Mapping Webinar 2 – Session 1 - Using Templates to Produce a Base Map

These notes include everything covered in my session, together with some further slides and templates which there wasn't time to show. All web-links are given at the end.

For further information on how to obtain and process templates using my preferred software (OOM and SAGA-GIS) please see my extended guidance notes on the British Orienteering Mapping Resources Website. Version 2 is currently posted. Version 3, taking account of issues raised during these webinars, will be posted shortly.

Martin Hore (SUFFOC)

Software

- I use Open Orienteering Mapper (OOM) for cartography (free open source software)
- This session should be equally relevant to OCAD users.
- The latest OCAD can process LiDAR data direct and efficiently.
- OOM and earlier OCAD versions require pre-processing in GIS (geographic information system) software. (eg QGIS or SAGA-GIS – both free).

Guidance on the various software options will follow later in this webinar.

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Template Sources

- Ordnance Survey (and other mapping)
- Aerial Photography
- LiDAR (Light Detection and Ranging)

Will cover: what is available, where from and how to interpret.

Will not cover: how to process and open as a template – all covered in accompanying notes.

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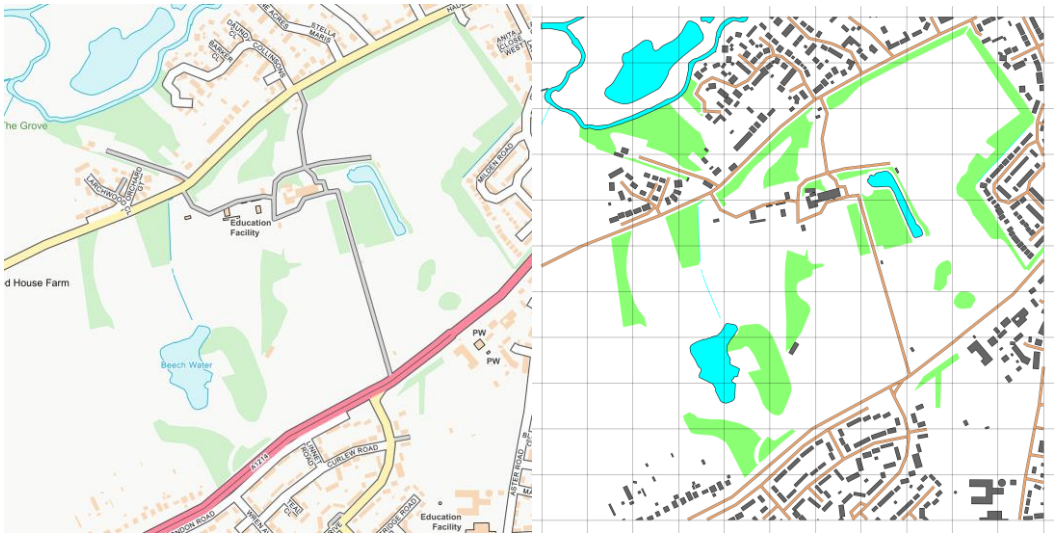
Ordnance Survey (and other mapping)

I first geo-reference my map to the OS Grid (how to do this depends on the mapping software used – see my extended notes for details for those using OOM.)

All geo-referenced templates will then open correctly positioned.

OS OpenMap – Local



This is a free download from OS OpenData – no copyright issues.

