LAR-IAC Elevation Data

How to Make It Manageable

Department of Regional Planning, Los Angeles County

Agenda

- Contours
  - Methods
  - Test Results and Process Estimation
- DEM
  - Methods
  - Test Results and Process Estimation
- DSM
  - Methods
  - Test Results and Process Estimation
- Q & A

Contours

- Problem: Lots of tiles (69.43GB); want to show as one seamless layer

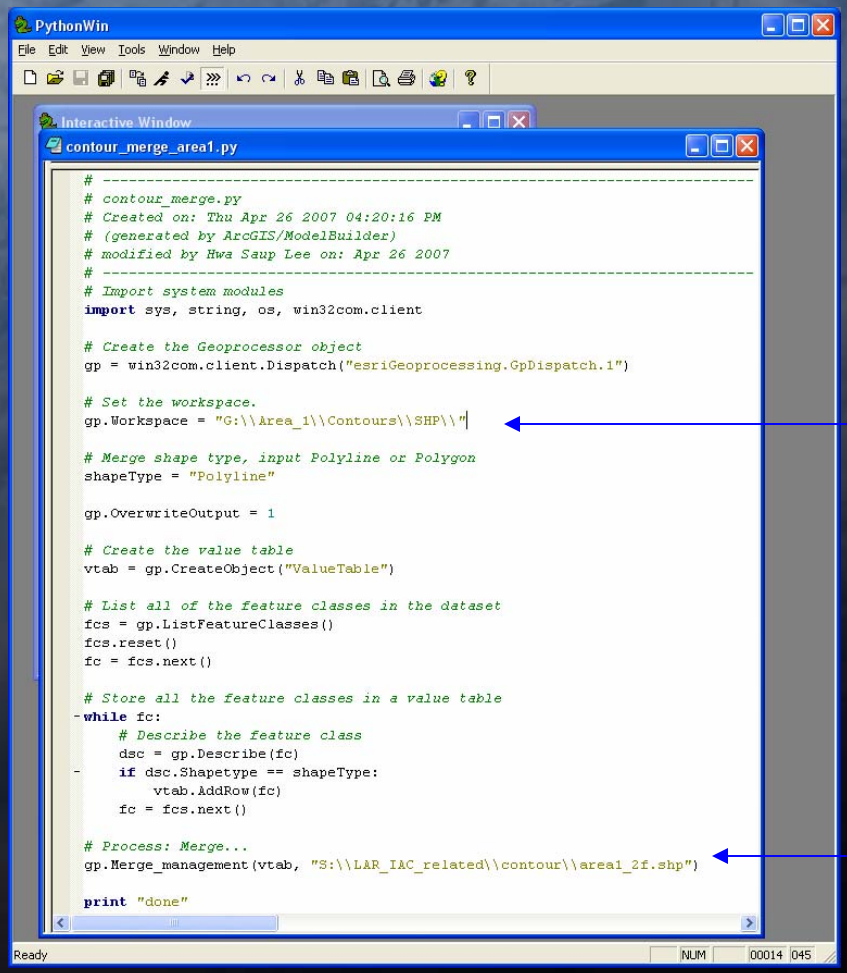
- Solution:
  - Method I: merge > index contours
  - Method II: merge > simplify > index contours
  - Method III: merge > polyline > index contours

Method I (merge)

- Merge:
  - Geoprocessing Tool: merge (ArcGIS 9.x)
  - Script: contour_merge.py (ArcGIS 9.x or PythonWin 2.1)
- Build Index Contours: 10’ and 50’ interval contour lines
  - Modulus function (ArcView 3.x)
  - Ex: ([Elevation] Mod 50 = 0) → creating 50’ interval contours

Tips and Tricks 1

- **contour_merge.py script (PythonWin)**:

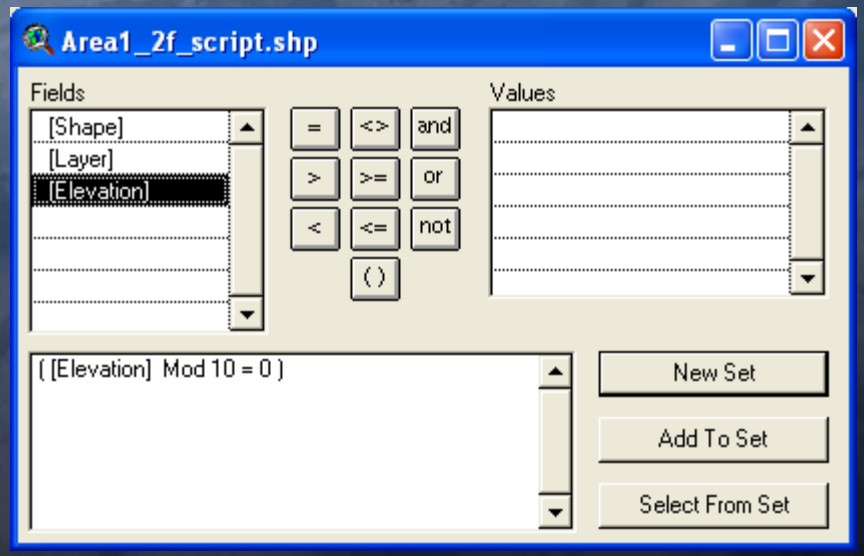


gp.workspace: data directory

Output: shapefile

Tips and Tricks 2

- Modulus Function in ArcView 3.2



[Elevation] Mod 50 = 0)
: creating 50' interval contours

[Elevation] Mod 10 = 0)
: creating 50' interval contours

Method II (merge + simplify)

- Merge: Same as Method I
- Simplify line:
  - Geoprocessing Tool: Simplify Line (ArcGIS 9.x)
  - Generalization Extension: Generalization Tool (ArcView 3.x)
- Build Index Contours: Same as Method I

