Simplification of digital terrain models using feature-based three-dimensional methods

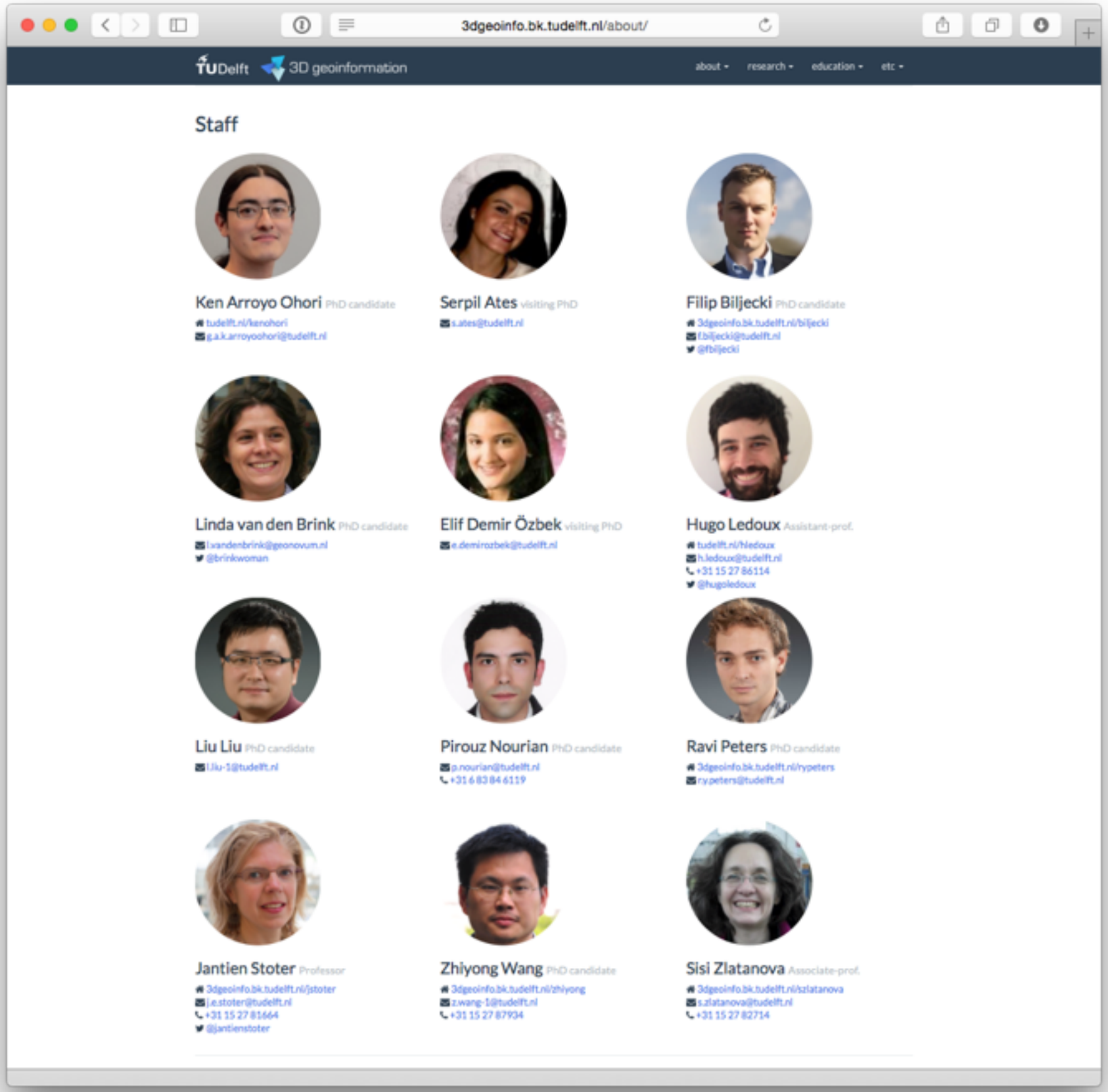
Hugo Ledoux, Ravi Peters and Jantien Stoter

3rd user committee meeting
2015/05/19
Amersfoort

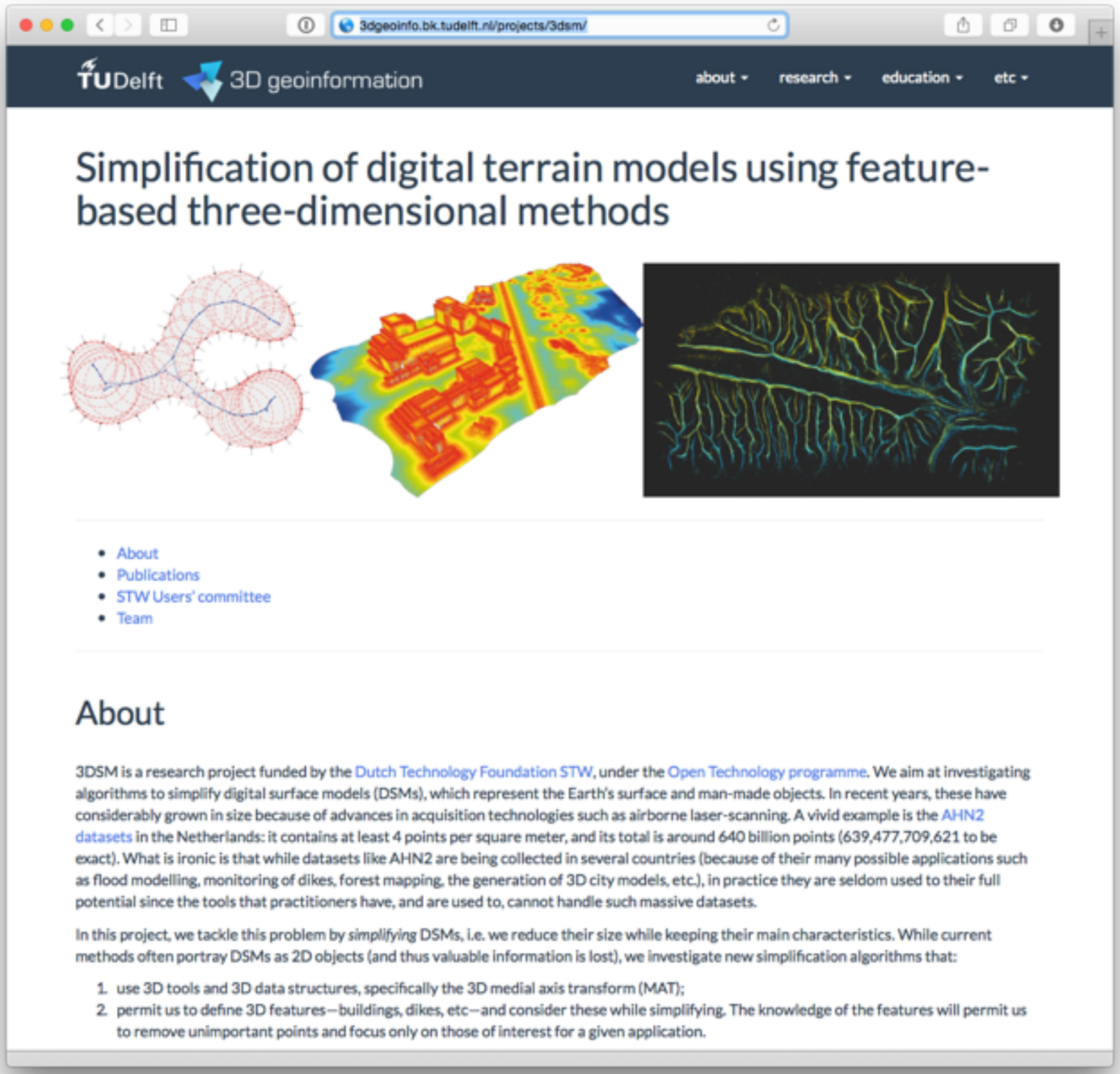
3D geoinformation
3dgeoinfo.bk.tudelft.nl
TU Delft Delft University of Technology

a new research group!

a new research group!

