Abstract

Accurate delineation of watershed and drainage networks is crucial for hydrological and geomorphological models, water resource management, change of floodplains, flood risk management, and surface water mapping. Since high-resolution digital elevation models (DEMs) are often not available, it is necessary to evaluate open source products. Various statistical measures were used to estimate the vertical accuracy of these freely available DEMs. Moreover, DEM products from SRTM, ASTER and Cartosat data were also compared. The study areas are located in the Vadodara district of Gujarat State of India. A comparison of SRTM-, ASTER-, and Cartosat-derived DEMs allowed a qualitative assessment of the vertical component of the error. The results depicted that Cartosat DEM should be given first preference followed by the SRTM DEM for the area under study, where the relief class belongs to a flat relief.

Information on land use and land cover plays a key role in analyzing earth information for human development. It plays a significant role in planning, management, and monitoring programs at the local, regional, and national levels. The study shows a novel approach to analyse Sentinel–2 multispectral satellite data using traditional and principal component analysis based approaches to evaluate the effectiveness of maximum likelihood estimation, random forest tree, and support vector machine classifiers to improve land use and land cover categorization.

The quantitative study of the morphometric features of watersheds is of considerable importance in the prediction of flood behaviour. The watershed hydrological response can be connected to the physiographic features of the watershed. The study evaluates the linear, aerial and relief morphometric parameters using the Cartosat-1 digital elevation model (30 metres) along with the curve number for assessing the flood influencing characteristics of the Vishwamitri River's sub-watersheds. The study prioritizes five sub-watersheds as high, medium, and low based on their flood influencing characteristics and compound value, as a result, needs the highest priority for flood mitigation measures. The integrated analysis of morphometric, land cover, and topographic analysis for characterising the hydrological behaviour of the Vishwamitri watershed, may be the sensible alternative until the automated observation network is built in such areas.

Flood hazard and flood risk maps are the main components of flood risk management around the world. An approach has been developed for operational flood extent mapping. Despeckle filters with excellent noise extraction capacities often appear to degrade the spatial and radiometric accuracy of the actual image and trigger image reflection deterioration. The most preferred speckle filters (Boxcar, Gamma map, Frost, Lee, Lee sigma and Median) with Kernel are, therefore, assessed in the current study over the data from Sentinel-1, intended for flood mapping applications. To evaluate the performances of a despeckling filters mean square error, speckle

suppression index, speckle mean preservation index and equivalent number of looks are used as performance measures. The Sentinel-1 (VV-vertical transmit, vertical receive and VH-vertical transmit, horizontal receive) polarised filtered data were later used for performance evaluation of machine learning algorithms, namely, random forest (RF) and support vector machine (SVM), to classify an inundated area. Moreover, the ability of the 2D-hydraulic model (rain-on-grid model) at the watershed scale to simulate flood events and predict flood-prone areas, considering multiple rain gauge data, which will facilitate more accurate flood inundation where ground-based observational data are limited or unavailable is shown.

The integrated watershed management is a multidisciplinary approach for rational utilization of natural resources existing in the watershed. A GIS-based conceptual framework is applied with MCDM technique using AHP to produce suitability map of potential runoff storage zones within the watershed. The conceptual framework will help to identify potential runoff storage zones for water storage sites based on the various physical characteristics (Rainfall, Slope, Land use/land cover, Height above the nearest drainage, Stream order, Curve number (CN), Topographic wetness index (TWI)) of the Vishwamitri watershed. Result shows that 17 % of the study area is optimally suitable, 33.2% of the area is moderately suitable, 33.1 % of the area is marginally suitable and 18.7% of the area is not suitable for water storage zones/structures.

In recent decades, population growth, industrialization and urbanization have directly affected landscape pattern metrics in developing countries. The study explores the impact on land surface temperature due to the spatial clustering of urban landforms with normalized difference vegetation index, normalized difference water index and dry bare-soil index. In order to determine the contribution of different land use/land cover classes in affecting the land surface temperature, the contribution index was used for summer and winter seasons. For analyzing the intensity of land surface temperature at the local scale, landscape index was used. Furthermore, the land surface temperature is estimated and explored by four machine learning and statistical models, including K-NN regression, NN, RT regression and SVM regression. It is hypothesized in the study that the explanatory variables (NDVI, NDWI and DBSI) influence the spatial changes of land surface temperature significantly in the study area. Meanwhile, all these three explanatory variables were also calculated at the 2 levels of the observation grids unit. Since, apart from sunlight, the land surface temperature is also affected by the surrounding land cover. A mean moving kernel of 2×2 and 5×5 were used as the observation grids unit for each explanatory variable. The model can help to predict land surface temperature under temporary cloud cover spots, which are present in the data at the time of the acquisition using neighboring biophysical (cloud free) independent variables relationship with land surface temperature.