

MTIGT1003: 4 Credits

GIS BASED 3D VISUALIZATION IN GEOTECHNOLOGY – Unit:2

**For 6 Year Integrated M.Tech. Geoinformatics and
Geotechnology programme**

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3D Visualisation of Topographic Data

Unit-2: 3D Visualisation of Topographic Data:

Generation of x, y, z data – 3D visualization of topography – DEM based topographic analysis – shaded relief – applications. **12 Hrs.**

Generation of x, y, z data

1. Topographic Data can be collected from **SOI toposheets**
 - Spot heights – as Point information in plains, Lake beds, River beds, etc.
 - Bench Marks – As points, with accurate height value in decimal places, e.g., BM69.459
 - Triangulated point height - 547.75
 - Relative Heights – As lines, along tank bunds, river bunds, etc., e.g. R4 
 - Open Contours – As lines
 - Broken Contours – As lines – Approximated
 - Closed Contours – As polygons.

Generation of x, y, z data ... contd ...

2. Elevation data from Aerial Photographs – using Parallax bar with Stereo-pair and Stereo-triplet
 - Stereoplotters can be used
 - Digital Stereoplotters – with computers
 - Digital Photogrammetric Softwares with special equipments like, Anaglyph and dual monitors, etc.

Generation of x, y, z data ... contd ...

3. Satellite data with different viewing angles

- SPOT
- CARTOSAT
- ASTER

4. Shuttle / Aerial Data – E.g. SRTM, RADAR, etc.

5. GPS survey data – from field survey

- DGPS surveys- Static mode
- Kinetic mode
- Semi-kinetic mode = Stop and Go.

Generation of x, y, z data ... contd ...

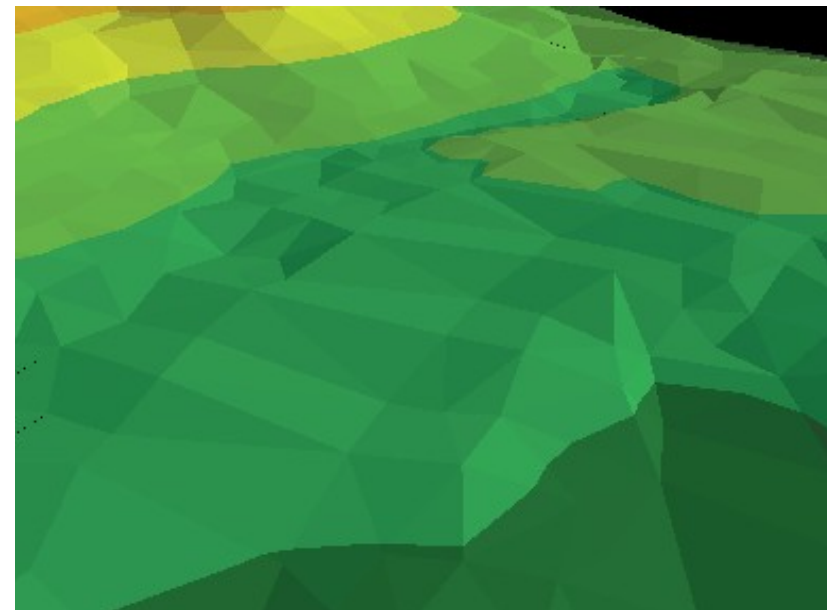
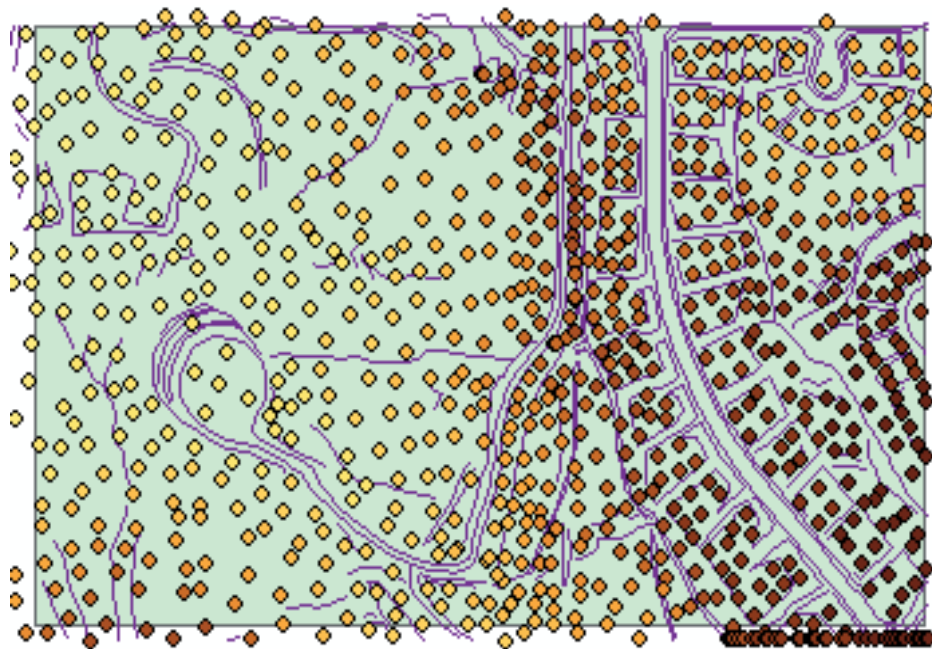
- Conventional method of converting Elevation data from SOI toposheet to Computer
 - Superimpose grid map over toposheet
 - Calculate average height value for each and every grid
 - Note x, y and z values as a table to enter into computer
- Directly note down the available height information from toposheet as discussed previously.
- Additional data collected through GPS survey in gap areas can be included in the data table.
- X,Y,Z-table can be used as direct input for generating manipulated data – For e.g., rasterization with grids.

