Air Pollution Mapping and Prediction
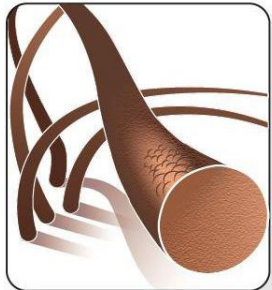
Gaurav Mahamuni

May 15th, 2019
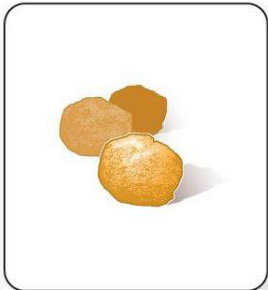
Particles having size less than 2.5μm are harmful to human health

Fine Particulate Matter Size Comparison
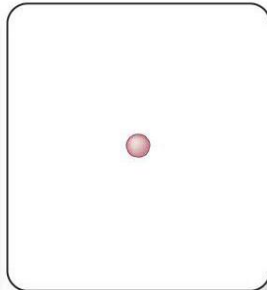μm = micrometer

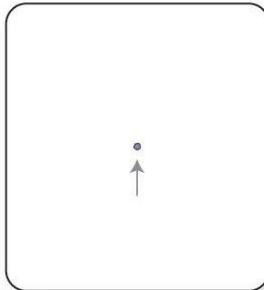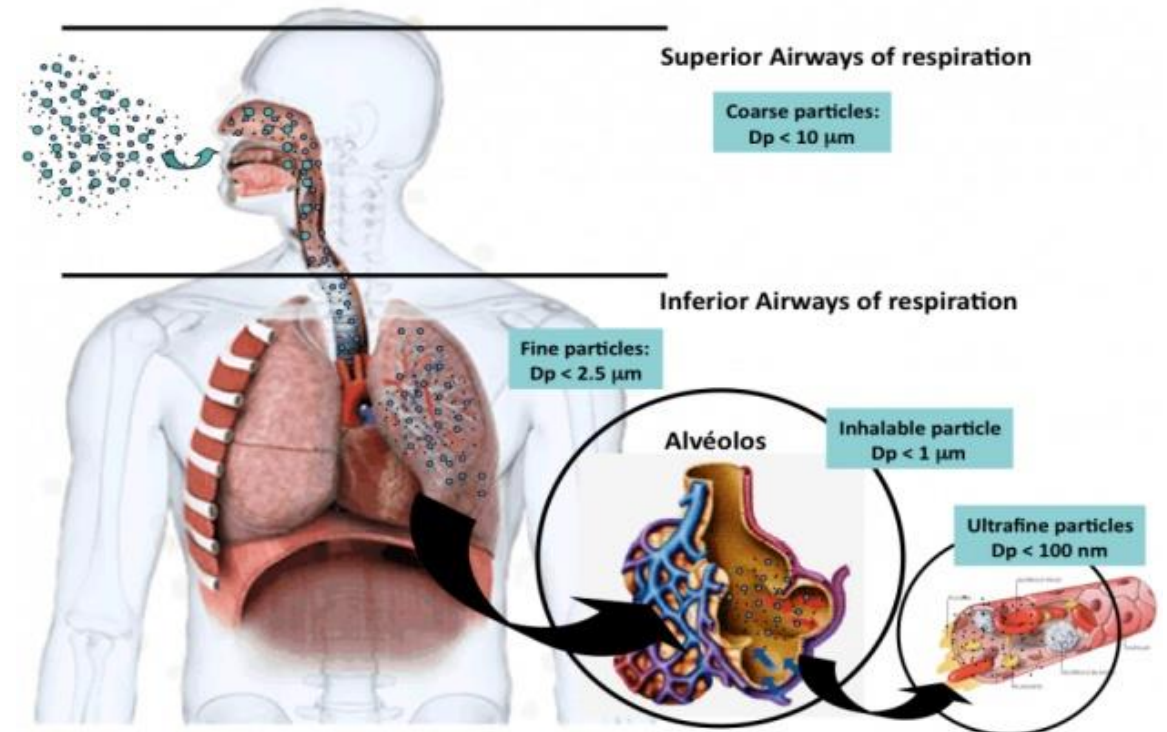Human hair (about 70μm wide)
Grain of sand (about 50μm wide)
PM₁₀ (less than 10μm wide)
PM₂.₅ (less than 2.5μm wide)

