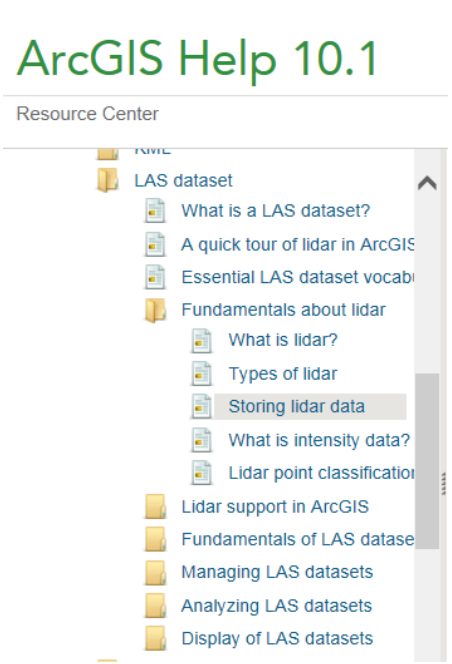
LAS format and processing DTMs from tins and local binning

Arrowsmith

LAS files: industry standard format



Storing lidar data

Originally, lidar data was only delivered in ASCII format. With the massive size of lidar data collections, a binary format called LAS was soon adopted to manage and standardize the way in which lidar data was organized and disseminated. Now it is quite common to see lidar data represented in LAS. LAS is a more acceptable file format because LAS files contain more information and, being binary, can be read by the importer more efficiently.

LAS is an industry format created and maintained by the American Society for Photogrammetry and Remote Sensing (ASPRS). LAS is a published standard file format for the interchange of lidar data. It maintains specific information related to lidar data. It is a way for vendors and clients to interchange data and maintain all information specific to that data.

Each LAS file contains metadata of the lidar survey in a header block followed by individual records for each laser pulse recorded. The header portion of each LAS file holds attribute information on the lidar survey itself: data extents, flight date, flight time, number of point records, number of points by return, any applied data offset, and any applied scale factor. The following lidar point attributes are maintained for each laser pulse of a LAS file: x,y,z location information, GPS time stamp, intensity, return number, number of returns, point classification values, scan angle, additional RGB values, scan direction, edge of flight line, user data, point source ID and waveform information.

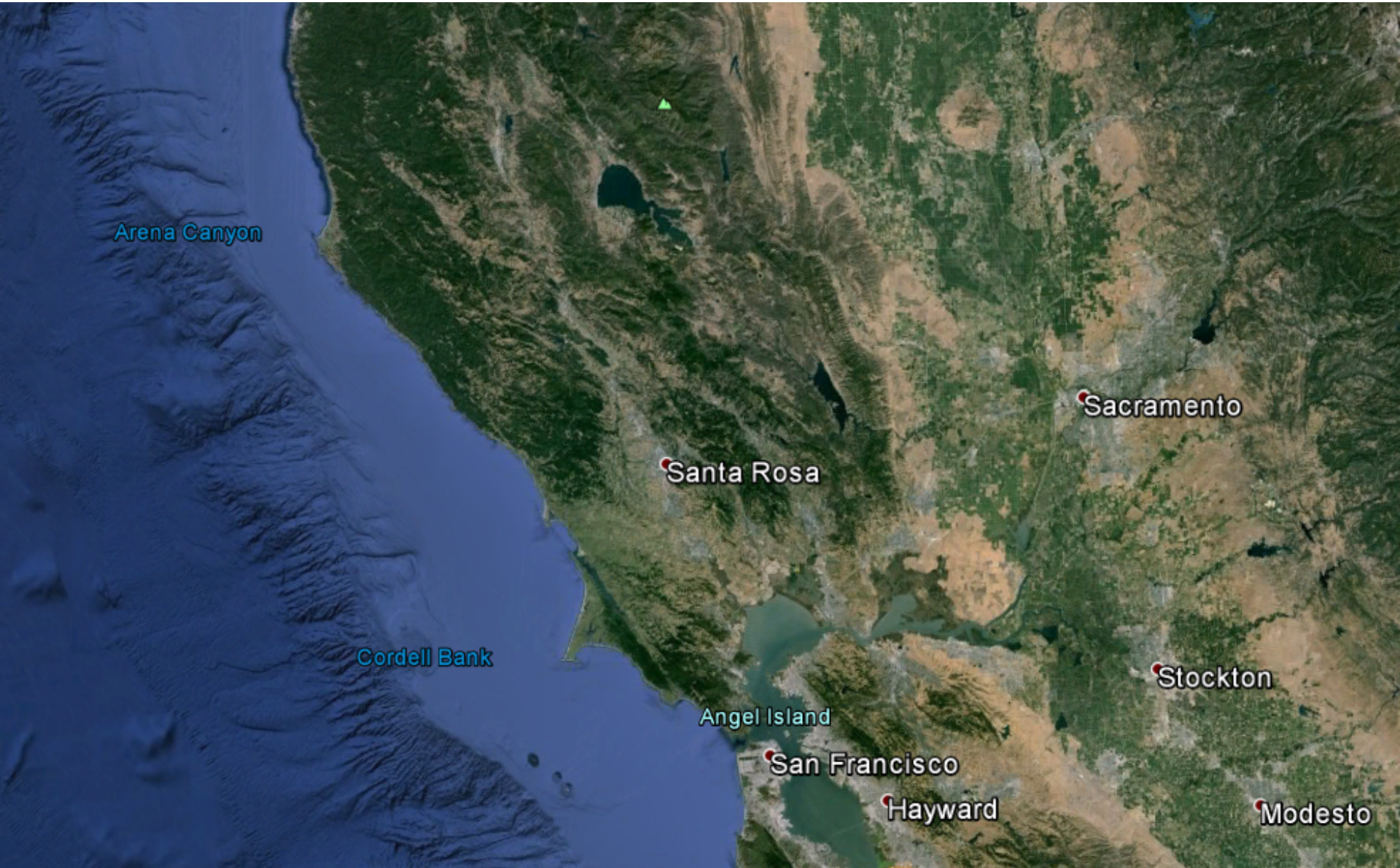
ArcGIS supports lidar data that is provided in either ASCII or LAS file format.

The attribute information is maintained in ArcGIS for further analysis.

The LAS dataset, mosaic dataset, and terrain dataset all support lidar data in LAS format. Only the LAS dataset and mosaic dataset work directly with LAS files, while the terrain dataset requires that LAS files be imported into the geodatabase using multipoint geometry.

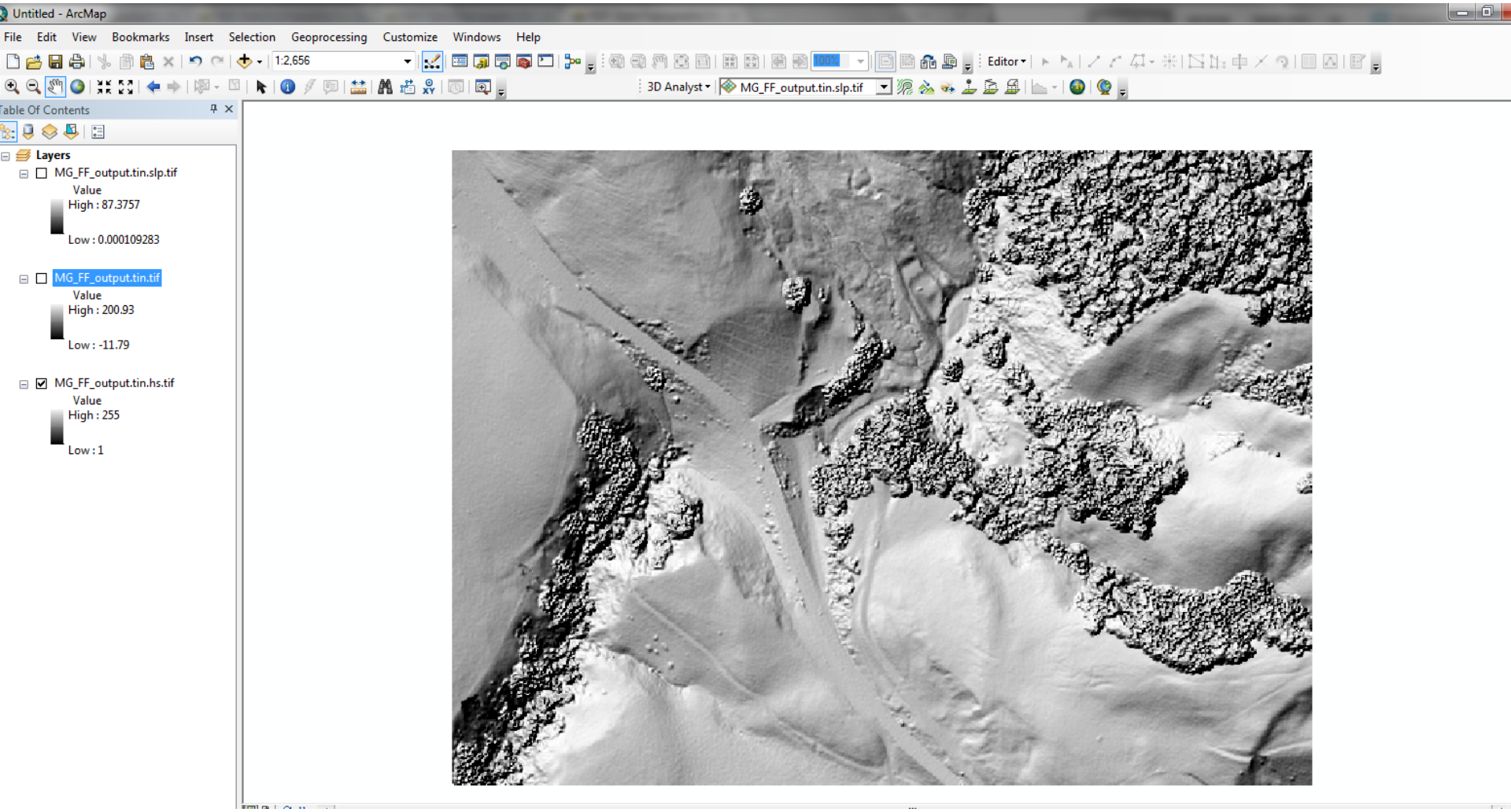
The terrain dataset supports lidar data in both ASCII and LAS formats. For more information on how to use ASCII data to build a terrain dataset, see Importing terrain dataset source measurements.

Example of EarthScope Northern California LiDAR data from Mill Gulch along the San Andreas Fault (NCALM data processed at and downloaded from OpenTopography)




© 2013 Google

Grids in ArcMap for context



LiDAR Job Metadata

Modify and resubmit this job ↑
LiDAR job report ↑

Download Job Metadata:

metadata-137954388704330297897 2.txt

Dataset Information:

Dataset Name: EarthScope Northern California LiDAR Project(NCAL)

Dataset Acknowledgement: This material is based on services provided to the Plate Boundary Observatory by NCALM (http://www.ncalm.org). PBO is operated by UNAVCO for EarthScope (http://www.earthscope.org) and supported by the National Science Foundation (No. EAR-0350028 and EAR-0732947).

Full Dataset Metadata

Horizontal Coordinates: UTM Zone 10 N WGS84 Meters
Vertical Coordinates: Ellipsoid

Data Access Acknowledgement: This material is based on [data, processing] services provided by the OpenTopography Facility with support from the National Science Foundation under NSF Award Numbers 0930731 & 0930643

Job Description:

User	ramon.arrowsmith@asu.edu
Job ID	137954388704330297897 2
Title	Mill Gulch Full Feature for VISES

LASTOOLS

www.cs.unc.edu/~isenburg/lastools/

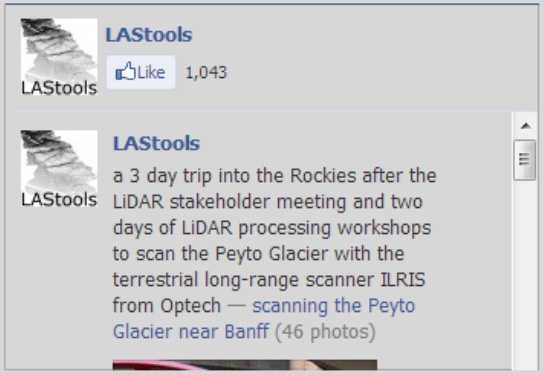
Introduction to the I... | Franklin & Marshall ... | Tectonic Geomorph... | GLG362/598--Geom... | About Underwood ... | The Finest Heirloom... | http://www.techbar... | Preventing Powdery... | Orga

