

Applying the Urban Health Index to Shanghai, China

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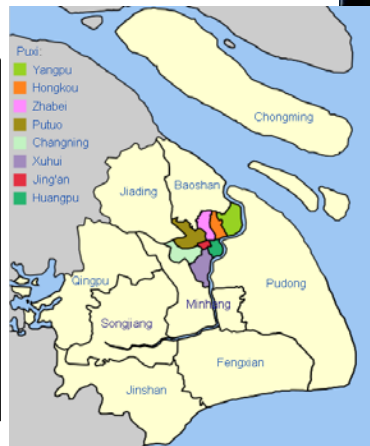
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Why Shanghai

- Largest city proper by population in the world
 - 24 million in total
 - 17 million in core district
 - 6,845/km²
- Global financial center
 - GDP: US\$352.36 billion



Examining the UHI for Shanghai

- Health determinants
 - Data source: 2000 Census Statistics
 - Small area unit: township (n=329)
 - Indicators
 - Economic, demographic, educational, and built environmental variables
 - Directions
 - make lower levels “worse” and higher levels “better”

Examining the UHI for Shanghai

- 10 indicators
 - Demographic
 - Non-agricultural population (%)
 - Economic
 - Employed population (%)
 - Professional and managerial job (%)
 - Education
 - Middle-school graduation (%)
 - High-school graduation (%)
 - Junior-college graduation (%)
 - Built environment
 - Household cooking using gas and electricity (%)
 - Household using tap water (%)
 - Household having its own bath heating facilities (%)
 - Household having its own lavatory (%)

- Standardize Indicators

$$I^s = \frac{I - \min^*(I)}{\max(I) - \min^*(I)}$$

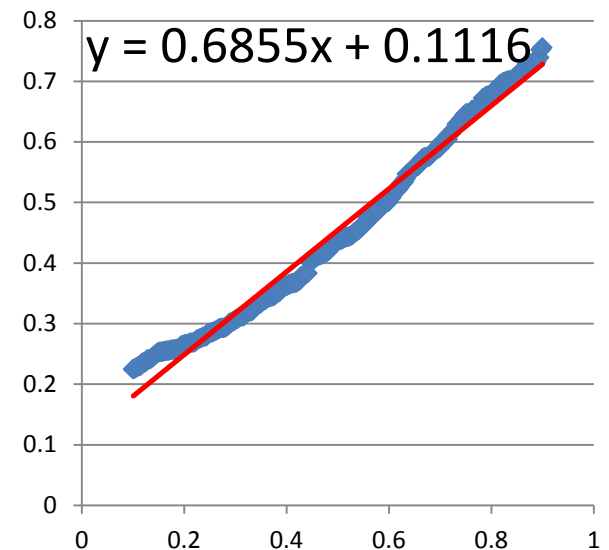
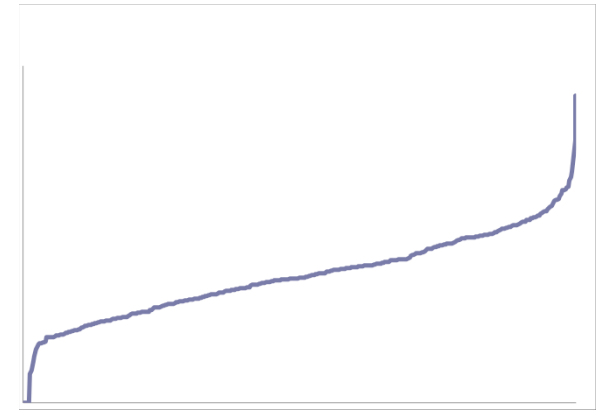
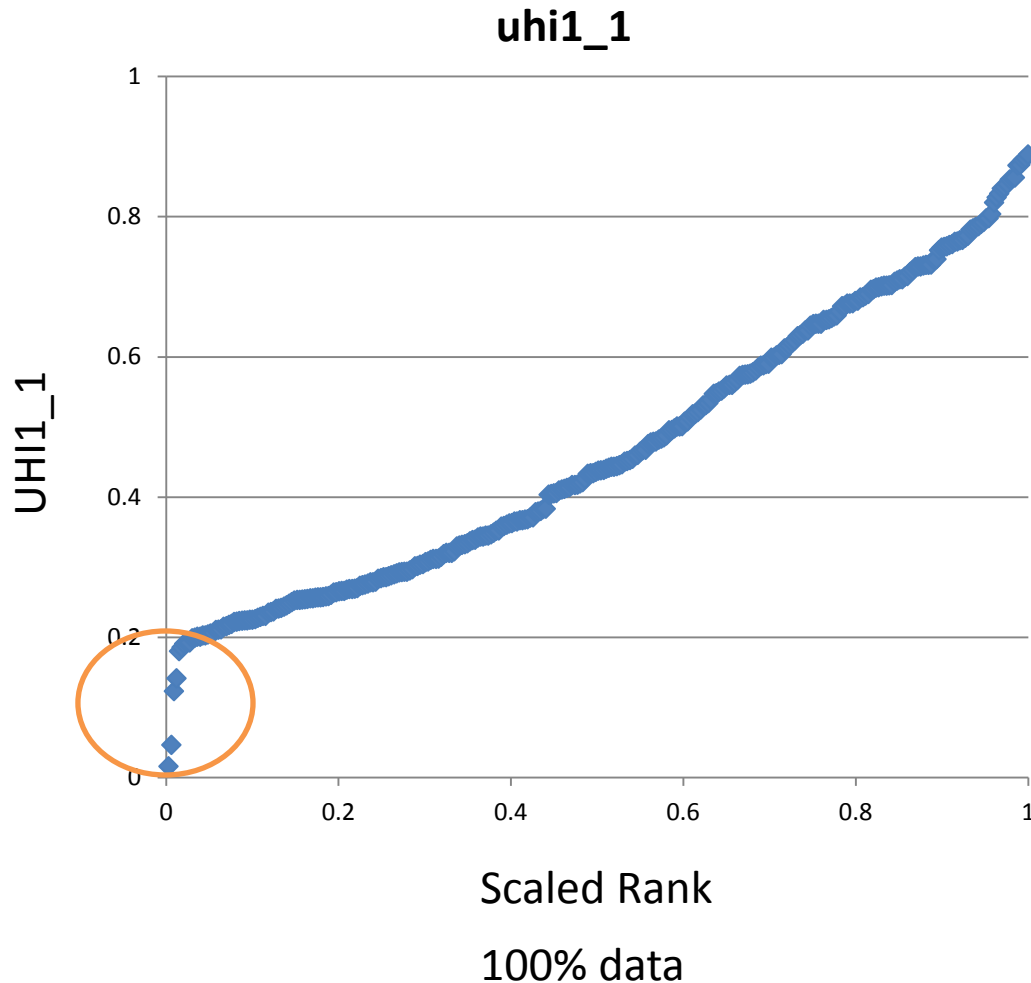
Where $\min^*(I)$ is the sample minimum minus small constant (0.1) to prevent zero values for I^s .

