

Urban Applications of LiDAR (2)

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5.1 Introduction

5.2 Road Extraction

5.3 Building Extraction and 3D Reconstruction

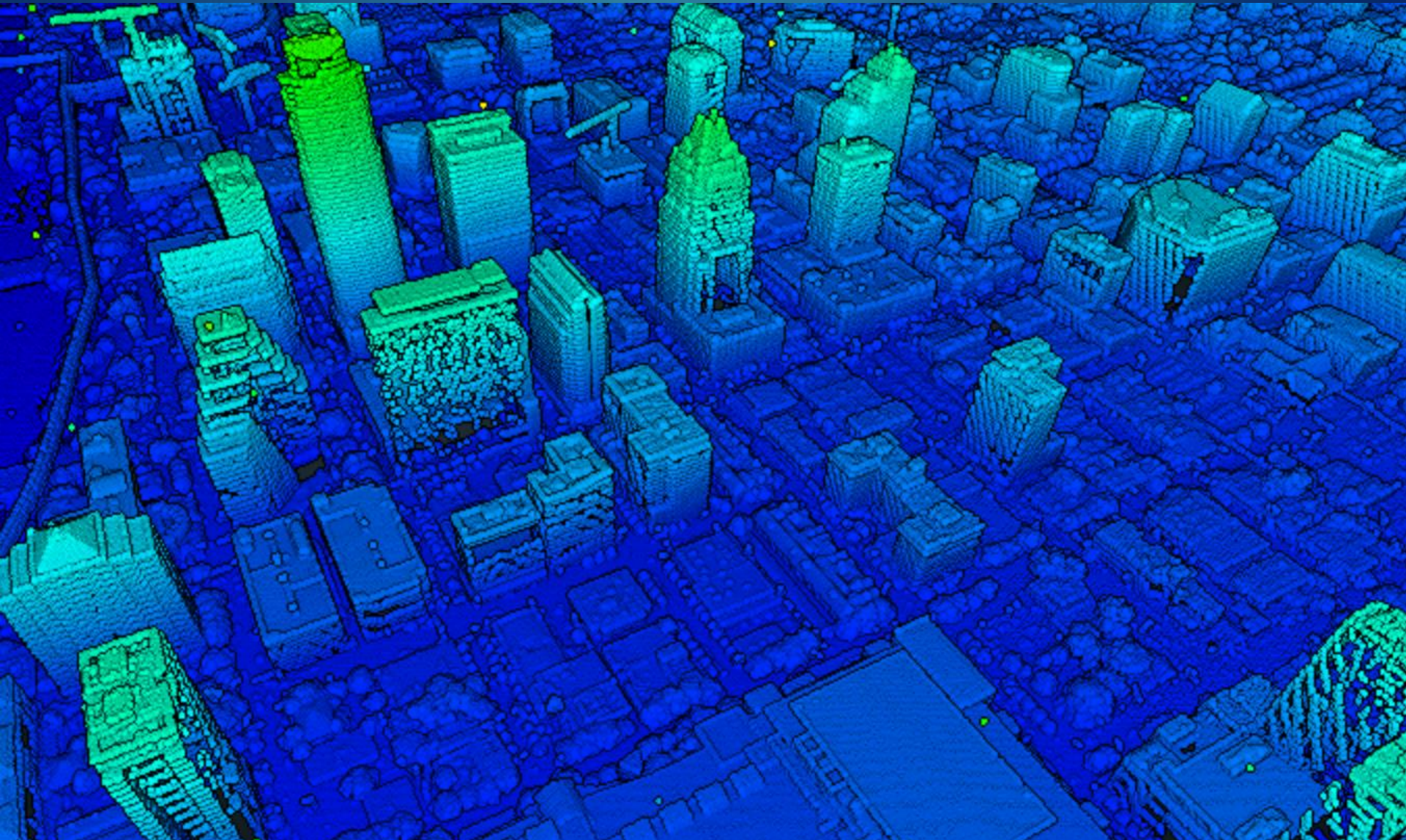
5.4 Population Estimation

5.5 Change Detection

5.6 Assessment of Post-Disaster Building Damage

5.7 Assessment of Post-Disaster Road Blockage

Airborne LiDAR point cloud data of Austin (2015)



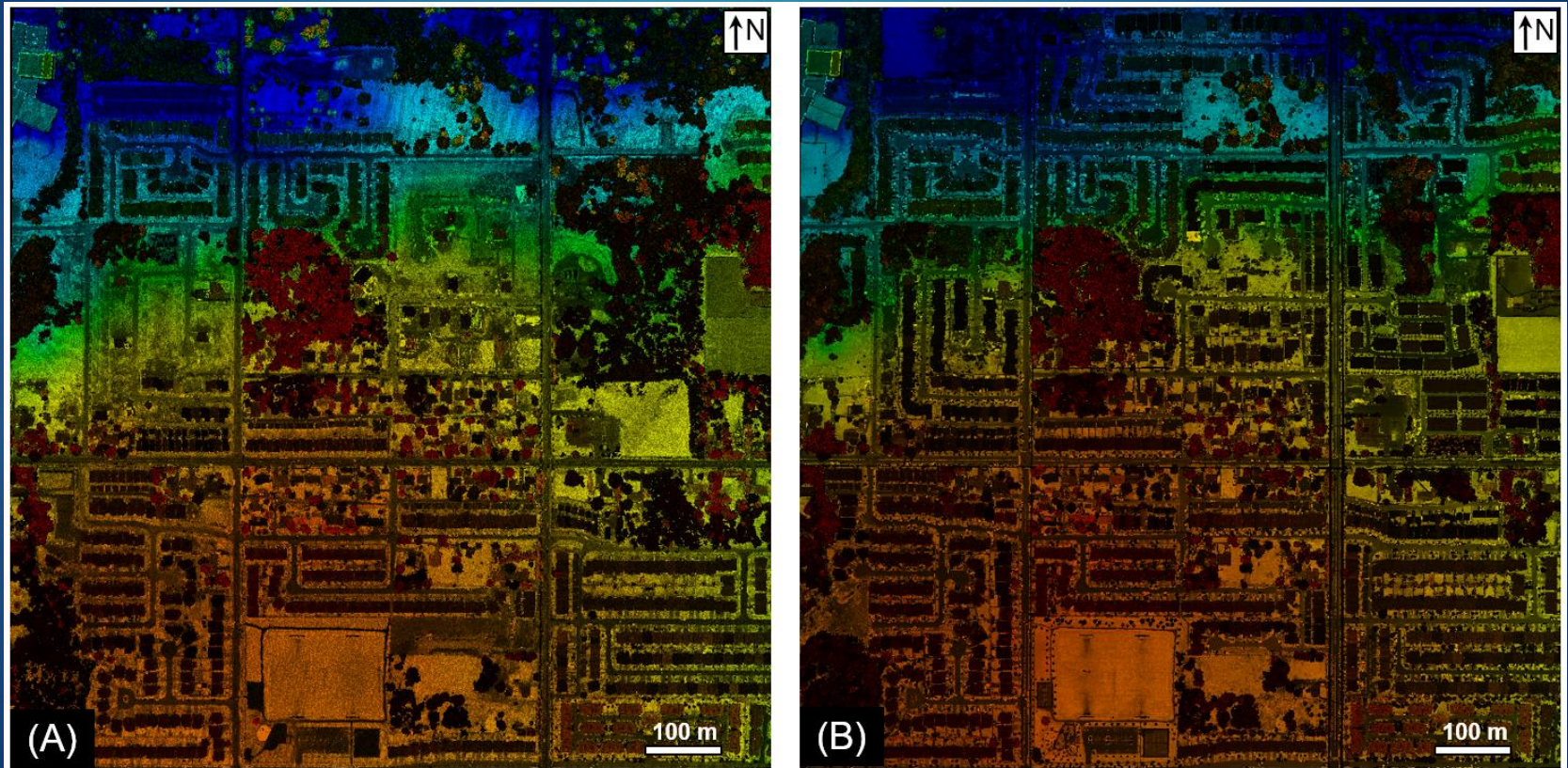
Airborne LiDAR point cloud data of Dublin city (2015)



