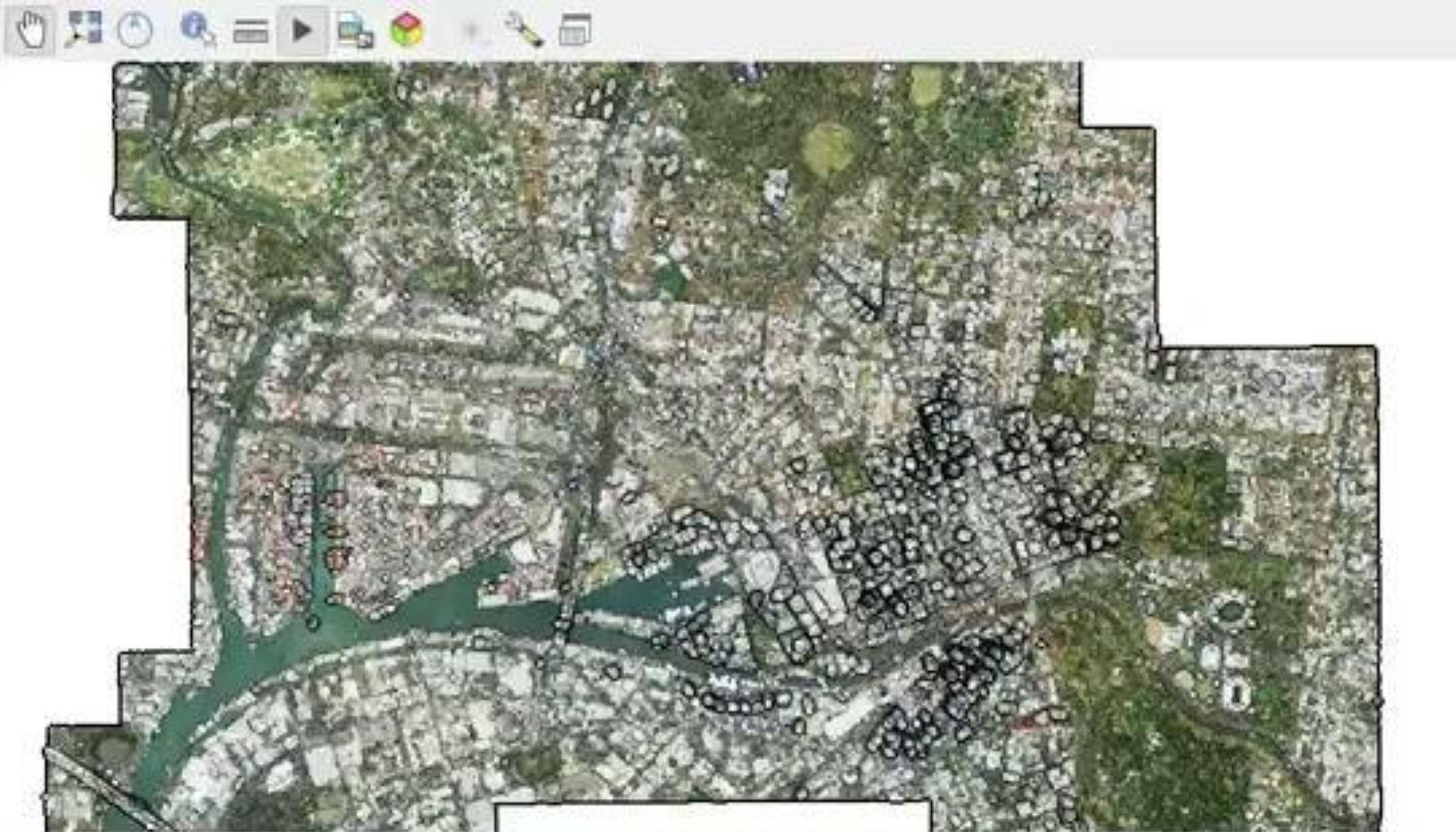


Eye-dome lighting in 3D









Keyframe <none> ▾



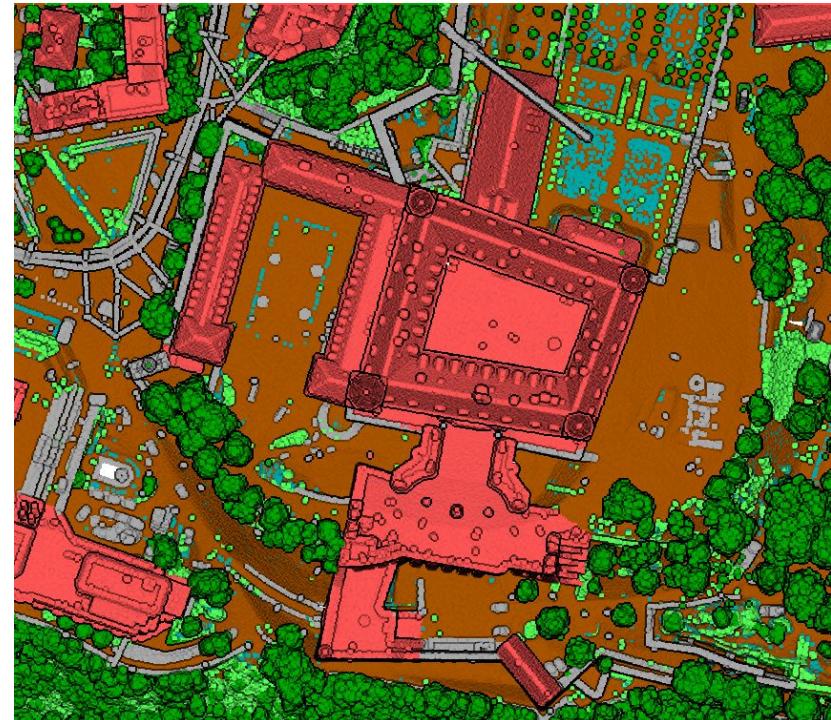
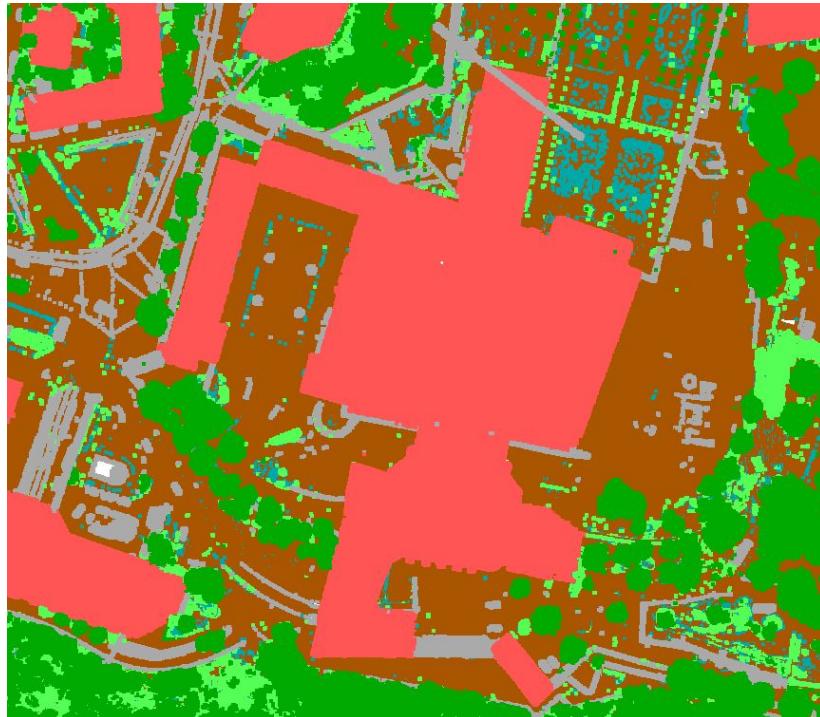
Interpolation Linear ▾



Loop

Point clouds: new features

Eye-dome lighting in 2D (coming to 3.28)



Ordered rendering in 2D (3.24)



Default



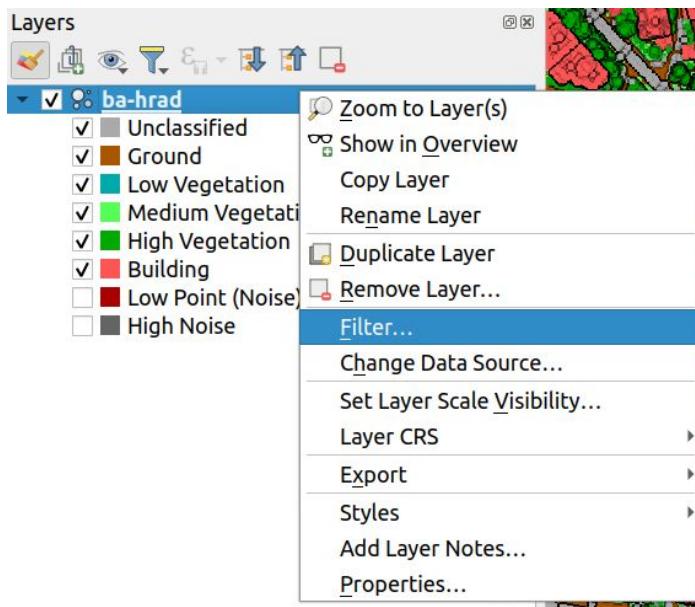
Bottom to top

Better classified renderer (3.26)

- Skip display of unused classes
- Show non-standard classes
- Percentage of points for each class

Classification				
Attribute	123 Classification	Color	Value	Legend
				Percentage
<input checked="" type="checkbox"/>	0	Grey	Created, Never Clas...	1,9
<input checked="" type="checkbox"/>	2	Brown	Ground	34,2
<input checked="" type="checkbox"/>	5	Green	High Vegetation	54,9
<input checked="" type="checkbox"/>	6	Red	Building	1,5
<input checked="" type="checkbox"/>	9	Cyan	Water	6,9
<input checked="" type="checkbox"/>	15	Magenta	Transmission Tower	< 0,1
<input checked="" type="checkbox"/>	17	Blue	Bridge Deck	0,1
<input checked="" type="checkbox"/>	19	Dark Red	19	0,1
<input checked="" type="checkbox"/>	64	Yellow	64	0,2
<input checked="" type="checkbox"/>	65	Pink	65	0,1
<input checked="" type="checkbox"/>	66	Light Green	66	< 0,1

Filtering of point clouds (3.26)



