

LIDAR

LANDSCAPES IN A DIFFERENT LIGHT

Aim

The main aim of today is to ensure that you know a bit more about lidar when you leave than you knew when you arrived.

It is as simple as that.

Part 1

- What is lidar?
- How does it work?

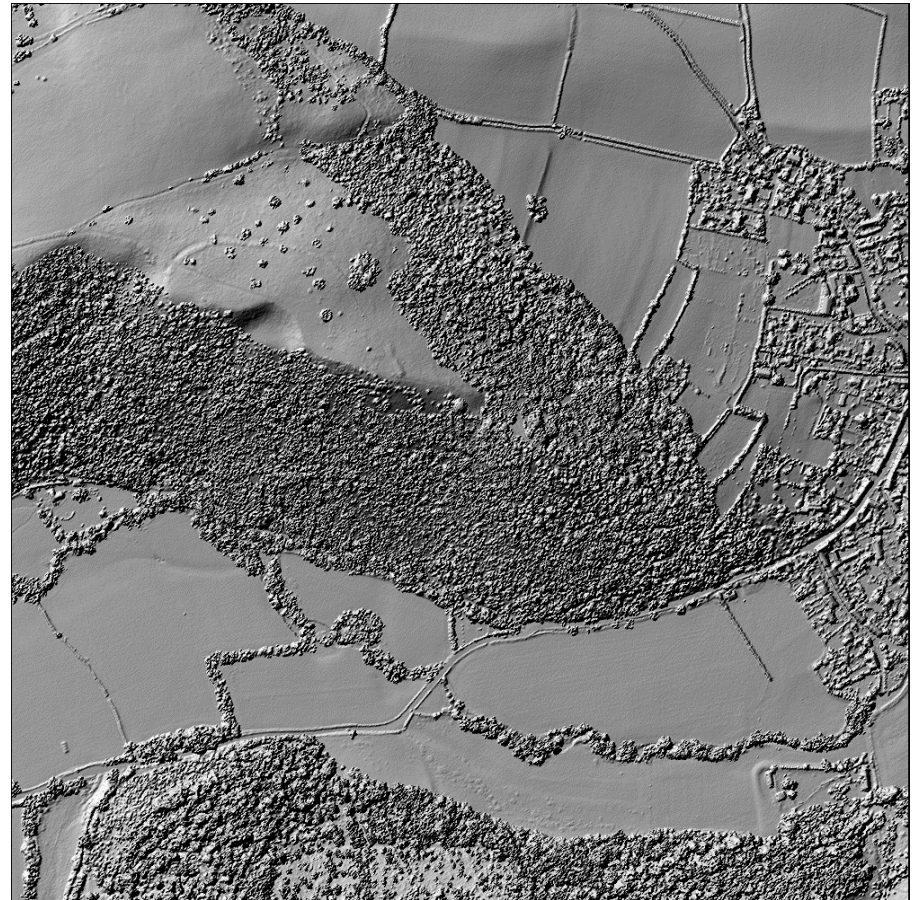
Break

Part 2

- Where can we get lidar?

The beginners guide to the language of lidar

1. RESOLUTION
2. POINT CLOUD
3. GEOREFERENCING
4. ASCII
5. GEOTIFF
6. MODELS
7. HILLSHADING



How is lidar data collected

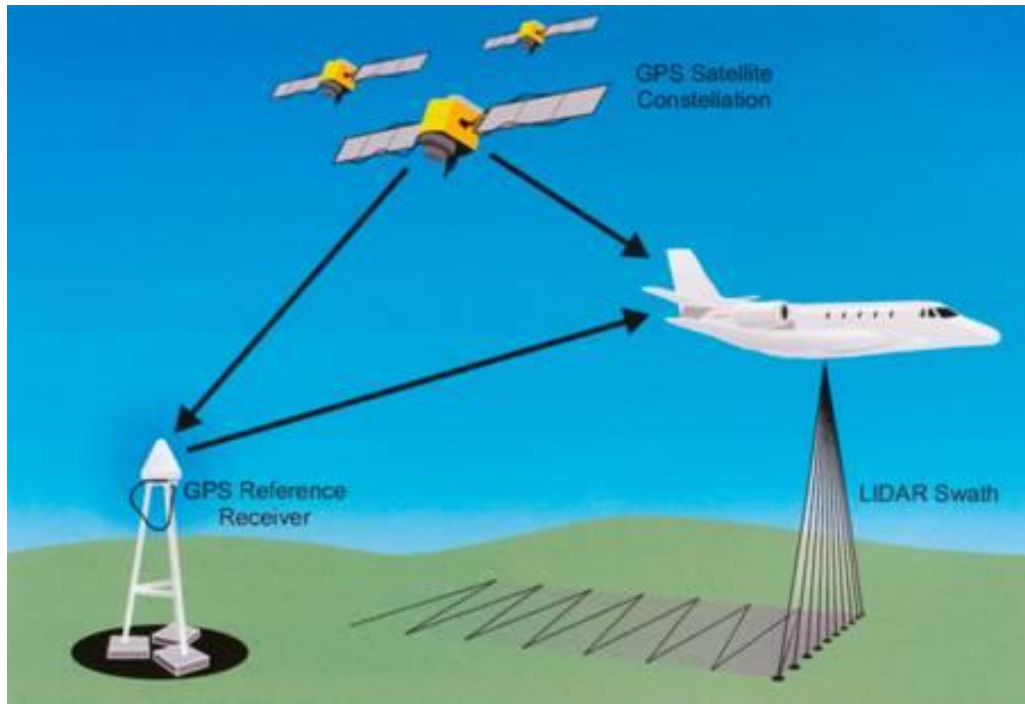
Solid state pumped lasers

Most airborne lidar systems work at wavelengths around 1.064nm in the NIR range

100,000 to 150,000 pulses per second

Oscillating mirrors, rotating mirrors, rotating prisms produce distinct pattern of returns known as the 'scan pattern'

