# FORECASTING REGIONAL TOURISM FLOWS IN ALBANIA USING ARIMA AND SPATIAL ANALYSIS: A DATA-DRIVEN APPROACH BASED ON NATIONAL ACCOMMODATION STATISTICS

***Medjon HYSENAJ*** [1*] ***and Ditmira TAHIRI*** [2]

DOI : 10.21163/GT_2025.202.11

**ABSTRACT**

Geographic Information Systems (GIS) have become essential tools for tourism planning and management, enabling spatial analysis and advanced data visualization. This study adopts a data-driven approach to forecast and interpret regional tourism flows in Albania by integrating GIS techniques with statistical time series modelling. The spatial component involves mapping tourism activity across three macro-regions North, Centre, and South while distinguishing between coastal and non-coastal zones using official data from the Albanian Institute of Statistics (INSTAT). To complement the spatial analysis, the study introduces a temporal dimension using a matrix-style visualization that highlights seasonal tourism trends throughout 2024, and applies the ARIMA (AutoRegressive Integrated Moving Average) model to generate regional forecasts for 2025. This combination of spatial and temporal methods enables a more comprehensive understanding of tourism dynamics, revealing both geographic concentration and predictive seasonal patterns. The findings underscore the dominance of the Central Region, the growing potential of the North, and the strong seasonal pressure on coastal areas during peak months. By integrating GIS, heatmaps, and ARIMA forecasts, the study provides a strategic framework for sustainable tourism development and more informed regional policy interventions.

***Key-words:*** *GIS, ARIMA, tourism forecasting, spatial analysis, heatmap, seasonality modelling.*

## 1. INTRODUCTION

In recent years, spatial and temporal analysis tools have become increasingly important for understanding regional disparities in tourism flows. Tourism, as a dynamic and seasonal sector, requires both geographical and predictive modelling approaches to inform strategic development, infrastructure planning, and sustainable growth. Geographic Information Systems (GIS) enable policymakers and researchers to visualize, quantify, and interpret visitor behaviours based on spatial zones, density, and accessibility (Longley et al., 2010).

Albania has experienced steady growth in tourism, both from domestic and international markets, contributing substantially to national economic performance (Merko, Ndreu, & Merko, 2025). This trajectory has been reinforced by academic studies that highlight Albania's long-term tourism potential and the need for strategic sectoral development (Burlea-Schiopoiu & Ozuni, 2021).

Tourism has been identified by international institutions as a pillar of Albania's economic diversification and regional development strategy (World Bank, 2025). This trend has been identified as a key economic pillar in recent national assessments, with tourism contributing significantly to employment and regional development (International Monetary Fund, 2025). The country's diverse geography ranging from alpine northern areas to Adriatic and Ionian coastlines results in regionally uneven visitor patterns. Understanding the spatial and seasonal distribution of visitors, especially distinguishing between coastal and non-coastal areas, is crucial for balanced tourism planning and infrastructure investment. This growth has also been recognized at the international level, where Albania is increasingly positioned as a strategic destination for tourism investment and development (World Tourism Organization, 2024). This aligns with previous research highlighting the need for integrated and sustainable tourism development strategies in Albania (Ciro & Toska, 2018), particularly those that consider territorial disparities and environmental capacity limits

----------------------------------------------

[1*] *Dept. of Geography, Universiteti i Shkodrës "Luigj Gurakuqi", Albania. Corresponding author* medjon.hysenaj@unishk.edu.al

[2] *Dept. of Informatics, Universiteti i Shkodrës "Luigj Gurakuqi", Albania.* ditmira.tahiri@unishk.edu.al

While previous studies have employed GIS to identify spatial trends and regional concentrations (Hysenaj, 2015), this study introduces an integrated approach that combines spatial visualization with time series modelling. By incorporating the ARIMA (AutoRegressive Integrated Moving Average) model, the research forecasts regional tourism flows based on monthly visitor data from 2021 to 2024.

This predictive component allows for a forward-looking understanding of visitor patterns, particularly useful in assessing regional seasonality and planning off-peak strategies.

In parallel, a seasonal intensity chart is employed to capture intra-annual fluctuations in tourism activity across the North, Center, and South regions. By presenting monthly visitor distributions in a matrix format, the heatmap highlights the seasonality and intensity of tourism loads across regions, offering a compact and intuitive interpretation of temporal trends (Zhou & Liu, 2022).

The combined use of GIS, heatmap visual analytics, and ARIMA modelling represents a methodological advancement in tourism studies. It bridges the gap between spatial observation and temporal forecasting, enabling evidence-based policy decisions for resource allocation, infrastructure scaling, and marketing diversification. This integrated approach responds to the growing need for predictive spatial intelligence in tourism governance, especially in countries like Albania where regional imbalances and seasonal pressures are significant.

