

Introduction

The City of Chicago's overall crime rate, especially violent crimes, ranks much higher than the US average. Reasons for Chicago's high crime rate are not clear, but many social and physical variables could affect patterns of criminal activity.

- Focus: Comparing model outputs from the Weather Research Forecast (WRF) model with daily crime data in the City of Chicago.
- Identify heat stress locations and decide heat mitigation solutions that can help in reducing violence
- The **overall scientific goal** of the project is to **analyze** and **identify seasonal patterns** of crimes as well as **locations sensitive to temperature change**.

Crime and Climate Factors

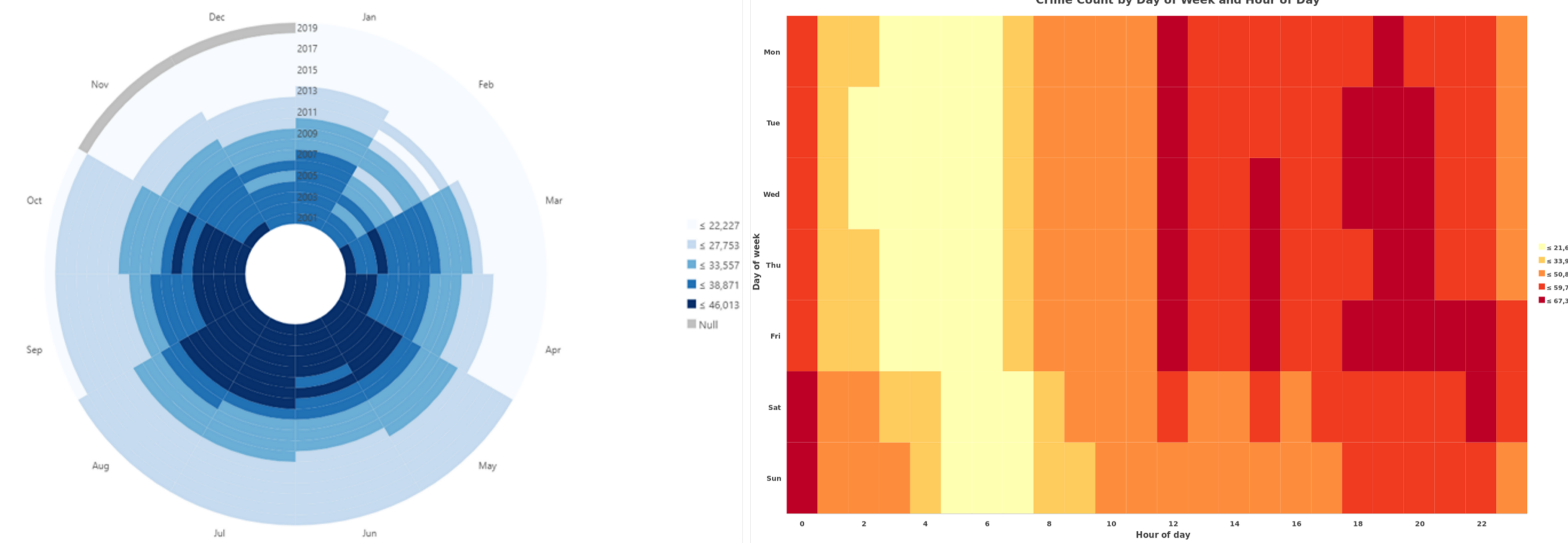


Figure 1. Data clock and calendar heat plot counting incidents of crimes in Chicago by month and year. Crimes peak in warmer months with steadily decreasing trends closer to the present.

