

February 27th Webinar “GIS in the Field: Using LiDAR Makes Sense” Participant, Participant Questions, Answers

Rebecca Elwood says (to Presenters) [14:29:27]:

1 - How to you place elevation labels on LiDAR contour lines?

NRCS uses ESRI software for GIS applications

ESRI ArcGIS ArcMap 10x users

Labeling using the Contour Placement style

Desktop > Mapping > Adding text to a map > Displaying labels > Placing labels with the Maplex Label Engine

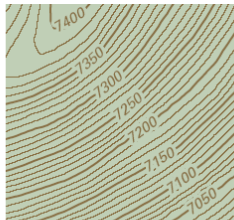
Contour lines are often represented by many individual line features in a GIS, which can result in many more labels being placed than necessary. To avoid this problem, line features that represent contours can be treated as special types of line features. The Maplex Label Engine groups the segments of contour features, if the symbology and label match and the features are connected, and treats them as single, long features. This allows labels to be placed for the contour as a whole rather than for each segment. Contour labels can be aligned in ladders where the label will appear to step up and step down the contours in a straight (or curved) path. These ladders can be created with labels from multiple label classes. The contour labels can be aligned to the page, ensuring that the label is never placed upside down, and also aligned to the contour elevations so that the top of the label is always facing uphill.

There are three placement positions for contour features: **Centered Horizontal**, **Centered Straight**, and **Centered Curved**.


You can also set the contour labels to repeat along the length of their feature.

[Learn more about setting up labels to repeat along lines](#)

The index contours below have been labeled using the centered curved placement position and aligned in ladders. The labels have had **halos** added to mask out the underlying contour feature.



Steps:


1. [Enable the Maplex Label Engine](#).
2. Click the **Label Manager** button  on the **Labeling** toolbar.
3. Check the check box next to the layer you want to label.
4. Choose a label class under the layer.
5. Click the **Properties** button.
6. Click the **Label Position** tab.
7. Choose **Contour Placement** from the line label placement style drop-down list.

The label position can change when you choose the **Contour Placement** style. This is because there are three placement positions for contour features: **Centered Horizontal**, **Centered Straight**, and **Centered Curved**.


8. Optionally, click **Position**, choose a different label placement position for your contour features, then click **OK**.
9. Optionally, click the **Options** button.

If the **Options** button is unavailable, you will need to choose **Contour Placement** from the line label placement style drop-down list. The contour options are only available for label classes that are placed with **Contour Placement**.

10. Optionally, choose a **Label Alignment** option. The contour labels can be aligned to the contour elevations so that the top of the label is always placed uphill. This option allows the labels to be placed upside-down. The contour labels can also be aligned to the page, ensuring that the label is never placed upside-down. The **Page alignment** option is the default. When placing labels using page alignment, you can enter a maximum label angle over which a label will not rotate.
11. Optionally, choose a **Laddering** option. Placing labels in ladders will place the label so it appears to step up and step down the contours in a straight (or curved) path. These ladders will run from the top of a hill to the bottom, will not cross each other, will belong to a single slope, and will not cross any other slope. The **Place labels in ladders** option is the default.
12. Click **OK** to close all dialog boxes.

 **Tip:** You can mask out the underlying contour feature in two ways:

- Create a **halo** around the label.
- Convert the labels to **annotation** and create **masks** to block the contour features but not the other underlying symbology.

 **Tip:** You can also open the **Placement Properties** dialog box by clicking the **Placement Properties** button on the **Labels** tab of the **Layer Properties** dialog box for the layer you want to label.

Related Topics

[Placing labels for contours](#)

[Repeating labels along lines](#)

2 - How do you know the slope is very accurate? Do you take the total length divided by the fall in elev, or what other method? Because, for example, with 1-meter resolution LiDAR DEMs, an accurate elevation value is provided for every 1-sq. meter on the ground – the computer can then perform a precise calculation of actual slope. So it is not an 'estimate' but rather a precise calculation.

Jon Bathgate says (to Presenters) [15:03:33]:

LiDAR is so detailed it gives information on micro-topography. In order to generate terrain attributes (slope, aspect, flow accumulation, flow direction, wetness index, etc) that is not on a micro-topographic scale, the DEMs generated from the LiDAR data must be smoothed. Smoothing during the interpolation will remove the pits and bumps yet retain the topographic integrity. What type of smoothing do you use to generate the DEMs?

In KY we run the ArcGIS tool 'Focal Statistics' on the original DEM – thereby creating a new 'smoothed' DEM. Consult ArcGIS 'Help' for more information pertaining to the Focal Statistic tool.

Gail Myers says (to Presenters) [15:04:21]:

Is planned outlet point the pour point? Yes

Jack Penegor says (to Presenters) [15:04:48]:

Upper Michigan shows no LIDAR data available. Will that change?

NRCS is an active participant in the National Digital Elevation Program (NDEP) and works with Federal, State and Local partners to acquire high resolution elevation data. NRCS staff can contact Bill Marken at 817 509 3524 or

William.marken@ftw.usda.gov to propose potential LiDAR projects. Non NRCS staff can contact their local USGS

liaison. Here is a web site that lists the USGS liaisons around the USA <http://liaisons.usgs.gov/geospatial/>

There is an effort underway to implement a National 3D Elevation Program to cover the lower 48 states. To learn more visit <http://nationalmap.gov/3DEP/>

Brant Miller says (to Presenters) [15:05:10]:

If map is showing no LIDAR available for part of a state, is it possible to get it, and if so, how expensive is it?

NRCS in partnership with USGS use the Geospatial Products and Services Contracts

http://geodatacontracts.er.usgs.gov/gpsc_information_sheet.html for acquiring high resolution elevation data. A good rule of thumb is \$500 per square mile. Factors such as geography, point density, vertical accuracy and deliverables can dramatically affect the price per unit. LiDAR projects can vary as much as \$100 to \$1000 per square mile. See the answer to the previous question on who to contact for more information.

Sam Carlton says (to Presenters) [15:06:06]:

what is the best source for the LiDAR 1 meter resolution data?

Each LiDAR collection comes with metadata for the las point cloud and for the derivatives. The nominal pulse spacing, classification of the las point cloud and the horizontal and vertical accuracy of the collection are the major factors that determine what post spacing is most appropriate. Generally speaking, a QL1 or QL2 will support a 1 meter raster.

Quality Levels	Elevation Source	Horizontal Resolution Terms			Vertical Accuracy Terms	
		Point Density	Nominal Pulse Spacing	DEM Post Spacing	RMSEz in Open Terrain *	Equivalent Contour Accuracy
QL 1	LiDAR	8 pts/m ²	0.35 m	1/27 arc-sec (~1 m)	9.25 cm	1-ft
QL 2	LiDAR	2 pts/m ²	0.7 m	1/27 arc-sec (~1 m)	9.25 cm	1-ft
QL 3	LiDAR	1 – 0.25 pts/m ²	1 – 2 m	1/9 arc-sec (~3 m)	≤18.5 cm	2-ft
QL 4	Imagery	1 – 0.04 pts/m ²	1 – 5 m	1/3 arc-sec (~10 m)	46.3 cm – 139 cm	5 – 15 ft
QL 5	IFSAR	0.04 pts/m ²	5 m	1/3 arc-sec (~10 m)	92.7 cm – 185 cm	10 – 20 ft

is there a cost?

