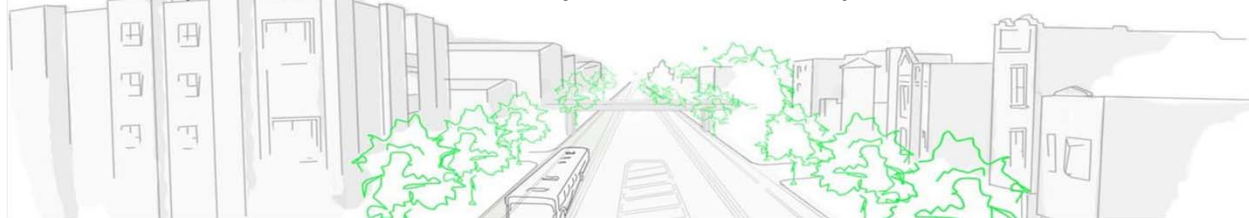


TRAQ

The Transportation & Air Quality Research Group



CAPTURING THE EFFECT OF DATA COLLECTION PROTOCOL ON LAND-USE REGRESSION MODELS AND EXPOSURE SURFACES FOR ULTRAFINE PARTICLES, BLACK CARBON, AND NOISE

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Scott Weichenthal, and Marianne Hatzopoulou**

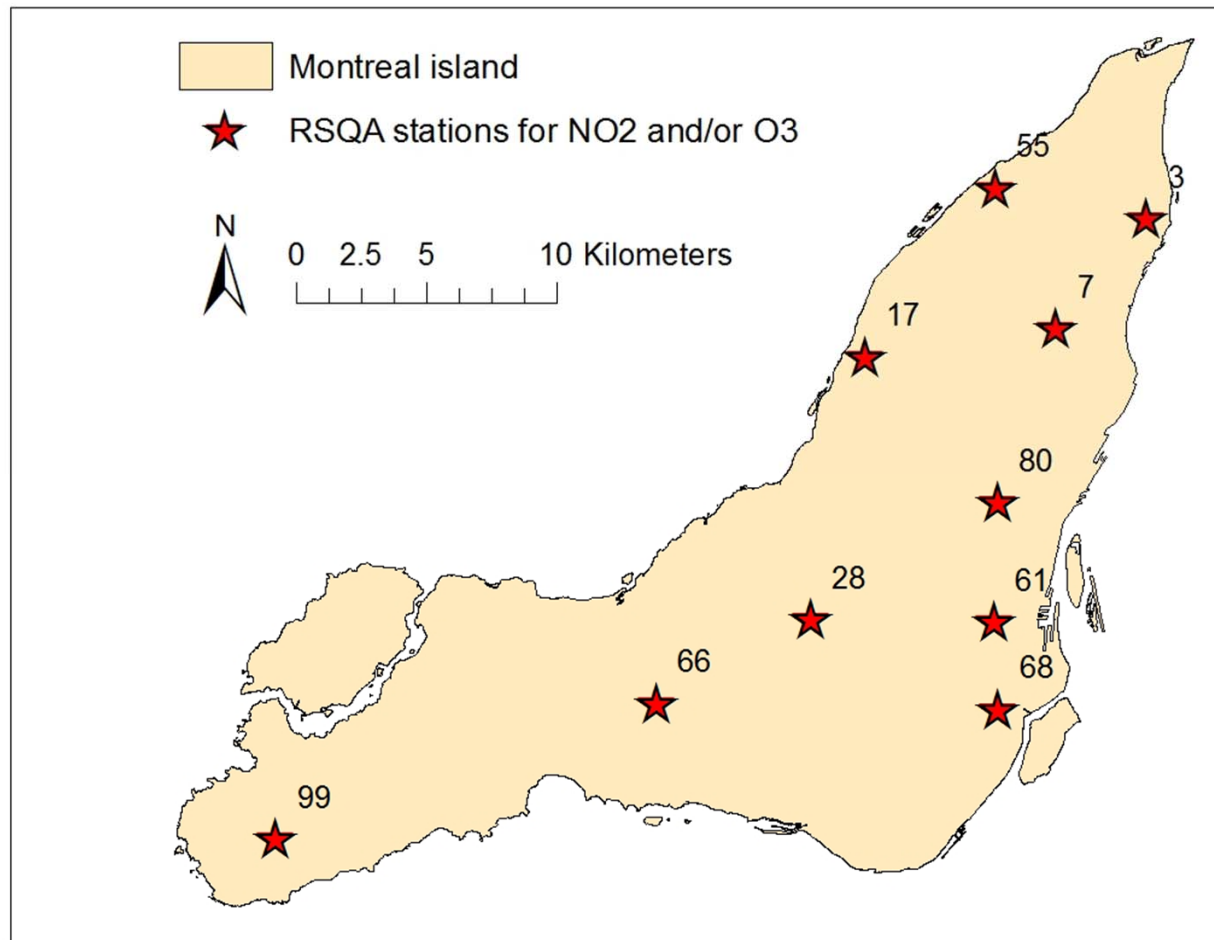
marianne.hatzopoulou@utoronto.ca



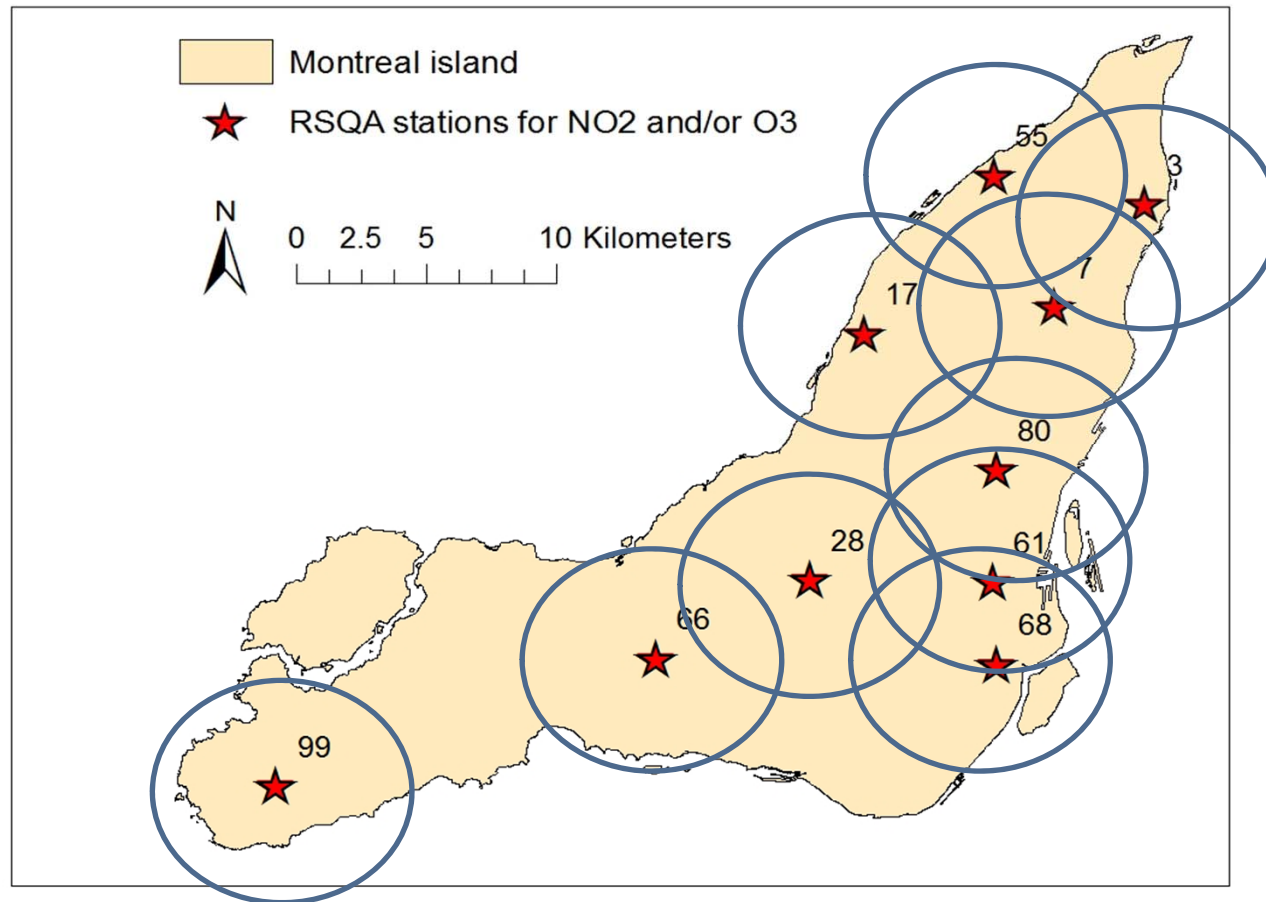
UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING
Transportation Research Institute

