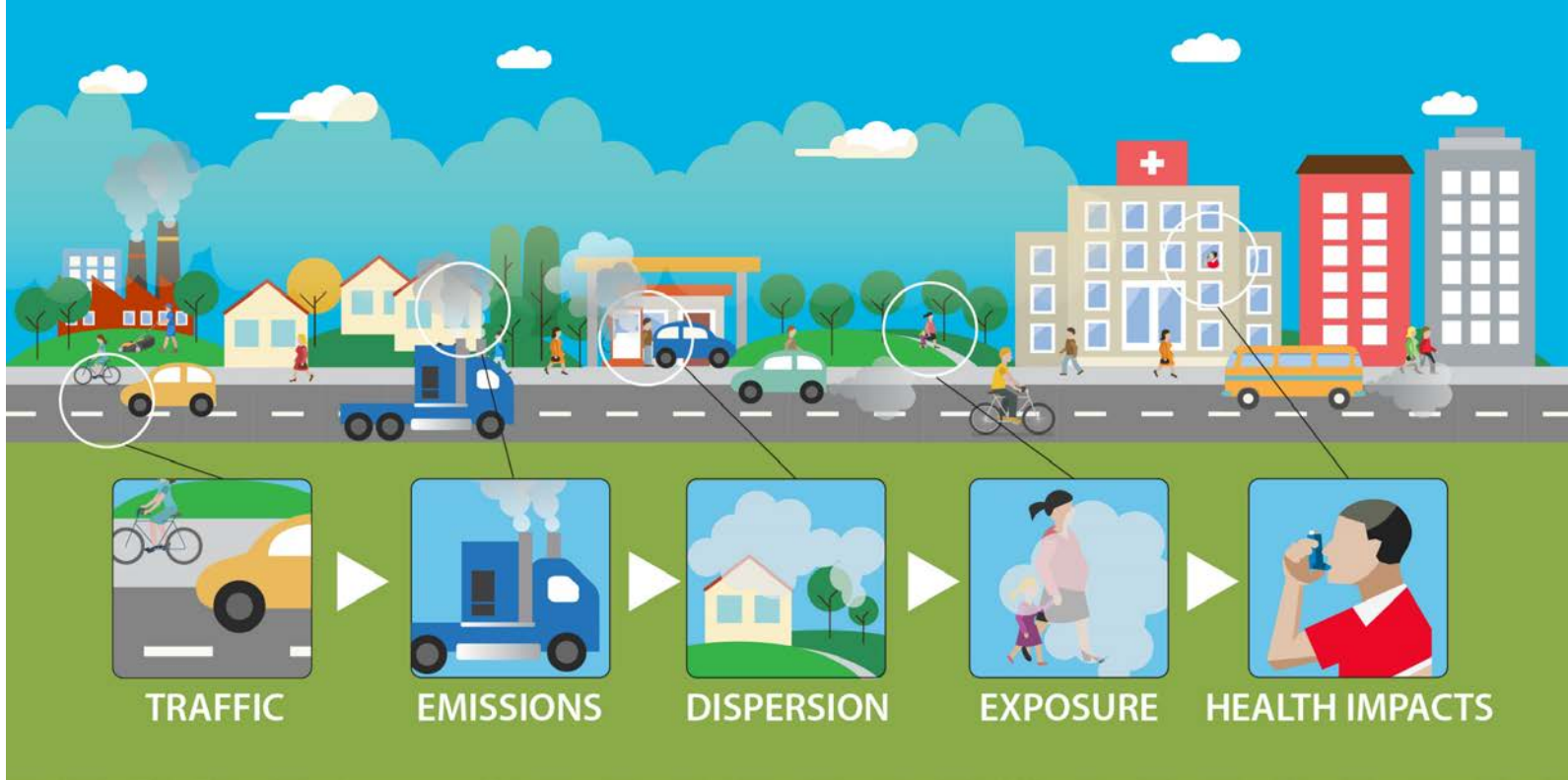# Maternal Exposure to Transportation-Related Air Pollution in South Texas

