Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

wissen wohin
savoir où
sapere dove
knowing where

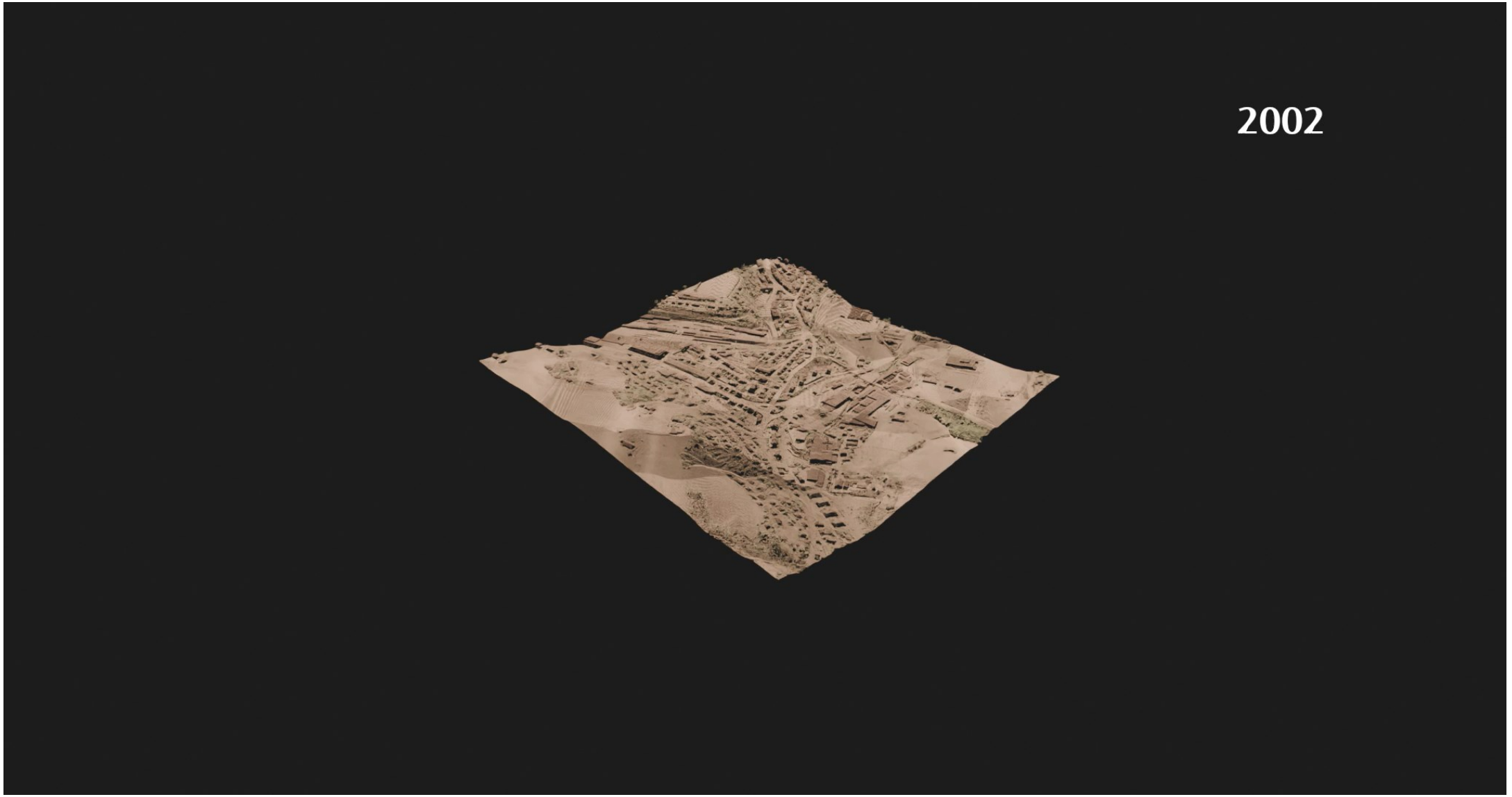
swisstopo

Third Time's the Charm ? – Switzerland's 3rd LiDAR Acquisition Cycle

SwissLiDAR Day 10.11.2026

Martin Schmid, Florian Gandor (@swisstopo.ch)

A journey through time: LiDAR acquisitions




2002: First cycle
(DTM-AV)


2018: 2nd cycle
(swissSURFACE3D)


2024: 3rd cycle
(swissSURFACE3D)

The third LiDAR acquisition cycle

Opportunities

Challenges

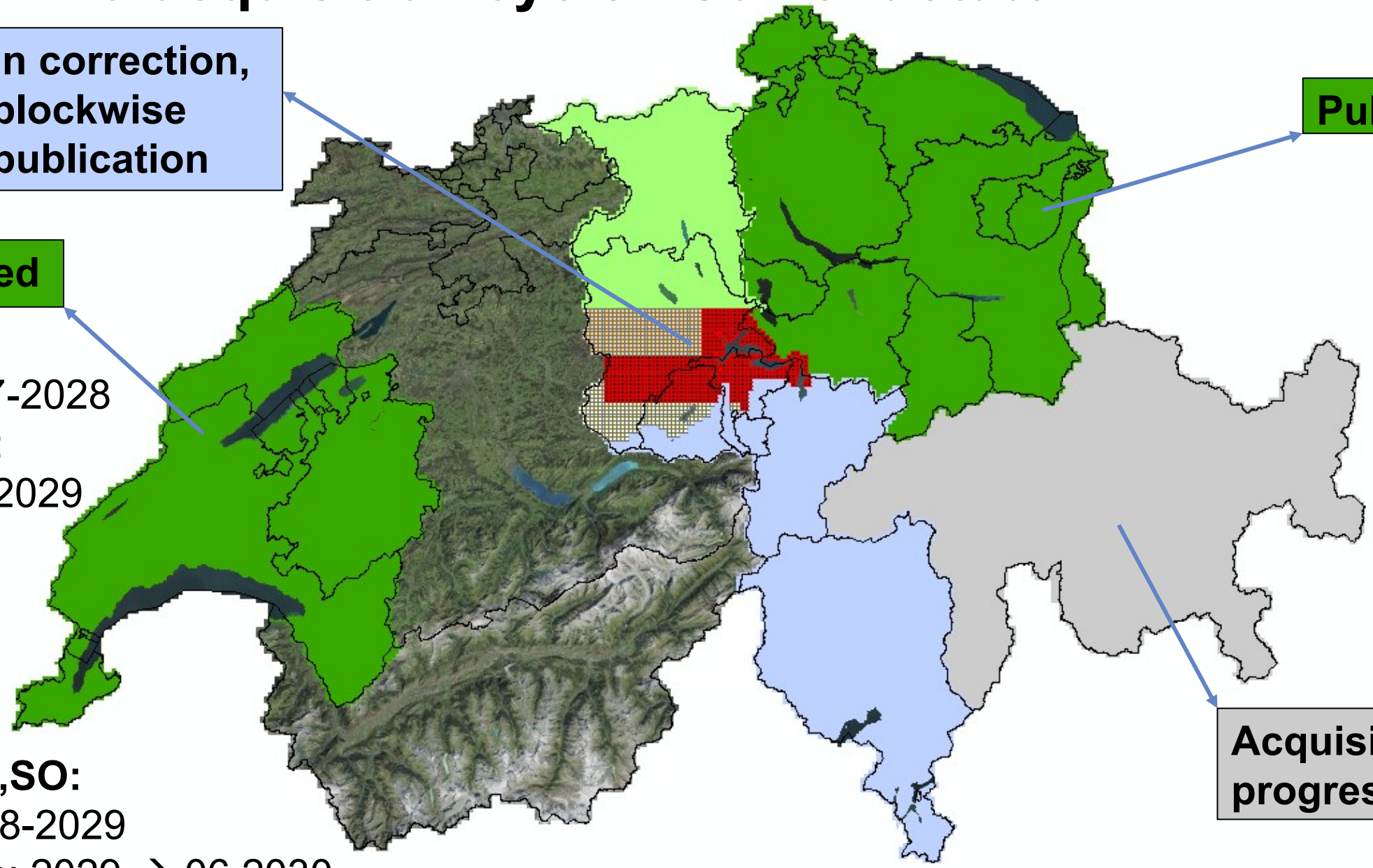
Importance of nationwide LiDAR data

How to get swissSURFACE^{3D}

Outlook

The third LiDAR acquisition cycle

Third acquisition cycle - Current state



LiDAR data quality assurance

22 exhaustive quality assurance (QA) belonging to 4 categories:

Integrity / Completion / Precision (file delivery, file information, perimeter, density (x3), interline precision, overlap of swath, normalized intensity)	9
Accuracy (Elevation accuracy (x2), planimetric accuracy)	3
Classification (Water, building, vegetation, bridge, unassigned, noise, powerline, building facades)	8
Quality of products (Hillshade of DTM, Colored hillshade of DSM)	2

