Correlation Between Eagle Owl's Flight Height and Mean Monthly Temperature for Male and Female Birds

Python in GIS: Final Project Presentation

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Background

Bubo bubo

-Found in Europe & Asia

-Diet:rats,mice,voles, beetle

-Mostly nocturnal

Research Question

"What is the correlation between monthly mean temperature variation and movement behavior of male and female eagle owls in terms flight height?"

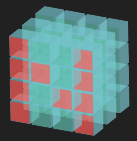
Platform & Technologies

Arcpy

Matplotlib

ArcGIS Pro

ArcMap



Numpy

Methodology

- Temperature & elevation data acquisition
- Data cleaning & pre-processing
- Analysis & post-processing
- Results & Conclusion

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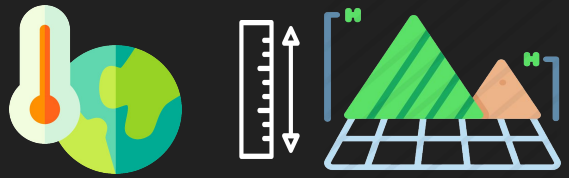
Methodology



Data Acquisition

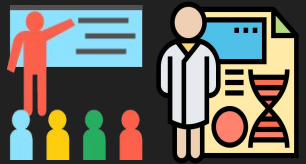
Data Cleaning & Pre-processing

Analysis

Post-processing

Validation

Results

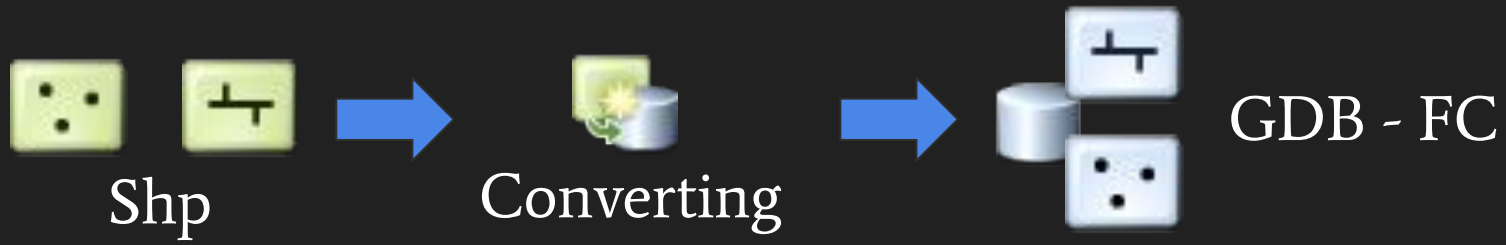


Conclusions

Data Preparation

- Creation of File Geodatabase & Feature classes
- Coordinate System Transformation of datasets (geographic to UTM)
- Update Bird gender information
- Extract month and year from timestamp field
- Extract mean ground temperature to Point feature class.
- Flight height calculation

Preparation: .shp to gdb



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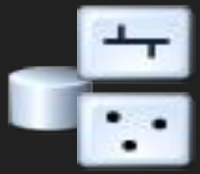
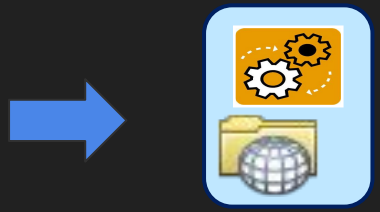
Preparation: Coordinates Transformation



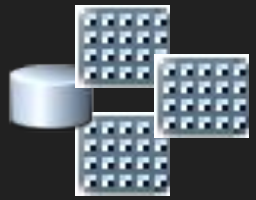
Geo-Coord.



Projected.
UTM 32 N.

Owl Vector data

DHDN / 3-degree
Gauss-Kruger zone 3



Projected.
UTM 32 N.

Temperature Raster data

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Preparation: Extract month and year

timestamp
2015-05-04 04:10:53

Arcpy

Year_Month
201505

Month
07
11
04
01
06
09
07
04
11

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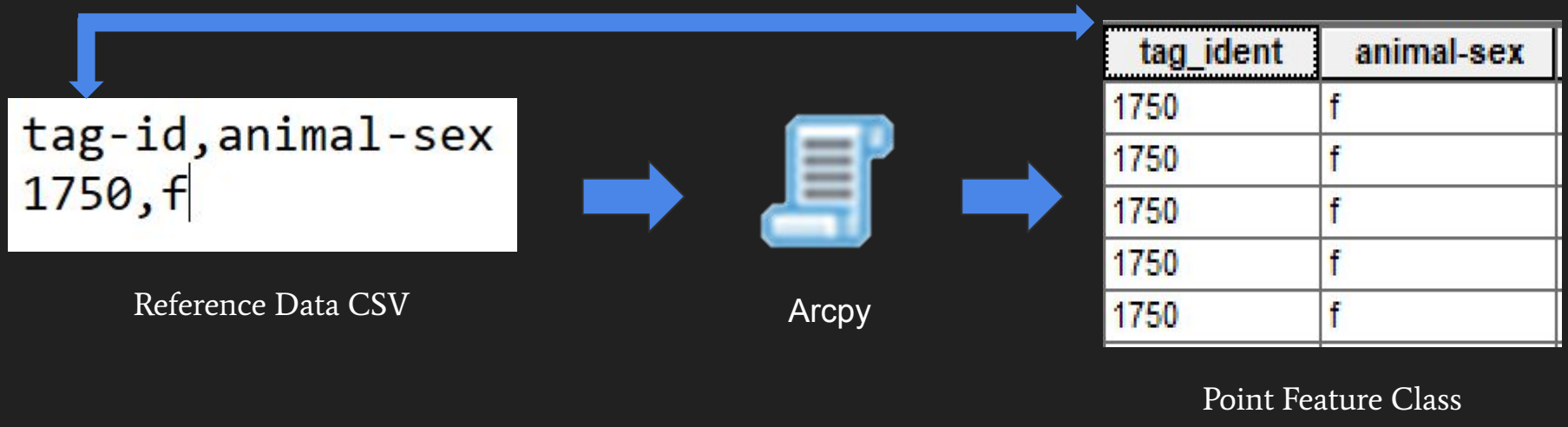
Preparation: Join Gender Information



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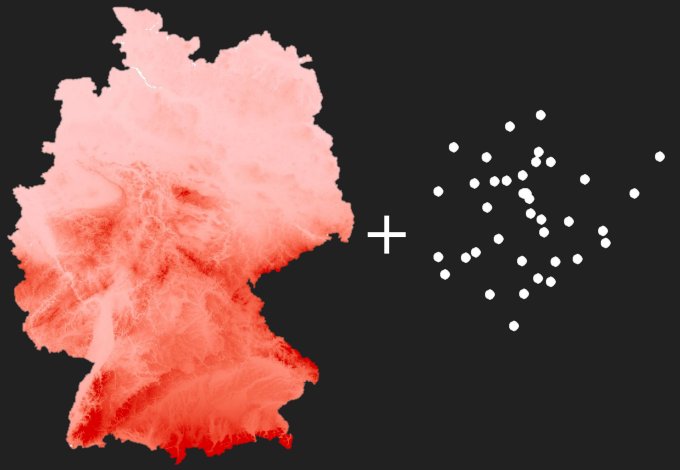
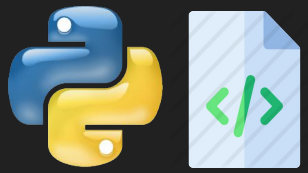
Preparation: Add Elevation from DEM



+



Arcpy

tag_ident	height	GroundEl
3897	588.8	540
3897	588.9	540
3897	587.5	540
3897	588	540
3897	588.9	540
3897	588.6	540
3897	588.3	540
3897	588.5	540

Device Height

Ground Elevation

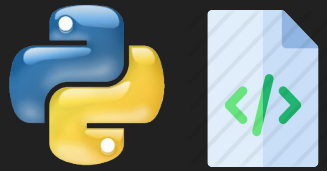
ifgi

Preparation: Add Elevation from DEM

tag_ident	height
3897	588.8
3897	588.9
3897	587.5
3897	588
3897	588.9
3897	588.6
3897	588.3
3897	588.5

