Point Cloud to Raster

LAStools to ArcGIS

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THE UNIVERSITY OF UTAH

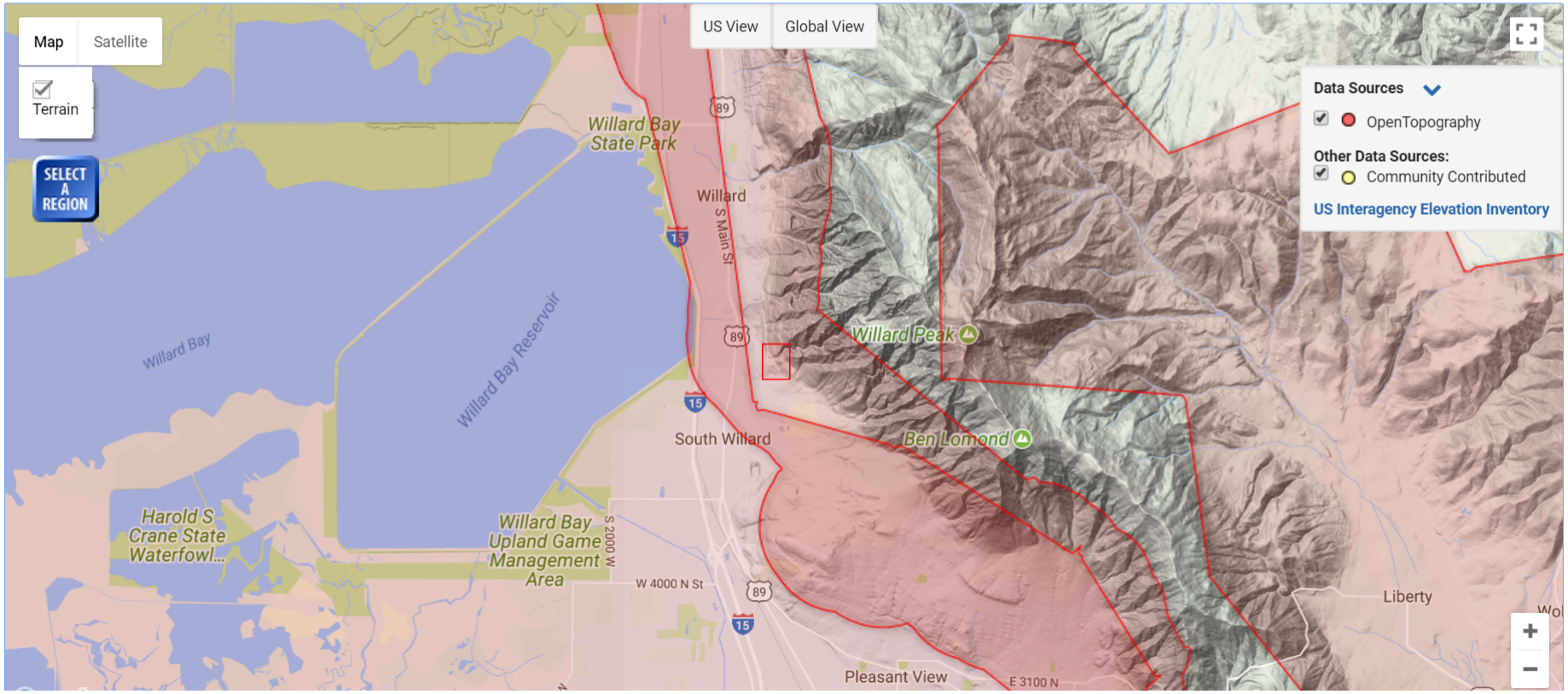
Tutorial notes

Applications of High Resolution Topography to Geologic Hazards in Utah
September, 2017, Salt Lake City, Utah

OpenTopography
High-Resolution Topography Data and Tools

Find Topography Data

Instructions

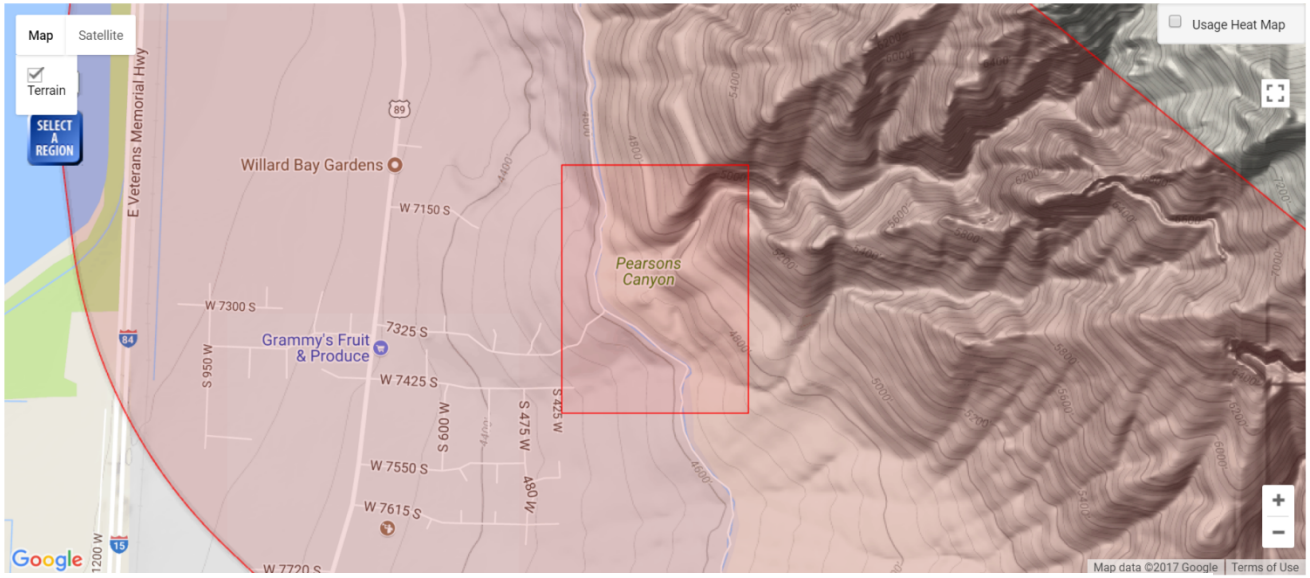


High Resolution Data | Global Data

1 State of Utah Acquired LiDAR Data - Wasatch Front — Raster Data | Point Cloud Data

State of Utah Acquired Lidar Data - Wasatch Front

1a. Select area of data to download or process



3A. DEM Generation (Streaming TIN)

Gridding Method

Calculate TIN

Unselect

1. Coordinates & Classification

Horizontal Coordinates: UTM Zone 12N, NAD83 (2011) [EPSG: 26912]
Vertical Coordinates: NAVD88 (GEOID12A) [EPSG: 5703]

Data Selection Coordinates: Manually enter selection coordinates (in the horizontal coordinate system listed above)

X_{min} = 414200.283785 Y_{min} = 4580776.748503 X_{max} = 414794.803033 Y_{max} = 4581560.78751

The selection area contains approximately 15,254,000 points.

Choose Return Classification — Ground — Unclassified

For now, don't select anything else

2. Point Cloud Data Download

Point cloud data in LAS format — Point cloud data in LAZ format — Point cloud data in ASCII format

Job Description

These options allow users to describe and keep track of their jobs. Information entered below is
archive accessed via myOpenTopo (available only to registered OpenTopography users).

Job title (up to 100 characters): UGS Pearsons Canyon demo

Job description (up to 500 characters): Job description

Enter your e-mail address for notification upon completion of processing: ramon.arrowsmith@asu.edu

SUBMIT

Point Cloud Job Report

Modify and resubmit this job
Full job metadata report

Download Job Metadata
View Job Configuration

Job Id	Dataset	Title	Submission	Completion	Duration	Num points	Final Status
pc1505615743550	UGS_Wasatch	UGS Pearsons Canyon demo	2017-09-16 19:35:44	2017-09-16 19:36:04	20 secs	14,014,140	Done ✔

Download Job Results

Point Cloud Results

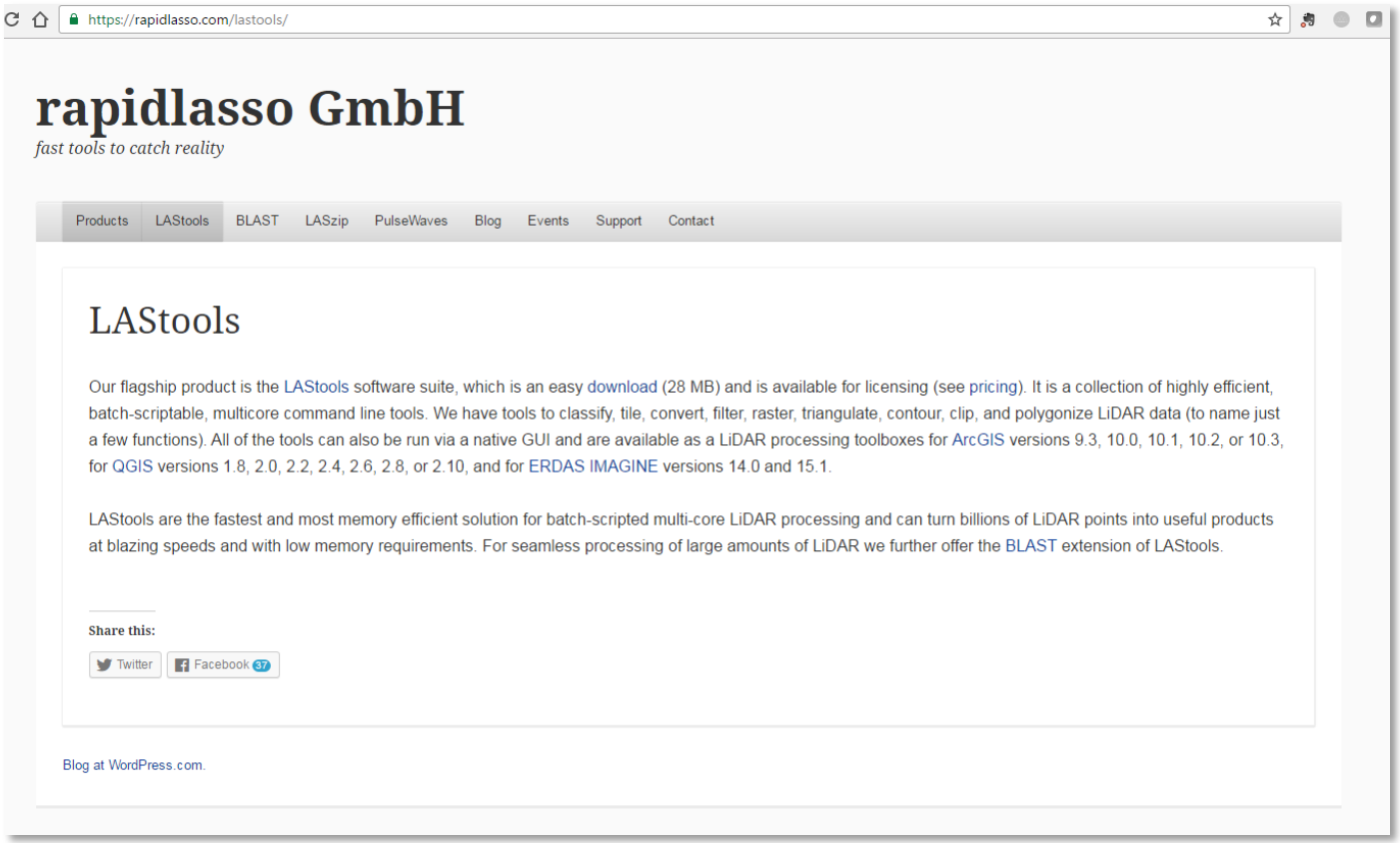
- Download point cloud data in LAZ format points.laz (63.3 MB)

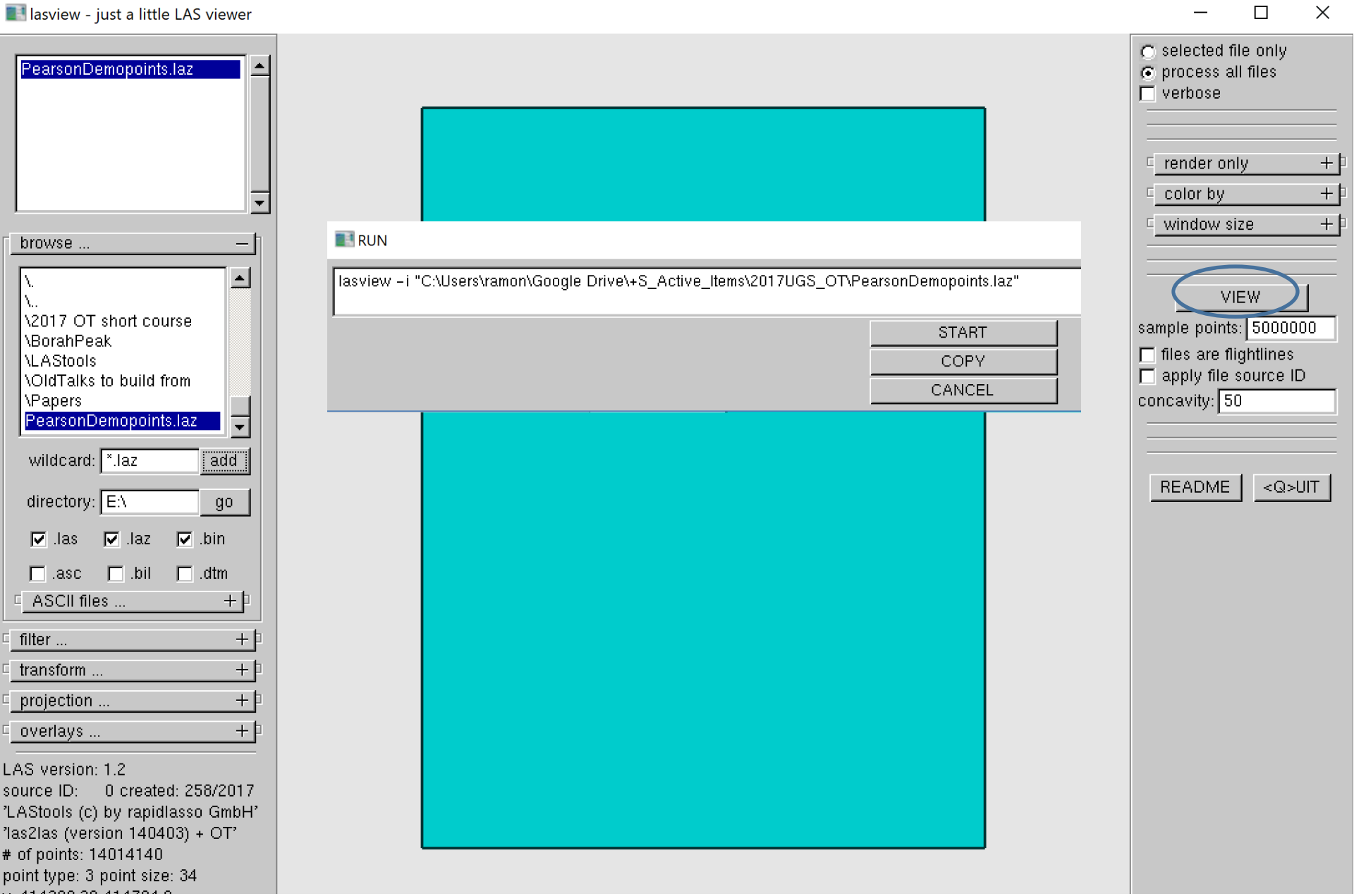
Rename it so you can remember

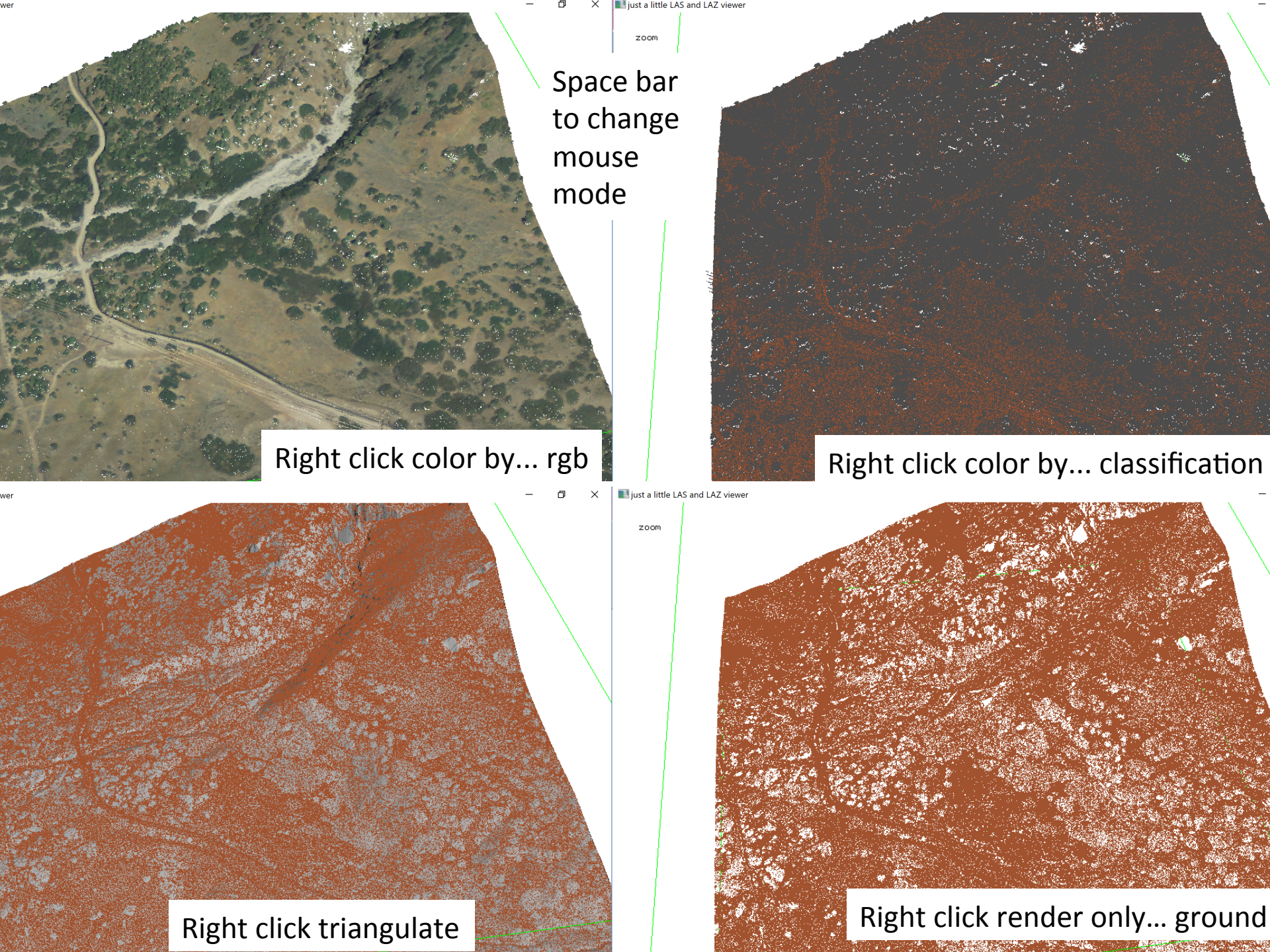
Share These Job Results

LAStools

- Open source and commercial tools for processing and analyzing lidar point cloud data in LAS/LAZ format
- https://rapidlasso.com/lastools/
- Native GUI, command line, ArcGIS, QGIS & ERDAS Imagine toolboxes.




lasview - just a little LAS viewer
PearsonDemopoints.laz
browse ...
\.
\..
\2017 OT short course
\BorahPeak
\LAStools
\OldTalks to build from
\Papers
PearsonDemopoints.laz
wildcard: *.laz
add
directory: E:\
go
.las
.laz
.bin
.asc
.bil
.dtm
ASCII files ...
filter ...
transform ...
projection ...
overlays ...
LAS version: 1.2
source ID: 0 created: 258/2017
'LAStools (c) by rapidlasso GmbH'
'las2las (version 140403) + OT'
# of points: 14014140
point type: 3 point size: 34
RUN
lasview -i "C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\PearsonDemopoints.laz"
START
COPY
CANCEL
selected file only
process all files
verbose
render only
color by
window size
VIEW
sample points: 5000000
files are flightlines
apply file source ID
concavity: 50
README
<Q>UIT


just a little LAS and LAZ viewer
zoom
Space bar to change mouse mode
Right click color by... rgb
Right click color by... classification
Right click triangulate
Right click render only... ground

ASPRS LAS*(er)* Format

- Binary public format for exchange of 3D point cloud data. Owned & maintained by ASPRS.
- Airborne lidar-oriented. v. 1.0 (2003) – v 1.4 (2011)

ASPRS Standard LIDAR Point Classes

Classification Value (bits 0:4)	***Meaning***
0	Created, never classified
1	Unclassified[1]
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point (noise)
8	Model Key-point (mass point)
9	Water

- .LAZ = LASzip – open source library for lossless compression of LAS lidar data. Developed by Martin Isenburg of LAStools.

