

Analyzing Hydro-Climatic activities of Girnar Hill area Using Geospatial technique

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ABSTRACT: In today's world climate change and sustainable development is very important part of research. Many of countries are spending many money and resource to these climatic studies. These study should be precise & accurate with optimum time limit. Hence there is a need of effective methodology so that these climatic study can be made effective and precise. Using this methodology several field of spatial application can be supported i.e. flood modelling and storm water drainage designing (by calculating runoff and infiltration). This model can also be utilised in agriculture scenario that how crops will behave with respect to land use and land cover, enhanced use of pesticides can also be directed using this approach. Siltation and sedimentation can also be calculated. Many other spatial significance may be arise by preparing this methodology. The aim or objective of this study is to provide a suitable method in aspect of hydrology and climate monitoring so that this method can be adopted by any one as an optimum way to sort climate and weather related study. For this purpose the study area is taken as a Hill area from Gujarat INDIA. As a part of methodology initially preparation of landuse land cover map than spatial representation of earth information i.e. soil than it involves simulation of 30 years of weather data. Major parameter will be land use land cover changes, solar, rainfall precipitation, wind, relative humidity. All this parameter will be taken as input to this research method. Major outcomes will be as -1-Modelling i.e. Hydrological and land cover changes 2- Simulation i.e. for weather assessment 3 - visualization of climate spatial data 4 - Validation and comparison. Final product methodology will also validated using systematic approach. Based on the output a desirable conclusion will be made and further future scope application will be projected.

KEY WORDS: Optimum methodology, Climate, Hydrology, sustainability, Geospatial technique, GIS, land use land cover, simulation, modelling, visualization,

1. Introduction

India is a huge and dynamic country, many of region are suffering problem of water and other climatic problem. There is a need of an effective method or model. So that this problem can be identified and precisely analysed or it may say that there is a need of an optimum and quick model for analyzing this hydro-climatic problem.

This research aiming to propose a GIS based method which uses both spatial and non-spatial data. This data may be of highly temporal in nature (i.e. periodicity). This model is dependent of several weather related parameter like precipitation, solar, wind and relative humidity. All this data is use to evaluate hydro-climatic nature of region.

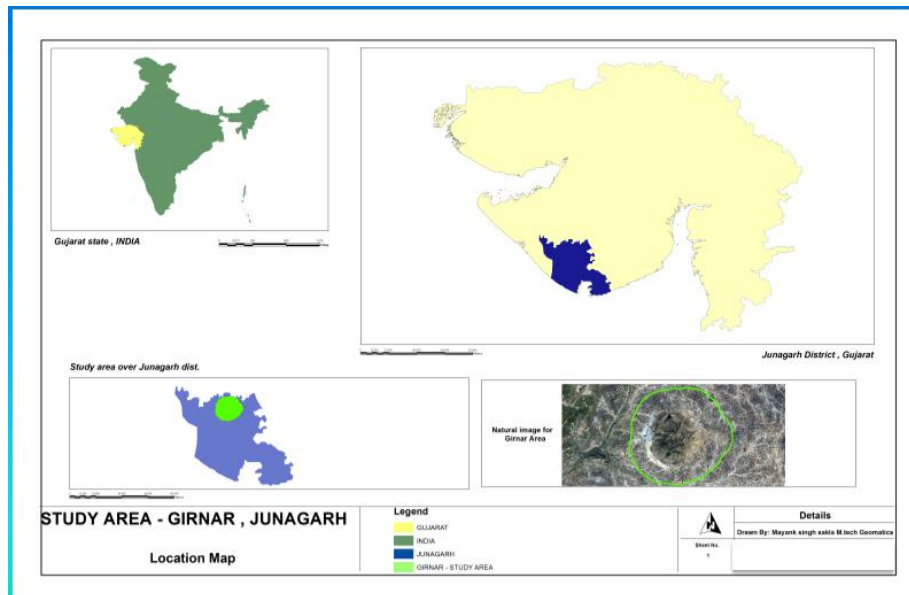
2. Study Area

This research is focusing over a hilly region in Gujarat State of India. The hilly region is selected because of dynamic nature of study area i.e. green cover, terrain profile and tourist spot for pilgrims.

Location – 21°31'12.1"N 70°32'57.5"E

Elevation - 1,031 m

Girnar, also known as Girinagar or Revatak Pravata, is a group of mountains in the Junagadh District of Gujarat, India, situated near Junagadh.