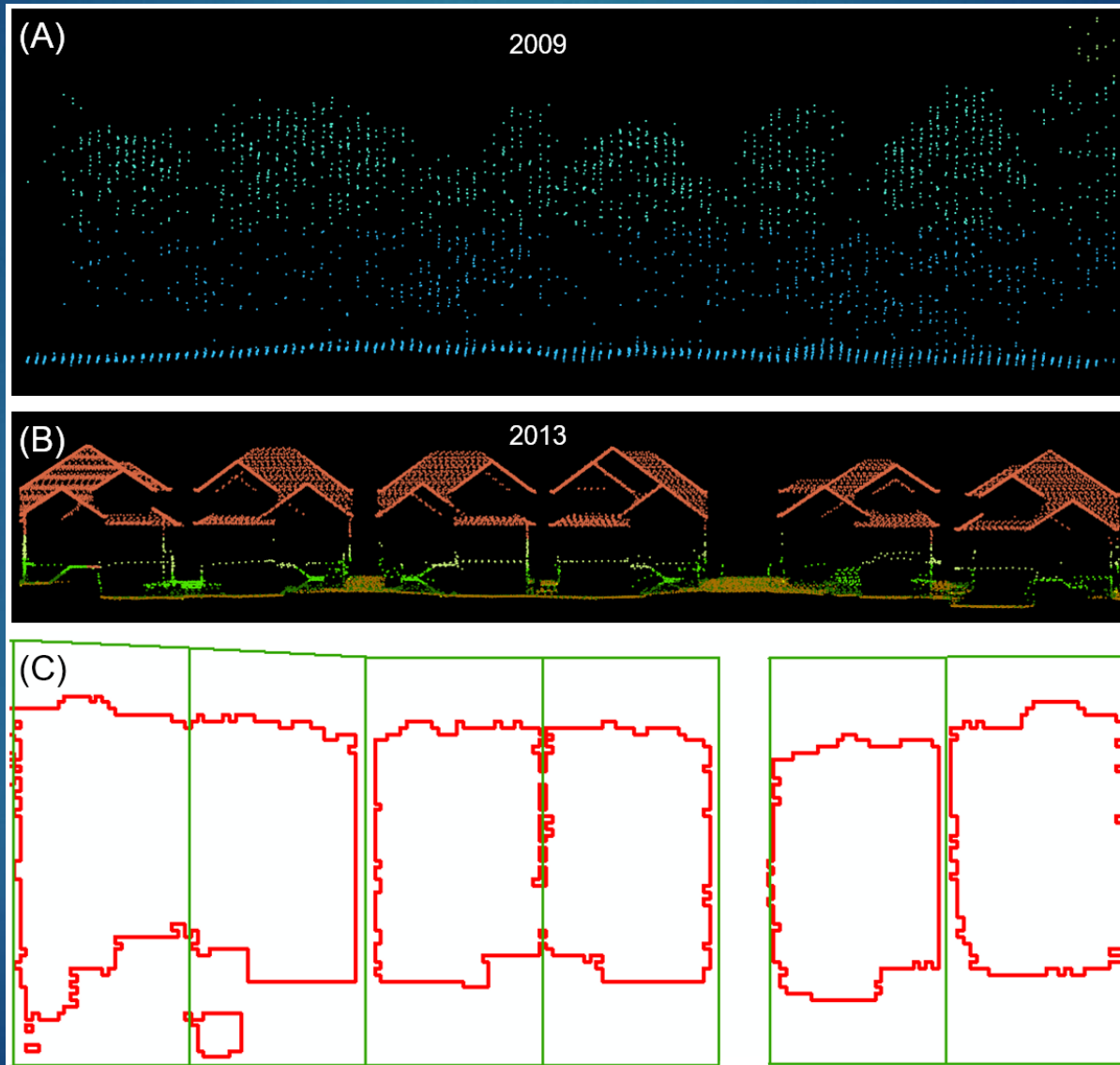
(Vo et al. 2019)

Change Detection

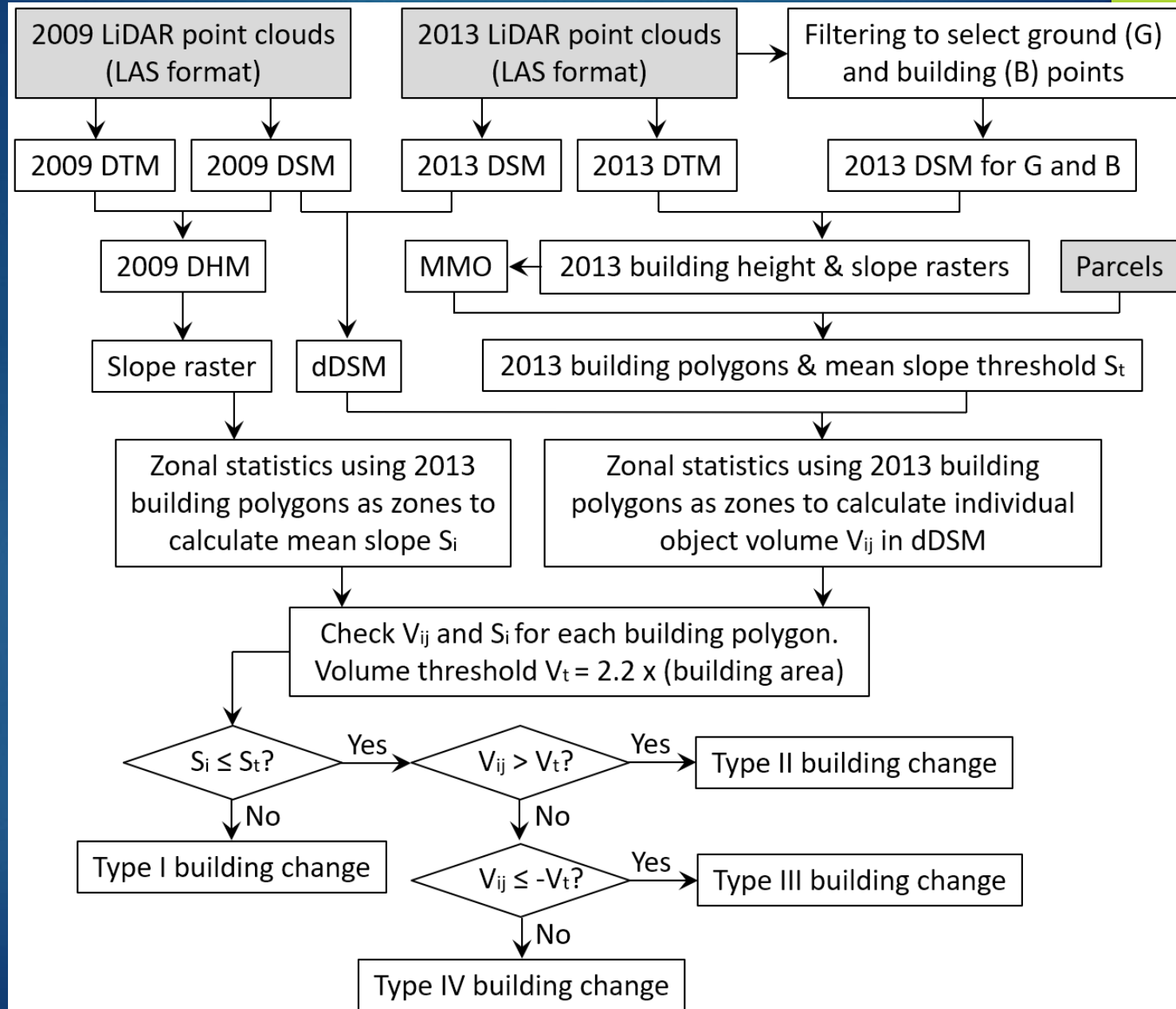
LiDAR Point Clouds for Surrey, B.C., Canada
Left: March 2009; Right: April 2013



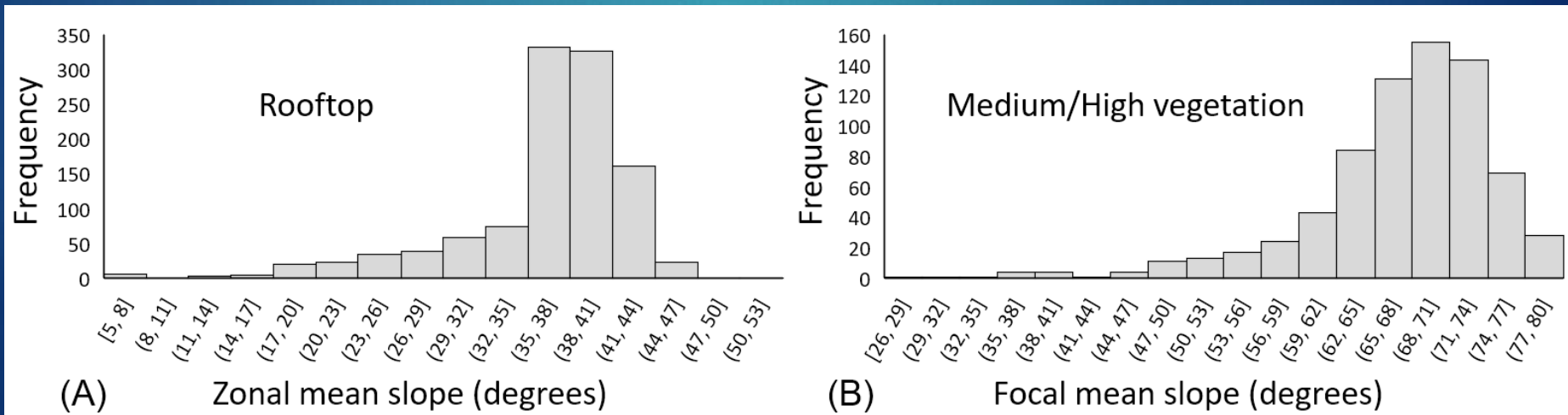
LiDAR Profiles, Parcels, and Building Footprints