Centers for Disease Control and Prevention

Superior Airways of respiration
Coarse particles: Dp < 10 μm

Inferior Airways of respiration
Fine particles: Dp < 2.5 μm

Alvéolos
Inhalable particle Dp < 1 μm

Ultrafine particles Dp < 100 nm

Source: Garieiro and Garieiro, (2013) Vehicle Emissions – What will Change with Use of Biofuel?

Deaths due to PM Exposure

In the year 2016, ambient air pollution was responsible for 4.2 million deaths. (7.6% of all deaths)

16% lung cancer deaths, 25% chronic obstructive pulmonary disease (COPD) deaths, 17% ischemic heart disease and stroke, 26% respiratory infection deaths.Global Health Observatory (GHO) data, World Health Organization

All causes attributable to Particulate matter pollution
Both sexes, All ages, 2016, Deaths per 100,000
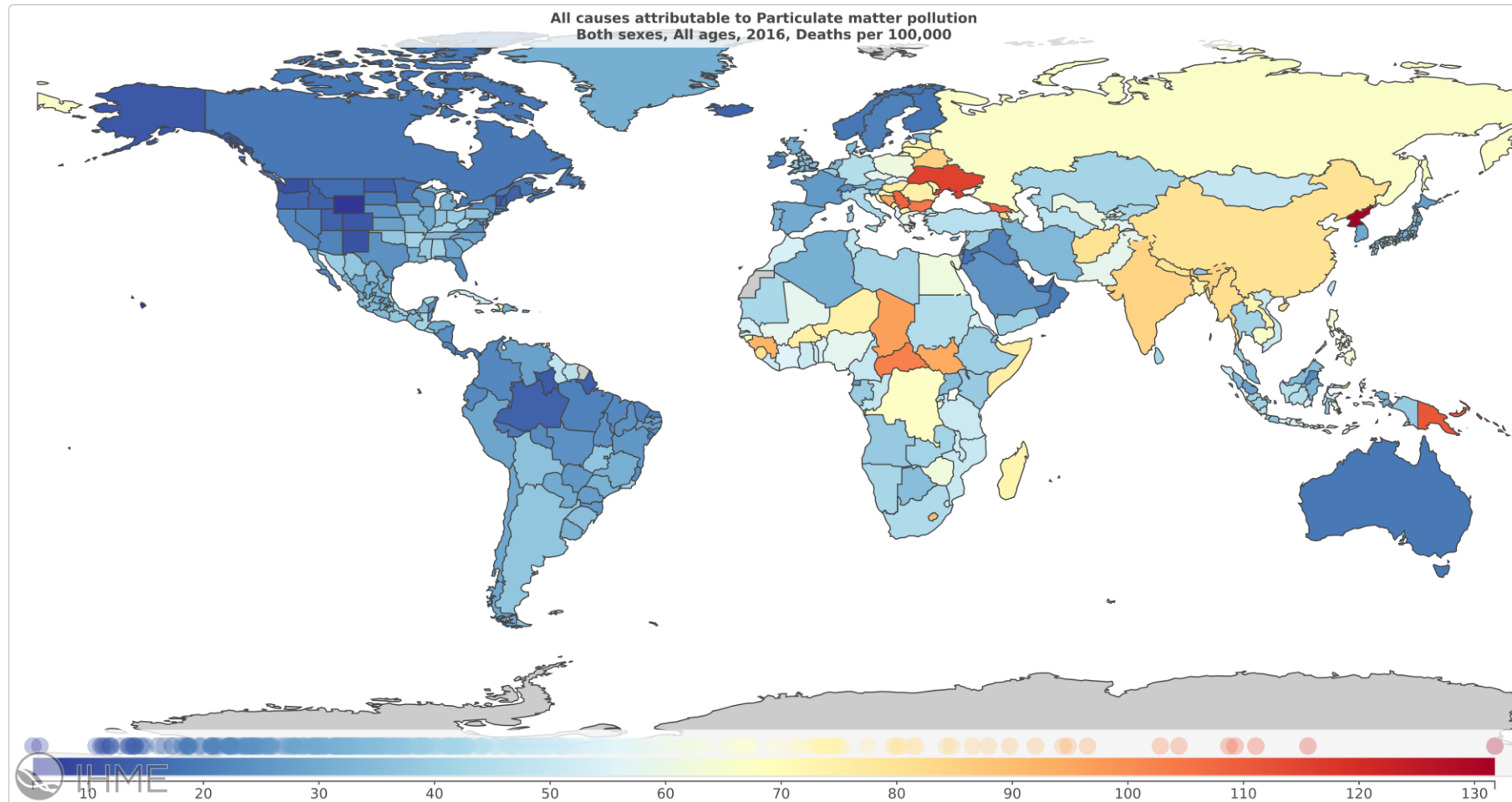
Dataset - Air Pollution and Meteorological Data in Krakow, Poland

