

# EXTRACTION OF DIGITAL ELEVATION MODEL (DEM) OF UTTARKASHI DISTRICT (UTTRAKHAND, INDIA) USING SRTM DATA IN OPEN SOURCE QGIS

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**Abstract :** -This article presents an enhanced method of creation of Dem & its various mode like Slope, Aspect, Hill shade, etc using satellite data of SRTM. DEM is used to know the elevation profile of any point. DEM is used in preparation of relief map, survey of remote areas. It can be used for modelling of water flow for hydrology, Extraction of terrain parameters, base mapping, etc. DEM of Uttarkashi is extracted using SRTM data by using QGIS software tool. SAGA GIS Software tool is also used to create slope aspect and hill shade of Uttarkashi district. Profile tool in QGIS is used to know the elevation profile of the area across a straight line in the shape file.

**Index Terms - DEM, SRTM, Uttarkashi, QGIS, SAGA-GIS, Profile tool.**

## I. INTRODUCTION

### DIGITAL ELEVATION MODEL

A digital elevation model is a statistical representation of the continuous floor of the ground. DEM is a 3-dimensional digital depiction of terrain surface of earth. Dem involves in extraction of elevation data from satellite imagery and it up comes with 3-D representations of earth topology. Dem has the ability to represent complicated topography with adequate resolution. . It can be generated from various sources like field surveying, contouring, and stereo data using photogrammetric techniques and also interferometric techniques. Creation of digital elevation model by the use of satellite data is still not common but the upcoming time is the age of remote sensing. Dem created from satellite data has some significant features over other sources-

1. Worldwide accessibility of satellite information without restriction.
2. Faster process through complicated software's and minimum manual effort.
3. Large covering area.
4. Less processing cost.
5. Satellite data can be obtained in any weather.

## II. OBJECTIVE & STUDY AREA

The main objective of this work is to create digital elevation model to know the elevation profile of Uttarkashi district of Uttarakhand state India.

The study area is located in Uttarakhand state of India

Uttarkashi is located at 30.73°N 78.45°E. It has an average elevation of 1,165 metres (4,436 feet). Most of the area is hilly.

## III. Data used

SRTM refers to shuttle radar topography mission .it is the space land surveys carried out by the U.S. space agency (NASA). The Shuttle Radar Topography Mission collects' data over most of the land surfaces terrain that is between 60 degrees north latitude and 54 degrees south latitude.

## IV. Software used-

- QGIS
- SAGA GIS

## V. Methodology

### Data collection & Preparation

- Extraction of Uttarkashi district shape file from the shape file of Uttarakhand, India.we could be done by using simple operations of QGIS Software or we can also create shape file if we know the closed loop co-ordinate of the Uttarkashi district

- Download Raster data of the respective place from <http://srtm.csi.cgiar.org/SELECTION/inputCoord.asp> and then, merge shape file of Uttarkashi on raster data in software tool.

**SRTM Data Selection Options**

1. Select Server:  CGIAR-CSI (USA)  HarvestChoice (USA)

2. Data selection method:  Multiple Selection  Enable Mouse Drag  Input Coordinates

Many tiles can be selected at random locations. These selected tiles are listed in the results page for download.

Decimal Degrees (ie 34.5, -100.5)  Degrees: Minutes: Seconds (ie 34 30 00 N, 100 30 00 W)

Longitude - min:  max:  Longitude - min:    East max:    East

Latitude - min:  max:  Latitude - min:    North max:    North

Longitude: 42.34 Latitude: 56.39 Tile X: 45 Tile Y: 1

3. Select File Format:  GeoTiff  ArcInfo ASCII

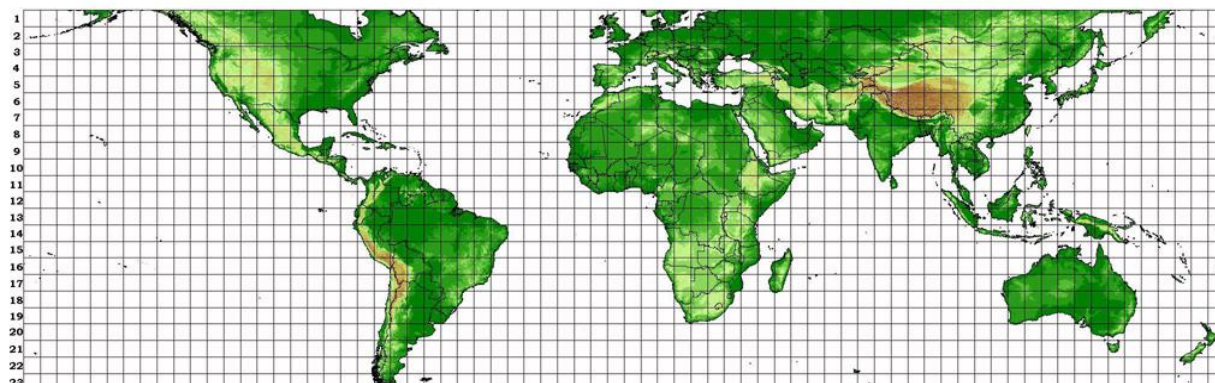


Fig -srtm website

Open QGIS Software & Add Raster Data and open the srtm data downloaded, And then click on add raster layer and add shape file and merge Shape File of Uttarkashi District on Raster Data by clicking on add vector layer.

