MOVES-Based NO_x Analyses for Urban Case Studies in Texas

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How do we reconcile mobile NO_x emissions?

Research Questions

1. *Does MOVES overestimate NO_x emissions?*

   Emissions reconciliation analysis

   Compare near-road monitoring data to output from MOVES to examine NO_x emissions estimates

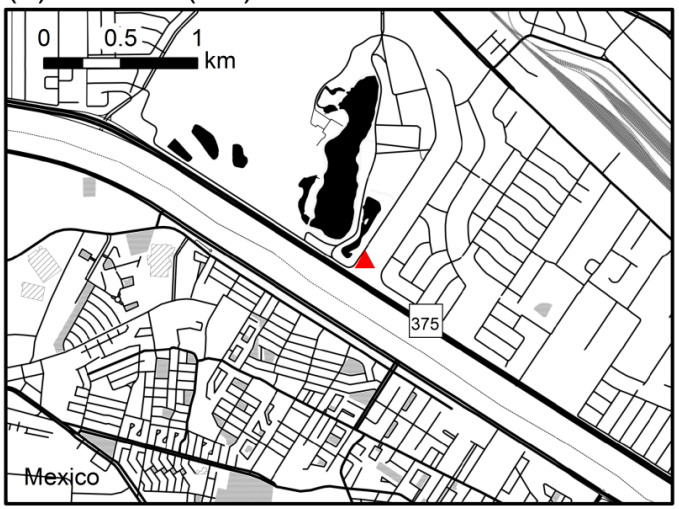
2. *What MOVES input data are important for NO_x emissions estimates?*

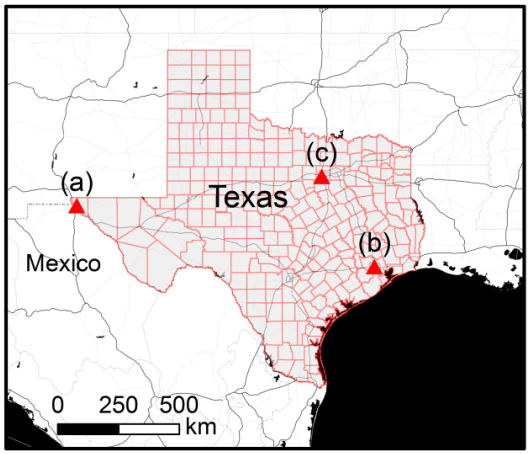
   Emissions sensitivity analysis

   Identify input parameters that have larger influence on MOVES-based NO_x emissions

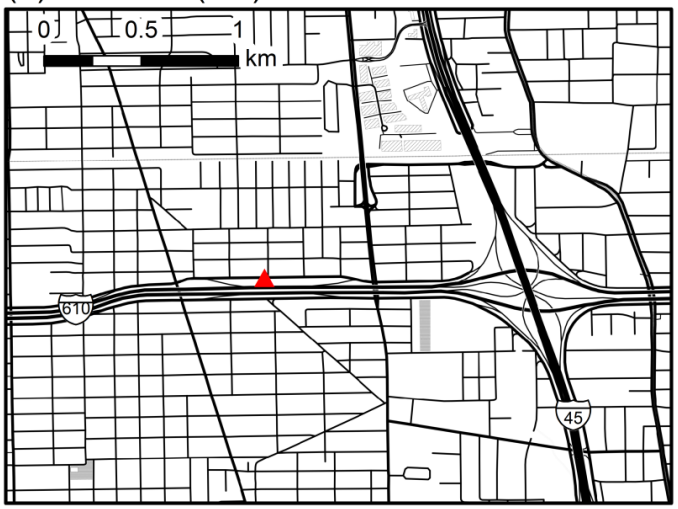
Case Study Settings

(a) El Paso (EP)