Pulse footprint eg 1000m flying height = 30cm pulse

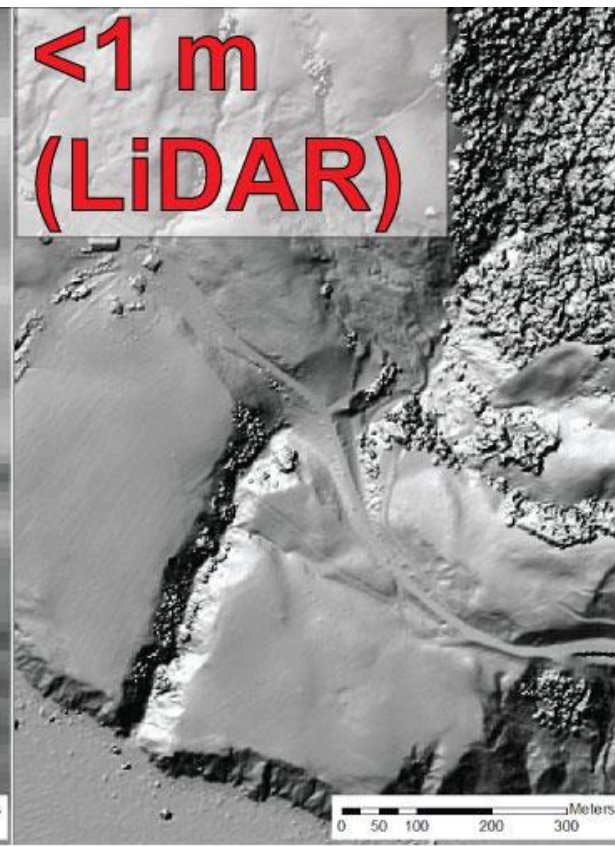


Historic England

1. RESOLUTION

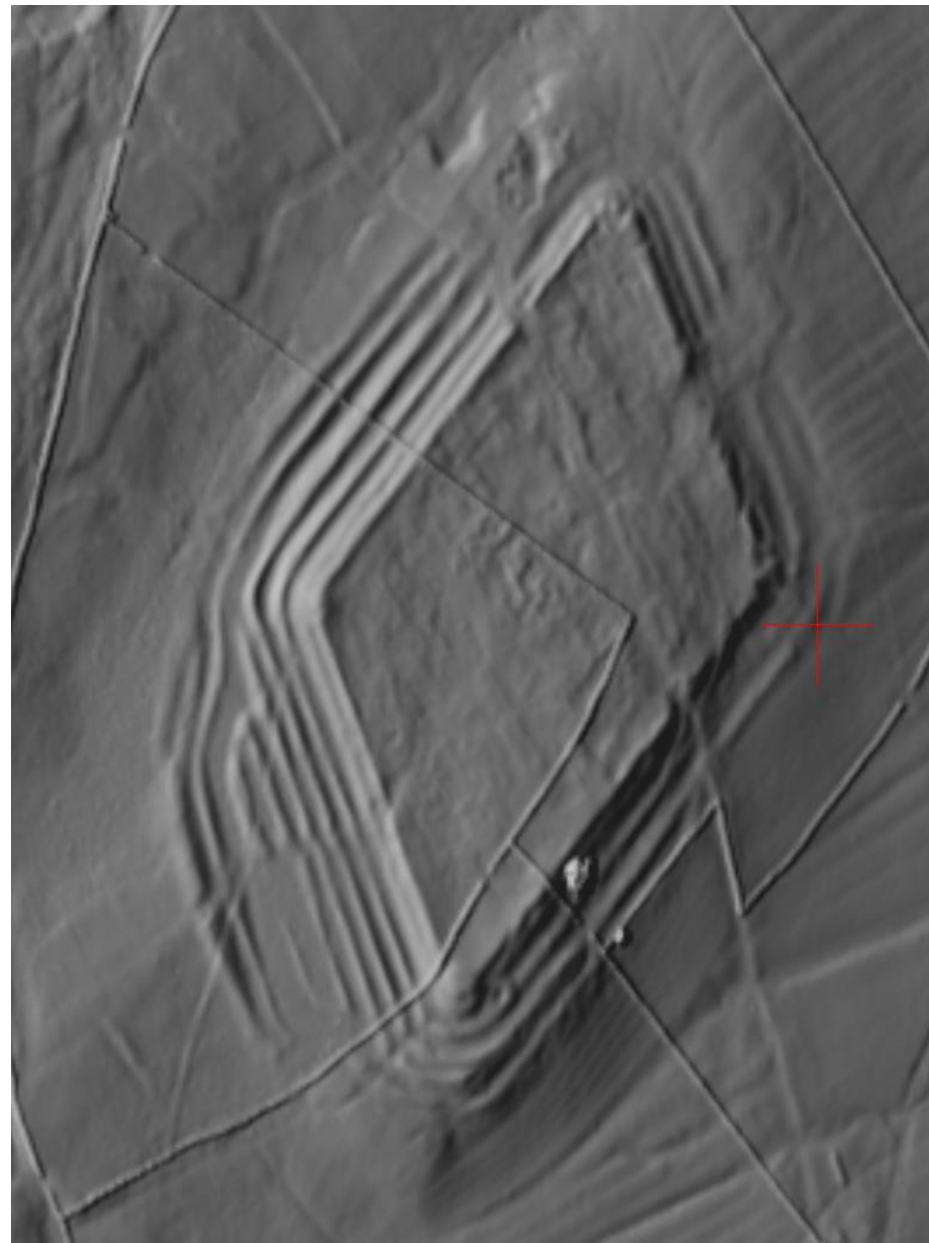
Depends on equipment used; flying height, relative height, slope angle etc

- 2m lidar (av 2 hits per sq m)
- **1m lidar (av 4 hits per sq m) = 5 million points in km**
- 0.5m lidar (av 8 hits per sq m)
- 0.25m lidar (av 16 hits per sq m)

