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Research Paper

HYDROGEOMORPHOLOGICAL MAPPING OF SOMAVATHINADI BASIN USING REMOTE SENSING AND GIS TECHNIQUES, ANANTAPUR DISTRICT, ANDHRA PRADESH, INDIA

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Anantapur District is a hot and semi arid climate zone, falls in rain shadow zone with a very low annual rainfall of 520 mm. The recurrence of drought increased considerably and unless collective measures are initiated on a permanent basis the situation will become grim in future. Somavathinadi Basin in Anantapur District is selected to demonstrate the capability of high resolution satellite data in Hydrogeomorphology mapping. This Basin is located in Survey of India toposheet Nos. 57F/16, 57J/4, 57G/13 and 57K/01. This Basin with an area of about 452 sq km is underlined by hornblendebiotite gneiss, Granodiorite, closepet granite and by dolerite dykes. Hydrogeomorphological mapping was carried out on 1:10,000 scale using IRS-P6 LISS-IV satellite data. The satellite data facilitates to update the extent of built-up area, road and drainage network. In the basin are digitized, mosaiced and superimposed on hydrogeomorphology map. This helps to give site specific recommendation on ground water prospects In addition; the impact analysis of check dams constructed in the watershed is also discussed. Studies showed that after construction of check dams the water levels in wells increased, abandoned wells got rejuvenated, new bore wells came up resulting increased irrigated area.

Keywords: SOI toposheet, Satellite data LISS IV, GIS, Hydrogeomorphology

INTRODUCTION

Somavathinadi basin and its surroundings of hornblende biotite gneisses by North Latitudes 13°20'0" to 14°37'30'' and East Longitudes 77°40'0" to 78°35'0" is one of the chronically drought affected areas of Anantapur district, Andhra Pradesh (Figure 1). The study area situated in the eastern and southern part of the Closepet Granite, and western part of the Granodiorite. The hornblendebiotite gneiss predominantly of acid volcanic (Rhyolite, rhyodacite, quartz porphyry, quartz-feldspar porphyry, muscovite-sericite schist and quartz-sericite schist) with minor basic volcanic

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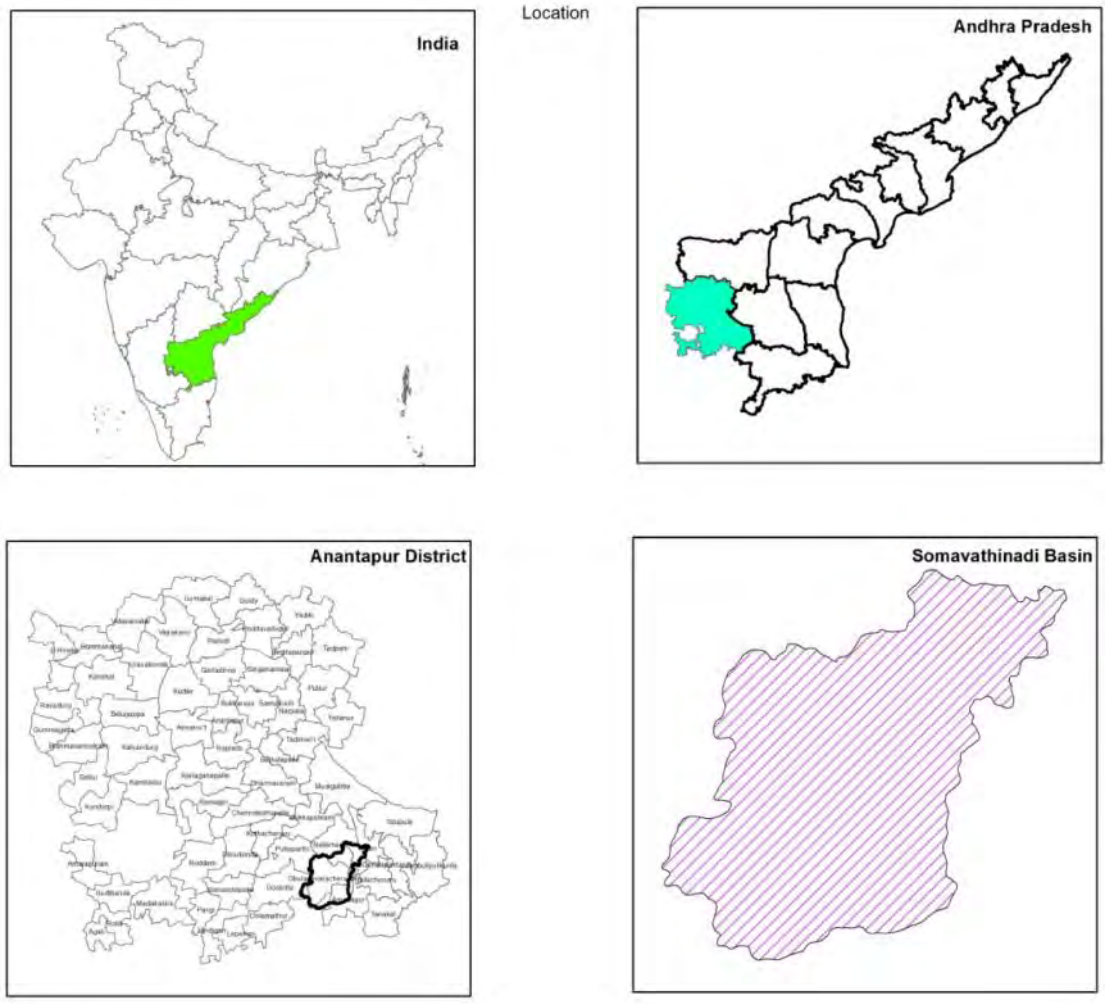
(Metabasalt and metagbbro/amphibolite) belonging to the Dharwar Supergroup. It is enveloped on all sides by migmatites and granites of Peninsular Gneissic Complex. Besides, impersistent bands of Banded Iron Formation (BIF) within acid volcanic occur as minor intercalations. The above lithounits are traversed by pegmatite veins, quartz reefs, calcite veins and dolerite dykes (Figure 2).