UTTRI

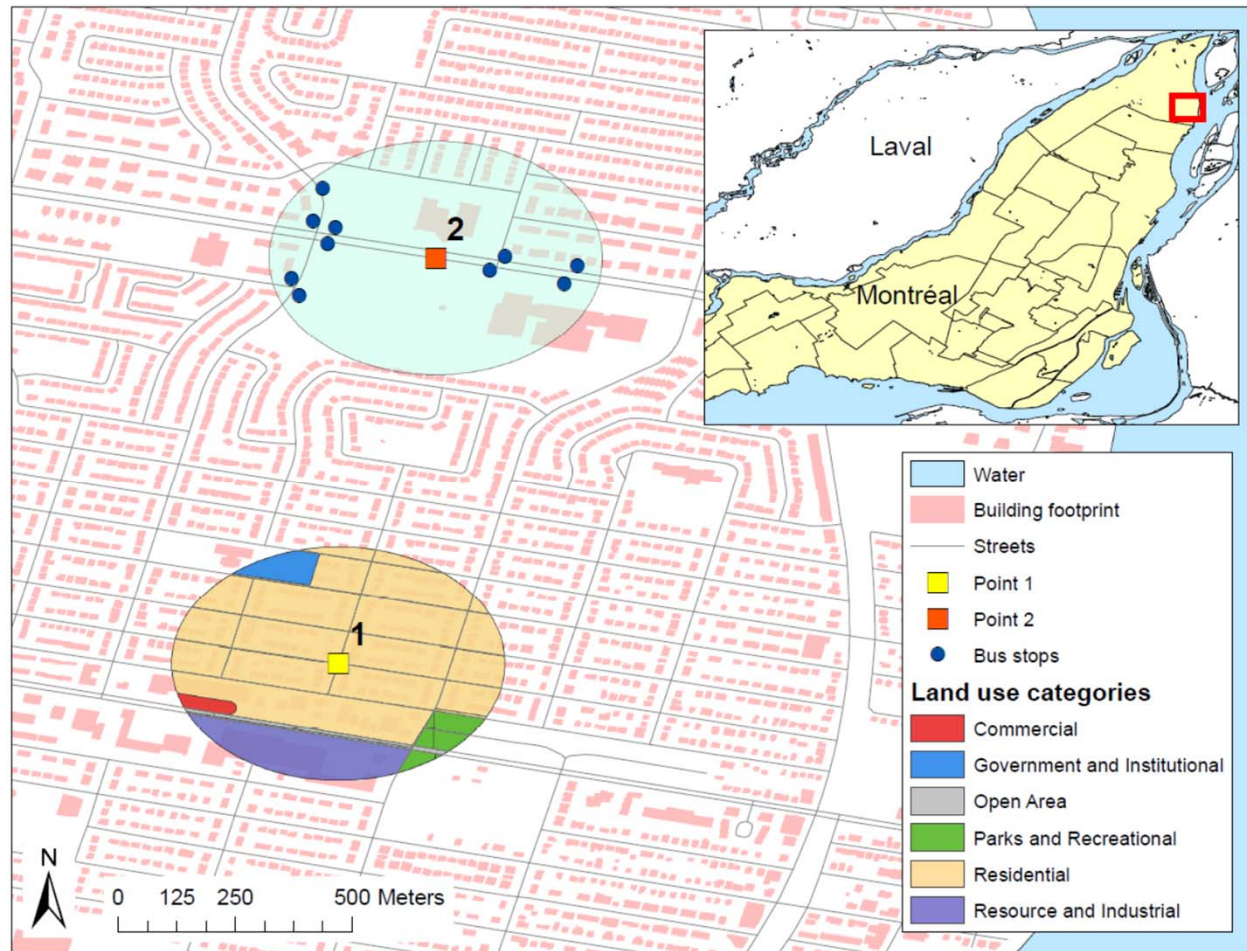
Land use regression (LUR)



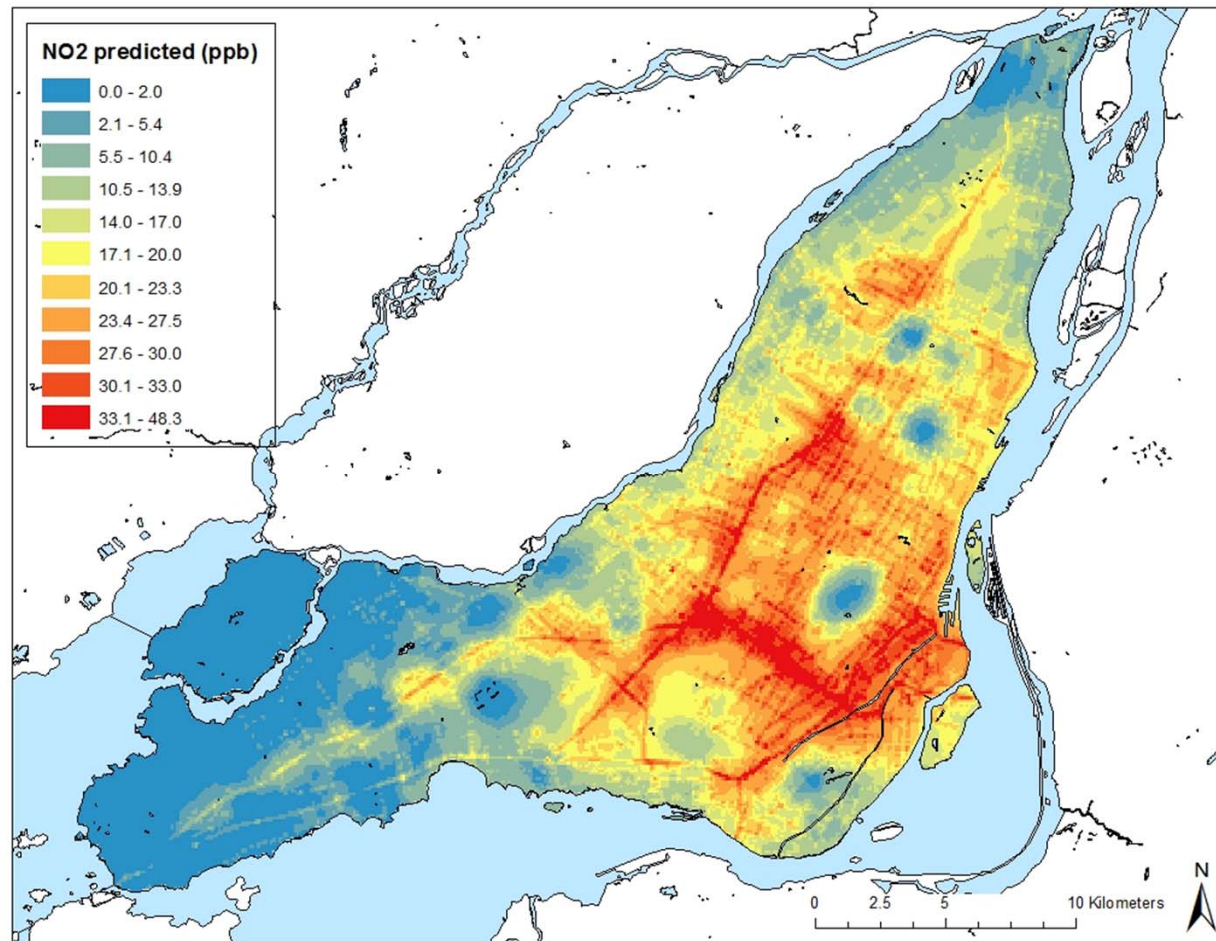
Land use regression (LUR)



