



Bird Migration

Where they came from, and where they're going

Project By

Priyal Patel
Meet Patel
Shrey Jani
Aditi Ghadge

Instructor : Dr. Pooya Moradian Zadeh

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Introduction to Bird Migration

- Animal migration is a widespread global adaptation that involves the movement of individuals in response to environmental conditions to improve their personal fitness [1].
- Migration, which is most evident among birds, ranges from full migratory to partially migratory species (some populations migrate while others do not).
- The individual choice of migrating or not in a partially migratory population is often influenced by behavioral differences, such as an individual's response to adverse weather, competition for food, and predator pressure, as well as intrinsic differences such as age and sex [2][3].
- The weather has played an important trigger for bird migration, with various studies demonstrating the importance of tailwinds, weak or no crosswinds, low rainfall, high temperatures, and atmospheric pressure [4][5][6].

Project Background

- In this project, we have tried to investigate the correlation between temperature and migration patterns.
- The project focuses on the visualization of the data for migratory species on the map to analyze various aspects of it.

Aimed to help the environmentalist to visualize and find patterns.

Methodology

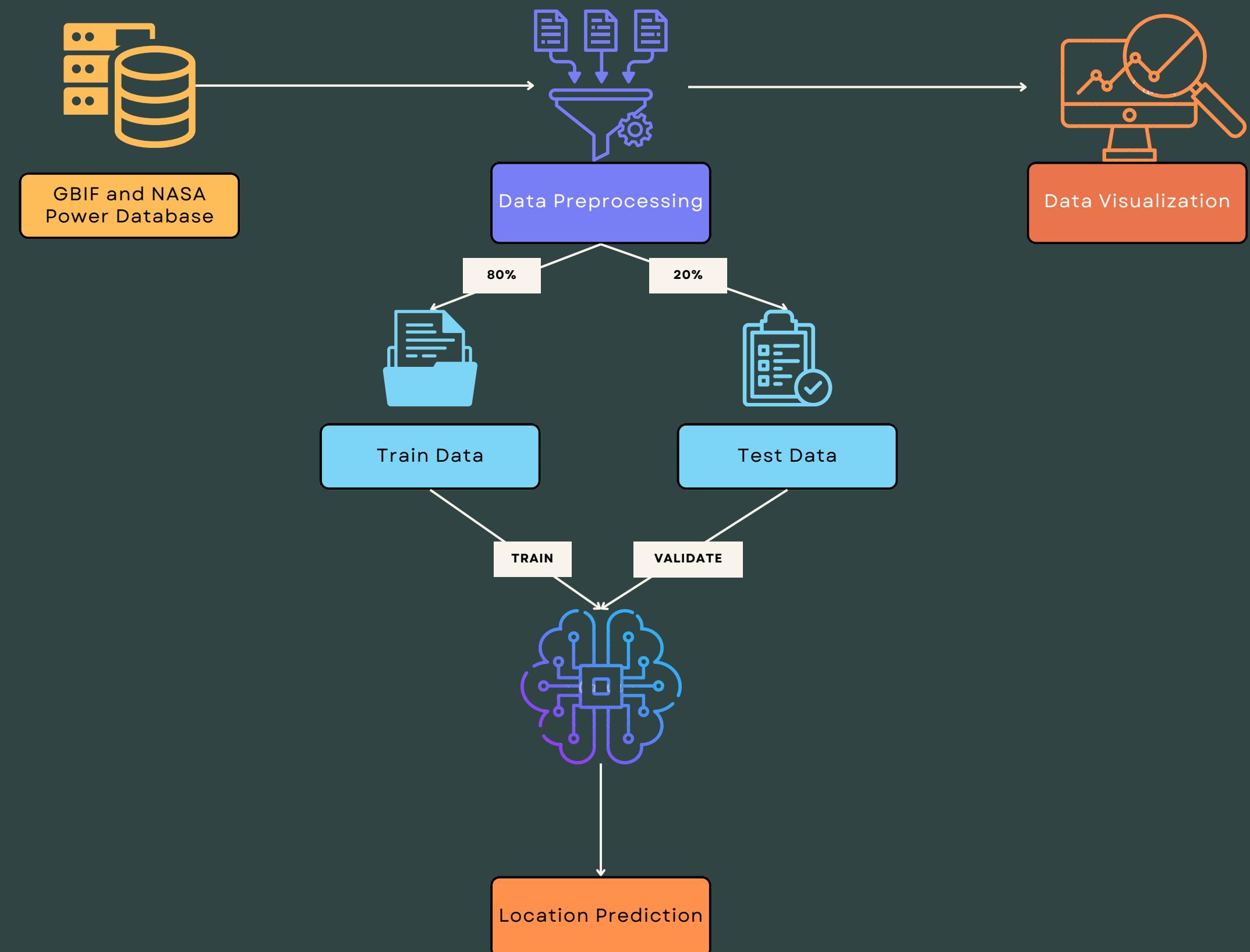


Fig 1. Architecture

Experiments



Bird

Data analysis
Location Prediction

Temperature

Map visualization

Experiments (Bird)

- Collected data from Global Biodiversity Information Facility (GBIF) [7].
- Data has been collected for 167 years and has 30,129 entries containing 50 attributes for North American region.
- We targeted 11 species of flamingos namely ('Phoenicopterus ruber' 'Phoeniconaias minor' 'Phoenicopterus chilensis' 'Juncitarsus gracillimus' 'Phoenicopterus minutus' 'Phoenicopterus copei' 'Phoenicoparrus andinus' 'Phoenicoparrus jamesi' 'Phoenicopterus roseus' 'Phoenicopterus floridanus' 'Phoenicopterus stocki').
- After data cleaning and formatting the outcome is shown below:

	date_time	flamingo_type	latitude	longitude	month	year
0	2012-02-14	Phoenicopterus ruber	22.448511	-78.292920	February	2012.0
1	2012-01-18	Phoenicopterus ruber	22.357620	-78.475070	January	2012.0
3	2008-10-28	Phoenicopterus ruber	25.558490	-80.348595	October	2008.0
4	2011-11-15	Phoenicopterus ruber	22.261010	-78.523160	November	2011.0
5	2011-11-13	Phoenicopterus ruber	22.389204	-78.446860	November	2011.0

Fig 2. Dataframe



Experiments (Bird)

After pre-processing only 4 species has significant entries in the data frame, in which, *Phoenicopterus Ruber*' has habit of traveling.

