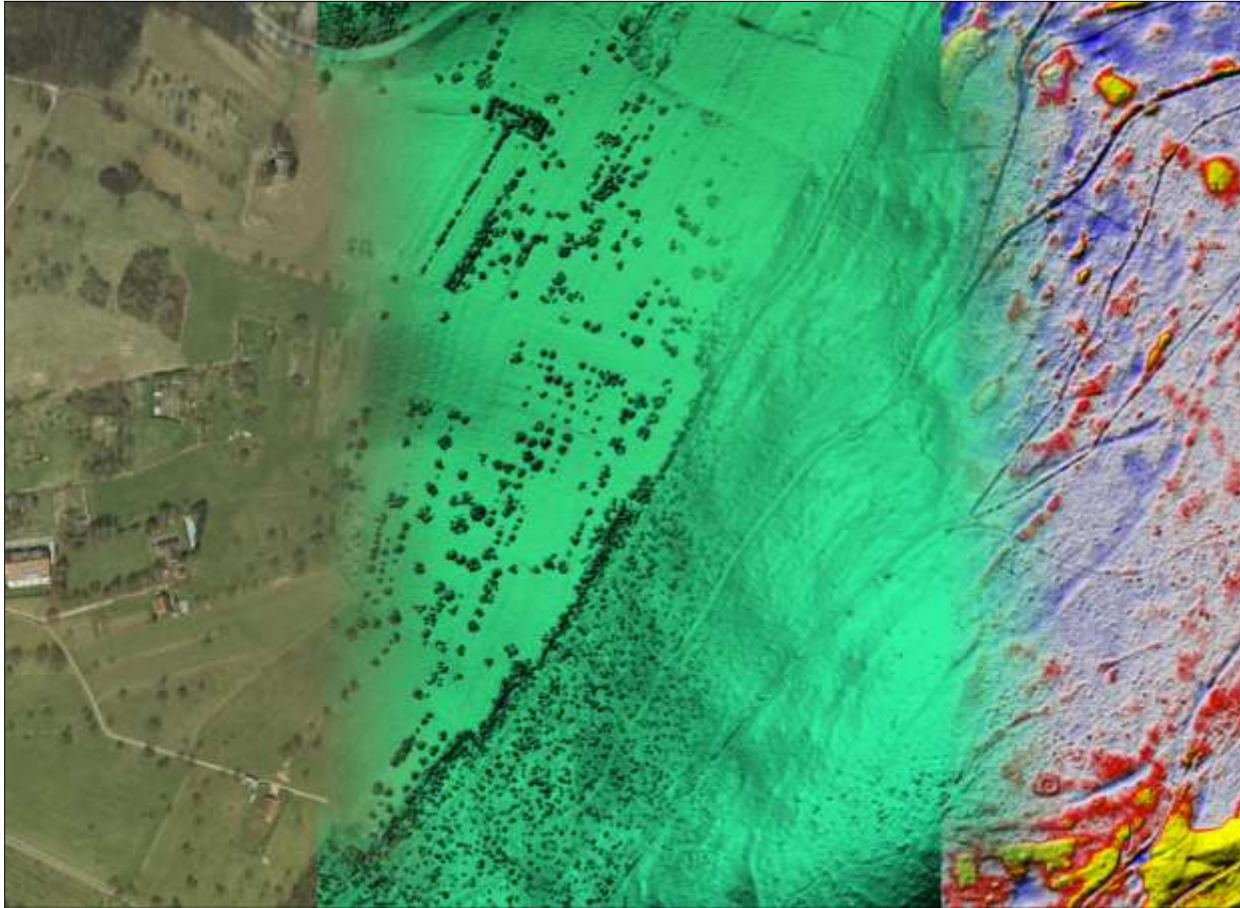


# **LIDAR-based archaeological prospection in Baden-Württemberg: data management and processing, first results and potential for future work**

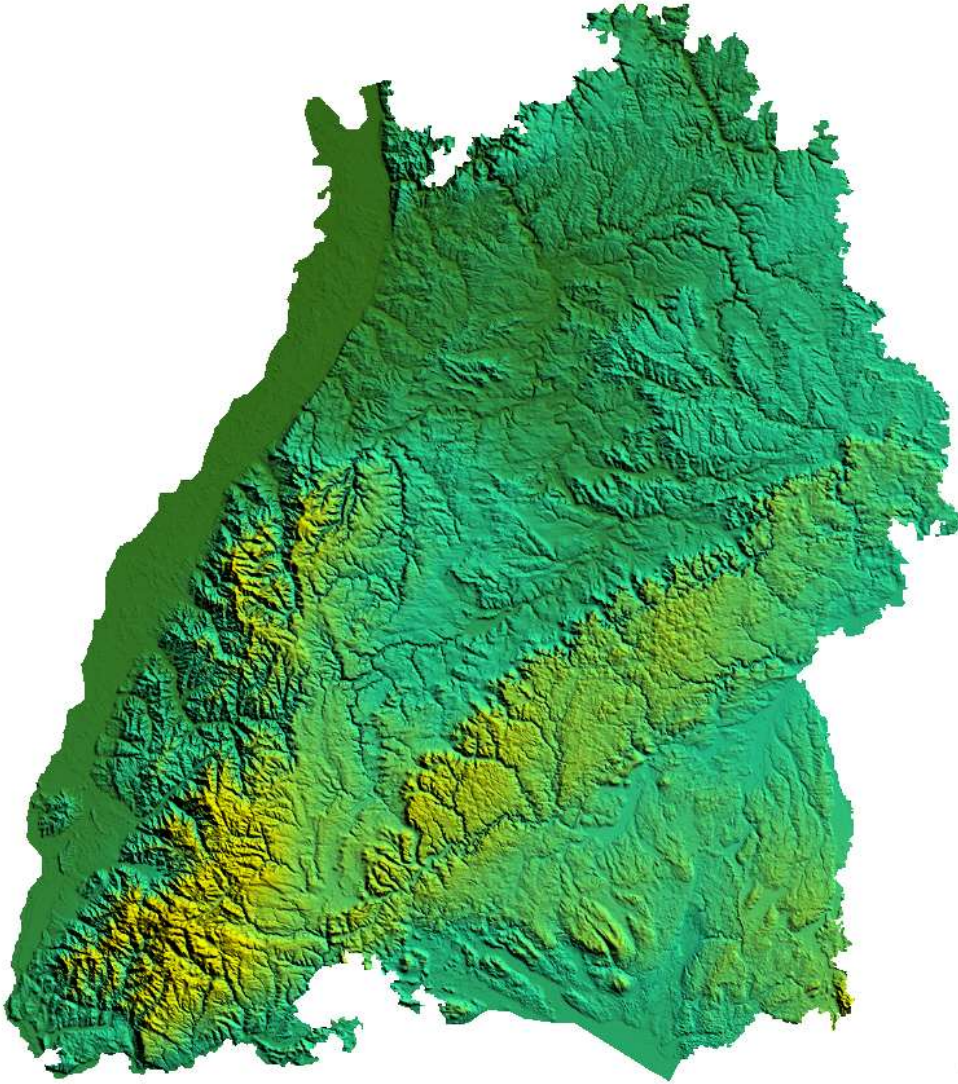


Ralf Hesse



**Baden-Württemberg**  
LANDESAMT FÜR DENKMALPFLEGE

# ***Introduction***

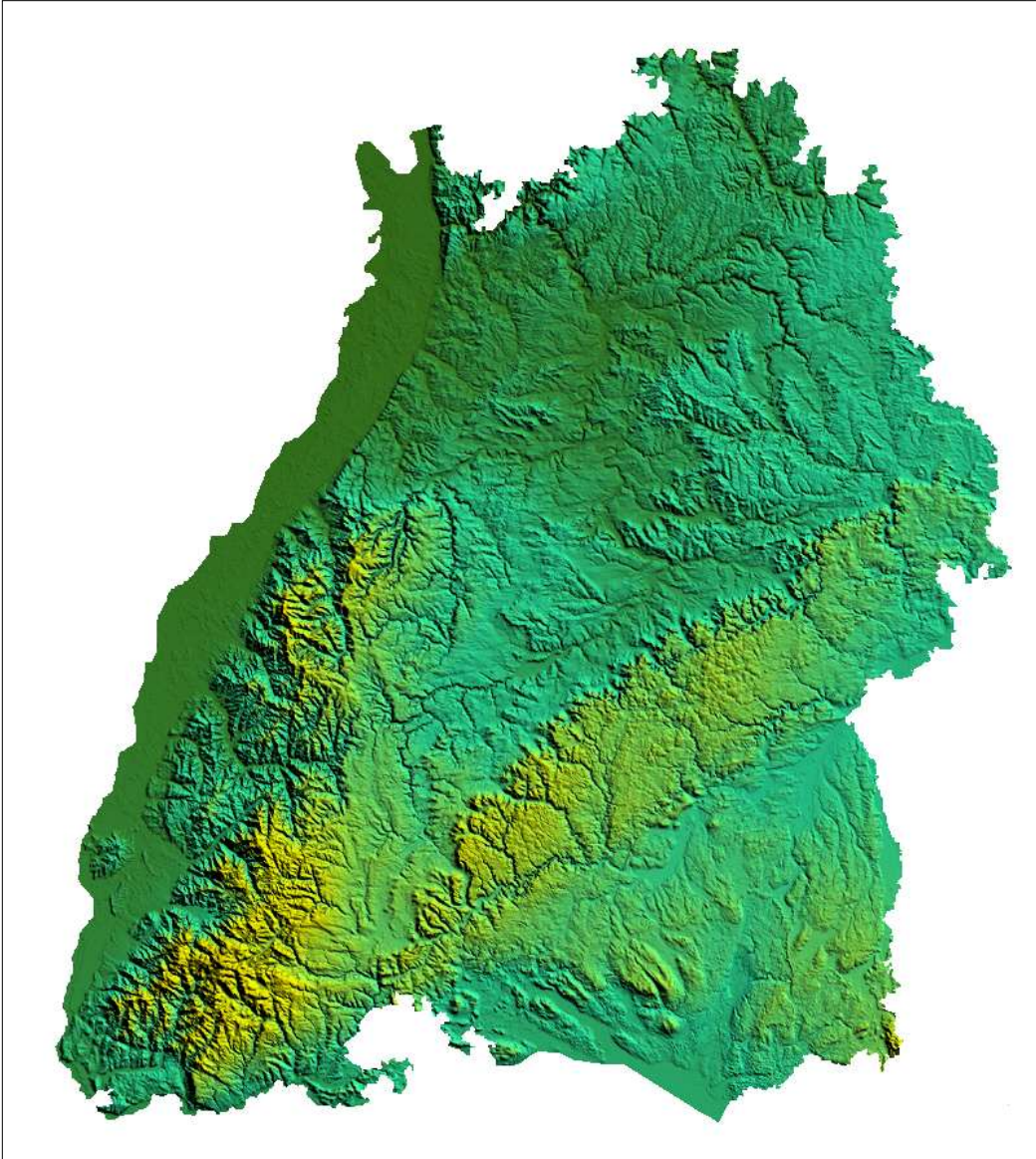


## **Aims:**

- archaeological prospection of Baden-Württemberg
- verification and extension of archaeological site database



