

3D DEM DELINEATION OF CHAMBAL RIVER BASIN FROM SRTM DATA USING REMOTE SENSING AND GIS TECHNOLOGY

(DEFINE METHODOLOGY WITH MODULES & SCREENSHOTS)

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Abstract

Geographic Information Systems and remote sensing, have proved to be efficient tools in delineation of drainage pattern and different geometric methodology of geomorphologic, watershed management even GIS has been widely used in several flood management, and environmental applications. However, Applications of Geographical Information Systems (GIS) to geomorphological research have been increasing with the increasing complex morphometric evolution of large and restricted area .Increasing availability of Digital Elevation Models (DEMs) at various resolutions has facilitated this trend. However, Chambal river basin is prehistoric in nature and vast in geomorphic studies. The fluvial geomorphology of Chambal River basin is so vast in terminology. Chambal basin is around 1,43,219 sq.km² in area. Therefore we are using remote sensing and GIS application and technique to analyzing the whole Chambal geomorphology in interval of space and time. Remote sensing and GIS is a modern technology to solve the analytical and statistical problems. However, the DEM is used for an accurate analysis the morphometric parameters. Its 90 meter spatial resolution data downloaded from <http://www.usgs.org> or [cgiar – csi.org](http://cgiar-csi.org) portal. DEM is digital elevation model which shows gridded array of elevation. The quality of DEM can also influence accuracy of surface analysis parameters. DEM has X,Y values which show 2 dimensional surface and Z values shows clear 3D interpretation of an area. 3D view of Chambal basin shows the base height and vertical exaggeration of data with aspect of area.

Keywords

Chambal river basin, 3D DEM, SRTM Data spatial resolution 90m, Arc-gis10v, Arc Scene

Introduction

Geomorphologic studies are always be a great significance for deciphering extend of different topography of landscape of the earth such as unstable hill slope with weak lithology and frequent slope failure [5]. Chambal River Origin lies at elevation of 2786 feet with latitude N22°27'36.5" and longi

tude 75°41'14.4"(source by: ground truth field data). View of Chambal basin in 3D manure is done by extraction of DEM [6]. The X, Y, Z values show the elevation and systematic view of basin Morphology. The processes of extraction of an AOI (area of interest) and converting into 2D DEM to 3D DEM are proceed further after download the SRTM 90m resolution data of Chambal river basin of path_row:51_07.tif, 51_08.tif, 52_07.tif, 52_08.tif (.tif generated for TIFF format).

SRTM data must include files having these four format aux, hdr, rrd, tfw and one text and one tiff image [Screenshots.1]. If any file of these format are missing in downloaded SRTM Data. Else it will show some analytical error with parameters results.

Location- Chambal River Basin in India

In present study, Chambal River is ground water origin and has perennial characteristics. Chambal River is so vast in catchment area and located in western and central part of India and flows through three Indian states i.e. Madhya Pradesh, Rajasthan and Uttar Pradesh. Chambal River is actually chief tributary of Yamuna River [4] [SOI-Toposheet] (Fig1.).

Methodology

Chambal River geomorphologic features are recognized and morphometric analysis has done by using Arc-GIS (9.3v) and by the SRTM Data. 3D DEM delineation from SRTM data has done from using through Arc-GIS (9.3v). This method is very handy in nature. Data downloaded in 90 meter resolution and through aerial images this data displayed in Google Earth. The various stage of methodology has been shown in Module [1].