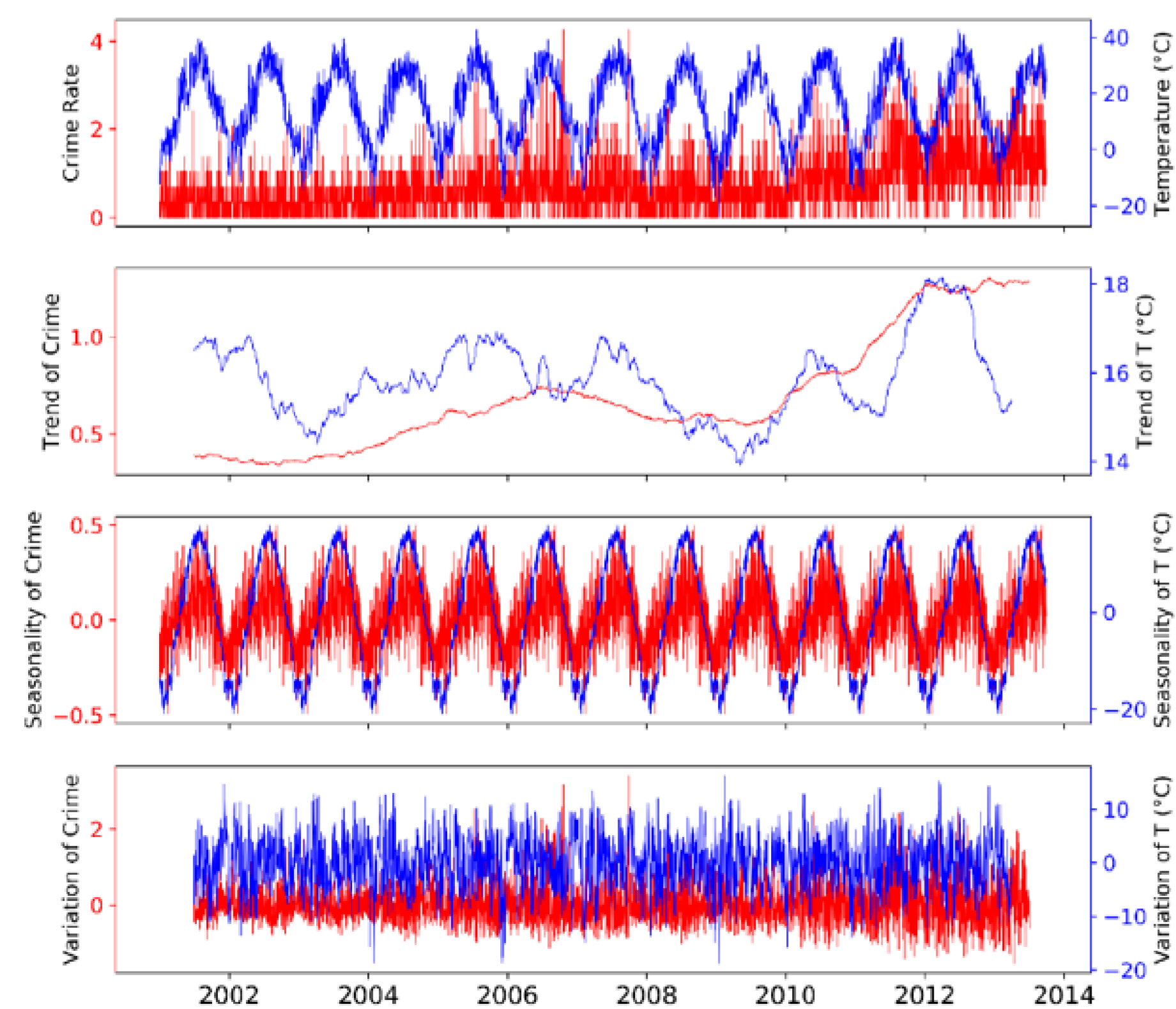


Figure 2. Time series decomposition of crime characteristics and daily temperature measurements show similar seasonal patterns (Lei et al., 2021 - unpublished).

Comparing Climate And Crime

Major differences between crime patterns and climate patterns makes comparison of the two difficult. However, the daily occurring data of both layers can be decomposed into the following 3 patterns.

1. Trend
2. Seasonality
3. Daily Variations

The general process is as follows:

- Conduct "Emerging Hotspot Analysis" of point crime data.
- Categorize crime data by census tract locations.
- Compute zonal statistics of WRF outputs to aggregate areas of similar climate patterns.
- Compute zonal statistics of crime locations categorized by hotspot locations.
- Conduct a bivariate analysis between temperature and crime count (Moran's I).