## 2. LITERATURE REVIEW

Prior studies have emphasized the pivotal role of spatial databases (SDBMS) and GIS technologies in supporting complex territorial decisions. Longley et al. (2010) established GIS as an essential tool for mapping spatial patterns in tourism, enabling planners to visualize accessibility, service dispersion, and environmental constraints. In Albania's context, Hysenaj (2015) demonstrated the use of geo-indexing and digital mapping to support urban and tourism development strategies, highlighting GIS's role in optimizing infrastructure and marketing initiatives.

More recent developments have extended GIS beyond static visualization to include real-time data integration and predictive modelling. Among these innovations, the emergence of digital twins virtual replicas used to simulate tourism dynamics has gained traction for its potential to enhance planning, personalization, and sustainability (Sampaio de Almeida, Brito e Abreu, & Boavida-Portugal, 2025).

Zhou and Liu (2022) conducted a bibliometric analysis showing a rise in research that combines GIS with advanced analytics such as machine learning, AI, and real-time sensor data to better predict tourism flows and environmental impact. This trend is further supported by Duarte et al. (2020), who provide a comprehensive overview of AI systems currently being applied to tourism optimization, forecasting, and user personalization. This integration enhances tourism resilience, particularly in regions facing seasonal overcrowding or ecological vulnerability.

A growing body of literature also points to the role of visual analytics, including intensity mapping techniques such as heatmaps, in tourism research. Heatmaps offer a clear and compact visual summary of seasonal variation and regional intensity in tourism flows (Kulyk & Sossa, 2018). When applied to monthly tourism data, they allow for intuitive comparisons between regions and reveal temporal spikes that can inform targeted marketing and service provision.

This approach is echoed in prior research published in Geographia Technica, where GIS tools and heatmap-style spatial analyses have been effectively applied to tourism planning and flow analysis (Nistor & Nicula, 2021; Ruda, 2016). For instance, Nistor and Nicula (2021) used GIS techniques to model tourism behaviour across spatial contexts, while Ruda (2016) demonstrated how spatial associations can reveal hidden tourism potential.

For instance, Šoltésová et al. (2025) applied GIS tools to guide sustainable tourism development in the Gelnica region, demonstrating how spatial technologies can support planning decisions at the local and regional level. In parallel, advanced data mining techniques such as market basket analysis are increasingly being applied to tourism data to uncover visitor behaviour patterns and inform decision-making strategies (Vavpotič, Knavs, & Knežević Cvelbar, 2021). These studies affirm the importance of combining spatial visualization with data interpretation to support evidence-based tourism policy.

The use of time series forecasting models, particularly ARIMA, is also gaining momentum in tourism analytics. ARIMA models have proven effective in forecasting short-term tourism demand by analyzing historical patterns (Song & Li, 2008). They are especially valuable in post-pandemic recovery planning and peak-load infrastructure management. Fathi et al. (2019) further expanded the use of ARIMA-based models in hydrological and climatic contexts, showing their versatility and robustness across spatial-temporal domains. This study builds on these foundations by combining GIS-based spatial classification, heatmap visualization, and ARIMA time series forecasting. This integrated approach enhances the ability to identify both current disparities and future tourism dynamics across Albania's macro-regions. It provides an evidence-based framework for proactive tourism planning that balances seasonal fluctuations with regional equity.

Foundational literature on time series analysis emphasizes the importance of ARIMA models in both theoretical and applied research. The classic work by Box and Jenkins (1970) laid the groundwork for ARIMA-based forecasting methods, which remain widely used across disciplines. Brockwell and Davis (2016) further advanced the field by integrating statistical theory with practical software applications. Haidu et al. (1987) applied Fourier-ARIMA modelling in hydrology, highlighting the model's flexibility in environmental forecasting. Additionally, Haidu (1997) provides a comprehensive treatment of time series methods applied in hydrology, contributing significantly to the methodological literature in the region.

## 3. DATA AND METHODS

### 3.1. Data Source

This study utilized official tourism statistics published by the Albanian Institute of Statistics (INSTAT), specifically the monthly dataset on accommodation establishments. The core dataset covers monthly arrivals of resident and non-resident tourists from January 2021 to March 2025. For spatial analysis, data from March 2025 were emphasized due to their availability and relevance for off-season tourism trends. For forecasting, monthly time series data from 2021-2024 were used as the training set. Administrative boundaries were retrieved from the GADM database (version 4.0), and macro-regions were defined following the national classification into North, Centre, and South. Each macro-region comprises several counties under the NUTS 3 classification.

### 3.2. GIS Data Processing

All spatial processing was conducted using QGIS 3.28, an open-source geographic information system. The geospatial methodology included the following steps:

a) Dissolution of Administrative Units: Albania's 12 counties were grouped and dissolved into three macro-regions (North, Centre, South).
b) Coastal Zone Identification: Municipalities within a 10 km buffer from the coastline were selected and classified as coastal areas, using spatial queries and buffer tools.
c) Overlay and Aggregation: Visitor data from INSTAT were manually joined to spatial layers using unique municipality identifiers. Regional totals and coastal/non-coastal classifications were computed.
d) Choropleth Map Generation: A graduated color ramp was applied to show the percentage share of visitor arrivals by region, using a green scale from light (low) to dark (high).