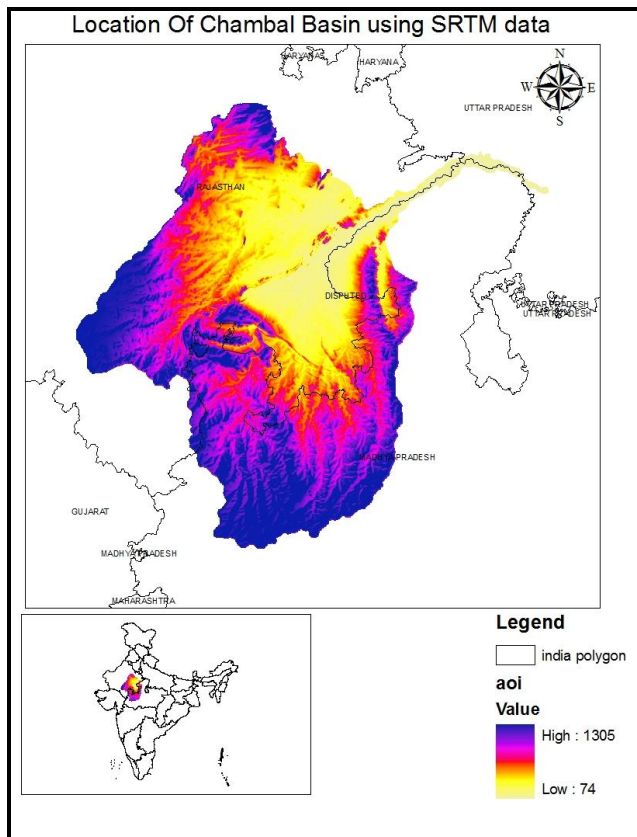


Fig1. Location of Chambal River Basin

Now, various stages of methodology used one by one and the corresponding results are discussed here—

Stage I- Avail SRTM data

The DEM is used for an accurate analysis the Morphometric parameters. Its 90 meter spatial resolution data downloaded from <http://www.USGS.org> or [http//, www.CGIAR – CSI.Org](http://www.CGIAR - CSI.Org) portal [2].

All SRTM data of Chambal basin open in Arc GIS 9.3v window through Arc catalogue.

First of all, Mosaic the all these data into one file, and after it projected the mosaic file into projected coordinate system to geographic coordinate system (WGS 1984 to UTM WGS 43_N.Prj). The Mosaicking file in extract in .img as default (.img show the imagine format of an image).

Stage II - Mosaicking the SRTM data.

Through Arc toolbox, [Input tiff] = [Output Grid (Save it in personal workspace folder)]

Now the pixel higher value is 1305 and low area pixel value is 74, therefore, the AOI has zero no data value values [Screenshot.4].

Chambal basin SRTM data are continuous data show the values of bright area (-44), and darkest area (2744) , therefore the pixel type is assign to 16-BIT Signed and the band is 1(by default) because of panchromatic data and other optional are let it as default[1].

Stage III- Project the SRTM data

[INPUT_GRID File] = [OUTPUT_IMAGINE File]

Project the mosaic GRID file of Chambal basin into IMAGINE format. Give it output Coordinate system is WGS_1984_UTM_ZONE_43N.Prj (Prj assign for projection). The resembling technique is carried out in CUBIC form; reason behind it is this SRTM data is continuous and Elevation data [1] the cell size is in 90m spatial resolution. The output file is DEM projected data [Screenshot.2]. Now, symbolize the histogram equalization from the mosaic data properties.

The output projected raster file is DEM data which has accurate Transverse Mercator projection system. Now remove all raster file beside projected DEM file from TOC in Arc-GIS window. [TOC is assign for Table of Content]. Now, only the output Mosaic Raster file opens in TOC and Different Spatial and Statistical Analytical information of Chambal River Basin has been calculated through this DEM data. Now, DEM has higher pixel value is (2745) and low is (-43). There are some negative values and no data values (32766) of holes areas [3] but this is quite large in area, so let's get it from large area and focus only on Chambal area. So, extract it from creating a polygon shape file with name Area of interest (AOI) and import on it the same projection coordinate of projected Raster DEM file.

Created Polygonal Shape file (.shp) with name AOI (Area of Interest) and draw a Polygon surrounding the Study area.

The AOI Shape file is created with UTM Projection and ready to drag in Arc-GIS window. Open this Shape file into Arc-GIS window with projected DEM raster file. Now start Editing and choose create new feature and choose pencil, draw a polygonal shape of Chambal basin on the basis of roughly view of tributary drainage network of Chambal River in DEM file, now save and stop editing and Extract it from Extract by Mask tool.

[INPUT GRID-{Raster data} and MASK feature-{AOI} = {OUTPUT GRID Raster file}]

For its pretty look to change the color ramp of the AOI raster data [Screenshot.3].