- Compute the Index using geometric mean of the standardized indicators

$$UHI = \left(\prod_{i=1}^n I_i^s \right)^{\frac{1}{n}}$$

Shanghai UHI graph

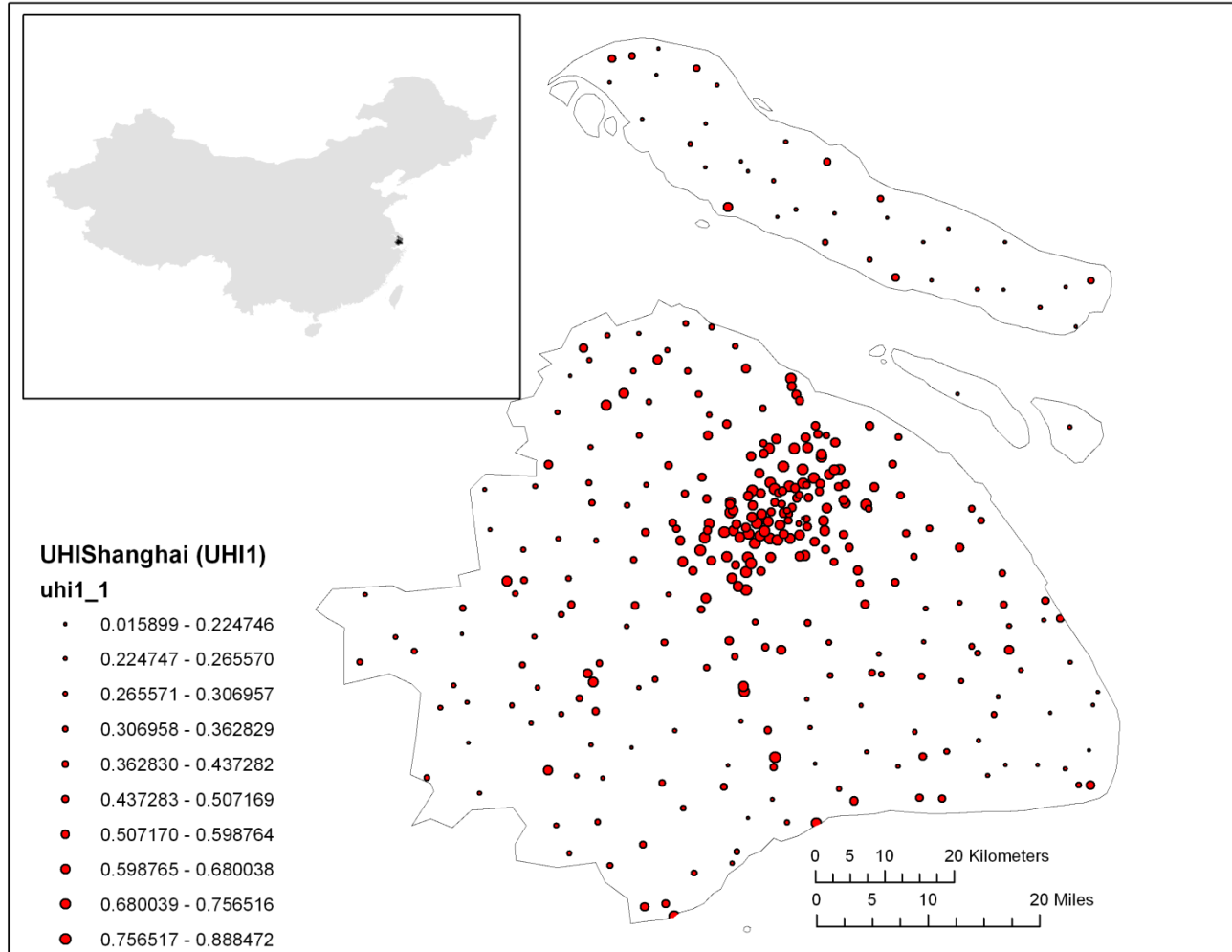
- UHI1: 10 indicators



Middle 80% data

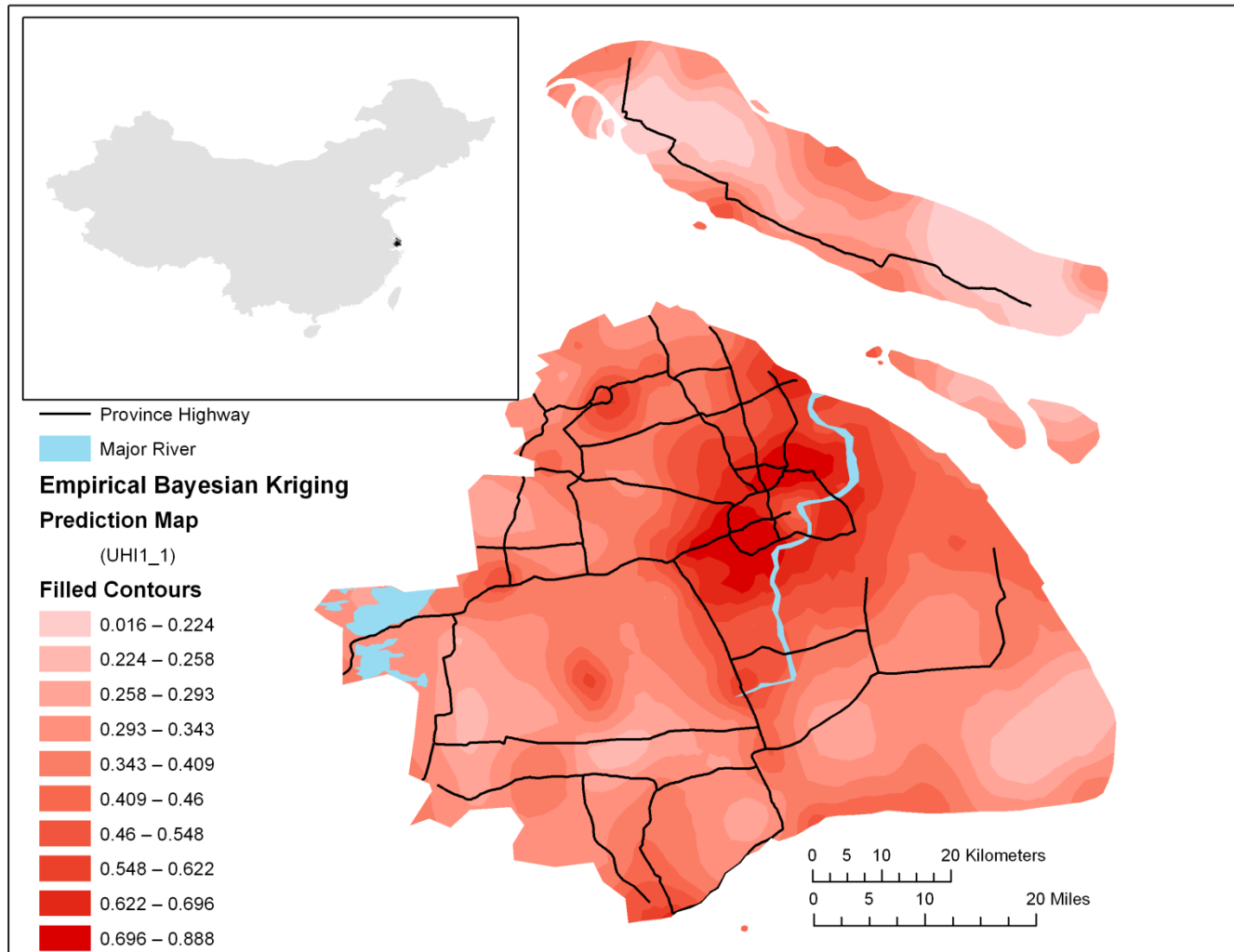
Shanghai UHI graph

- UHI1: 10 indicators



Shanghai UHI graph

- UHI1: 10 indicators



Selection of variables

- 10 indicators
 - Demographic
 - Non-agricultural population
 - Economic
 - Employed population
 - Professional and managerial job
 - Education
 - Middle-school graduation
 - High-school graduation
 - Junior-college graduation
 - Built environment
 - Household cooking using gas and electricity
 - Household using tap water
 - Household having its own bath facilities
 - Household having its own lavatory
- UHI1_1
- UHI1_2
- UHI1_3
- UHI1_4
- UHI1_5

Selection of variables

- 8 indicators
 - Demographic
 - Non-agricultural population
 - Economic
 - Employed population
 - Professional and managerial job
 - Education
 - Middle-school graduation
 - High-school graduation
 - Junior-college graduation
 - Built environment
 - Household cooking using gas and electricity
 - Household using tap water
 - Household having its own bath facilities
 - Household having its own lavatory
- UHI1_1
- UHI1_2
- UHI1_3
- UHI1_4
- UHI1_5

Selection of variables

- 6 indicators
 - Demographic
 - Non-agricultural population
 - Economic
 - Employed population
 - Professional and managerial job
 - Education
 - Middle-school graduation
 - High-school graduation
 - Junior-college graduation
 - Built environment
 - Household cooking using gas and electricity
 - Household using tap water
 - Household having its own bath facilities
 - Household having its own lavatory
- UHI1_1
- UHI1_2
- UHI1_3
- UHI1_4
- UHI1_5