Query Builder

Set provider filter on ba-hrad

Fields

- X
- Y
- Z
- Intensity
- ReturnNumber
- NumberOfReturns
- ScanDirectionFlag

Values

- Minimum: 69.61
- Maximum: 291.8
- Mean: 0
- StdDev: 0

Operators

- =
- <
- >
- AND
- IN
- <=
- >=
- !=
- OR
- NOT IN

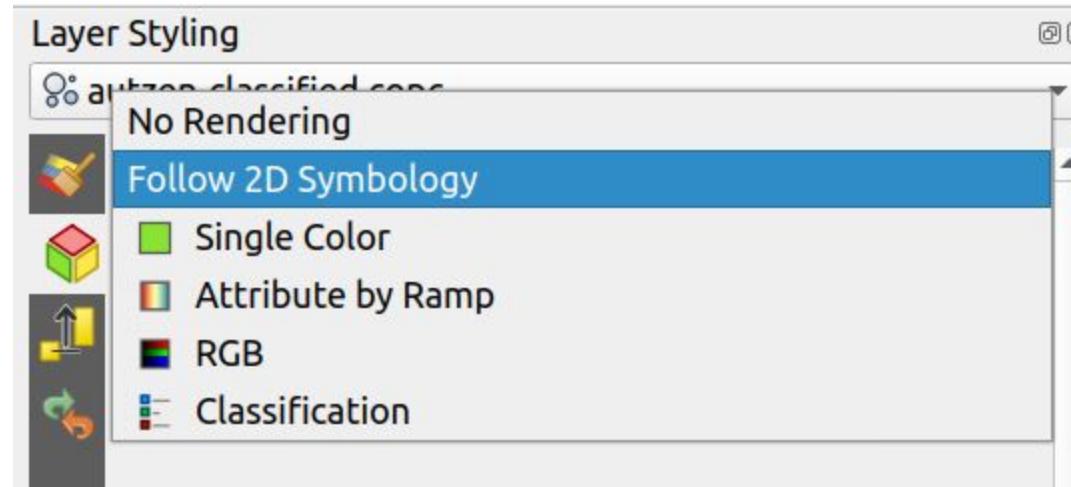
Provider Specific Filter Expression

```
Z >= 200 AND Z <= 250 AND Classification = 6
```

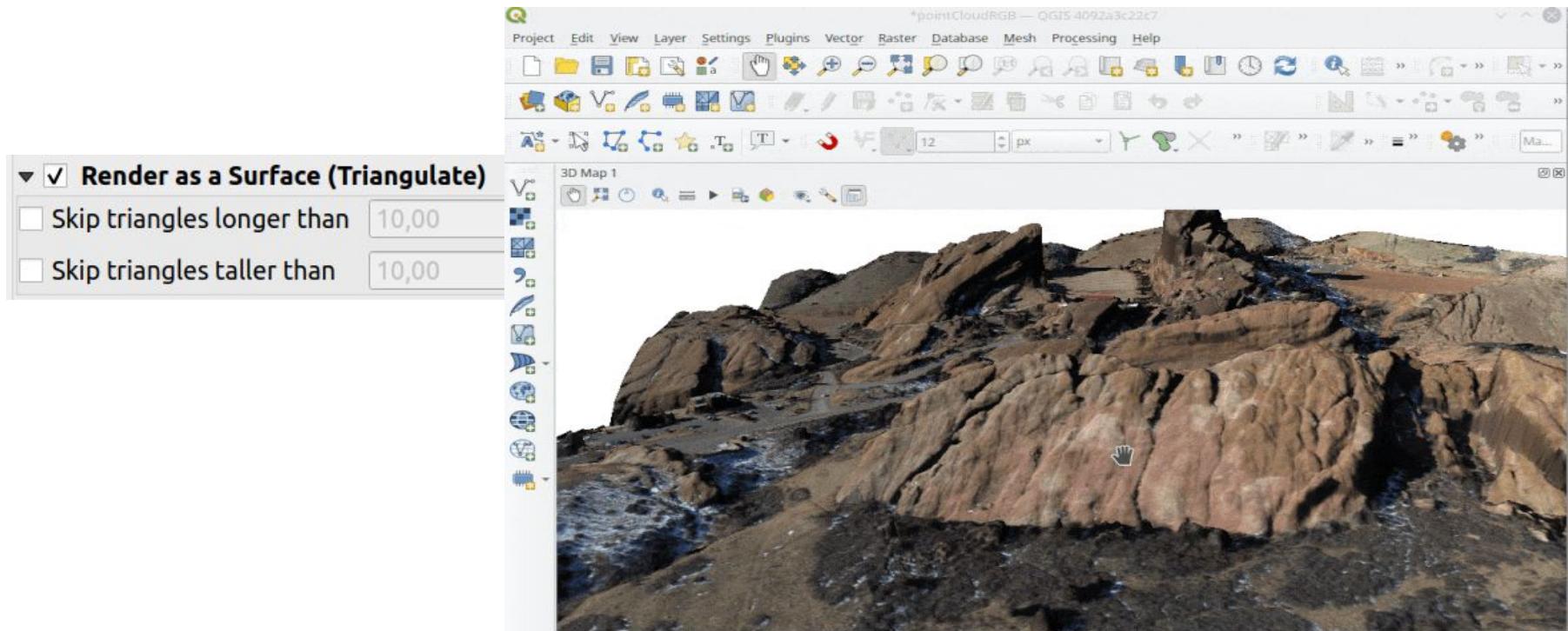
Test Clear Save... Load... Cancel OK

This screenshot shows the 'Query Builder' dialog box. It is set to 'Set provider filter on ba-hrad'. The 'Fields' section lists various point cloud attributes: X, Y, Z, Intensity, ReturnNumber, NumberOfReturns, and ScanDirectionFlag. The 'Values' section displays statistical information for the Z field: Minimum 69.61, Maximum 291.8, Mean 0, and StdDev 0. Below these are the standard comparison operators (=, <, >, AND, IN, <=, >=, !=, OR, NOT IN). The 'Provider Specific Filter Expression' field contains the filter expression: `Z >= 200 AND Z <= 250 AND Classification = 6`. At the bottom are buttons for 'Test', 'Clear', 'Save...', 'Load...', 'Cancel', and 'OK'.