STAGE IV: Create Height and Vertical Exaggeration from AOI Dem [1]

Now click on arc scene object in arc GIS window, a new window appear and drag the AOI raster data by (+) sign in TOC (table of content), navigate the DEM in perfect orientation direction and promote the create pyramid of AOI Dem .Now right click on the file in legend and choose properties, now choose base height option from the open properties box. Then obtain height from layer surface and click on ok. Right click on scene properties button from view menu bar and choose vertical exaggeration, calculate vertical exaggeration from extend and click ok. Now Chambal river basins are appear in 3D DEM view. For pretty look change its color ramp. However, click on rendering tab, click on effect – shade then ok. Now return to Arc scene Window, it's very pretty look to view Chambal basin DEM area in 3D view (Fig2).

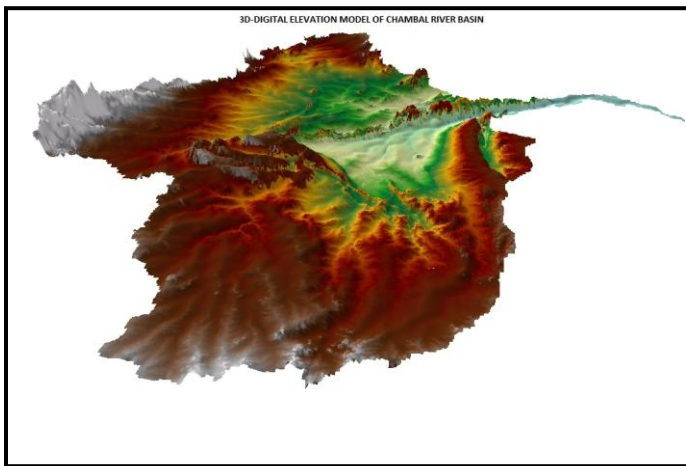


Fig.2- 3D Dem of Chambal River Basin showing prospective view of Chambal elevated area.

Conclusion

The Chambal river basin usually has very large in area and characterized by badland topography. Rajasthan and Madhya pradesh area of Chambal basin cover by scrub land and ravenous landscape with nexalite boundary region. Therefore, the Remote sensing and GIS application is very best to study of this nexalite area. However, 3D Dem view show the elevated and plain area which is also show the most gentle and steep area for Chambal river . The SRTM data (90 m) resolution data has been used to analysis the morphometric interpretation in a systematic view. This 3D view show X,Y,Z coordinate value in accuracy term.. The more essential contribution of GIS and DEMs is their capability of quantitative analyses. Major Fields of GIS/DEM applications in Geomorphology include, Basic morphometric analyses mainly related to height, slope and Aspect, analysis of stream framework and watersheds, landform classification, soil erosion modeling, landslide susceptibility modeling and detection and analysis of topographic changes.

Acknowledgments

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References

- [1] Arc GIS manual (9.3)/ help
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- [3] Jon Harvey by David Wampler (wamplerd@uw.edu)UW Hydro Computing Workshops, Last updated on 242014. Jan 27, 2014. Topographic Analysis of the Sierra Nevada Mountains. Modified from Earth 176, Fall 2013
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- [5] Singh. S, 2004. Physical Geomorphology. Introduction. pp.1-23
- [6] Steve Zuppa. 2008, GIS Procedural Guide Create a 3D Scene in Arc Scene 9.2+ , Map Library Assistant - Serge A. Sauer Map Library

Biographies

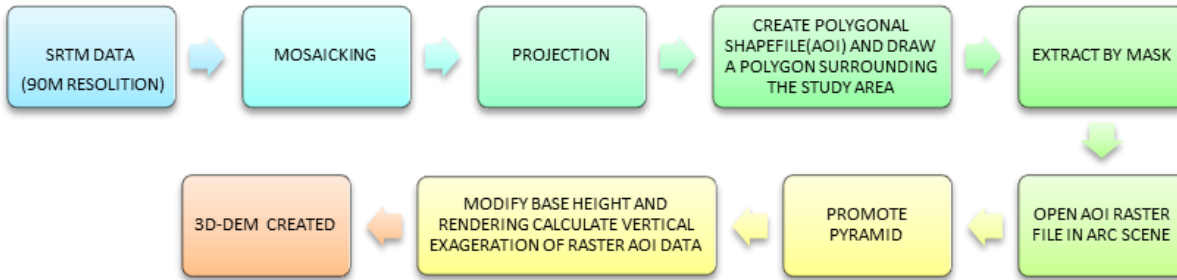


[1]. Miss. Pradeepika Kaushik (SRF) received the DST INSPIRE research Fellowship award and currently, she is engaged in Ph.D. with Title” Geomorphologic Evolution of Chambal River Basin using Remote Sensing and GIS technology from Banaras Hindu University, Varanasi, UP respectively. Her research areas include Geomorphology and Remote sensing Software and GIS and, 3D Dem Modeling, and embedded map design. She has authored a textbook ie; Pradeepika Kaushik (2013). “Geomorphological Studies of the Himalayan Glaciers in .Brief.” LAP Lambert Academic Publishing, Germany (ISBN-978-3659482137), pp.60