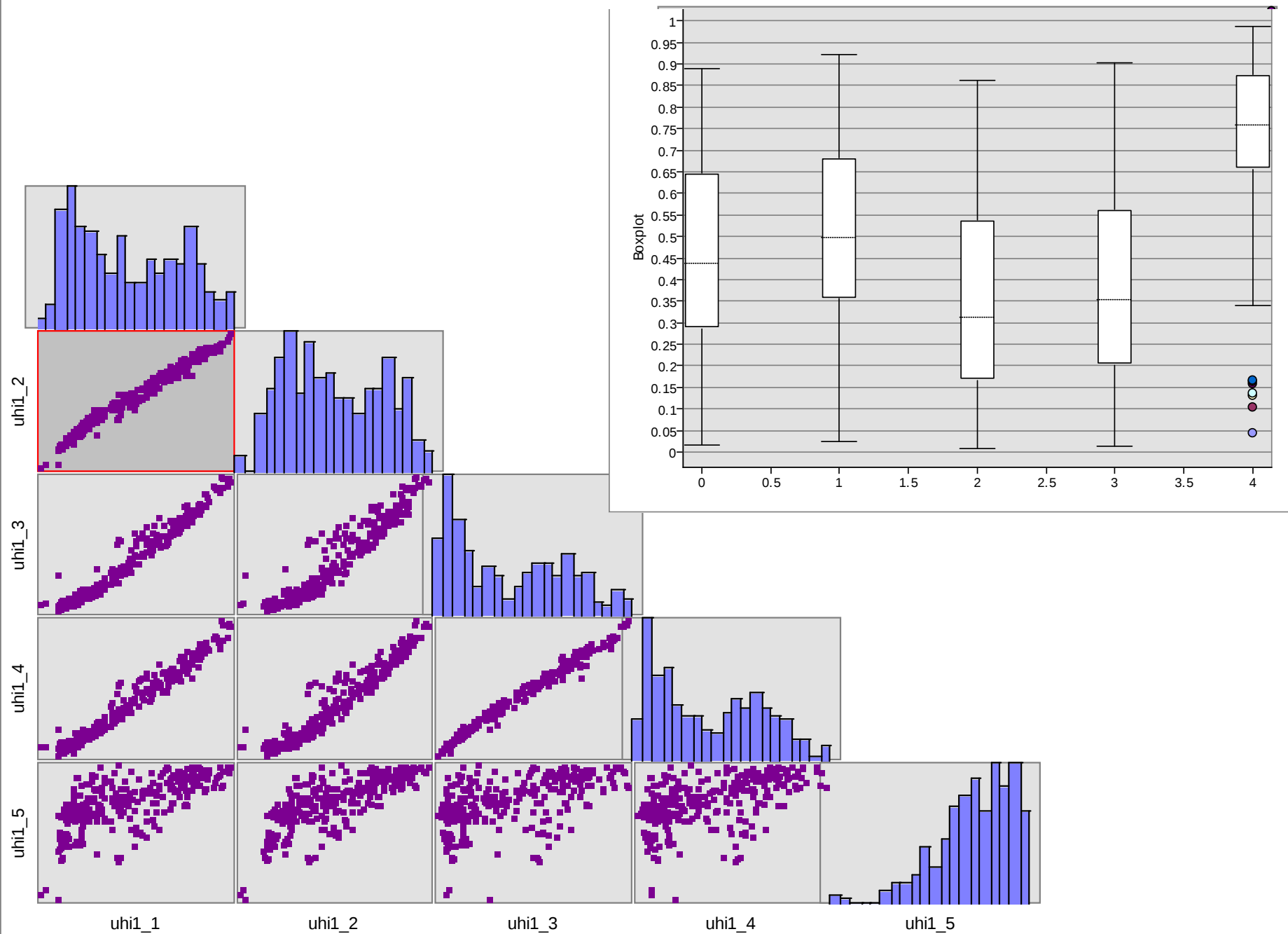
Selection of variables

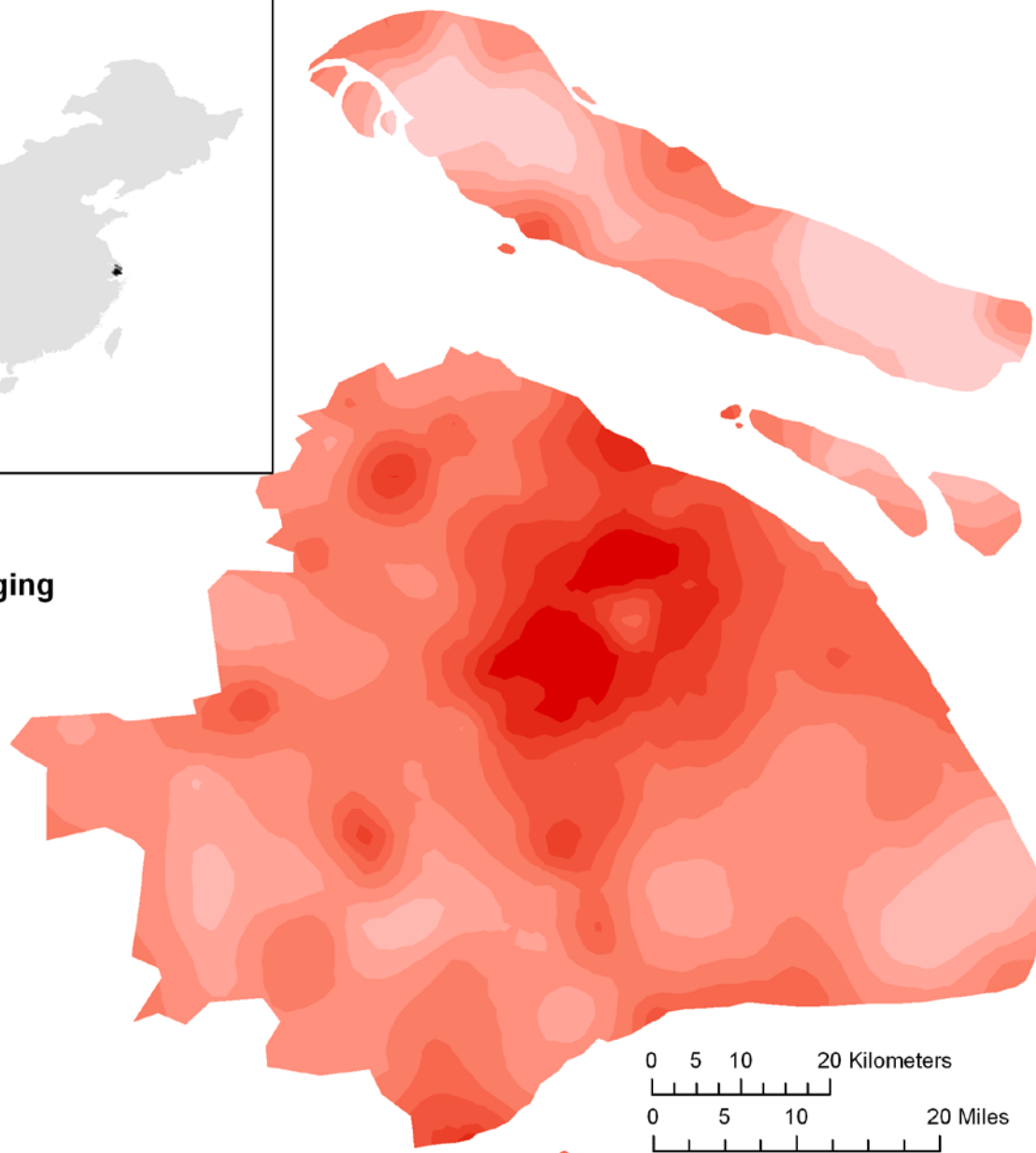
- 4 indicators
 - Demographic
 - Non-agricultural population
 - Economic
 - Employed population
 - Professional and managerial job
 - Education
 - Middle-school graduation
 - High-school graduation
 - Junior-college graduation
 - Built environment
 - Household cooking using gas and electricity
 - Household using tap water
 - Household having its own bath facilities
 - Household having its own lavatory
- UHI1_1
 - UHI1_2
 - UHI1_3
 - UHI1_4
 - UHI1_5

Selection of variables

- 4 indicators
 - Demographic
 - Non-agricultural population
 - Economic
 - Employed population
 - Professional and managerial job
 - Education
 - Middle-school graduation
 - High-school graduation
 - Junior-college graduation
 - Built environment
 - Household cooking using gas and electricity
 - Household using tap water
 - Household having its own bath facilities
 - Household having its own lavatory
- UHI1_1
- UHI1_2
- UHI1_3
- UHI1_4
- UHI1_5