LAStools: award-winning software for rapid LiDAR processing

download LAStools HERE

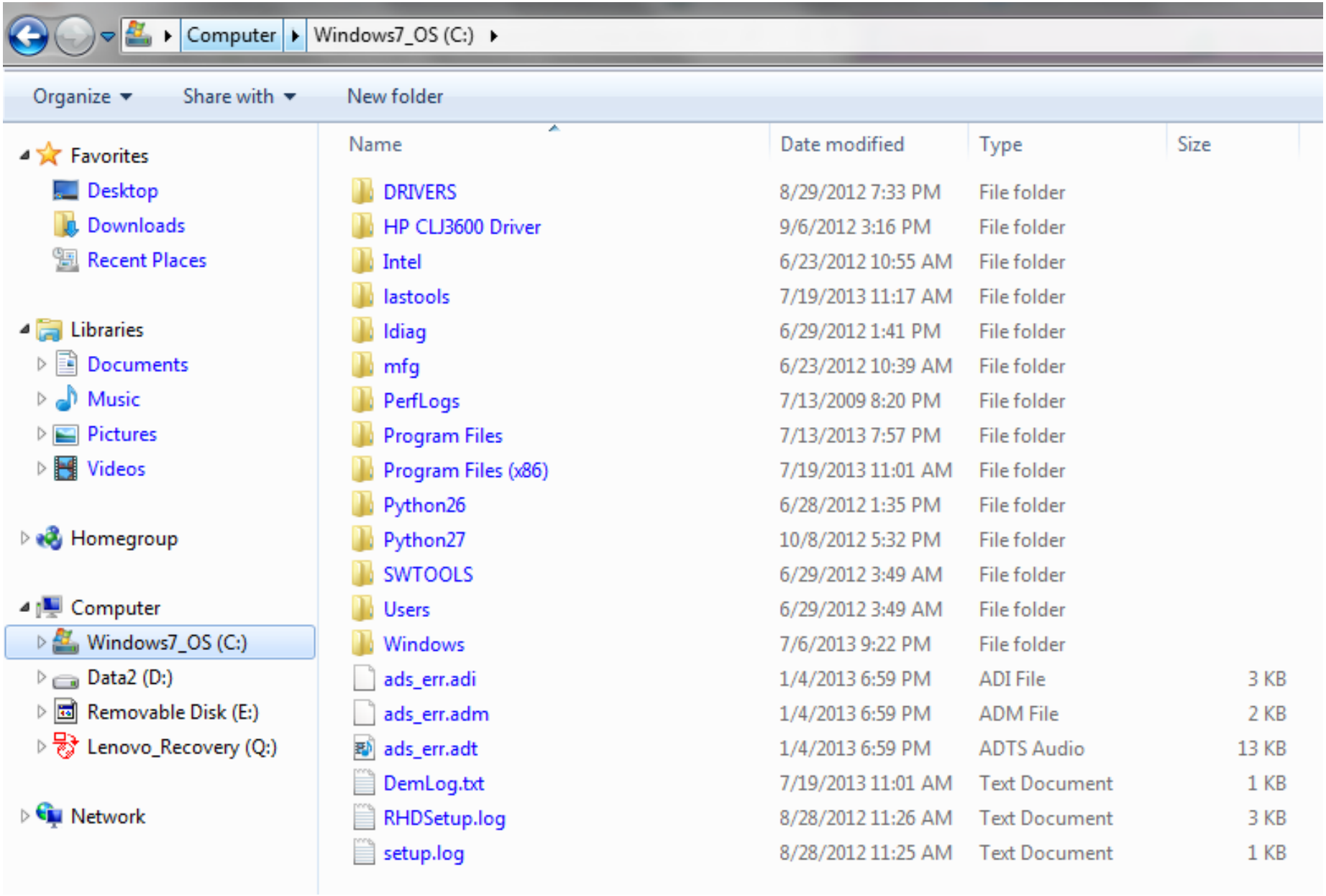
rapidlasso

now with GUIs and ArcGIS toolbox

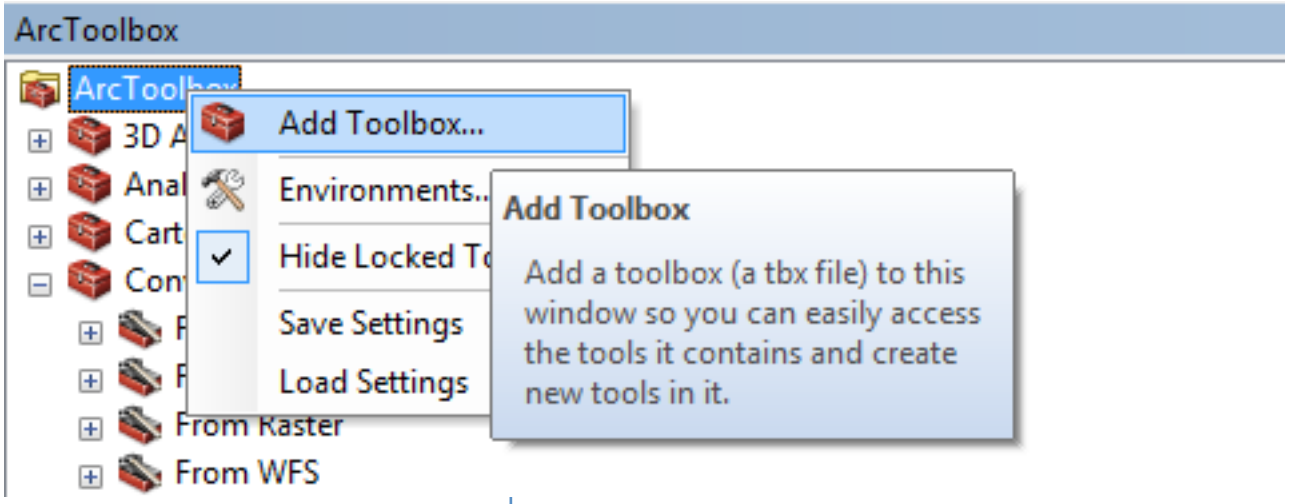


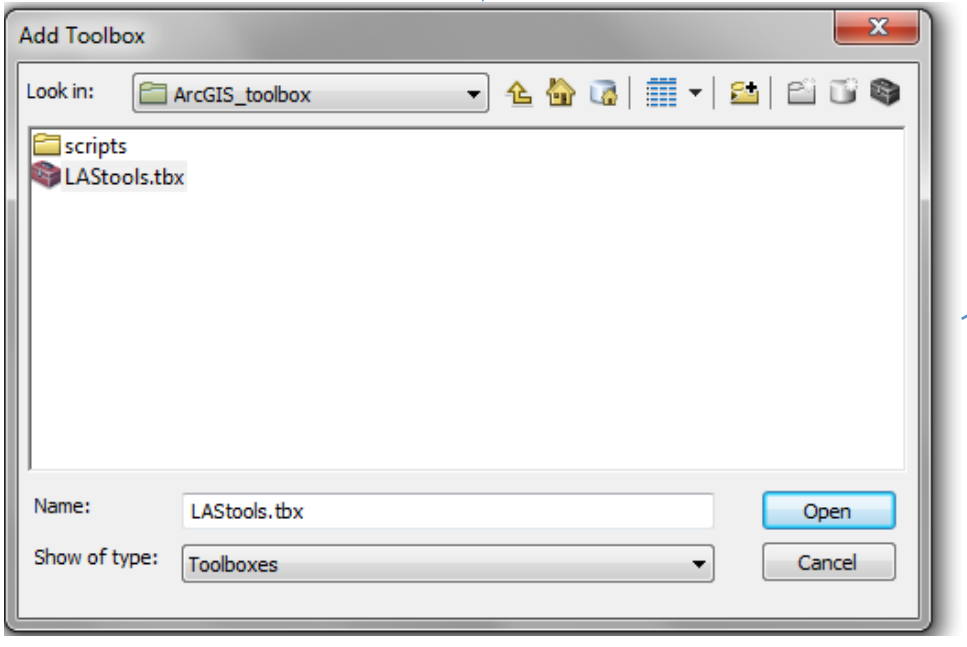
abstract:
We provide an easy-to-use, ultra-light-weight, very efficient C++ programming API called LASlib (with LASzip DLL) that implements reading and writing of LiDAR points from and to the ASPRS LAS forma
compressed, but otherwise identical twin --- the LAZ format (see below). All source code (LGPL) is included.

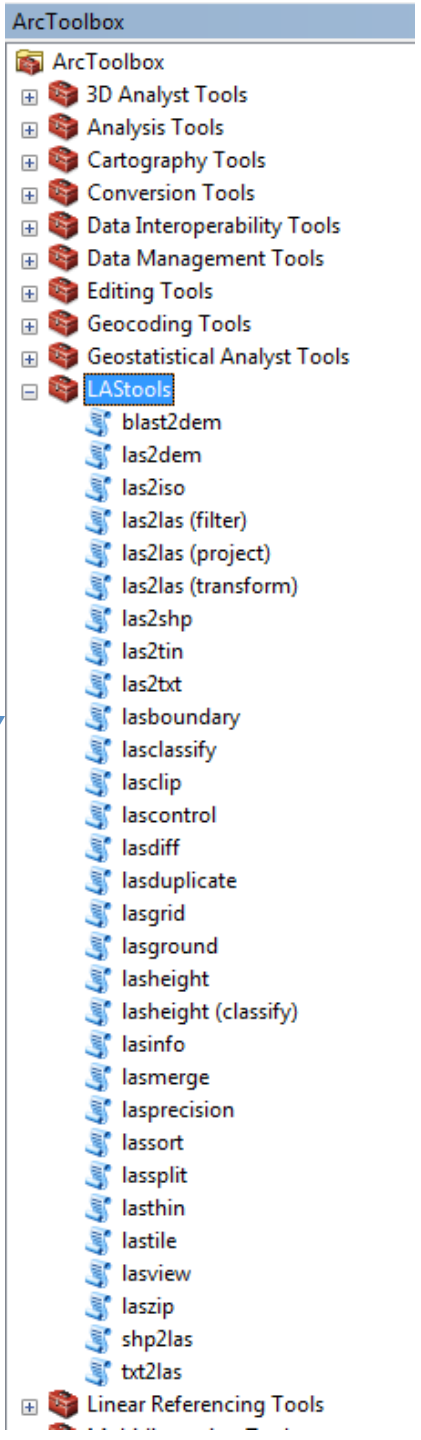
Install LASTOOLS somewhere like C:

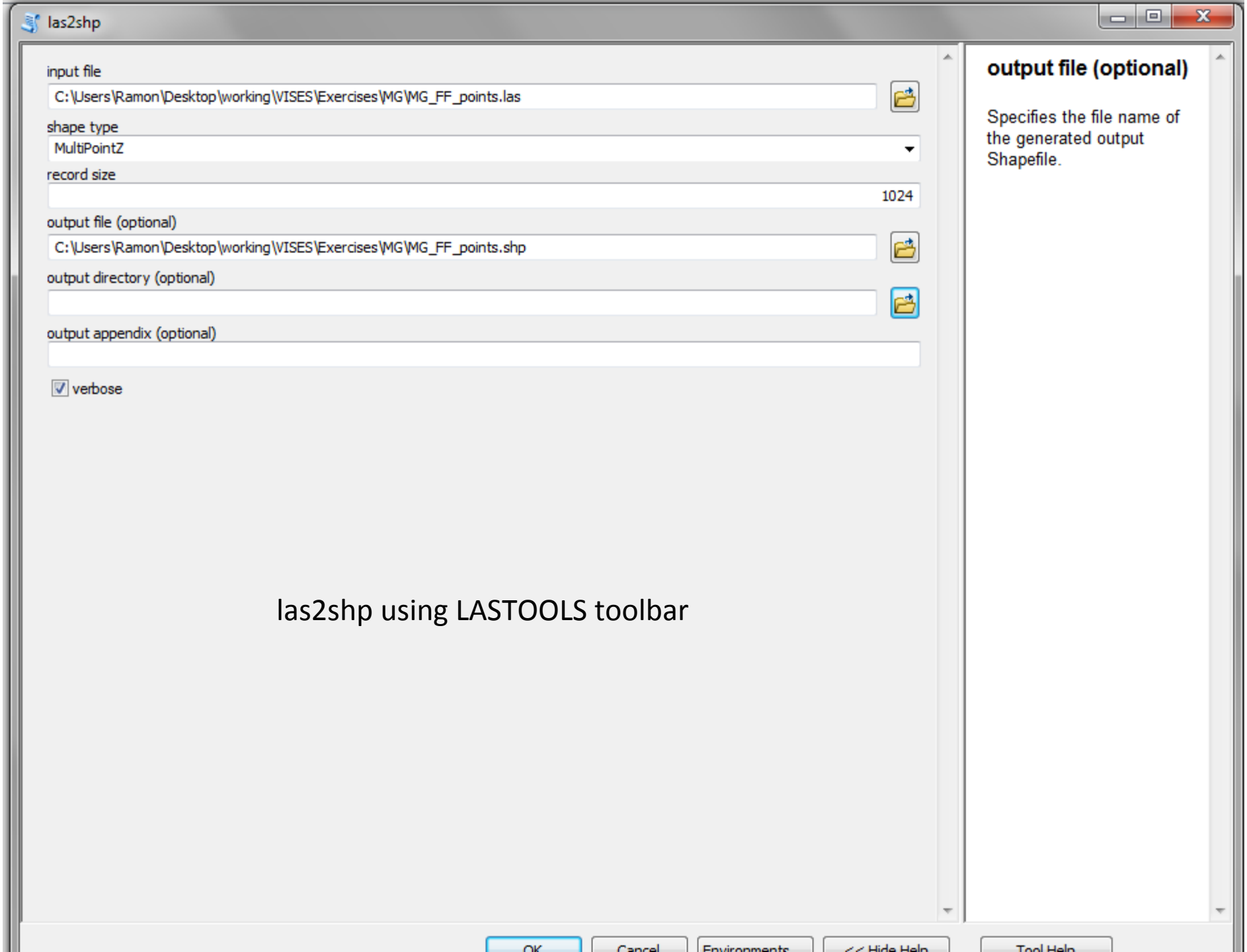


Install LASTOOLS arc toolbar

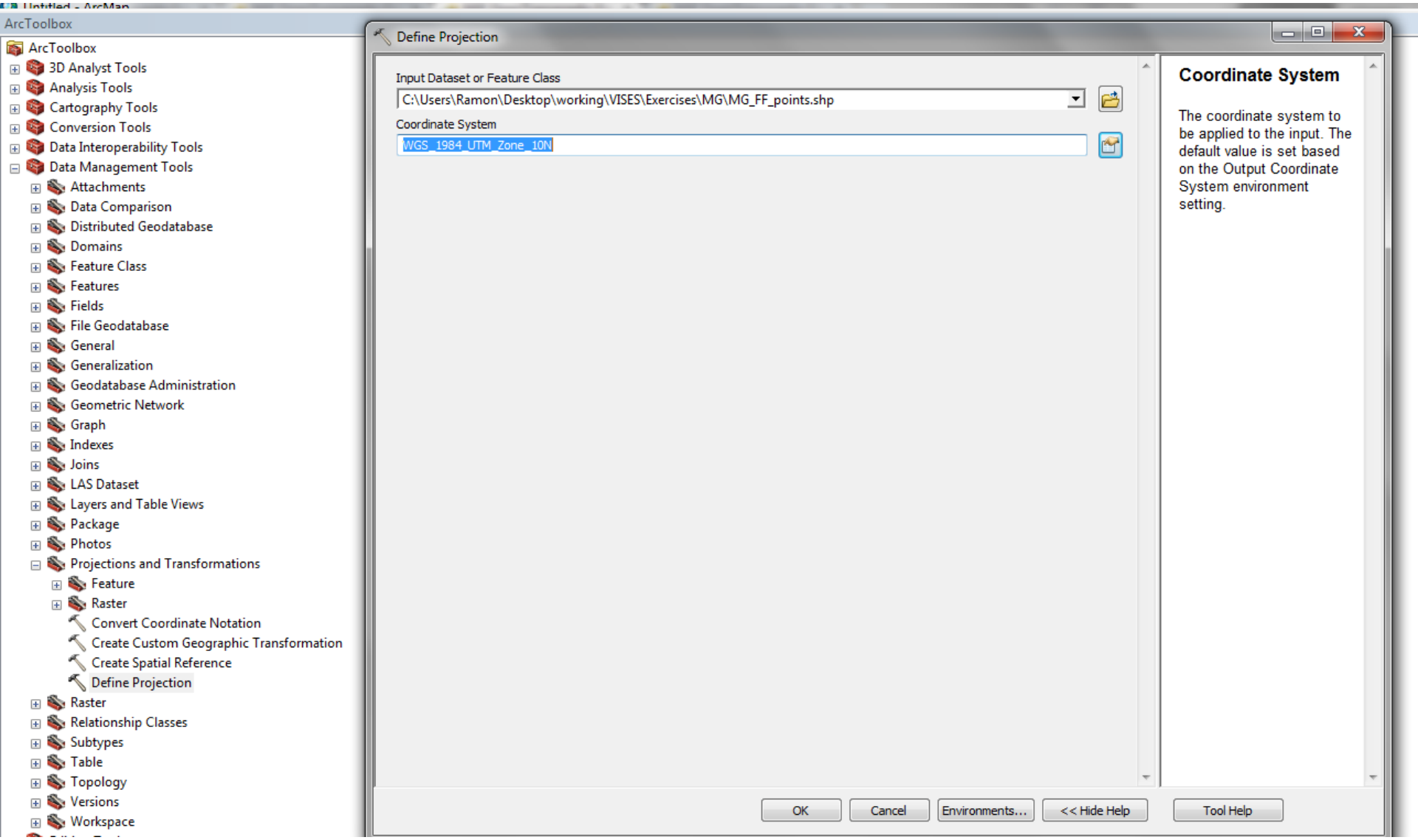




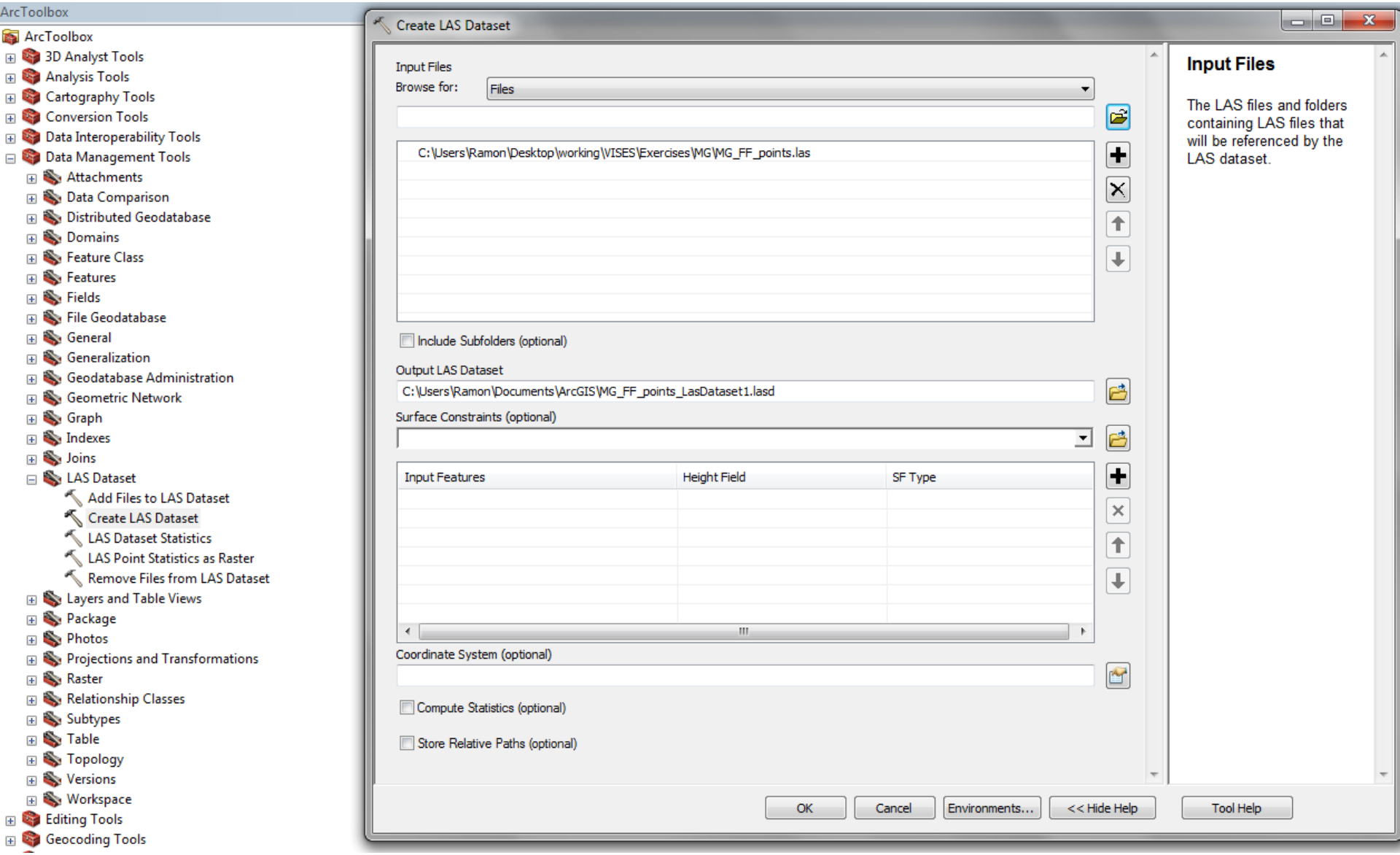



las2shp
input file
C:\Users\Ramon\Desktop\working\VISES\Exercises\MG\MG_FF_points.las
shape type
MultiPointZ
record size
1024
output file (optional)
C:\Users\Ramon\Desktop\working\VISES\Exercises\MG\MG_FF_points.shp
output directory (optional)
output appendix (optional)
verbose
output file (optional)
Specifies the file name of the generated output Shapefile.
las2shp using LASTOOLS toolbar
OK
Cancel
Environments...
<< Hide Help
Tool Help

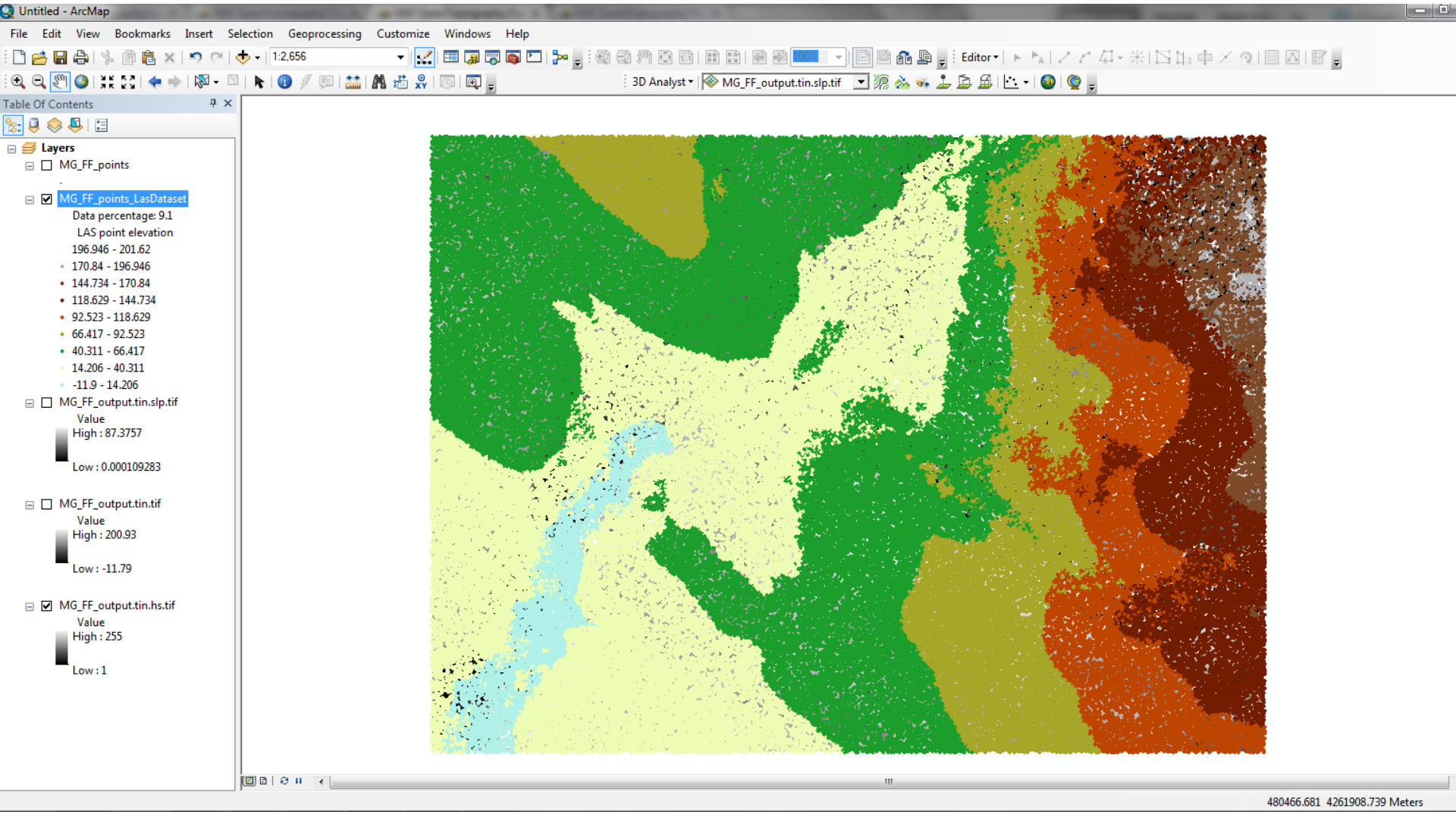
Need to define the projection for the shapefile