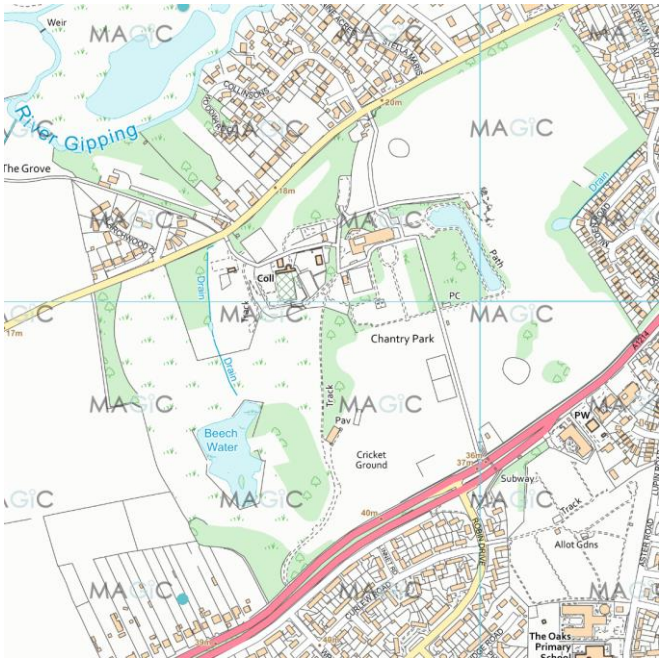
It downloads in geo-referenced, raster format (left hand image) or vector format (right hand image).

Raster format can only be used as a template.

Vector format can be opened as a template or imported directly to the map.

I find this not really accurate or detailed enough, especially as better OS mapping is freely available.

OS VectorMap – Local - formerly referred to as “OS 1:10,000”

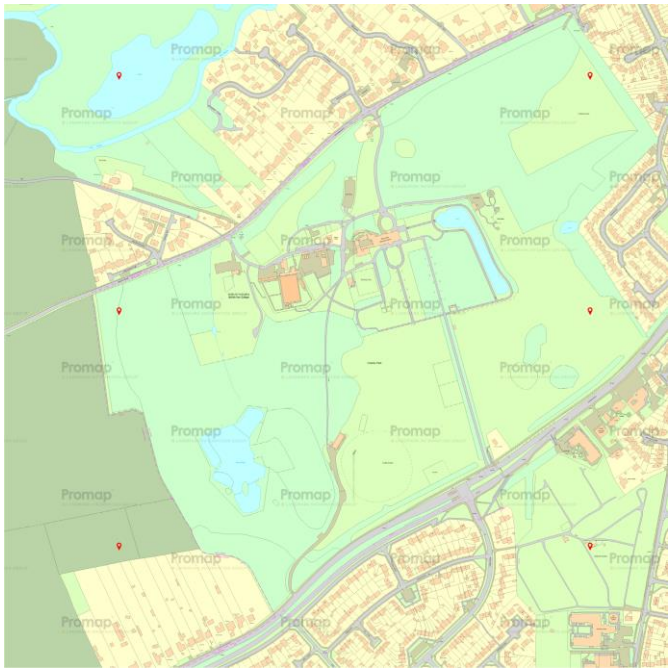


This is a free raster download in 1km^2 tiles from MagicMap, a UK government (DEFRA) site. Not geo-referenced so needs template adjustment or GIS processing.

A geo-referenced version in raster or vector format is available at cost (~ £20 per km^2) from OS agents. (UK MapCentre or Promap).

This has more detail than Open Map – I find it good enough for 1:10,000 or 1:15,000 forest mapping.

OS MasterMap - formerly referred to as OS “1:2500” (rural areas) or “1:1250” (urban areas)



This is the gold standard - very accurate and detailed (used for land registration / planning)

I obtain small raster tiles as screenshots from Promap. They need stitching in image-handling and/or GIS software and geo-referencing or adjusting to fit. This is not quick.

A ready geo-referenced version in vector format is available at substantial cost (> £300 per km^2) from OS agents. (eg UK MapCentre or Promap). Or possibly free from Local Authorities or Schools.

MasterMap is best for urban or sprint maps at 1:4000. Too time consuming for forest mapping, and in any case offers less detail in rural than in urban areas.

NB: Copyright

Apart from OS OpenMap, which is covered by the free OS OpenData licence, all other OS mapping is subject to copyright restrictions, which should be displayed in the Terms and Conditions of the source website. The British Orienteering OS licence covers the use of OS mapping to create printed maps for registered events. But it's not fully clear which current OS mapping the licence covers. It may be prudent to assume that it does not cover OS MasterMap, and possibly not OS VectorMap Local.