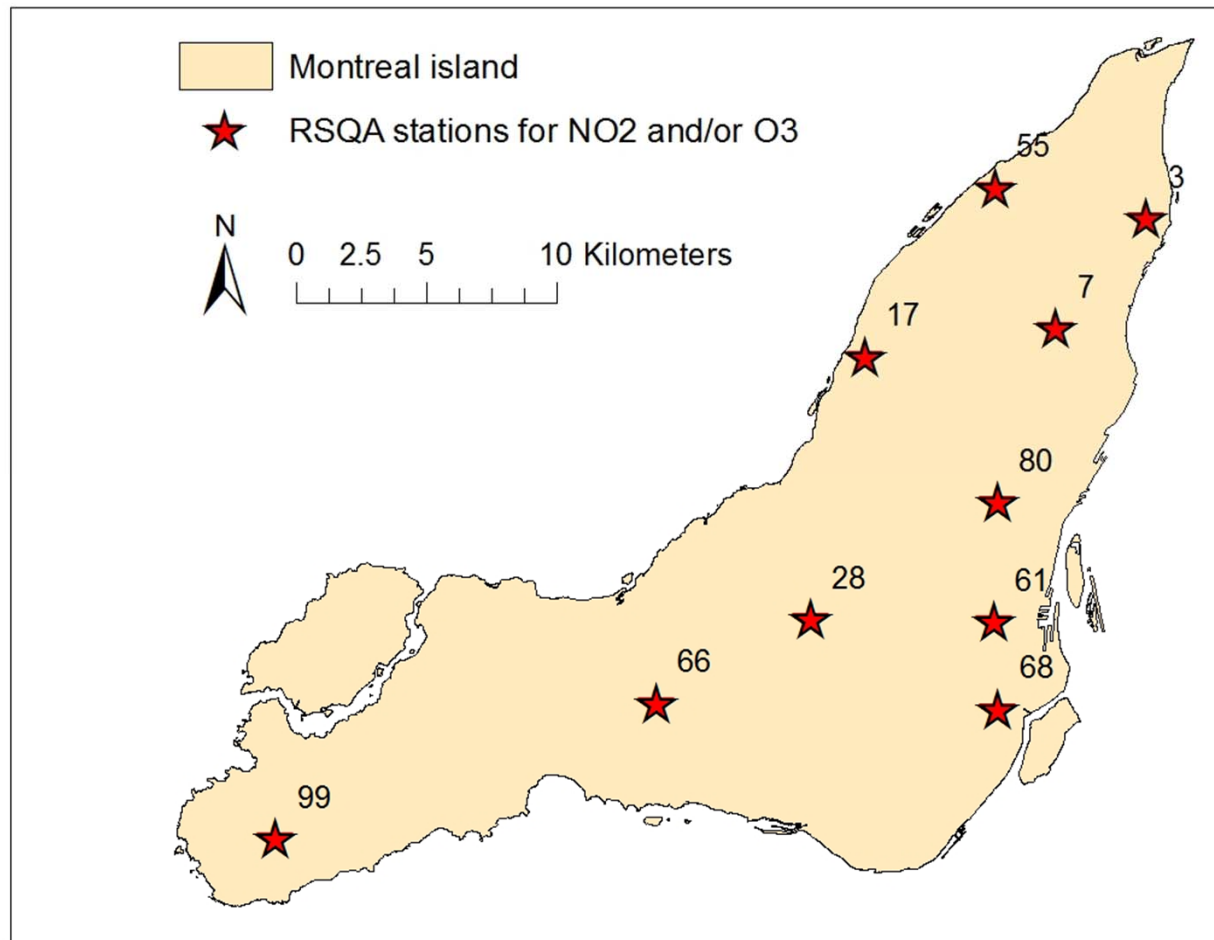
Land use regression (LUR)



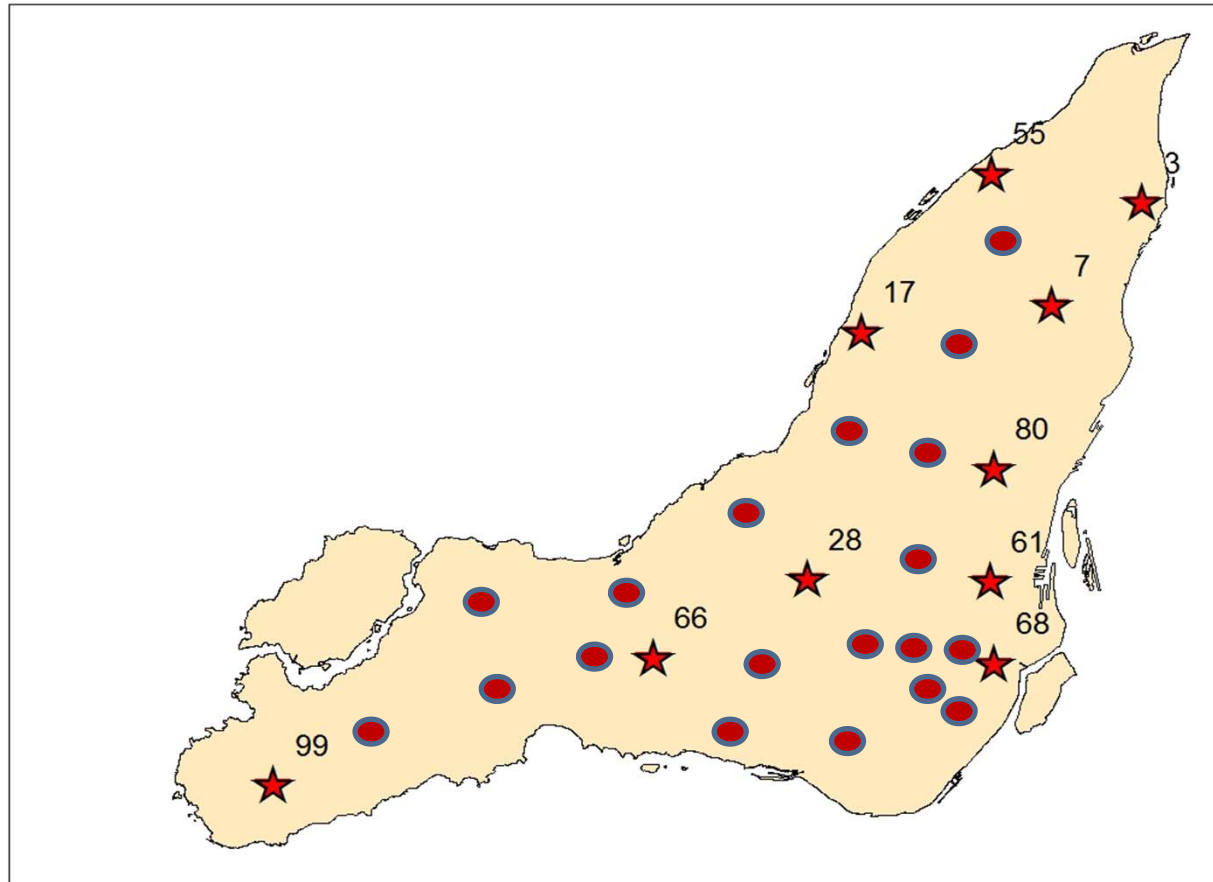
Exposure surface



Spatial variability and spatial coverage are important



Advances in portable air pollution devices enabled denser sampling campaigns



Mobile sampling achieves unparalleled spatial coverage



Does the data collection protocol influence LUR models and associated exposure surfaces?



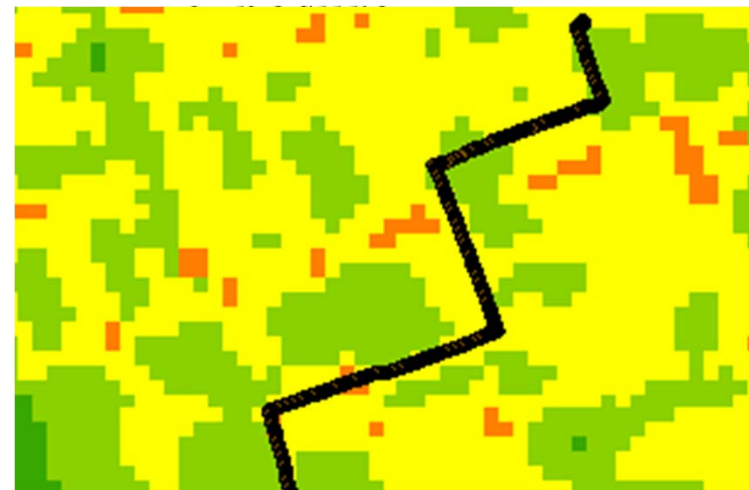
Short-term exposure estimation

- Personal



Photo credit: Tyler Irving/U of T Engineering

- Mobility-based



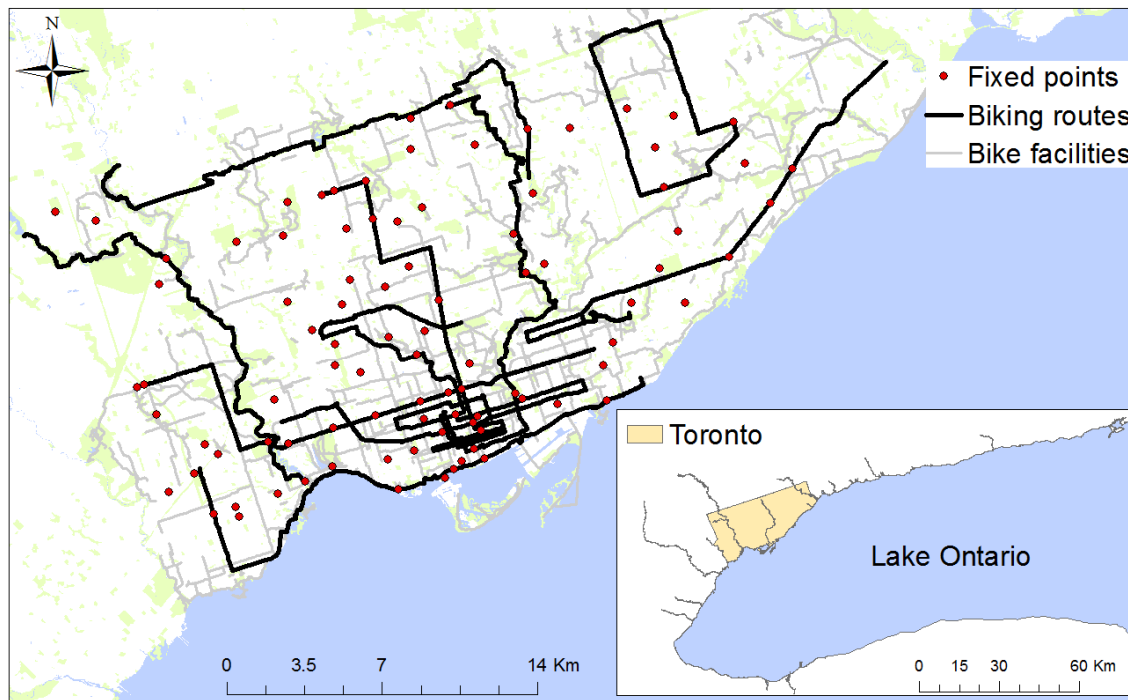
GPS intersecting exposure surface

How do mobility-based exposures compare with personal exposures?