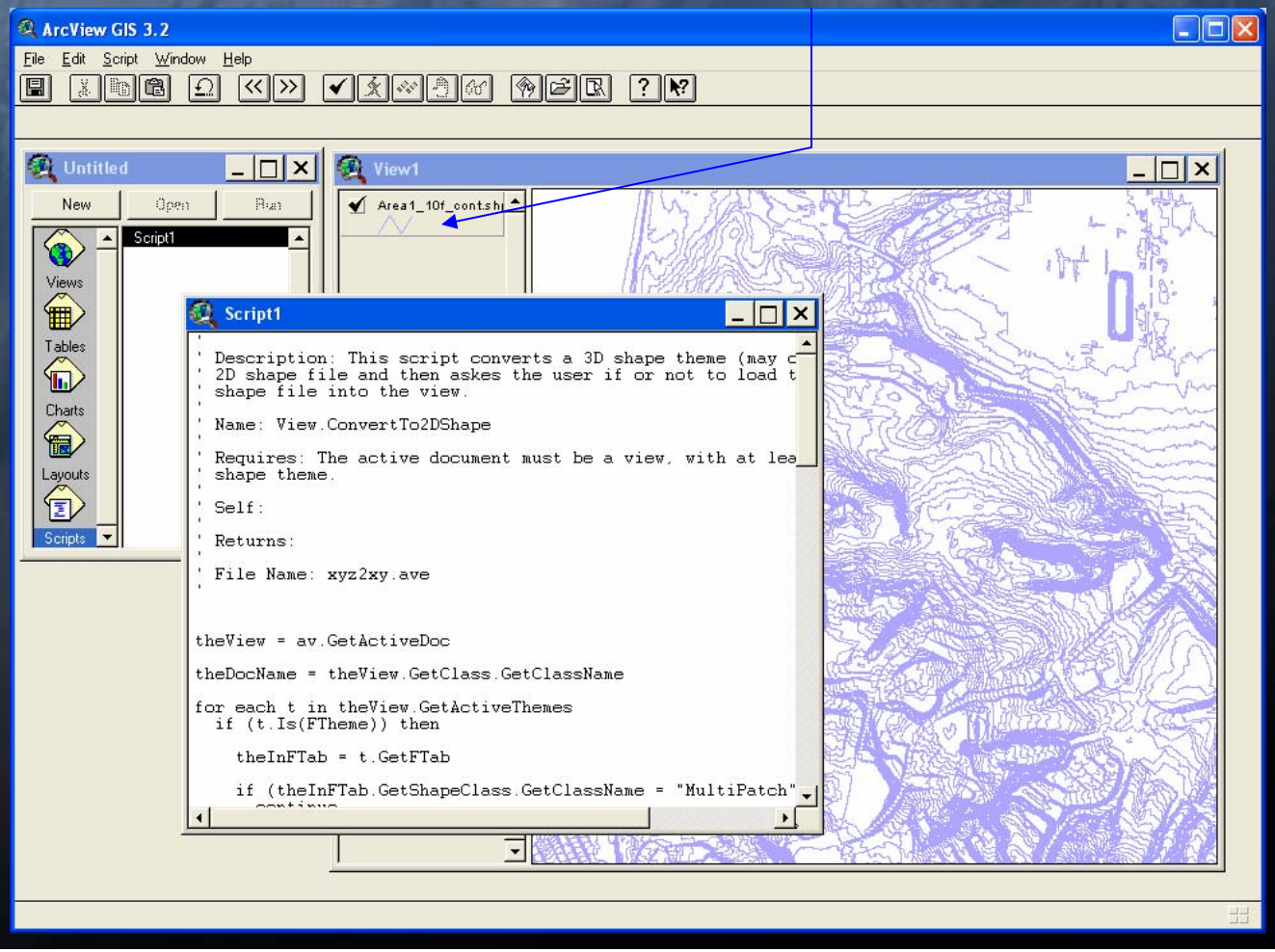
Method III (merge + polyline)

- Merge: Same as Method I
- Convert Polyline Z* into Polyline format
  - Script: XYZtoXY.ave (ArcView 3.x)
- Build Index Contours: Same as Method I

*Polyline Z is 3D feature (z-values from geometry)
Polyline is 2D feature (z-values from an attribute)

Tips and Tricks 3

- **XYZtoXY script**:
  - make sure the theme is **active** and **visible**



Method Comparison

	Output Size	Processing Time	Display Performance	Original shape
Method I (merge)	Largest (original size)	Shortest	Long	Yes
Method II (simplify line)	Smallest (30% of original size)	Longest	Short	No (simplified line*)
Method III (polyline)	Moderate (50% of original size)	Moderate	Short	Yes

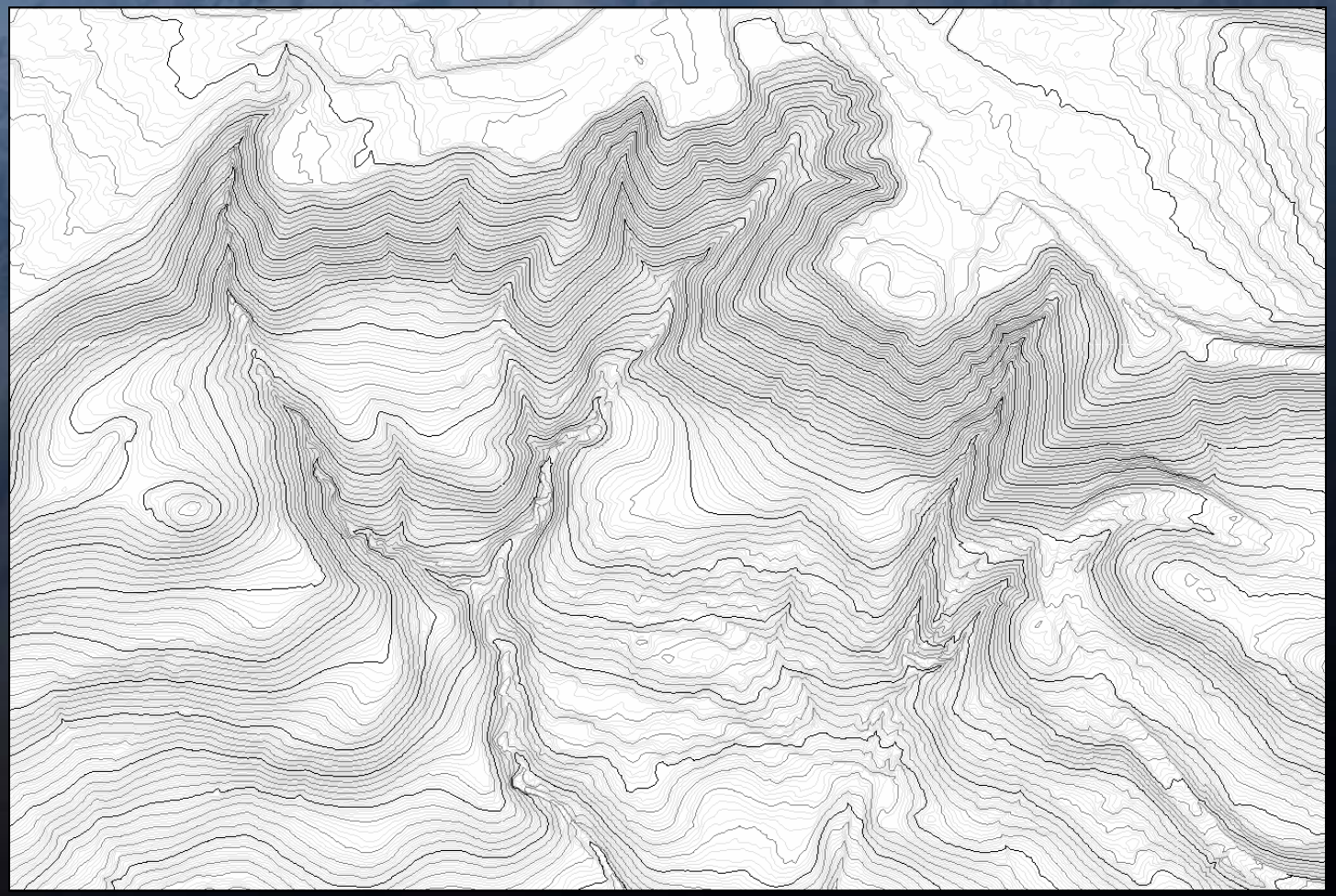
*Simplified line (with 1 foot tolerance): the difference between the original and the simplified would be less than 1 foot.

