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DU CANTON DE VAUD
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Théo Quant
Nouvelles approches en Géographie Théorique & Quantitative

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Haute Ecole Spécialisée
de Suisse occidentale
Fachhochschule Westschweiz
University of Applied Sciences and Arts
Western Switzerland

Analysis of georeferenced landscape pictures extracted from public picture collections

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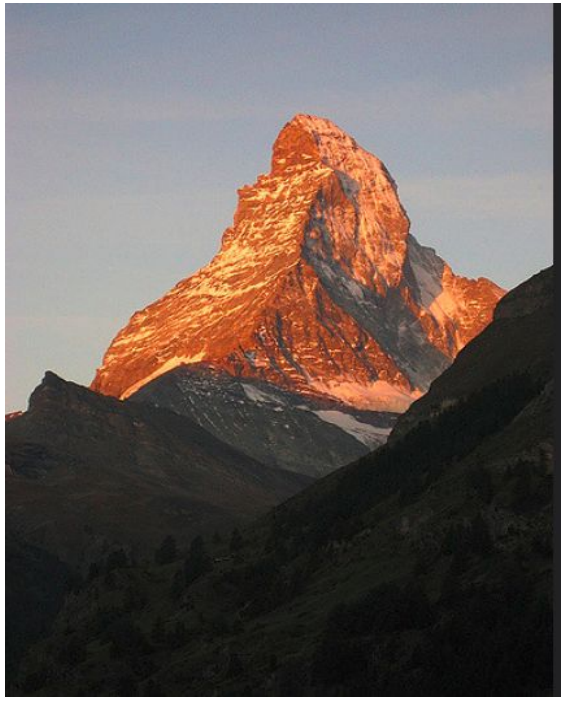
Landscape pictures



Smartphone : georeferencing

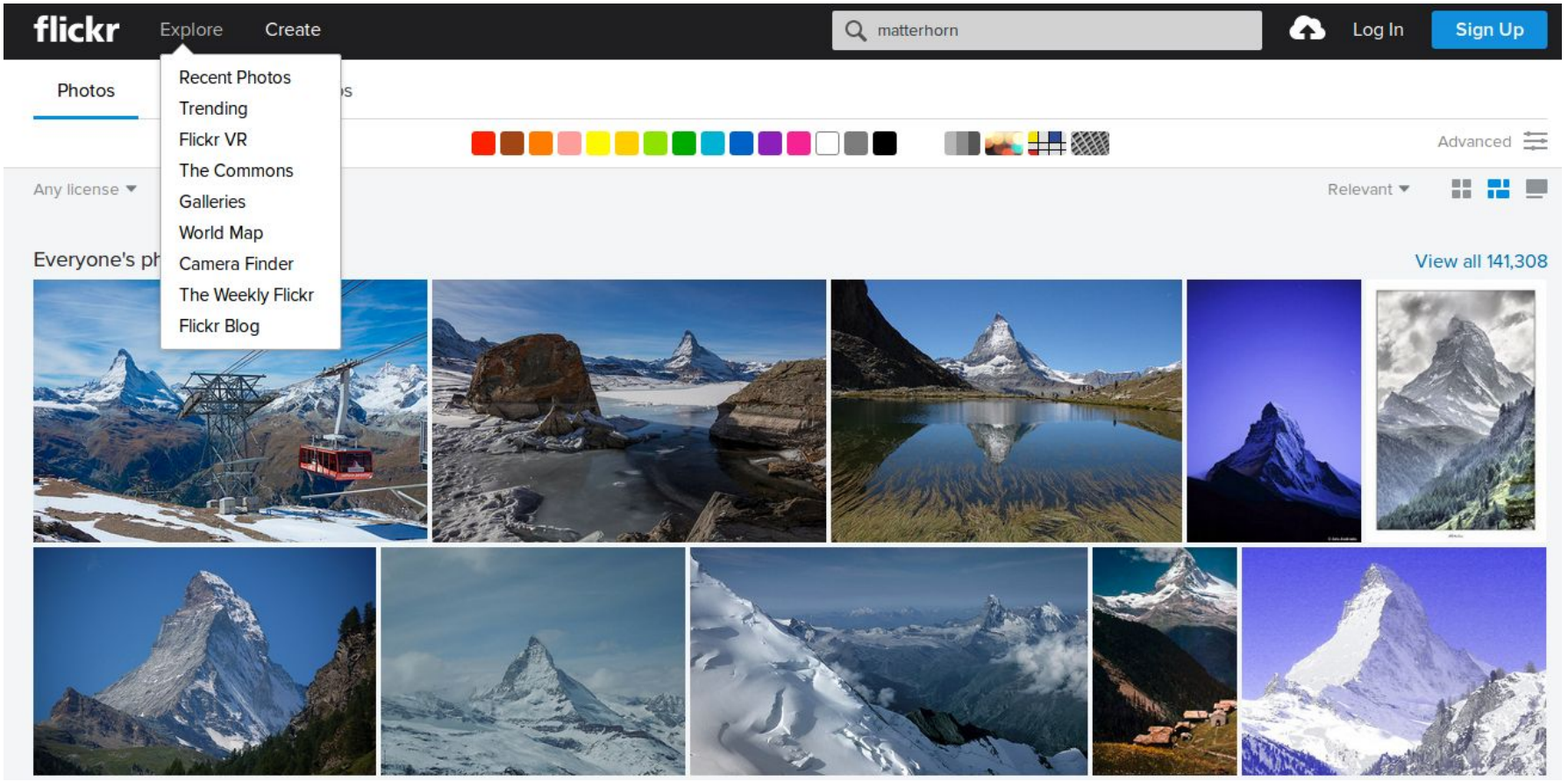
EXIF-Tags (automatically stored); e.g.

