

Effects of Met Data Processing in AERMOD Concentrations

March 15, 2012

Wenck



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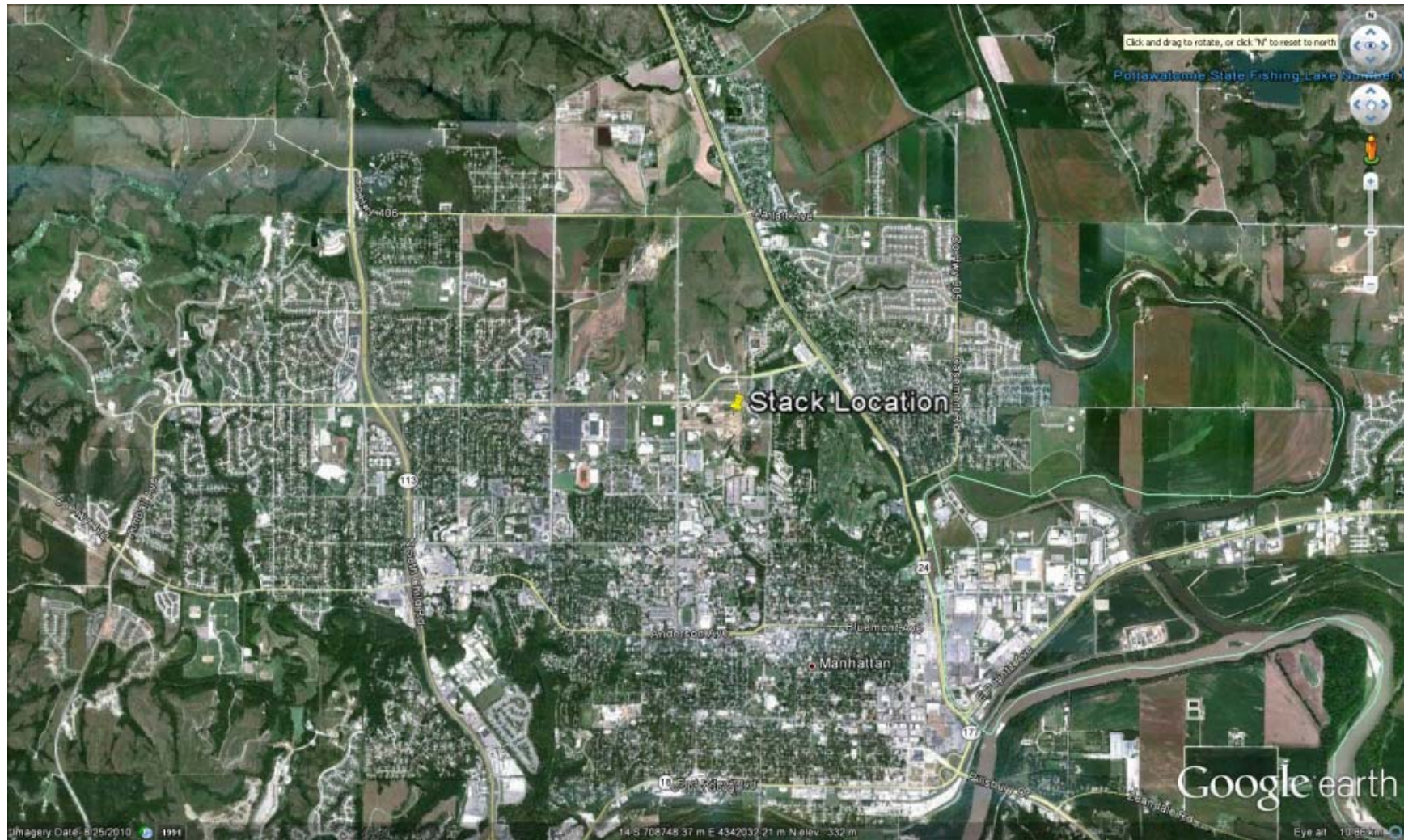
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Sensitivity Analysis

- Hypothetical point source in Manhattan, KS
- Study is based on the processing in AERMET of:
 - Integrated surface hourly data (ISHD)
 - Upper air data and
 - 1-minute ASOS data
- Surface station: Manhattan Regional Airport , KS
- Upper Air station: Topeka Municipal Airport Station, KS
- Downwash and terrain effects were not considered in this study

