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Swiss Tropical and Public Health Institute
Schweizerisches Tropen- und Public Health-Institut
Institut Tropical et de Santé Publique Suisse

Research to optimize monitoring and health effect assessments in the mega-city of Tehran

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also on behalf of

Prof. Vahid Hosseini, Sharif University Tehran and

Heresh (Hassan) Amini, MSc, PhD Student at SwissTPH

Prepared for Focus Event of the 19th ETH Conference on Combustion Generated Nanoparticles

July 1st, 2015 – ETH Zürich


SCHOOL BUS

In 64 countries , air pollution is Risk Factor…

«Nr. 1»

Afghanistan
Bangladesh
Benin
Butan
Cambodia
Cameroon
Comeros
Congo
Eq. Guinea
Gambia
Ghana
Guinea
India
Laos
Malawi
Mauretania
Mozambique
Myanmar
Nepal
North Korea
Pakistan
Ruwanda
Tanzania
Zimbabwe

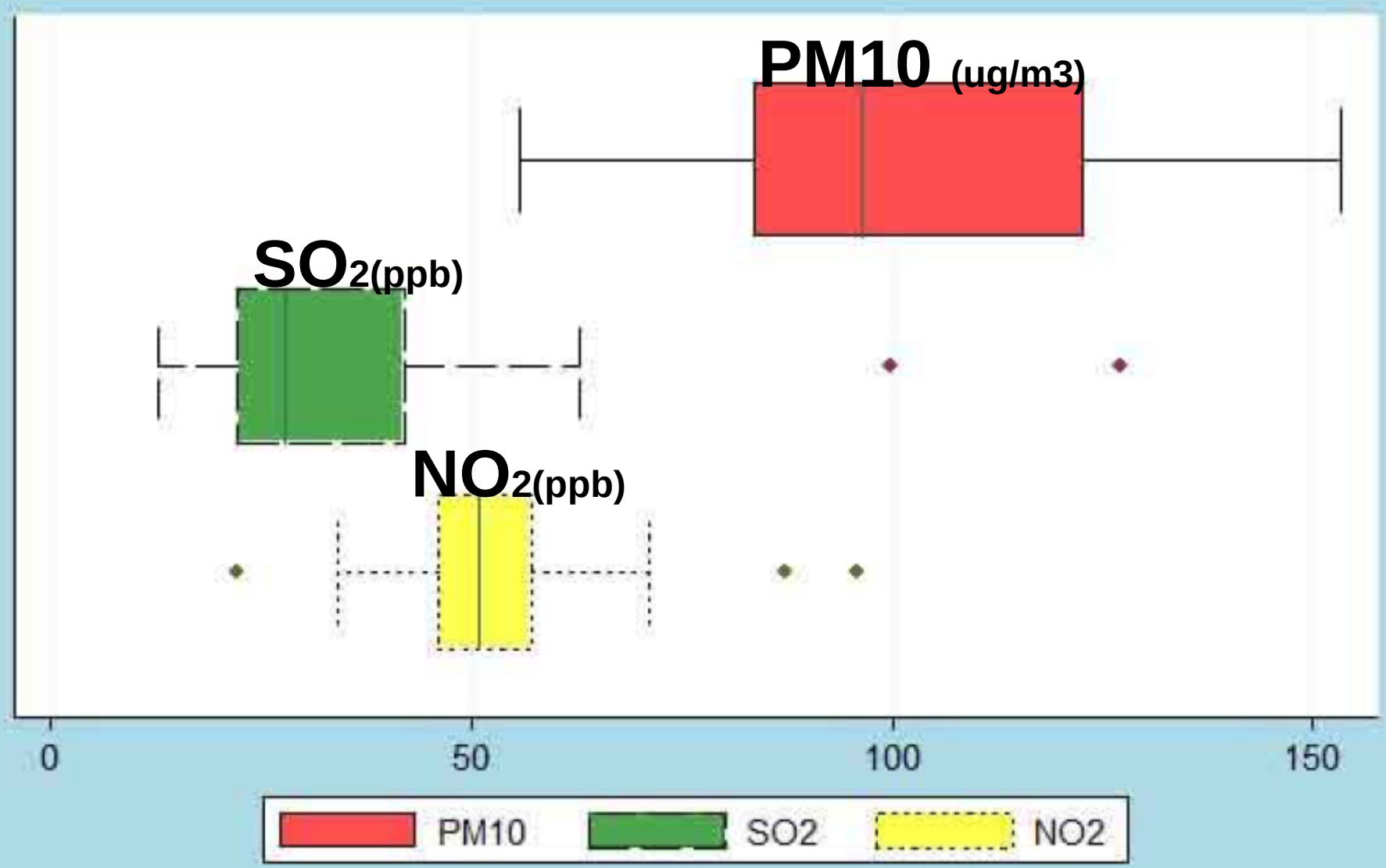
… «Nr. 2»

