



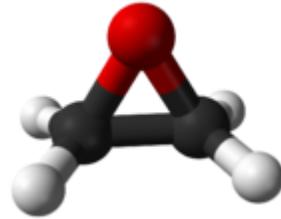
DEPARTMENT OF
ECOLOGY
State of Washington

Ethylene Oxide Measurements in Western Washington

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Ethylene Oxide



- Gas at room temperature
- Lifetime of 3-6 months
- Manufactured from ethylene, chemical intermediate in manufacturing, sterilizing agent for medical and dental equipment
- 2016: EPA classifies EtO as a human carcinogen → ASIL more stringent by a factor of 57
- 2018: EtO is added to NATTS sampling sites, T0-15 method

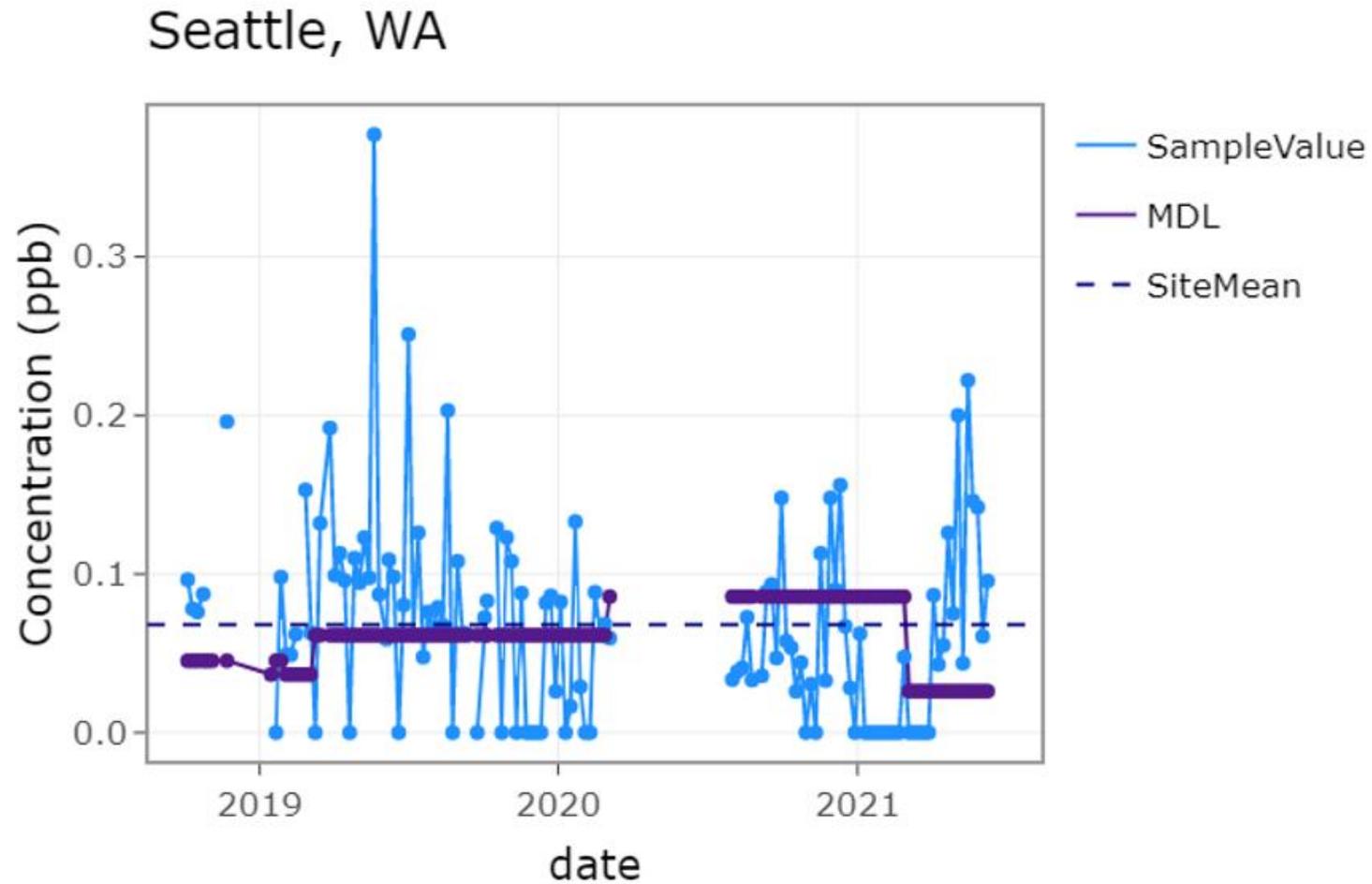
EtO Measurements at Air Toxics sites

T0-15 method

- Since 2018 (Seattle-Beacon Hill), 2018-2019 (Lacey)
- 24 hour samples, every six days
- Offline analysis
- Challenges:
 - Analytical MDL is higher than the ASIL (0.02-0.09 ppb vs. 0.011 ppb for 100 in a million risk)
 - Interferences with other common species (i.e., acetaldehyde, methanol)
 - Canister effect: formation and growth of EtO in canisters over time in humid air → bias ambient measurements to be high
 - 4-5 week hold time, electropolished canisters, 7-10x increase in EtO



