LiDAR Project

Massachusetts Military Reservation

Kevin Bartsch
Civil Engineering, Otis Air National Guard Base

Northeast Arc Users Group

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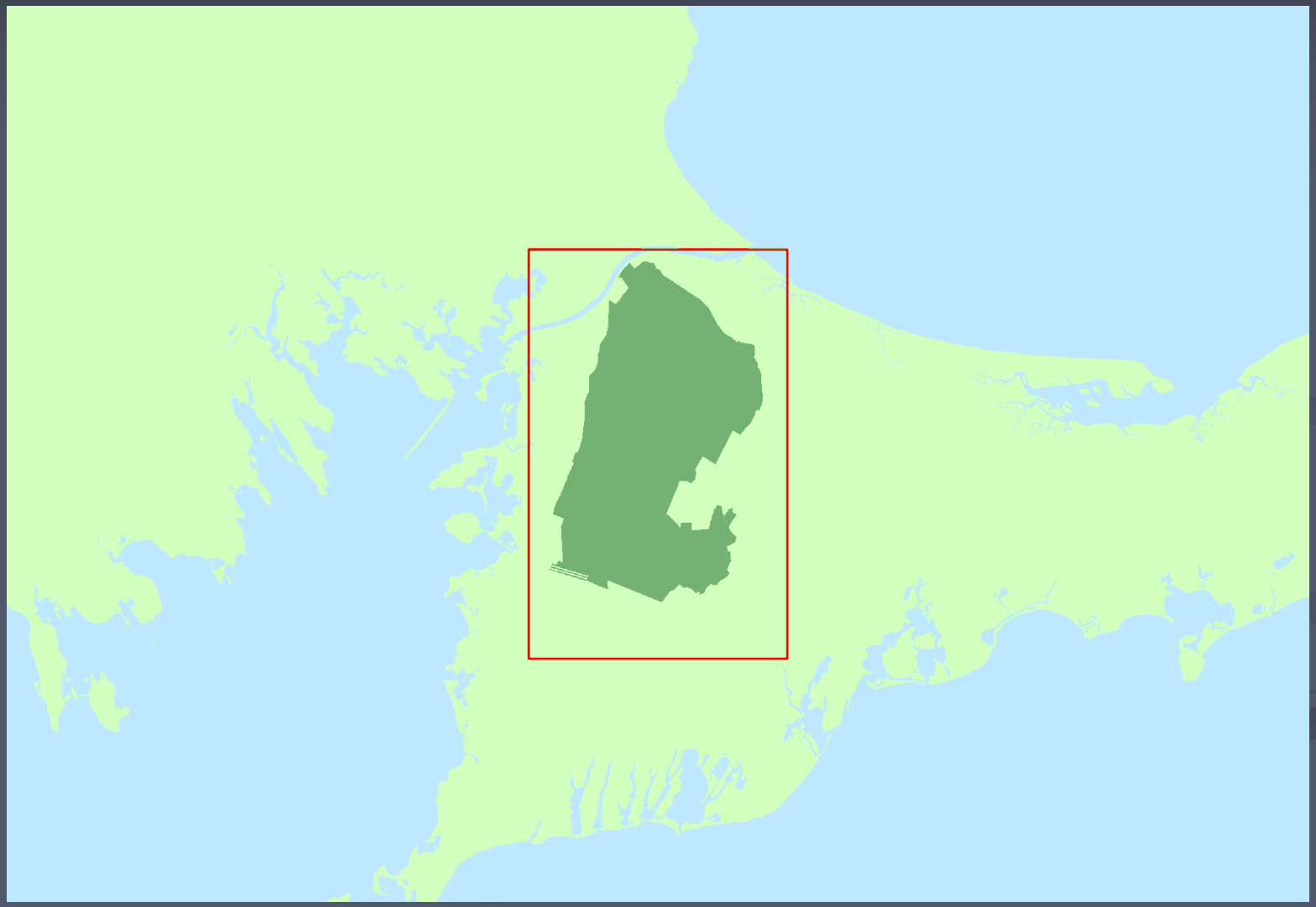
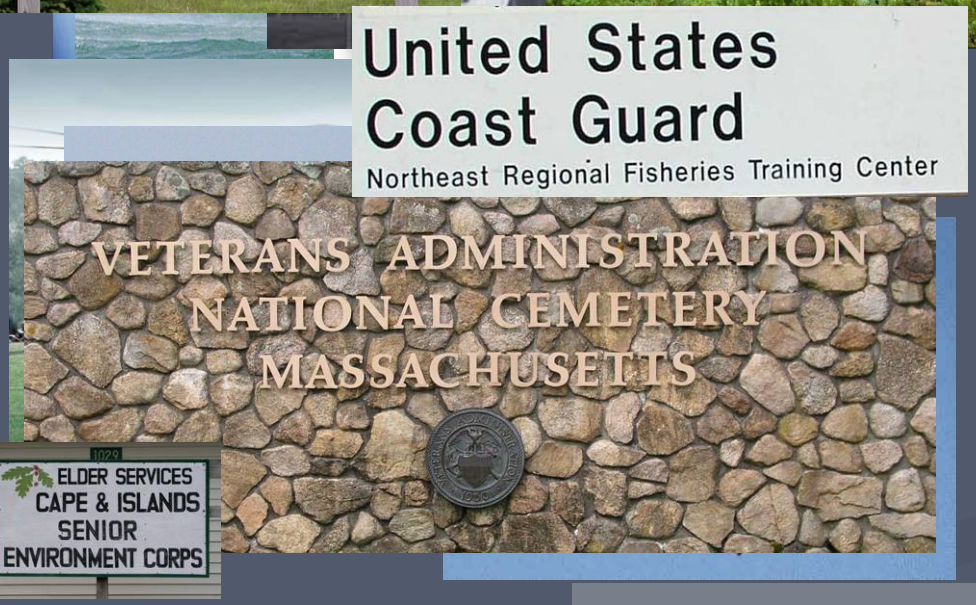
Main Points of this Discussion