### 3.3. Heatmap Generation

To visualize seasonal fluctuations in tourism across Albania's macro-regions, a monthly matrix-style heatmap was generated (**Fig. 1**) using Python 3.11, with the help of the Pandas, Seaborn, and Matplotlib libraries (Waskom, 2021). The dataset included total monthly arrivals (resident + non-resident) from January to December 2024 for each macro-region. The heatmap used the YlOrRd color palette to represent intensity of tourist volumes. Annotated numerical values were embedded in each cell to improve readability. This approach allowed compact visualization of regional seasonality and intra-annual trends.

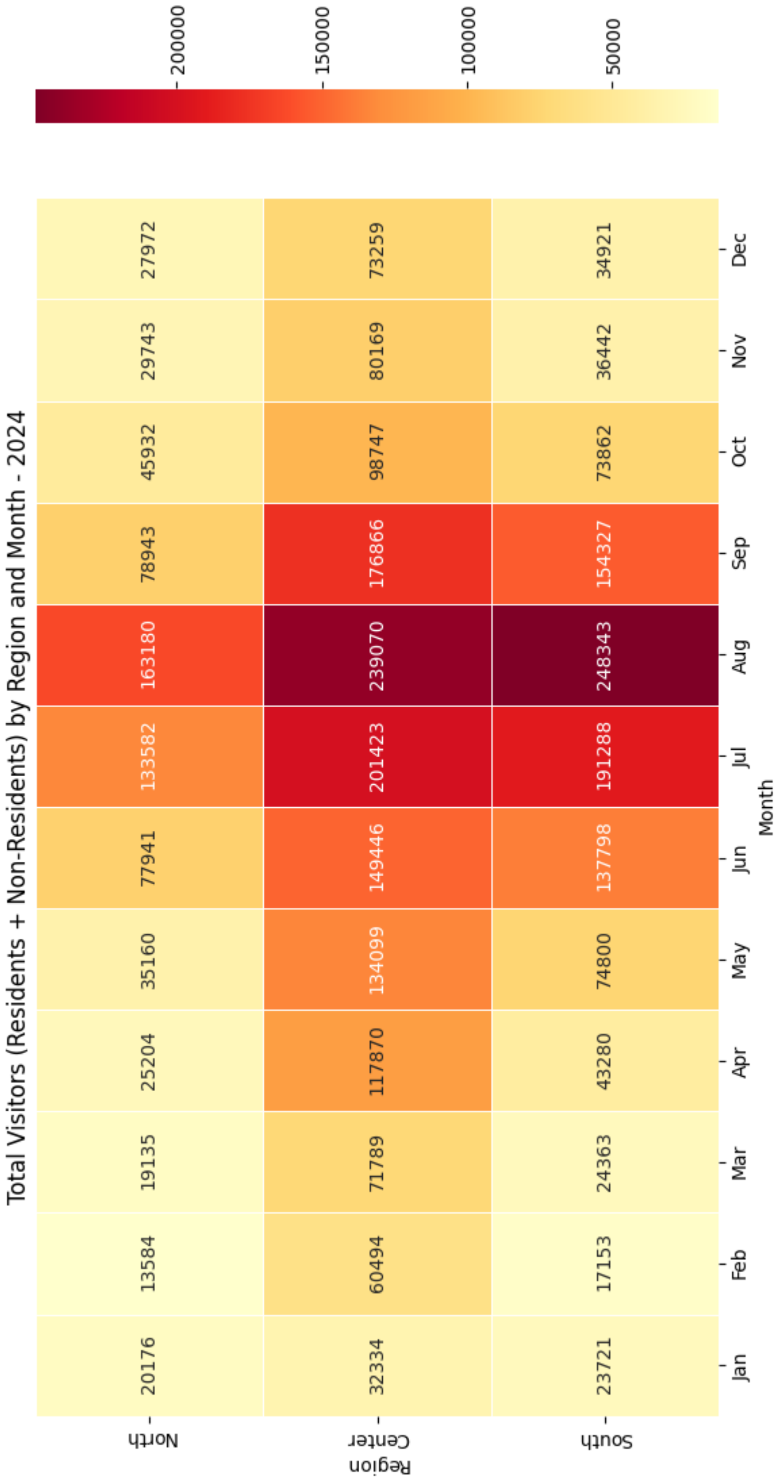


**Fig 1.** Regional Heat Map of Tourism Activity in 2024

The resulting heatmap revealed distinct seasonal patterns. Both the Center and South regions experienced a dramatic increase in visitor numbers during the summer months, peaking in July and August. In contrast, the North region showed a more modest but still notable seasonal trend. The visual clearly illustrated the cyclical nature of tourism, characterized by high concentration during the summer season and a decline in winter. This chart provided a compact yet comprehensive view of Albania's tourism distribution, supporting further analysis and offering a visually intuitive tool for stakeholders involved in regional planning and tourism development.