USGS is the national data steward for elevation. The National Elevation Database (NED) is available from the National Map <http://nationalmap.gov/elevation.html> You can also download the las data from the USGS Center for LiDAR

Information Coordination and Knowledge (CLICK) <http://lidar.cr.usgs.gov/> NRCS users can access elevation data from the Geospatial Data Gateway <http://datagateway.nrcs.usda.gov> FTP is free and there is a nominal charge for media and bulk orders.

HILL BRYAN says (to Presenters) [15:06:18]:

I love topographic maps, and I find the detail in lidar maps very fascinating. I appreciate our ability to use this type of information as a planning tool from the office and to provide some design information (watershed boundaries, etc.). However, here are a few observations:

- 1.) Once again, engineers and scientists have developed new technology that destroys jobs of the past.
- 2.) One big reason many folks join NRCS is because of the "traditional" mix of field and office work.
- 3.) In the wetland example with the house at the 9' contour, if the house had a basement or a septic field, flood damage might occur at an elevation lower than 9', but you can't tell that from the lidar map. Field investigation is probably still needed.
- 4.) The example ditch project which apparently was designed without any field survey/investigation whatsoever might fool some folks into assuming they will never need to go to the field again. The example showing a difference in ground elevations obtained by on-site survey versus that obtained by lidar are very instructive. This example proves that lidar has disadvantages and that there will always be a need for field investigation/survey to verify certain lidar data, to get more accurate and detailed on-site information that may be needed for certain projects.

LiDAR is a remote sensing technology and is a proven supplement to field investigations and studies. It is not a replacement for field work. Trust but verify. Quality LiDAR data are far superior to legacy USGS topographic maps. LiDAR can be used for planning purposes and in some cases even design work. It depends on the quality level and the application.

michael bobek says (to Presenters) [15:06:35]:

How soon will the instructions for the watershed analysis rollout to states and are there plans to include TR-55 methods for urbanizing watersheds? Please contact Madalene.Ransom@gnb.usda.gov

James Rospopo says (to Presenters) [15:07:26]:

We are in the area that was shown on the map of the US that had LiDAR information available. In checking on the Geospatial Data Gateway in my county under the elevation tab I see 3 files. A 3 meter, 10 meter and 30 meter file. Are those LiDAR files and if so with one should we use. USGS has an excellent information posted in the National Elevation Database (NED) release notes that provide metadata on the source of the different resolutions. Download the latest version at Visit <http://ned.usgs.gov/Ned/faq.asp> and look at the FAQ list.

The LiDAR format is .las and is not available from the Geospatial Data Gateway. To download .las, visit the USGS Center for LiDAR Information Coordination and Knowledge (CLICK) <http://lidar.cr.usgs.gov/>

Ryan Stitt says (to Presenters) [15:07:47]:

How do you access the top most layer in a DEM?

Using LiDAR software you can filter the first return to create a Digital Surface Model (DSM). NRCS generally orders the DSM as a standard deliverable and is in the process of publishing map and data services for users to visualize and download DSMs where LiDAR is available. NRCS users can contact Steve Nechero at 817 509 3366 or steven.nechero@ftw.usda.gov Non NRCS users can view DSM products on ESRI ArcGIS.com World Elevation Services at [http://www.arcgis.com/home/group.html?owner=esri&title=World%20Elevation%20Services%20\(BETA\)](http://www.arcgis.com/home/group.html?owner=esri&title=World%20Elevation%20Services%20(BETA)) Ask to join the group and check out the interface and data available for the world.

James Rospopo says (to Presenters) [15:08:13]:

which one should we use. The farther in you are – say, with one farm showing, the more detailed data resolution you need. If your purpose is to map an area using 2 foot contours, you'd need to download the 3 meter file, and it should give you useful information. If you are instead working at an 8-digit Sub-basin level, those 3m data are going to be cumbersome, and there could be too much info for the computer to use efficiently.

Mark Washechek says (to Presenters) [15:09:23]:

Has anyone used lidar data to determine length and slope to use in a water erosion calculation in Rusle2

East GIS Workgroup Response, March 1st: We are assuming that the question involves Rusle2 for HEL determinations.

Currently Food Security Handbook requires a field visit for HEL determinations. However, one state is considering using LiDAR in Rusle2 as an information base to enhance the efficiency of the field visit.

Victor Slowik says (to Presenters) [15:09:48]:

When cropping LiDAR, what is the difference between cropping using Extract by Mask from Spatial Analyst or from Data Management Tools? Data Management tools seems faster, but are there other differences?

(Steve C.): For 'clipping rasters such as a LiDAR DEM... I simply use 'Raster Calculator' after FIRST setting the EXTENT to the current screen and a MASK to my desired CLIP area – the result will be a new 'clipped' raster.

TERI EDEAL says (to Presenters) [15:09:48]:

how do we view the written questions?

If you wish, contact Madalene.Ransom@gnb.usda.gov to discuss.

Andrew Kessler says (to Presenters) [15:09:51]:

Is NRCS GIS Hydro tool you presented publicly available? Yes – will be 'cleaned up' and made available soon!
If yes, what versions of GIS are supported? Originally at v.9.2 – now also for v.10.0 & 10.1

s gray says (to Presenters) [15:09:51]:

background conversations are cutting off the speaker. The background noisemakers should be cuffed, clipped and shut down.
However, LiDAR data will be of no help in this endeavor.

HILL BRYAN says (to Presenters) [15:10:26]:

While waiting for lidar coverage, the Web Soil Survey can be used for hydrology information. It has a topomap background option. AOI area can be drawn in irregular shape on the topo background to delineate/measure drainage area, hydrologic soil group areas. (Steve C.): Yes, that is true. However, the LiDAR derivatives provide a much more accurate option than using the old topo base. NRCS users have a robust set of tools to do on-screen digitizing of delineations using ArcMap (instead of doing this on Web Soil Survey). But again – the old topos are not accurate compared to new high-resolution elevation data.

Dennis Renken says (to Presenters) [15:12:53]:

my question was the same as Jack Penegor on the UP of Michigan. Dennis Renken

ken oanes says (to Presenters) [15:13:29]:

Can you derive first vs successive returns from LAS data? As long as the LAS data that is delivered to you is "classified" as to which return it is, yes. Each laser pulse will usually have multiple returns. As the sensor picks up all the reflections from that pulse of light, it assigns a return order to them. Usually, they're given 1st, last, and 'intermediate' values. I don't recall seeing each intermediate reflection given a numerical value other than 'intermediate'. In general, one would treat the intermediate values together as a cloud, to show the shape of a tree, for instance.