GIR hill, Junagarh Gujarat INDIA

3. Data and Software used

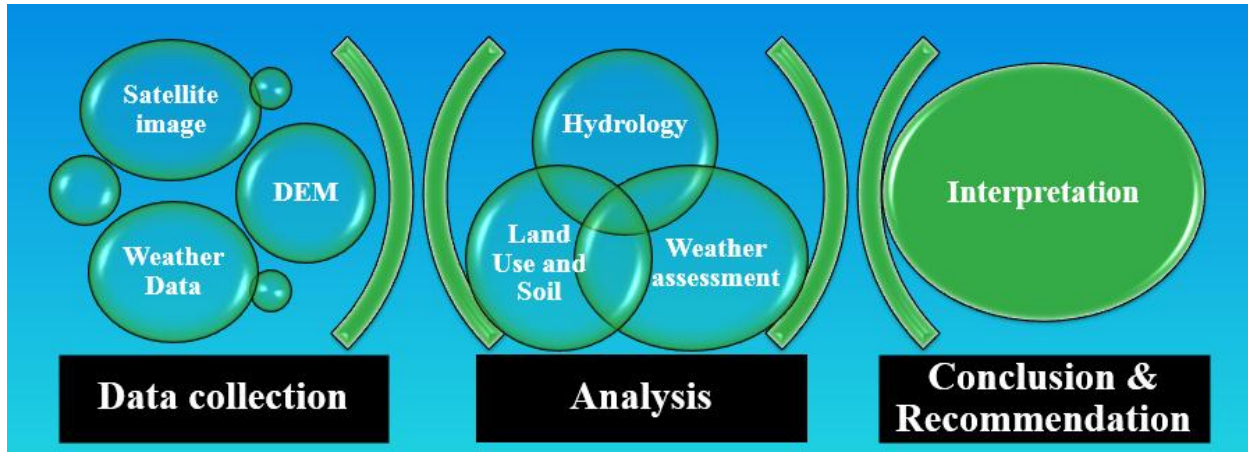
Spatial data	Non-Spatial data
Satellite imagery Resourcesat –LISS III	Weather data <ul style="list-style-type: none"> • Rainfall • Humidity data • Wind data • Solar energy data
DEM	Soil data
Boundary shape-file	Properties of soil

All this data mentioned in shown table is taken for span of 36 years so that a proper simulation exercise may be achieved. The temporal variability of data is from year 1979 to 2014.

Software used – ArcGIS 10.2.2
 Arc SWAT and Q GIS

4. Methodology

The Working methodology of this research study is very deep and analytical because of use of several dataset and formulas of concept proving. The conceptual methodology to describe this paper is shown under – as under three phase of work i.e. data collection and preparations than analysis over this collected spatial and non-spatial data and final conclusion statement after a careful interpretation.



Conceptual Flow Chart

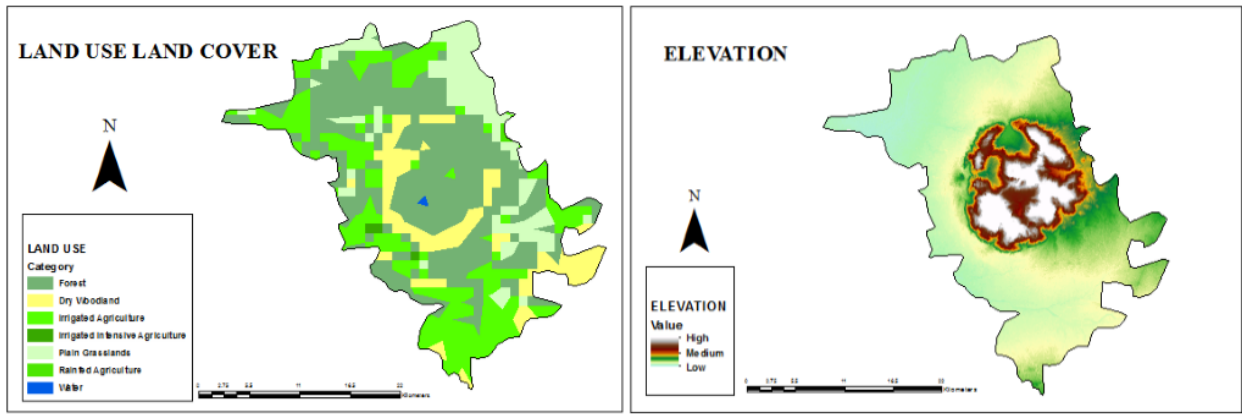
Working methodology for this analytical study consists of initially data preparations which includes land use maps, slope map, soil classification etc. all this prepared data is significantly used as input for soil and weather assessment tool in Geographical Information System (GIS). This work further consists of hydrology data and calculation on various DEM (digital elevation model) based output i.e. flow direction, flow accumulation, stream generation and grading over DEM. All this generated stream and accumulated flow is used for calculation of outlets and delineation of watershed along outlet or pour points.

This generated watershed is further used for calculation of basin and sub basin parameter. Over laying of landuse and classified slope over this watershed delaminated area is achieved so that proper relation between landuse and hydrology may be maintained. This overlay analysis along incorporated several weather parameter i.e. precipitation value, solar, wind and relative humidity. All this above mention generated parameter is used as input to SWAT model. For this study to be carried out 36 (thirty six years) years of data has been taken and simulation over this spatial and non-spatial parameter is achieved. As a output to SWAT model, this analysis will gives runoff, infiltration, evapotranspiration, lateral flow, aquifer information and too many crop related and climate related information which may be used for planning and strategy management purpose.

