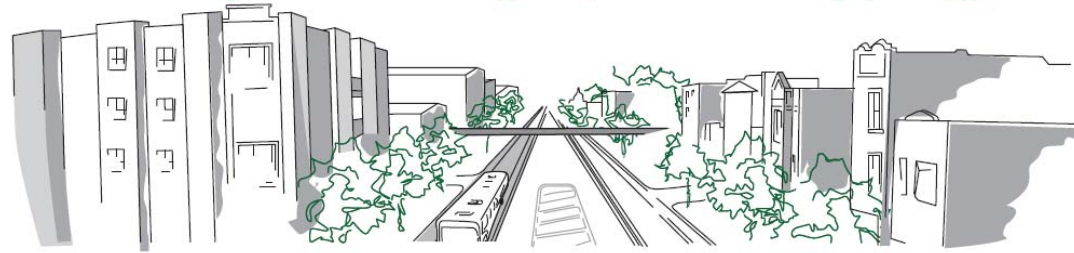


University of Toronto
Transportation and Air Quality Research Group (TRAQ)



Air Quality and Health Benefits of Greening Freight Movements

Dr. Laura Minet

Postdoctoral Fellow - Earth Sciences and Civil & Mineral Engineering
University of Toronto

Ambient Air Pollution: a Threat for Human Health

Health risks

Acute:
stroke, hypertension,...



Long-term:
cancer, diabetes, asthma,...



