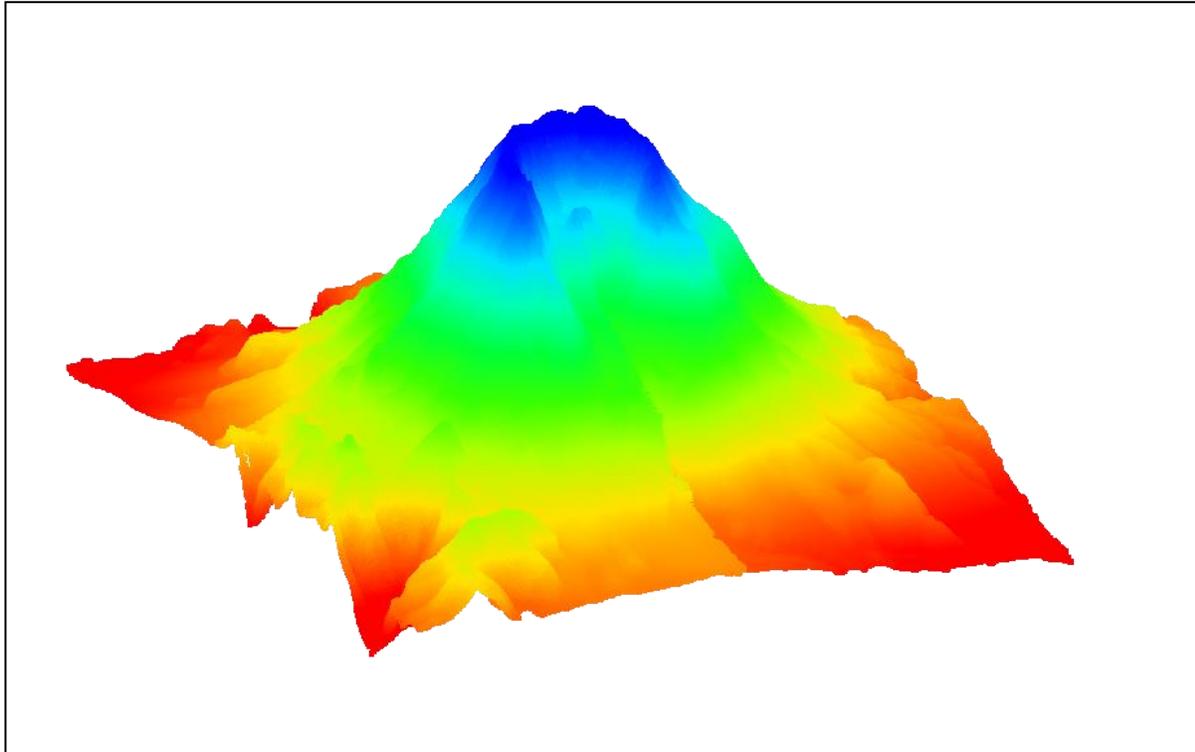


## GMS 10.5 Tutorial

### **Lidar with Multiple Files**

Using multiple lidar files for interpolation and visualization in GMS



#### Objectives

This tutorial teaches how multiple lidar files can be used in GMS for display and interpolation to rasters and UGrids.

#### Prerequisite Tutorials

- Lidar

#### Required Components

- GIS Module
- UGrid Module

#### Time

- 10–20 minutes



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## 1 Introduction

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Lidar is often used to conduct elevation and shallow bathymetric surveys that can be saved as point clouds or rasters. These can then be imported into GMS for use in various projects. If multiple lidar files are loaded into GMS, they can all be used to create rasters and to be interpolated to UGrids. They can also be merged together for convenience.

For discussion of the basic lidar interface in GMS, please refer to the “Lidar” tutorial. It is recommended that tutorial be completed prior to this tutorial.

### 1.1 Getting Started

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Do the following to get started:

1. If necessary, launch GMS.
2. If GMS is already running, select *File / New* to ensure that the program settings are restored to their default state.