Other Map Sources

A previous O-map:

If more than 5 years old it will probably not be geo-referenced accurately across the map and will have an out of date symbol set. Normally it will need adjustment to fit as a template, and will not fit accurately.

Vector import is possible but template tracing from scratch is usually preferred.

Old O-maps are good for spotting "what's there" but not always exactly "where it is".

In future, previous O-maps will more probably be accurately geo-referenced, so importing will be preferred, and hopefully, re-drawing from scratch will not be necessary.

OS 1:25,000 (Explorer)

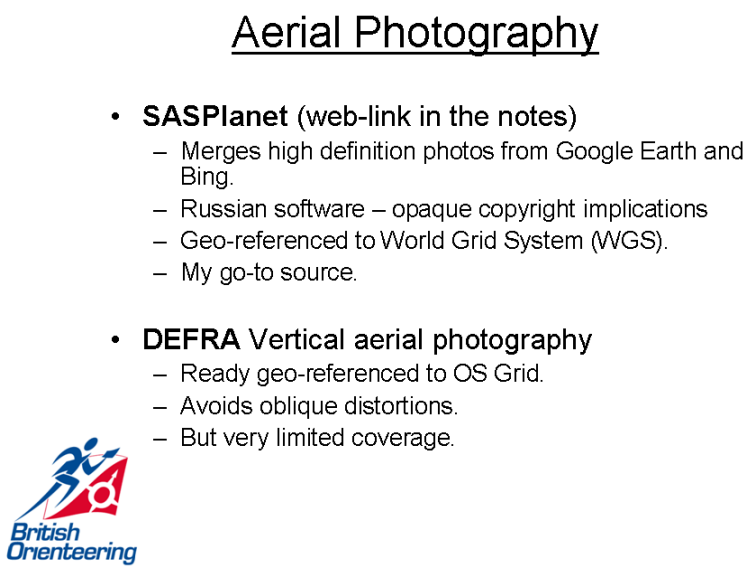
Obtainable from MagicMap but its only real use for us is for 5m contours when no LiDAR is available.

Open Street Map

This is in vector format but often the detail is inaccurate. Not especially useful for that reason.

Open Street Map is geo-referenced to the World Grid System (WGS) as also used by Google Earth, GPS systems and MapRun. (That's a simplification - it's actually more complicated than that!). The latest OCAD and OOM versions can convert from WGS to the OS grid (and vice versa), but the algorithm used is an approximation (fully accurate conversion is not possible). I find that errors of up to 5m are inherent, varying across the UK. It's possible to correct for the error in your area.

Aerial Photography



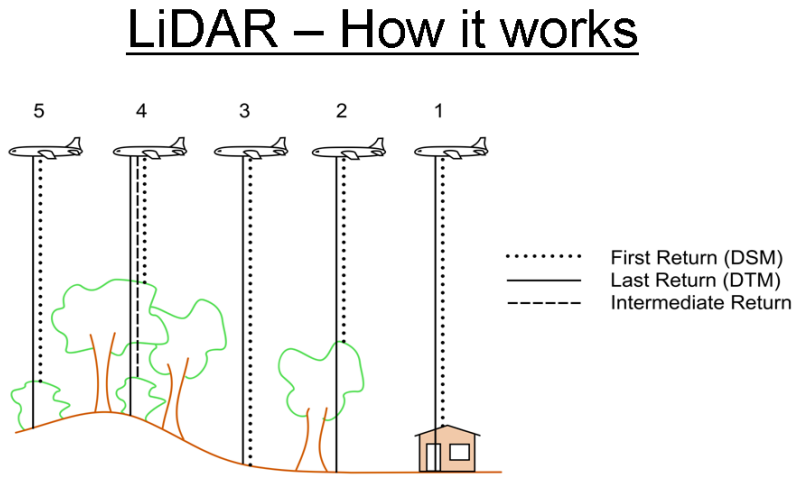
Aerial photography, especially from SASPlanet, a free source, is very useful base map material. By and large, "what you see is what you get" (at the year and season of the flight). But there are limitations:

- OS/WGS conversion errors – as per Open Street Map above.
- Lens distortion and tile stitching errors – should mostly be pre-corrected.
- Oblique errors – can't normally be avoided, but absent in vertical aerial photography.
- Shadows can confuse.
- The camera can't see through the trees!