LiDAR data quality assurance

QA reflectance



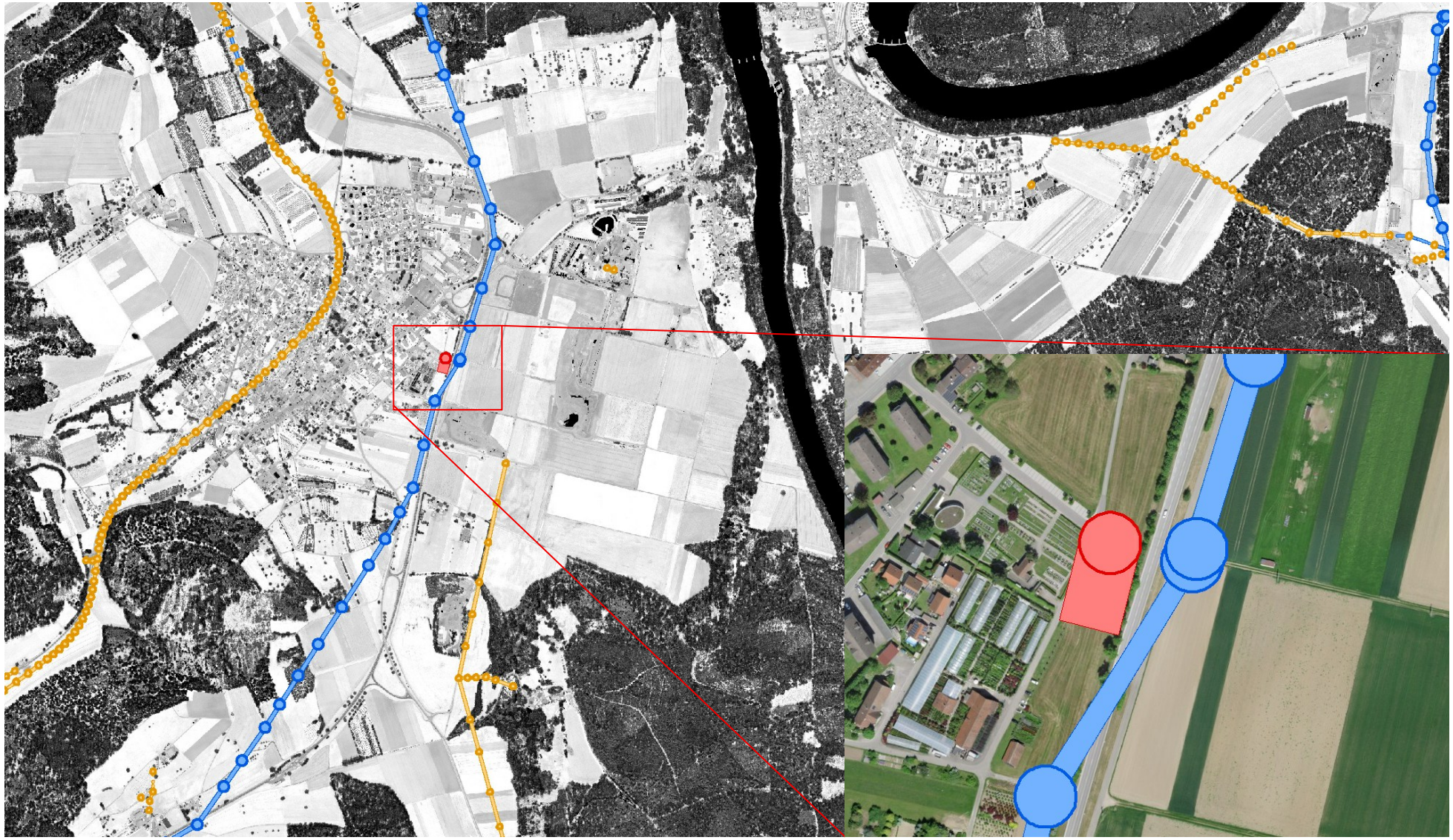
LiDAR data quality assurance

QA Hillshade DSM



LiDAR data quality assurance

QA Powerline and Mast



LiDAR data quality assurance

QA Building Facades

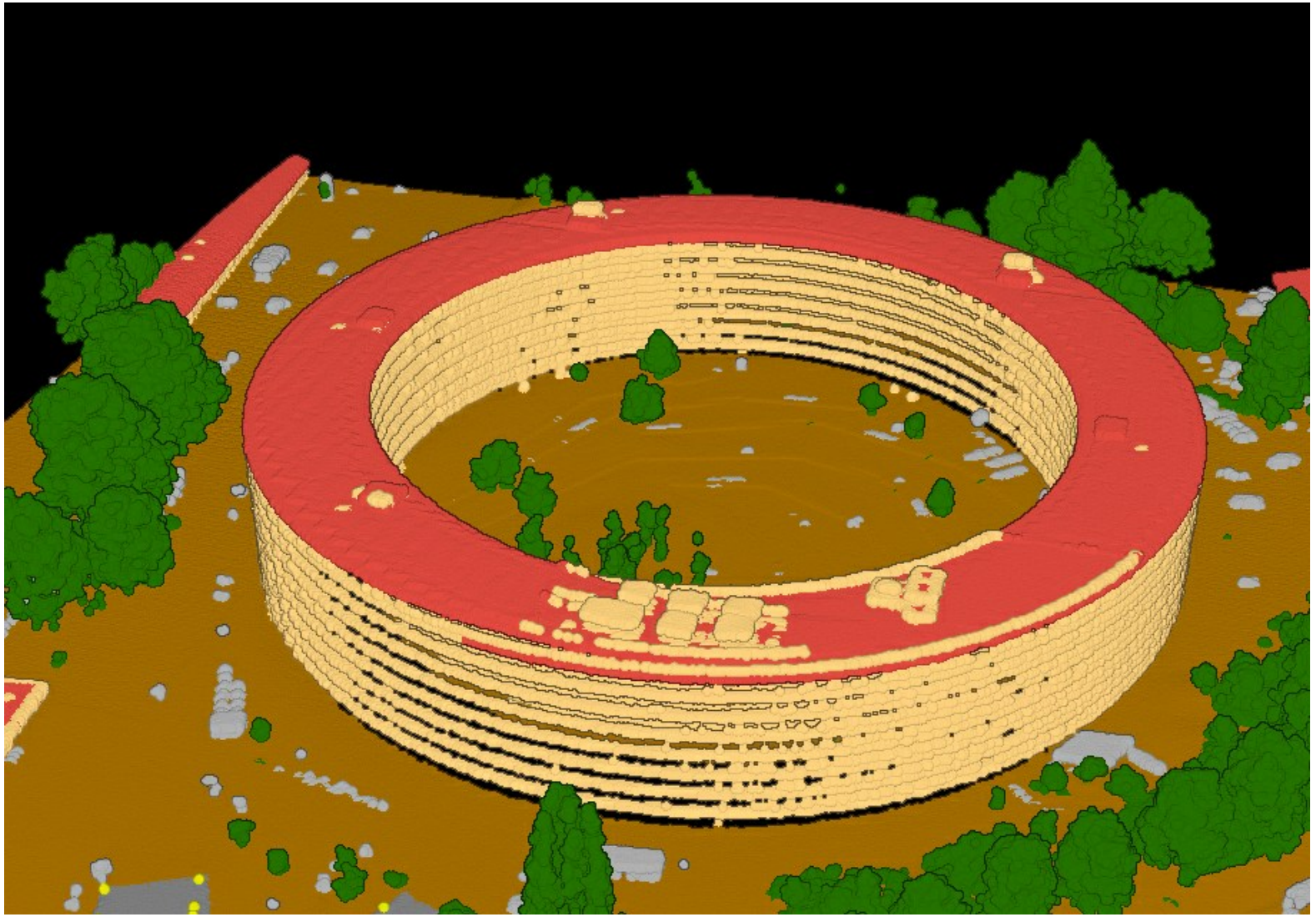


Opportunities

Comparison 2nd and 3rd cycle: Opportunities

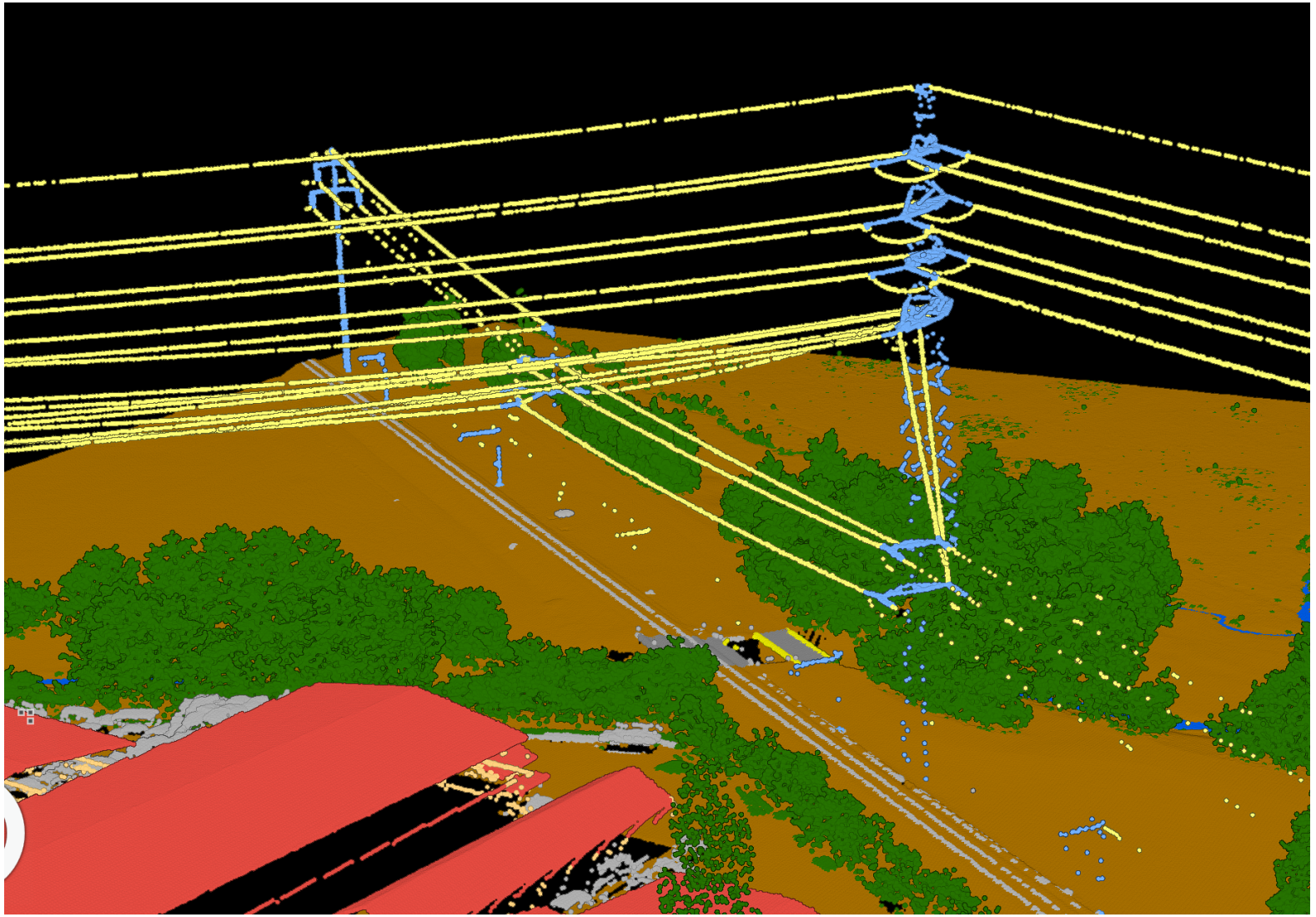
- New classes
- Quality of data (higher nominal density, reflectance)
- Change Detection
- New distribution format: LAZ 1.4 now OGC community standard, COPC

Opportunities: New classes



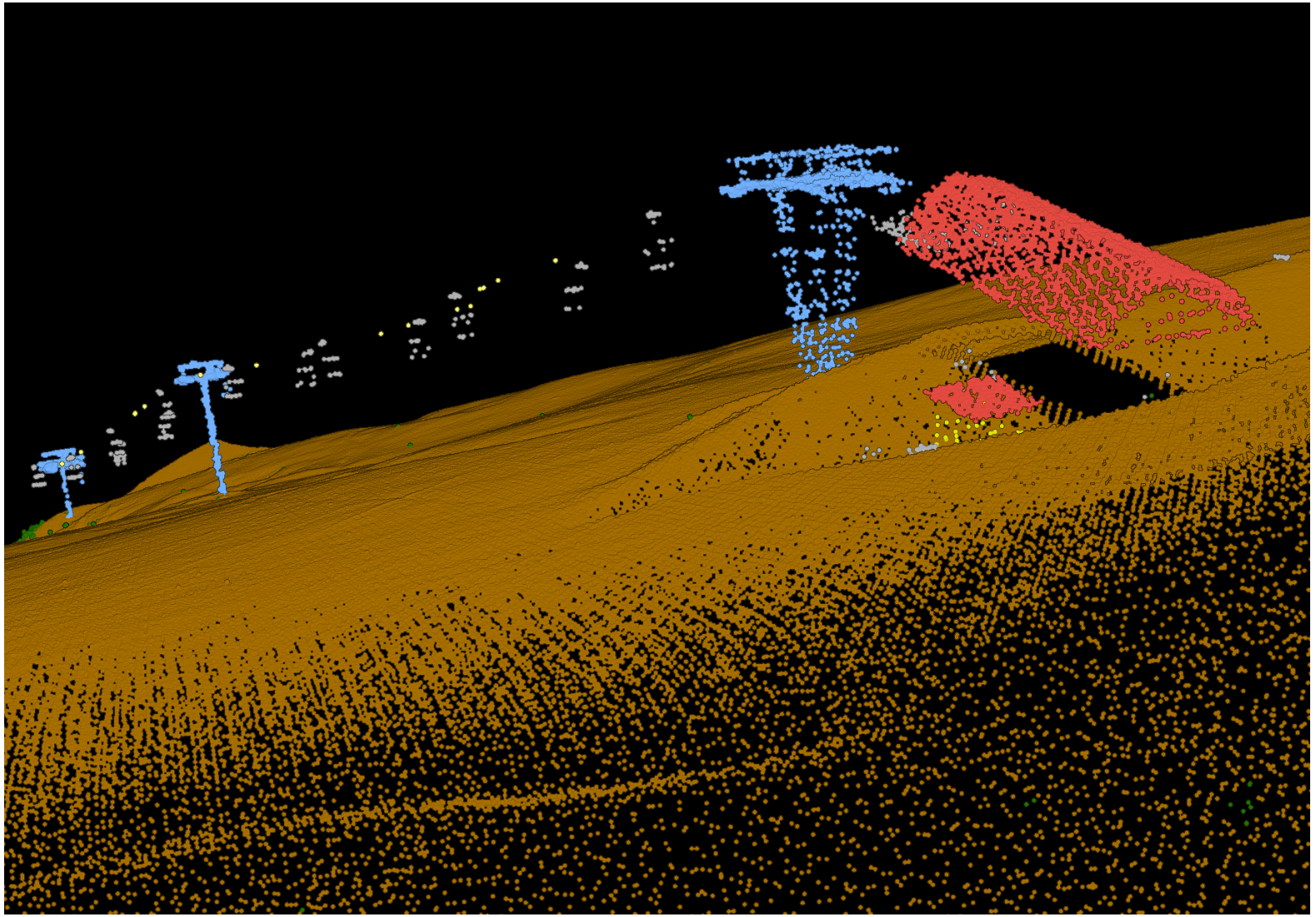
- Building Roof (class 6)
- Building Facade (class 26)