Suriya Vallamsundar and Joe Zietsman
Texas A&M Transportation Institute

January 25, 2018

Texas A&M
Transportation
Institute

TRAFFIC → EMISSIONS → DISPERSION → EXPOSURE → HEALTH IMPACTS

Texas A&M
Transportation
Institute

Introduction

- ❑ Motor vehicles emit large quantities of pollutants

- ❑ Maternal exposure to air pollution during pregnancy increases the risk for childhood asthma
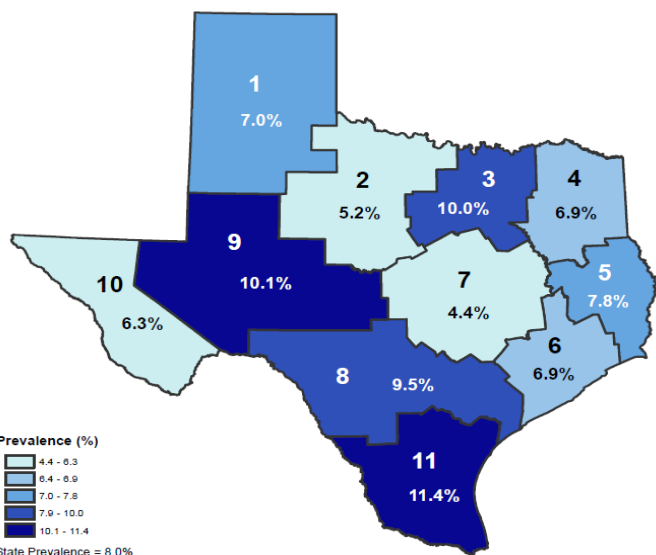
Background

- Cross disciplinary Health Pilot Study

- Characterize maternal and in-utero exposure to traffic related air pollution

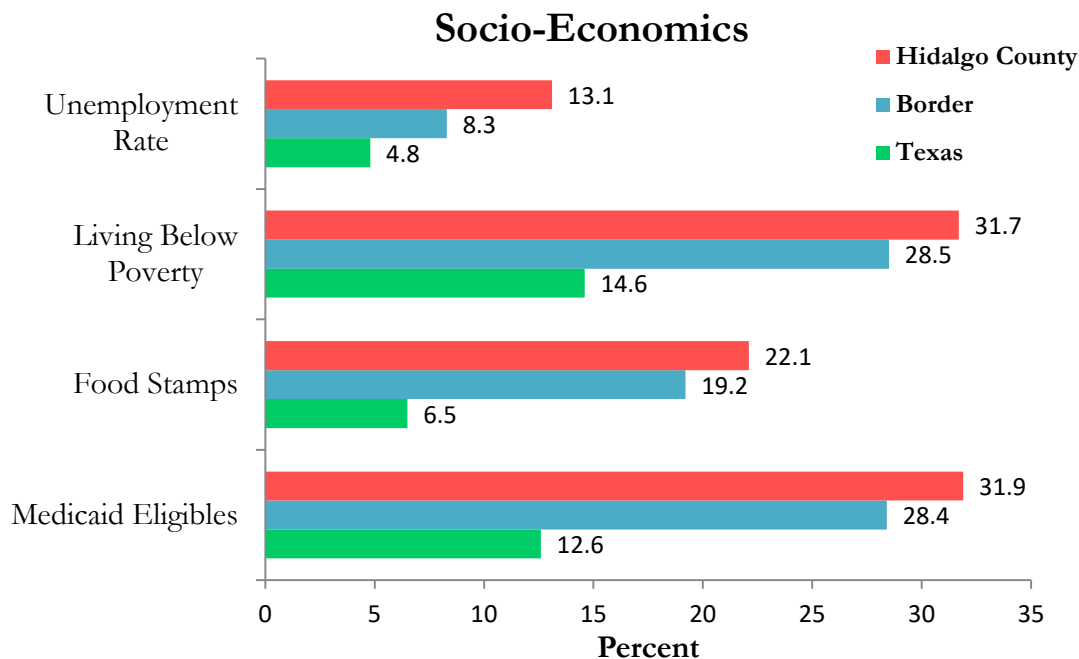- One of the early studies focused on a vulnerable population of pregnant women