EtO Measurements at Air Toxics Sites: T0-15 method



Method Comparison: TO-15 vs. CRDS

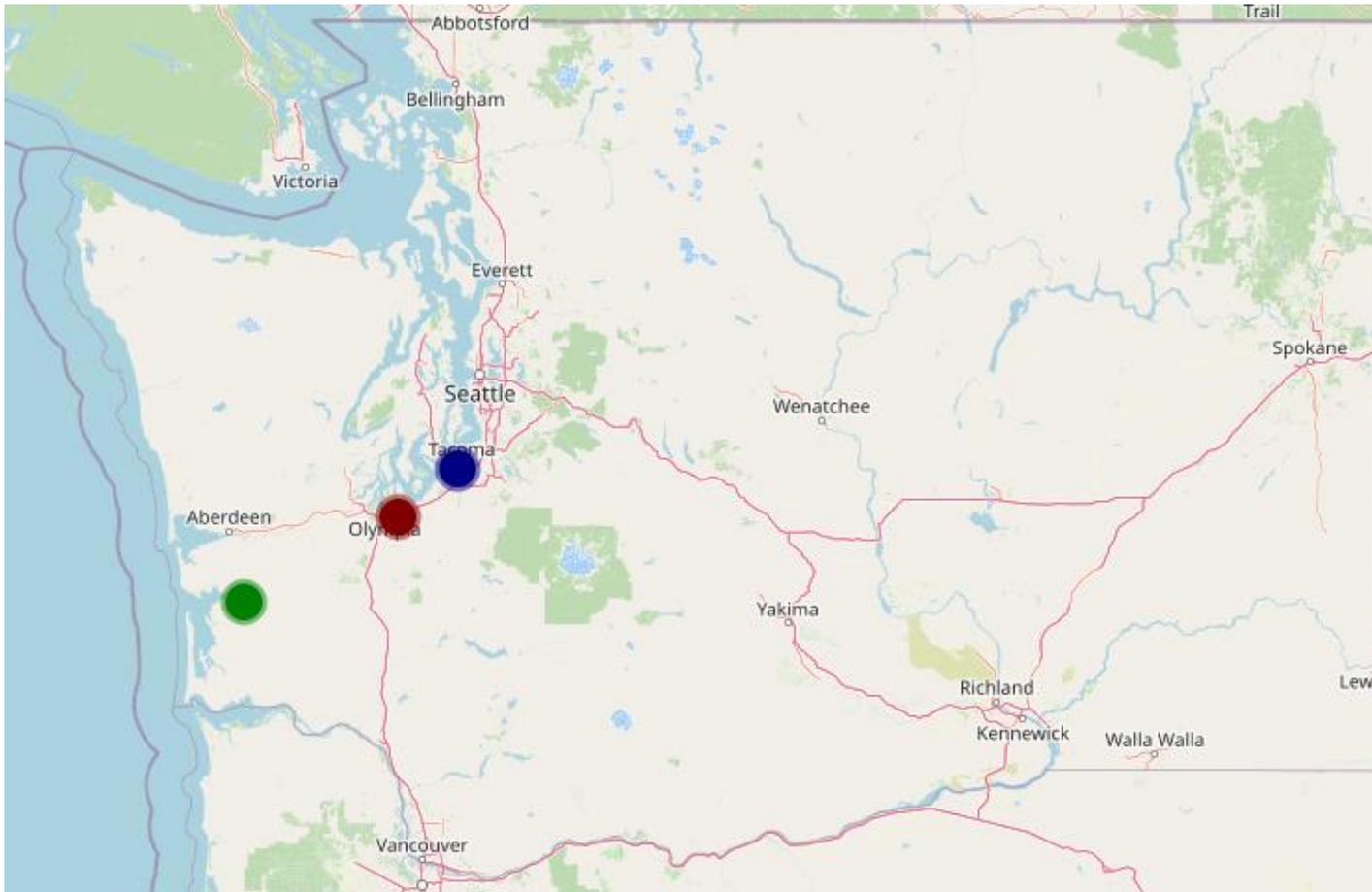
TO-15 for Ethylene Oxide/NATTS	Picarro Cavity Ringdown Spectroscopy (CRDS)
24 hour samples, every six days, offline analysis	<2 sec, continuous, online analysis
<p>Challenges:</p> <ul style="list-style-type: none"> • Interferences with other common species (i.e., acetaldehyde, methanol) • Canister effect: formation and growth of EtO in canisters over time in humid air → bias ambient measurements to be high <ul style="list-style-type: none"> ○ 4-5 week hold time, electropolished canisters, 7-10x increase in EtO 	<p>Challenges:</p> <ul style="list-style-type: none"> • inlet tubing type (HDPE vs. stainless steel) <div data-bbox="1574 905 2137 1205" data-label="Image">  <p>A photograph of a Picarro Cavity Ringdown Spectrometer (CRDS) for Ethylene Oxide. The device is a dark grey, rectangular box with a front panel. The brand name 'PICARRO' is printed in white on the front. Below it, there is an orange label that reads 'CAVITY RINGDOWN SPECTROMETER Ethylene Oxide'.</p> </div>