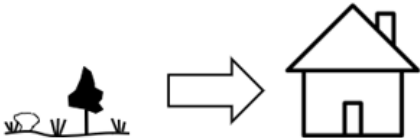
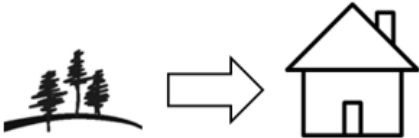
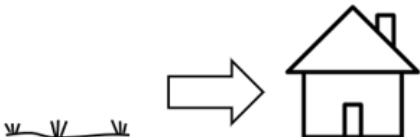
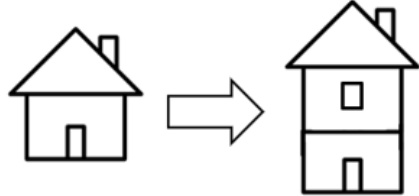
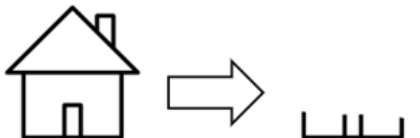
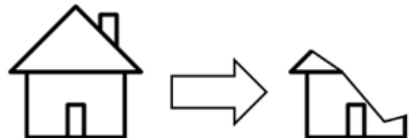
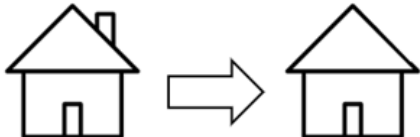
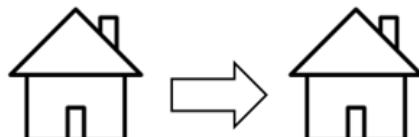
Change Detection Flowchart



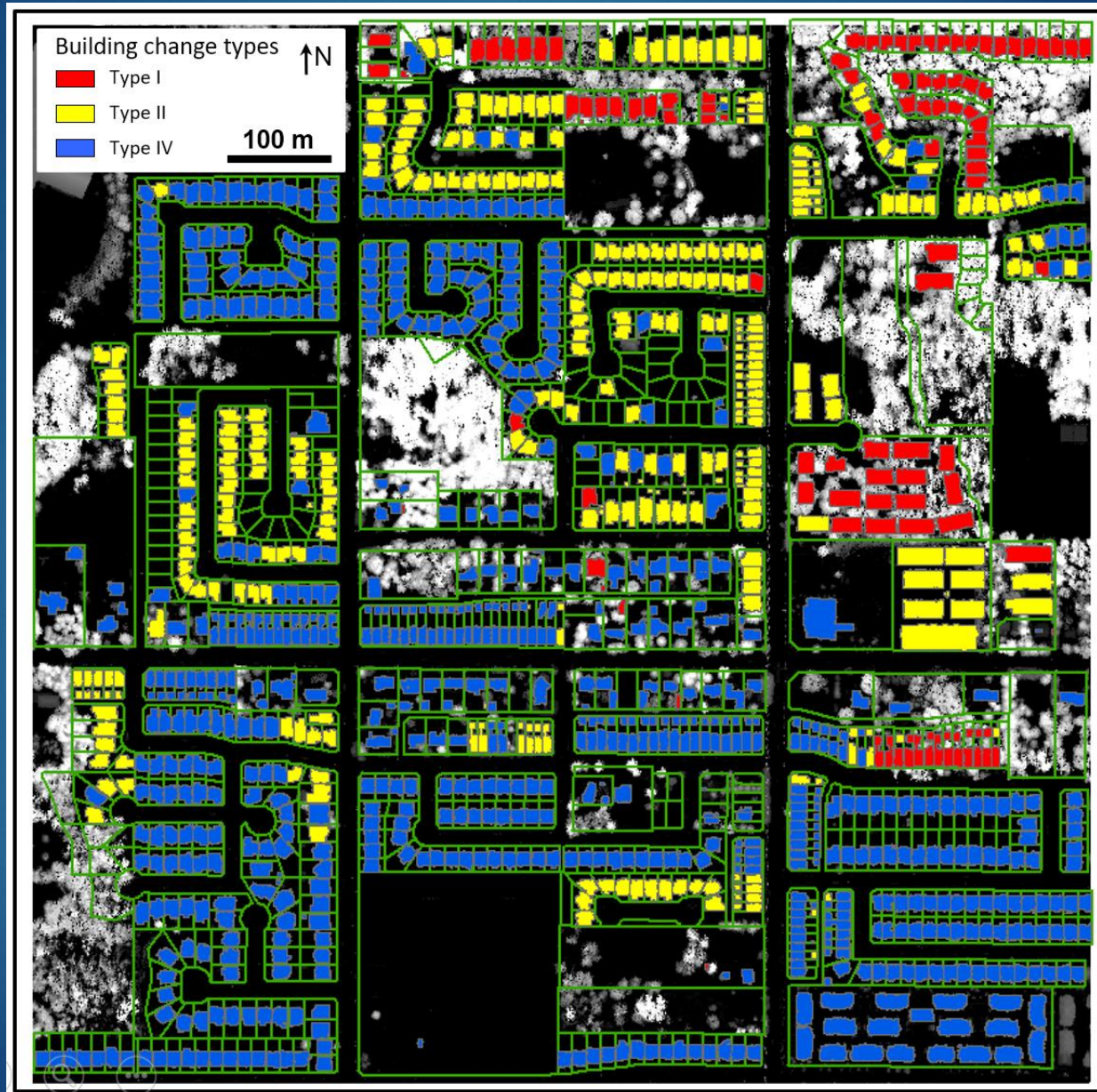
Comparison of Mean Slopes Derived from Rooftop and Vegetation



