Temperature-adjusted Wood Stove Emissions (WSTA14 version 2)

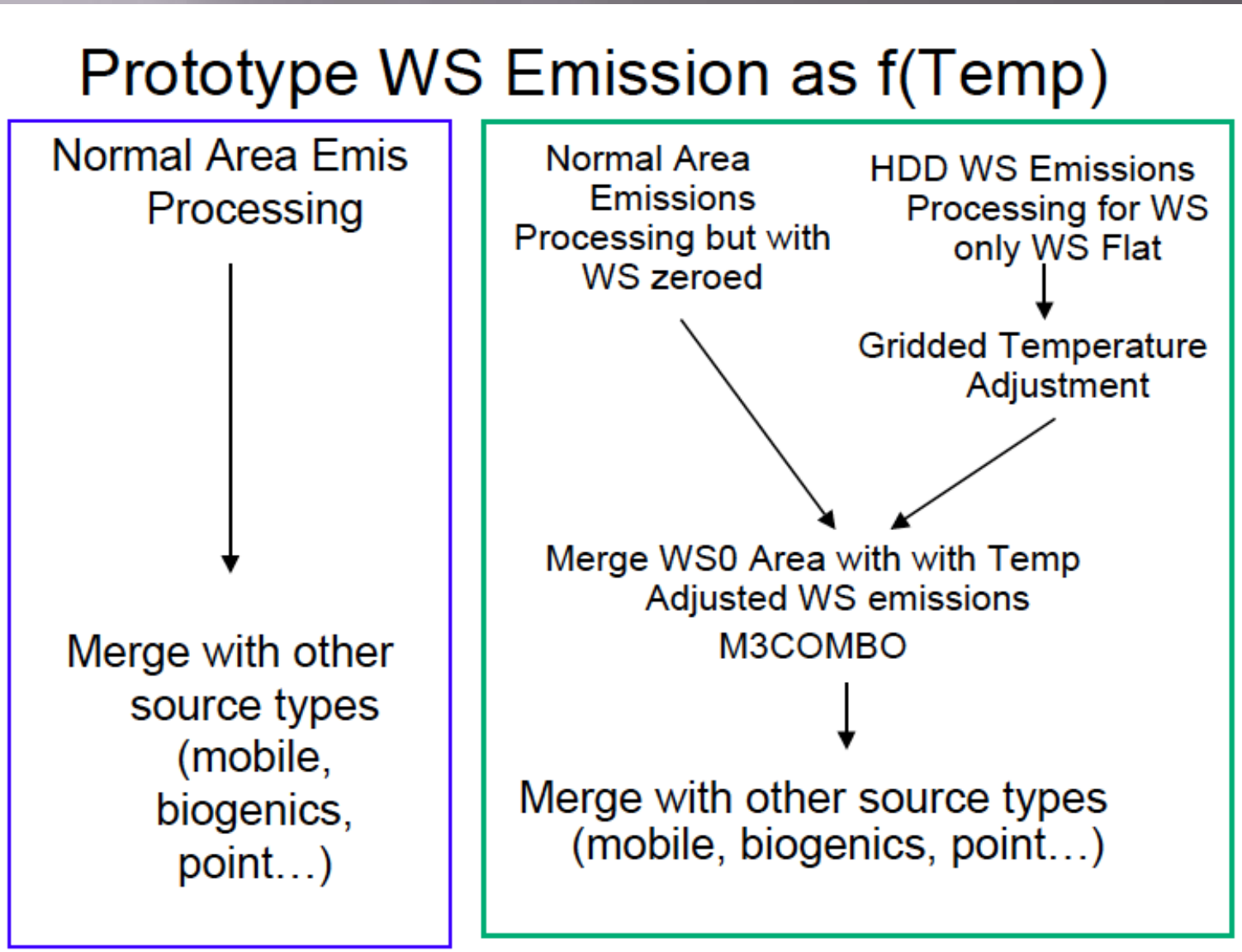
- Joe Vaughan and contributors
  - Brian Lamb
  - Farren Herron-Thorpe
  - Sally Otterson
  - Clint Bowman