Annual premature
deaths due to
ambient air pollution



4.2 million¹



14,600²

**\$114 billion of
health expenses**

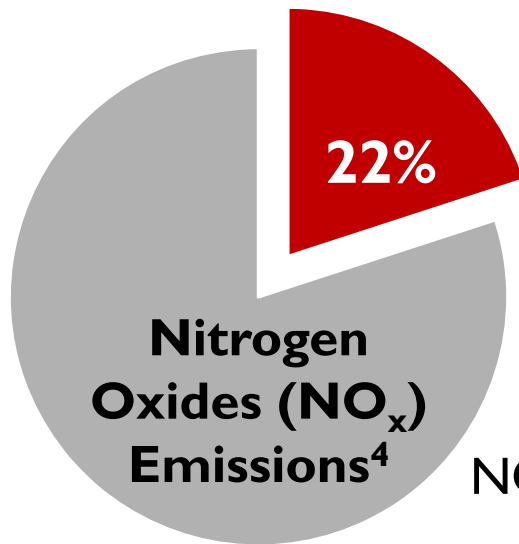


700³

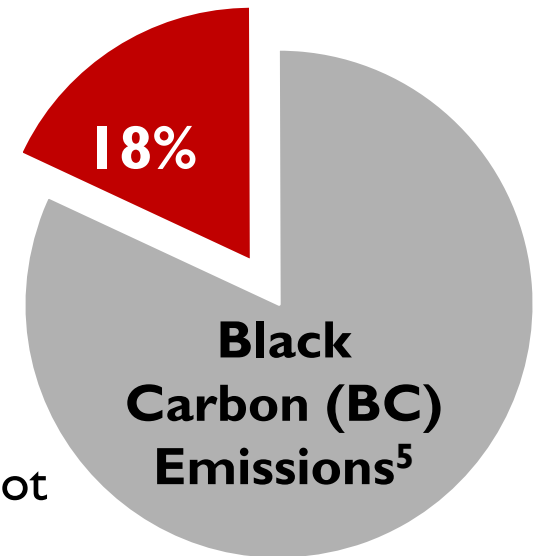
**\$4.6 billion of
health expenses**

On-Road Transportation: the Main Source of Emissions in Cities

On-road transportation

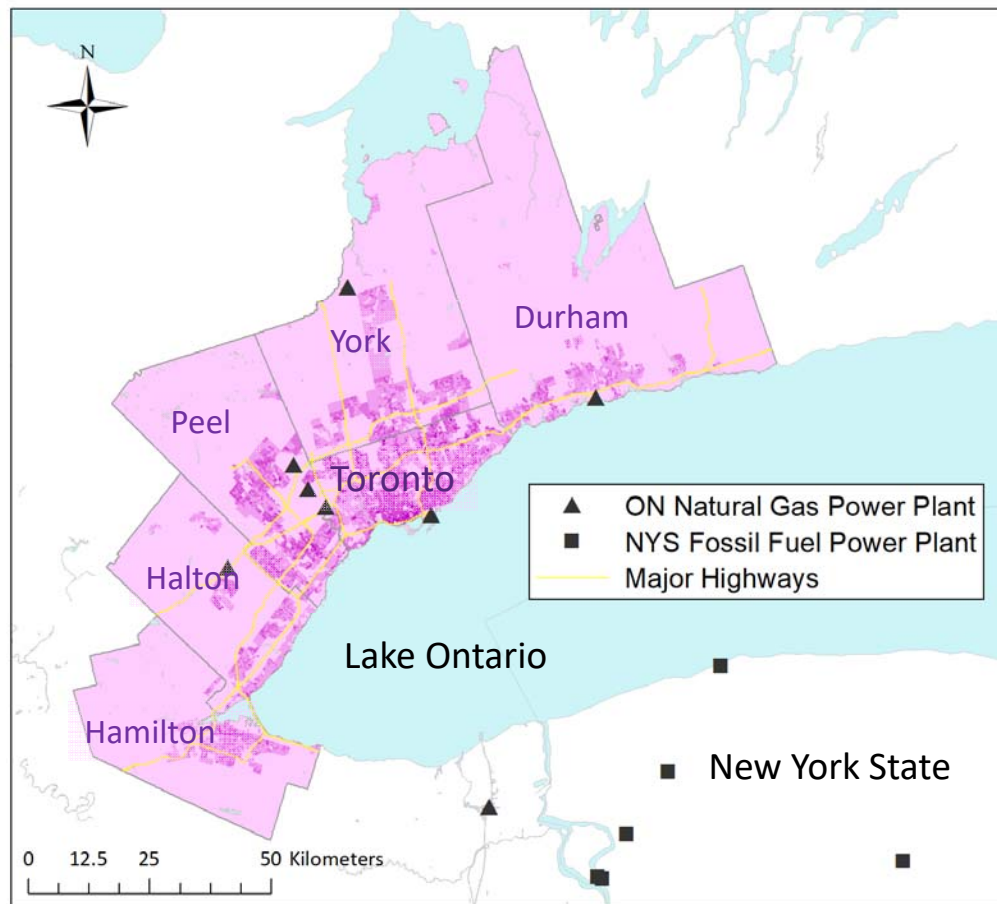


BC = Soot



Markers of traffic-related air pollution

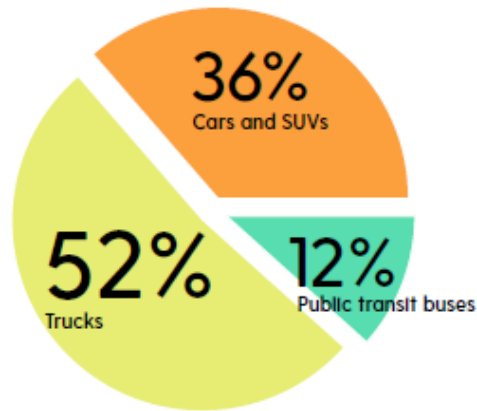
Study Area - The Greater Toronto and Hamilton Area (GTHA)



Trucks are the Largest Emitters of Traffic-Related NO_x and BC Emissions in the Greater Toronto and Hamilton Area

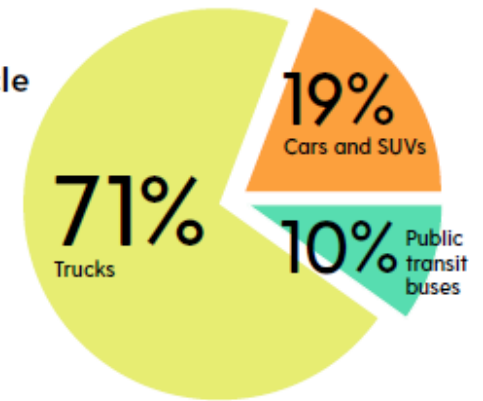
Traffic-related nitrogen oxides (NO_x) emissions by vehicle type in the GTHA

30 tonnes NO_x/day



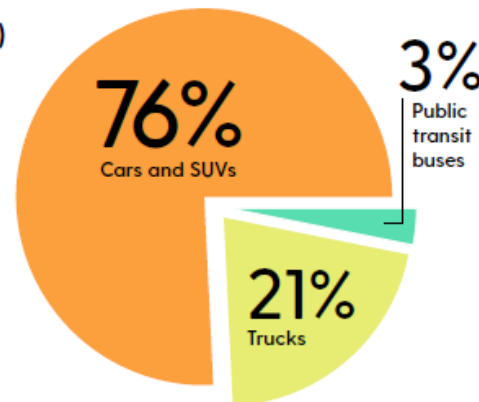
Traffic-related black carbon (BC) emissions by vehicle type in the GTHA

