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GEOSPATIAL ANALYSIS OF WATER EROSIONAT DISTRICT LEVEL IN INDIA

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Abstract

The general objective of this paper was to study the hot spots of covid - 19 – epidemic at district level in Uttar Pradesh during1st May 2020 to 1st June2021. Four specific objectives were set as the first to know the Trend of Covid Cases in Uttar Pradesh, the second was to map the Hotspots for Confirmed and death Cases, third to analyse the relationship between Confirmed & Diseased cases and finally the fourth to know the spatial pattern of the residuals obtained from studied relationship. COVID19-India API dataset was used *for conformed and death Cases at district level in Uttar Pradesh*.The results show the overall trend of the confirmed cases and death cases was strongly positive with r^2 values of 0.76 & 0.98 respectively. The six hot spots for confirmed cases were identified as 01 at 99%, 03 at 95% & 02 at 90% confidence level. The six hot spots for death cases were identified as 03 at 99%, 02 at 95% & 01 at 90% confidence level.The results of the Ordinary Least Squares (OLS) linear regression show the strong positive relationship in between both the variables. There were 11 districts below - 0.5 Std. Dev (standard deviation) and 11 districts above + 0.5 Std. Deviation. The results of Probability ($p < 0.01$) and Robust Probability ($p < 0.01$) indicate coefficient is statistically significant. Spatial pattern of the residuals with p-value (0.037097) is statistically significant, and the z-score (2.084691) is positive. So, spatial distribution of residual's high values and/or low values in the dataset is more spatially clustered. Results indicate the districts in central part were more affected due to Covid-19 in Uttar Pradesh. This work will help to identify the more variables to explain the variability in the covid-19 cases in Uttar Pradesh.

Keywords*: COVID19,Geostatistical analysis, Hot Spot Analysis.*

1. Introduction

In this work trend analysis was performed using Excel, hot spot and spatial relationship was analysed using ArcGIS.

It was significant to study because, the same topic has not been studied widely by geospatial experts using space time cube analysis. The findings of the work will help the policy makers to develop the programmes to minimise the spread of Covid-19 and to minimise the deceased rate in hard hit districts by providing infrastructure in the health centres.

2. Materials and methods

2.1 Study Area

Uttar Pradesh, the most populous and fourth largest state of India. It lies in the north-central part of the country (Mathur, 2020). Uttar Pradesh regional state of India was chosen as a study area, it extends between latitudes 23°51'30.454"N and 30°24'44.389"Nand longitudes 77°9'14.694"E and 84°39'28.416"E(Fig. 1).It with a total area of 243,290 square kilometres is India's fourth-largest state in terms of land area. Uttar Pradesh with a population of more than 166 million holds distinction of being the most populous state in the country followed by Maharastra (97 million) and Bihar (83 million). ("Census of India" 2021).

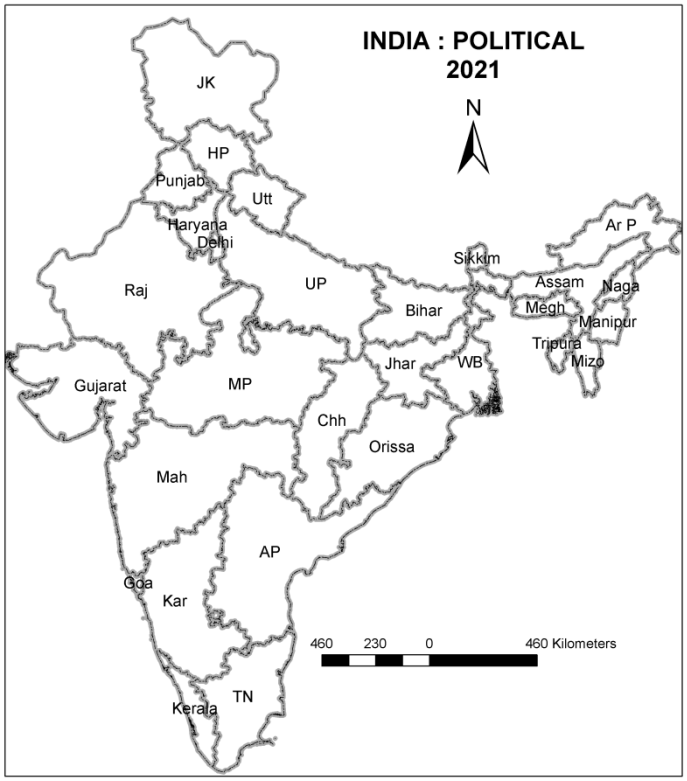

Fig. 1The study area

2.2 Data used

2.2.1 District Boundaries

Information on district boundaries was collected from official website of Indian Geo Plateform of IISRO, National Remote Sensing Center, Government of India (https://bhuvan.nrsc.gov.in/bhuvan_links.php#) ("ISRO," 2021).