Sam Carlton says (to Presenters) [15:23:43]:

are overlays of aerial photos on to hillshades available publically? if so, where? There may be an entrepreneur who has done this, but each GIS user can do the same thing on their own system for an area of interest. The key is the ability of the software to impart transparency to the layers.

Peter Julovich says (to Presenters) [15:26:57]:

Can Lidar be useful in developing pollutant loading from a particular watershed to a particular water stream? Insofar as LiDAR would help us assess the speed of runoff, the aspect and slope of the land it runs across, and even whether there is an overstory, understorey, etc., yes. We'd have to put some of those derivative products together and calculate, perhaps, an index of loading.

cassius spears says (to Presenters) [15:27:37]:

Can the grass water water EFH2 drainage tool Mr. Crabtree developed be made available to other NRCS states? See above

Geoffrey Schoming says (to Presenters) [15:28:22]:

Are 3D-analyst and/or spacial analyst needed? Most all tools demonstrated require the Spatial Analyst extension, some require 3D-analyst extension

Lane Johnson says (to Presenters) [15:28:26]:

What GIS software will CDSI web application use and will LiDAR DEMs be able to be used The CDSI web application, referred to as Conservation Desktop, was a set of business requirements and technical specifications that was given to a contractor. They could use whatever software they wanted to come up with an answer that met our requirements. I believe they have chosen to program in one of the enterprise database environments, using or creating GIS functions out of that software's toolboxes. Also, for the latest about GIS in CDSI, consider contacting Steven.Nechero@ftw.usda.gov

An Email Exchange after the Webinar:

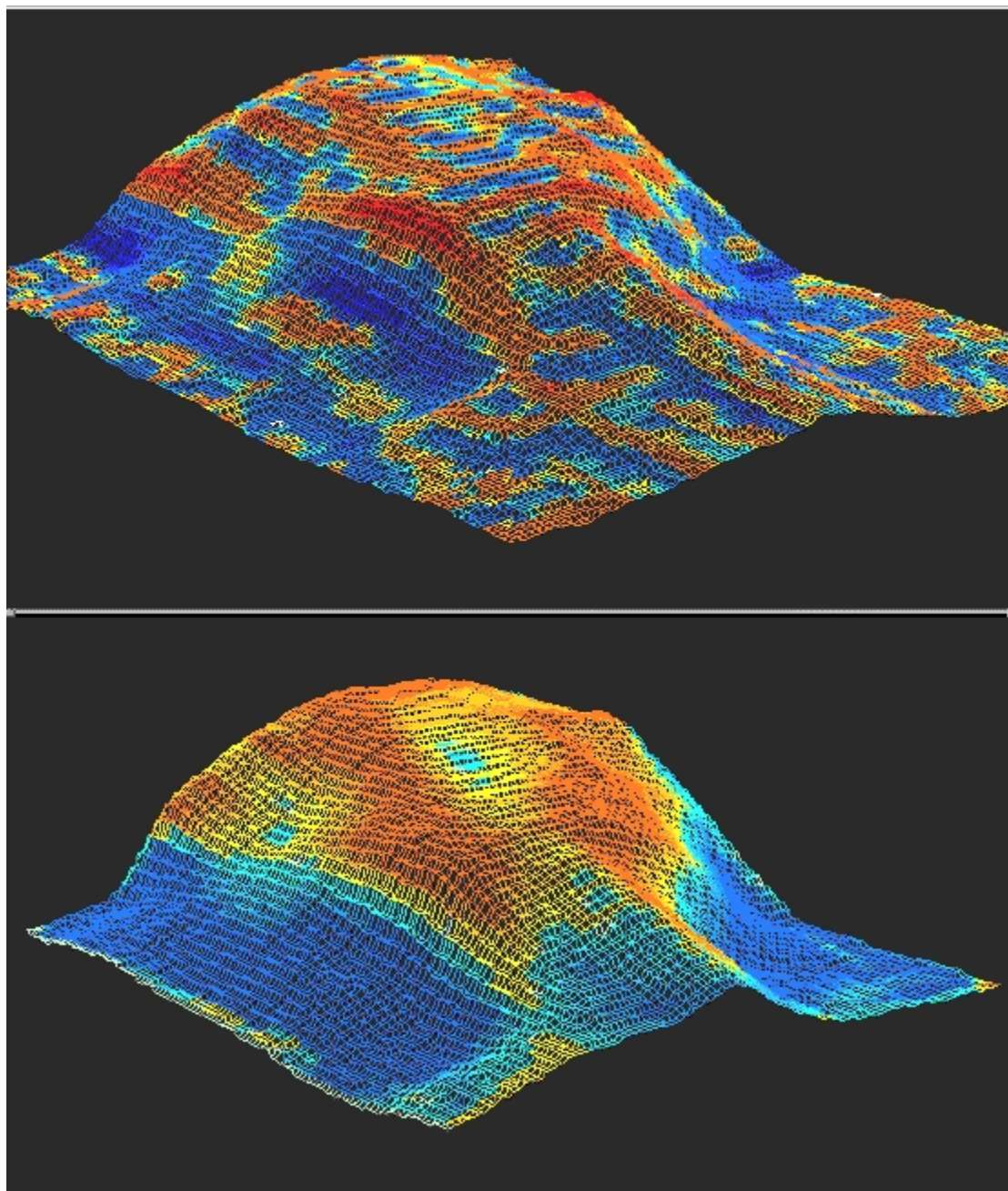
Jon Bathgate says (to Presenters) [03/01/13]:

I work for a soil survey office, though a few Field Offices have requested LiDAR data processing. The products that I have been giving the FO are painted reliefs and contours. If anyone is interested, I have converted Jeff Nighbert's painted relief aml into a python script/toolbox (ArcGIS 10.0). Let me know if you want it, and I will email it to you. In creating the contours I'm still playing around with smoothing factors. The FOs have not yet asked for any terrain attributes, though Steve Crabtree's presentation has resulted in a couple of DCs asking me how to get the Hydro program...and along with the Hydro program, terrain attribute data will be needed. Seeing Steve's presentation and how he was using slope data automatically made me think "how was the LiDAR DEM smoothed to generate the terrain attributes?"

As you know, LiDAR data gives a great amount of detail on the micro-topography. Any terrain data derived from the LiDAR data will be at the same scale. In soil survey we are doing Order 2 mapping at a scale of 1:12,000. Therefore, before anybody uses LiDAR data for any type of continuous soil mapping, the scale of the LiDAR data needs to be adjusted. To do this you need to smooth out the pits and bumps of the terrain. By doing this, any terrain information derived from the smoothed data (slope, aspect, flow accumulation, flow direction, wetness index...etc) will be at the appropriate scale to map soils (continuous mapping and/or discrete mapping). This also maintains the data integrity and the resulting terrain derivatives will be based on the actual terrain. Unfortunately, I have seen people misusing LiDAR data. I have seen folks generate terrain attribute data on the micro-topography and then they try to adjust the final product by applying repetitive filters (either nibbling or focal means). These filter routines do not

look at the terrain, it just looks at a cell's neighbors, and thus it loses some data integrity. This is not the proper way to derive terrain attributes. The proper way would be to smooth the topography before you generate the terrain data. This can be done in many different ways. For those of you familiar with 3dMapper, Jim Burt's slope routine allowed you to adjust the scale on the fly. The most common way would be to adjust smoothing factors during the interpolation of the DEM. For elevation data, I use a spline interpolation. I use to work for CERL, and I always used Helena Mitsova's s.surf.tps GRASS command to generate my DEMs. She used to have some great animated gifs that showed how changing the smoothing and tension factors influence the surface.