Scatter Plot Matrix

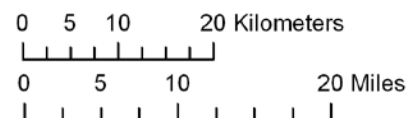
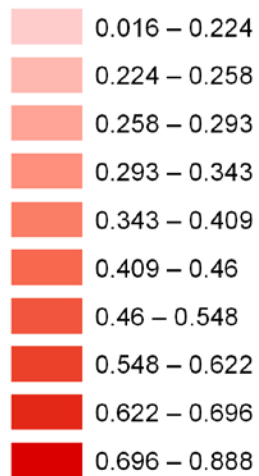


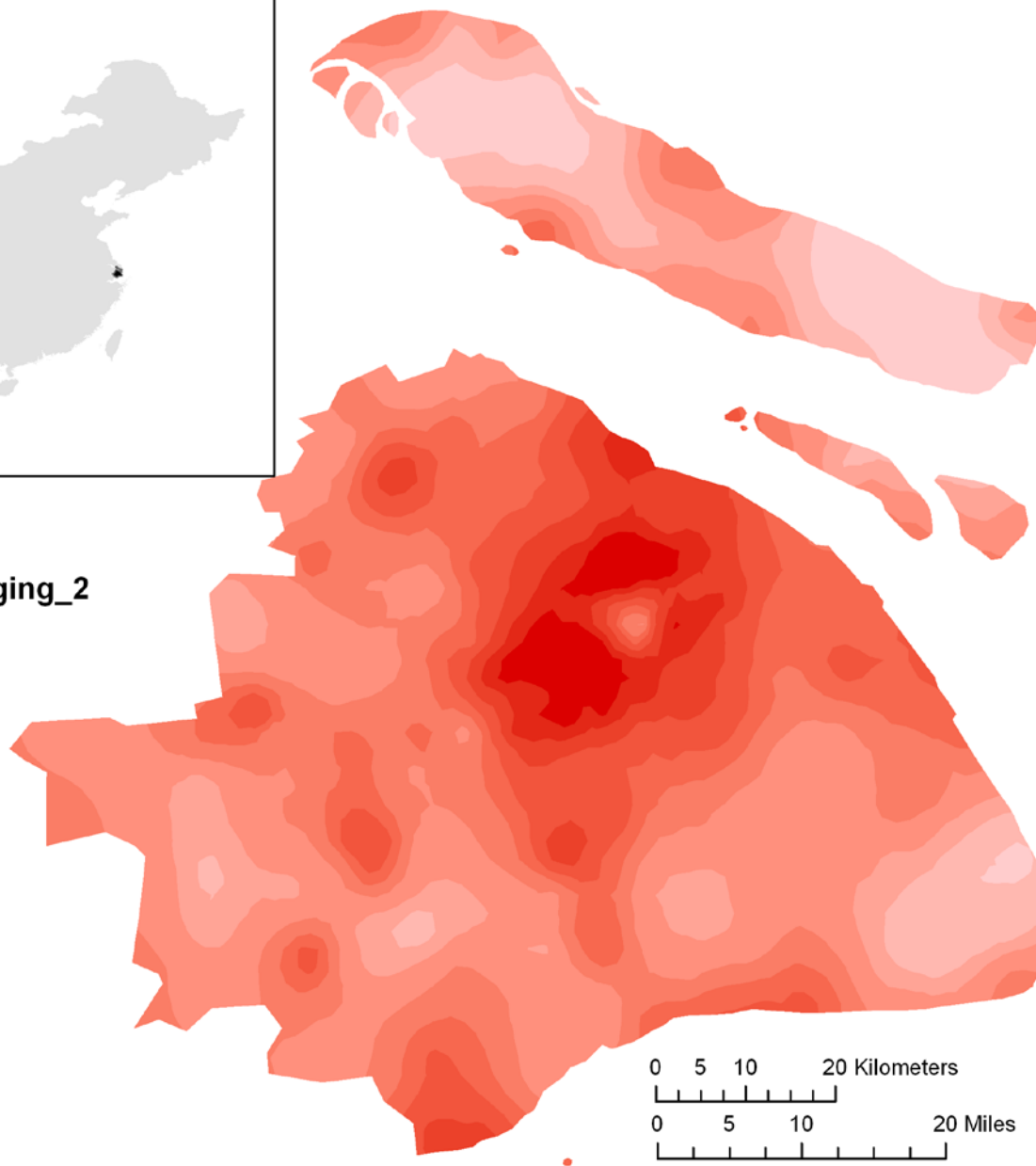


**Empirical Bayesian Kriging
Prediction Map**

(UHI1_1)

Filled Contours

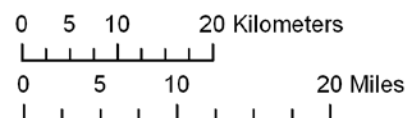
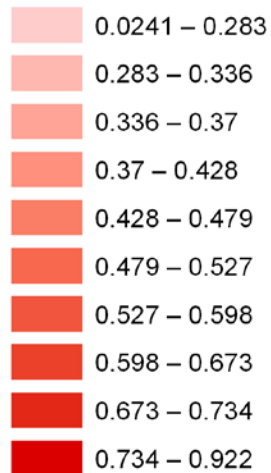


