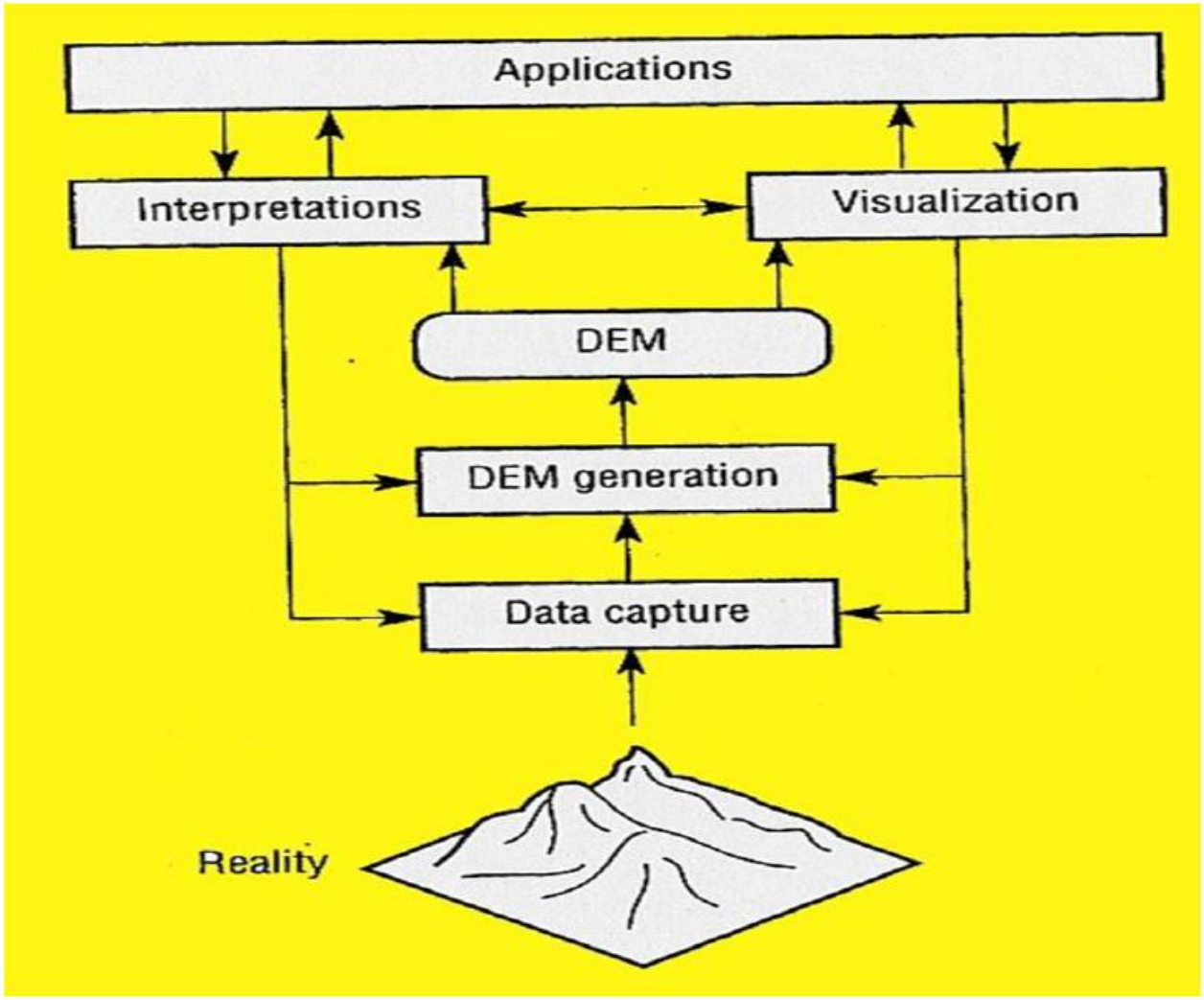
Applications of DEM

- Estimating elevation
- Estimating slope and aspect
- Determining drainage networks
- Determining the watershed
- Terrain stability – areas prone to avalanches are high slope areas with sparse vegetation, which is useful when planning a highway or residential subdivision
- Soil mapping – DEMs assist in mapping soils which is a function of elevation
- Profile graph creation – graph is created from digitized features of a surface