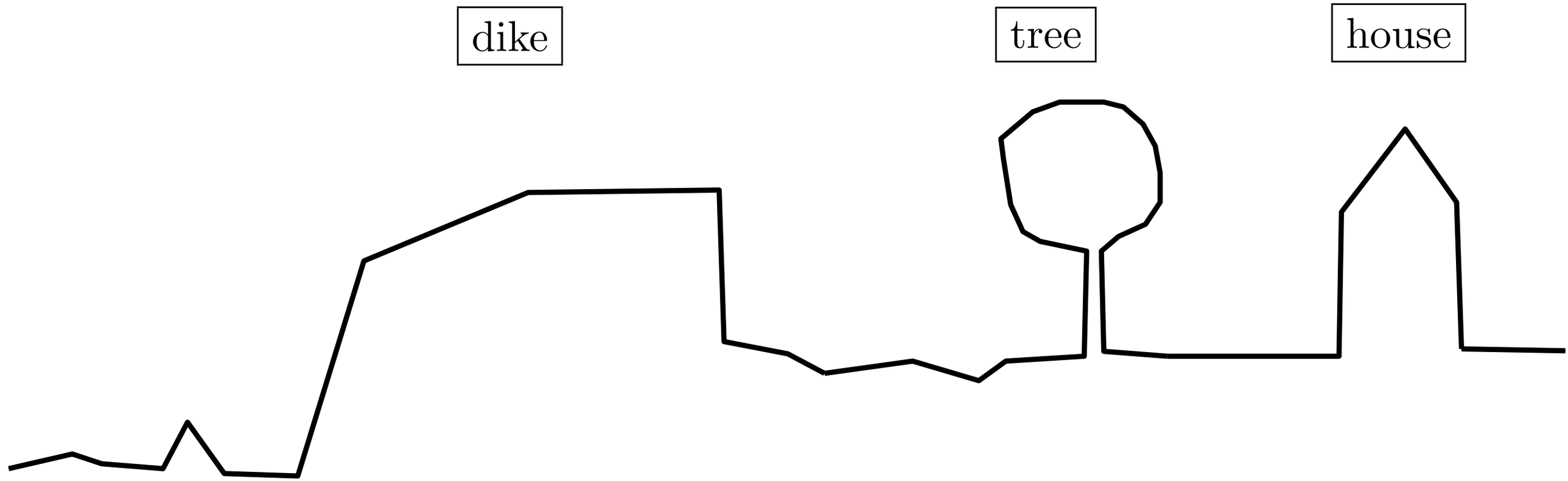


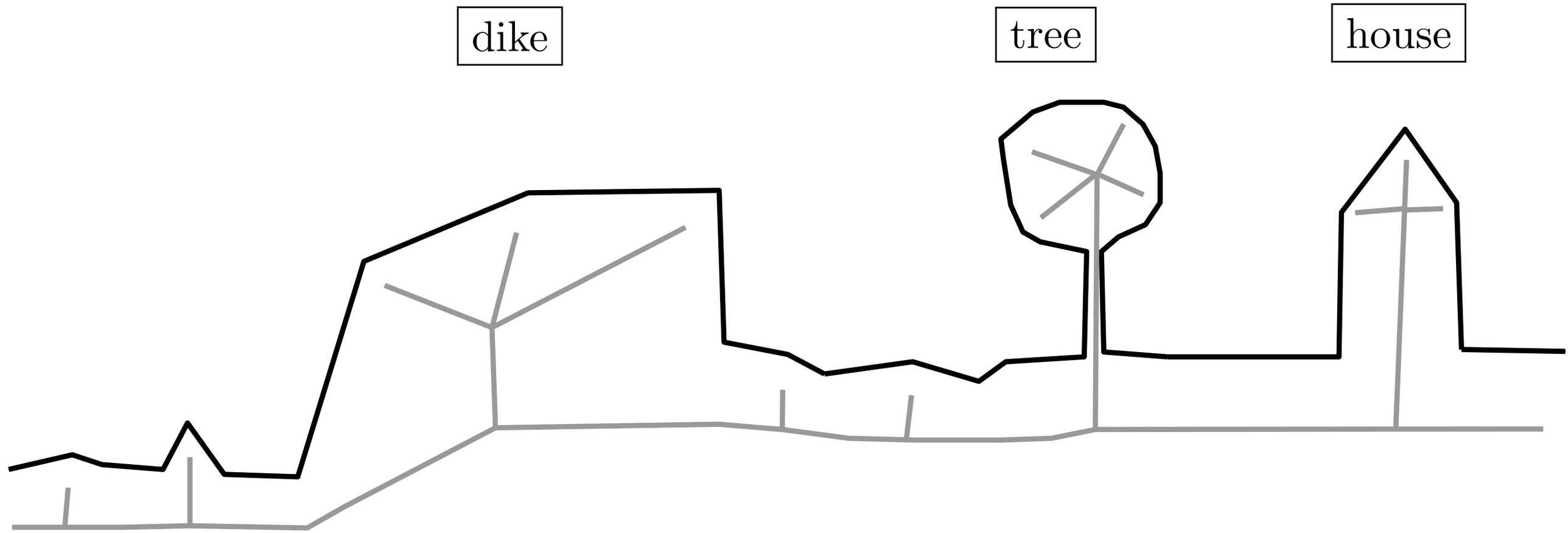
a new research group!