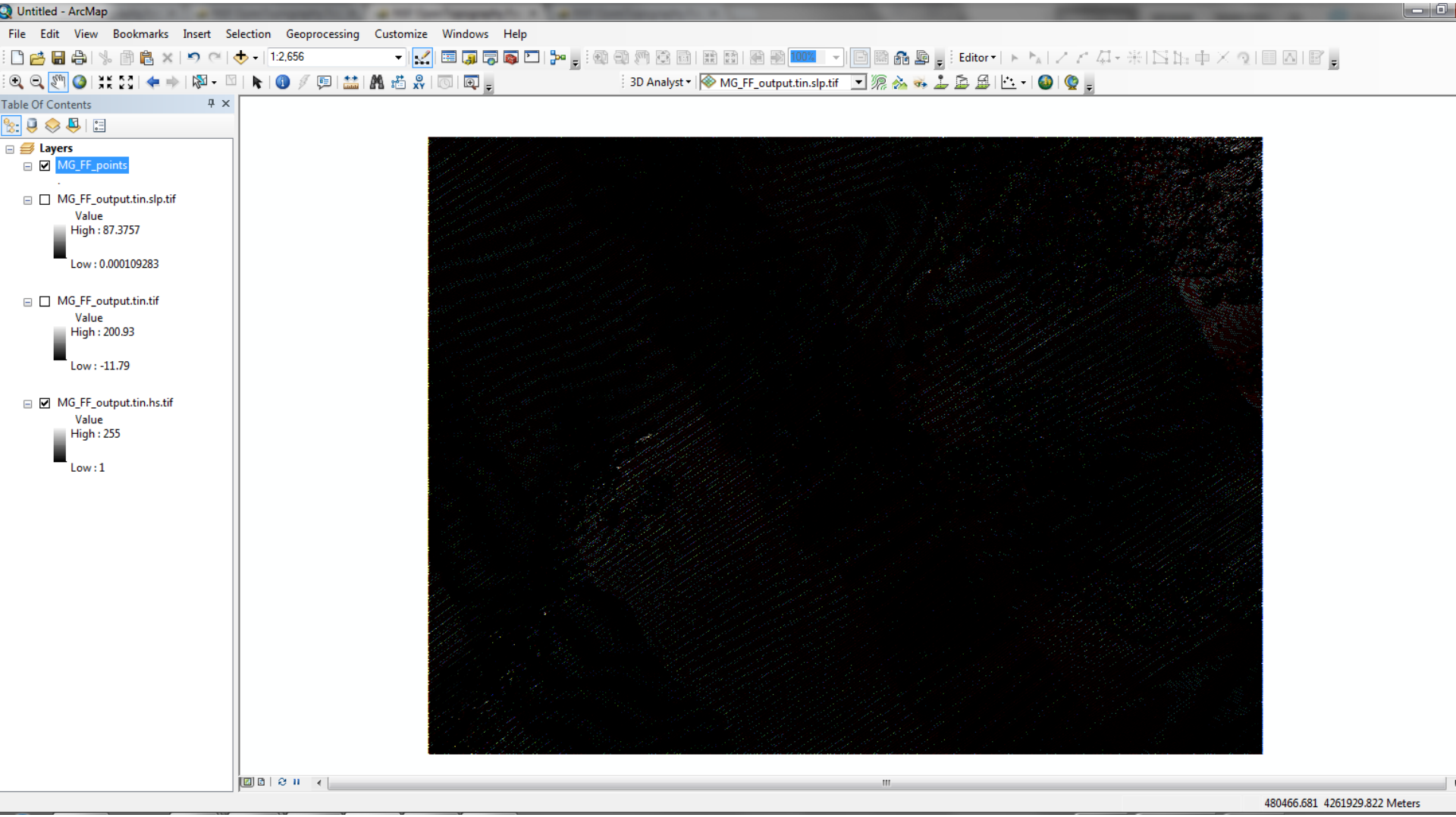
Need to make a las dataset in Arc



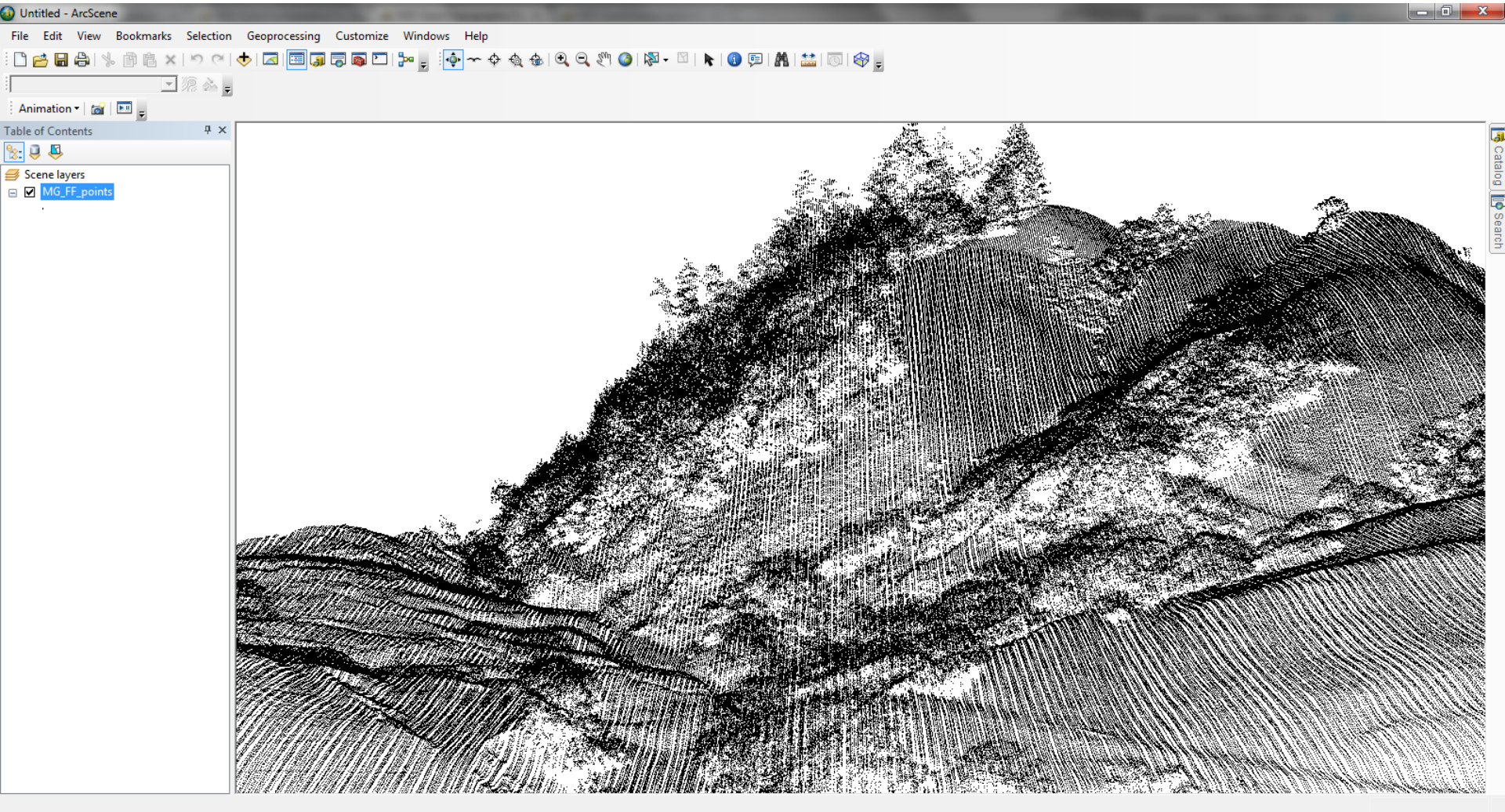
LAS dataset in ArcMap



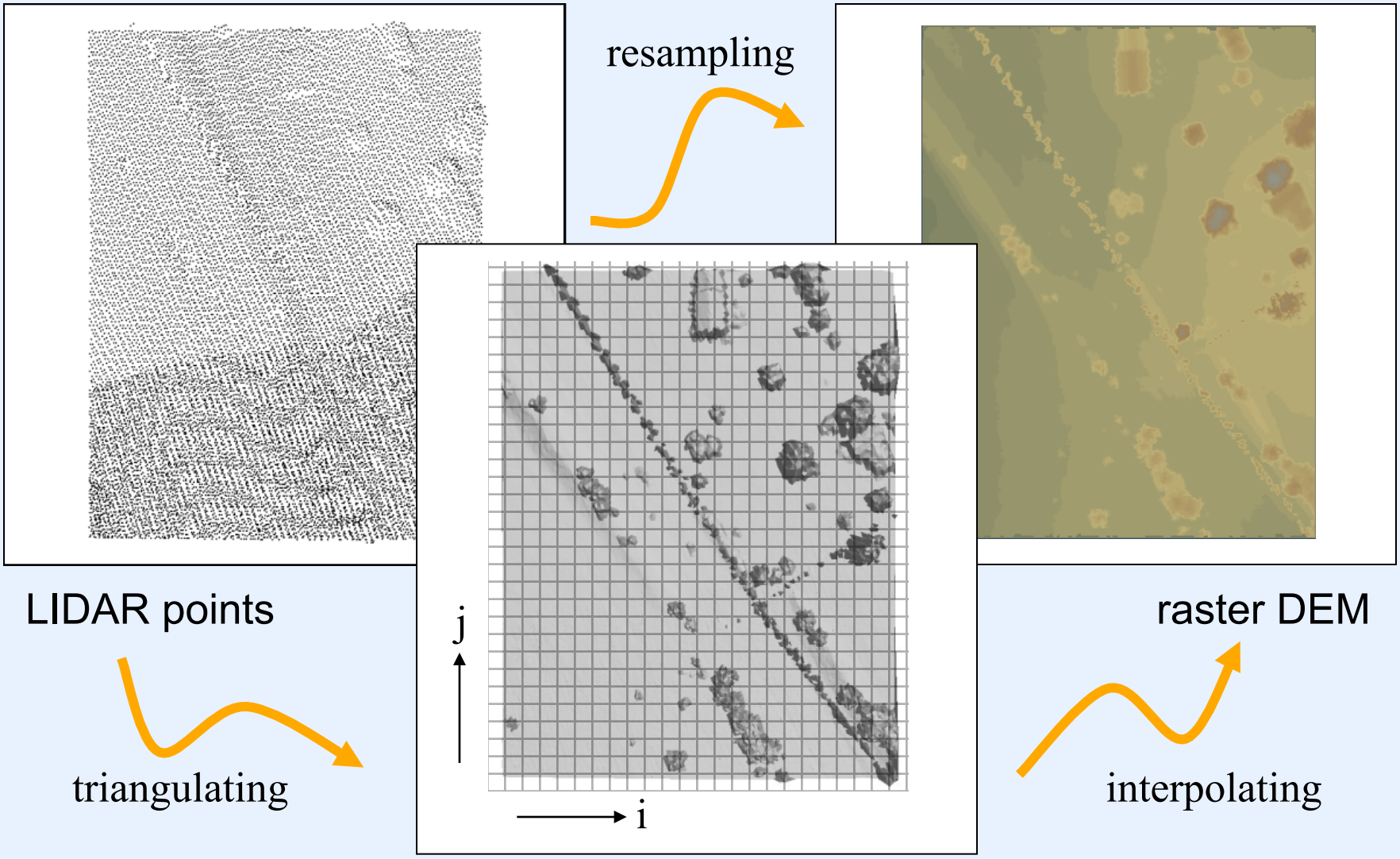
LAS file in ArcMap



LAS file in ArcScene



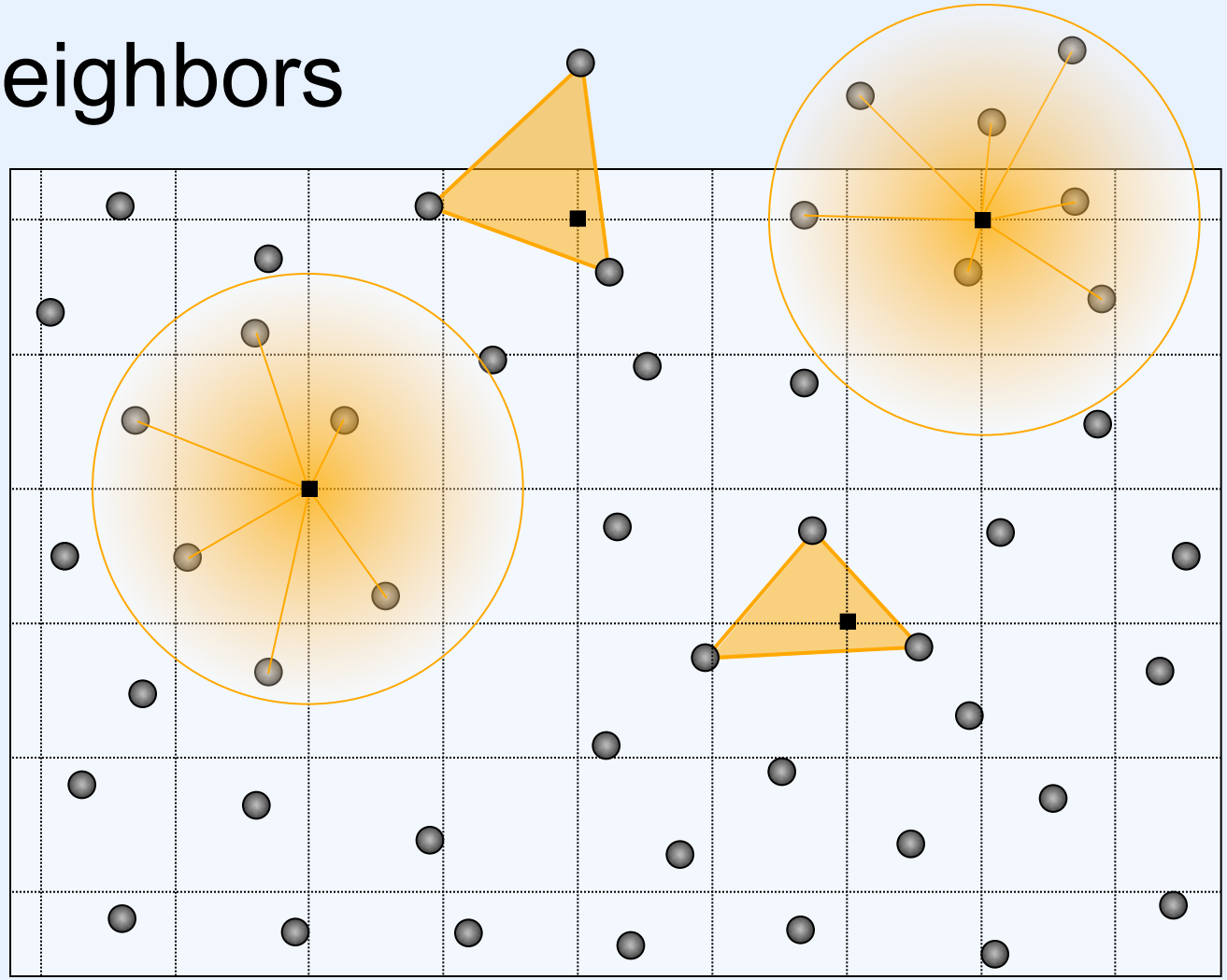
Generating DEMs from LIDAR



Isenburg, et al., 2006

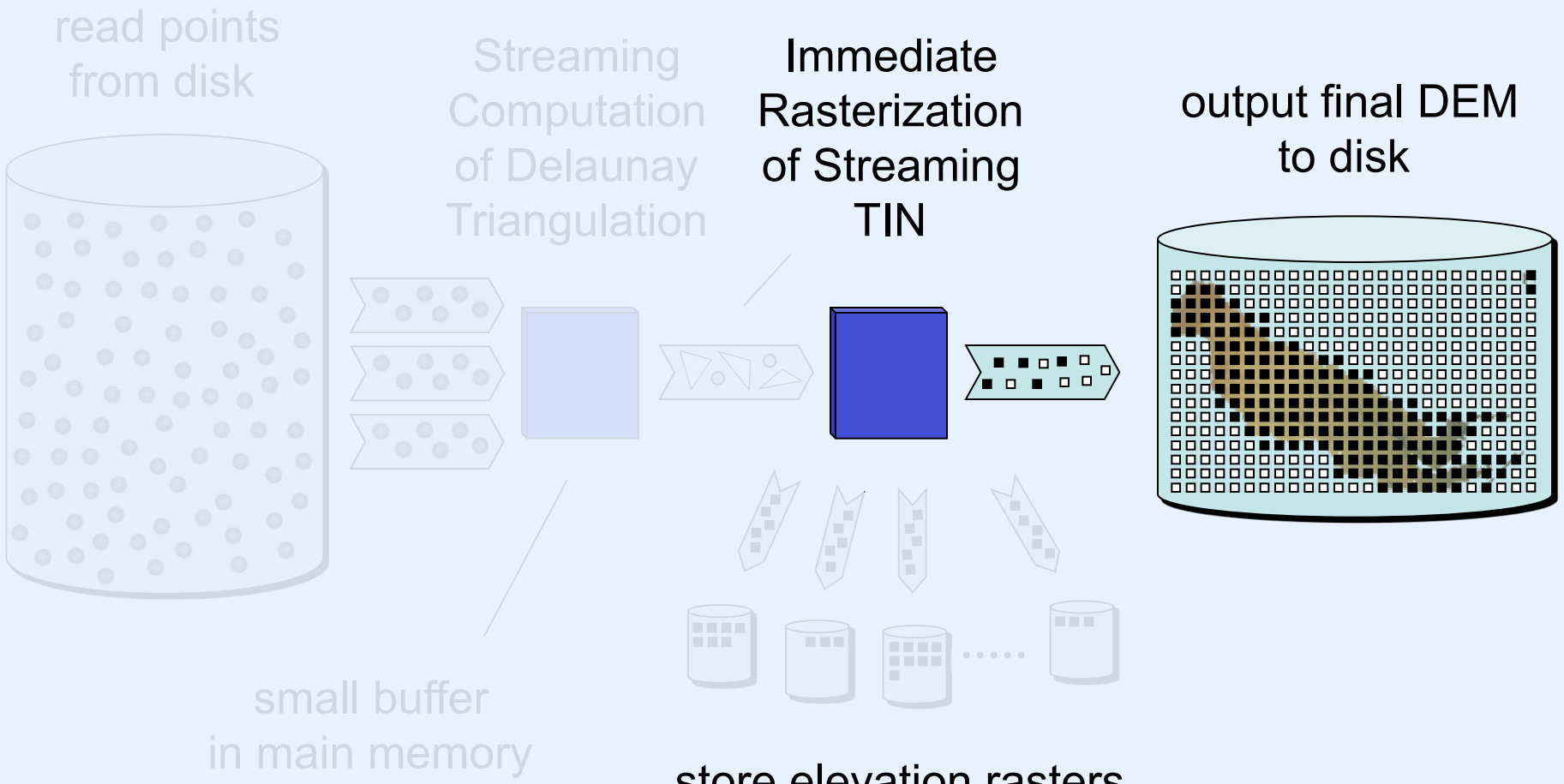
Interpolation Methods

- Inverse Distance Weighting (IDW)
- Natural Neighbors
- Kriging
- Splines
- TIN