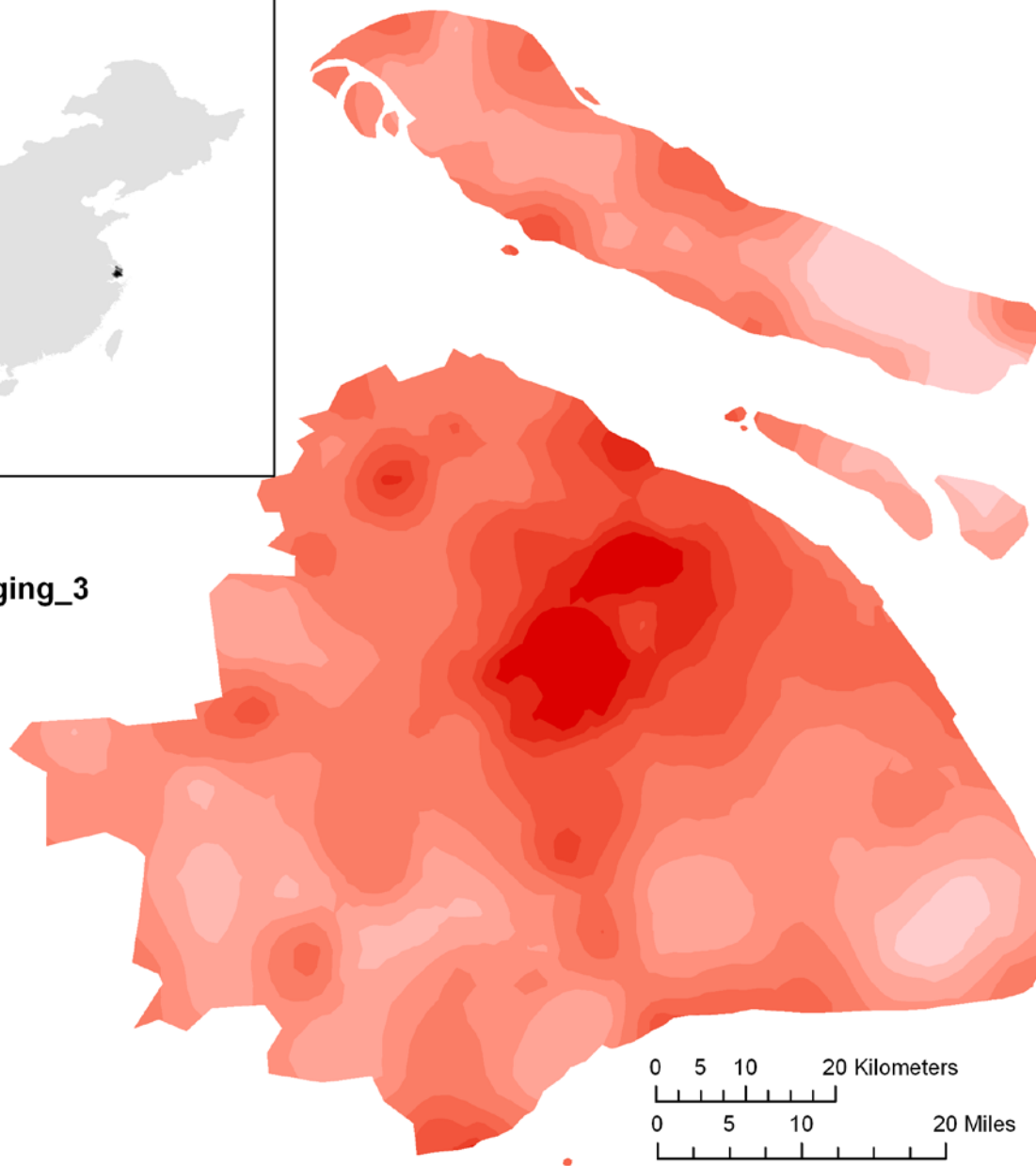


**Empirical Bayesian Kriging_2
Prediction Map**

UHI1_2

Filled Contours

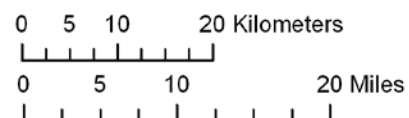
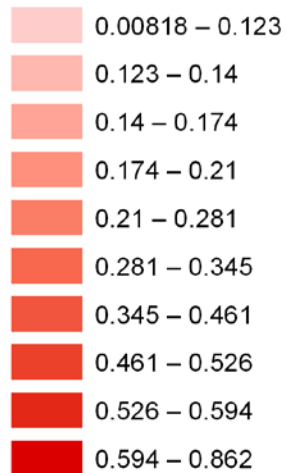