- GPS coordinates
- Azimuth
- Type of camera
- Crop factor

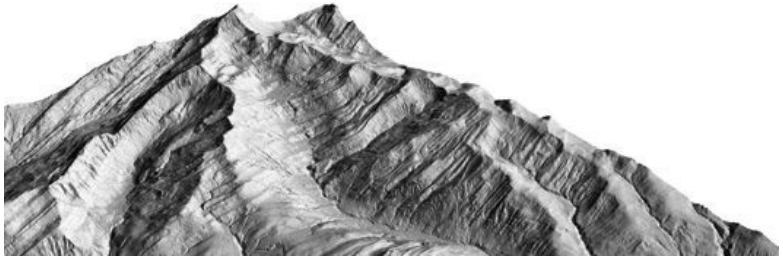
Uploaded to public picture collections (Flickr, Panoramio, etc)

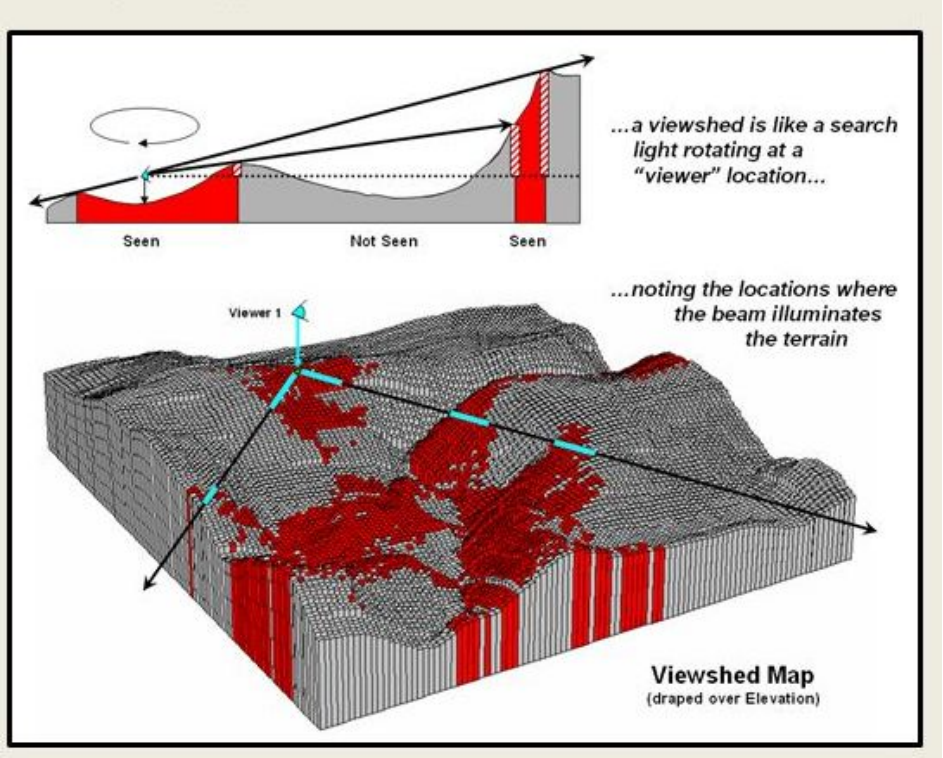
→ Extractable using API's

Public picture collections