Opportunities: New classes



- Mast (class 15)
- Aerial line (class 14)

Opportunities: New classes



- Mast (class 15)
- Aerial line (class 14)

Opportunities: New classes



- Bridge deck (class 17)
- Bridge pier and stay cable (class 27)

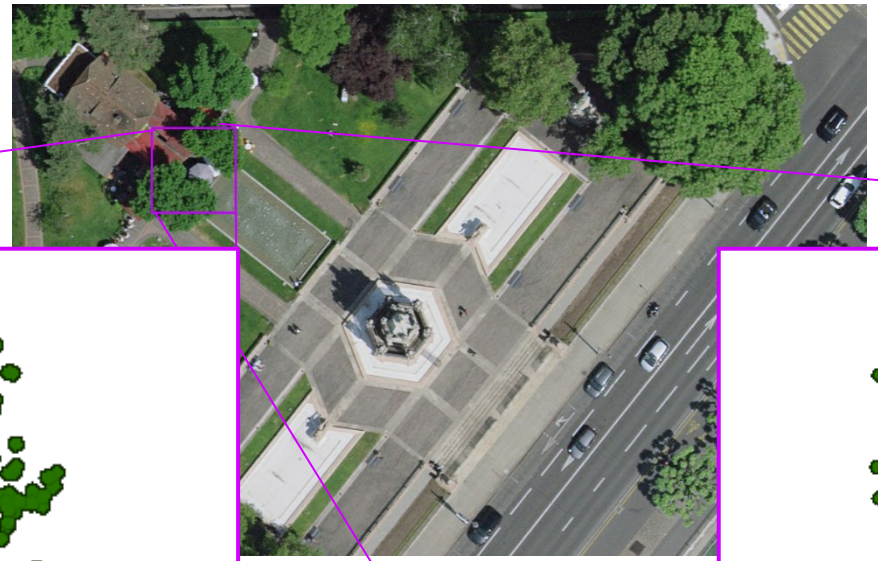
Opportunities: Normalized intensity



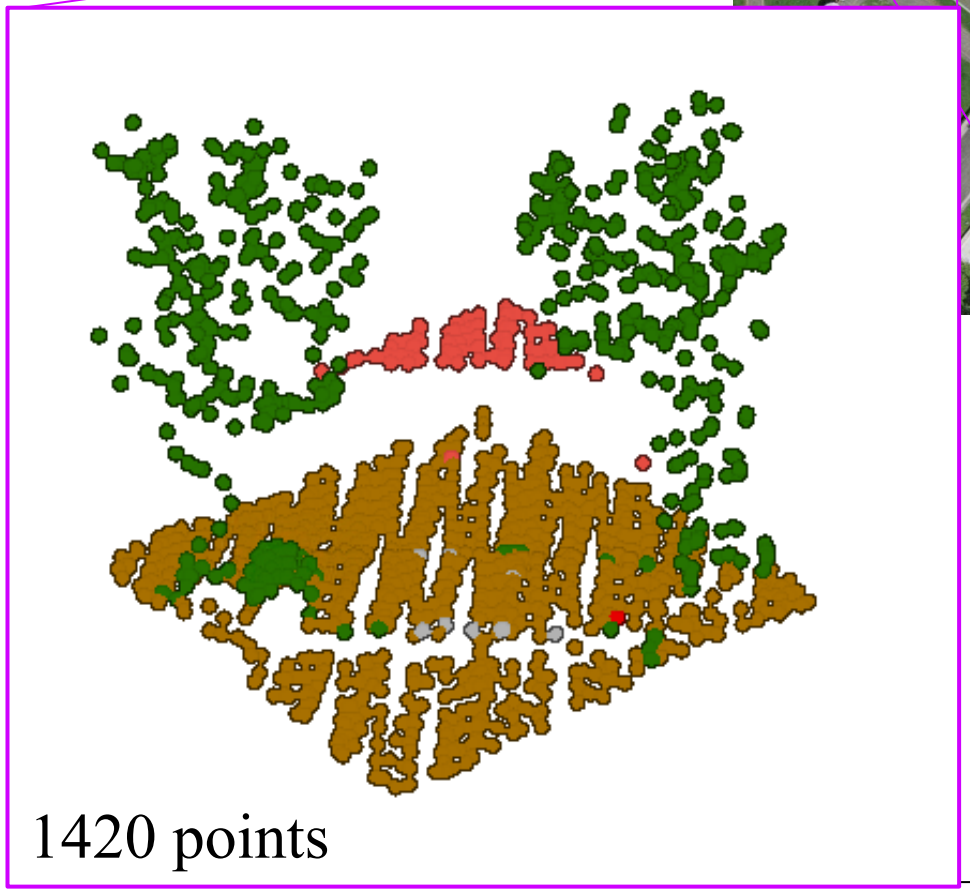
Normalized Intensity

Opportunities: point density

2nd Generation:
5-20 points/m²

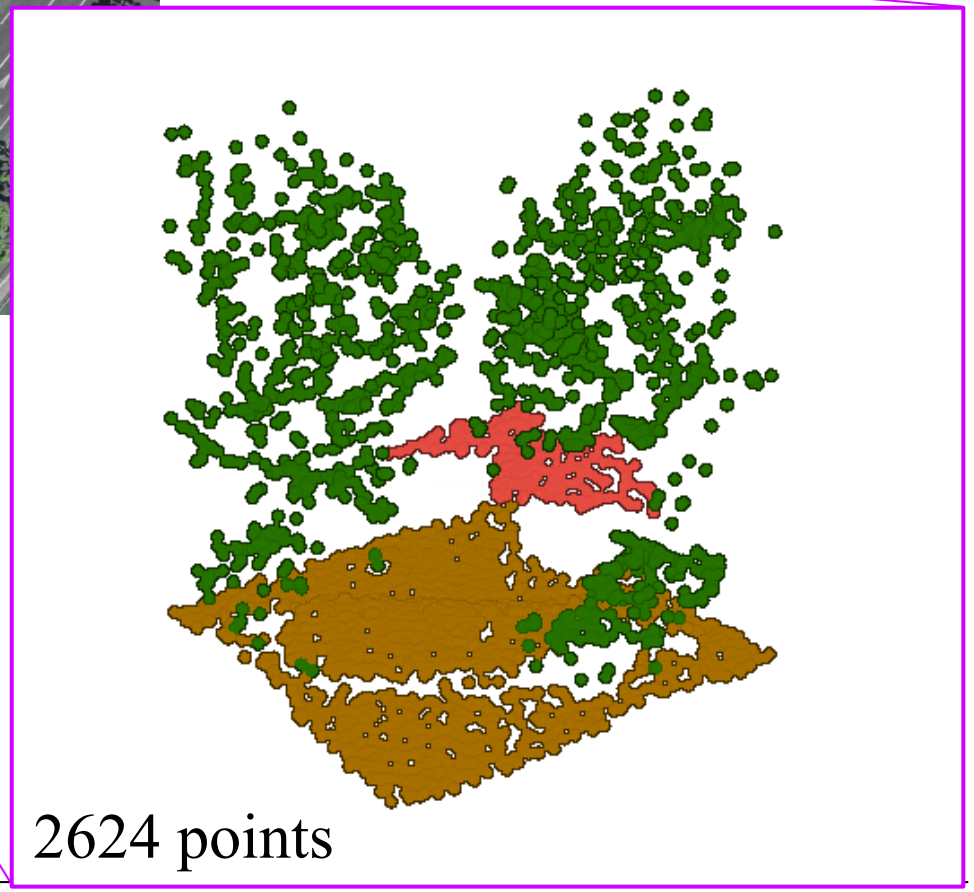


3rd Generation:
10-25 pulses/m² (25-40 points/m²)



