

Residential Woodsmoke Monitoring Report

Comox Valley – January/February 2017

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Introduction

Wintertime residential woodsmoke is a significant contributor to fine particulate matter (PM_{2.5}) air pollution in British Columbia (BC). Although the BC Ministry of Environment (MENV) operates a provincial PM_{2.5} monitoring network, there are not enough monitors to accurately characterize the impacts of residential woodsmoke. During the winter of 2016-17 we used a new method to more fully map the levels of woodsmoke in communities with and without MENV monitoring stations, including Courtenay (station) and Cumberland (no station). This report provides an overview of project results. More detailed results will be included in an MSc thesis to be published in early 2018.

Methods

Two different air quality measurement instruments were installed in a vehicle (Figures 1 and 2) and driven on two pre-determined routes around the region (separated by the Courtenay river) between January 24th and February 6th, 2017. Each instrument recorded measurements every second (~1 measurement every 10 meters for a typical driving speed of 35km/hr), collecting approximately 100,000 measurements per route. The routes were driven between 9pm and 1am each night for a total of seven trips following each route. Similar instruments were installed at the MENV station in Courtenay to compare with the mobile instruments. We also filtered air samples to measure concentrations of the woodsmoke tracer levoglucosan.



Figure 1: Instruments installed in vehicle for mobile monitoring.



Figure 2: Mobile monitoring equipped vehicle.

Results

Data from the filter samples at the Courtenay station show that woodsmoke was a major source of PM_{2.5} pollution during the monitoring campaign (Figure 3).

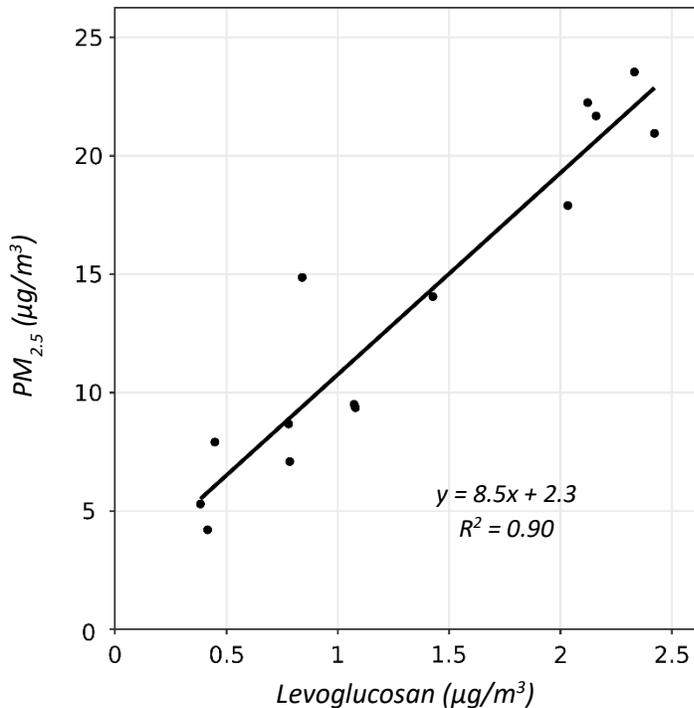


Figure 3:
Strong linear correlation between levoglucosan (a chemical marker of woodsmoke) concentrations and total PM_{2.5} concentrations calculated from the daily filter at the Courtenay station.

Measurements from the Courtenay and Cumberland route show smoke hotspots throughout the route, particularly in the centre and southeast of Courtenay and the northeast of Cumberland (Figure 4). Measurements from the Courtenay and Comox route east of the Courtenay river show hotspots around the Courtenay station, in the main residential area of Comox and in the northwest of the route (Figure 5). The maps are shaded based on their Z-scores, which show how each point compares with the overall mean of that route (which is equal to a Z score of 0) during the monitoring period. The PM_{2.5} levels at the Courtenay station were higher than the average across the Courtenay and Cumberland route ($Z = 0.44$) and much higher than the average across the eastern Courtenay and Comox route ($Z = 1.4$) during the monitoring period. Substantial variation was observed across the routes; measured levels across the Courtenay and Cumberland route were up to two times higher than the levels measured at the station, while levels across the Courtenay and Comox route were up to seven times higher than those measured at the Courtenay station.

Routes were alternated each night in an attempt to monitor each route in as similar conditions as possible. However, the MENV equipment reported average PM_{2.5} concentrations of 31 µg/m³ during the drives on the Courtenay and Cumberland route, and 21 µg/m³ during the Comox route. This should be considered when comparing the two route maps and associated PM_{2.5} values presented in the legends (Figures 4 and 5).

