ArcGIS Pro: An overview of 3D Analysis

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2021 ESRI USER CONFERENCE

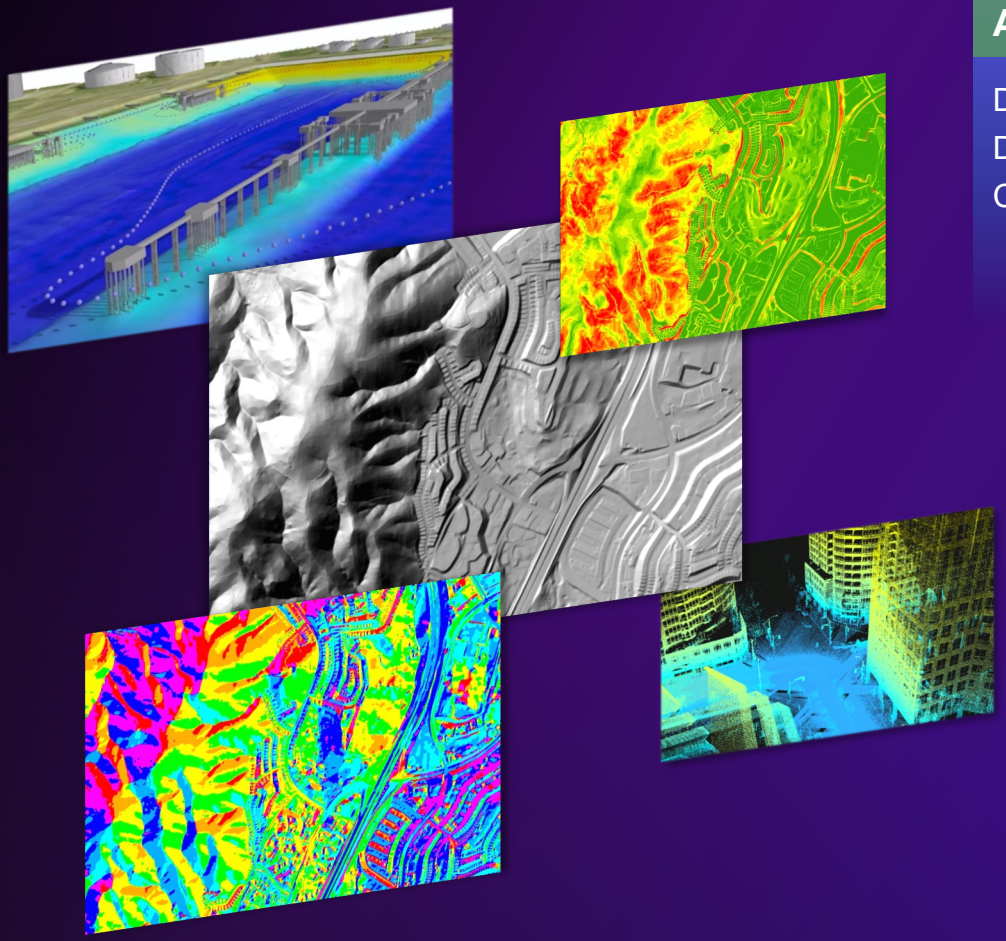
Workshop Overview

- Overview of 3D Analyst
- Interactive analysis
- Automated analysis
- Demos: Lidar extraction, visibility and skyline analysis
- Constructing 3D Data
- Proximity and Volumetric analysis
- Demo: Volumetric analysis

What’s New in ArcGIS Pro 2.7 and 2.8 for 3D Analysis?

- Three new deep learning tools to classify point clouds
  - Prepare point cloud training data
  - Train point cloud classification model
  - Classify point cloud using trained model
- Interactive tools: Object detection and Elevation profile
- 3D object feature layer
- Select LAS points using a volumetric 3D box, sphere, or cylinder
- Power Line selection tool to select a series of LAS points
- Extract Power Lines from Point Cloud tool
- Extract LAS tool supports point cloud scene layers

3D Analyst Extension



Area & Volume

Detect Change
Determine Cut/Fill
Calculate Surface Area & Volume

Visibility

Line of Sight
Viewshed
Skyline
Shadow Modeling

Data Management

Data Conversion
Lidar QA/QC
Lidar Classification
Surface Interpolation
Import/Export Data