Stack location in Manhattan, Kansas



Three Modeling Scenarios

Input parameter	Short	Medium	Tall
Emission Source	RICE	Boiler	Power Plant
Stack height (m)	3	23	168
Emission rate (g/s)	1	1	1
Exit temperature (degrees K)	640	420.8	325
Diameter (m)	0.46	0.76	7.8
Exit velocity (m/s)	37.37	8.86	10.9

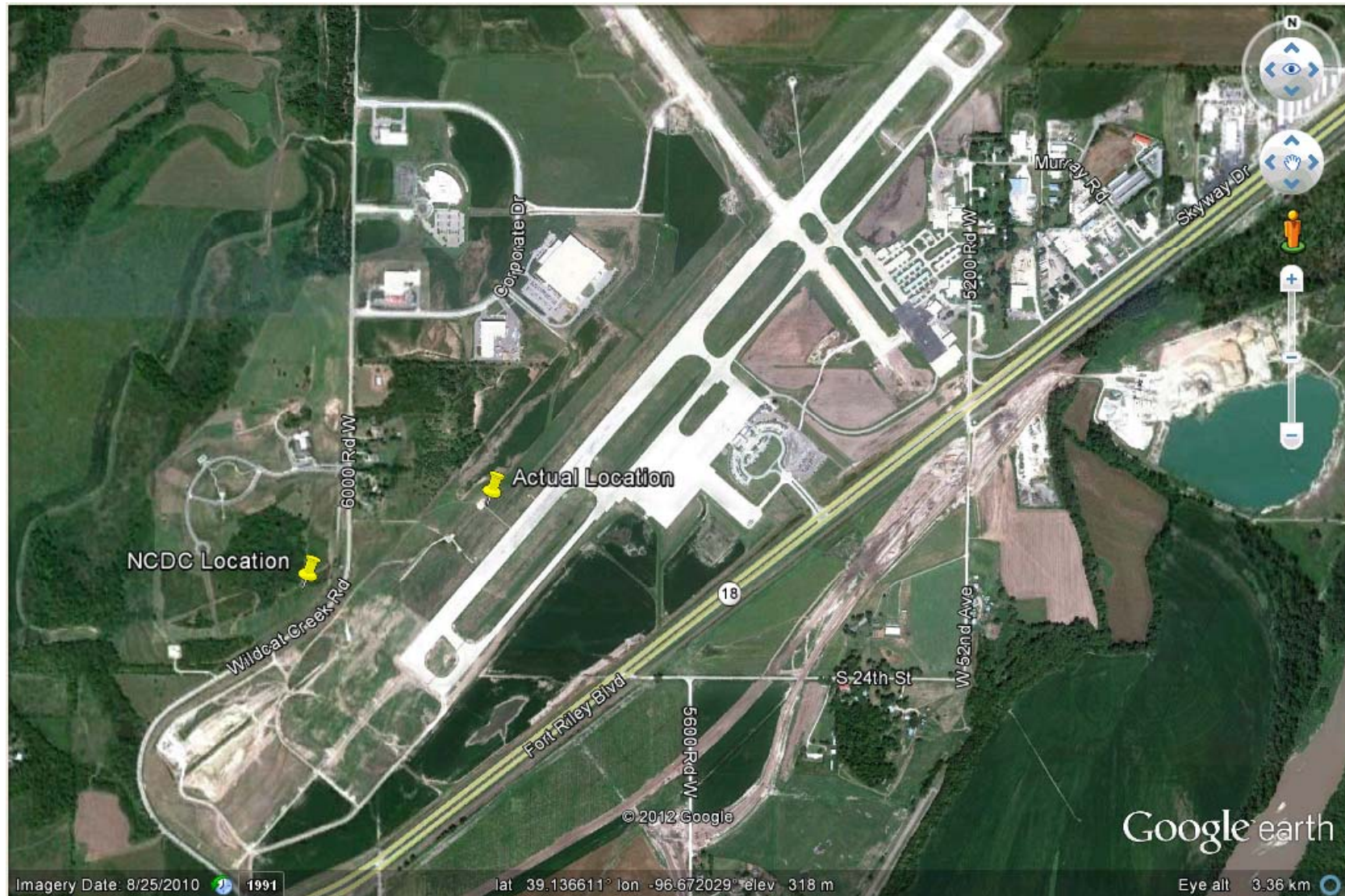
Nine sets of Met Data

Met data Iterations	Station Location	Anemometer Height (m)	Surface Moisture	Rural/Urban	Use of AERMINUTE	IFW Group
Met Iteration 1	Refined	7.9	Average	Urban	Yes	Yes
Met Iteration 2	NCDC	7.9	Average	Urban	Yes	Yes
Met Iteration 3	Refined	7.9	Dry	Urban	Yes	Yes
Met Iteration 4	Refined	7.9	Wet	Urban	Yes	Yes
Met Iteration 5	Refined	10	Average	Urban	Yes	Yes
Met Iteration 6	Refined	7.9	Average	Urban	No	-
Met Iteration 7	Refined	7.9	Average	Rural	Yes	Yes
Met Iteration 8	Surrogate	7.9	Average	Urban	Yes	Yes
Met Iteration 9	Refined	7.9	Average	Urban	Yes	No