Methodology

Data collection campaign (Summer 2016)

1. Ultrafine Particles (UFP) and Black Carbon (BC) levels



- ❖ 92 fixed points:
Average sampling:
 - 102 minutes
 - 5 visits

- ❖ 270 km of cycling routes/3,095 road segments:
Average sampling:
 - 121 seconds
 - 5 visits

Data collection campaign (Summer 2016)

Time block	Time
1	7 am to 11 am
2	11 am to 3 pm
3	3 pm to 7 pm

Data collection campaign (Summer 2016)




2. Panel study

Are you a healthy, non-smoking adult between 18-60?
Are you willing to participate in a study of
traffic related air pollution
and health effects?

Would you
consider wearing
air pollution monitors and
health sensors as you walk around the city
on two separate days?

Help us better understand
the potential health effects of traffic pollution in Toronto!

This study was approved by the research ethics board of the University of Toronto
For volunteering, please contact
airpollution.health.study@gmail.com,
alternatively, call 416-458-1737.
Compensation would total \$60.



- ❖ 1 visit:
 - 6 hours / day
 - 2 hours outdoors

- ❖ Total:
 - 43 participants
 - 63 visits

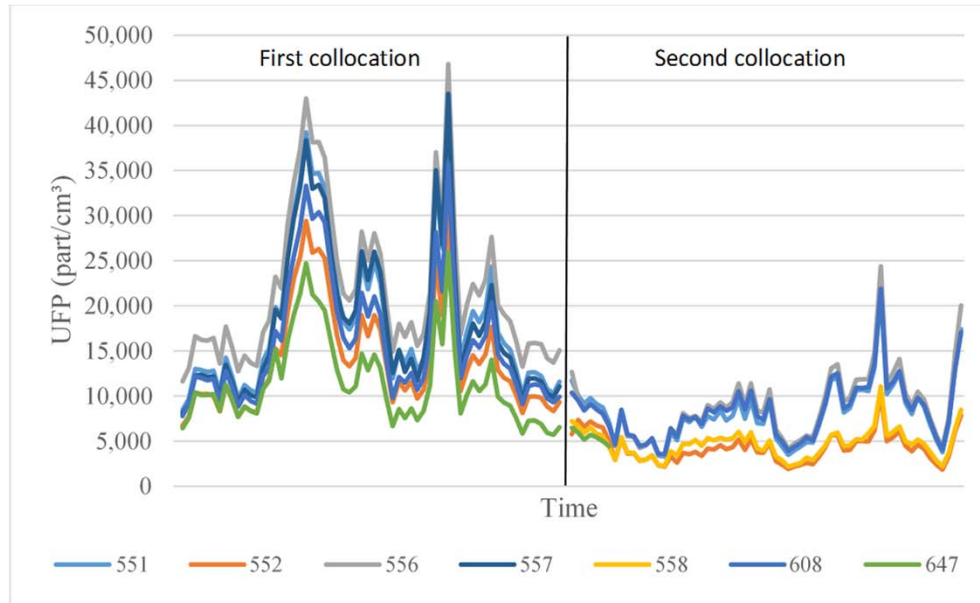
Data collection campaign (Summer 2016)

3. Equipment

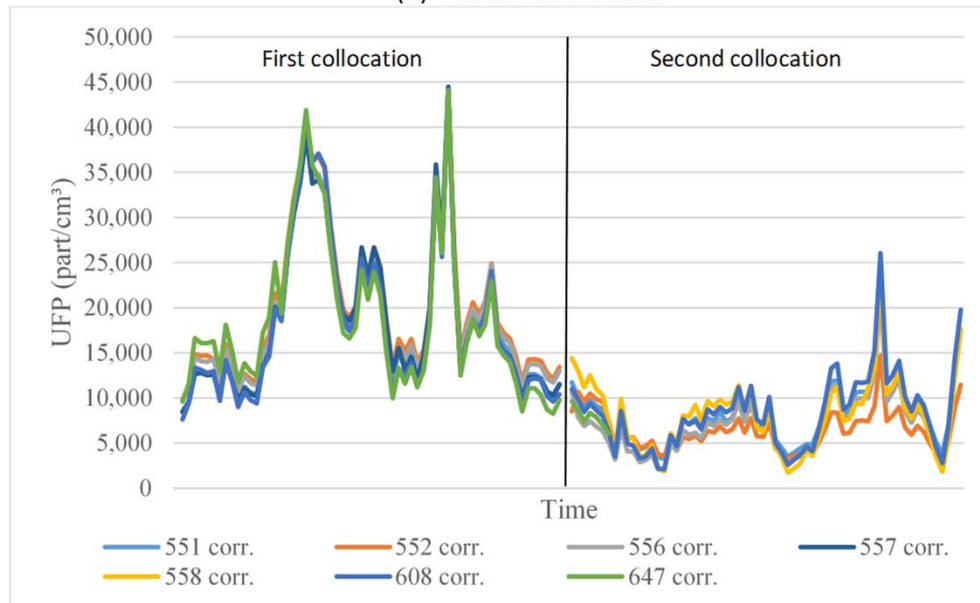


- ❖ GPS:
 - Garmin or Mobile app Strava
 - Time resolution: 1s
- ❖ UFP:
 - DiscMini
 - Time resolution: 1s
- ❖ BC:
 - MicroAethalometer
 - Time resolution: 30s (average of 30s)

Collocation UFP



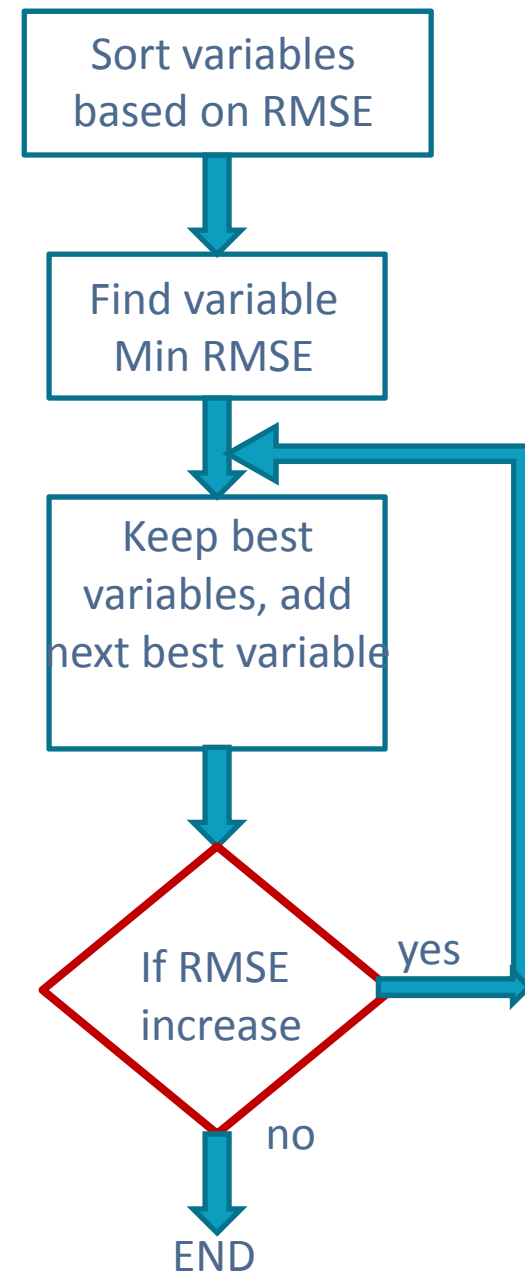
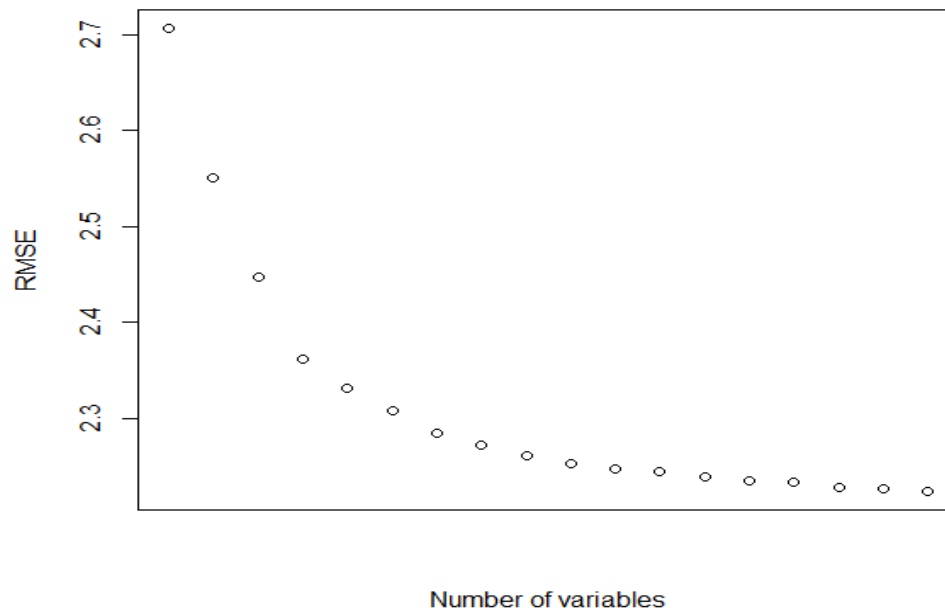
(a) Before correction