Estimation with Countywide Data

- With 69.43 GB Data
- Processing Time:
  - Method I: 754.5 hours (32 days)
  - Method II: 2152.7 hours (89 days)
  - Method III: 968.7 hours (41 days)
- Output Size:
  - Method I: 71.1 GB (65.3 [merged] + 4.9 [10']+ 0.9 [50'])
  - Method II: 28.5 GB (22.7 [simplified] + 4.9 + 0.9)
  - Method III: 40.3 GB (34.5 [polyline] + 4.9 + 0.9)

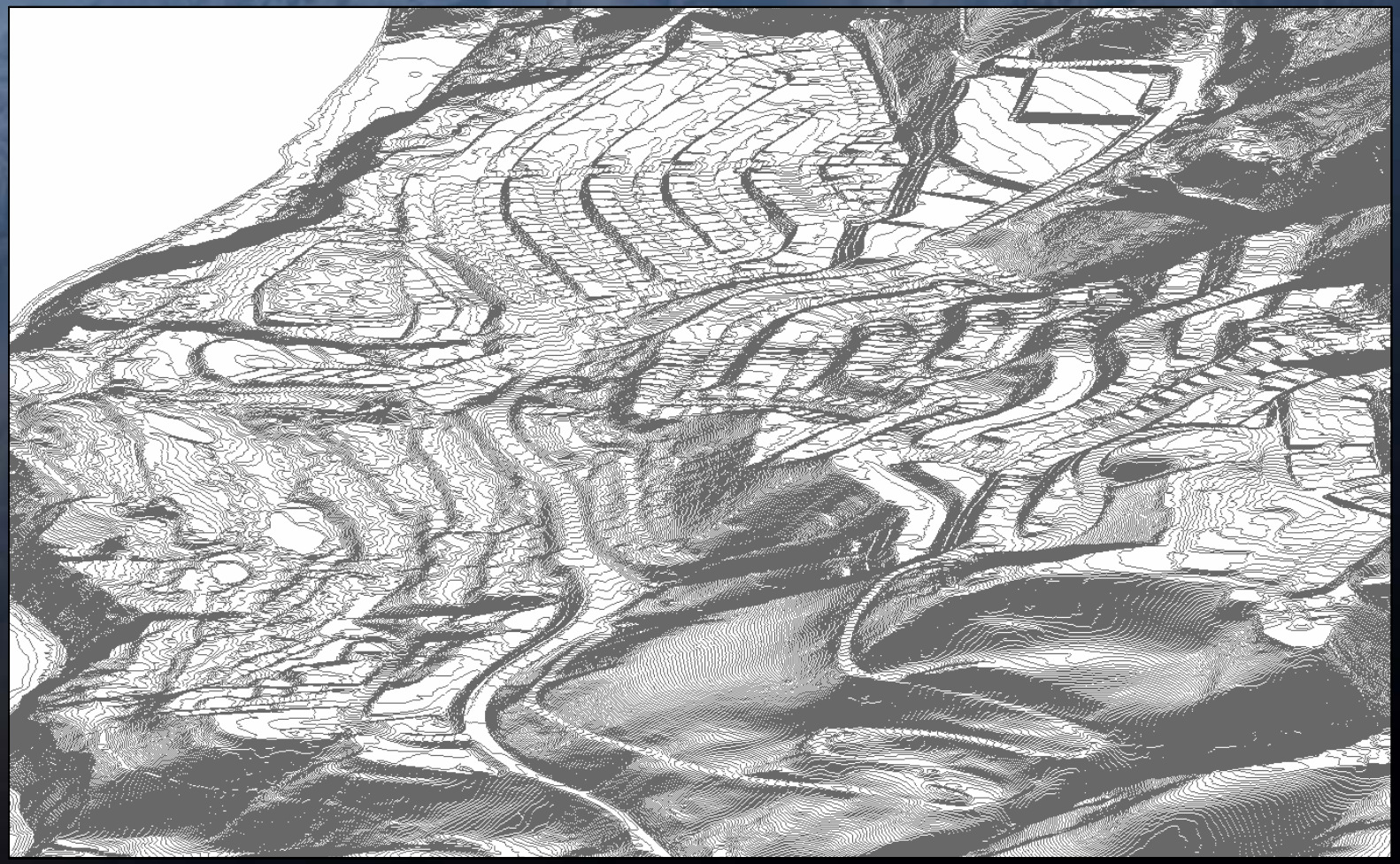
Screenshots (Contours)

- 2’ contours with 10’ and 50’ interval index contours



Screenshots (Contours)

- 3D perspective view



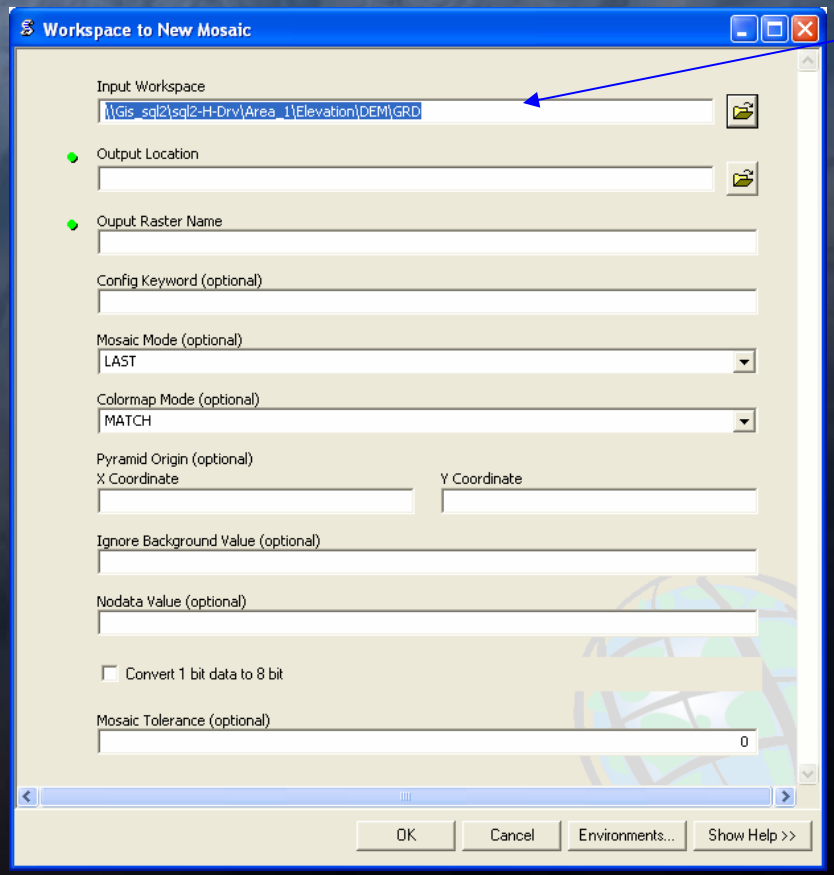
Digital Elevation Model (DEM)

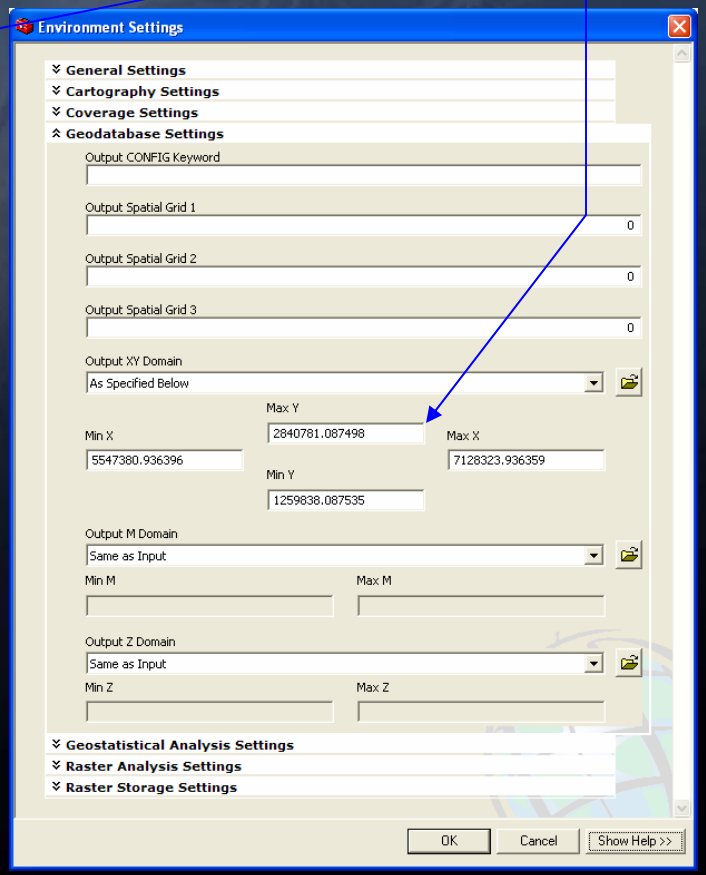
- Problem: Lots of tiles (19.9GB); ramps show too much variation; want to show as one seamless layer

