

Enhancing military operations using geospatial analysis in logistics planning

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Course: Spatial Data Science

1. Introduction

Effective military logistics and strategic positioning are crucial for national security. This study enhances military operations by identifying optimal locations for new bases near borders with minimal civilian presence and establishing efficient routes from nearby airports. Using geospatial analysis and diverse datasets, the objectives are to:

- Optimize logistics routes for rapid deployment and resupply.
- Ensure base locations offer strategic advantages and safety.

2. Problem Statement

- Where are the optimal locations for new military bases near borders with zero population?
- What are the most efficient routes from the nearest airports to these military bases?

3. Data

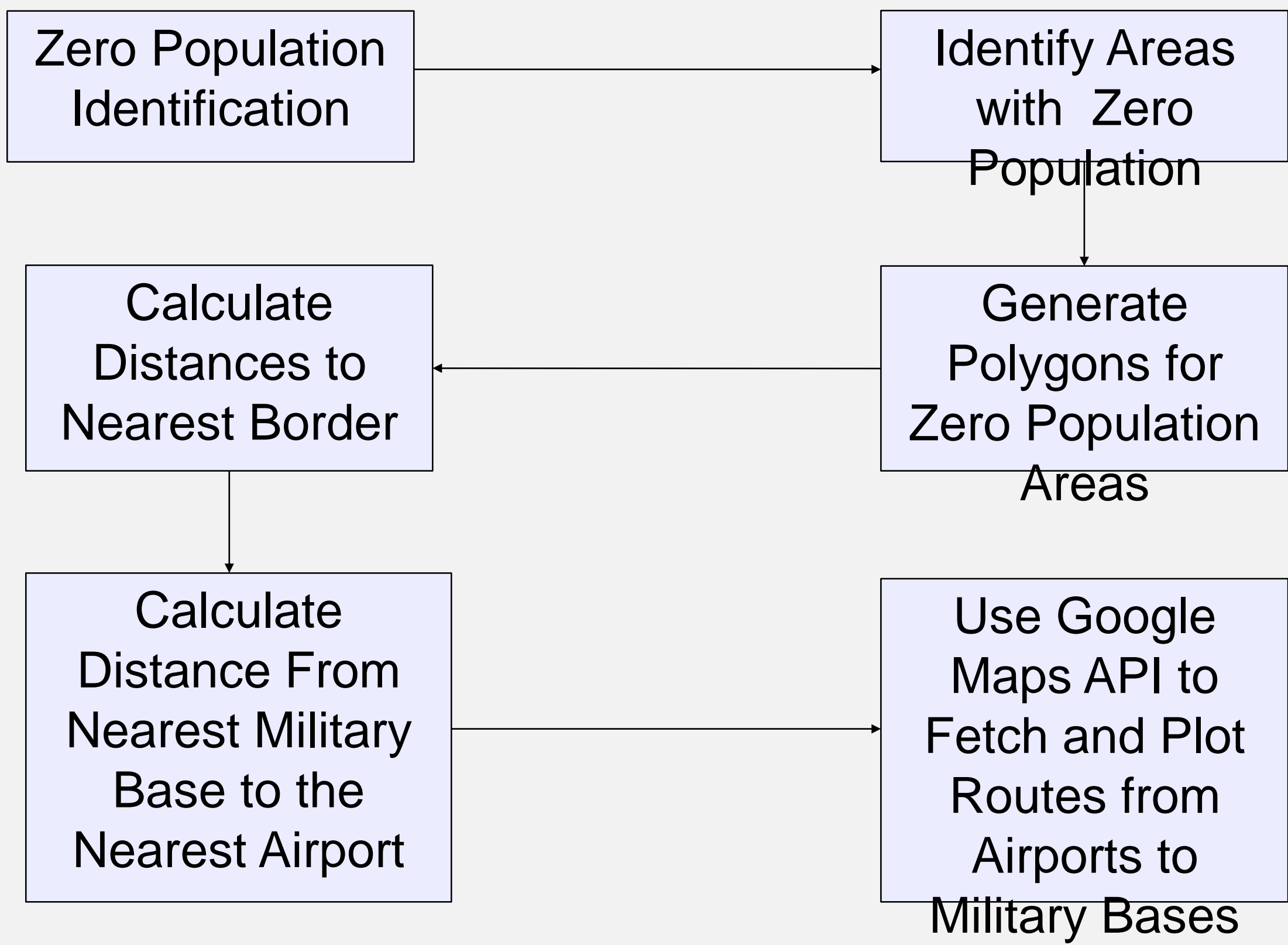
Datasets Used:

- Population density TIFF file.
- Airports data from a CSV file.
- USA mainland shapefile.
- USA border shapefile.

