Digital Elevation Model

M.Sc. Remote Sensing and GIS
IInd Semester

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Introduction:

Digital Elevation Model (DEM) is the digital representation of the land surface elevation with respect to any reference datum.
DEM is frequently used to refer to any digital representation of a topographic surface.

DEM is the simplest form of digital representation of topography .

DEMs are used to determine terrain attributes such as elevation at any point, slope and aspect.

Terrain features like drainage basins and channel networks can also be identified from the DEMs.

DEMs are widely used in hydrologic and geologic analyses, hazard monitoring, natural resources exploration, agricultural management etc.

Creation of DEM

a) Conversion of printed contour lines

The first method is conversion of printed contour lines and use it in raster or vector form.

The elevation contours are "tagged" with elevations. Any other additional elevation data are created from the hydrography layer.

Finally, an algorithm is used to interpolate elevations at every grid point from the contour data.

b) Photogrammetry:

This can be done manually or automatically:

i) Manually, an operator looks at a pair of stereophotos through a stereoplotter and must move two dots together until they appear to be one lying just at the surface of the ground

ii) Automatically, an instrument calculates the parallax displacement of a large number of points.

Types of DEM:

A DEM can be represented as a raster (a grid of squares, also known as a heightmap when representing elevation) or as a vector-based triangular irregular network (TIN).

The TIN DEM dataset is also referred to as a primary (measured) DEM, whereas the Raster DEM is referred to as a secondary (computed) DEM.

Production:

Mappers may prepare digital elevation models in a number of ways, but they frequently use remote sensing rather than direct survey data.

One powerful technique for generating digital elevation models is interferometric synthetic aperture radar where two passes of a radar satellite.

TIN structure :

TIN is a more robust way of storing the spatially varying information.

It uses irregular sampling points connected through non-overlapping triangles.

The vertices of the triangles match with the surface elevation of the sampling point and the triangles (facets) represent the planes connecting the points.

Contour-based structure :

Contours represent points having equal heights/ elevations with respect to a particular datum such as Mean Sea Level (MSL).

In the contour-based structure, the contour lines are traced from the topographic maps and are stored with their location (x, y) and elevation information.

These digital contours are used to generate polygons, and each polygon is tagged with the elevation information from the bounding contour.

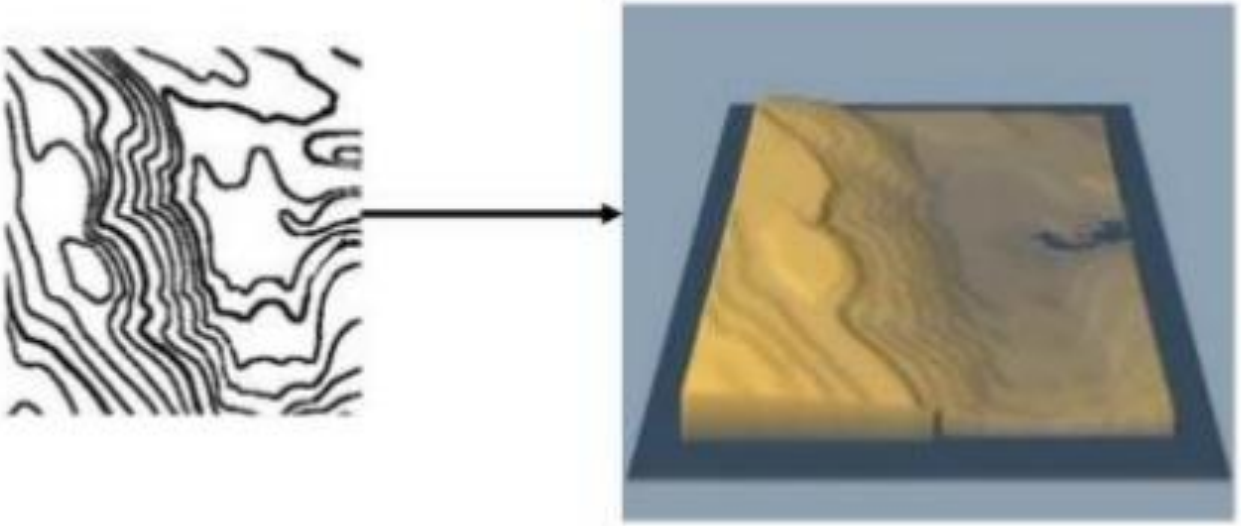

Figure 6. Contour-based DEM

LIDAR and DEM:

Light Detection and Ranging (LIDAR) sensors operate on the same principle as that of laser equipment. Pulses are sent from a laser onboard an aircraft and the scattered pulses are recorded.

The time lapse for the returning pulses is used to determine the two-way distance to the object.

Satellite interferometry with synthetic aperture radar such as Shuttle Radar Topography Mission uses two radar images from antennas at the same time to create DEM.

SRTM (Shuttle Radar Tomography Mission) is a good source of DEM data for almost anywhere in the

world. The CGIAR-CSI GeoPortal is able to provide SRTM 90m Digital Elevation Data for the entire world.

The SRTM digital elevation data, produced by NASA originally, is a major breakthrough in digital mapping of the world, and provides a major advance in the accessibility of high quality elevation data for large portions of the tropics and other areas of the developing world.

The SRTM digital elevation data provided on this site has been processed to fill data voids, and to facilitate it's ease of use by a wide group of potential users.

BHUVAN data sources-CARTOSAT in India:

Indian Space Research Organisation provides all DEM data of India through it portal Bhuvan.

Catrosat-1 and 2 provide all these sources.

Common uses of DEMs :

Extracting terrain parameters.
Modeling water flow or mass movement (for example, landslides).
Creation of relief maps.
Rendering of 3D visualizations
Creation of physical models (including raised-relief maps).
Rectification of aerial photography or satellite imagery.