## 2 Importing Multiple Lidar Files

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Begin by opening four lidar files containing data from Mount St. Helens, a volcano that erupted violently in 1980 in the state of Washington in the United States.

Open the four files by doing the following:

1. Click **Open**  to bring up the *Open* dialog.
2. Browse to the *Tutorials\GIS\lidarWithMultipleFiles* directory
3. Select “Raster/DEM Files” from the *Files of type* drop-down.
4. While holding the *Shift* key down, select “mounnelst.las”, “mounnwlst.las”, “mounselst.las”, and “mounnswlst.las”.
5. Click **Open** to close the *Open* dialog and import the files.

After several seconds, the Graphics Window should appear similar to Figure 1. By default GMS displays a maximum of 50,000 points per lidar file, so 200,000 points are being drawn. The total number of points is over 23 million.

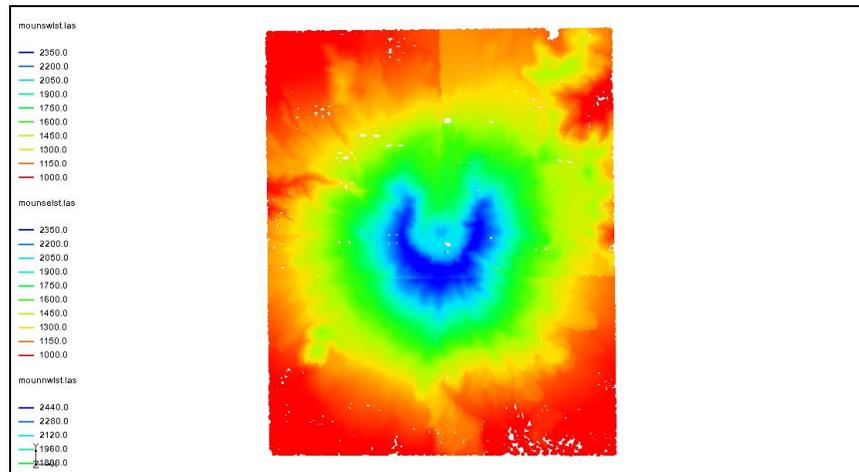


Figure 1 Mount St. Helens lidar files

Now change the perspective to be able to see the elevation more clearly.

6. Switch to **Oblique View**  to see the volcano in perspective view.

The project should now appear similar to Figure 2.

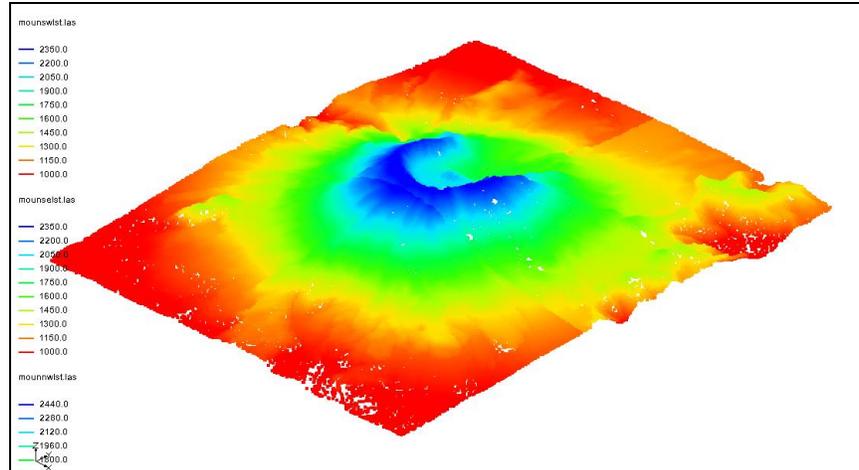


Figure 2 In oblique view

Now return the view to the top-down, or Plan view, by doing the following:

7. Switch to **Plan View** .

Notice that the edges of each lidar file can be discerned as a break in the color shading. This is a result of each lidar file having its own display options and thus its own minimum and maximum data range used in the contour options. Setting the contour range to be the same for all the lidar files is one way to correct this. Merging the lidar files into one file, as demonstrated in the next section, is another way.