Preprocessing Steps:

- Cleaned and filtered the airport dataset, retaining fields including name, latitude, longitude.
- Converted airport data into a GeoDataFrame with CRS 'EPSG:4326'.
- Defined latitude and longitude bounds for the continental USA and filtered the airport GeoDataFrame.
- Loaded and exploded the USA mainland shapefile, calculated areas, and retained the largest polygon.
- Masked the population density raster to include only the mainland USA using the shapefile boundaries.
- Buffered the USA border shapefile to consider proximity to the border.
- Reprojected all data to 'EPSG:4326' for consistency.

4. Methodology



5. Results & Discussion

Route Optimization:

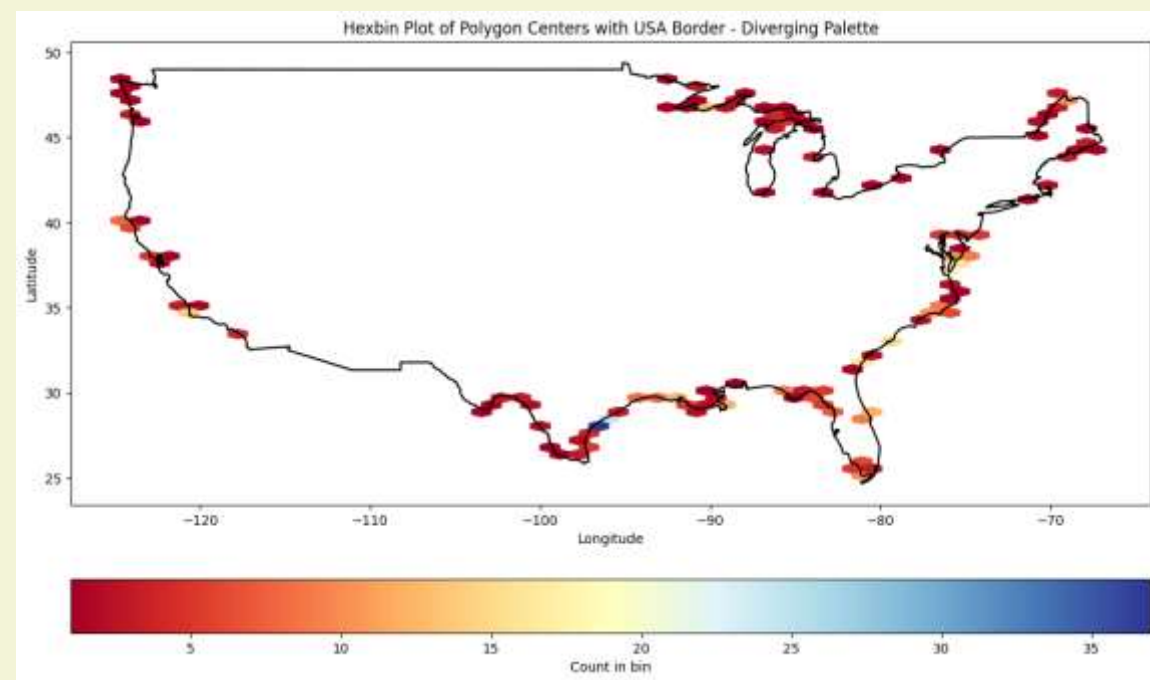
- Found the nearest airport for each potential base and determined the most efficient routes using the Google Maps Routes API.
- Visualized these routes on a map to assist in logistics planning

Summary:

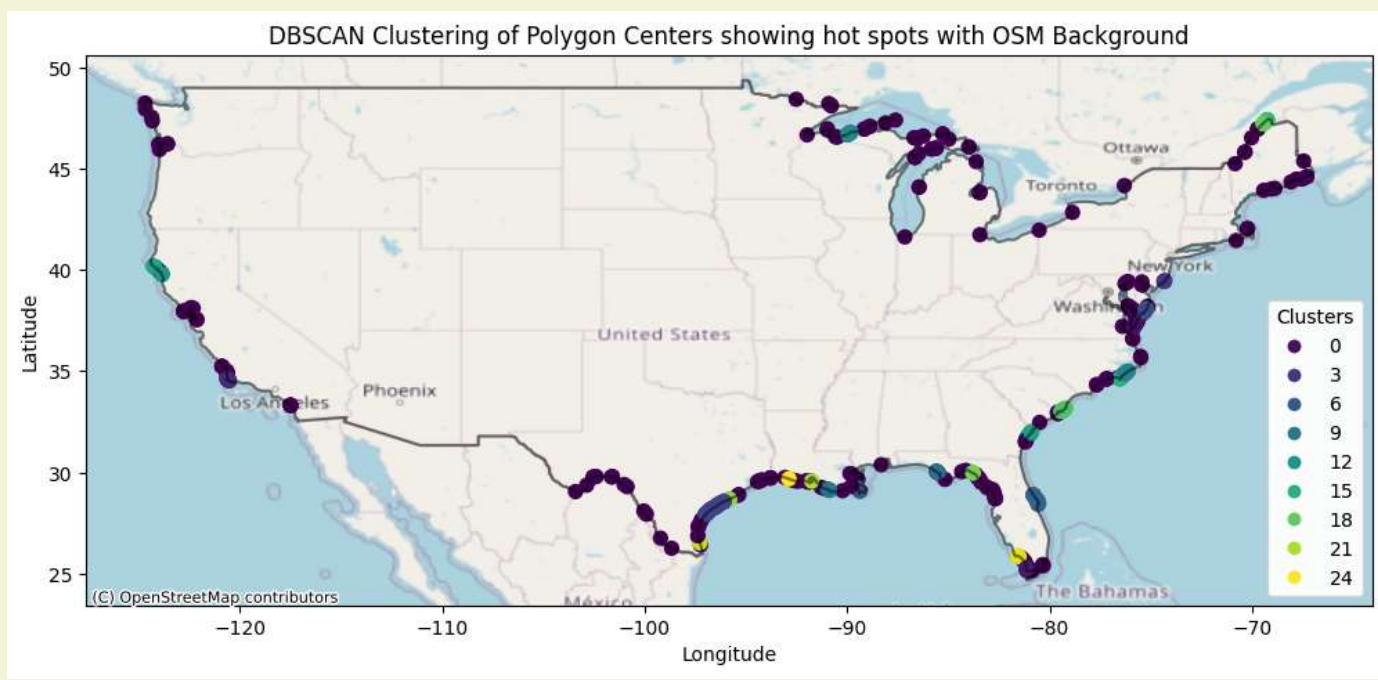
- Successfully identified optimal locations for new military bases, ensuring minimal civilian impact and efficient connectivity to airports.
- Provided a robust methodology applicable to other regions with suitable data inputs.

Future Work:

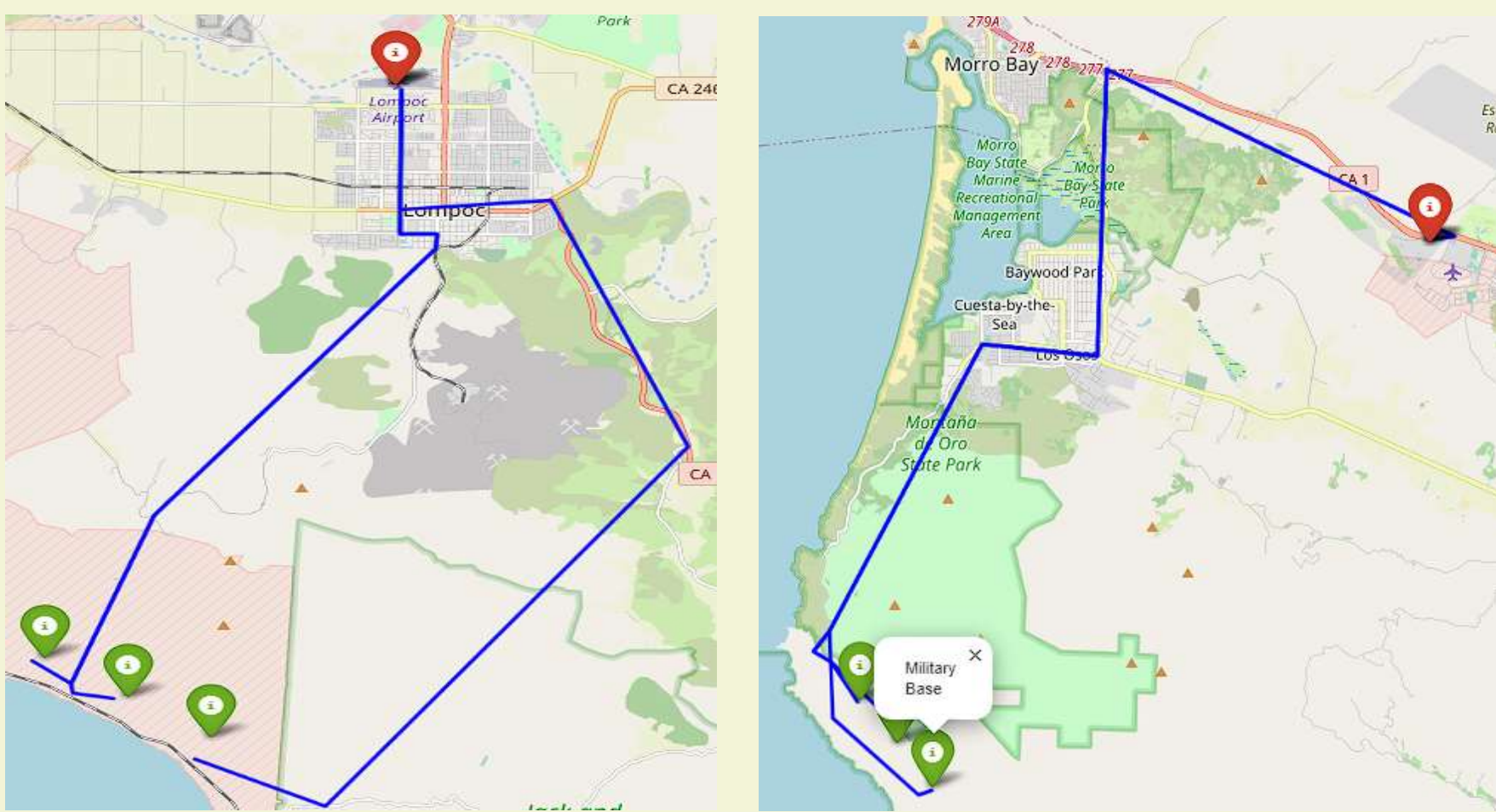
- Improve the accuracy of input data and consider additional factors such as terrain and climate.
- Expand the analysis to include more sophisticated routing algorithms and real-time data integration for dynamic planning.