Source: Google Maps

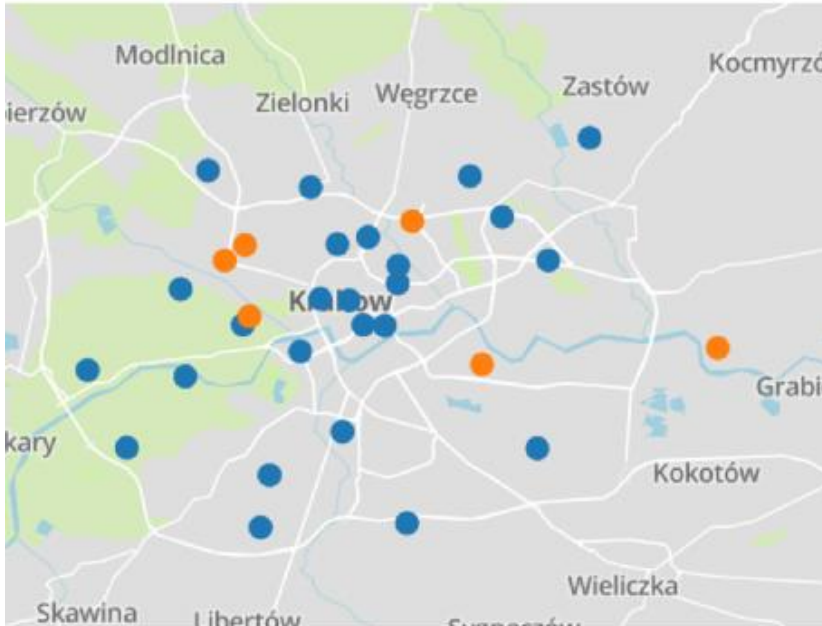32 Sensors Distributed Across Krakow, Poland

Air Quality Data from 2017 for 10 months:

- Concentrations of particulate matter PM2.5, Concentrations of particulate matter PM10
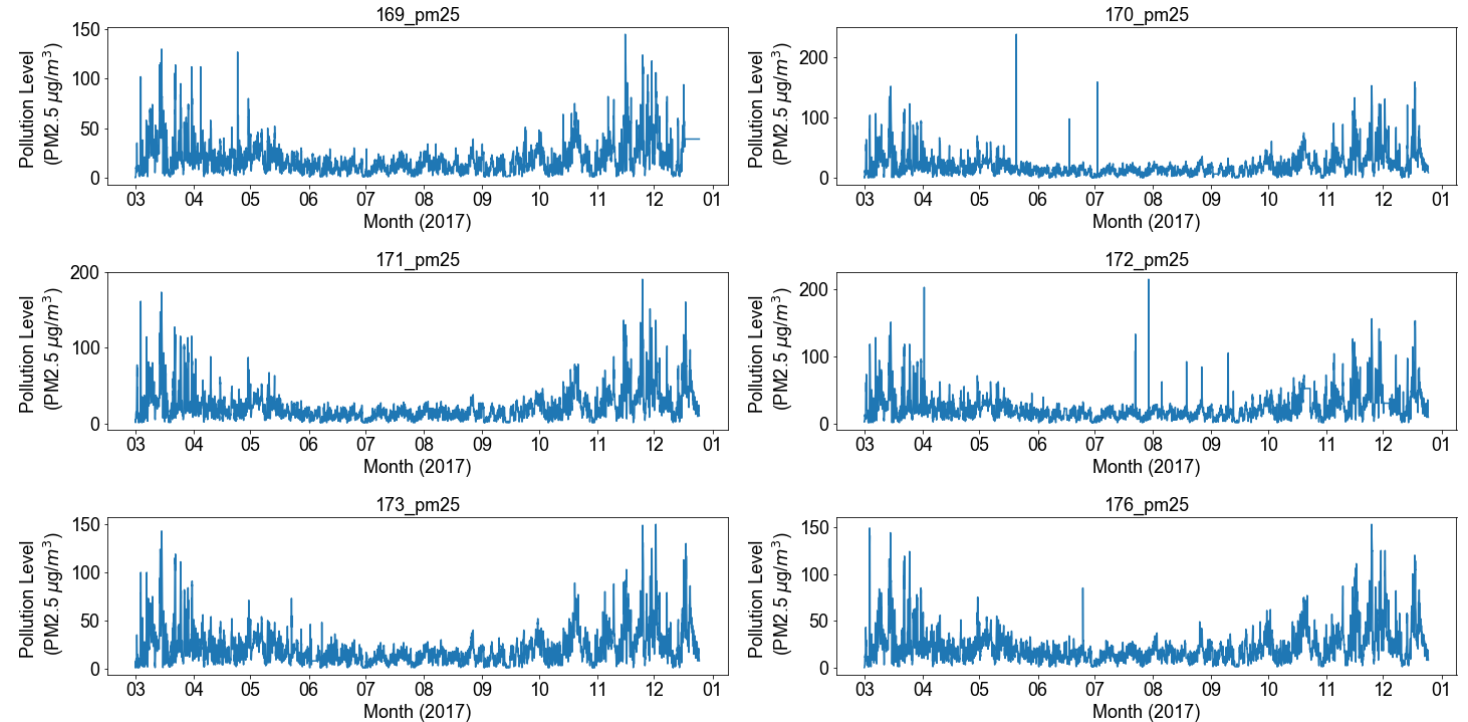- Temperature, Air Pressure, Humidity