−

GroundEl
540
540
540
540
540
540
540
540



Arcpy

tag_ident	height	GroundEl	FlightH
3897	588.8	540	48.8
3897	588.9	540	48.9
3897	587.5	540	47.5
3897	588	540	48
3897	588.9	540	48.9
3897	588.6	540	48.6
3897	588.3	540	48.3
3897	588.5	540	48.5

Actual flight height above ground

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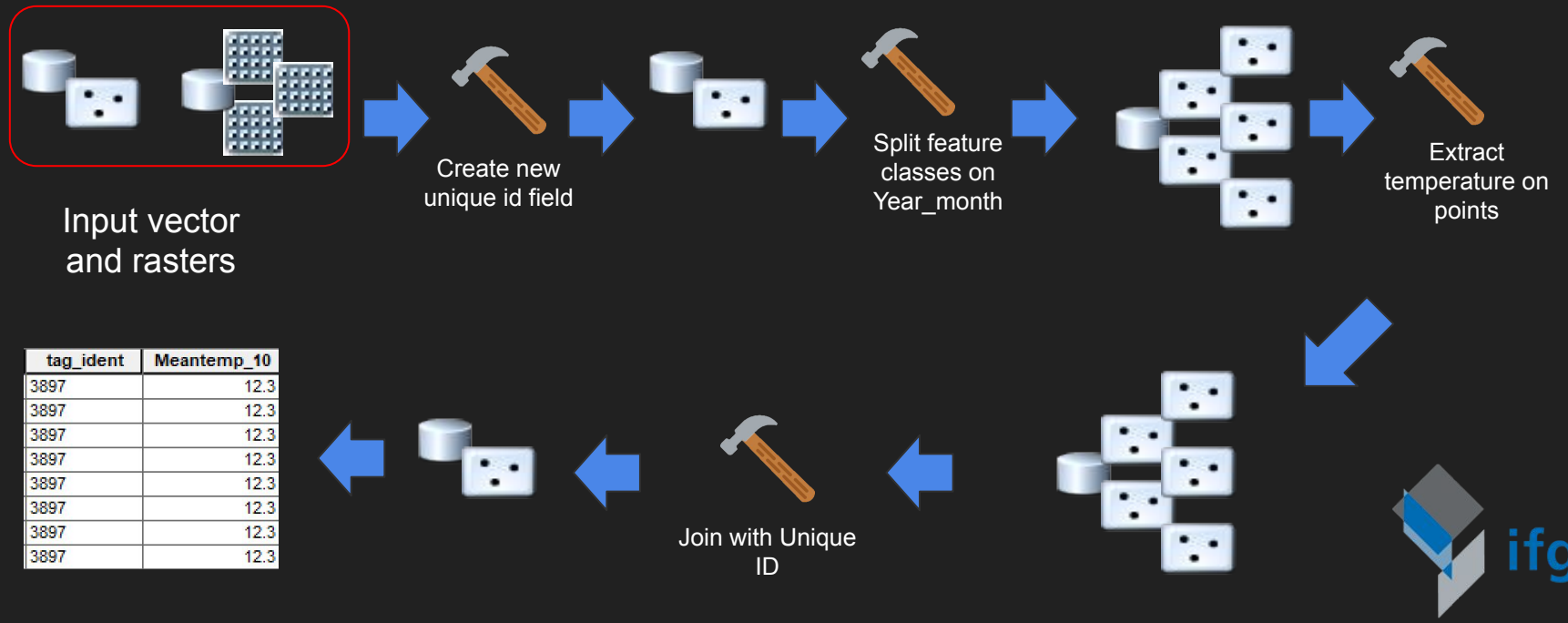
Preparation: Add Temperature value



tag_ident	Meantemp_10
3897	12.3
3897	12.3
3897	12.3
3897	12.3
3897	12.3
3897	12.3
3897	12.3
3897	12.3
3897	12.3

Analysis & Post-Processing

- Thematic plots of birds with monthly mean temperature and monthly mean flight height above the ground.
- Scatter plot for mean temperature vs flight height for male and female birds.
- Bar graphs of temperature, altitude and Convex Hull per month from all years.
- Gender comparison between temperature and altitude monthly.
- Geoprocessing tool development using ArcGIS Pro to create user friendly interface.

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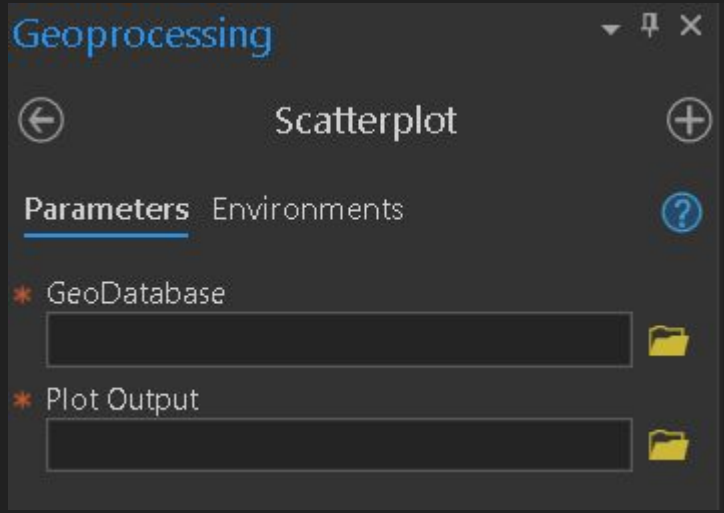
Analysis & Post-Processing

- Thematic Plot
- Scatter Plot
- Bar Graphs

Analysis & Post-Processing

Geodatabase used

Output for the plot



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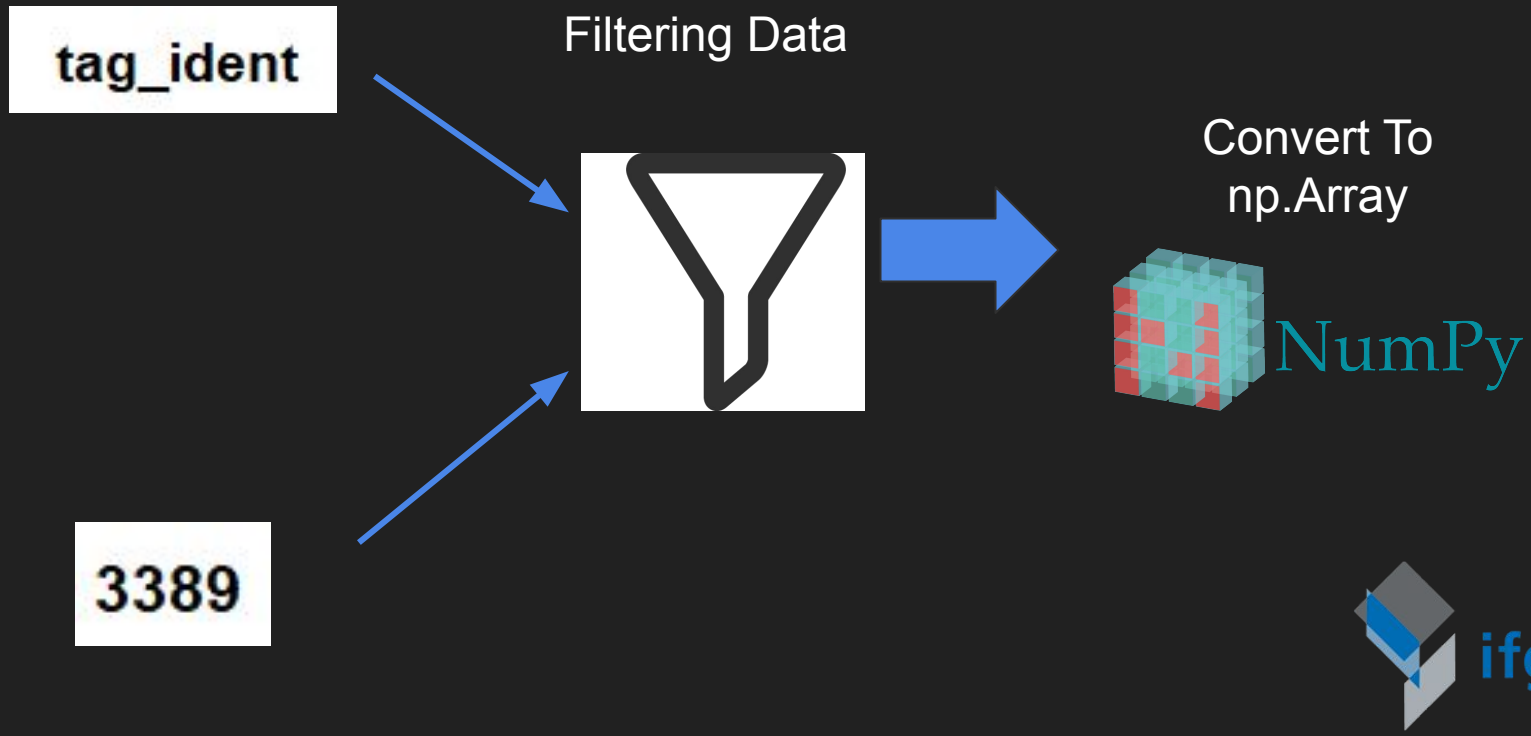
Post-Processing