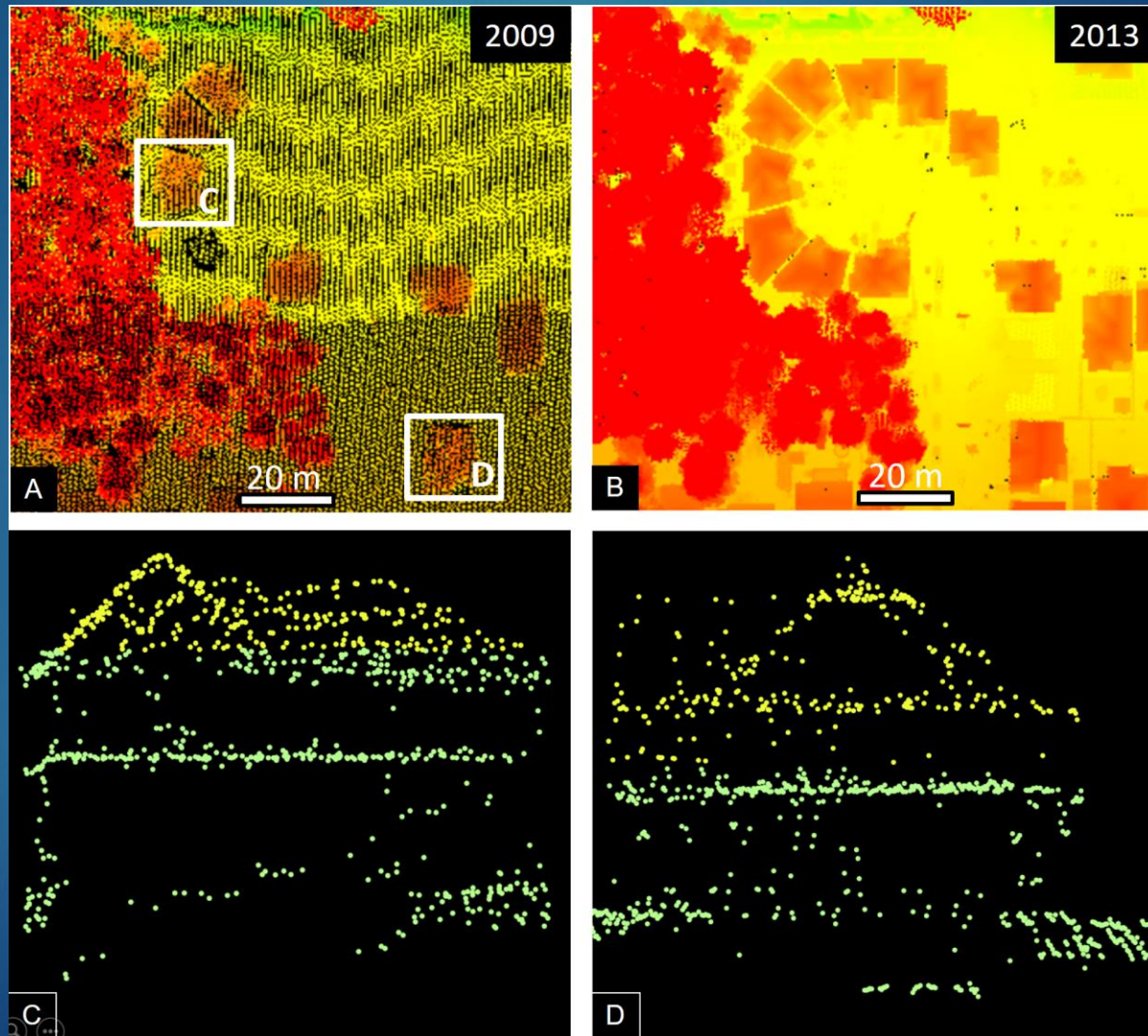
Change Detection Scenarios

If $S_i > S_t$ (Type I)	  (From medium/high vegetation to building)
If $S_i \leq S_t$	If $V_{ij} > V_t$ (Type II)   (Bare earth/low vegetation to building, or one-story to two-story)
	Else If $V_{ij} < -V_t$ (Type III)   (Demolished) (Damaged)
	Else (Type IV)   (Minor changes) (No changes)

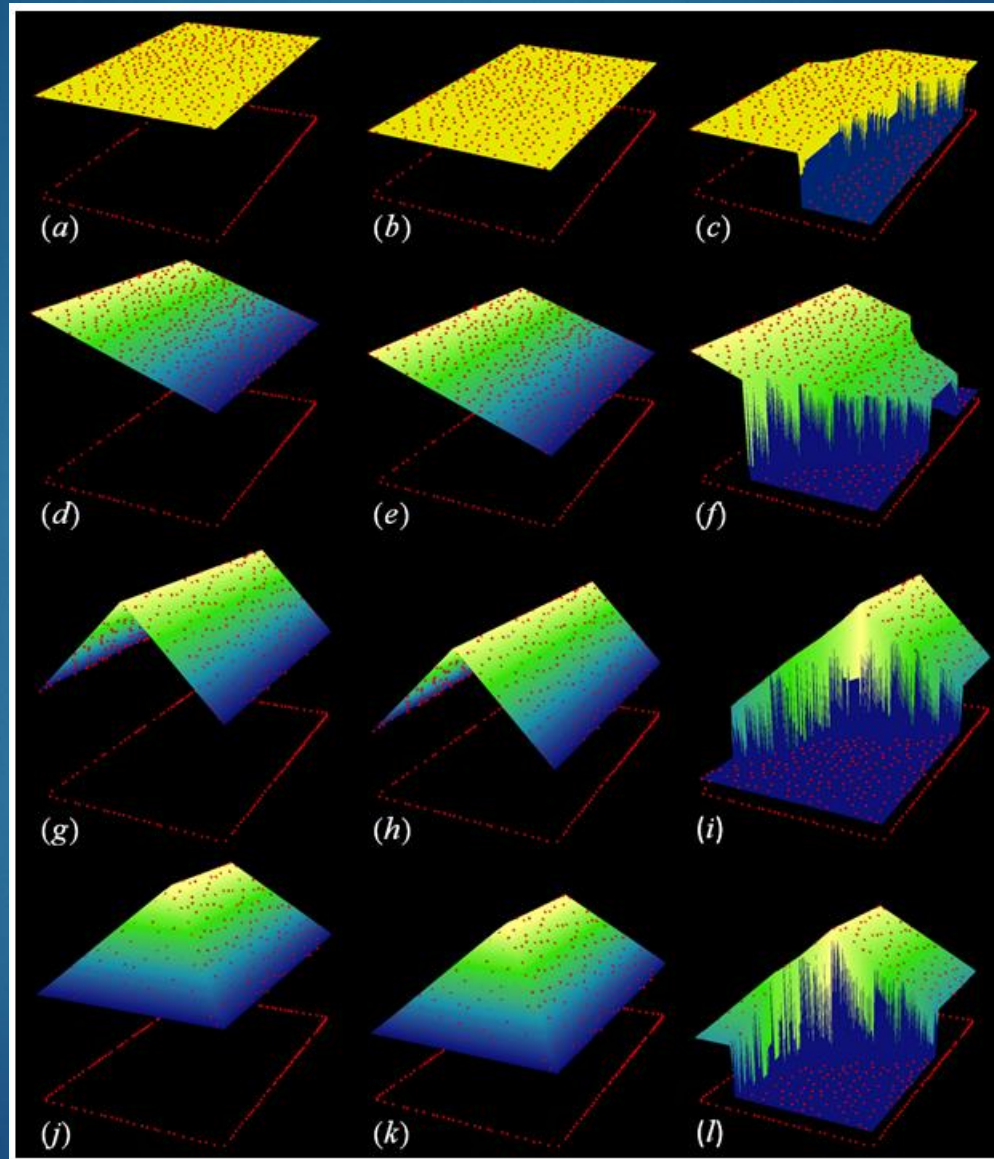
Building Change Types



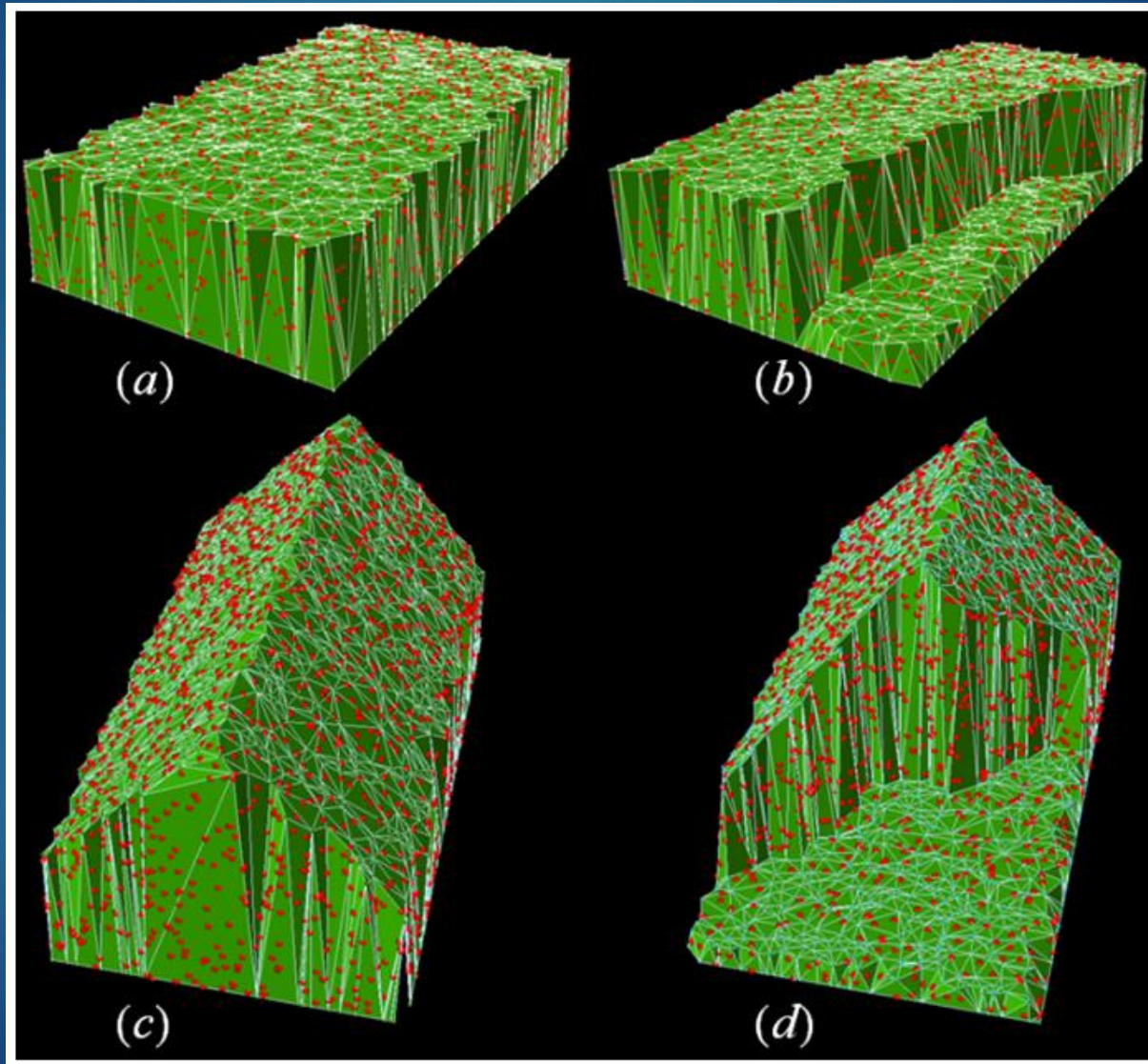
Special Cases: Buildings under construction misclassified as vegetation