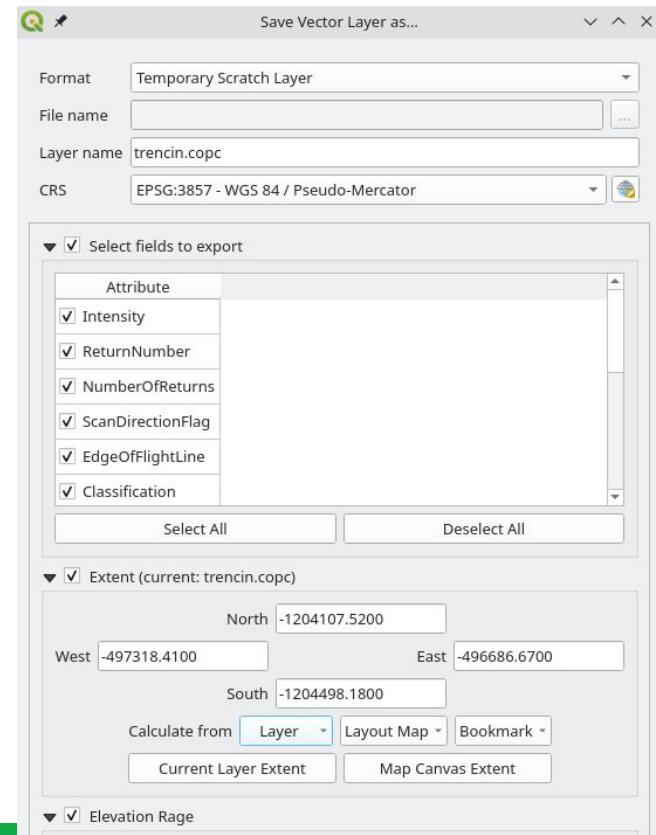
Sync 2D and 3D style of point clouds (3.26)



Point clouds as surfaces (3.26)



Export of point clouds (coming to 3.28)

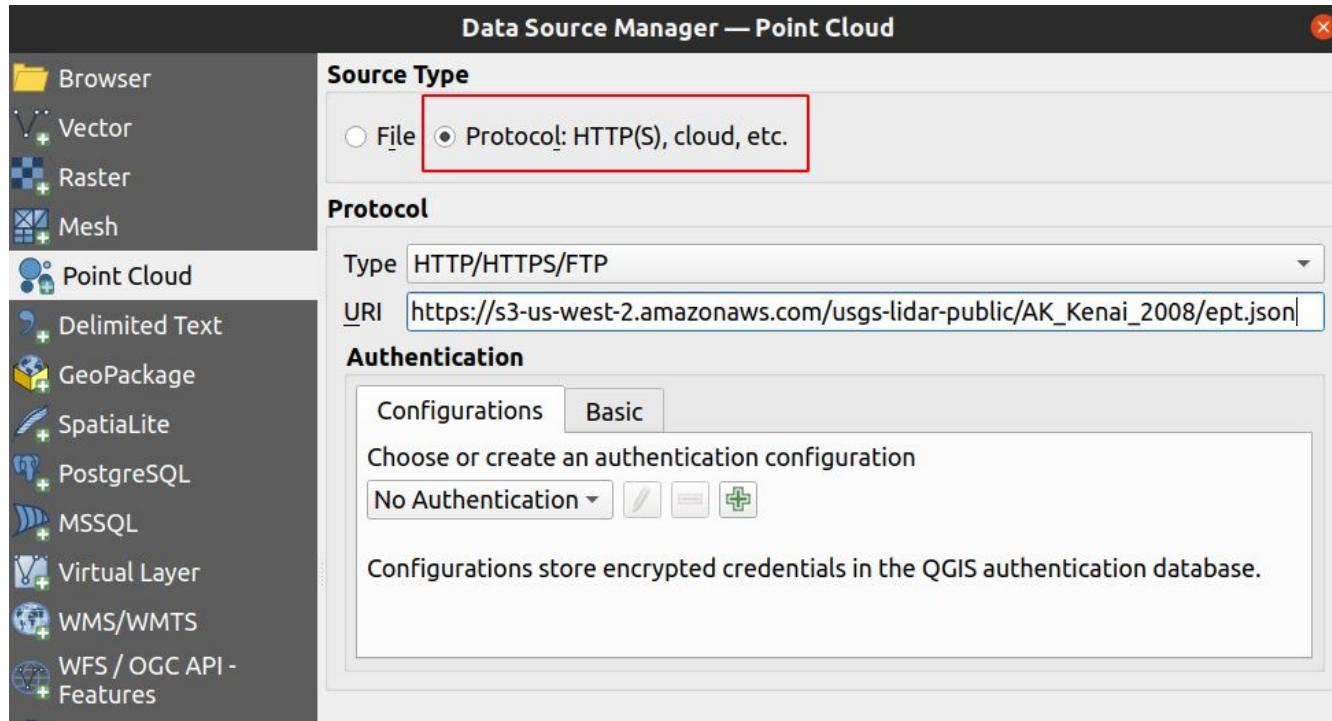


Cloud-optimized Point Cloud (COPC)