Thematic plots of birds with monthly mean temperature and monthly mean flight height.

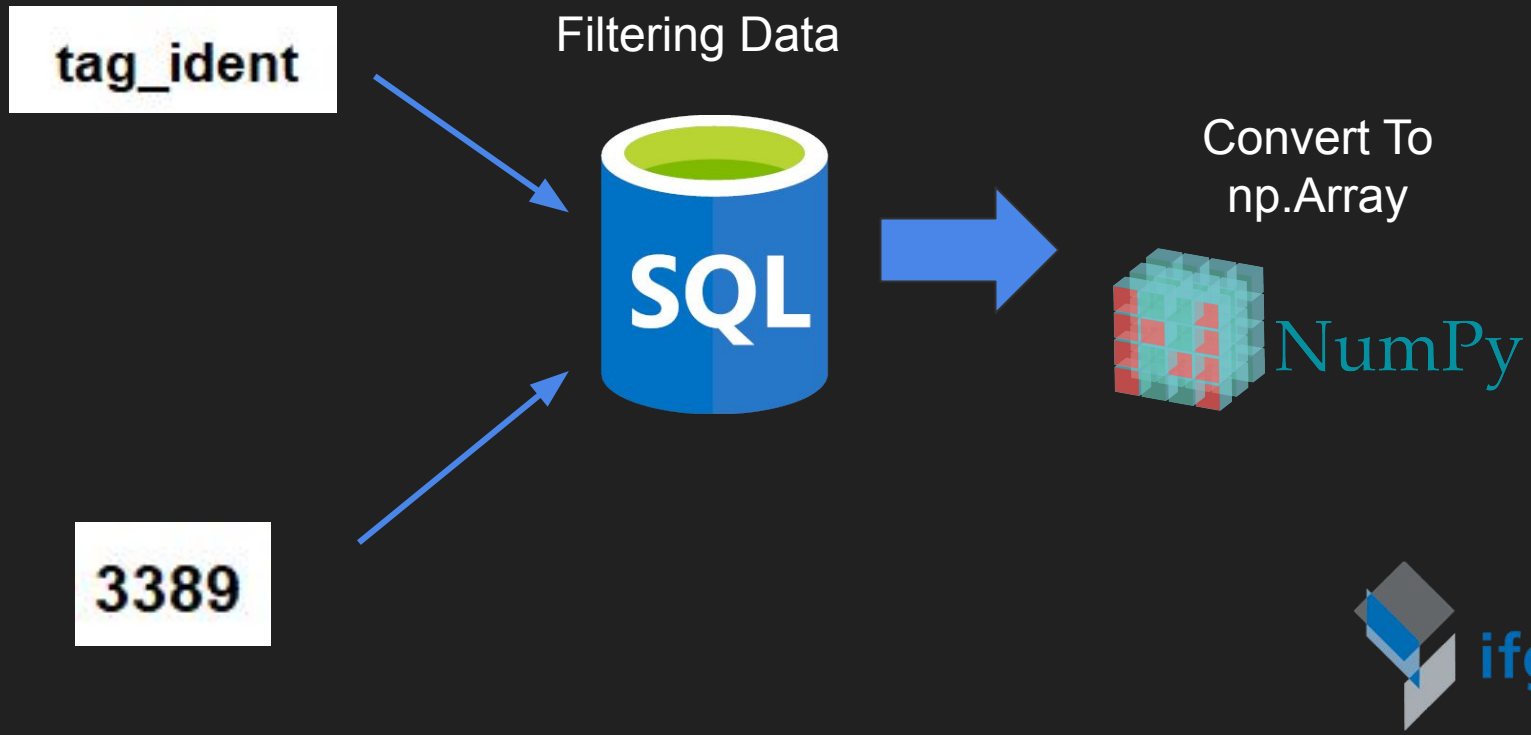
source: ESRI Web Course –Python for Everyone