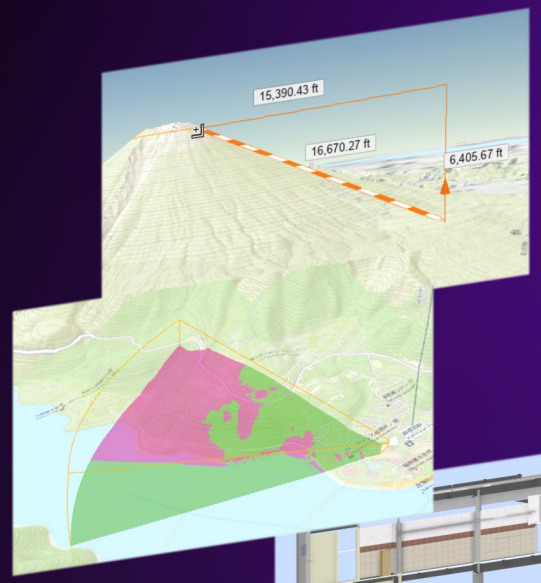
Overlay

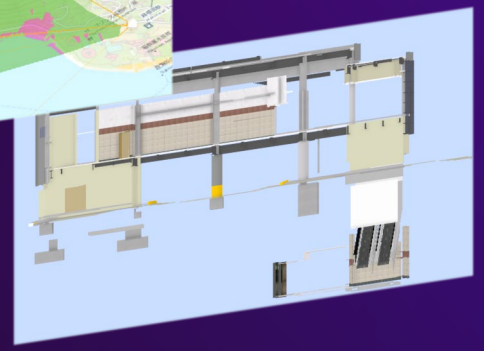
3D Statistics
3D Proximity
3D Intersections
Visualization
Profile Graphs
Interpolate Features
Extrude Between Surfaces

Surface Derivatives

Contours
Slope
Aspect
Hillshade
Statistics
Identify Outliers
Interpolate Geometry
Perform Math Operations

Interactive 3D Analysis Tools



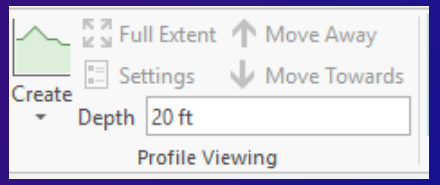


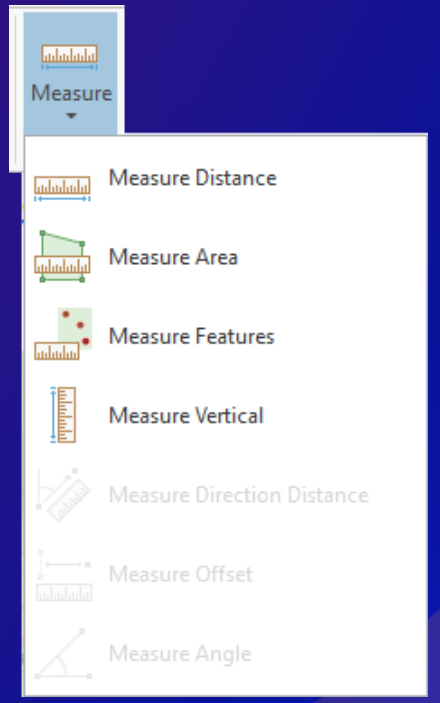
Proximity & Overlap

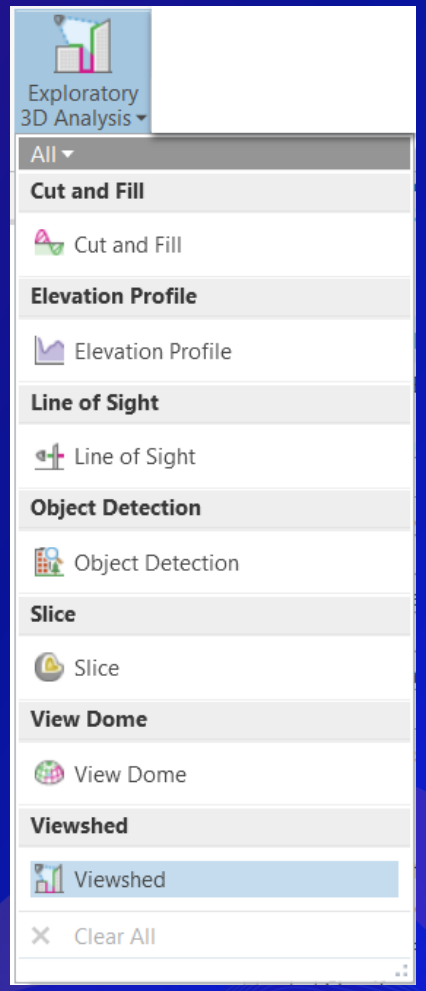
- Measure
- Cut and Fill
- Slice
- Profile View
- Elevation Profile