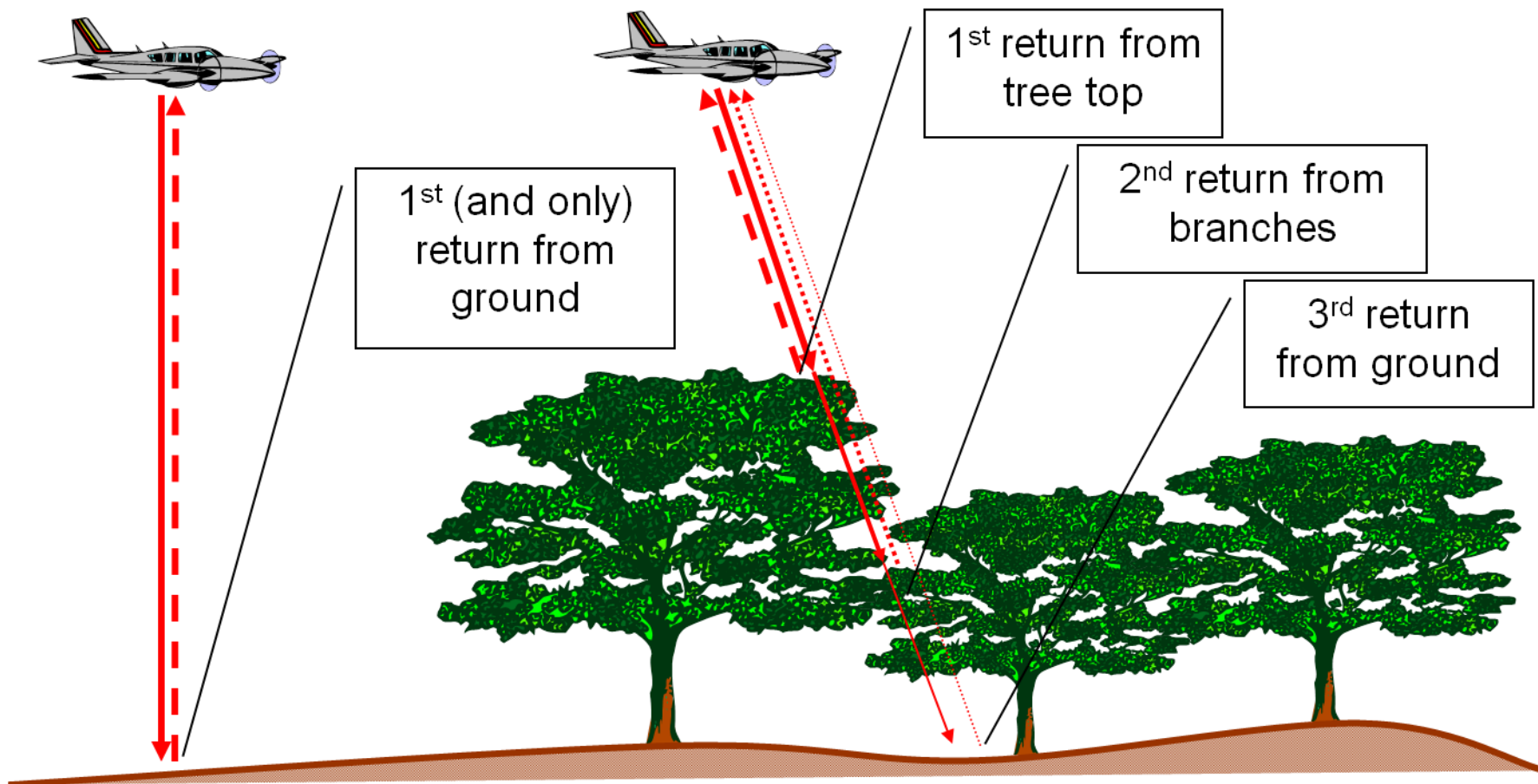




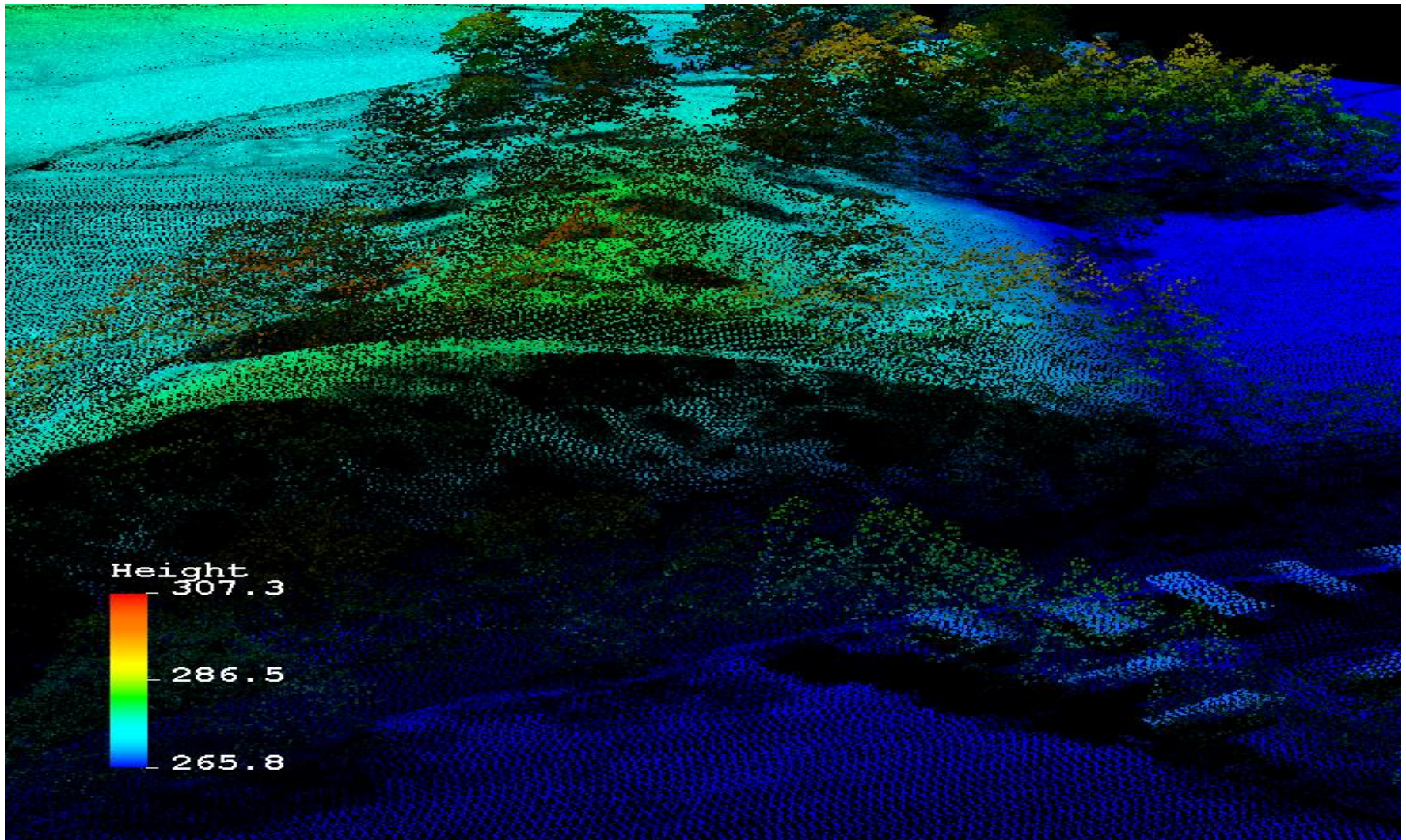
0.5 m resolution



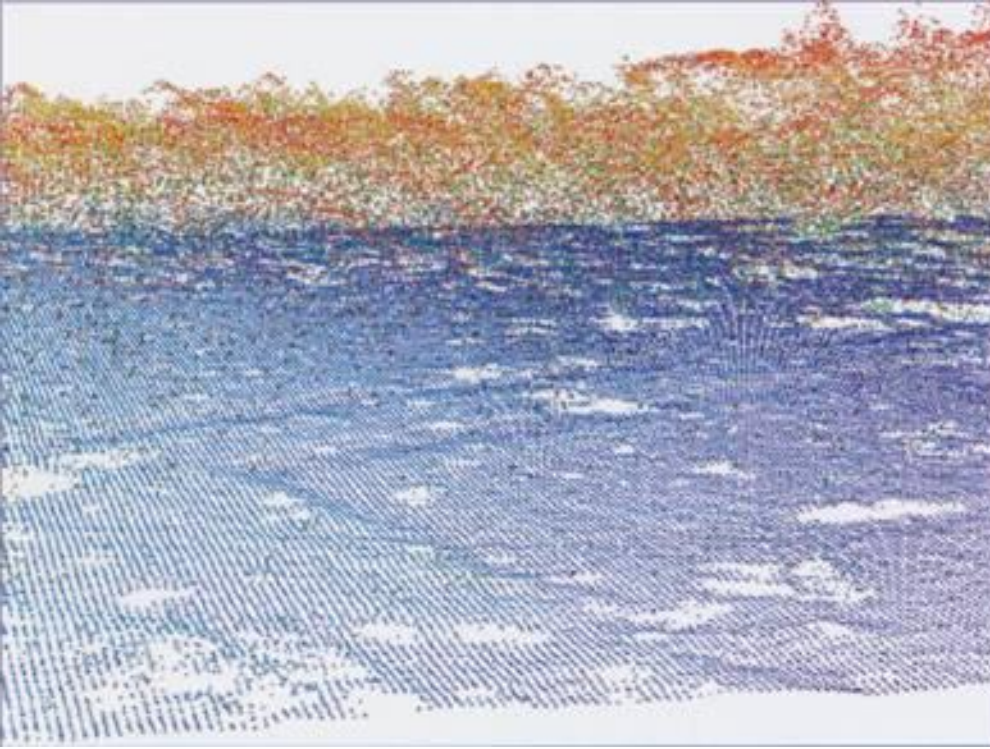
1 m resolution



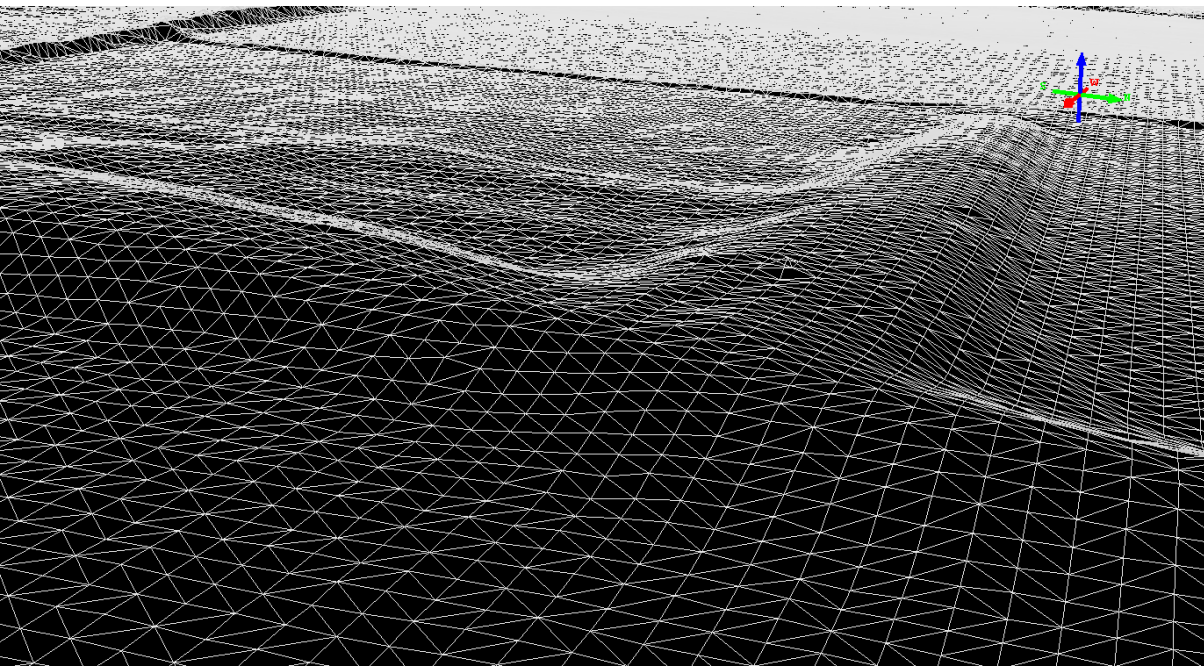
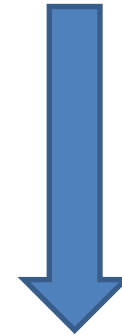
2. POINT CLOUD



Point cloud data is a set of xyz values e.g. eastings, northings and height for each point the laser pulse hit



Point cloud – raw data collected from sensors and converted into x y z coordinate values for each individual point