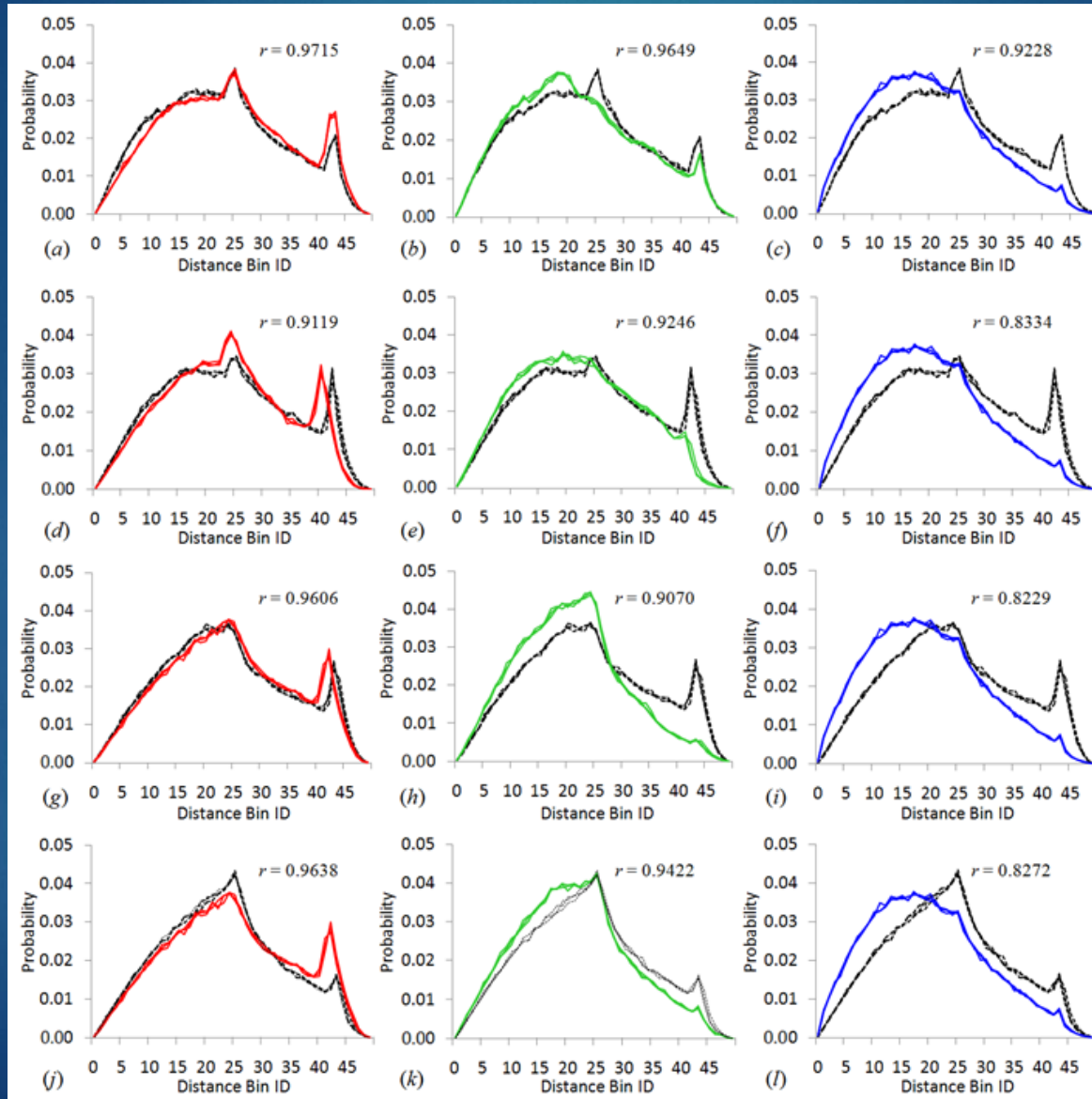
Building Damage Simulation



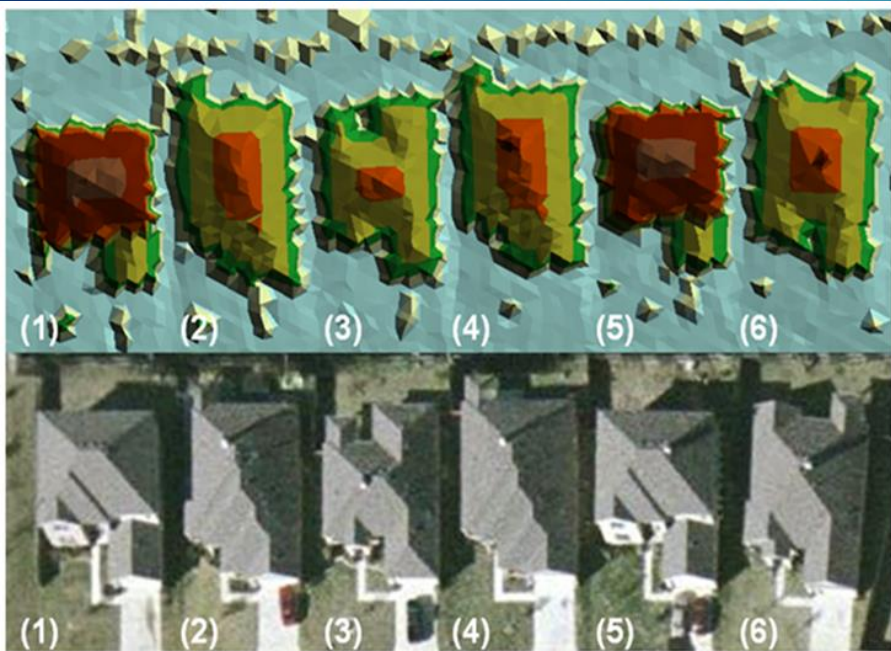
Simulated LiDAR Points for Buildings



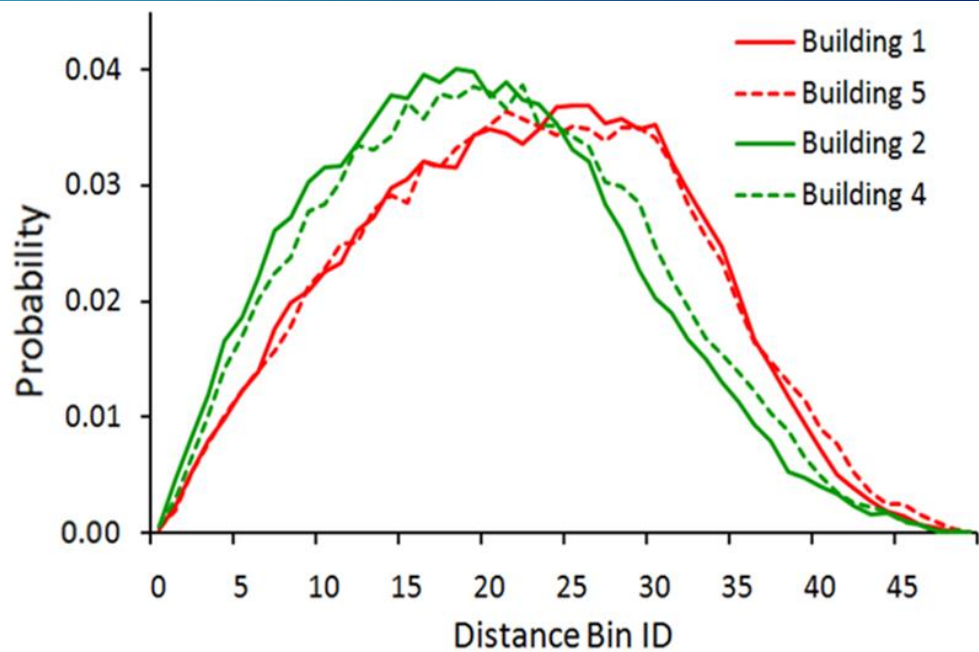
Detection of Building Damage Using 3D Shape Signatures