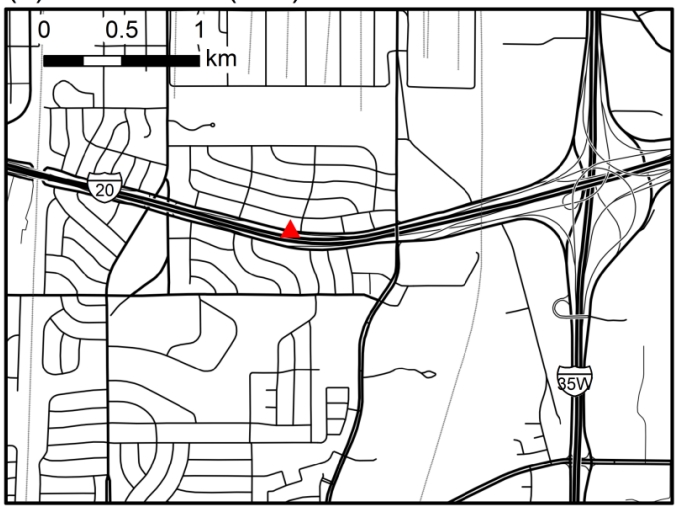




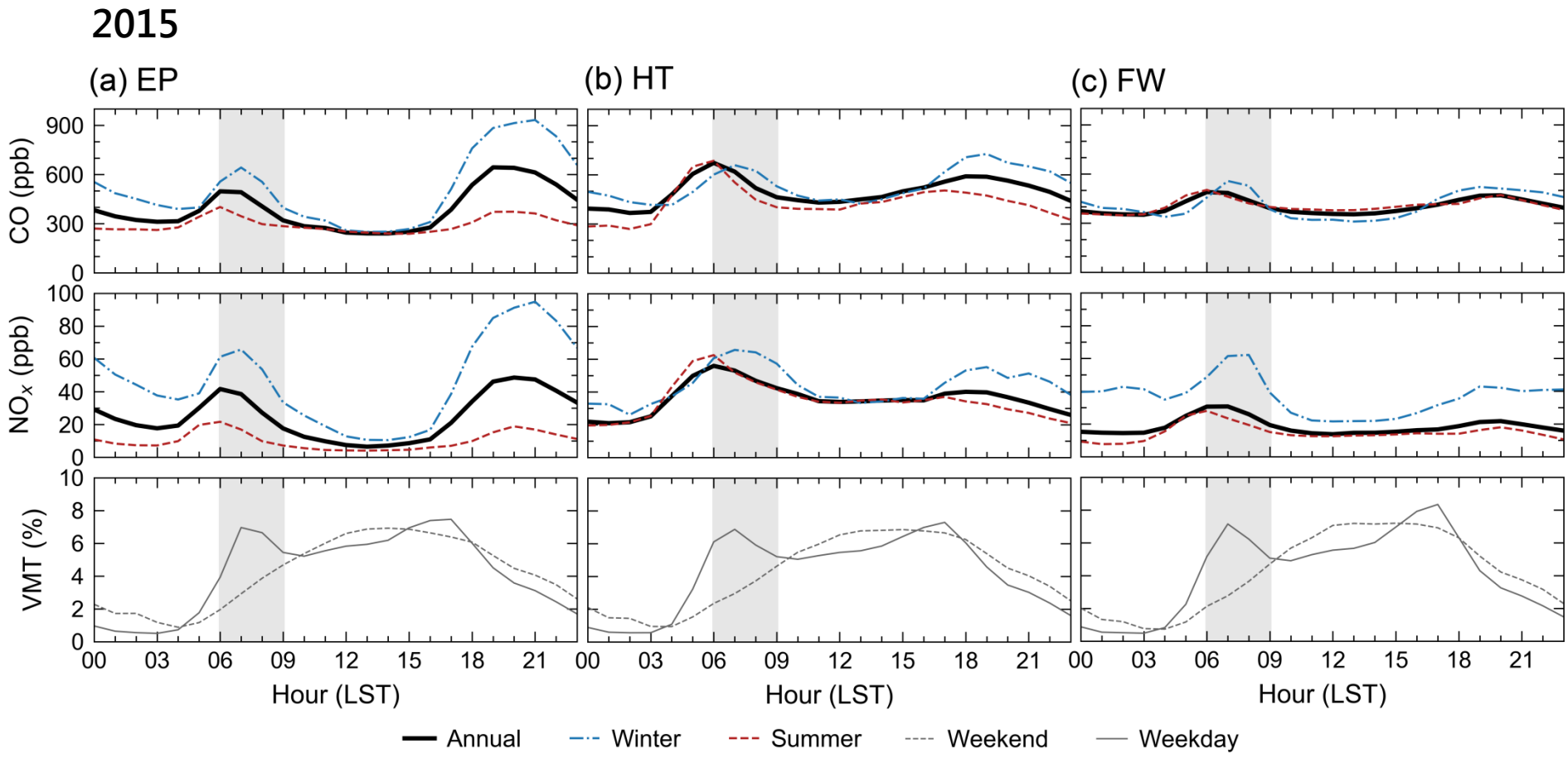
(b) Houston (HT)



(c) Fort Worth (FW)