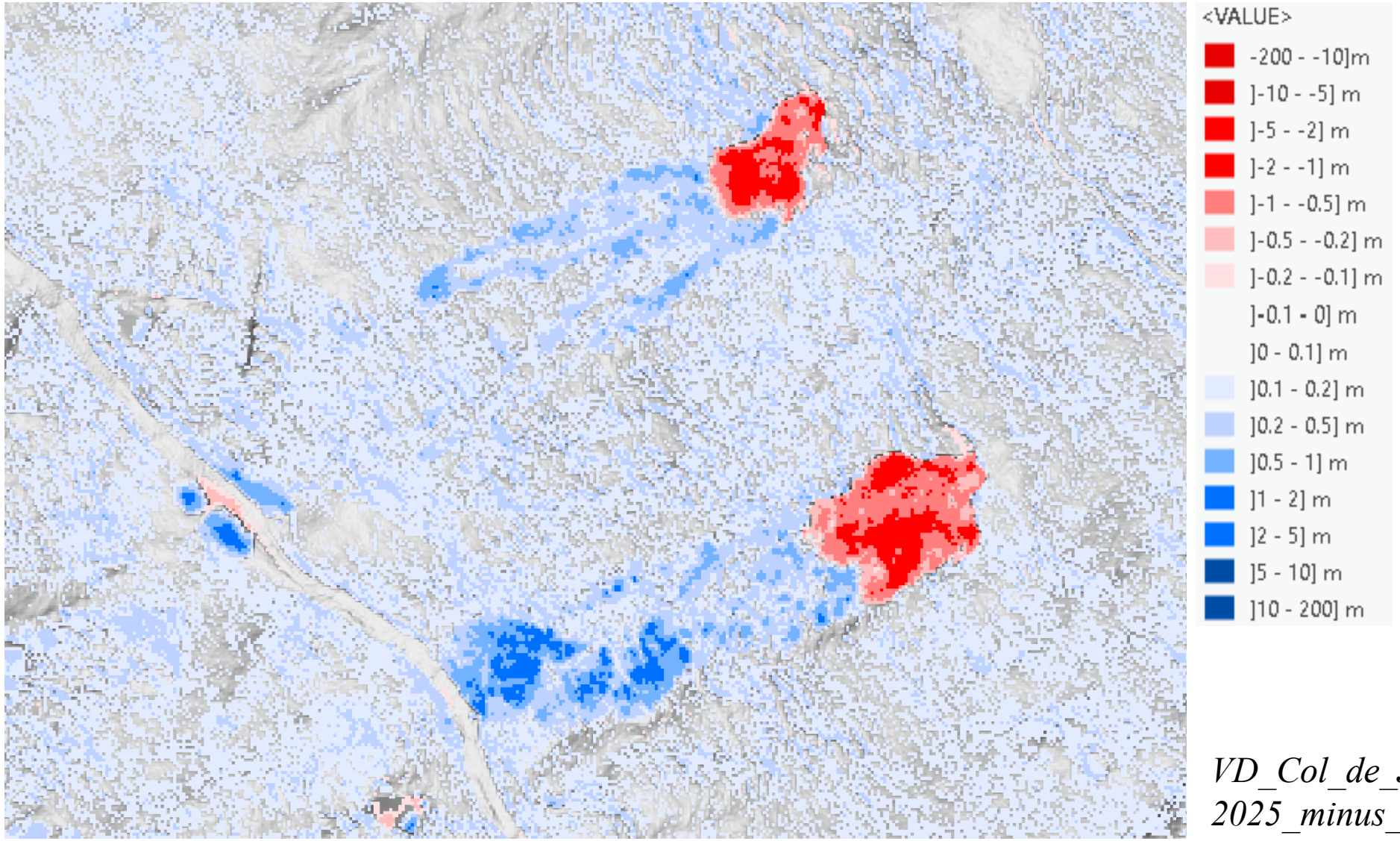
1420 points

100 m²



2624 points

Opportunities: Change Detection



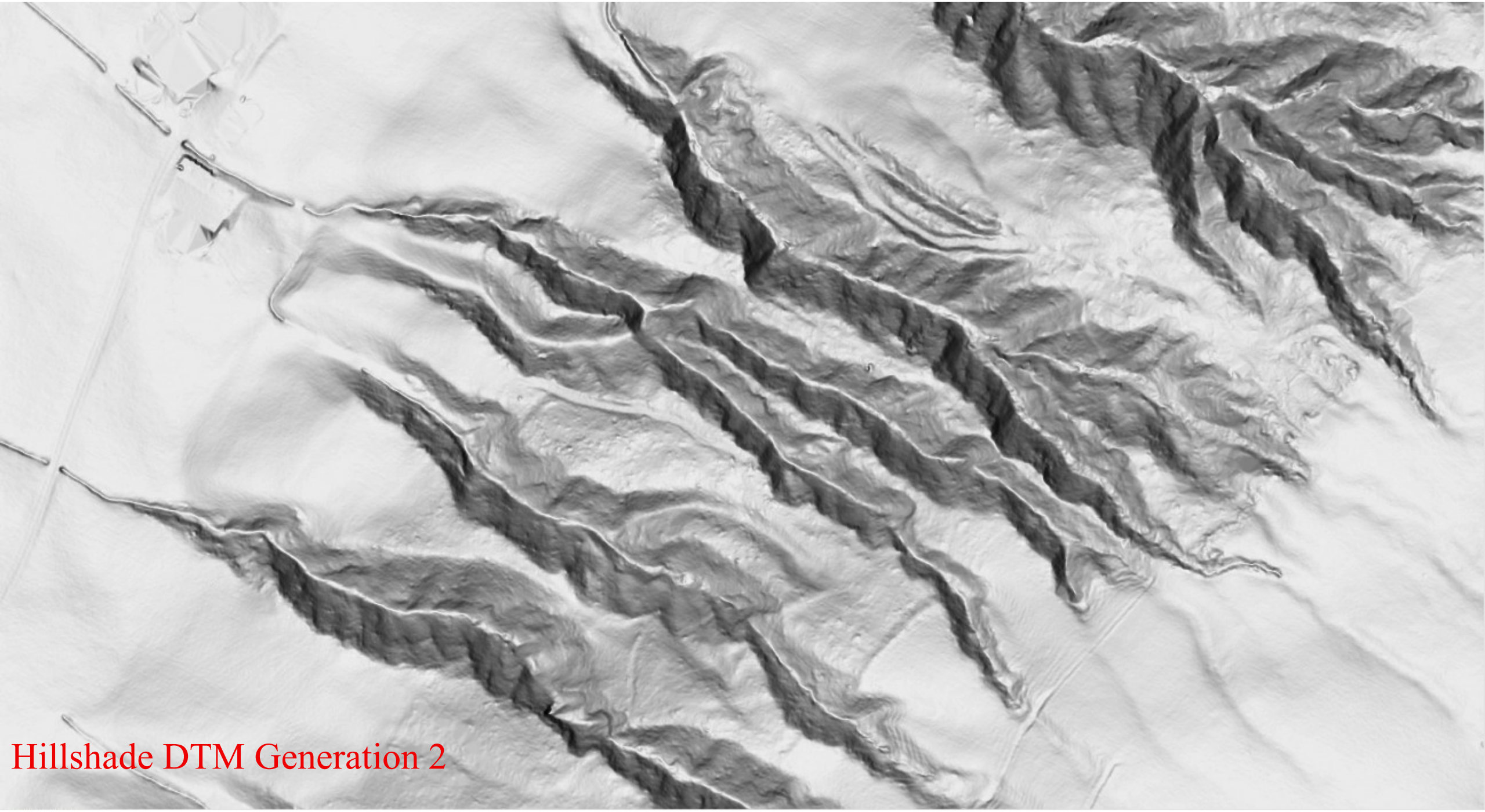
VD_Col_de_Jable_393_2025_minus_2020_LV95

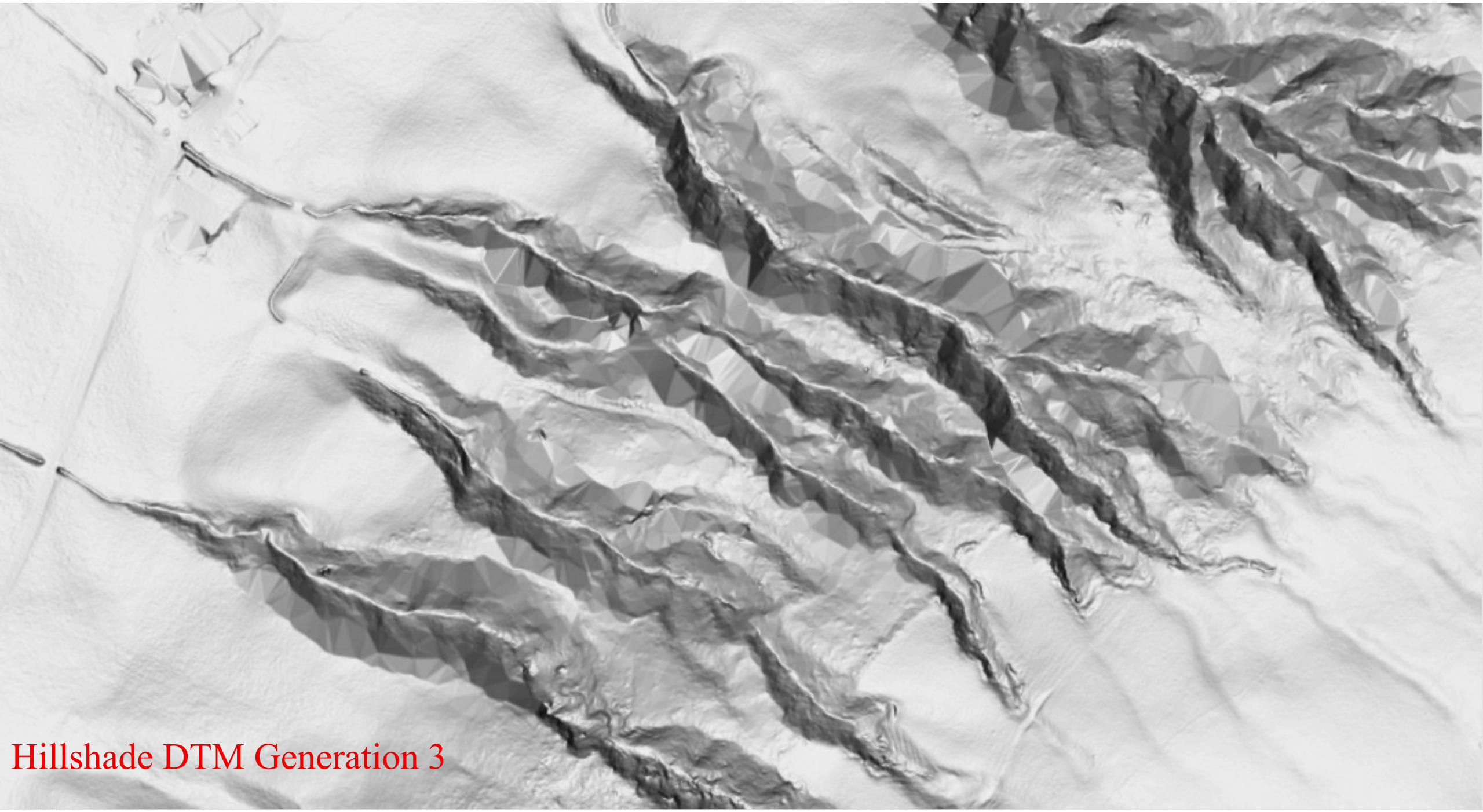
Challenges

Comparison 2nd and 3rd cycle: Challenges

- Complete new acquisitions depending on
  - → Flight conditions (rain, cloud, flight restrictions),
  - → technical issues (miscalibration, instrument failure),
  - → workflow issues (systematic shifts, strip adjustment, etc),
  - → terrain realities (snow (early or long lasting), leaves, etc…)

- Having more classes means more quality assessment is necessary.
- Coherence of classification can be an issue.


Hillshade DTM Generation 2

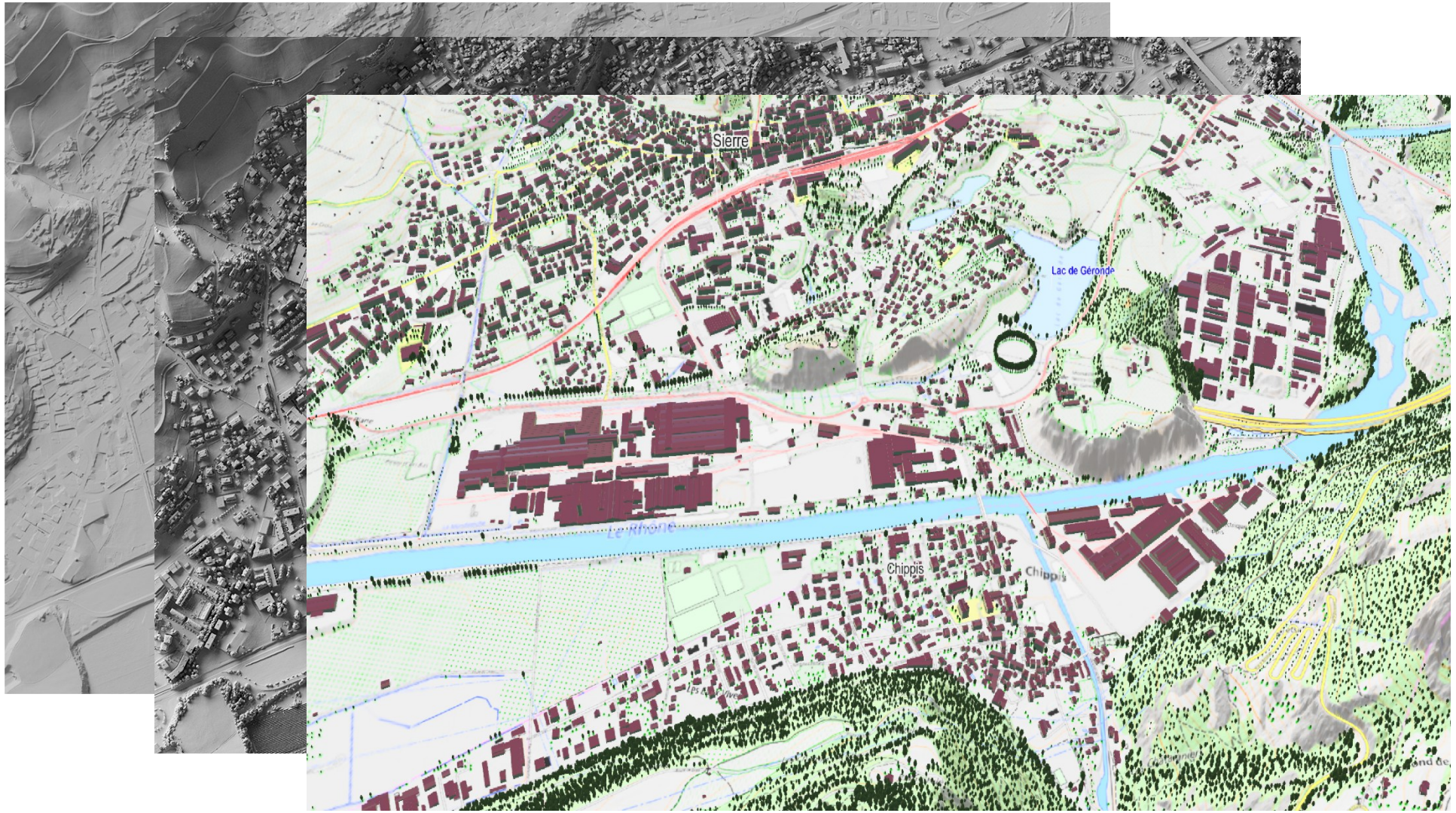

Hillshade DTM Generation 3

Importance of nationwide LiDAR data

Importance of continuous LiDAR data coverage

- For swisstopo
  - Update of topographic models
  - Facilitation of change detection for production
  - Faster update cycle for swissALTI^{3D}
  - …
- External:
  - Use mostly unknown since OGD
  - Steady increase in requests and downloads
  - Exemplary use cases:
    - development stages of forest stands
    - Brienz debris flows
    - Ground displacement analysis
    - Shade calculator
    - …