EtO sampling: June 2 – June 17, 2021:

Is there a diurnal cycle in EtO concentrations?

What is the regional/site variability in EtO concentrations?

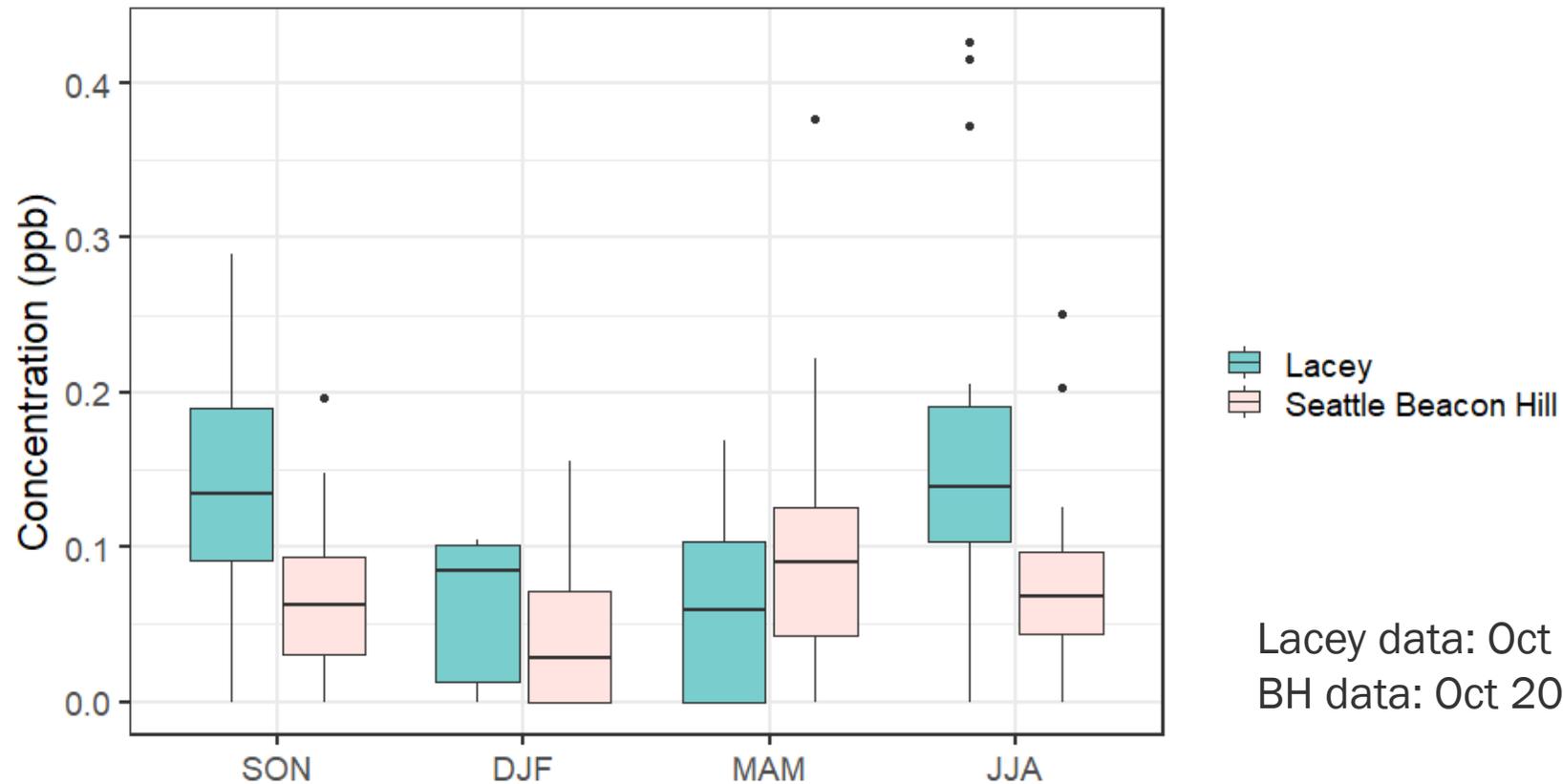


Lacey
June 2 – June 4

Raymond (background)
June 4 – June 7

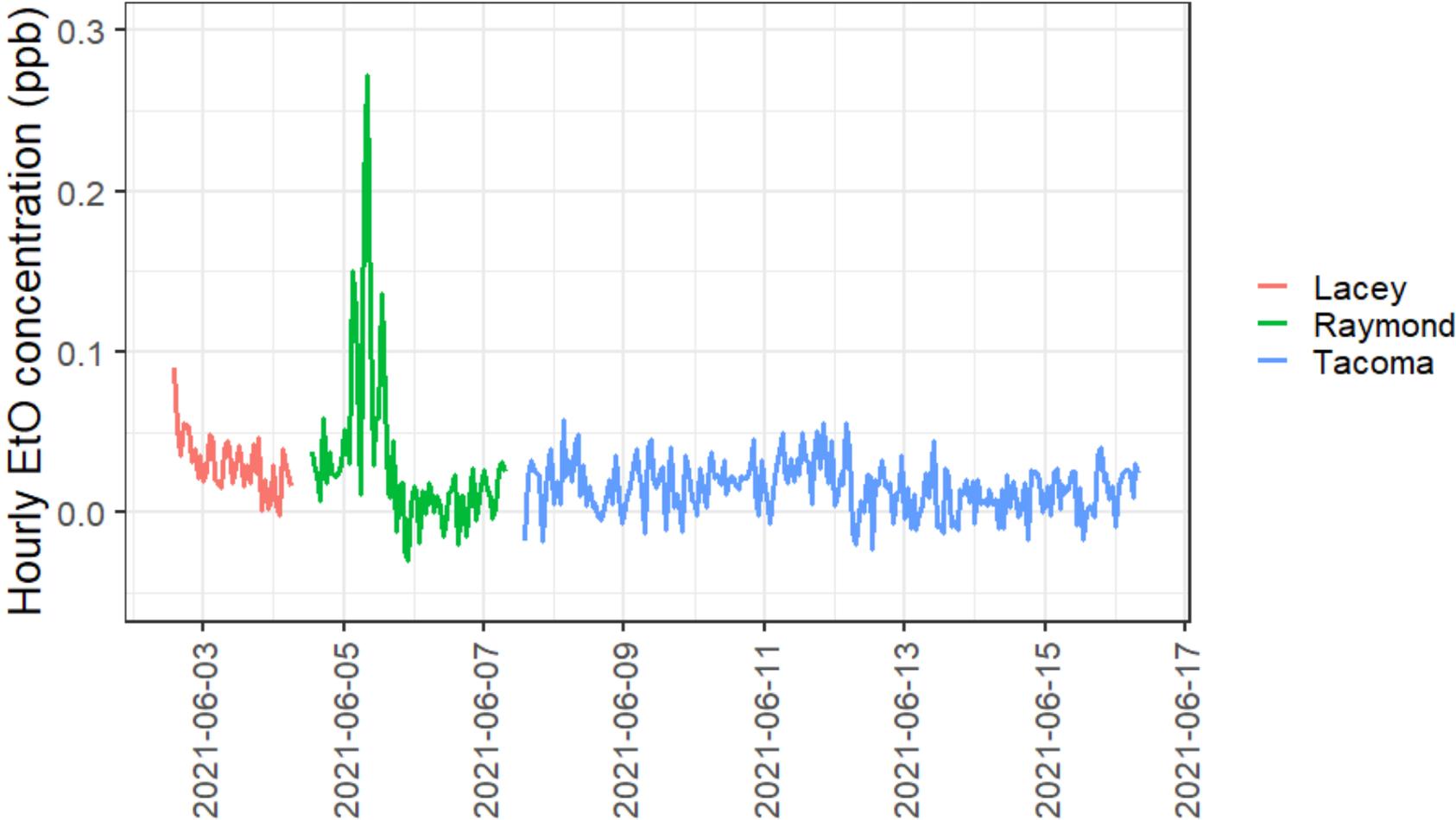