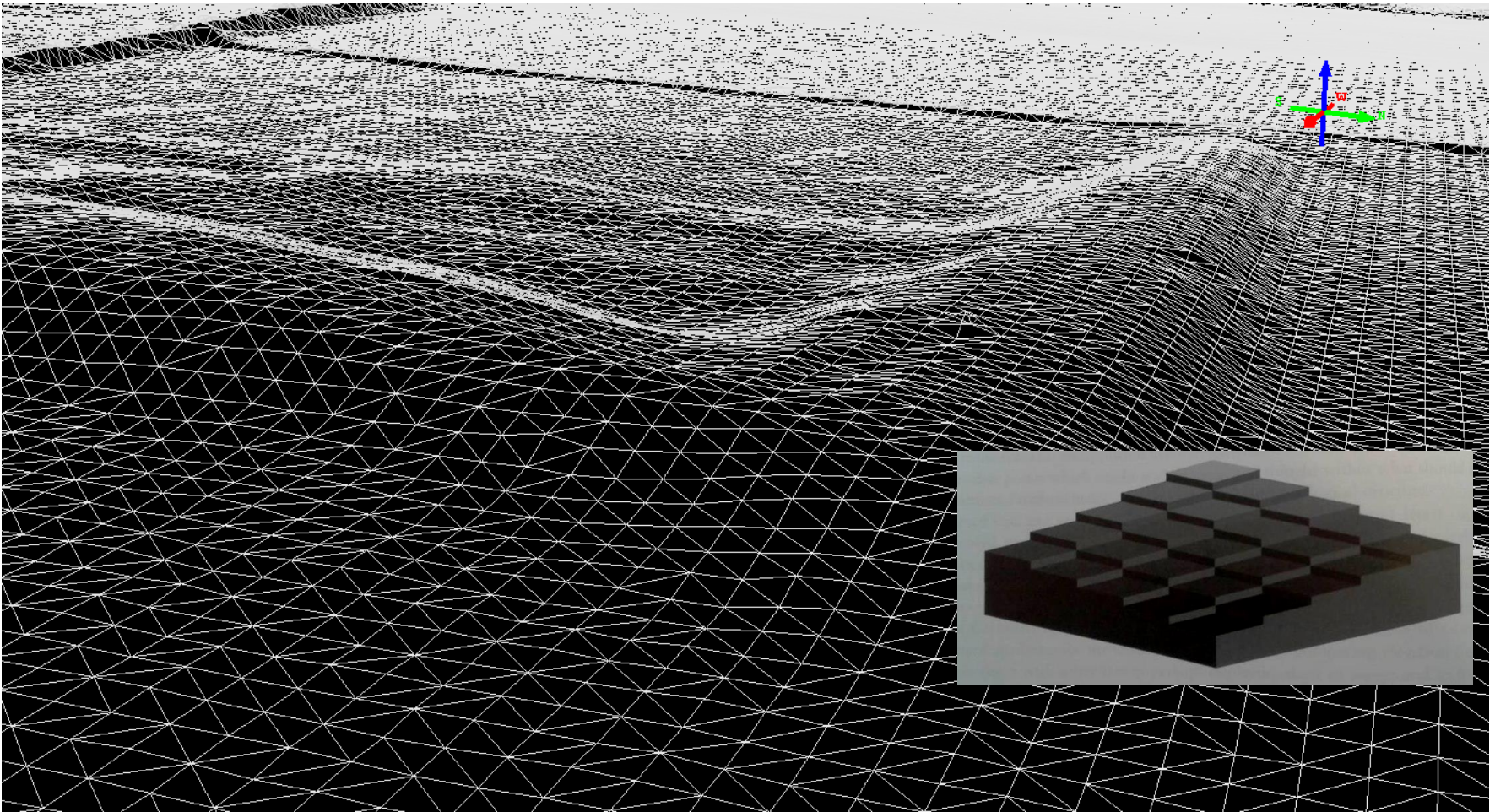


Rectangular mathematical grid (e.g. 1m resolution) can then be constructed from the **point cloud** to create a surface model

In most cases this will be the basis of surfaces you see on Web sites

3. GEOREFERENCING

- Each cell grey-scale shaded according to height
- Imagine wire netting laid over the ground surface
- Each corner has an XYZ coordinate. In UK that is usually EASTINGS; NORTHINGS; HEIGHT (Ordnance Survey)

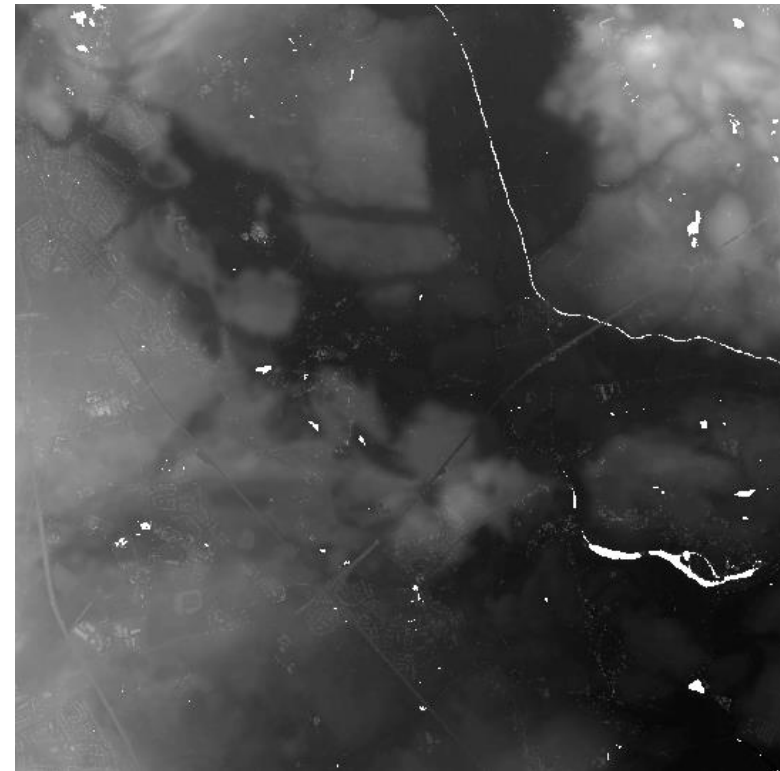


4. ASCII

Coordinates of each cell corner can be made available as **ASCII** grid data.