STUDY AREA

Somavathinadi area Anantapur District, Andhra Pradesh state longitude 77°40'00" to 78°35'00" latitude13°20'00" to 14°37'30" Basin area around 452 sq km. Four Mandals are covered namely Gorantla, Obuladevacheruvu, Nallamada, Amadgur, and Kadari. The Study area is mostly plain land and western part is covered with residual hills, Denudational hills and some pediments are there. Anantapur district area experiences semi-arid climate, the summer is very hot and the Mercury rises to + 42° Celsius. Winter is pleasant; night temperature is about 13° Celsius to 15° Celsius. Average rain fall per annum 168.1 mm in the year of 2017.

Figure 1: Location Map of Somavathinadi Basin, Anantapur District, AP



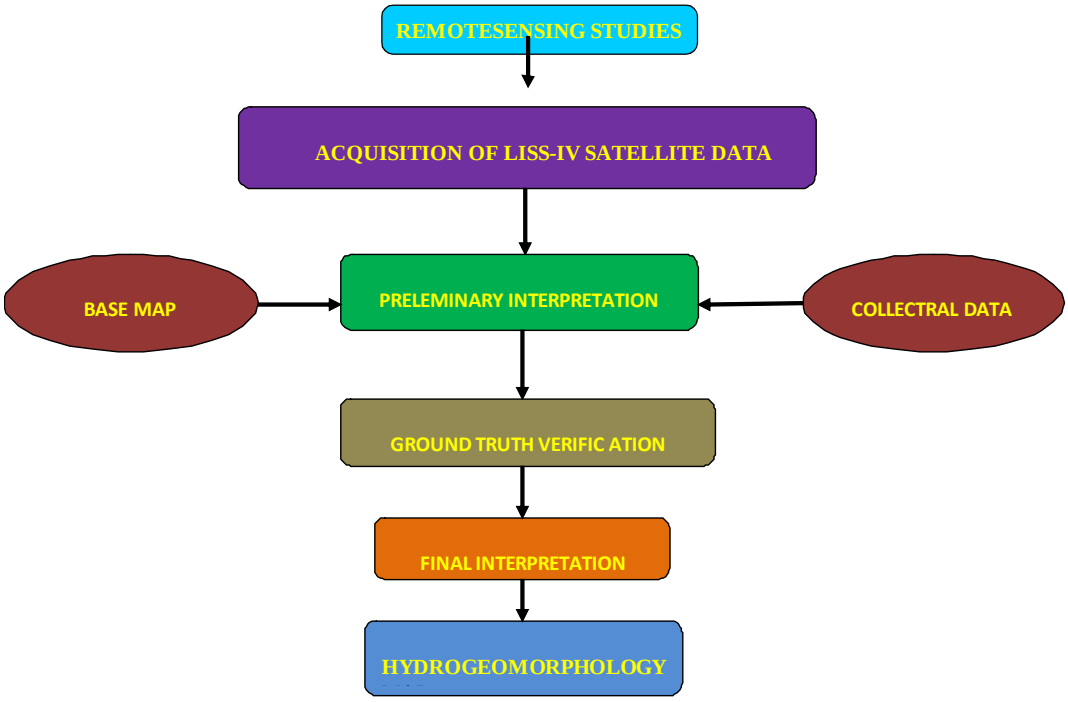
METHODOLOGY

High resolution Indian Remote Sensing satellite, IRSP6 LISS-IV data of 8th March, 2012 and 12 February, 2012 with a spatial resolution of 5.8 m covering Somavathinadi is analyzed. Onscreen interpretation is carried out delineating different geomorphological units/landforms, lithological formations, geological structures and hydrogeomorphological map is prepared by integrating the above said parameters (NRSA, 2008). Further, well inventory data collected during fieldwork is made use in finalizing hydrogeomorphological/ ground water prospects map of the study area on 1:10,000 scale (Figure 2). By zooming the satellite data up to 1:4,000 scale, extent of built up area, drainage and road network is updated as well as with hydrogeomorphology map. The Drainage, Road network layer is superimposed onto the hydro geomorphological map to give local-specific ground water locations for drilling.

Geomorphology

Geomorphology involves study of landforms, reconstruction of process responsible for their rigin and study of influence of tectonics in time space frame. The geomorphological mapping includes inventory and classification of landforms. Each landform depends by its composition depth of weathering structural frame and the environment which includes soil cover, hydrology and hydrogeology. The landfroms are classified on the basis of mode of origin, relief slope factor and surface cover. The landforms occurring in the area as grouped as denudational hill, residual hill, pediment, pediplain, linear ridges and The geomorphological mapping is important for understanding resource potential, resource utilization, resource depletion and degradation associated with landforms. Pediment, pediplain, is the most important landforms delineated in the area using the geocoded imagery. Each land form