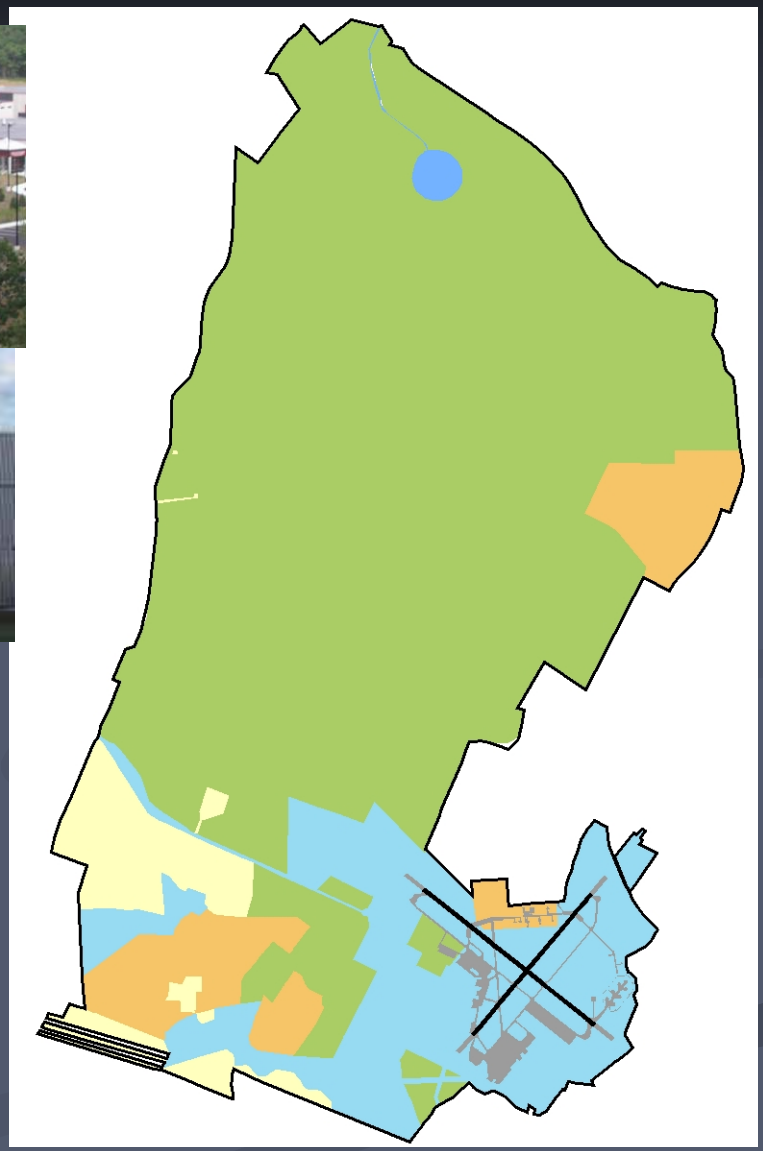
- Establish some basic information about LiDAR
- Illustrate some by-products from LiDAR data
- Introduce examples of the MMR LiDAR data

Extent of MMR LiDAR Data



Many Others

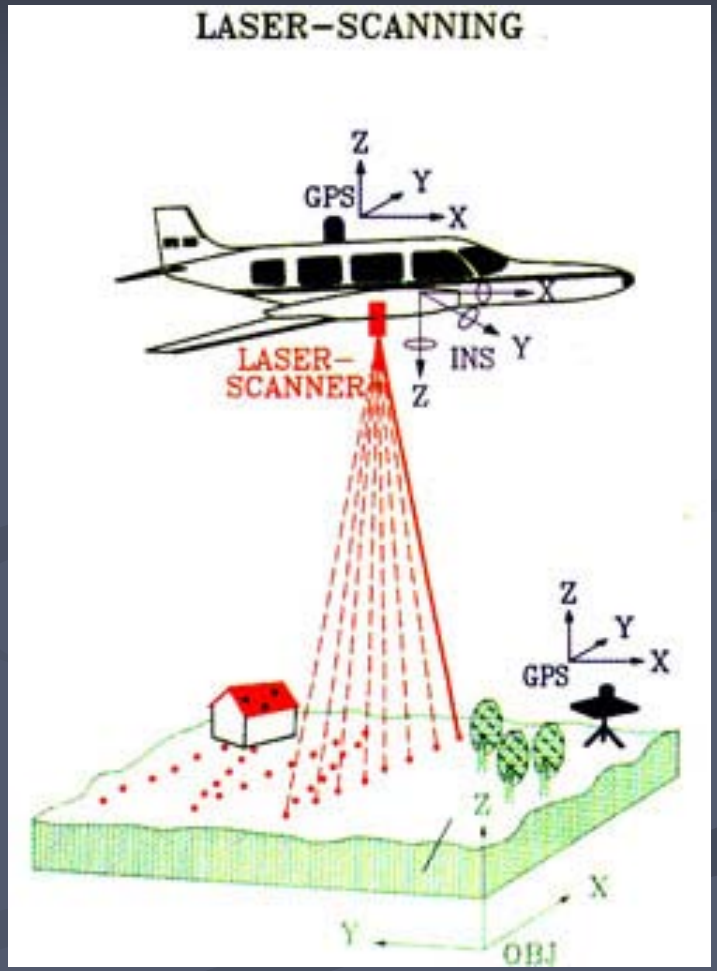




Occupants at the MMR

LiDAR Basics

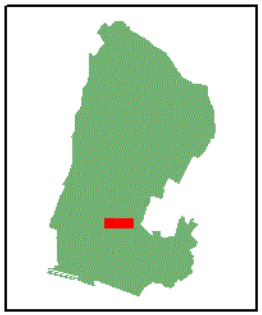
- Light Detection And Ranging
- Airborne on plane or helicopter
- Uses pulses of laser light
- GPS & return time of the pulse
- Pulse Beam is about 18”
- Multiple returns are collected
- Creates elevation data
- Data is in form of X-Y-Z (UTM meters)



Possible Products from LiDAR

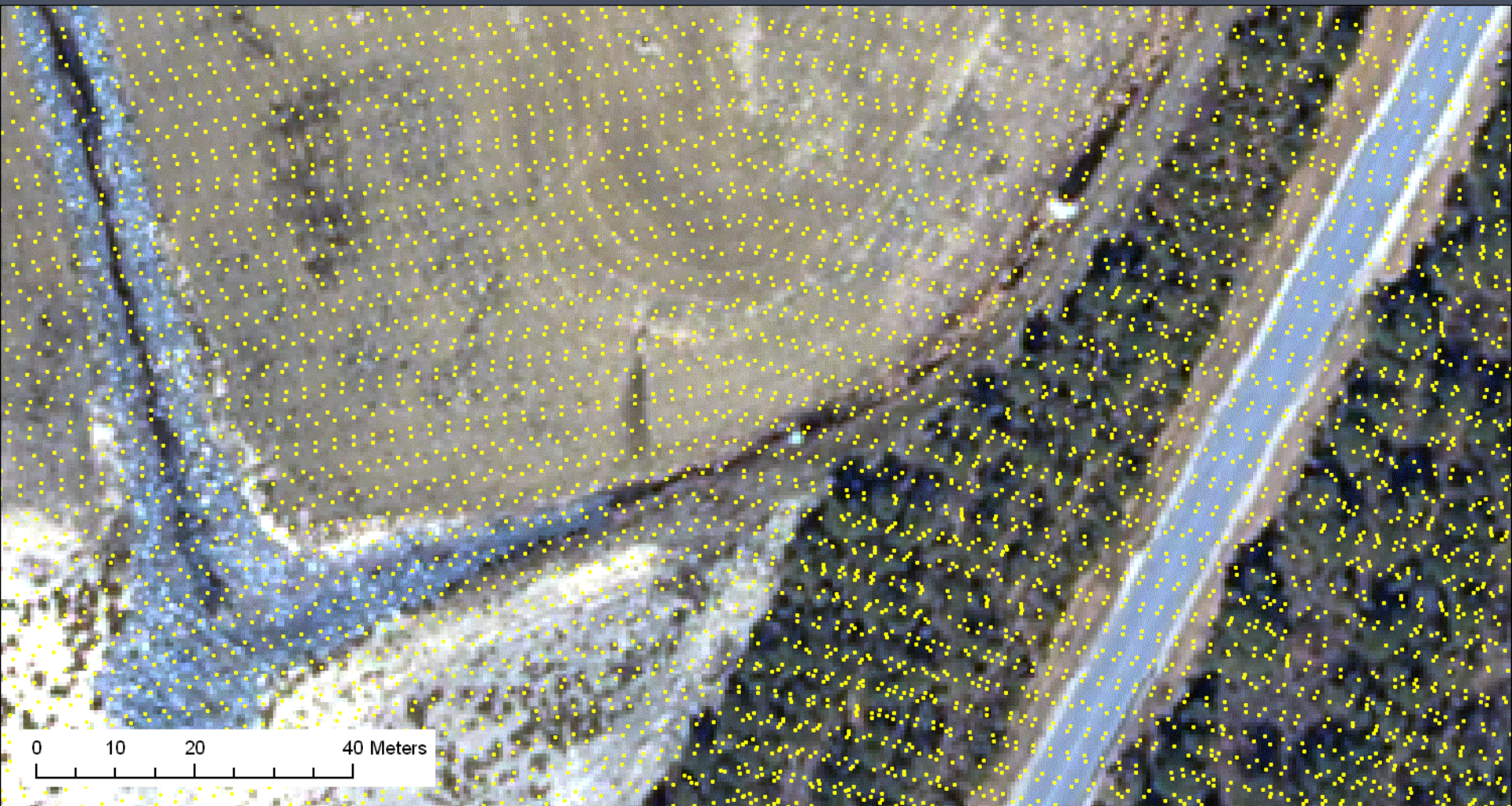
- Triangulated Irregular Networks (TIN)
- Digital Elevation Models (DEM)
- Hydrology
- Contours
- Line-of-Site Analysis
- 3-D Renderings
- Canopy Profiles
- Cartographic Enhancement
- Feature Extraction - Buildings