Visibility

- Line of Sight
- View Dome
- Viewshed
- Object Detection





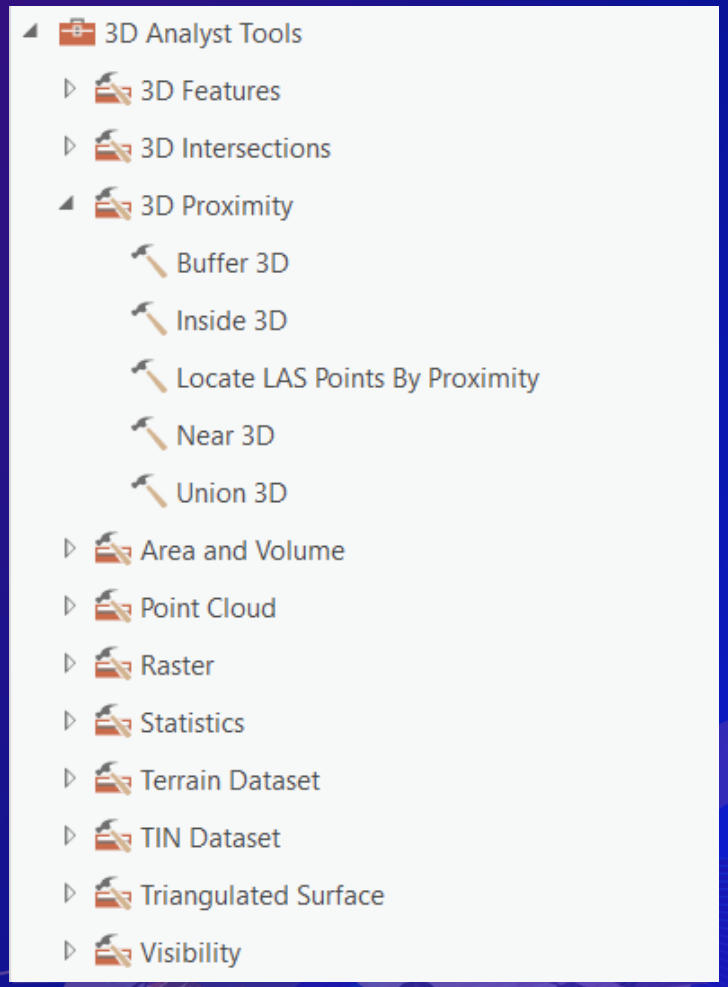


Workshop Overview

- Many tools are available (grouped by general function)
- Calculate actionable values and data
  - EG: The visible surface area from a viewpoint
- Generate derived content from existing data
  - EG: A geological volume between two surfaces

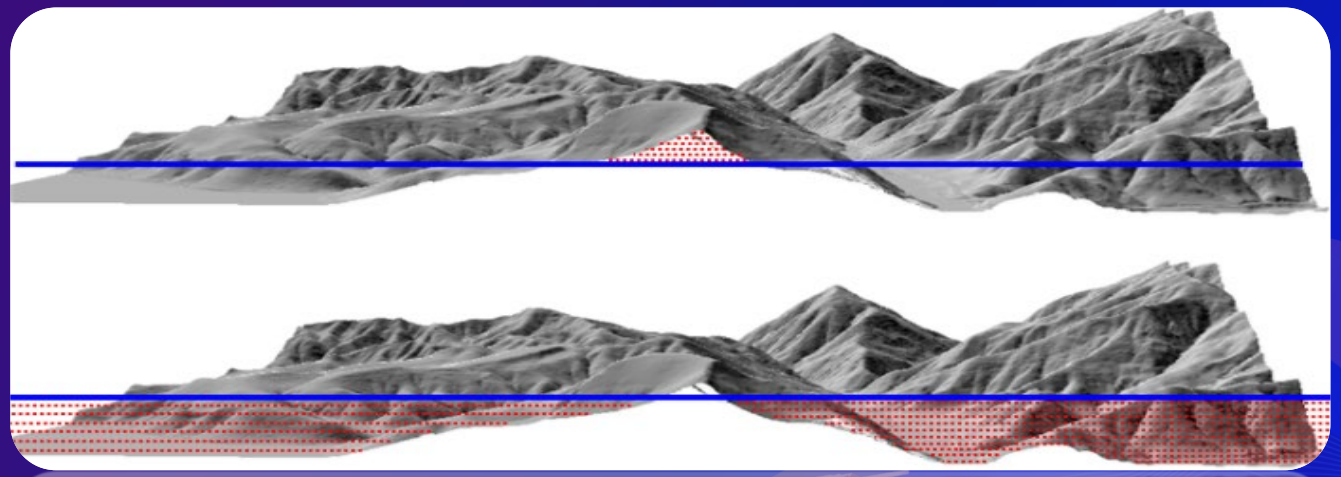
Tips

- Use Model Builder to connect many analysis steps together
- Iterate through features and datasets
- Summarize results for use in maps and reports
- Run analysis from 3D, from 2D, or as a service
- Some tools require a particular data format (eg: TIN)



Surface Analysis

- Change detection
- Calculate area & volume
- Proximity analysis
- Robust mathematical operations
- Surface derivatives
  - Slope
  - Aspect
  - Curvature
  - Contour Lines



Lidar Analysis

- Automated classification support:
  - Ground
  - Building
  - Noise
  - Overlap scans
  - Height above ground
  - Interactive editing
- Proximity analysis
- Surface derivatives

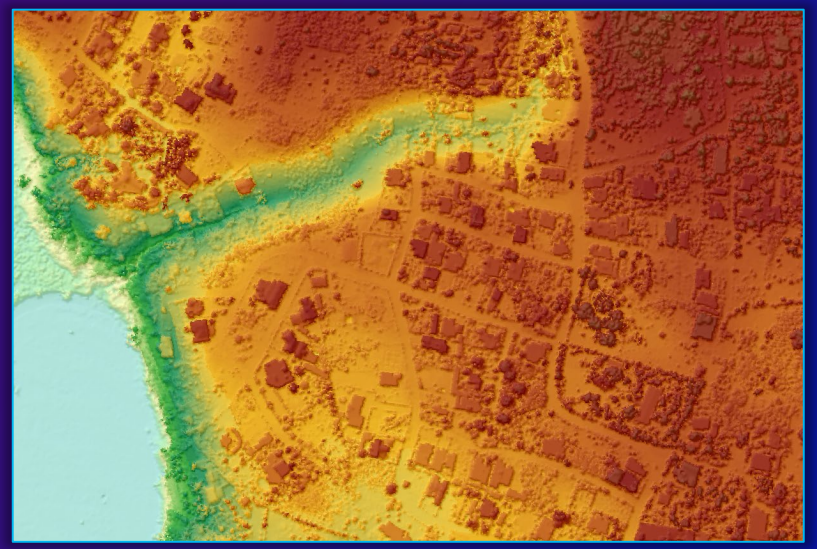
Creating content from LAS

Surfaces

- DEM
- DSM
- TIN
- Changes through time

Features

- Buildings
- Footprints
- Contours
- Maximum bounding volumes
- Scene layer packages