ifgi

Thematic plots

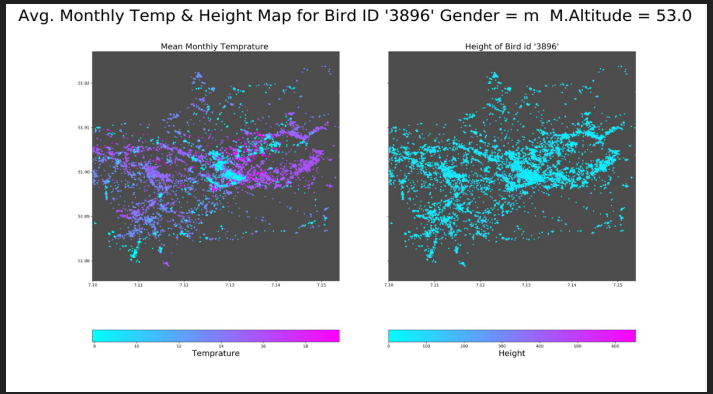


Thematic plots



Thematic plots

Thematic Maps for selected bird for all available month



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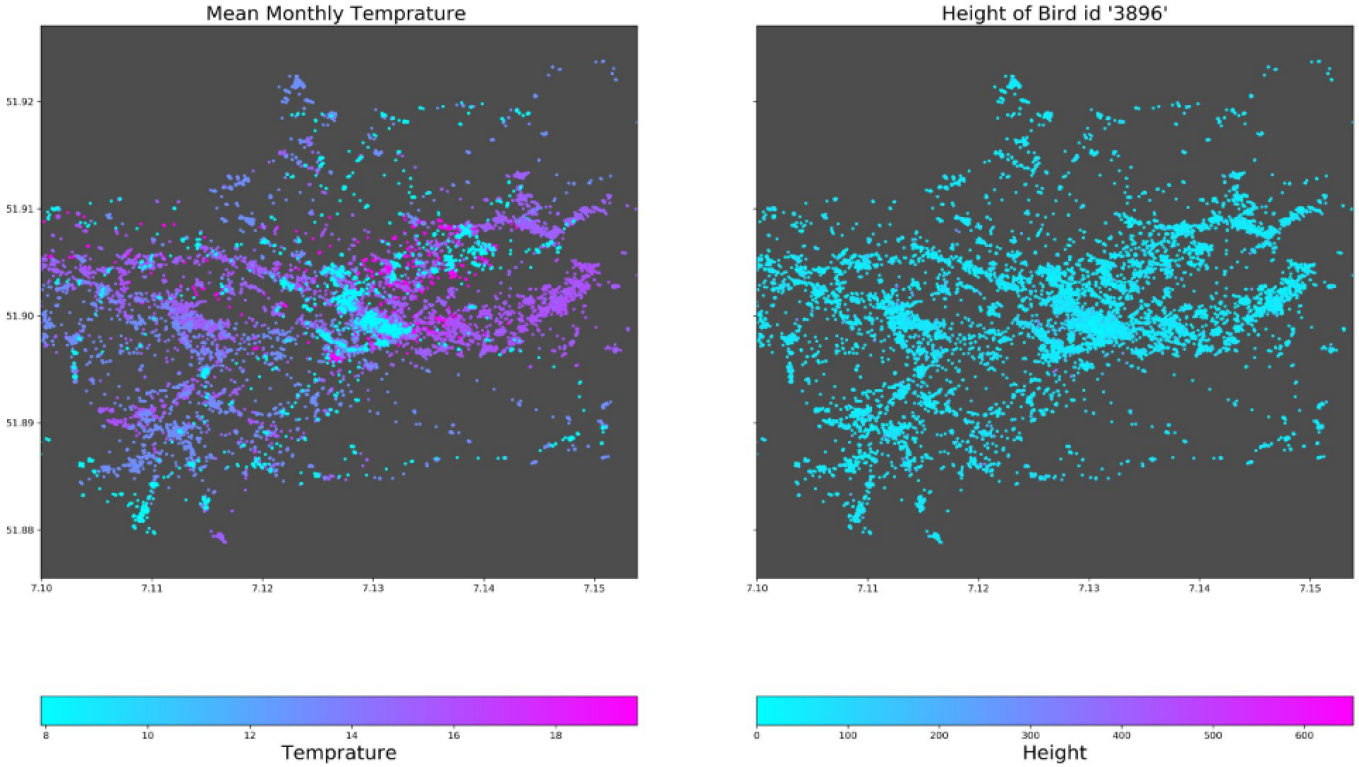
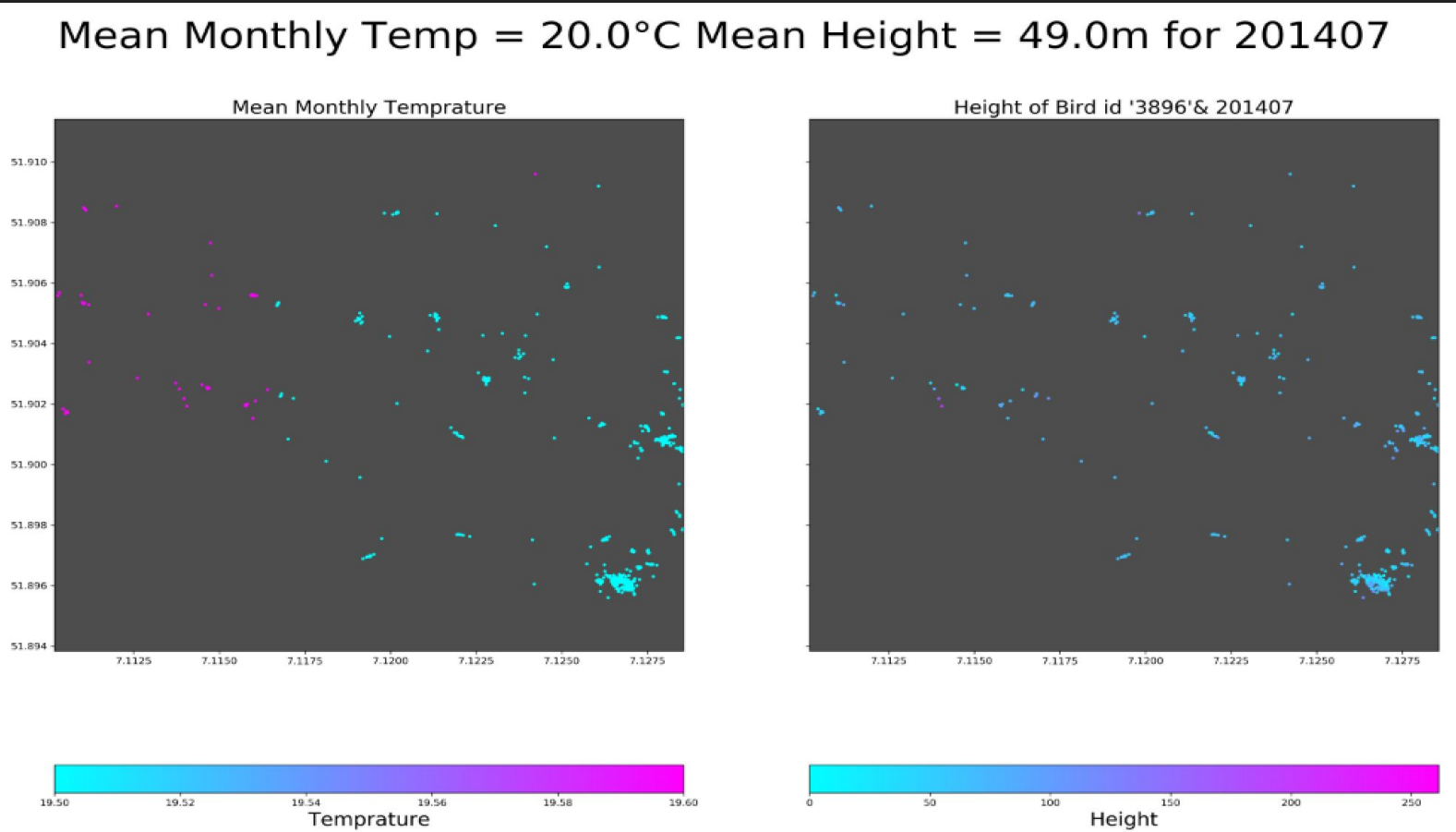
Thematic plots (Results)

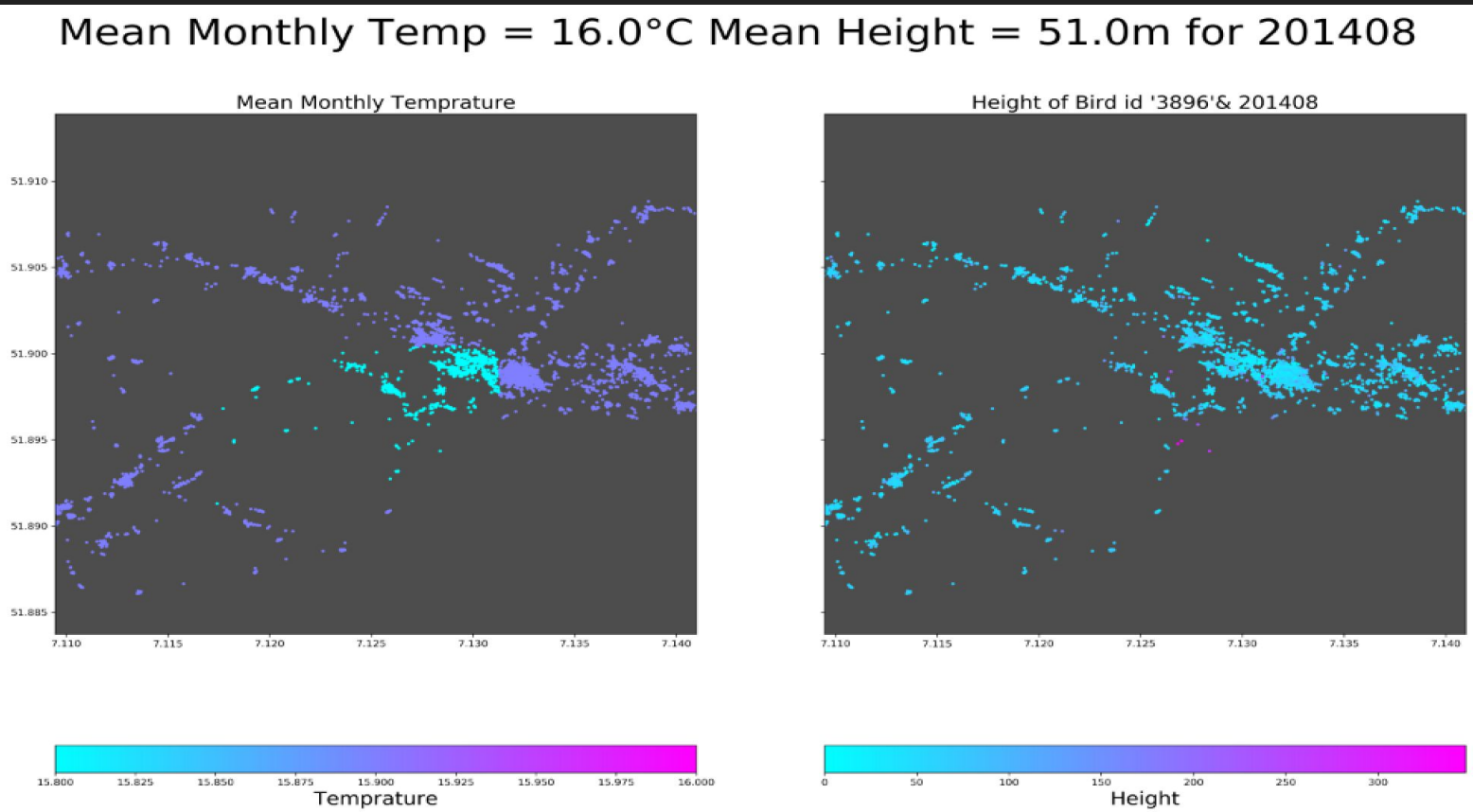
Avg. Monthly Temp & Height Map for Bird ID '3896' Gender = m M.Altitude = 53.0