Overview of Sample Area



0 100 200 400 Meters

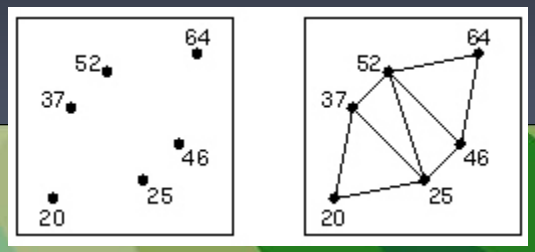
Raw LiDAR Points (37m records)



Processed Points (Bare Earth)

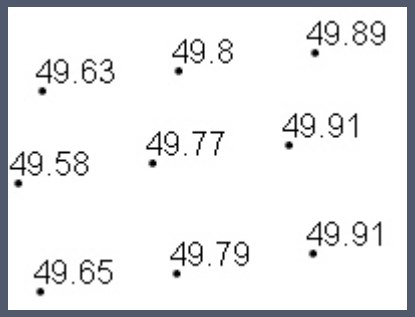
Detail Area

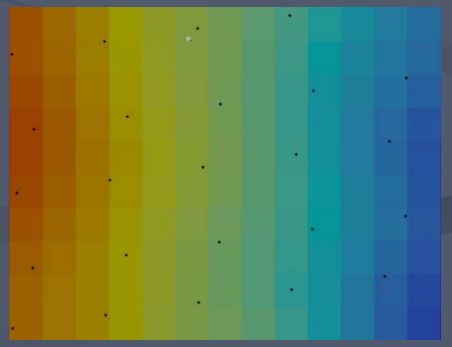
Triangulated Irregular Networks



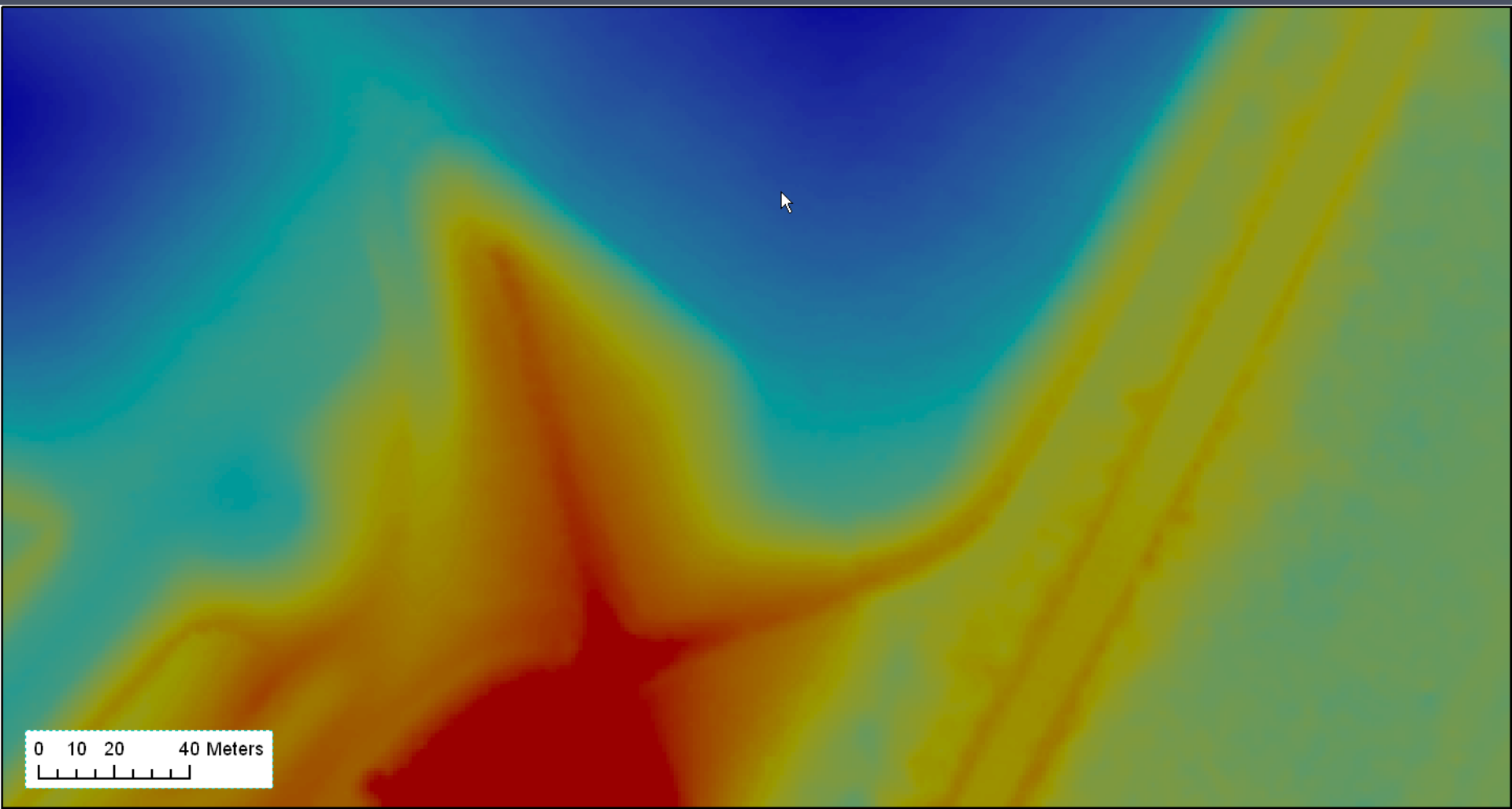
Digital Elevation Model

- Raster Based Elevation
- X-Y-Z data is **Interpolated** into cell based data
- Each cell has an elevation value
- DEMs are continuous
- First step to other products