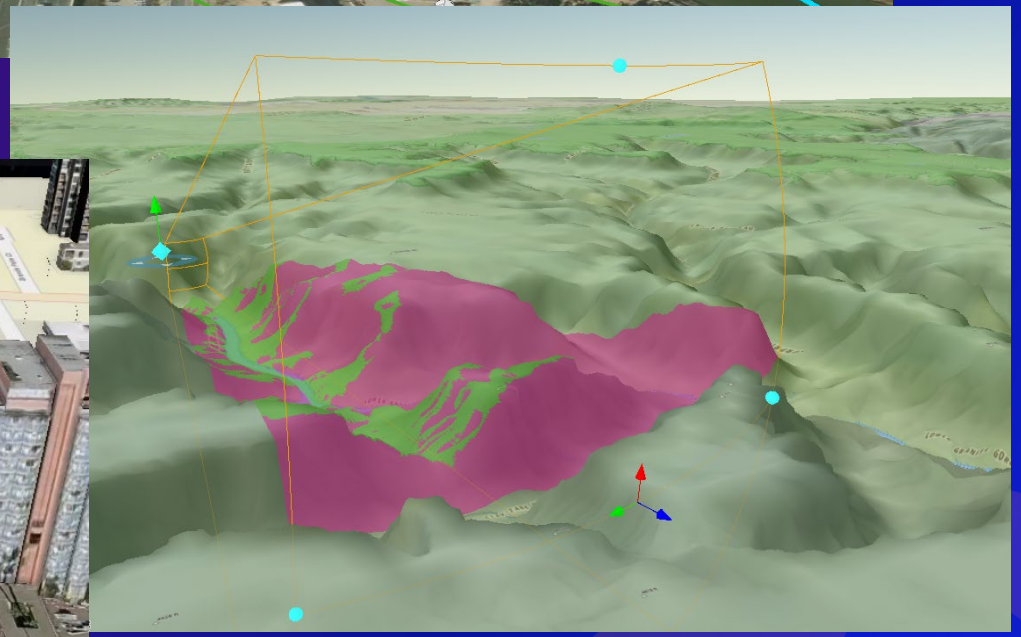


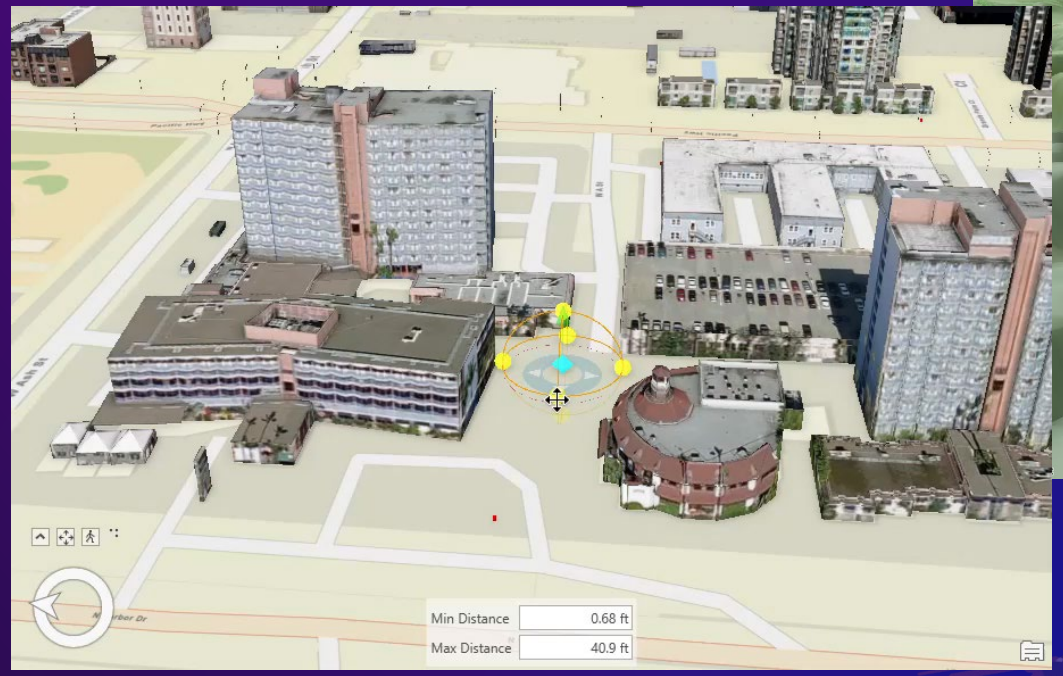
Sun Shadow Analysis

- **Create closed volumes modeling shadow cast from sunlight**
- **Determine shadow frequency on surface**
  - Right-to-light studies
  - Urban heat island estimation