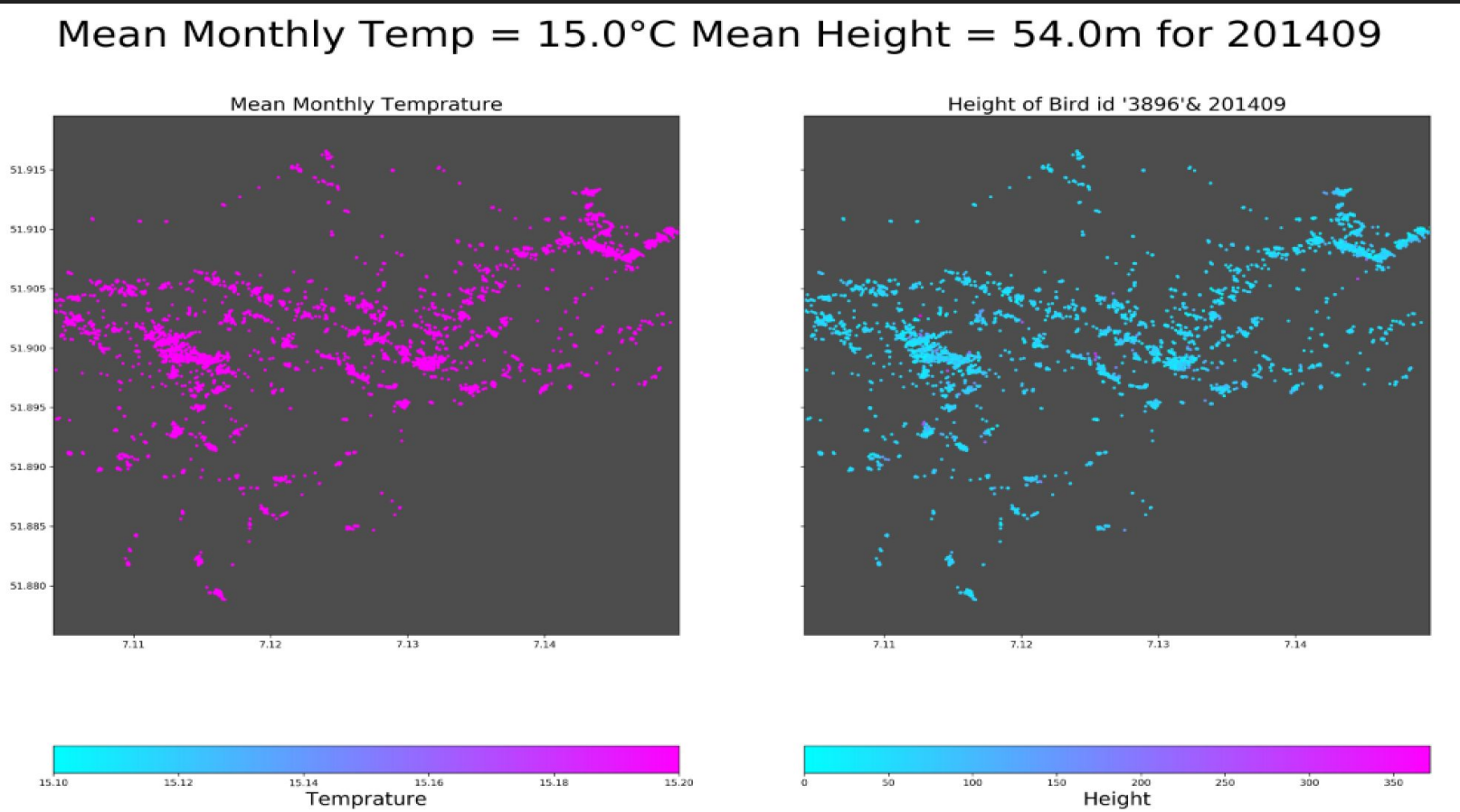
Thematic plots (Results)



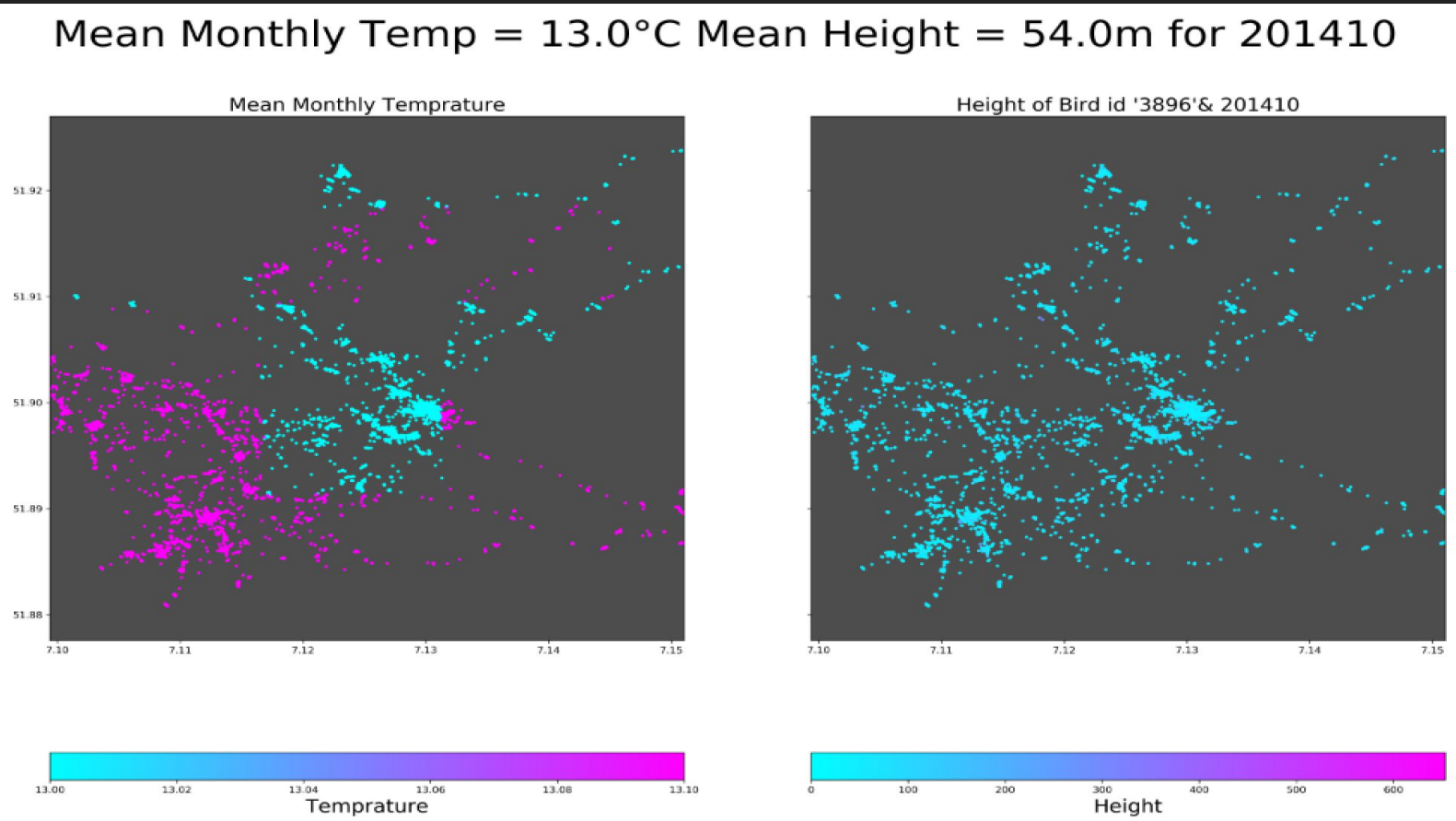
Thematic plots (Results)