### 3.4. Time Series Forecasting Using ARIMA

To predict visitor flows for 2025, ARIMA (AutoRegressive Integrated Moving Average) models were developed for each macro-region: North **(Fig. 2)**, Center **(Fig. 3)**, South **(Fig. 4)**. The ARIMA model is formally denoted as ARIMA(p, d, q), where:

p is the number of autoregressive terms (AR),
d is the number of nonseasonal differences needed for stationarity,
q is the number of lagged forecast errors in the moving average model (MA).

Mathematically, the general ARIMA model can be written as:

$$\phi(B)(1 - B)^d y_t = \theta(B)\epsilon_t$$

where $\phi(B)$ and $\theta(B)$ are polynomials in the backshift operator $B$, and $\epsilon_t$ represents white noise.

Since the monthly data exhibit seasonality, we used the Seasonal ARIMA form, SARIMA(p, d, q)(P, D, Q, s), where the uppercase parameters refer to the seasonal components and s=12 represents the 12-month cycle. Model parameters were selected using the *auto_arima()* function from Python's *pmdarima* library. Forecasting was performed using the *SARIMAX* class in *statsmodels*, following a standard pipeline of differencing tests (ADF), model fitting, and forward prediction. The models were implemented in Python using the Statsmodels package (Seabold & Perktold, 2010).

The following steps were taken:

- Monthly visitor totals from January 2021 to December 2024 were used as the training data.
- Time series were tested for stationarity using the Augmented Dickey-Fuller test.
- Optimal SARIMA parameters (p, d, q)(P, D, Q, s) were selected using the Akaike Information Criterion (AIC) and autocorrelation diagnostics (ACF and PACF).
- Separate SARIMA models were fitted for each region, and forecasts for 2025 were generated.
- The forecasted values were visualized using line charts for each region and overlaid with 95% confidence intervals.

This forecasting method enabled short-term prediction of regional tourism trends and provided actionable insights for policy and planning.

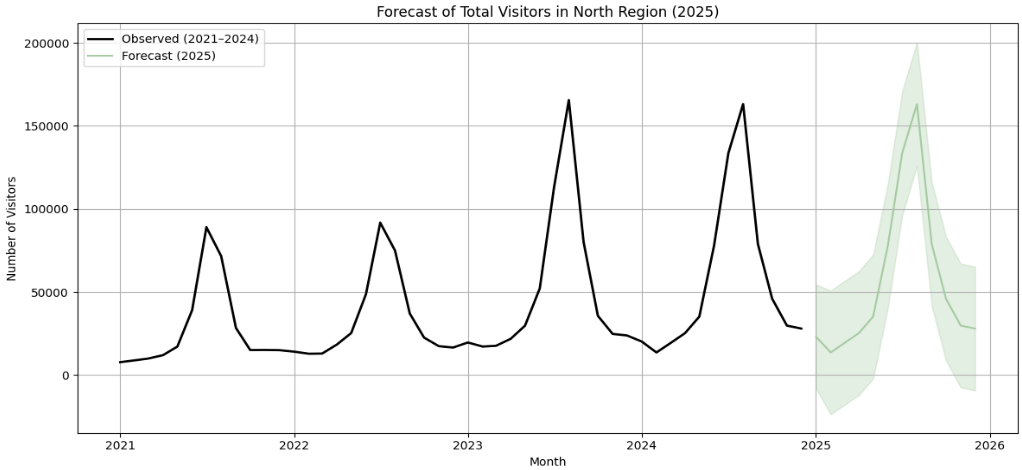


**Fig 2.** ARIMA-Based Time Series Forecast for Northern Region (2025). The shaded area around the forecast curve represents the 95% confidence interval.