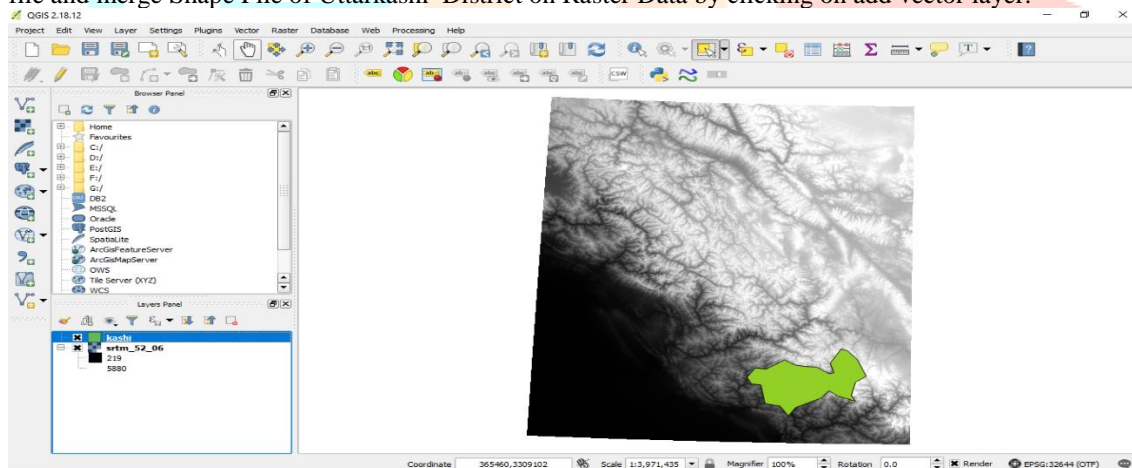


Figure -Uttarkashi shape file merged on raster data

- Extraction of clipped raster image of the shape file by making use of raster tab.
- Click on Raster present in the toolbar and then move on to extraction tool then click on to clipper option and clip only along the required shape file using the Mask layer.

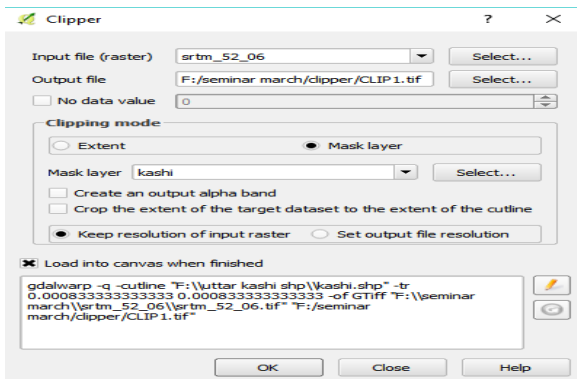


Figure -Clipper dialogue box

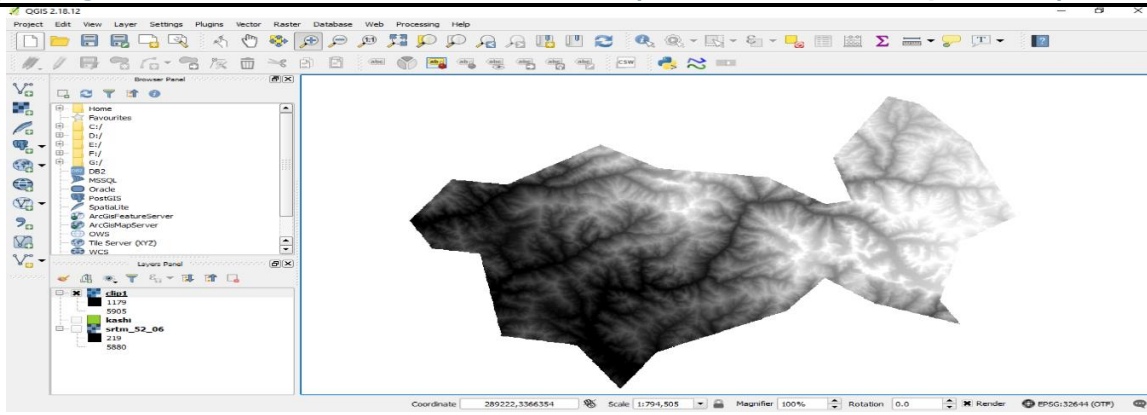


Figure -clipped file

- When we click on the raster tab we get many options there we shall move on to Extraction and click on to contour then we will get a dialogue box and we will Create contour line of 100 meter interval using extraction segment of raster toolbar.