- Solution:
  - Method: Workspace to new mosaic (Geoprocessing Tool)
  - Test result with 475 MB input data
    - Processing Time: 475MB took 2 hours and 52 minutes
    - Output size: 608 MB in SDE (**28%** increased, pyramid level 5)

Tips and Tricks 4

- **Workspace to new mosaic**
  - Input Workspace: select Grid data directory
  - Make sure XY domain is big enough to cover the entire area



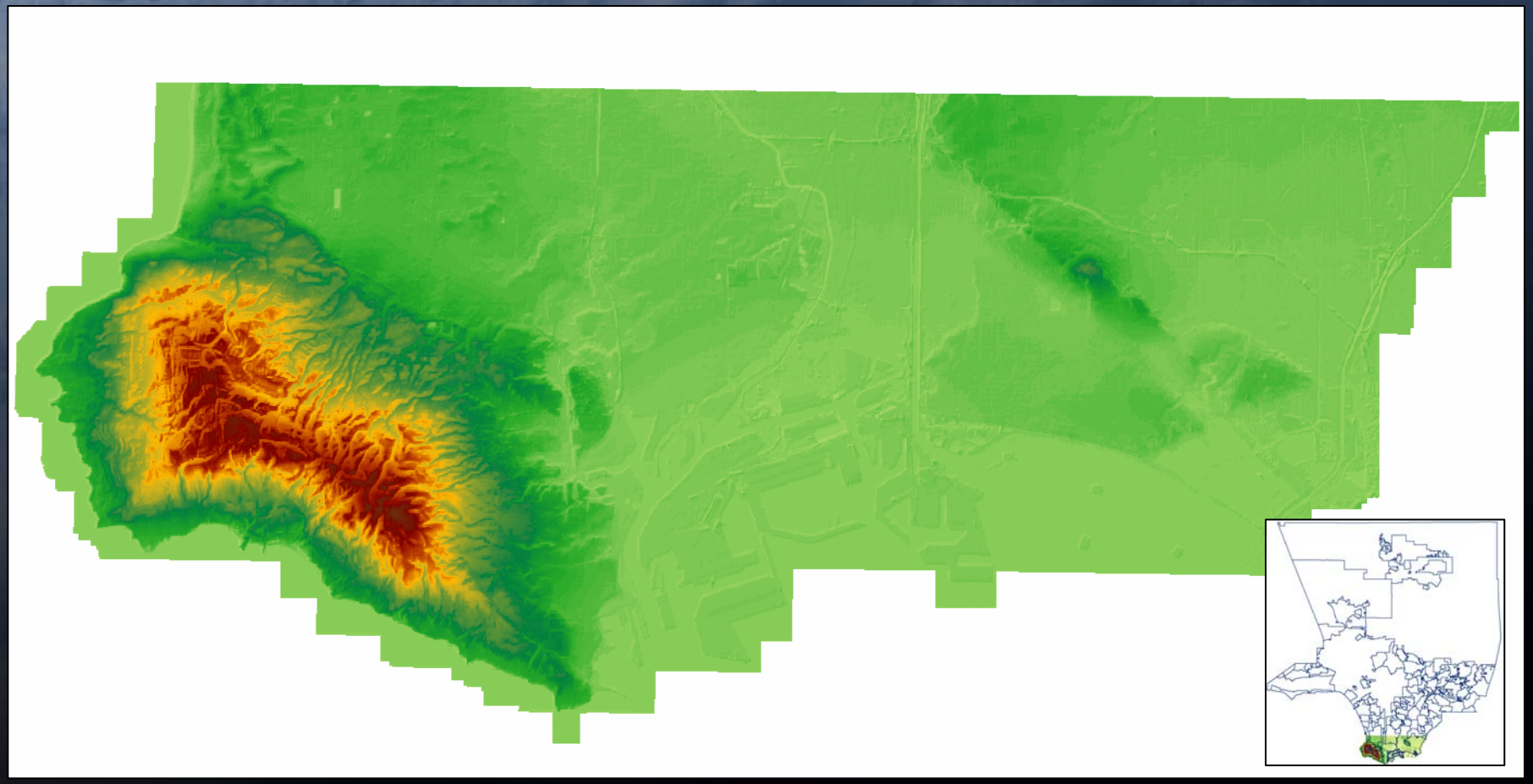


Estimation with Countywide Data

- With 19.9 GB data (pyramid level 5)
- Processing Time: 119.8 hours (5 days)
- Output Size: 25.47 GB

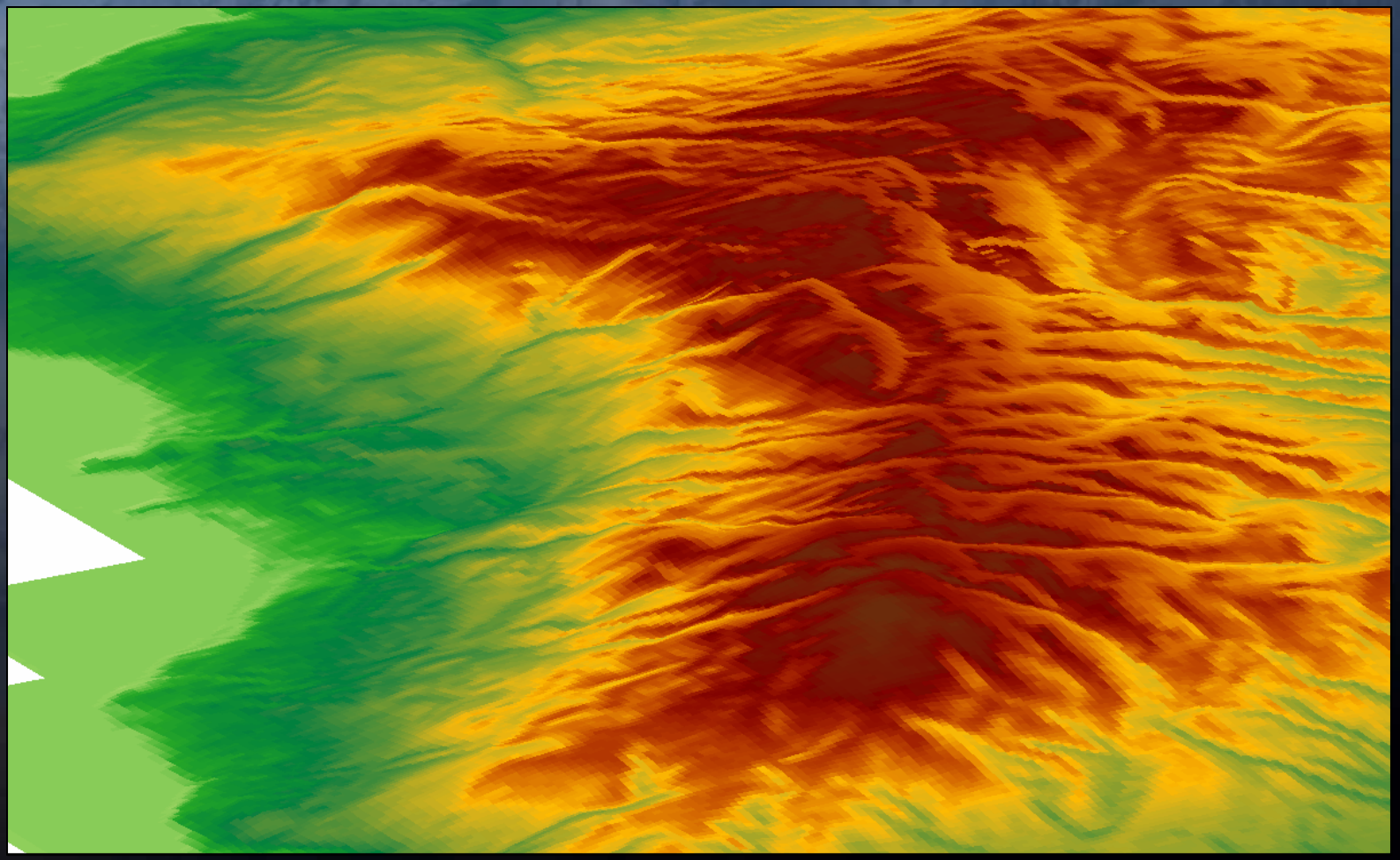
Screenshots (DEM)