Generation of x, y, z data ... contd ...

- Alternate way to generate digital data using GIS is
 - Digitize all the point data and enter z value – height in PAT
 - Digitize Relative heights as lines with elevation detail in LAT by adding adjacent terrain height
 - Digitize open and dashed contours as lines with height data in LAT
 - Digitize closed contours as polygons with height values in PAT
 - Digitize the field surveyed points with elevation detail in PAT
 - Then, convert all line and polygon files into point feature files and
 - Finally integrate them all and use this Integrated Point Output (IPO file) as input for the generation of Raster DEM using Krigging method of interpolation.

Use of Break lines

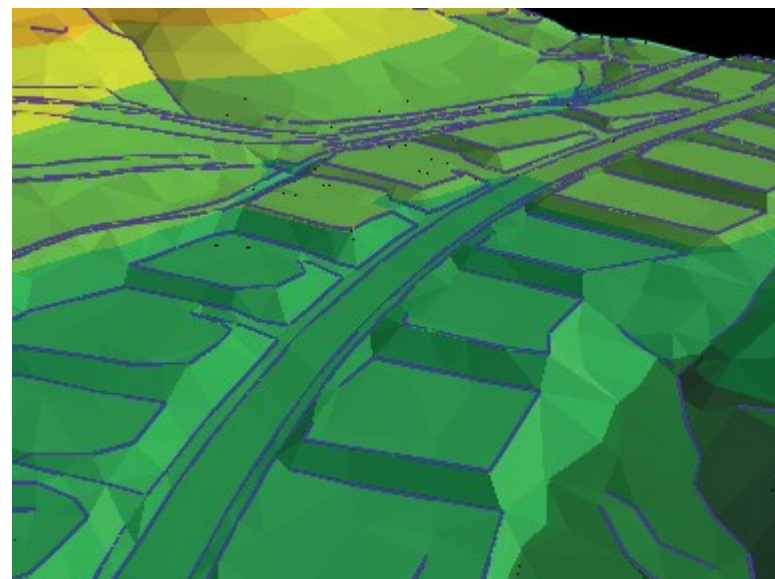
- Digitize Escarpments, Ridges, Stream line in Valley, Edges, Pits, Cols and Borders of angular features
- This file containing all the above line features can be used as Breaklines
- It is an additional input for the generation of DEM with visual clarity and improved accuracy.