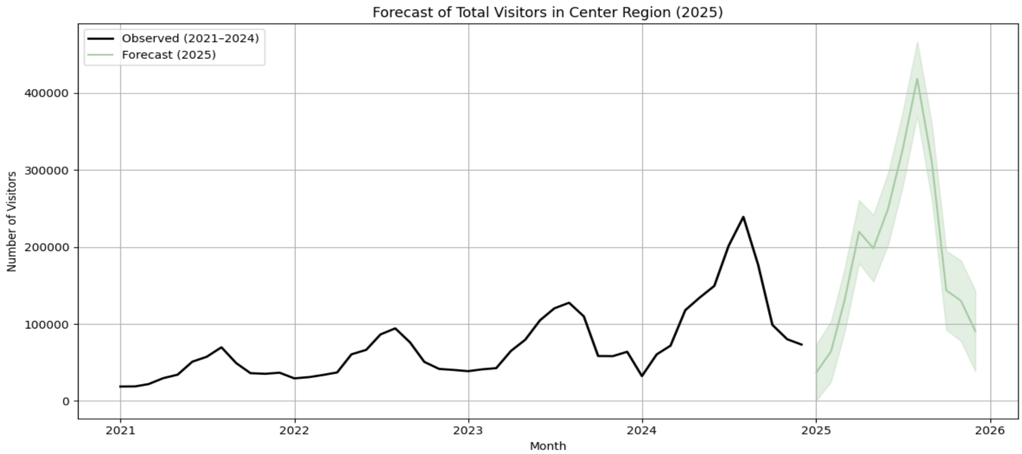


**Fig 3.** ARIMA-Based Time Series Forecast for Center Region (2025). The shaded area around the forecast curve represents the 95% confidence interval.

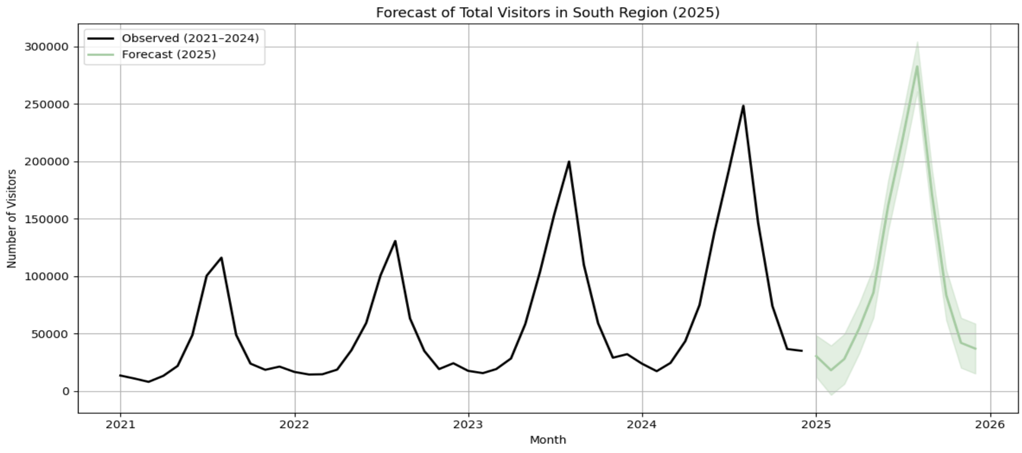


**Fig 4.** ARIMA-Based Time Series Forecast for South Region (2025). The shaded area around the forecast curve represents the 95% confidence interval.

### 3.5. Descriptive Statistics and Comparative Analysis

To complement the spatial and temporal modeling, descriptive statistics were computed to evaluate the share of tourism flows across macro-regions and between coastal and non-coastal zones. INSTAT visitor data were manually cross-referenced with GIS-classified municipalities. Total counts and percentages were calculated to reflect the relative contributions of each zone to national tourism activity. To highlight seasonal disparities, visitor data from March 2025 were compared with the peak tourism month of August 2024 **(Tab. 1, Tab. 2** and **Tab. 3).** These comparisons were visualized using tables and thematic maps created in QGIS. For example, while coastal areas accounted for 35.4% of visitors in March, this figure rose to 75.6% in August. This approach enabled a clearer understanding of off-peak vs. peak dynamics and informed spatial equity assessments. All analytical scripts and visualizations were developed using Python (v3.11) and QGIS (v3.28), ensuring reproducibility and alignment with open-source scientific standards.

**Table 1.**

**Regional Distribution of Visitors in Albania**

| Region | Total Visitors | Percentage (%) |
|---|---|---|
| North | 25,113 | 17.8% |
| Center | 86,050 | 61.3% |
| South | 29,315 | 20.9% |

**Table 2.**

**Regional Visitor Growth Comparison (2024–2025, Period: March)**

| Region | 2024 | 2025 | Growth |
|---|---|---|---|
| North | 19,135 | 25,113 | 31.24% |
| Center | 71,789 | 86,050 | 19.87% |
| South | 24,363 | 29,315 | 20.33% |

**Table 3.**

**Visitor Distribution by Area Type**

| Area Type | Total Visitors (August 2024) | Total Visitors (March 2025) |
|---|---|---|
| Coastal | 491,903 | 49,701 |
| Non-Coastal | 158,690 | 90,777 |
| Total (Albania) | 650,593 | 140,478 |

## 4. RESULTS AND DISCUSSIONS

The analysis of Albania's tourism dynamics integrates spatial classification, heatmap visualization, and ARIMA-based forecasting to provide a holistic picture of regional visitor flows.

### 4.1. Spatial Patterns

The core spatial analysis focused on visitor data for March 2025, using INSTAT data combined with GIS-based classification of administrative units. Three macro-regions North, Center, and South were analyzed, along with a binary distinction between coastal and non-coastal areas based on proximity to the coastline.