Incorporating Climate Models

Spatial variability across meteorological stations makes comparisons of individual crime point locations difficult. Running the WRF model at 1 km resolution allows city officials to identify discrepancies in climatic conditions amongst different neighborhoods.

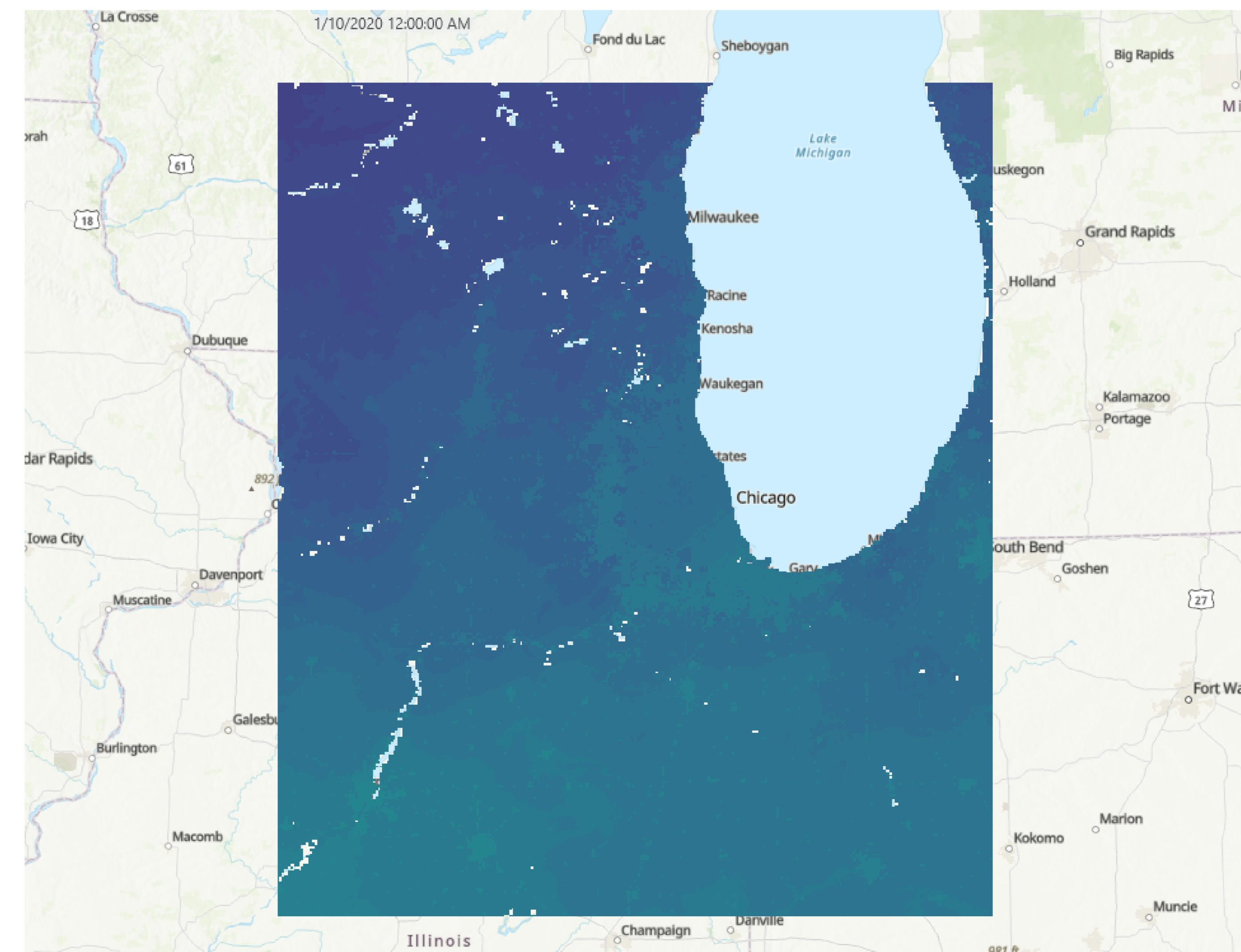


Figure 3. Screenshot of the WRF Model running in ESRI's Cloud Raster Format (01/20/2020).