The data is recorded every hour for 12 months

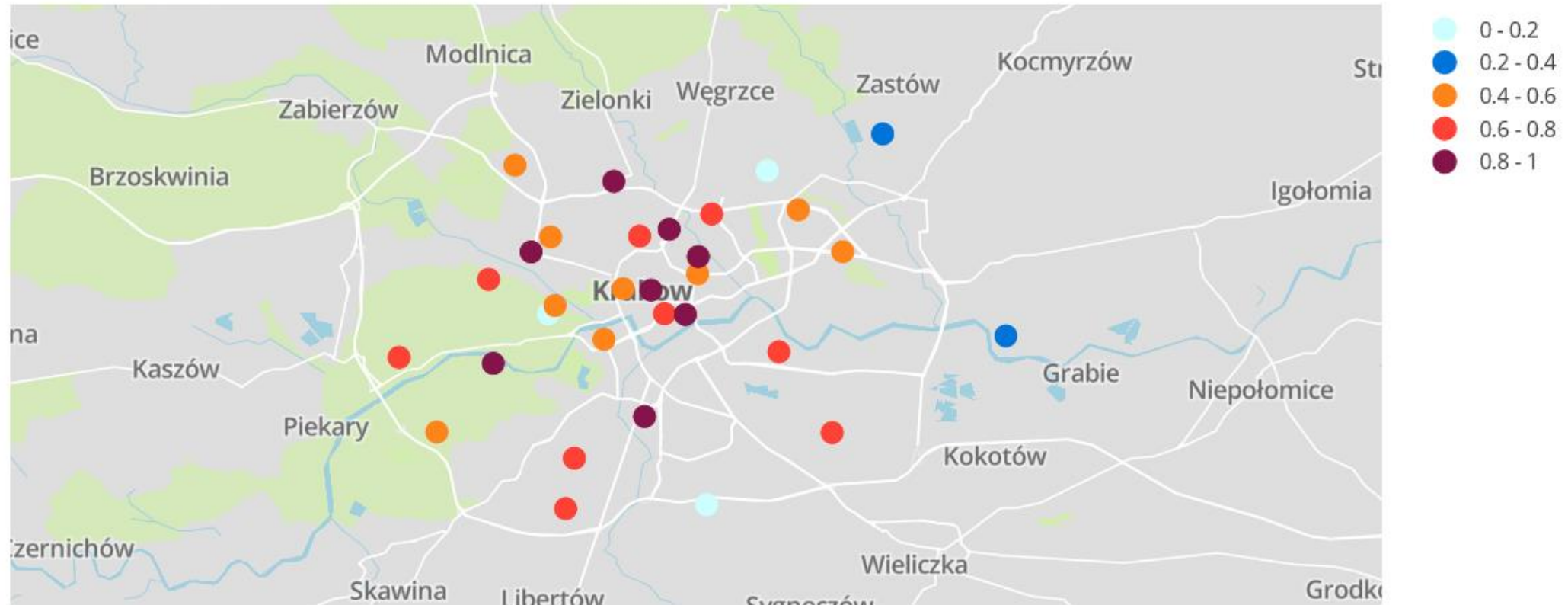# Variation of PM2.5 over 10 months in 2017 in Krakow, Poland

The air quality seems to be good during summer and fall months

PM2.5 concentrations are high in winter and spring months with unusual spikes in summer and fall months
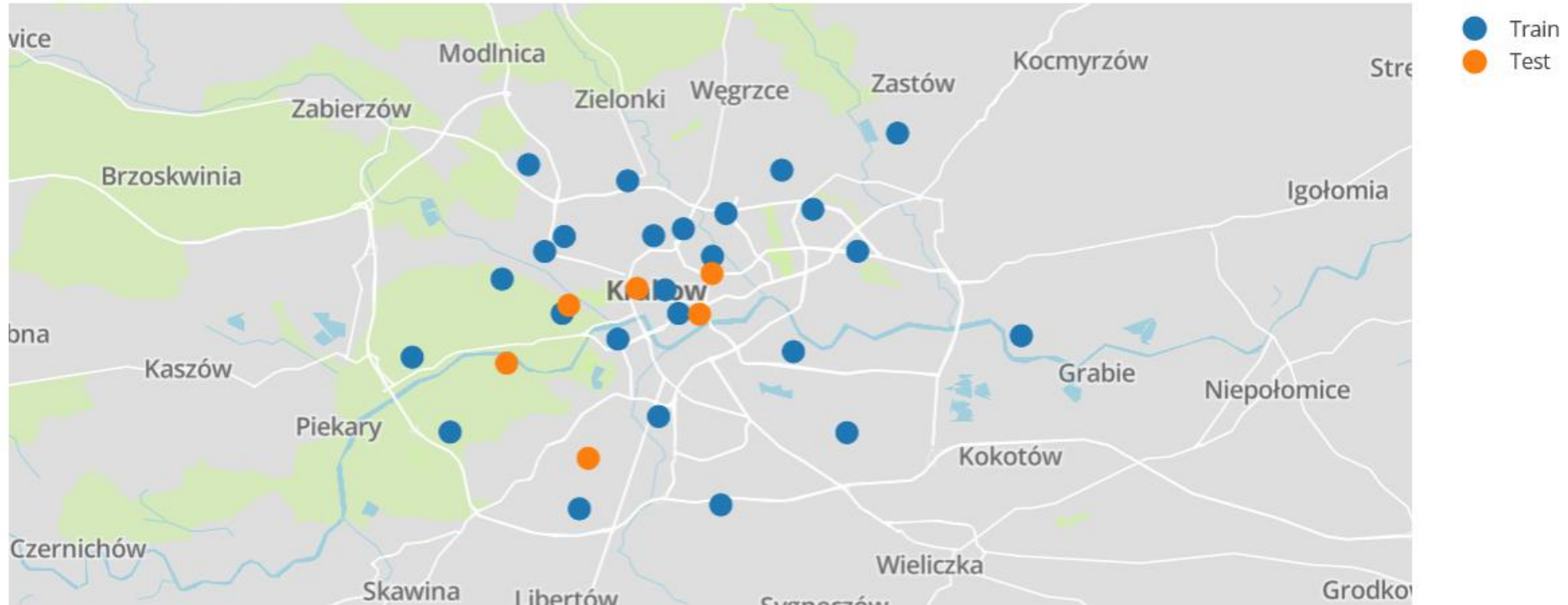
Locations PM2.5 Distribution at Sensor Locations over 2017