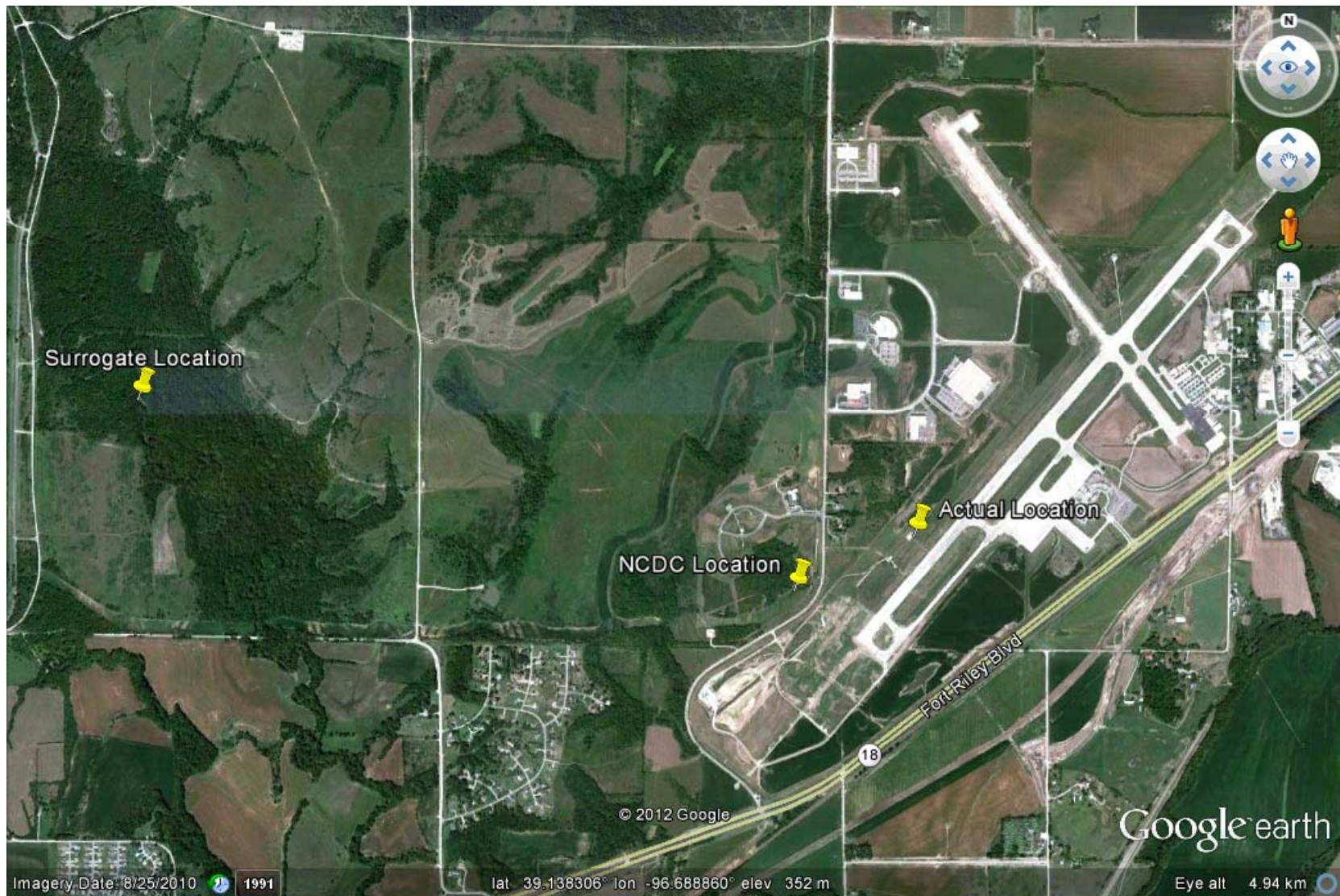
Nine sets of Met Data

Met data Iterations	Station Location	Anemometer Height (m)	Surface Moisture	Rural/Urban	Use of AERMINUTE	IFW Group
Met Iteration 1	Refined	7.9	Average	Urban	Yes	Yes
Met Iteration 2	NCDC	7.9	Average	Urban	Yes	Yes
Met Iteration 3	Refined	7.9	Dry	Urban	Yes	Yes
Met Iteration 4	Refined	7.9	Wet	Urban	Yes	Yes
Met Iteration 5	Refined	10	Average	Urban	Yes	Yes
Met Iteration 6	Refined	7.9	Average	Urban	No	-
Met Iteration 7	Refined	7.9	Average	Rural	Yes	Yes
Met Iteration 8	Surrogate	7.9	Average	Urban	Yes	Yes
Met Iteration 9	Refined	7.9	Average	Urban	Yes	No

Actual and NCDC Location for the MHK Met Station in Kansas



Surrogate, Actual, and NCDC Location for the MHK Met Station in Kansas



Location- Short stack scenario

RICE		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	190.7	0.0	69.6	0.0	4.0	0.0
Iteration 2	NCDC location	189.3	-0.8	68.4	-1.7	4.1	2.5
Iteration 8	Surrogate location	163.3	-14.4	78.6	12.9	6.6	64.3

Location- Medium stack scenario

Medium Stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	29.7	0.0	6.6	0.0	1.1	0.0
Iteration 2	NCDC location	29.6	-0.6	7.1	7.4	1.2	4.4
Iteration 8	Surrogate location	31.0	4.4	9.6	46.5	1.4	26.9

Location- Tall stack scenario

Tall stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	13.1	0.0	2.0	0.0	0.15	0.0