Update of topographic Models with LiDAR-Data

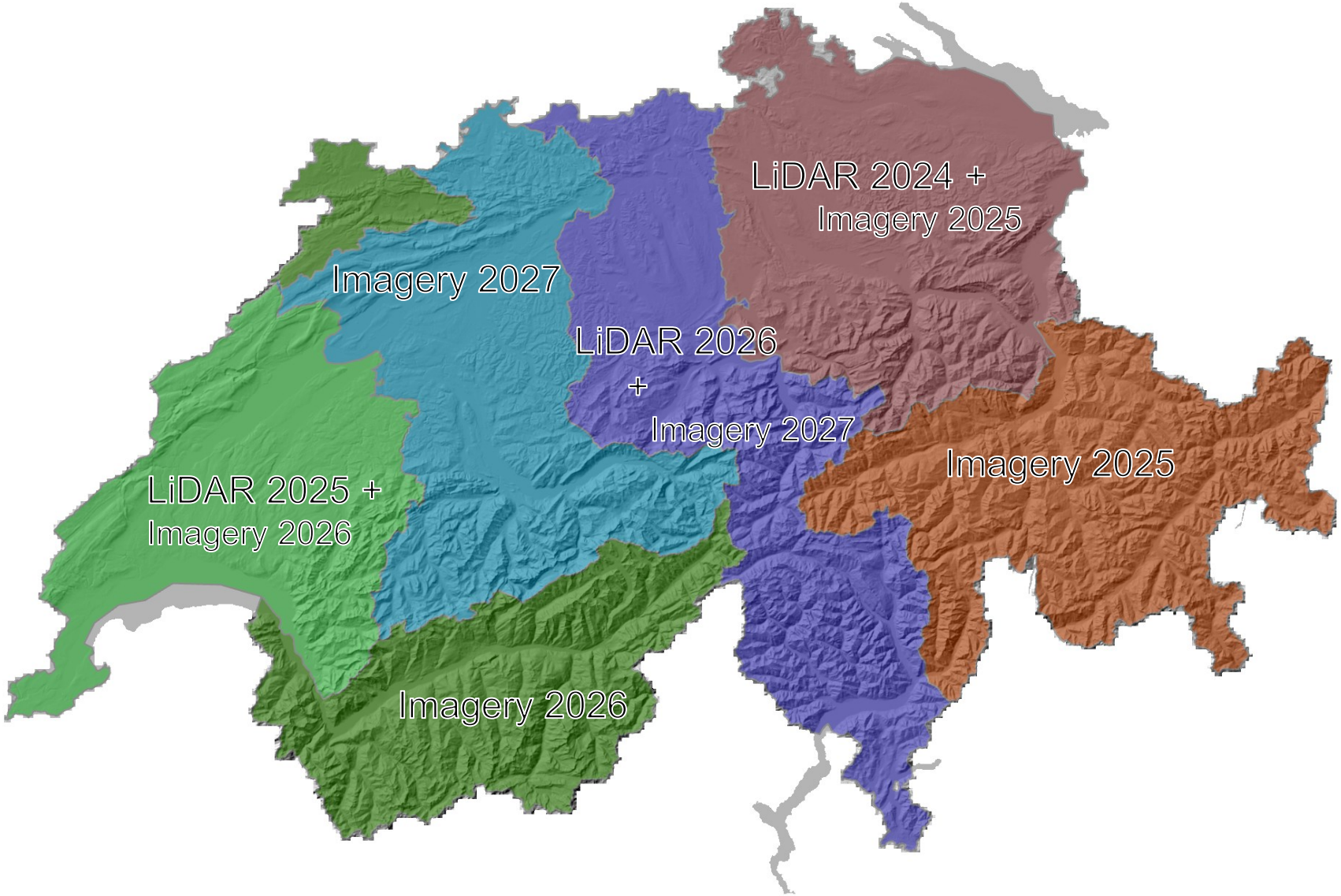


Update of topographic Models: swissALTI^{3D}

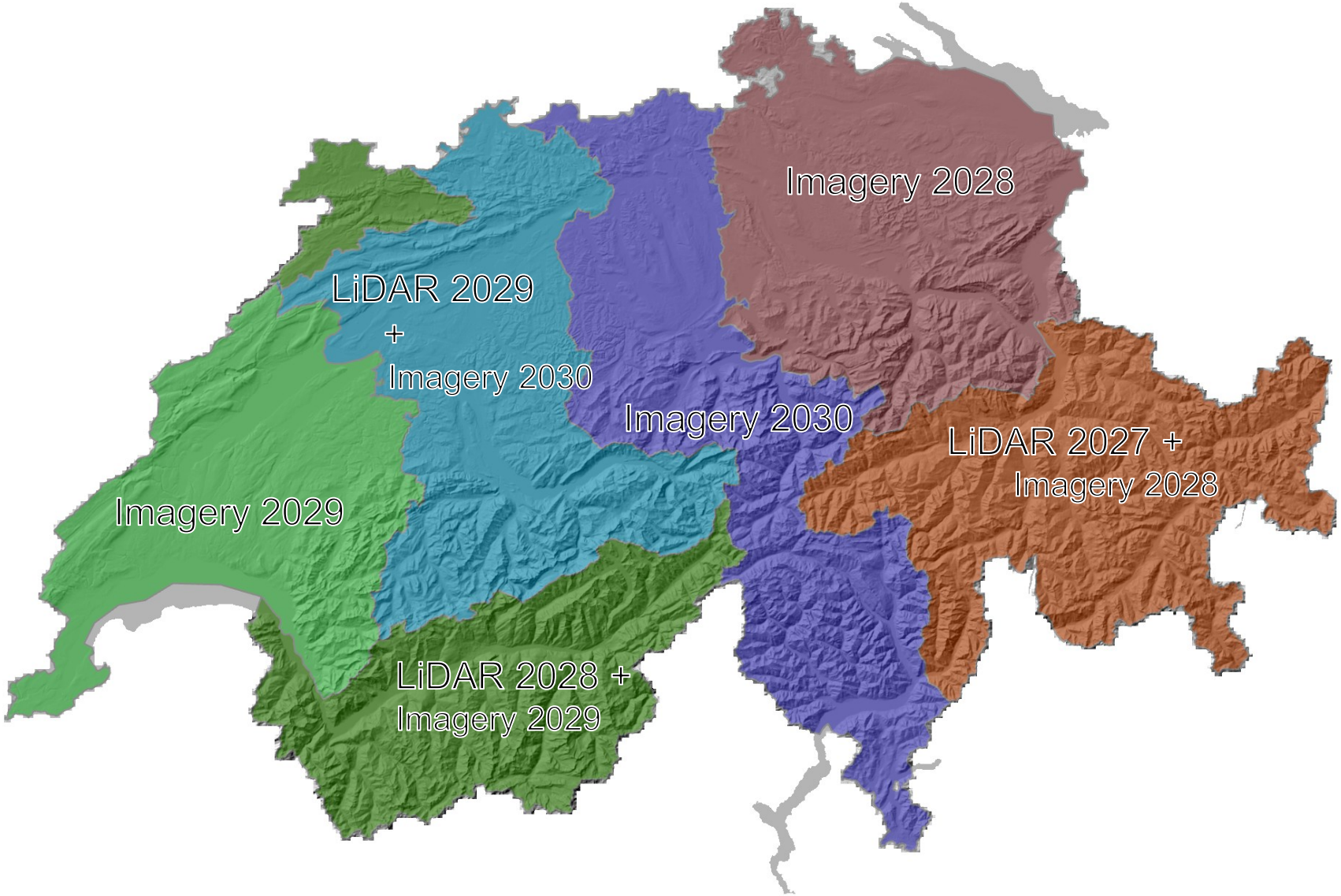
Hybrid update: LiDAR & aerial image correlation



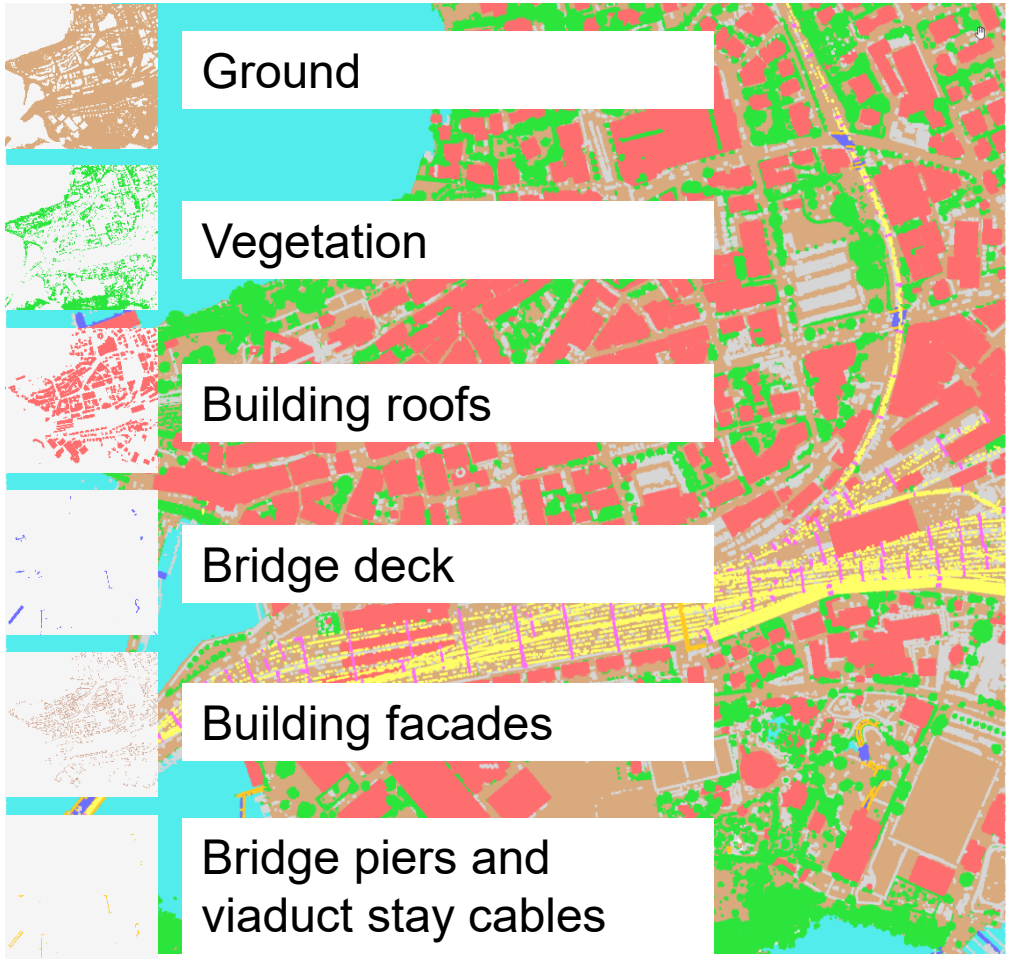
Update of swissALTI^{3D} : New 3 year cycle