# Introduction



## **LIDAR data:**

- State Surveying Office
- $\sim 1$  point/m<sup>2</sup>
- costs: annually 50 €/km<sup>2</sup>  
(split among all users:  
several ministries and  
subsidiary institutions)

## **Project details:**

- persons: 1
- access to results: in-house

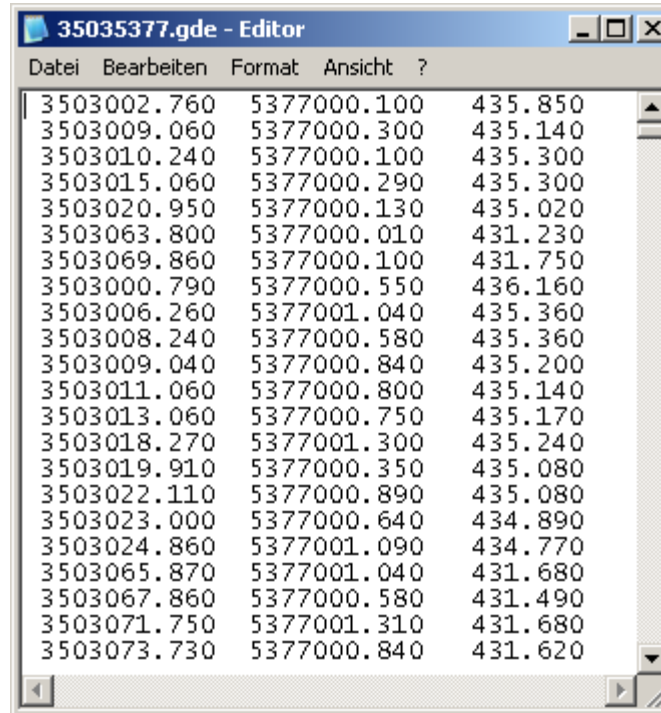
# Challenge 1: data management

## Data amount

- 35 751 km<sup>2</sup>
- raw data:
  - >1 TB in ~160 000 files

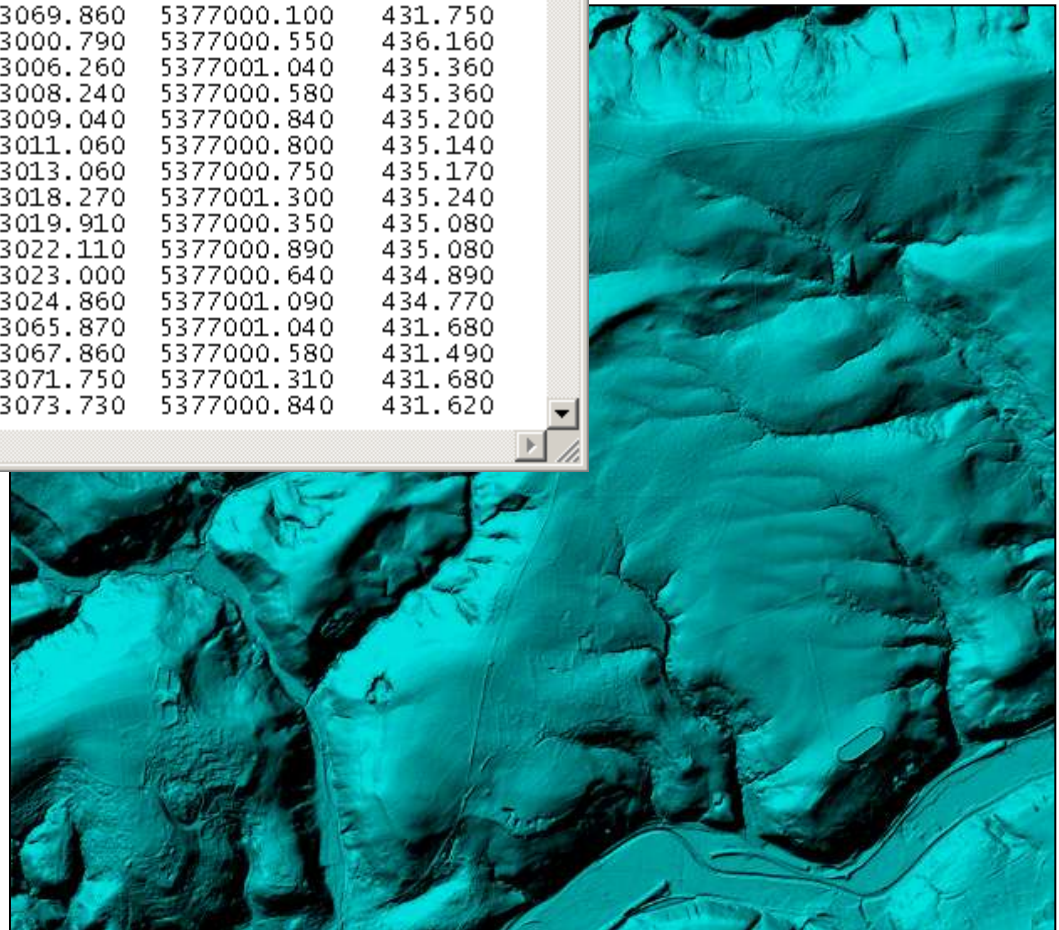
## File sizes

- combine files
- max. ~0.5 GB
- 25-100 km<sup>2</sup> per file
- 400-1600 files per raster layer
- 8-9 raster layers
- up to 22 vector layers