(b) After correction

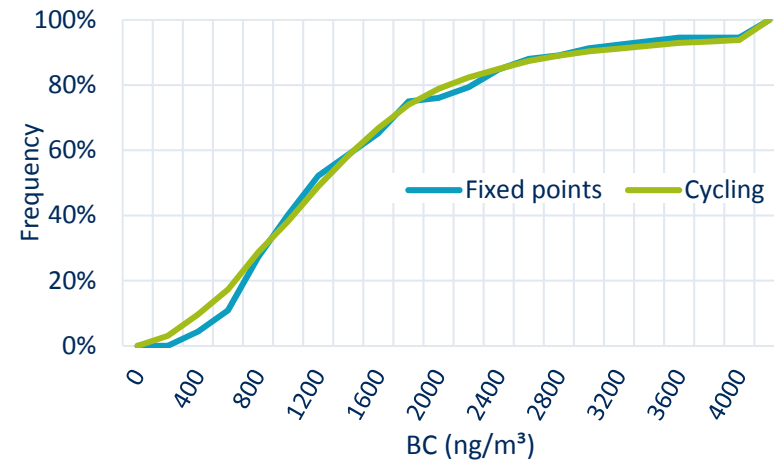
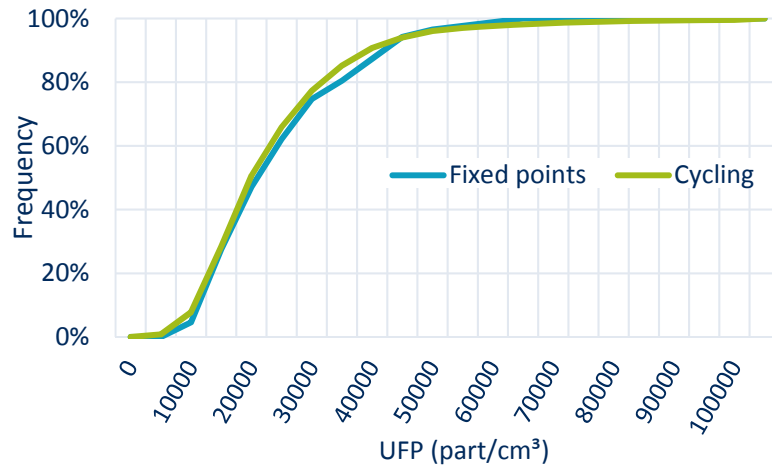
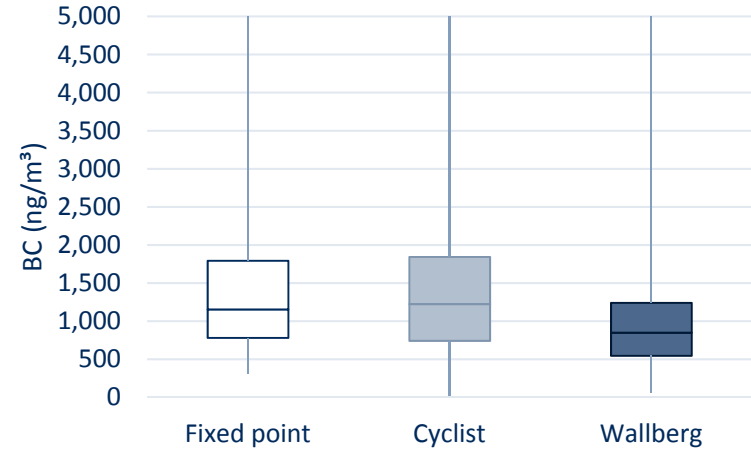
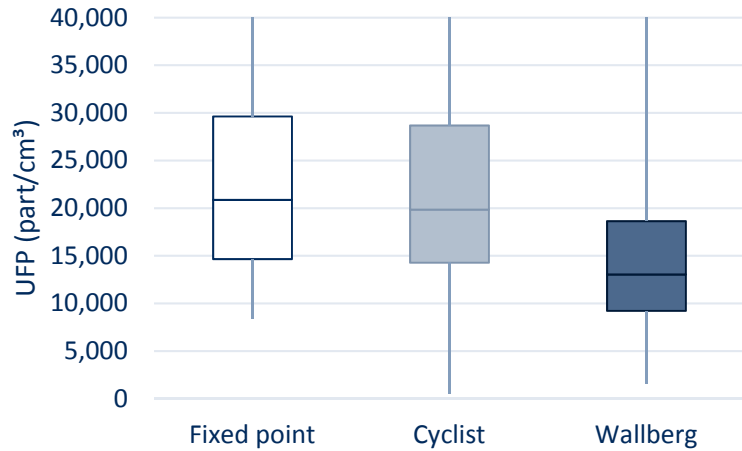
LUR model development

- ❖ A leave one out cross-validation (LOOCV) was applied to choose the best predictor variables in order to minimise the Root Mean Square Error (RMSE)



Results

Average UFP and BC concentrations recorded



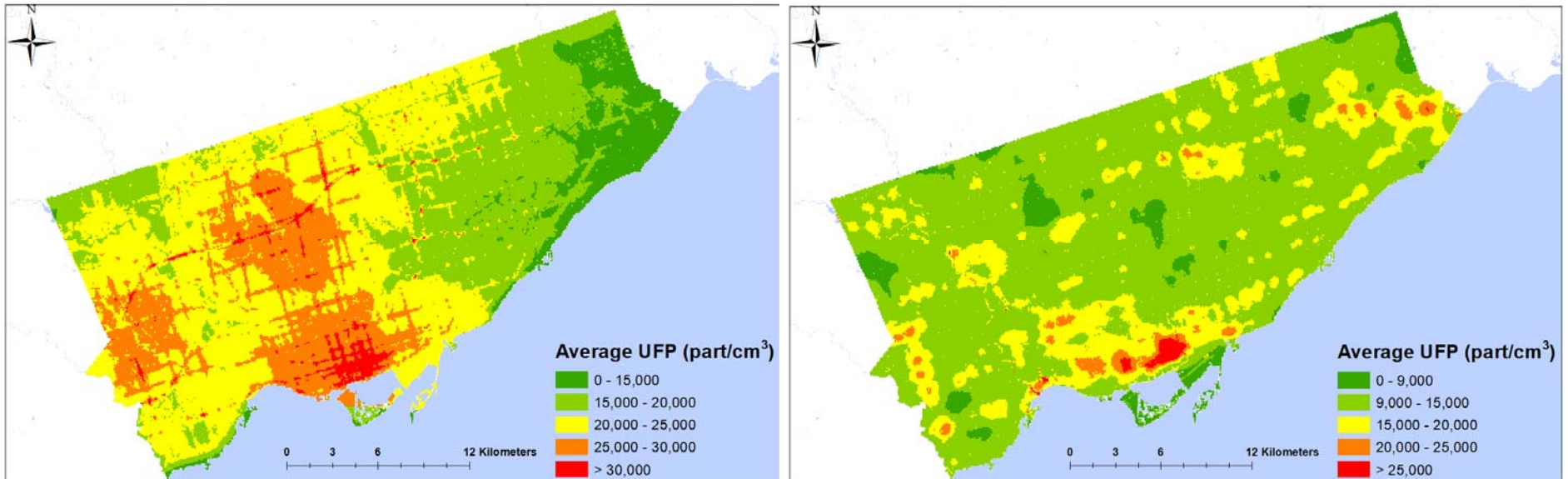
LUR models

	ln(UFP)		ln(BC)	
	Fixed points	Cycling	Fixed points	Cycling
Adjusted R²	0.405	0.430	0.525	0.434