Burkina Faso
Burundi
Cent. African R
Chad
China
Cote d'Ivoire
D.R. Congo
Eritrea
Ethiopia
Guatemala
Guinea-Bissau
Kenya
Lesotho
Madagascar
Mali
Niger
Nigeria
Papua New
Guinea
Sao Toma
Senegal
Sierra Leon
Somalia
Sudan
Taijikistan
Timor Leste
Togo
Uganda
Zambia

«Nr. 3»

Angola
Cap Verde
Georgia
Kyrgystan
Liberia
Mongolia
Peru
Sri Lanka
Uzbekistan
Vietnam
Yemen

Amini et al. (2013) J Adv Env Res



Heresh Amini, PhD student SwissTPH

Vahid Hosseini,
Head of AQCC and
Prof. at Sharif University

Location of Tehran AQCC and Iran DOE monitoring sites (2010)

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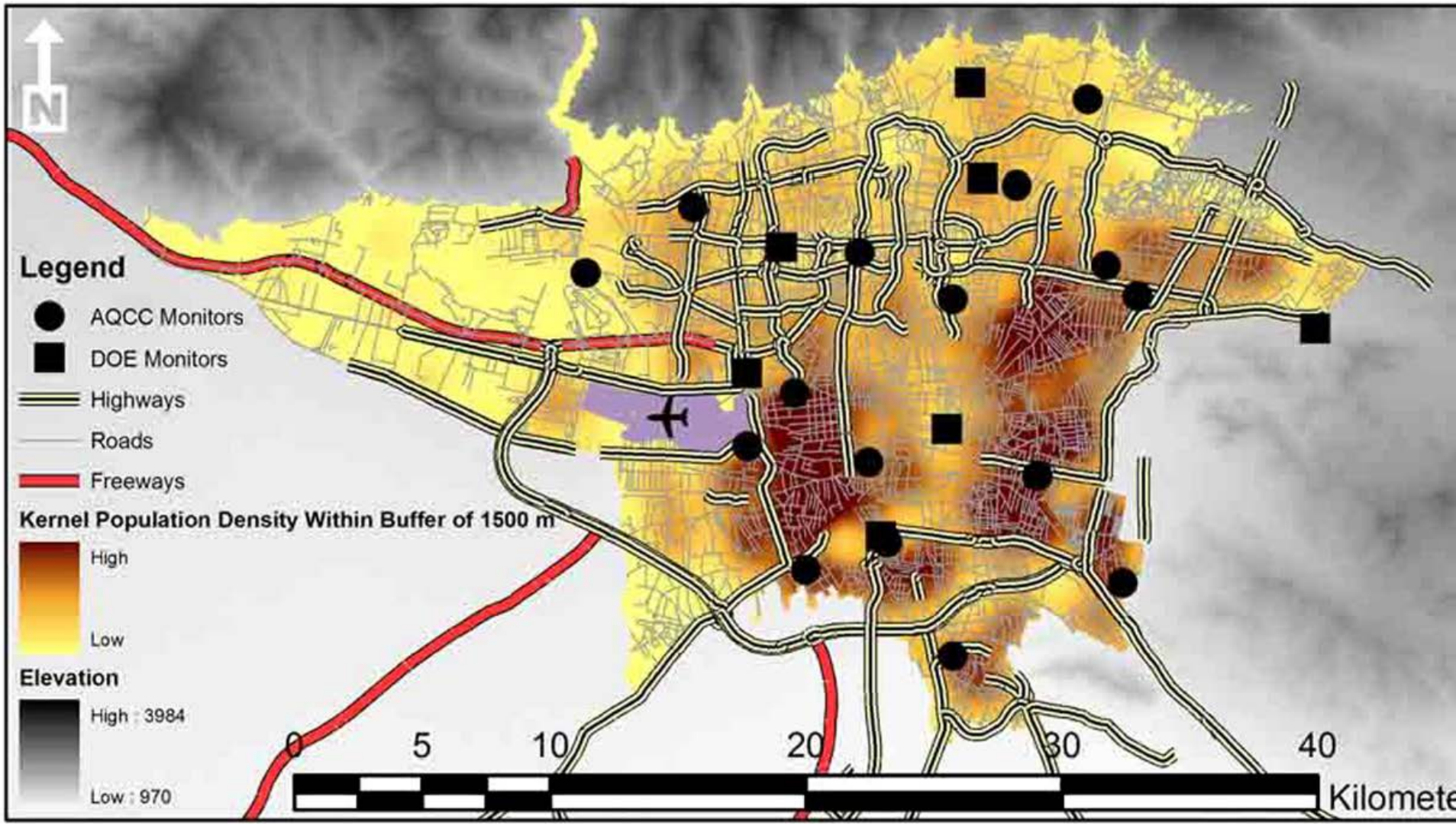
H. Amini et al. / Science of the Total Environment 488–489 (2014) 343–353

