Delineation and Characterization of Geomorphological Features in a Part of Lower Maharashtra Metamorphic Plateau Using IRS-ID LISS-III Data

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ABSTRACT

In the present study, an attempt has been made to delineate and characterize the different geomorphic units of Tundiya river catchment in a part of Lower Maharashtra Metamorphic Plateau, north-eastern part of Nagpur district, Maharashtra. The drainage, contour and delineated geological units have been overlaid on IRS-ID LISS III satellite imagery (bands 2, 3 and 4) in EASI/PACE analysis system to delineate and characterize different geomorphological units and analysis of their processes based on the field observations. The study area is basically of metamorphic in origin with different geological formations and is influenced by the various fluvio-morphological processes. Based on the satellite data analysis, the distinct geomorphological units viz., table top summits, structural hills, subdued plateau, linear ridges, shallow, moderate and deeply buried foot slopes, shallow valley fills and deep valley fills have been delineated and characterized. The information generated from satellite data in the form of vector layers has been used in GIS to generate geological and geomorphological maps of the study area. The present study demonstrates that IRS-ID LISS-III data in conjunction with geology, drainage and contour parameters to enable detailed evaluation of different geomorphological units and analysis of their processes based on the field observations. The delineated geomorphological units can be utilized for evaluation and management of natural resources and geo-environment on sustainable basis at river catchment level.

Introduction

Geomorphological mapping involves the identification and characterization of the fundamental units of the landscape. Geomorphic unit is defined as an individual and genetically homogeneous landform produced by a definite constructional or destructional geomorphic process (Fairbridge, 1968). Each part of the land surface is the end product of an evolution governed by parent
geological material, geomorphological processes, past and present climate and time (Demek, 1972). Detail information on geomorphic units and their processes in an area is very useful in evaluation and management of land resources, environmental planning and developmental activities (Cook and Doornkamp, 1974; Crofts, 1974; Panizza, 1978; Demek, 1982). Geomorphological features are manifestations of underlying parent materials and the nature and duration of geomorphic processes that have produced the associated geomorphic units (Wright, 1993). The geomorphic position on a toposequence plays a vital role in classification of geomorphic units. Delineation and characterization of geomorphological features and analysis of their processes is of immense help in the fields of pedology, hydrology and environmental engineering applications.

The remote sensing techniques have become the most efficient tools for geological, structural, geomorphological studies and their mapping because of its synoptic view, multi-spectral, multi-temporal capabilities (Krishnamurthy and Srinivas, 1996). The geomorphic units have specific set of characteristics that determine its image signature. High resolution satellite data provides reliable source of information to delineate and generate comprehensive and detail inventory of geomorphic units in an area (Mukerjee, 1982). The geomorphological mapping of a terrain and analysis of their processes also help in soil resources mapping, groundwater potential zones identification, landscape ecological planning, hazard mapping and other environmental applications (Reddy et al., 2001). In the present study, Tundiya river catchment in Lower Maharashtra Metamorphic Plateau in northern part of Nagpur district has been selected for delineation and characterization of geomorphological units using IRS-ID LISS III satellite imagery and analysis of their processes based on the field observations.

**Methodology**

The IRS-ID LISS-III satellite data of March 2000 pertaining to the study area was collected and registered to Survey of India (SOI) topographical sheets at 1:50,000 scale in EASI/PACE (ver 7.0) image analysis system (PCI, 2000). The surface lithological analysis of the study area has been carried out through visual interpretation of the satellite data considering the geological Quadrangle map on 1:1 mile scale (GSI, 1978) as a base. The boundaries of the geological units have been modified based on the image characteristics and field observations. The slope map of the area was generated from the Digital Elevation Model (DEM) using the standard in-built algorithm of SPANS GIS (ver 7.0) (PCI, 1997). Visual interpretation techniques have been followed in delineation of geomorphic units based on the tone, texture, shape, drainage pattern, colour and differential erosion characteristics of the satellite imagery in conjunction with collateral information. Adequate field checks were conducted for deriving information on geomorphic units and to establish the relationship between the image elements and geomorphic unit characteristics. The various land...