The below image is an example of micro-slope curvature from a 10m DEM and the resulting slope from a smoothed surface. I made these images 15 yrs ago on a SUN Sparc II using GRASS4.1



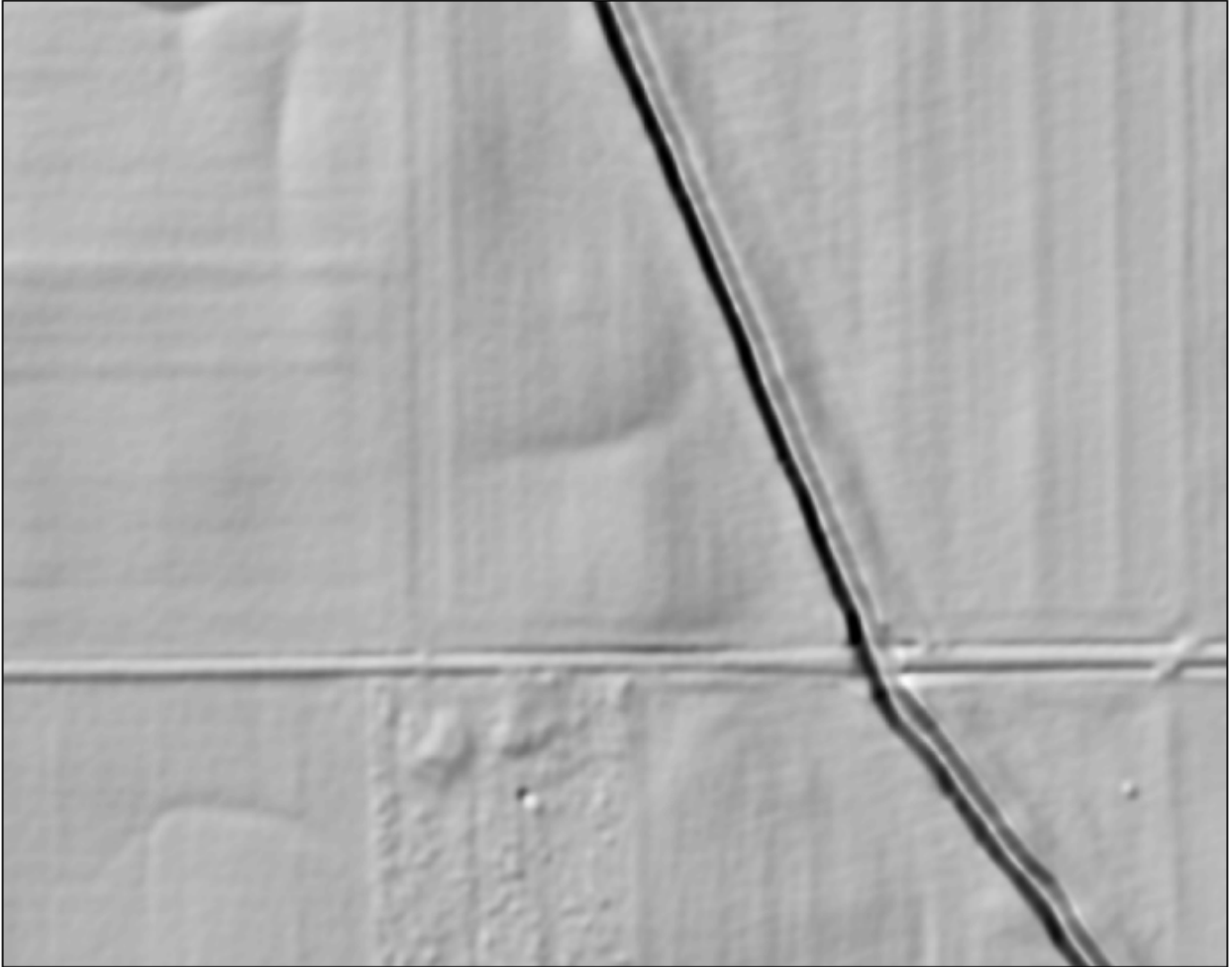
Currently I use ArcGIS and Merrick's MARS software. I do all my LiDAR processing using MARS. In MARS, when you generate a DEM, you have the option to set a smoothing factor. I am not sure what type of interpolation the software is using and I'm not sure

what kind of smoothing factor is being used. That is why I asked my question the other day. How are folks smoothing their DEMs so they can create terrain attributes? Below I have a few examples from a small area in Champaign County, IL. It is an area of very little relief.