## 3 Merging Lidar Files

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Multiple lidar files can be merged into one file. GMS creates a new lidar file that contains the data of all the individual files.

### 3.1 Exporting a Merged Lidar File

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1. In the Project Explorer, select all four Mount St. Helens lidar files by selecting the first file then holding down the *Shift* key and selecting the last file.
2. Right-click on any of the selected files and select the **Merge...** command to open the *Lidar File* dialog.
3. Enter “all.laz” in the *File name* field and click **Save**.

It may take several seconds to create the merged file. The LAZ format is a compressed lidar format.

### 3.2 Importing a Merged Lidar File

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Now import the file that was just created.

1. Click **Open**  to bring up the *Open* dialog.
2. Select “Raster/DEM Files” from the *Files of type* drop-down.
3. Select the “all.laz” file.
4. Click **Open** to close the *Open* dialog.
5. In the Project Explorer, turn off the original four LAS files.

Notice that the merged file appears sparser because only 50,000 points are being drawn to represent 23 million points. This could be changed by increasing the number of points displayed in the *Lidar Display Options* dialog.

Also notice that the coloration is now smooth with no sharp breaks. This is because there is only one minimum and maximum range used for contouring.

The rest of the tutorial will use the original four lidar files so the merged lidar file can be removed.

6. In the Project Explorer, right-click the “ all.laz” file and select **Remove**.
7. Turn on the four LAS files.

## 4 Converting Lidar to a Raster Using Multiple Files

A raster can be created from multiple lidar files. If the files overlap, the overlapping data will be averaged to get the raster values.

Convert all the lidar to a raster by doing the following:

1. In the Project Explorer, select all four lidar files using the *Shift* key.
2. Right-click on any of the selected files and choose the *Interpolate To | Raster* command to open the Interpolate *Lidar to Raster* dialog.
3. Accept all of the default values and click **OK** to open the *Raster File* dialog.
4. Change the *File name* to “all” and click **Save** to close the *Raster File* dialog.
5. In the Project Explorer, turn off the original four LAS files.

The raster should appear similar to Figure 3.

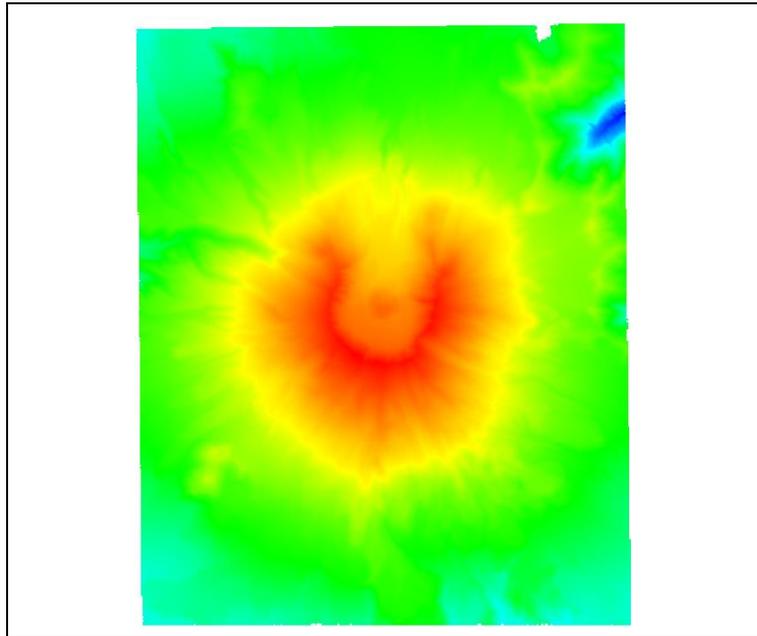


Figure 3 Raster converted from multiple lidar files

The rest of the tutorial does not use the raster file, so it can be deleted.