Figure 2: Flow Chart of Methodology

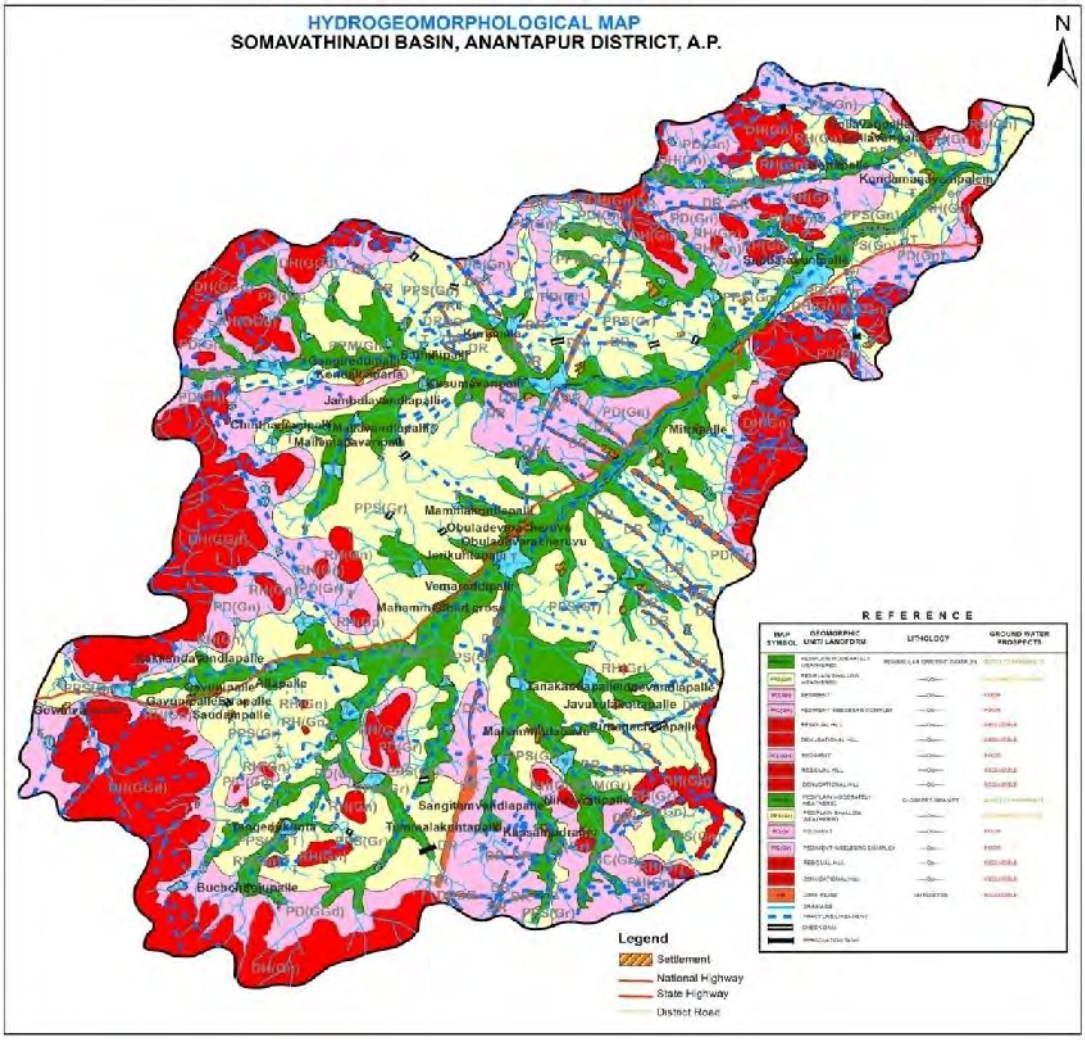


is defined by its composition depth of weathering, structural form and the environment area includes soils, slopes, vegetation cover, perennial or ephe perennial stream network and tanks and ground water resource. Geomorphic zones play a very important role in understanding occurrence and distribution of groundwater. Geomorphological mapping through Satellite Remote Sensing gives very useful information about spatial variation of aquifer's material but when coupled with geophysical electrical resistivity (VES) survey it gives depth wise information also.

Denudational Hill (DH)

Acts as a run-off zone, Limited prospects along fractures at the lower levels. It is a granitic hill formed due to differential erosion and weathering so that a more resistant formation stands and occupies a large area. The groundwater prospects are negligible in this area as it acts as a runoff zone contributing very limited recharge to the narrow valleys within the hills and surrounding plains. Poor yields are expected along fracture/lineaments.

Figure 3: Hydrogeomorphology Map of Somavathinadi Basin, Anantapur District, AP



Residual Hill (RH)

It is an isolated low relief relict hill occupying considerably small area. The groundwater prospects are poor. These landforms are seen in the granite terrain of the area. These landforms are located in the North part of catchment area.

Pediment (PD)

It is a gently sloping smooth surface of erosional bedrock of granite gneiss between hill and plain with thin veneer of detritus. This unit forms runoff zones with limited prospects along favorable locales. In general, the ground water prospects in this landform are poor.

Pediment Inselberg Complex

Pediment inselberg complex is mixture of two terms pediment + Inselberg .But this not found in standard text books on Geomorphology. It is a gently sloping smooth surface of erosional bedrock of Hornblende-biotite gneiss between massive isolated hill and plain with thin veneer of detritus. In general, the ground water prospects in this landform are poor.

Dyke Ridge (DR)

These are dykes a narrow linear ridge with heap of boulders of dolerite composition or steep massive ridge standing above the ground level or sometimes highly jointed. Which generally act as barriers for ground water movement? Negligible to poor yields are expected in this landform. Moderate yields are expected in the upstream direction.