Identification of visible areas





DEM (Digital Elevation Model)

1. Viewshed algorithm

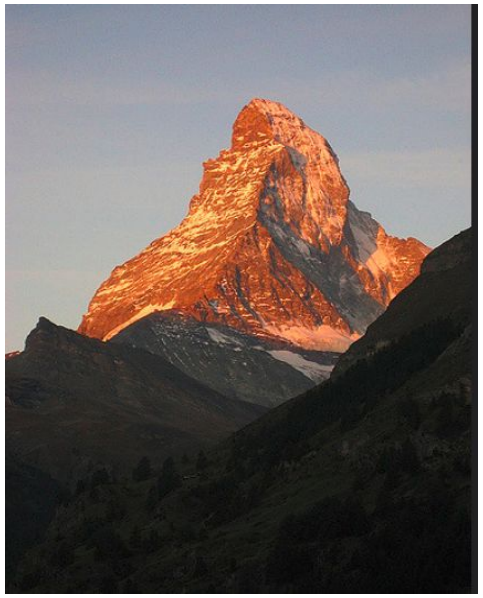
2. Cut viewsheds using calculated angular aperture

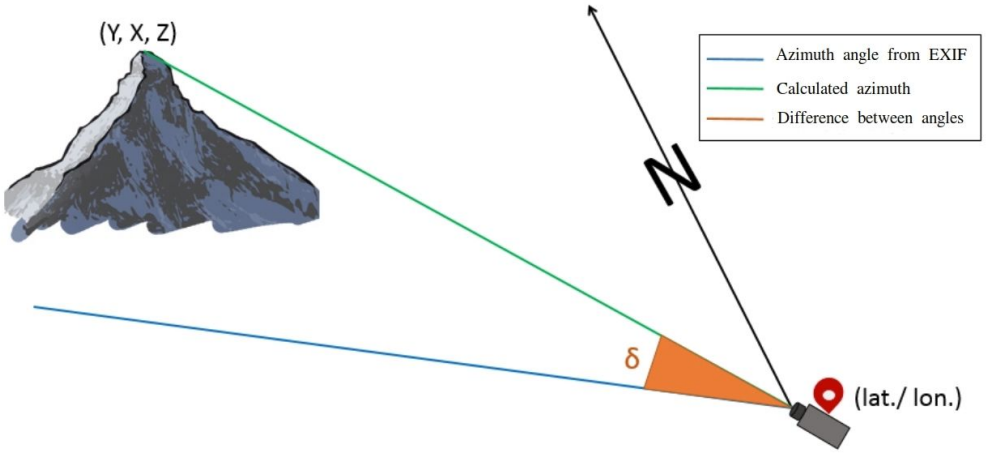
→ Obtain visible areas on a DEM for each picture