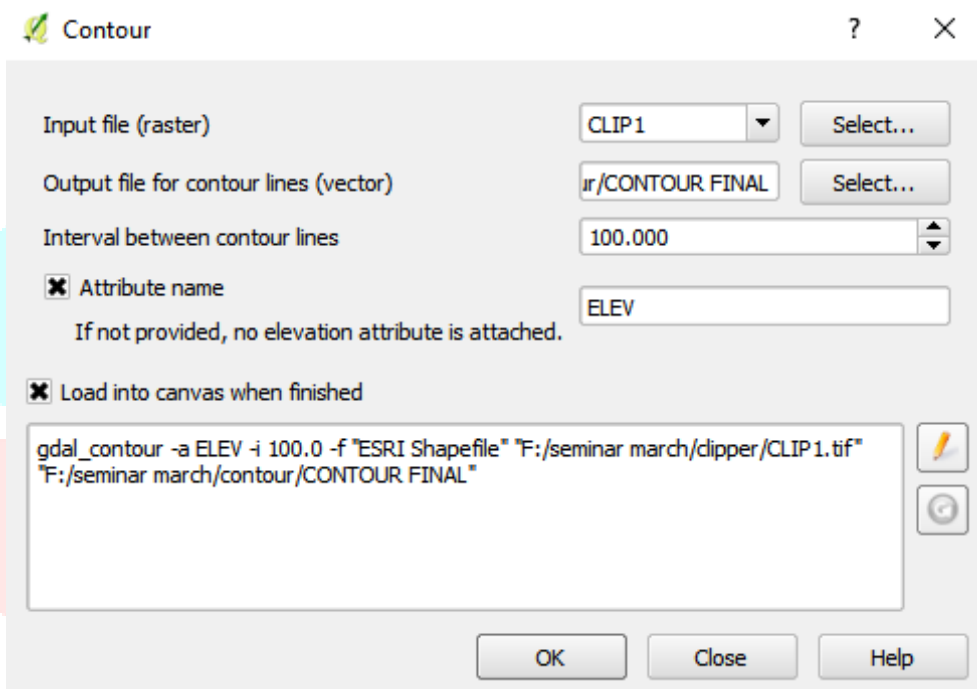


Figure -Contour dialogue box

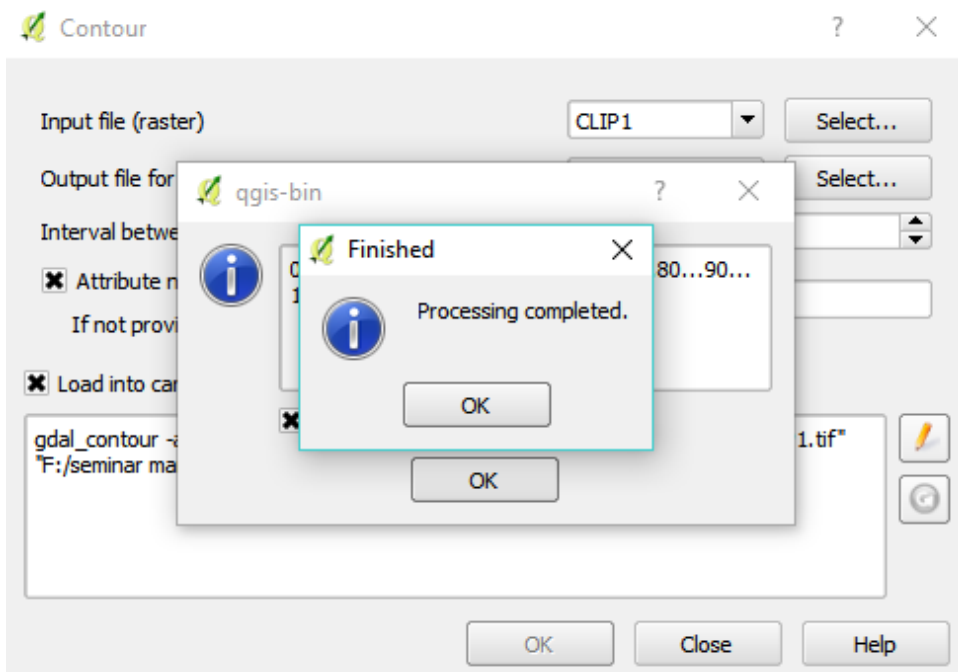


Figure -contouring finished

- Open properties of contour layer by double clicking on the layer and show label for this layer and label it with ELEV. This will show the elevation with contouring on every contour line which has been created.