The spatial mapping revealed that the Center Region attracted the majority of visitors (61.3%), followed by the South (20.9%) and North (17.8%). Notably, coastal zones accounted for 35.4% of visits during March, rising to 75.6% during the peak month of August 2024. This confirms the seasonal pressure on coastal infrastructure, a phenomenon that demands spatial planning approaches tailored to resilience and sustainability in coastal communities (Abdullah et al., 2025), while also underlining the increasing relevance of inland destinations during the off-season.

A choropleth map and spatial overlay of visitor concentration effectively illustrated these disparities, validating GIS as a tool for strategic zone-based planning and resource distribution **(Fig. 5, Fig. 6** and **Fig. 7).**

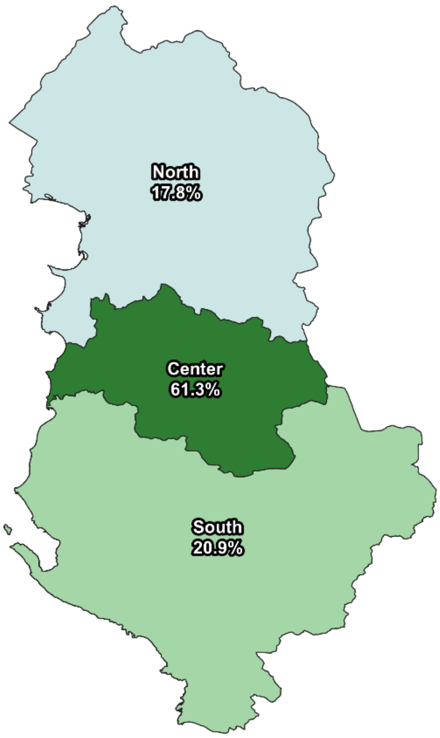


**Fig. 5.** Spatial Distribution of Tourist Visits by Region (March 2025)

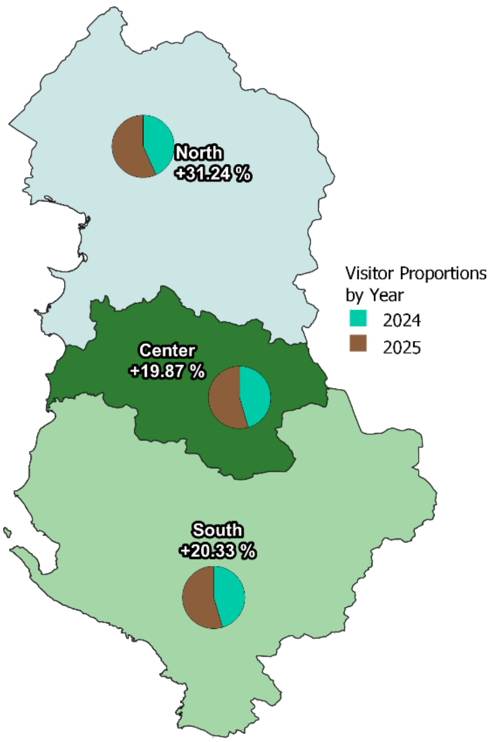


**Fig 6.** Year-over-year growth comparison


**Fig 7.** Coastal vs. non-coastal visitor distribution

### 4.2. Seasonal Trends: Visual Analysis of Monthly Visitor Fluctuations

To complement the March snapshot, a monthly intensity chart of monthly visitor flows across 2024 was generated using Python's Seaborn and Matplotlib libraries. The matrix-format heatmap displayed months along the horizontal axis and macro-regions along the vertical axis, with color intensity representing the number of visitors.

The visualization revealed:

- A sharp peak in the Center and South regions during July and August, reflecting classic summer tourism behavior.
- A more moderate but steady trend in the North region, with increased activity in spring and early autumn, aligning with nature-based and cultural tourism preferences.

This visualization not only clarified seasonal intensity and distribution, but also revealed opportunities for developing counter-seasonal tourism offers, especially in less saturated inland areas.

### 4.3. Forecasting Tourism Flows: ARIMA Results

ARIMA models were built separately for the North, Center, and South regions using monthly tourism data from 2021 to 2024. The models forecasted visitor numbers for 2025, offering a predictive layer to complement the spatial and historical insights.

Key findings:

- The Center region is expected to maintain its dominance, with steady growth continuing into the early summer of 2025.
- The South region shows significant seasonal fluctuation, with forecasts indicating a sharp rise beginning in May.
- The North region, while having the lowest absolute visitor numbers, shows the highest relative growth rate, especially in spring, suggesting a rising interest in alpine and eco-tourism. As demonstrated in similar GIS-based studies in national parks (Amangeldi et al., 2025), the integration of innovative mapping technologies can significantly enhance visitor experience and support sustainable destination development in protected natural areas.

The ARIMA forecasts provide vital input for pre-season planning and regional investment prioritization. Forecast curves also help stakeholders anticipate pressure on transport, accommodation, and cultural services across regions.