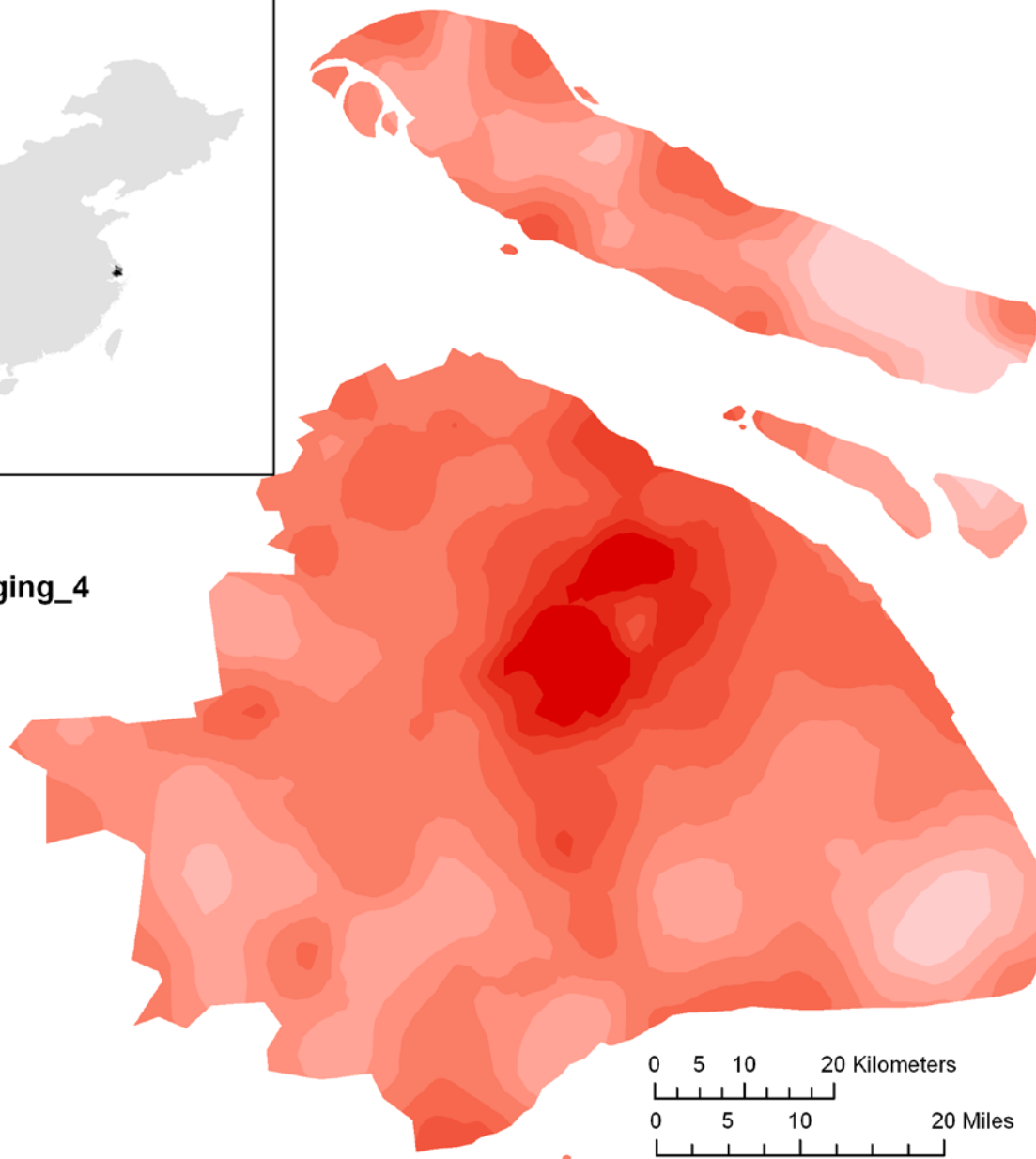


Empirical Bayesian Kriging_3 Prediction Map

UHI1_3

Filled Contours

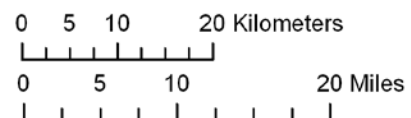