TIN created from mass points

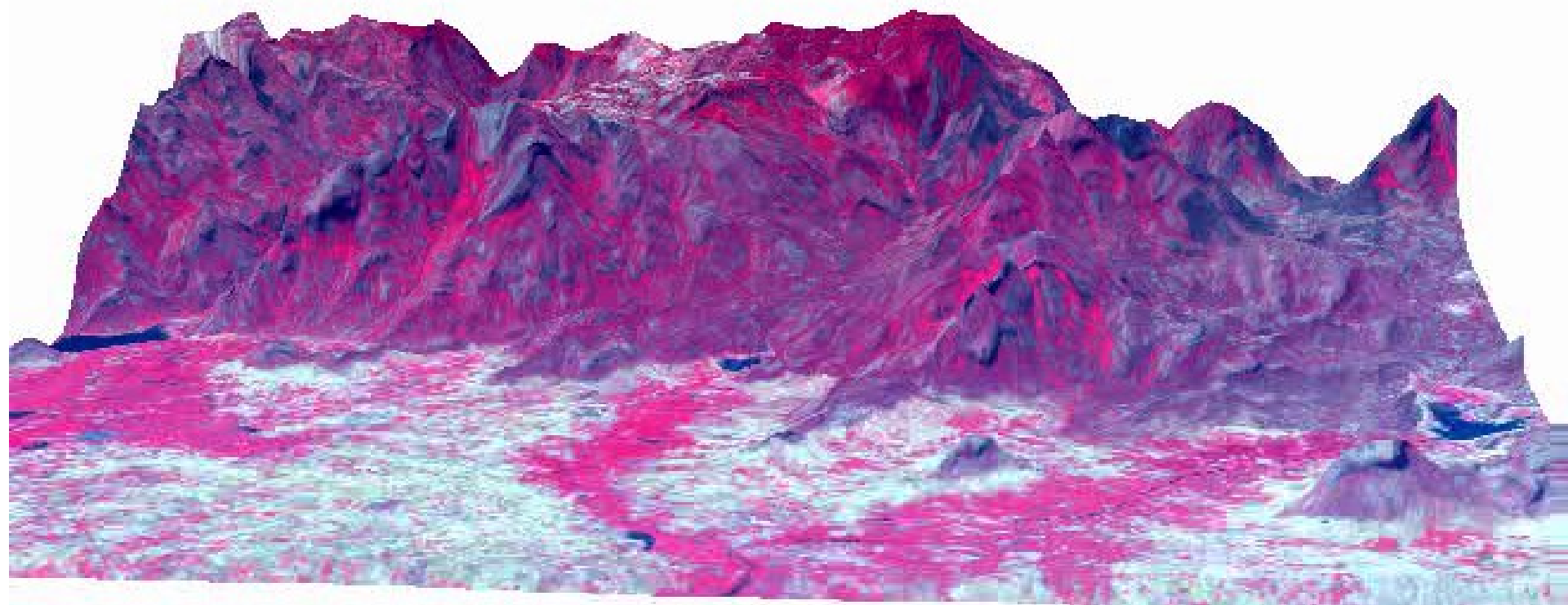
Breaklines are lines with or without height measurements.