Normalized PM2.5 Distribution 2017

PM2.5 levels seems to be high within the city and reduce as we move farther from the city

Dividing into Training and Test Set for Predicting Pollution Levels and Mapping

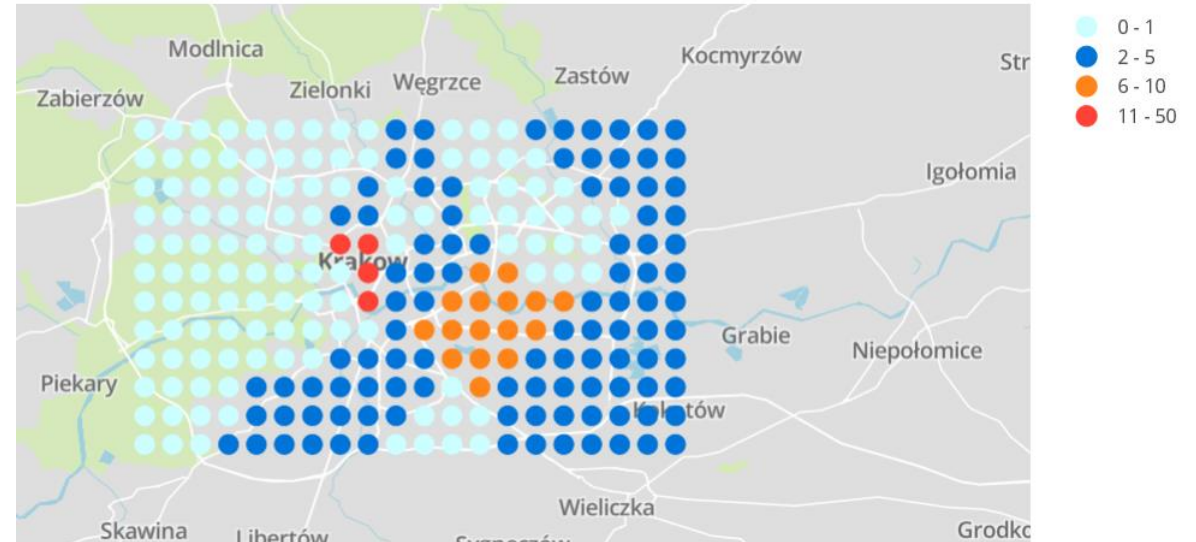Location data can be divided into training and test locations

Pollution concentrations over time can be divided into training and test concentrations for each location

Mapping onto 1km X 1km Grids to Determine Location Specific Pollution Levels

The Machine Learning model can be set up to map and predict pollution to grid locations across the city

This will improve space resolution of air pollution exposure assessments

Thank You!

Questions?