Update of swissALTI^{3D} : New 3 year cycle

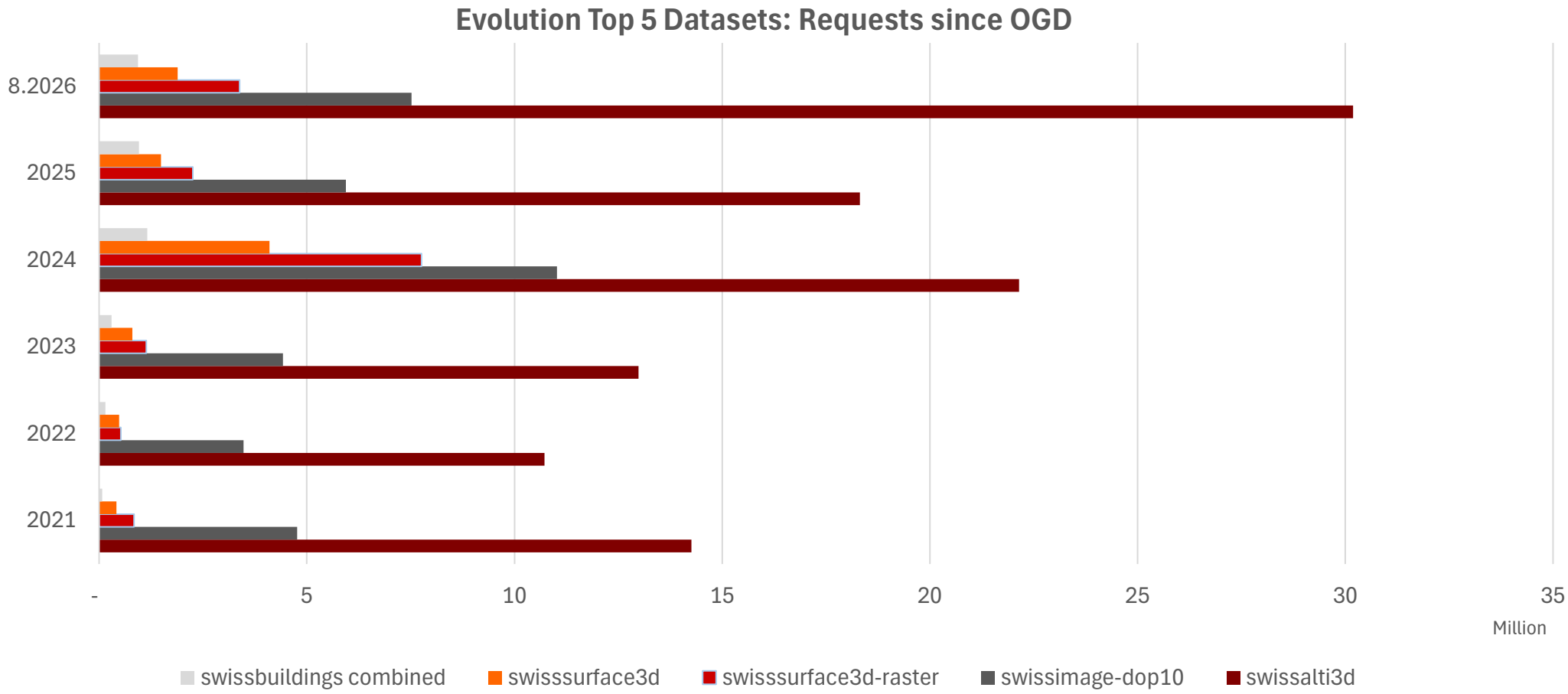


Update of DSM: swissSURFACE^{3D} Raster

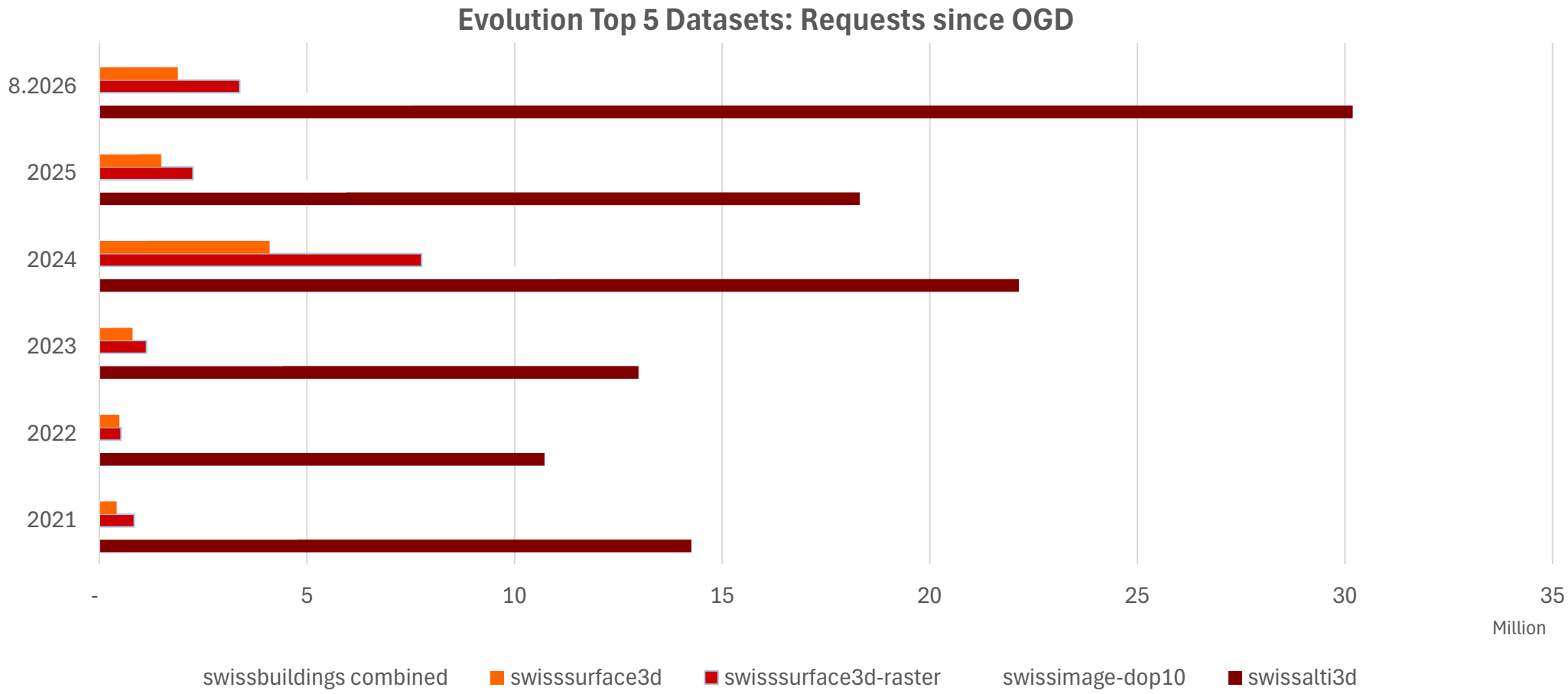




Importance of LiDAR-based national reference Models: Number of Requests / Downloads

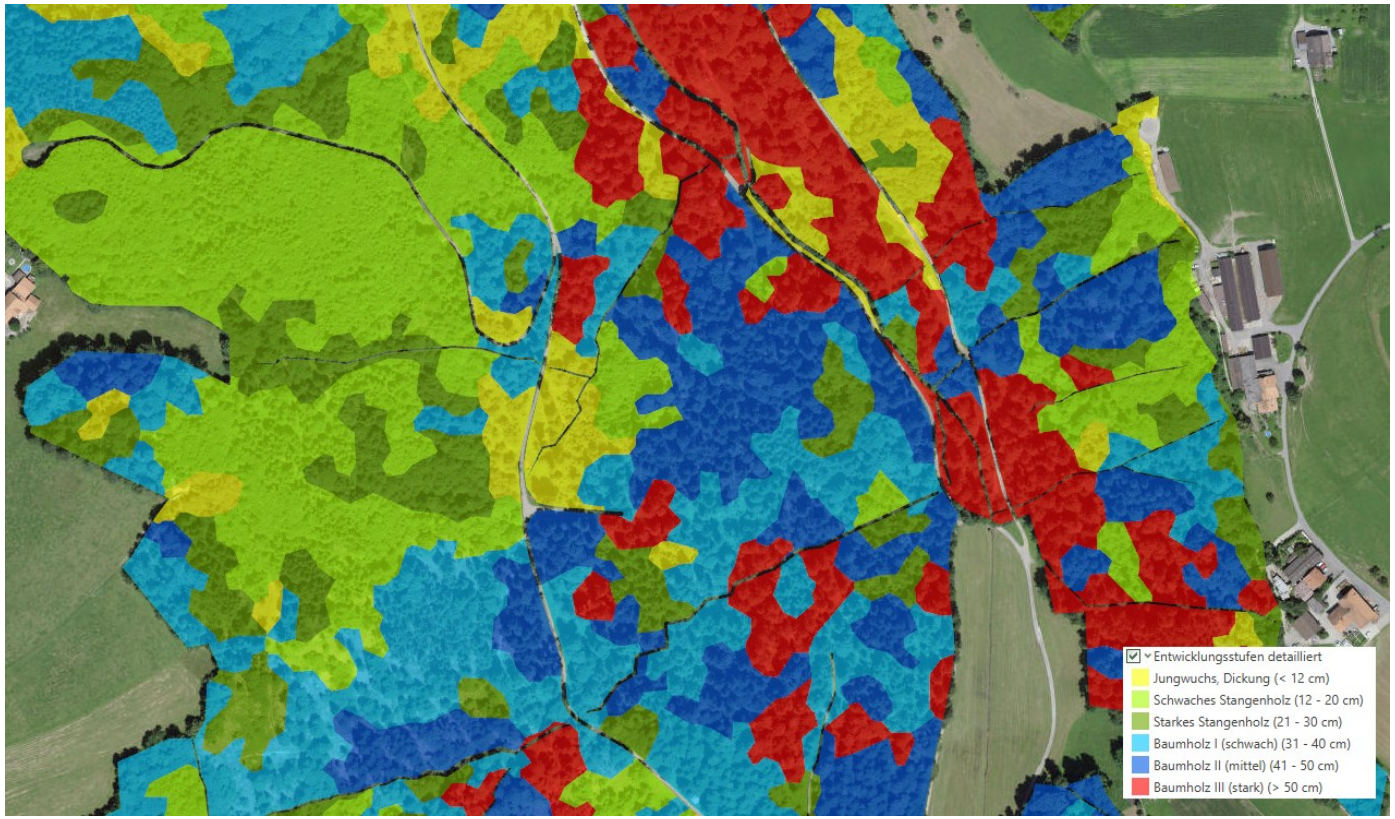


Importance of LiDAR-based national reference Models: Number of Requests / Downloads



