DAILY ASSESSMENT FORMAT

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Course:	**IIRS**	**USN:**	**4AL17EC075**
Topic:	**DEM AND DERIVATIVES AND ORTHOIMAGE**	**Semester & Section:**	**6TH B**
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FORENOON SESSION DETAILS
Image of session 
Report – Report can be typed or hand written for up to two pages. A Digital Elevation Model (DEM) is a representation of a land surface in a 3 dimensional space with elevation as the third dimension along X (horizontal coordinates) and Y (vertical coordinates) dimensions. DEM is a useful data source in hilly areas terrain analysis; DEM plays an important role in various areas like disaster management, hydrology and watershed management, geomorphology, urban development, map creation and resource management etc. Cartosat-1 or IRS P5 (Indian Remote Sensing Satellite) is a state-of-the-art remote sensing satellite developed and launched by ISRO (May 5, 2005). It has been designed for terrain modeling and large-scale mapping applications.

This high resolution stereo data has great potential to produce high quality DEM. The high resolution Cartosat-1 stereo image data is capable to provide significant impact in topographic mapping and watershed applications. The objective of the present study is to generate high resolution DEM (10 m and 30 m) and ortho-rectified image through Cartosat-1 stereo pair, quality evaluation in different elevation strata, generation of terrain parameters. Aglar watershed in Tehri-Garhwal and Dehradun district has been used as the test site. The present study reveals that DEM generated (10 m and 30 m) using CARTOSAT-1 stereo pair is of high quality. The derived terrain parameters like slope, aspect, drainage, watershed boundaries etc., are also of good quality. A comparison of the DEM and the parameter derived from it reveals significant improvement in the quality as compared to the freely available DEM in internet.

DEMETER (Detection of Electromagnetic Emissions Transmitted from Earthquake Regions)

DEMETER is a French microsatellite mission (the first mission of the CNES microsatellite program referred to as Myriade) with the objective to observe geophysical parameters of the terrestrial environment. This involves the study of ionospheric perturbations (measurement of electromagnetic waves and their effects), caused by natural phenomena, such as earthquakes and volcanic eruptions, or resulting from human activities (power lines, VLF, HF broadcasting). Of particular interest is the potential occurrence of electromagnetic perturbations in relation to earthquakes. One hypothesis is that they might offer an early warning prior to earthquakes or eruptions. The scientific participants in the DEMETER project are: LPCE (Laboratoire de Physique et de Chimie de l'Environnement d'Orléans), CETP (Centre d'etude des Environnements Terrestre et Planetaire) in Velizy/ Saint-Maur, IPG-Paris (Institut de Physique du Globe de Paris), CESR (Centre d'Etude Spatiale des Rayonnements) in Toulouse, and ESA/ESTEC. LPCE is responsible for the science payload. Note: In Greek mythology, Demeter, daughter of Cronus and Rhea, is the goddess of vegetation and fecundity.An orthophoto, orthophotograph or orthoimage is an aerial photograph or satellite imagery geometrically corrected ("orthorectified") such that the scale is uniform: the photo or image follows a given map projection.A digital orthophoto quadrangle (DOQ)--or any orthoimage--is a computer-generated image of an aerial photograph in which displacements (distortions) caused by terrain relief and camera tilts have been removed. It combines the image characteristics of a photograph with the geometric qualities of a map.Unlike an aerial photograph, an orthoimage has a uniform scale, so it can be used as a base map onto which other map information is overlaid. It is possible to measure directly on an orthoimage, just like other maps.Comparison of an aerial photograph and an orthophoto (orthoimage) from the Tenth Legion quadrangle in Virginia near the town of Arkton. The aerial photo shows a straight pipeline that is distorted by displacements caused by camera tilting and terrain relief (topography). The orthophoto removes the effects of tilt and relief and shows the true, straight path of the pipeline. Unlike the aerial photo, the orthoimage is a photographic map with a uniform scale. The orthoimage can be directly laid over other maps (and vice versa).(Public domain.)Digital Elevation Models (DEMs) are raster files with elevation data for each raster cell. DEMs are popular for calculations, manipulations and further analysis of an area, and more specifically analysis based on the elevation. ArcGIS has several built-in functions that are very easy to use and will turn the DEM into a derivative map.

Basic-Manipulations

There are several basic manipulations that can be done with ArcMap. This involves tools under Spatial Analyst > Surface (the Spatial Analyst extension needs to be turned on in order for this to work properly).

1. Slope: The DEM can easily be transformed into a slope map with the Slope tool (fig. 2.1). This map describes the slope for each raster cell in degrees based on the elevation at each point.

2. Aspect: Another derivative is the aspect map (fig. 2.2). This map displays the aspect of each raster

cell grouped into compass directions (north, northwest, etc.).
3. Hillshade: This tool creates a map with a shade-effect (fig. 2.3) based on the input parameters that are entered in the tool. The resulting map is easier to interpret than the original DEM, because some topographic features are better visible (on small scale especially).
4. Curvature: The curvature map (fig. 2.4) is calculated by using the curvature tool. This basically calculates the relative change in slope, could be seen as a second order DEM derivative.
5. Contour: Topographic contour lines can be plotted with the contour tool (fig. 2.6). Based on the user defined parameters the new map will display (elevation based) contour lines.
6. Viewshed & Observer Points: These tools are used to calculate a (set of) positions relative to a user defined (point) feature (fig. 2.7). This is useful to determine the visibility of a location.
7. Another useful way to display a DEM is to use the "Select attribute" feature (fig. 2.8). By inserting a query and selecting a threshold, it is possible to select certain elevations on the map and display the location of these points.
8. If you want to go a step further, maybe in order to classify the DEM based on elevation, you could use the reclassify tool (fig. 2.9). With the reclassified map it is possible to do a raster calculation in order to calculate a function for each raster cell (with each variable having its own map with values).Other possibilities with a DEM include interpolations. With certain tools it is possible to calculate unknown values based on known values that surround these unknown values. There are several ways to interpolate. It is also possible to convert the raster DEM to a vector map, and use vector related manipulations. This will however decrease the quality of the elevation data.

The 3D Analyst tool can also be used to make a topographic profile of a section line in the DEM. This line can be drawn with the 3D analyst tool, and the profile can be made or customized with this tool as well (fig. 3).

In-Depth-Analysis

DEMs are good for landscape analysis. There are many more advanced and specialized functions and applications in ArcMap that can be used for analysis. This includes, but is not limited to, hydrologic analysis, geologic and geomorphic analysis and landscape development.
It is also possible to do calculations with raster data. The DEM elevation values can be used for this, but another option is to reclassify the map and give each class a certain value that is used in a function. This can easily be displayed in a model, which can also be made in ArcMap (fig. 4).

A good example is the Revised Universal Soil Loss Equation (RUSLE). This equation can be calculated by using several maps and manipulating/reclassifying those maps and subsequently use the raster calculator tool. The function is as follows: A= R*K*LS*C*P with A as average annual soil loss, R the rainfall-runoff erosivity factor, K the soil erodibility factor, LS the slope length and steepness factor, C the cover management factor and P the support practice factor. More information about the RUSLE can be found online.

The DEM is a very useful feature in the geospatial analysis. It is used for many research fields and can be manipulated in many ways. The possibilities described in this GIS in Practice are just a summary of all possibilities of a single DEM.