2.2.2Water Erosion Data

Satellite data

Three seasons' Ortho-rectified Resourcesat-2 LISS III satellite data viz. Kharif, Rabi & Zaid for the years 2005-2006 were used as base data for visual analysis. Approximately 300 LISS-III scenes were used for each season mentioned above. The initial mapping was carried out with Lambert Conical Conformal (LCC) projection. The final outputs were later converted Albers equal area with parameters. Projection: Albers Conical Equal Area projection Spheroid: WGS84 Datum: WGS84 Standard Parallel 1: 28:00:00 N Standard Parallel 2: 12:00:00 N Central Meridian: 78:00:00 E Origin of Latitude: 20:00:00 N. (NRSC, 2007).

Legacy/ancillary data

For mapping land degradation on 1 : 50,000 scale, available land use/land cover, wetland and wastelands thematic information from similar scale was used. Besides, forest cover map generated by FSI were also referred to. The 1:250000 scale salt-affected map generated under national mission was also used as reference information while mapping. Apart from this district boundaries from India WRIS and Survey of India topographical maps, meteorological data, soil maps and DEM information were used as inputs Universal Soil Loss Equation to assess the soil loss especially while mapping water erosion categories. The process-wise land degradation maps at their original scale were collected as thematic service from Bhuvan at following URL.

http://bhuvan.nrsc.gov.in/gis/thematic/index.php

2.2.3Work Flow Chart

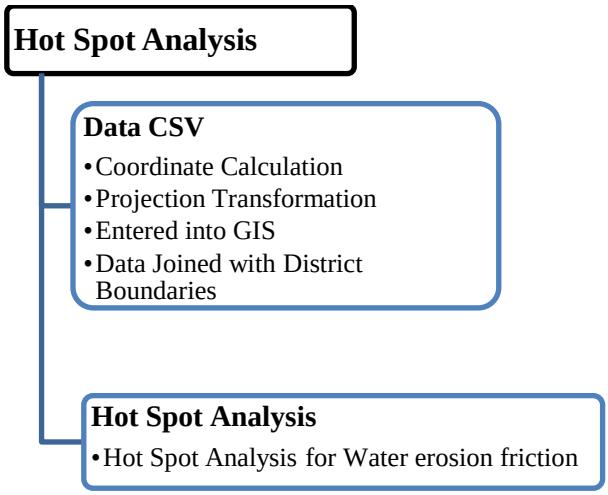

Fig. 2 the flowchart of the used methodology in the study area

2.3 Data Analysis

2.3.1Hotspot analysis

Getis-Ord Gi* statistic was used to identify hot spots.

The Getis-Ord local statistics is given as follows:

$$G_i^* = \frac{\sum_{j=1}^{n} w_{i,j}x_j - \bar{X}\sum_{j=1}^{n} w_{i,j}}{s\sqrt{\frac{\left[n\sum_{j=1}^{n} w_{ij}^2 - \left(\sum_{j=1}^{n} w_{i,j}\right)^2\right]}{n-1}}} \quad (1)$$

Where $x_j$is the attribute value for feature *j*. $w_{ij}$is the spatial weight between feature *i* and *j*. *n* is equal to the total number of features and:

$$\bar{X} = \frac{\sum_{j=1}^{n} x_j}{n} \quad (2)$$

$$z_I = \sqrt{\frac{\sum_{j=1}^{n} x_j^2}{n}} - (\bar{X})^2 \quad (3)$$

Getis-Ord statistic is a z-score so no further calculations are required.

3.Results

3.1. Hot Spot area of water erosion in India

The graphical representation of overall trend of confirmed cases is shown in Figure 1. The trend line shows large gap in the later half the time period, it indicate abruptly raise of the confirmed cases.