LiDAR Use Case: Vegetation

- Automated derivation of the development stages of forest stands based on LiDAR



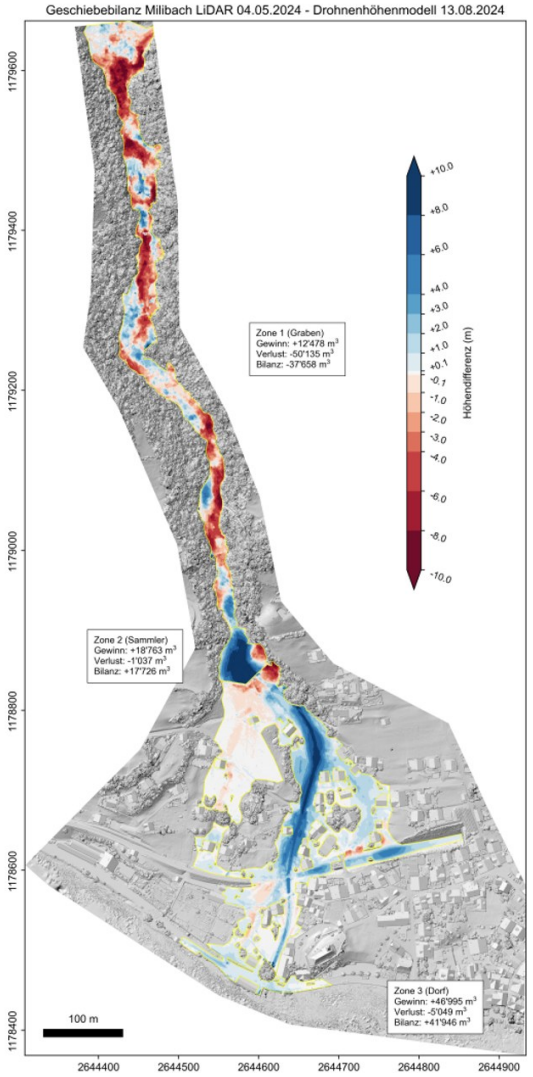
Source: Office of Forests and Natural Hazards, Canton of Berne

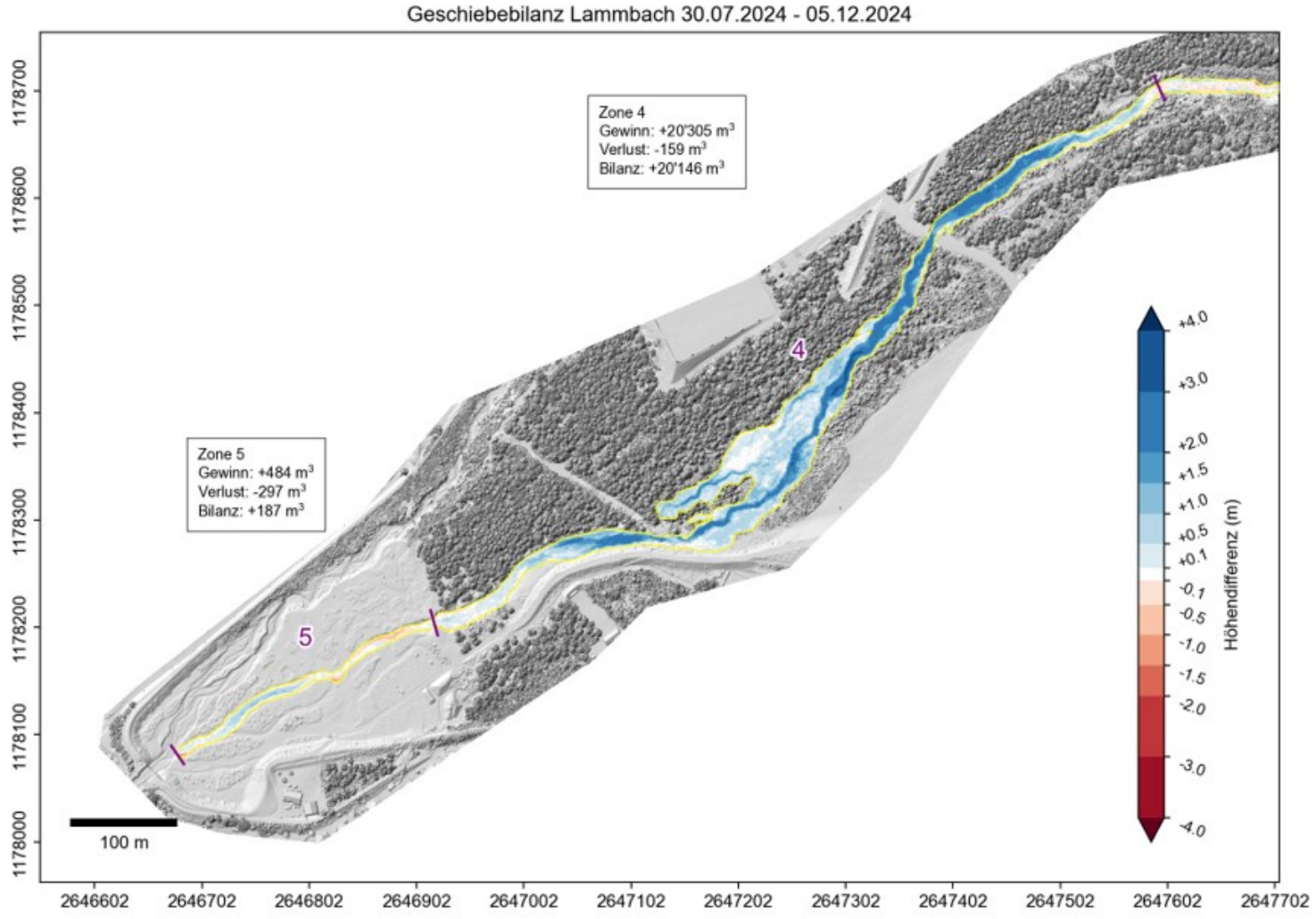
Use Case of LiDAR data: Brienz (BE) debris flow post disaster analysis