Pilot Project Overview

Pilot Project Approach

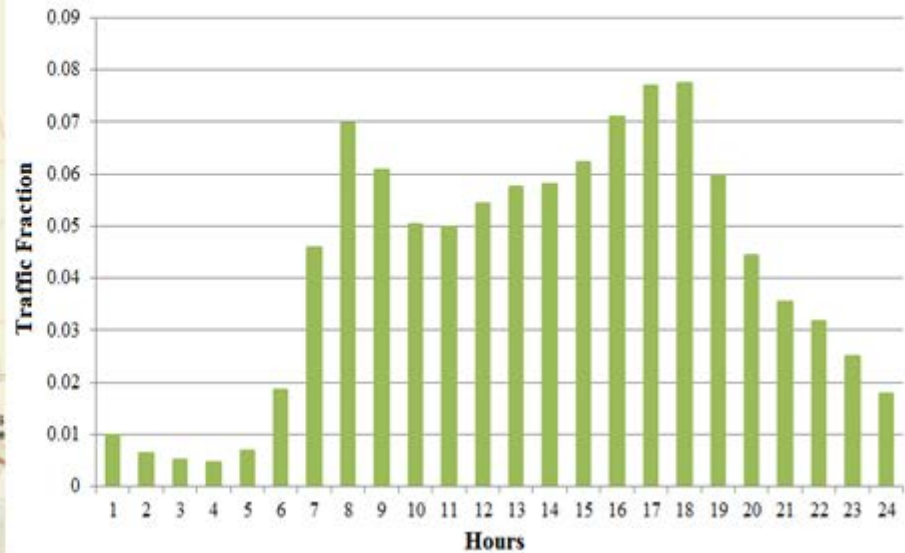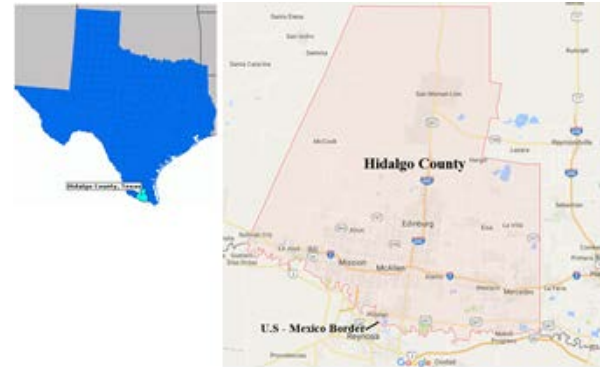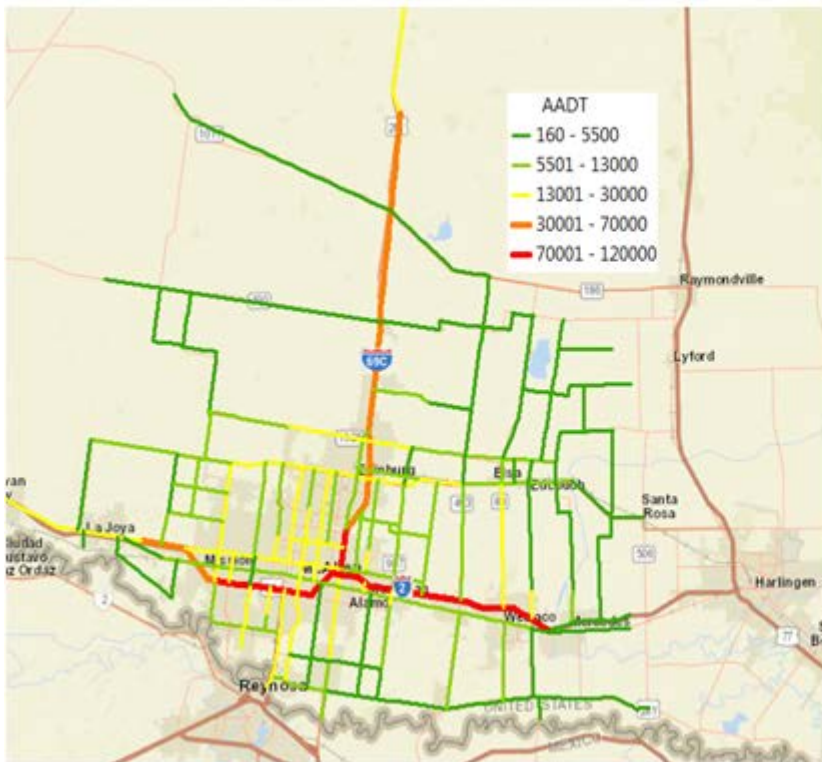| TTI	JHU	HSC
• Model Traffic Emissions • Pollutant Dispersion • Exposure Assessment	• Time Activity Pattern Assessment • Location, Time spent and Exposure	• Collect blood, urine, and hair samples • Biomarkers of exposure