This type of data is a grey-scale image file needs lidar or GIS **software** to turn it into an image that makes some sense and easier to use

```
PyMolViewer - Notepad
File Edit Format View Help
rects 2000
rows 2000
x1corner 275000
y1corner 145000
cellsize 0.5
ASCII_data -8899
295.13 295.05 295.02 294.95 294.82 294.79 294.95 295.13 294.97 294.53 294.18 294.62 294.45 294.44 294.39 294
284.02 287.95 287.89 287.84 287.83 287.77 287.72 287.68 287.56 287.57 287.51 287.47 287.44 287.41 287.37 287.33 287
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275.17 275.34 275.52 275.52 275.84 275.84 275.64 275.52 275.42 275.12 265.54 265.43 265.43 265.42 265.47 265.44 265
49 262.48 261.46 261.43 261.42 261.36 261.33 261.33 261.4 261.38 261.42 261.43 261.42 261.43 261.44 261.47 261.47
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249.43 300.12 300.6 300.74 301.74 301.74 301.7 301.7 301.74 301.74 301.74 301.74 301.74 301.74 301.74 301.74 301.74
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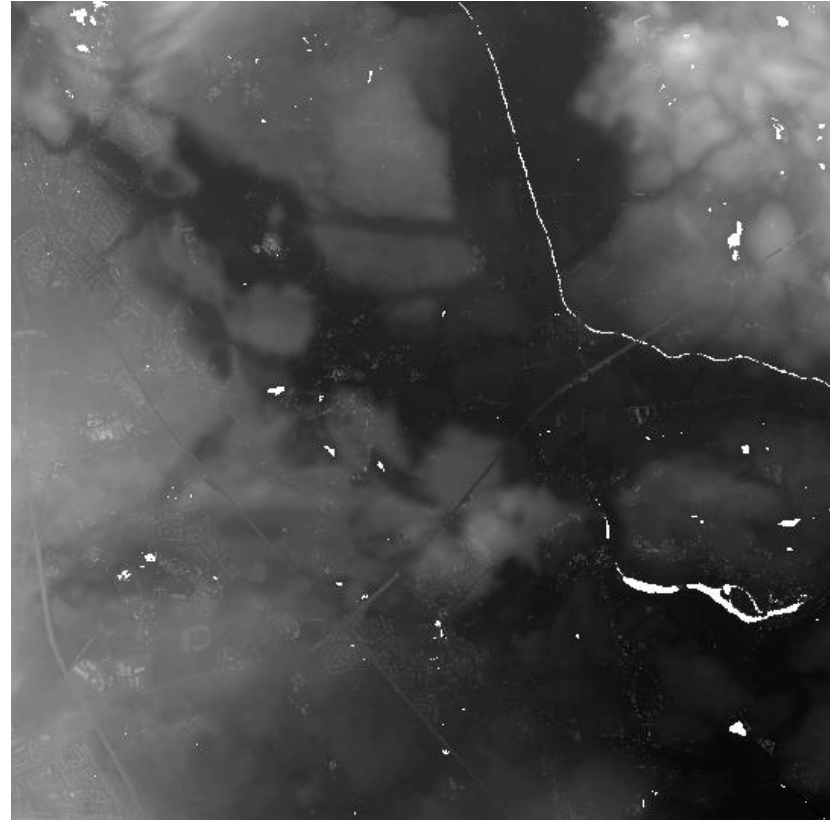


5. GEOTIFF

An alternative to ASCII is GeoTiff

The GeoTIFF format embeds coordinate data into image files such as aerial photography, satellite imagery, and digitized maps so that they can be used in GIS applications.

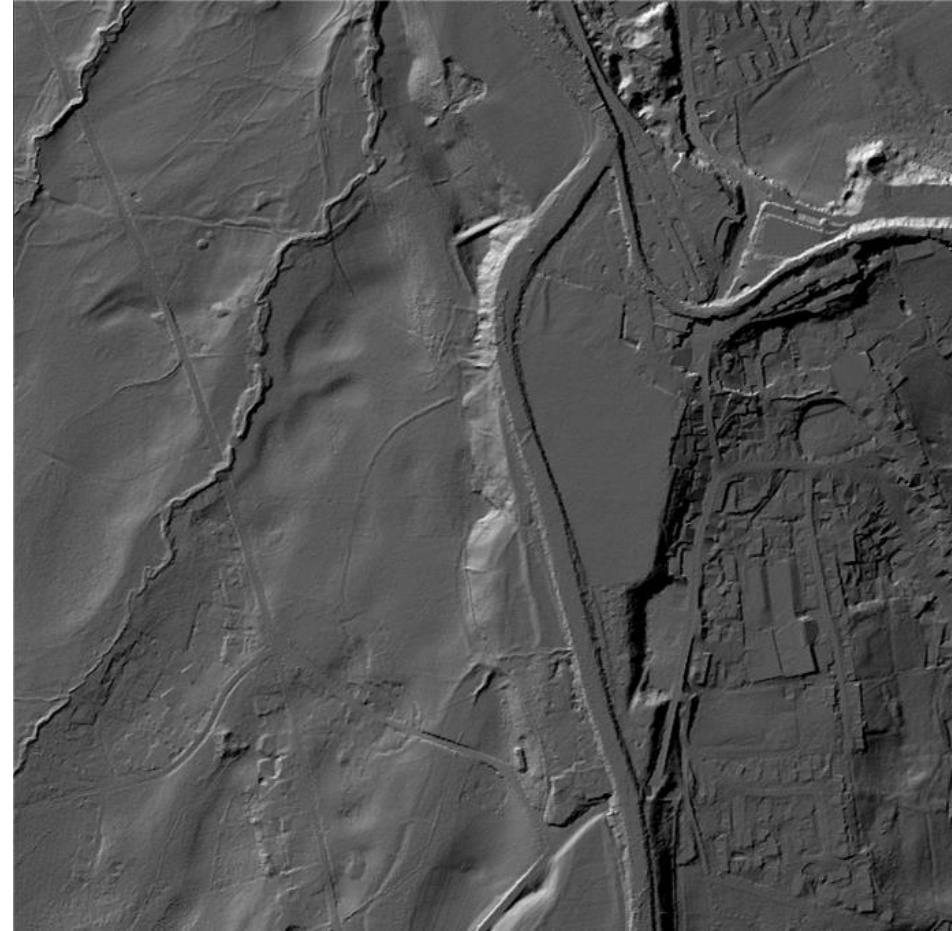