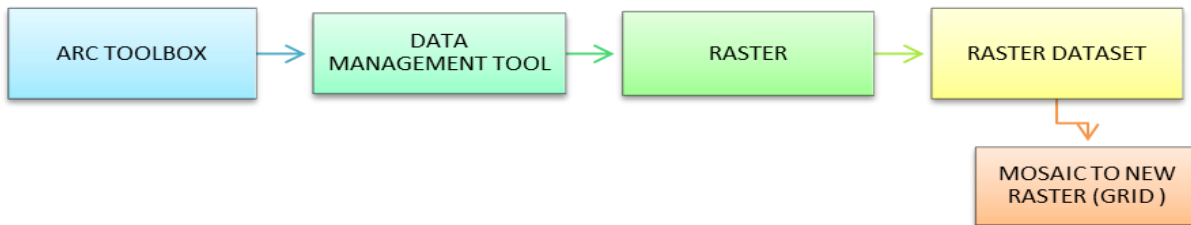


[2]. Dr. P. Ghosh received M.Tech degree from University of Roorkee (Now IIT Roorkee) in 2000. Currently, he is an Assistant Professor of Geology from 2004 to present at Banaras Hindu University, Varanasi, UP. His teaching and research areas include Mineralogy, Metamorphic petrology, Crystallography, Remote Sensing and GIS, Geomorphology.