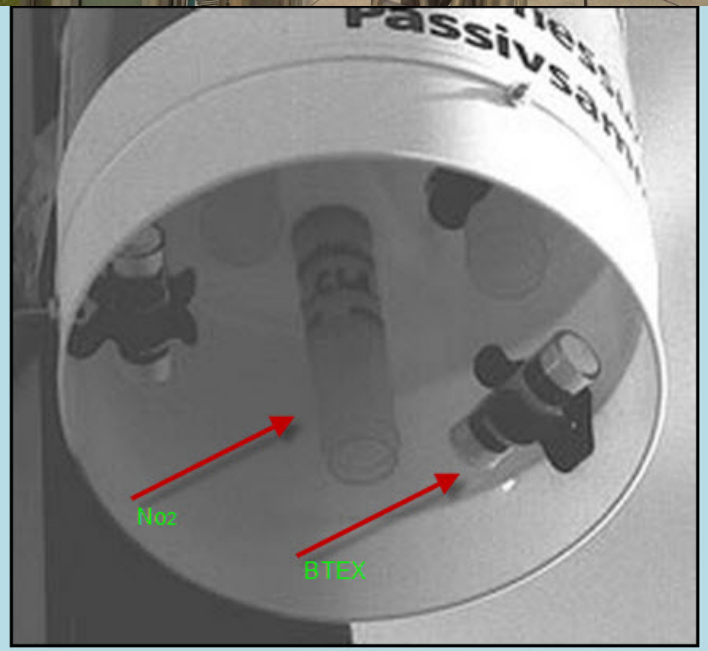


Background and Objectives

- Long-term health effect studies require spatial models of long-term concentrations
- Concentrations and mixtures are city-specific and in Tehran expected to fastly change
- → current levels and spatial distributions may not reflect the past nor the future
- → → spatial models need to be updated regularly

Question: can fixed site monitors be used for (repeated) spatial models, serving both health research and monitoring needs?

- Objective of research project:
  - Develop «cadillac models» for gasous criteria pollutants (and UFP?)
  - Validate land-use regression (LUR) models based on fixed sites with the «cadillac models» based on 179 measurement sites
  - Evaluate optimal selection of locations for fixed site monitoring for future spatial modelling, based on fixed monitoring sites



- at each site (N=179),
- during each season (3)
- 2-week passive sampling campaigns of:
  - **NOx**
  - **Ozone**
  - **SO2**
  - **BTEX**
  - **(UFP – separate reduced project)**

All passive samplers from Passam, Switzerland

Possible sites for passive sampling
(N=276, defined by AQCC)