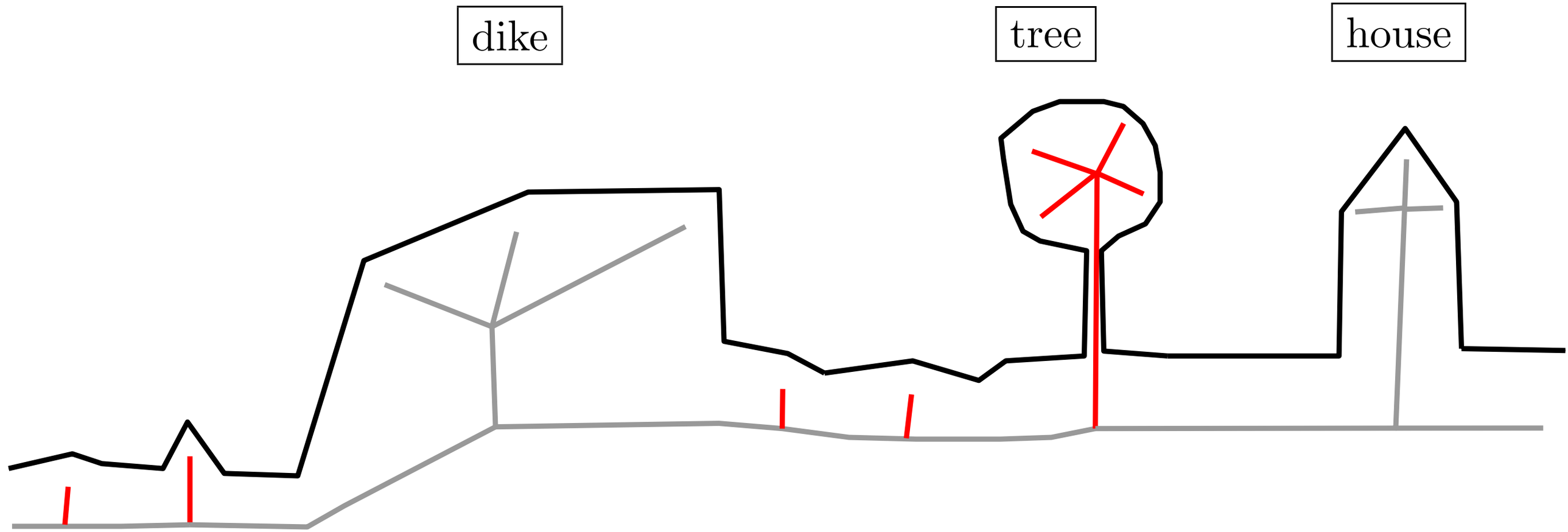


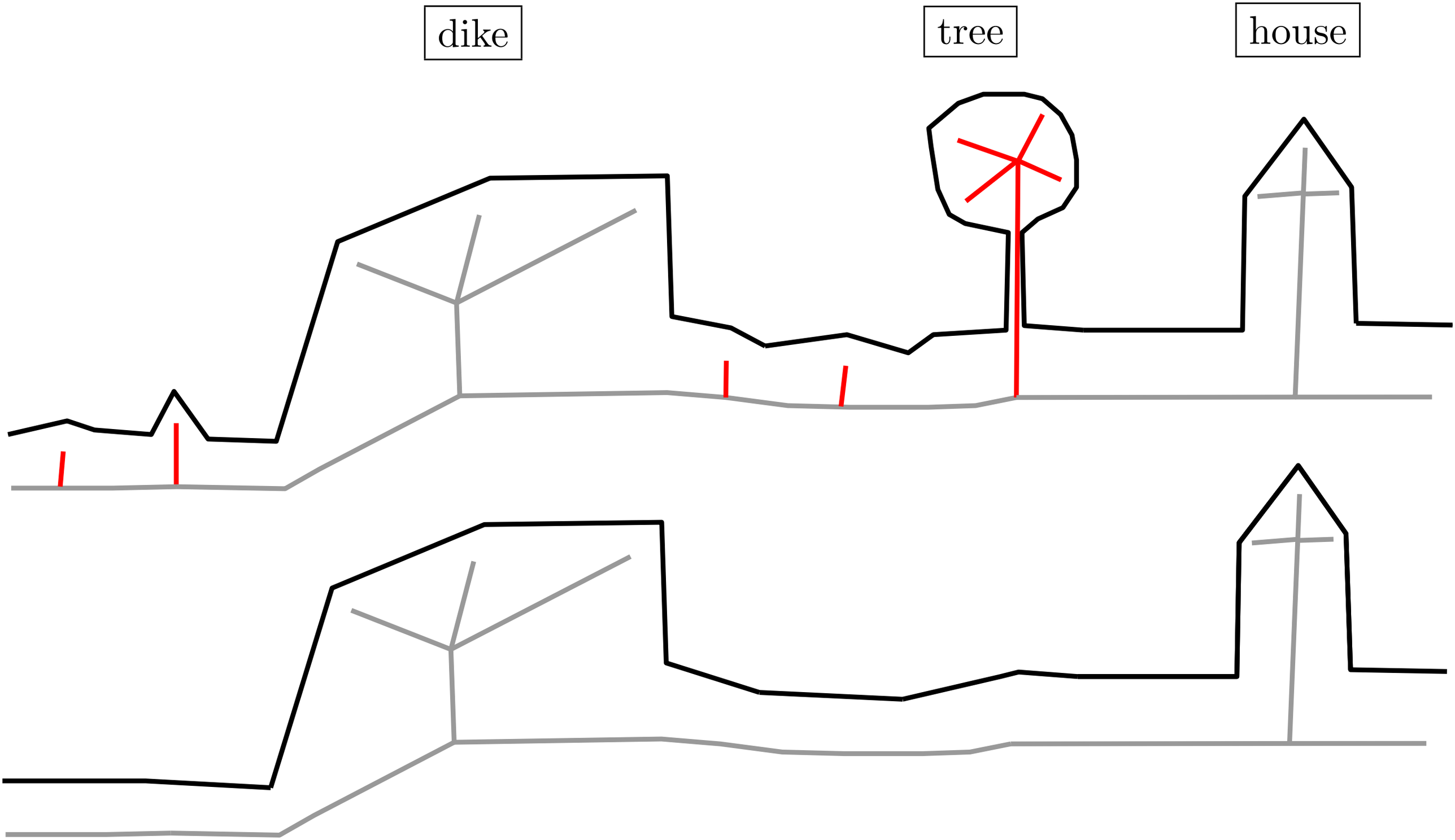
another related STW-funded project

What was the project about again?

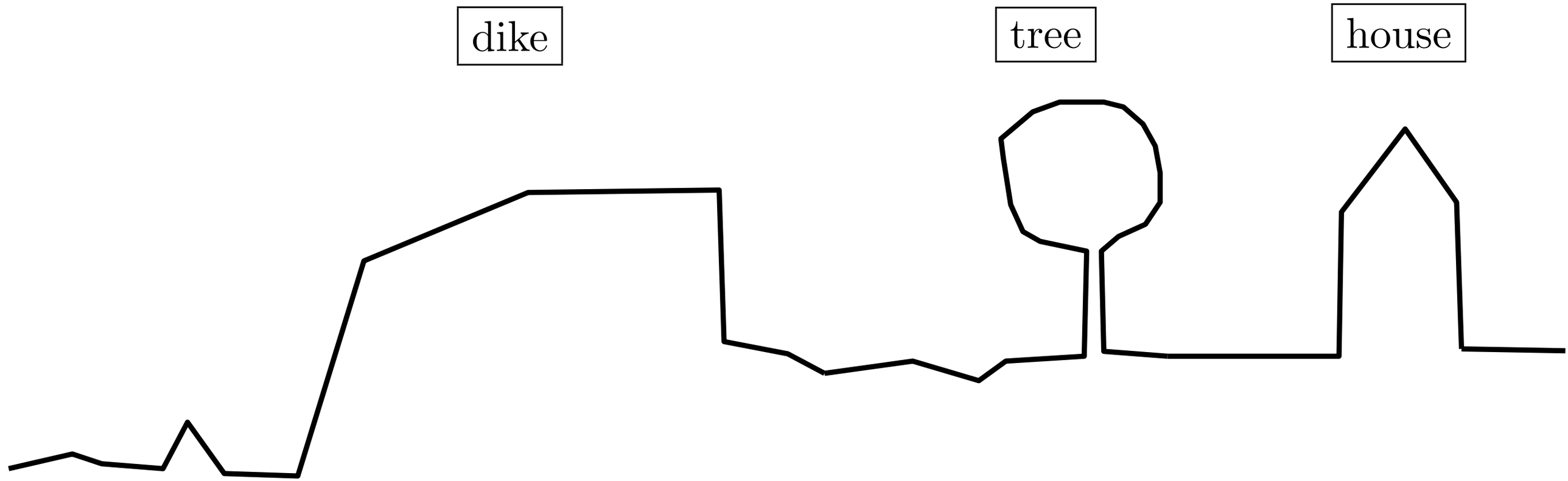

dike
tree
house


dike
tree
house

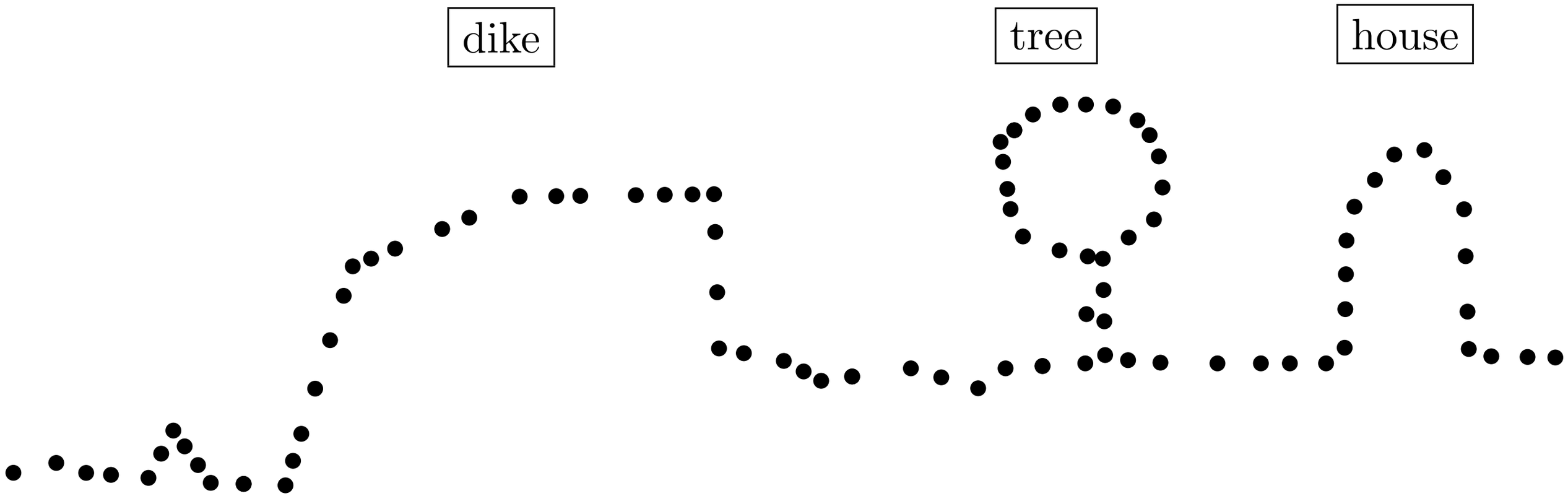

dike
tree
house


dike
tree
house

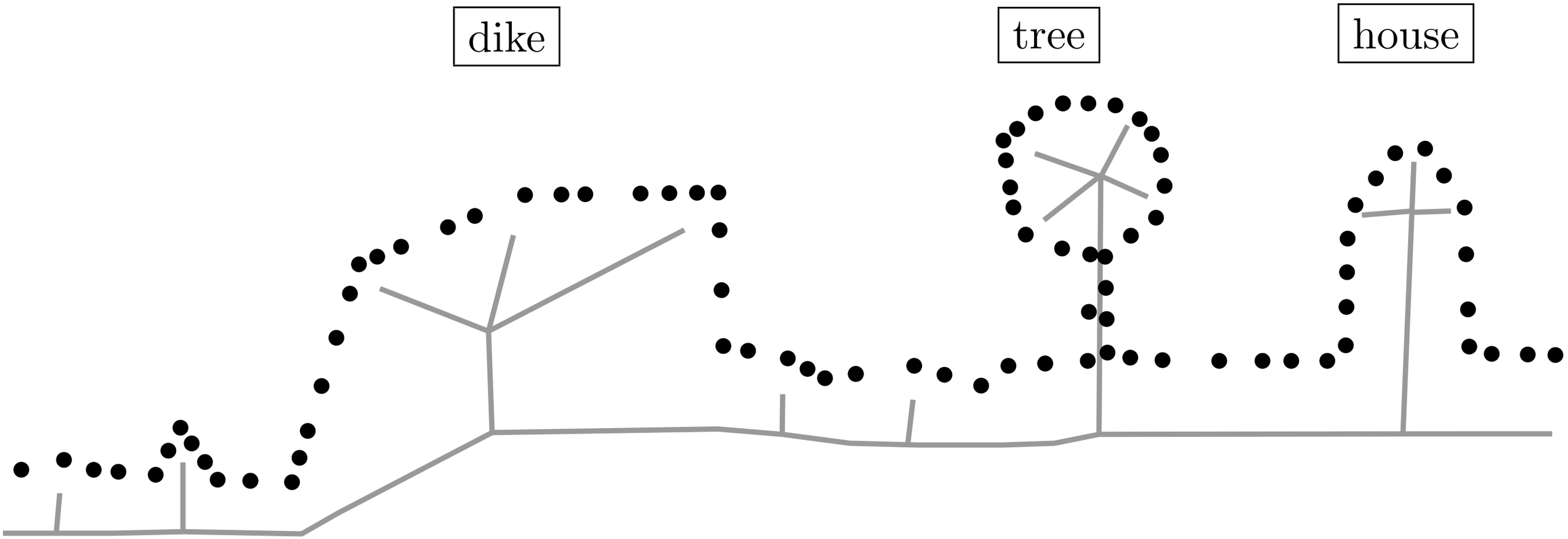
no more surface, just the points (eg AHN2)



no more surface, just the points (eg AHN2)



no more surface, just the points (eg AHN2)