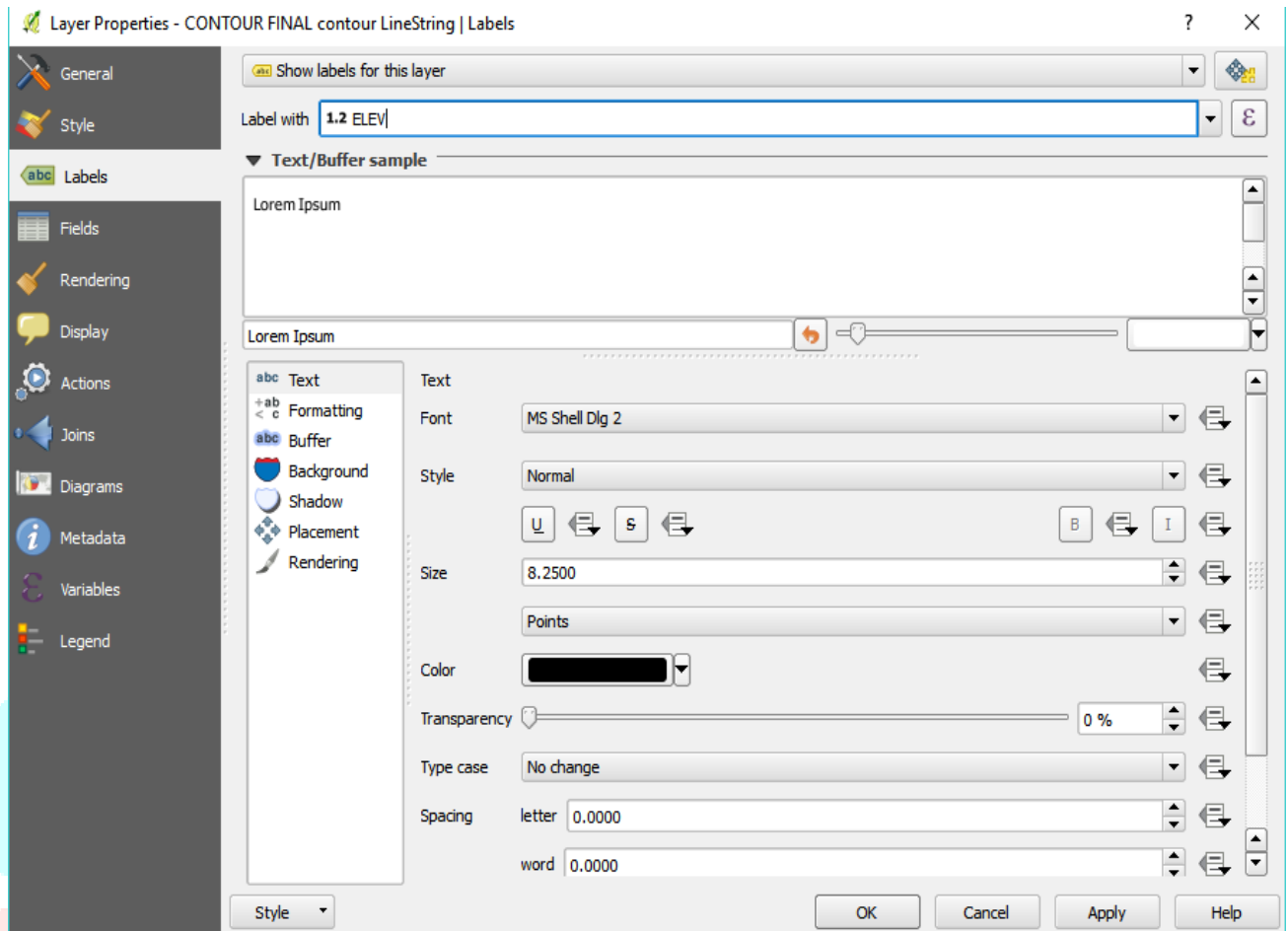


Figure - layer properties

- Contouring of the area has been completed by using contour toolbar.
- Open contour layer property and show label for this layer with elevation.

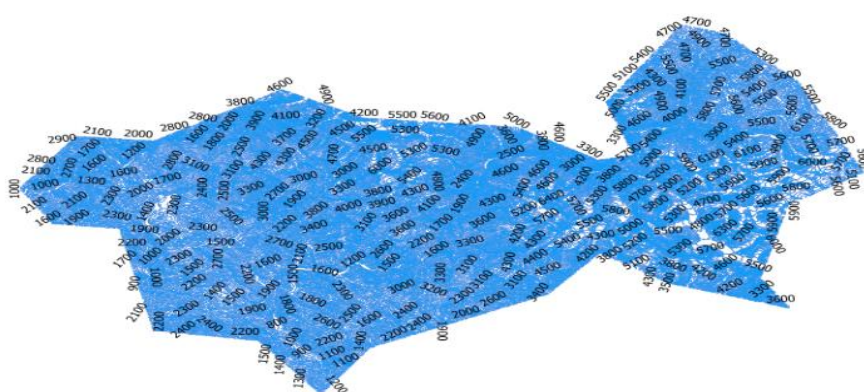


Fig- contour map of Uttarkashi district with elevation

- Elevation profile of any point could be known by clicking at any point.