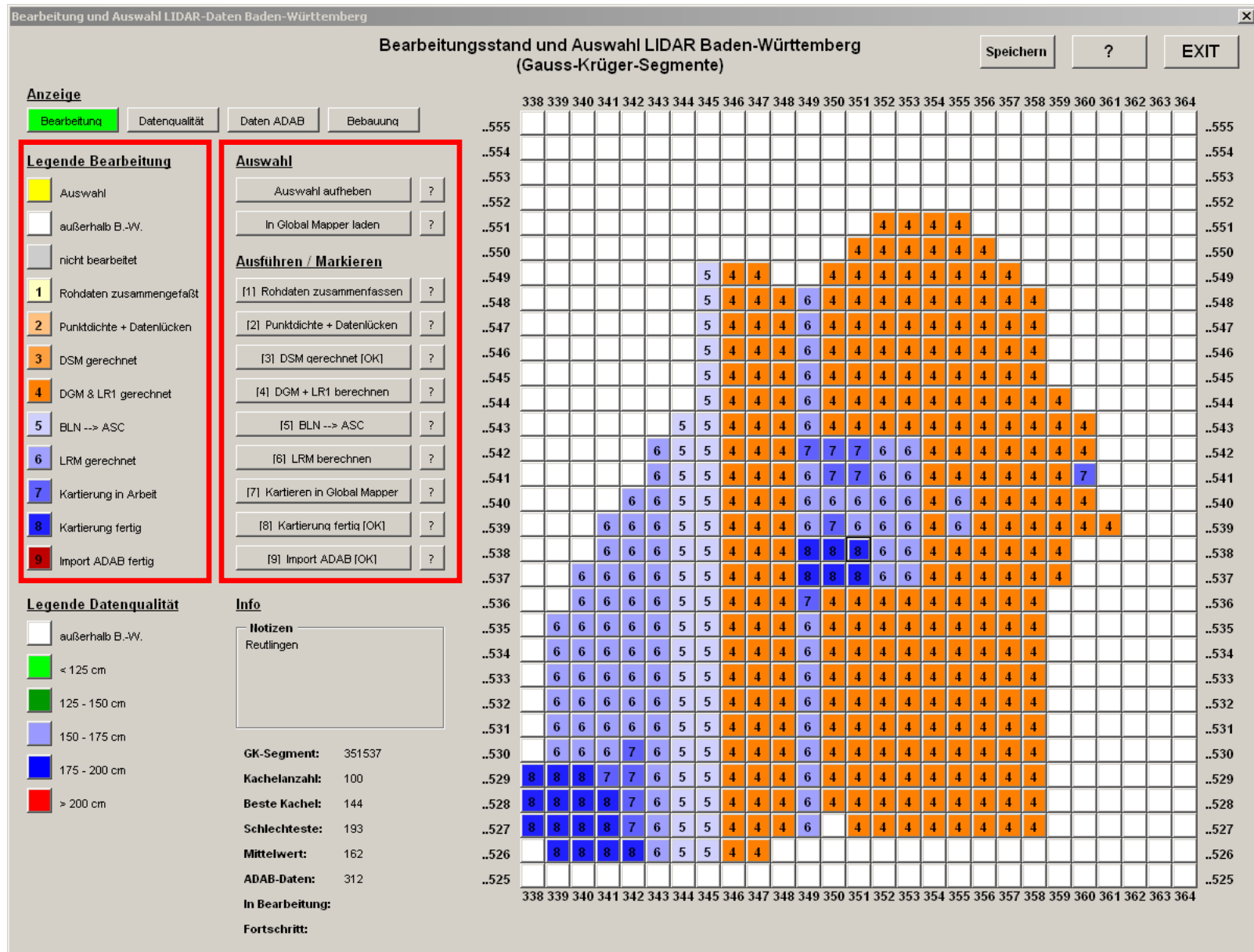


35035377.gde - Editor

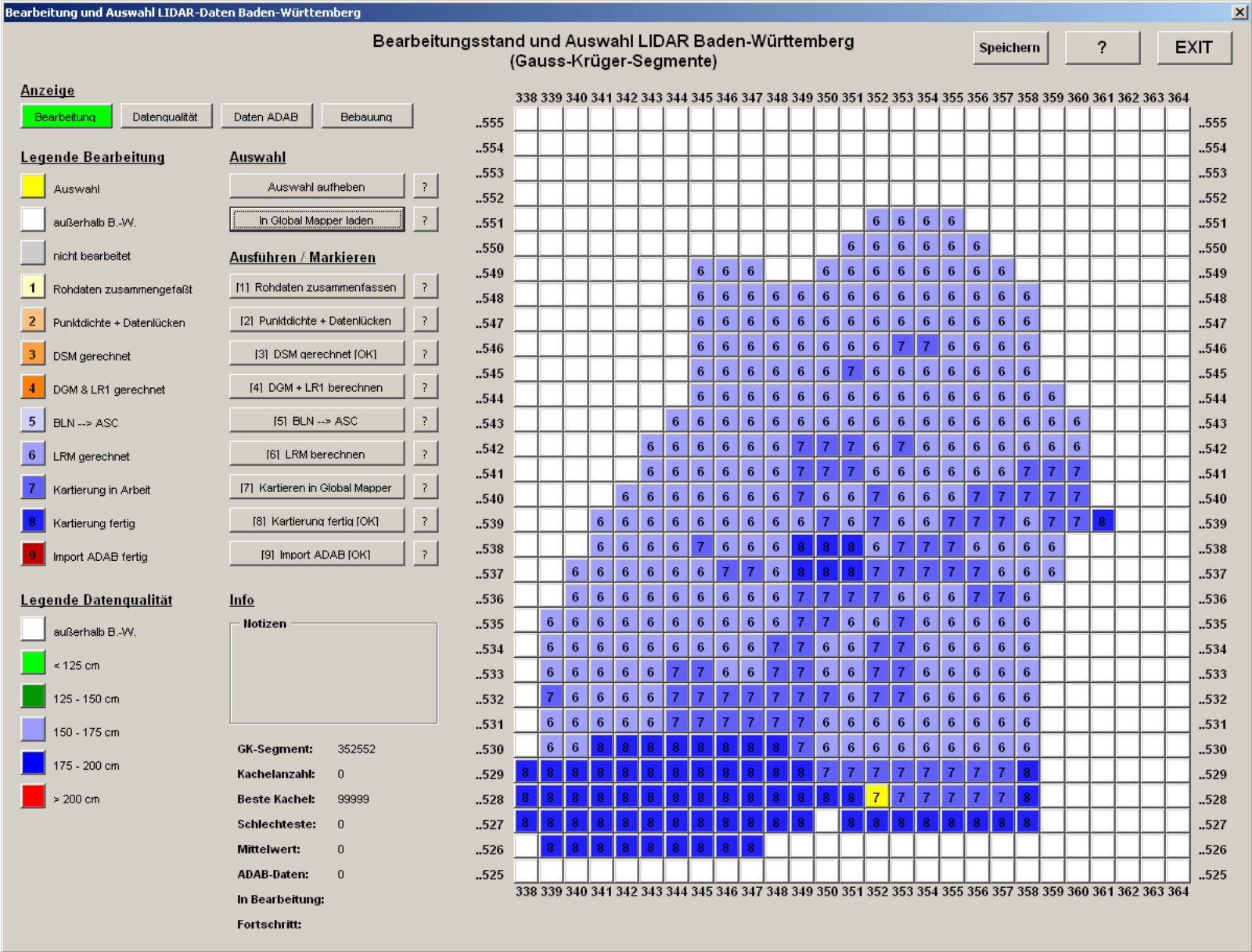
Datei	Bearbeiten	Format	Ansicht	?
3503002.760	5377000.100	435.850		
3503009.060	5377000.300	435.140		
3503010.240	5377000.100	435.300		
3503015.060	5377000.290	435.300		
3503020.950	5377000.130	435.020		
3503063.800	5377000.010	431.230		
3503069.860	5377000.100	431.750		
3503000.790	5377000.550	436.160		
3503006.260	5377001.040	435.360		
3503008.240	5377000.580	435.360		
3503009.040	5377000.840	435.200		
3503011.060	5377000.800	435.140		
3503013.060	5377000.750	435.170		
3503018.270	5377001.300	435.240		
3503019.910	5377000.350	435.080		
3503022.110	5377000.890	435.080		
3503023.000	5377000.640	434.890		
3503024.860	5377001.090	434.770		
3503065.870	5377001.040	431.680		
3503067.860	5377000.580	431.490		
3503071.750	5377001.310	431.680		
3503073.730	5377000.840	431.620		