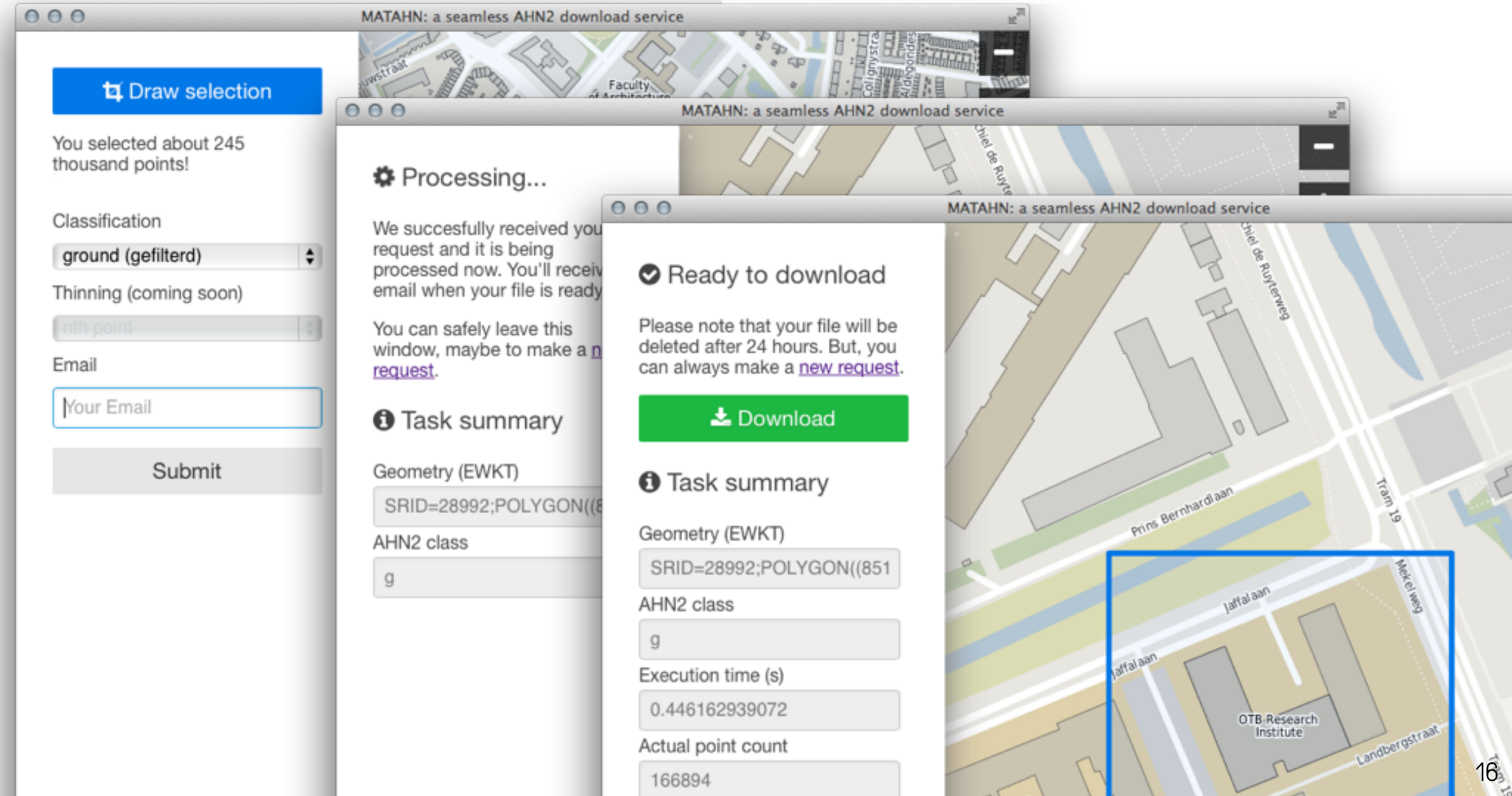


Medial axis transform (MAT) = skeleton

Overview first 2 years

1. MATAHN: an AHN2 download tool

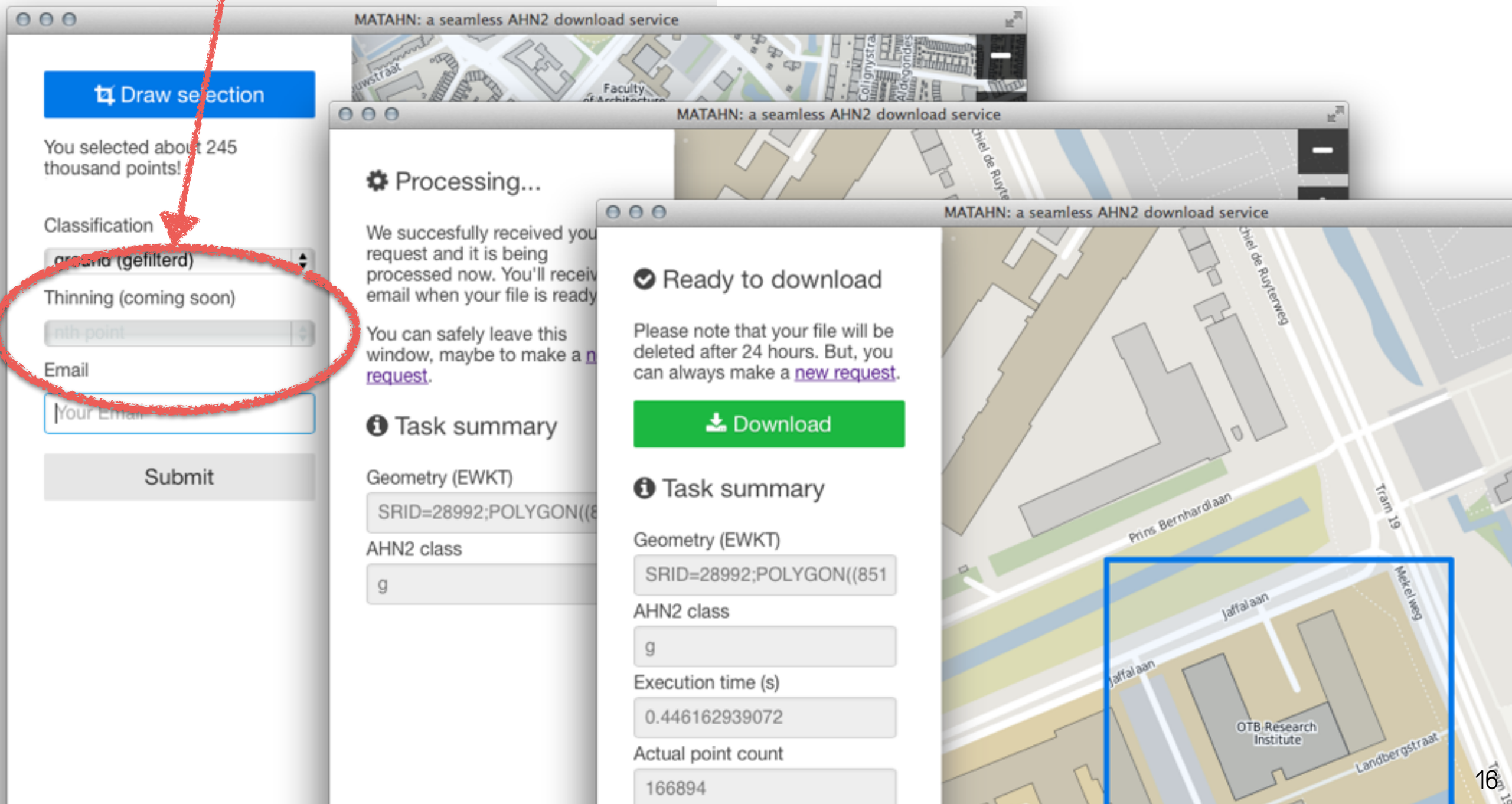
- As simple as possible
- Download only what you need
- No tiles



1. MATAHN: an AHN2 download tool

- As simple as possible
- Download only what you need
- No tiles

working on it



2. several papers/conferences/workshops

- **Visualisation of massive point clouds based on the medial axis transform**. Peters, R. & Ledoux, H., Submitted to Computers & Geosciences (2015)