Tacoma (near-road)
June 7 – June 17

Previous June EtO concentrations T0-15

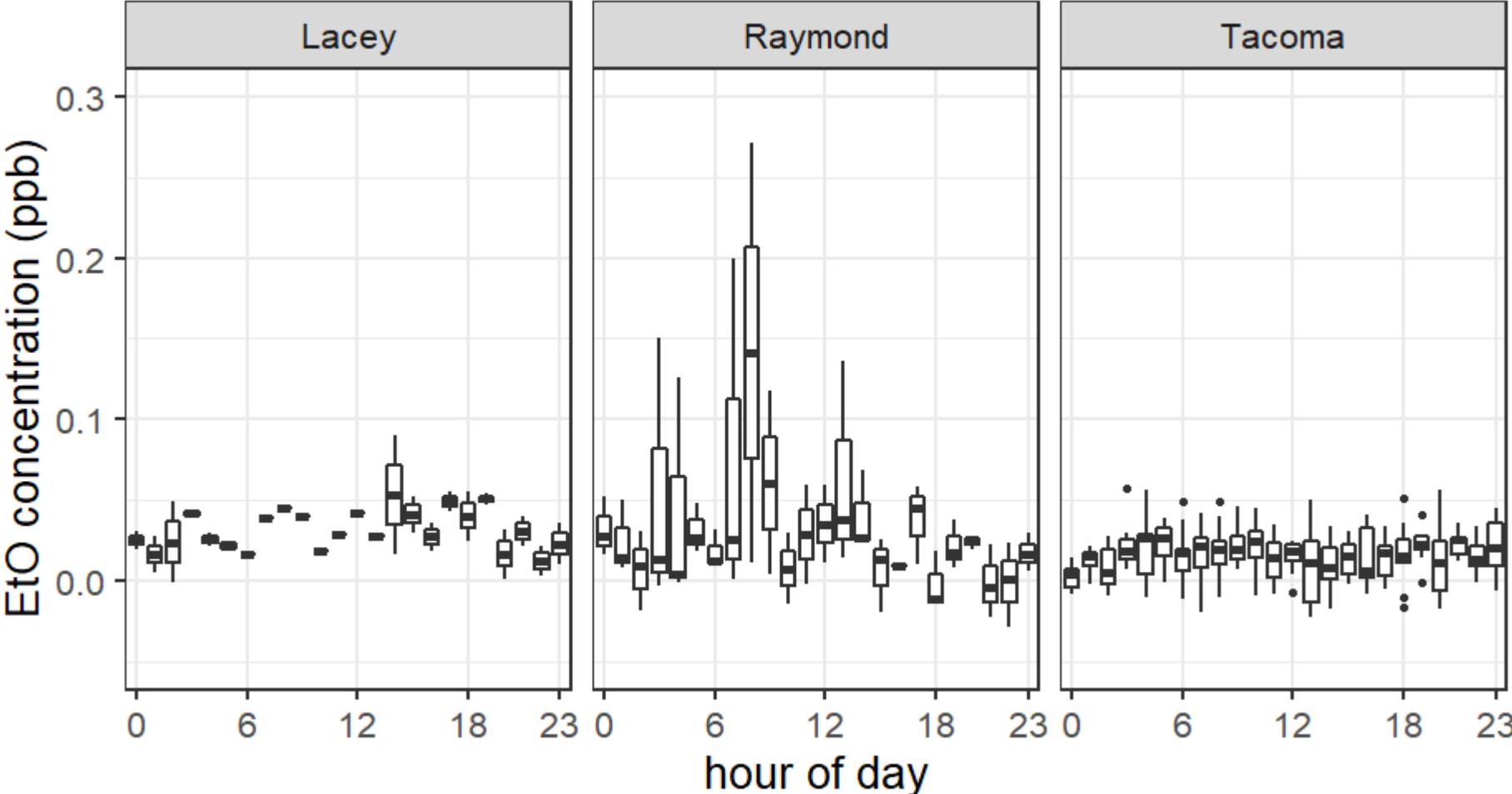


Lacey data: Oct 2018 - Sept 2019
