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LIDAR Image Processing for Amateur Archaeology Groups

Summary: This short article describes how free software and LIDAR images can be processed to show earthwork features at their best by varying the angle a 'Virtual Sun' is casting its shadows. This process can be done on a single or multiple LIDAR files.

LIDAR images are available free for non-commercial use by archaeology groups on the Geomatics Website (https://www.geomatics-group.co.uk/geocms/). When placing an order request the DTM ASCII files. Read the copyright text file that accompanies each download. Note: When ordering LIDAR images from the Geomatics website the commercial use cost is displayed. This reverts to zero when you state it is for non-commercial use.

Software requirements.

The software recommendations are my preferences. No doubt other programs will do the same job.

1) QGIS (http://qgis.org/en/site/forusers/index.html). This is open source freeware.
2) IrfanView (http://www.irfanview.com/main_download_engl.htm). Freeware. N.B. when installing make sure you check each option carefully so you don't agree to download any other software that the download site tries to get you to install. If you have an image editor that can read .tif files then you do not need IrfanView.
3) If you have Microsoft Office on your PC then you should have Microsoft Office Picture Manager installed. This is not essential but it is mentioned in the procedure.

QGIS Setup **(The terms used are from QGIS V2.6 Brighton November 2014)**

The mapping grid used in this document is the British National Grid using the OSGB 1936 datum. If you are based elsewhere always substitute your appropriate national/regional code.

1) Download and install QGIS. Click on the desk-top icon to open.
2) Set up default project options by following these steps.
    a. Click Settings> Options > CRS
        i. **Default CRS for new projects** > Select > OSGB 1936 / British National Grid EPSG:27700
        ii. **CRS for new layers** > Select > OSGB 1936 / British National Grid EPSG:27700
    b. Then **check that the radio buttons** are set as:
        i. Don't enable 'on the fly' re-projection
        ii. Use default CRS displayed below
    c. Click > General
        i. Under **Project files** – Open project on launch > Select > Most recent
    d. Click > **Map Tools** check Preferred measurement units = Meters

Click OK to finish

LIDAR Data

I suggest that you create a LIDAR folder for both the Geomatics download data and the QGIS data. In a sub-folder extract your Geomatics data from the .zip file. You will need the password from the Geomatics download page to extract the files from the zip file.

QGIS LIDAR Data Processing

QGIS is complex software that integrate GRASS with QGIS. If you generate any errors whilst following these instructions then I suggest that you *Google search the issue* to see if there is a solution, or try the QGIS support error reporting wiki on the QGIS website. No doubt there are other methods when using QGIS that will work, but the 2 methods described are the simplest.

Create a New Project

Click Project > New then immediately save the project by clicking Project > Save as, then after browsing to your LIDAR Data folder enter a suitable project name and click Save.

Immediately double check the defaulted parameters are correct by clicking Project > Project Properties and under General Option double-check that Canvas Units = Metres, and that CRS Option has been configured to OSGB 1936 / British National Grid EPSG: 2770. Apply and save any changes.

Method1: Single LIDAR Tile Processing

Look for the Add Raster Layer icon,  click it and browse to the LIDAR .asc file of your choice.

When it has loaded it will be a B&W image with little detail like this:

Applying Hillshade:

- In the Layers panel you will now see the LIDAR tile's name.
- Click the name to highlight it.
- Select Raster > Terrain Analysis > Hillshade
- Click the Output layer **…** icon
- Browse to the correct folder and enter a file name for the Hillshade raster layer
- Output format: Select > GeoTIFF
- Then under Illumination enter the compass angle 0-360 and the Vertical angle 0-90 Click OK
- You should now see the LIDAR detail in the image and that a new raster file has been generated in the Layers panel.
- If required, repeat the above varying the filename and illumination values.
- For each new hillshade LIDAR raster layer there will be an associated **tif** image file in your selected folder.
- Preferred image processing method is to **Stage 1:** Open the tif image using IrfanView and immediately save the image as a .jpg and when saving make sure the JPG Save Options > Save Quality is set to 100 (no compression). **Stage 2:** In File Explorer, right click the jpg image filename and select open with Microsoft Office Picture Manager (MOPM). Click Auto-

Correct and/or the Edit>Brightness and Contrast>Advanced settings. Click the X icon to close the MOPM when you will be prompted to Save or Discard.
Also read para 12) in Method 2 below.

Method 2: Merged LIDAR Tiles Processing

In this example I am using a Geomatics download that crosses two 100km OS grids: NZ and SE.