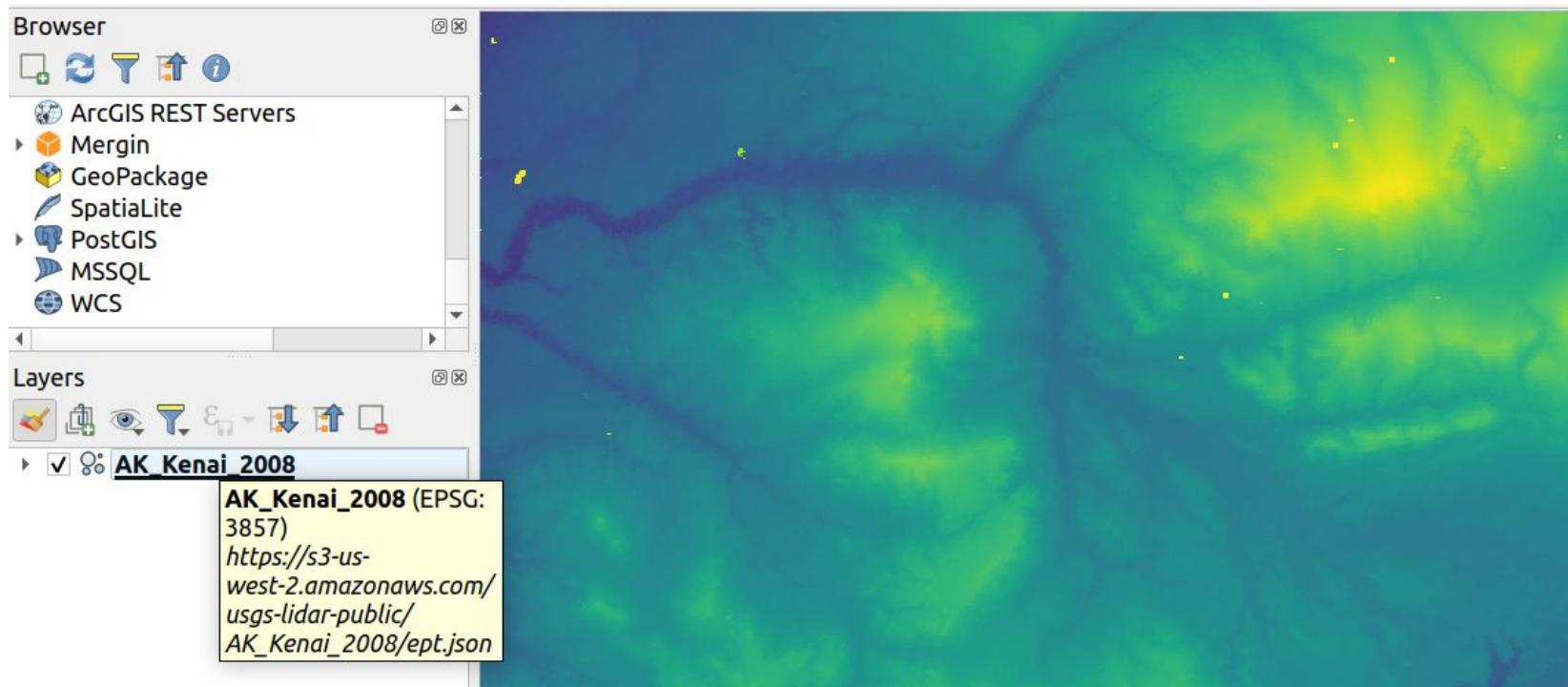
Cloud-optimized Point Cloud (COPC)

- <https://copc.io/>
- Similar idea to Cloud-optimized GeoTIFF applied to point clouds
- Ordinary compressed LAZ file
- File content reorganized for efficient access to data even if the file is on a remote server
- Easy to use in client software, no need to further process (index) data
- Both local and remote COPC files supported since QGIS 3.26!

Remote datasets (COPC or EPT)