Oblique errors – an example:

The error is obvious in the church roof, but it also applies to tall trees, and, potentially, to high ground.

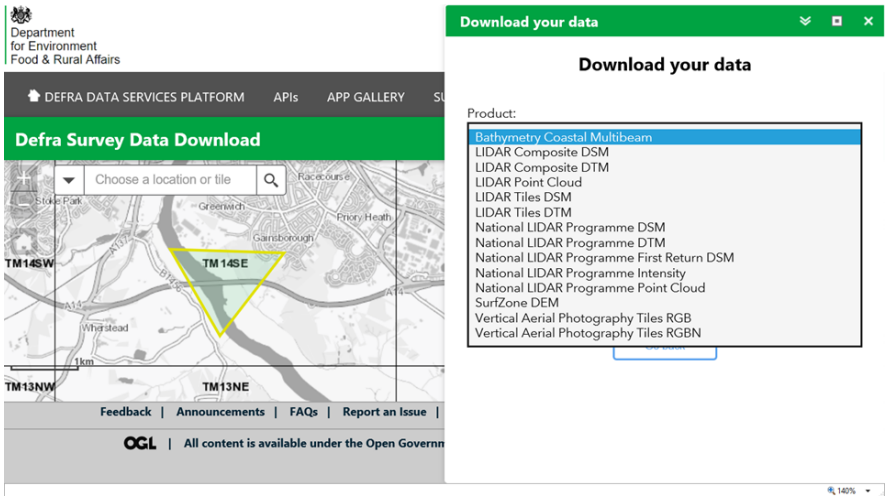
LiDAR



The Digital Terrain Model (DTM) automatically ignores buildings and gives an accurate map of the height of the ground above sea level (apart from occasional artefacts – eg where very dense vegetation cover is totally opaque to light).

First Return DSM (Digital Surface Model) data gives the height of the tree cover above sea level, but must be “normalised” to give the height above ground by subtracting the DTM values.

DEFRA LiDAR Download Site (England only)

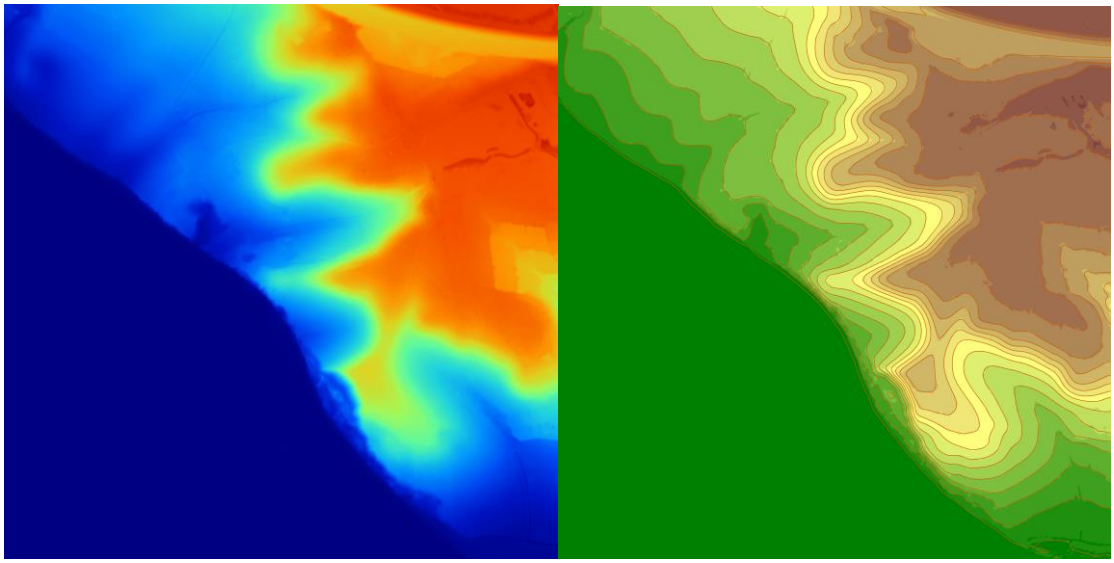


I find the National LiDAR Programme is best – I use DTM and First Return DSM

Vertical photos when available, can be downloaded from this site.