python™

SAGA
System for Automated Geoscientific Analyses

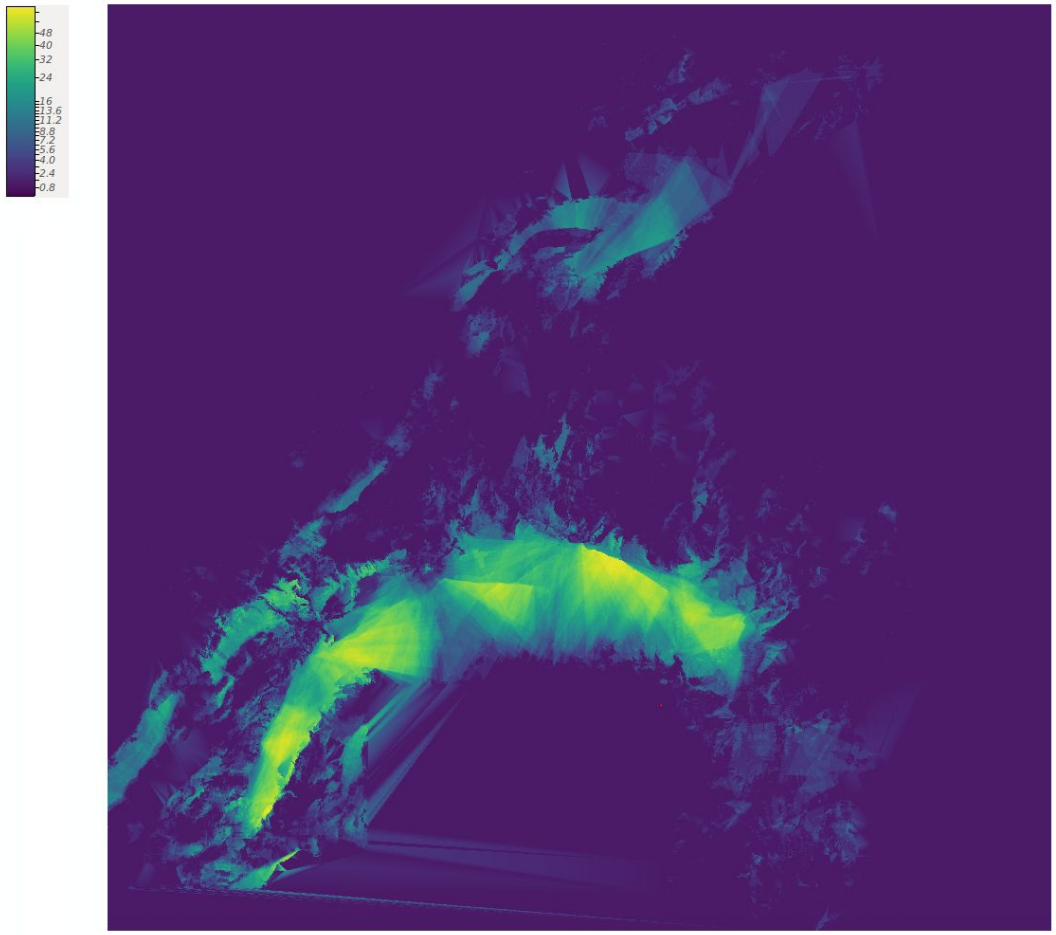
Usability of the azimuth angle





Ground truth: 29 photos taken from Zermatt showing the Matterhorn
→ 70% of the photos had matching azimuth angles
→ Newer models: increasing accuracy

Case study - data



5'131 images for the Swiss Canton of Vaud downloaded from FlickR

Pictures taken outside of OSM building footprint:

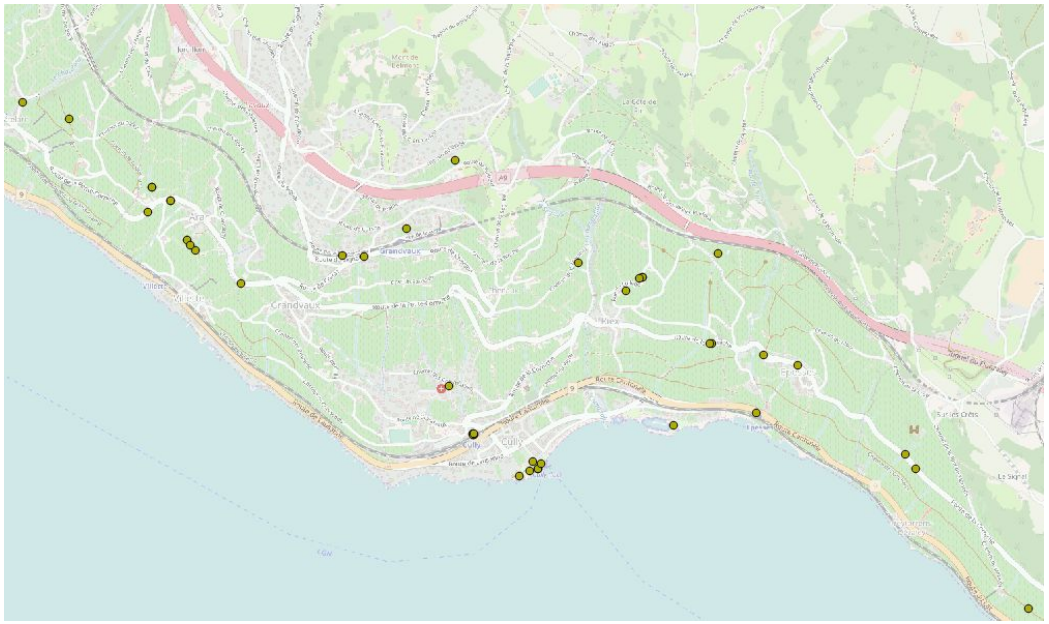
3'483 potential landscape images

Result : map with accumulated fields of view

→ Pictures taken from points that are easily accissible
→ Waterbodies very visible
→ Rural areas less prominent

→ **accessibility and population density can induce a bias**

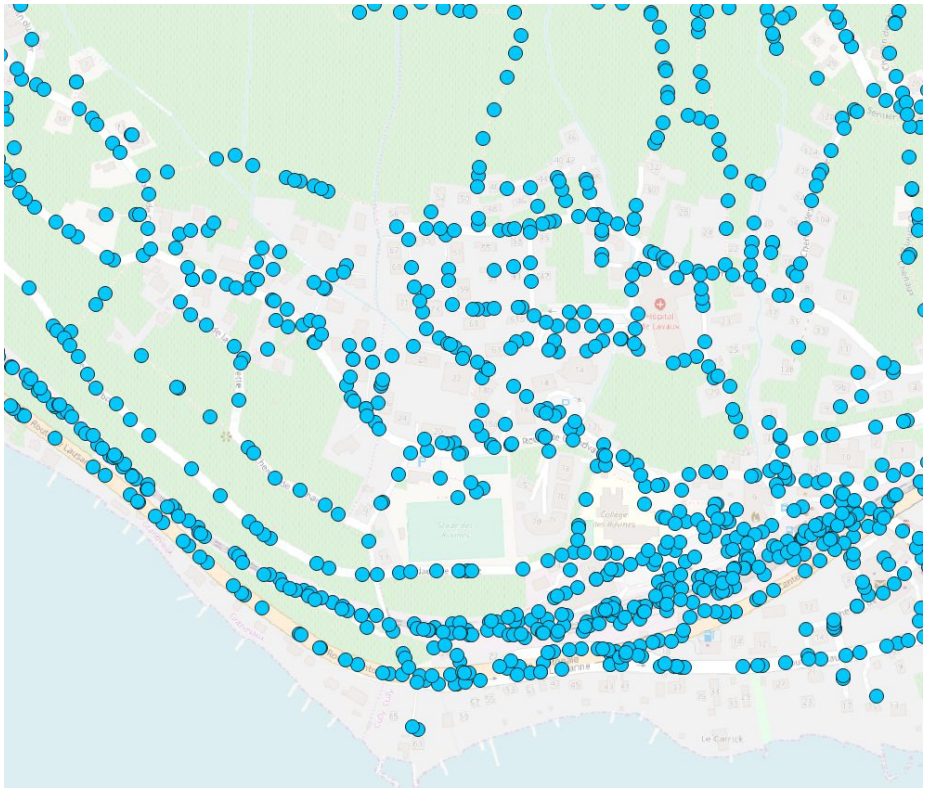
Case study – accessibility bias



Only 2,4 % of the pictures have been taken more than 10 meters away from a path / road/ railroad (based on OSM data)

→ **Accessibility induces a bias**

Case study – accessibility bias



2 datasets :

1 million random points on roads / railroads / paths

→ viewsheds for each point (based on a 20 meter DEM)

20 K random points on roads / railroads / paths

→ viewsheds for each point (based on a 10 meter DEM)