Interactive Visibility Analysis

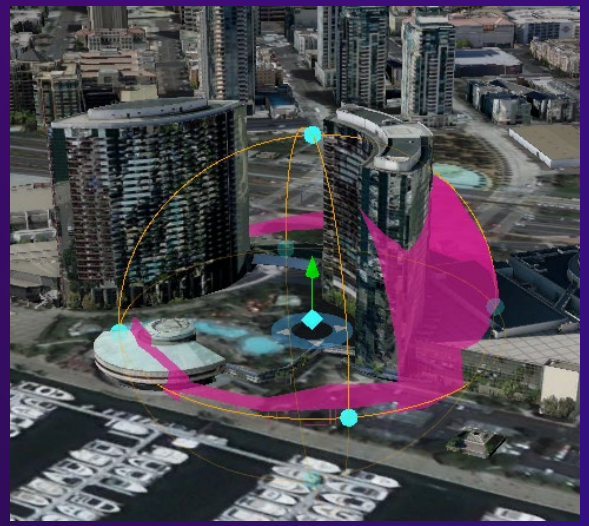
- Line of Sight
- View Dome
- Viewshed

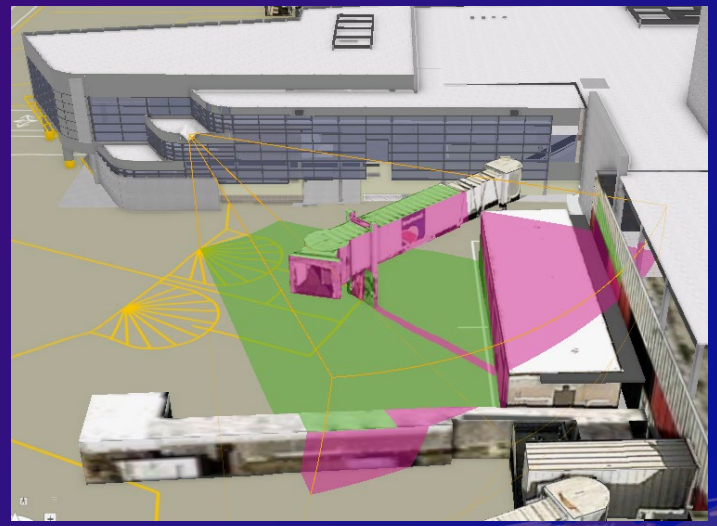


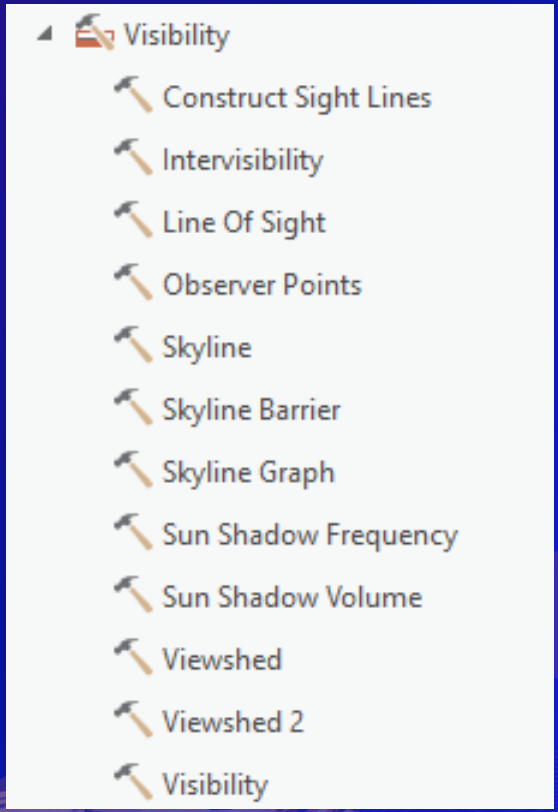


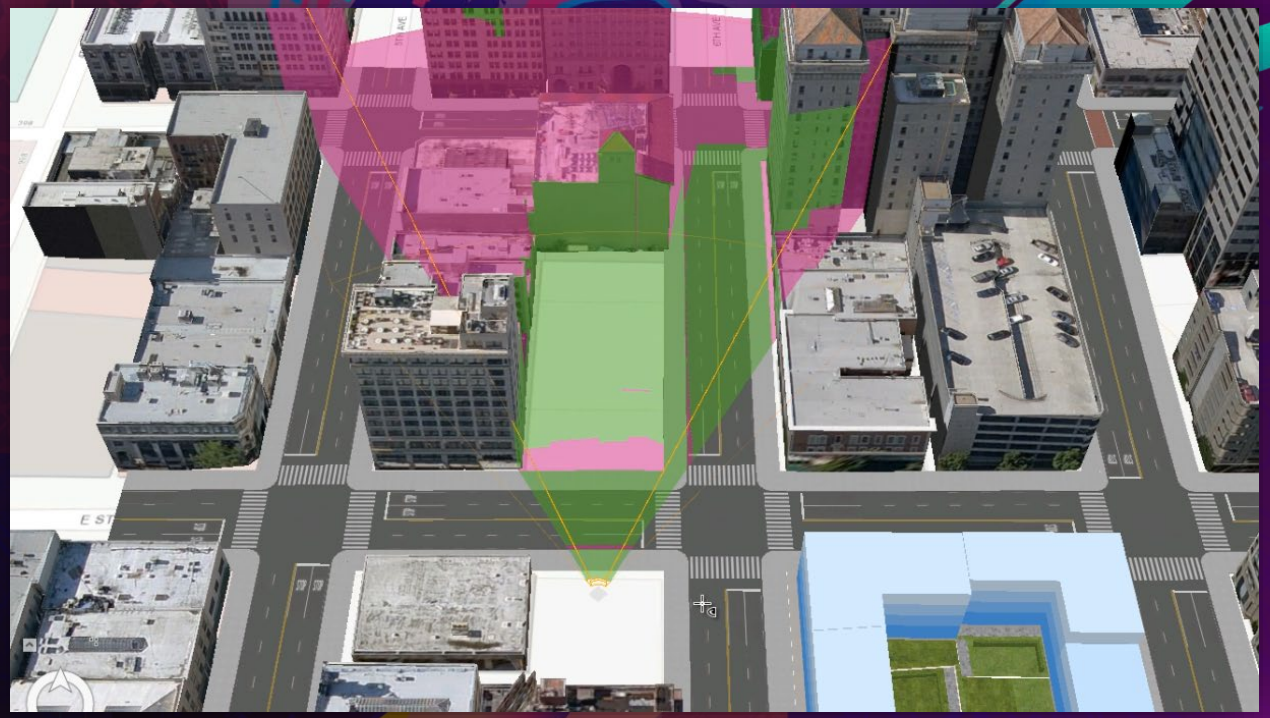
Visibility Analysis – Geoprocessing tools

- Identifies what can be seen from one or more observer locations
- Calculate the coverage of visibility
- Calculate connectivity through line-of-sight