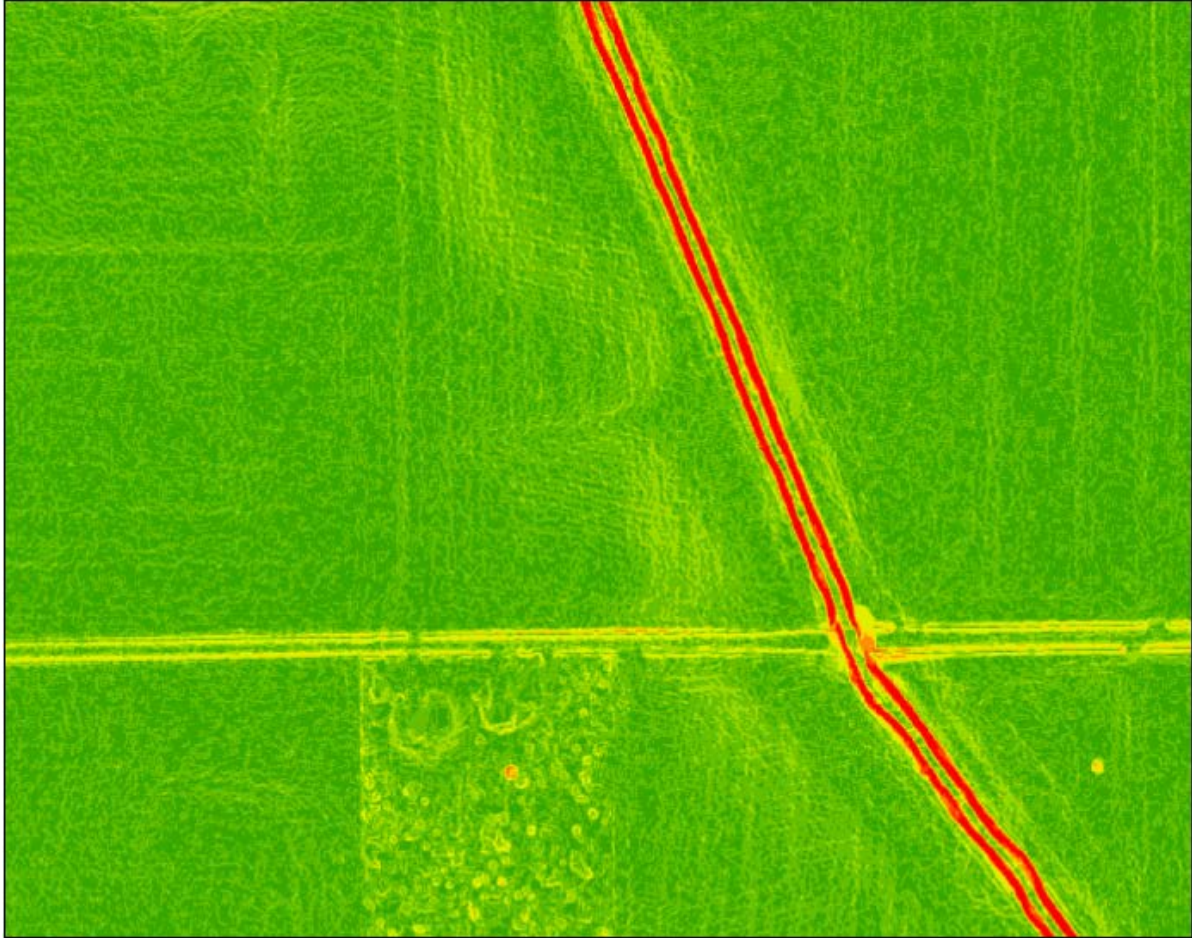


Non-smoothed Hillshade data set created from LiDAR data in Champaign County, IL

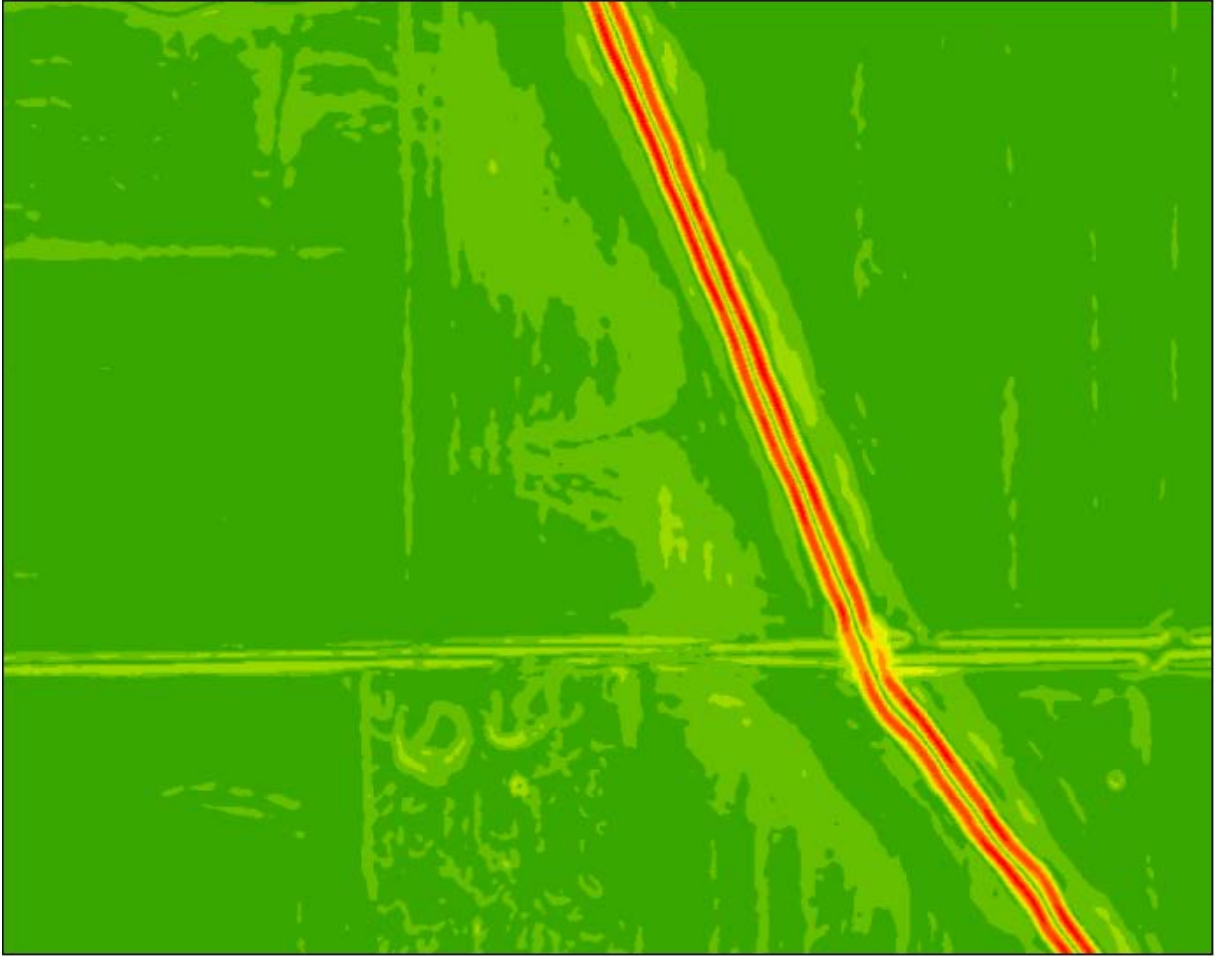
Below is the Hillshade data created from smoothed DEM (smoothing factor of 10). Notice how the texture on the surface has been removed without jeopardizing the integrity of the terrain.