## 5. DISCUSSION

The integrated use of GIS, seasonal intensity charts, and ARIMA forecasting validates a multi-dimensional approach to tourism analysis. While GIS helps localize and quantify regional disparities, heatmaps offer clarity on seasonal intensity, and ARIMA models provide foresight into emerging trends.

The observed growth in the North region both in actual March data (31.24% YoY growth) and in forecasted values signals a shift in tourist preferences toward natural and cultural destinations outside traditional coastal zones. Destinations like Shkodër, Valbona, and Theth are emerging as strategic nodes for adventure and eco-tourism. This growth highlights the urgency of targeted investment in infrastructure and digital services in Northern Albania.

Meanwhile, the seasonal concentration in the South and Center, especially in summer, underscores the ongoing challenge of managing tourism saturation. The steep forecasted rise in visitors during May-July in these regions necessitates proactive service scaling, especially in coastal municipalities.

The use of heatmaps enabled intuitive communication of seasonality, particularly to non-technical stakeholders, while the ARIMA models offered data-backed projections that can inform policy decisions well in advance of tourism peaks. These tools are aligned with national priorities outlined in Albania's 2025–2030 country strategy, which emphasizes sustainable infrastructure, regional development, and digital modernization as key drivers of economic resilience (European Bank for Reconstruction and Development, 2025).

Looking ahead, integrating real-time mobility data (e.g., anonymized GPS tracking) and climate-adjusted predictive models could further enhance tourism governance. Albania can also draw lessons from neighboring countries like Croatia and Slovenia, which have successfully applied GIS and forecasting techniques to balance coastal and inland tourism, and mitigate environmental pressures. A national-level SWOT analysis by Leskaj and Lazimi (2024) similarly underscores the urgent need to diversify tourism offerings beyond the coastal concentration, highlighting internal disparities and capacity limitations that GIS-based planning can help address.

## 6. CONCLUSIONS

This study demonstrates the value of integrating spatial analysis, visual analytics, and predictive modeling to understand and manage tourism flows in Albania. By combining GIS-based spatial classification with heatmap visualization and ARIMA time series forecasting, the research provides a robust, multi-dimensional perspective on both the current distribution and future dynamics of regional tourism.

The spatial analysis confirmed the dominance of the Central Region, the emerging role of the North, and the continued seasonal dependence on coastal areas. The seasonal intensity visualization offered a clear, month-by-month view of seasonal trends, helping to pinpoint periods of over-concentration and underutilization across regions. Meanwhile, ARIMA-based forecasts provided forward-looking insights that are essential for pre-season planning, infrastructure investment, and strategic marketing.

This integrative approach not only enhances academic understanding but also supports evidence-based decision-making for tourism policymakers, local governments, and industry stakeholders. The findings underscore the need for regionally differentiated strategies, prioritizing capacity management in peak zones while stimulating growth in underutilized inland destinations.

Looking forward, future work should incorporate real-time mobility data, climate variables, and tourist sentiment analysis to build more adaptive and responsive tourism forecasting models. Furthermore, the development of an open-access, centralized GIS and forecasting platform could empower Albanian institutions to manage tourism in a smarter, more sustainable, and more inclusive manner.

## REFERENCES

Abdullah, S. N. F., Kamarudin, M. K. A., Mat Som, A. P., Sanopaka, E., & Ferizone. (2025). GIS-based spatial modelling to enhance tourism resilience and conservation for sustainable leadership in coastal communities. Planning Malaysia, 23(1), Article 1659. https://doi.org/10.21837/pm.v23iS3.1659 .

Amangeldi, A., Seidullina, D., Mukatov, A., Mukatova, R., Bilisbekov, T., & Sagtbayev, Y. (2025). Innovative technologies to improve tourism experience in national parks: Development of GIS maps and their value. GeoJournal of Tourism and Geosites, 58(1), 210–224. https://doi.org/10.30892/gtg.58118-1403 .

Box, G. E. P., & Jenkins, G. M. (1970). Time Series Analysis: Forecasting and Control. Holden-Day, San Francisco.

Brockwell, P. J., & Davis, R. A. (2016). Introduction to Time Series and Forecasting (3rd ed.). Springer.

Burlea-Schiopoiu, A., & Ozuni, F. (2021). The potential of Albanian tourism sector. Sustainability, 13(7), 3928. https://doi.org/10.3390/su13073928 .

Ciro, A., & Toska, M. (2018). Sustainable tourism development in Albania / Zhvillimi i turizmit të qëndrueshëm në Shqipëri. Annual Review of Territorial Governance in Albania, 1, 84–91. https://doi.org/10.32034/CP-TG-CA2018-08 .

Duarte, L., Torres, J., Ribeiro, V., & Moreira, I. (2020). Artificial intelligence systems applied to tourism: A survey. arXiv. https://arxiv.org/abs/2010.14654 .