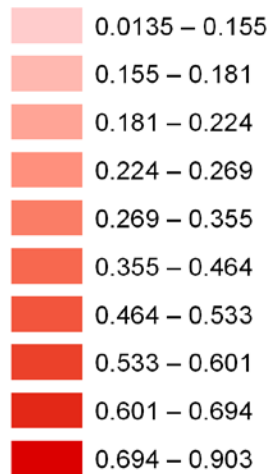


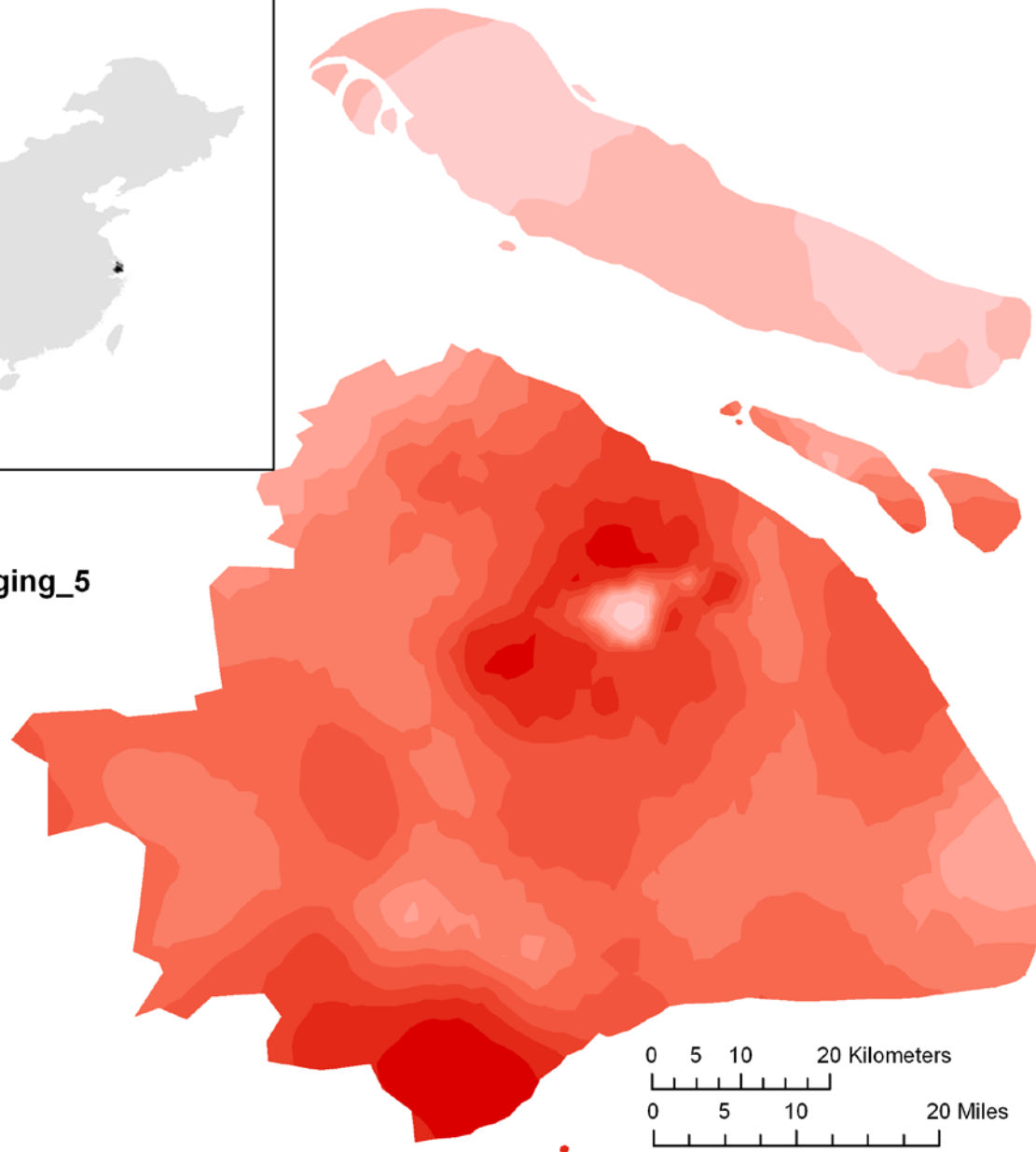
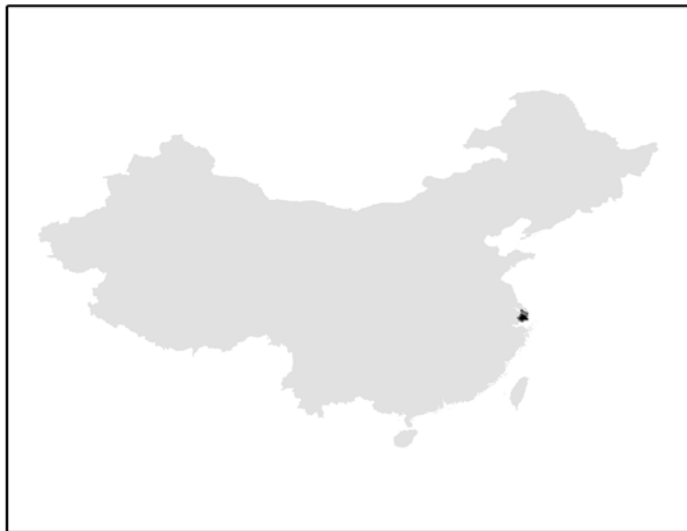