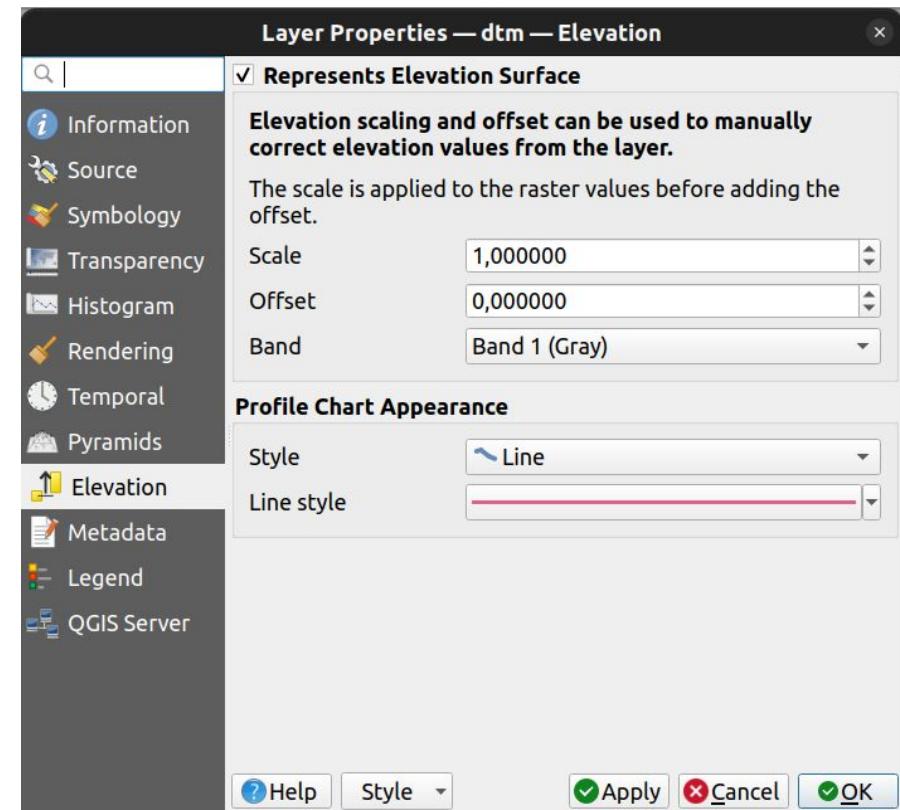
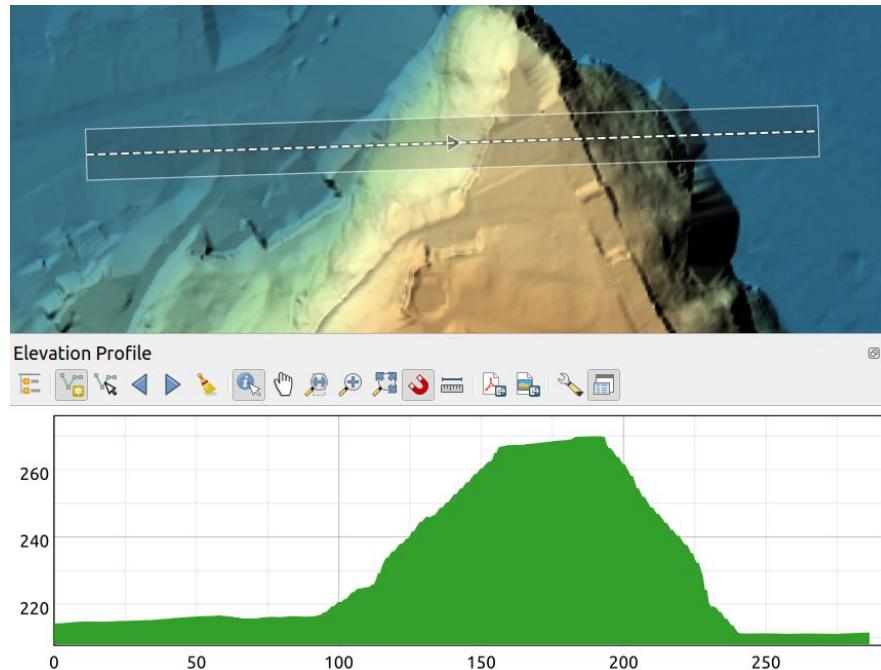


Remote datasets (COPC or EPT)

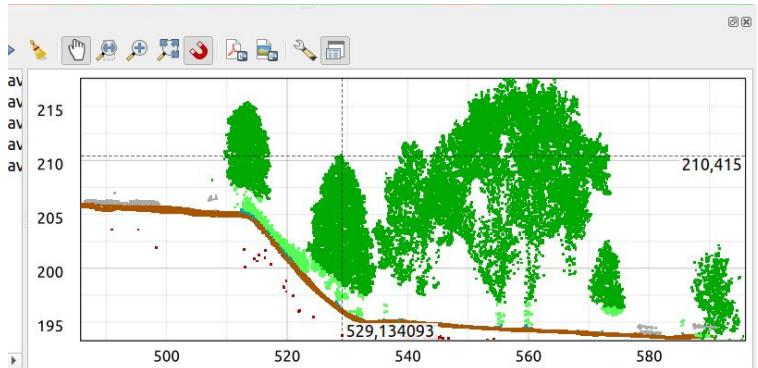
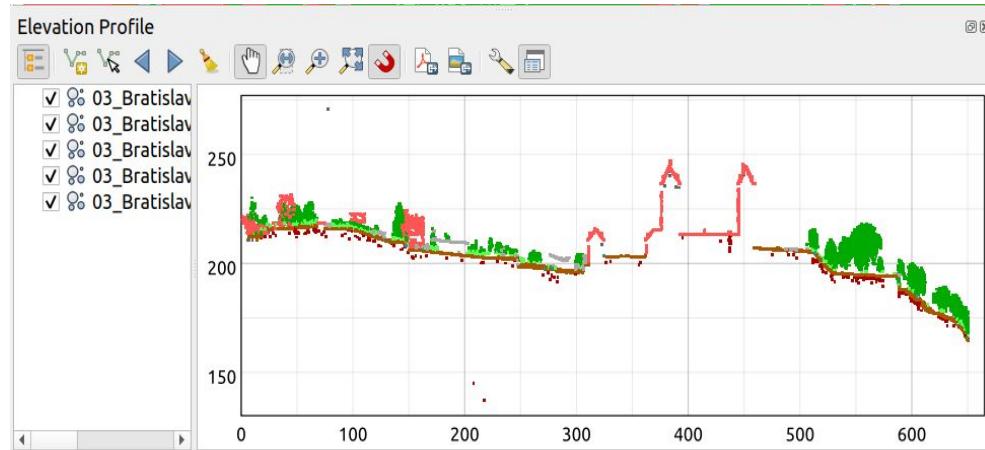
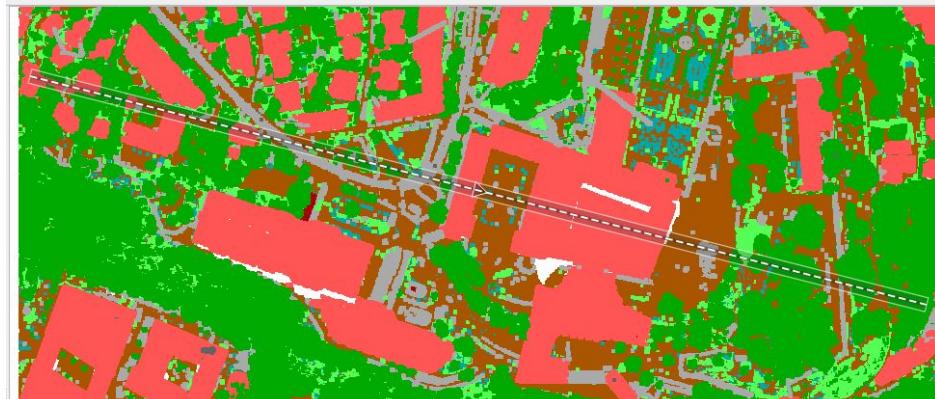