0.54 tonnes BC/day



Traffic-related greenhouse gas (GHG) emissions by vehicle type in the GTHA

34,340 tonnes CO₂ eq./day



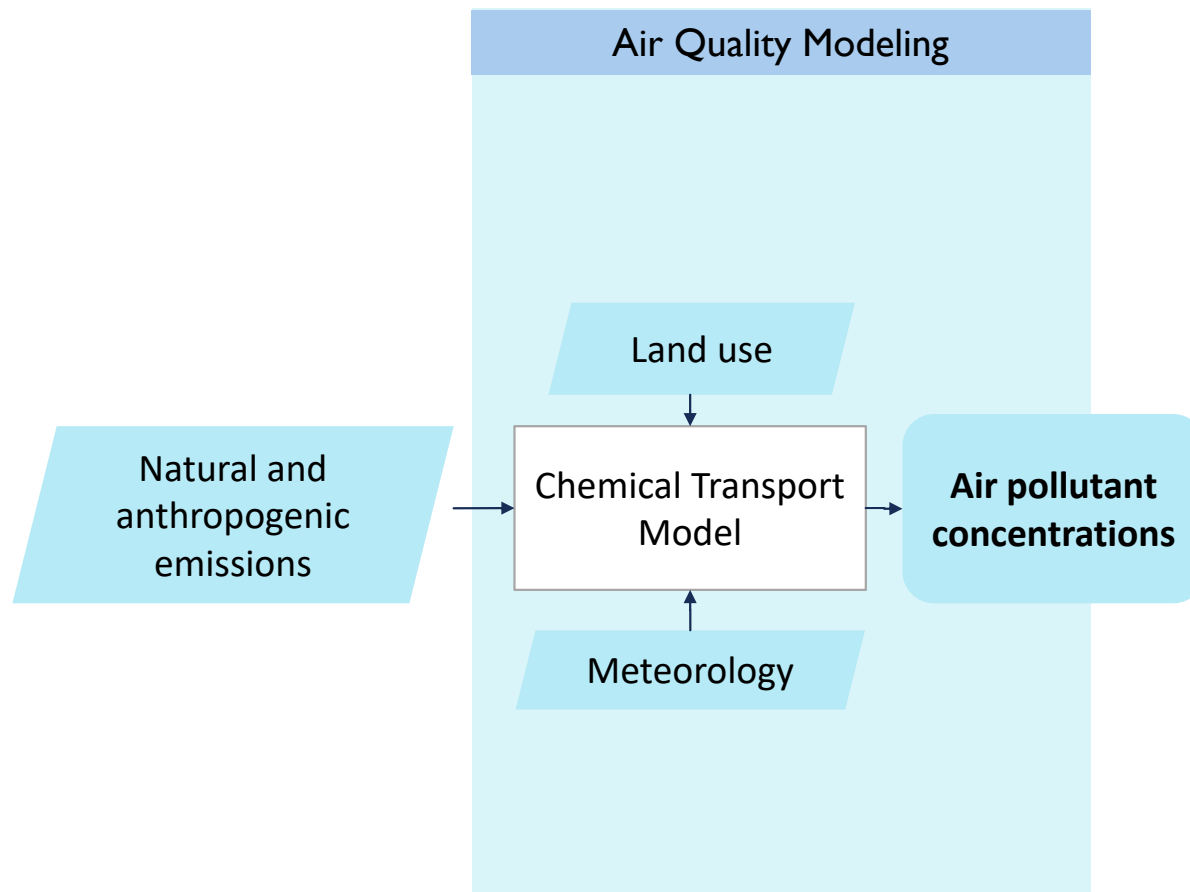
How Can we Improve Urban Air Quality with Policies Targeting Commercial Vehicles?

- What is the health burden of commercial vehicles in the Greater Toronto and Hamilton Area (GTHA)?
- What are the health benefits of getting cleaner commercial vehicles on the roads in the GTHA?