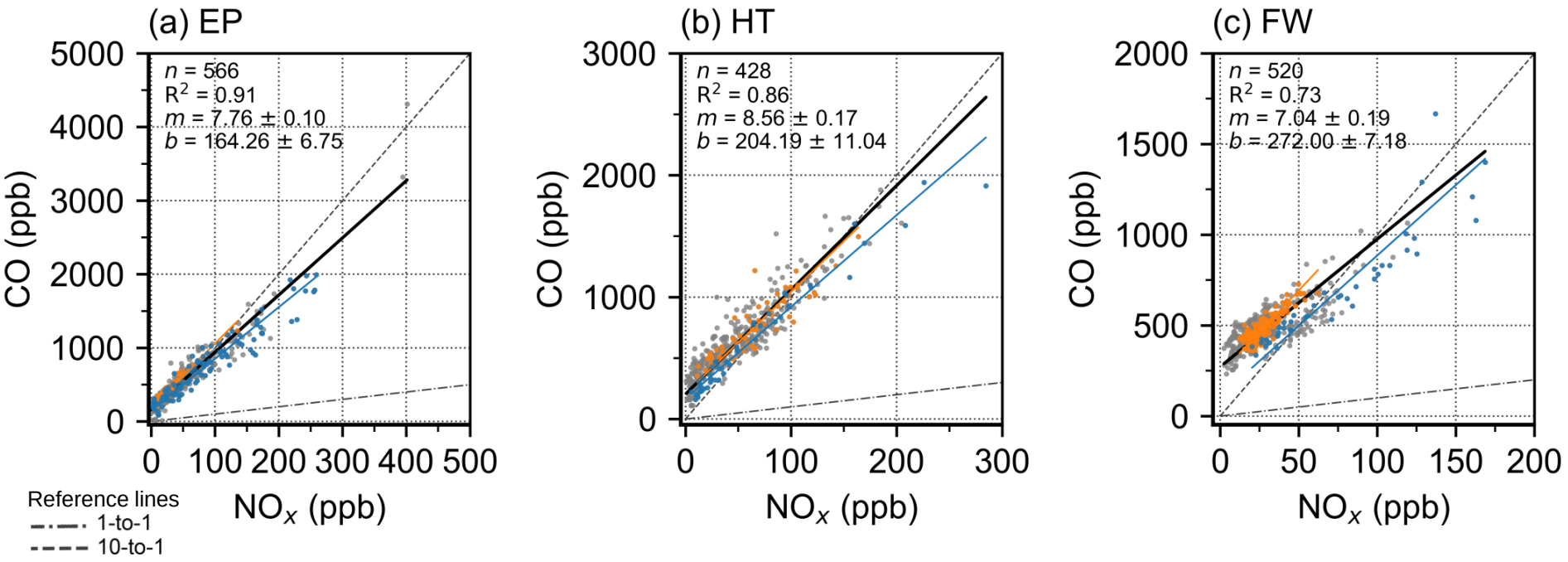
Ambient Data



- ✓ Near road
- ✓ 06:00 – 09:00
- ✓ Monitor downwind
- ✓ CO/NO_x ratios

Ambient CO/NO_x Ratios

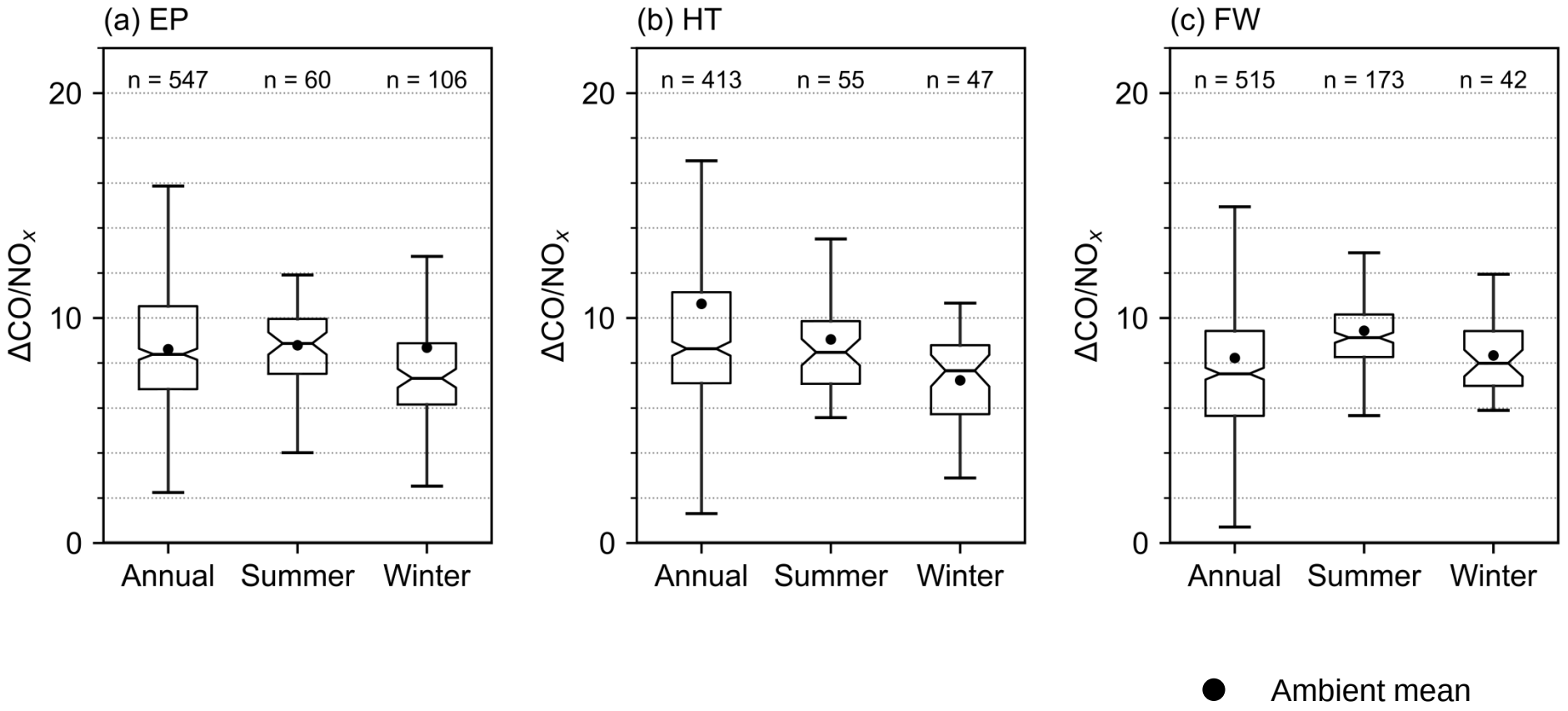
2015



Total linear least-squares regression

Annual, Summer (Jun-Aug), Winter (Dec-Feb)

Comparison of CO/NO_x Ratios



MOVES Modeling

MOVES 2014a
Motor Vehicle Emission Simulator

Section	Setting
Scale	
Domain/Scale	County
Calculation Type	Inventory
Time Span	
Aggregation Level	Hour
Year	2015
Months	All
Days	Weekend, Weekday
Hours	Start Hour: 6, End Hour: 9
Geographic Bounds	Texas Counties: El Paso, Harris, Tarrant
Vehicles/Equipment	All
Road Type	Urban restricted-access roads
Pollutants and Processes	
Processes	Running Exhaust, Crankcase Running Exhaust
Species	CO, NO, NO_2