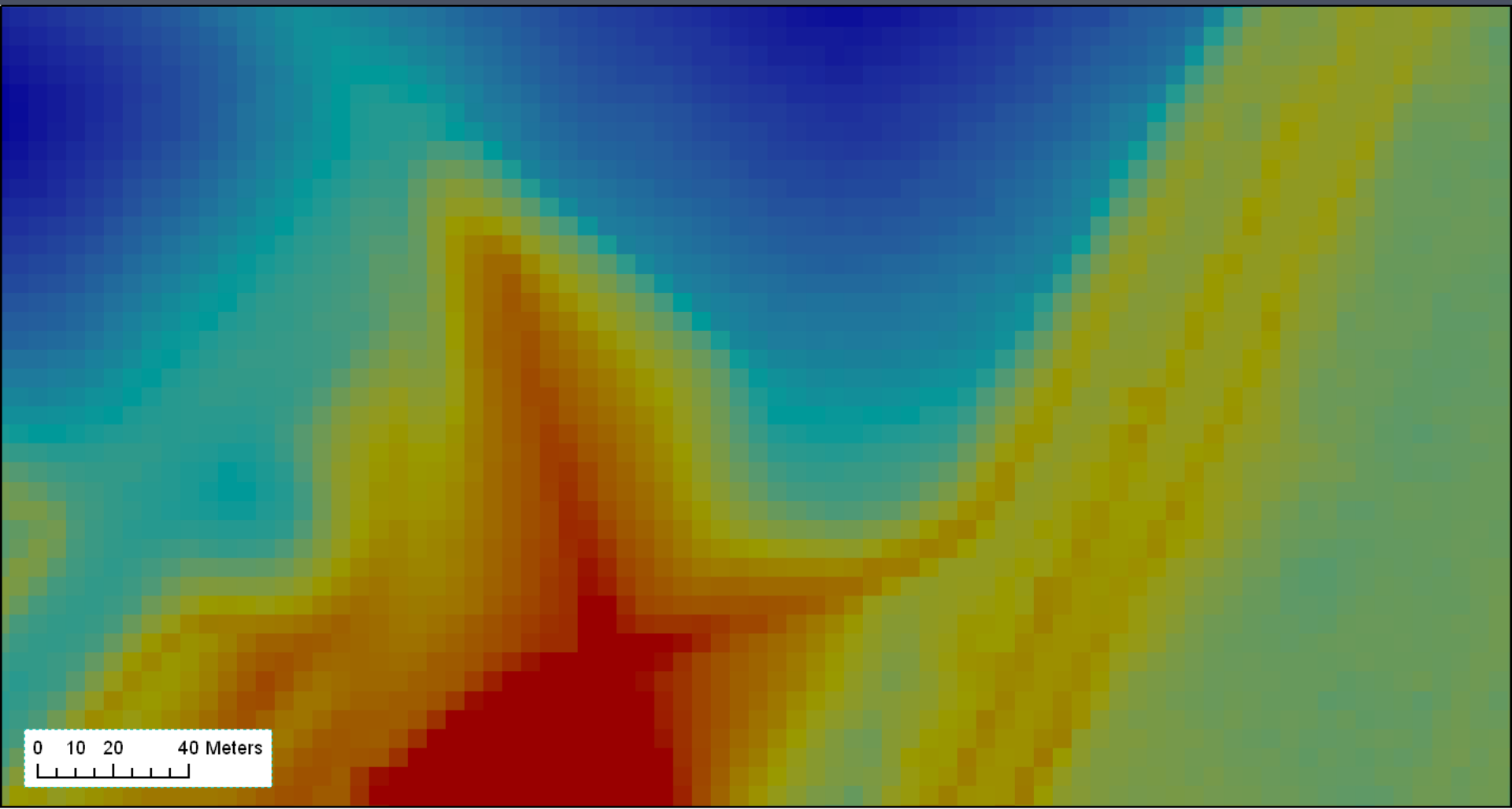




DEM (1 meter cell size)



DEM (5 meter cell size)



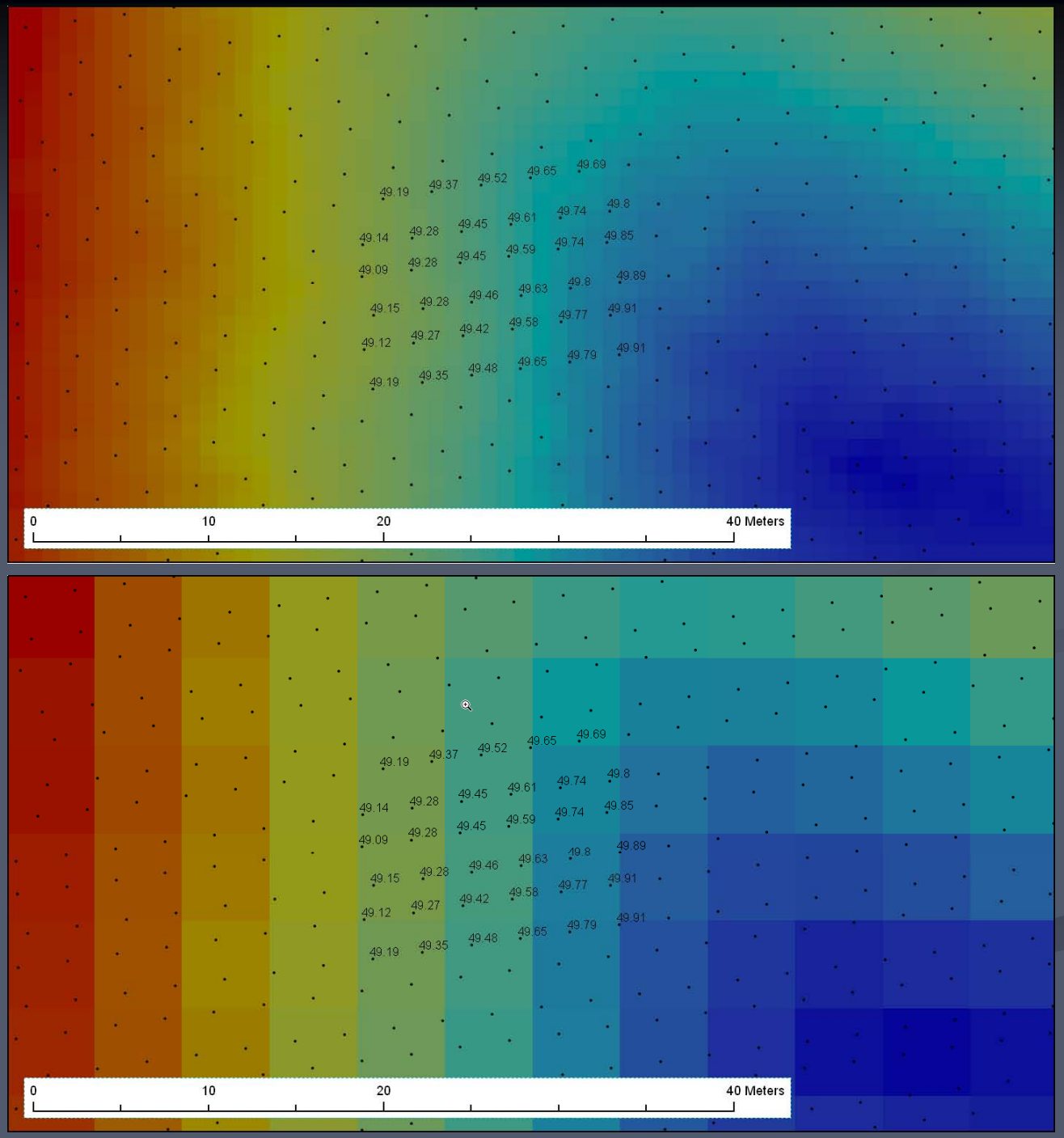
1 meter cell size

Interpolation

Natural Neighbor
Spline
Kriging

Cell size, smoothing, neighboring cells, break lines …

5 meter cell size



Smallest Cell Size with Minimum Artifacts

1. Determine transect or posting distance (t)
2. Determine test size (x) by dividing by 8 (t/8=x)
3. Create test grids with cell sizes of 2x, x, x/2, x/4
4. Check for artifacts
5. Determine scale ratio (sr) for each test grid