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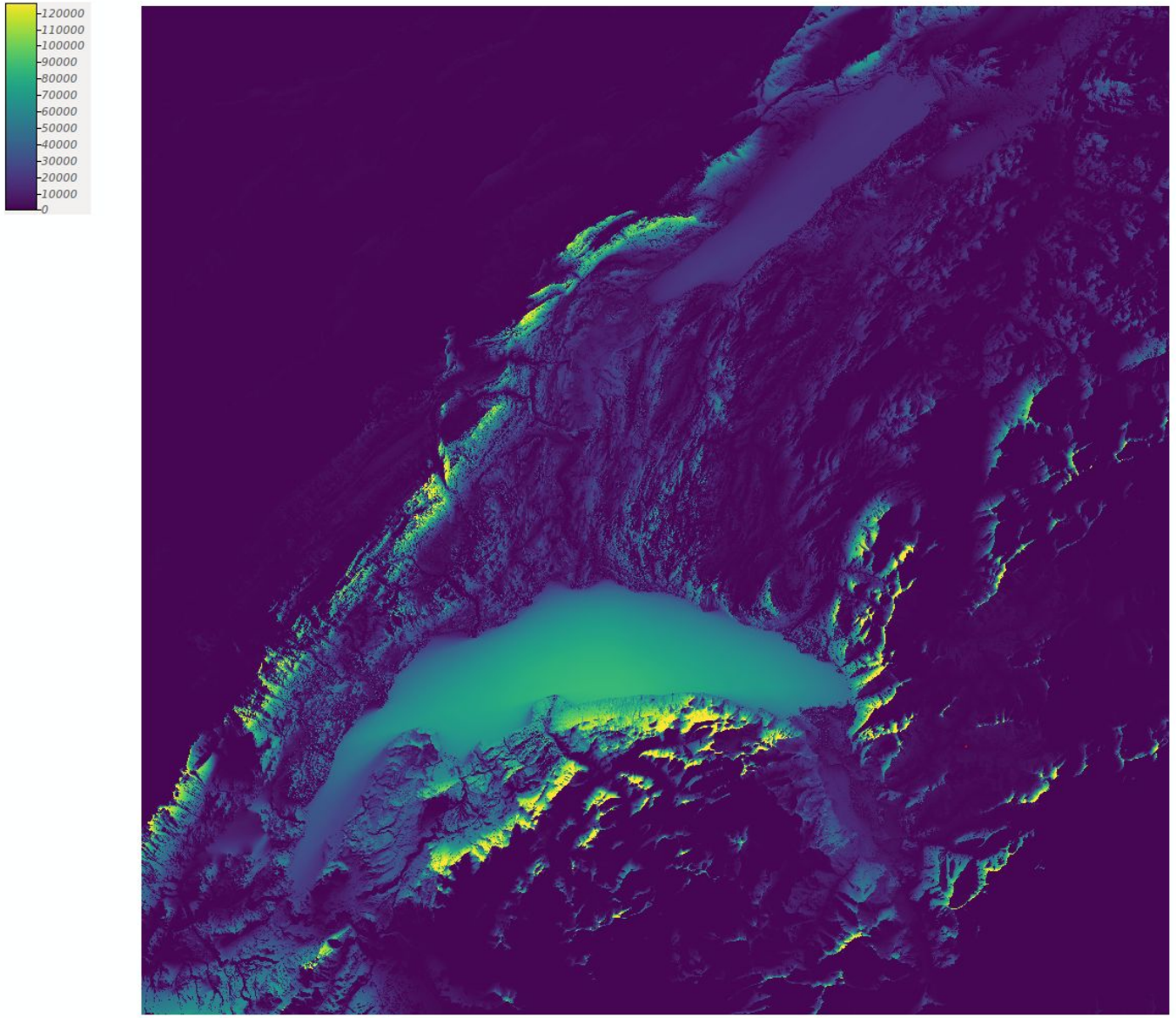
Case study – accessibility bias



Result :

1 million random points on roads / railroads / paths

Viewsheds for each point on:
→ DEM France (01, 25, 74)
→ DEM swissALTI3D outside canton Vaud
→ D**S**M inside canton Vaud

More than 1 month parallel computation on a 50 cores + 256 GB RAM machine.

