

Esri ArcGIS - IDW Temperature Data Points using a Meteobike Sensor System

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## **Introduction**

A UIA World Countries Boundaries map was retrieved from the Esri ArcGIS Hub to create a map of the urban heat island Freiburg im Breisgau, Baden Wurttemberg, Germany. The data was also independently provided from collecting the dataset in the summer of 2018. Data was collected using a new traversing sensor system that includes a temperature, humidity along with a GPS data collector. Instantaneous data was collected as bikes traversed through the city. Each map utilized from an external source provided enough information to obtain base layer information in order to carry out the remaining GIS functions. The goal of this project was to determine the urban heat island in Freiburg using the new traversing sensor system. This data can be used in a geospatial information system (GIS) program such as Esri ArcGIS in order to produce a map that is both visually appealing and displaying accurate data simultaneously. The map can then be used to display in public settings to inform the general public different areas around the city that are significantly cooler than other areas. The map can be extremely useful for public health during the summer months and heat waves. Future studies using the Meteobike system and Esri ArcGIS in different cities can be beneficial worldwide.

## **Methodology**

The project that was conducted here includes using a spatial analyst tools such as interpolation and inverse distance weighted (IDW). Inverse distance weighted (IDW) interpolation determines cell values using a linearly weighted combination of a set of sample. This allowed the information to be displayed as a temperature gradient map over the entire city rather than displaying it as individual data collection points. Using the ArcGIS Hub I was able to obtain the UIA World Countries Boundaries and isolate Germany as a shapefile. From this, an excel file with all the GPS (latitude and longitude) data points collected throughout the city of Freiburg im Breisgau that included the temperature and humidity values was imported. With this information I used the Interpolated Distance Weighted (IDW) Spatial Analyst Tool to display the temperature gradients around the city. Using the layout frame, I was able to produce a more informative map that included the scale bar, temperature legend, north arrow and display where in Germany Freiburg was located using various additional tools from Esri ArcGIS.

## **Results**

The map of Freiburg im Breisgau urban heat island that was created using Esri ArcGIS program was extremely beneficial to use in order to produce the map of temperature difference from the downtown core to the outskirts of the city. This project displayed the useful technique of inverse distance weighted moving averages on the Esri GIS program. The map was created using the IDW interpolation displayed clear patterns regarding the temperatures of the urban heat island in Freiburg im Breisgau, Germany (Figure 1). There are many different techniques that could have been used to display this data such as using local and global methods of interpolation, which include Thiessen polygons and pycnophylactic interpolation or trend surface analysis, and regression. Thiessen polygons and the pycnophylactic method would also be an accurate approach when creating maps using the geocoded temperature data points. This is because Thiessen polygons are often used when a set of sample points are needed to represent greater areas but this does assume homogeneity therefore may not represent reality well. Thus, the pycnophylactic method is then used to smooth the polygons that were created ensuring there are not abrupt changes at borders, resulting with smoother more realistic surfaces.

## **Conclusion**

As the many different Geographic Information Systems (GIS) softwares continue to improve, it is essential to produce maps that are creative and effective at displaying accurate data. This project displays the many useful tools and techniques that are available when using the Esri ArcGIS program. From completing this project I have gained valuable skills in operating the program and look forward to using it for future projects in both educational and recreational use. With the help of obtaining the Esri Canada Scholarship, I will be able to further improve my skills within the program and continue to share the knowledge gained by displaying the various maps that can be produced.

**Figure 1.** Urban heat island displayed in Freiburg im Breisgau, Germany.