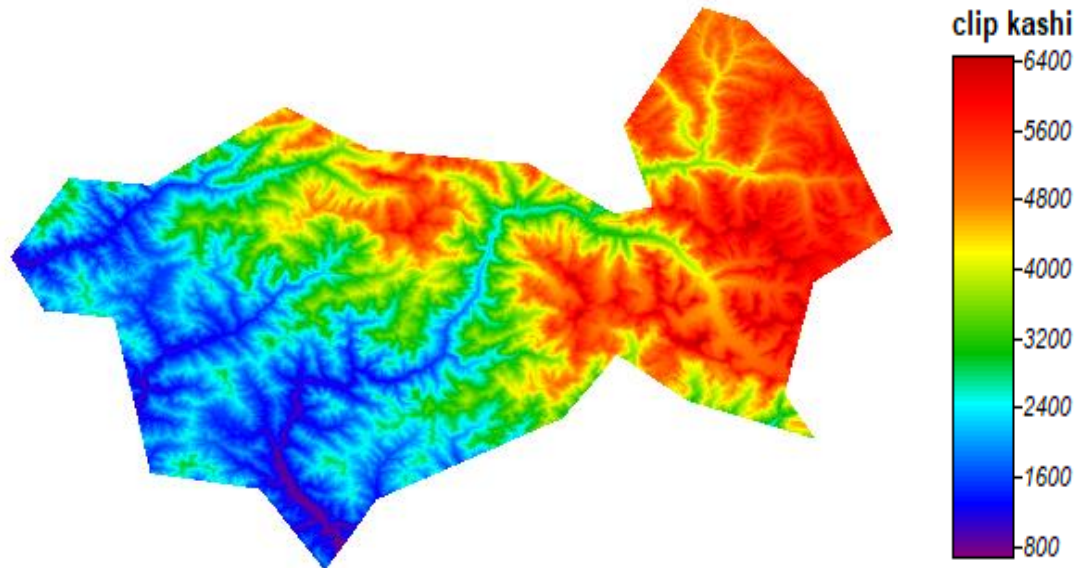


Fig-elevation map created using Saga-Gis

- Dem could be used to construct various things like-

**1. Slope**

In gis slope is quite important for many reason like quality analysis, prophetical modelling, and predicting potential hazards

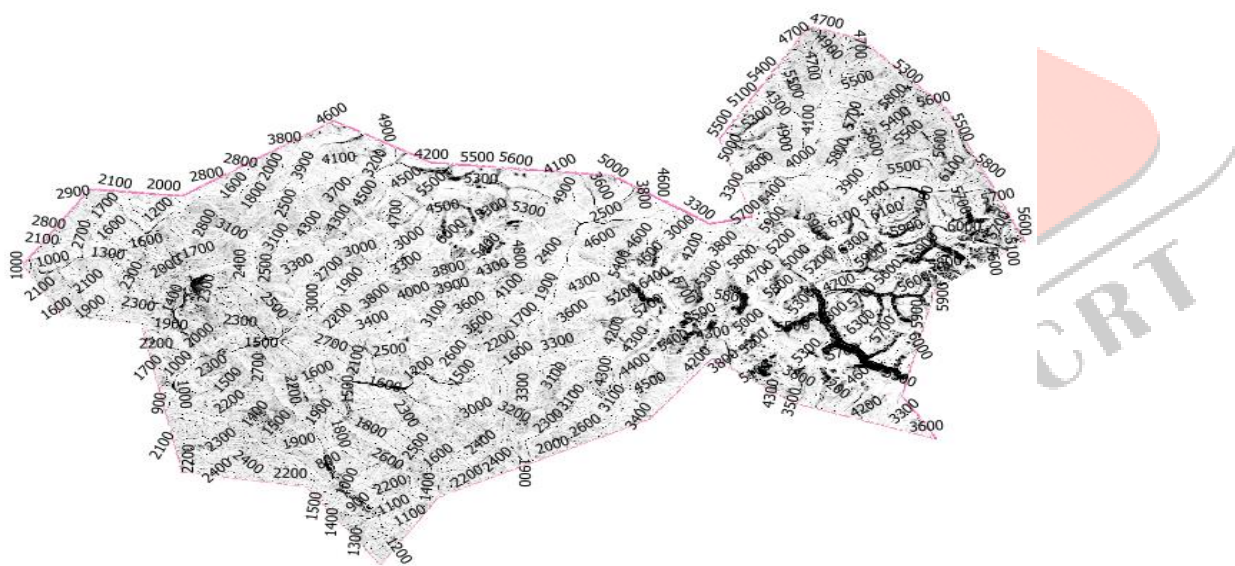


FIG-slope with contour labelling.

- By using SAGA GIS, we can also get slope of the area by using tool terrain analysis then clicking on morphometry and after that using the tool Slope Aspect Curvature which Calculates the local morphometric terrain parameters like slope, aspect and if supported by the chosen method it will also calculate curvature. Besides tangential curvature also its horizontal and vertical components (i.e. plan and profile curvature) can be calculated.