Calculated the distance traveled by all four birds in each month

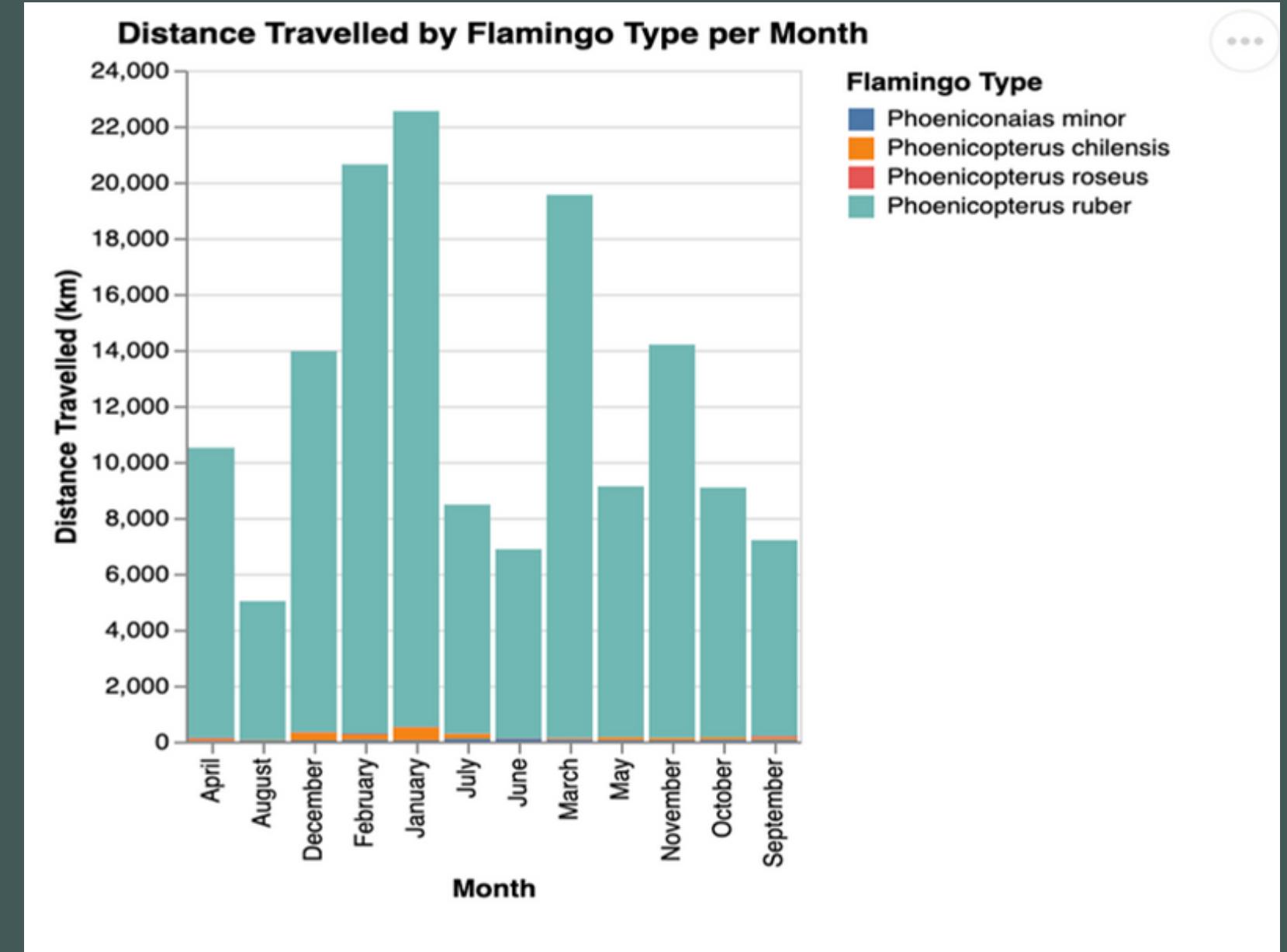


Fig 3. Distance travelled

Experiments (Bird)

- Further, the data is plotted through various graphs and on various maps for visualization
- We have studied the data for month-wise.
- The same data is given to the deep learning model for the prediction of bird location
- We have incorporated and trained two models one for predicting latitude and the other for longitude from month and year.

Experiments (Temp)

- Collected data from the NASA Power Website [8].
- 20 years of data from the North American region has been collected from 1225 points having a distance of 0.5 degrees each.
- This data is preprocessed and sent for visualization.
- Temperature changes are plotted on a map using folium library.

Demonstration

Plotting for 'Phoenicopterus ruber'
type flamingos spotted in north
american region.



Fig 4. Location of spotted birds



Demonstration

Mean value of birds's position for the year of 2019 during each month.