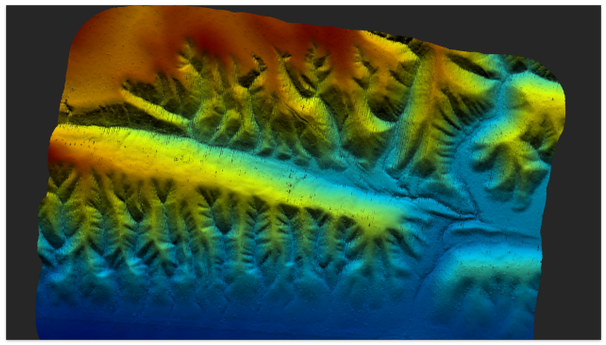
- **A Voronoi-based approach to generating depth-contours for hydrographic charts**, Peters, R.; Ledoux, H. & Meijers, M., Marine Geodesy 37(2), 145--166 (2014)

- **Het 3D skelet van een puntenwolk**. Ravi Peters. Presentation at the AHN/NCG studiemiddag (Amersfoort, the Netherlands) (2015)

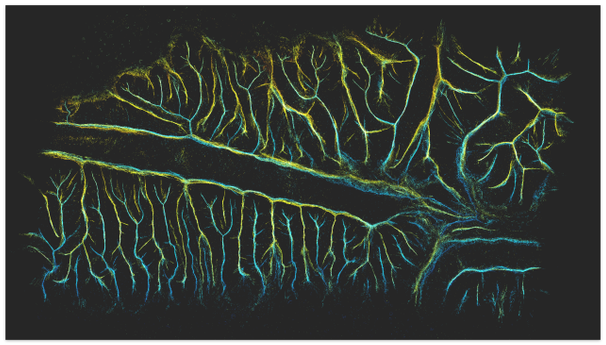
- Peters, R. (2014). **Feature-aware LiDAR point cloud simplification**. Poster at the GeoBuzz conference (November 2014)

- **Approximating the Medial Axis Transform of LiDAR point clouds**, Peters, R., Poster at the Lorentz workshop on geometric algorithms in the field, Leiden, the Netherlands (2014)

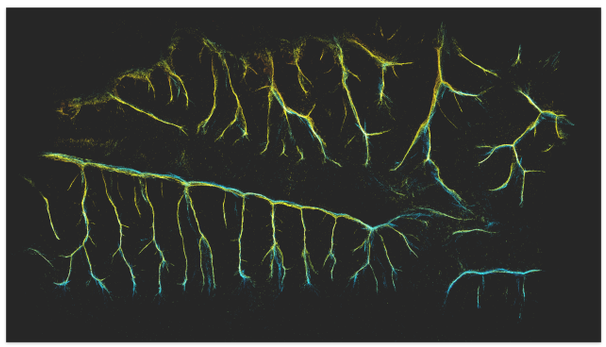
3. new methodology for MAT of real-world LiDAR



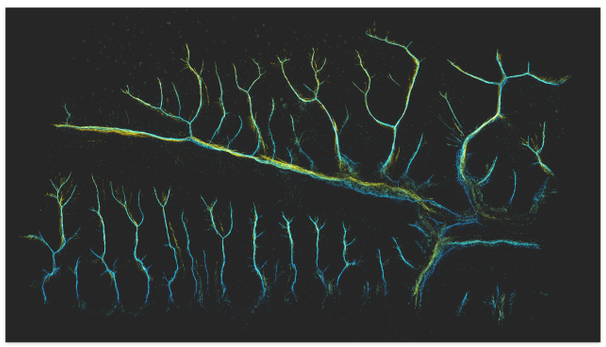
(a) Raw pointcloud.