Spatial Distribution of Crime Types

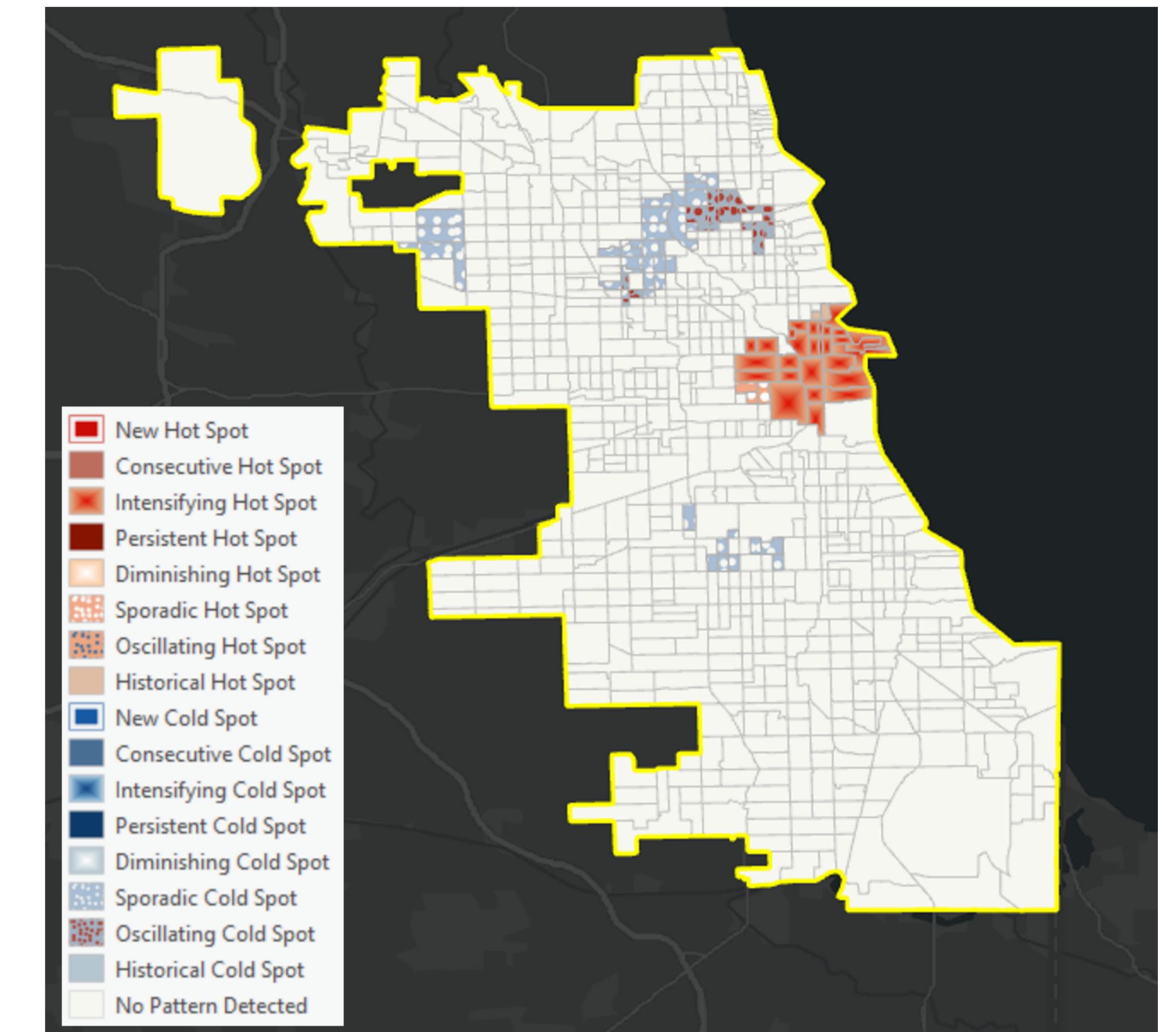


Figure 4. Emerging Hotspot Map for Property Crimes.