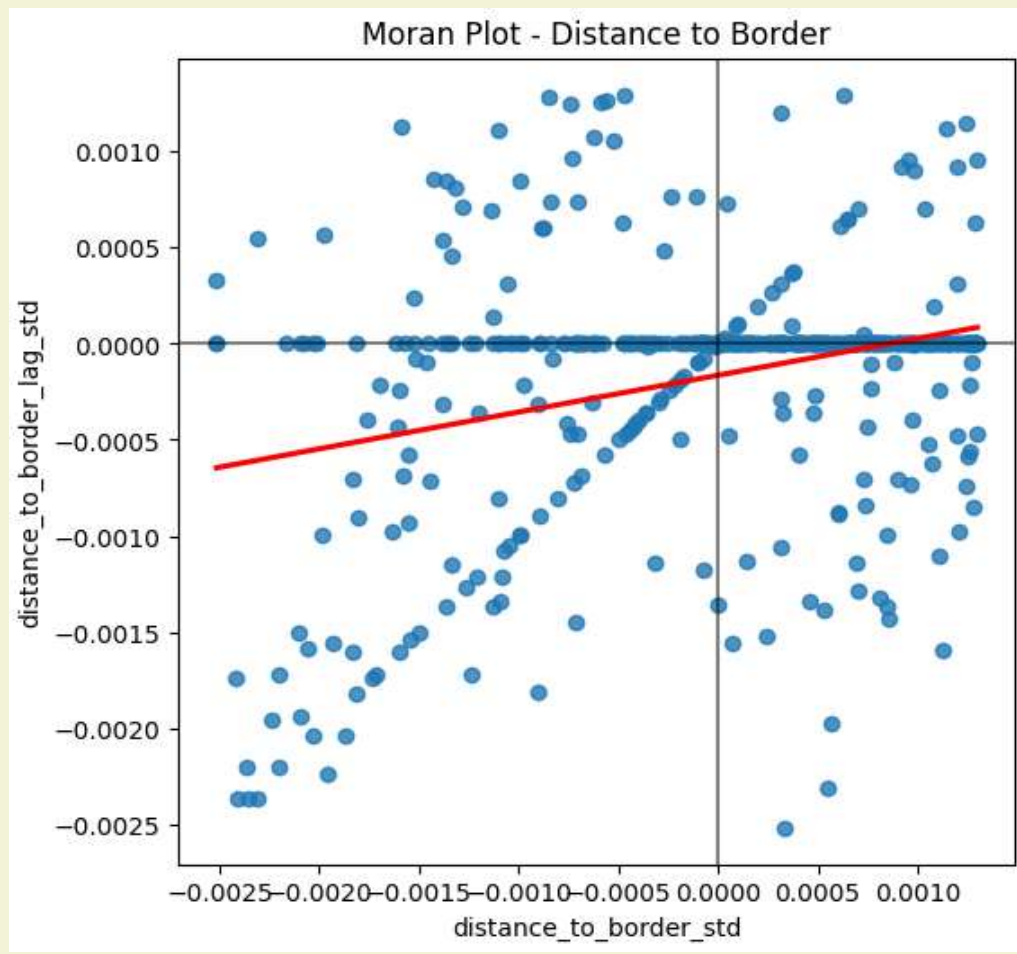
Hexbin Plot showing military base hotspots



DB scan showing military bases with similar characteristics



Routes from airports to military bases using google maps Routes API



moran plot

Acknowledgments: Data.gov