3D Analyst: An Introduction

Deepinder Deol
Jinwu Ma
Why use 3D GIS?

Because our world is 3D

Improve understanding
3D is easy for everyone to understand

Solve 3D problems
Some spatial problems can only be solved in 3D

Better communication
3D makes it easier to articulate ideas
What can you do with ArcGIS 3D?

- Multiscale 3D Models
- Surface modeling
- 3D Analysis
- Native lidar support
- Share 3D scenes
- Integrated 3D
- ArcGIS for 3D Cities
- 3D Geodesign
- 3D Analysis
Contents

• What is 3D Analyst?
• 3D Visualization
  - ArcGlobe
  - ArcScene
  - 3D Symbology, 3D Editing, Animation…
  - Demo (ArcGlobe)
  - ArcGIS Pro
  - Demo (ArcGIS Pro)
• 3D Geoprocessing
  - Data processing
  - Surface analysis
  - Feature-oriented tools
  - Demo
What is 3D Analyst?

- ArcGIS extension that provides capabilities for:
  - Interactive 3D Visualization of spatial data
  - 3D Editing of feature data
  - 3D Geoprocessing tools
  - Publish globe services (ArcGIS Server)
  - Publish globe documents (Publisher toolbar) for use in ArcReader
  - Export ArcScene documents to 3D web scenes
Data Types

• **Vector features**
  • Points, lines, polygons, multipatches

• **Surface types**
  • Triangular Irregular Networks (TINs)
  • Rasters
  • Terrain datasets
  • LAS datasets
ArcGlobe

- 3D visualization application
  - Data placed on 3D globe
  - Map like & oblique views
- Integrated topography
  - One logical ‘globe surface’
  - One multi-resolution mesh
- Caching
  - Disk cache and memory cache
  - Levels-of-detail (raster data)
ArcGlobe: Levels-of-detail

Far (less detail) -> Near (more detail)
ArcScene

- 3D visualization application
- Memory based application
- Better for smaller study areas
- Export to 3D web scene (.3ws)
3D Effects Toolbar

- Real-time feedback for
  - Transparency
  - Front/backface culling
  - Lighting
  - Depth priority (ArcScene only)
  - Swipe tool (ArcGlobe only)
  - Flicker tool (ArcGlobe only)
3D Symbology

- Applied to feature data
- Add realism to your documents
- Match to symbols in style
3D Styles

• **Points**
  - 3D Geometric primitives: Spheres, Cones, etc.
  - 3D Models: Street furniture, Houses, etc.
  - 3D Character Markers
  - Import 3D models –
    - OpenFlight (*.flt), 3DS Max (*.3ds), Virtual Reality Markup Language (*.vrml), and SketchUp (*.skp), Collada (*.dae) models

• **Lines**
  - 3D Texture Line Symbols: Pavement, Concrete, etc.
  - 3D Geometric primitives (ArcScene): Tube, Strip, Wall etc.

• **Polygons**
  - 3D Texture Fill Symbols: grass texture...
3D Editing

- Feature editing in ArcGlobe and ArcScene
- Template based editing
- Support for snapping
3D Graphics and KML support

- 3D Graphics Toolbar
  - Digitize point, line, polygons and text graphics
  - Apply 3D Symbology to the graphic elements

- Keyhole MarkUp Language (ArcGlobe only)
  - Add KML data using the KML toolbar in ArcGlobe
Animation Tools

Animation Controls

Animation Manager

Keyframes | Tracks | Time View
---|---|---

- Time Scale: 1.000
- View enabled tracks only
- Restore state after preview

View capture track

0.000 0.500 1.000

Delete Keyframes  Add time...
Customization framework

- **Customization environments**
  - Visual Basic for Applications (VBA) in ArcGlobe and ArcScene applications
  - C#, VB.NET, Java, C++, etc.

- **GlobeControl and SceneControl**
  - Used in custom applications
  - Can easily view existing documents
Demo - ArcGlobe
ArcGIS Pro

- 64-bit desktop application
- Multithreaded processing
- New graphics engine
- Modern user interface
- Visualize, design, edit (2D/3D)
- Geoprocessing tools
- Share
- Customize
  - SDK for Microsoft .NET
  - ArcPy
Demo – ArcGIS Pro
Why 3D Analyst?

- Visualize Data, 2D and 3D
- Surface Creation & Analysis
- 3D Operators and Visibility Tools
- Conversions
What Is a Surface?

- **Functional Surface**
  - $f(X) = aX + b$
  - $Z = a + bX + cY$

- **Raster Surface**

- **TIN Surface**
  - Triangulated Irregular Network

- **Terrain**

- **Las Dataset**
Why GeoProcessing?

- Prepare data for visualization and analysis
- Performing surface & visibility analysis
- Batch/non-interative data processing
Host Applications

- Desktop applications
  - ArcCatalog
  - ArcMap
  - ArcScene
  - ArcGlobe
- ArcGIS Server
  - As GP services
Different Ways to Run GP Tools

• How are they used?
  - Graphical user interface
  - Command line mode
  - Model Builder
  - Scripting

Python:
```python
import arcgisscripting
gp = arcgisscripting.create()
gp.CheckOutExtension ("3D")
gp.workspace = "C:/UC09"
gp.toolbox = "3D"
gp.createtin_3d ("MyTin4")
```
Categorization of 3D GP Tools

How are they organized?
- Toolbox
  - Toolset
  - Subset...
- 3D Analyst Tools Toolbox
  1. Data conversion/preparation
     - Text/binary files, Feature classes, Rasters, TIN-based data
  2. Surface creation
     - Raster interpolation, TIN/Terrain/LASD creation
  3. Surface analysis
     - Aspect/slope, Contour, Feature interpolation
  4. 3D operator & visibility
     - Intersect3D, Skyline, Intervisibility, and Sun Shadow analysis
Task Levels

• Level of GP tasks (from high to low)
  - UI/Model
  - Command line/scripting
  - ArcObjects

• Example: Creating a TIN Surface
  1. Using the 3D Analyst Toolbar, done by end users
  2. Using GP tools, done by power end users
  3. Using ArcObjects, done by customization developers

```vbnet
Dim pDoc As IMxDocument
Set pDoc = ThisDocument
Dim pEnv As IEnvelope
Set pEnv = pDoc.ActivatedView.FullExtent
Dim pTinEdit As ITinEdit
Set pTinEdit = New Tin
pTinEdit.InitNew pEnv
pTinEdit.SaveAs "C:\temp\myTin"
pTinEdit.AddFromFeatureClass ... ...
```
Demo

• Surface analysis primer
  - Common tasks
  - Surface types

• User interface
  - 3D Analyst Toolbar
  - 3D GP Toolbox

• Sample tools
  1. CreateTIN and EditTIN – TIN surface creation
  2. LineOfSight – linear visibility analysis
  3. Viewshed – areal visibility analysis on raster
  4. Interactive Profile – cross sections
  5. Skyline suite of tools
3D Analyst Geo-Processing Summary

• Prepare data for 3D visualization and surface analysis
  - Creating Surface
  - Surface Analysis
  - Conversion
  - 3D Feature and Visibility

• Provide a way for processing data on the UI or on batch mode
  - Application UI as Geo-Processing Tool Dialog
  - Command Line or Python Scripting
  - Model Builder

• Sample Tool Demo
Thank you…

- Please fill out the session survey in your mobile app
- Select **3D Analyst: An Introduction** in the Mobile App
  - Use the Search Feature to quickly find this title
- Click “Technical Workshop Survey”
- Answer a few short questions and enter any comments
Understanding our world.