  - linear
  - quintic
- …



Isenburg, et al., 2006

DEM Generation via TIN Streaming

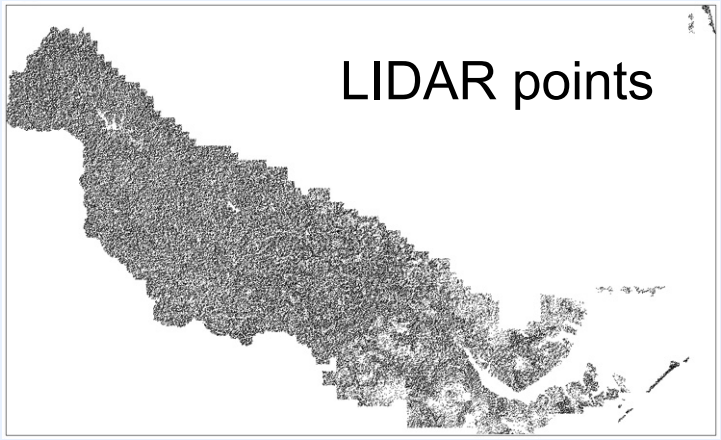


Isenburg, et al., 2006

Example Result

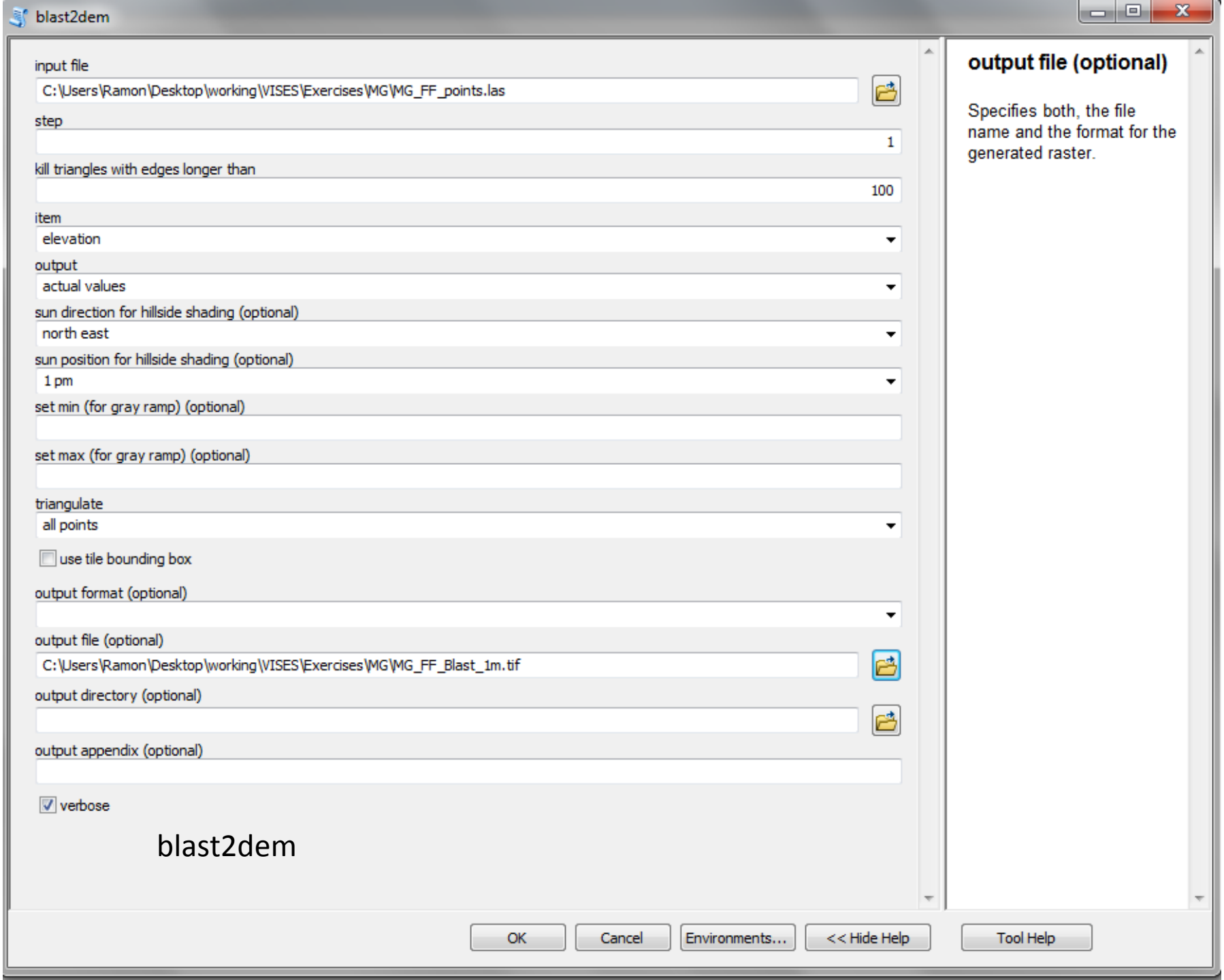
500,141,313 Points
11 GB
(binary, xyz, doubles)

50,394×30,500 DEM
3 GB
(binary, BIL, 16 bit, 20 ft)

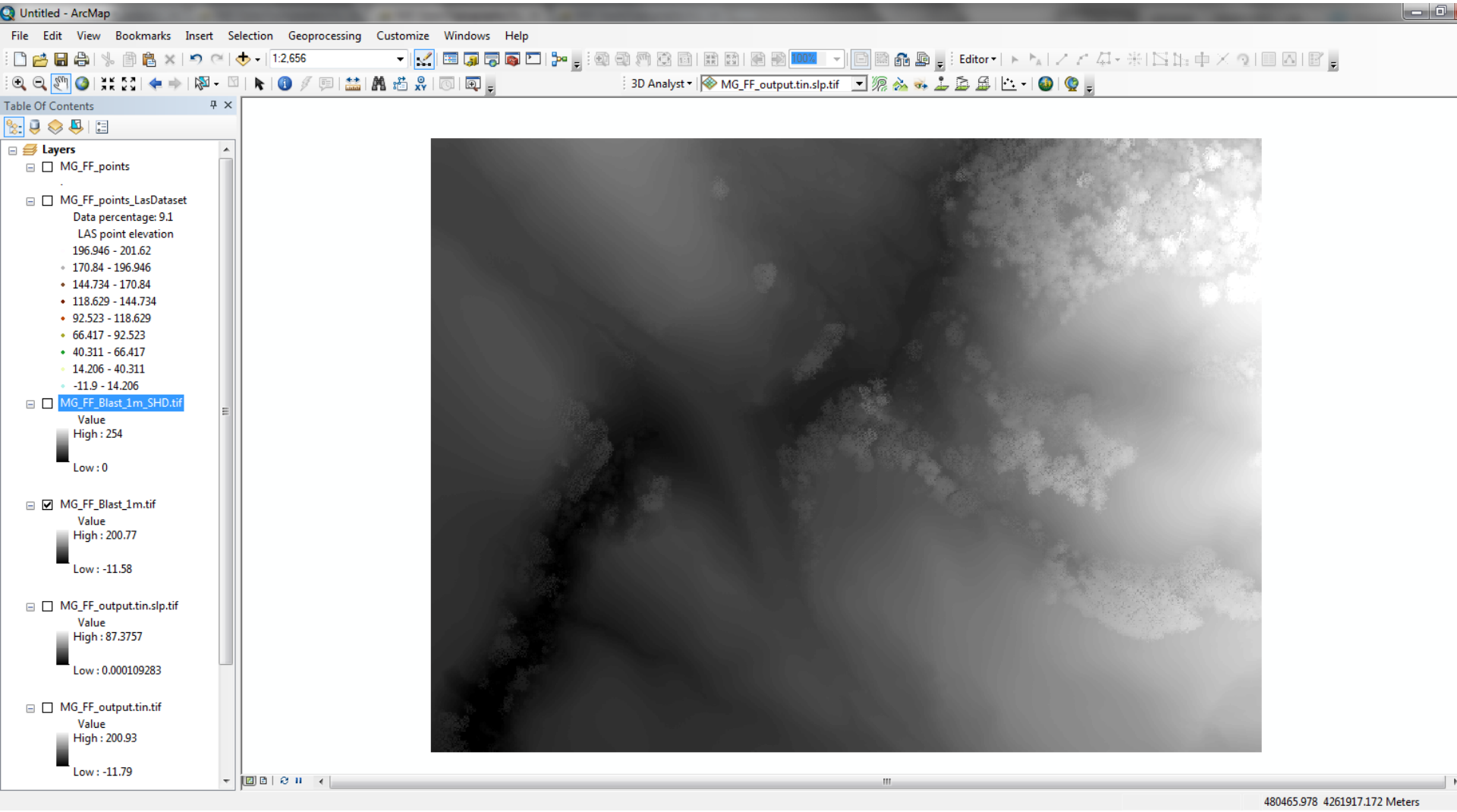


- on a household laptop with two harddisks
- in 67 minutes
- 64 MB of main memory
- 270 MB temporary disk space