- ❖ R² ranges between 0.405 and 0.525
- ❖ Various predictors

NOISE (LAeq)	Model 1	Model 1 modified
Adjusted R²	0.6	0.44
N. of predictors	14	10

Exposure surfaces - UFP

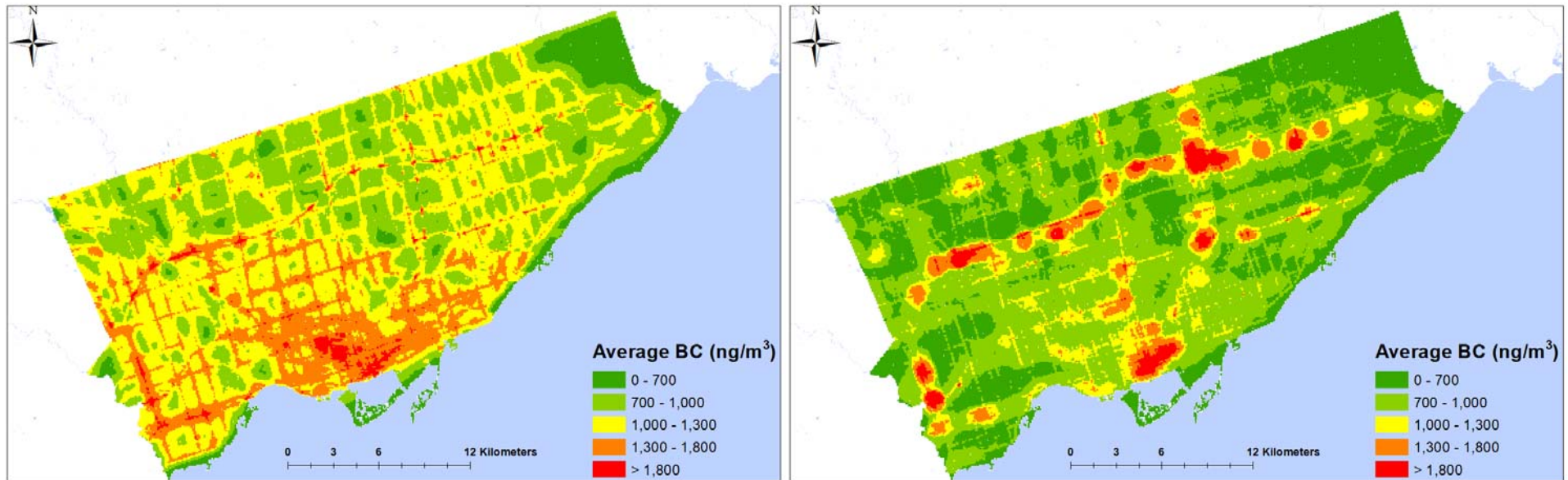


(a) Cycling model

(b) Fixed points model

Pearson correlation coefficient: 0.235

Exposure surfaces - BC



(a) Cycling model

(b) Fixed points model

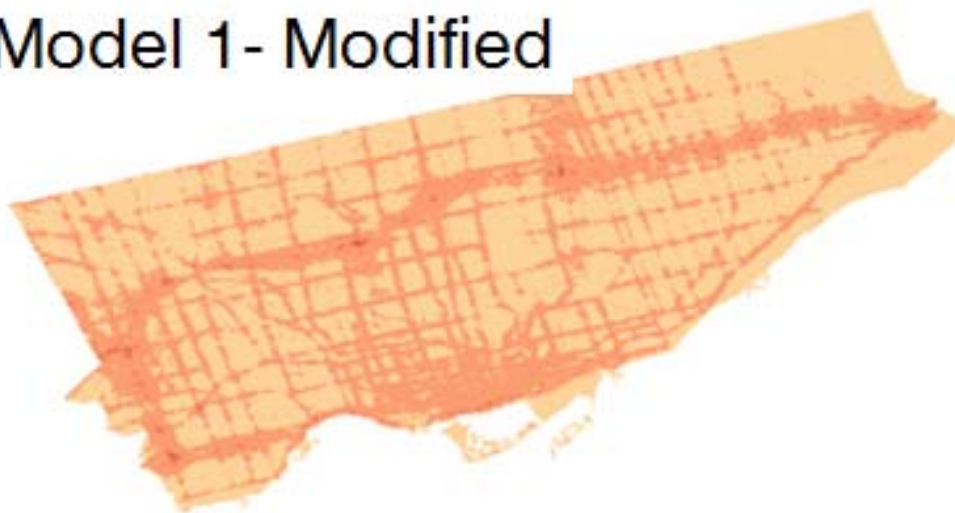
Pearson correlation coefficient: 0.5

Exposure surfaces – Noise (LAeq)