MODULES



Module 1- Different stage of delineation of 3D DEM from SRTM data



Module2. Methodology of Mosaicking



Module 3- Projection processes of SRTM Data

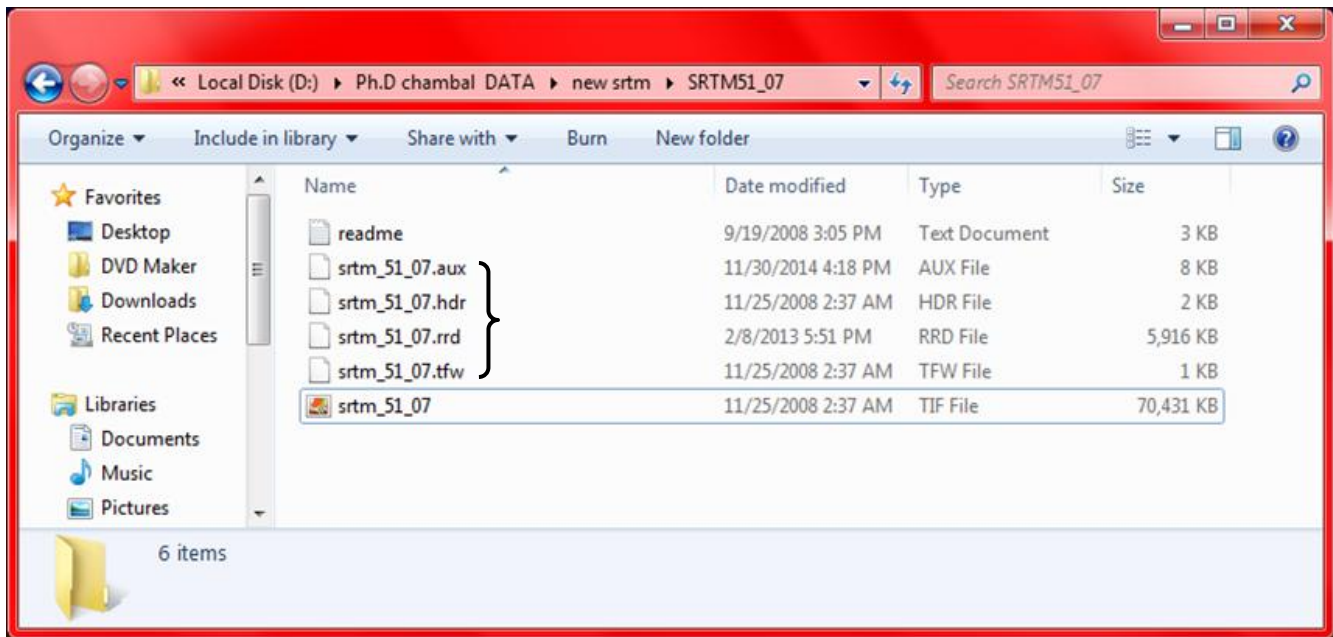


Module.4- processes of creating a new shape file with accurate UTM Projection Data