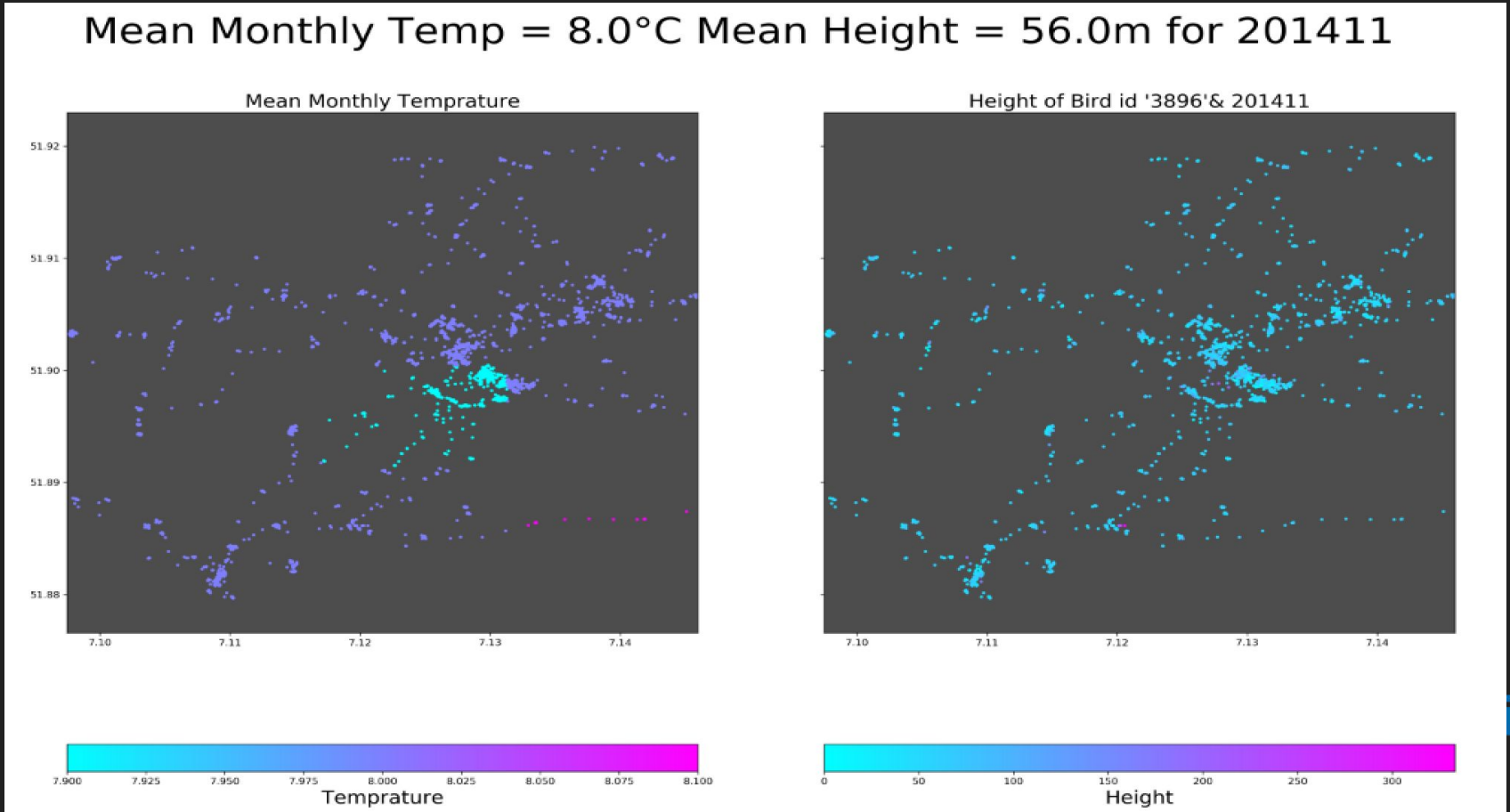
Thematic plots (Results)



Thematic plots (Results)



Thematic plots (Results)



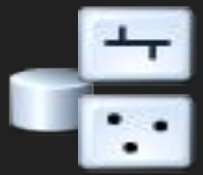
Analysis & Post-Processing

Scatter plot for mean temperature vs flight height for male and female birds.

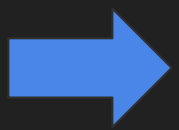
source: ESRI Web Course –Python for Everyone

ifgi

Scatter Plot (Results)