asprs THE IMAGING & GEOSPATIAL INFORMATION SOCIETY

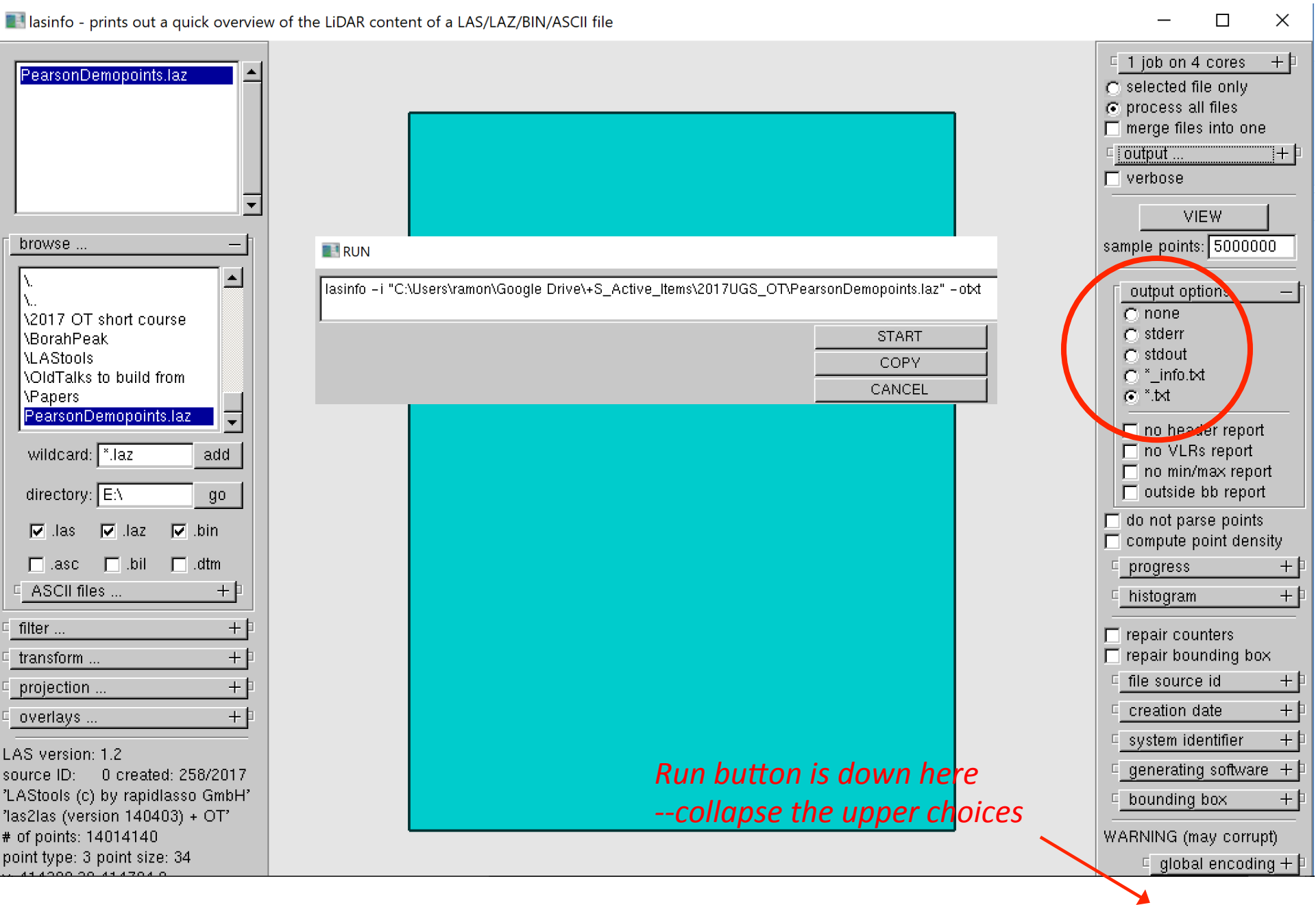
Overview

Starting with an LAS/LAZ file, let's explore the contents of the file, do some manipulation and filtering, and then maybe reproject the file. Next we'll make elevation and other rasters using Lastools and visualize and examine them in Google Earth and ArcGIS.

Outline

1. LASinfo to see what's in the file (attributes etc)
2. LAS2txt to look at contents in human readable form
3. LASboundary to make an outline of the file and plot it on a map
4. LASground to classify ground vs vegetation points
5. LAS2LAS for filtering on attributes and reprojection
6. Lasgrid point density
7. Lecture burst on generating DEMs from points
8. Neighborhood approach for DSM and DTM (Lasgrid DEM)
9. Tinning approach with tiling for DSM and DRM (lastile and blast2dem)
10. ArcGIS DEM visualization, manipulation, and simple raster math

LASinfo – reports contents of LAS file



LASinfo – reports contents of LAS file

PearsonDemopoints - Notepad

File Edit Format View Help

```
reporting all LAS header entries:
  file signature:             'LASF'
  file source ID:             0
  global_encoding:            1
  project ID GUID data 1-4:   00000000-0000-0000-5455-484100000000
  version major.minor:        1.2
  system identifier:          'LAStools (c) by rapidlasso GmbH'
  generating software:        'las2las (version 140403) + OT'
  file creation day/year:     258/2017
  header size:                227
  offset to point data:       1487
  number var. length records: 3
  point data format:          3
  point data record length:   34
  number of point records:    14014140
  number of points by return: 13428282 578830 6177 846 5
  scale factor x y z:         0.01 0.01 0.01
  offset x y z:               0 0 0
  min x y z:                  414200.29 4580776.75 1355.91
  max x y z:                  414794.80 4581560.78 1599.66
variable length header record 1 of 3:
  reserved             43707
  user ID              'LASF_Projection'
  record ID            34735
  length after header  96
  description          'GeoTIFF GeoKeyDirectoryTag'
    GeoKeyDirectoryTag version 1.1.0 number of keys 11
      key 1024 tiff_tag_location 0 count 1 value_offset 1 - GTModelTypeGeoKey: ModelTypeProjected
      key 1025 tiff_tag_location 0 count 1 value_offset 1 - GTRasterTypeGeoKey: RasterPixelIsArea
      key 1026 tiff_tag_location 34737 count 31 value_offset
      key 2049 tiff_tag_location 34737 count 6 value_offset 3
      key 2054 tiff_tag_location 0 count 1 value_offset 9102
      key 3072 tiff_tag_location 0 count 1 value_offset 26912
      key 3076 tiff_tag_location 0 count 1 value_offset 9001
      key 4096 tiff_tag_location 0 count 1 value_offset 5703
      key 4097 tiff_tag_location 34737 count 14 value_offset
      key 4098 tiff_tag_location 0 count 1 value_offset 5103
```

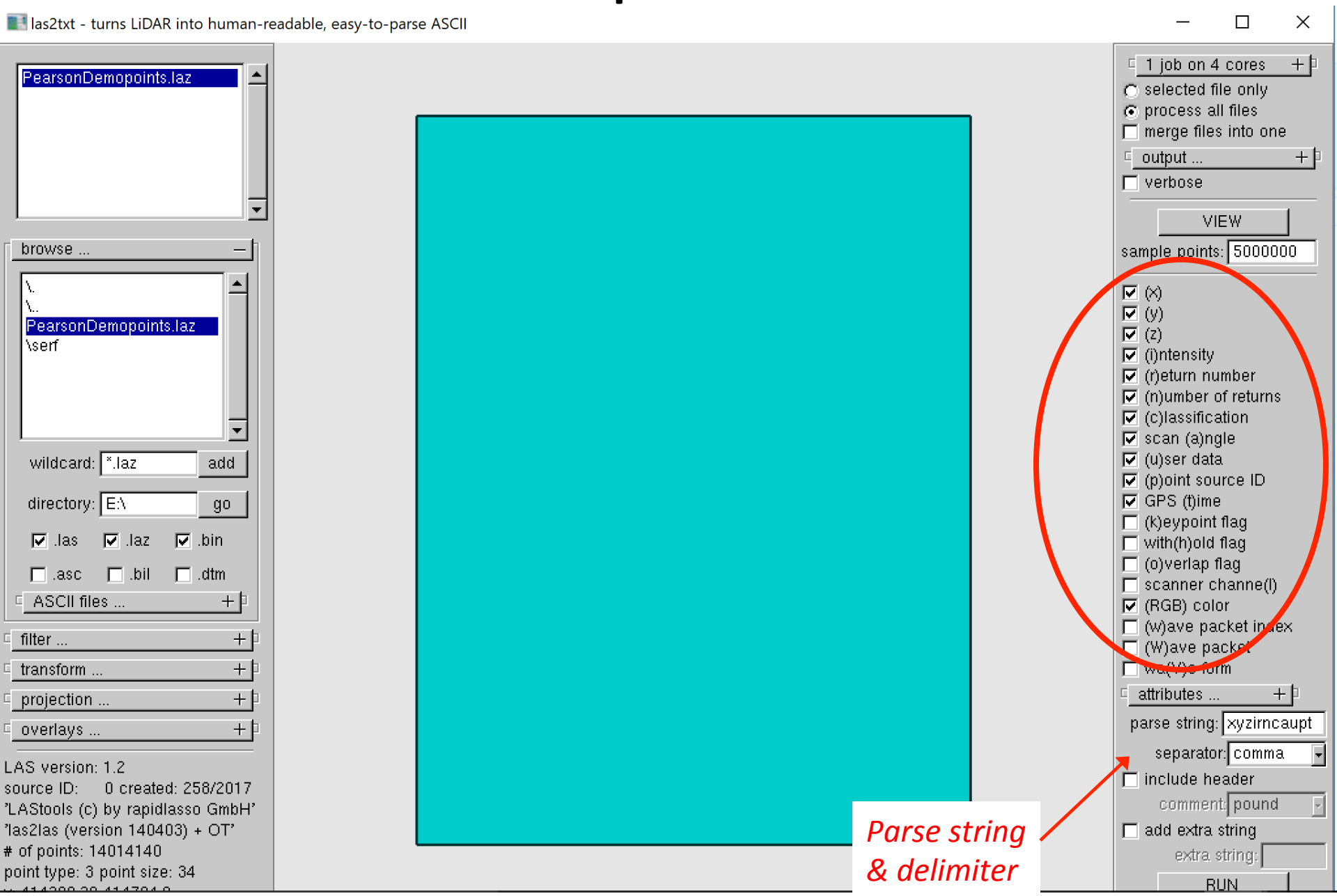
Header summary

Georeferencing information

```
  X                 41420029   41479480
  Y                458077675  458156078
  Z                   135591     159966
  intensity                0        255
  return_number            1          5
  number_of_returns        1          5
  edge_of_flight_line      0          0
  scan_direction_flag      0          1
  classification           1          7
  scan_angle_rank        -16         20
  user_data                0          0
  point_source_ID       6165      12218
  gps_time 67454341.779927 68227738.997013
  Color R 7424 61440
        G 8192 61696
        B 10752 59648
number of first returns:        13428282
number of intermediate returns: 7035
number of last returns:         13428388
number of single returns:       12849565
overview over number of returns of given pulse: 12849565 1145177 16008 3368 22 0 0
histogram of classification of points:
        10625129  unclassified (1)
         3388321  ground (2)
             690  noise (7)
```

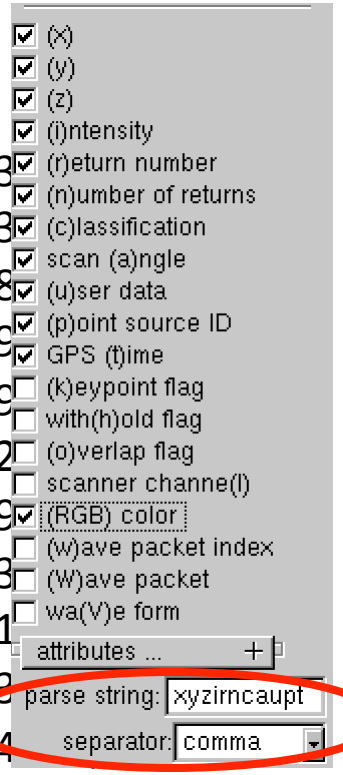
Summary of file contents - Min/max & histogram – from scan of file

LAS2TXT – points in ascii



LAS2TXT – points in ascii

414248.13,4580776.87,1363.64,134,1,1,1,5,0,6165,67454341.779927,22528,23
414248.04,4580776.97,1363.51,148,1,1,1,5,0,6165,67454341.782320,23040,23
414246.79,4580776.96,1363.12,192,1,1,1,5,0,6165,67454341.800585,27904,28
414247.00,4580777.40,1363.19,185,1,1,1,5,0,6165,67454341.800597,29184,29
414246.90,4580777.54,1363.31,162,1,1,1,5,0,6165,67454341.803013,29440,29
414246.68,4580777.08,1363.20,170,1,1,1,5,0,6165,67454341.803025,31488,32
414245.40,4580776.88,1363.18,199,1,1,1,5,0,6165,67454341.821231,29696,29
414245.62,4580777.35,1363.11,221,1,1,2,5,0,6165,67454341.821243,33024,33
414245.84,4580777.80,1363.14,230,1,1,2,5,0,6165,67454341.821255,31488,31
414246.05,4580778.24,1363.22,205,1,1,1,5,0,6165,67454341.821266,33792,33
414245.98,4580778.42,1363.16,233,1,1,2,5,0,6165,67454341.823683,35072,34
414245.74,4580777.94,1363.15,236,1,1,1,5,0,6165,67454341.823695,31488,30720,25088
414245.51,4580777.45,1363.18,231,1,1,1,5,0,6165,67454341.823707,32512,32512,26624
414245.27,4580776.96,1363.20,206,1,1,1,5,0,6165,67454341.823718,28416,28160,22272
414244.14,4580777.17,1363.16,235,1,1,1,5,0,6165,67454341.841924,26624,24576,23040
414244.36,4580777.63,1363.17,202,1,1,2,5,0,6165,67454341.841936,27904,26368,23296
414244.58,4580778.09,1363.19,236,1,1,1,5,0,6165,67454341.841948,28672,27392,23040
414244.80,4580778.53,1363.25,213,1,1,1,5,0,6165,67454341.841960,28928,27648,23040
414245.01,4580778.98,1363.24,236,1,1,1,5,0,6165,67454341.841971,29440,27648,23296
414245.23,4580779.44,1363.22,237,1,1,1,5,0,6165,67454341.841983,29184,27648,23552
414244.97,4580779.17,1363.20,237,1,1,1,5,0,6165,67454341.844376,28672,27136,22784
414244.73,4580778.69,1363.22,215,1,1,1,5,0,6165,67454341.844388,29184,27648,23296



LASboundary – generate outline of point data

lasboundary - computes the exact boundary polygon for massive amounts of LiDAR points

PearsonDemopoints.laz

browse ...

filter ...

by coordinates:

by classification or return:

by various criteria:

number of values: 25

ADD

keep_random_fraction 25

transform ...

projection ...

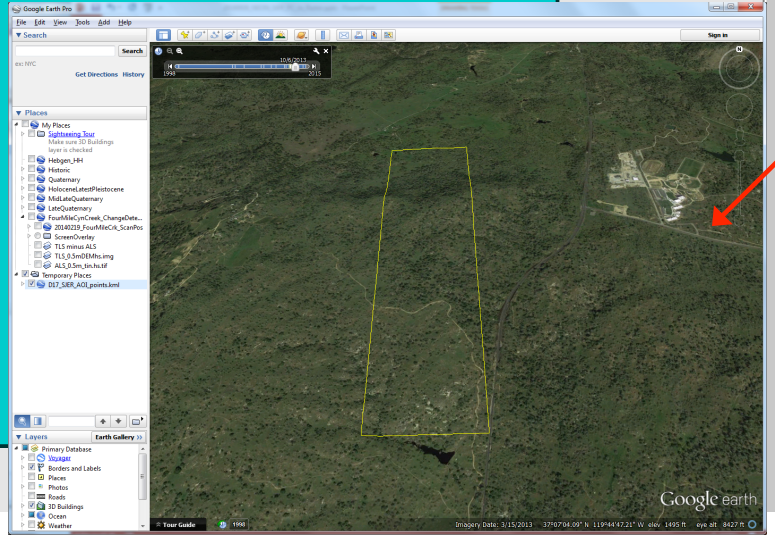
overlays ...

LAS version: 1.2
source ID: 0 created: 258/2017
'LAStools (c) by rapidlasso GmbH'
'las2las (version 140403) + OT'
# of points: 14014140
point type: 3 point size: 34
x: 414200.29 414794.8

Filter to use fraction (25%) of points = faster!

Larger the value, the less detailed the outline

Output format



1 job on 4 cores

selected file only

process all files

merge files into one

output ...

verbose

VIEW

sample points: 5000000

use points

use bounding box

use tile bounding box

use LAX information

concavity: 100

holes

disjoint

convex hull

overview

labels

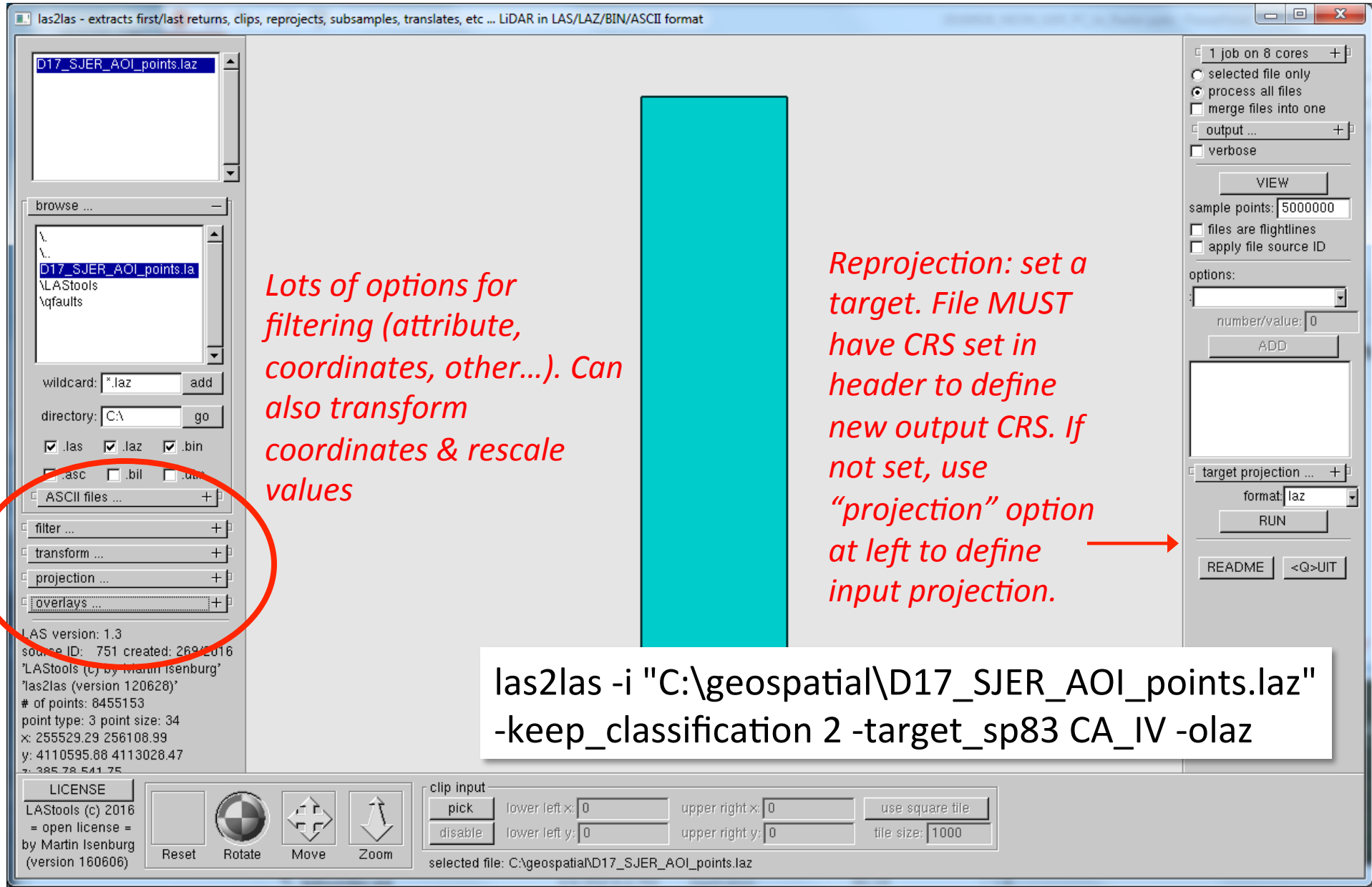
output: kml

RUN

README

<Q>UIT

LAS2LAS – filtering, clipping, coordinate transformation



Lecture burst:
Point cloud classification

Lidar ground classification

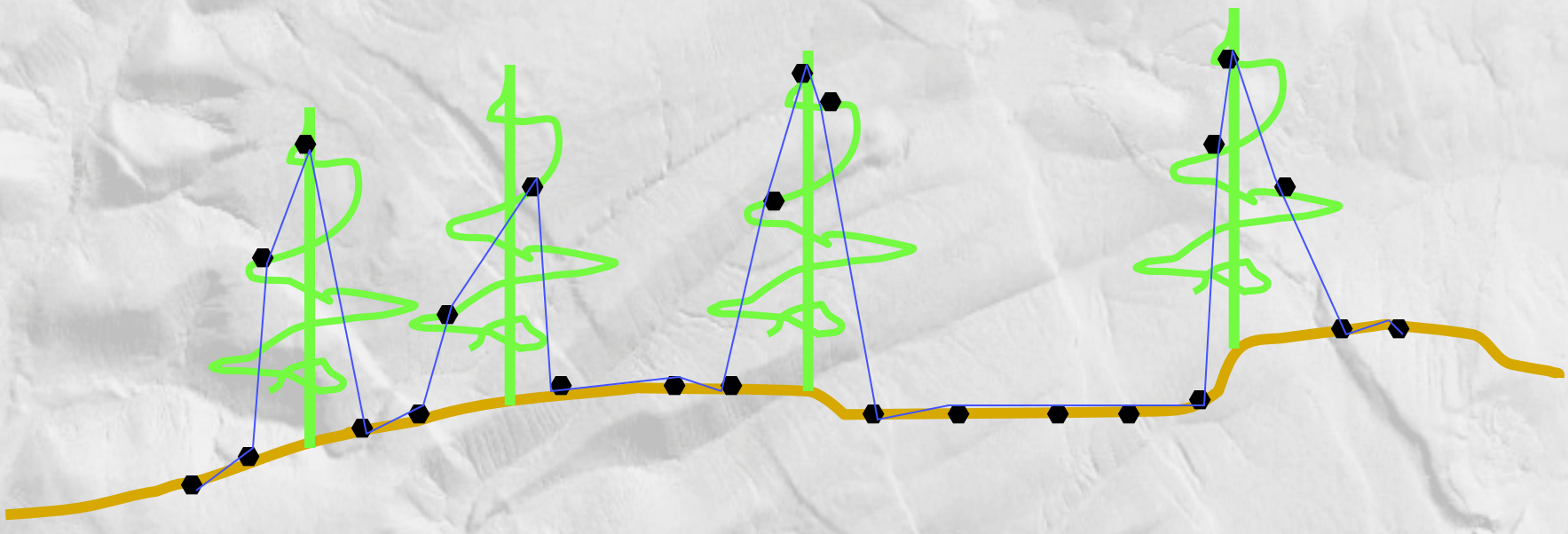
…simplified…

Three assumptions:

1. Ground is smooth
   - Assumption: high curvature is not a point on the ground
2. Ground is continuous (single-valued)
3. Ground is lowest surface in vicinity

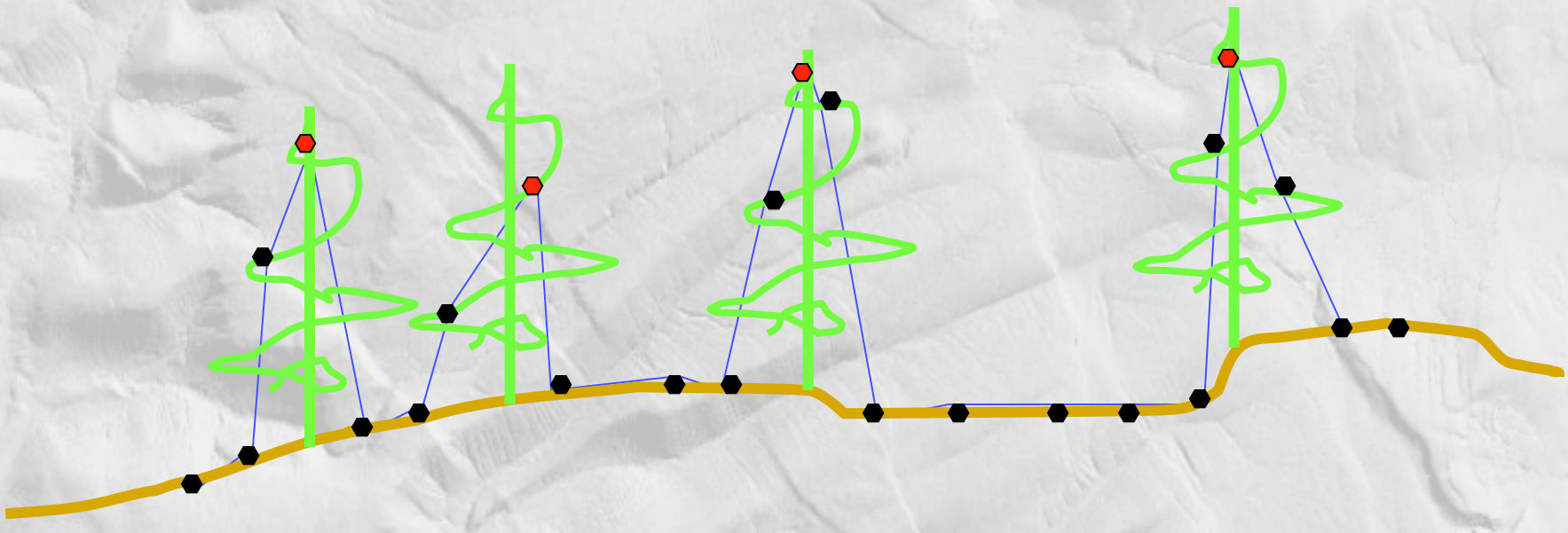
Modified from: R. Hagerud, USGS

Start with mixed ground and canopy returns (e.g. last-return data), build TIN



R. Hagerud, USGS

Flag points that define spikes (strong convexities)

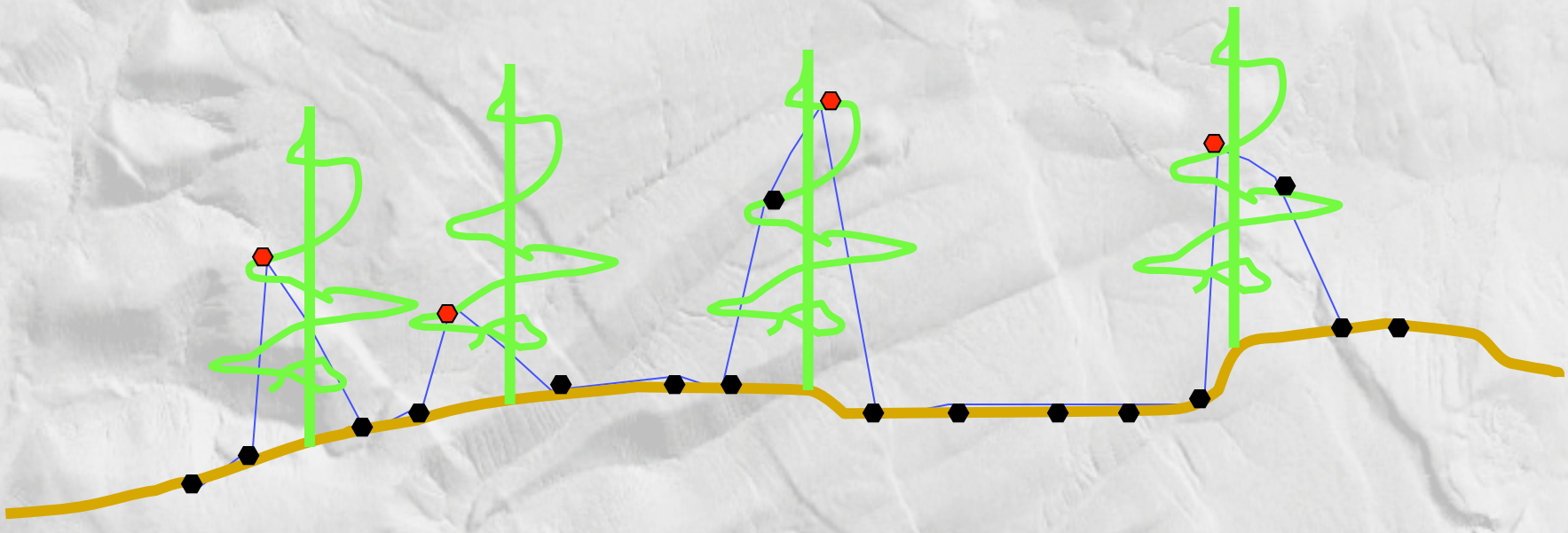


R. Hagerud, USGS

Rebuild TIN

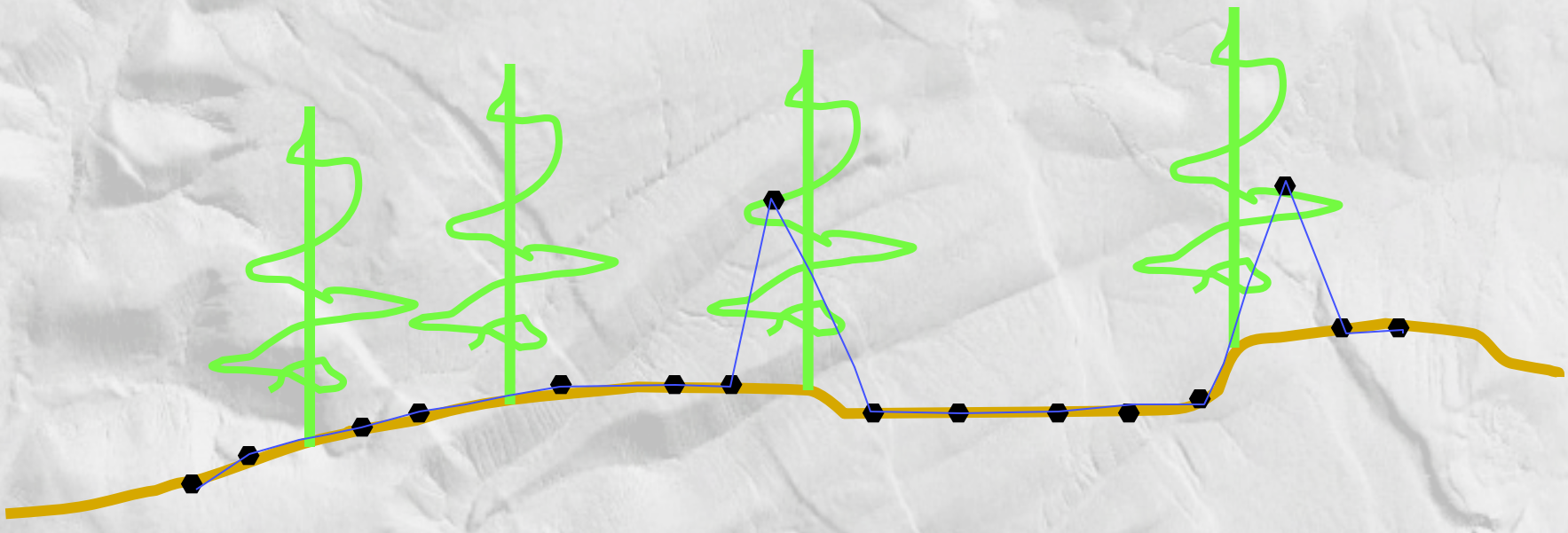
R. Hagerud, USGS

Flag points that define spikes (strong convexities)



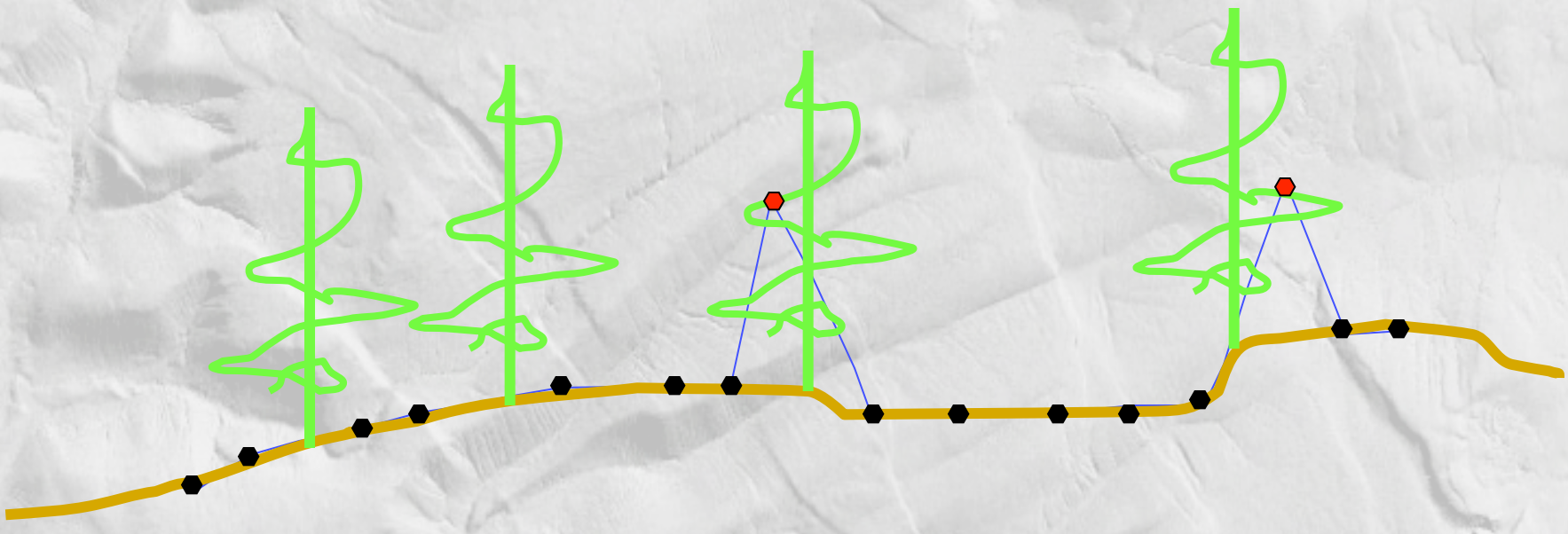
R. Hagerud, USGS

Rebuild TIN



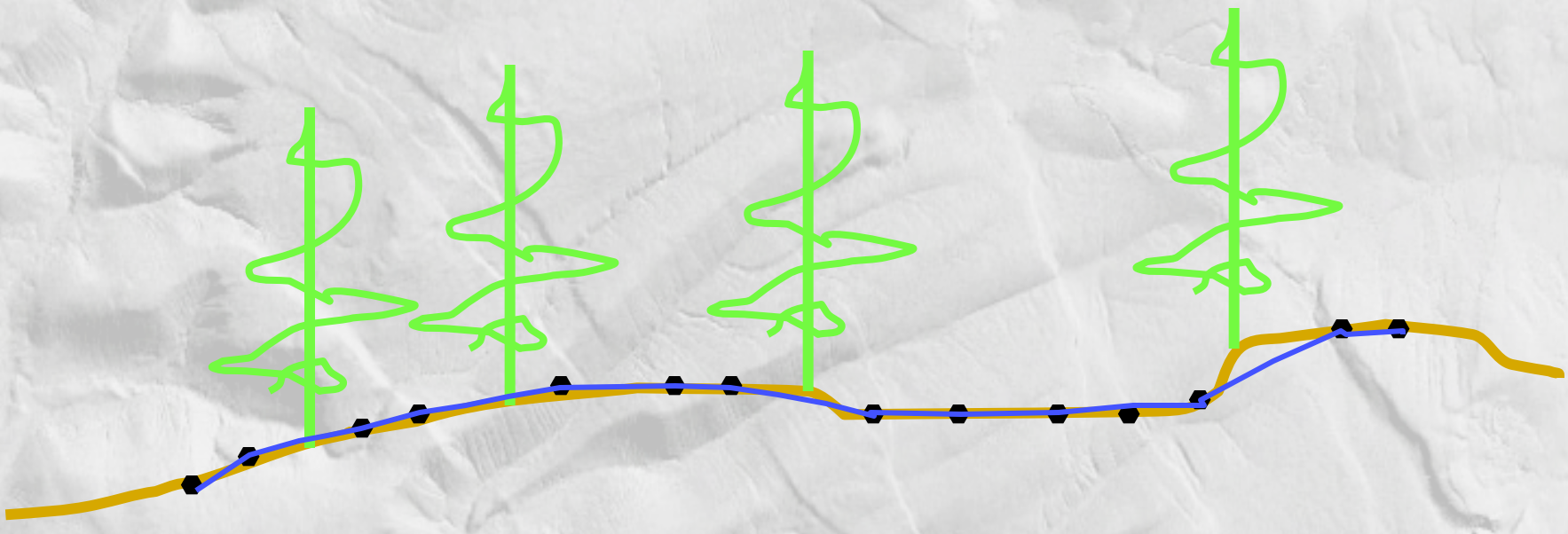
R. Hagerud, USGS

Flag points that define spikes (strong convexities)



R. Hagerud, USGS

Rebuild TIN



R. Hagerud, USGS

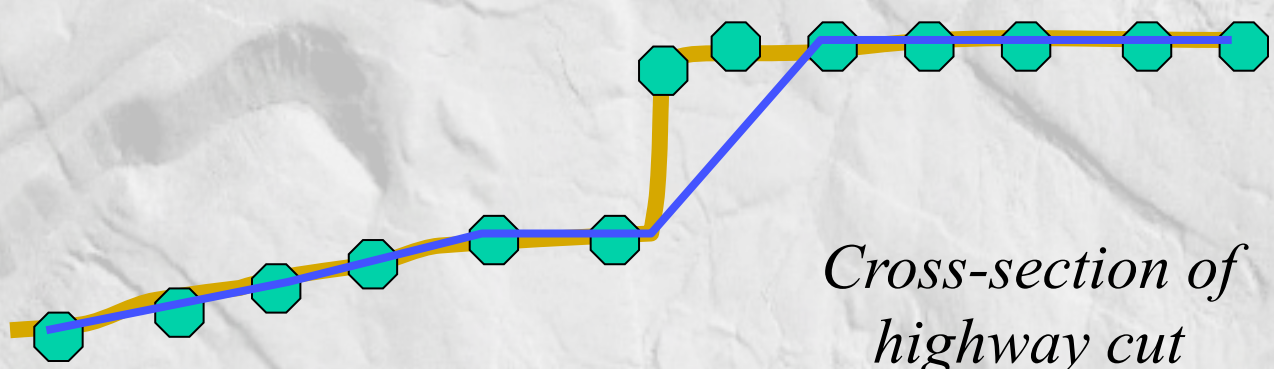
Despike algorithm

Benefits:

- It works
- It's automatic
  - Cheap
  - All assumptions explicit
- It can preserve breaklines
- It appears to retain more ground points than other algorithms

R. Hagerud, USGS

Despike algorithm



Cross-section of highway cut

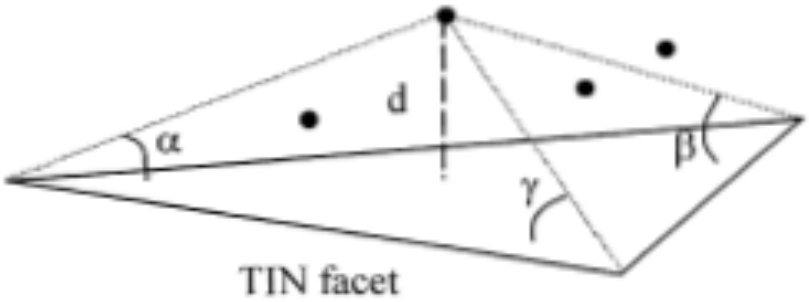
Problems:

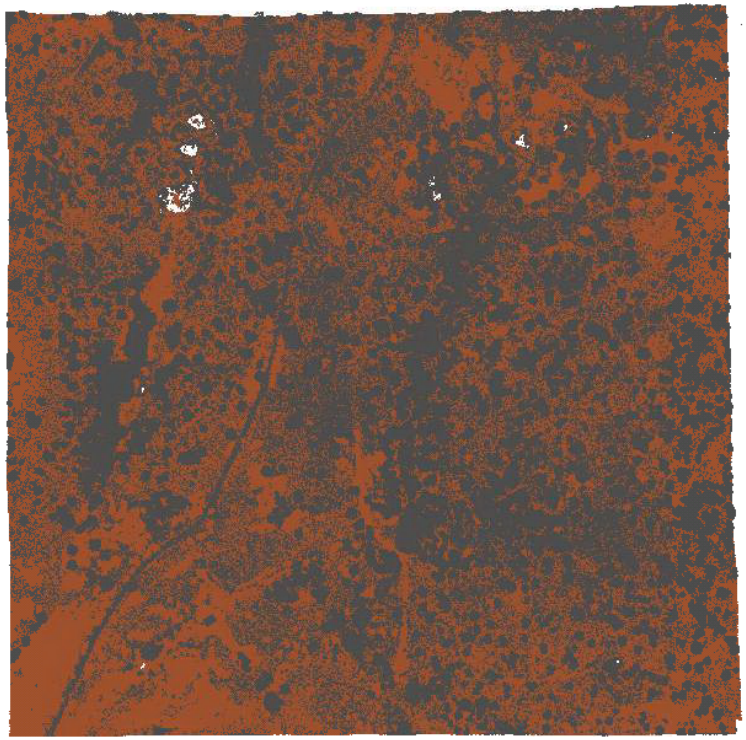
- Removes some corners
- Sensitive to negative blunders
- Computationally intensive
- Makes rough surfaces
  - Real? Measurement error? Misclassified vegetation?