European Bank for Reconstruction and Development. (2025). Albania country strategy 2025–2030. https://www.ebrd.com/publications/country-strategy-albania .

Fathi, M. M., Awadallah, A. G., Abdelbaki, A. M., & Haggag, M. (2019). A new Budyko framework extension using time series SARIMAX model. Journal of Hydrology, 570, 827–838. 8. https://doi.org/10.1016/j.jhydrol.2019.01.037

GADM (2024). Database of Global Administrative Areas. Retrieved from https://gadm.org .

Haidu, I., Serban, P., & Simota, M. (1987). Fourier-ARIMA Modelling of the Multiannual Flow Variation. In vol. The Influence of the Climatic Change and Climatic Variability on Hydrologic Regime and Water Resources, IAHS Publ.- Red Books No. 168, pp. 281-286. https://www.researchgate.net/publication/237075838_Fourier-ARIMA_modeling_of_the_multiannual_flow_variation .

Haidu, I. (1997). Analiza seriilor de timp. Aplicații în hidrologie (Time series analysis. Applications in hydrology). Editura H*G*A*, București. ISBN: 973-98077-3-9. https://www.researchgate.net/publication/297032182_Analiza_seriilor_de_timp_Aplicatii_in_hidrologie

Hysenaj, M., & Hoxha, E. (2015). Modelimi hapësinor potencial i së ardhmes, , BSHN (UT) 20/2015.

Hysenaj, M., & Hoxha, E. (2015). Analiza gjeo-hapësinore oportunitet për zhvillimin e një plani strategjik, BSHN (UT) 20/2015.

Institute of Statistics (INSTAT). (2025). Tourism statistics: Accommodation establishments, March 2025. https://www.instat.gov.al/en/themes/industry-trade-and-services/tourism-statistics/ .

International Monetary Fund. (2025). Albania: Selected issues. https://www.imf.org/en/Publications/CR/Issues/2025/04/01/Albania-Selected-Issues-530600 .

Kulyk, V., & Sossa, R. (2018). Determining the tourist attractive regions by GIS analysis using heatmaps. Geodesy and Cartography, 44(2), 52–57. https://doi.org/10.3846/gac.2018.8322 .

Leskaj, E., & Lazimi, L. (2024). Albania's tourism landscape: A SWOT analysis for sustainable development. In International Scientific Conference EMAN 2024 – Conference Proceedings. https://doi.org/10.31410/EMAN.2024.459 .

Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2010). Geographic Information Systems and Science (3rd ed.). Wiley.

Merko, F., Ndreu, G., & Merko, F. (2025). The progress and economic effects of tourism on the Albanian economy (Version 2). Zenodo. https://doi.org/10.5281/zenodo.15010809.

Nistor, M.-M., & Nicula, A.-S. (2021). Application of GIS Technology for Tourism Flow Modelling in the United Kingdom. Geographia Technica, 16(1), 1–12. DOI: 10.21163/GT_2021.161.01. https://technicalgeography.org/pdf/1_2021/01_nistor.pdf

Ruda, A. (2016). Exploring Tourism Possibilities Using GIS-Based Spatial Association Methods. Geographia Technica, 11(2), 87–101. DOI: 10.21163/GT_2016.112.09. https://technicalgeography.org/pdf/2_2016/09_ruda.pdf

Sampaio de Almeida, D., Brito e Abreu, F., & Boavida-Portugal, I. (2025). Digital twins in tourism: A systematic literature review. arXiv. https://arxiv.org/abs/2502.00002 .

Seabold, S., & Perktold, J. (2010). Statsmodels: Econometric and statistical modeling with Python. Proceedings of the 9th Python in Science Conference.

Šoltésová, M., Iannaccone, B., Štrba, Ľ., & Sidor, C. (2025). Application of GIS technologies in tourism planning and sustainable development: A case study of Gelnica. ISPRS International Journal of Geo-Information, 14(3), 120. https://doi.org/10.3390/ijgi14030120 .

Song, H., & Li, G. (2008). Tourism demand modelling and forecasting—A review of recent research. Tourism Management, 29(2), 203–220.

Vavpotič, D., Knavs, K., & Kneževič Cvelbar, L. (2021). Using a market basket analysis in tourism studies. arXiv. https://arxiv.org/abs/2110.10679 .

Waskom, M. L. (2021). Seaborn: Statistical data visualization. Journal of Open-Source Software, 6(60), 3021. https://doi.org/10.21105/joss.03021 .

World Bank. (2025). Albania overview. https://www.worldbank.org/en/country/-albania/overview .

World Tourism Organization. (2024). Tourism doing business – Investing in Albania. UN Tourism. https://doi.org/10.18111/9789284425426 .

Zhou, L., & Liu, X. (2022). Bibliometric analysis of GIS-based tourism research. SAGE Open, 12(4), 1–15. https://doi.org/10.1177/21582440251335733 .