- Interactively explore the visible extent









Lidar, Visibility and Skyline Analysis

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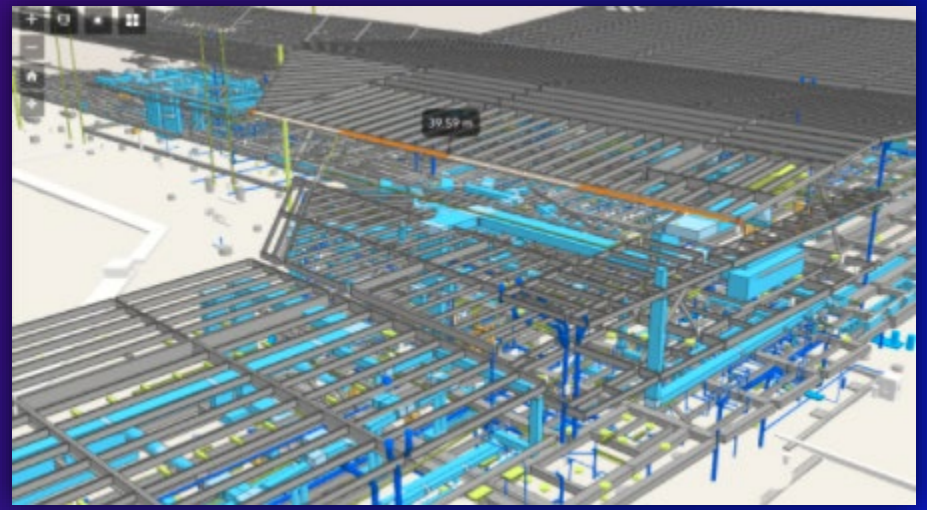
Sources of 3D Data

Khalid H. Duri

Sources of 3D Data

- 3D points, lines, polygons & mesh geometry
- 2D features symbolized as 3D
- Derived from surface operations
- Raster & TIN based surface models
- Multi-dimensional data
- Point clouds
- Space-time cube
- Building information models (BIM)