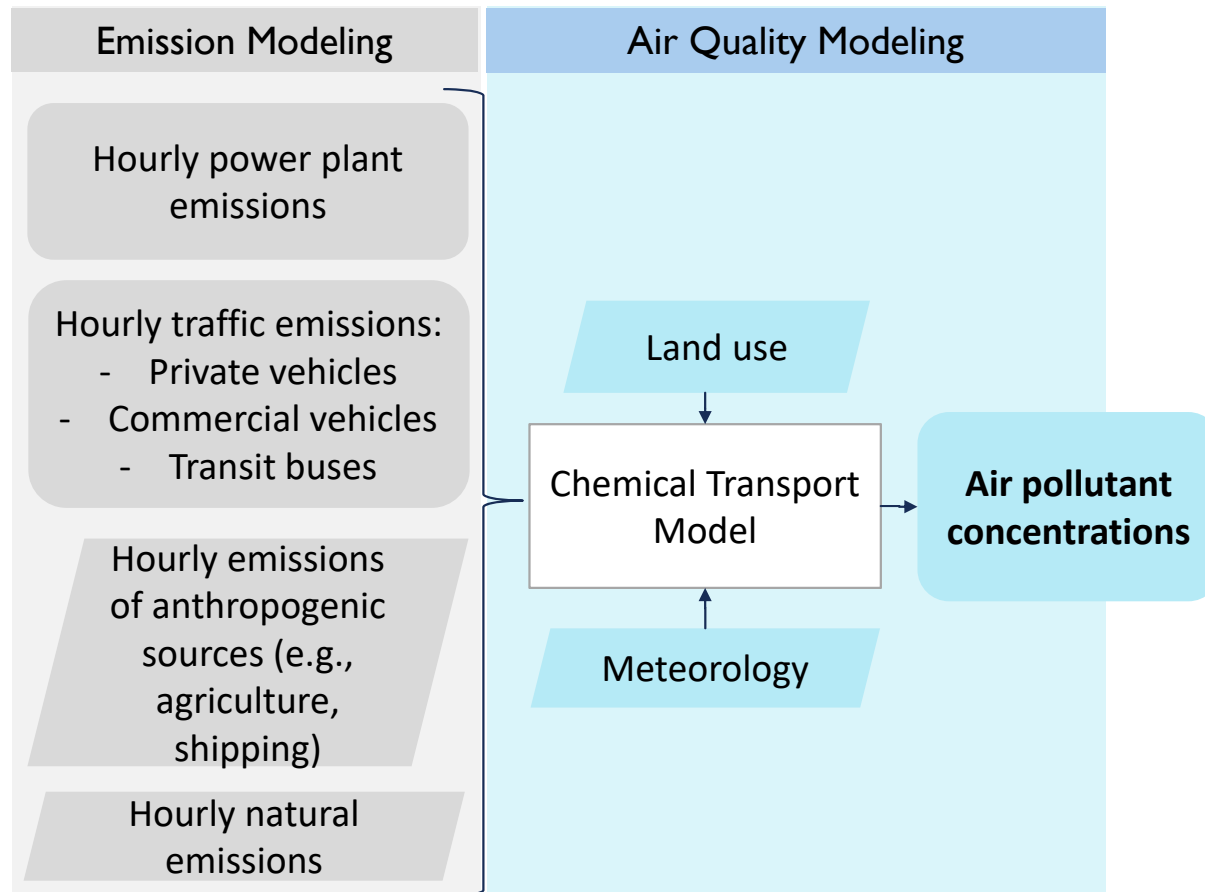
Minet, L., Chowdhury, T., Wang, A., Gai, Y., Posen, I.D., Roorda, M. and Hatzopoulou, M., 2020. Quantifying the air quality and health benefits of greening freight movements. *Environmental Research*, 183, p.109193.

Minet, L., Wang, A., Hatzopoulou, M. Health co-benefits of greenhouse gas reductions in the transportation sector. *Submitted to Environmental Science & Technology*.