Iteration 2	NCDC location	12.8	-2.2	1.9	-5.8	0.14	-7.2
Iteration 8	Surrogate location	12.0	-8.1	1.6	-20.1	0.09	-36.9

Surface Moisture and Anemometer height- Short Stack Scenario

Short stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	190.7	0.0	69.6	0.0	4.0	0.0
Iteration 3	Dry surface moisture	190.7	0.0	69.6	-0.1	4.2	5.5
Iteration 4	Wet surface moisture	190.7	0.0	69.6	-0.1	3.9	-2.9
Iteration 5	10 m anemometer height	190.9	0.1	66.4	-4.7	3.7	-6.4

Surface Moisture and Anemometer height- Medium Stack Scenario

Medium stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	29.7	0.0	6.6	0.0	1.1	0.0
Iteration 3	Dry surface moisture	30.9	4.1	6.6	-0.2	1.1	0.4
Iteration 4	Wet surface moisture	30.1	1.1	6.6	0.0	1.1	-0.9
Iteration 5	10 m anemometer height	29.7	-0.2	6.6	-0.1	1.1	1.4

Surface Moisture and Anemometer height- Tall Stack Scenario

Tall stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	13.1	0.0	2.0	0.0	0.15	0.0
Iteration 3	Dry surface moisture	13.1	0.0	2.0	0.0	0.15	1.0
Iteration 4	Wet surface moisture	13.1	0.0	2.0	0.1	0.15	-0.7
Iteration 5	10 m anemometer height	13.1	6.2	2.0	-0.4	0.16	10.2

Rural vs Urban- Short Stack Scenario

Short stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	190.7	0.0	69.6	0.0	4.0	0.0
Iteration 7	Rural	201.8	5.8	74.2	6.6	4.0	0.7