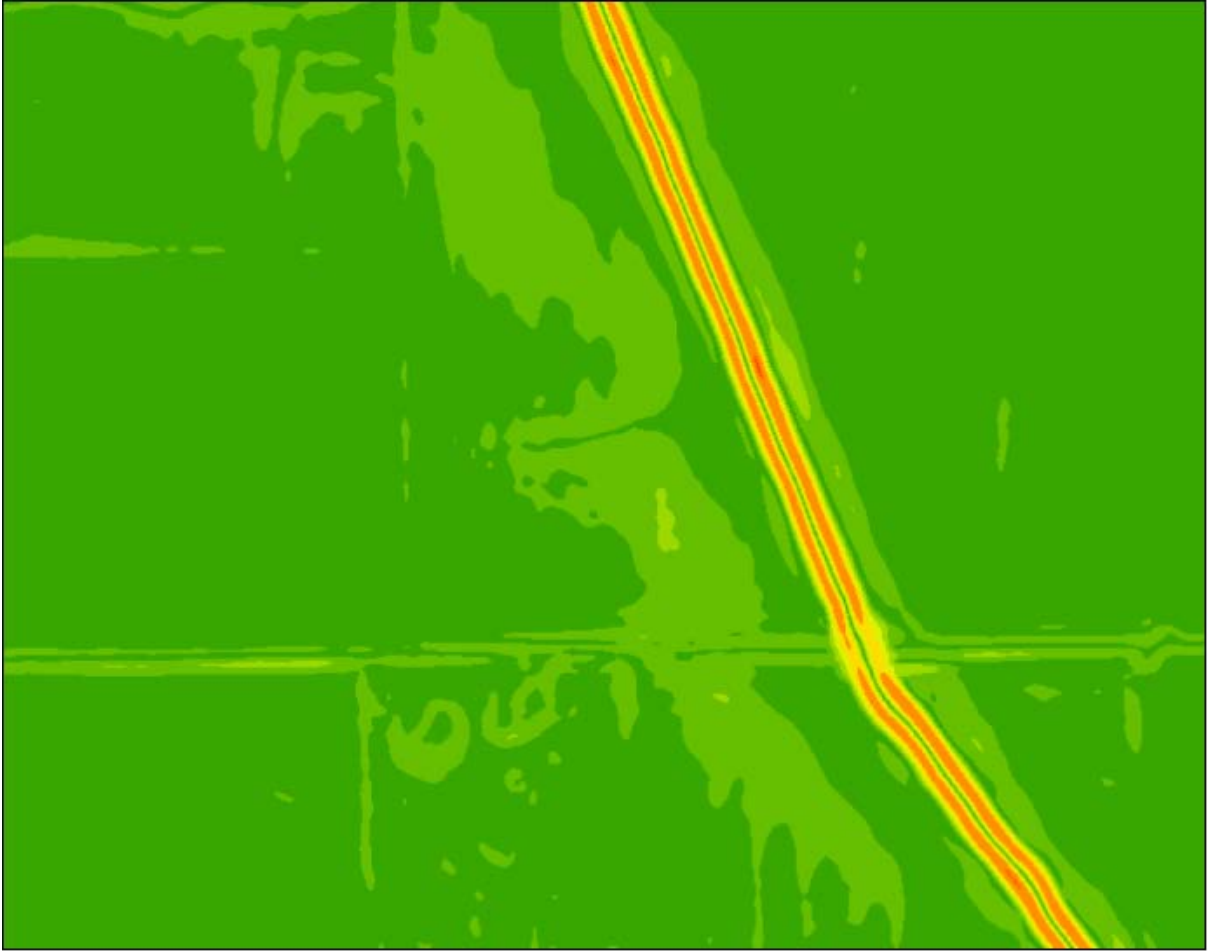
Non-smoothed Slope data: Dark Green 0-2%, Mid Green 2-5%, Light Green 5-10%, Yellow-Green 10-18%, Yellow 18-25%, Orange 25-35%, Red 35-45%, Dark Red >45%. This is micro-topography slope.



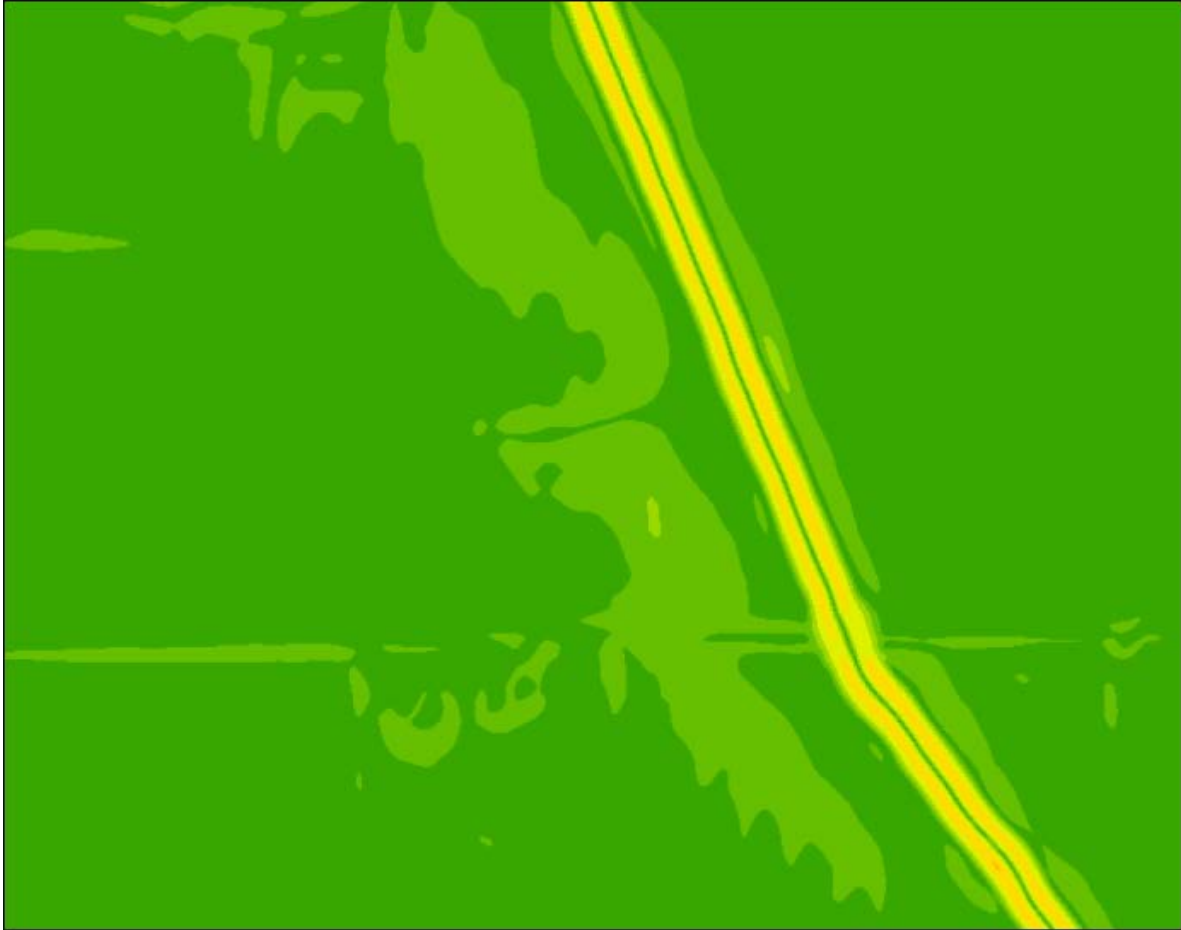
Slope generated from DEM that was smoothed with a smoothing factor of 10. Notice how the slope fits the landscape.