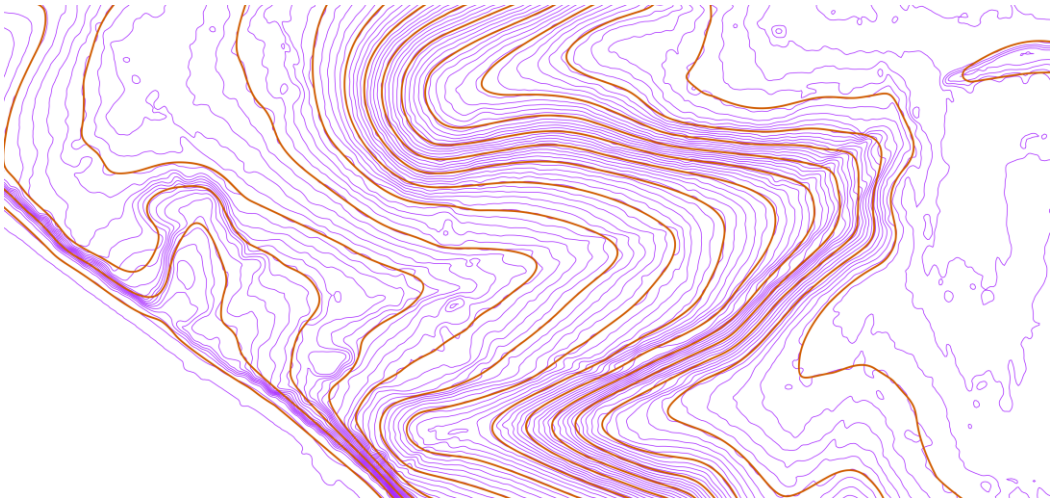
How to process LiDAR varies according to the software you use. Detailed “How to” notes for OOM using SAGA-GIS are in my extended guidance notes on the British Orienteering Mapping Resources page.

Contours from LiDAR DTM datasets

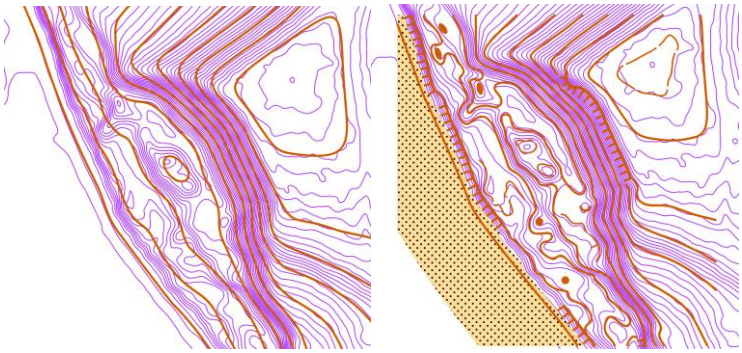


The left slide shows a basic altitude heatmap –1 million readings at 1m^2 spacing – blue low, red high.

The right slide shows more familiar colours, grouped in 2.5m altitude ranges with smoothed contours overlaid.