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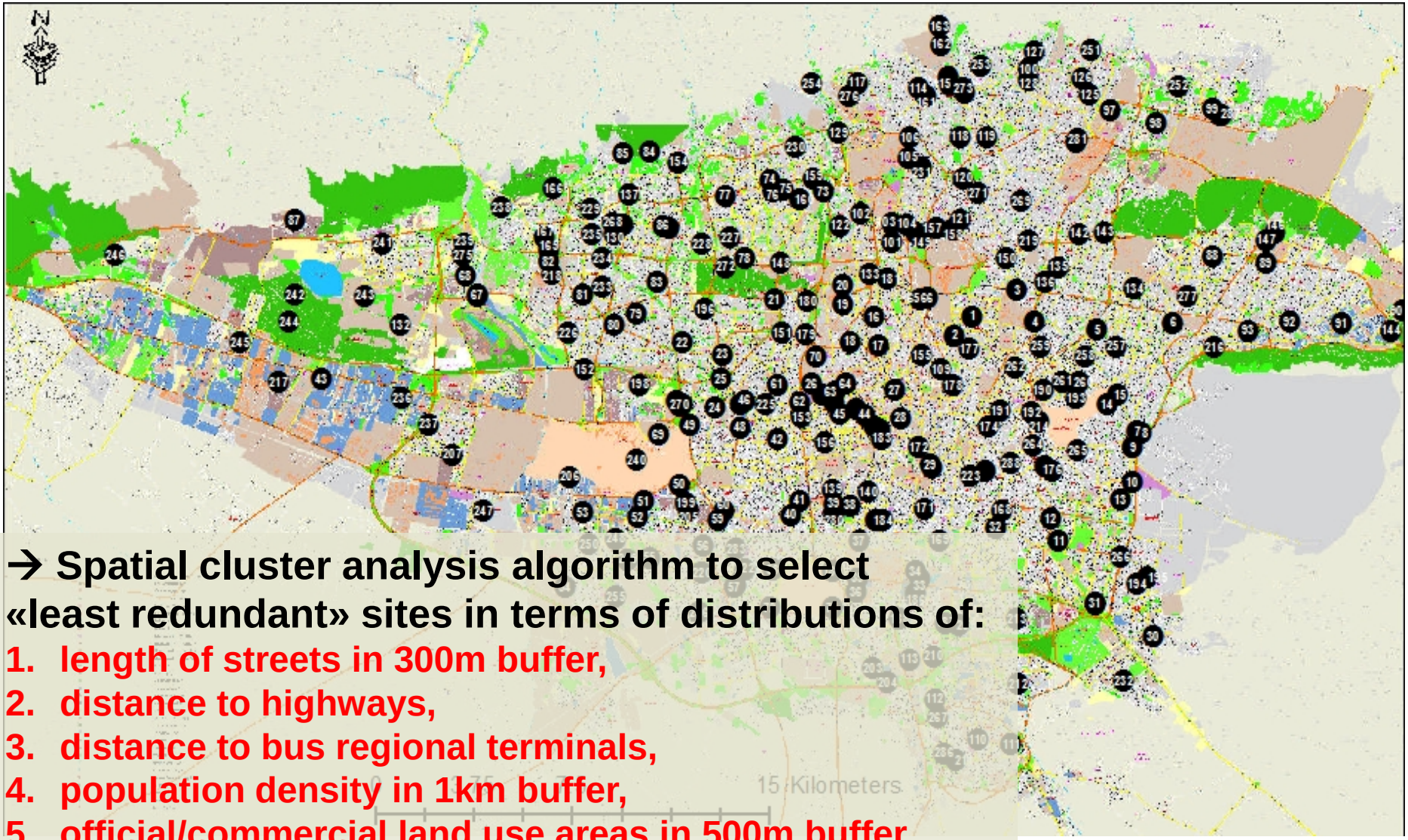

→ Spatial cluster analysis algorithm to select «least redundant» sites in terms of distributions of:

1. length of streets in 300m buffer,
2. distance to highways,
3. distance to bus regional terminals,
4. population density in 1km buffer,
5. official/commercial land use areas in 500m buffer,
6. “other” land use areas in 300m buffer

Selection based on Amini et al. (2014) Sci. Total Environ. 488:343 - 353

Selected sites (N=179)

