

WASHINGTON STATE JNIVERSITY

Methane and Carbon Dioxide Concentration Patterns over Washington State University's PACCAR Building

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Introduction

Wind speed, wind direction, methane (CH₄), and carbon dioxide (CO₂) were measured on a 10-meter tall meteorological tower atop the roof of Washington State



1.0			
0.9			
0.8			
E ^{0.7}			
dd 0.6	•		
r ⁴ 0.5			
0.4	•	•••	

Figure 7: A linear relationship between aboveaverage CH_4 and CO_2

University's PACCAR Environmental Technology Building from June 27 to July 5, 2016.

Table 1: Sensors on the tower.

Sensor	Height(s) (m)
CSAT3B Sonic Anemometer	1.22, 2.34, 3.90, 5.78
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WXT520 Weather Transmitter	10
Ultra-Portable Greenhouse Gas Analyzer	2.34

Objectives

 Understand CH₄ and CO₂ diurnal patterns and determine if there are any wind direction dependencies.

•Determine if Grimes Way Steam Plant is a potential source for CH_{a} emissions.

 Compare the variations between the concentrations of CH_{4} and CO_{2} in relation to wind direction and wind

Figure 3: Diurnal cycle of CH_4 and CO_2 from June 27-July 5, 2016.



Figure 4: Wind rose from CSAT3B Sonic Anemometer (2.34m). **a)** Wind direction and speed from 8 a.m. to 8 p.m. **b)** Wind direction and speed from 8 p.m. to 8 a.m. 14%

b)

NW



Figure 8: Wind direction from the highest CSAT3 Sonic Anemometer (5.78m). a) Delta CH₄ values versus wind direction show the higher concentration events closer to 90°. b) Delta CO₂ values versus wind direction shows a similar pattern at the higher height.









Figure 1: Aerial view of measurement site at Washington State University (green circle) and Grimes Way Steam Plant (yellow circle) located 0.25 km east of the site.

a)

NW

Method

The Los Gatos Ultra-Portable Greenhouse Gas Analyzer measured and stored CH_4 and CO_2 concentrations. CR5000 and CR3000 data loggers were used to store meteorological data from the tower. Five-minute averaged data from the period were analyzed to relate CH₄ and CO₂ concentrations to wind speed and direction and determine the correlation between CH_{4} and CO₂ concentrations.



Figure 5: Concentration rose from CSAT3B Sonic Anemometer (2.34m) from 8 p.m. to 8 a.m. a) Wind direction and CO₂ concentrations. **b)** Wind direction and CH_4 concentrations.



Figure 6: a) Aboveaverage CH₄ values compared to wind direction at 2.34m. **b)** Aboveaverage CO₂ values compared

SE



(m/s)

■ >4.7

Figure 9: Wind rose from WXT520 (10m) from 8 p.m. to 8 a.m.

Figure 10: Brandon Daub and Nathan Sparks working at the weather tower atop the PACCAR roof.

Conclusion

•Diurnal patterns between CH₄ and CO₂ were correlated.

•The data suggests the Grimes Way Steam Plant may be a source of CH_4 due to the relation between CH_4 and CO₂ concentrations during peak events. The correlation between CH_4 and CO_2 was a result of a combustion source.

•The PACCAR building impacts the wind direction at lower and higher heights of the weather tower.

Figure 2: CSAT3B Sonic Anemometer and Ultra-Portable Greenhouse Gas Analyzer inlet atop the PACCAR roof

(2.34m).



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