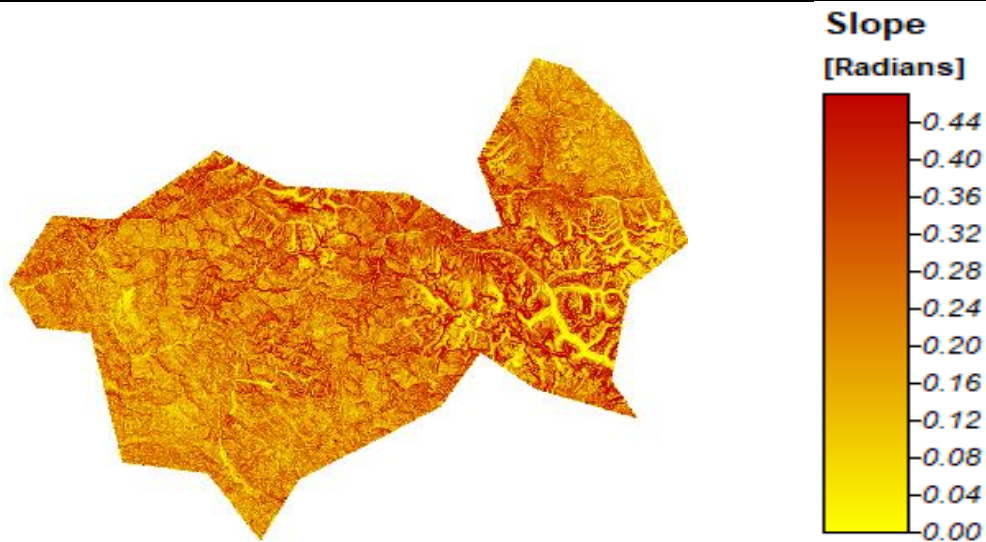
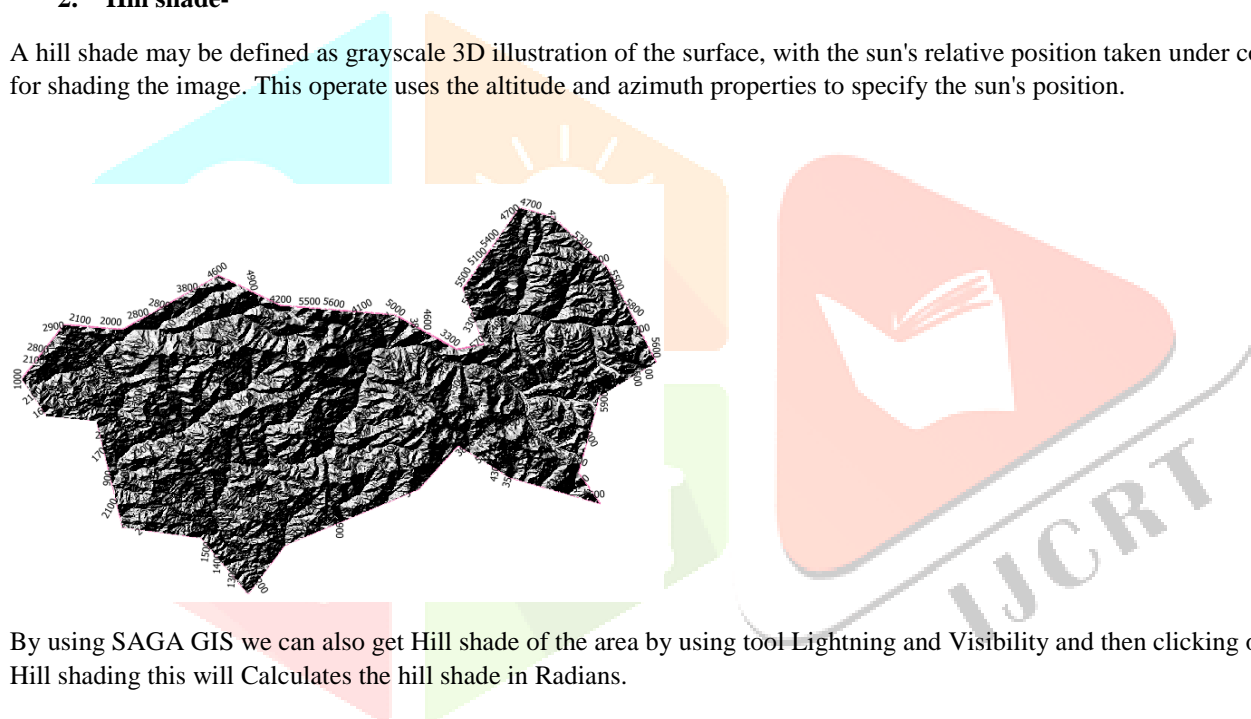


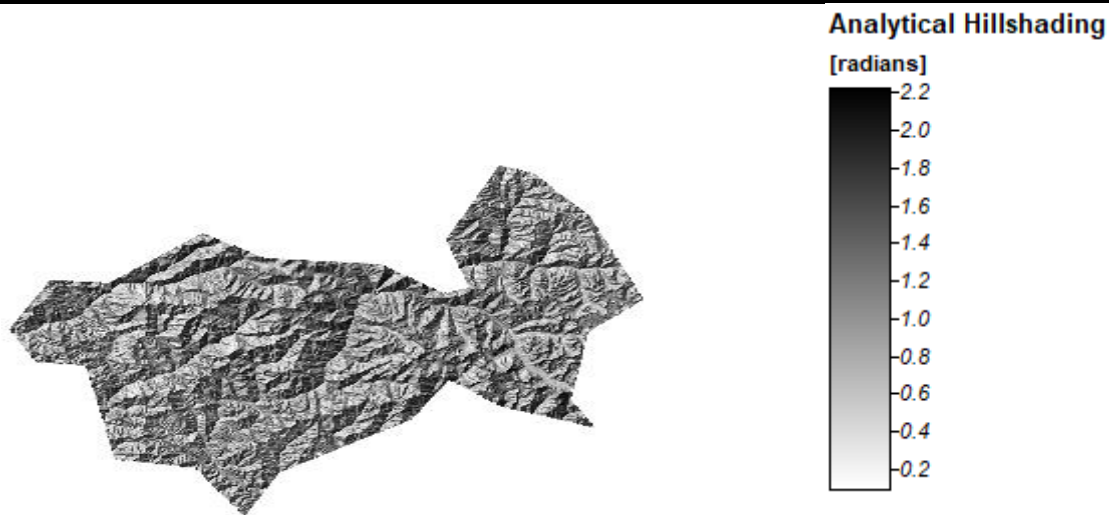
Figure- slope map created using saga-gis