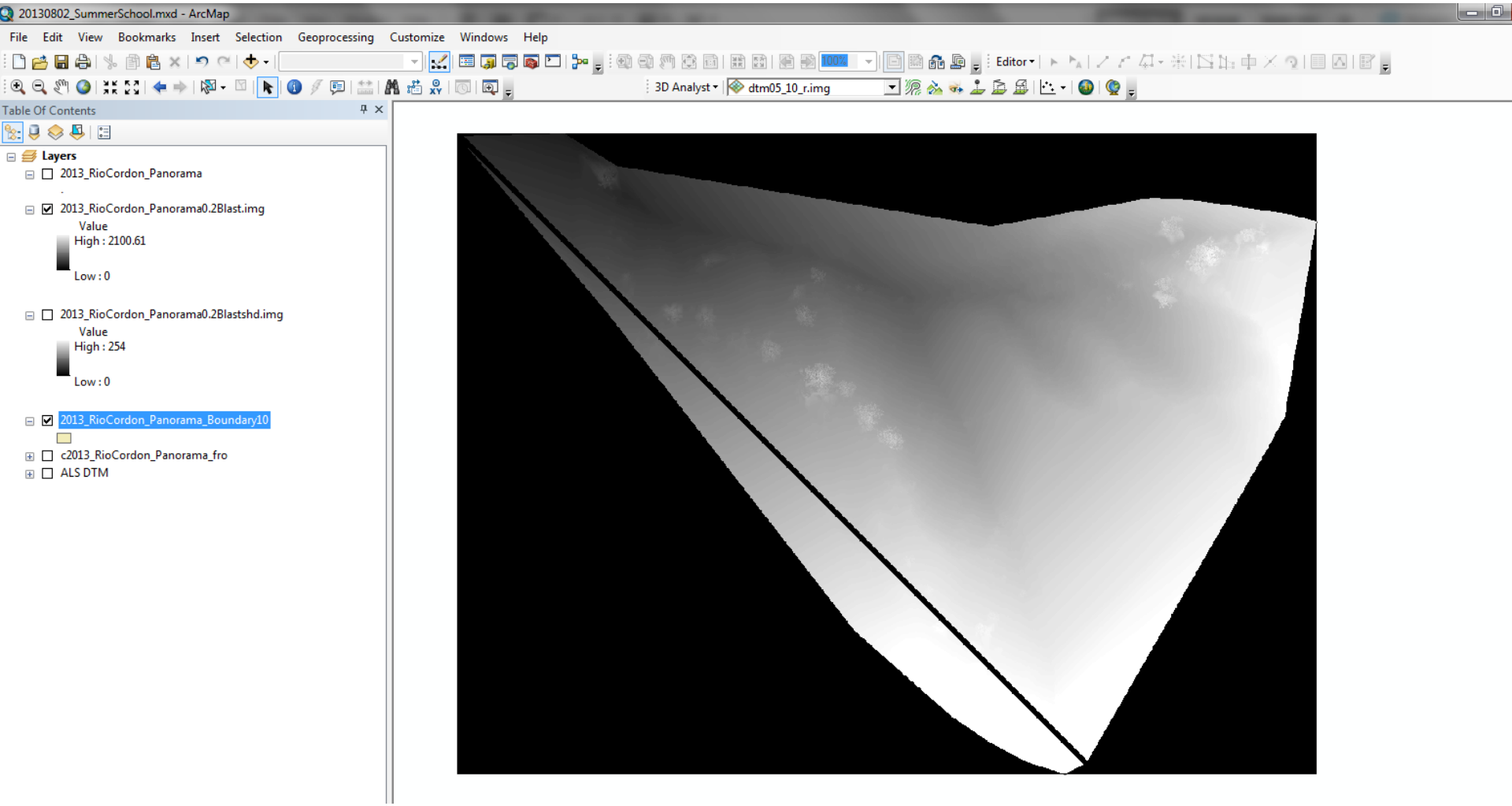
Isenburg, et al., 2006


blast2dem
input file
C:\Users\Ramon\Desktop\working\VISES\Exercises\MG\MG_FF_points.las
step
1
kill triangles with edges longer than
100
item
elevation
output
actual values
sun direction for hillside shading (optional)
north east
sun position for hillside shading (optional)
1 pm
set min (for gray ramp) (optional)
set max (for gray ramp) (optional)
triangulate
all points
use tile bounding box
output format (optional)
output file (optional)
C:\Users\Ramon\Desktop\working\VISES\Exercises\MG\MG_FF_Blast_1m.tif
output directory (optional)
output appendix (optional)
verbose
blast2dem
output file (optional)
Specifies both, the file name and the format for the generated raster.
OK
Cancel
Environments...
<< Hide Help
Tool Help

BLAST2DEM DEM



BLAST2DEM DEM



Strip: "…it's a licensing issue. to get around it (for academic or personal use) you can simply use lastile to make it small enough and then run blast2dem on smaller tiles and then recomposite with GDAL. "—Martin Isenburg

In this section

Tools
Contribute
OTforge

Points2Grid

General Information:

Tool Type:	DEM generation
Description:	Points2Grid is a robust and scalable tool for gridding LIDAR point cloud data to generate Digital Elevation Models (DEMs). Points2Grid uses a local gridding method to compute grid cell elevation using a neighborhood defined around each cell based on a search radius provided by the user (see image below). Points2Grid offers two processing modes - in-core and out-of-core - to allow it to handle generation of rasters larger than available memory.
Keywords:	gridding, P2G, point cloud, binning, local gridding, DEM
Licensing:	BSD license
Cost:	Free

Version History:

Version	Note	Update Time
1.0.1		18 Jul 2011
1.0		23 Jun 2011

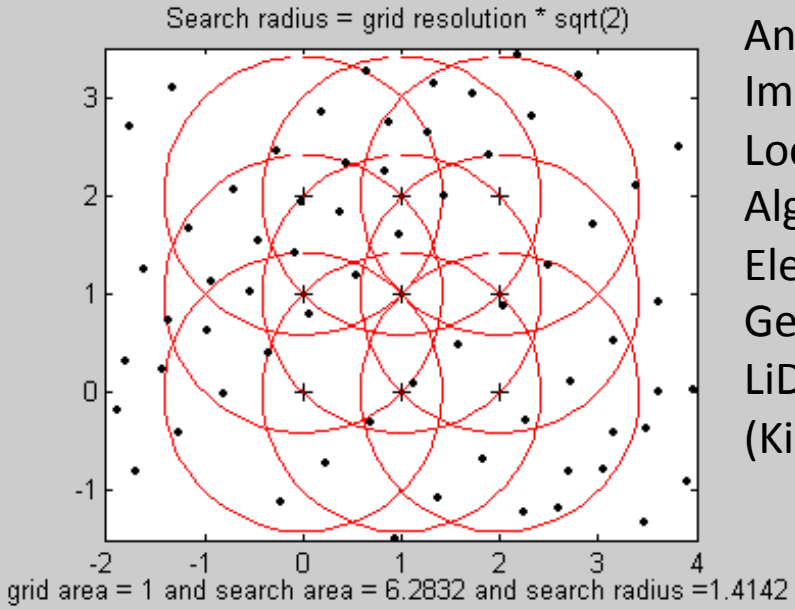
Download URL:	http://sourceforge.net/projects/otforge/files/points2grid/1.0.1/
Project URL:	http://www.opentopography.org/index.php/resources/otforge/points2grid

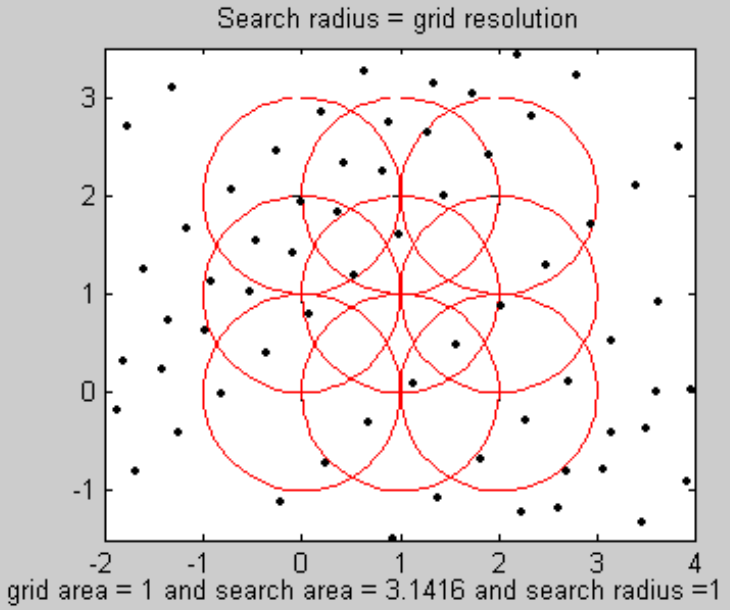
Technical Information:

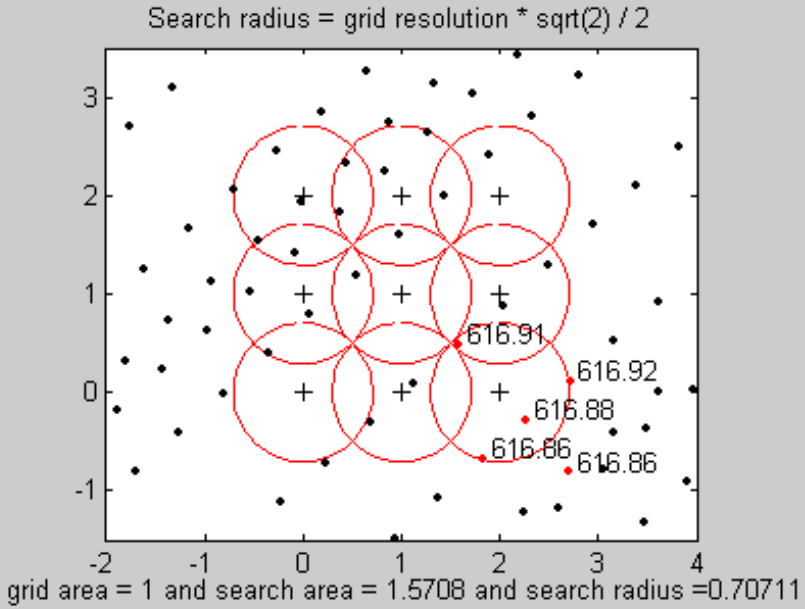
OS:	Mac, Unix, Linux, Other
Code Type:	Libraries/Source code
Language:	C++
Dependencies:	curl (tested to work with version 7.20.0 of libcurl) and liblas (tested to work with version 1.2.1 of liblas)

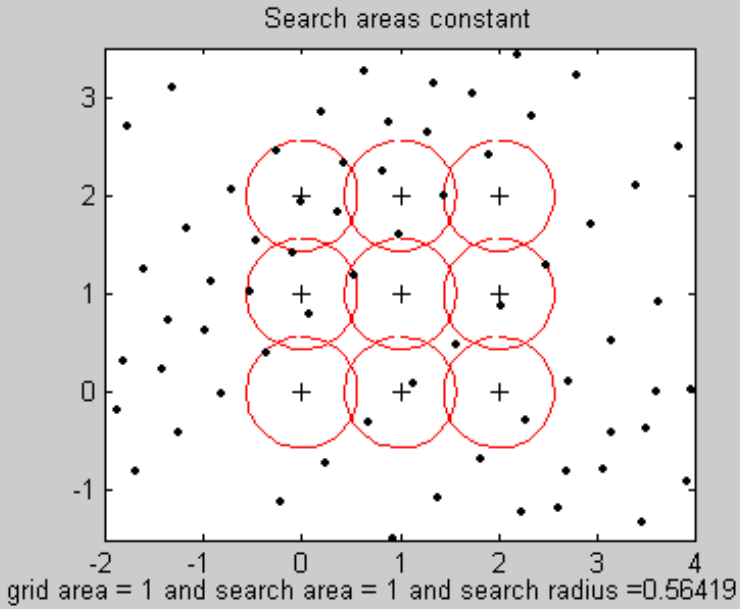
[Windows version: http://lidar.asu.edu/points2grid.html](http://lidar.asu.edu/points2grid.html)

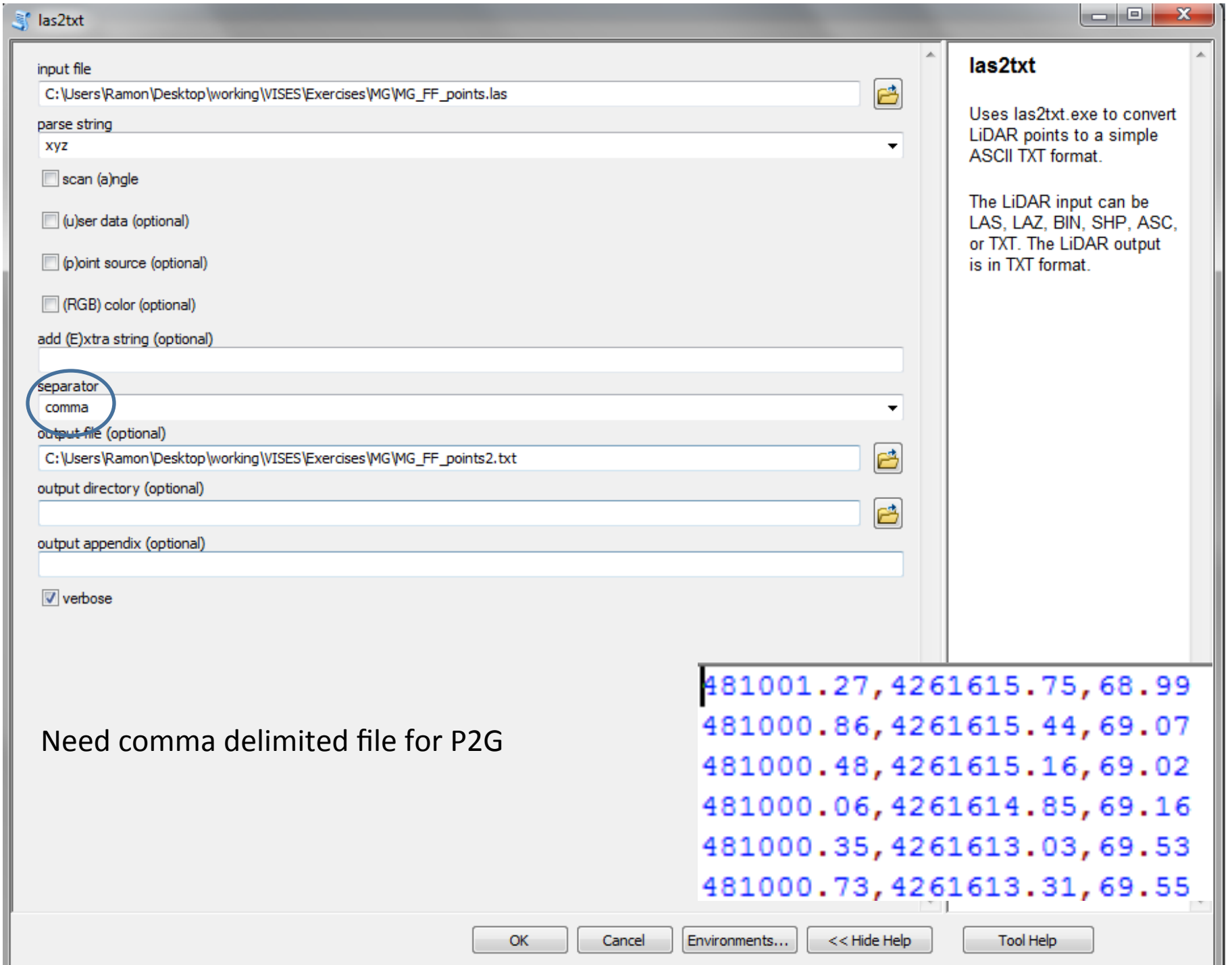
An Efficient Implementation of a Local Binning Algorithm for Digital Elevation Model Generation of LiDAR/ALSM Dataset (Kim, et al., 2006)