Texas A&M
Transportation
Institute

Lives, Time and Resources
Lives, Time and Resources
Lives, Time and Resources

Individual Measurement
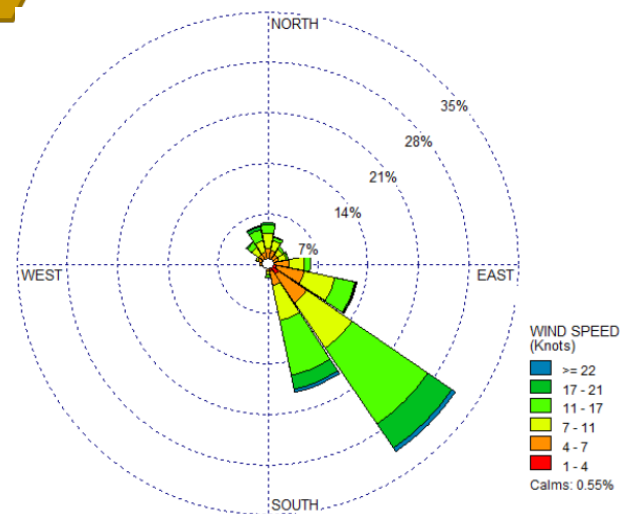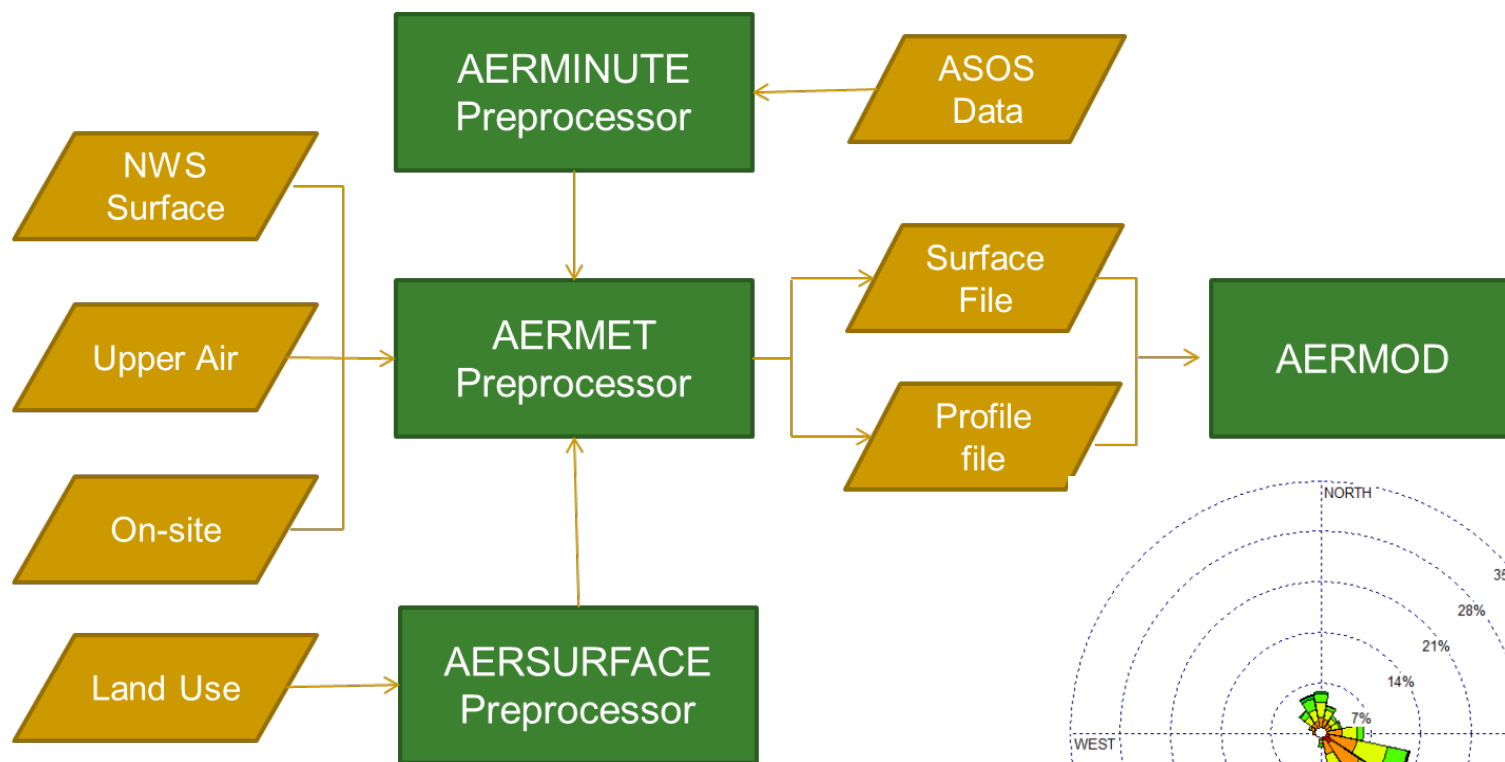
❑ Monitor 17 non-smoking women in their third trimester of pregnancy for 3 non-consecutive days