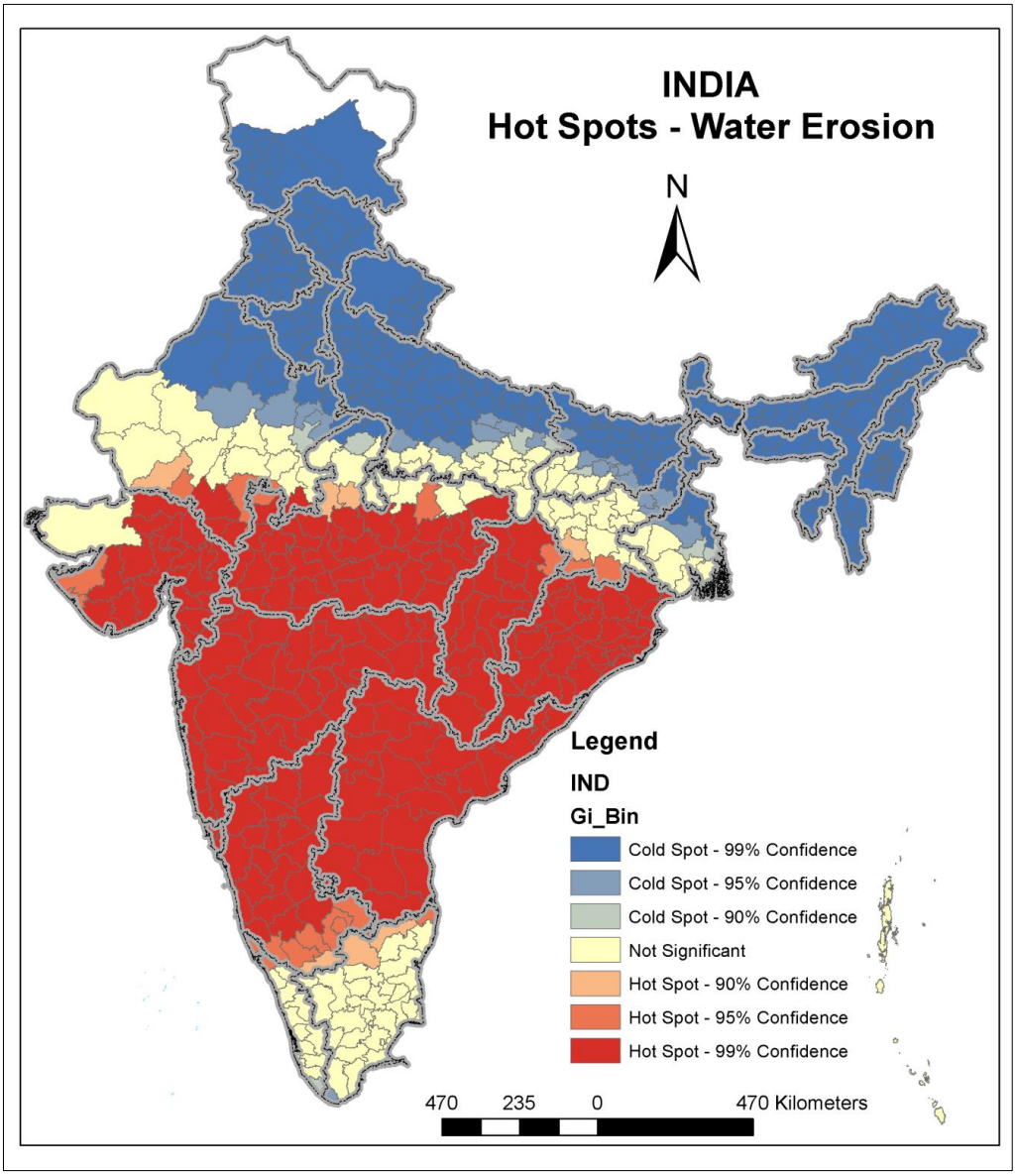

Fig. 1Water Erosion

Table 5 : Global Moran's I Summary

Moran's Index	0.084847
Expected Index:	-0.013514
Variance:	0.002226
z-score:	2.084691
p-value:	0.037097
Distance Threshold	102382.6104 Meters

4. Discussion

The major findings of this study are first there is overall increasing trend of the Corona – 19 cases in Uttar Pradesh. Secondly there is a significant spatial and temporal variation in the confirm and decease cases at district level in Uttar Pradesh. Thirdly there are eleven districts which have performed well on the other hand eleven districts have not saved the life as compared to rest of the districts in the most populous state of India. The performance of the state compare to another states of India have been remarkably outstanding well.

Overall increasing trend of the Corona – 19 cases in Uttar Pradesh is mainly because the state the most populated in India.

The result of ordinary least squires demonstrates a correlation between the findings and reports published. Lucknow still has the highest number of active cases with 44,145, followed by Kanpur Nagar with 17,856, Varanasi (15,454), Prayagraj (13,186).This trend is long term but in short term reported by Chief Minister Yogi Adityanath while chairing a Covid review meeting on 12th June 2021. "The number of active Covid-19 patients has come down to 9,806, which is similar to the situation before March end. An average of more than 2.5 to 3 lakh tests conducted daily has ensured that the cumulative positivity rate is sustained at low levels and is presently following a downward trajectory. UP's daily test positivity rate was 0.19 per cent which is one of the lowest figures in the country. The recovery rate has climbed up to 98.1 per cent," (Express News Service, 2021).

Conclusion

The major research question answered in the present work was to find the spatial and temporal variability in term of corona conformed cases and deceased cases at district level. The research explored the potential use of space time pattern mining tool provided by ArcGIS platform for geospatial analysis. The findings will be helpful for all stockholders working to minimise the Corona problem.

Acknowledgement

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Conflict of interest

The authors declare no competing financial interests.

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