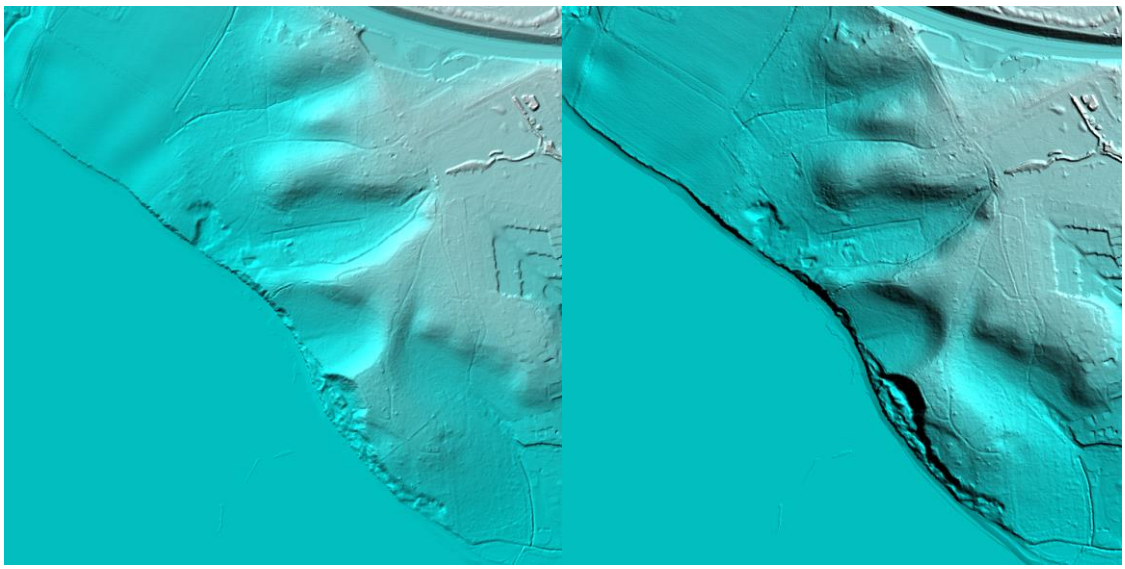


The smoothed 2.5m contours are generated in vector format. Here, I’ve imported these and opened 0.5m interval contours as a template beneath. Some mappers always trace the contours over a template, but I find importing and adjusting pre-smoothed contours is normally quicker. An obvious area for adjustment is the pronounced gully at the head of the valley.



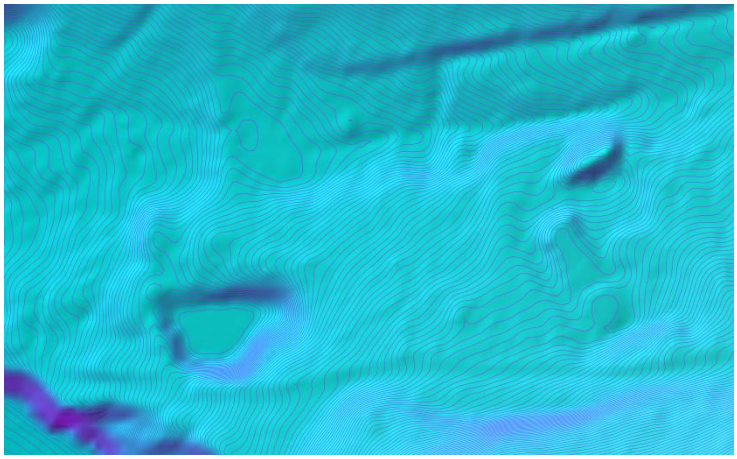
This shows a complex area of the map where significant adjustment was required, aided by my field visit.

Hillshade Templates – from LiDAR DTM datasets.