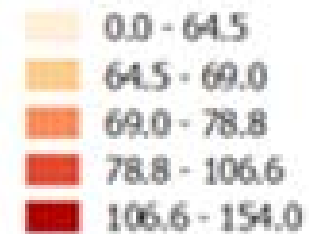
Model 1



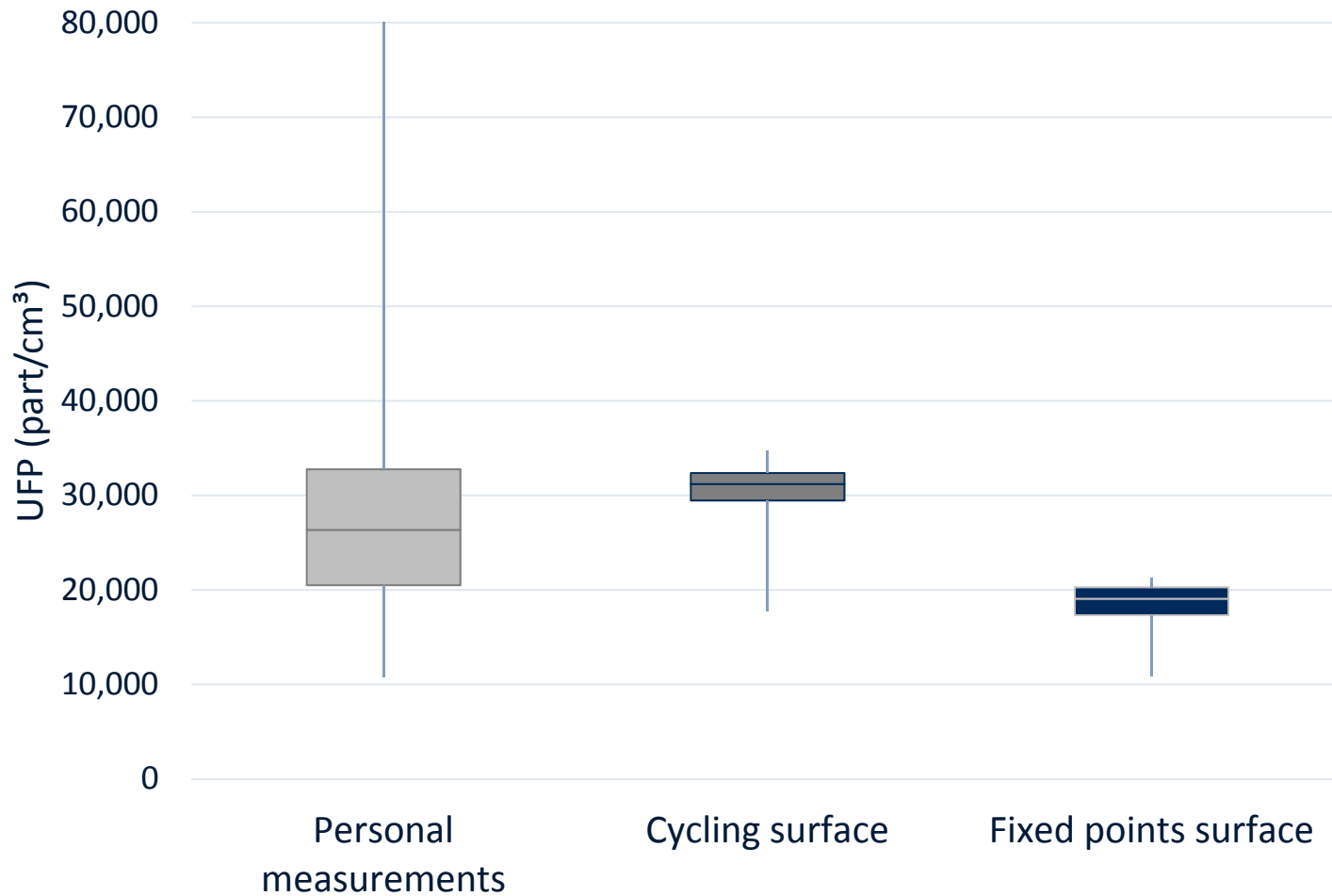
Model 1- Modified



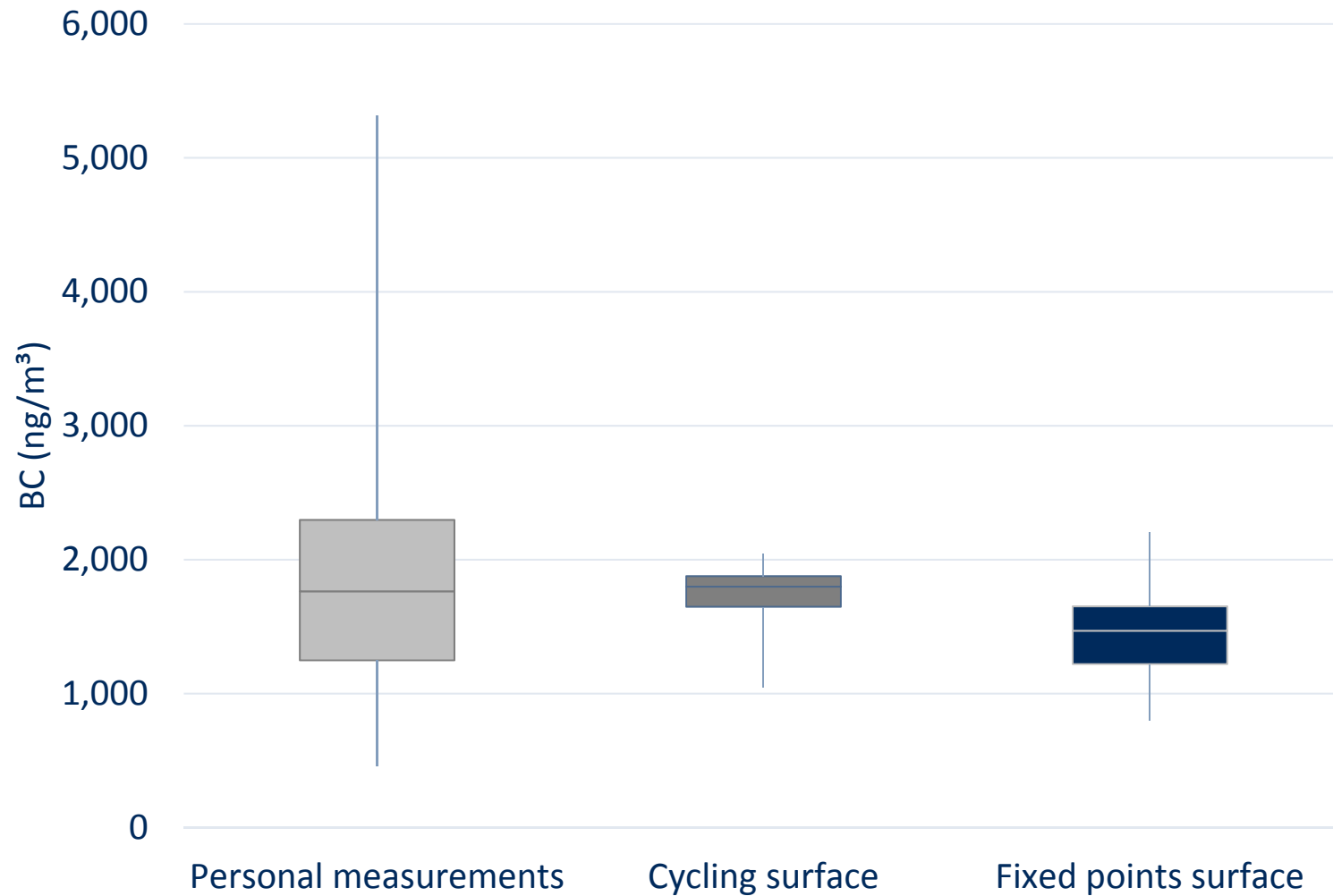
LAeq,20 min



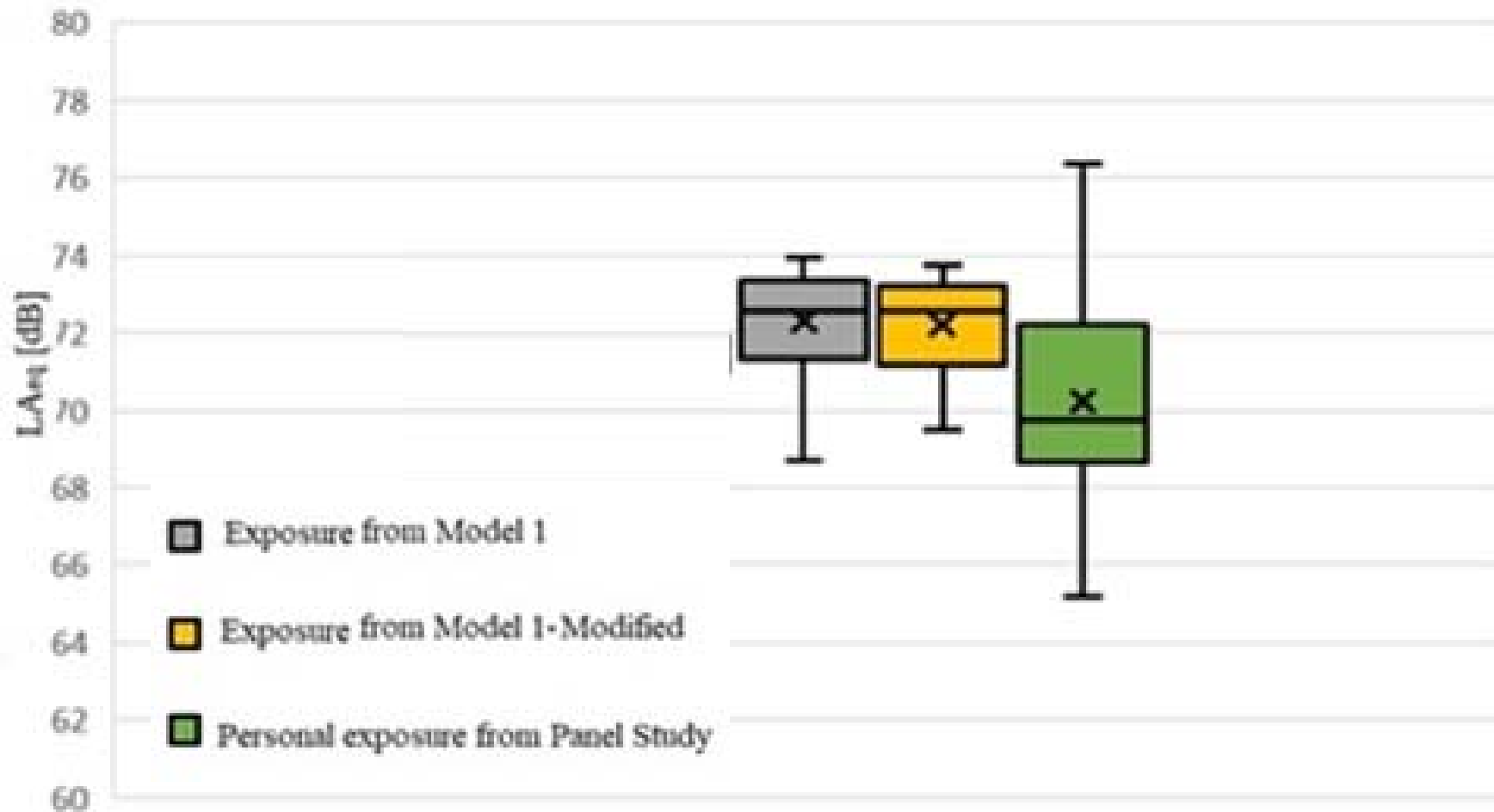
Comparison of the exposures - UFP



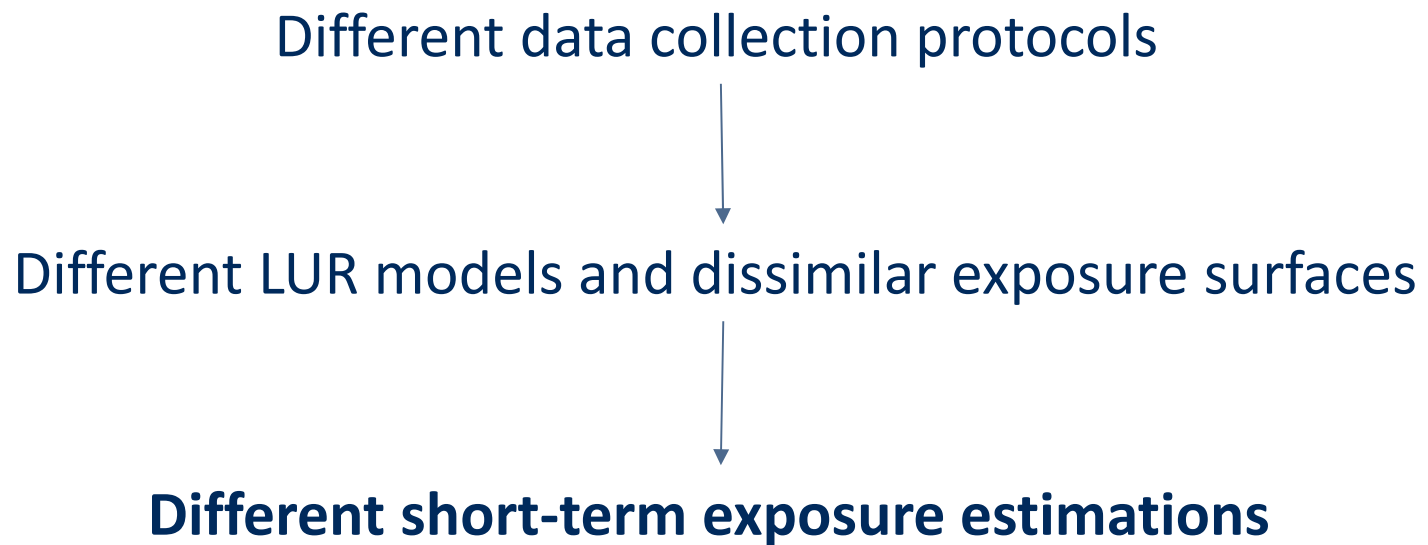
Comparison of the exposures - BC



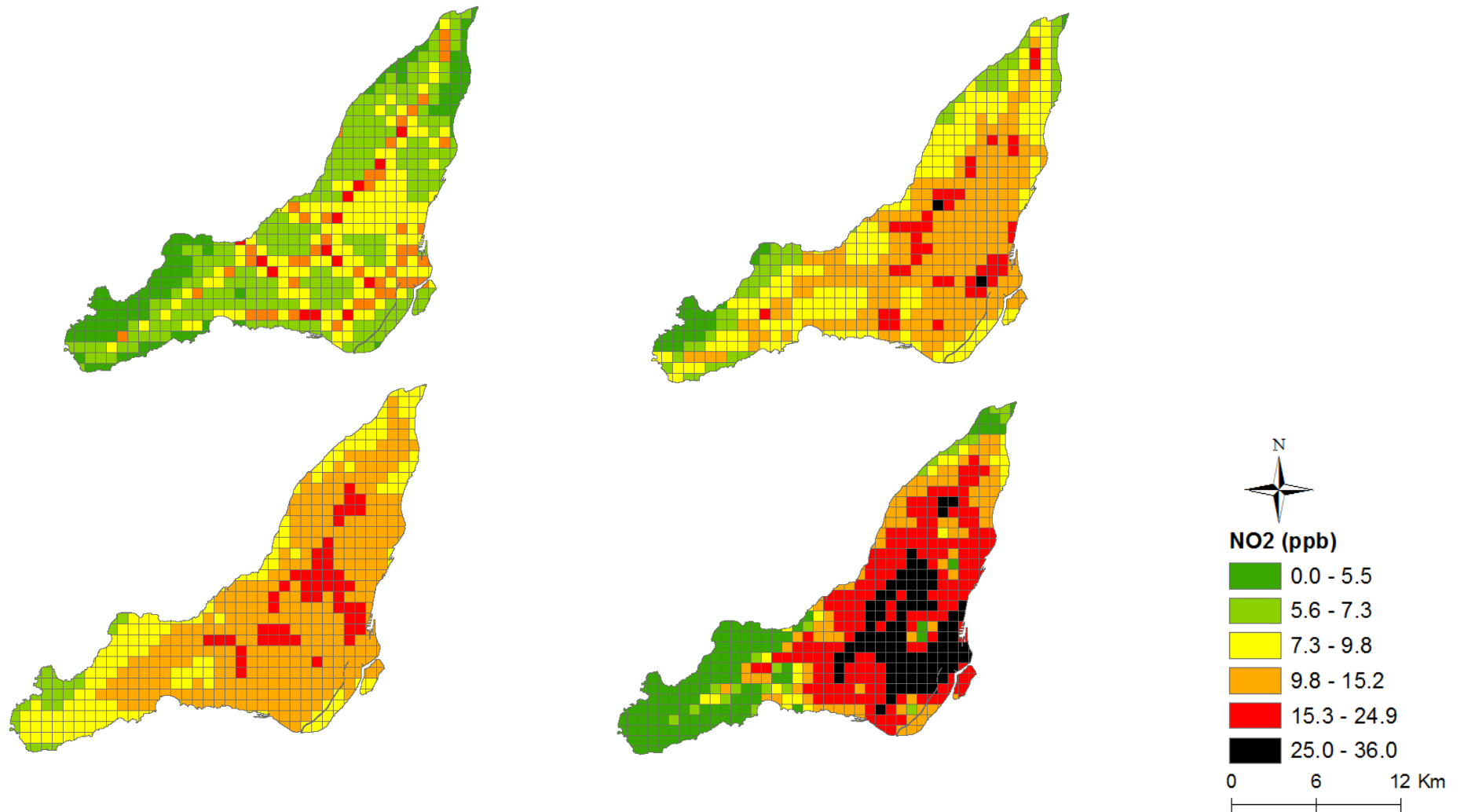
Comparison of the exposures - Noise



Conclusions