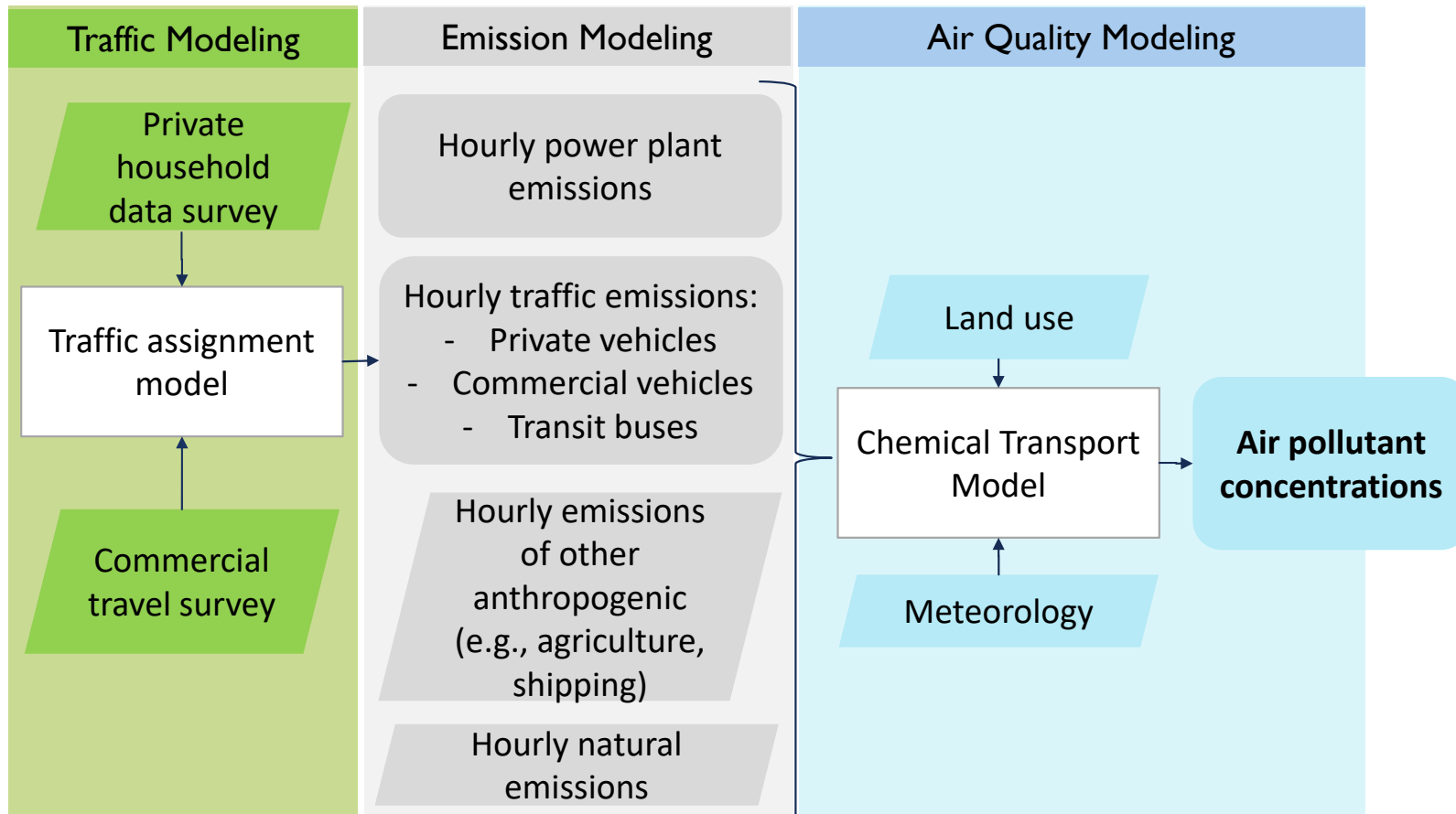
Modeling Framework



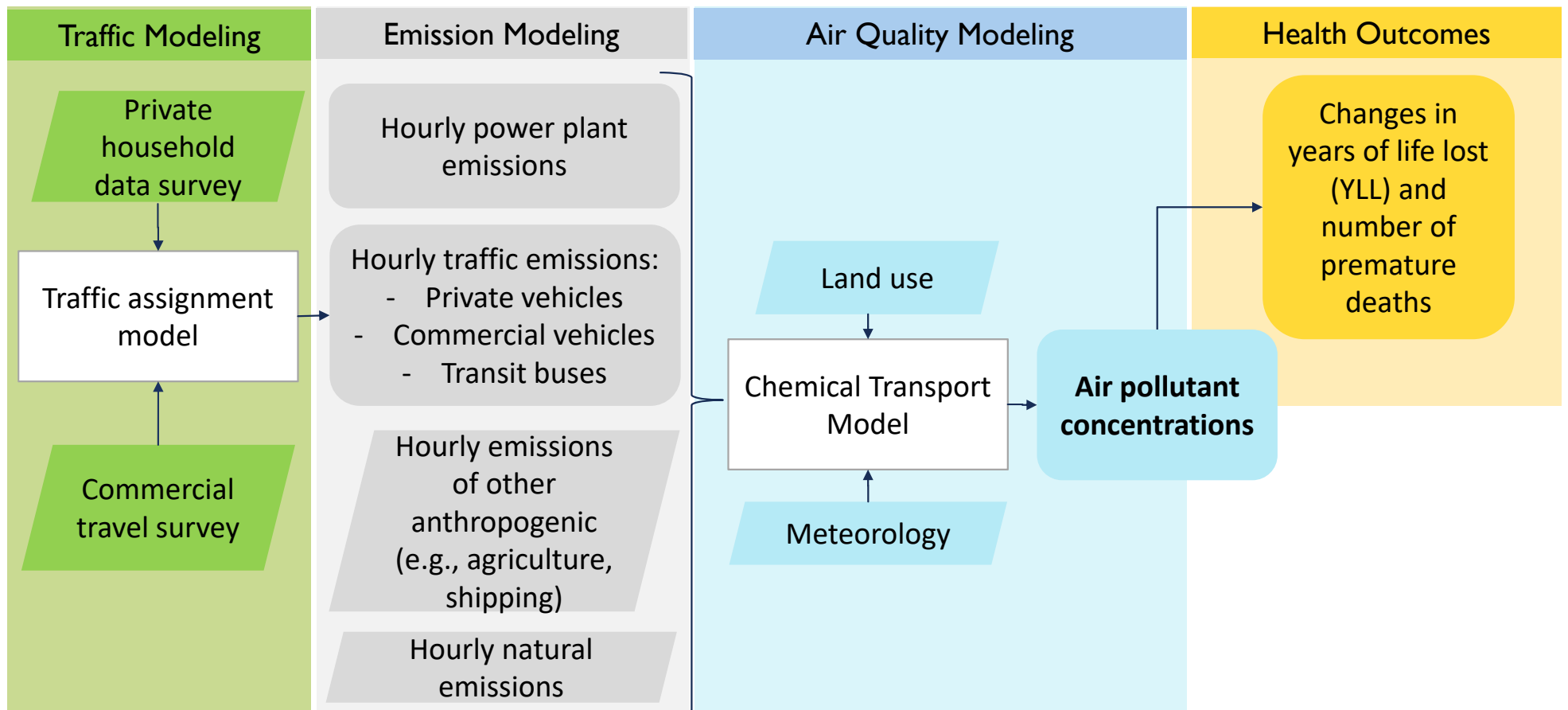
Modeling Framework