MOVES Modeling

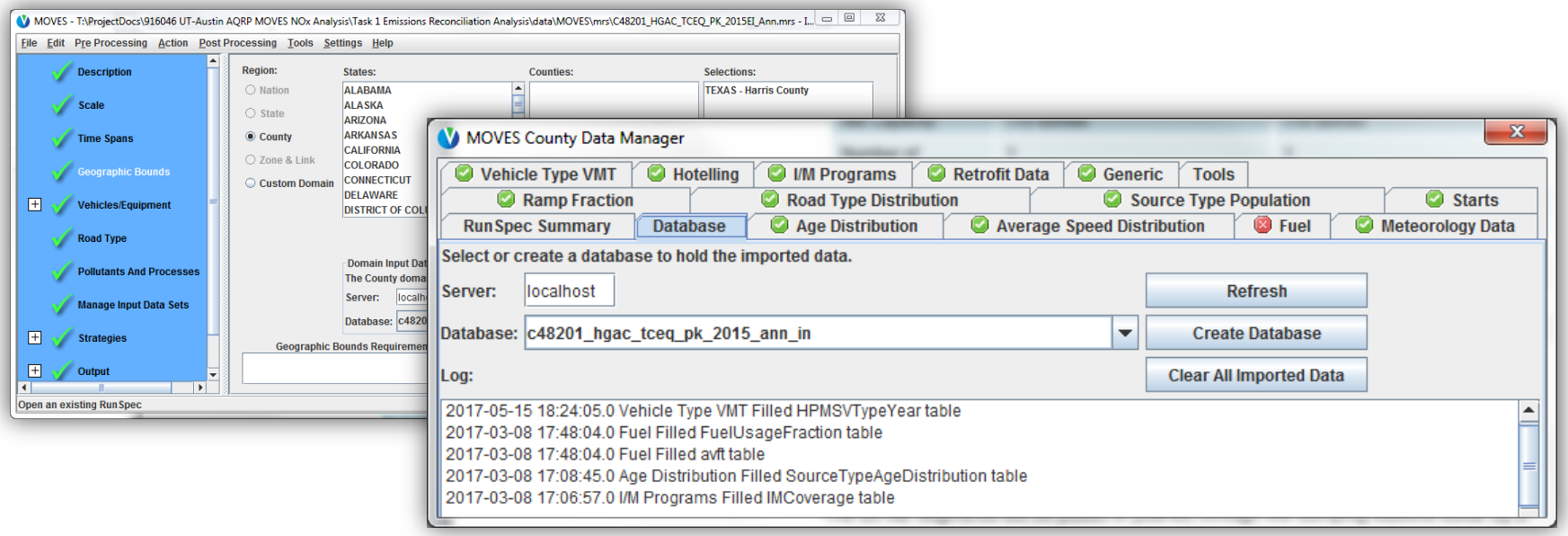
Default scenario:

MOVES2014a national default inputs

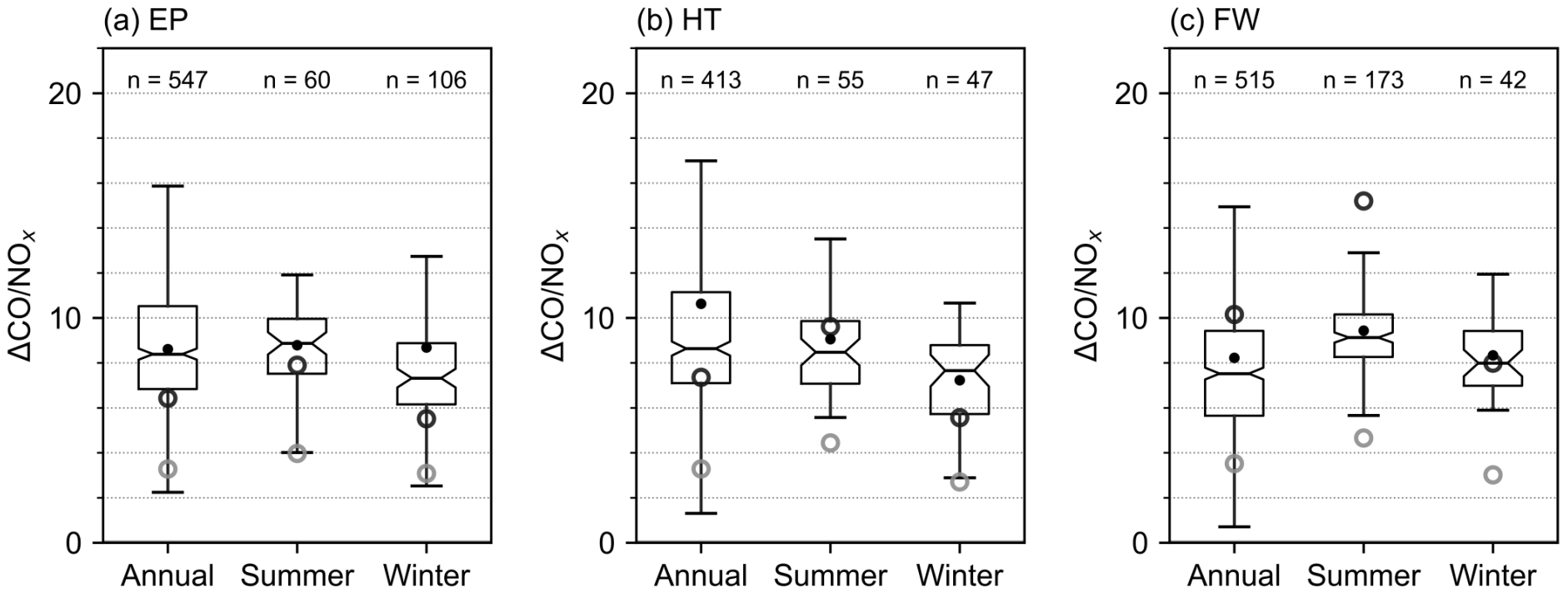
Best Available Local (BAL) scenario:

MOVES county databases (CDBs) from TCEQ, HGAC, NCTCOG

Local activity data from TxDOT Roadway Inventory



Comparison of CO/NO_x Ratios



- CO/NO_x ratios based on MOVES Default are much lower than ambient-based ratios
- MOVES-based ratios using BAL inputs and ambient-based ratios are in good agreement