Pediplain Shallow Weathered (PPS)

It is a gently sloping flat and smooth surface of weathered granite gneiss with less than 10 m of Weathering generally covered with red soil. Poor to moderate yields are expected in this unit. Moderate yields are expected along fracture/ lineament.

Pediplain Moderate Weathered (PPM)

Here the pediplain Moderate weathered is characterized by a gently undulating to flat topography spreading over the granites, gneisses and schistose formations. Pediplain Moderate occupies a very small area; patches of pediplains are noticed around Kadiri and also on either side of Kadiri – adanapalle road. The pediplain is mostly covered with reddish-brown, medium-to coarse-gravel and at places pebbly soil ranging in thickness from 20 cm to 30 cm. Sheet wash, rill and gully erosion are quite common in the area and a major part of pediplain is under dry cultivation of groundnut and millets.

CONCLUSION

The Indian Remote Sensing satellite (IRS P6 LISS-IV) data with a spatial resolution of 5.8 m can be enlarged even up to 1:4,000 scales. With the help of high resolution data, expansion of rural settlements, drainage and road network is updated. The boundaries of all geomorphic units are drawn more precisely. With the advent of high resolution satellite data, Geologically the area is mainly occupied by Hornblende biotite gneiss. It is a linear Archean greenstone belt Dharwar group of closepet granite and southwestern part of the Cuddapah Basin. The structures associated with these rocks played a dominant role in the occurrence and movement of groundwater. Remote sensing data has been used to interpret the landforms in order to identify the groundwater prospect zones. The promising groundwater zones are the stream channels (alluvial/colluvilal plains) being high in porosity and permeability. Pediplains are classified as moderately favorable zones of groundwater. Major part of the area is

occupied by Pediplain shallow weathered and moderate weathered denudational, residual and that act as run-off zones, hence generally not favorable for groundwater exploration.

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