❑ Participants are equipped with backpacks containing air sampling equipment ($PM_{2.5}$), a GPS device and instruments to measure temperature and humidity

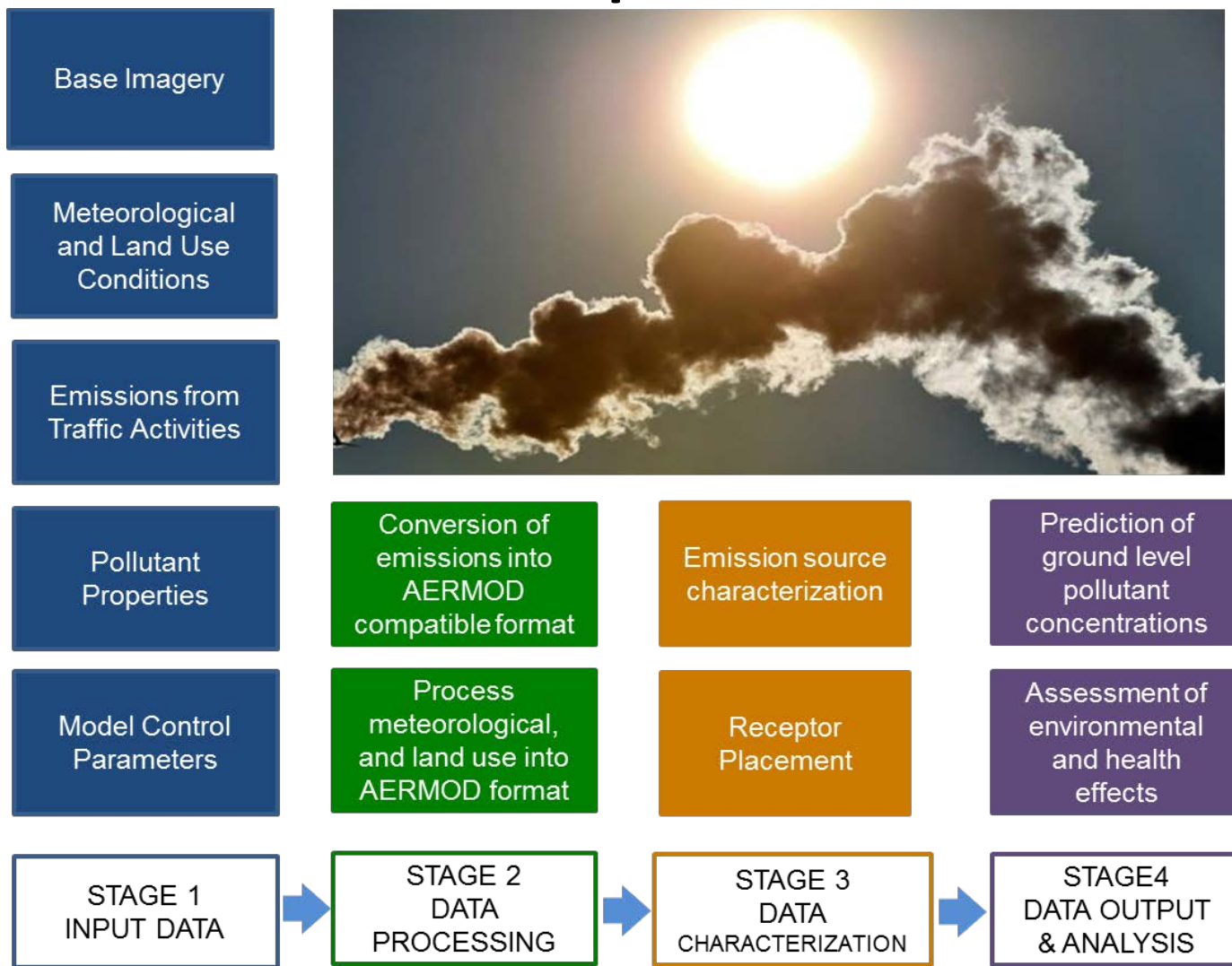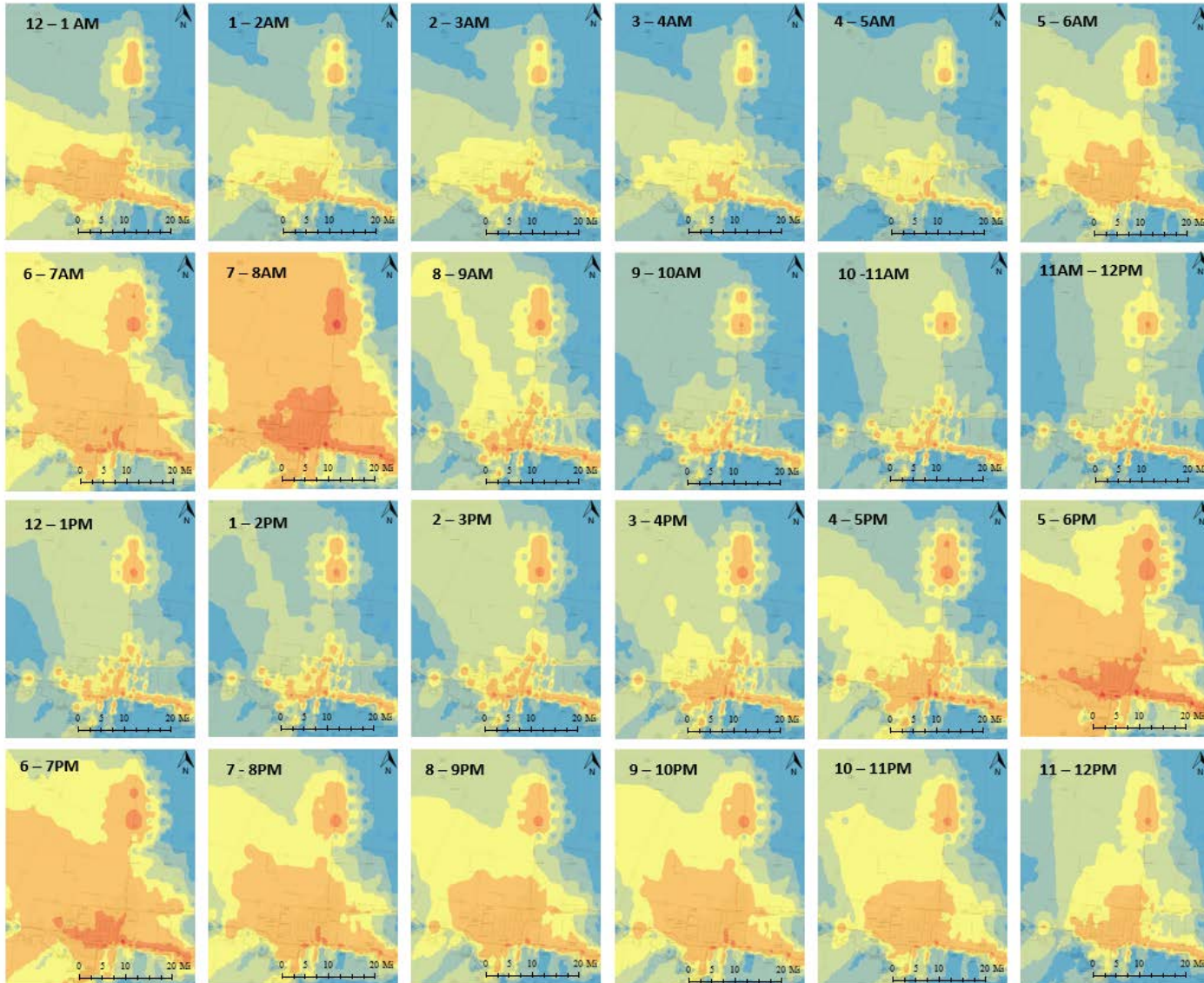❑ Sampling Period (Nov, 2015 - April, 2016)