The path to the data files looks like this: C:\ASCII LIDAR\Reeth Ascii Geomatics Download\GMG130586161471876584\Saleproducts\Geomatics2013\1M_res

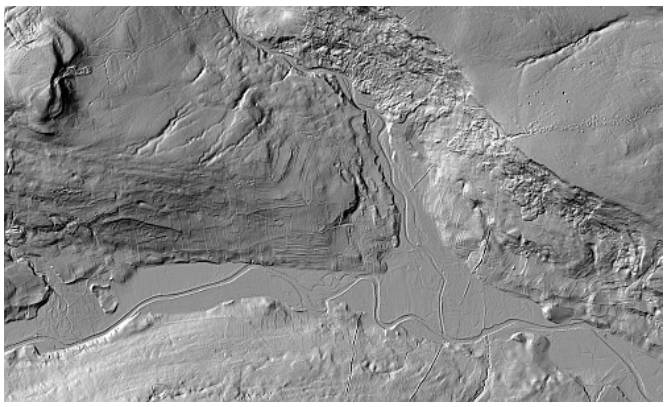
Inside the 1M_res folder are the NZ and SE data sub-folders and eventually in further sub-folders the .asc and geo-referencing data files.

In this example I will point QGIS to look in all the folders below 1M_res folder to merge all the files present. In this example 15 tiles centred on Reeth in Swaledale are merged as 3 rows of 5 tiles.

1) Start a new project and check properties to make sure that OSGB 1936 / British National Grid EPSG: 2770 has been set.
2) Select Raster > Miscellaneous > Merge (to open the Merge panel)
3) In the Merge panel > Click: Choose input directory instead of files
4) Make sure Recursive subdirectories is checked
5) Click: Select … on the Input Directory row, and browse to the 1M_res (or your equivalent) folder then click Choose.
6) On the Output row, click: Select … > and browse to the folder where you want the file to be saved, enter a file name and finally select under Files of type: GeoTIFF. Click Save.
7) Click Creation Options and then under Profile select No compression, then check by clicking Validate.
8) Click OK keeping the cursor over the Merge box so that you can see that it is still processing the data — it can take time depending on the number of files and your computer's data processing speed. Click OK
9) Save project.
10) The merged tiles will now be present as a single raster file in the layers panel. Process the raster file as detailed in Applying Hillshade in the Method 1 Individual LIDAR Tile Processing section.
11) Preferred 2 stage image processing method is: **Stage 1:** Open the tif image using IrfanView and immediately saving the image as a .jpg and when saving make sure the JPG Save Options > Save Quality is set to 100 (no compression). **Stage 2:** In File Explorer, right click the jpg image filename and select open with Microsoft Office Picture Manager (MOPM). Click Auto-Correct and/or the Edit>Brightness and Contrast>Advanced settings. Click the X icon to close the MOPM when you will be prompted to Save or Discard.
12) Note the more tiles you merge together the less dynamically broad is the greyscale image. You will need to use your image editor to improve contrast and greyscale tones. Both IrfanView Image>Corrections or Shift+G and/or the Microsoft Office Picture Manager

(MOPM) using the Edit>Brightness and Contrast>Advanced settings and/or the Auto Correct function can be used. In practice I prefer to use MOPM and I usually find when the manual improvements have been made, the Auto Correct button further increases the greyscale range. Experiment with this software and / or your own image editor.

13) When merging multiple tiles you will find that at a certain point the merged product gets too big. I think this will depend on whether you are using a 32 or 64 bit Operating System and the speed of your computer hardware. Keep the image files at maximum resolution then you will get the best result when you decide to create a compressed image to publish.
14) You can also do multiple merges. In Swaledale we get four 100 sq km map grids (British National Grid) meeting, called NY, NZ, SD and SE grids. A block of tiles overlapping all four grids was too big to be merged. The above process was then used to initially get four merged blocks for each of these four grids which I called the NY, NZ, SD and SE blocks. The above process with one variation, was then used to merge these four intermediate NY, NZ, SD and SE block files, by unticking the **Choose input directory instead of files** at stage 3) and selecting all four block files to get a single image (albeit a large one). This can be adapted to your local situation. It may not be advantageous to merge such big groups particularly if there is a large height differential, but it can give a nice visual perspective of an area.



15 tiles merged showing Reeth in Swaledale where the Arkle Beck meets the River Swale.

Please acknowledge **Stephen Eastmead swaag.org** if you use or modify these instructions.

Check for updates to this document at https://www.swaag.org/LIDAR/LIDAR.htm