   sr= distance of raw point to artifact/test grid cell size
6. Choose smallest cell size where sr<4

from: Larry Ellis et al., University of Florida, 2005 SSSA Presentation

Digital Elevation Model

Some of the neat things you can do with a DEM

Hillshades

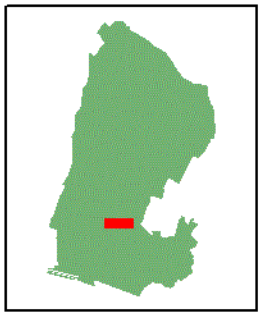
Slope

Aspect

Hydrology

Line-of-site

Overview of Sample Area

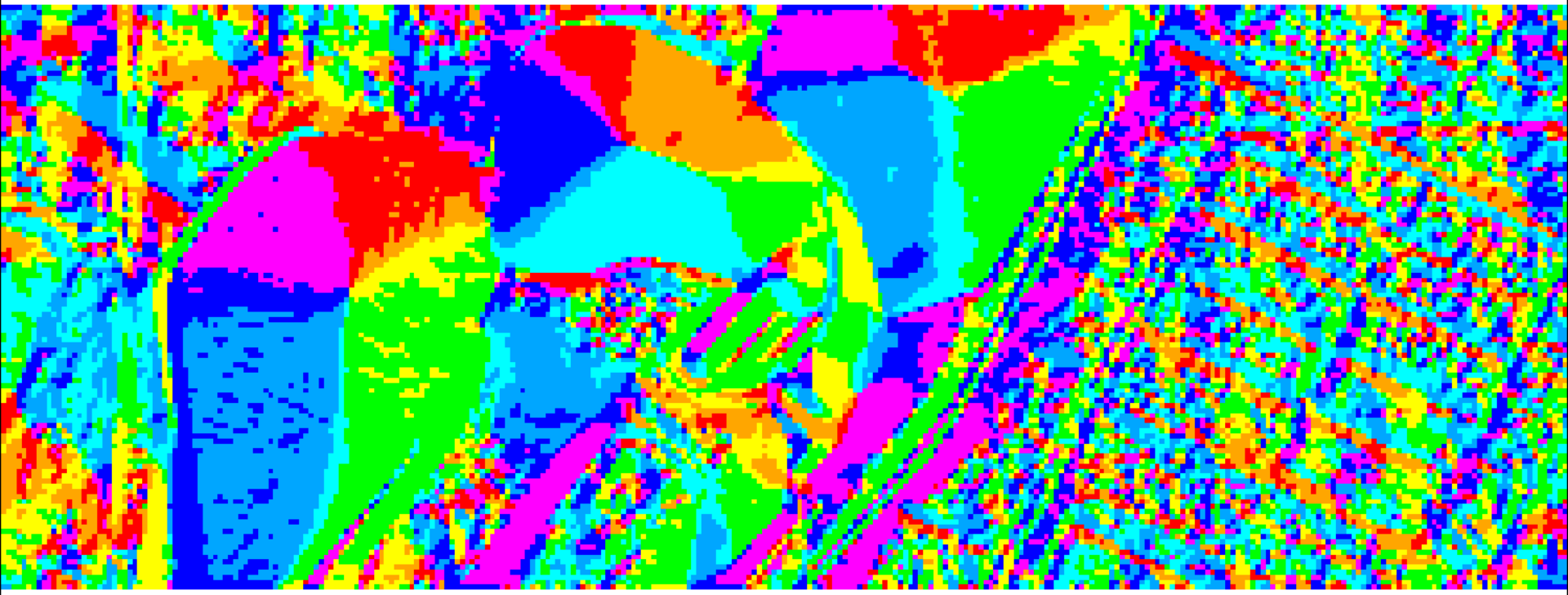


0 100 200 400 Meters

Slope

0 100 200 400 Meters

Aspect

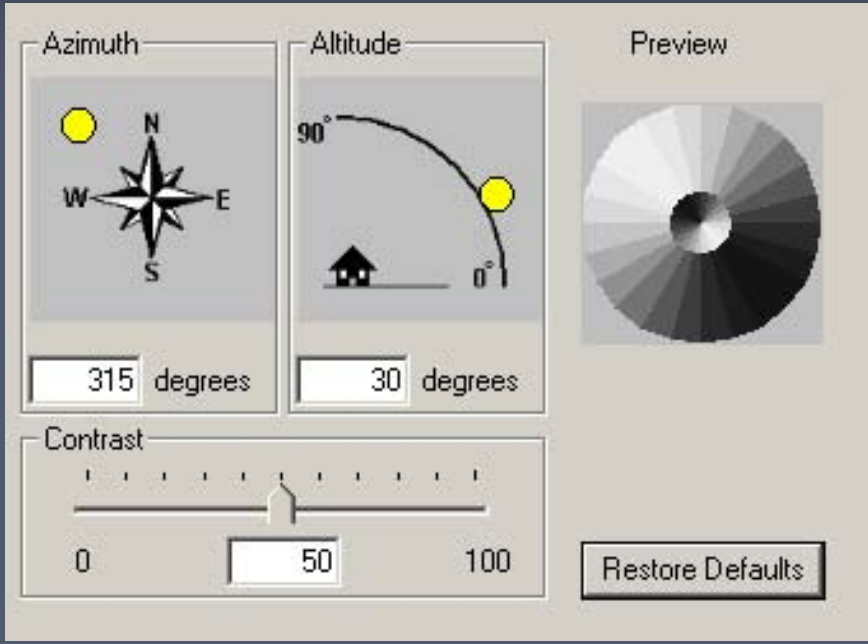


0 100 200 400 Meters

Detail Area for Channels

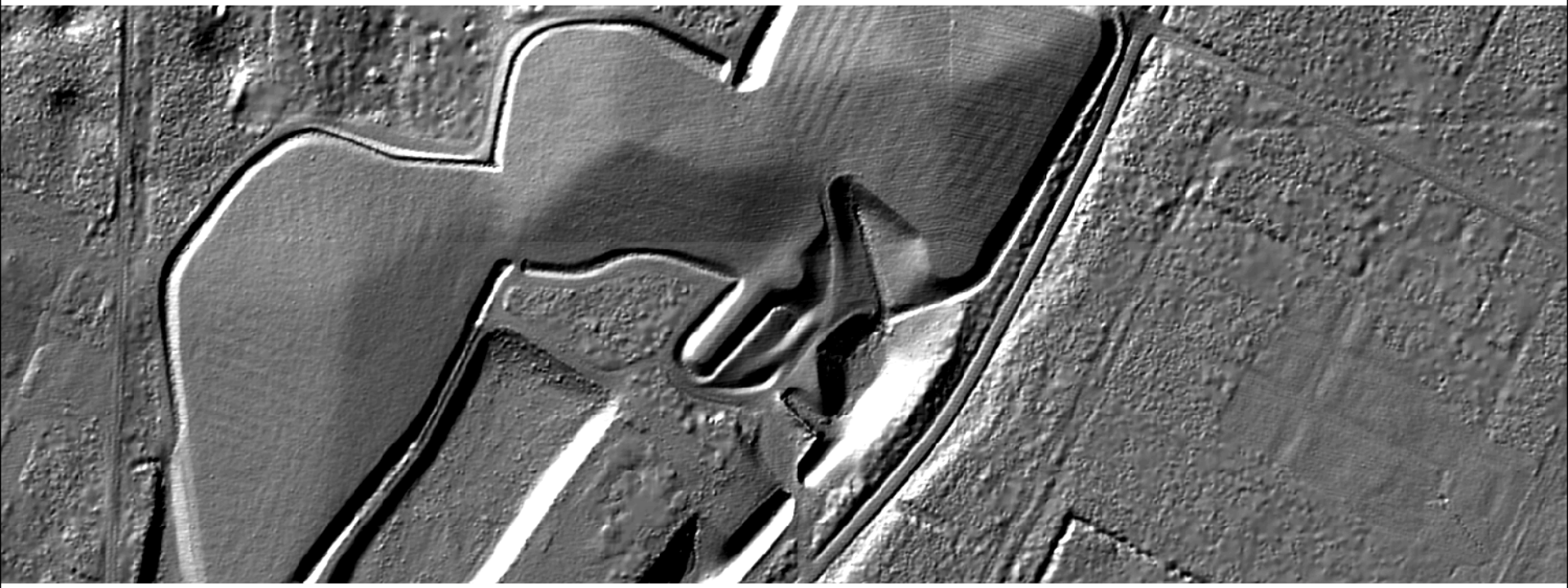
Flow Accumulation

Hillshade



- Shadows that the surface would have in bright sunlight
- Enhances features for visual analysis
- May also imply features that are not there