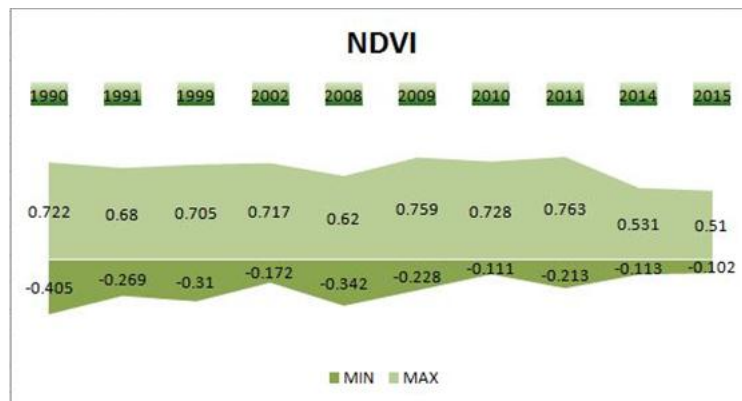
5. Analysis and Results

The overall analysis is done keeping in concerned the relation of climate and hydrological parameter.

Landuse land cover map and Elevation profile for Junagarh taluka

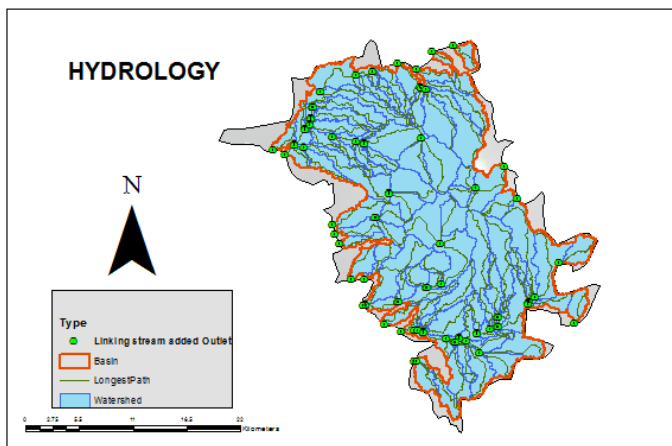


The above two map showing two dimensional and three dimensional profiling of study region. LISS III image are used to prepare landuse land cover classification map using supervised classification algorithm. For three dimension profiling and slope calculation Cartosat image of 2.5 meter spatial resolution is used.



Temporal dynamic range of NDVI (Normalized Difference Vegetation Index)

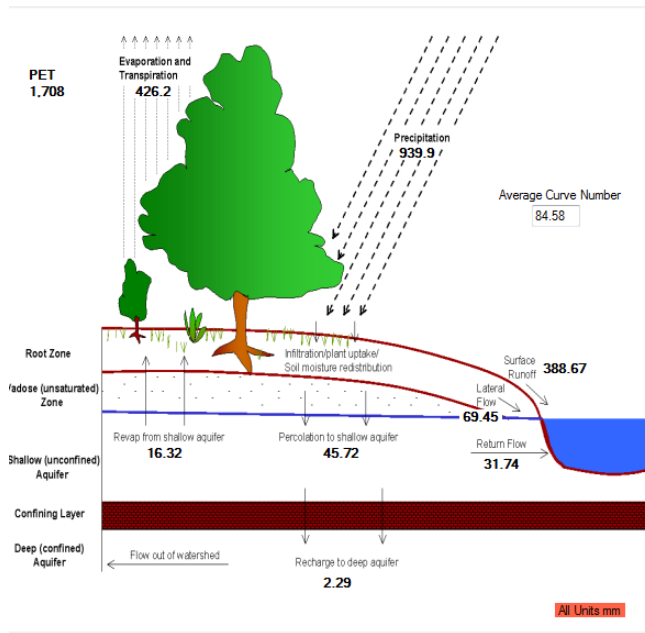
In the above mentioned map digital analysis technique of image enhancement for calculation of NDVI over temporal data. This segment of NDVI calculation is adopt in such a thinking that relation can be analysed between climate and hydrologic response unit.



Hydrology map

The along hydrology map shows delineation of watershed and basin. It also shows location of outlet points.

All this output is generated from SWAT. Simulation workout is adopted over this data of watershed and basin after calculating sub basin and basin parameter.



Output - Hydro-climatic Analysis

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Evapotranspiration, Aquifer information

Runoff, Lateral flow, Return flow

Inference from hydrological response unit

- Surface Runoff - High
- Ground water – Low
- Lateral Flow is greater than Ground water
- Sediment yield may be too high
- Surface runoff may be excessive
- Less than 22% water is base flow
- Average sediment >> 10 metric ha

6. Conclusion and recommendations

- One of the major problems faced around the world is water scarcity and this study gives the prime solution to that which region to be treated as prime focus so that problem redressing may be achieved.
- A proper relation between landuse, soil, water and water conservation was brought out.
- Hydrological response unit also suggests the quantity of Nitrogen and phosphorous required for the crops or biomass.
- This study would help to decide on which aquifer to be recharged.
- Rain water harvesting could be improvised using this methodology.
- More data of reservoir and other pits if available, the study could be taken to another horizon.

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