BH data: Oct 2018 - June 2021

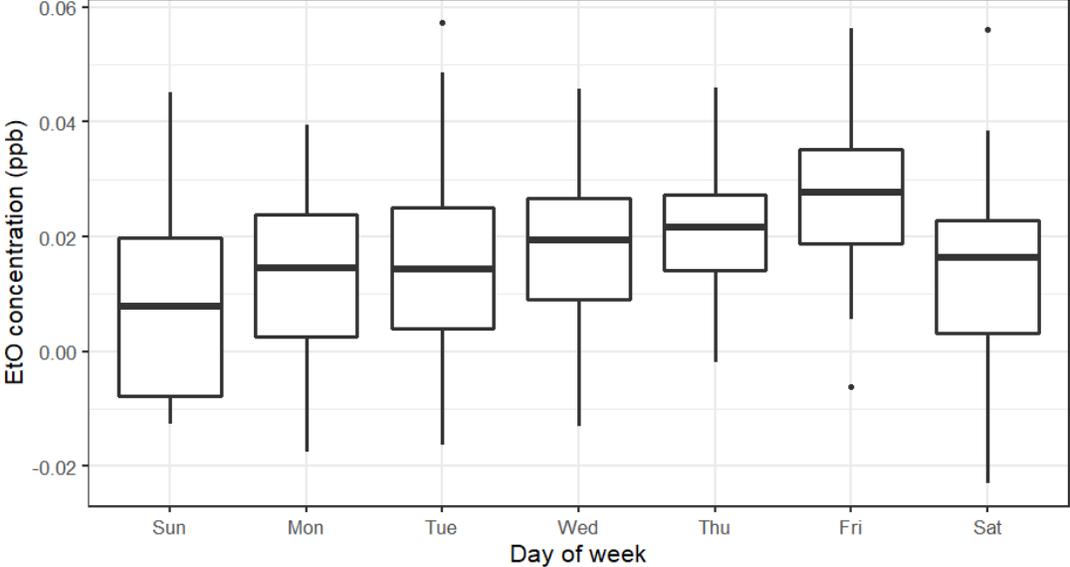
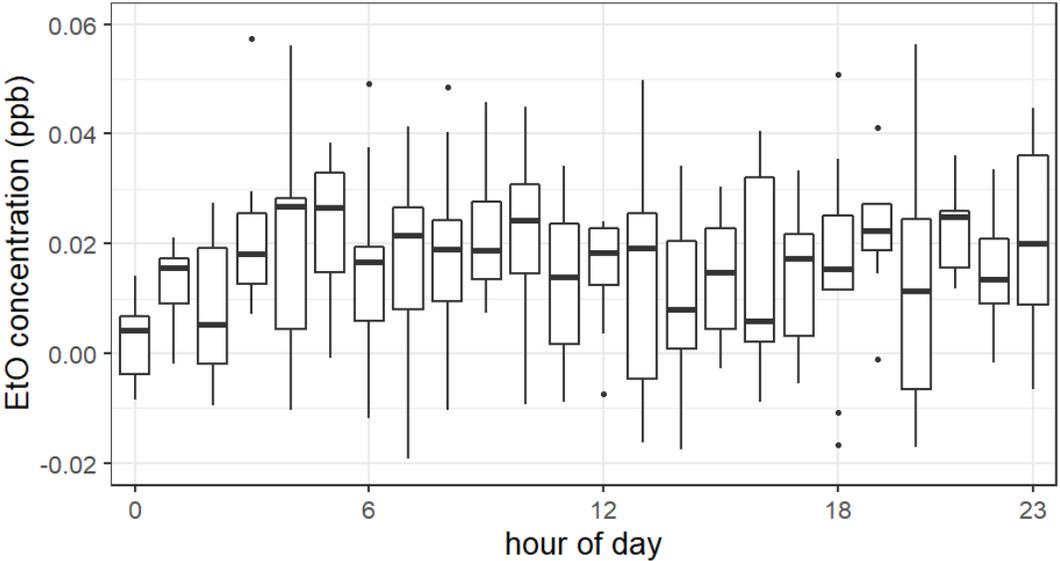
Hourly EtO concentrations