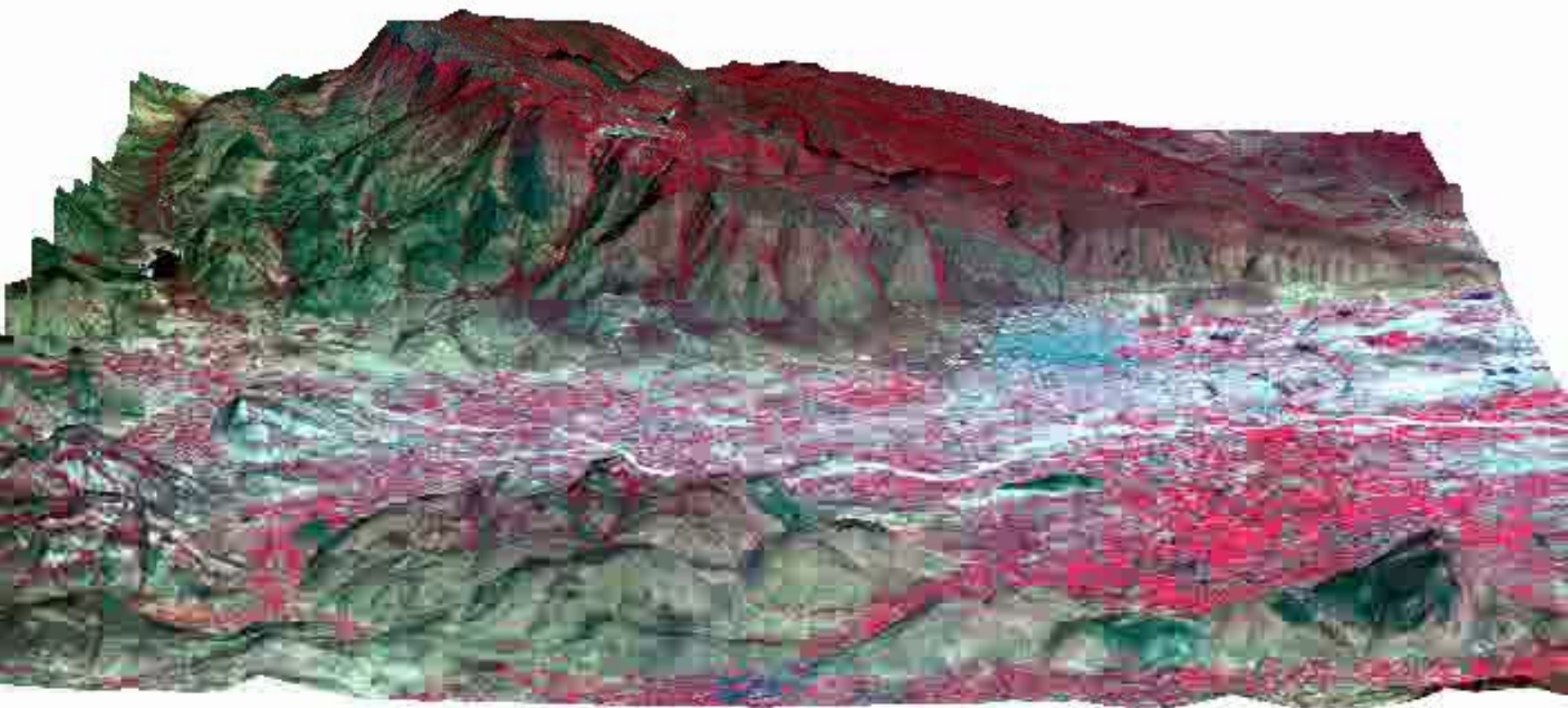
TIN created from mass points and breaklines



3D visualization of topography

- Density sliced DEM
- Shaded Relief Map
- Profiles
- FCC Wrapped DEM
- Aerial Photograph Wrapped DEM
- Fly through models.