- Ambient mean
- MOVES Default
- MOVES BAL

Reconciliation Analysis: Findings

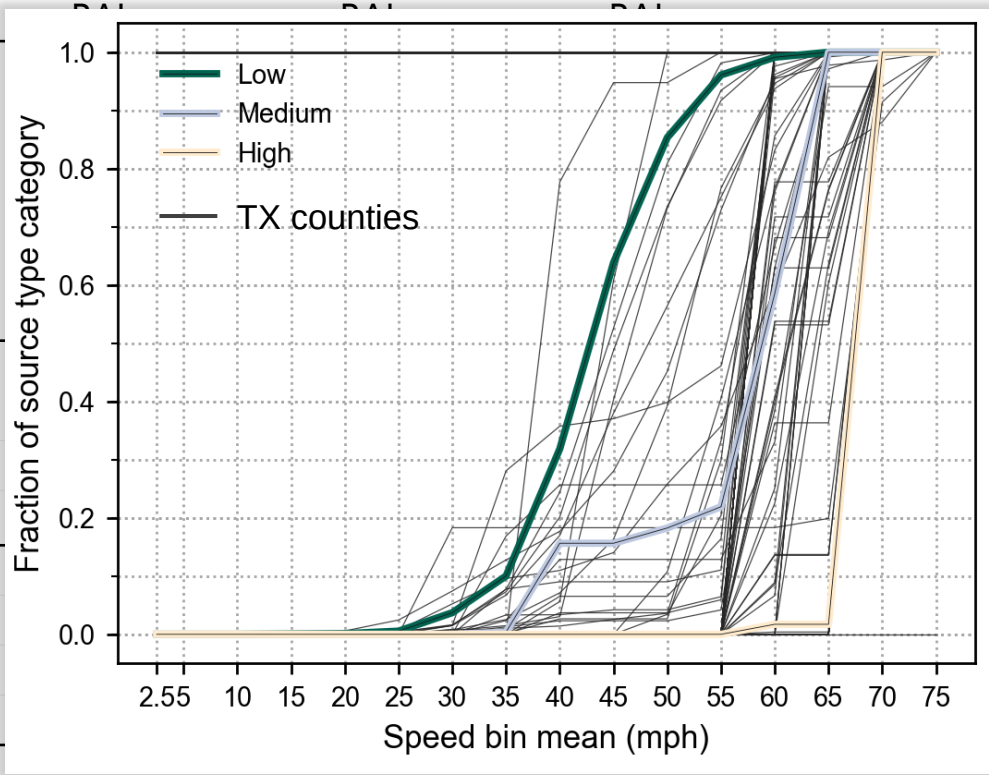
- MOVES emissions for CO or NO_x or both pollutants based on **Default** inputs did not reasonably represent on-road mobile sources
- MOVES emission ratios using **BAL** inputs are comparable with the respective ambient ratios (within the acceptable 25-50% range of agreement)
- Using BAL inputs is key to generate reasonable emissions estimates

Emissions Sensitivity Analysis

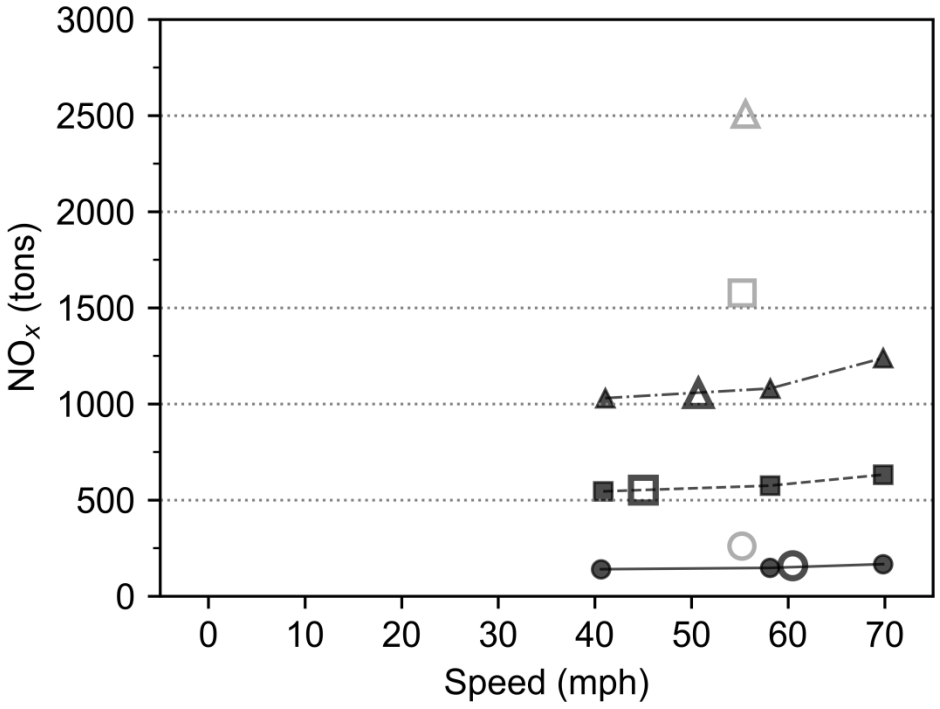
	Scenario	Speed Distribution	Truck %	Age Distribution	Temperature and RH
	Base	BAL	BAL	BAL	BAL
Speed	Speed Base-Default	**Default**	BAL	BAL	BAL
Speed	Speed Low	**Low**	BAL	BAL	BAL
Speed	Speed Medium	**Medium**	BAL	BAL	BAL
Speed	Speed High	**High**	BAL	BAL	BAL
Fleet Mix	Truck Base-Default	BAL	**Default**	BAL	BAL
Fleet Mix	Truck 0	BAL	**0**	BAL	BAL
Fleet Mix	Truck 5	BAL	**5**	BAL	BAL
Fleet Mix	Truck 10	BAL	**10**	BAL	BAL
Fleet Mix	Truck 20	BAL	**20**	BAL	BAL
Fleet Mix	Truck 30	BAL	**30**	BAL	BAL
Age	Age Base-Default	BAL	BAL	**Default**	BAL
Age	Age Old	BAL	BAL	**Old**	BAL
Age	Age Mid	BAL	BAL	**Mid**	BAL
Age	Age New	BAL	BAL	**New**	BAL
Met.	Season Base-Default	BAL	BAL	BAL	**Default**
Met.	Season Half	BAL	BAL	BAL	**6 month mean**
Met.	Season Quarter	BAL	BAL	BAL	**3 month mean**
Met.	Season Month	BAL	BAL	BAL	**1 month mean**