Owl Vector data



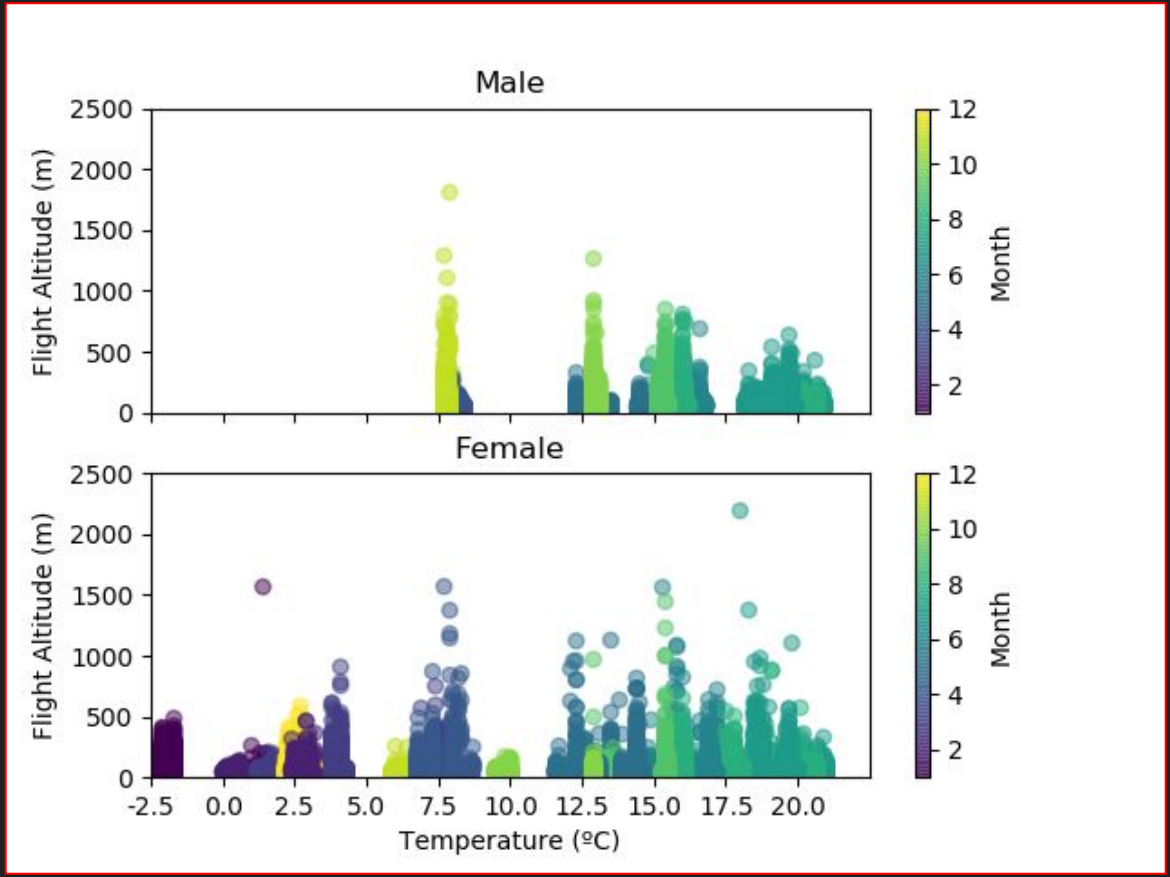
Arcpy

Flight Altitude

Temperature

Gender

Scatter Plot



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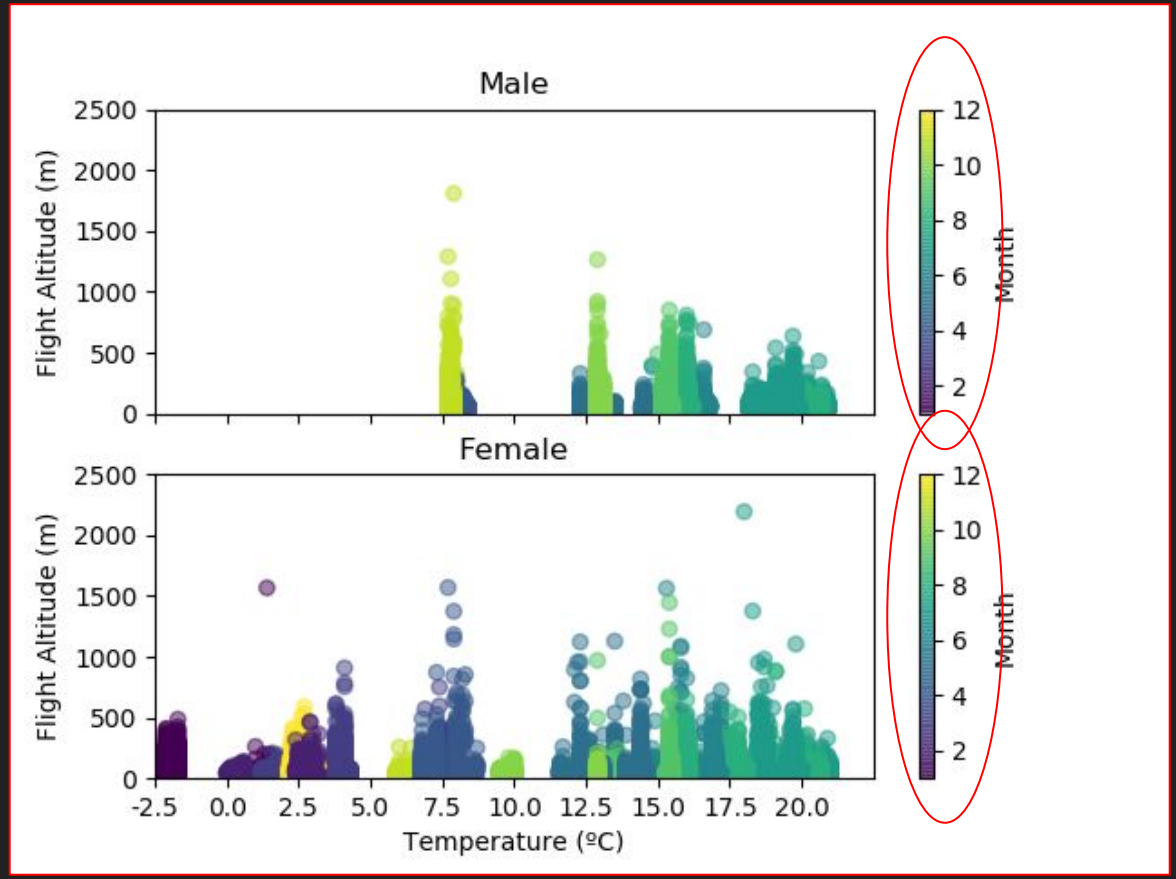
Scatter Plot (Results)



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Analysis & Post-Processing

Bar graphs of temperature and flight height per month from all years.

source: ESRI Web Course –Python for Everyone

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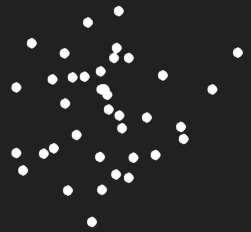
Bar Graphs

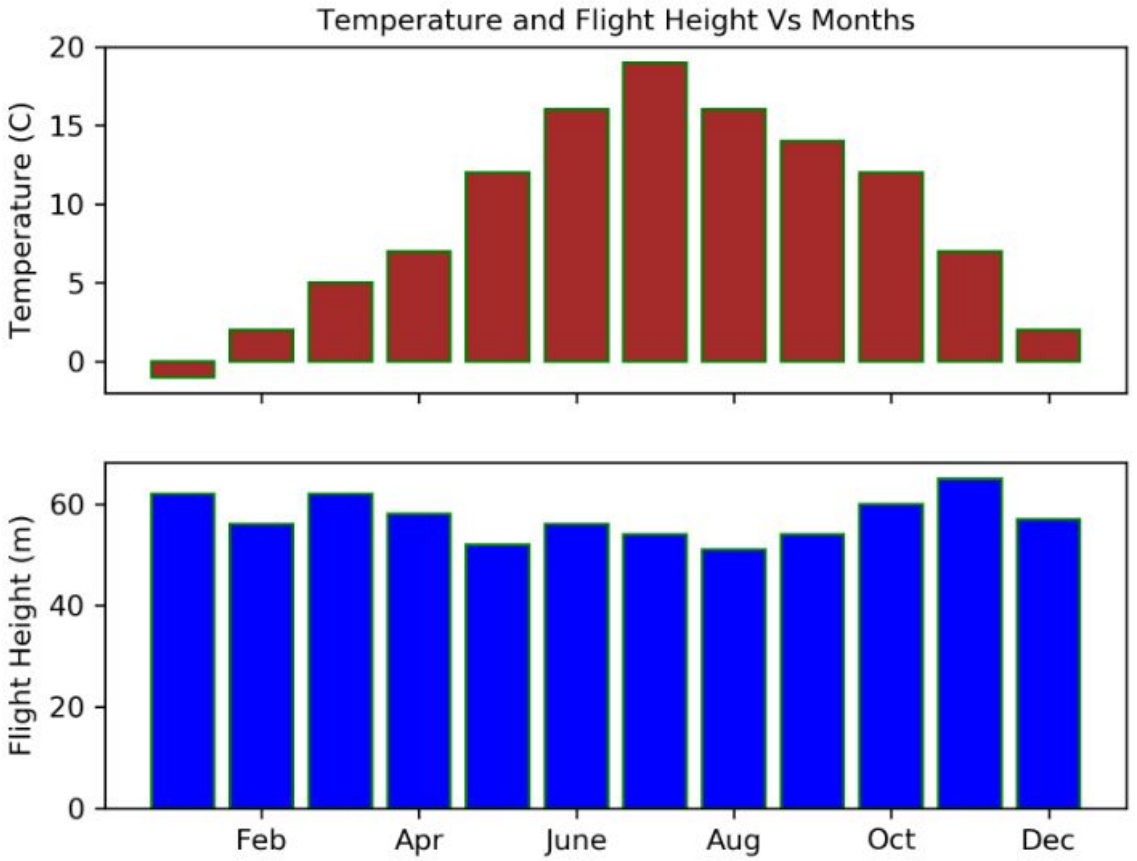


Using Arcpy
Statistics
Analysis

Month	MEAN_FlightH	MEAN_Meantemp_10
01	62.054851	-1.699331
02	56.806999	2.758417
03	62.013839	5.881111
04	58.540437	7.544693
05	52.87513	12.850864
06	56.305689	16.337674
07	54.081453	19.434102
08	51.489693	16.955067
09	54.147769	14.744607
10	60.30466	12.612951
11	65.409197	7.772095
12	57.718311	2.535937

matplotlib

Bar Graphs (Results)