This type of data is a grey-scale image file needs lidar or GIS **software** to turn it into an image that makes some sense and easier to use



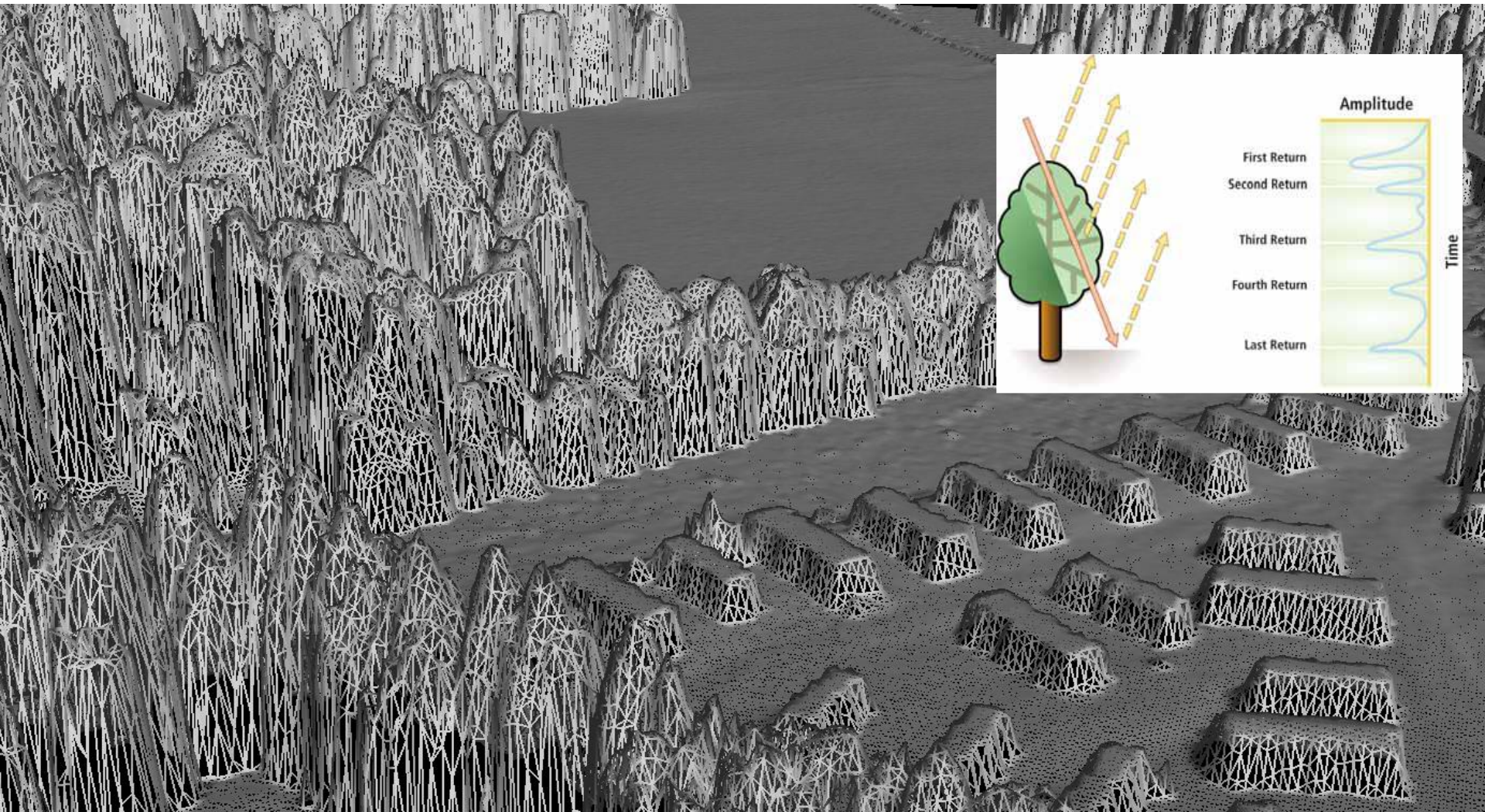
6. MODELS

- **DSM** (Digital Surface Model)
- **DTM** (Digital Terrain Model)

sometimes called 'bare-earth'

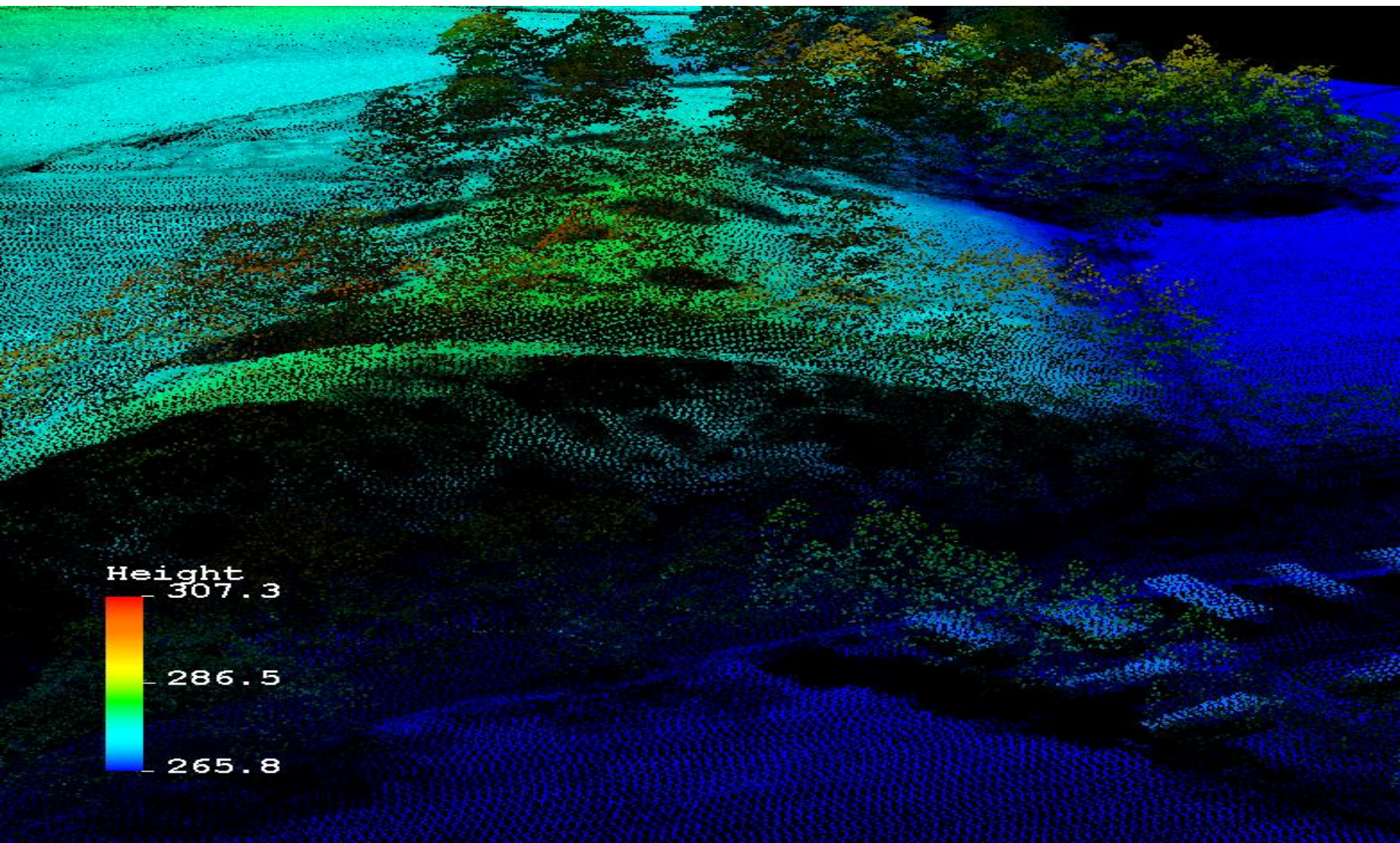


7. Digital Surface Model (DSM)



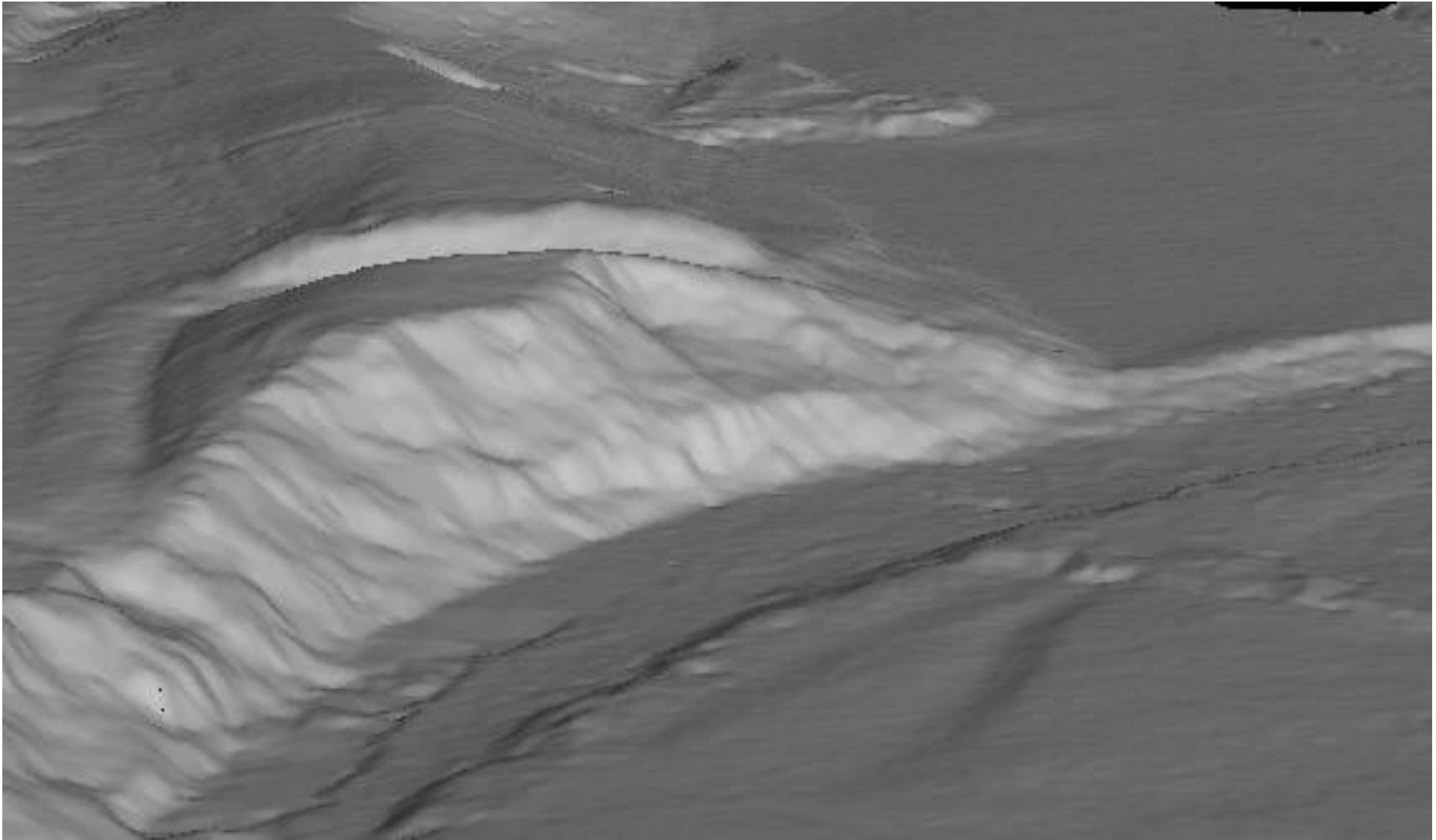
Can lidar can see through trees?





LIDAR LANDSCAPES

Digital Terrain Model (DTM)

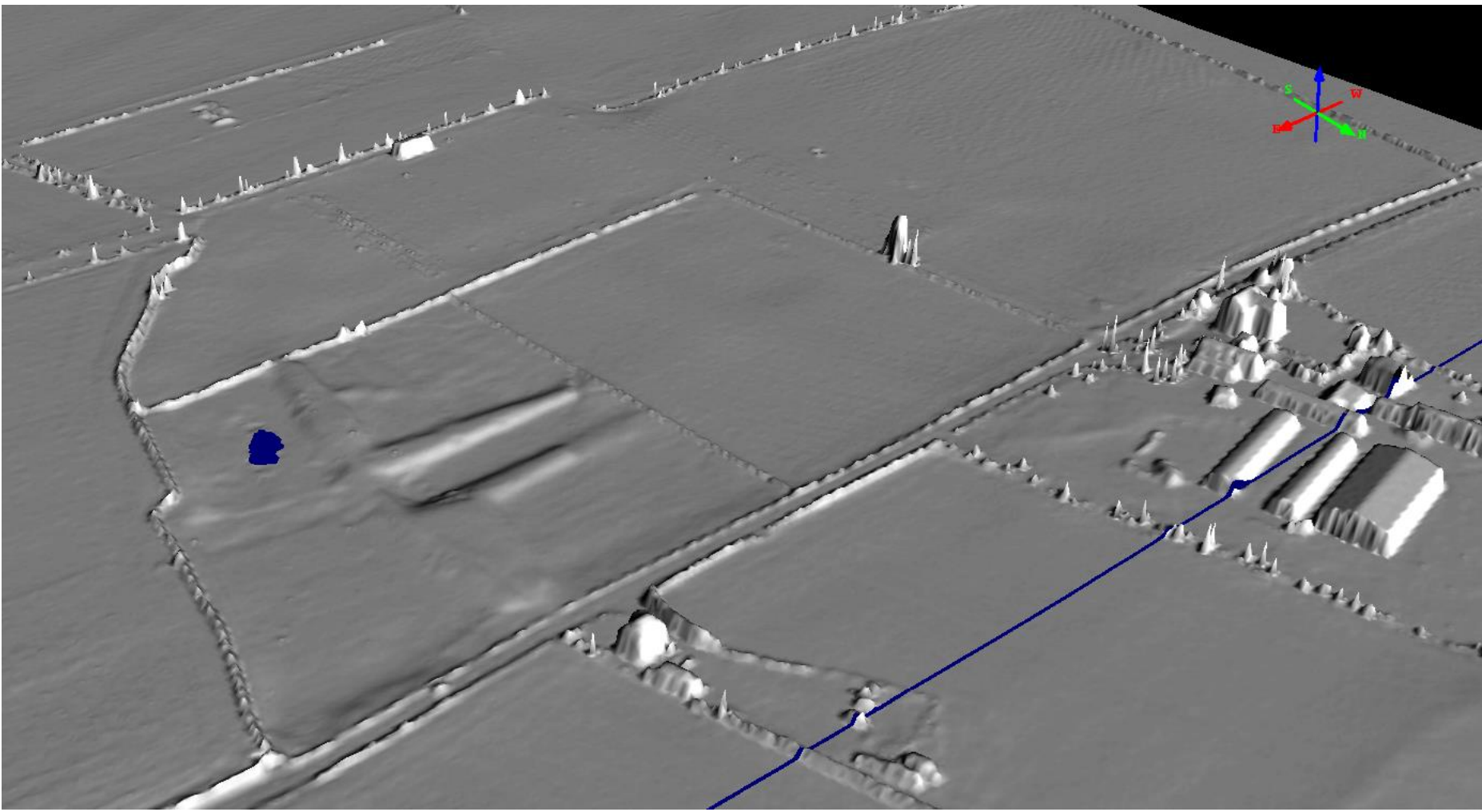


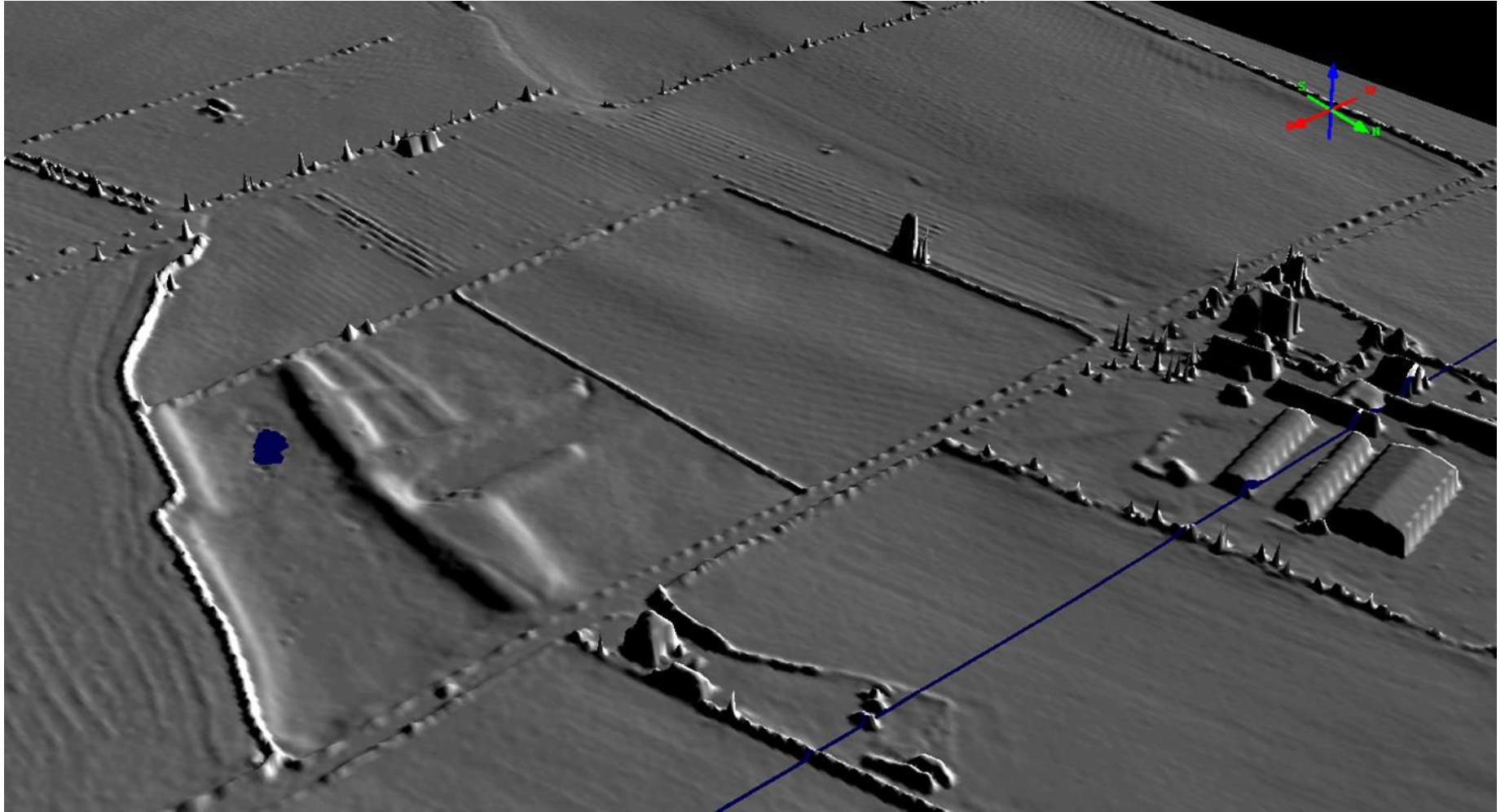
LIDAR LANDSCAPES

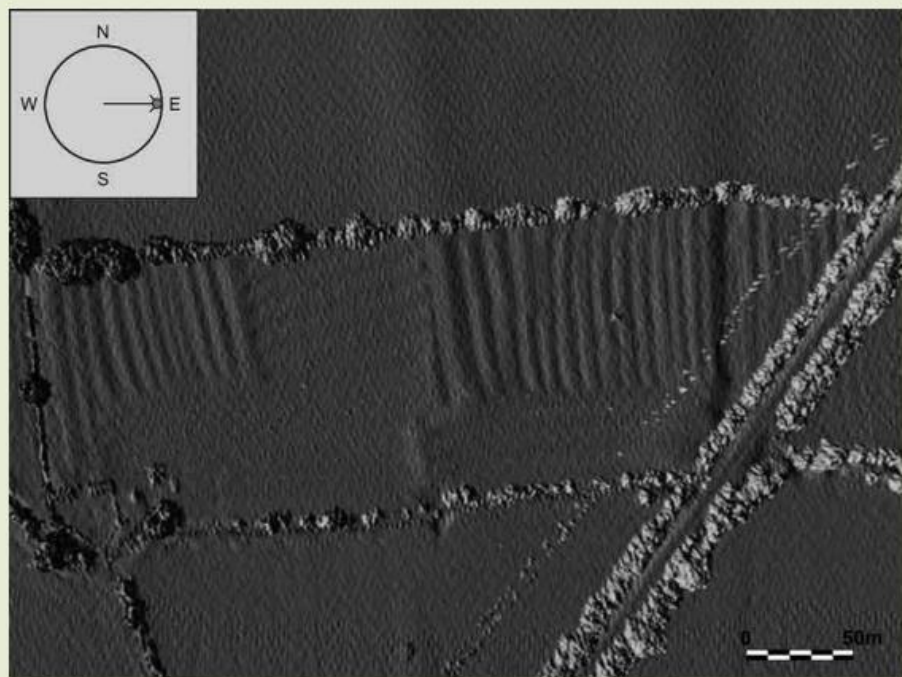
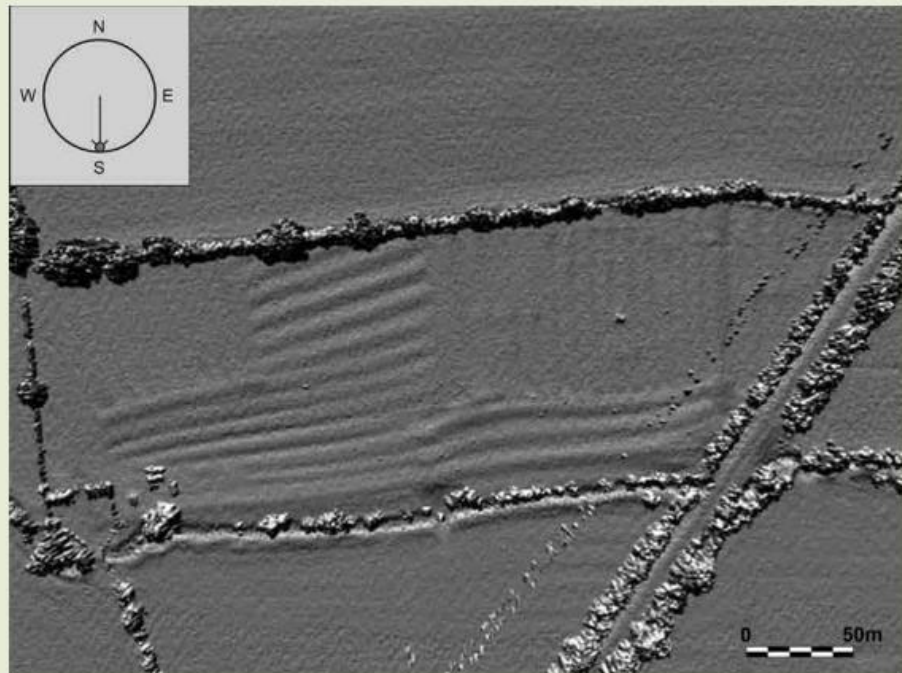
7. HILLSHADING

Making the **DSM** and **DTM** models easier to understand