Applications
Interpretations
Visualization
DEM
DEM generation
Data capture
Reality

DIGITAL ELEVATION MODEL (DEM)

- DEM is a digital representation of 3- dimensional information (X, Y, Z) of the continuous topography of the bare earth surface in a particular reference coordinate system.
- A digital elevation model is a digital representation of ground surface topography or terrain.

DIGITAL ELEVATION MODEL

- A DEM is digital representation of topographic surface with the elevation or ground height above any geodetic datum. Following are widely used DEM in GIS.

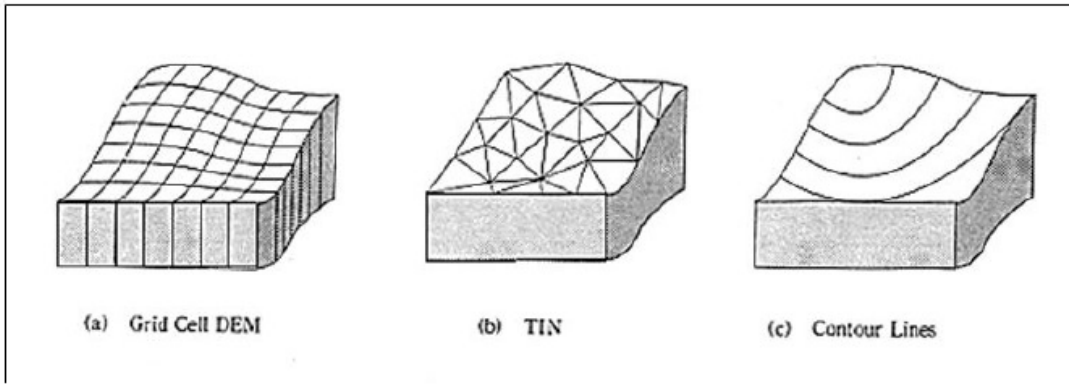
TYPES OF DEM

- DEMs are generated by using the elevation information from several points spaced at regular or irregular intervals.
- The elevation information may be obtained from different sources like field survey, topographic contours etc. DEMs use different structures to acquire or store the elevation information from various sources.

TYPES OF DEM

- Three main type of structures used are the following.
- a) Regular square grids
- b) Triangulated irregular networks (TIN)
- c) Contours

TYPES OF DEM



(a) Grid Cell DEM (b) TIN (c) Contour Lines

TYPES OF DEM

- Grid DEM : The result is a matrix whose indices are the coordinates and values are the elevation value at each point (raster representation)
- From this sample representation it is possible to get a representation of the relief.

REPRESENTATION OF DEM

- Grid DEM: They are based on the values of the elevation at the sampling points- one height per pixel (grid cell).
- The grid representation is the consequence of sampling elevation values in regular intervals of latitude and longitude.

DEM - PARAMETERS

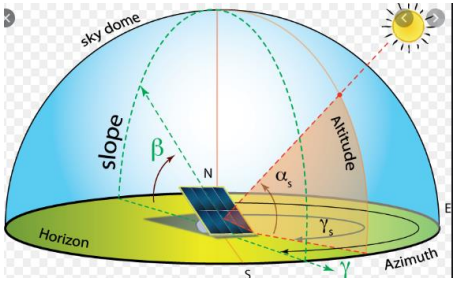
- A DEM (Digital Terrain Model) is digital representation of terrain features including elevation, slope, aspect, drainage and other terrain attributes.
- Usually a DTM is derived from a DEM or elevation data.
- Several terrain features including the following DTMs.
- 1. Slope and Aspect
- 2. Drainage network
- 3. Catchment area
- 4. Shading
- 5. Shadow
- 6. Slope stability

PARAMETERS DERIVED FROM DEM

- Slope – Displays the grade of steepness expressed in degrees or as percent slope. This image can reveal structural lineaments, fault scarps, fluvial terrace scarps, etc.
- 2. Aspect – Identifies the down-slope direction. Aspect images may enhance landforms such as fluvial networks, alluvial fans, faceted fault related scarps, etc.

