SMAT-CE

Utah Division of Air Quality

Introduction

Utah DAQ used the Software for Model Attainment Test - Community Edition (SMAT-CE) v. 1.01 utility from EPA[1]. Although not the most recent version of SMAT-CE, Utah DAQ was reassured by EPA that version 1.01 produces the same results as the latest build (v. 1.2) as of creating this document. The SMAT-CE utility faithfully follows EPA guidance[2] on conducting a modeled attainment test for daily PM2.5.

Species fractions

The State of Utah has three Chemical Speciation Network (CSN) monitors: Hawthorne, Bountiful, Lindon. Hawthorne is located in Salt Lake County, while Bountiful is in Davis to the North, and Lindon is located in Utah County to the South (outside of the Salt Lake nonattainment area). Of the three, Hawthorne samples one out of three days, while the other two sample at half the frequency (i.e., one-in-six days).
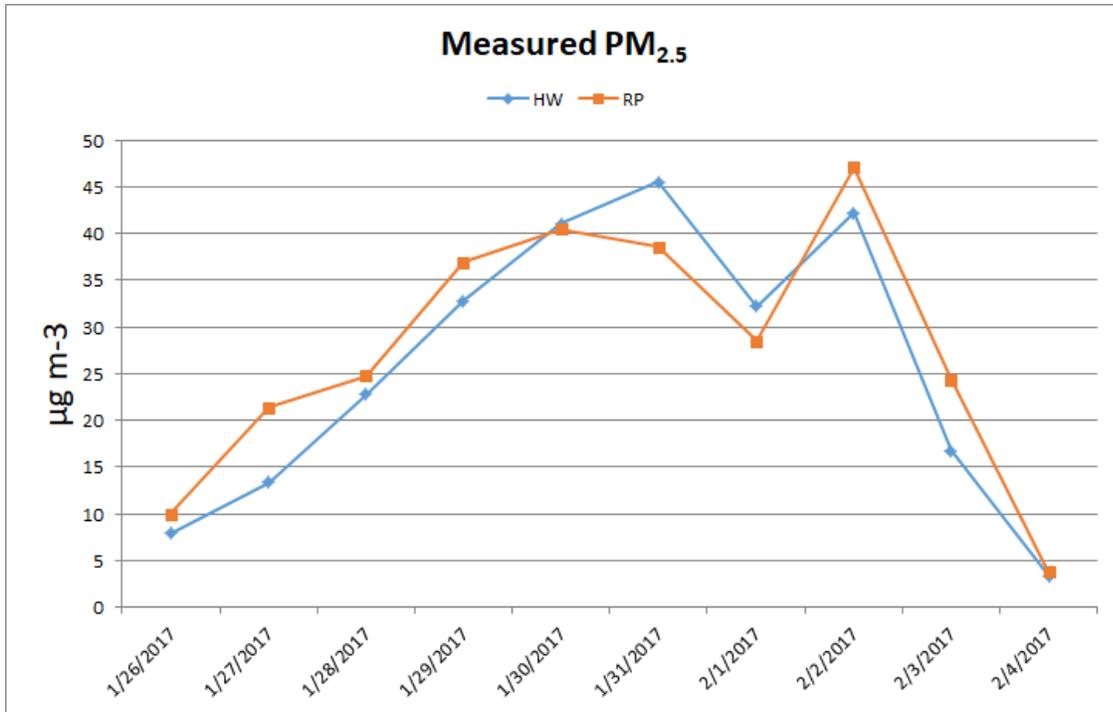
Because of the mismatch in sampling frequency, Utah DAQ found that the interpolated speciation profiles SMAT-CE initially created were not uniform for Salt Lake Valley as expected. To create more realistic PM2.5 speciation profiles for all Salt Lake Valley FRM sites, Utah DAQ used only the Hawthorne CSN monitoring data. In other words, all FRM monitors in the Salt Lake nonattainment area used the same (Hawthorne) species profile for assigning species fractions. Utah DAQ believes this is reasonable based on prior special studies.

Figure 1, below, shows a time-series comparison of PM2.5 for Rose Park and Hawthorne for a PCAP event (January 26 - February 4, 2017). The measured 24-hour PM2.5 from both sites are close in terms of magnitude and temporal correlation.

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[1] https://www.epa.gov/scram/photochemical-modeling-tools
[2] https://www3.epa.gov/ttn/scram/guidance/guide/final-03-pm-rh-guidance.pdf

Figure 1: Observed 24-hour PM2.5 at Hawthorne (blue) and Rose Park (orange) for January 26 - February 4, 2017.