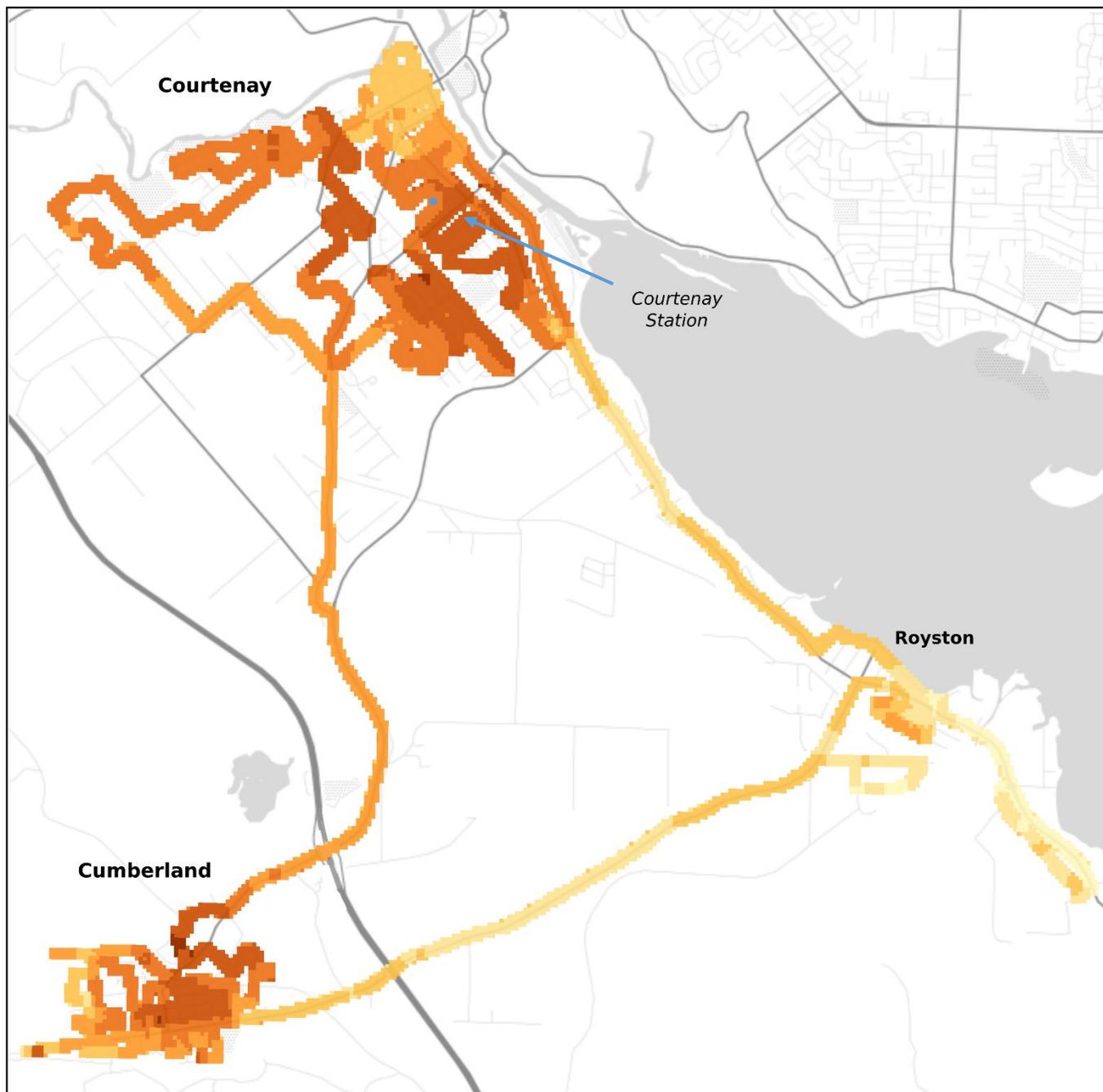
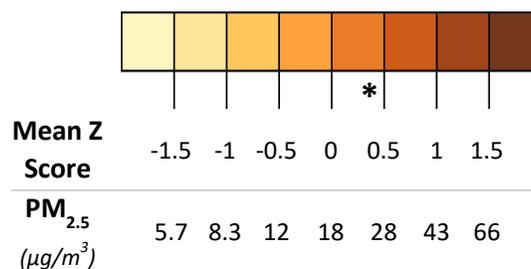


Figure 4: Courtenay and Cumberland Route

Map shows the average spatial patterns of $PM_{2.5}$ measured on the Courtenay and Cumberland Route. The map is shaded based on average Z score, showing the relative concentrations of $PM_{2.5}$. The Z scores and equivalent $PM_{2.5}$ concentrations are included in the legend along with the average value measured at the Courtenay monitoring station during the runs.