## ***Data management***

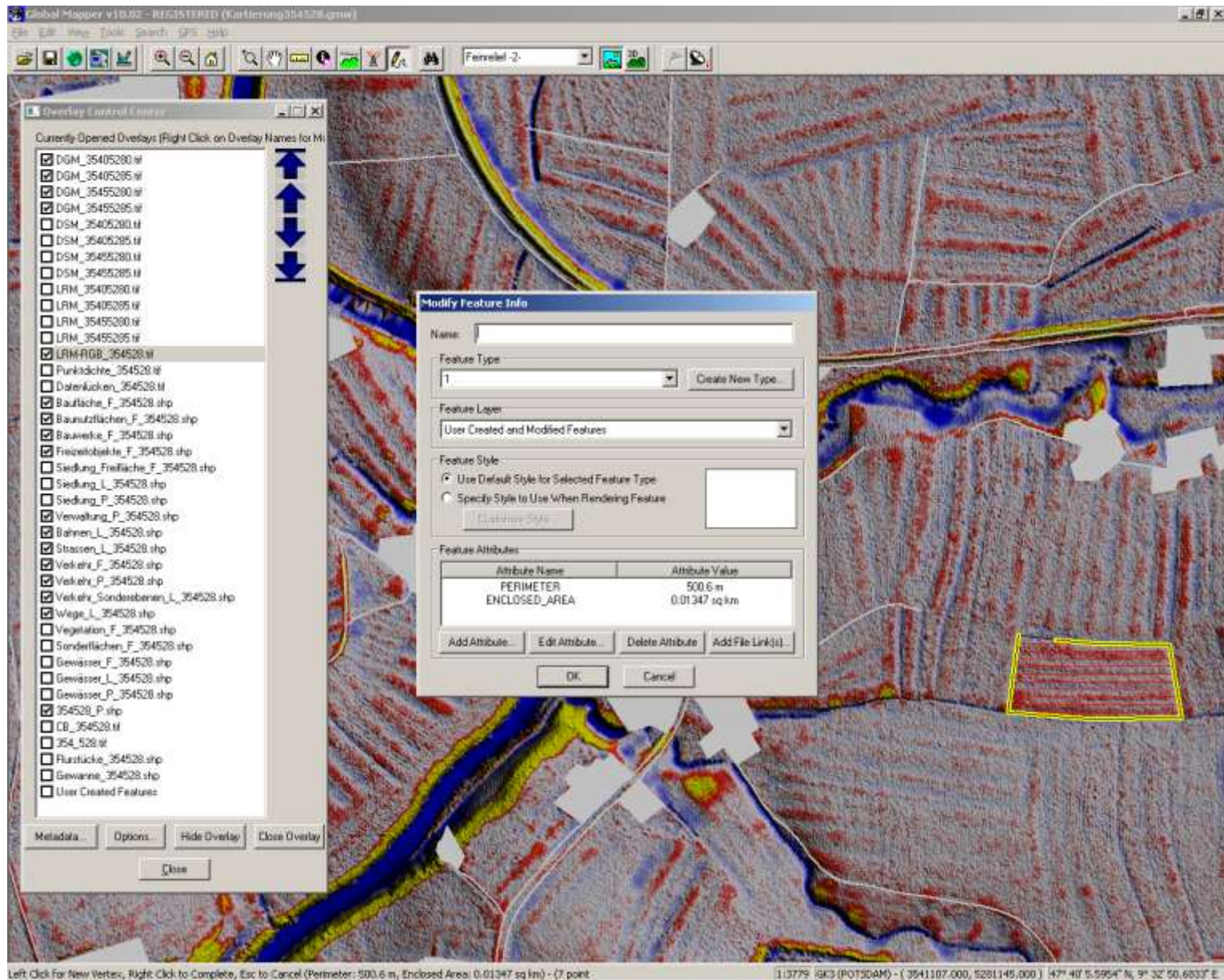


# Data management





# Data management





# Data management

Steuerung für Global Mapper

Beleuchtung Kartierung Speichern

Standard vertikal

Höhe: 58 Richtung: 315 OK

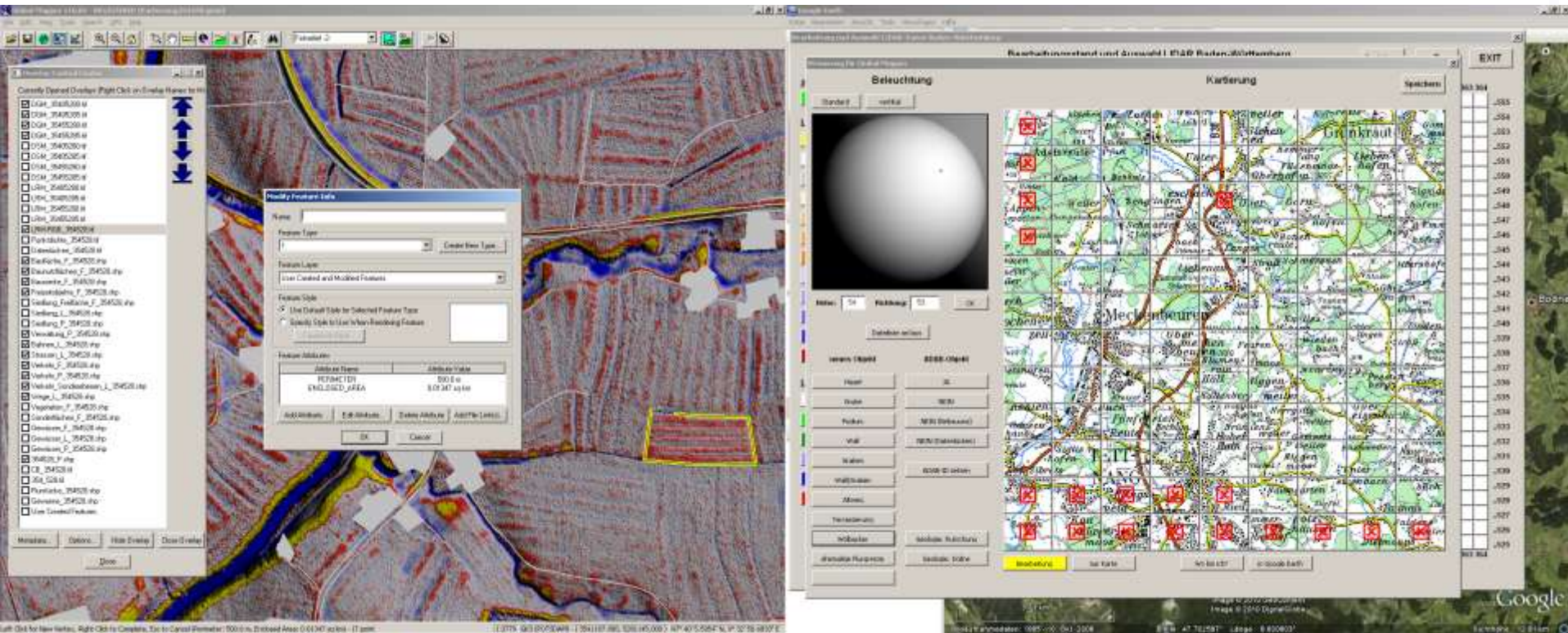
Dateiliste an/aus

neues Objekt	ADAB-Objekt
Hügel	JA
Grube	NEIN
Podium	NEIN (Bebauung)
Wall	NEIN (Datenlücken)
Graben	
Wall/Graben	ADAB-ID setzen
Altweg	
Terrassierung	
Wölbacker	Geologie: Rutschung
ehemalige Flurgrenze	Geologie: Doline

Bearbeitung nur Karte Wo bin ich? in Google Earth

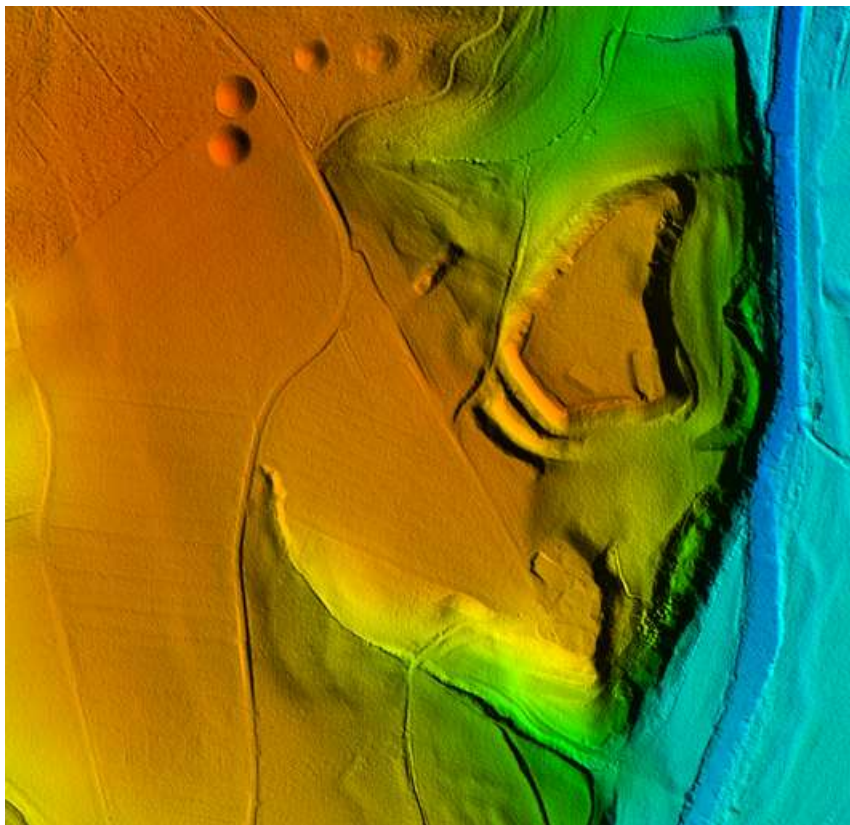


## ***Data management***



## ***Challenge 2: finding hills in the mountains***

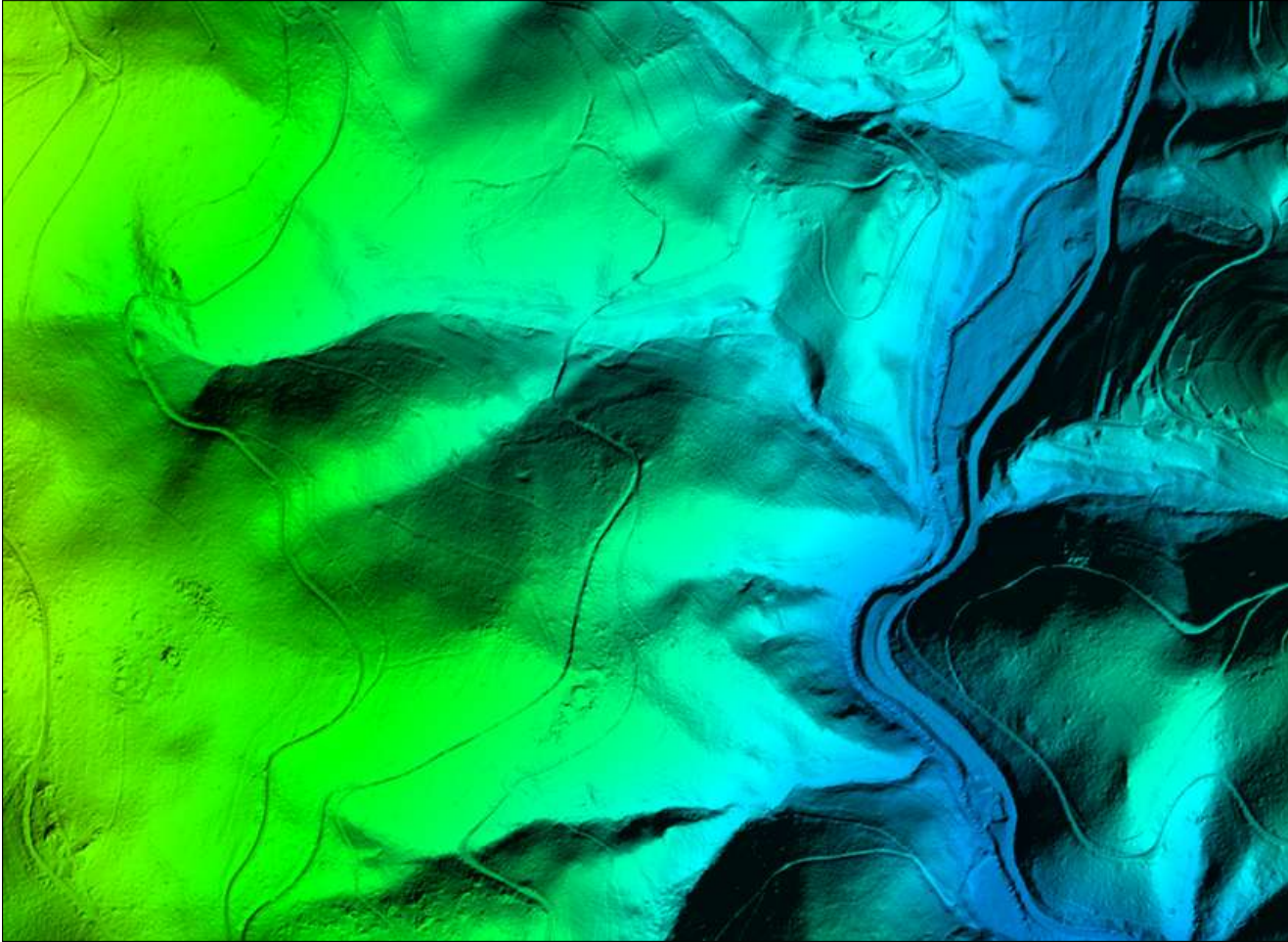
- conventional hill shading
- visibility depends on illumination