- DEM with hillshade effect for Delivery Area 1



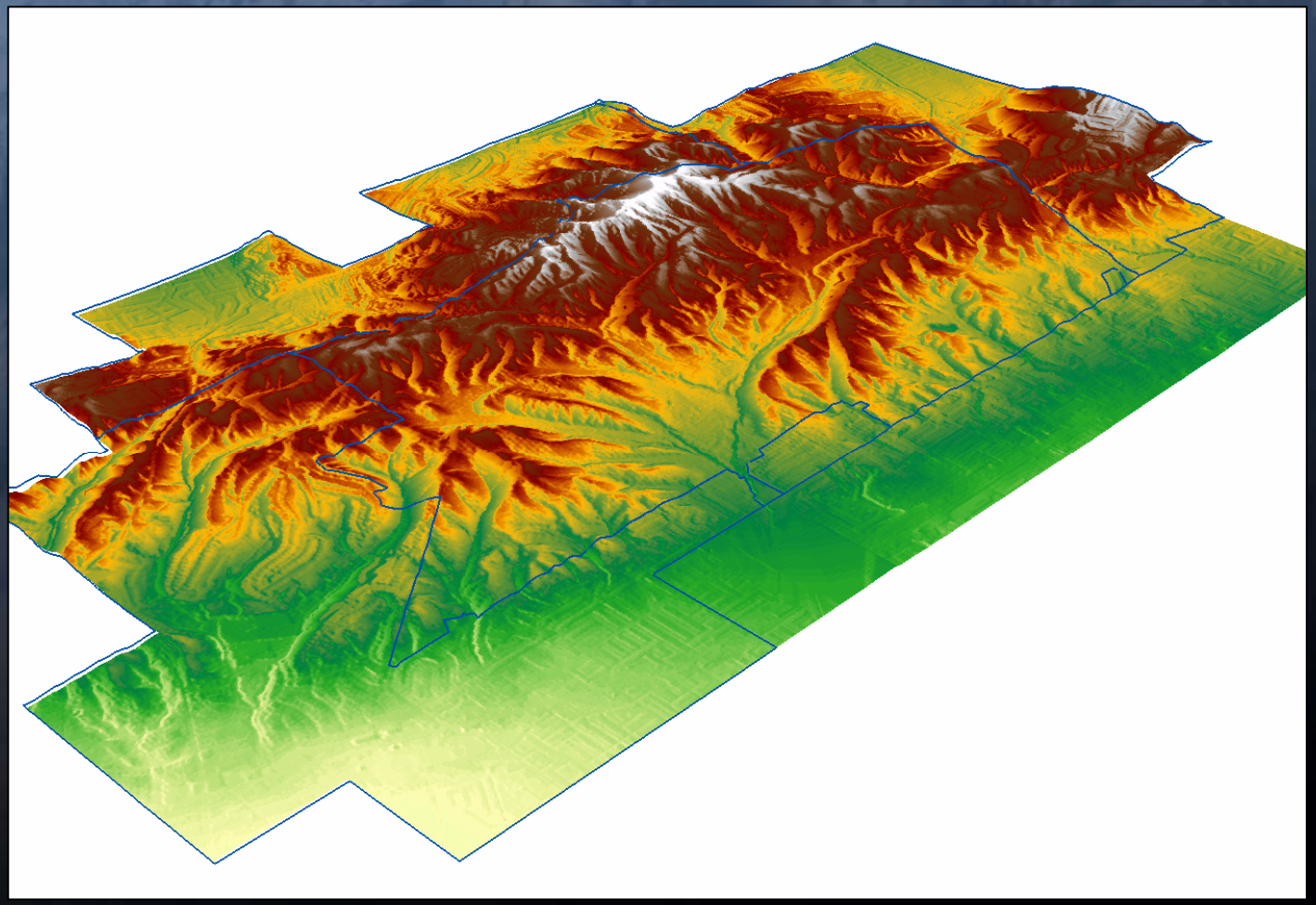
Screenshots (DEM)

- DEM perspective view (Delivery Area 1)



Screenshots (DEM)

- Perspective View (La Habra Heights)



Digital Surface Model (DSM)

- Problem: Same as before…tile structure (425.2GB), want to show as one seamless layer

- Solution:
  - Method I: TIN
  - Method II: TIN to Grid
  - Method III: Terrain
  - Method III + II: Terrain to Grid

Method I: TIN

- Build TIN*: Geoprocessing Tool (ArcGIS 9.x)
  - This method is for small areas (less than 10 million points: about 60 titles)

*TINs are typically used for high-precision modeling of smaller areas (up to10 million points).

Delivery Area 1 alone has 153 million points.

Method II: Tin to Grid

- Create TIN: same as Method I

- Convert TIN into Grid:
  - Convert TIN to Grid using “TIN to Raster” in Geoprocessing Tools
  - This method is for small areas, same as Method I

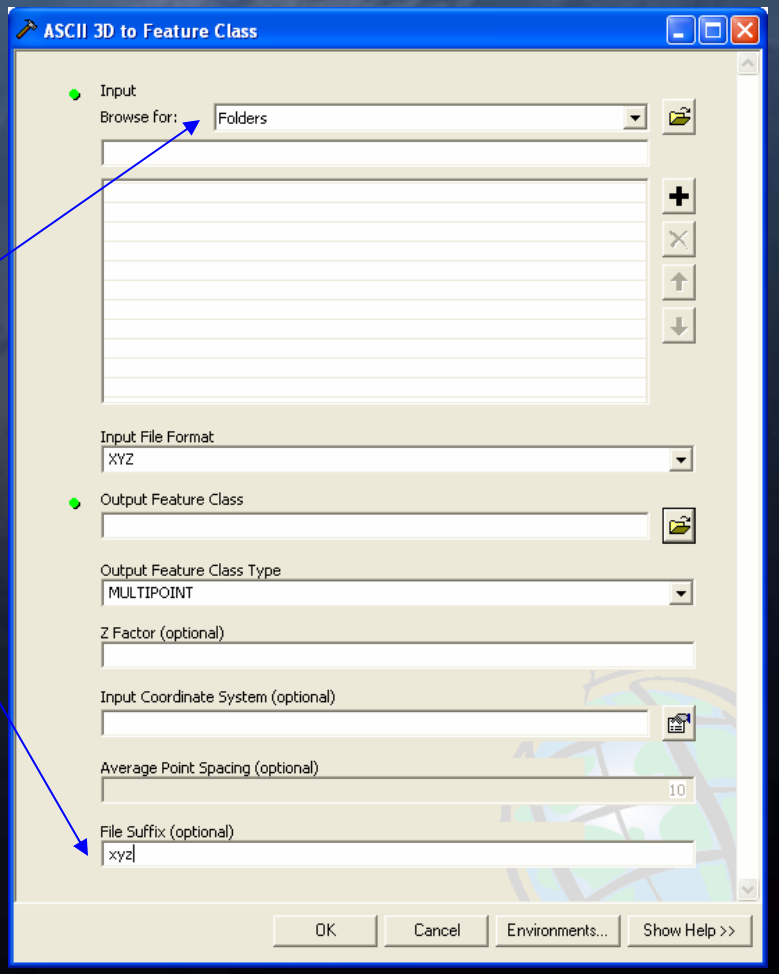
Method III: Terrain

- Create a SDE dataset (can be personal or file geodatabase)
- Load points into the SDE dataset
  - Import feature class (multiple) into SDE (individual tiles)
  - Merge points and import into SDE
  - Geoprocessing Tool: ASCII 3D To Feature Class*