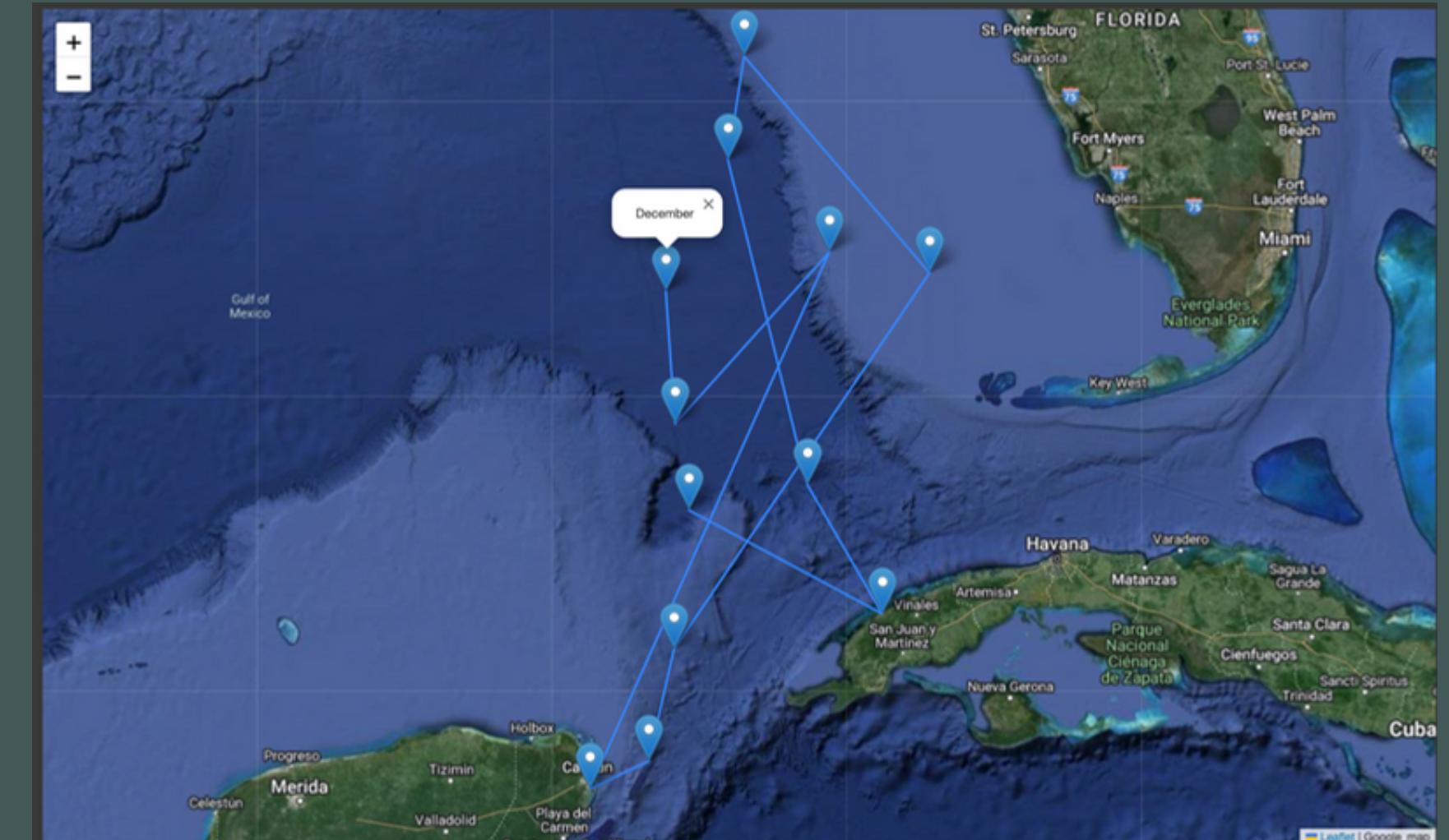