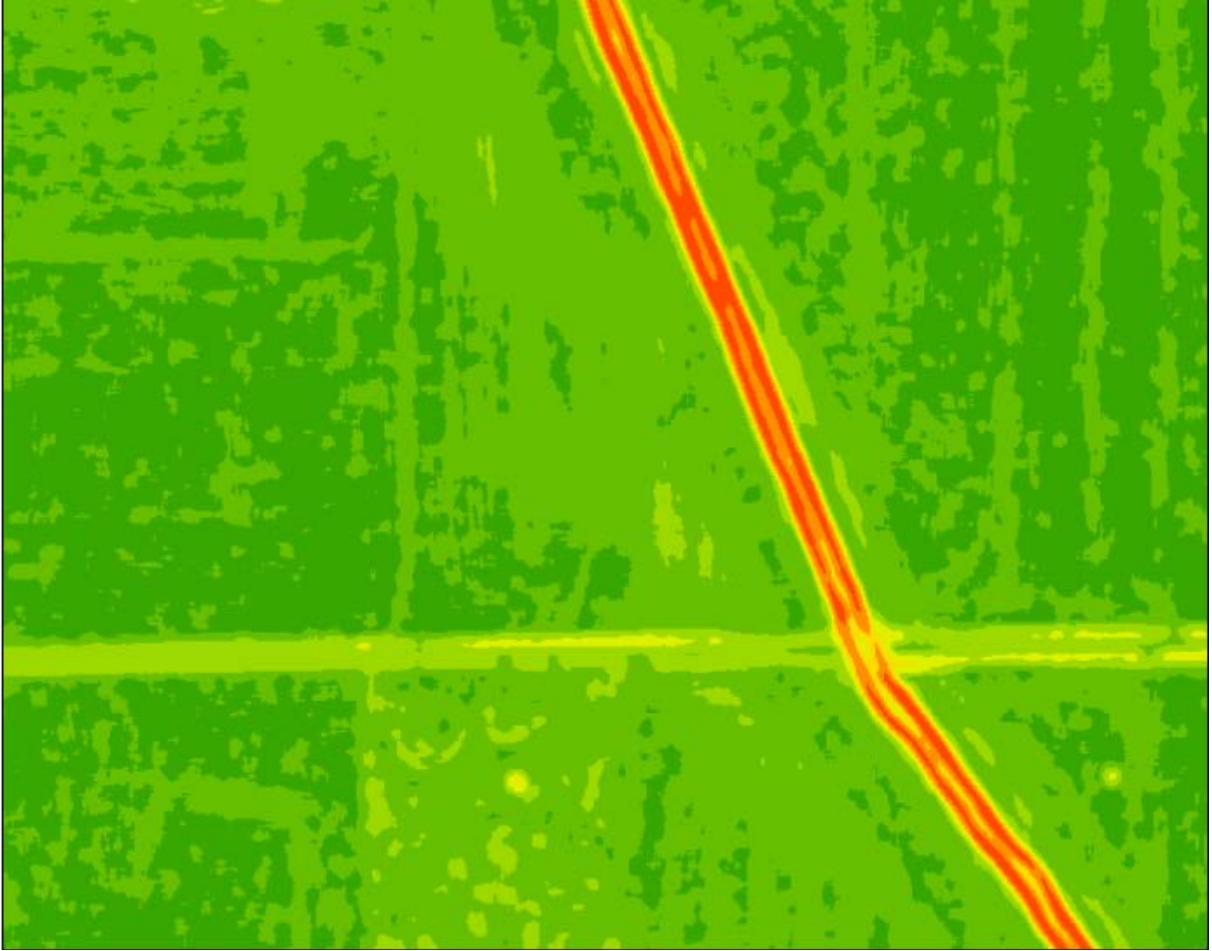
Slope generated from DEM that was smoothed with a smoothing factor of 25.



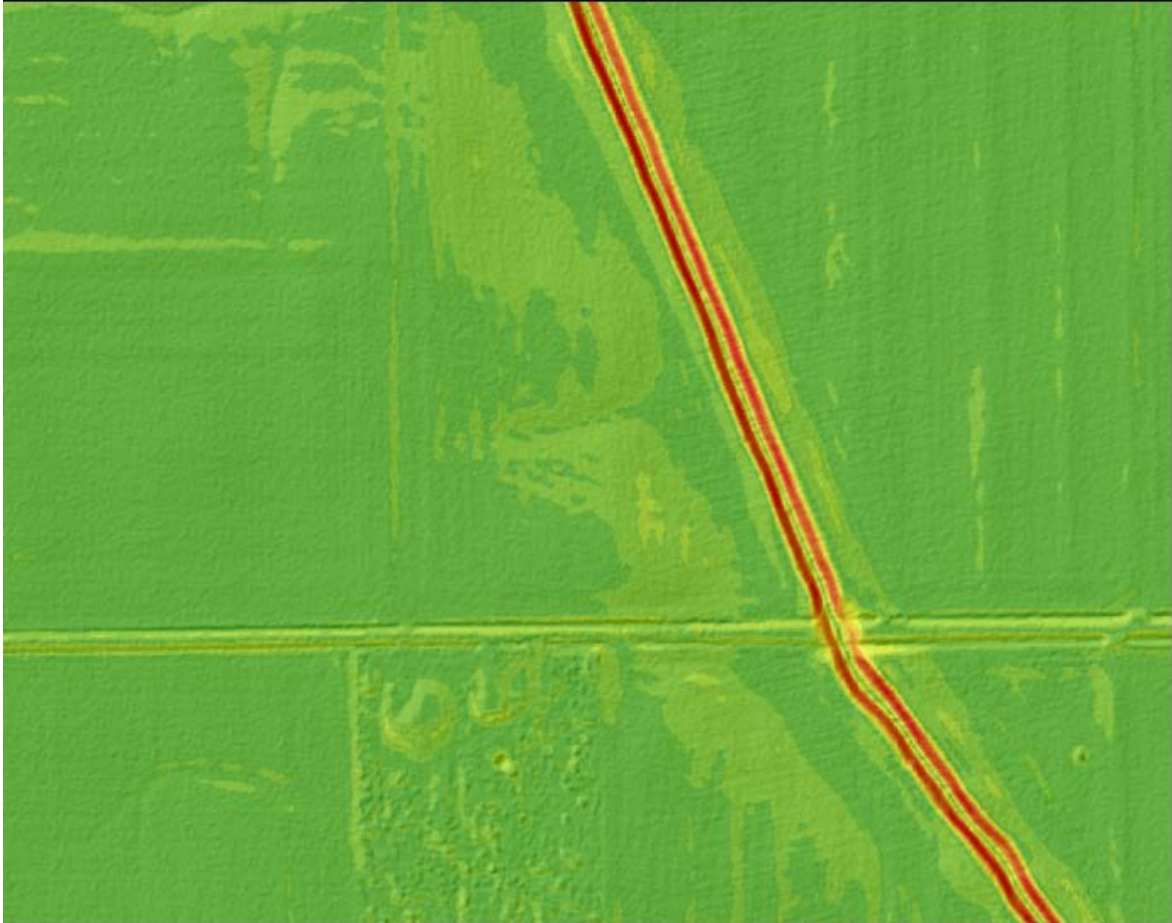
Slope generated from DEM that was smoothed with a smoothing factor of 50.