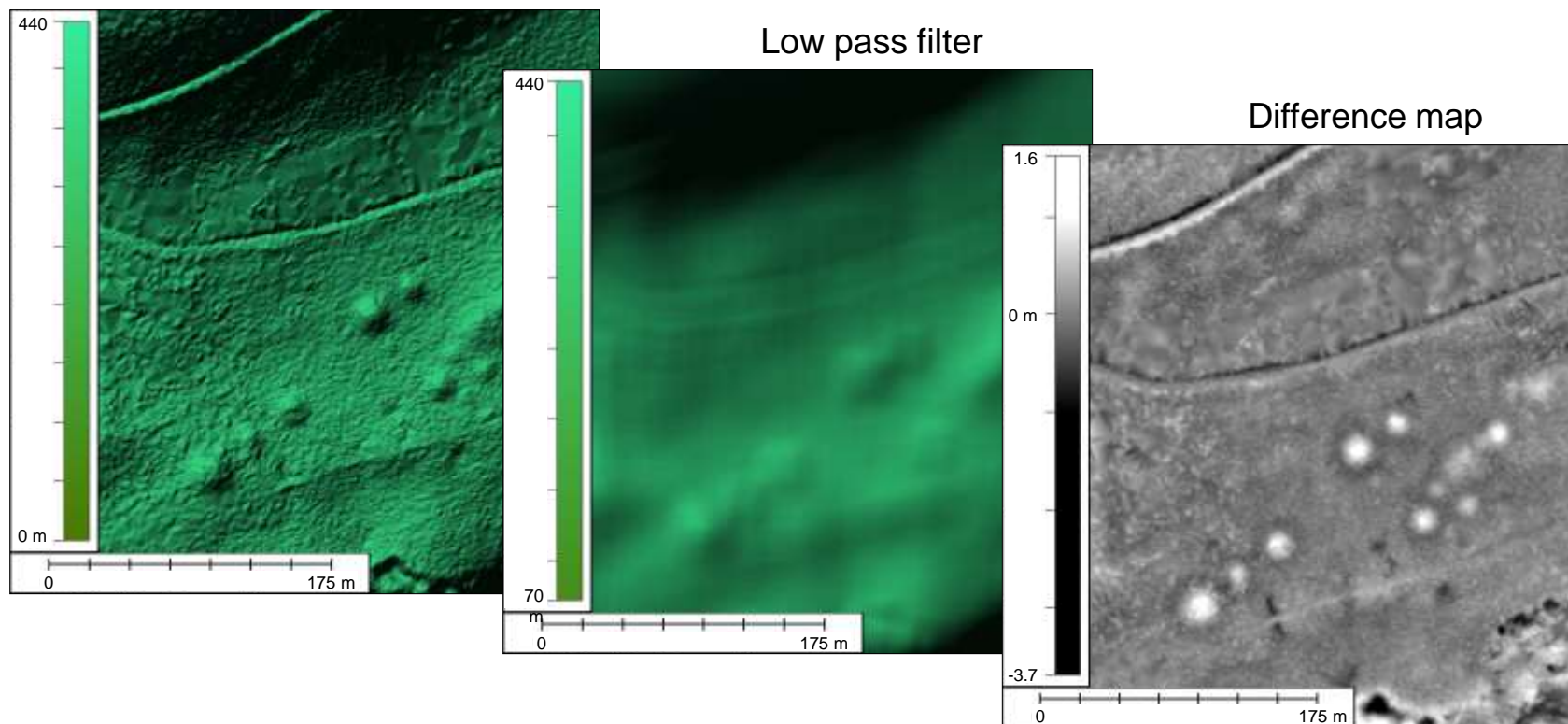
## ***Finding hills in the mountains***

- optical illusion: relief inversion



# ***Finding hills in the mountains***

- What is interesting, what isn't?
  - + small-scale surface structures
  - + small elevation differences (mostly  $\sim 0.1$  to  $1.0$  m)
  - large-scale landscape forms

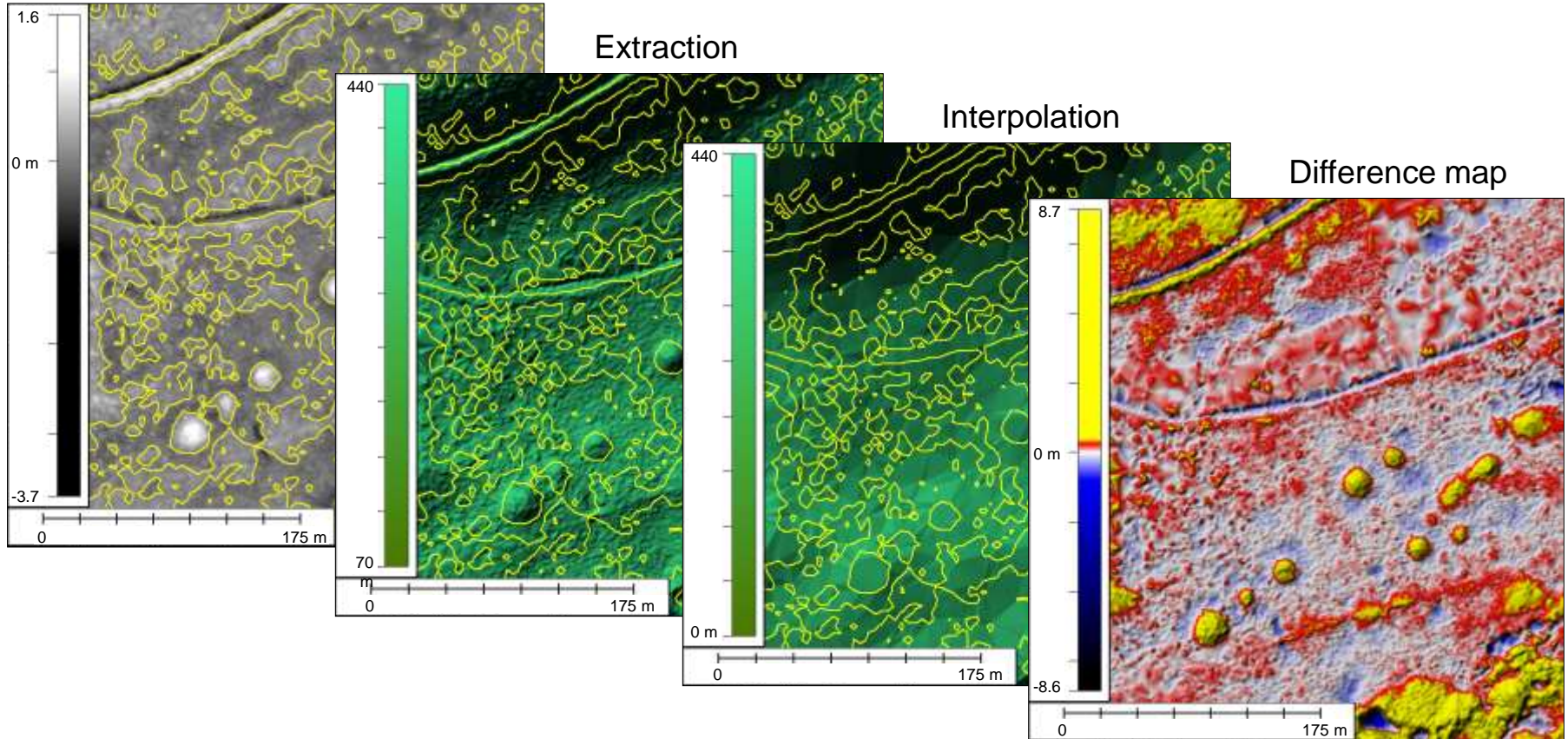




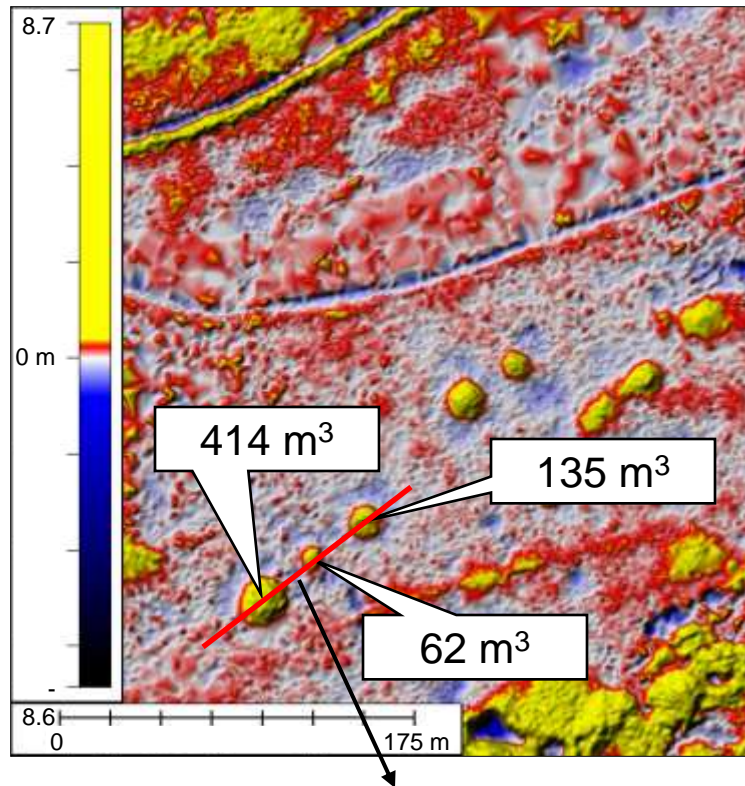
# ***Finding hills in the mountains***

## Difference map

- advantages/disadvantages
- improvement



# Finding hills in the mountains



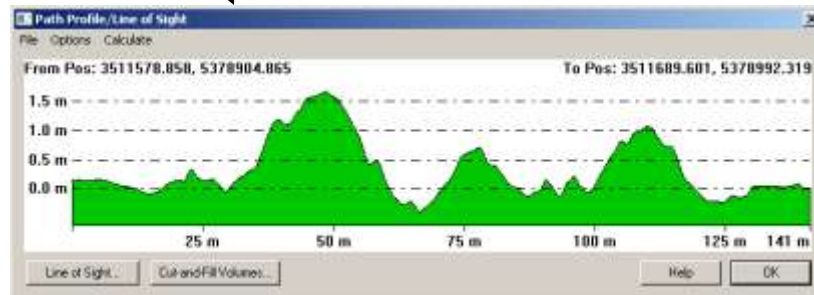
## Local Relief Model

### Advantages:

- local topographic anomalies
- independent of illumination
- morphometry applications