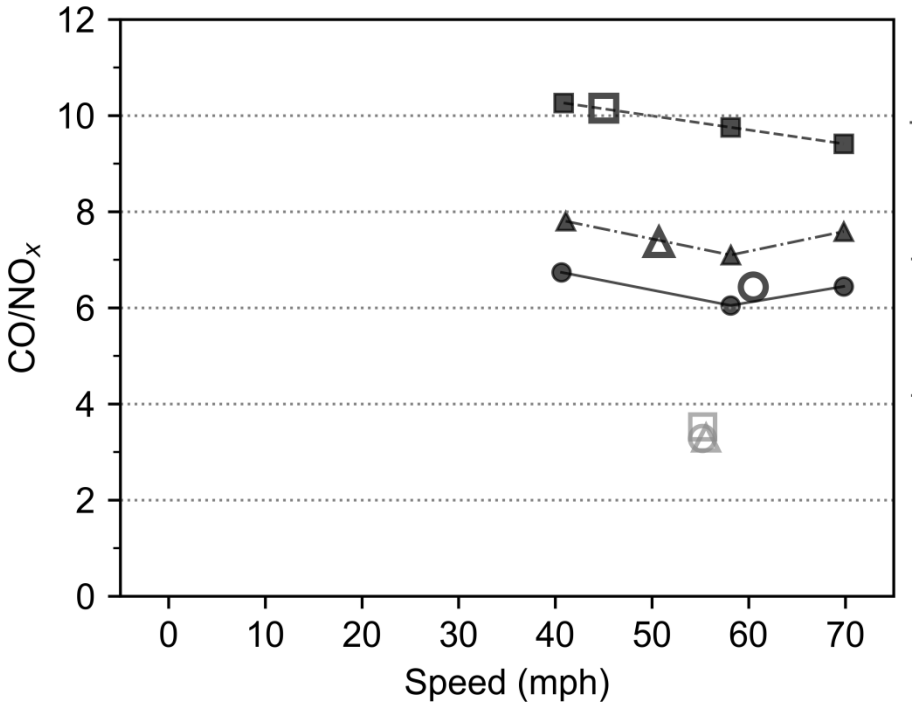
Emissions Sensitivity Analysis

	Scenario	Speed Distribution	Truck %	Age Distribution	Temperature and RH
	Base	BAL	BAL	BAL	BAL
Speed	Speed Base-Default	**Default**	BAL	BAL	BAL
Speed	Speed Low	**Low**	BAL	BAL	BAL
Speed	Speed Medium	**Medium**	BAL	BAL	BAL
Speed	Speed High	**High**	BAL	BAL	BAL
Fleet Mix	Truck Base-Default	BAL			
Fleet Mix	Truck 0	BAL			
Fleet Mix	Truck 5	BAL			
Fleet Mix	Truck 10	BAL			
Fleet Mix	Truck 20	BAL			
Fleet Mix	Truck 30	BAL			
Age	Age Base-Default	BAL			
Age	Age Old	BAL			
Age	Age Mid	BAL			
Age	Age New	BAL			
Met.	Season Base-Default	BAL			
Met.	Season Half	BAL			
Met.	Season Quarter	BAL			
Met.	Season Month	BAL			