Rural vs Urban- Medium Stack Scenario

Medium stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	29.7	0.0	6.6	0.0	1.1	0.0
Iteration 7	Rural	60.8	104.4	7.8	18.5	1.0	-9.9

Rural vs Urban- Tall Stack Scenario

Tall stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	13.1	0.0	2.0	0.0	0.15	0.0
Iteration 7	Rural	0.8	-94.0	0.1	-94.4	0.01	-92.5

Anemometer

Sonic



Cup and vane



AERMINUTE

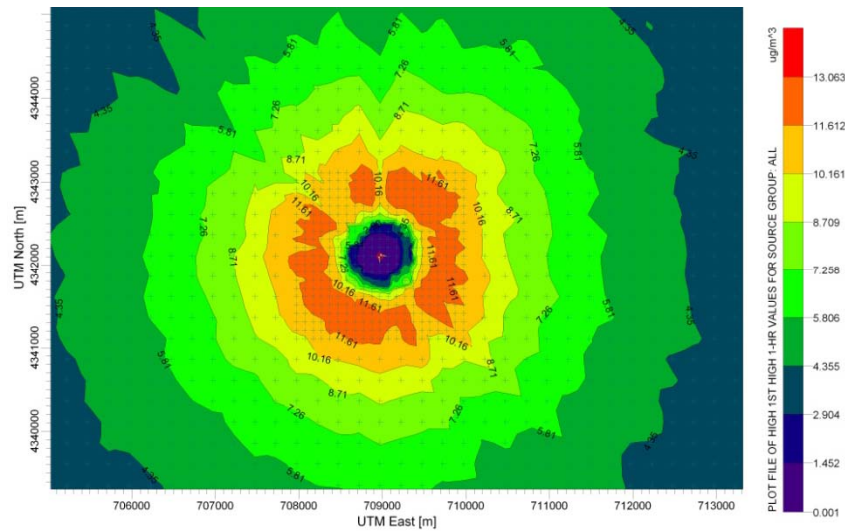
- Non-regulatory component of AERMOD
- Light wind conditions may be controlling factor in some cases due to limited dilution
- Concentrations not calculated in AERMOD for hours with calm or missing meteorological data
- Purpose of AERMINUTE is not to increase conservatism but to “reclaim” data that was lost due to METAR reporting in NWS data

Number and Percent of Calm and Missing Wind Data for Met Data Iterations

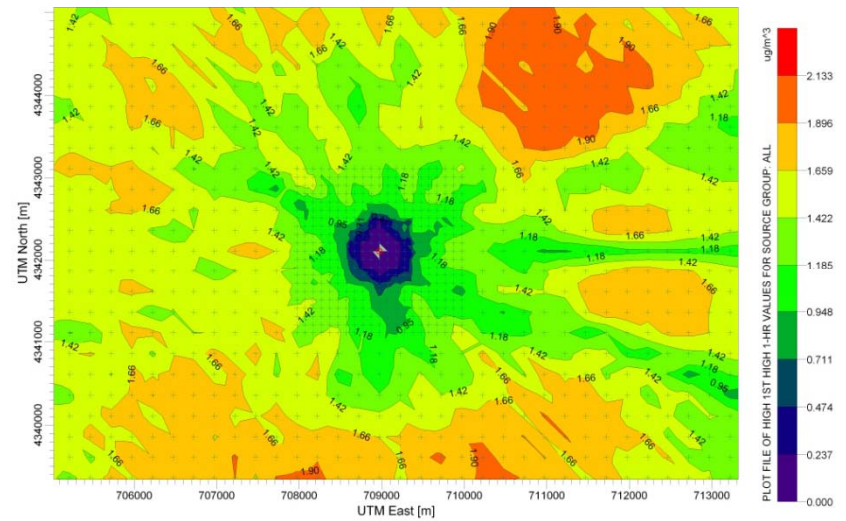
Met Data Iterations	AERMINUTE	IFW	Total Observations	Calm Winds (%)	Missing Winds (%)
Iterations 1,2,3,4,5,7,8	Yes	Yes	8760	80 (0.9%)	45 (0.5%)
Iteration 6	No	-	8760	2316 (26%)	349 (4%)
Iteration 9	Yes	No	8760	1303 (15%)	45 (0.5%)

