Measuring the Real-World Effects of UHI Countermeasures
A Case Study of Pavement-Watering

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CONTEXT
Typical UHI Countermeasures

→ Few experimental field studies at the street scale or higher
  (Bowler et al. 2010; Santamouris 2013)
Exception of Pavement-Watering

Kinouchi and Kanda 1997
Takahashi et al. 2010
Maillard et al. 2014
Yamagata et al. 2008
Field Methods

Kinouchi and Kanda 1997

Yamagata et al. 2008  
Takahashi et al. 2010  
Maillard et al. 2014
MATERIALS AND METHODS
Station Positions

Louvre Stations
Station Positions

![Diagram showing watered and control stations over time with a map indicating watered and dry portions and weather stations.]

Watered station
Control station

0
200
400
600
800
1000

Solar Irradiance (W/m²)

06:00 10:00 14:00 18:00 22:00 02:00 06:00

Time
Station Instruments

→ Air temperature at 1.5 m and 4 m a.g.l.

Temperature, Humidity, Globe Temperature (1.5 m height)
Temperature, Heat Flux (5 cm depth)

Wind, Temperature, Humidity, Presence of rain, Solar Irradiance

Street sign post
Rooftop infrared camera
Measurement cage
Analysis Method

\[ Y = Y_{\text{watered}} - Y_{\text{control}} \]

→ Pasquill Stability Class A or A-B
RESULTS
Problems Arise...

Differences between sites in the absence of watering...
What’s the Difference?

Dry

Watered

Air Temperature Difference (°C)

Time

h=1.5 m
What’s the Difference?

Dry

n = 28

h = 1.5 m

Air Temperature Difference (°C)

Time

Watered

n = 12

h = 1.5 m

Air Temperature Difference (°C)

Time
What’s the Difference?

Air Temperature Effect (∘C)

Time

h=1.5 m

h=4 m
Summary

- Identical sites in urban areas don’t exist!

- Approach is generalizable to other countermeasures

- Stations don’t need to be so strictly paired, but signal noise may increase if distances are too great

- Sites must be characterized prior to UHI countermeasure implementation
Future Work

• Additional feedback from other field studies
  – Other sites
  – Other countermeasures

• Other analysis tools?
  – Time series analysis
  – Data mining techniques
  – …
Thank you for your time


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References