### 2. Hill shade-

A hill shade may be defined as grayscale 3D illustration of the surface, with the sun's relative position taken under consideration for shading the image. This operate uses the altitude and azimuth properties to specify the sun's position.

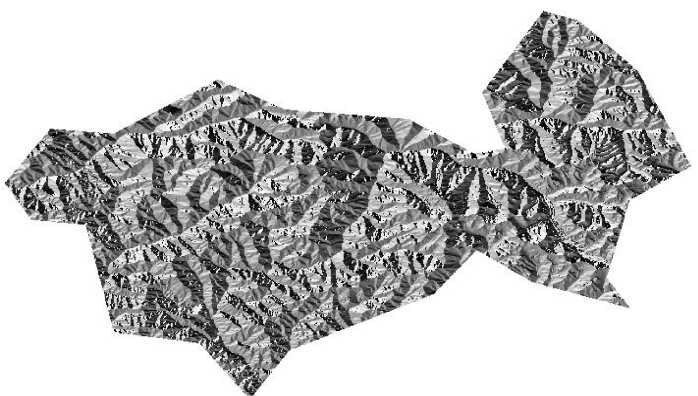


By using SAGA GIS we can also get Hill shade of the area by using tool Lightning and Visibility and then clicking on Analytical Hill shading this will Calculates the hill shade in Radians.



### 3. Aspect

The compass direction that a topographical slope faces, typically measured in degrees from north. Aspect's is generated from continuous elevation surfaces.



We could use SAGA GIS to get aspect of the area by using tool terrain analysis then clicking on morphometry and after that using the tool Slope Aspect Curvature. we can get aspect in radians or degree as our need is.

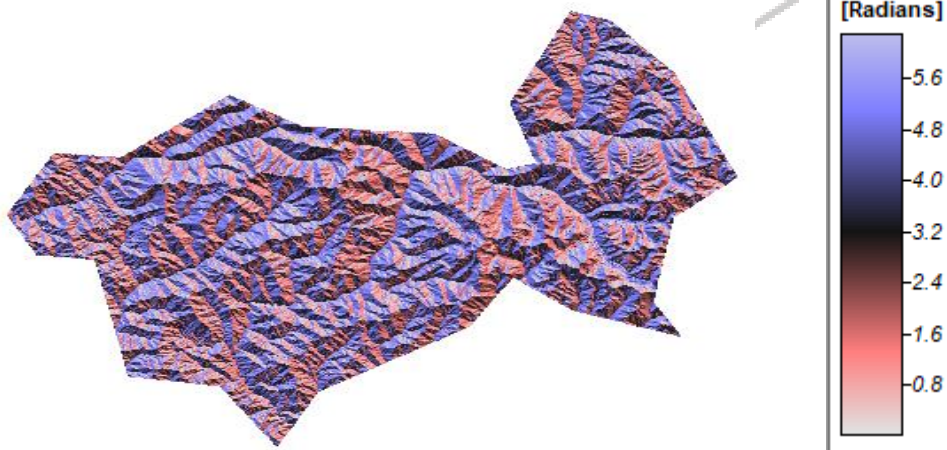
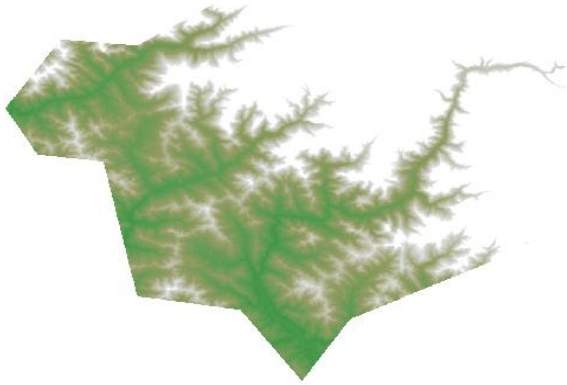


Figure-aspect map created using saga-gis

#### 4. Color relief

Color reliefs is also used to extract the elevations of the area.



#### 5. Terrain ruggedness index

It is used to express the quantity of elevation differences in the adjacent cells of dem.



#### VI. Result Analysis

The analysis of result is carried out by analysis of elevation profile of every place present in Uttarkashi which could be used in development planning of the area and for military use as it is present near international border

This could be done using QGIS Software tool Firstly we have to install profile tool via plugin.