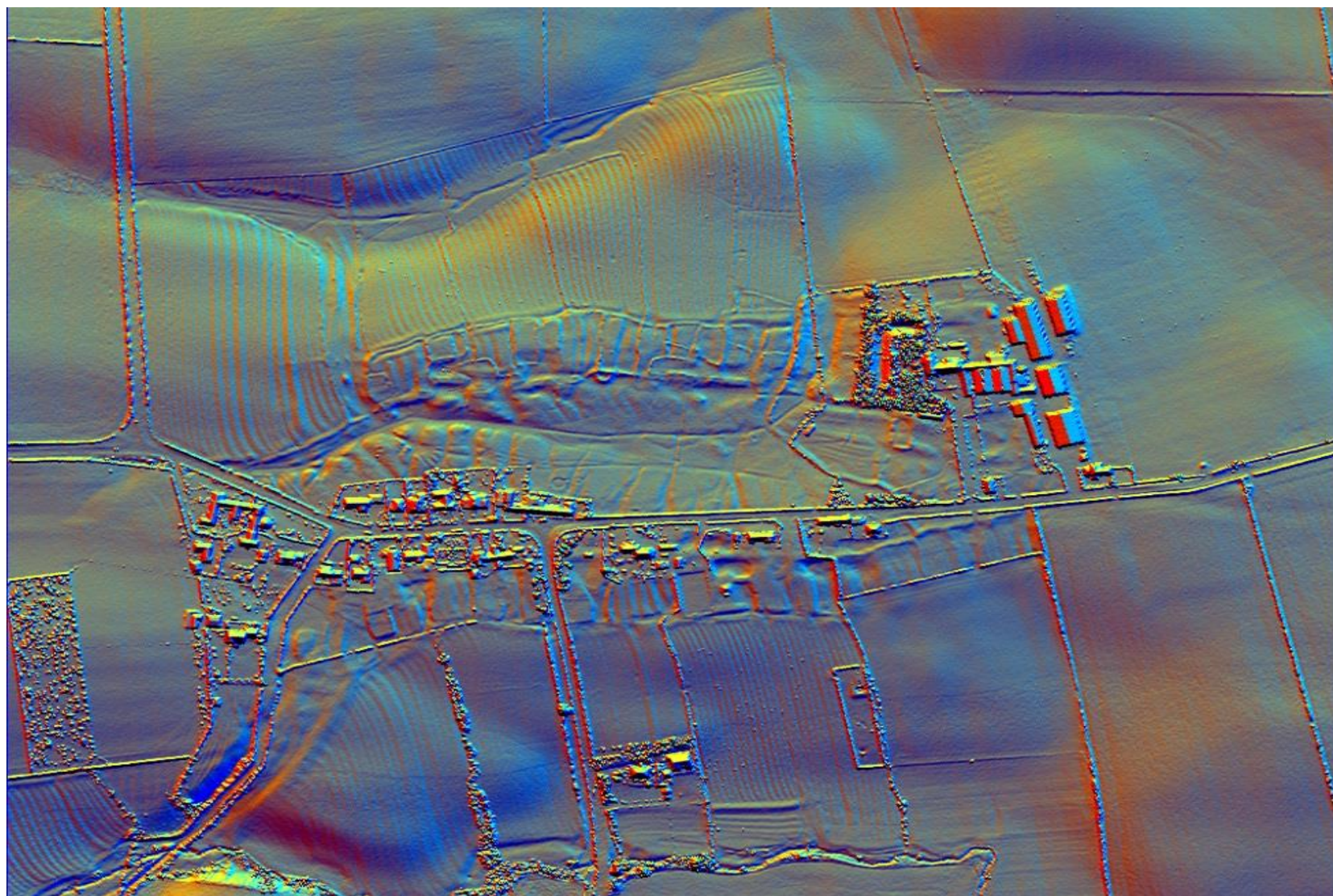




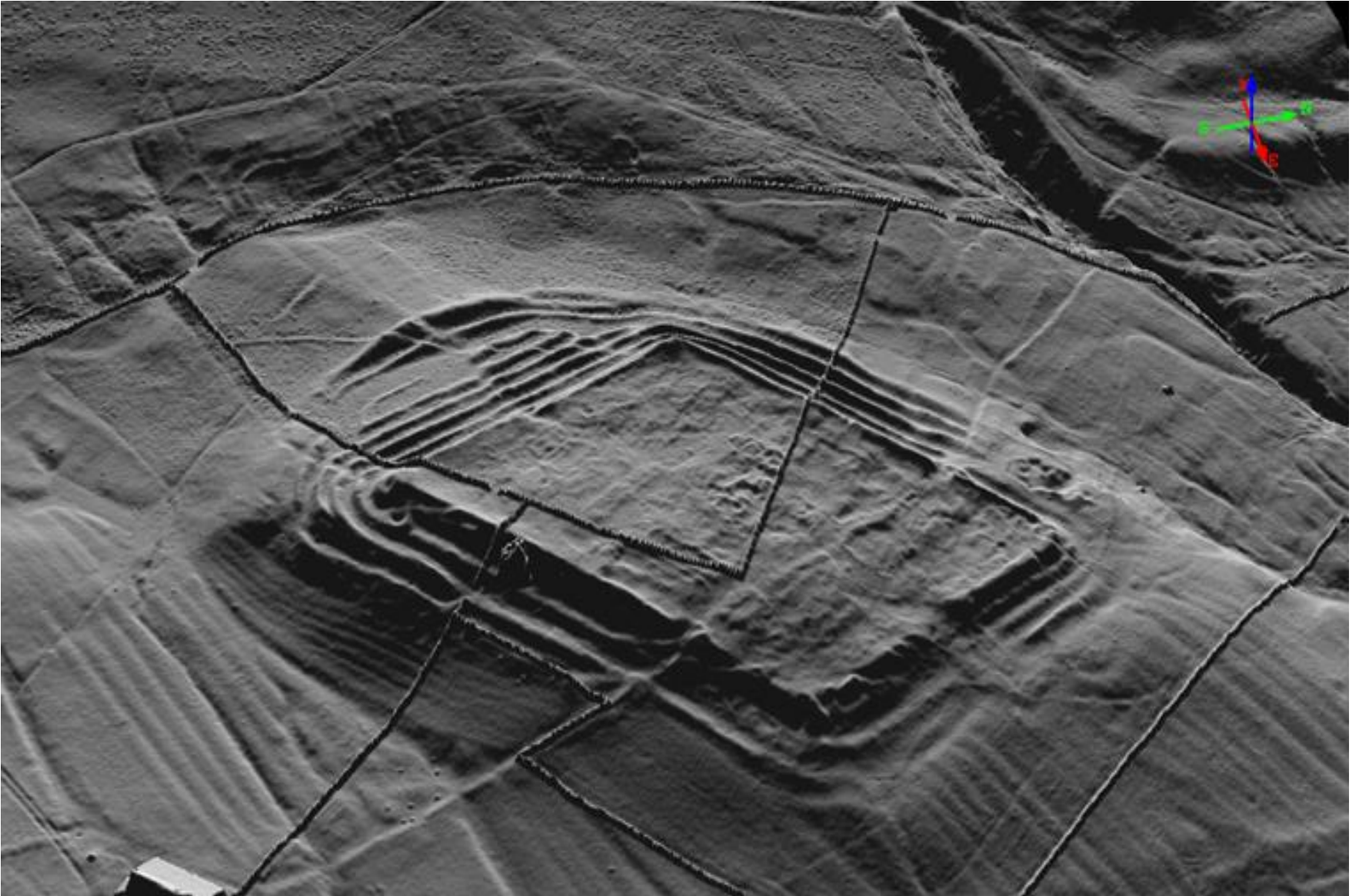


Hillshading from multiple directions





3D models



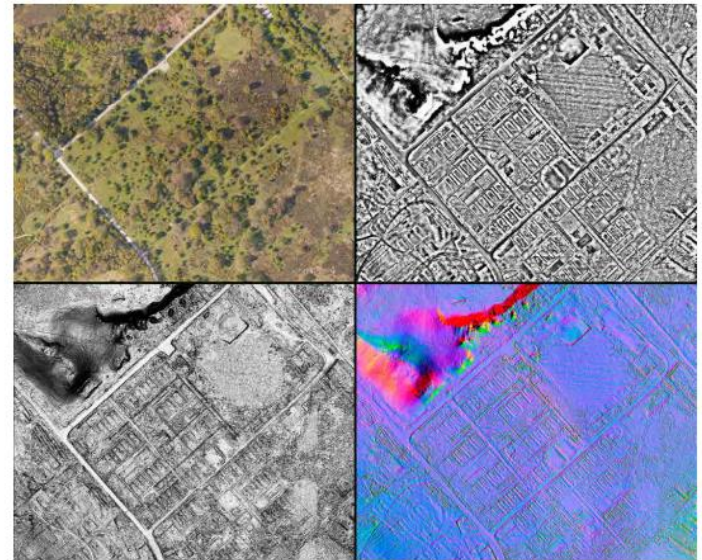
<https://historicengland.org.uk/images-books/publications/using-airborne-lidar-in-archaeological-survey/heag179-using-airborne-lidar-in-archaeological-survey/>



Historic England

Using Airborne Lidar in Archaeological Survey

The Light Fantastic



ArcLand
International

Forest Research

Options:

- **Download data freely from websites and process it yourself**
- **View it on websites where someone else has done**
 - **all the processing**

**THE LATTER IS THE SIMPLEST
AND BEST WAY TO START**