PARAMETERS DERIVED FROM DEM

- 3. Shaded topographic relief or hill-shading – This image depicts relief by simulating the effect of the sun's illumination on the terrain.
- The direction and the altitude of the illumination can be changed in order to emphasize faults, lineaments, etc.
- This image is probably the most useful to display geological data related to landforms in terrains that show a close correlation between geology and topography.

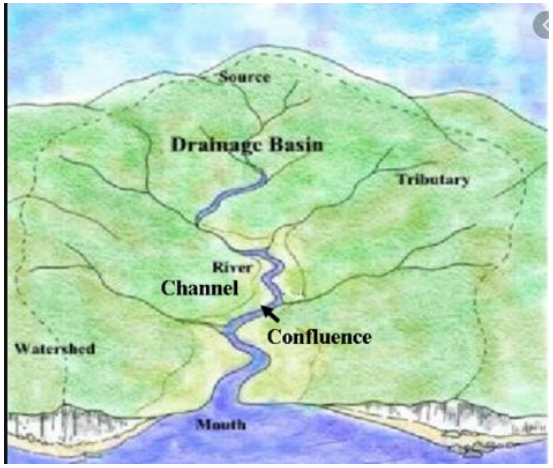


PARAMETERS DERIVED FROM DEM

- 4. Flow direction – Shows the direction of flow by finding the direction of the steepest descent or maximum drop. This DEM derived surface depicts the drainage.
- 5. Basin – Function that uses a grid of flow direction (output of flow direction) to determine the contributing area.

DEM PARAMETERS

- Drainage basins : Drainage basin, also called Catchment Area, or Watershed, area from which all precipitation flows to a single stream or set of streams.
- Channel networks :

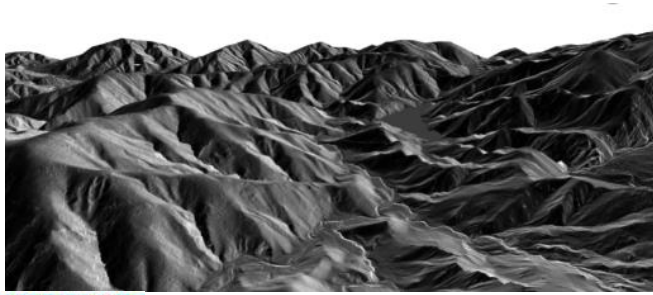


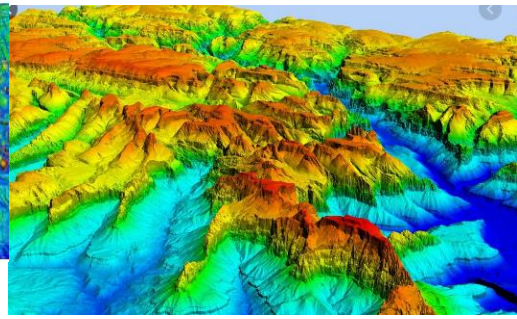
APPLICATION OF DEM

- Landslide probability
- Estimation of the volume of proposed reservoir
- Flood prone area mapping
- Hazard monitoring
- Natural resources exploration
- Agricultural management

MODELING SURFACE

- Surface is denoted here Earth's surface, Moon or asteroid created by using terrain's elevation data.
- Surface can be modeled by using
- DTM : Digital Terrain Model
- DEM: Digital Elevation Model
- DSM: Digital Surface Model





DIGITAL TERRAIN MODEL

- A Digital Terrain Model is a topographic model of the bare-earth terrain relief, that can be manipulated by computer programs.
- The data files contain the spatial elevation data of the terrain in a digital format which usually presented as a rectangular grid.
- Vegetation, buildings and other man-made (artificial) features are removed digitally- leaving just the underlying terrain.