Detection of Building Damage Using 3D Shape Signatures

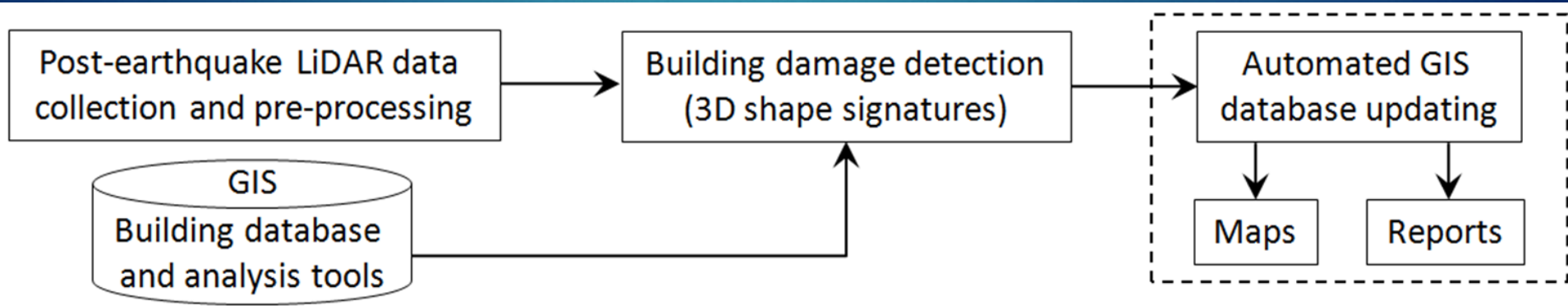


(A)

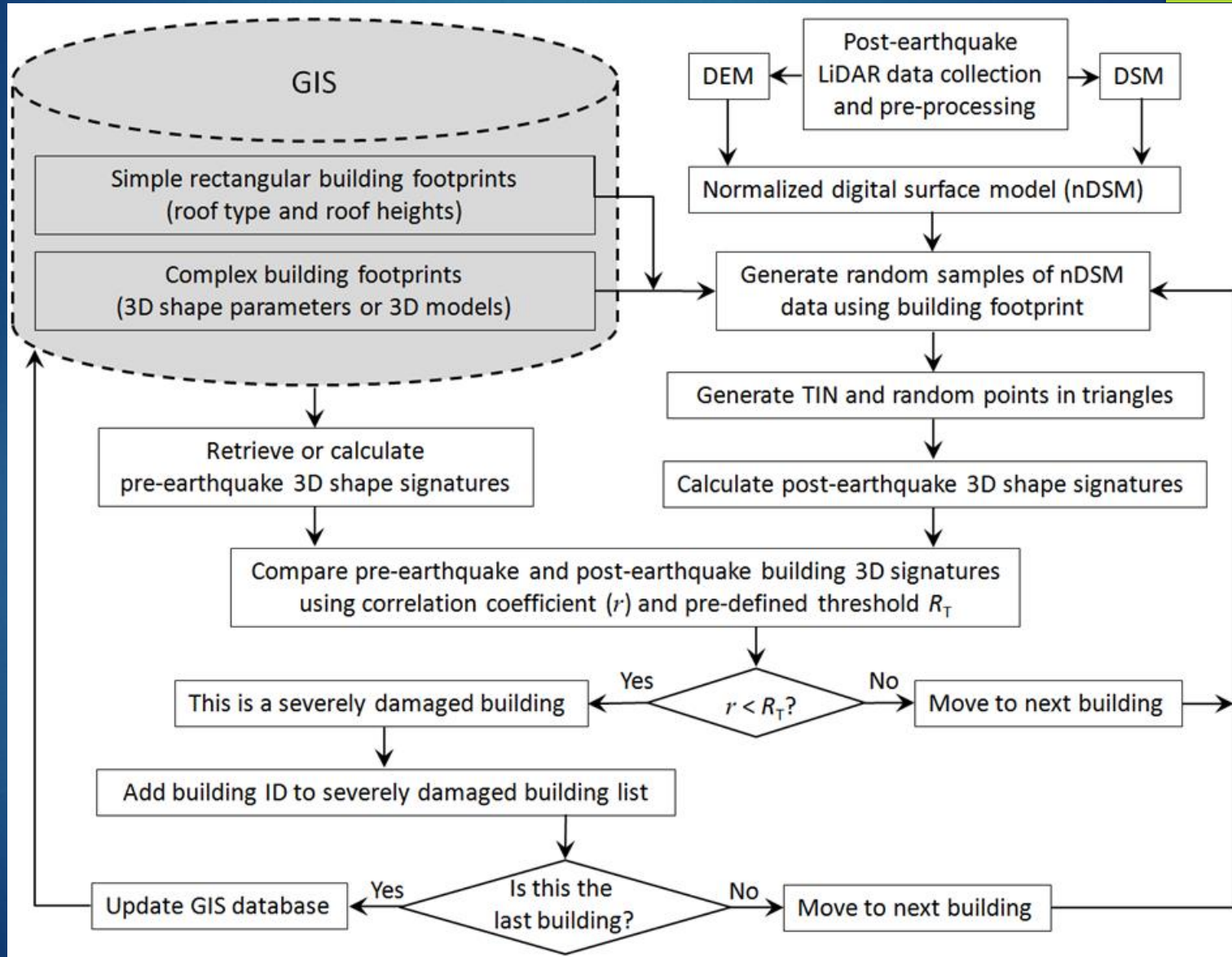


(B)