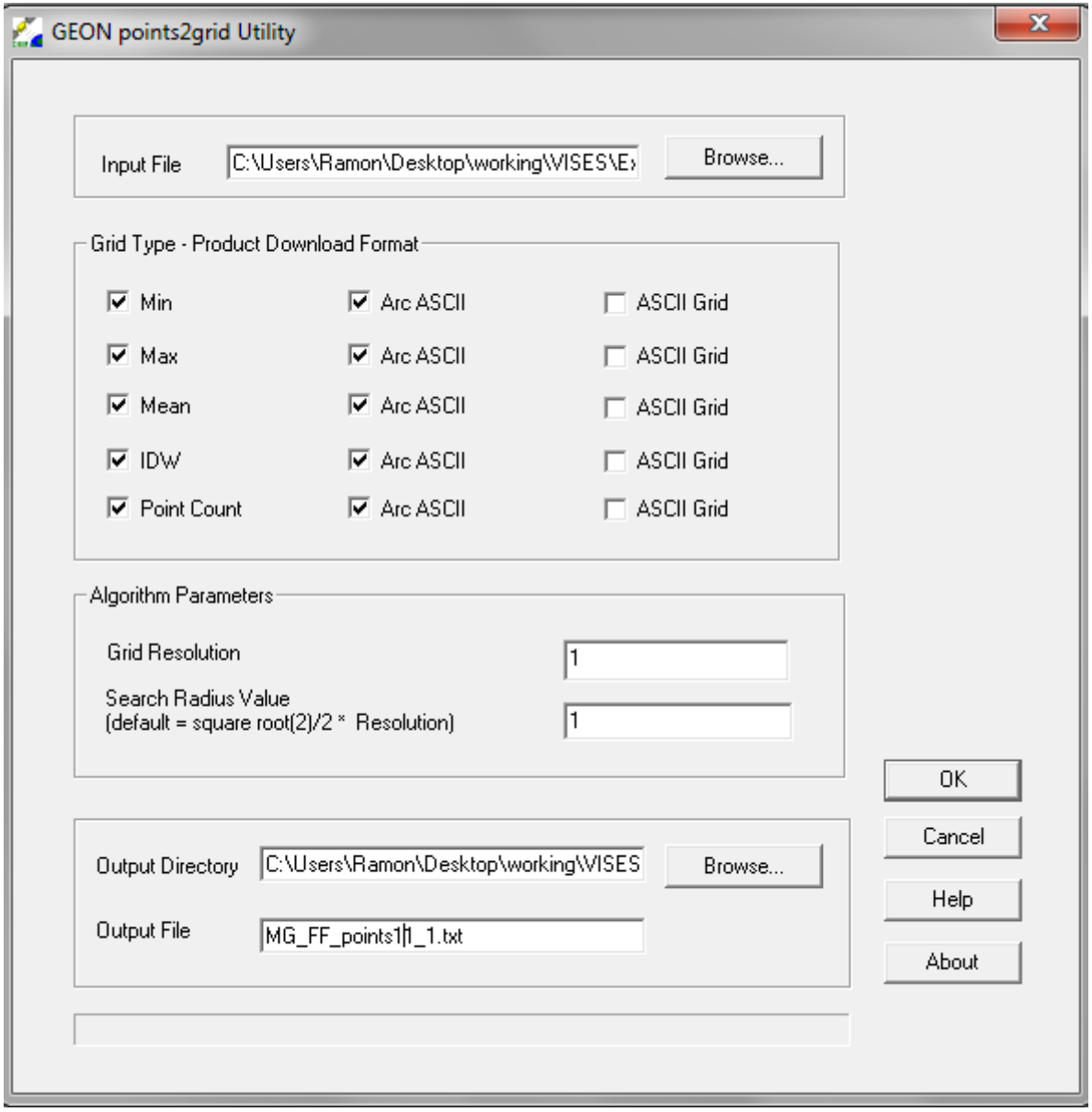


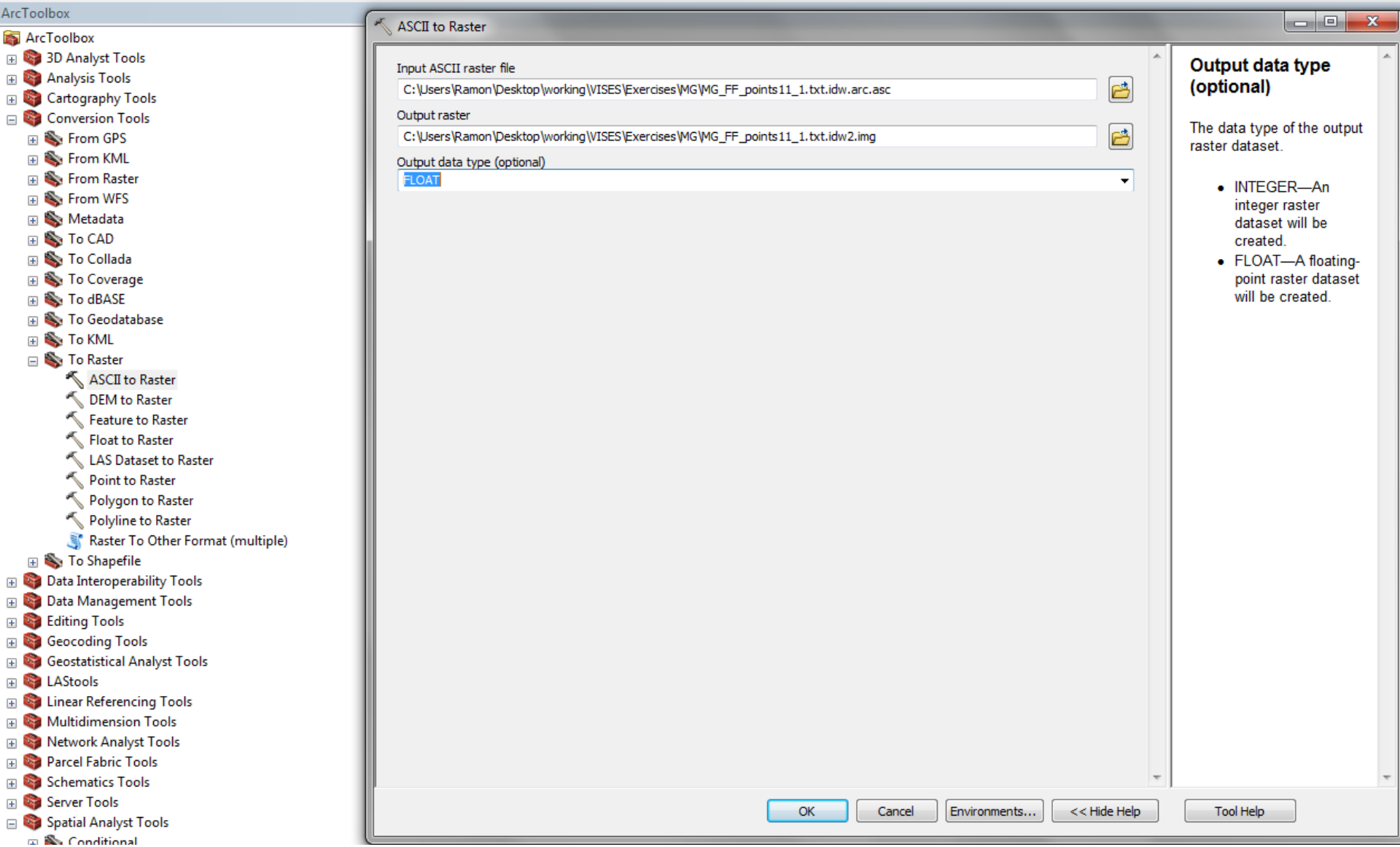




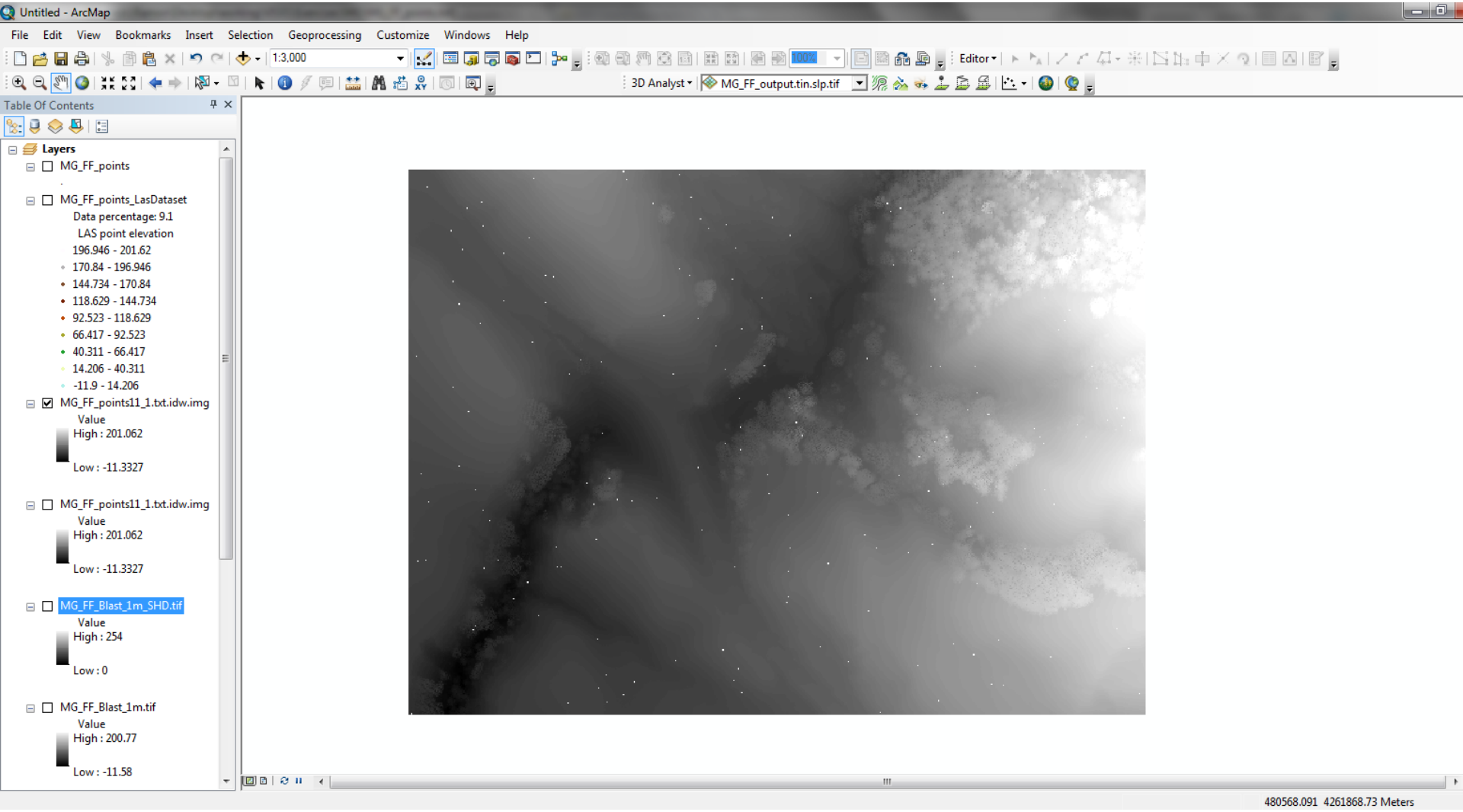


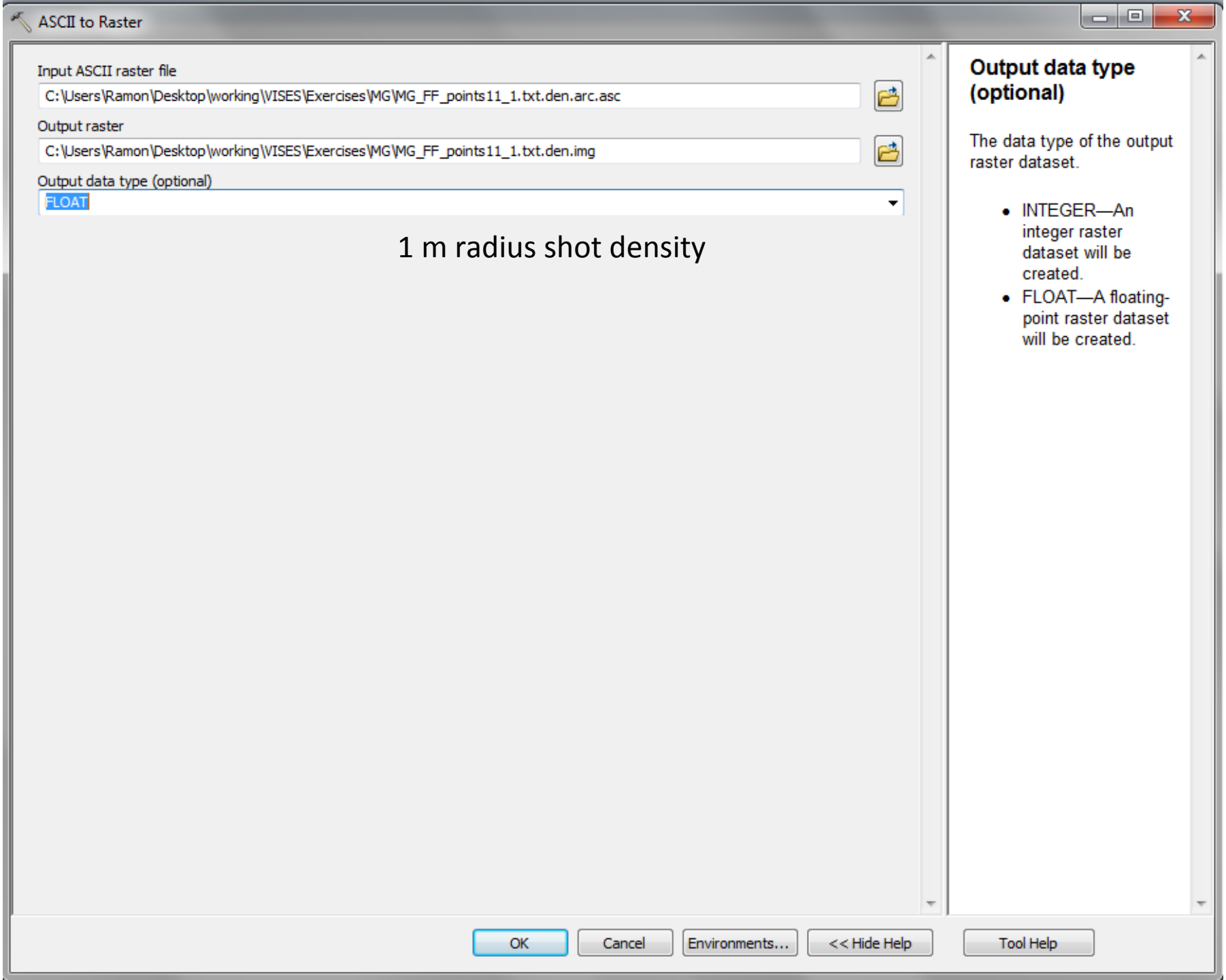
Need comma delimited file for P2G


GEON points2grid Utility
Input File
C:\Users\Ramon\Desktop\working\VISES\E
Browse...
Grid Type - Product Download Format
Min
Arc ASCII
ASCII Grid
Max
Arc ASCII
ASCII Grid
Mean
Arc ASCII
ASCII Grid
IDW
Arc ASCII
ASCII Grid
Point Count
Arc ASCII
ASCII Grid
Algorithm Parameters
Grid Resolution
1
Search Radius Value
(default = square root(2)/2 * Resolution)
1
OK
Cancel
Help
About
Output Directory
C:\Users\Ramon\Desktop\working\VISES
Browse...
Output File
MG_FF_points1|1_1.txt

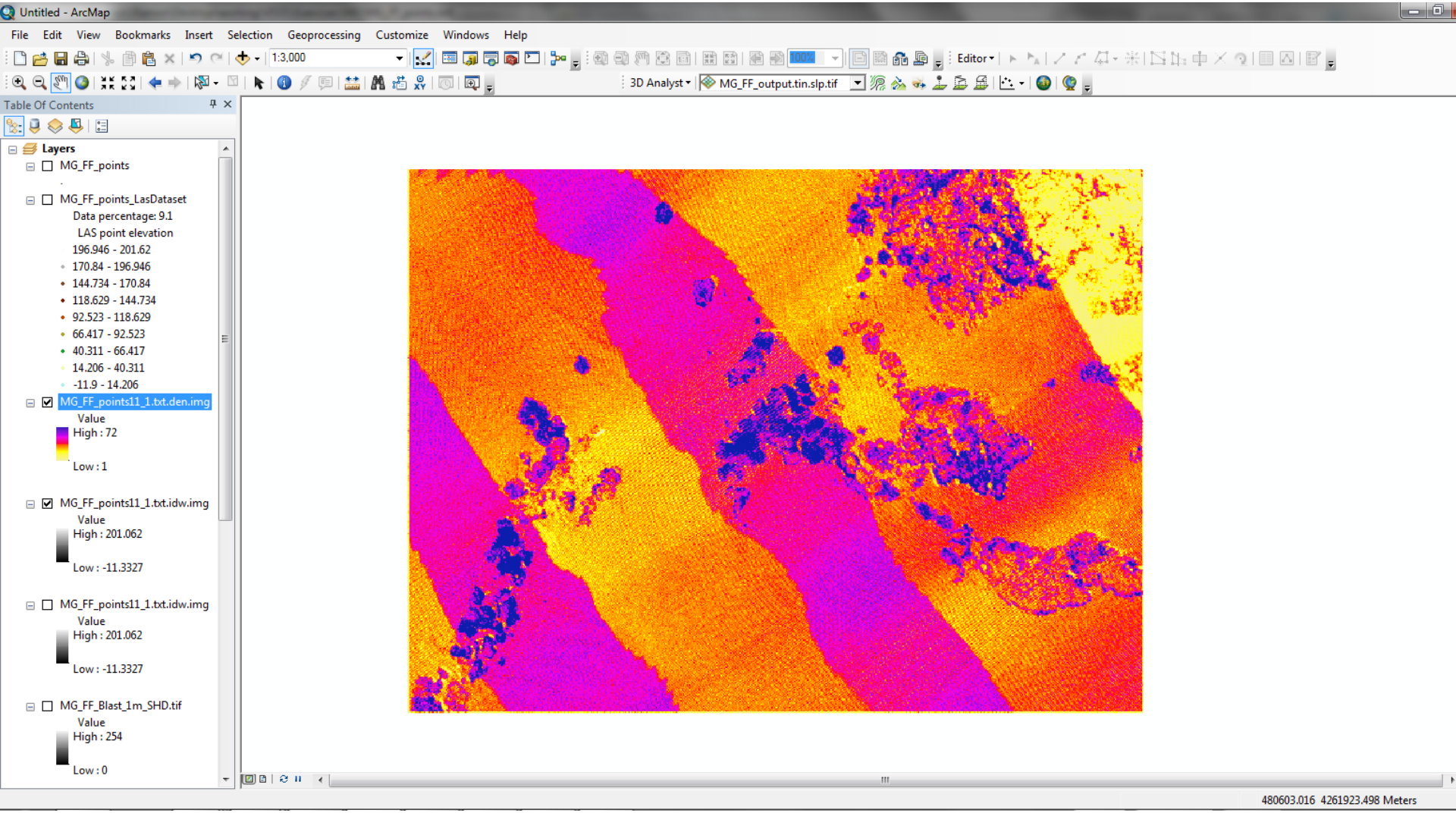

ArcToolbox
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
From GPS
From KML
From Raster
From WFS
Metadata
To CAD
To Collada
To Coverage
To dBASE
To Geodatabase
To KML
To Raster
ASCII to Raster
DEM to Raster
Feature to Raster
Float to Raster
LAS Dataset to Raster
Point to Raster
Polygon to Raster
Polyline to Raster
Raster To Other Format (multiple)
To Shapefile
Data Interoperability Tools
Data Management Tools
Editing Tools
Geocoding Tools
Geostatistical Analyst Tools
LAStools
Linear Referencing Tools
Multidimension Tools