DIGITAL TERRAIN MODEL

- DTM model is mostly related as raster data type, stored usually as a rectangular equal-spaced grid, with space of between 50 and 500 meters mostly presented in Geographic coordinate system.

DIGITAL SURFACE MODEL

- DSM : Surface model which captures the natural and built features on the Earth's surface.
- DSM's measure the height values of the first surface on the ground. This includes terrain features, buildings, vegetation and power lines etc. DSM's therefore provide a topographic model of the earth's surface. DSM's can be used to create 3D fly-through, support location-based systems and augmented simulated environments.

DIGITAL SURFACE MODEL

- DSM is generated using LIDAR (Light Detection and Ranging) system, which sends pulses of light to the ground and when the pulse of light bounces off/back its target and returns to the sensor, it gives the range of the Earth.
- LIDAR delivers a massive point cloud filled of varying elevation values (Height can come from the top of buildings, tree canopy, power lines, other built and natural features).
- DSM is useful in 3D modeling for telecommunications, urban planning and aviation (objects extrude from the earth, particularly useful in these application to identify obstructions).

Use of GIS in Resource Mapping

1) https://www.sciencedirect.com/science/article/pii/S0169555X01000277
2) https://www.sciencedirect.com/science/article/pii/S0921800906002357
3) https://onlinelibrary.wiley.com/doi/abs/10.1002/j.1681-4835.2004.tb00112.x
4) https://www.jstage.jst.go.jp/article/jmps/99/3/99_3_83/_article/-char/ja/
5) https://www.sciencedirect.com/science/article/pii/S0301479710002926

Use of GIS in Groundwater and Runoff modeling

1) https://link.springer.com/article/10.1007/s11269-006-9024-4
2) https://link.springer.com/article/10.1007/s11269-006-9024-4
3) https://www.sciencedirect.com/science/article/pii/S0098300406000331
4) https://link.springer.com/article/10.1007/s10040-011-0703-8
5) https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1745-6584.2004.tb02455.x

https://link.springer.com/article/10.1007/s10040-011-0703-8

Land use and Land cover analysis

1) https://www.tandfonline.com/doi/abs/10.1080/01431160500117865
2) https://www.sciencedirect.com/science/article/abs/pii/S0143622806000154
3) https://www.sciencedirect.com/science/article/pii/S0301479701905092
4) https://link.springer.com/article/10.1007/s12524-009-0016-8
5) https://link.springer.com/article/10.1007/s10708-004-4946-y

Use of GIS in Geology

1) https://www.tandfonline.com/doi/abs/10.1080/01431160010014260
2) https://link.springer.com/article/10.1007/s10040-004-0378-5
3) https://www.nrcresearchpress.com/doi/abs/10.1139/f02-006#.XJNcXSIzbIU
4) https://link.springer.com/article/10.1007/s12517-014-1391-1
5) https://www.ingentaconnect.com/content/asprs/pers/2004/00000070/00000005/art00005

Use of GIS in Regional and Urban Planning

1) https://www.jstor.org/stable/26271983?seq=1#metadata_info_tab_contents
2) https://www.sciencedirect.com/science/article/pii/S0303243403000230
3) https://pdfs.semanticscholar.org/f80d/1cc64b37bee0faf97ce8a9cf879c99f2d0d3.pdf
4) https://www.sciencedirect.com/science/article/pii/S0921344901000908
5) https://www.sciencedirect.com/science/article/pii/S0169204603002500

Integrated with Remote sensing

1) https://www.sciencedirect.com/science/article/pii/0097849396000088
2) http://enviroinfo.eu/sites/default/files/pdfs/vol102/0555.pdf
3) https://www.tandfonline.com/doi/abs/10.1080/01431161698215018
4) https://www.sciencedirect.com/science/article/pii/S0169555X9700069X
5) https://link.springer.com/article/10.1007/s002670010258
6) https://www.tandfonline.com/doi/abs/10.1080/02693799608902114