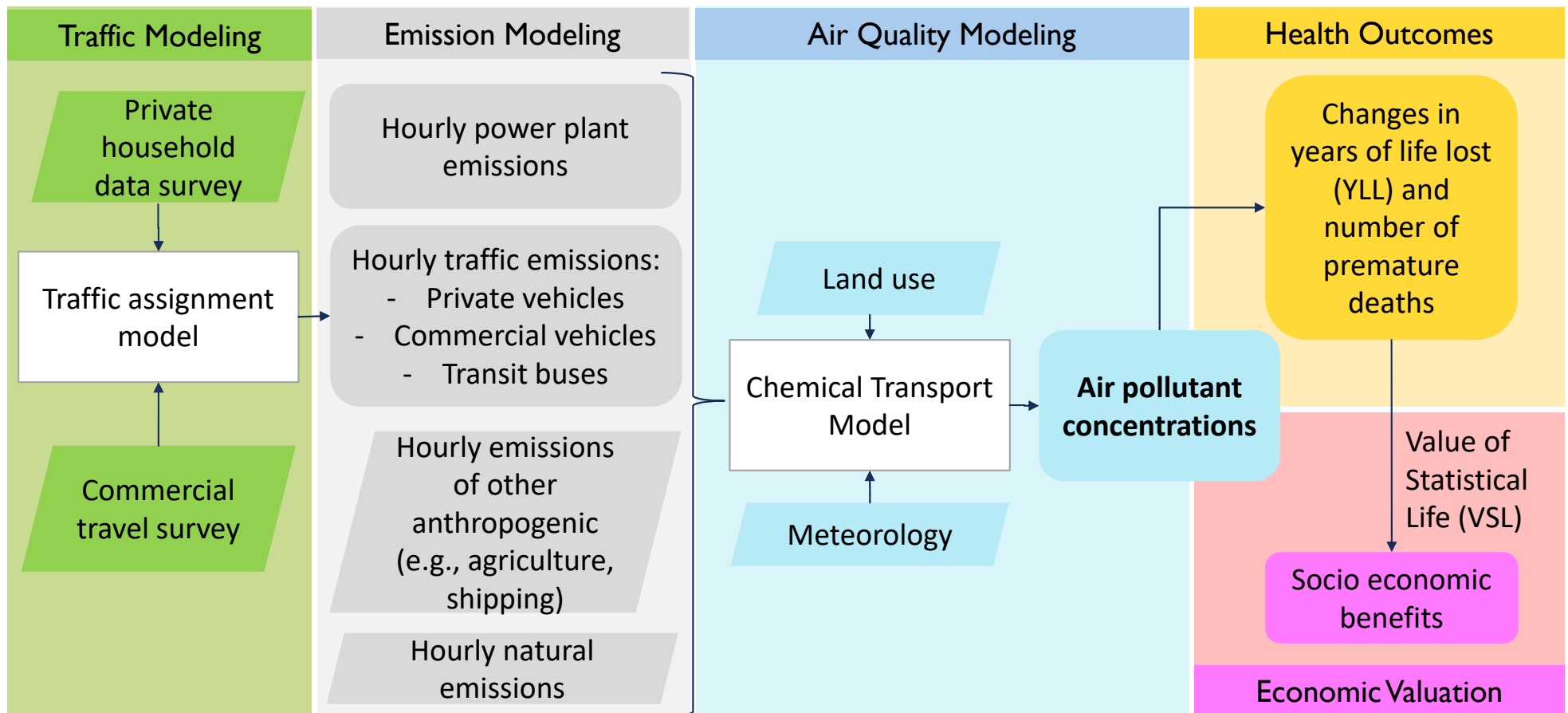
Modeling Framework



Modeling Framework



Modeling Framework



Case Study and Scenario

Base Case