**Empirical Bayesian Kriging_4
Prediction Map**

UHI1_4

Filled Contours

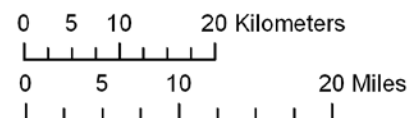
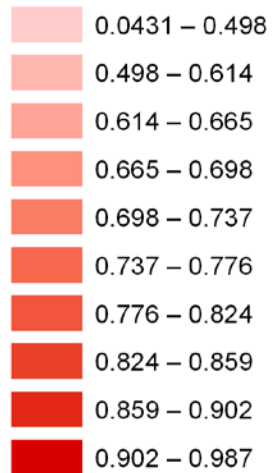




**Empirical Bayesian Kriging_5
Prediction Map**

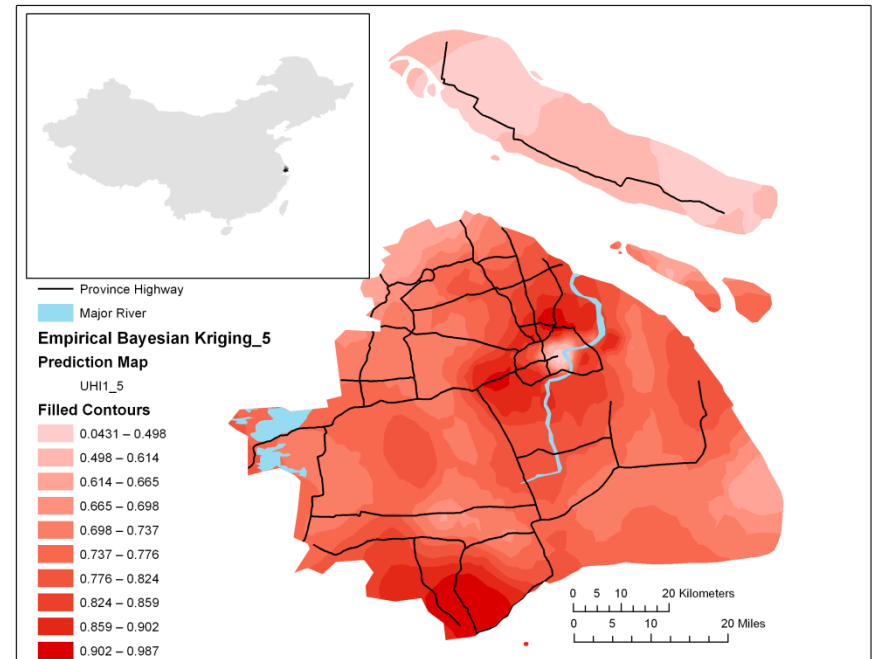
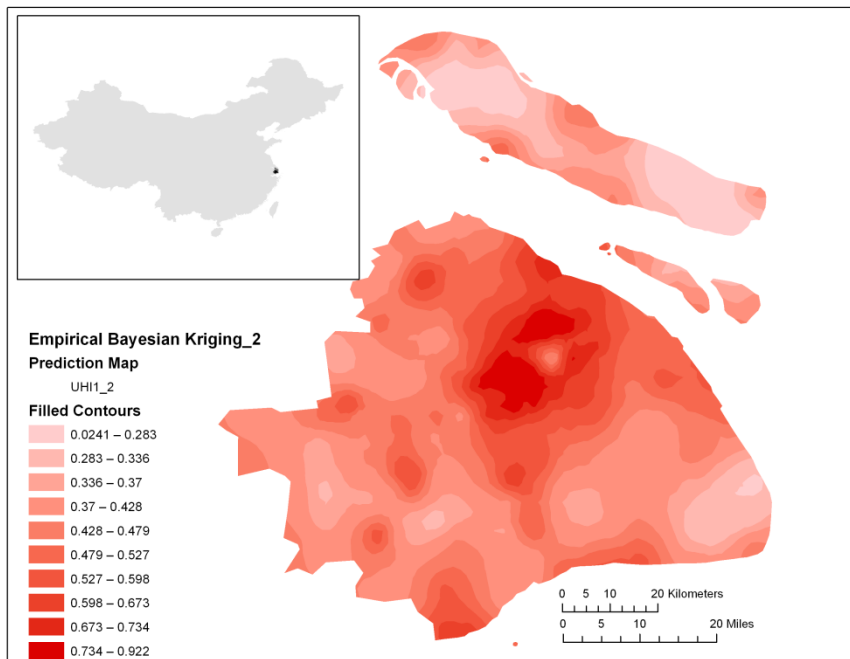
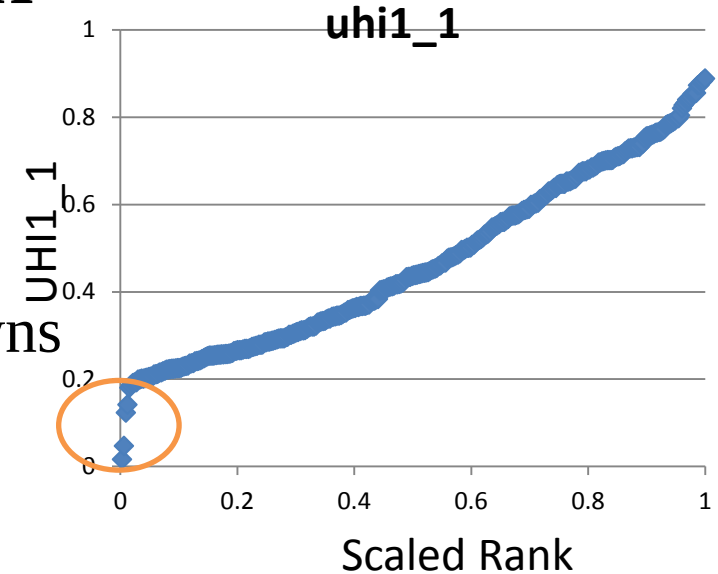
UHI1_5

Filled Contours



Discussion

- Disparities exist
- No sharp upturn
 - Less disparities among higher-end towns
- Hollowed out center of cities





Thank you! Questions?