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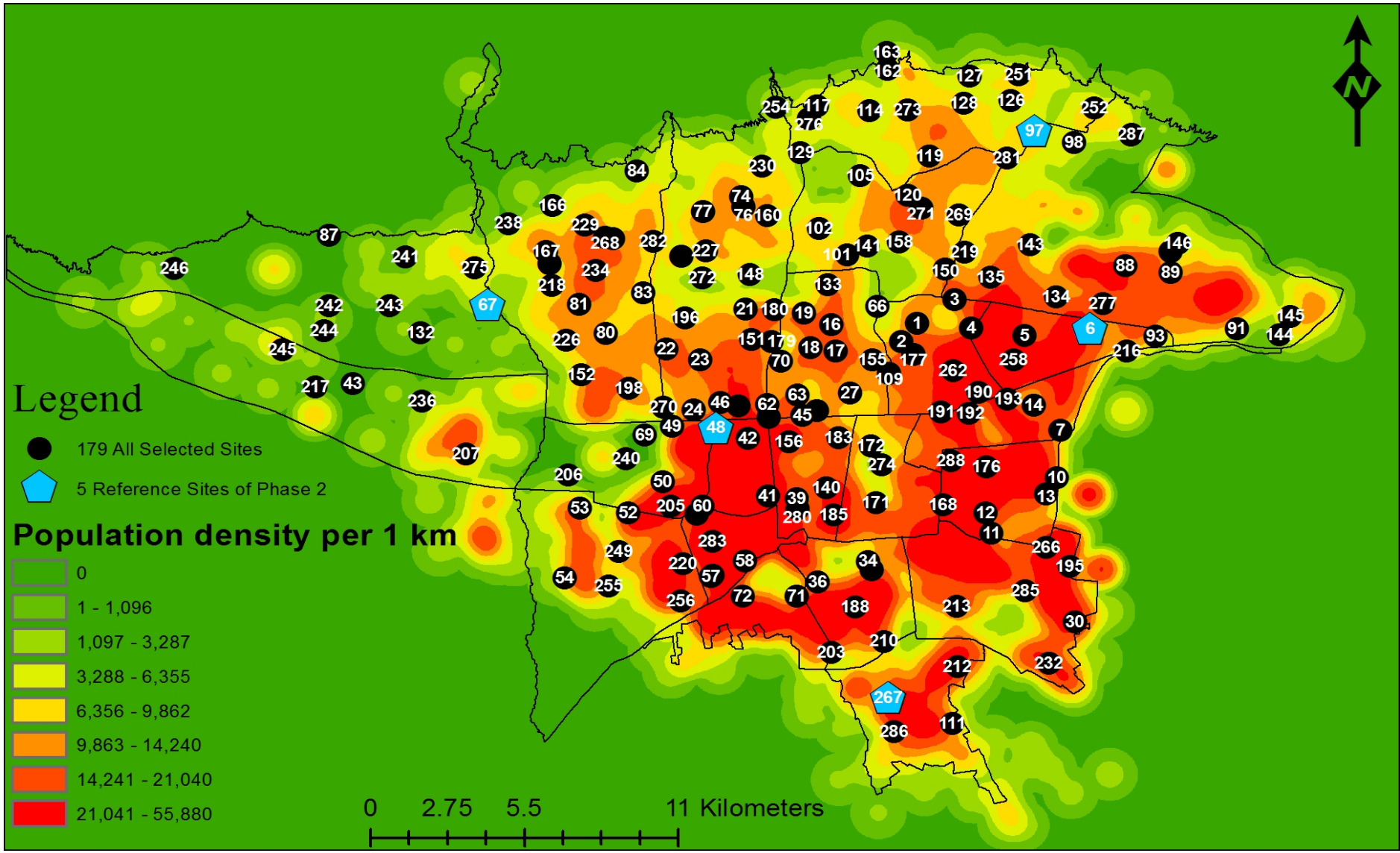
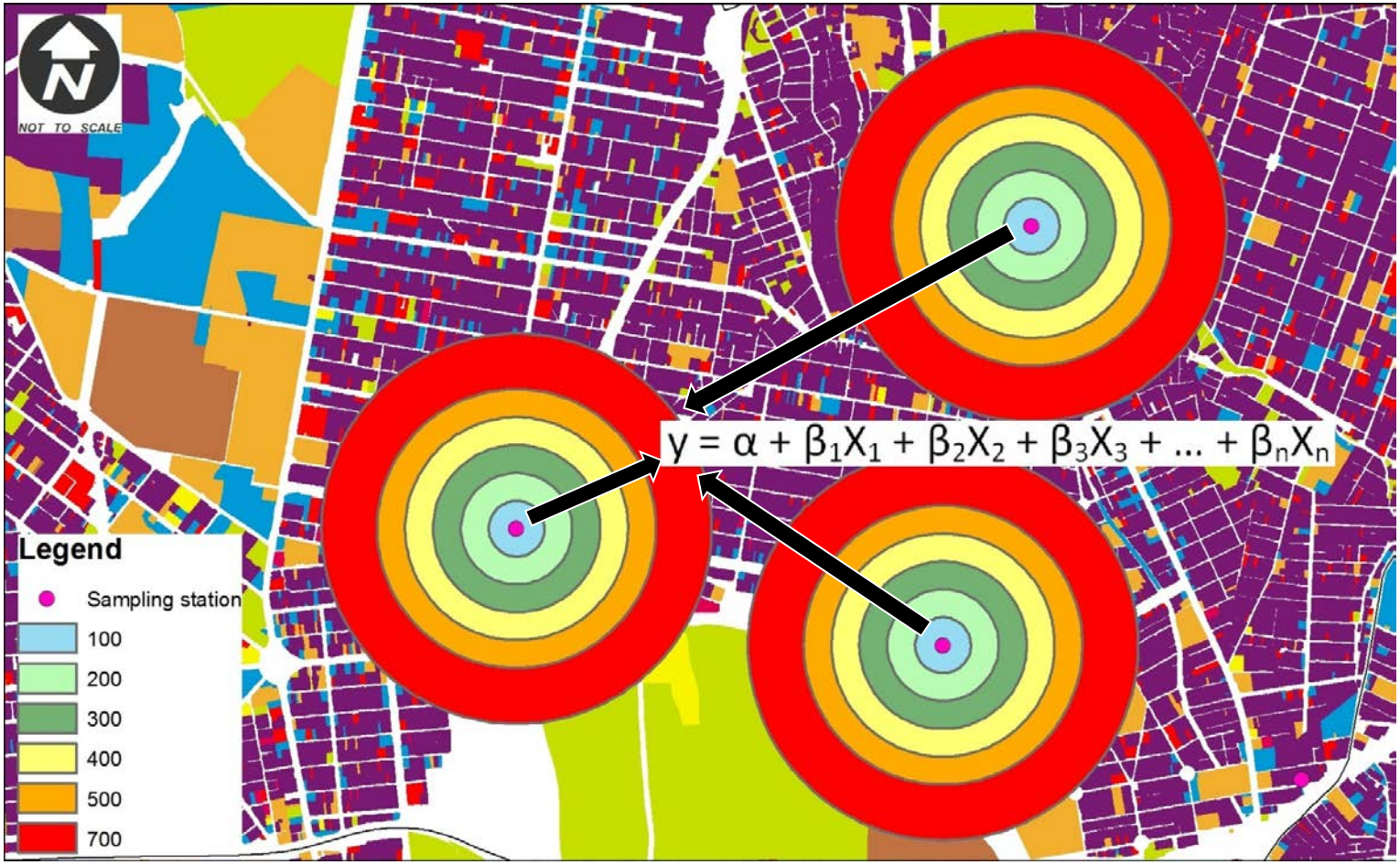


What is land use regression (LUR)?



Spatial predictors offered in LUR

210 variables in five classes

- Traffic Surrogates (N = 76)
- Land Use (N = 50)
- Distance Variables (N = 60)
- Population Density (N = 22)
- and Geographic Location (N = 2)

Next Steps & Conclusions

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- Phase I ended in June (comparison of 10 fixed sites and validation of samplers
- Phase II:
  - starts mid July: parallel 2-week monitoring at all 179 sites, including all fixed monitoring sites;
  - Repeated campaigns in fall and winter
  - Analyses and modelling: summer 2016

Thank you for your attention

Example of LUR in Tehran. See Amini et al. (2014) article

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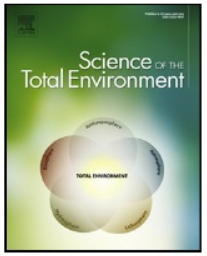

Land use regression models to estimate the annual and seasonal spatial variability of sulfur dioxide and particulate matter in Tehran, Iran

Hassan Amini [a,b,*], Seyed Mahmood Taghavi-Shahri [c,d,**], Sarah B. Henderson [e,f,***], Kazem Naddafi [b,g], Ramin Nabizadeh [b], Masud Yunesian [b,g,****]