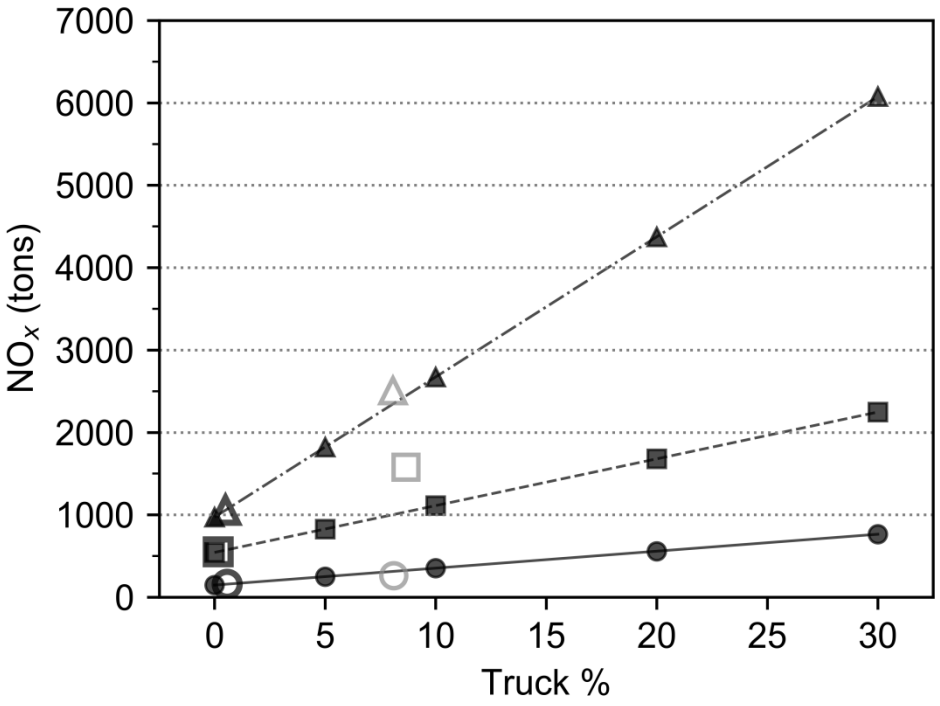
Sensitivity: Speed

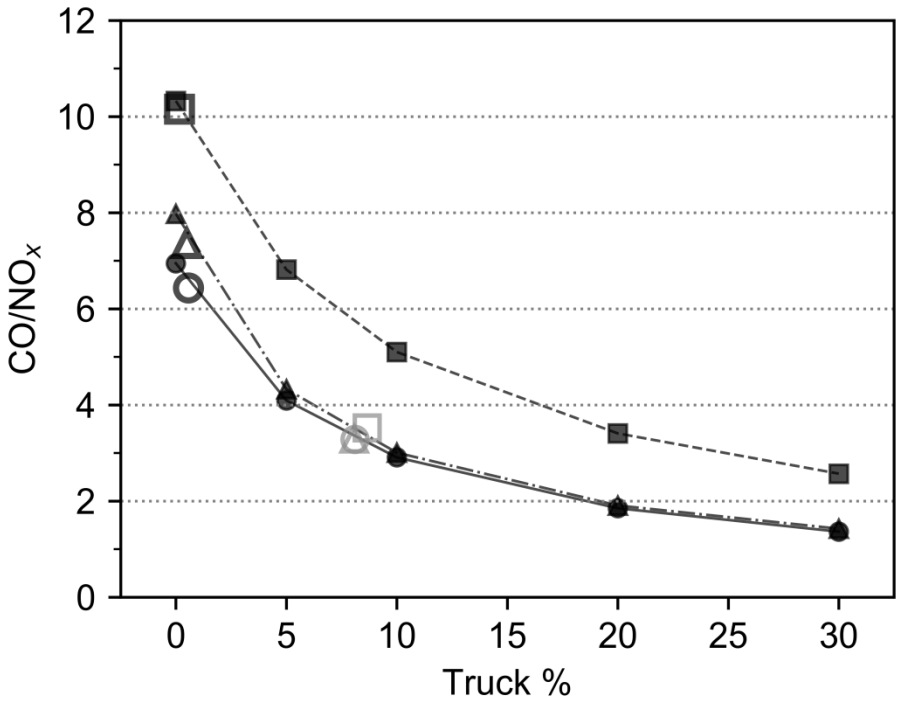


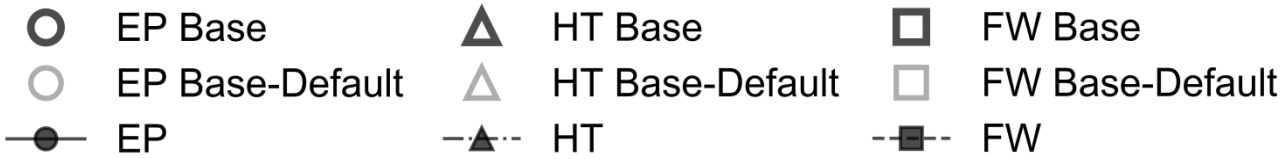


EP Base
EP Base-Default
EP
HT Base
HT Base-Default
HT
FW Base
FW Base-Default
FW

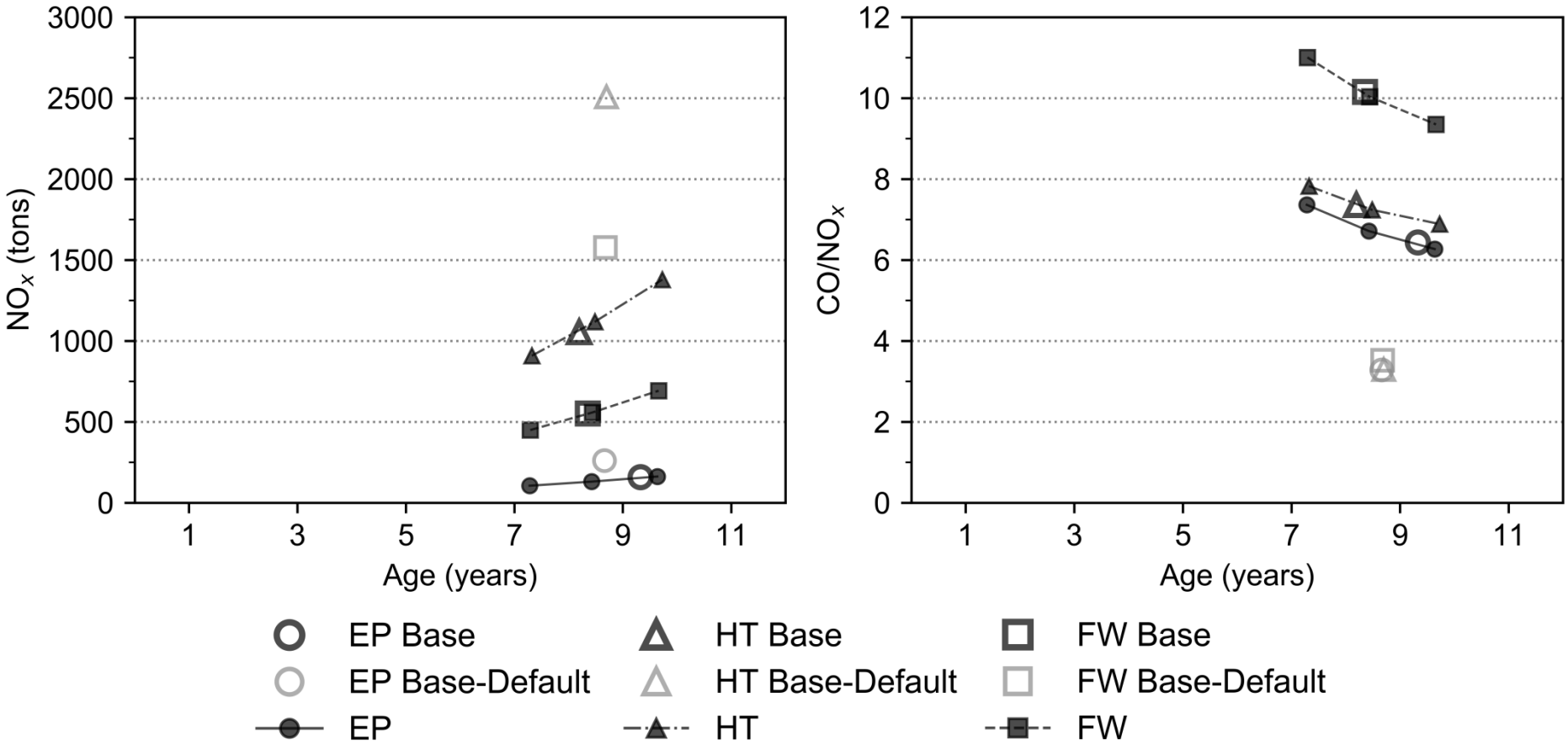
Sensitivity: Fleet Mix



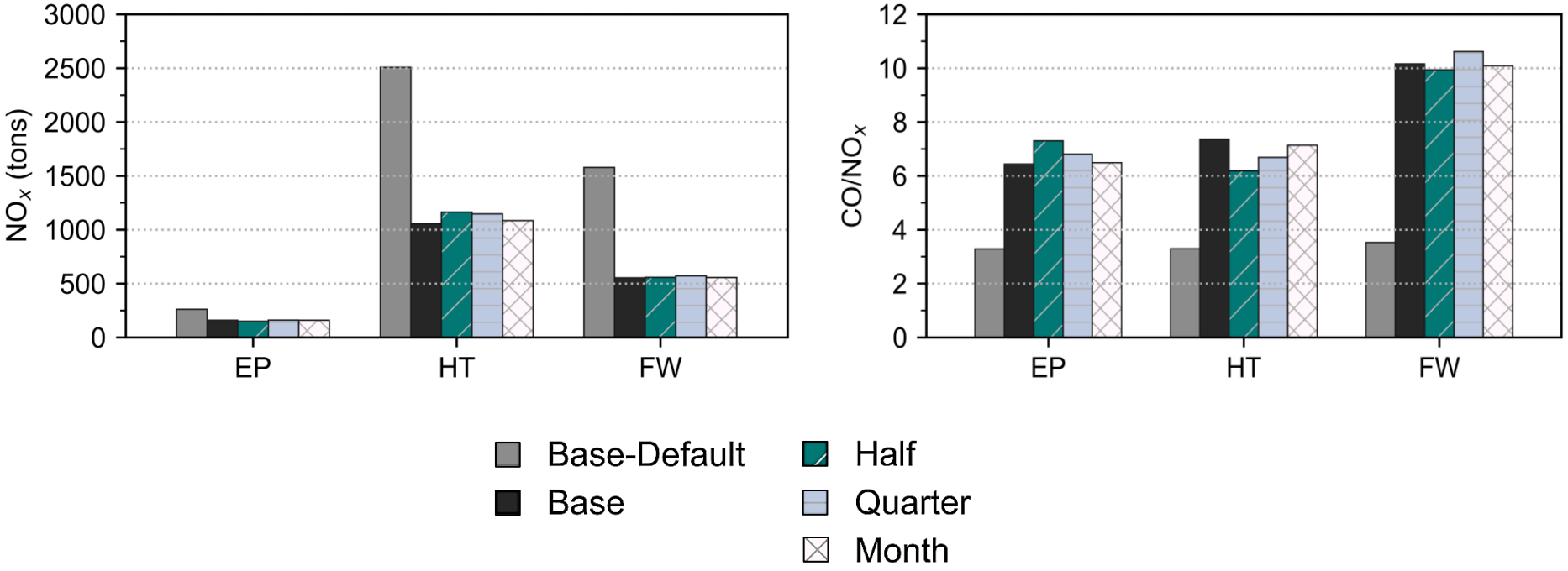




Sensitivity: Age



Sensitivity: Meteorology



Sensitivity Analysis: Findings

- NO_x running exhaust emissions estimates are more sensitive to fleet mix and vehicle age distribution
- Data collection priority should be on fleet characteristics

Conclusions

1. *Does MOVES overestimate NO_x emissions?*
   - MOVES Default inputs can generate biased ratios and lead to incorrect emissions assessment
   - Using local (BAL) input data, MOVES emissions-based ratios are comparable to ambient-based ratios—no substantial over-estimation was found
2. *What MOVES input data are important for NO_x emissions estimates?*
   - Priority for local data collection and quality assurance should be given to parameters that emissions are more sensitive to, e.g., truck percentage and vehicle age distribution.

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Questions?
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