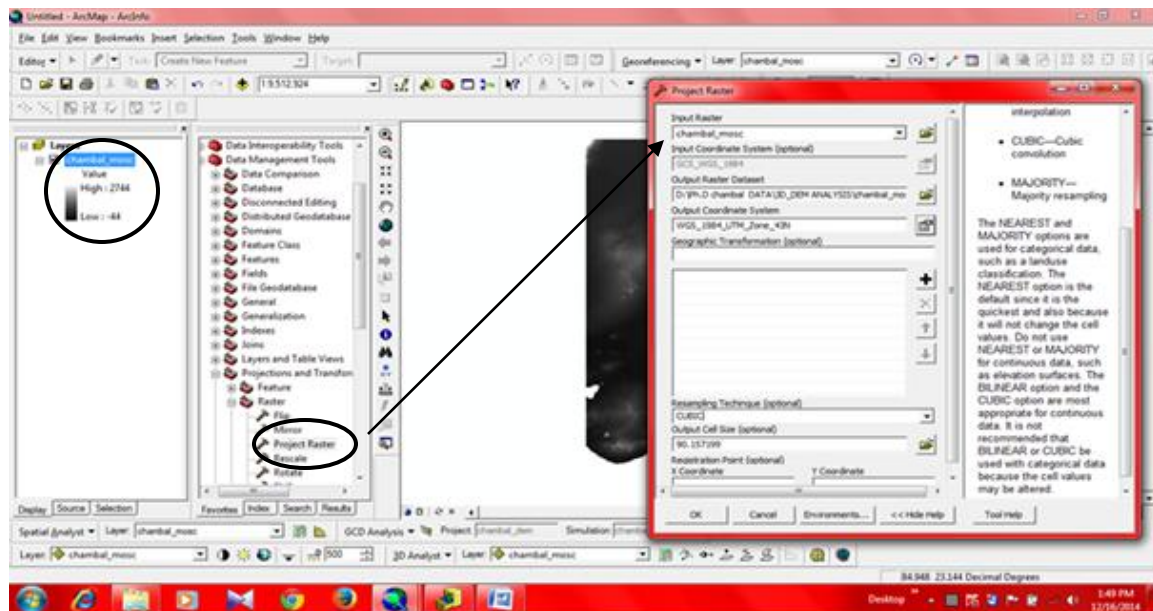


Module.5. processes of Extraction of Chambal study area by Extraction of Mask

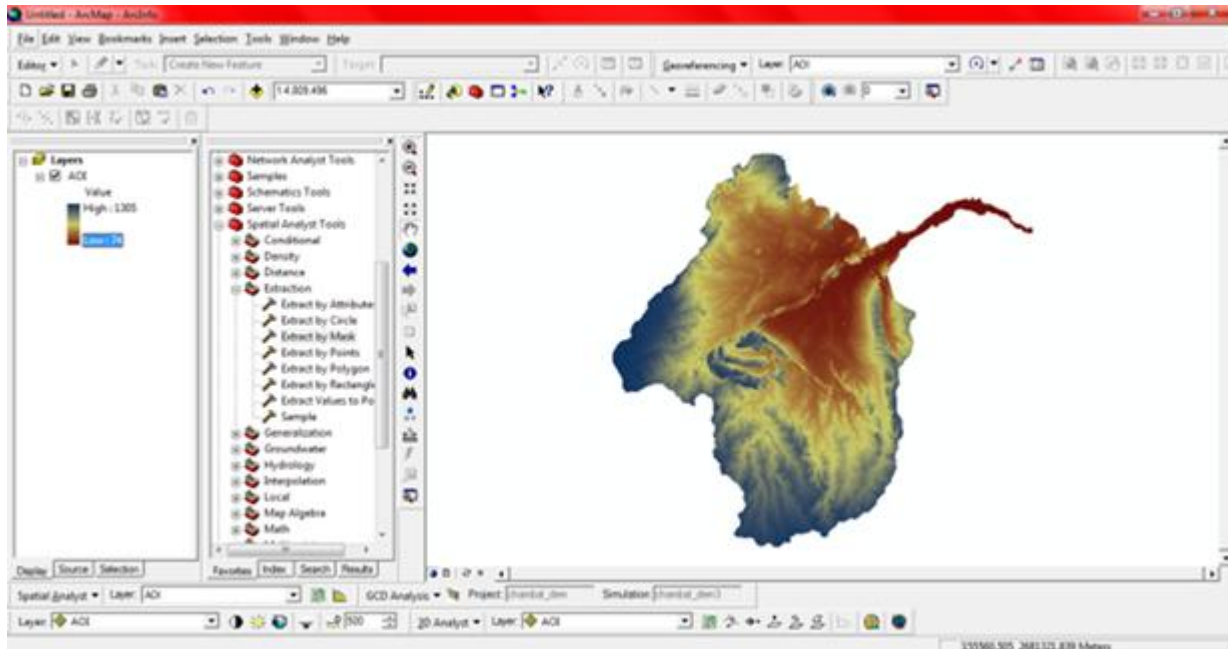
SCREENSHOTS



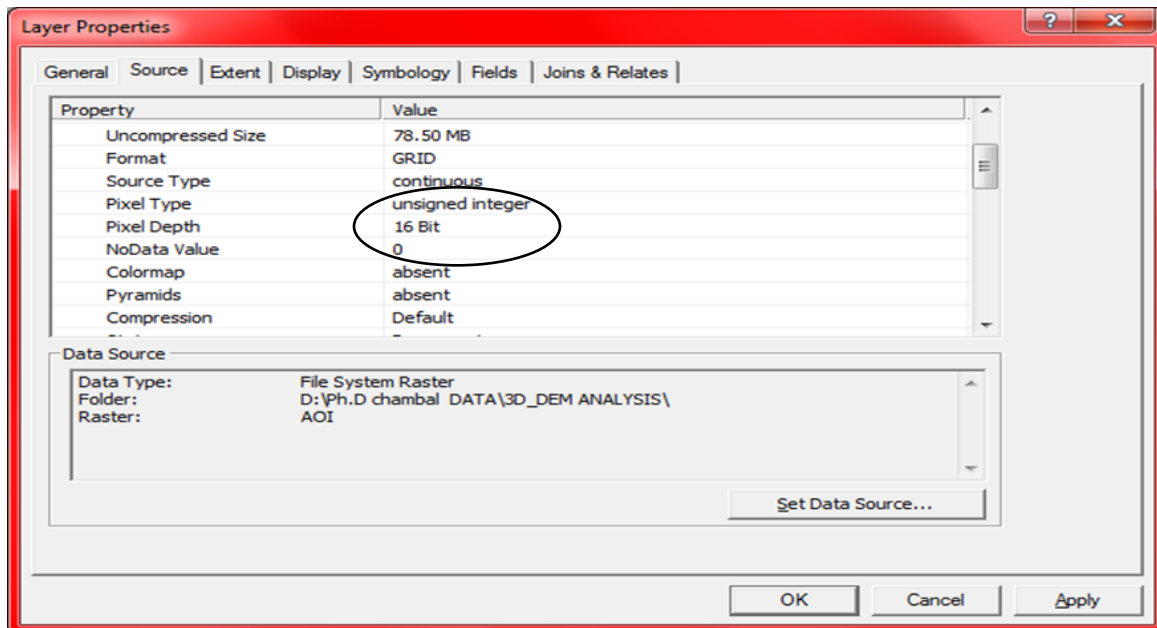
Screenshot1- Complete set of downloaded one SRTM DATA



Screenshot2. Process of projection of SRTM DATA



Screenshot.3- Changing the Color ramp for pretty look



Screenshot.4- Layer properties show different source CHAMBAL_DEM file