(b) Interior and exterior MAT

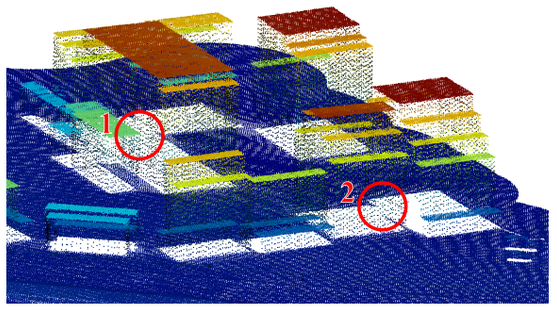


(c) Interior MAT

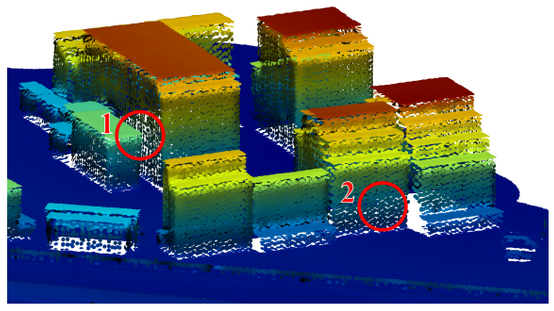


(d) Exterior MAT

deals with noise

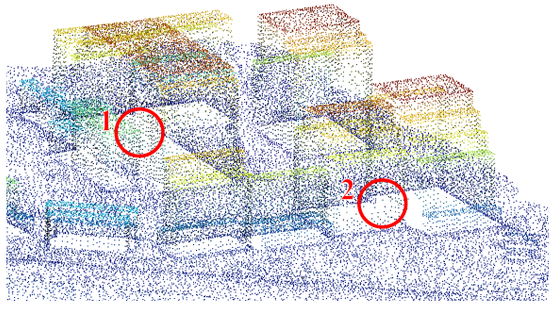


(a) Full point cloud with simple points

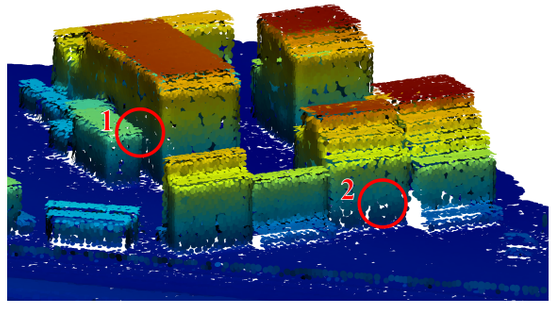


(b) Full point cloud with fixed-radius splats

“smart” simplification

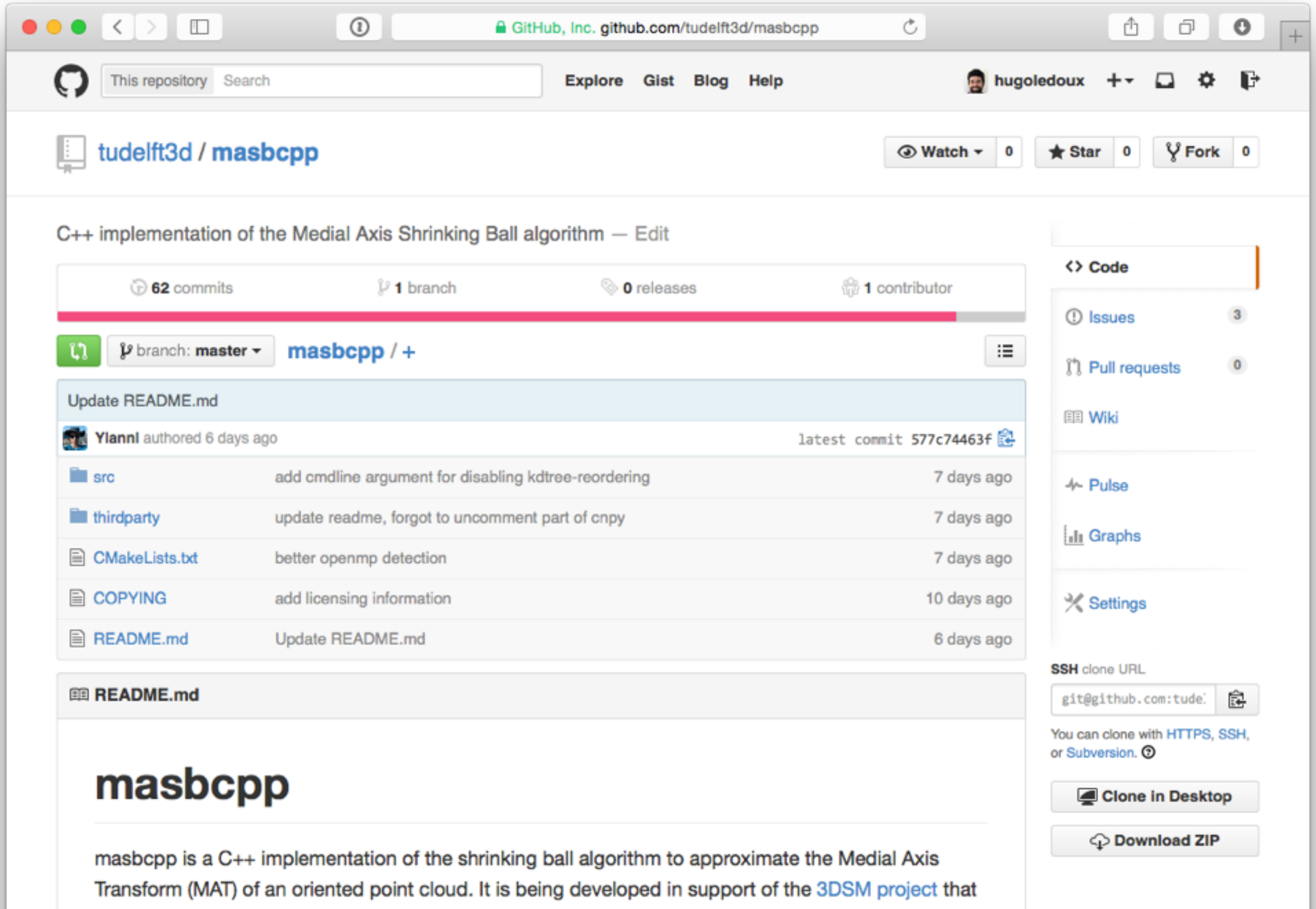