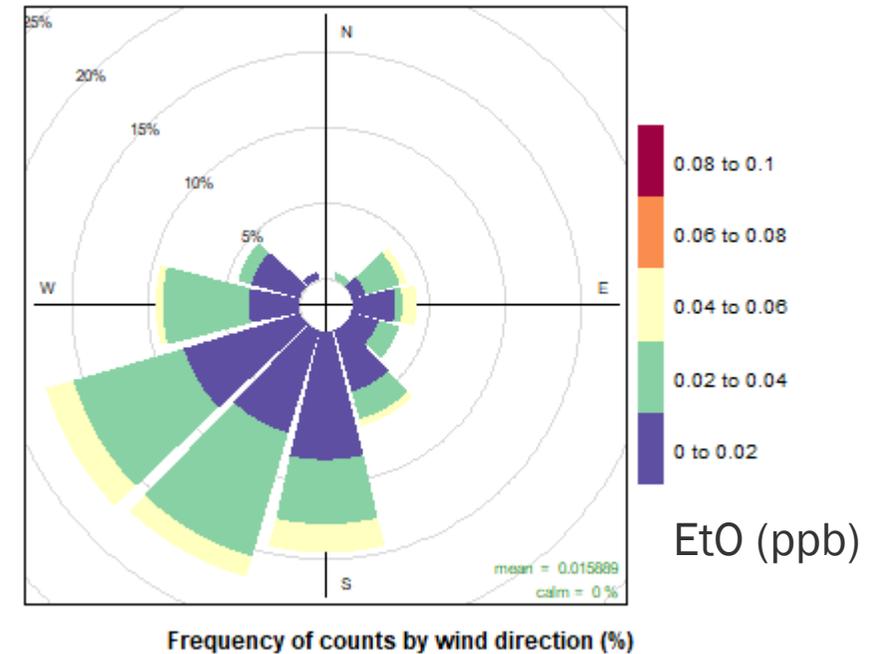
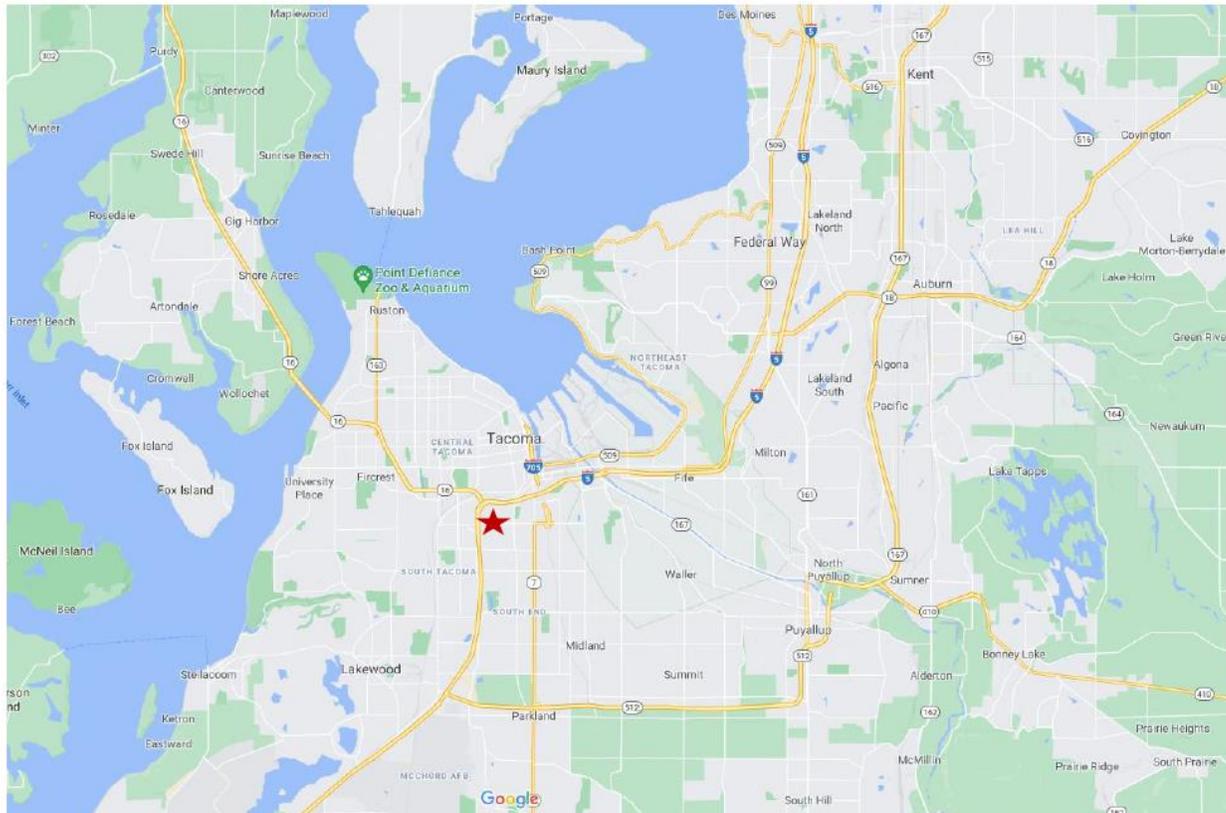
Diurnal Cycles