NO₂ surfaces Dispersion-1 (a) Dispersion-2 (b) LUR-1 (c) LUR-2 (d)

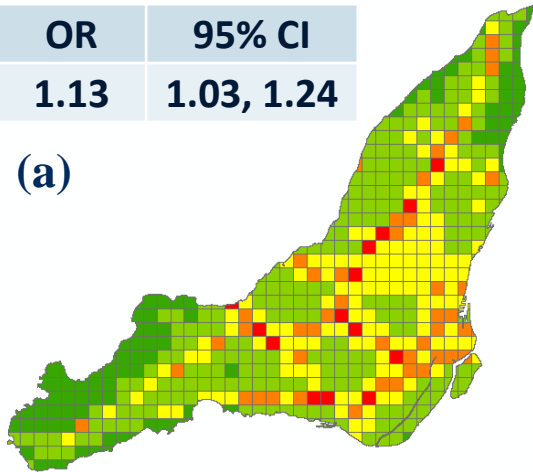


OR for Prostate Cancer

NO₂ surfaces Dispersion-1 (a) Dispersion-2 (b) LUR-1 (c) LUR-2 (d)

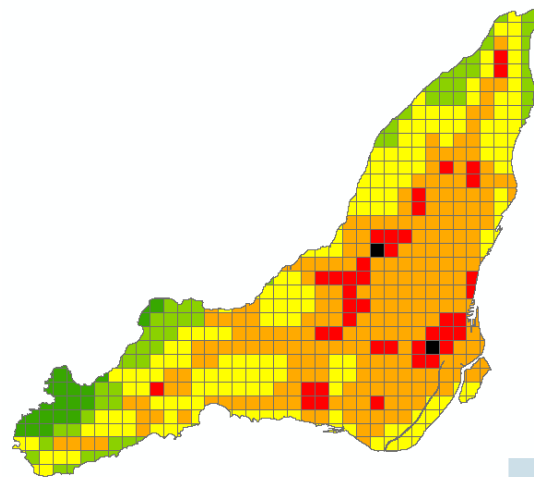
OR	95% CI
1.13	1.03, 1.24

(a)



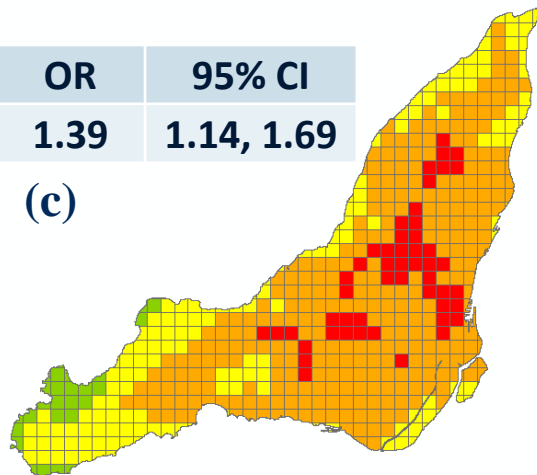
OR	95% CI
1.04	0.94, 1.16

(b)



OR	95% CI
1.39	1.14, 1.69

(c)



OR	95% CI
1.30	1.08, 1.56

(d)