(c) Simplified point (90% of points removed) cloud with simple points

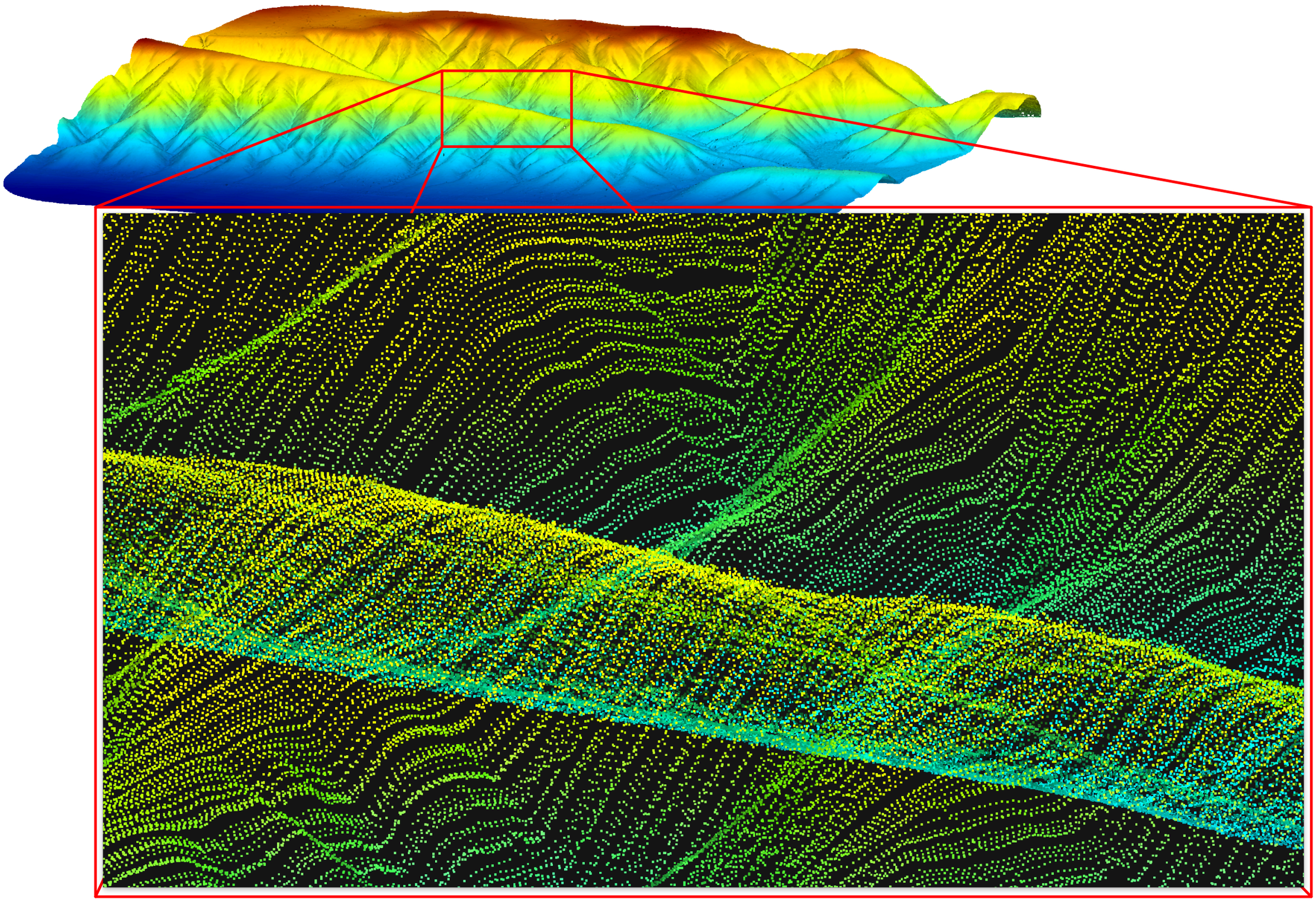


(d) Simplified point (90% of points removed) cloud with lfs-radius splats

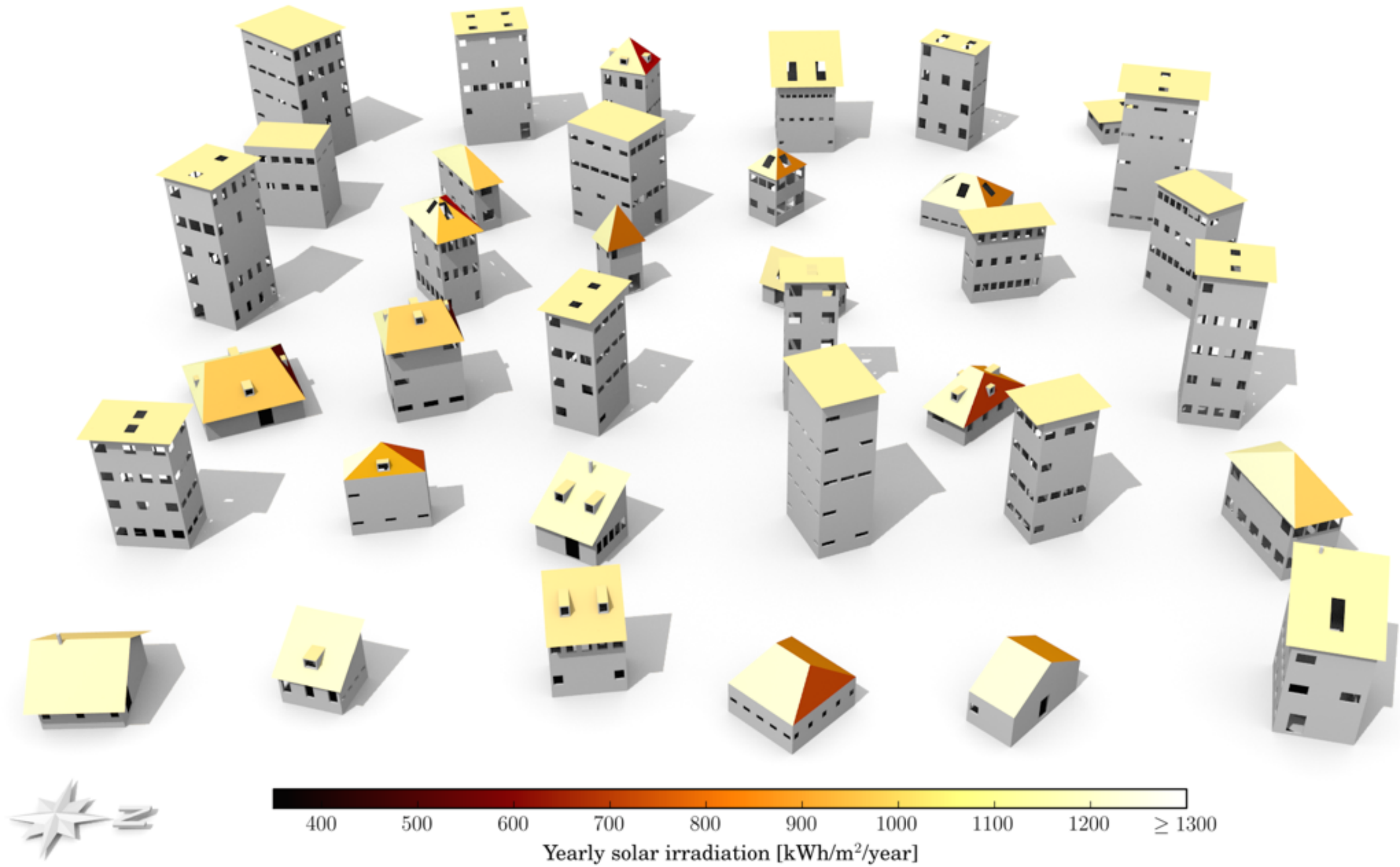
4. code released open-source

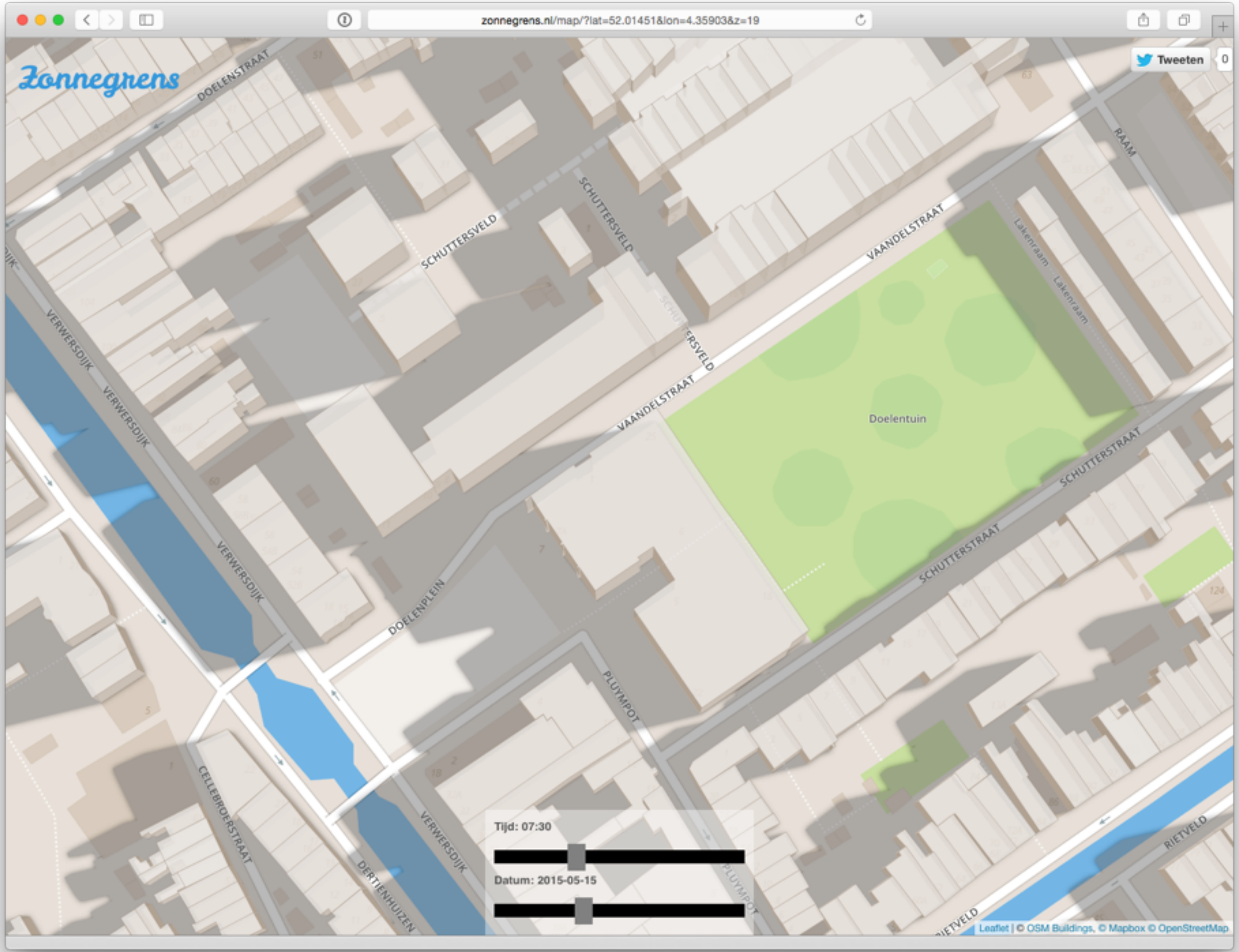


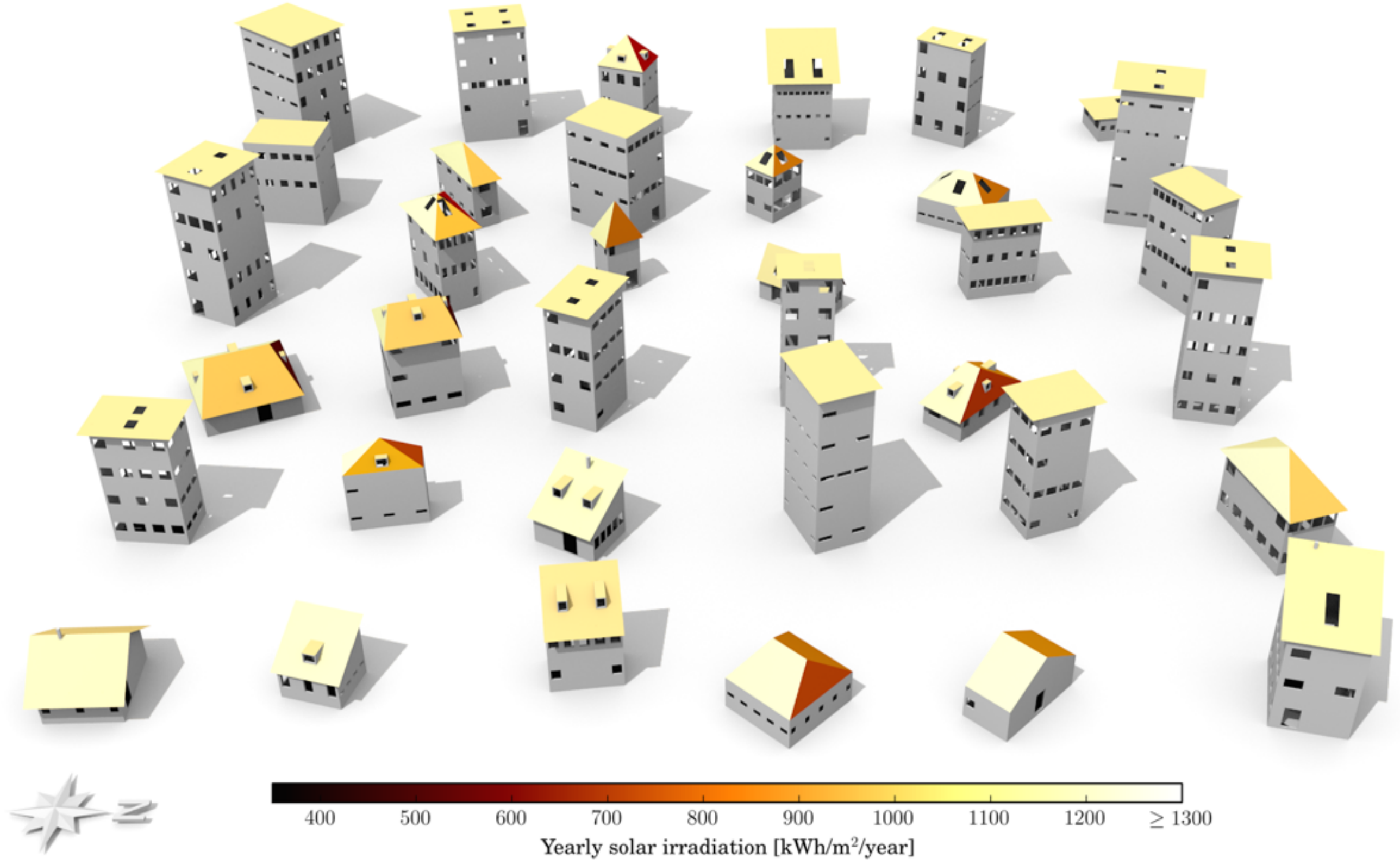
5. use-cases: mostly visualisation up to now