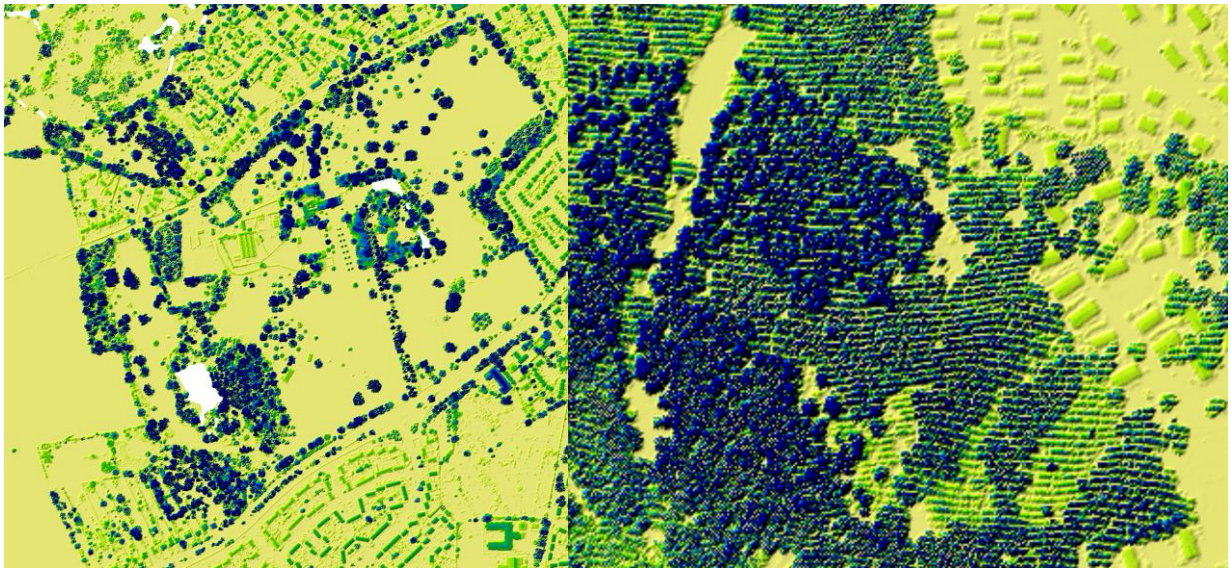
The left hand template is created with the “virtual sun” in the NW, and the right hand with the “virtual sun” in the NE. Composite images are also possible.

Many relief features are visible, including earthbanks, ditches and sunken or raised paths.



Adding “micro contours” at eg 10cm intervals can highlight knolls etc, but don’t over-detail the final map!!

Vegetation Height Template from a “normalised” DSM dataset.



The colours have been set by me in SAGA-GIS: yellow = open, blue = high trees, green = bushes. This template complements an aerial photo. It often shows location more accurately – no shadows and no oblique errors. The left hand image shows the whole of Chantry Park. Excellent for individual trees in parkland. The right hand image shows part of Bridge Wood with some obvious vegetation boundaries.

Other Useful LiDAR Templates

The left hand template comes from a LiDAR “Intensity” dataset which records the reflectivity of the surface (darker = more reflective). It can show paths well, even sometimes in woodland.

The right hand template is obtained by processing the “intermediate” LiDAR returns which are recorded in a “Point Cloud”. This is extra work to obtain, but gives an indication, not always accurate, of the undergrowth between defined heights above ground, in this case between 20cm and 2m above ground.

These last two are a “slope gradient” template where steeper ground is shown in darker colours, and a hillshade template obtained from a DSM dataset. This picks out hedges and walls well. I haven’t used these, but other mappers have found them useful.

There are many more possible results from different ways of processing LiDAR data.

Drawing up the Base Map

This shows an example of the base map I take out into the field. A small section is already completed. I've drawn with "proper" symbols all the features I'm pretty confident are correct – eg because they are confirmed on at least two templates. I've used "drafting" symbols – eg thin lines of different colours – for features that I'm not confident in – for example because they are suggested by only one template.

I also often take prints of one or more templates with me into the field.

Different mappers will have their own preferred methods for this.

Further information:

Further information

- Notes of this session will be emailed (including all web-links) – relevant to OCAD or OOM.
- My detailed "how to" guidance notes on processing for OOM using SAGA-GIS are on the British Orienteering Mapping Resources Page. Version 2 up now. Version 3 to follow shortly.
- Notes on processing using QGIS are also available on the same page.
- The latest OCAD version has a comprehensive "Help" facility covering most of this.

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Website Links:

OS OpenData

MagicMap

Promap

UK MapCentre

SASPlanet

Environment Agency (DEFRA) LiDAR site