R. Hagerud, USGS

Point cloud classification

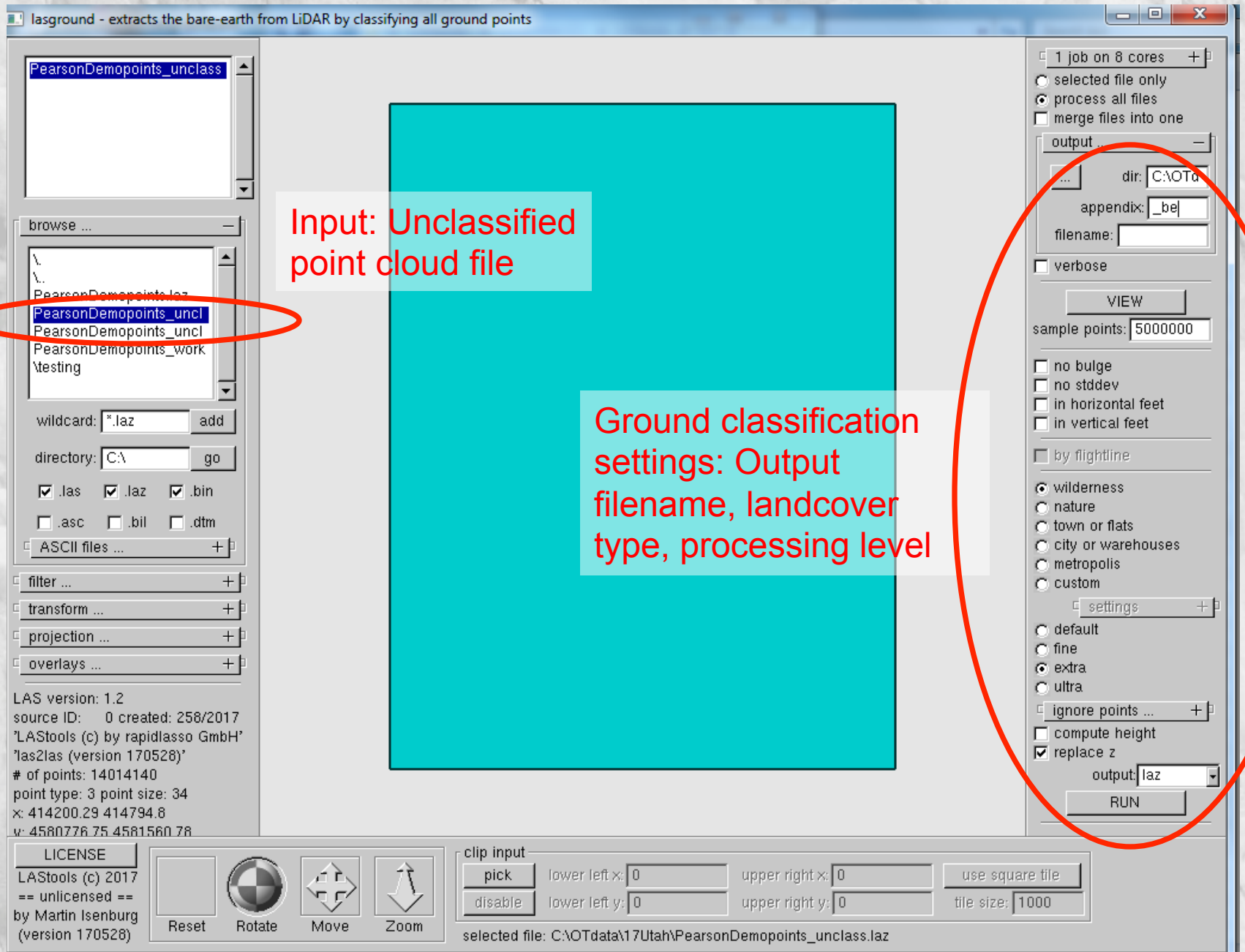
- LAStools LASground
- Other software:
  - Terrascan
  - QT Modeler
  - ENVI lidar
  - Global Mapper
  - MCClidar
  - CANUPO (CloudCompare)
- Still an area of active research
- Based on algorithm in Axellson (2000)*, with some modifications



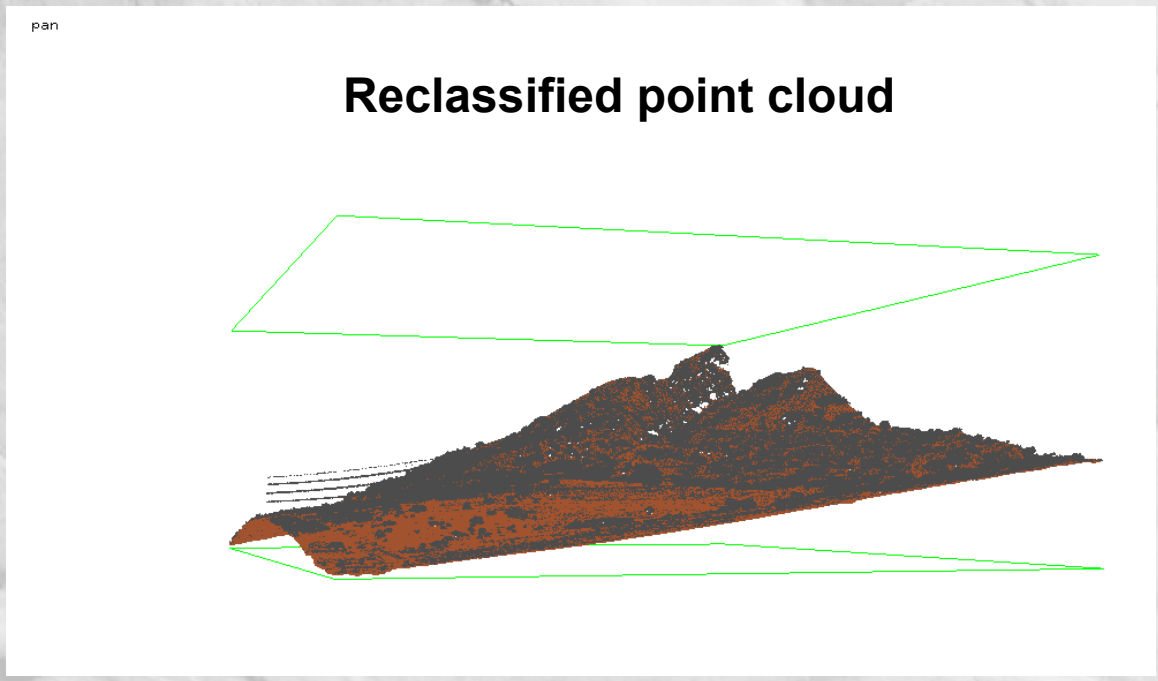


Modified from T. Goulden, NEON

LASground – identify bare-earth (ground) points



LASground – identify bare-earth (ground) points



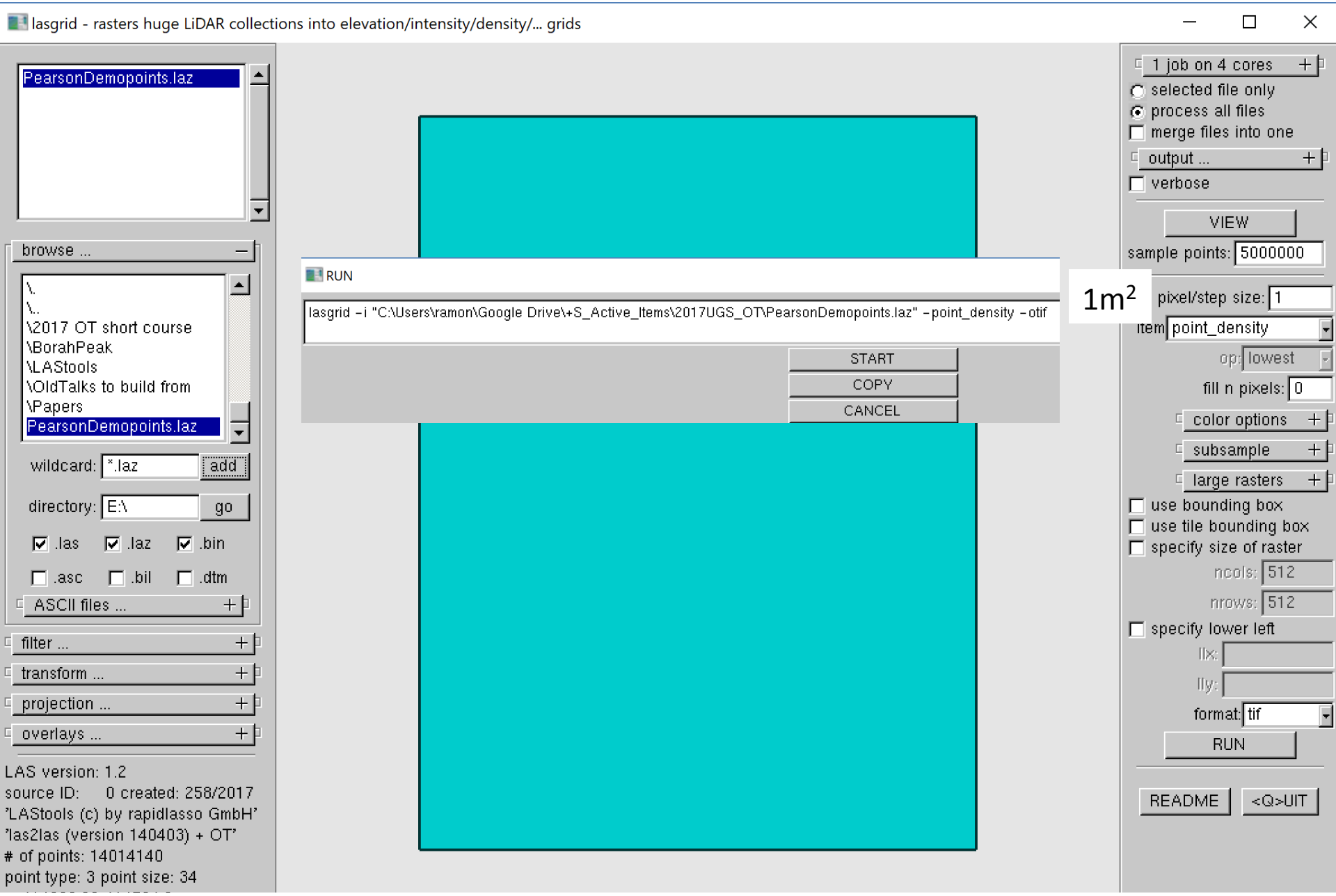

```
X              41420029   41479480
Y             458077675  458156078
Z                135591     159966
intensity             0        255
return_number         1          5
number_of_returns     1          5
edge_of_flight_line   0          0
scan_direction_flag   0          1
classification        1          7
scan_angle_rank     -16         20
user_data             0          0
point_source_ID    6165      12218
gps_time 67454341.779927 68227738.997013
Color R 7424 61440
      G 8192 61696
      B 10752 59648
number of last returns:        13428388
number of single returns:      12849565
overview over number of returns of given pulse: 12849565 1145177 16008 3368 22 0 0
histogram of classification of points:
       10625129  unclassified (1)
        3388321  ground (2)
            690  noise (7)
```

Original point cloud classification

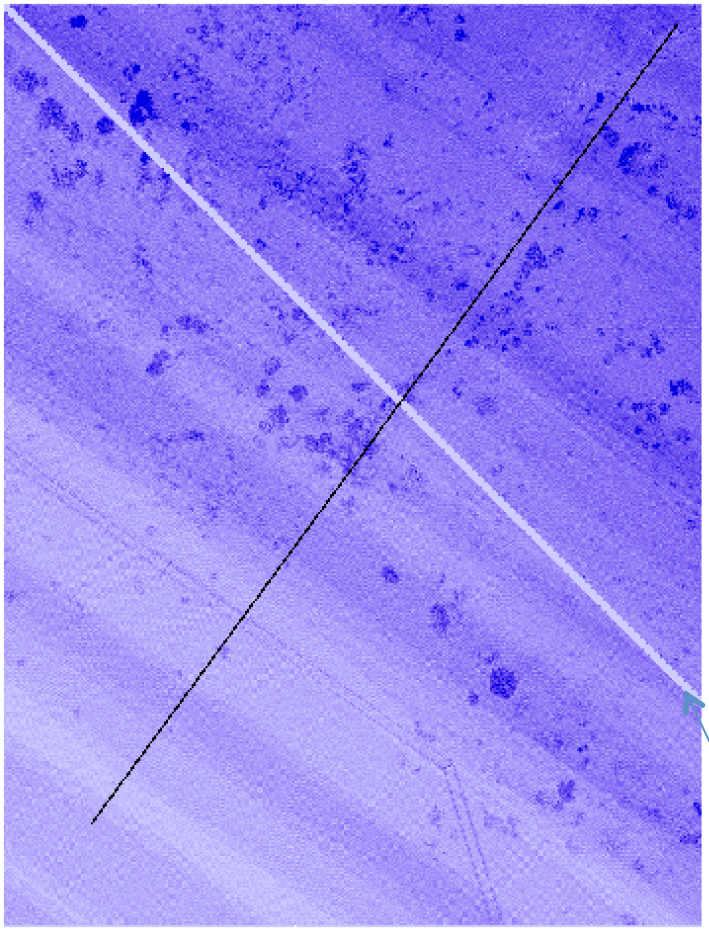
```
X              41420027   41479482
Y             458077673  458156080
Z                135590     159964
intensity             0          0
return_number         1          5
number_of_returns     1          5
edge_of_flight_line   0          0
scan_direction_flag   0          1
classification        1          2
scan_angle_rank     -16         20
user_data             0          0
point_source_ID       0          0
gps_time 0.000000 0.000000
Color R 7424 61440
      G 8192 61696
      B 10752 59648
WARNING:
number of intermediate returns: 7035
number of last returns:        13428388
number of single returns:      12849565
overview over number of returns of given pulse: 12849565 1145177 16008 3368
histogram of classification of points:
        5315758  unclassified (1)
        8698382  ground (2)
```

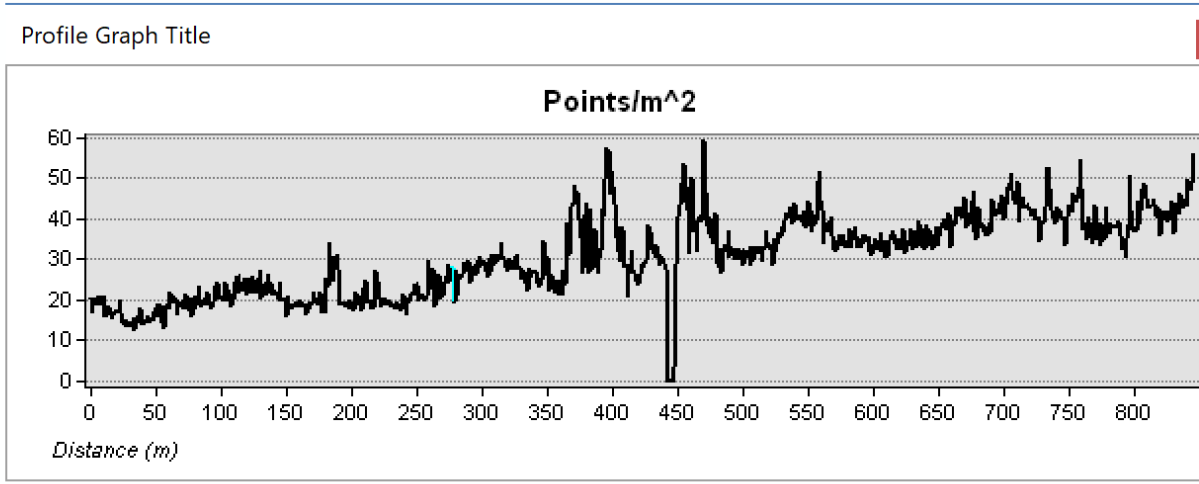
After point cloud (re)classification

point density



point density





Load .tif into ArcMap, change color map, use 3D Analyst to profile density

Slash of no data is telling us that we have exceeded the license limit

Digital Elevation Models

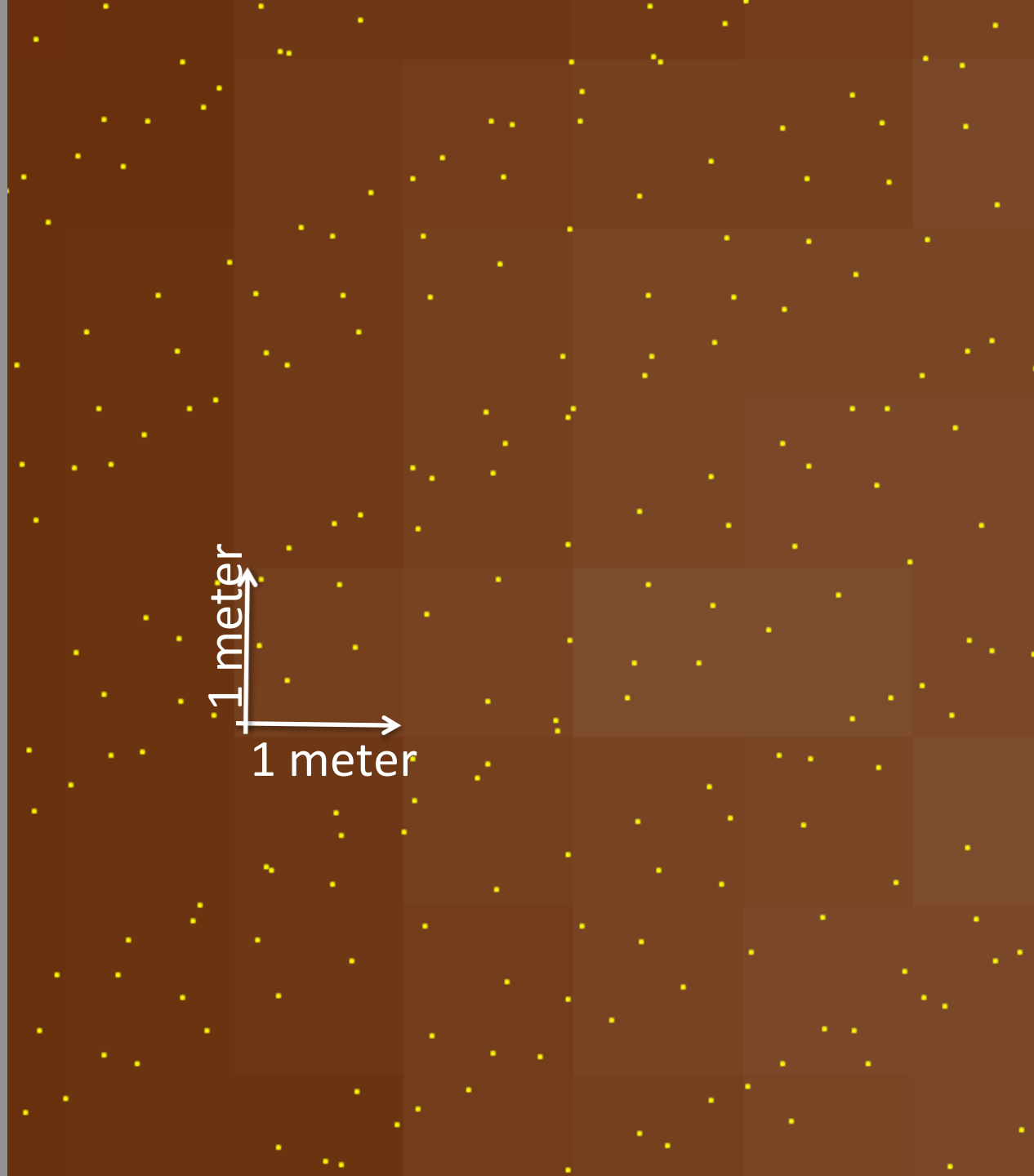
- Digital representation of topography / terrain
  - "Raster" format – a grid of squares or "pixels"
  - Continuous surface where Z (elevation) is estimated on a regular X,Y grid
  - "2.5D"

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	0
0	50	100	100	100	100	100	100	100	100	100	100	100	100	100	50	0
0	50	100	150	150	150	150	150	150	150	150	150	150	150	100	50	0
0	50	100	150	200	200	200	200	200	200	200	200	200	150	100	50	0
0	50	100	150	200	250	250	250	250	250	250	250	200	150	100	50	0
0	50	100	150	200	250	300	300	300	300	300	250	200	150	100	50	0
0	50	100	150	200	250	300	350	350	350	300	250	200	150	100	50	0
0	50	100	150	200	250	300	350	400	350	300	250	200	150	100	50	0
0	50	100	150	200	250	300	350	350	350	300	250	200	150	100	50	0
0	50	100	150	200	250	300	300	300	300	300	250	200	150	100	50	0
0	50	100	150	200	250	250	250	250	250	250	250	200	150	100	50	0
0	50	100	150	200	200	200	200	200	200	200	200	200	150	100	50	0
0	50	100	150	150	150	150	150	150	150	150	150	150	150	100	50	0
0	50	100	100	100	100	100	100	100	100	100	100	100	100	100	50	0
0	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

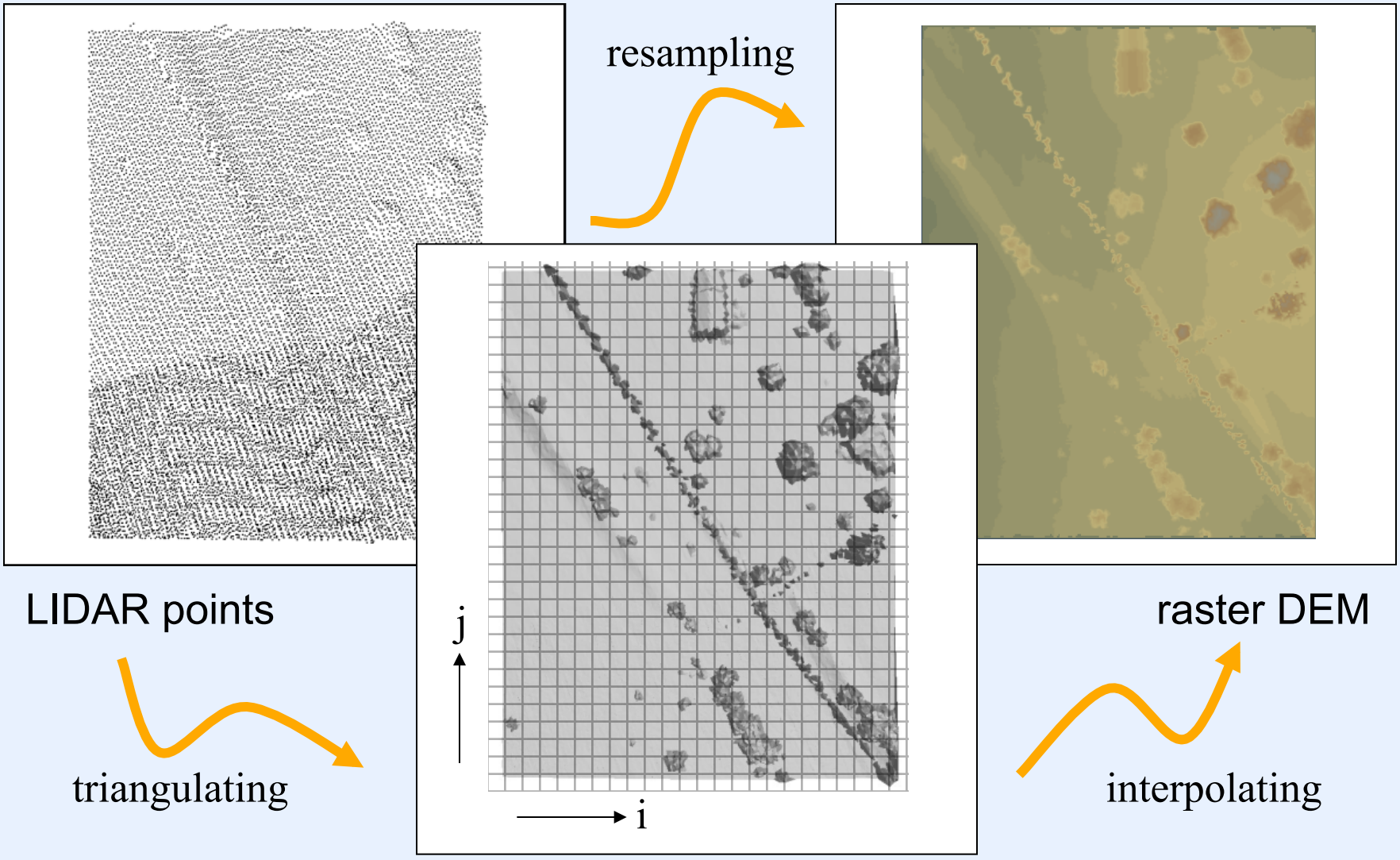
Source: http://www.ncgia.ucsb.edu/giscc/extra/e001/e001.html

- Grid resolution is defined by the size in the horizontal dimension of the pixel
  - 1 meter DEM has pixels 1 m x 1m assigned a single elevation value.