Elevation profile tool

Elevation profile tool (3.26)



Elevation profile tool

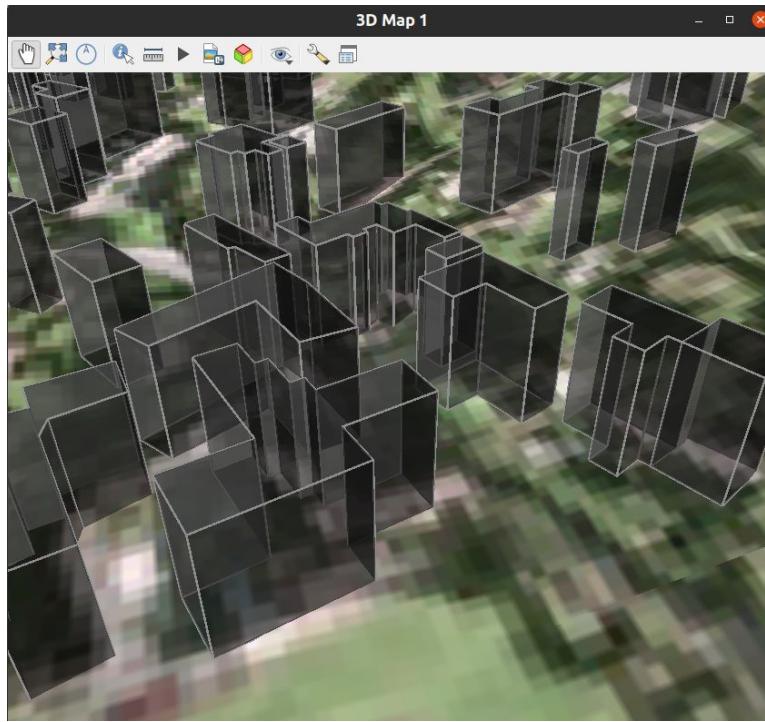


Elevation profile tool

- Supports raster, vector, point cloud, mesh layers
- Zoom in/out, pan in the profile view
- Configure symbology
- Identify data, measure distances/elevations
- Export profiles
- ...
- Check out Nyall Dawson's video for more details:
<https://www.youtube.com/watch?v=AknJjNPystU>

3D view improvements

Semi-transparent vector objects (3.26)



Ambient occlusion (coming to 3.28)

