Flythrough Generation using High Resolution Satellite Imagery

By

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Presentation Outline

- Representation of Terrain Surfaces
- Introduction to Modeling
- Types of Terrain Models
- Data Models
- DEM Products
- Applications
- Hydrological Analysis - Case Study
- DEM of Pakistan and its affect on floods
REPRESENTATION OF TERRAIN SURFACES

• Representation of terrain surfaces aid:
  ➢ Civil Engineers for designing and construction of buildings
  ➢ Geologists in the study of underlying construction of the terrain
  ➢ Geo-morphologists in understanding processes responsible for the formation of landscape
  ➢ Topographic scientists to describe and present surface and its measurements conveniently and accurately

• Different ways of representing terrain include:
  ➢ Paintings
  ➢ Maps
  ➢ semi-symbolic and semi-pictorial descriptions
A scientific generalization and abstraction of features on the terrain

Employ a well-designed symbol system

A well-established mathematical basis for representation

Possess following characteristics:

- measurability warranted by the mathematical rules
- overview provided by generalization
- intuition by symbolization

Give intuition of depth by using any of the following:

- Contours
- Shading
- Hachuring
• “A model is reality scaled down and converted to a form which we can comprehend” (Meyer 1985)
• A terrain model suggests a perspective view of the piece of terrain
• There are three types of models:
  ➢ Conceptual
  ➢ Physical
  ➢ Mathematical
TYPES OF TERRAIN MODELS

Digital Terrain Model (DTM)
• Digital representation of the spatial distribution of one or more types of terrain information
• Represented by 2-D locations plus a mathematical representation of terrain information

Digital Surface Model (DSM)
• Digital representation of relief variations of topmost surface of Earth
• Incorporates heights of trees, building etc.

Digital Elevation Model (DEM)
• Digital representation of the continuous variation of relief over space
• Subset of DTM showing only relief variations
Grids

- Represent regular raster surface that use regularly space points
- Represented by 2-D locations plus a mathematical representation of terrain information

**TIN (Triangulated Irregular Network)**

- Represent surfaces using contiguous non overlapping triangles
- Point storage, but not in regular raster
- Minimum number of points to sufficiently represent surface
- Dense points in areas of high variation, sparse points in flat regions
# NIMA & USGS Elevation (DEM) Data Products

<table>
<thead>
<tr>
<th>Products</th>
<th>Post spacing (arc-sec)</th>
<th>Post spacing (meters)</th>
<th>File size (MB)</th>
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<tbody>
<tr>
<td>DTED Level 0</td>
<td>30 arc-sec</td>
<td>approx. 1,000m</td>
<td>0.03</td>
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<td>approx. 100m</td>
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<td>DEM 7.5 Minutes</td>
<td>---</td>
<td>true 30m</td>
<td>---</td>
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**USGS** - United States Geological Survey

**NIMA** - National Imagery and Mapping Agency

**HRTI stands for** High Resolution Terrain Information

**DTED stands for** Digital Terrain Elevation Data
DEM Applications

- Extracting topographic information
- Perspective viewing
- Landscaping
- Generating digital orthophoto maps
- Road Designing and civil work
- Terrain analysis e.g. for Trafficability
- Planning routes of roads/highways
- Siting dams
- Hydrological Modeling
- Slope aspect analysis
- Urban Planning
- Siting communication towers
Hydrological Applications

Basin / Watershed Development
Topographic Applications

Contours Development

Input elevation raster

Output contours
Topographic Applications

Slope Measurements

Elevation dataset

Output slope dataset (in degrees)
Topographic Applications

Aspect Measurement
Topographic Applications

Hillshade

Azimuth 45°  Azimuth 315°  Output hillshade
Topographic Applications

Viewshed

The elevation in the area of the observation point

Green cells are visible from the observation point, red cells are not visible.
3-D City Modeling
Slope Map of the Study Area (Karachi)

Source: SRTM 90m Resolution
PHYSIOGRAPHY

Source: SRTM 90m, Landsat 15m
Drainage Network of Study Area (Karachi)

Source: Landsat 15m Resolution (Year-2000)
Stream Network of Study Area (Karachi)
Source: SRTM 90m Resolution

Stream Orders
- Order 1
- Order 2
- Order 3
- Order 4
- Order 5

ARABIAN SEA
Flow Length of Streams

Source: SRTM 90m Resolution

Flow Length Value
High : 3.31758
Low : 0

ARABIAN SEA
Catchments / Basins of Study Area (Karachi)

Source: SRTM 90m Resolution
SUITABLE SITE LOCATION FOR WATER RESERVOIRS
Identified through SDSS Model

Suitability index
High : 20689.082031
Low : 164.155548

ARABIAN SEA
DEM Presenting Regional Elevation Perspective of the Country

Legend:
- Settlements
- Provincial Boundary
- Undermarcated Boundary
- International Boundary
- LOC

Elevation Ranges (m):
- High: 8268
- Low: 56

Source: SRTM DEM 90 meters
Gradient Map: Flood Water 2nd Jan 2011

Legend
Slope Values
- 0
- 0 - 88.01
- 88.02-89.1
- 89.15 - 89.7
- 89.71 - 90
- Flood Status 2Jan2011

Source: Flood water extracted from MODIS
Thank You