DEM based topographic analysis

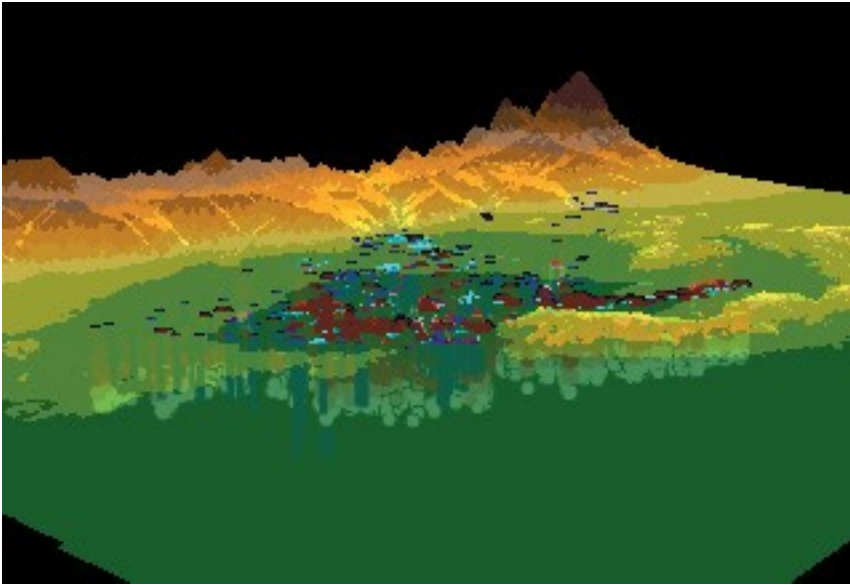
1. Volume estimation by numerical integration Using,
 - Block diagrams, profiles and horizons
 - Contour maps
2. Establishing viewsheds for applications such as microwave transmission tower setup, hide point in defence ministry, etc., using
 - Line of sight maps
 - Maps of slope, convexity, concavity and aspect
 - Shaded relief maps
3. Integrated Watershed Management through drainage morphometric analysis in GIS using DEM
 - Drainage network and drainage basin delineation using DEM
 - Drainage / stream orders, flow length, flow direction and accumulation, etc.

Shaded Relief Mapping and Analysis

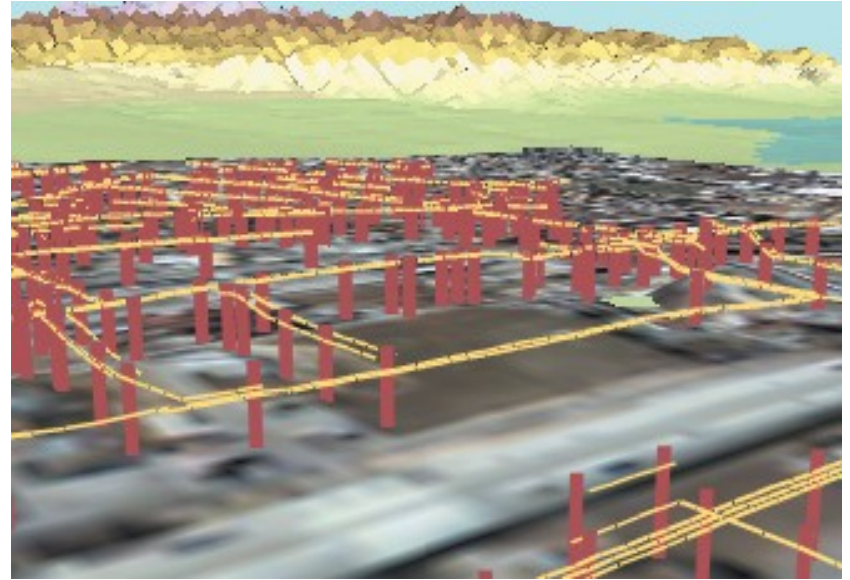
- Lineament / Fracture swarms / Fault mapping
- Classification of lineament based on their length and direction
- Calculation of Lineament Frequency, Lineament Intersection density, Lineament Length density
- Drainage mapping and density calculations
- Hiding / shadow region estimation