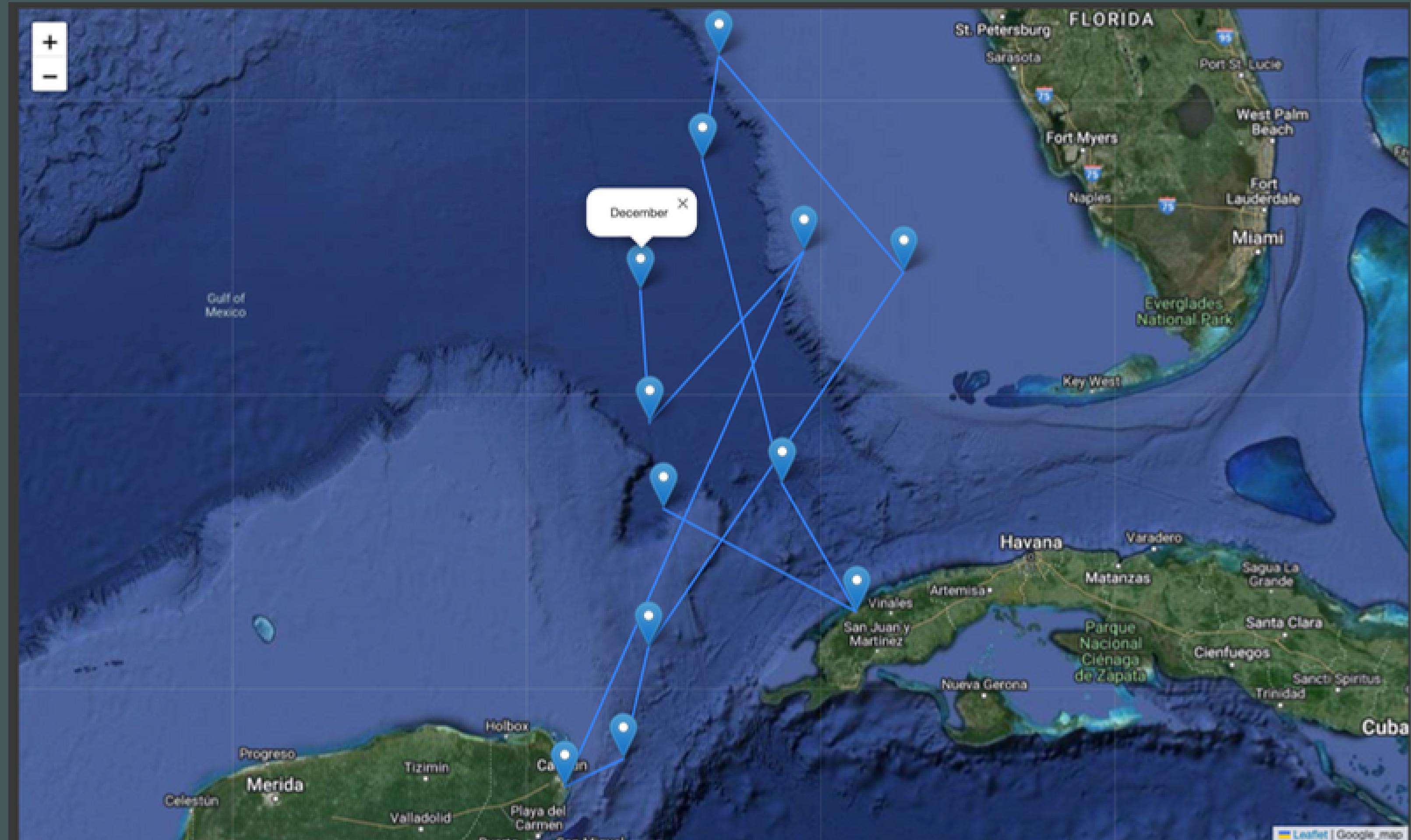