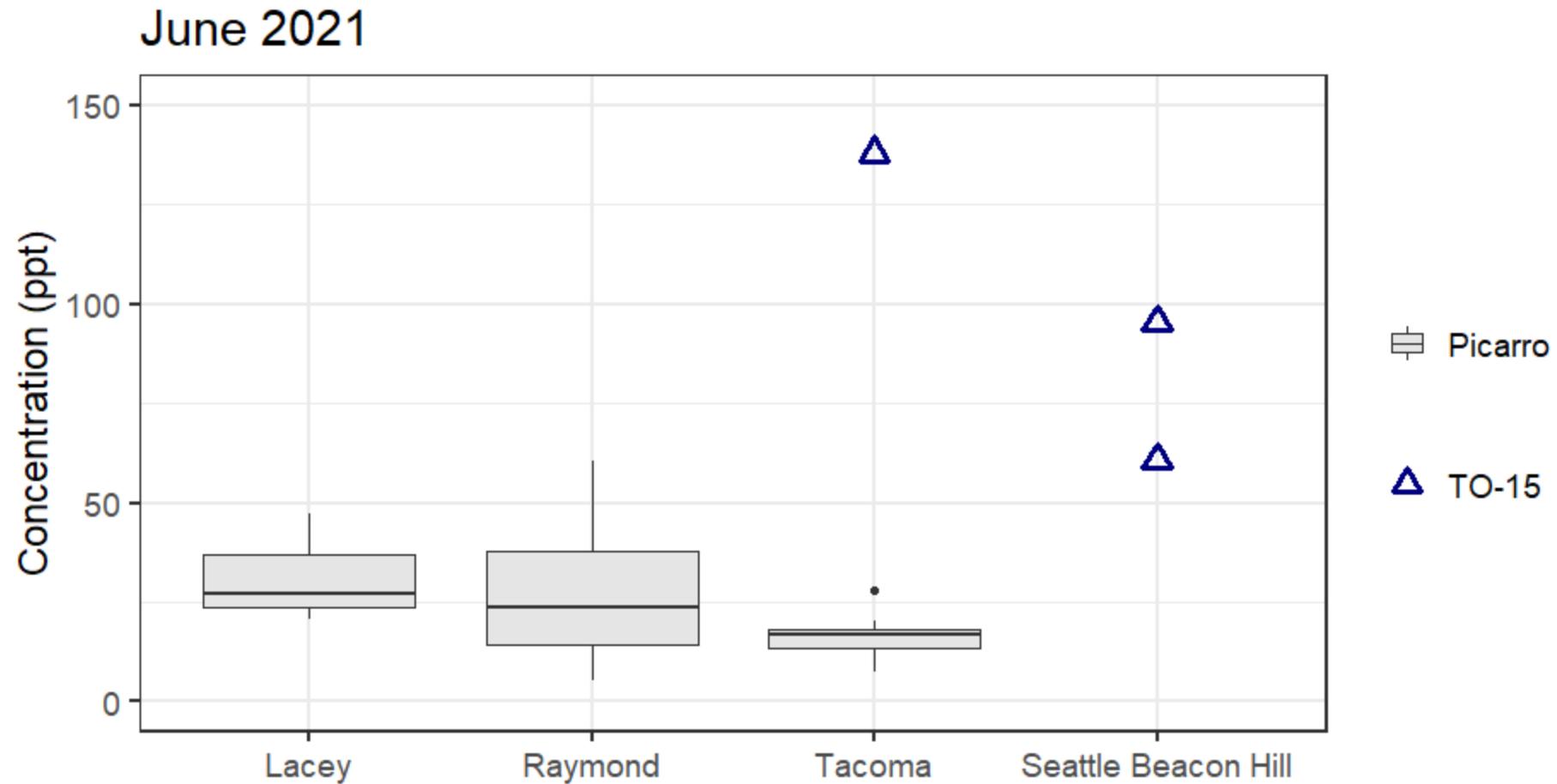
Tacoma: no variation by day of week or hour of day



Tacoma: winds mostly from the SW



June 2021 EtO data: T0-15 and Picarro



Summary

- Very little site to site variability, diurnal or day of the week variability
- Consistent with regional background of EtO (no nearby sources)
- Continuing to track NATTS data, other EtO studies, and EPA method development