Slope generated using a focal mean filter. Notice how the slope does not fit the landscape. There is way too much 2-5% slope mapped using this method. This is just the slope data. Imagine what this would do to some of the flow data sets.



Slope generated from a smoothed DEM (smoothing factor of 10) draped over hillshade.



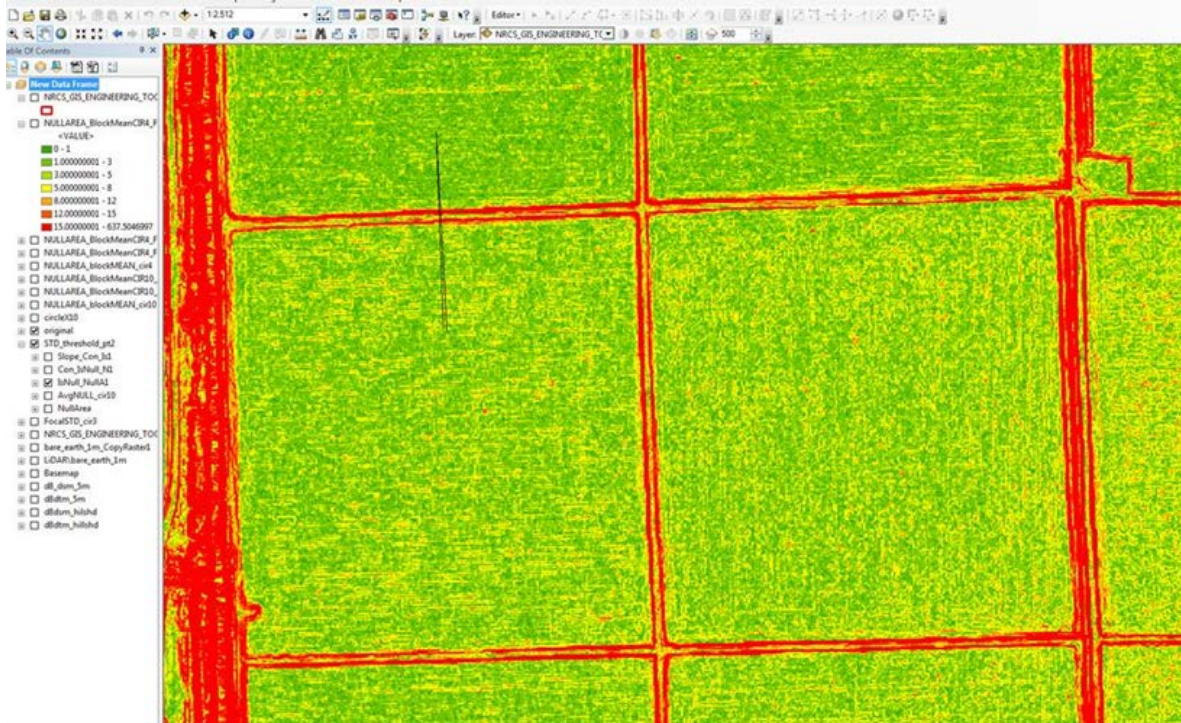
So you can see that in order to generate terrain attributes, LiDAR generated DEMs must be smoothed. The question is how to do this, and what kind of smoothing factor to use? How are folks in our agency processing this data?

Dwain Daniels (to Jon Bathgate) [03/01/13]:

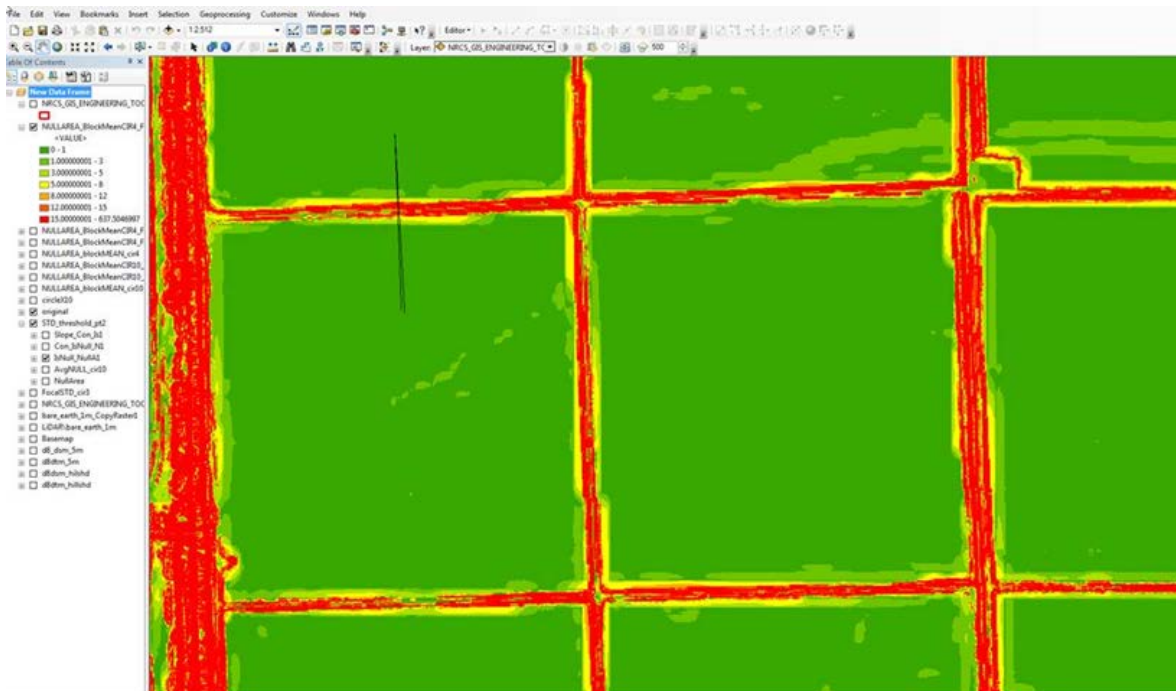
The results Jon has displayed look very similar to the slope derivatives created from the ArcGIS LP360 extension DEM export when the the IDW interpolation option is used. Generalization of remotely sensed data is a very complex subject that is not limited to LiDAR derived elevation data. I wish R.H. Griffin was still available to provide his perspective. I still believe the statement that all models can be shown to be wrong, however some are useful.

I would hesitate to use words like “misuse” or “improper” in any case regarding how digital elevation data is being processed and used **when** that data is being adequately tested for its validity for the intended use by on-site evaluation.

Here is an example of the LiDAR data from Washington Co. MS. Very flat ground. This is the slope gradient of the full resolution 1m Bare Earth raster. The slope symbology is the same in both screen captures.



This is a work in progress but here is the result of generalization using some zonal statistics and conditional functions that attempt to generalize the surface in the cultivated fields while trying to not impact the detail that characterizes the shape of the drainage ditches.



By isolating specific locations in the terrain for more intense smoothing may also be a viable option.