Profile tool is a tool by which we could create a temporary layer and do the operations of obtaining the elevation profile of the respective area which has been captured by SRTM satellite.

Now, we could use this elevation profile tool to get the elevation profile in a straight line across the area.

In the graph plotted here X- Axis show the ground distance and Y- Axis shows elevation in meters.

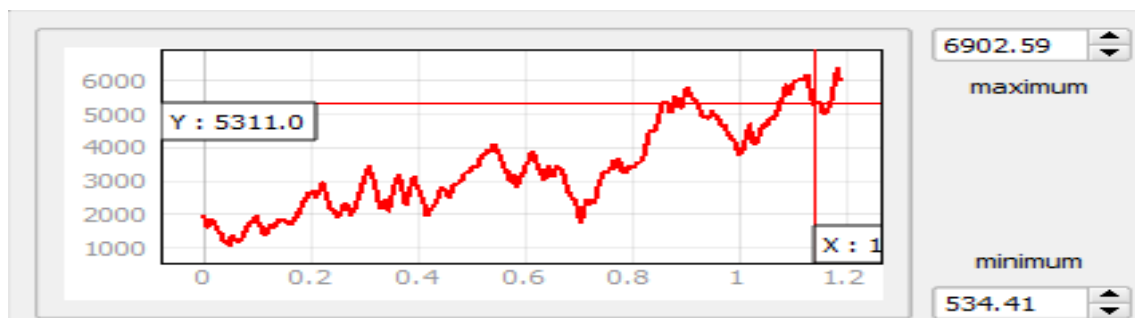


Fig-elevation profile



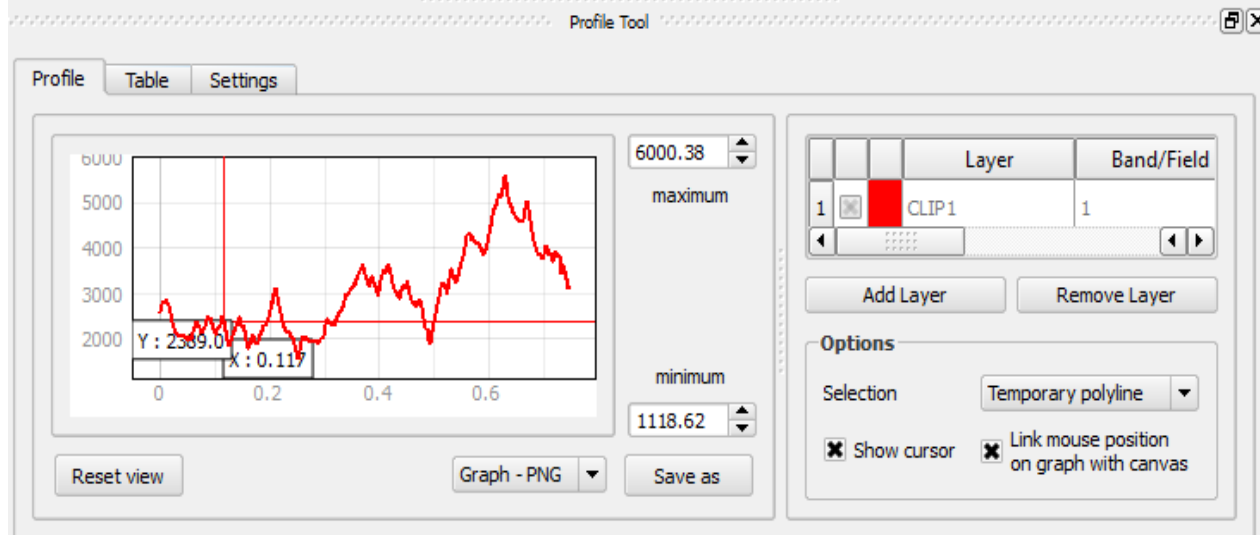


Figure-profile tool dialogue box

One table is also created which gives us point to point detail of the elevation of the area

|   | 1   | 2          | 3          | 4          | 5          | 6          | 7          | 8          | 9          | 10      | 11     |
|---|-----|------------|------------|------------|------------|------------|------------|------------|------------|---------|--------|
| 1 | 0   | 0.00085... | 0.00171... | 0.00257... | 0.00343... | 0.00428... | 0.00514... | 0.00600... | 0.00686... | 0.00772 | 0.0085 |
| 2 | 846 | 847        | 811        | 822        | 807        | 771        | 704        | 654        | 580        | 604     | 603    |

Figure-profile tool table

## VII. CONCLUSION

A method comprising of remote sensing and GIS techniques has been used in this study. RS & GIS are effective techniques and which offers us a great help in monitoring of any specified place. Digital Elevation Model Could be used to know the elevation profile of the area by using profile tool. The X- Axis shows the distance travelled across the straight line and Y-Axis shows the elevation at the specific point.

## VIII. ACKNOWLEDGEMENT

I am ineffably indebted to Supervisor- Dr.R.K. Shukla (Associate professor civil engineering dept. MMMUT, Gorakhpur), for continuous support, guidance & Encouragement, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this paper. I could not have imagined having a better advisor and mentor for my research study.

## IX. REFERENCES

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