Network Analyst Tools
Parcel Fabric Tools
Schematics Tools
Server Tools
Spatial Analyst Tools
Conditional
ASCII to Raster
Input ASCII raster file
C:\Users\Ramon\Desktop\working\VISES\Exercises\MG\MG_FF_points11_1.txt.idw.arc.asc
Output raster
C:\Users\Ramon\Desktop\working\VISES\Exercises\MG\MG_FF_points11_1.txt.idw2.img
Output data type (optional)
FLOAT
Output data type (optional)
The data type of the output raster dataset.
INTEGER—An integer raster dataset will be created.
FLOAT—A floating-point raster dataset will be created.
OK
Cancel
Environments...
<< Hide Help
Tool Help

1 m local binning dem



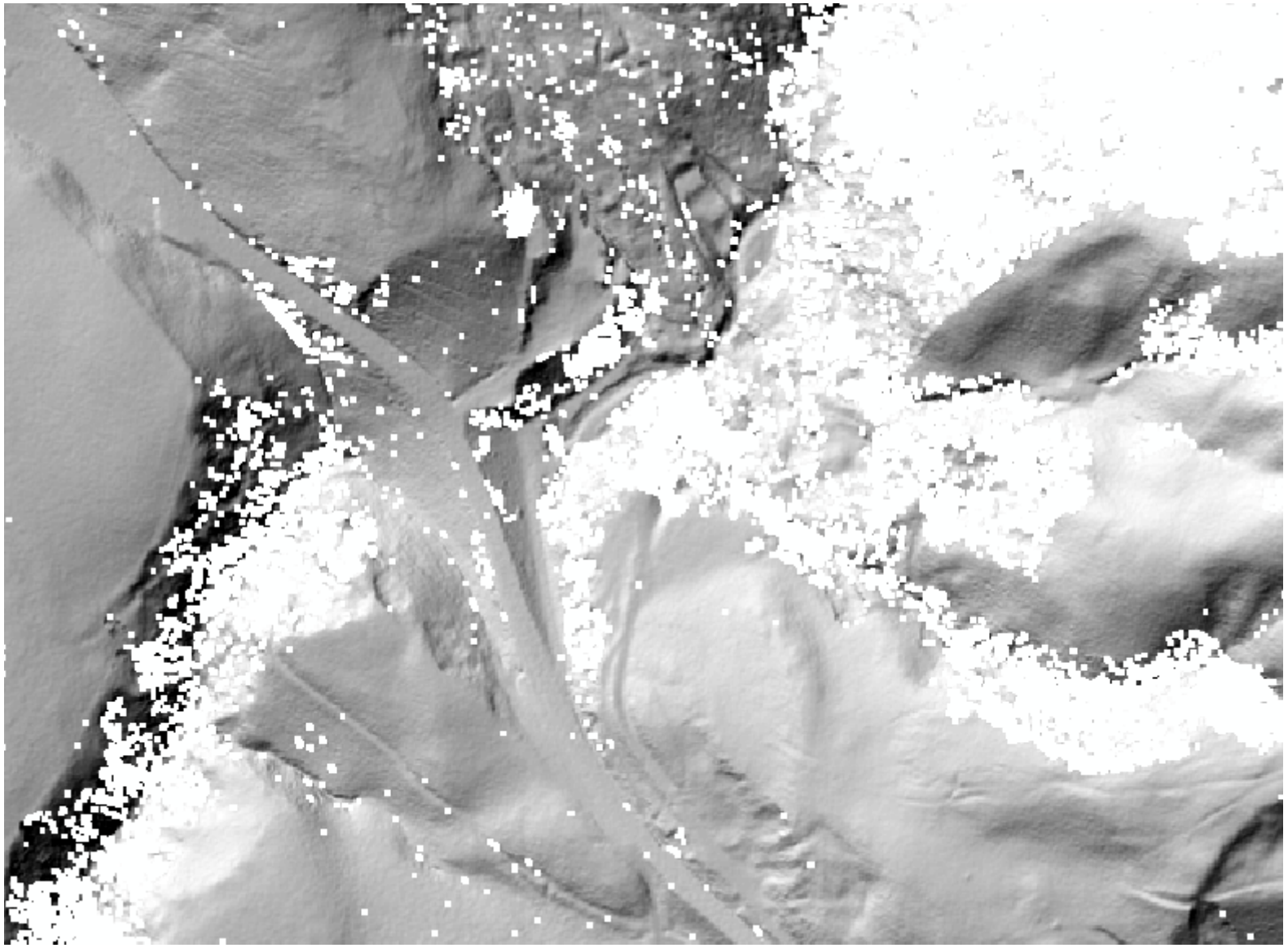

ASCII to Raster
Input ASCII raster file
C:\Users\Ramon\Desktop\working\VISES\Exercises\MG\MG_FF_points11_1.txt.den.arc.asc
Output raster
C:\Users\Ramon\Desktop\working\VISES\Exercises\MG\MG_FF_points11_1.txt.den.img
Output data type (optional)
FLOAT
1 m radius shot density
Output data type (optional)
The data type of the output raster dataset.
INTEGER—An integer raster dataset will be created.
FLOAT—A floating-point raster dataset will be created.
OK
Cancel
Environments...
<< Hide Help
Tool Help

1 m radius shot density



Ground returns only (TIN)

Ground returns only (1 m radius IDW)



Points over bare earth surface