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Historical water body changes using spatio temporal indices - a case study of Dakshina Kannada

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Abstract

The spatiotemporal shift of surface water affects the structure, performance, and development of the ecosystem in Dakshina Kannada as well as its agricultural, economic, and social development. In order to better recognize the long-standing variations in the surface water area in Dakshina

Kannada, the study used all available Landsat images, the modified Normalized Difference Water Index (MNDWI), the Enhanced Vegetation Index (EVI), and the Normalized Difference Water Index (NDWI) to map the open-surface water from 2014 to 2020 in the Google Earth Engine (GEE) cloud platform. The study looked at precipitation, temperature, and irrigated land to see how weather variation and anthropological actions affect long-standing surface water changes. The following are the outcomes. (1) The Dakshina Kannada, the extreme, periodic, and yearly average water body area values have all decreased during the last 8 years. In the meantime, the number of extreme, periodic, and lasting waterbodies has been steadily increasing. (2) The maximum water body area influences the variance of surface water area in the Dakshina Kannada, whereas the number of minimum water bodies influences the variation of water body number. (3) The area and number of water bodies are statistically significantly improved by rainfall, which also significantly improves water body area and number. The city's water surface area has changed significantly during the last 8 years, according to this study.

Introduction

Surface water resources play a significant role in supporting nationwide financial growth and preserving the stability of global and water environments as part of the land–water cycle [1]. Ecosystems, agriculture, and the natural environment When it comes to global climate change, there are many different types. The temporal and spatial differentiation of water resources is clearly visible [2], [3]. It's true Strengthening the active identification and examination of water resources is critical, predominantly for arid and semi-arid environments. The water resources are changing, and the efficiency of those resources is improving. Economic development and agricultural productivity are critical. Due to the escalation of human activity and global climate change over the last century, the surface of the earth has changed dramatically. Water resources have been plagued by issues such as a rapid decrease in water volume, deterioration of water quality, and shrinking of the area. These issues have resulted in significant losses in life and agricultural production for residents of the Dakshina Kannada, as well as a significant impact on the local economy's development. Problems like shrinking surface water areas, fragmentation of the water landscape, and environmental degradation have sparked considerable concern. Surface water dynamic monitoring is a major topic in resource and environmental change research [4]. Surface water change data must be collected in a timely and correct manner if water resources are to be protected, utilized, and developed sustainably. Wide coverage, high return frequency, rich information, and low cost are properties of remote sensing image data, which are employed in land use and land cover mapping with diverse time–space spectra [5]. Mechanism learning techniques and classical algorithms are two types of surface water extraction processes based on remote sensing data [6]. Support Vector Machine (SVM)[7], Random Forest (RF) [8], Decision Tree (DT) [9], Deep Learning (DL) [10], and other machine learning algorithms are examples. Machine learning methods necessitate expert knowledge of sample selection and algorithm training, and fast mapping huge geographic scales like the world and a country is difficult [11].Various band indices

of water extraction for multispectral data are available in the current context[12], [13] these procedures. Each method has its own set of benefits and drawbacks. Some of the potential strategies for extracting water bodies that are being investigated in this study are as follows. The main objective of this study is to compare the NDWI, MNDWI, and AWEI for the study area from 2014 to 2021 using Landsat 8 satellite imagery in Google Earth Engine also study the change water body surface area for various years using different indices.

Section snippets

Studyarea

The coastal city of Mangalore serves as the administrative centre for the Indian district of Dakshina Kannada. Because Mangalore stands as a major hub, it is the only district headquarters of Karnataka to have connectivity to all major modes of transportation: road, railway, water, and air. Dakshina Kannada district had 2,083,625 people who live there as per the 2011 Indian census.

Seashores in the west and the Western Ghats in the east make up the district's geography. Most of the soil is…

Landsat data

For this investigation, top-of-atmosphere (TOA) reflectance pictures calibrated to Landsat 8 Collection 2 Tier 1 from January 2014 to December 2021 are used. It has a 30m spatial resolution. Tier 1 is intended for the best-quality Landsat images are those that are suitable for time-series processing analysis. Tier 1 data will include Level-1 Precision Terrain (L1TP) processed data with well-characterized radiometry and inter-calibrated across the numerous Landsat sensors [14].…

Sentinel data

Sentinel-2…

Methodology

The following methodology carried out determine the process.…

Quantitative changes in waterbodies

In this instance, AWEI produced superior surface water delimitation findings compared to the other two approaches. Since it only barely accomplishes the demarcation of the channel, the

surface water extraction utilising NDWI was the least effective. Regarding the delineation of surface water, MNDWI is an intermediate state.

The difference of water body surface area shown in (Fig. 3). The NDWI index shows in during the year of 2014 to 2020 is downward trend. The value of 2014 is 26.52 and it is…

Conclusions

Surface water data has been extracted and analysed using satellite sensors with varied spatial, temporal, and spectral resolutions. Studies based on NDWI and MNDWI, AWEI have been used lake extraction lakes. MODIS imaging is commonly used for coverage of wider areas. NDWI map shows the 10.41% decrease in the water body surface area from 2014 to 2021.MNDWI map shows the 23.13% decrease in the water body surface area from 2014 to 2021.AWEI map shows the 7.46% decrease in the water body surface …

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.…

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