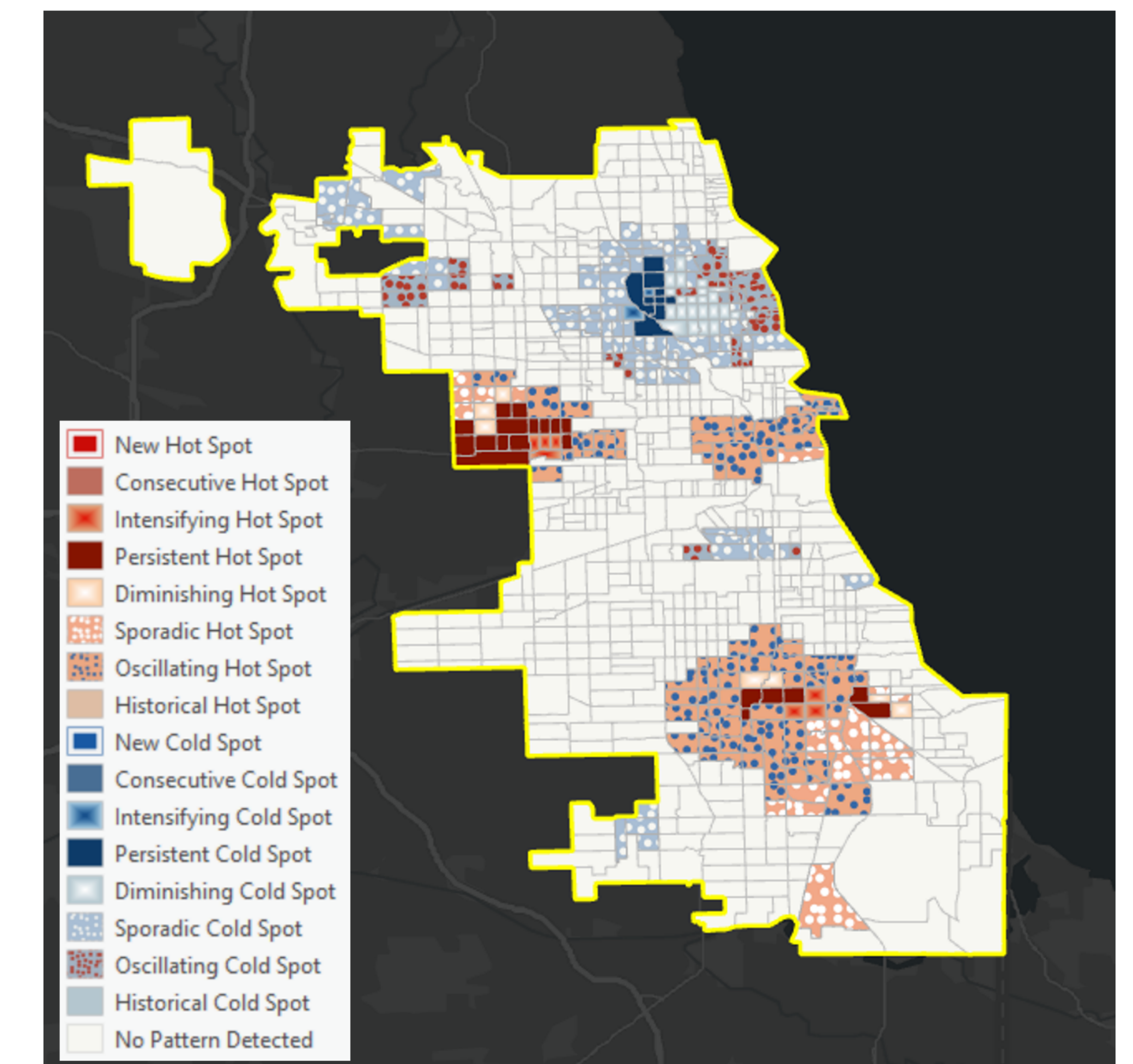


Figure 5. Emerging Hotspot Map for Violent Crimes.