### Disadvantage:

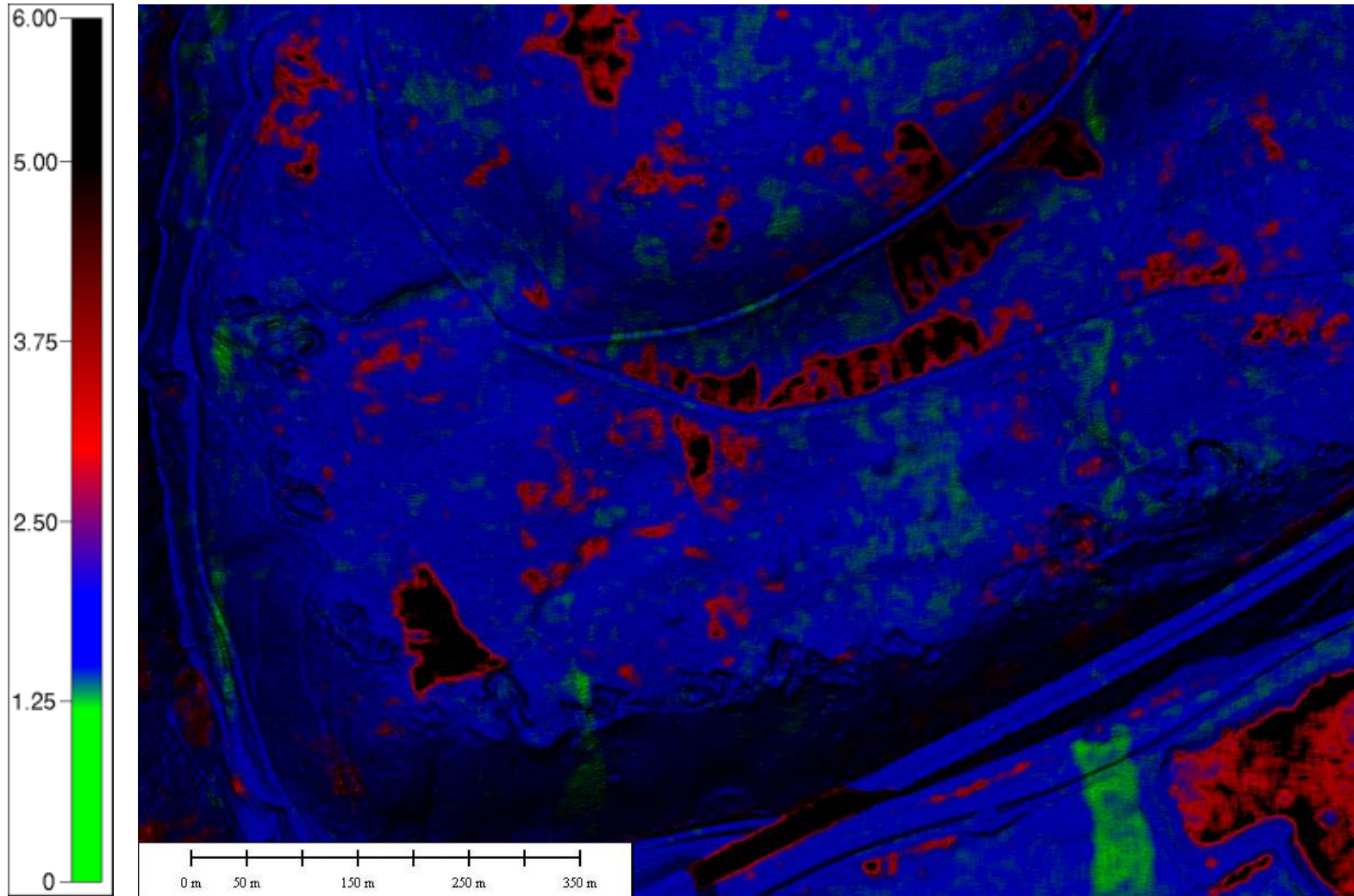
- computation



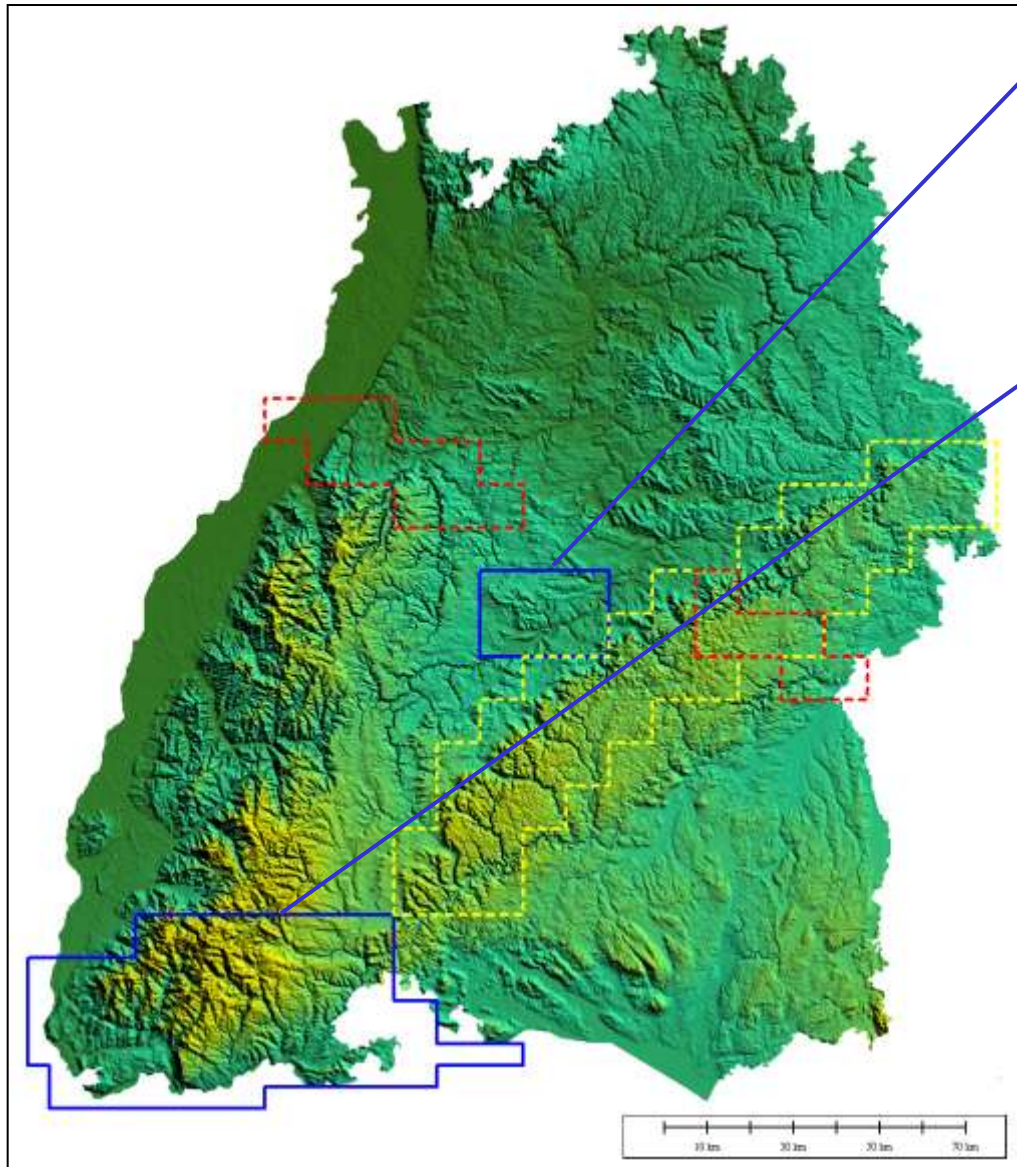


## ***Supplementary data***

- data gaps and point density



# First results



## Schönbuch

- 600 km<sup>2</sup>
- 1966 known sites
- 2513 LIDAR results

## Southern Black Forest

- 2750 km<sup>2</sup>
- 3760 known sites
- 59337 LIDAR results

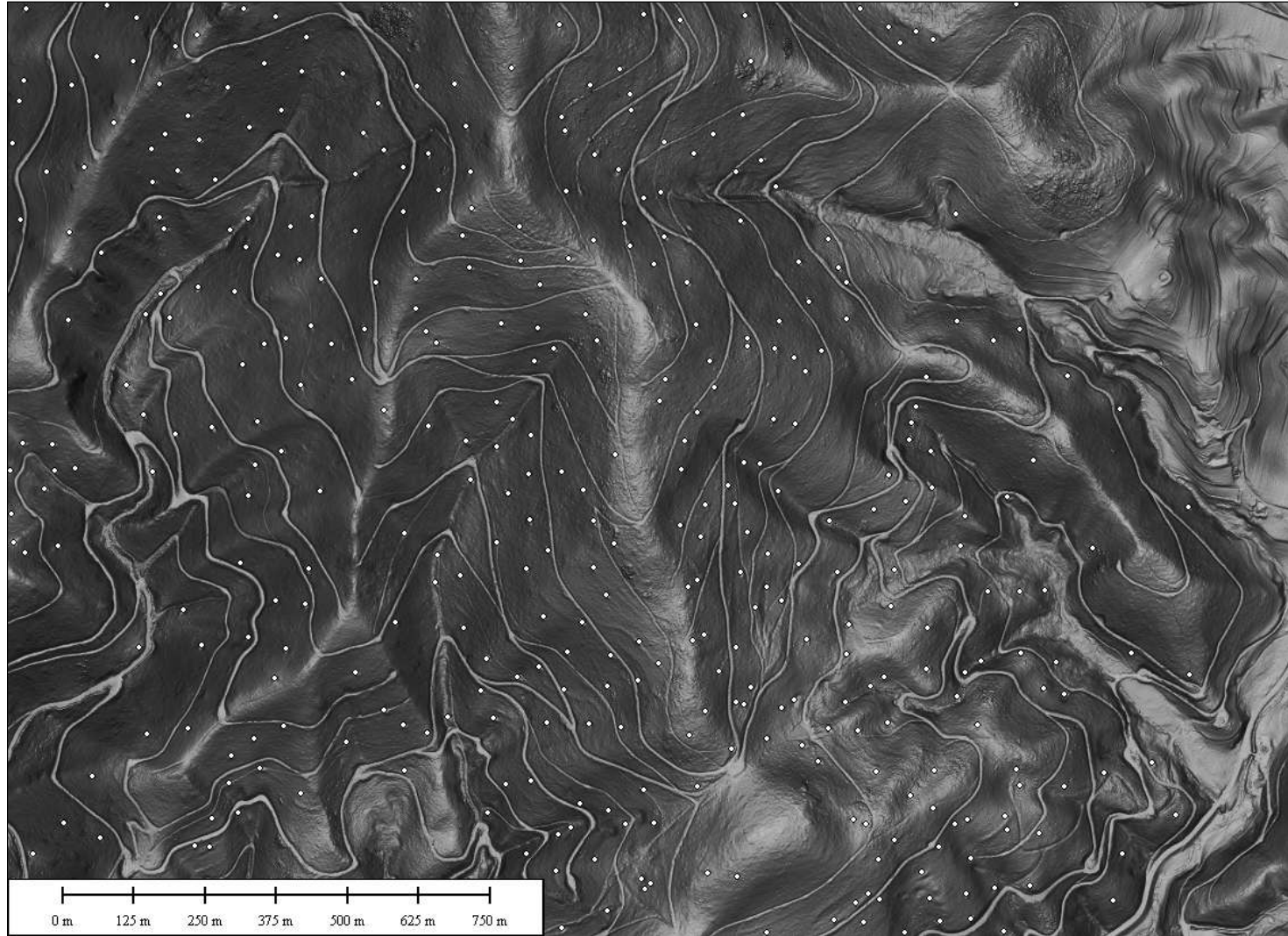
## Results

- charcoal kiln sites
- terraces, ridge and furrow
- mining traces
- sunken roads
- (burial) mounds
- earthworks