Case Study : impact of commercial vehicles on air quality

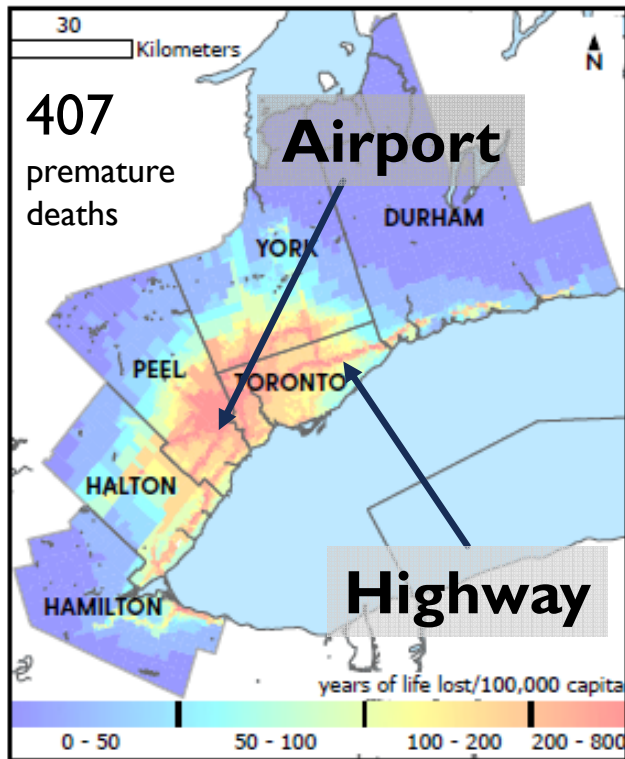


Scenario : cleaner trucks (2008 technology standards)