- 1 meter grid
- LiDAR returns from EarthScope data collection
- Example from flat area with little or no vegetation so ground is sampled approx. 5+ times per square meter
- How do we best fit a continuous surface to these points?
- Ultimately wish to represent irregularly sampled data on a regularized grid.



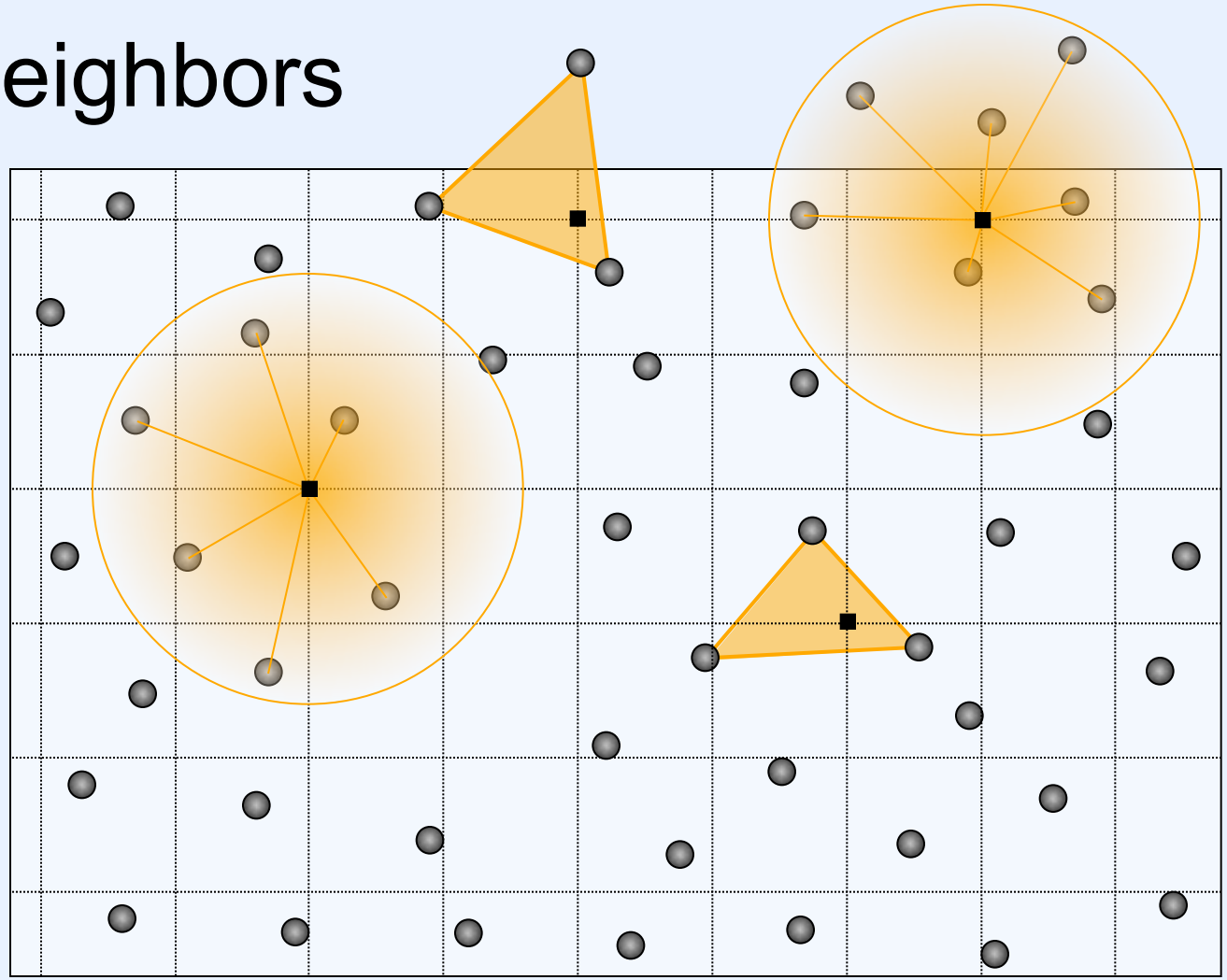
Generating DEMs from LIDAR



Isenburg, et al., 2006

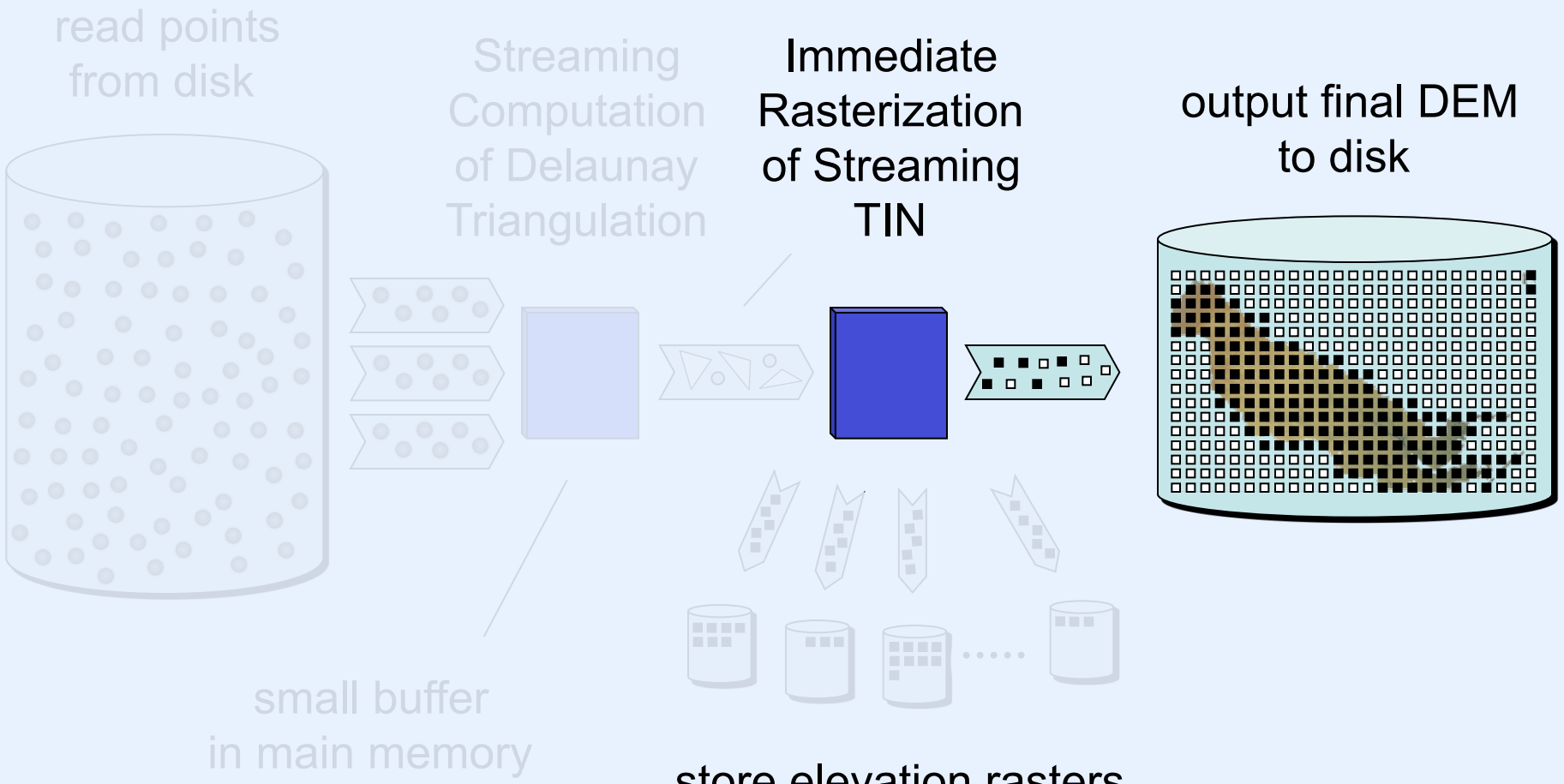
Interpolation Methods

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



Isenburg, et al., 2006

DEM Generation via TIN Streaming

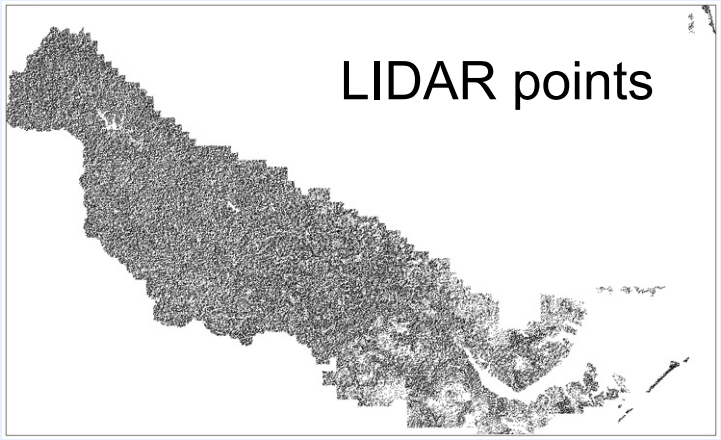


Isenburg, et al., 2006

Example Result

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

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

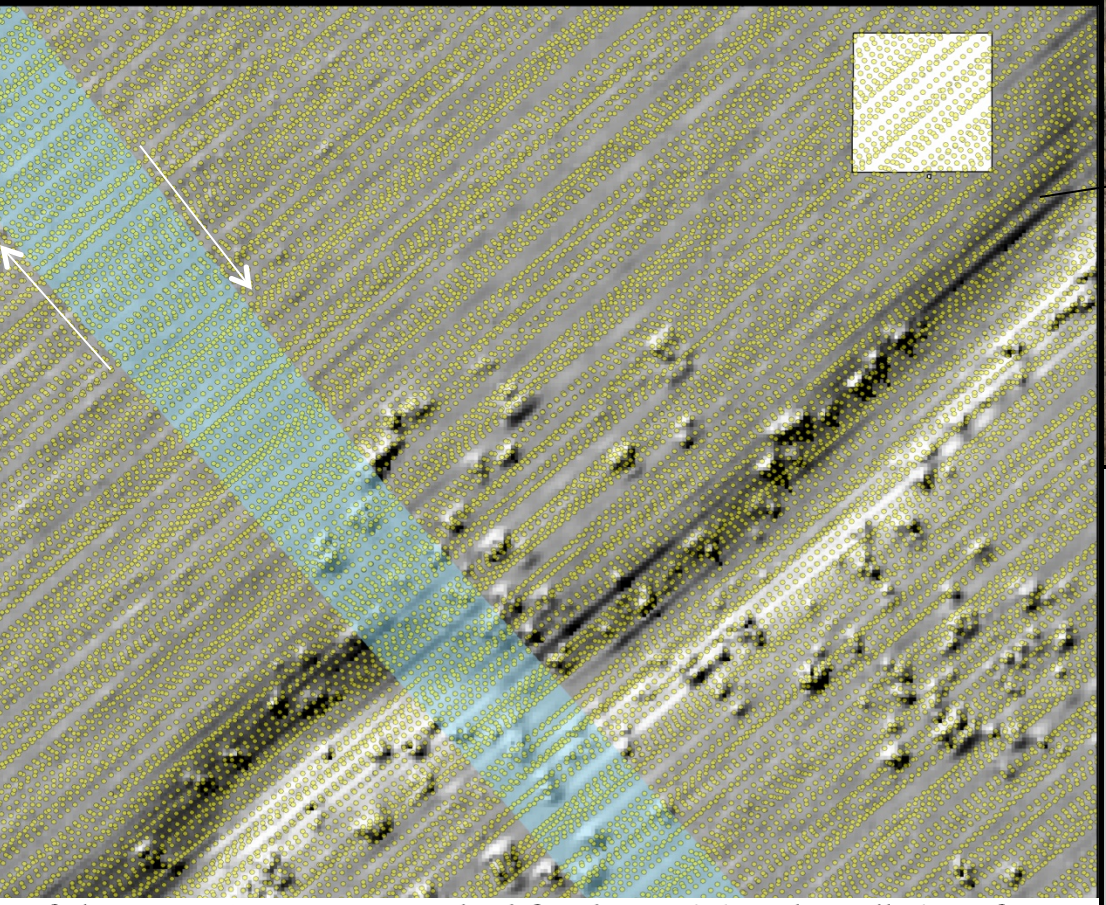


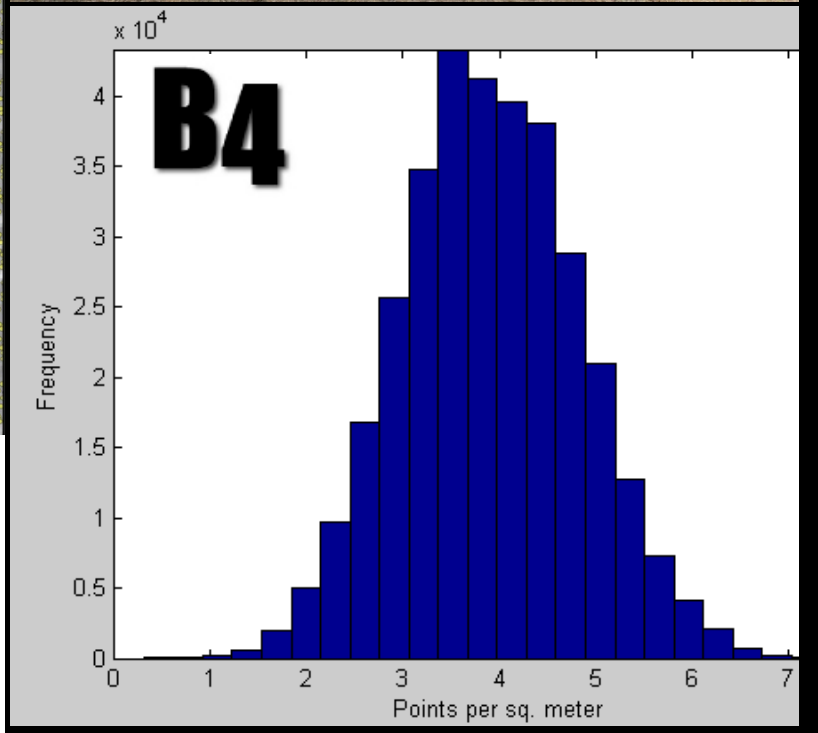
- on a household laptop with two harddisks
- in 67 minutes
- 64 MB of main memory
- 270 MB temporary disk space

Isenburg, et al., 2006

Measure fault slip at the appropriate scale

B4 LiDAR topography 0.25 m DEM





of the DEM. A common method for determining the cell size of a DEM has been defined by Hu (2003). The grid size of a DEM can be estimated by:

Langridge, et al. 2014

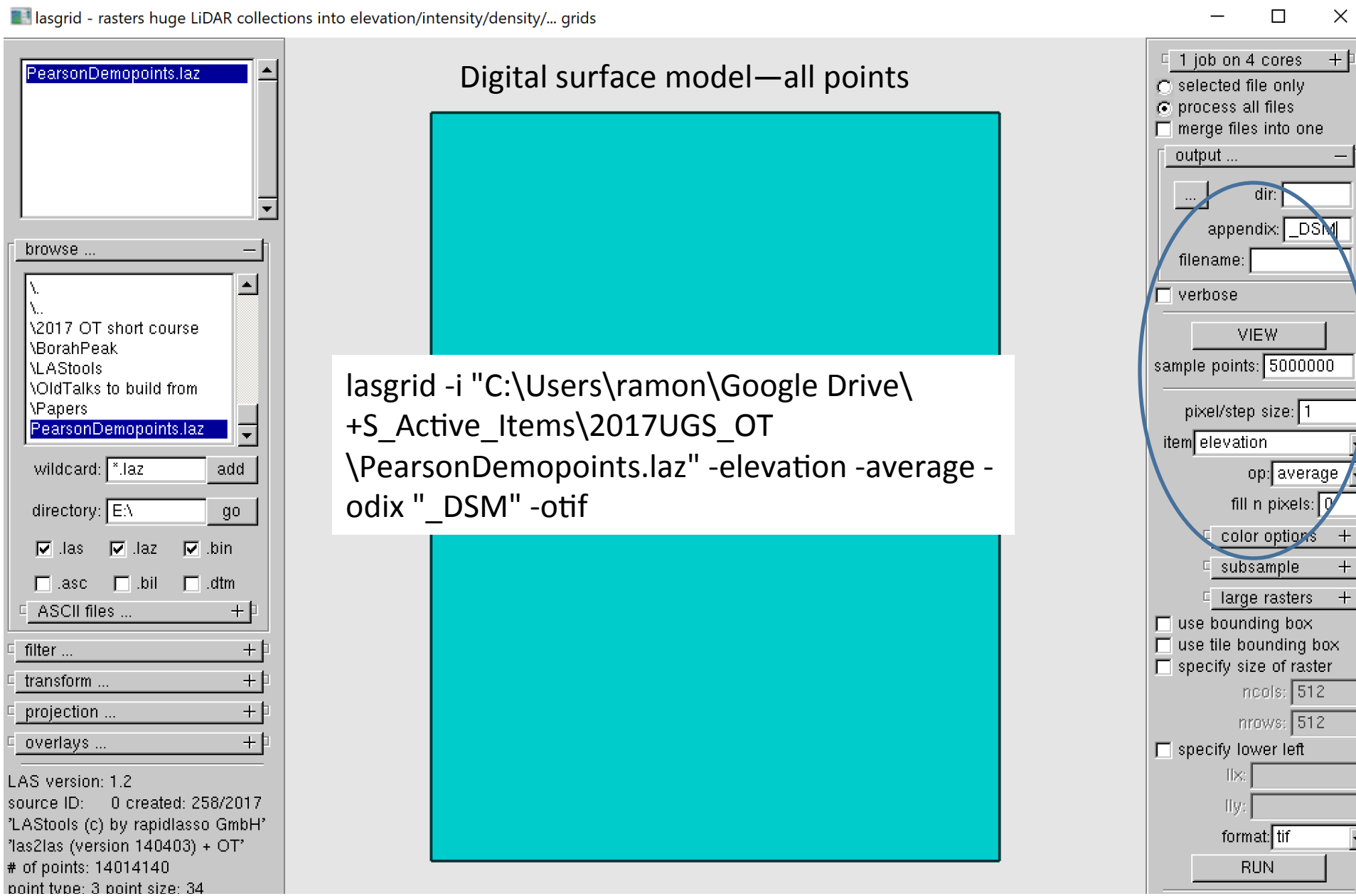
$$s = \sqrt{\frac{A}{n}} \qquad (1)$$

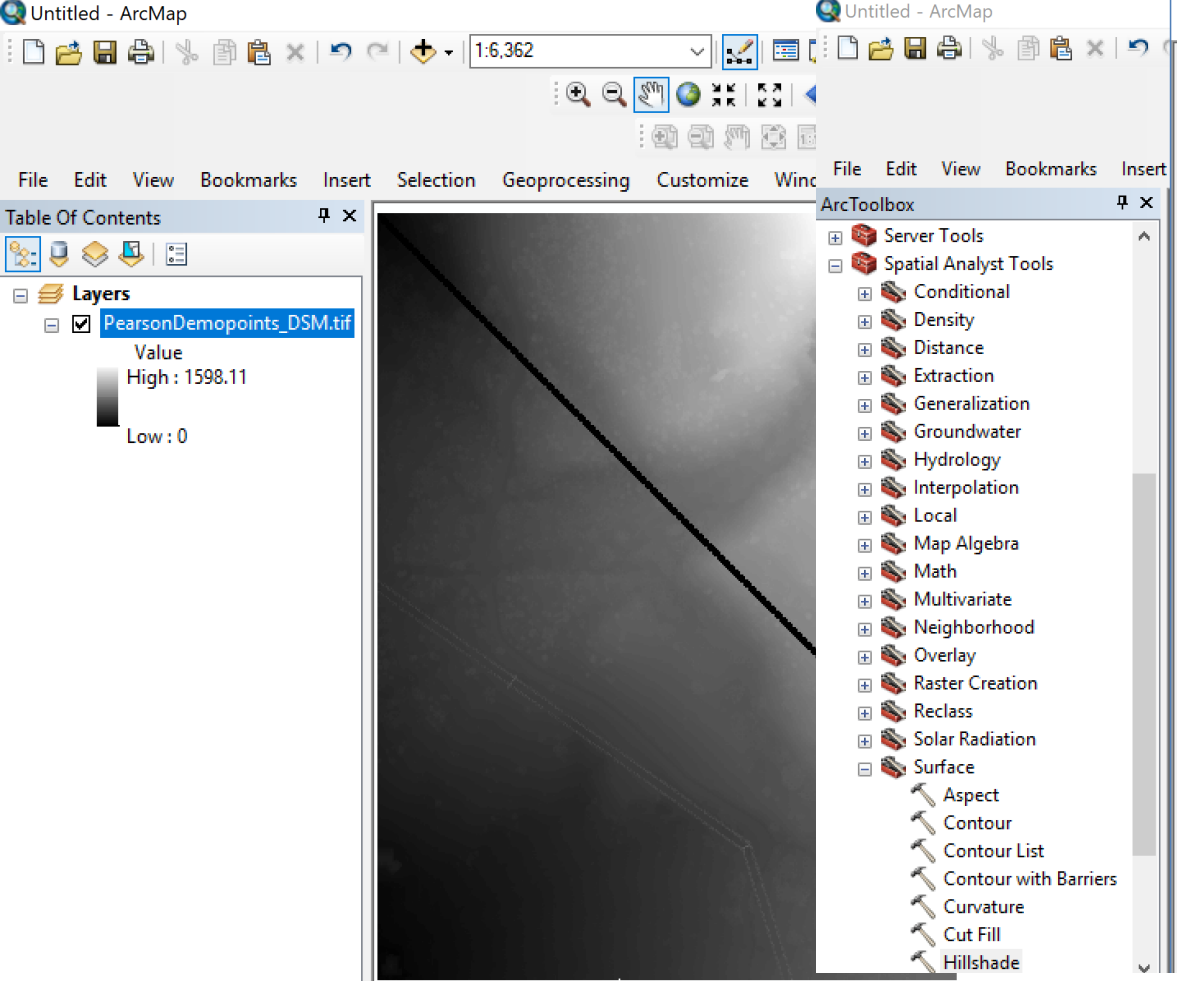
Sqrt(1m²/4)= 0.5 m/pix

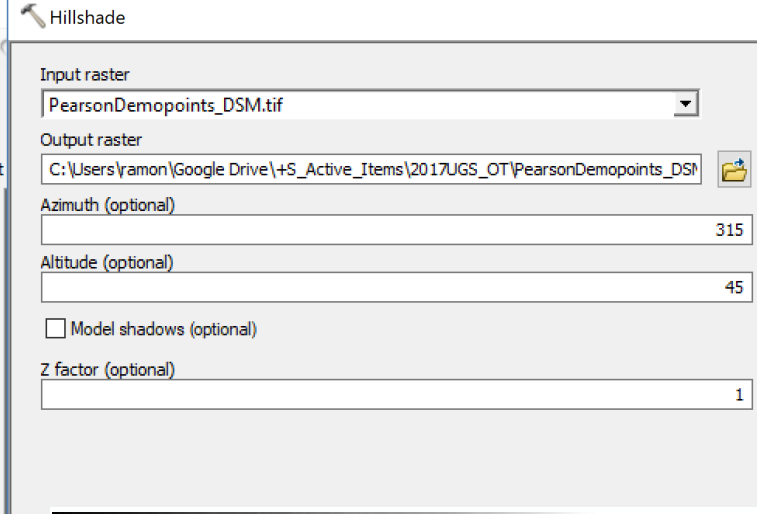
where s is the estimated cell size (typically in m), n is the number of sample points and A is the area containing the sample points. The

Mean ~4 shots/sq. m

LASGRID is neighborhood approach for DEM computation

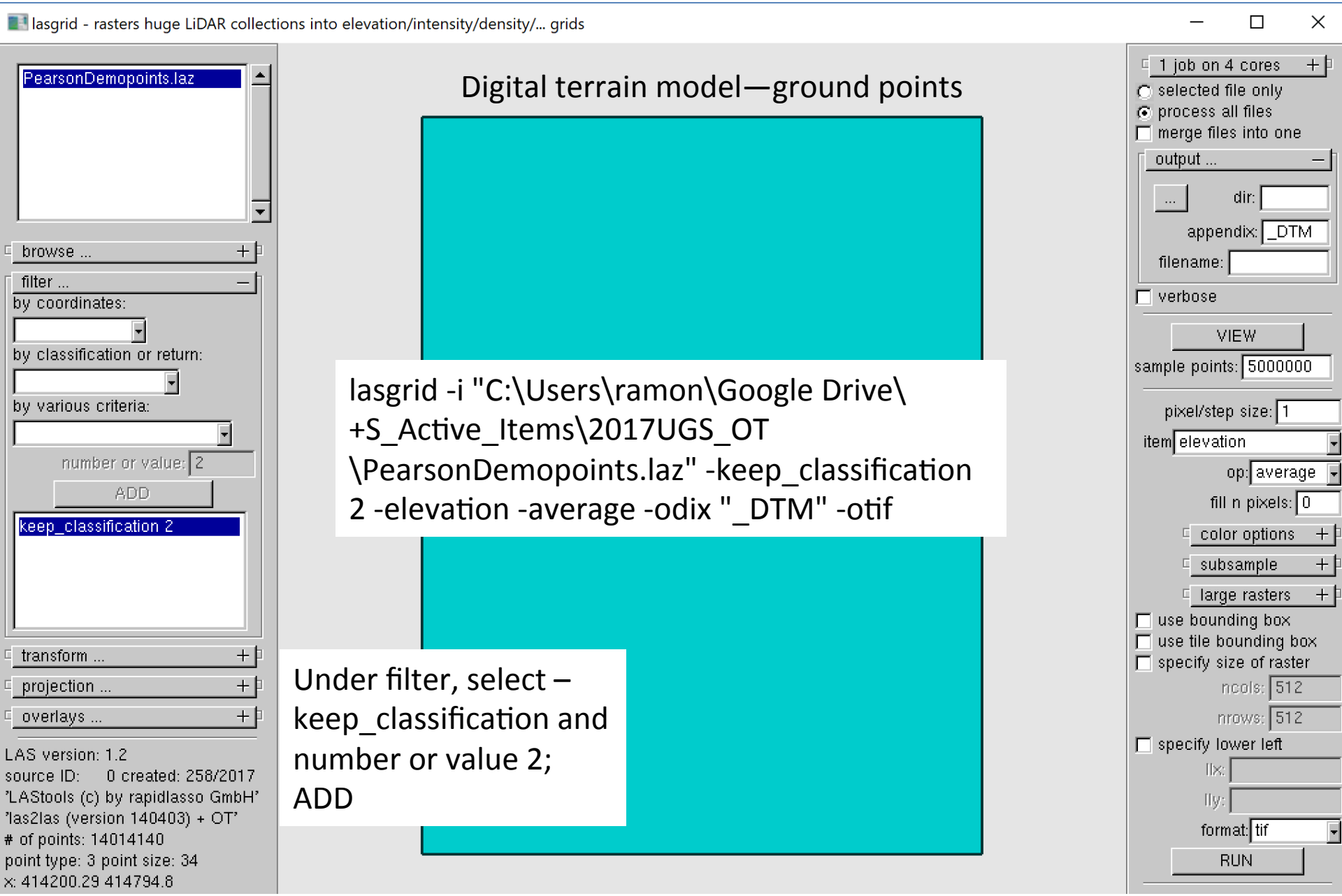






Open lasgrid produced 1 m pixel Digital Surface Model and compute hillshade using Spatial Analyst toolbox

LASGRID is neighborhood approach for DEM computation



Untitled - ArcMap

1:6,362

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

Table Of Contents

Layers

PearsonDemopoints_DTM_sh

Value

High : 254

Low : 0

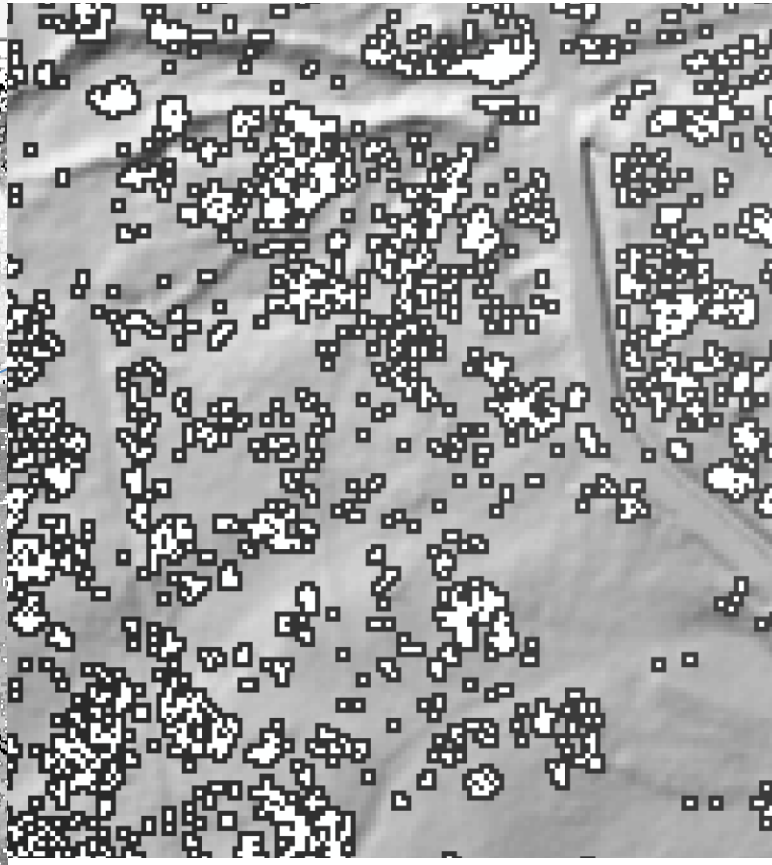
PearsonDemopoints_DTM.tif

PearsonDemopoints_DSM_sh

PearsonDemopoints_DSM.tif

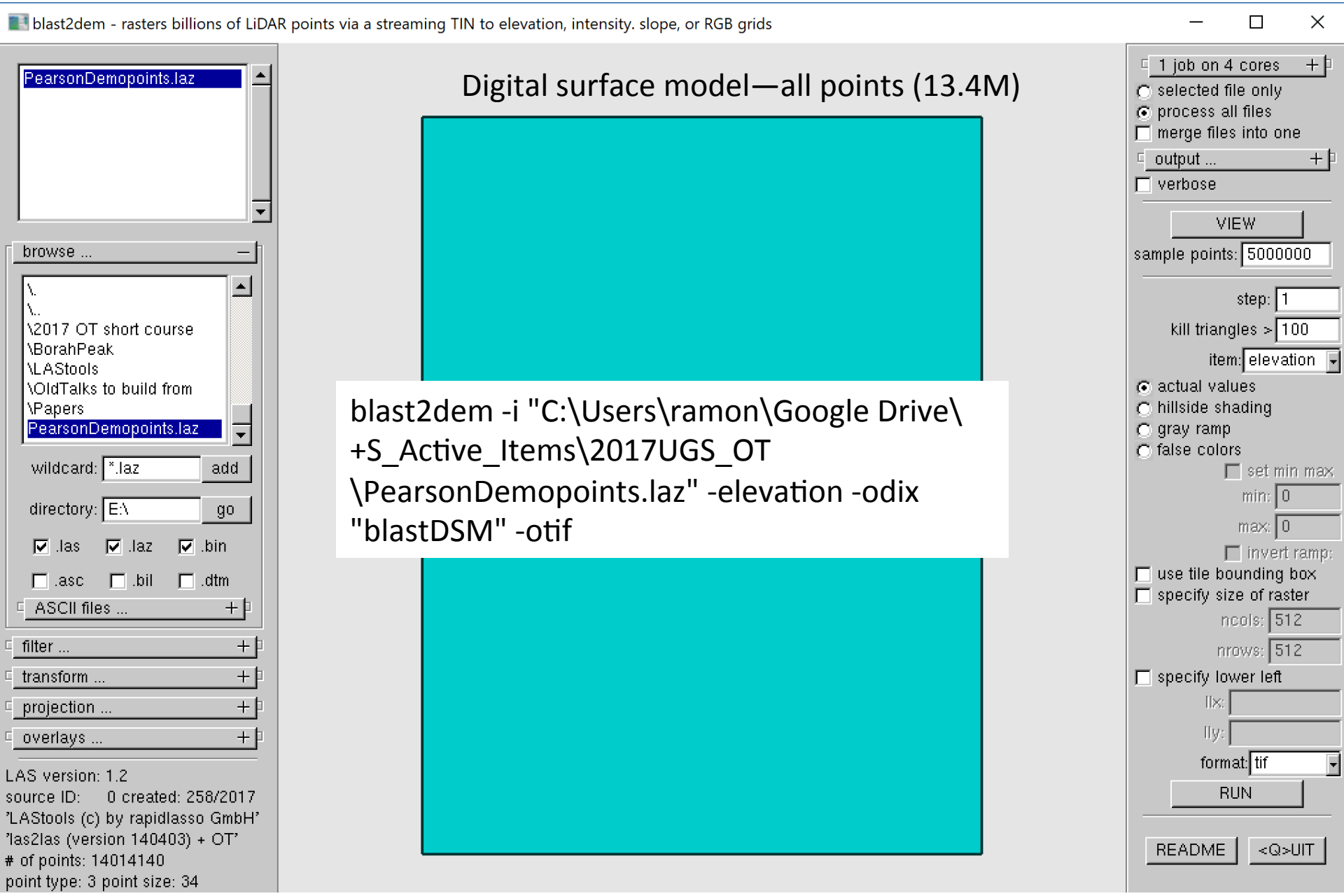
Results ArcToo... Table ...

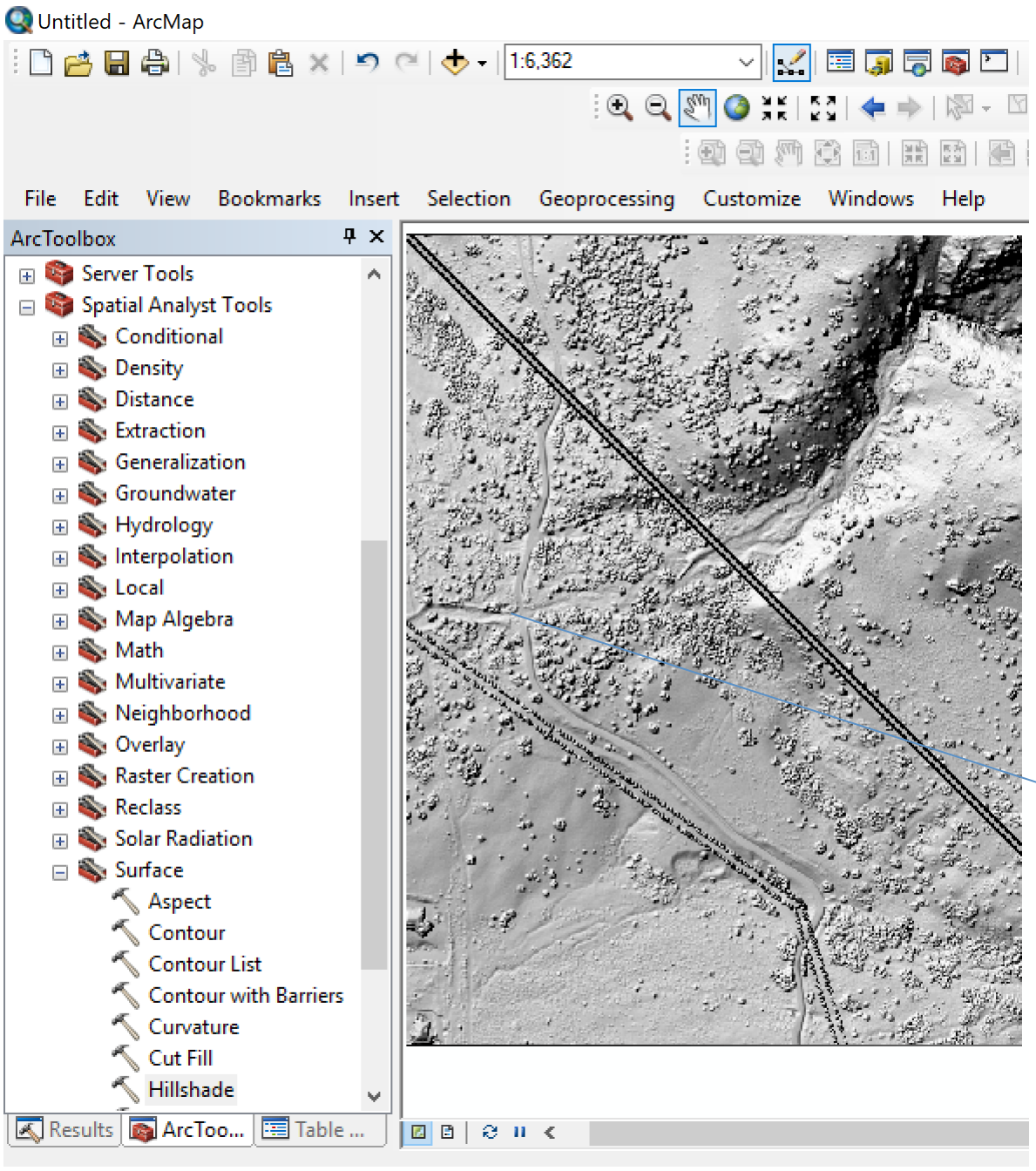
Digital terrain model—ground points



Open lasgrid produced 1 m pixel Digital Terrain Model and view as hillshade. No ground returns under the trees!