  *ASCII format is read more efficiently than shapefile; in SDE loading process (15GB →2GB). LAS format would be better (something to be considered for next acquisition).
- Build Terrain: Geoprocessing Tool

Tips and Tricks 5

- **ASCII 3D to Feature Class**
  - Select **folder** for input (It will go through all the files in the folder and merge into a single feature class.)
  - Type **xyz** for file suffix (even it says optional, if you don't enter xyz, you will get an error.)



Method III + II: Terrain to Grid

- Create Terrain: same as Method III

- Create Grid from Terrain
  - Terrain to Raster*: 3D Analysis Tool
  - test result: 245 MB input →1.73 GB output ** (30 minutes)

*The processing time depends on the terrain pyramid levels and the cell size (feet). This is not tested with large data set. You can use a clipping mask to process a sub-set of data.

**This test result is based on the 4 pyramid levels and 0.3 cell size (4 inch).

Method Comparison

	Output Size	Processing Time	Display Performance	3D Analysis Tool	Visualize Software	Feasible for large area
TIN	Large	Moderate	Slow	Limited*	ArcMap ArcScene ArcGlobe (as elevation source but cannot display)	No (limit: about 10 million points, About 60 titles)
Grid	Small	Long	Fast	Supported	ArcMap ArcScene ArcGlobe	Yes or No (Yes: Method III + II, No: Method II)
Terrain	Large	Long	Fast	Limited*	ArcMap ArcGlobe	Yes (can reach into the billions of points)

*Some basic 3D analysis available with this format. To do more advanced analysis, you need to Convert into Grid format (TIN and Terrain can be converted into Grid)

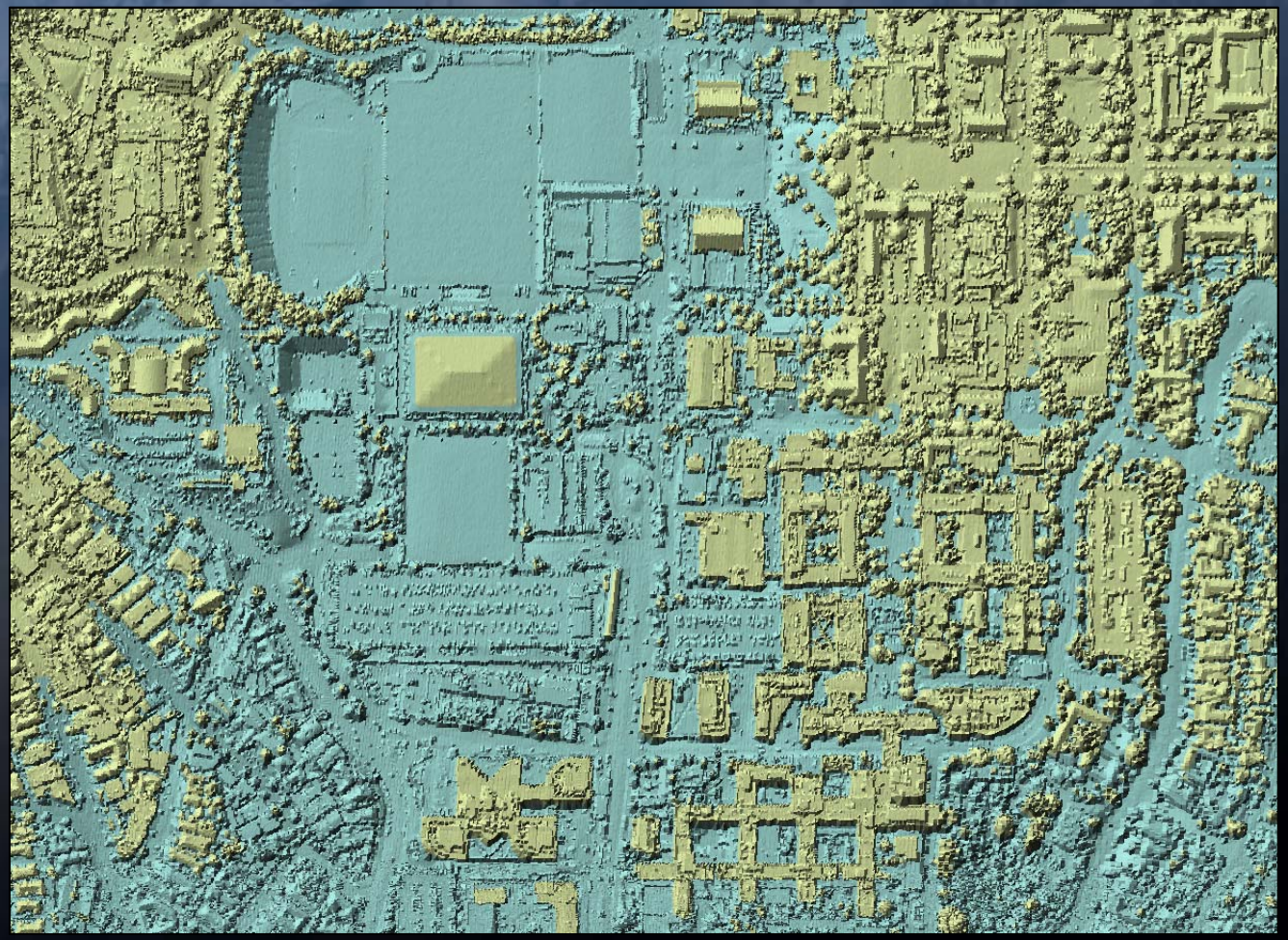
Estimate with Countywide Data

- With 425.2 GB Data
- Processing Time
  - Method I*: 245 MB took 30 minutes to create TIN
  - Method II*: not tested
  - Method III**: 234 hours (10 days)
  - Method III + II*: 245 MB took 30 minutes to create Grid***
- Output Size
  - Method I*: 245 MB input → 70 MB output
  - Method II*: not tested
  - Method III**: 54.9 GB (test result:15.5GB input →2 GB output)
  - Method III + II*: 245 MB input →1.73 GB output***

* Not tested with large data set
** This test result is based on the 1 terrain pyramid level and 10 feet average point distance.
*** This test result is based on the 4 pyramid levels and 0.3 cell size (4 inch).