DEM BASED VISUALIZATION OF TERRAINS / SURFACES

3D view of raster and vector data



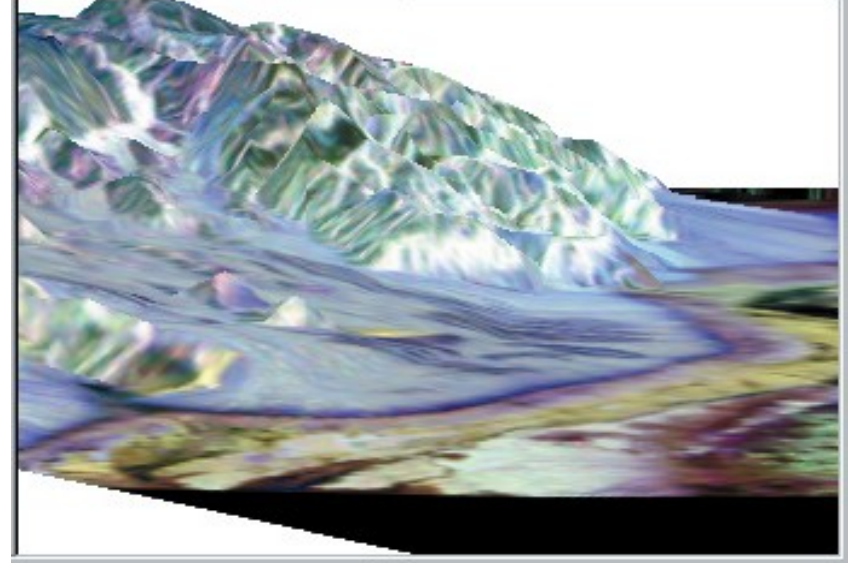
3D view of utility poles and power lines



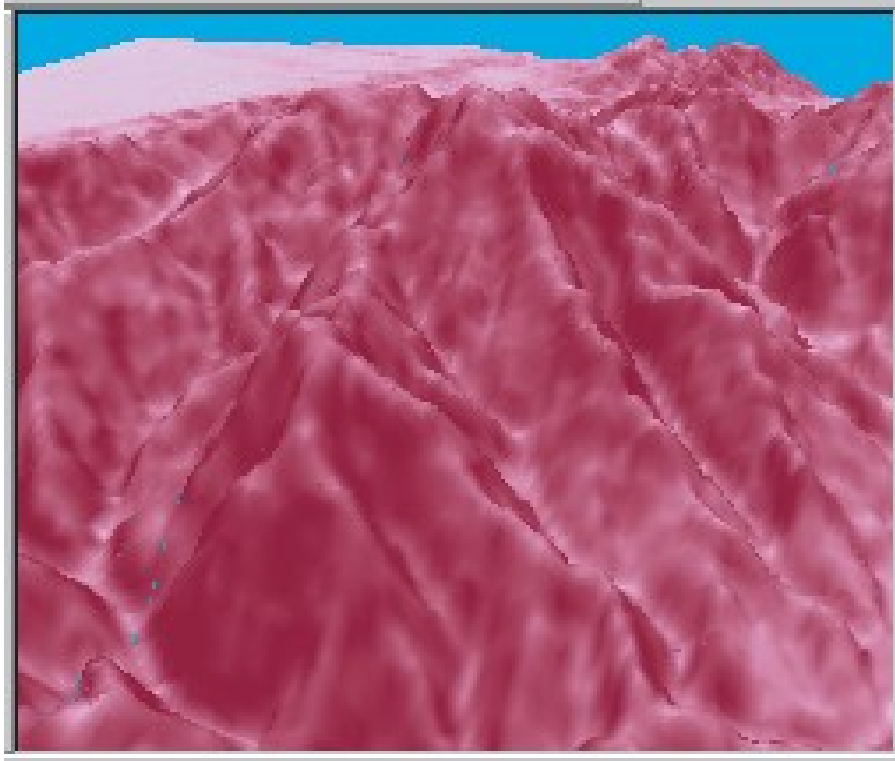
3Dimensional choropleth map -vector data