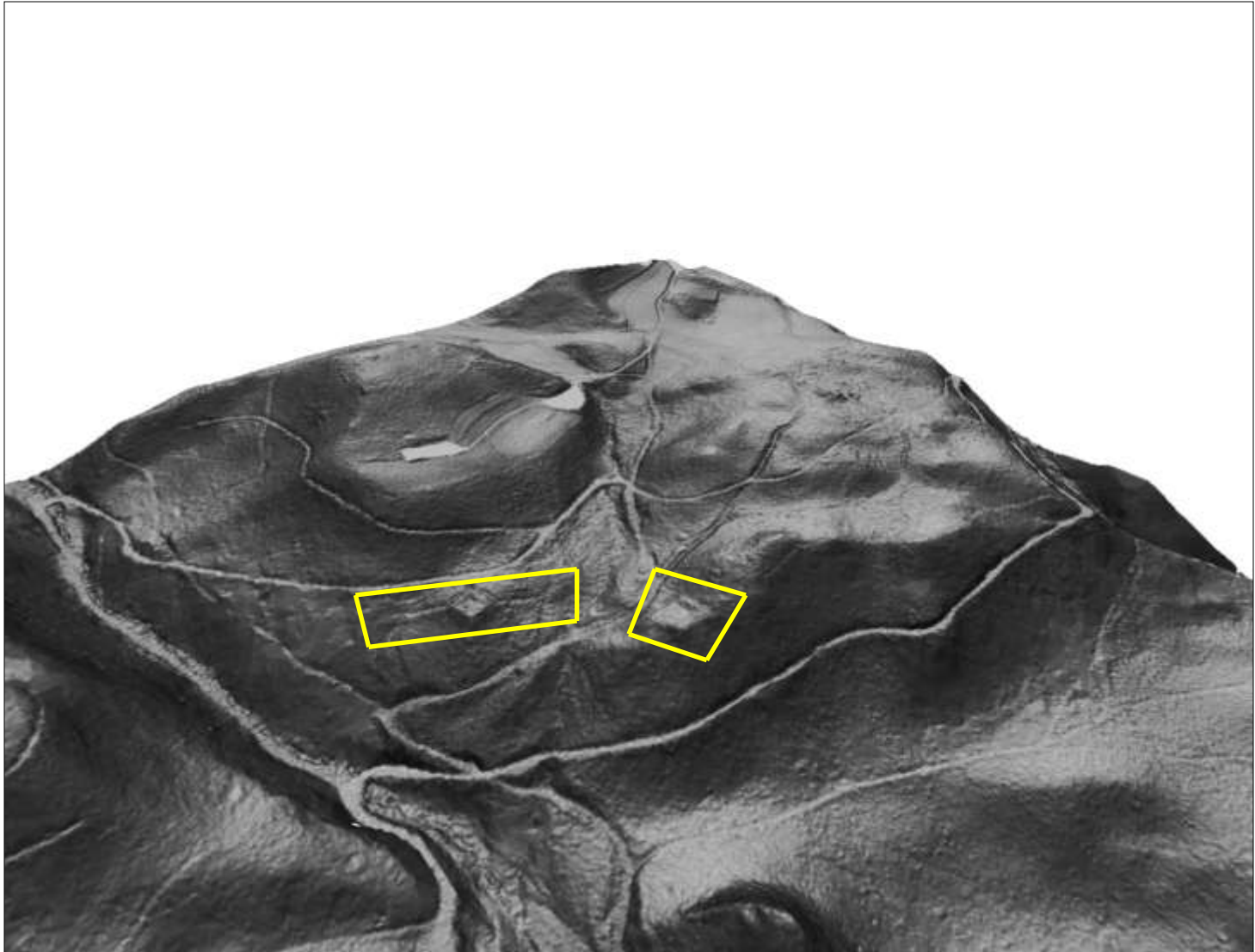
## ***First results***

### Southern Black Forest: charcoal production



## ***First results***

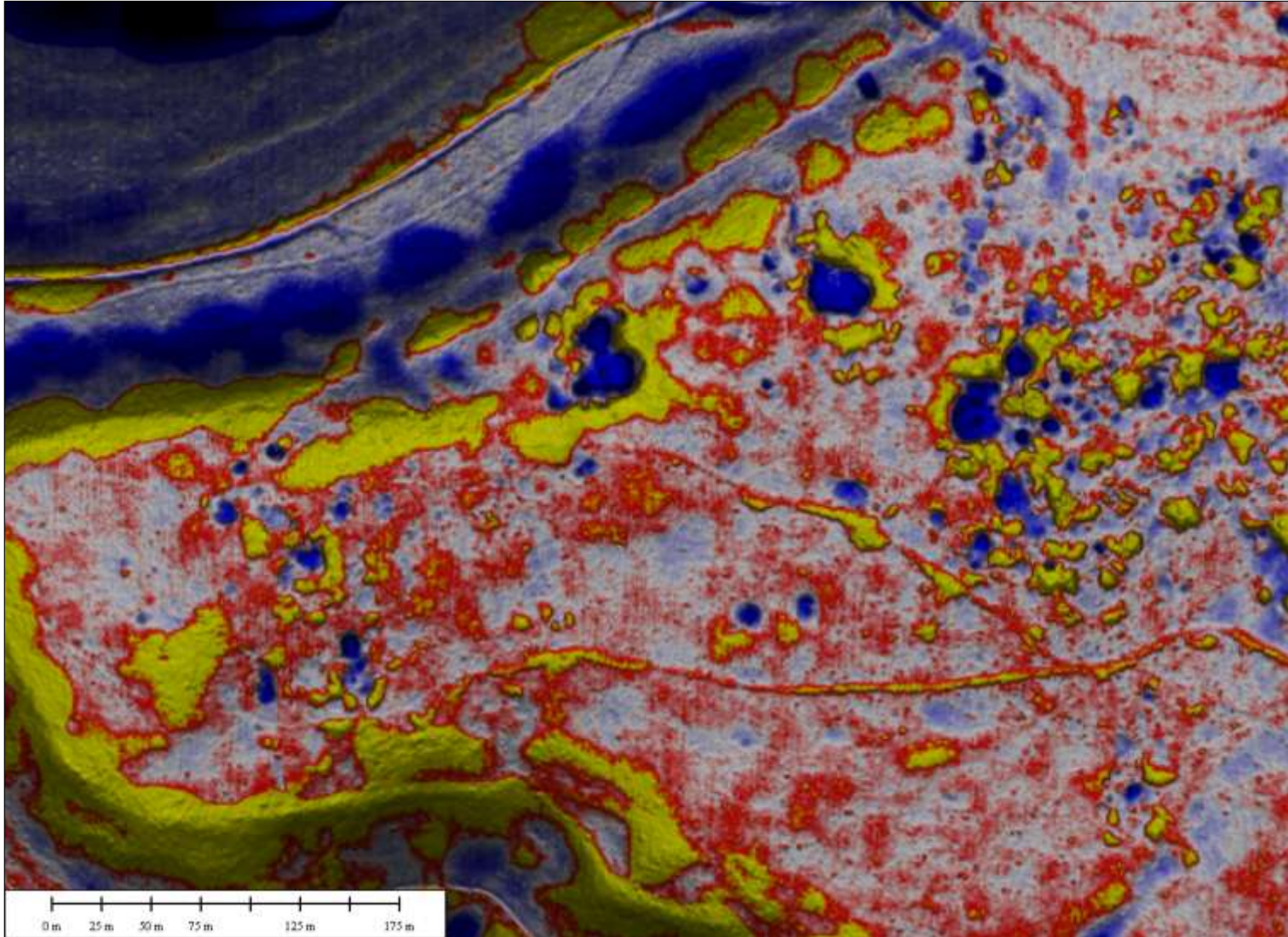
Upper Rhine area: fortifications





## ***First results***

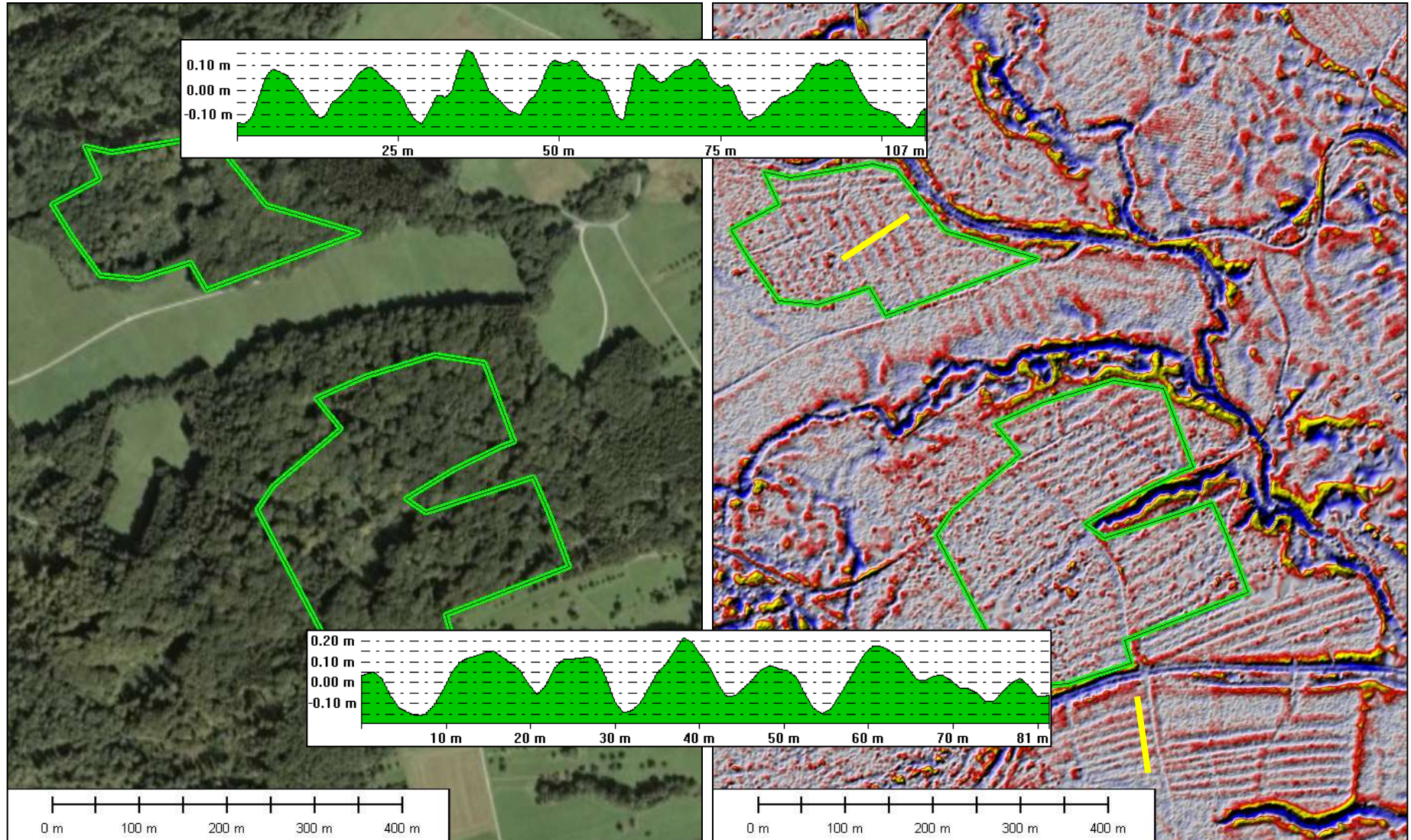
Upper Rhine area: mining traces





# First results

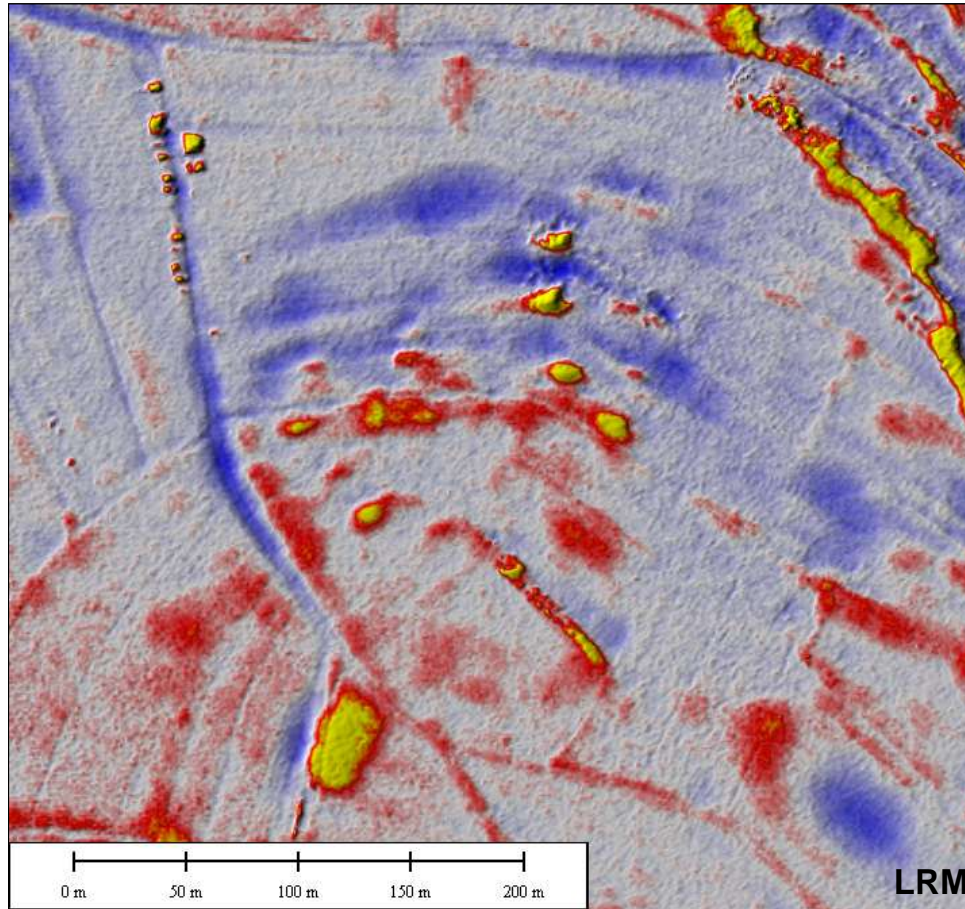