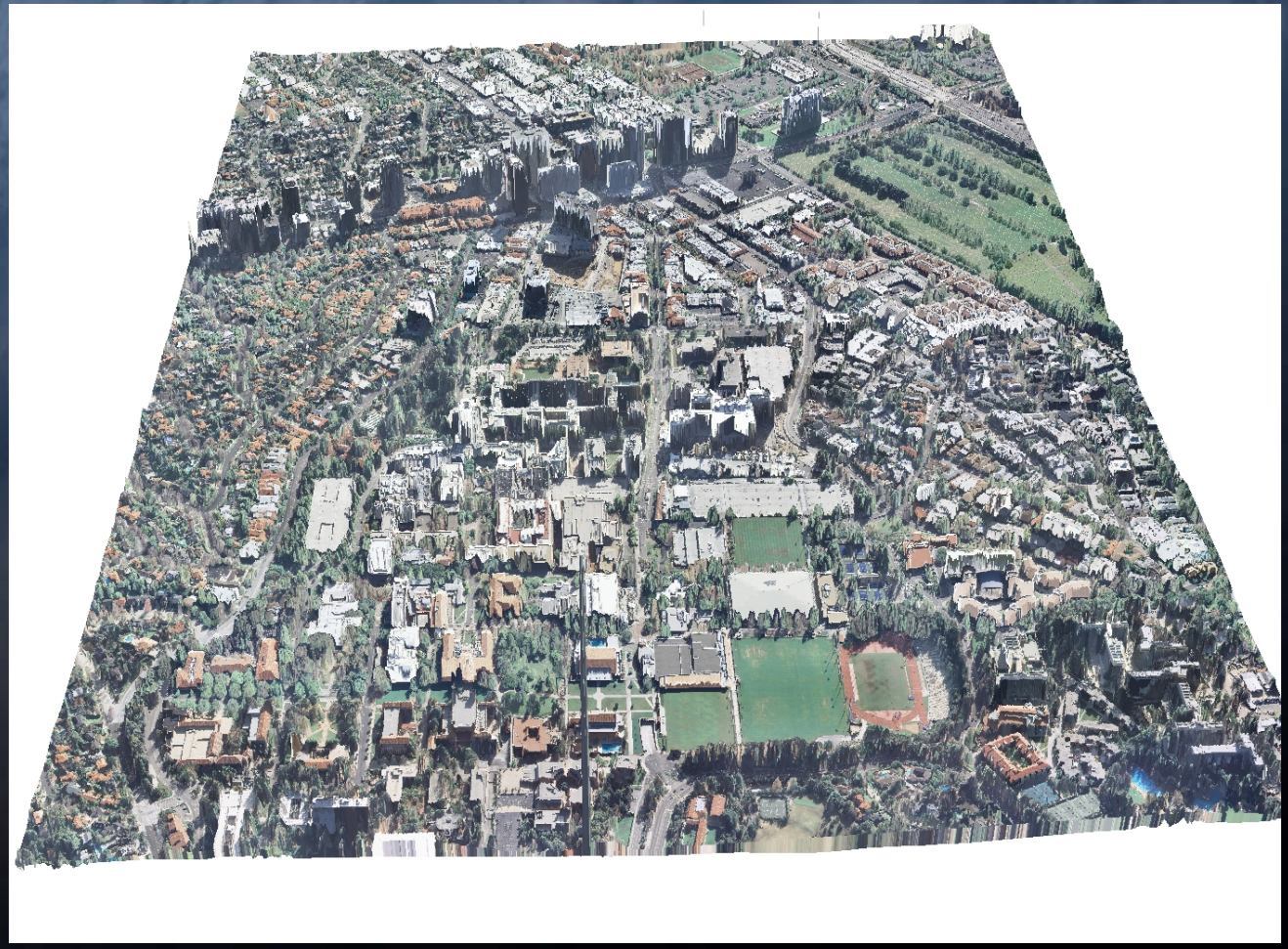
Screenshots (DSM)

- TIN (UCLA)



Screenshots (DSM)

- TIN (UCLA): Ortho Draped On Top



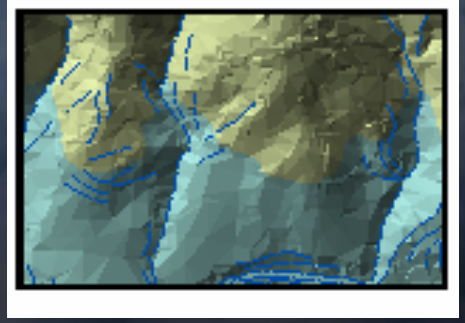
Screenshots (Oblique)

- Oblique Image

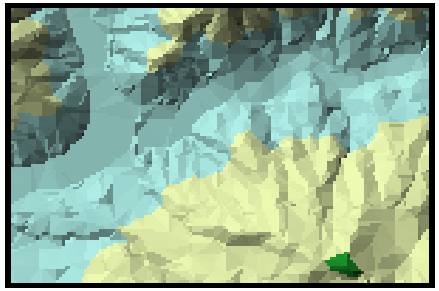
Screenshots (DSM)

- Terrain (level of detail based on the pyramid level)

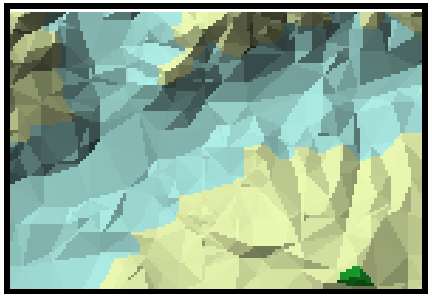
Pyramid level: 1
Z resolution: 1
Map Scale:
Less than 10,000



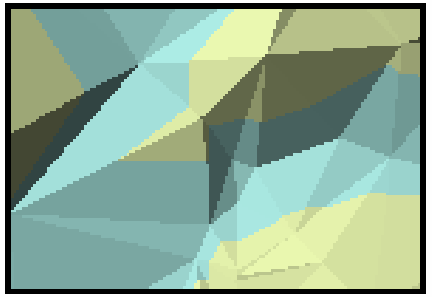
Pyramid level: 4
Z resolution: 10
Map Scale:
30,000 to 50,000