*** Courtenay Station**
 $Z = 0.44$
 $PM_{2.5} = 27 \mu g/m^3$

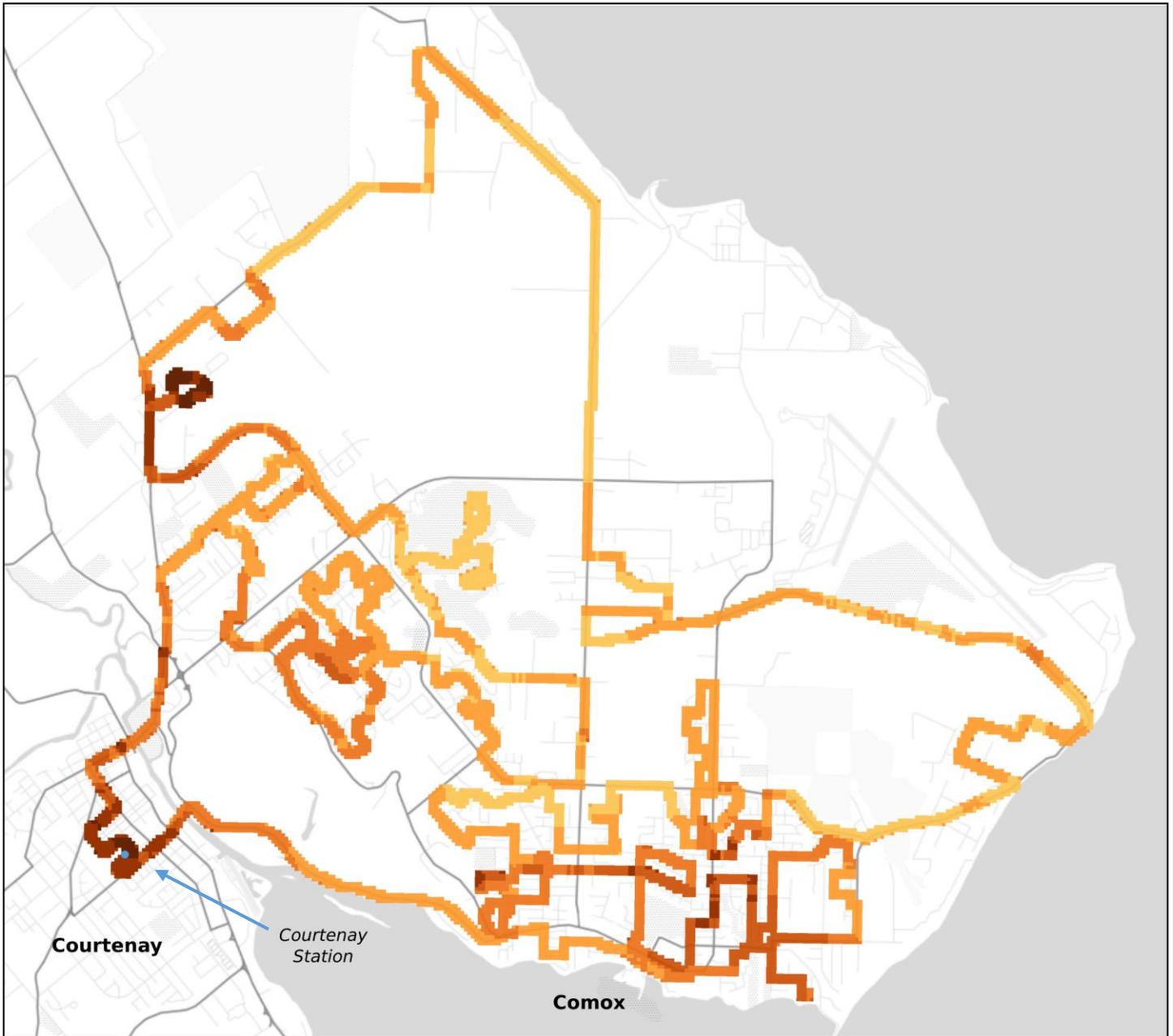
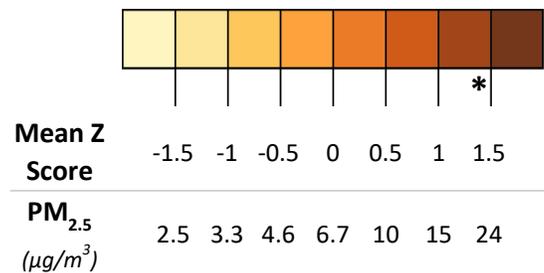


Figure 5: Courtenay and Comox Route

Map shows the average spatial patterns of $PM_{2.5}$ measured on the Courtenay and Comox route. The map is shaded based on average Z score, showing the relative concentrations of $PM_{2.5}$. The Z scores and equivalent $PM_{2.5}$ concentrations are included in the legend along with the average value measured at the Courtenay monitoring station during the runs.



*** Courtenay Station**

$Z = 1.4$

$PM_{2.5} = 22 \mu g/m^3$