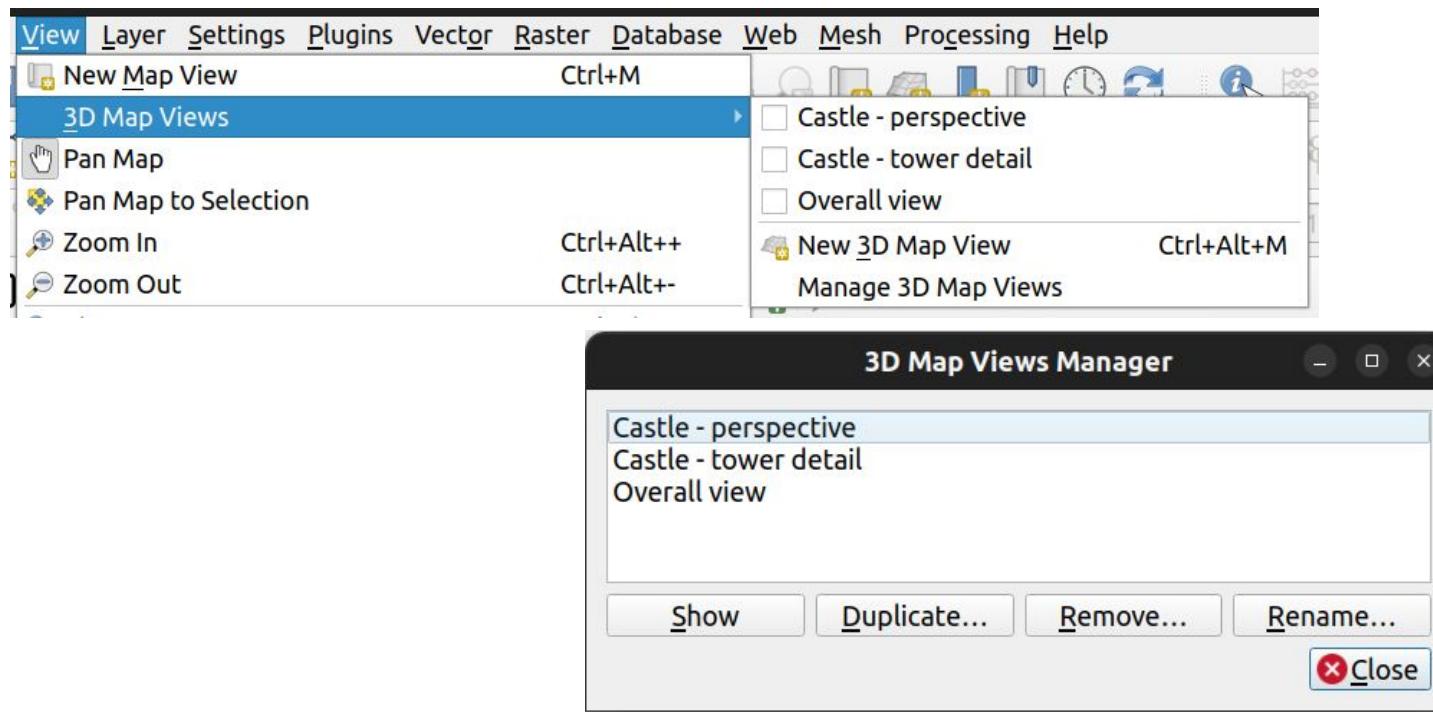




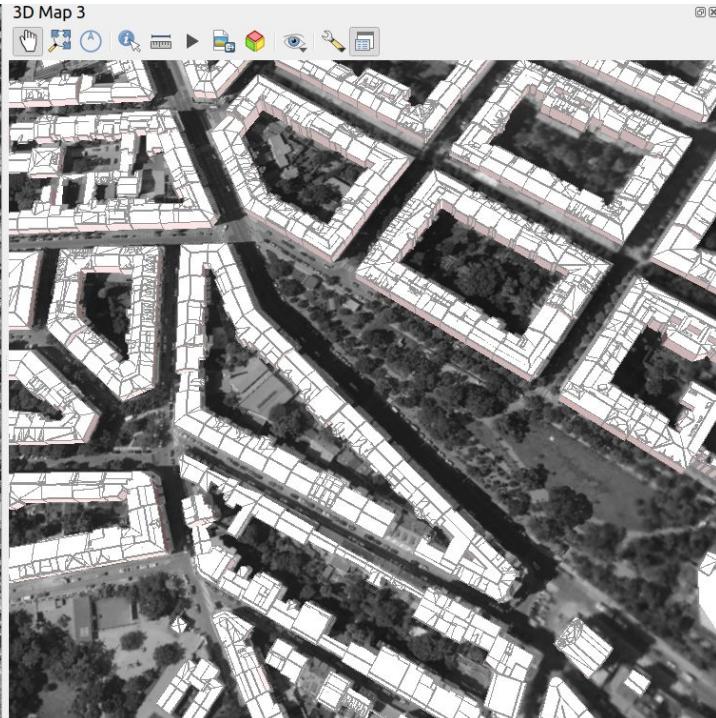
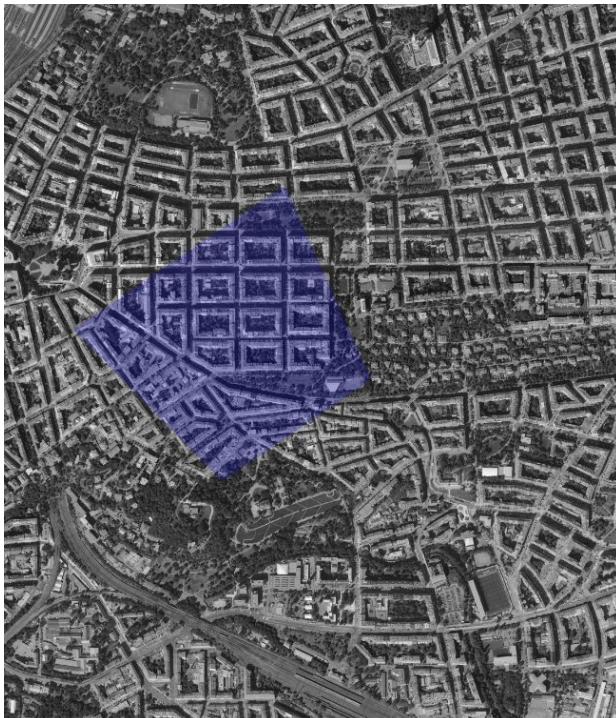
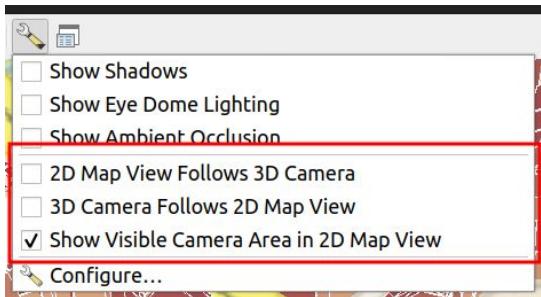
Dock/undock 3D views (3.24)



Manage 3D views (3.24)



Sync 2D and 3D views (3.26)



What's next?

Future outlook

- QGIS 3.28 (October 2022) will bring some of the new features mentioned here
- Another crowdfunding campaign to be launched in autumn!
 - Improvements to the elevation profile tool
 - Add PDAL algorithms to Processing toolbox
 - Better support massive amounts of point clouds
 - Further improve 3D map views

Thank you!

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Twitter: @lutraconsulting



Image by Raymond Nijssen