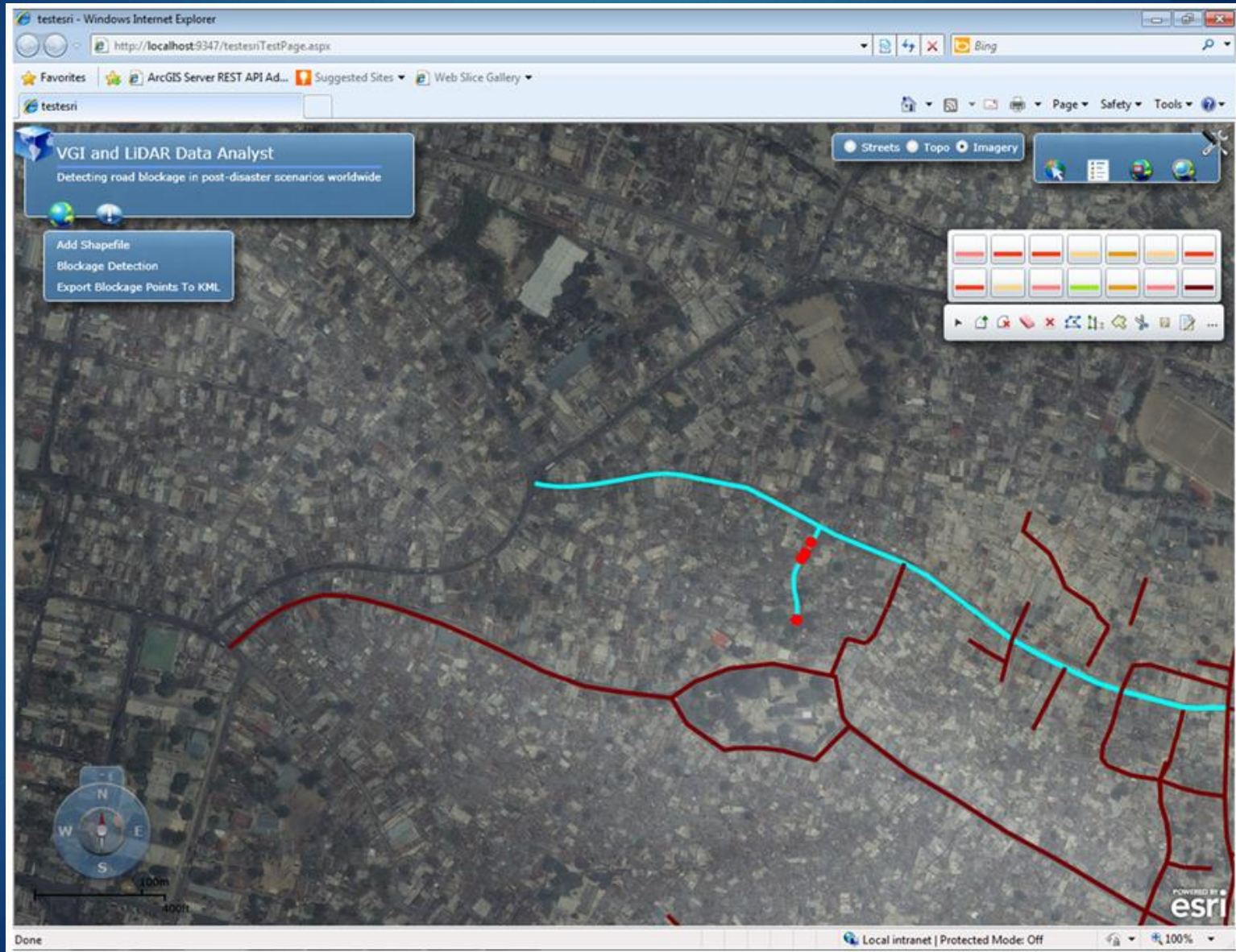
Building Damage Detection



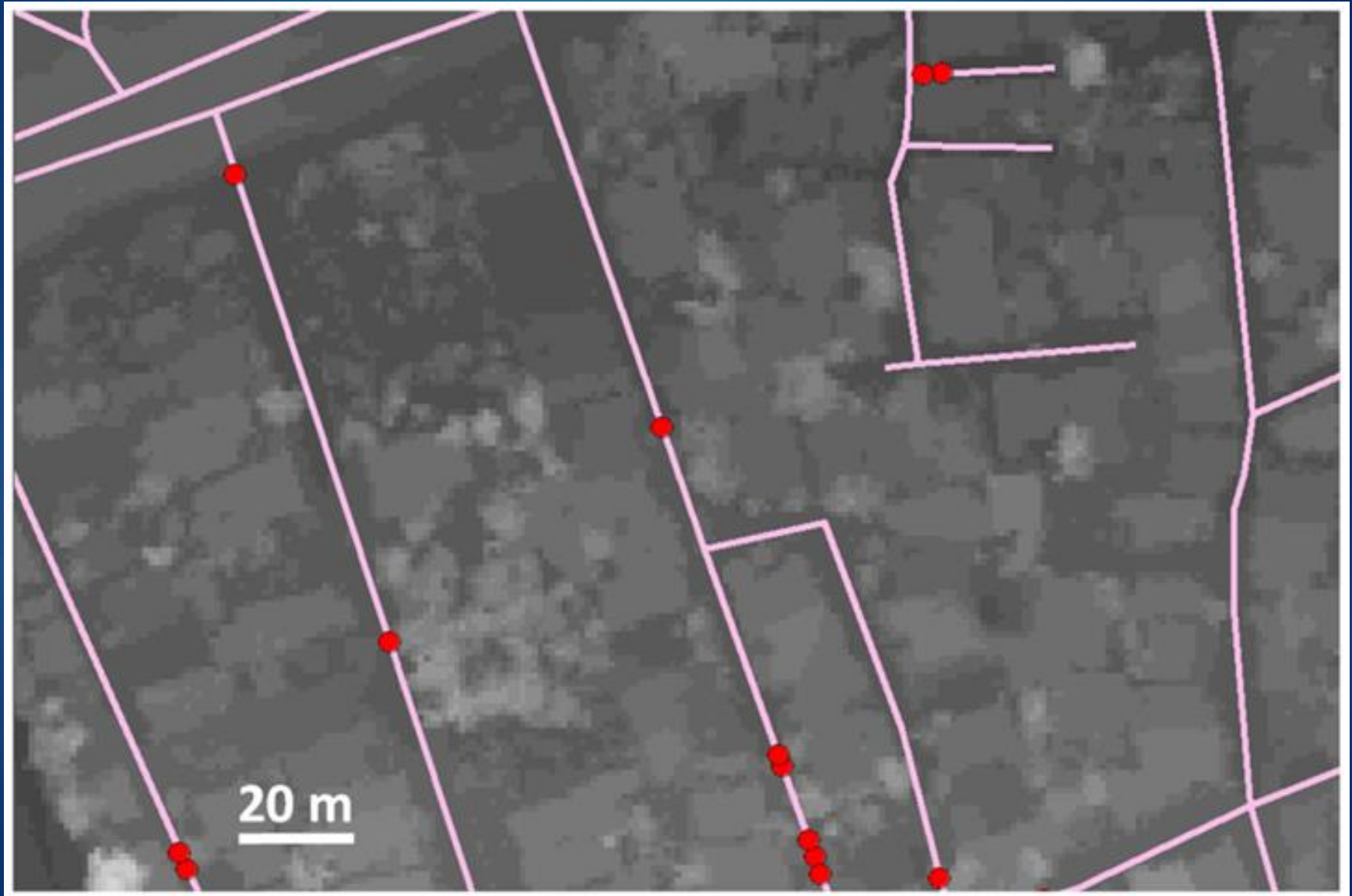
Building Damage Detection



Road Blockage Detection (Haiti Earthquake)



Road Blockage Detection (Haiti Earthquake)



3D Sample Tools

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Conversion

- ↶ ASCII Text To LAS
- ↶ LAS Dataset To Point
- ↷ LAS Dataset To Tiled Rasters
- ↶ LAS File Extent As Polygon
- ↶ LAZ To zLAS
- ↷ Mosaic To LAS Dataset
- ↷ Terrain To Tiled Rasters
- ↶ TIN To LandXML
- ↶ TIN to Multipatch
- ↶ zLAS To LAZ

Feature Analysis

- ↶ Adjust Multipatch Z
- ↶ Cast Shadows On Raster
- ↶ Contour Multipatch
- ↷ Create Sun Sightlines
- ↷ Create Sun Skymap
- ↶ Cross Section Lines
- ↷ Cross Section Polygons
- ↶ Explode Multipatch
- ↶ Simplify 3D Line

Lidar Analysis

- ↶ LAS Building Multipatch
- ↶ LAS Building Polygon
- ↶ LAS Overlap Areas
- ↶ LAS Point Statistics By Area
- ↶ Locate LAS Points By Proximity
- ↶ Sample Z From LAS

Lidar Classification

- ↶ Classify LAS By Height
- ↶ Classify LAS Ground Points
- ↶ Classify LAS Model Key Points
- ↶ Classify LAS Noise
- ↶ Classify LAS Overlap Points
- ↶ Classify LAS Rooftop Points

Lidar Management

- ↷ Check LAS
- ↶ Create PRJ for LAS
- ↷ Delete PRJ For LAS
- ↷ EzLAS Optimizer
- ↶ LAS File Information
- ↷ LAS Reporter
- ↶ LAS To LAS
- ↶ Rearrange LAS Points
- ↷ Split LAS File

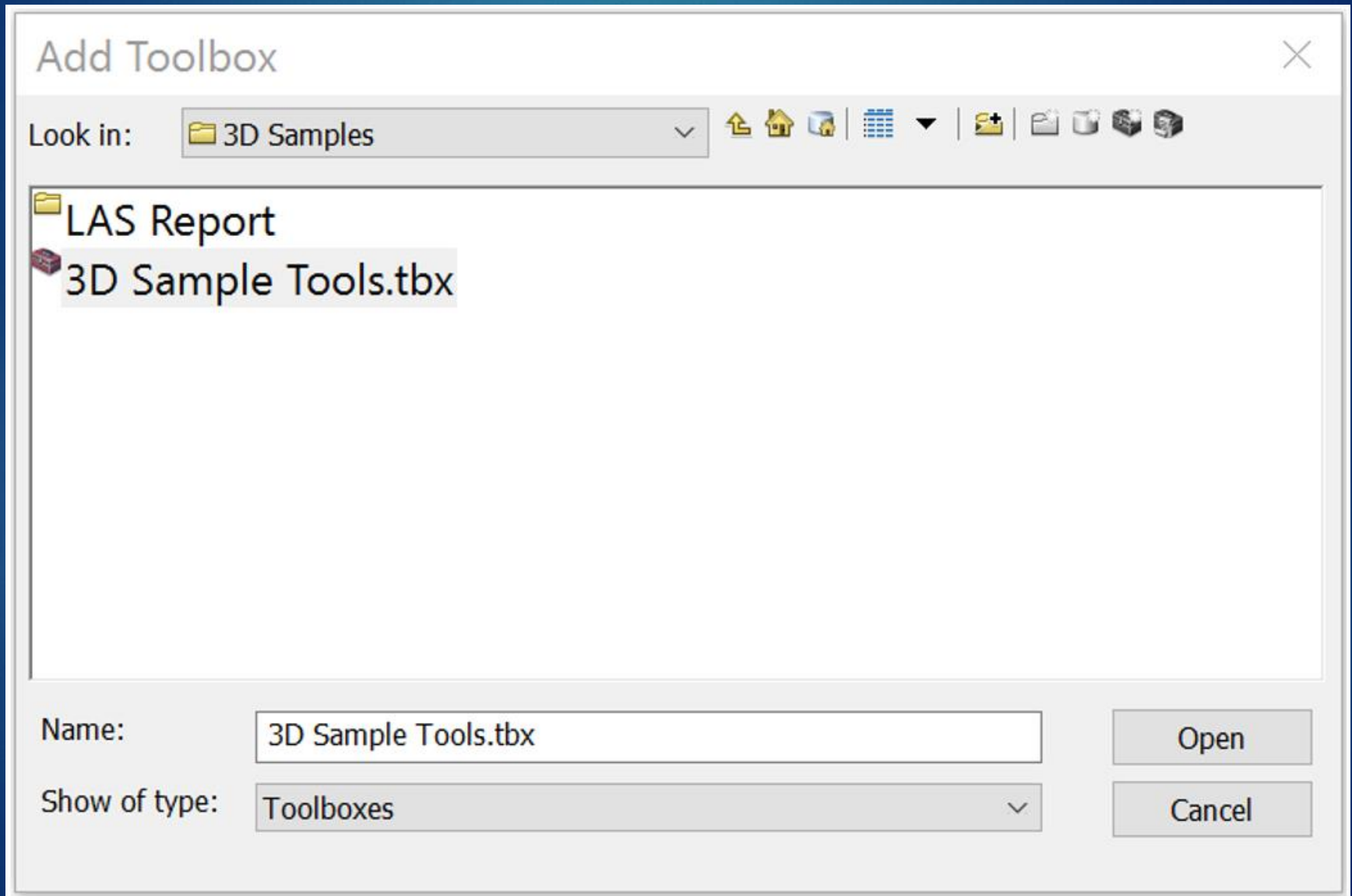
TIN

- ↶ Closest TIN Node
- ↶ Create Fence Diagram
- ↶ Extract TIN
- ↶ Integrate TINs
- ↶ Set TIN Node Z