5. use-cases: other visibility-based applications



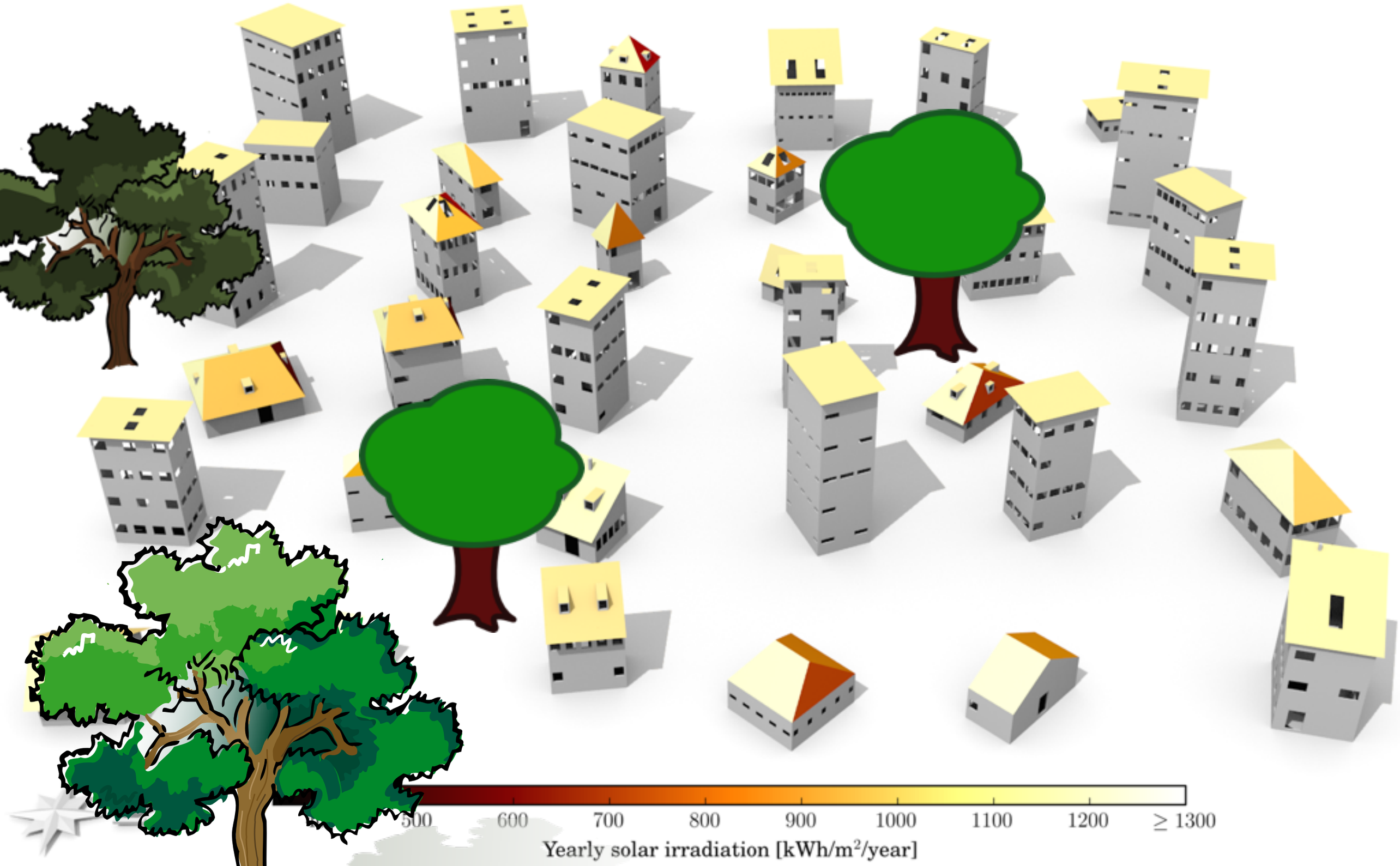

zonnegrens.nl/map/?lat=52.01451&lon=4.35903&z=19
Zonnegrens
Tweeten
0
DOELENSTRAAT
SCHUTTERSVELD
VAANDELSTRAAT
RAAM
Lakenraam
Doelentuin
SCHUTTERSTRAAT
VERWERSDIJK
DOELENPLEIN
PLUYMPOT
CELLEBROERSTRAAT
DERTIENHUIZEN
RIETVELD
Tijd: 07:30
Datum: 2015-05-15
Leaflet | © OSM Buildings, © Mapbox © OpenStreetMap

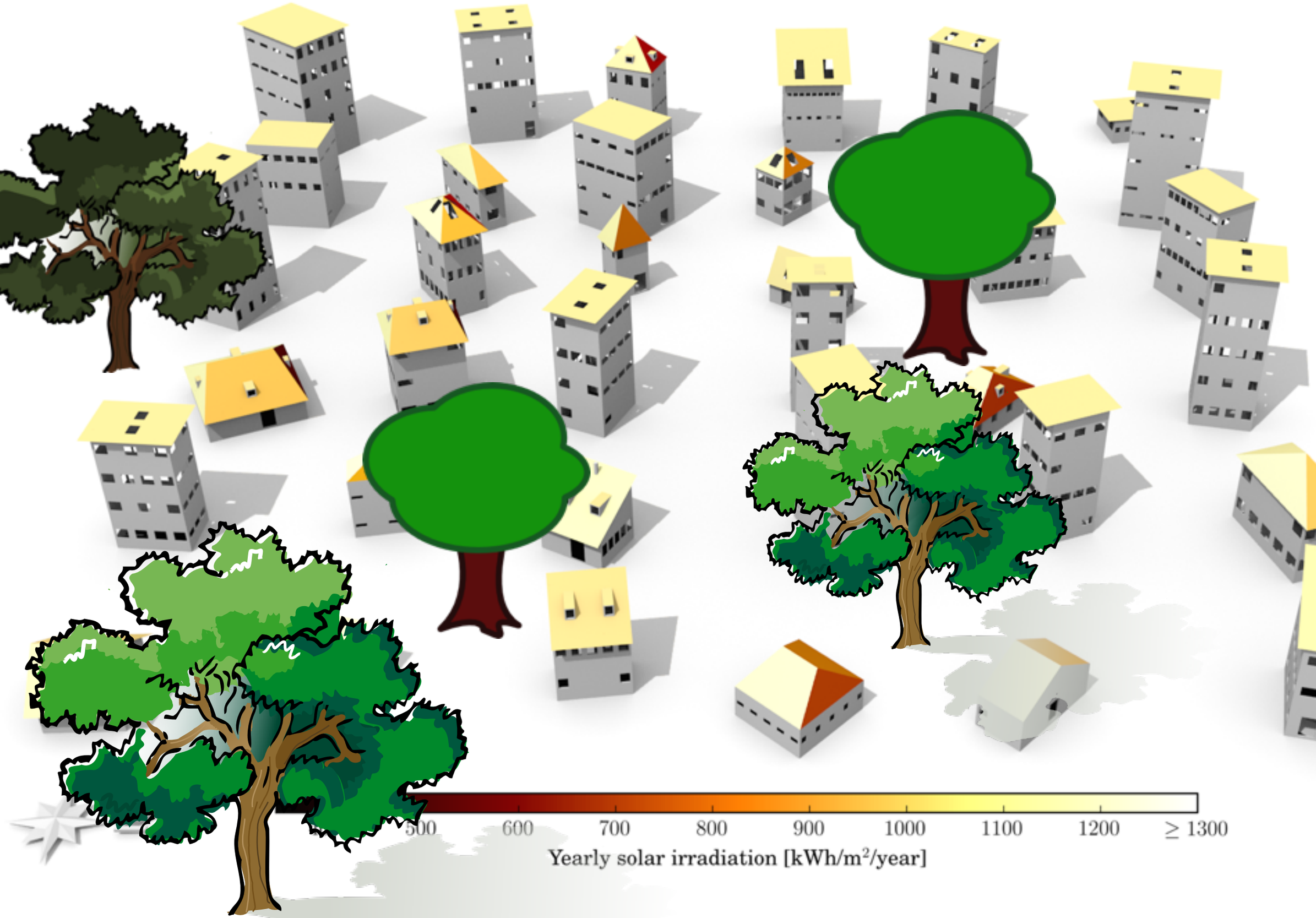

N
400
500
600
700
800
900
1000
1100
1200
≥ 1300
Yearly solar irradiation [kWh/m²/year]


500
600
700
800
900
1000
1100
1200
≥ 1300
Yearly solar irradiation [kWh/m²/year]


500
600
700
800
900
1000
1100
1200
≥ 1300
Yearly solar irradiation [kWh/m²/year]


500
600
700
800
900
1000
1100
1200
≥ 1300
Yearly solar irradiation [kWh/m²/year]


500
600
700
800
900
1000
1100
1200
≥ 1300
Yearly solar irradiation [kWh/m²/year]


500
600
700
800
900
1000
1100
1200
≥ 1300
Yearly solar irradiation [kWh/m²/year]

slide from September 2014

Activities coming year:

1. Continue prototype for real-cases
2. attempt to scale to massive datasets
3. starting work on the identification of features in point clouds
4. Ravi will make a research visit in February 2015 to Dr Michela Spagnuolo in Genova, Italy
5. write and publish one conference paper (based on use-cases), and write another journal paper (in collaboration with Michela Spagnuolo)

slide from September 2014

Activities coming year:

1. Continue prototype for real-cases ✔
2. attempt to scale to massive datasets ✔
3. starting work on the identification of features in point clouds ✔
4. Ravi will make a research visit in February 2015 to Dr Michela Spagnuolo in Genova, Italy [→ postponed to end of this year]
5. write and publish one conference paper (based on use-cases), and write another journal paper (in collaboration with Michela Spagnuolo) ✔ [partly]

objectives next ~9 months

- Use-cases and the use of the MAT for different applications. We will first continue exploring how it can be used for “**visibility applications**” (which is very promising) and for other use-cases previously discussed with the users’ committee.

- Explore how can **features be identified** in a point cloud (with the help of the MAT obviously). Once identified, these could be deleted (and thus we would obtain a simplified point cloud). In the coming period we expect to develop the theory (with synthetic datasets), and in the next one (final year of the project) to apply it to the use-cases of the members of the users’s committee.

- Better scaling of altos (with MSc student Marco Lam).

questions/comments from Joris Goos

- Interesting to see wether the method can be scaled to large datasets, wether datasets from Niels (AHN3) and Marc (**point from image matching**) yield similar results and wether noise in the datasets can be found

- I did come across the following: How about discussion/insights into the **use of generaliserd terrain models in 3D city models**? We are currently investigating. More specifically: Is the idea of constrained generelisation indeed the way to go, and if so, can it be combined (now or in the future) with the methods in this project? In other words: **can we mark specific points to be ’non-deletable”**? This might definitely be off-topic and if so: do forgive me and feel free to skip. Just some of my thoughts.

3dsm.bk.tudelft.nl