Comparison AERMINUTE

AERMINUTE

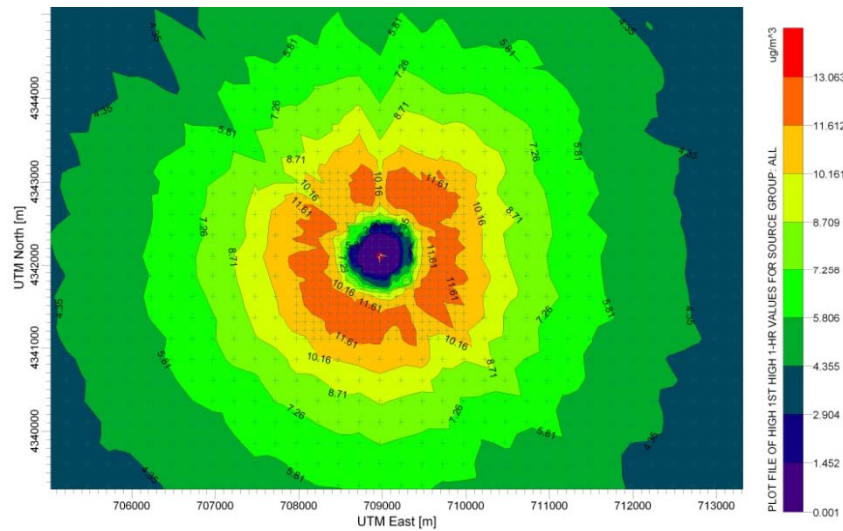


No AERMINUTE

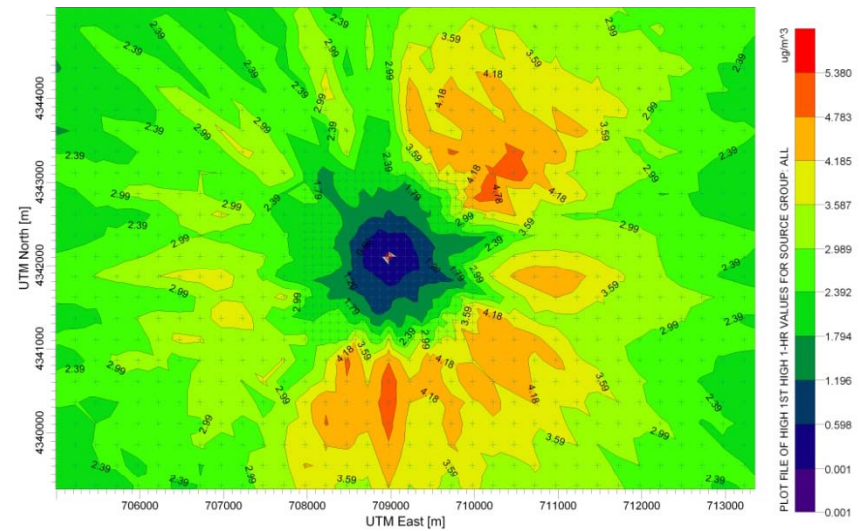


Comparison IFWGROUP

AERMINUTE



No IFW GROUP



AERMINUTE and IFWGROU- Short Stack Scenario

Short stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	190.7	0.0	69.6	0.0	4.0	0.0
Iteration 6	No AERMINUTE	188.5	-1.1	51.4	-26.2	5.2	30.2
Iteration 9	AERMINUTE but no IFW group	190.7	0.0	69.6	0.0	4.6	14.3

AERMINUTE and IFWGROU- Medium Stack Scenario

Medium stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	29.7	0.0	6.6	0.0	1.1	0.0
Iteration 6	No AERMINUTE	28.8	-3.2	7.3	11.1	1.2	6.7
Iteration 9	AERMINUTE but no IFW group	29.7	0.0	7.4	13.3	1.2	2.1

AERMINUTE and IFWGROUP- Tall Stack Scenario

Tall stack		1-hr		24-hr		Annual	
Met Data Used	Description	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference	$\mu\text{g}/\text{m}^3$	Percent Difference
Iteration 1	Control	13.1	0.0	2.0	0.0	0.15	0.0
Iteration 6	No AERMINUTE	1.9	-85.4	0.4	-80.9	0.02	-88.4
Iteration 9	AERMINUTE but no IFW group	4.7	-64.2	0.6	-67.6	0.03	-77.9

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