## Schönbuch: ridge and furrow





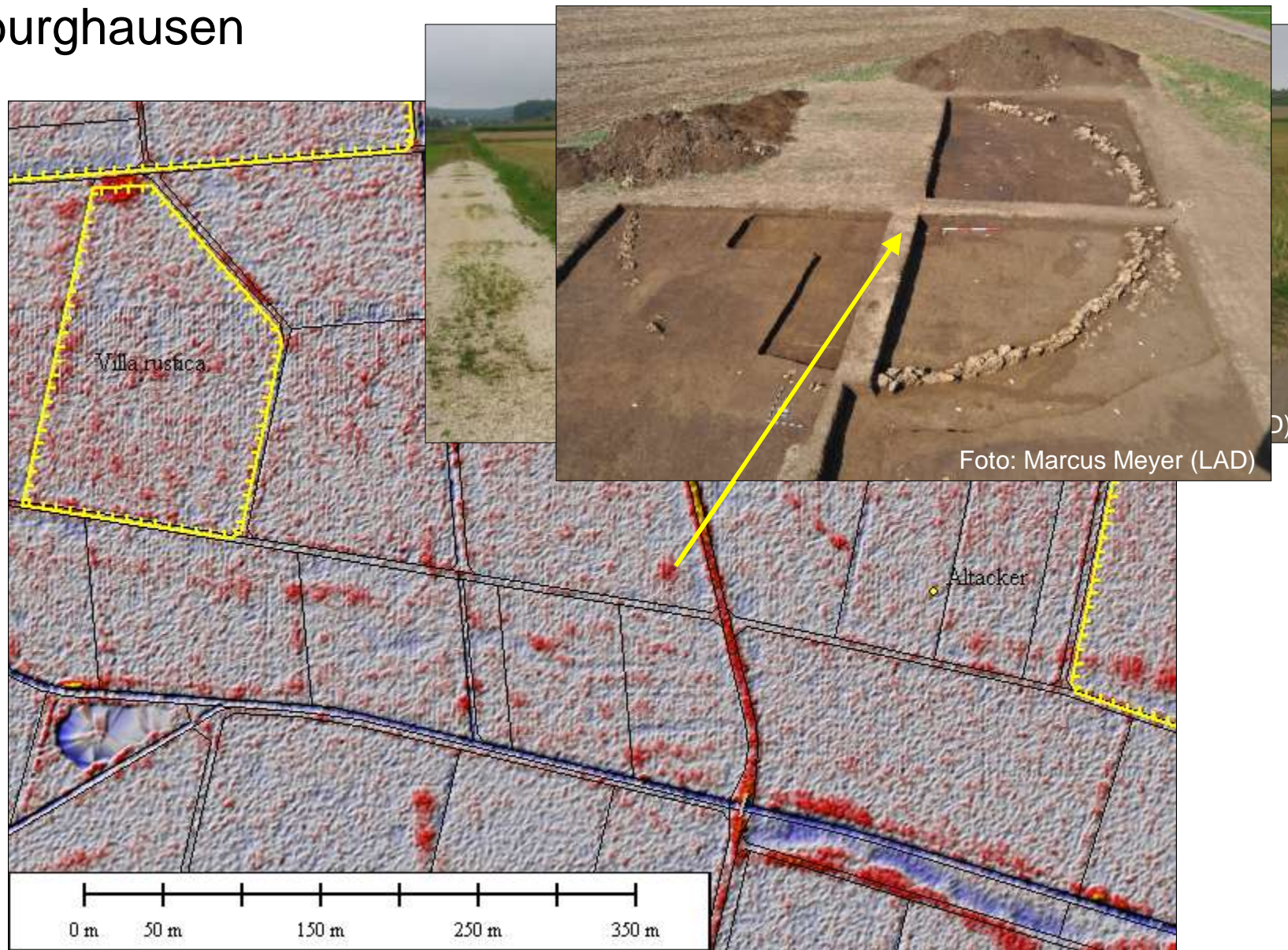
## ***First results***

### Southern Black Forest: burial mounds



# ***First results***

## Goldburghausen





# ***First results***

## Upper Rhine area: neolithic ring fort



## ***Potential for future work***

- spatial / topographic analyses
- application for predictive modelling