Image Wrapped DEM



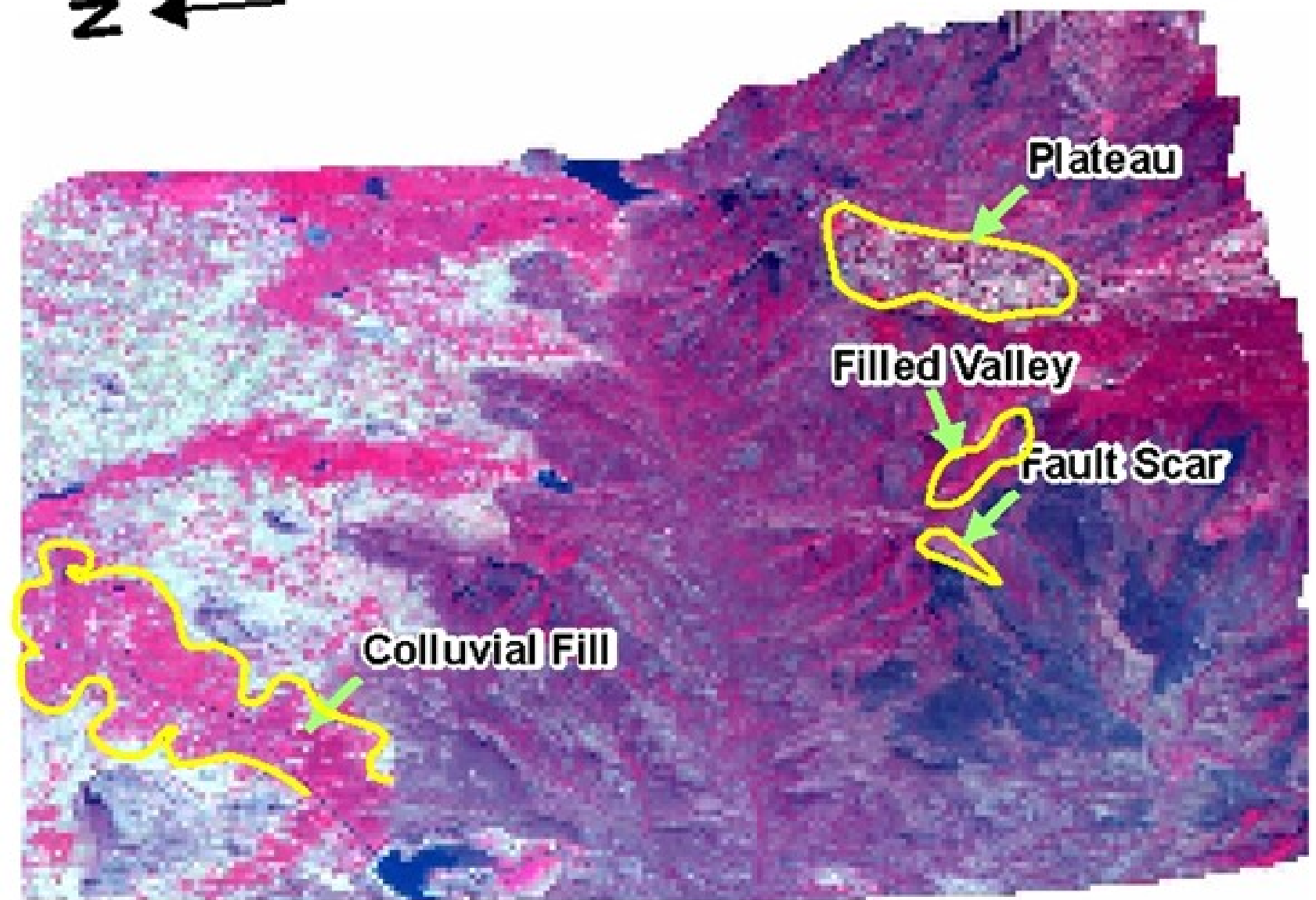
Understanding the shape of a surface



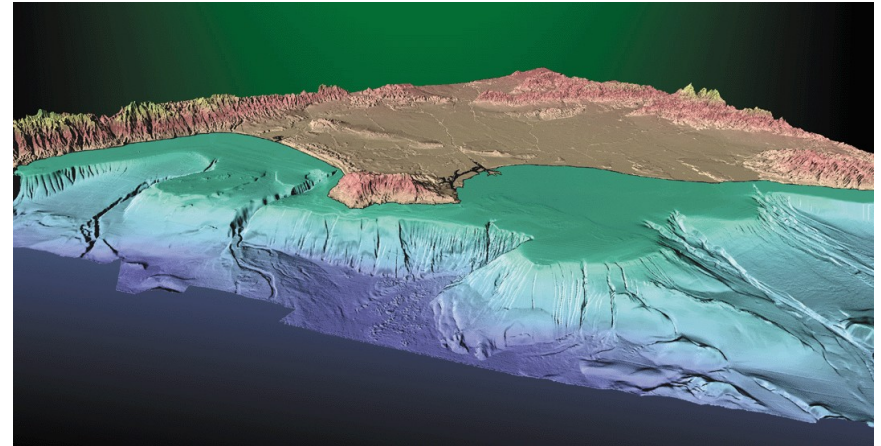
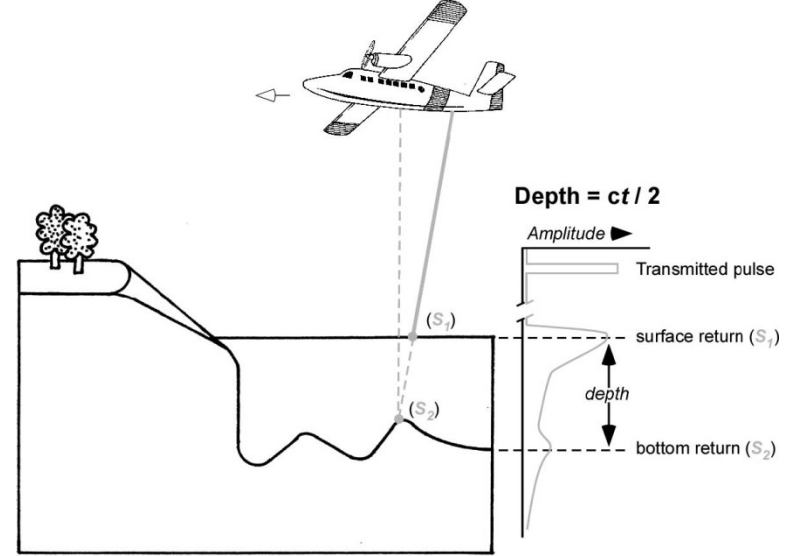
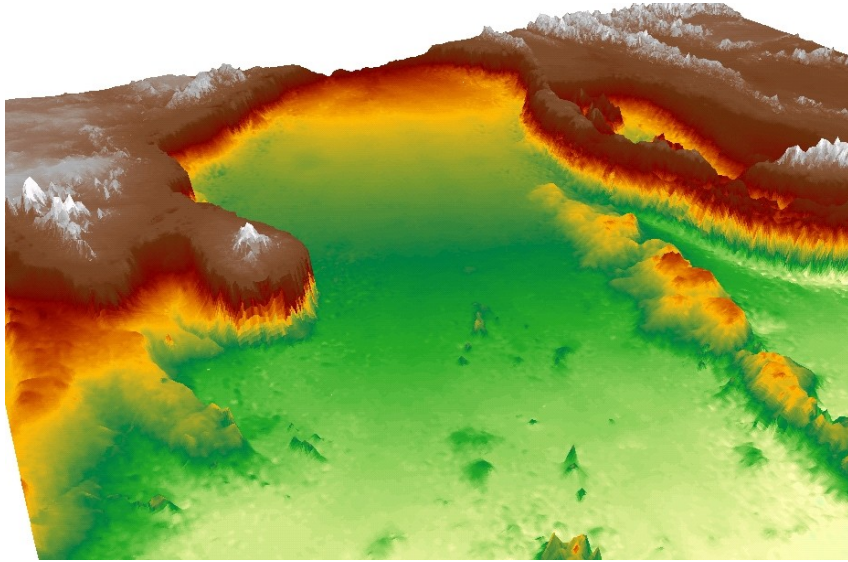
Other Applications

- Structure mapping – Trend lines, Fold styles
- Lithology mapping
- Geomorphology mapping
- Site selection for Dam construction,
- Bathymetry mapping, etc.

Z ←



BATHYMETRY:



For any offshore structures including harbor development

Pipeline etc.,