Source: Christian Kienholz, Geotest

Use Case of LiDAR data: post disaster analysis

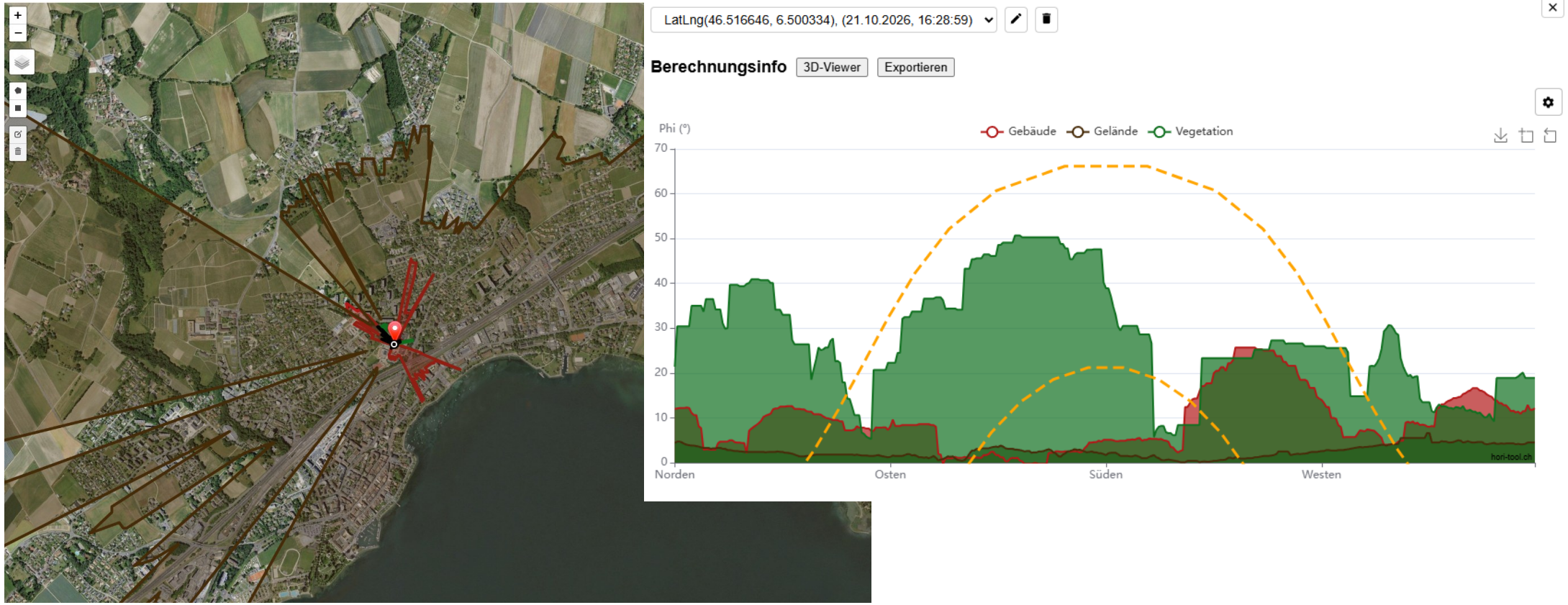




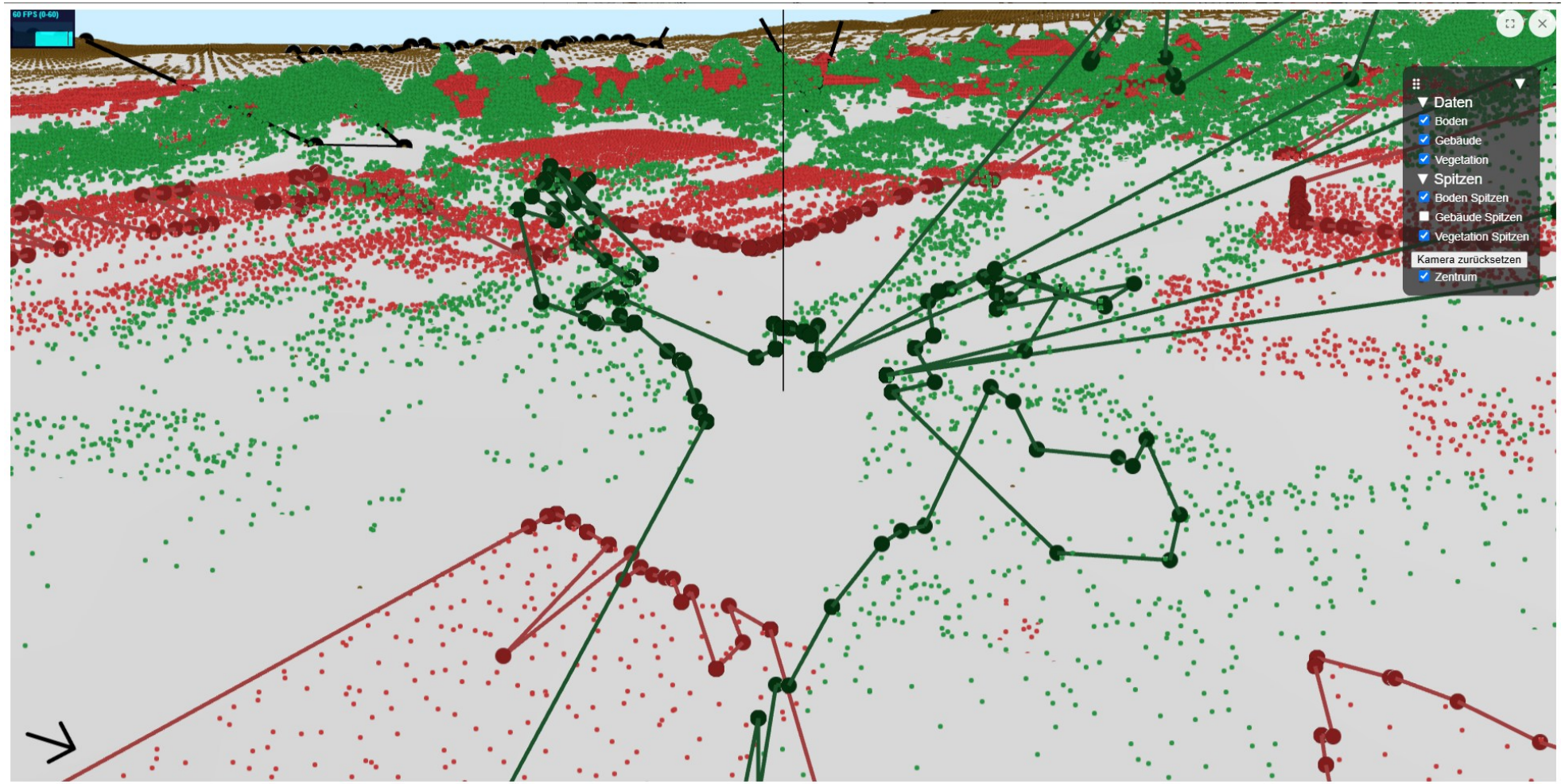
Source: Christian Kienholz, Geotest

Use Case of LiDAR data: Shading and viewshed Analysis

- https://hori-tool.ch/



Use Case of LiDAR data: Shading and viewshed Analysis



How to get swissSURFACE^{3D}

How to get swissSURFACE^{3D}



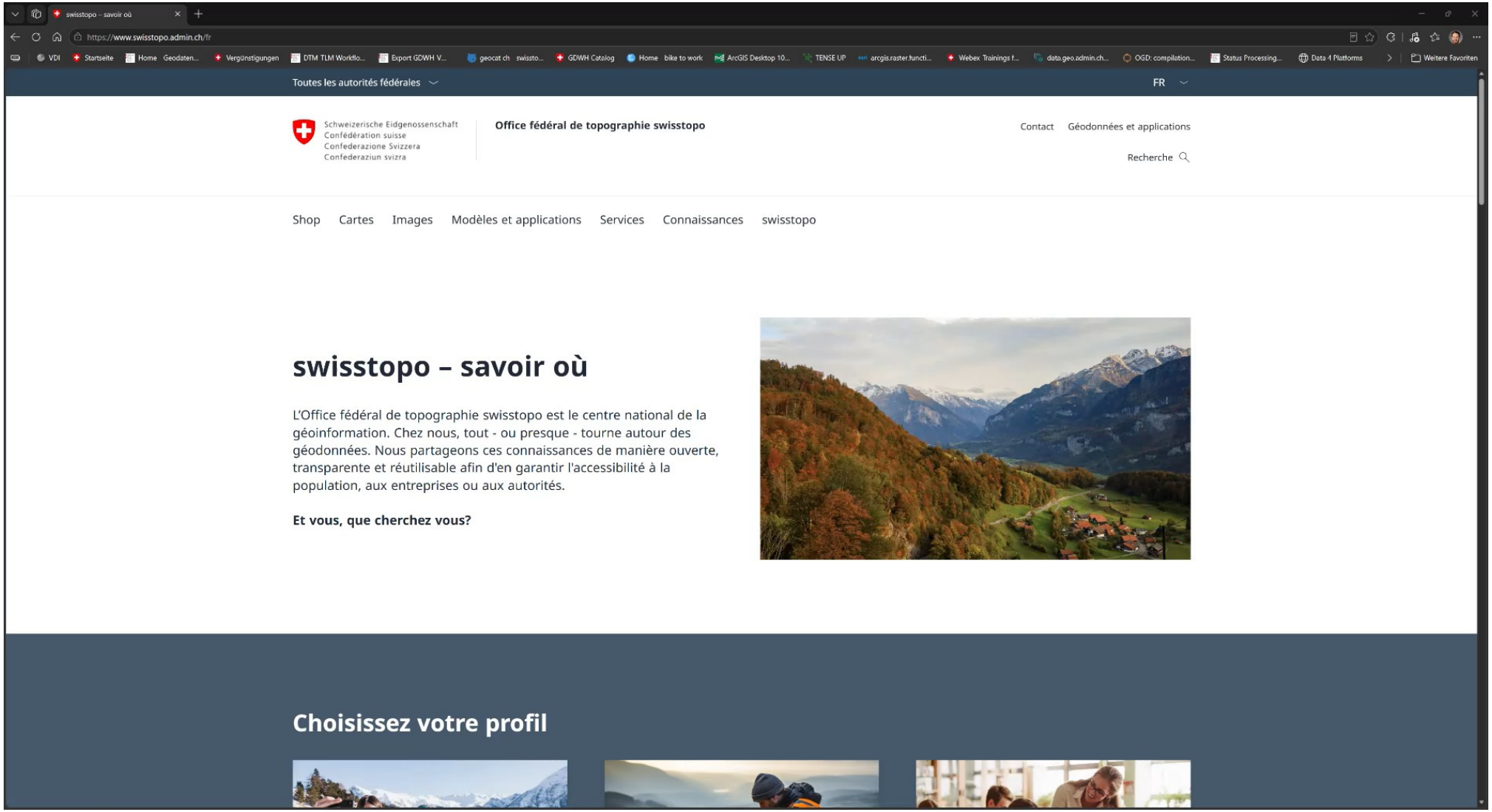
Swiss Geo Downloader

Plugin ID: 2419

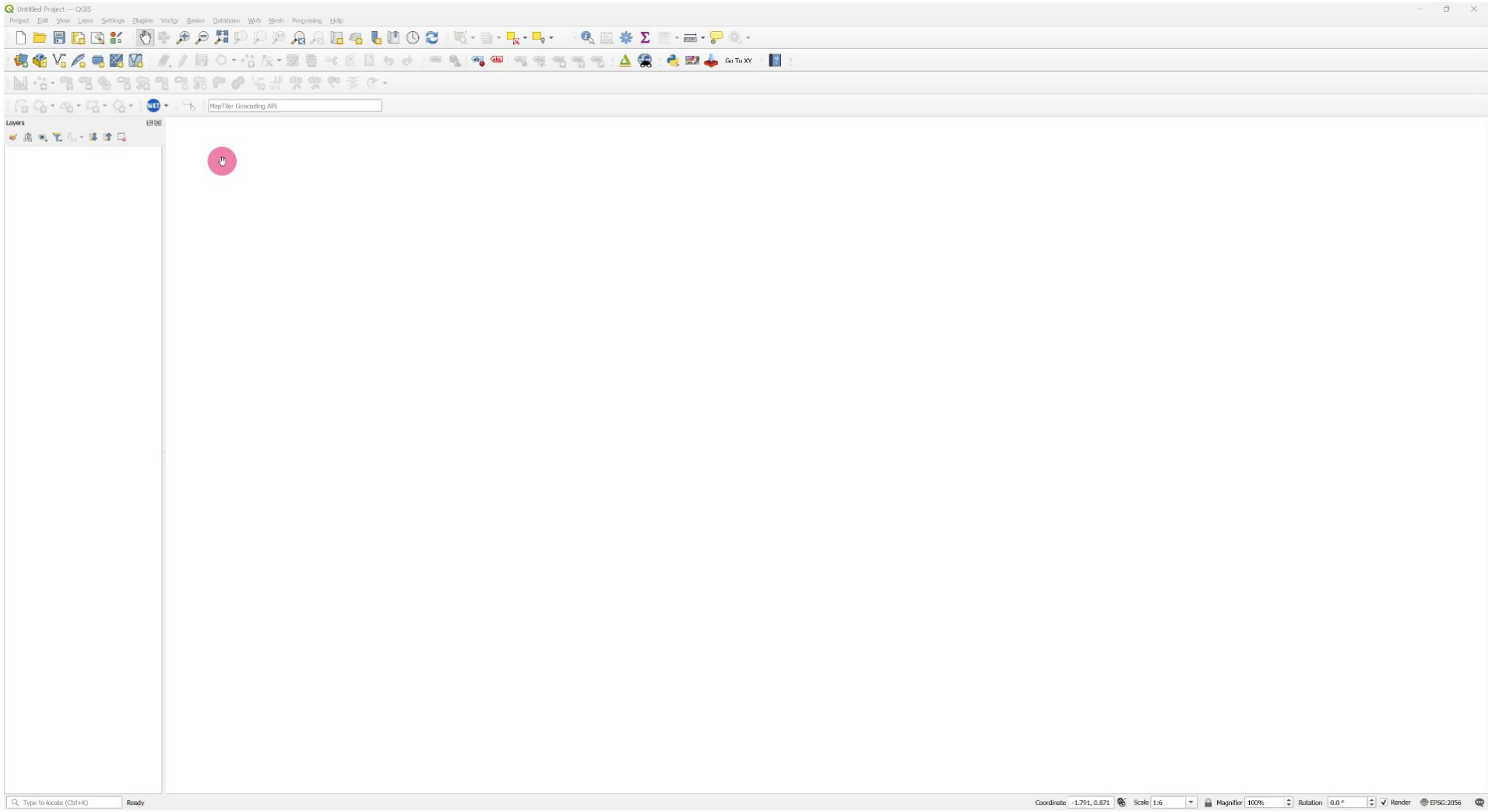
Download swiss geodata comfortably inside QGIS

STAC

Product page / streaming



Swiss Geo Downloader QGIS-Plugin



STAC API

- **S**patial **T**emporal **A**sset **C**atalog API
- Programming interface (machine to machine)
- Allows for structured queries and access
- Main elements: **Collection, Item, Asset**
- REST-Interface: Spatial Temporal Asset Catalog API

STAC API queries: Examples

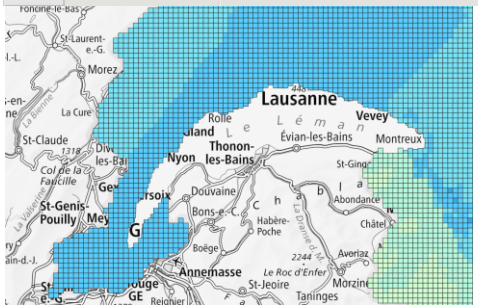
- All items within a bounding box (Morges Area): https://data.geo.admin.ch/api/stac/v0.9/collections/ch.swisstopo.swisssurface3d/items?bbox=6.50, 46.51, 6.51, 46.52
- A specific item (swissSURFACE3D_2025_2527-1151) https://data.geo.admin.ch/api/stac/v0.9/collections/ch.swisstopo.swisssurface3d/items/swisssurface3d_2025_2527-1151
- Download the asset of the item above https://data.geo.admin.ch/ch.swisstopo.swisssurface3d/swisssurface3d_2025_2527-1151/swisssurface3d_2025_2527-1151_2056_5728.copc.laz

Outlook

Outlook

- Metadata for swissSURFACE3D in STAC

	id	data_url	objectid	tilekey	tempkey	releasekey	pointcount	ptdensity	height_min	height_max	gpstimemin	gpstimemax
1	1	https://data.geo.admin.ch/ch.swisstopo.swisss...	2087	2759_1254	2024	10	48139798	48.13999938964...	792.1099853515...	957.7899780273...	11.08.2024 07:3...	11.08.2024 08:2...
2	2	https://data.geo.admin.ch/ch.swisstopo.swisss...	5813	2723_1200	2024	10	48118492	48.11999893188...	1457.680053710...	1844.939941406...	30.07.2024 15:2...	30.07.2024 16:0...
3	3	https://data.geo.admin.ch/ch.swisstopo.swisss...	7808	2745_1237	2024	10	29023022	29.02000045776...	1152.4599609375	1873.550048828...	12.08.2024 06:0...	15.08.2024 06:5...
4	4	https://data.geo.admin.ch/ch.swisstopo.swisss...	3393	2677_1291	2024	10	46682591	46.68000030517...	459	624.6300048828...	26.03.2024 22:0...	26.03.2024 22:2...
5	5	https://data.geo.admin.ch/ch.swisstopo.swisss...	1636	2676_1267	2024	10	55496173	55.5	426.3999938964...	583.6099853515...	14.02.2024 01:2...	14.02.2024 01:5...
6	6	https://data.geo.admin.ch/ch.swisstopo.swisss...	1245	2684_1264	2024	10	44895565	44.90000152587...	446.3800048828...	595.0999755859...	14.02.2024 02:2...	14.02.2024 02:5...



- All swissSURFACE^{3D} distribution in COPC-format rather than zipped .las