FRM filters from Rose Park (January 30 and February 2, 2017) were sent for lab analysis to compare to CSN composition at Hawthorne. OC and NO3 composition was found to be similar between Hawthorne and Rose Park (see Figure 2, below).
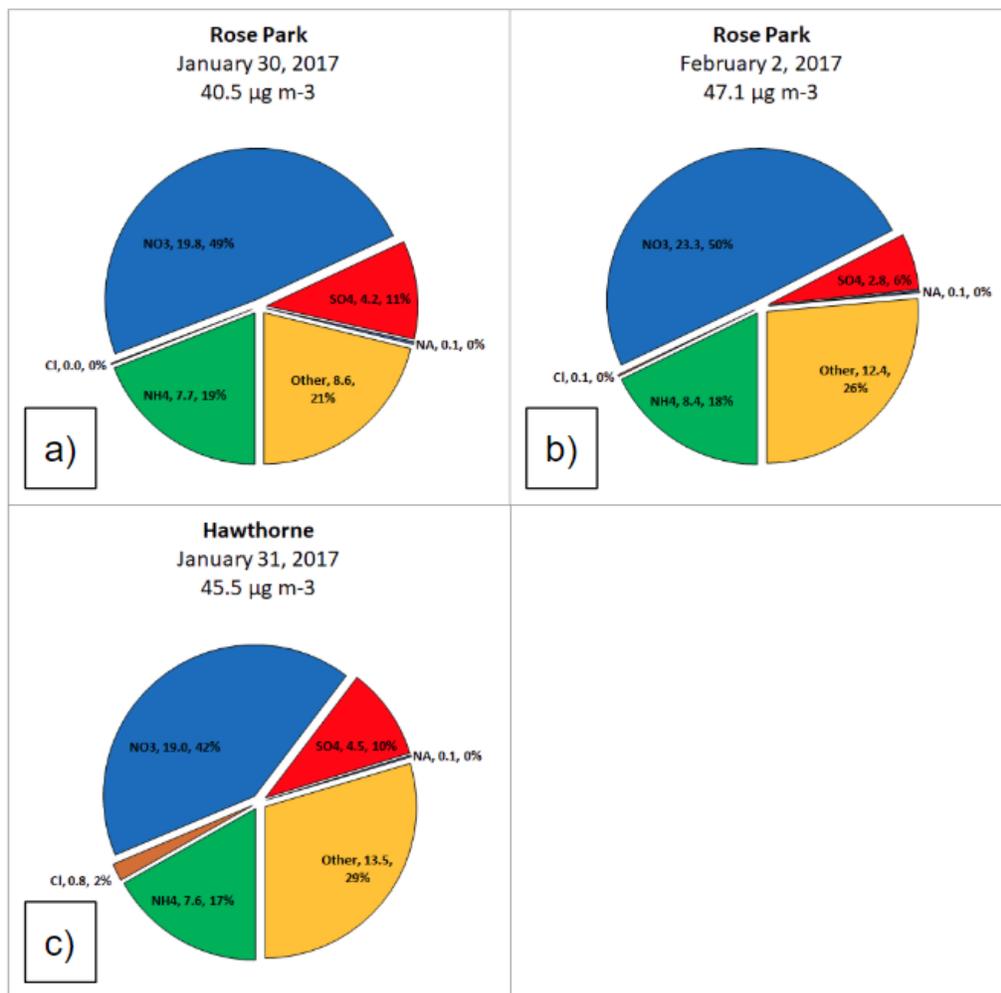
Figure 2: Speciation comparison between Rose Park (a,b) and Hawthorne (c). Figure suggests PM2.5 composition is similar between Hawthorne and Rose Park for days of elevated PM2.5.

SMAT-CE options used

Utah DAQ used one year (2011) of CSN data to create species fractions profiles for FRM monitors. 2011 CSN data presented a profile representative of typical wintertime peak daily PM2.5 speciation. 2011 CSN data was used for species fractions as well as CSN filter mass.

A grid of 3-by-3 (9) cells surrounding the monitors was used for relative response factor (RRF) calculations. Utah DAQ's grid resolution is relatively high at 1.33 km, implying a nine-cell window of 4 km x 4 km centered around monitor location. Since the grid-cell window was small in extent, Utah DAQ felt comfortable using the mean statistic for computing RRF values; A larger window could extend into upper elevation areas, where PM2.5 would naturally be less concentrated.

Utah DAQ used the most up-to-date AQS PM.25 monitoring data for its baseline design value (BDV) calculations. EPA guidance[2] (page 22) says one possibility for deriving baseline design values is using : "The design value period that straddles the baseline inventory year". Therefore, a 3-year period (2015 - 2017) was used for constructing BDV's straddle the 2016 base year and get a representative estimate of Utah air quality. The more recent year, 2016, was chosen as the 2016 emissions inventory reflects recent state rules and regulations.

The table below (Table 1) shows a list of different options in SMAT-CE used by Utah DAQ to complete their modeled attainment demonstration. Options not listed should be assumed to be default.

SMAT-CE Option	Setting
Species Monitor Data File	SpeciesAtHawthorne_17apr2018.csv
Unofficial Daily Average PM2.5 Data File	unOfficial_2002_2017_1may2018.csv
Official Daily Average FRM Data File	fOfficial_2012_2017_26jul2018.csv
Model Data/Baseline File	2016SL_4jun2018_summer.csv
Model Data/Forecast File	2019SL_3aug2018_summer.csv
Species Fraction Options	
Improve-CSN Monitor Data Years	2011 - 2011 (1-year)
Use top X percent of daily monitor days	15%
PM2.5 Monitor Data Years	2011 - 2011 (1-year)
Use top X percent of daily monitor days	15%
PM2.5 Monitor Data Years	
PM2.5 Monitor Data Years	2015 - 2017 (3-year)
Model Data Options	
Grid for Point Forecast	3x3
Grid for Spatial Forecast	3x3
Statistic	Mean
Use top X number of daily model days (RRF)	3

Table 1: List of different SMAT-CE parameters used in Utah DAQ's modeled attainment demonstration.

The results of the modeled attainment test will be discussed in the next section.