Freight Transport is Responsible for 407 Premature Deaths per Year in the GTHA

Annual number of years of life lost per 100,000 capita



Social Costs Induced by Air Pollutant Vehicular Emissions



CA\$ **182,000** / truck

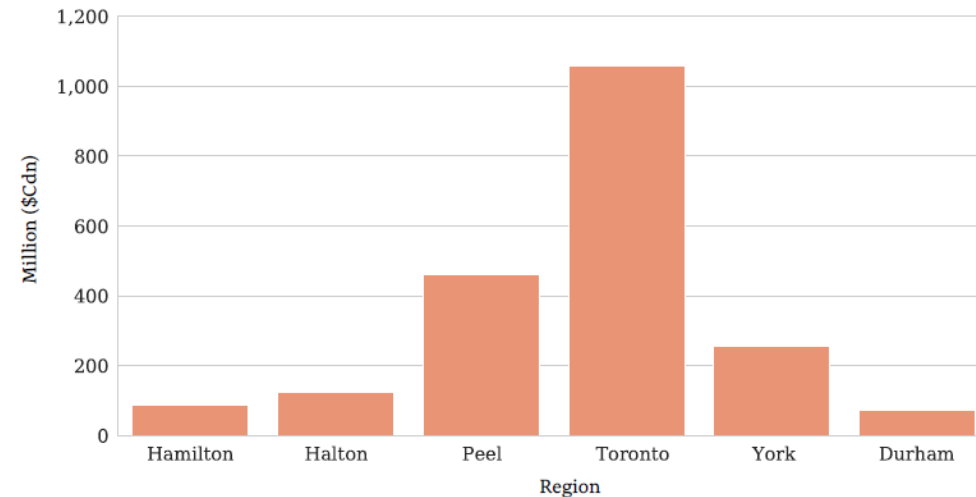
Air Quality and Social Benefits of Cleaner Trucks

275 premature deaths prevented
(trucks: **407 premature deaths**)

\$2.1 billion per year in social benefits

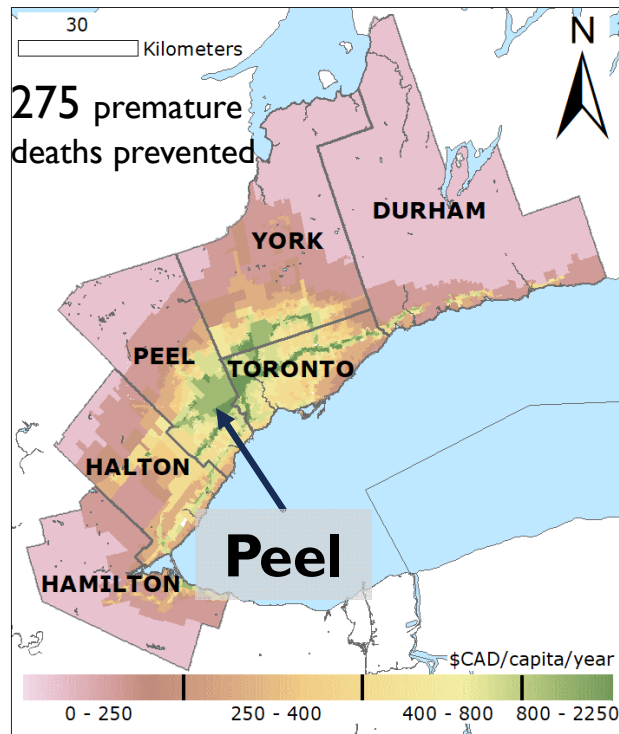
Greatest benefits **where truck traffic is concentrated**

ANNUAL SOCIAL BENEFITS WITH 100 PER CENT CLEANER TRUCKS BY REGION (IN MILLIONS \$CDN)



Cleaner Trucks Can Help Prevent Premature Deaths

Annual Social Benefits
per 100,000 capita



Social Benefits for Each Cleaner
Truck Deployed



CA\$**308,000** / cleaner truck

What Are the Strategies to Deploy Cleaner Commercial Vehicles?



Getting to cleaner trucks:

- Scrappage programs
- Low Emission Zones
- Incentives for cleaner trucks

Acknowledgements

Tufayel Chowdhury

Prof. Matthew Roorda

Prof. Marianne Hatzopoulou

Yijun Gai

Prof. Daniel Posen

Dr. An Wang



QUESTIONS?

References

- 1: [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)
- 2: <https://www.canada.ca/en/health-canada/services/air-quality/health-effects-indoor-air-pollution.html>
- 3: <https://www.peelregion.ca/health/resources/healthbydesign/pdf/moh-report.pdf>
- 4: <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/air-pollutant-emissions.html>
- 5: <https://www.canada.ca/en/environment-climate-change/services/air-pollution/publications/black-carbon-inventory-emissions-2020/chapter-2.html>
- 6: <https://www.eea.europa.eu/media/infographics/many-factors-contribute-to-air-1/view>