Traffic Data

Meteorology

Air Dispersion

Base Imagery			
Meteorological and Land Use Conditions			
Emissions from Traffic Activities			
Pollutant Properties	Conversion of emissions into AERMOD compatible format	Emission source characterization	Prediction of ground level pollutant concentrations
Model Control Parameters	Process meteorological, and land use into AERMOD format	Receptor Placement	Assessment of environmental and health effects
STAGE 1 INPUT DATA	→ STAGE 2 DATA PROCESSING	→ STAGE 3 DATA CHARACTERIZATION	→ STAGE4 DATA OUTPUT & ANALYSIS

PM2.5 Concentration Contours (ug/m3)
- 0.0 - 0.01
- 0.01 - 0.025
- 0.025 - 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 2.0
- 2.0 - 16.0

Location Information

Symbols
- ◯ Participant Home
- 🔵 Indoor
- ⬠ Outdoor
- 🟥 Driving
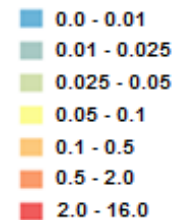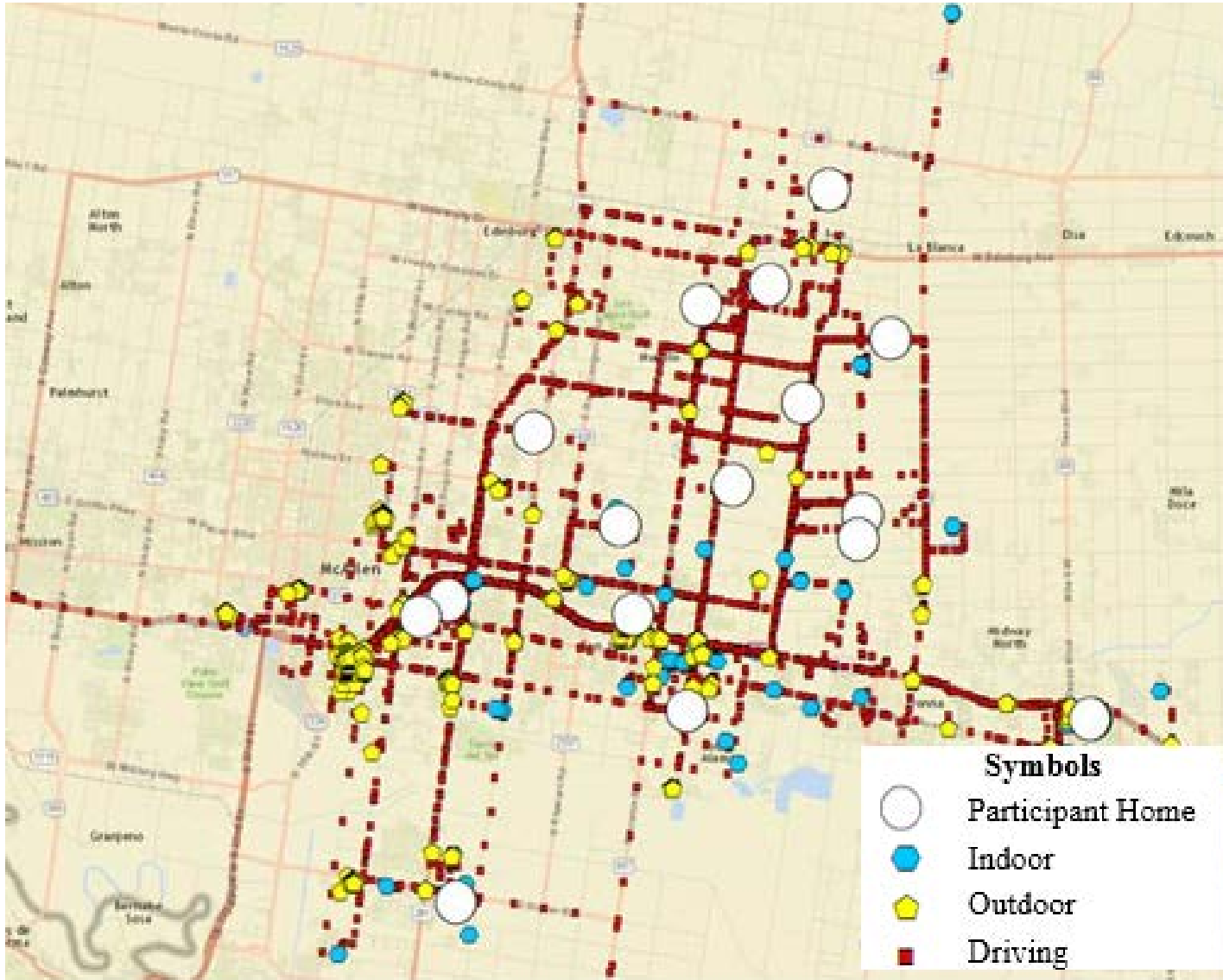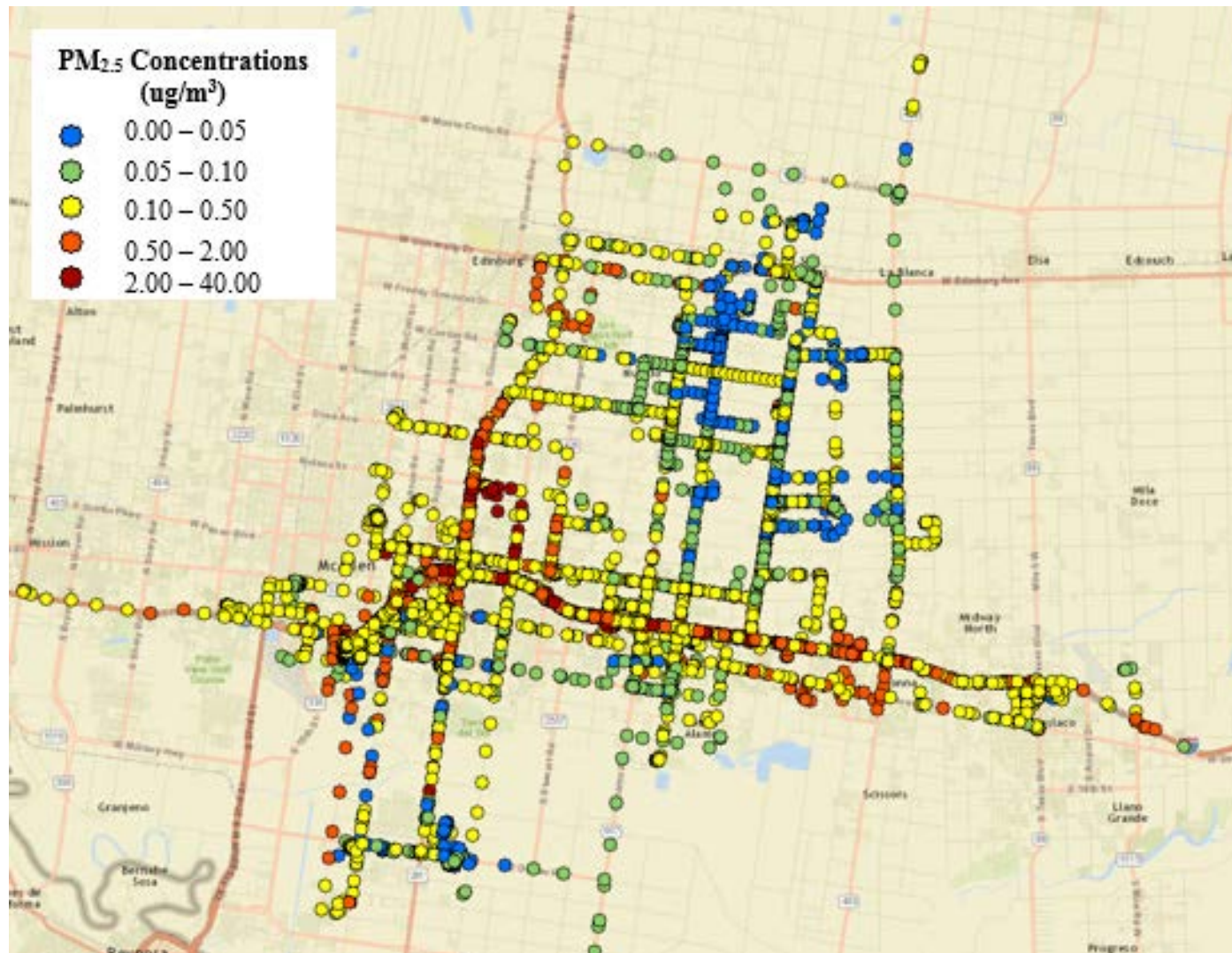
Exposure Assessment

Exposure Assessment

- Total exposure in 3 microenvironments:

$$E_i = \sum(T_{in}\, C_{in} + T_{io}\, C_{io} + T_{iv}\, C_{iv})$$

- T: time
- C: concentrations

- i: person
- v: in-vehicle microenvironment
- o: outdoor microenvironment
- n: indoor microenvironment

- AERMOD provides outdoor concentrations

We use the ratio of indoor to outdoor concentrations
and ratio of in-vehicle to outdoor concentrations

Center for Advancing Research in Transportation Emissions Energy and Health (CARTEEH)

"CARTEEH is a premier University Transportation Center where transportation and public health experts work together to address the impact of transportation emissions on human health."

www.carteeh.org

CARTEEH Consortium Members

Concluding Remarks

- Integration of health and transportation – topic of growing importance

- Emergence of novel data collection methods

- Targeted policy and intervention measures

- Finalize the biomarker evaluation

- Future: increase sample size, focus on a case study where traffic emissions are greater

zietsman@tamu.edu