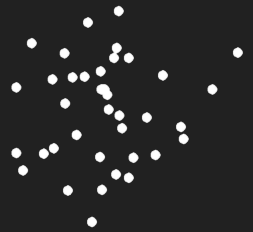
Analysis & Post-Processing

Bar graphs of temperature and Convex Hull per month from all years.

source: ESRI Web Course –Python for Everyone

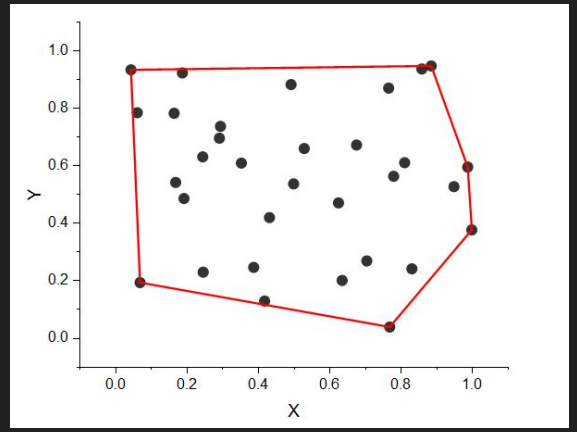
ifgi

Bar Graphs



Arcpy

Using arcpy
Minimum
Bounding Box
Analysis



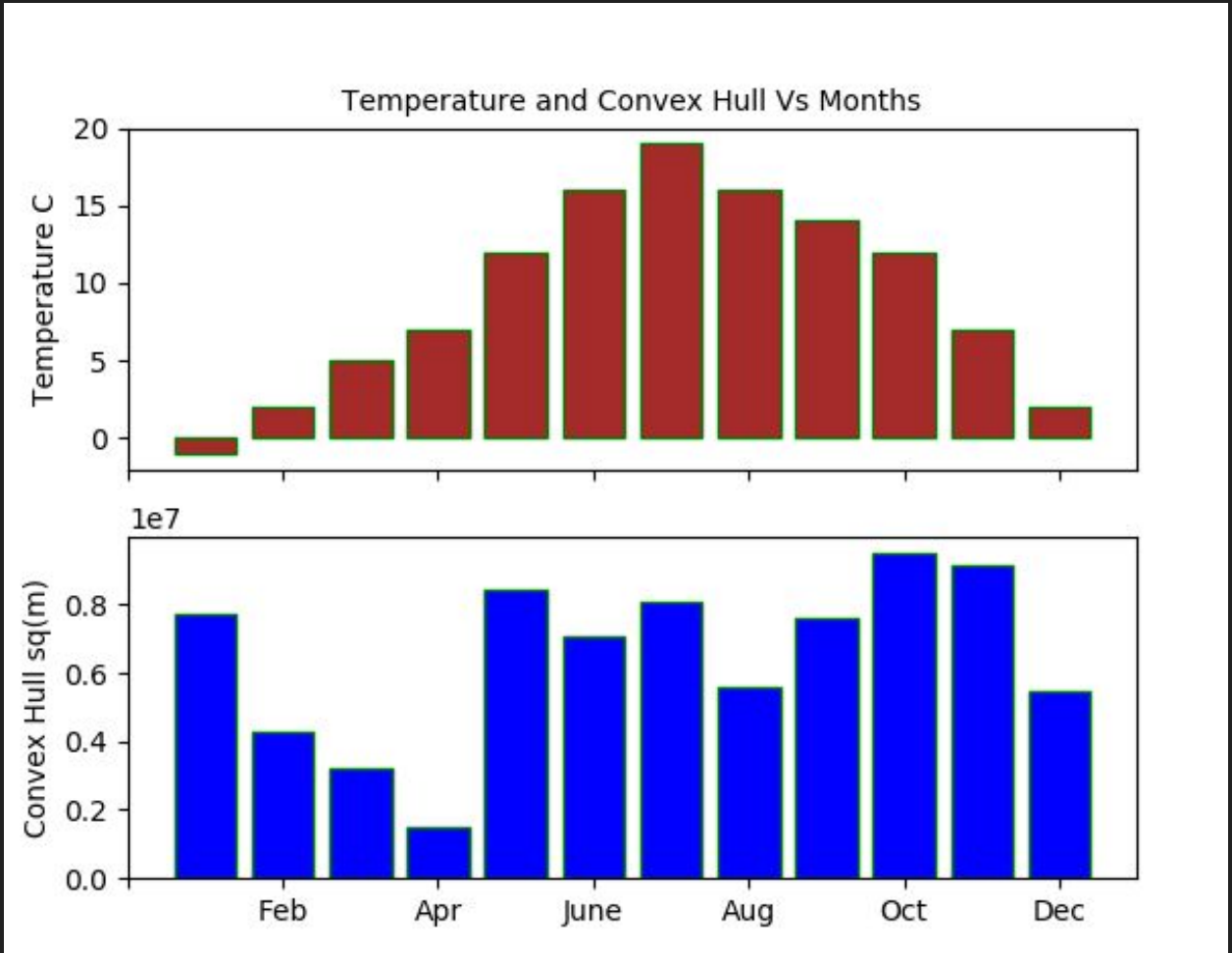
Arcpy

Using arcpy
Statistics
Analysis

Month	MEAN_Shape_Area
01	7749160.287707
02	4284057.332994
03	3202847.463888
04	1508030.609402
05	8418626.827286
06	7089013.258238
07	8053284.235978
08	5594205.164908
09	7613825.549595
10	9491839.736323
11	9126122.658616
12	5469193.851202

matplotlib

Bar Graphs (Results)



Mean and standard deviation summary

Month	MEAN_FlightH	MEAN_Meantemp_10	STD_FlightH	STD_Meantemp_10
01	62.054851	-1.699331	36.385542	0.781055
02	56.806999	2.758417	22.584183	0.505628
03	62.013839	5.881111	36.515883	1.781215
04	58.540437	7.544693	46.756465	0.487283
05	52.87513	12.850864	28.168656	0.861403
06	56.305689	16.337674	30.688394	0.504789
07	54.081453	19.434102	25.732669	0.825422
08	51.489693	16.955067	22.105149	1.695645
09	54.147769	14.744607	26.129507	1.047813
10	60.30466	12.612951	29.389313	1.289811
11	65.409197	7.772095	43.177524	0.39005
12	57.718311	2.535937	32.147471	0.412752

Discussion

The correlation matrix performed to have a better understanding between the three variables (Temperature, Flight Height and Convex Hull Area)

Variable	*Mean Monthly Temperature*	*Mean Convex Hull Area per Month*	*Mean Flight Height Per Month*
Mean Monthly Temperature	**1**	**0.35**	**-0.5912**
Mean Convex Hull Area per Month	**0.35**	**1**	**0.037**
Mean Flight Height Per Month	**-0.592**	**0.037**	**1**

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Limitations

Limitations

- The dataset had inadequate Temporal distribution which was not representative of the Bird's Lifespan.
- More data for the female birds compared to the male birds
- Low Spatial Resolution of the temperature Raster
- Errors in the DEM presented some altitude outliers

Recommendations

- Download temperature point data and create surface through interpolation

Conclusion

The project demonstrated the potential of automating repetitive workflow using Python on spatial data.

For the eagle owl, a change in temperature has no direct effect on flight height attained.

With limited variation in flight height, these findings can be used to determine possible sample locations for the Eagle owl.

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References

Kang, T.-H., Kim, D.-H., Lee, H., Cho, H.-J., Hur, W.-H., Han, S.-H., … Paik, I.-H. (2014). Analysis of Home Range of Eurasian Eagle Owl (Bubo bubo) by WT-100. *Journal of Asia-Pacific Biodiversity*, *6*(3), 369–373. https://doi.org/10.7229/jkn.2013.6.3.369

Tanneberger, F., Flinks, H., Arbeiter, S., Minets, M., & Hegemann, A. (2017). Diet Analysis of Wetland Passerine Nestlings Using Neck Collars or Faecal Sampling Produces Similar Results. *Ardea*, *105*(2), 145–152. https://doi.org/10.5253/arde.v105i2.a7

https://www.gwct.org.uk/blogs/news/2016/april/eagle-owls-%E2%80%93-are-they-making-a-comeback-in-britain/

Questions???