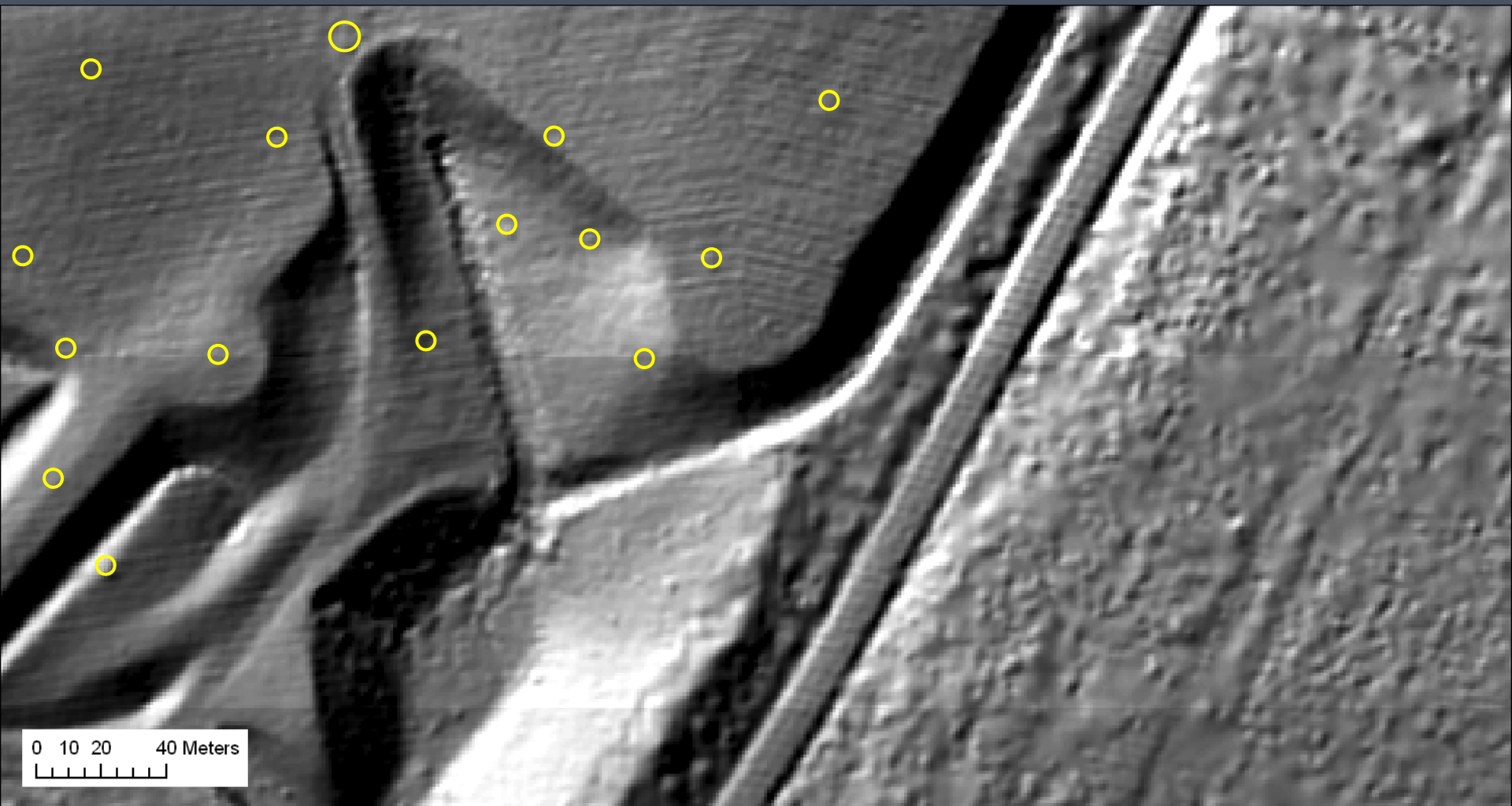
Hillshade



0 100 200 400 Meters

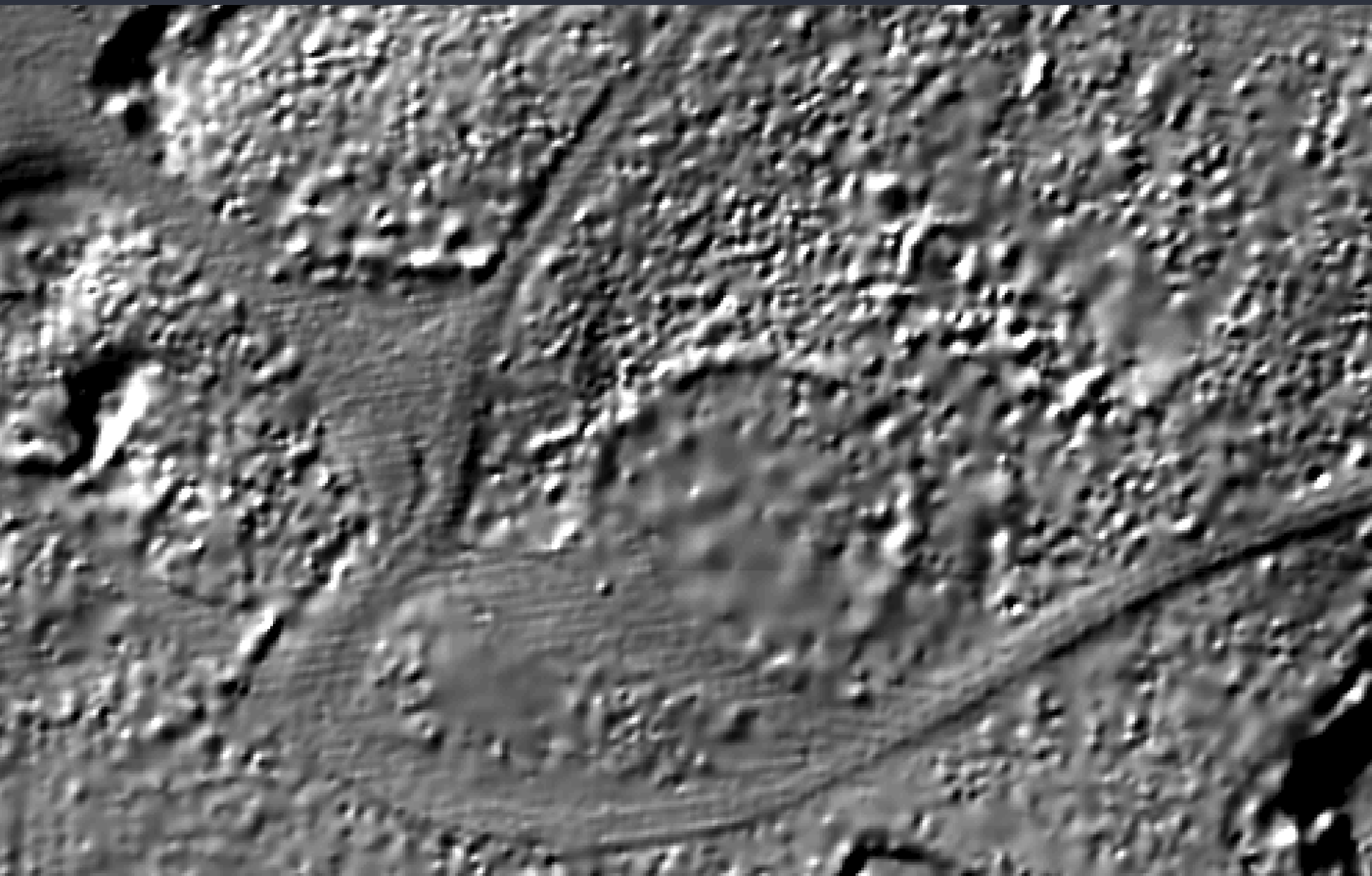
Artifacts

Hillshade Detail



Hillshade for Feature Detection

Hillshade for Feature Detection



Line of Site Analysis

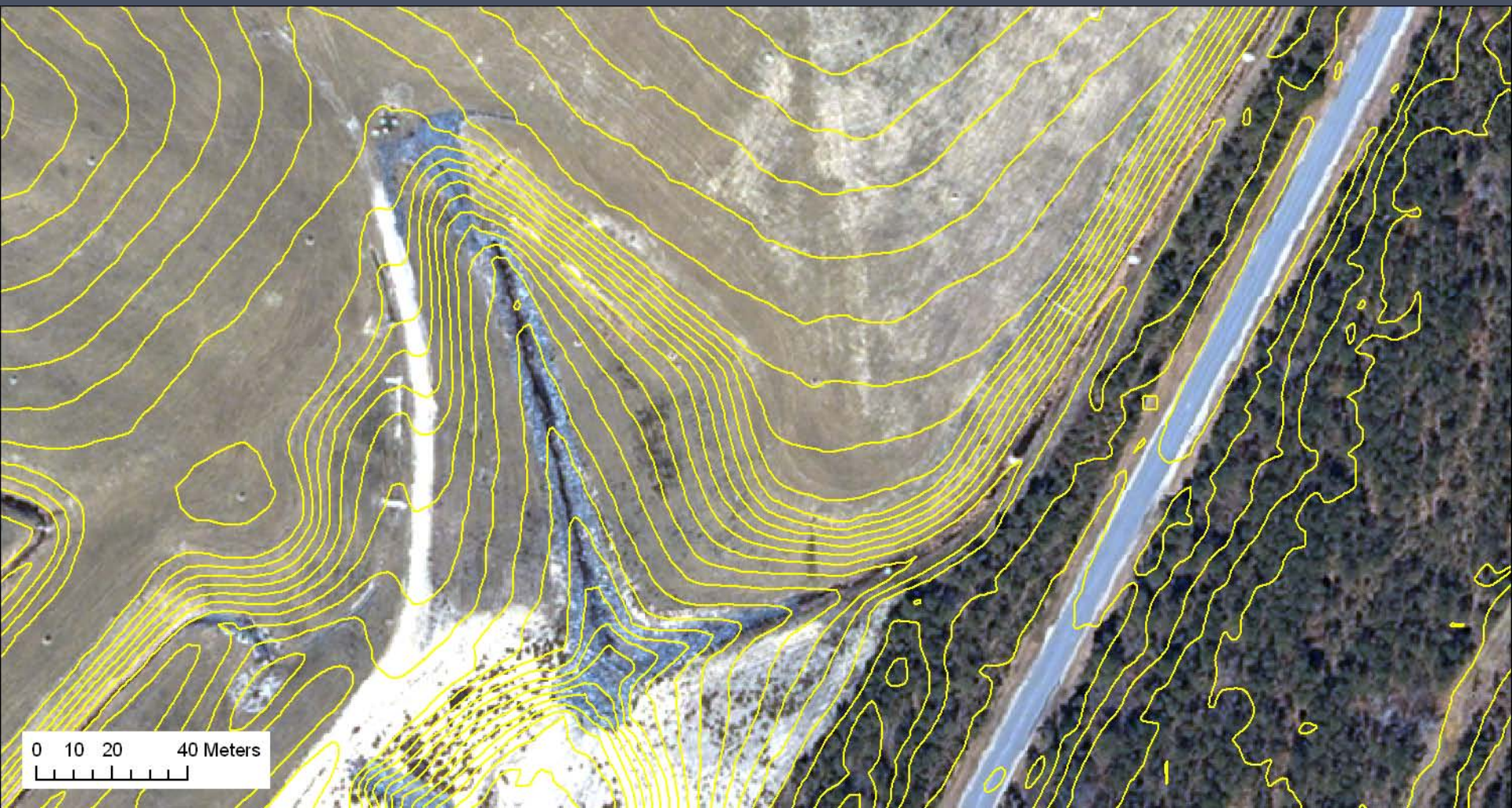
DOQ draped on DEM

DOQ draped on DEM

Contours

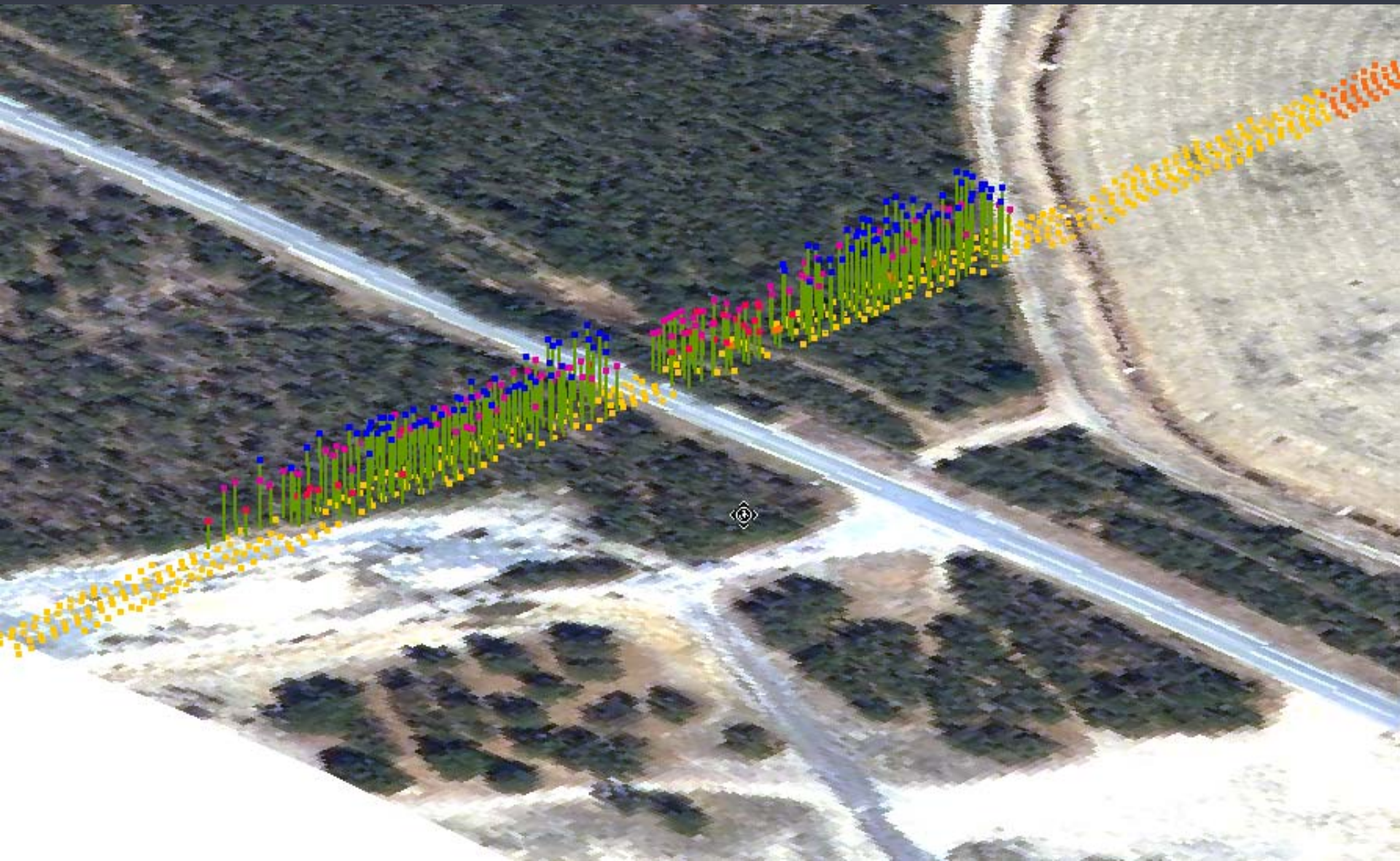
- From X-Y-Z, DEM, or TIN
- Many algorithms – complex technology