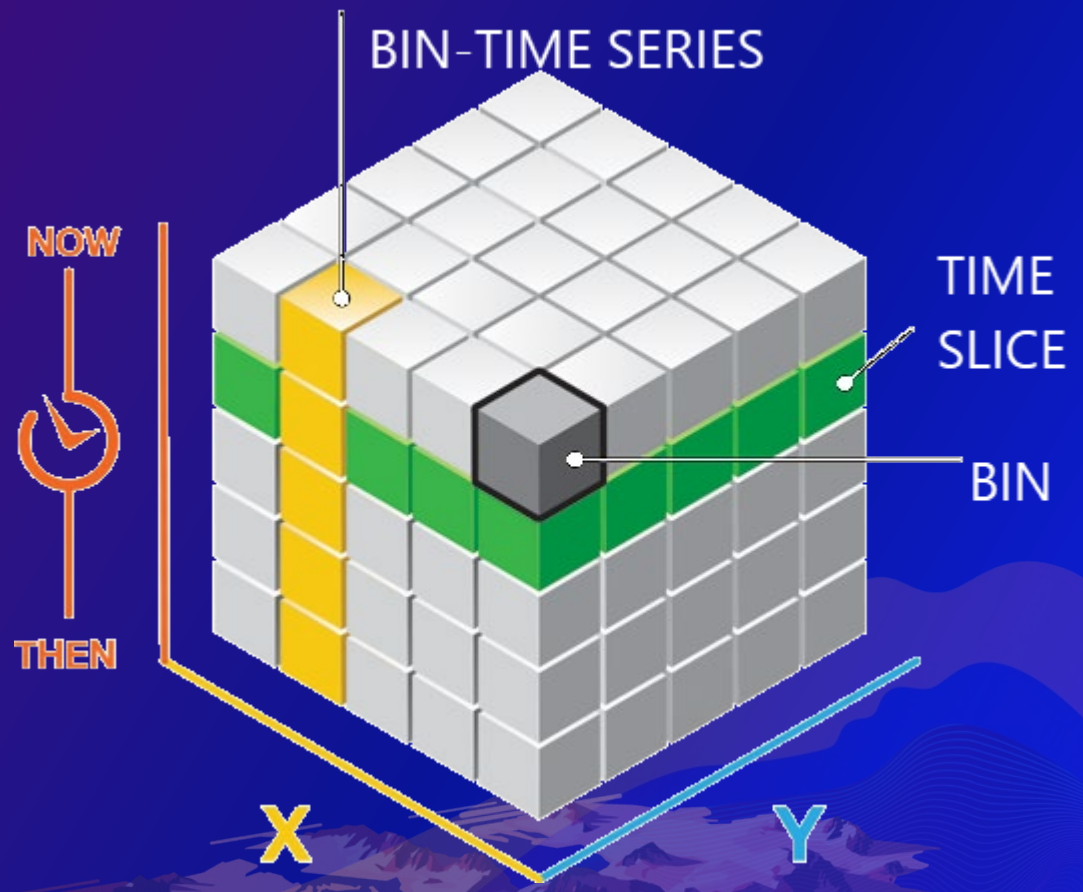


Elevation Surfaces in ArcGIS Pro

- Elevation surfaces define height values & provide a Z-value reference for 2D layers in a scene
- Elevation surface data sources:
  - Locally stored raster and mosaic datasets
  - Locally stored TIN datasets
  - Remotely hosted elevation service
- Each elevation surface can have multiple data sources
- Multiple elevation surfaces can be easily created from multiple data sources

Space Time Cube

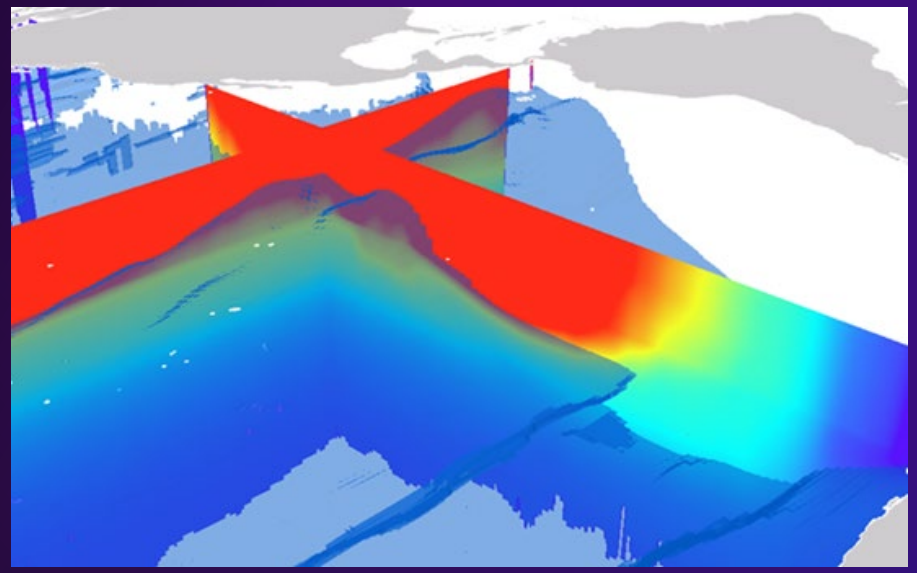
- 3D model for analyzing patterns in the distribution of statistical information in the context of both space and time
- Z-axis represents time
- Enables space-time pattern mining



See the "Imagery in ArcGIS: Working with Time Series Data" session for more info.