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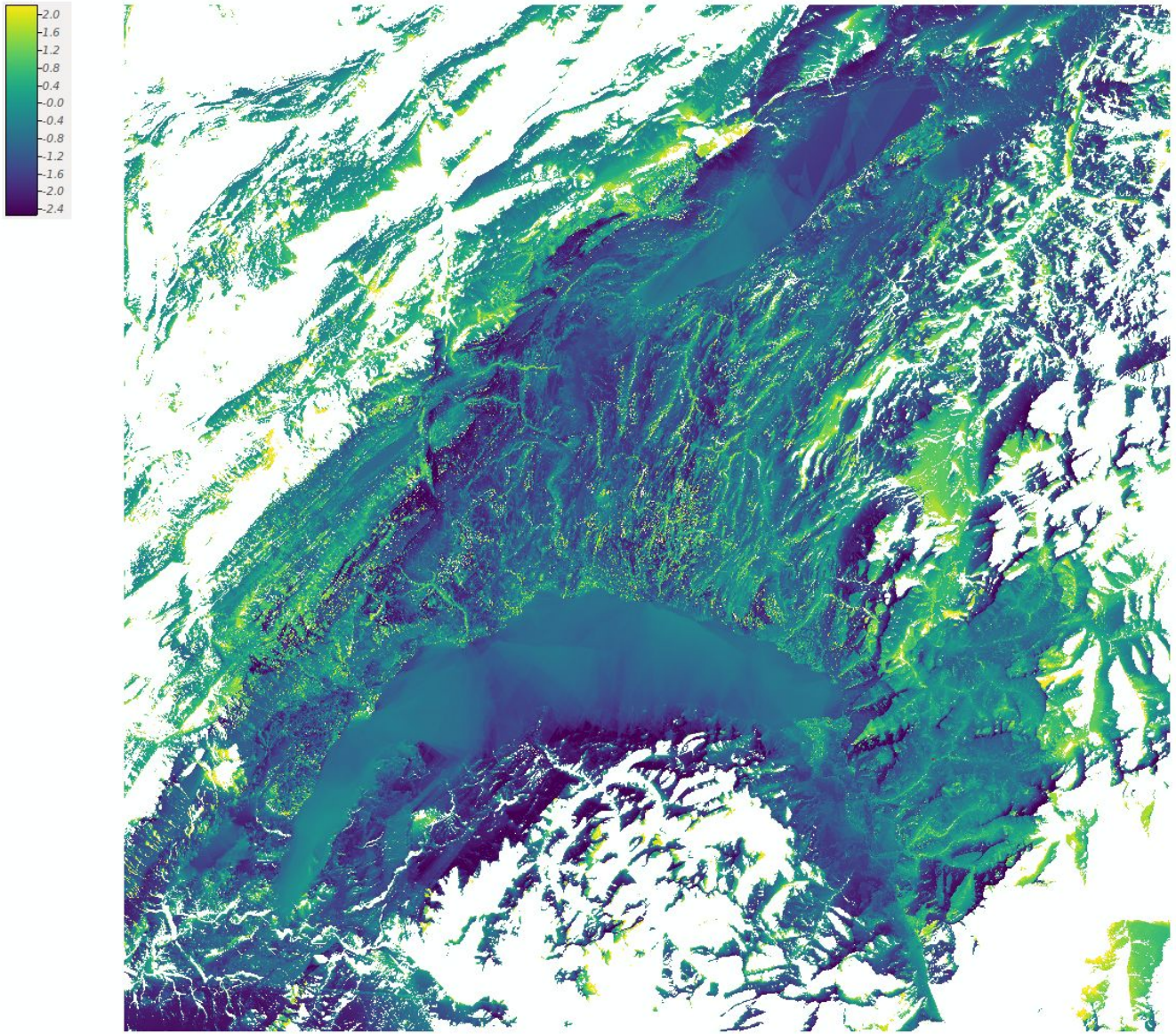

Delta view indicator :

Ratio between the pixels that have been photographed and the total number of photos divided by the number of pixels that can be photographed divided by the number of points :

$$\delta v = \left(\frac{\frac{V_{px}}{V_{tot}}}{\frac{T_{px}}{T_{tot}}} - 1 \right) * 100\%$$

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Conclusions & Perspectives

High potential for spatial planning decision support

e.g.
- finding spots for the construction of windmills
- tourism: find scenic routes
- find beautiful spots to build houses (do the very frequently covered places correlate with landmarks?)
- define protected areas
- …

Perspectives:

- Population bias
- Seasonal changes
- Machine learning for the automated characterization of the photos

Questions?

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