- Incorporate break lines, ponds, anthropologic features…
- Depression contours
- Prepared by contractor: 2 foot increment

Contours



Transect of Raw X-Y-Z Data

Canopy Analysis



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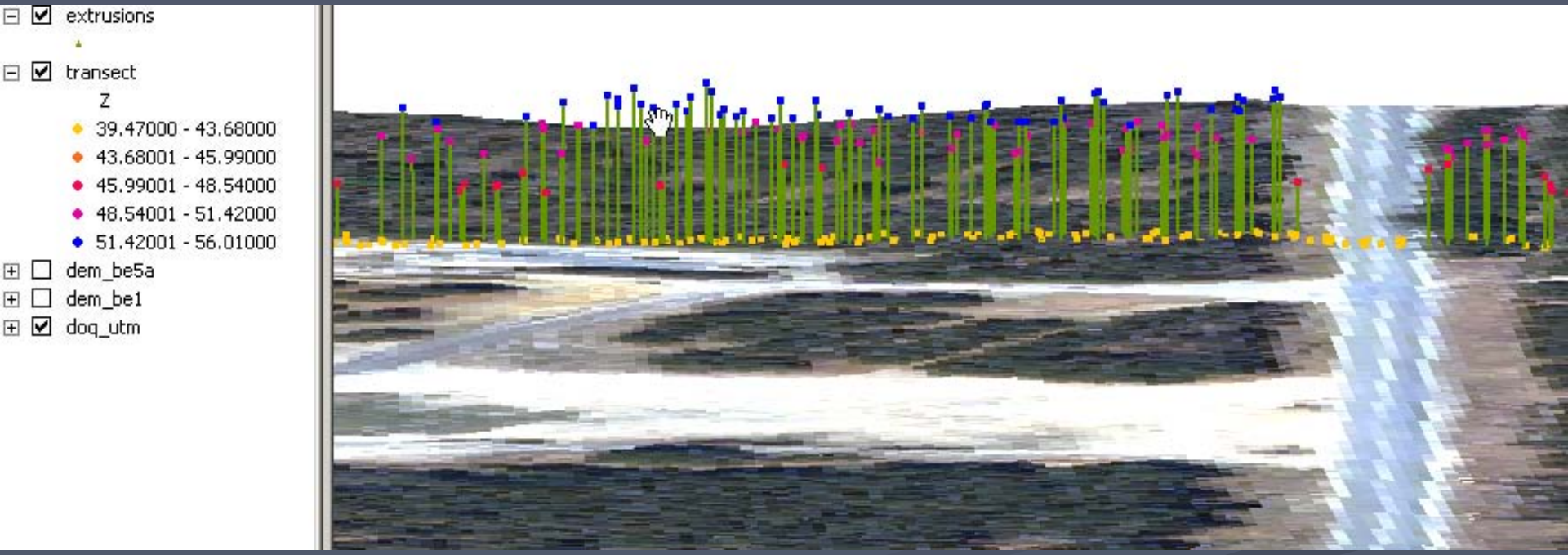

MMR LiDAR

- Contractor: EarthData
- Acquired 15 March 2005
- About 3-5 meter posting
- Deliverables include:
  - 2 foot contours (+/- 1ft vertical accuracy)
  - DEM (3m pixel size)
  - X-Y-Z data (25 million records for bare Earth)
- Bare Earth and Raw Data

Last Slide

The MMR LiDAR Data:

- Mediocre 2 foot contours
- Great cartographic enhancement
- Countless products from DEMs
- Can be used to detect hidden features
- Not suitable for detecting features less than 3m
- Can be used for analysis of tree canopies
- Not suitable for construction detail

Contact: kevin.bartsch@ang.af.mil