6. In the Project Explorer, right-click the “ all.tif” file and select **Remove**.
7. Turn on “ GIS Layers”, which will turn on all of the lidar files.

## 5 Interpolate Lidar to a UGrid Using Multiple Files

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Multiple lidar files can be interpolated to a Ugrid, much in the same way the raster was created. If the files overlap, the overlapped regions will be averaged to determine the data values.

Start with importing a 2D UGrid.

1. Click **Open**  to bring up the *Open* dialog.
2. Select “All Files (\*.\*)” from the *Files of type* drop-down.
3. Select “multipleLidar.vtu” and click **Open**.

This is a 2D grid that is in a location where a groundwater model could be created.

4. Select all of the LAS files in the Project Explorer.
5. Right-click on any of the selected files and select *Interpolate To | UGrid* to open the *Interpolate Lidar to UGrid* dialog.
6. In the *Target dataset location* section, select *Points*.
7. Enter “all” as the *New dataset name*.
8. Click **OK** to close the *Interpolate Lidar to UGrid* dialog.

Once it is done processing, notice the new “ all” dataset under the “ UGrid Data” folder in the Project Explorer. To see the interpolated values of the UGrid, turn on contours for the UGrid.

9. Click **Display Options**  to open the *Display Options* dialog.
10. Select “UGrid: multipleLidar – [Active]” from the list on the left.
11. Check *Face contours*.
12. Click on **Options...** next to *Face contours* to bring up the *Dataset Contour Options – Ugrid – all\_filtered* dialog.
13. Select “Block Fill” from the *Contour method* drop-down.
14. Click **OK** to close the *Dataset Contour Options – Ugrid – all* dialog.
15. Click **OK** to close the *Display Options* dialog.
16. Uncheck “ GIS Layers” in the Project Explorer.

The display should now appear similar to Figure 4.

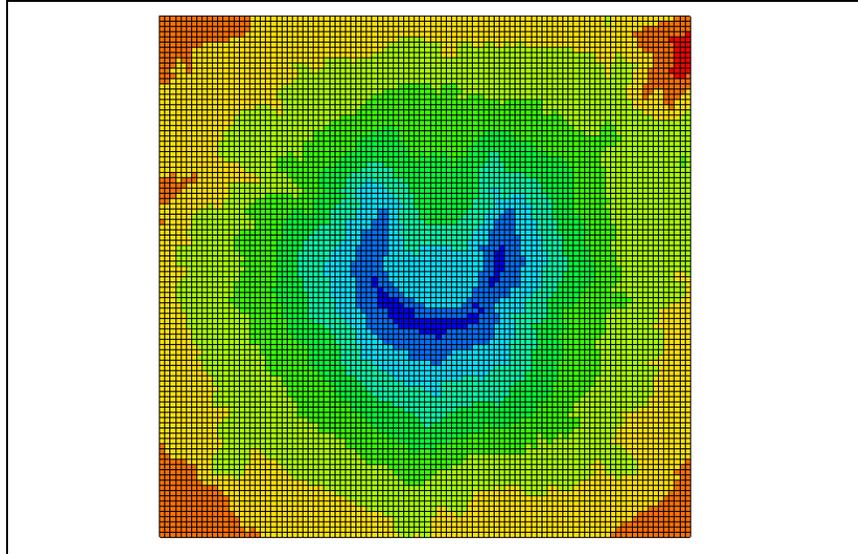


Figure 4 UGrid with interpolated values from multiple lidar.

## 6 Conclusion

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This concludes the GMS “Lidar with Multiple Files” tutorial. The following topics were discussed and demonstrated:

- Multiple lidar can be displayed and used for interpolation to rasters and UGrids.
- GMS can merge multiple lidar files into a single lidar file.
- Lidar files each have their own display options.