Fig 5. Bird positions in 2019



Demonstration

Visualization of how the layer of temperature data over the map can look.

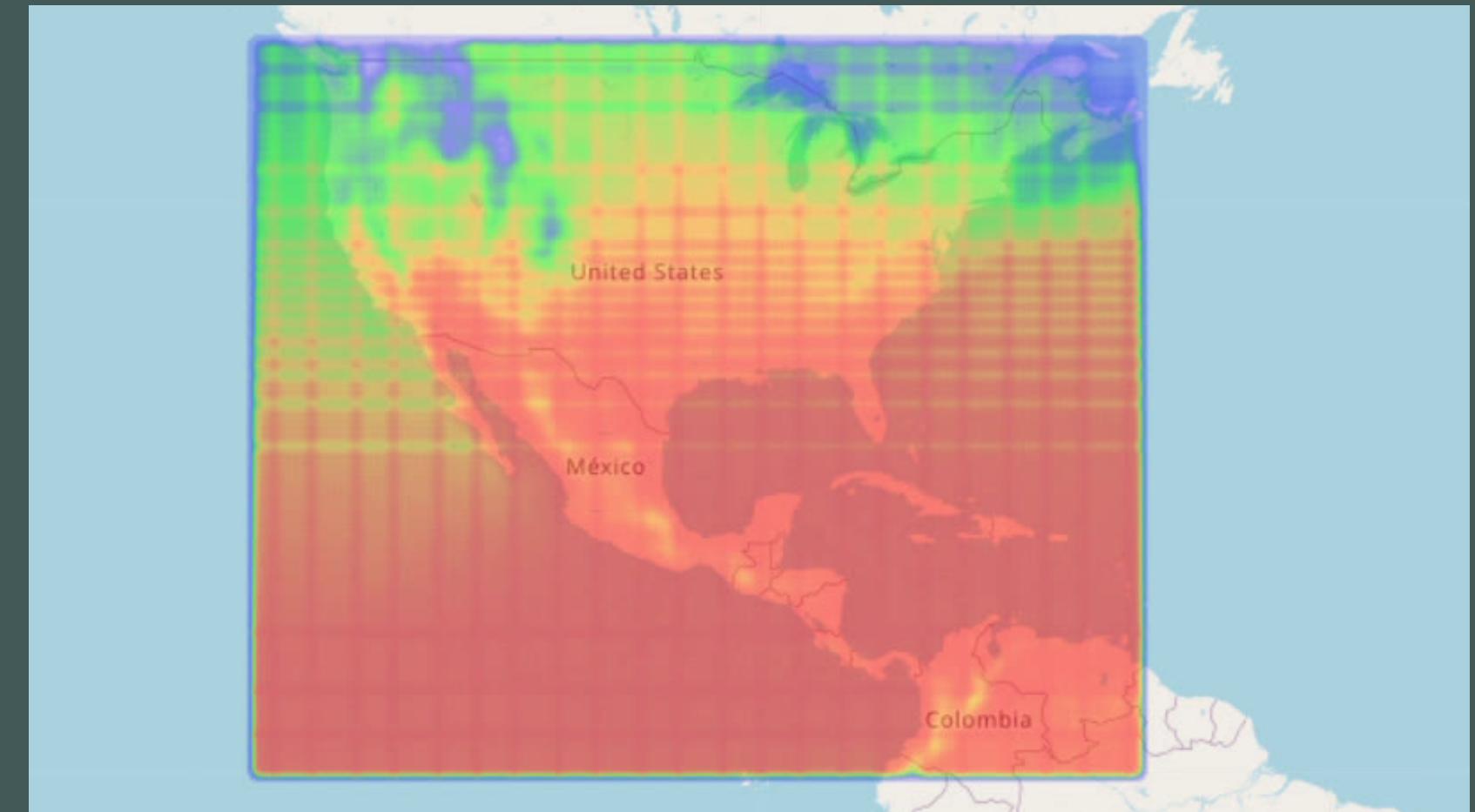
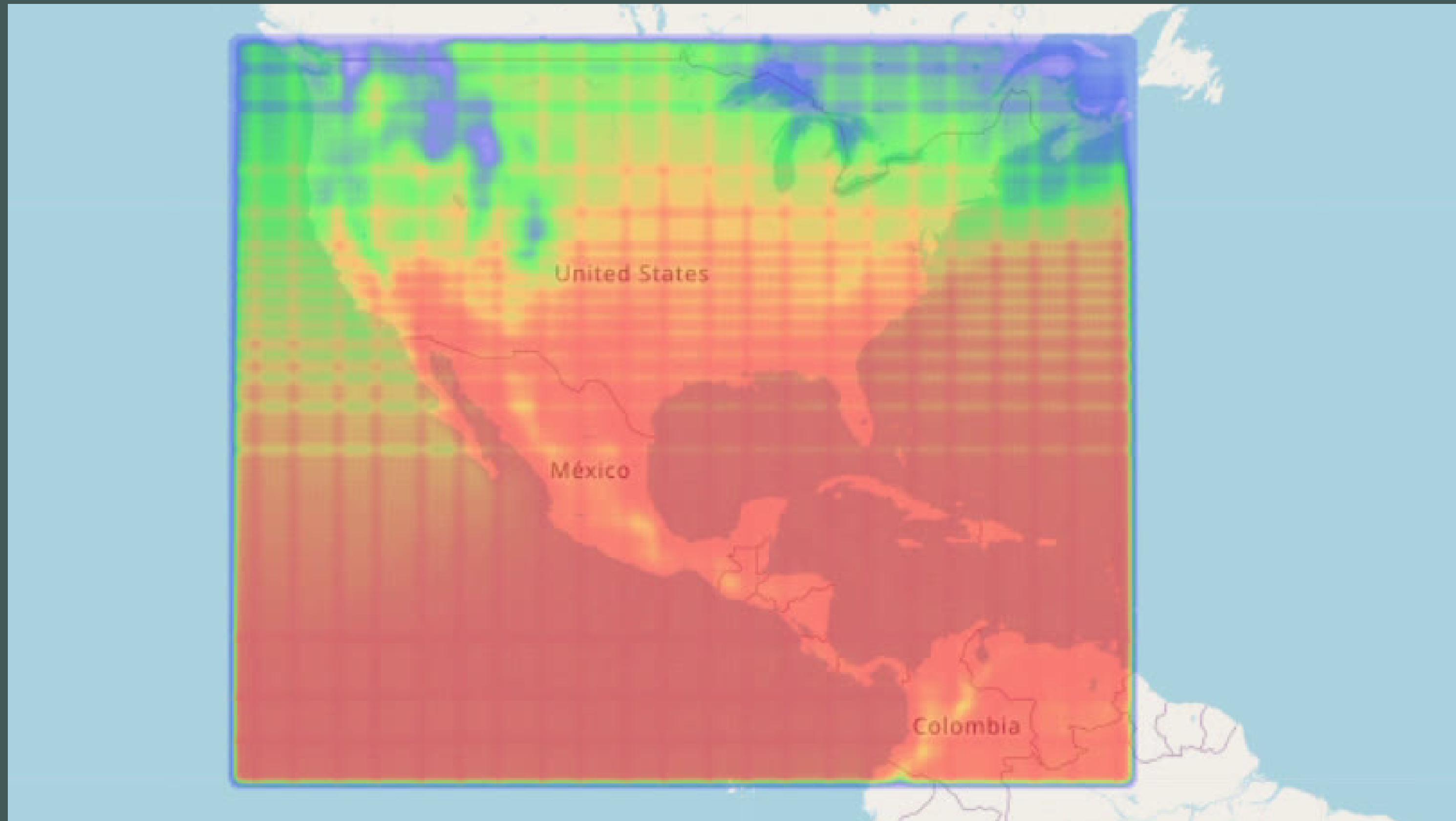


Fig 6. Temperature change



Results

We have created two separate deep learning model, One for predicting Longitude value and another for predicting latitude.

longitude Evaluation:

Mean Absolute Error is : 6.1

Mean Squared Error is : 87.9

Root Mean Squared Error is : 9.3

latitude Evaluation:

Mean Absolute Error is : 3.9

Mean Squared Error is : 19.2

Root Mean Squared Error is : 4.3

Challanges

Data Collection

Difficulties in finding accurate data with proper attributes like latitude and longitude

Computational Difficulties

Difficulties to visualize the very large amount of data on map

Integration

Difficulties integrating two or more models to simutalte together

Conclusion

- With the help of this project, we can identify the correlation between temperature fluctuations and bird migration patterns.
- This project can help environmentalists find different species' migration patterns.
- Prediction models can be used to assess the location of different species at a given point in time.
- Raise awareness by providing people the insights in an interesting manner.

FUTURE WORK:

- Future studies should consider incorporating temperature along with different factors as precipitation, wind patterns and habitat availability for a more comprehensive analysis.
- Conducting a spatial analysis of bird migration routes can help identify critical stopover sites and migration corridors. This information is invaluable for conservation efforts, as it can inform the establishment of protected areas and migration-friendly habitats.

References

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Thank you