Multi-dimensional Data

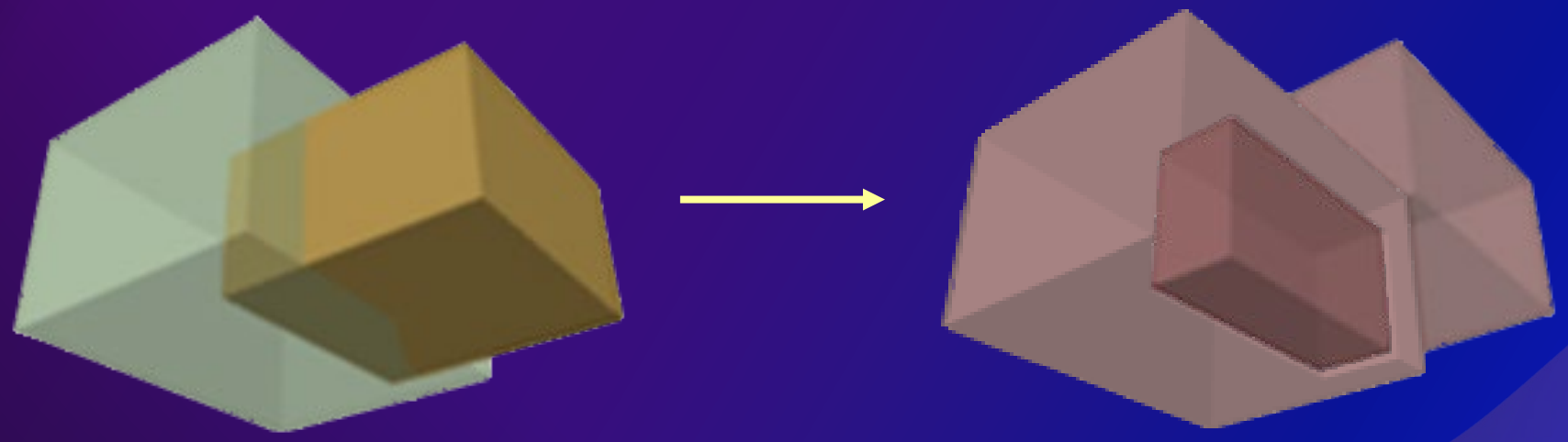
- XY + 2 or more dimensions (height, time, temperature, pollution levels, etc…)
- Multi-dimensional raster data supported in numerous raster analysis operations
- 3D kriging can interpolate multi-dimensional surface models from sparse measurements
- Voxel layer visualization provides immersive display experience

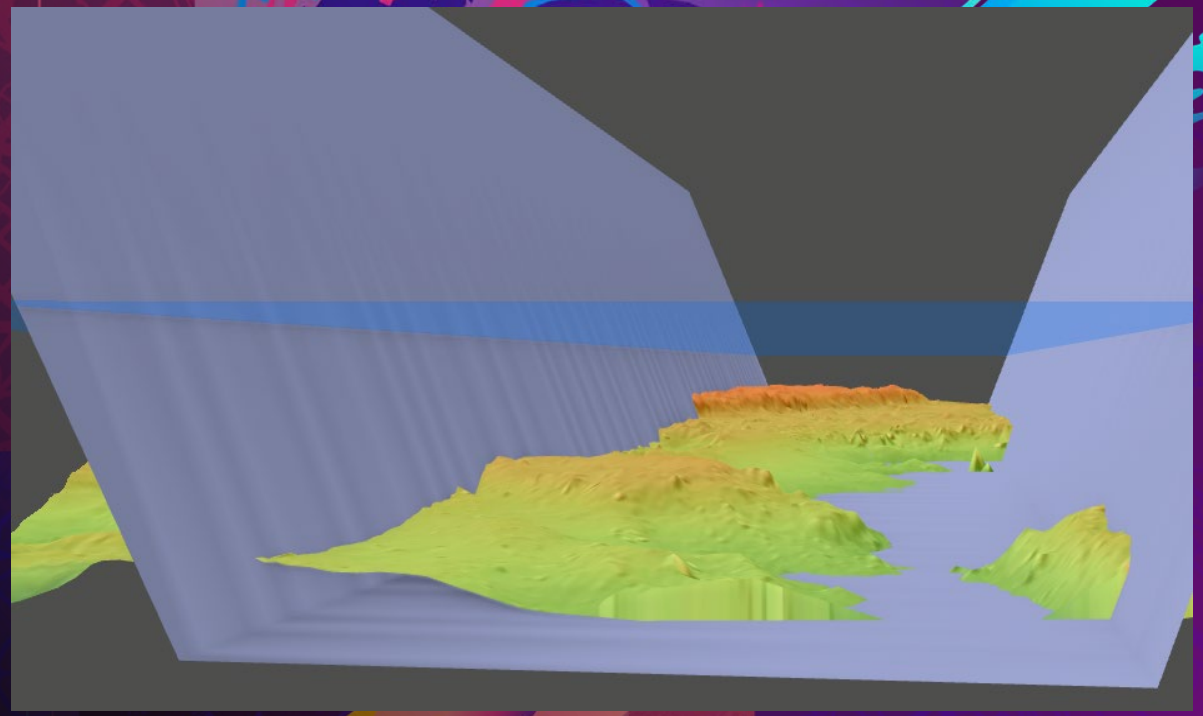


See "ArcGIS Image Analyst: An Introduction" session for more info.

Proximity Analysis

- Compute intersections between 3D objects
- Find nearest objects to 3D features
- Perform geometric operations on volumetric shells
- Perform robust raster operations on neighboring cells





Dredging & Vegetation Encroachment

Khalid H. Duri

Analysis of Well-bores & Stockpile Volumes

Matthew Ballard

Summary

Pre-recorded video section (45 mins)

- Overview of 3D Analysis
- Interactive / Exploratory 3D Analysis
- Geoprocessing-based 3D Analysis

Live Q&A (15 mins)

Questions?

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