BLAST2DEM is TIN approach for DEM computation

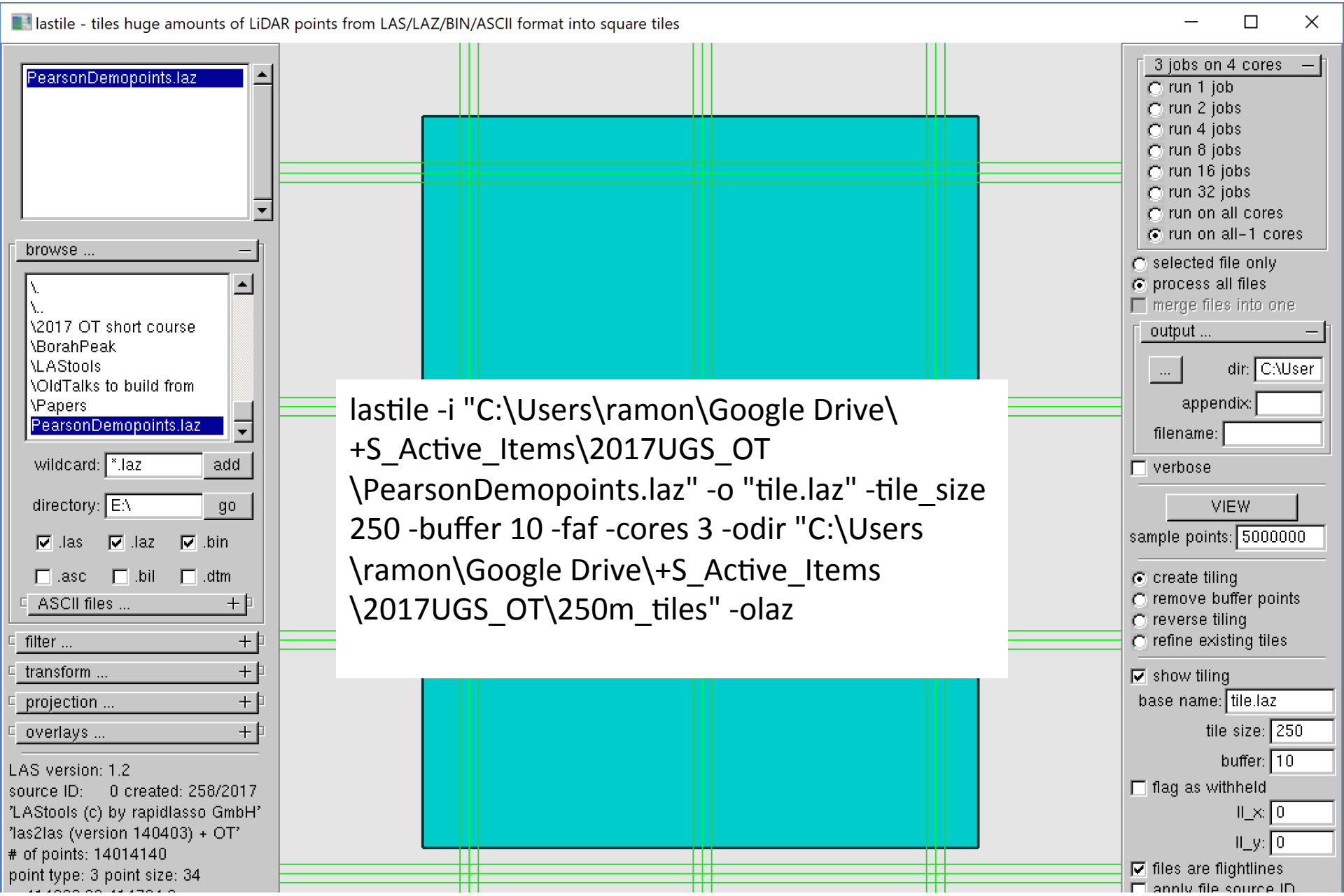




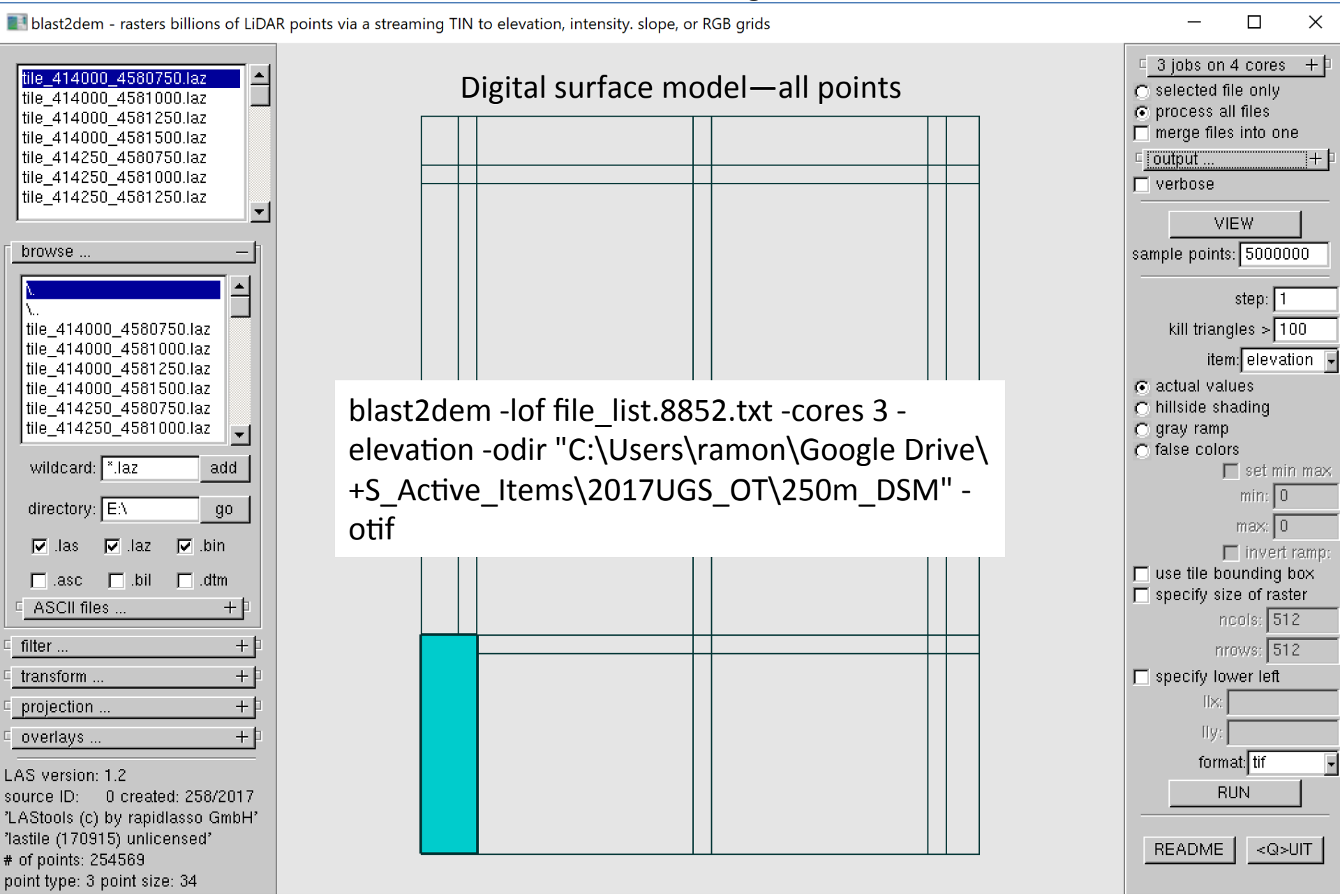
Looks good but what is that white slash?

We exceeded the unlicensed limit for blast2dem of 5M points!

We need to tile the data – be sure to make a folder to capture the tiles



Now let’s blast again



Mosaic the tiles (with their buffers) into a seamless DSM in ArcGIS

Arctoolbox

- Data Management Tools
  - Archiving
  - Attachments
  - Data Comparison
  - Distributed Geodatabase
  - Domains
  - Feature Class
  - Features
  - Fields
  - File Geodatabase
  - General
  - Generalization
  - Geodatabase Administration
  - Geometric Network
  - Graph
  - Indexes
  - Joins
  - LAS Dataset
  - Layers and Table Views
  - Package
  - Photos
  - Projections and Transformations
  - Raster
    - Mosaic Dataset
    - Raster Catalog
    - Raster Dataset
      - Copy Raster
      - Create Random Raster
      - Create Raster Dataset
      - Download Rasters
      - Mosaic
      - Mosaic To New Raster

Mosaic To New Raster

Input Rasters

C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM\tile_4
C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM\tile_4
C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM\tile_4
C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM\tile_4
C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM\tile_4
C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM\tile_4
C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM\tile_4

Output Location: C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM

Raster Dataset Name with Extension: 250m_DSM_mosaic.tif

Spatial Reference for Raster (optional):

Pixel Type (optional): 32_BIT_FLOAT

Cellsize (optional):

Number of Bands: 1

Mosaic Operator (optional): LAST

Mosaic Colormap Mode (optional): FIRST

OK | Cancel | Environments... | << Hide Help | Tool Help

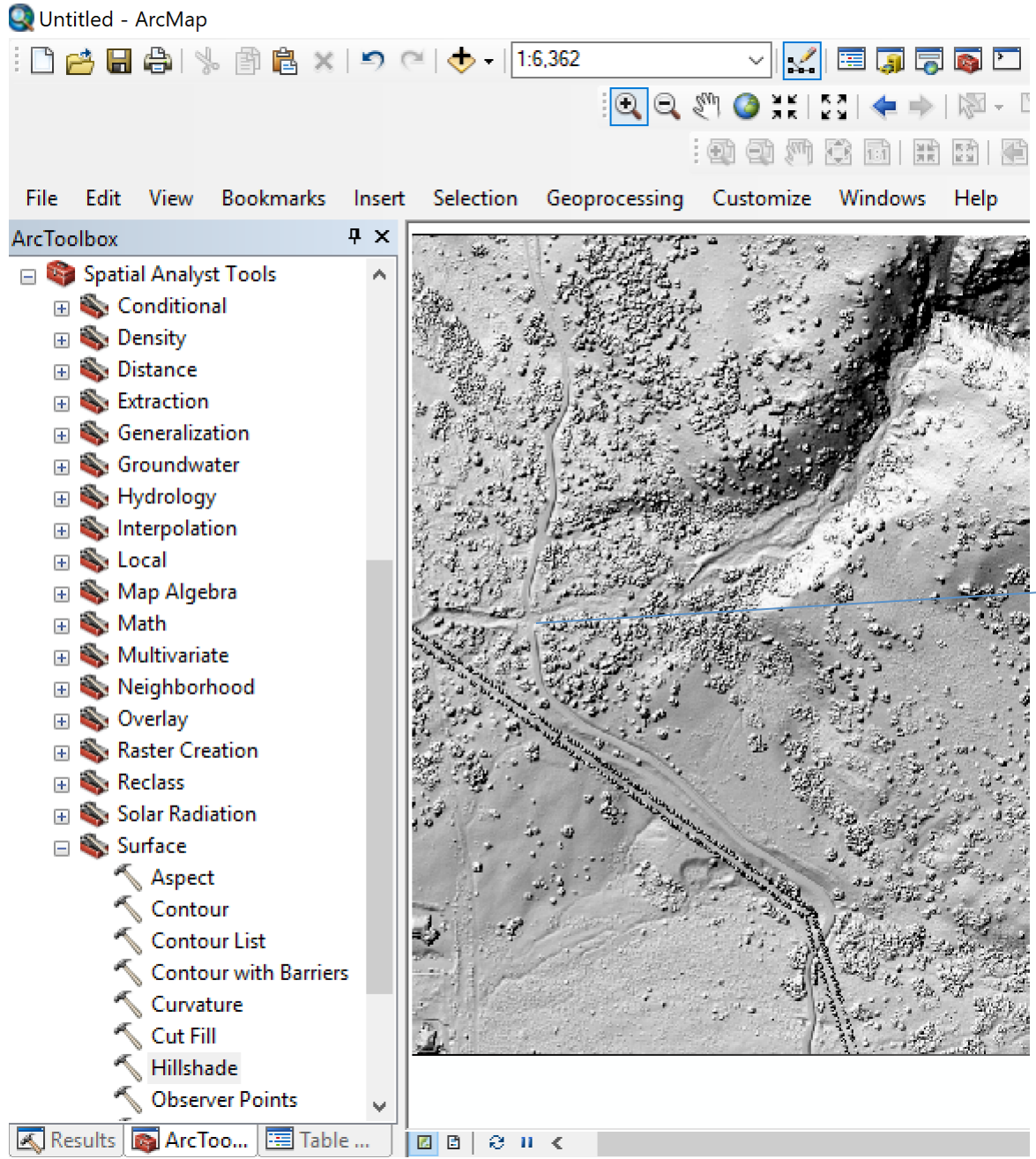
Mosaic To New Raster

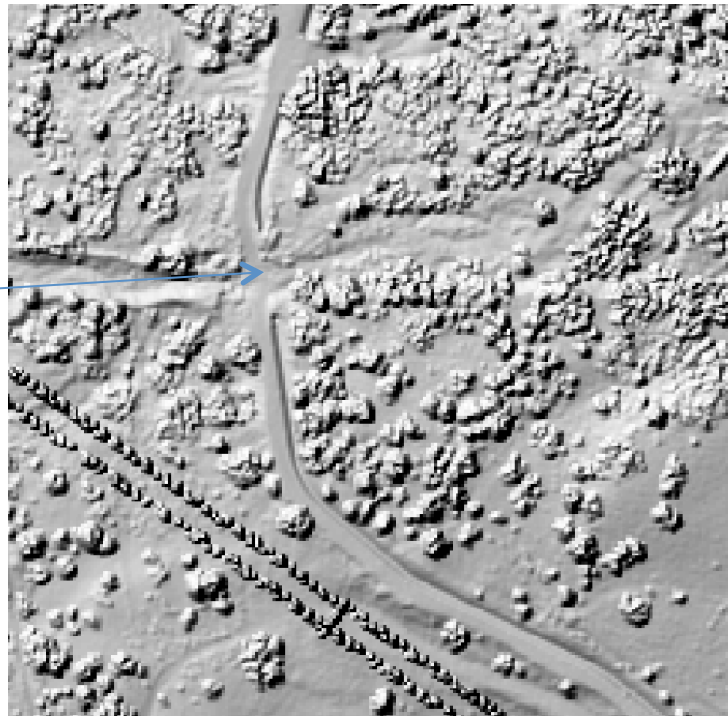
Mosaics multiple raster datas

Load all the tiles with a shift-select

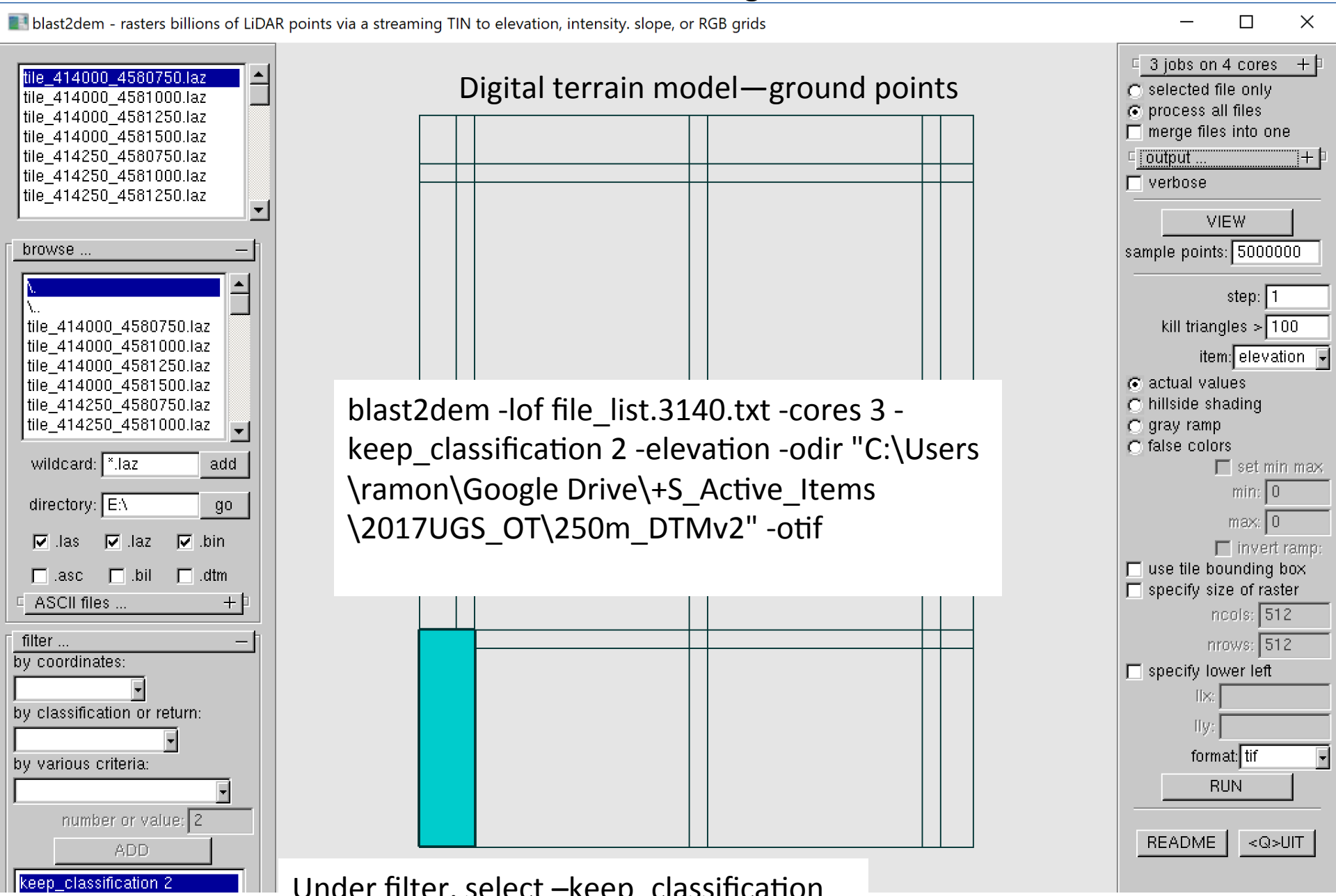
These do matter

Visualize the seamless DSM in ArcGIS as a hillshade



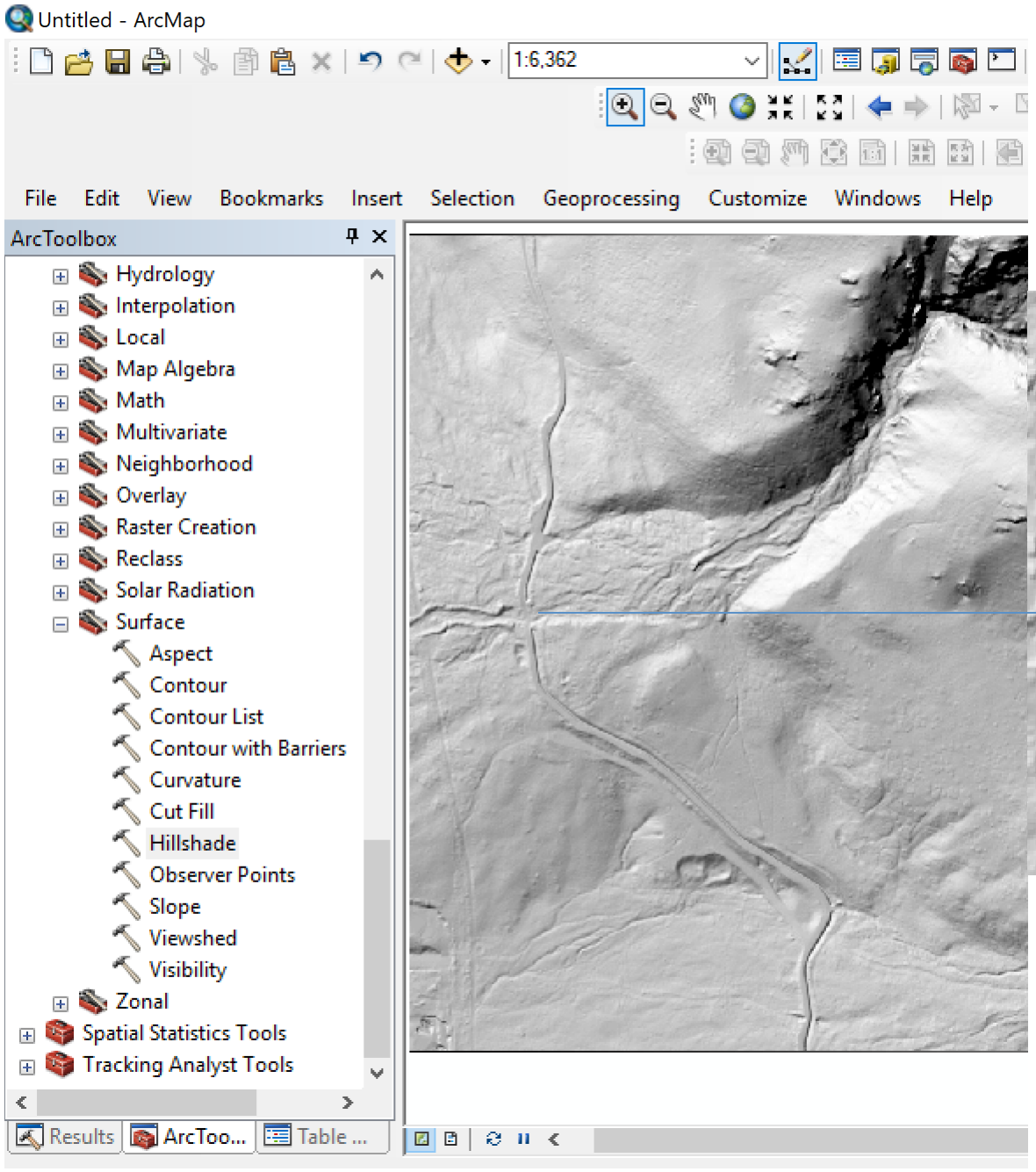


Now let's blast again

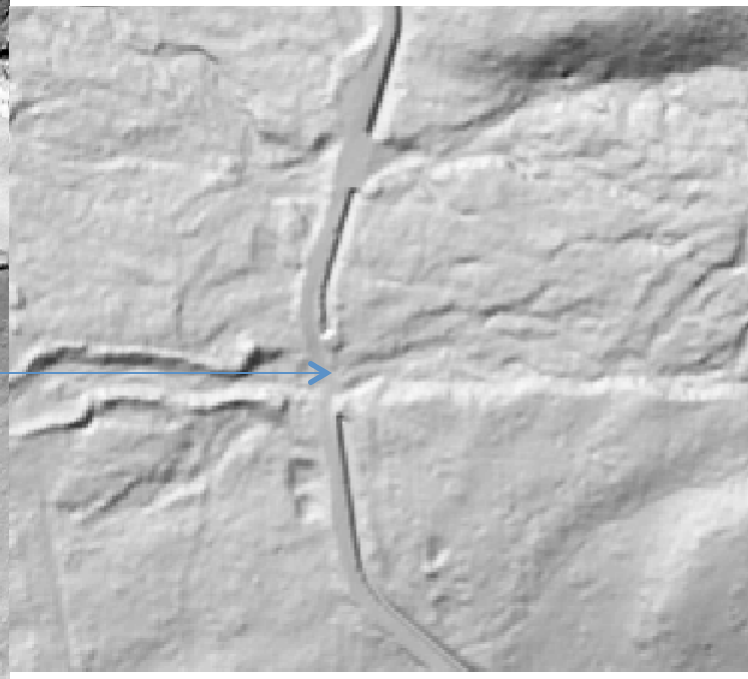


Under filter, select –keep_classification and number or value 2; ADD

Visualize the seamless DTM in ArcGIS as a hillshade



(mosaic as we did for the DSM)



