Remote sensing

Unit 5

Remote sensing in study of drainage patterns

Advanced techniques have been well demonstrated in illustrating streams and surface water basins. In this respect, DEM can be well utilized, and it can help inducing flow directions, and locating low-lands. However, erroneous results sometimes appear from DEM if the digital applications do not accurately obtain. Topographic maps are also used to delineate drainage systems. Therefore, streams are directly digitized in the GIS system, and thus catchment areas are extracted following geomorphologic and hydrological concepts.

In this study, topographic maps, of scale 1:50000 and contour interval 20m, were utilized and they were supported by the application of DEM in order to extract the related parameters for drainage systems, and they were directly digitized in the GIS system using Arc-GIS 9.3 software. Consequently, streams were illustrated for each watershed and the watershed boundaries were identified. The area of study is about 1947km2

Accordingly, the watersheds in the area of concern were divided into three types as follows: 1. Major basin: It encompasses principal hydrological characteristic, mainly funnel-like shape, where the difference between the numbers of branches is high in upstream and downstream areas, and it is characterized by uniform run-off. There are 10 major basins in the study area. 2. Minor basin: It is characterized by smaller areas than the major ones (usually less than 50km2), and it has almost a uniform run-off regime. They are 10 minor basins existing in the study area. 3. Joining basin: It is a geographic land extension between the major and minor basins. It is characterized by non-uniform run-off. There are 9 joining basins in the study area. There are 29 watersheds in the area of study, 19 of them outlet towards Jeddah city at the coast, and totaling an area of about 1170 km2, while the rest outlet into Wadi Fatima to the southern side of Jeddah city. The largest watersheds are Ghouimer (319.7km2) and El Assla (289.4 km2).

Major land forms

Remotely sensed imagery has been used extensively in geomorphology since the availability of early Landsat data, with its value measurable by the extent to which it can meet the investigative requirements of geomorphologists. Geomorphology focuses upon landform description/classification, process characterization and the association between landforms and processes, while remote sensing is able to provide information on the location/distribution of landforms, surface/subsurface composition and surface elevation. The current context for the application of remote sensing in geomorphology is presented with a particular focus upon the impact of new technologies, in particular: (1) the wide availability of digital elevation models; and (2) the introduction of hyperspectral imaging, radiometrics and electromagnetics. Remote sensing is also beginning to offer capacity in terms of close-range (<200 m) techniques for very high-resolution imaging. This paper reviews the primary sources for DEMs from satellite and airborne platforms, as well as briefly reviewing more traditional multispectral scanners, and radiometric and electromagnetic systems. Examples of the applications of these techniques are summarized and presented within the context of geomorphometric analysis and spectral modelling. Finally, the wider issues of access to geographic information and data distribution are discussed.

Geological structures

Remote sensing is becoming an important and useful tool in mapping large, remote areas and has many applications in geosciences such as geologic and geo-structural mapping, mineral and water exploration, hydrocarbon exploration, natural hazards analysis, and geomorphology. The recent advances in remote-sensing imaging acquisition and availability of images can help geoscientists to explore and prepare maps quickly and evaluate the geo-potential of any specific area on the globe. Advances in remote-sensing data analysis techniques have improved the capacity to map the geological structures and regional characteristics and can serve in mineral exploration in complex and poorly understood regions. In this chapter, geophysical remotely sensed data (airborne geophysics) are integrated with other sources of remotely sensed data to analyze three separate areas, one each for geological structure, lineament presence and orientation, and geothermal potential. Three case studies are discussed in this chapter from three countries—Afghanistan, United Arab Emirates, and Algeria—to show the effectiveness of remote sensing in mapping and detecting geo-structural, geomorphological, and geothermal characteristics of ground surfaces.

Ground water exploration

A service user of remote sensing data , Providing hydrogeological services to other charities and not-forprofit organisations , Technical expertise sourced through a membership of over 200 groundwater experts , In last 12 months Groundwater Relief has carried out 15 projects working with UN, INGOs and smaller charities. Projects have included: borehole siting and drilling in northern Uganda; groundwater resource assessments at two Protection of Civilian camps in South Sudan; supporting the humanitarian response through developing water supplies in Cox's Bazaar, Bangladesh . Over the course of the last two years Groundwater Relief has also been working in partnership with E04HumEn+ to explore remote sensing opportunities for groundwater supply;

Groundwater is stored within fractures and the weathered zone. Topographic data has proved useful to help identify lineaments/fracture systems/deeper weathered zones

Mineral exploration

Remote sensing images are used for mineral exploration in two key ways:

1. The mapping and analysis of the geology, faults and fractures of an ore deposit.
2. Recognizing hydrothermally altered rocks by their spectral signature.

Images are gathered either through optical sensors, or through synthetic aperture sensors. Optical sensors measure the spectral data of sunlight reflected from the Earth's surface. Synthetic aperture sensors are able to detect electromagnetic data by transmitting microwave radiation and receiving the back-scatter waves from the Earth's surface.

Remote sensing is a valuable tool in mineral exploration, thanks to its ability to save time and money while providing helpful information. It is best used for the discovery of high-value commodities such as diamonds and gold, which are becoming more difficult to locate. While it may not show exactly where major deposits are, data gathered through sensors can be used to narrow field surveys to smaller areas.

Applications of remote sensing can also provide value by reducing the risk of a project and helping prioritize which sites to explore first. Expensive operations like drilling and field work can come after information is gathered.

The greatest advancement in mineral exploration is the ability to synthesize various forms of data. Known drill results can be integrated with topographic maps, air photos, structural maps and ore grade data. Data synthesis can greatly increase the accuracy and effectiveness of an exploration program.

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