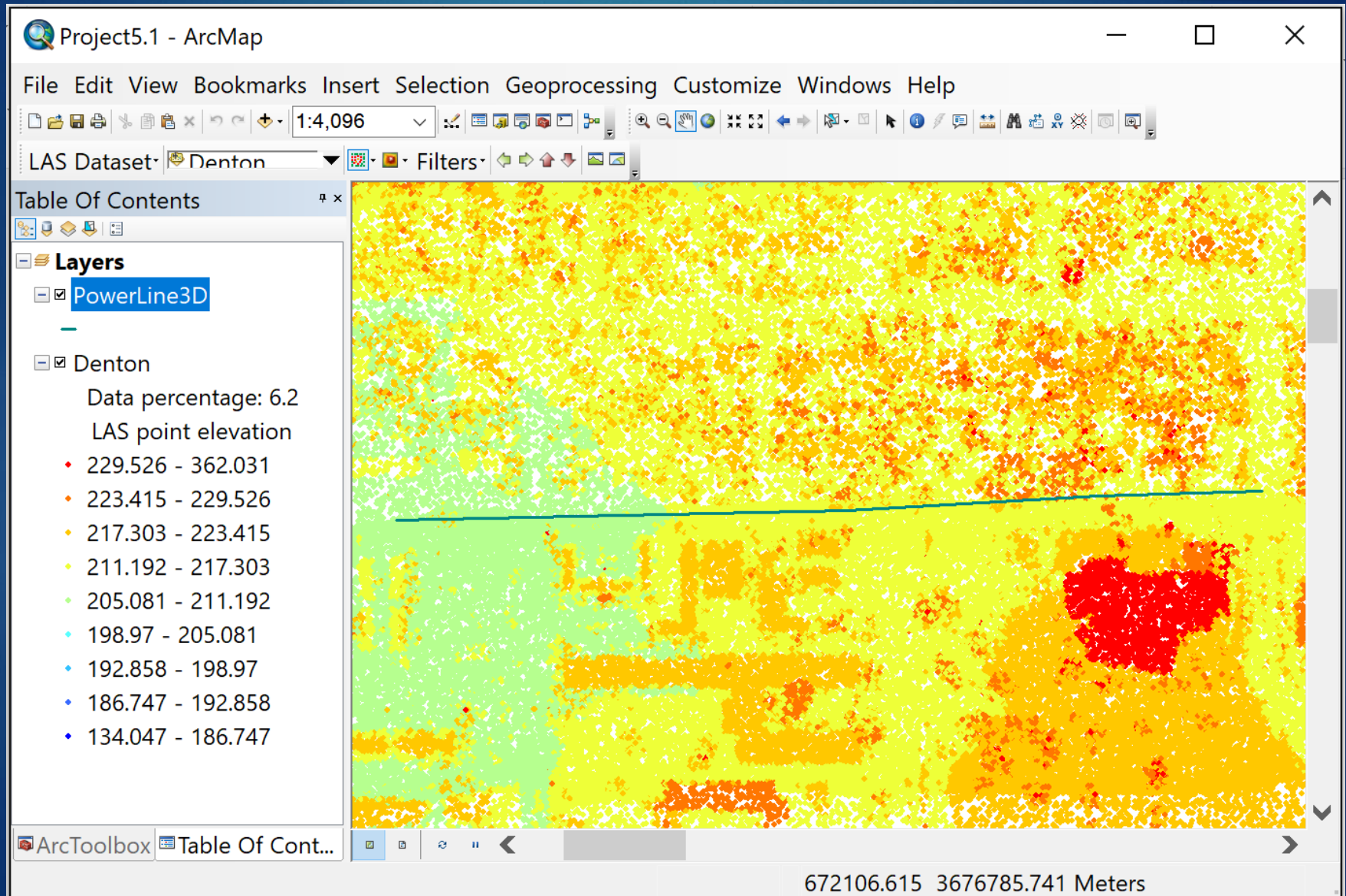
Vegetation Analysis

- ↶ Canopy Peaks
- ↶ LAS Height Metrics As Raster
- ↶ Tree Crown Extent
- ↶ Tree Crown Radius

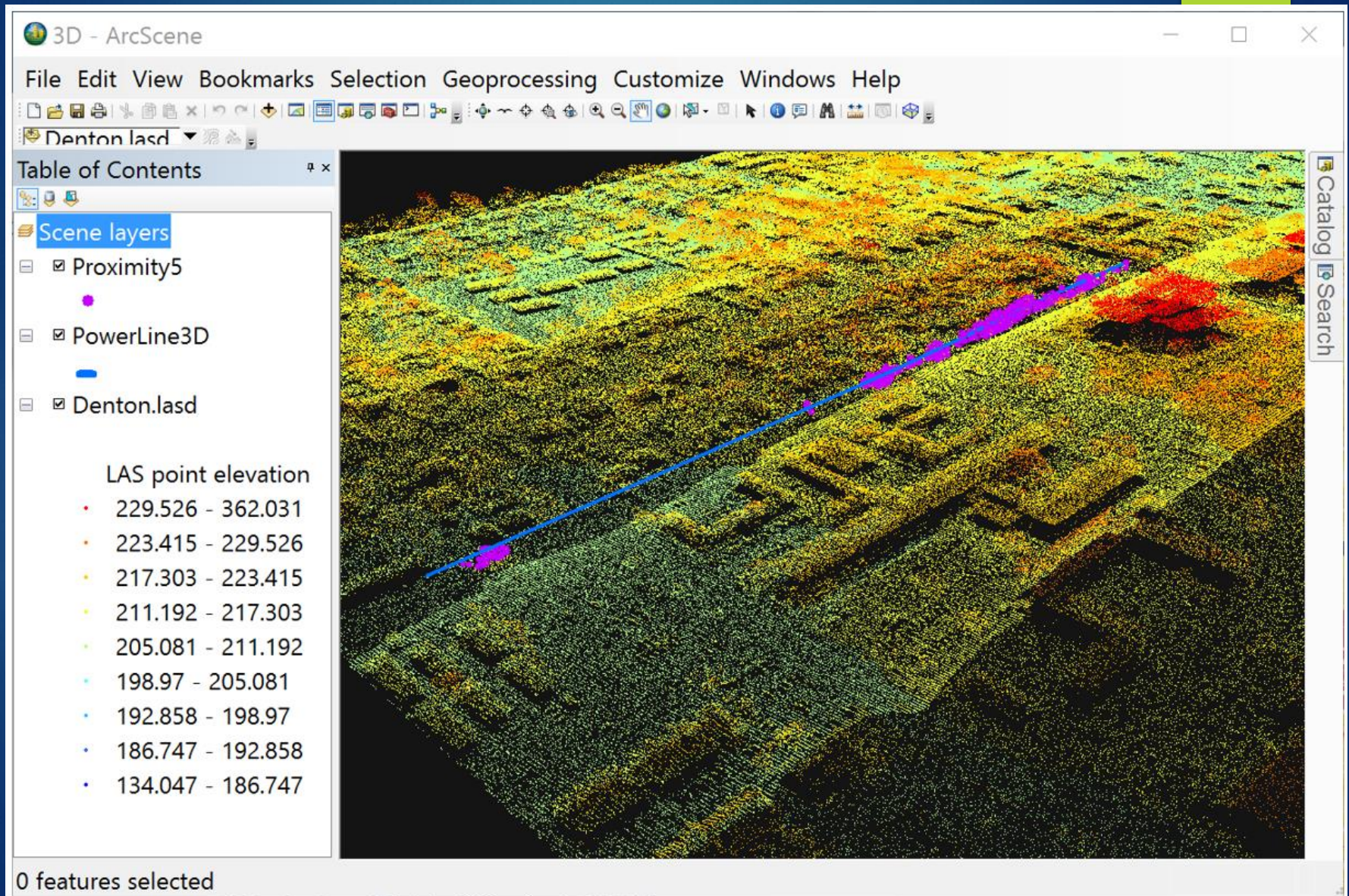
Adding 3D Sample Tools



Project 5.1: 3D Proximity Analysis



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Questions?