DEMs in ArcMap and ArcScene

Basic visualization and colorization

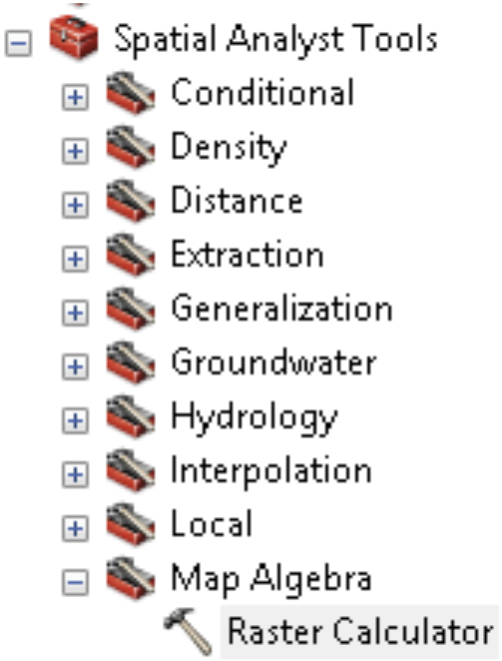
Point and profile measurements

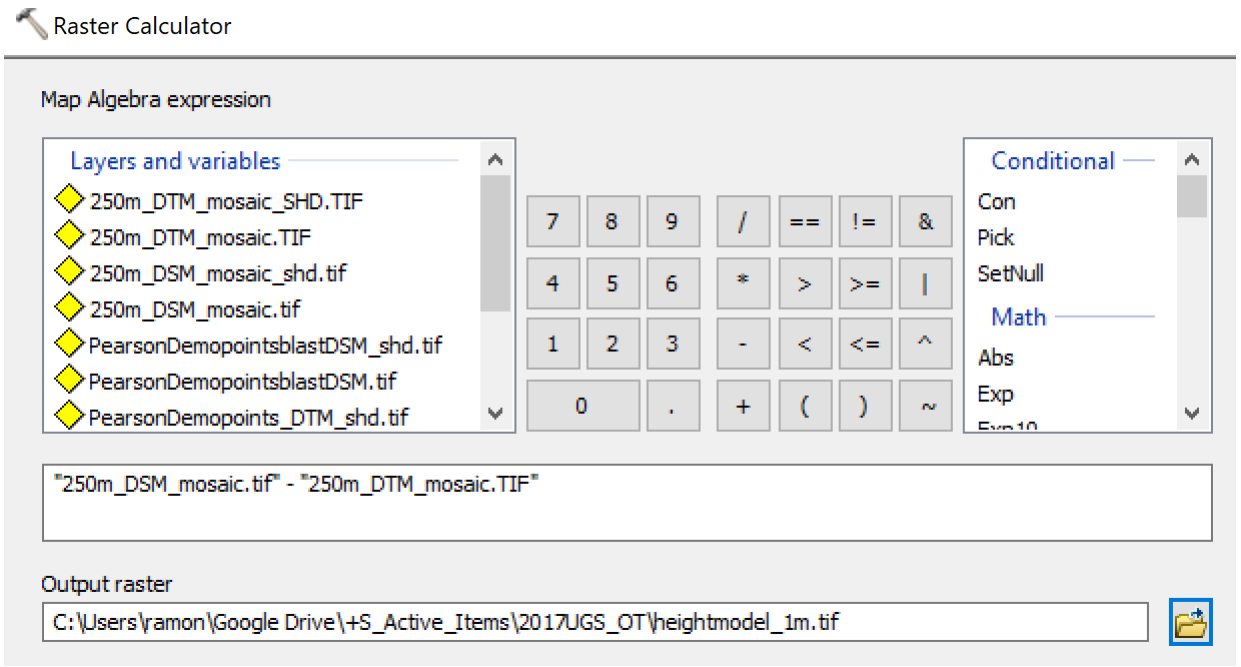
Raster Math (difference and conditional)

Canopy

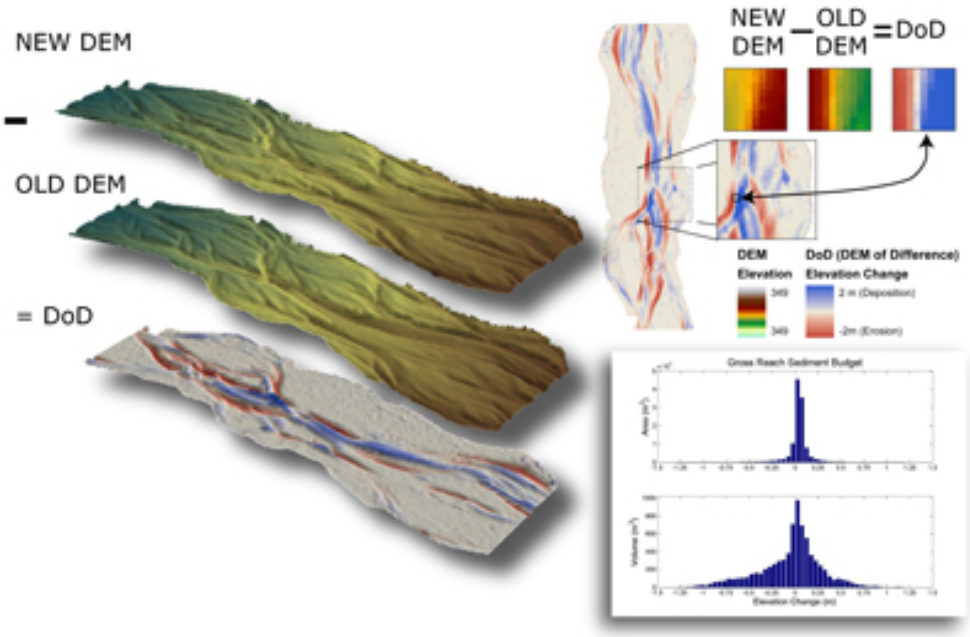
3D viewing in ArcScene

Raster math!





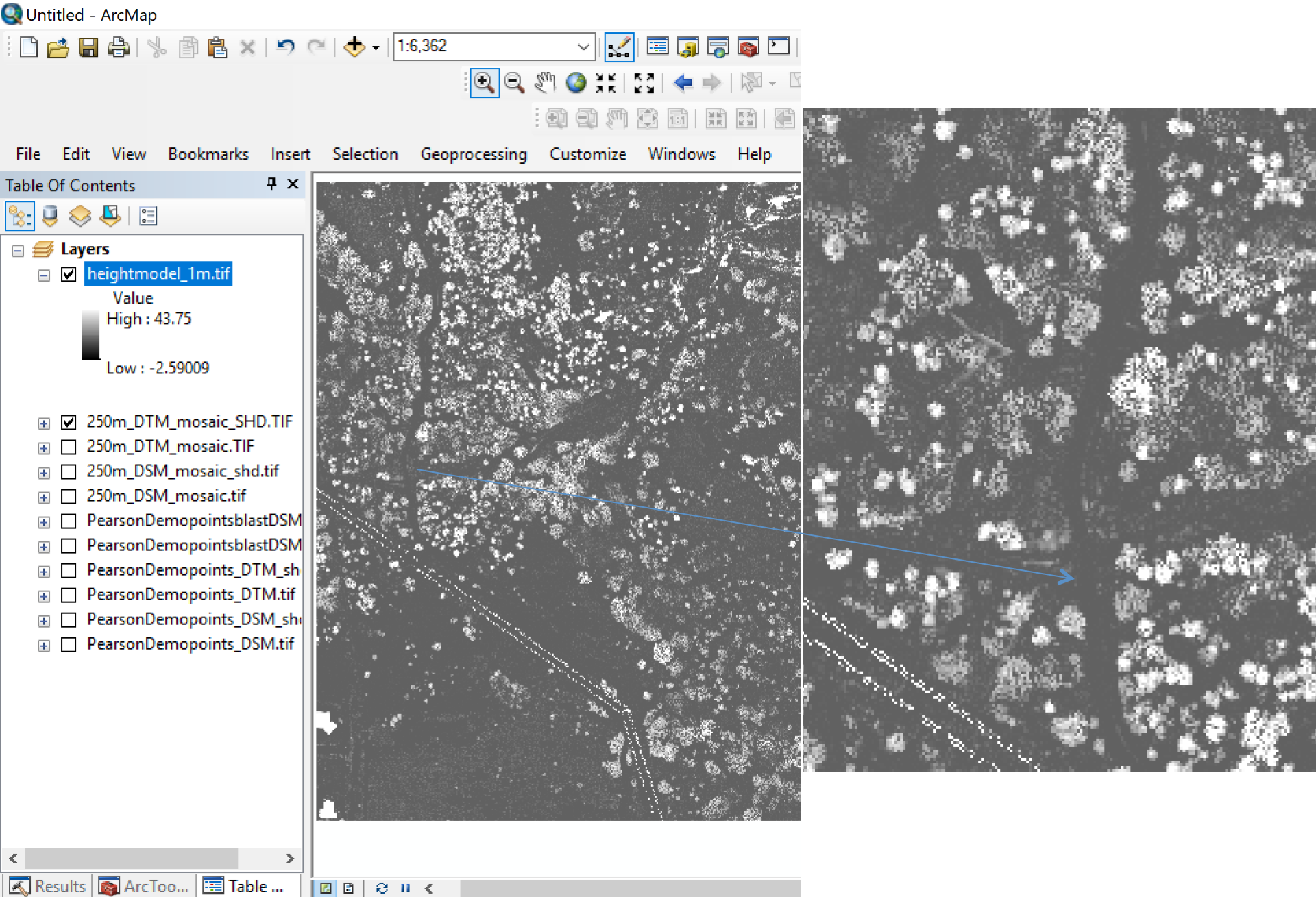
Note that is the beginning of other sorts of topographic differencing
e.g., Morphological sediment budgeting



JOSEPH M. WHEATON
Research Linking Fluvial Geomorphology & Ecohydraulics

http://www.joewheaton.org/

Simple Canopy Height Map



Canopy higher than 1 m

Raster Calculator

Map Algebra expression

Con: Performs a conditional if/ else evaluation on each of the input cells of an input raster. Really powerful!!!

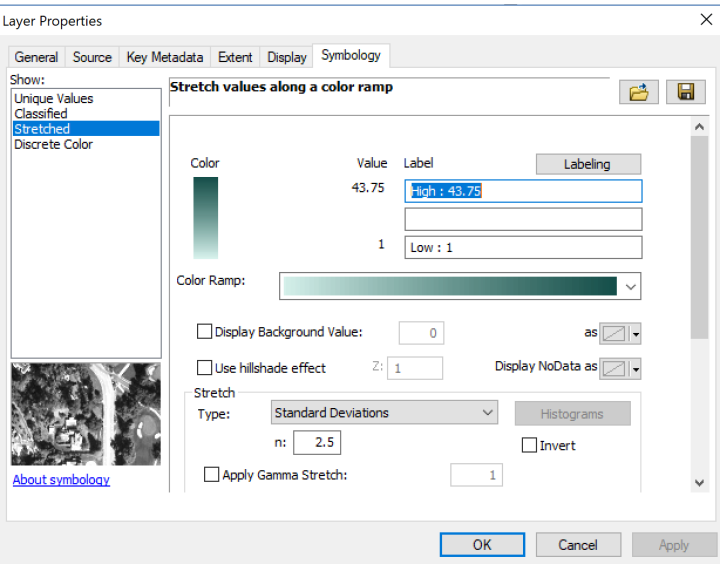
Layers and variables
- heightmodel_1m.tif
- 250m_DTM_mosaic_SHD.TIF
- 250m_DTM_mosaic.TIF
- 250m_DSM_mosaic_shd.tif
- 250m_DSM_mosaic.tif
- PearsonDemopointsblastDSM_shd.tif
- PearsonDemopointsblastDSM.tif

7 8 9 / == != &
4 5 6 * > >= |
1 2 3 - < <= ^
0 . + ( ) ~

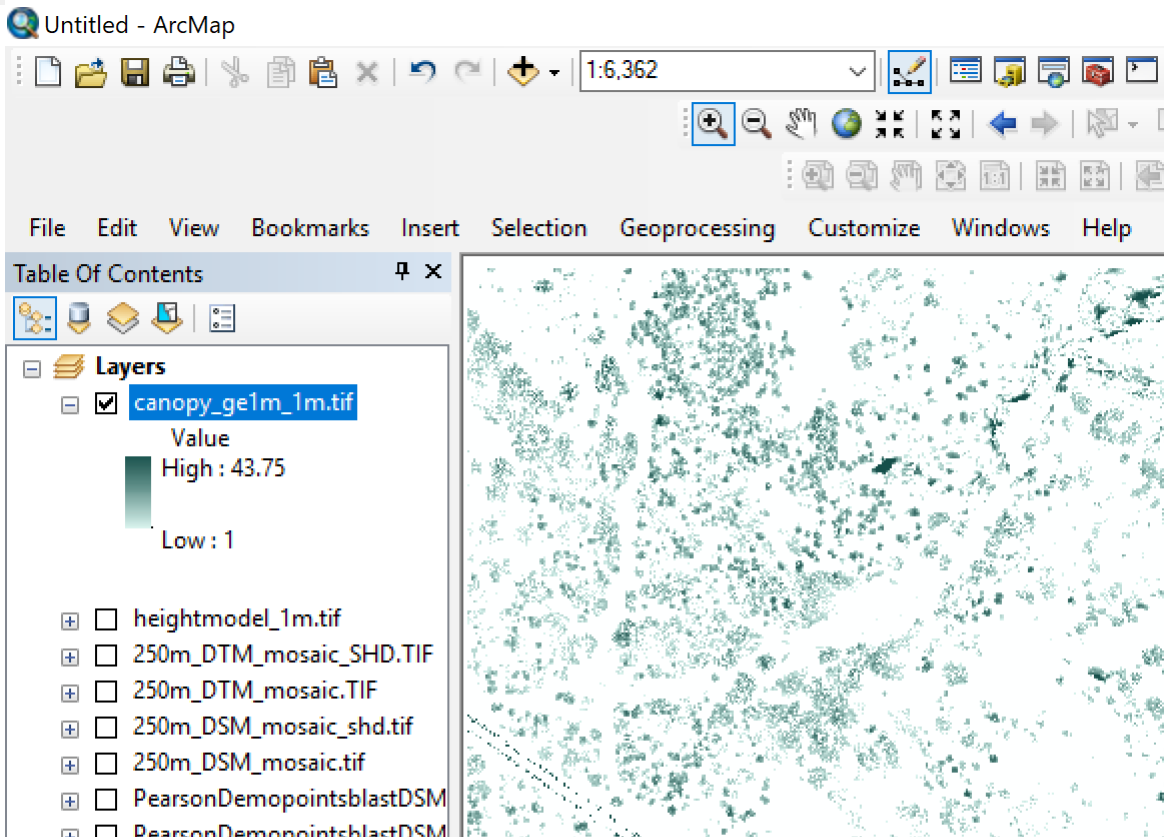
Conditional
Con
Pick
SetNull

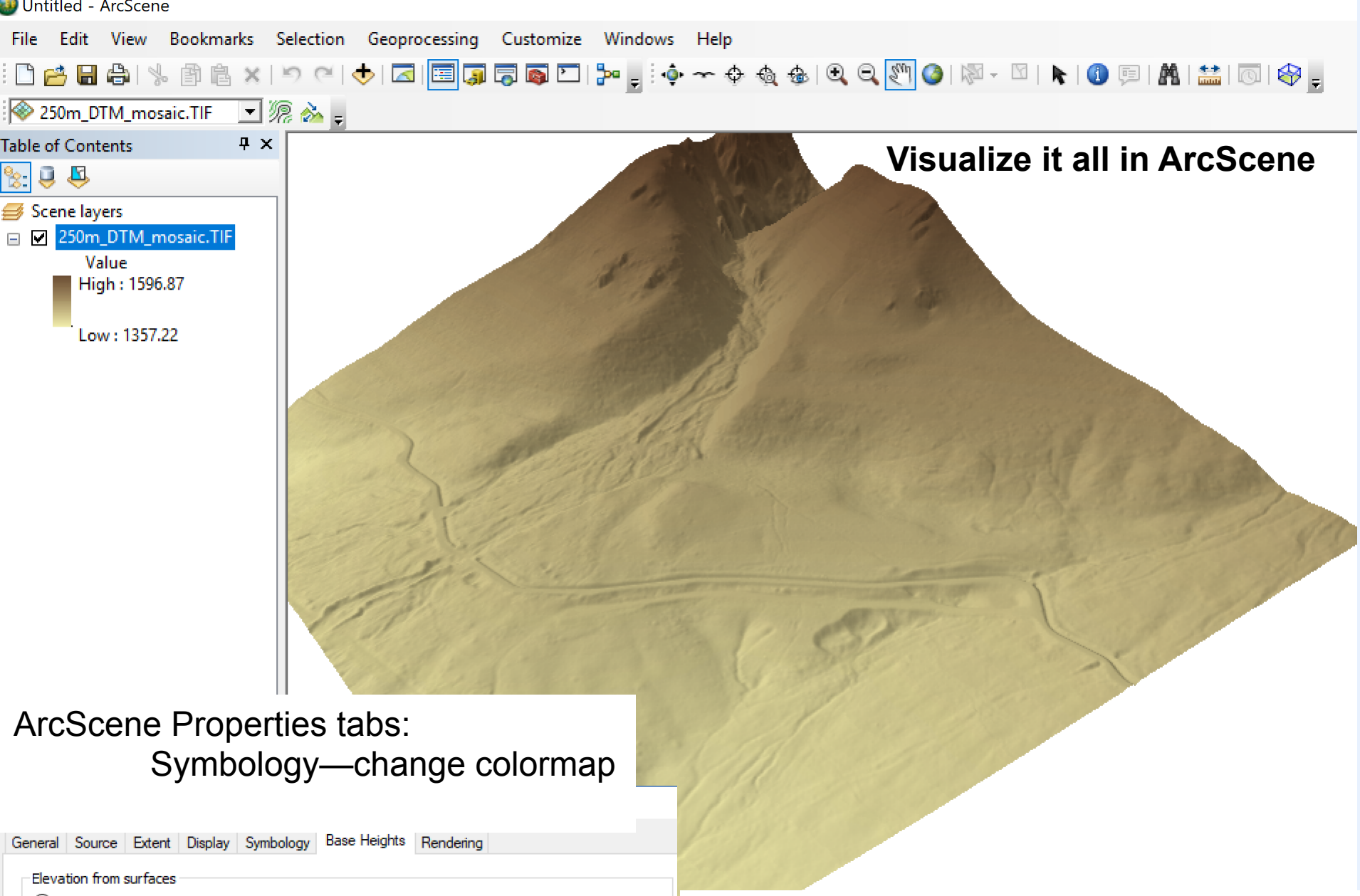
Math
Abs
Exp

```
Con("heightmodel_1m.tif" >= 1,"heightmodel_1m.tif")
```



Properties-> Symbology -> Change the color ramp





ArcScene Properties tabs:

Symbology—change colormap

General | Source | Extent | Display | Symbology | Base Heights | Rendering

Elevation from surfaces

- ○ No elevation values from a surface
- ◉ Floating on a custom surface:

C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DTMv2\250m_DTM

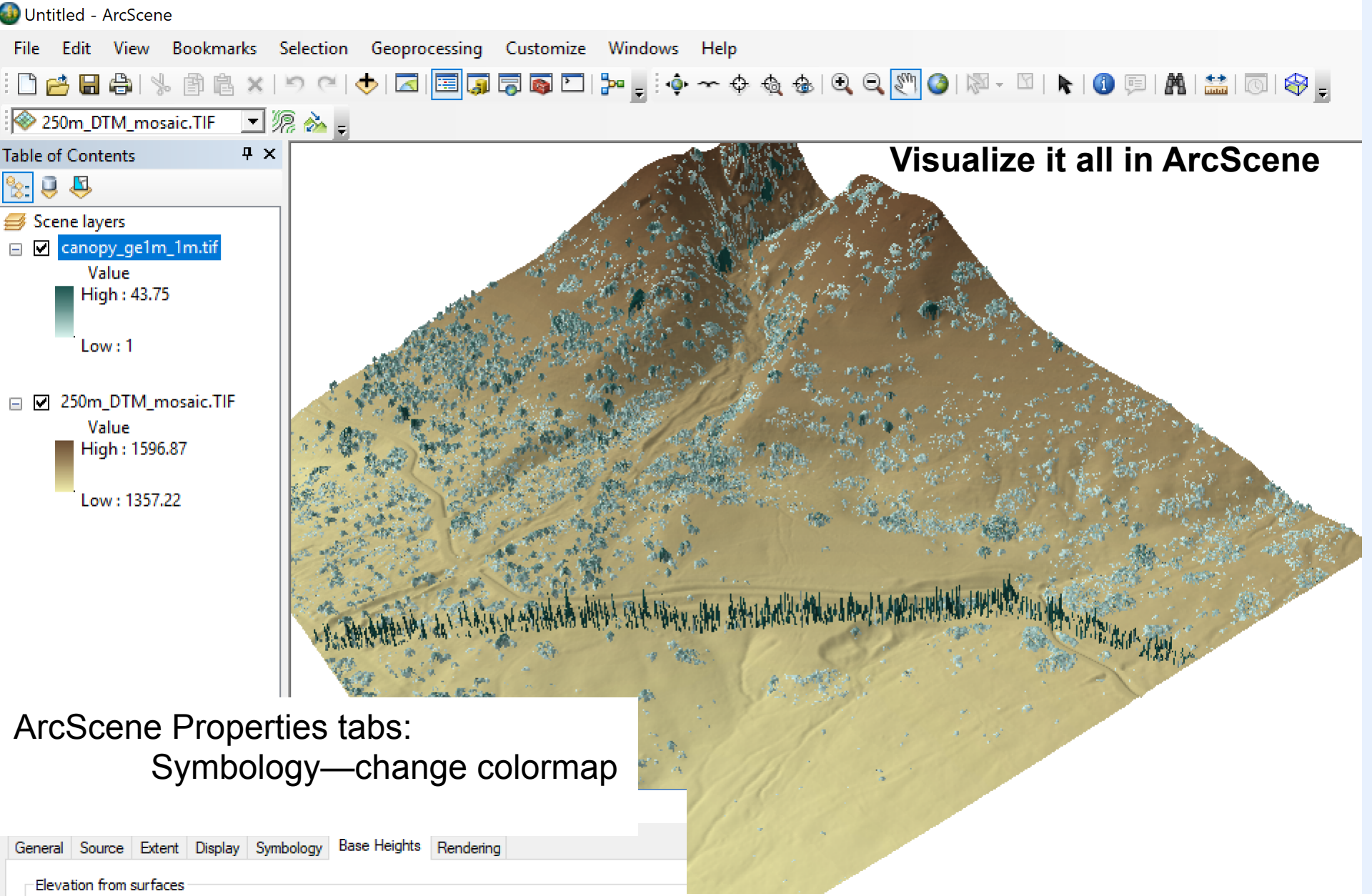
Raster Resolution...

1 m cell size

Rendering

Shade areal features

High quality enhancement



ArcScene Properties tabs:

Symbology—change colormap

General | Source | Extent | Display | Symbology | Base Heights | Rendering

Elevation from surfaces

- No elevation values from a surface
- Floating on a custom surface: Drape it on the DSM

C:\Users\ramon\Google Drive\+S_Active_Items\2017UGS_OT\250m_DSM\250m_DSM_r

Raster Resolution... 1 m cell size

Rendering

Shade areal features

High quality enhancement