Pyramid level: 6
Z resolution: 25
Map Scale:
100,000 to 300,000



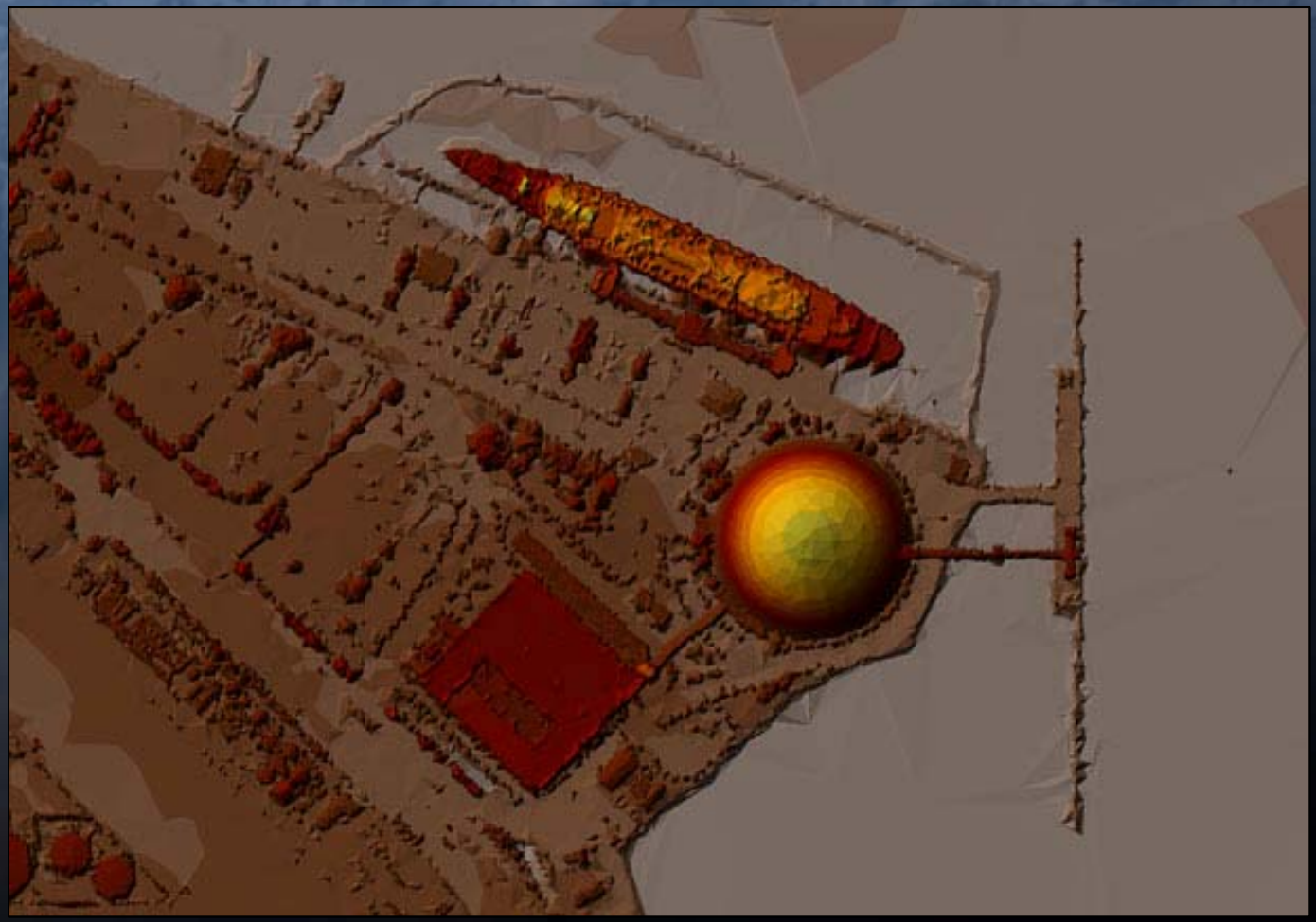
Pyramid level: 7
Z resolution: 50
Map Scale:
Greater than 300,000



(Source: ESRI ArcGIS Desktop Help 9.2 – Terrain Data Concepts)

Screenshots (DSM)

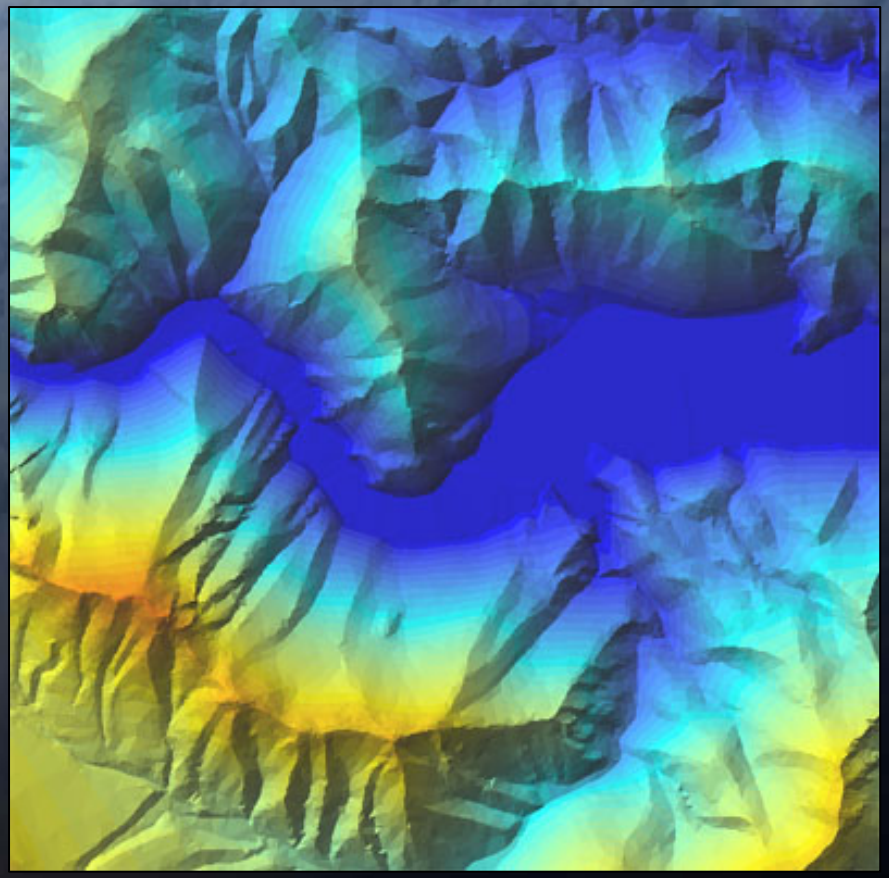
- Terrain* (Delivery Area 1)

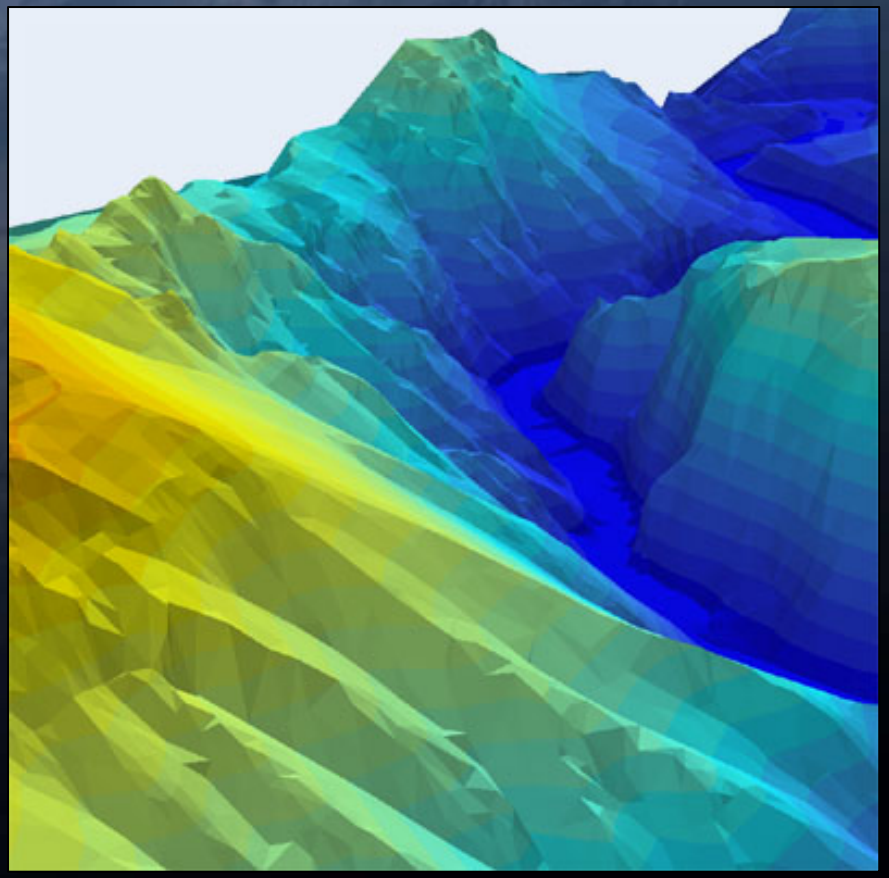


*Overview image: pyramid level 7, z resolution 50

Screenshots (DTM)

- TINs from DTM Data





Screenshots (Elevation Data)

- DSM

Questions?