Using 3D Visualization Tools for Integrated Decision Making and Risk Characterization

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Introduction

• Background – decision making, traditional approaches, why 3D visualizations
• How is 3D accomplished, what are the key components
• Adding rising water simulations to 3D visualizations
• Generating and distributing 3D content
BACKGROUND
Decision Making Building Blocks

Data - What do we know?

Values - What do we care about?

Future – What could happen?

Risk

Linked to Decision-Makers Proper Scale

Action - What are we willing to do about it?

Who is “we”? Who is willing to accept responsibility and assign resources?
Common Tools of the Decision Maker

• Charts and Tables and Maps – “Oh My”

<table>
<thead>
<tr>
<th>Disability status of the civilian noninstitutional population</th>
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<tbody>
<tr>
<td><strong>POPULATION 5 YEARS AND OVER</strong></td>
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<tr>
<td>Total</td>
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<td>With a disability</td>
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<td>Percent with a disability</td>
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<td><strong>POPULATION 5 TO 15 YEARS</strong></td>
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<tr>
<td>Total</td>
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<td>With a disability</td>
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<td>Percent with a disability</td>
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<tr>
<td>Sensory</td>
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<td>Physical</td>
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<tr>
<td>Mental</td>
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<td>Self-care</td>
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</tbody>
</table>
The Great Map Issue

• The reality is that most people, including many decision makers, have difficulty with “correctly” interpreting traditional 2D maps
Modern Flood Map Example

ZONE X
NOT A DESIGNATED SPECIAL FLOOD HAZARD AREA

ZONE AE
ELEVATION 9.0 FEET
NGVD 1929
(7.4 FEET NAVD 1988)
Historic Flood Map
3D View of Downtown Ft. Lauderdale
Why 3D?

• Situational awareness
• 3D helps make data more relevant to the user
• Better suited for demonstrating the need for a proposed solution or action
• An “attention getter”
• Some Applications include:
  – Scenario planning
  – Visualizing uncertainty
  – Risk Characterization
Ensuring Data/Model Credibility

• NOAA’s Three A’s for Photo Visualizations
  – Accuracy
  – Accountability
  – Accessibility

• Other key questions to consider
  – Do the images / models look real
  – Are the visualizations defensible
  – How representative are the views
  – Are the visualizations sufficient for the project
HOW TO GET TO 3D
Basic Parts of a 3D Visualization

• Elevation data
• Imagery
• Key Infrastructure
  – Buildings
• Visual Overlay of Interest
  – Flooding
  – Population vulnerability
  – Plume cloud
Building the Base – Elevation is Key!!

Asheville Region
Building the Base – Elevation is Key!!

Fort Lauderdale
Scale Considerations

It's all about the decision

Coast

Port

Downtown
Types of 3D Building Models

• 3D Building Model Symbology
  – Most basic, easiest to generate
  – Least detailed / realistic

• Sugar Cubes
  – Intermediate, assuming data already exists
  – Resembles actual environments, can do analysis

• Detailed Models
  – Advanced, most detailed
3D Building Symbology Approach
3D Building Model Symbology

Coast looking west
3D Building Model Symbology

Downtown looking east
Sugar Cube Approach
Building Sugar Cubes

Coast looking west
Building Sugar Cubes

Port looking north
Building Sugar Cubes

Downtown looking east
Building Sugar Cubes

Riverfront looking downstream
Detailed Building Model Approach
3D Detailed Building Models

Coast looking west
3D Detailed Building Models

Port looking north
3D Detailed Building Models

Downtown looking east
3D Detailed Building Models

Riverfront looking downstream
RISING WATER OVERLAY
FRAMEWORK FOR CLIMATE ASSESSMENTS

- Severity of impacts depend on the **vulnerability** of the system
- How are resources or services affected?
- How do we measure what it is we value?
Climate Assessment
Conceptual Model of Linked Relationships
Sea Level Rise and Storm Surge

Population, Development

Sea Level Rise and Storm Surge

Salt Water Intrusion

Freshwater Aquifers

Freshwater Aquifers

Habitat Destruction

Wetlands Inundation

Natural Systems

Infrastructure Inundation

Limited Mobility

Evacuation Routes

Homes

Businesses
Rising Water Simulations

• With elevation and 3D models in place, can now do rising water simulations
  – Flooding
  – Storm surge
  – Sea level rise

• Simulations can only be as detailed as the data that feed into them
  – Bathtub approach vs. USGS hydro models
Rising Water in the Mountains
Category 1 and 2 Storm Surge

Downtown looking east
Category 1 - 3 Storm Surge

* Downtown looking east*
Category 1 - 4 Storm Surge

*Downtown looking east*
Category 1 - 5 Storm Surge

Downtown looking east
CONTENT GENERATION AND DISSIMINATION
Content Development Platforms

- Esri’s ArcGIS
  - 3D Analyst Extension
    - ArcScene
    - ArcGlobe
  - CityEngine
- Trimble SketchUp
  - Formerly Google SketchUp
- Unity3D
- NewTek’s LightWave
Dissemination Products and Platforms

• Posters (2D and 3D)
• Movies
  – Desktop / Viz Wall
  – Web (YouTube)
  – Immersive (GeoDome)
• Interactive Viewers
  – Desktop
  – Web
  – TouchScreen / TouchTable
3D Graphic Examples
Challenges

• Effectively and efficiently incorporating real-world data (GIS data) into 3D visualizations
• Integrating with existing GIS infrastructure
  – Data Storage, database connections
• Technology
  – Software learning curves
  – Hardware
• Resources
  – Time
  – Money
Summary

• 3D Visualization tools provide an alternative “look” at real world issues (rising water)
• Creating 3D visualizations correctly and realistically impacts the final products
• It's all about the decision, make the visualizations relevant and meaningful for the user
QUESTIONS?

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