History of Tests for Temperature-adjusted Wood Stove Emissions

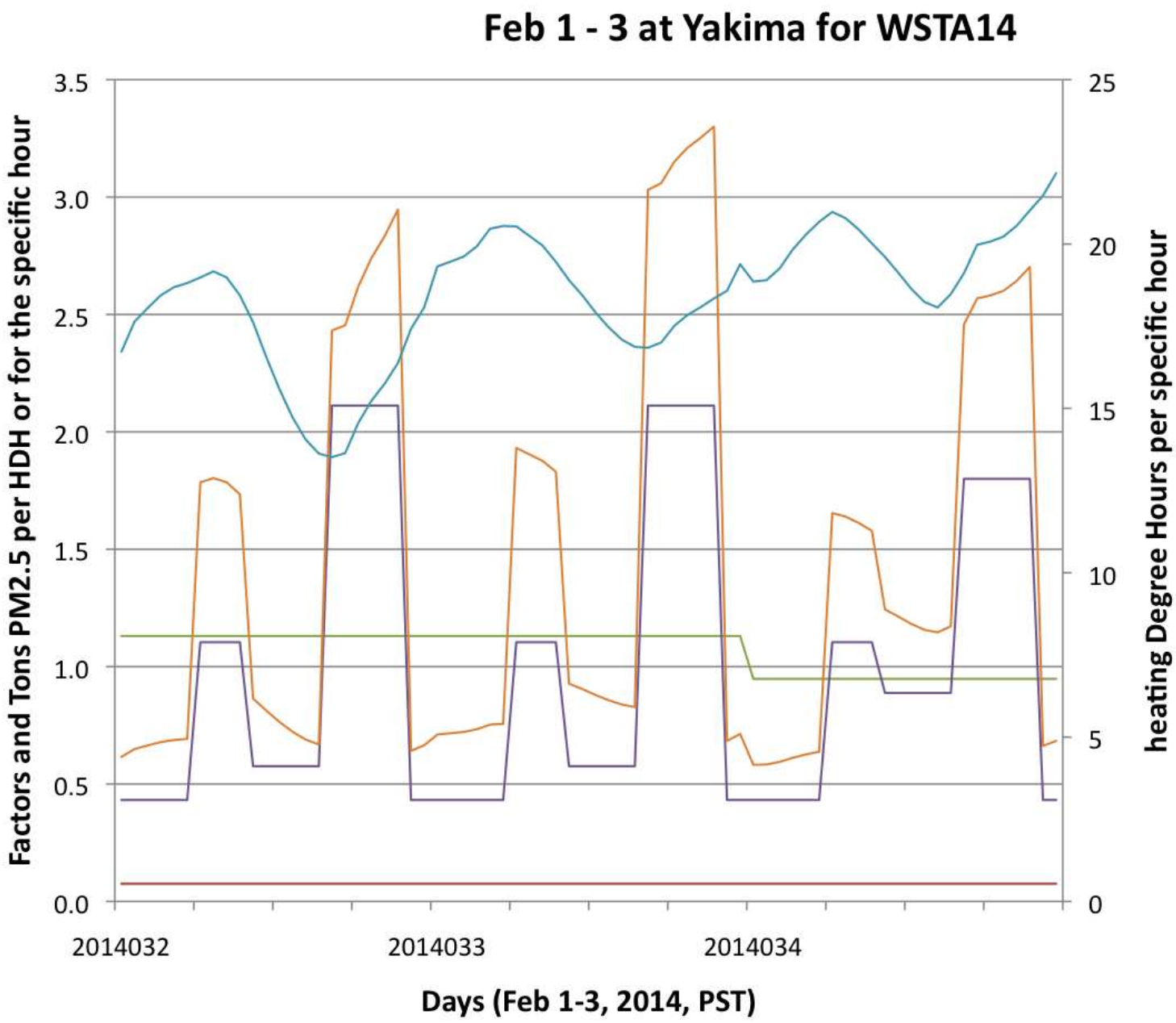
- 2010: Simple (T/HDD > T/HDHr) x $HDH_{(20-50)}$
  - Over-estimated emissions in AP3
- 2013: (T/HDD > T/HDHr) x $HDH_{(20-50)}$ x f(MoY) x f(DoW) x f(HoD, DoW)
  - Over-estimated emissions in AP3 – so revisit for AP4 with re-normalizd factors?
- 2013 – reviewed SMOKE GenTPRO; for retro runs!
- 2014a – (T/HDHr) x $HDH_{(20-50)}$ x f(MoY) x f(DoW) x f(HoD, DoW)
  - Found minor emission inventory errors to correct.
  - Over-estimated emissions in AP4 – so redo without MoY factor.
- 2014a – (T/HDHr) x $HDH_{(20-50)}$ x f(DoW) x f(HoD, DoW)
  - Today!

HDD Heating Degree Day HDHr Heating Degree Hour
HoD Hour of Day MoY Month of Year DoY Day of Year

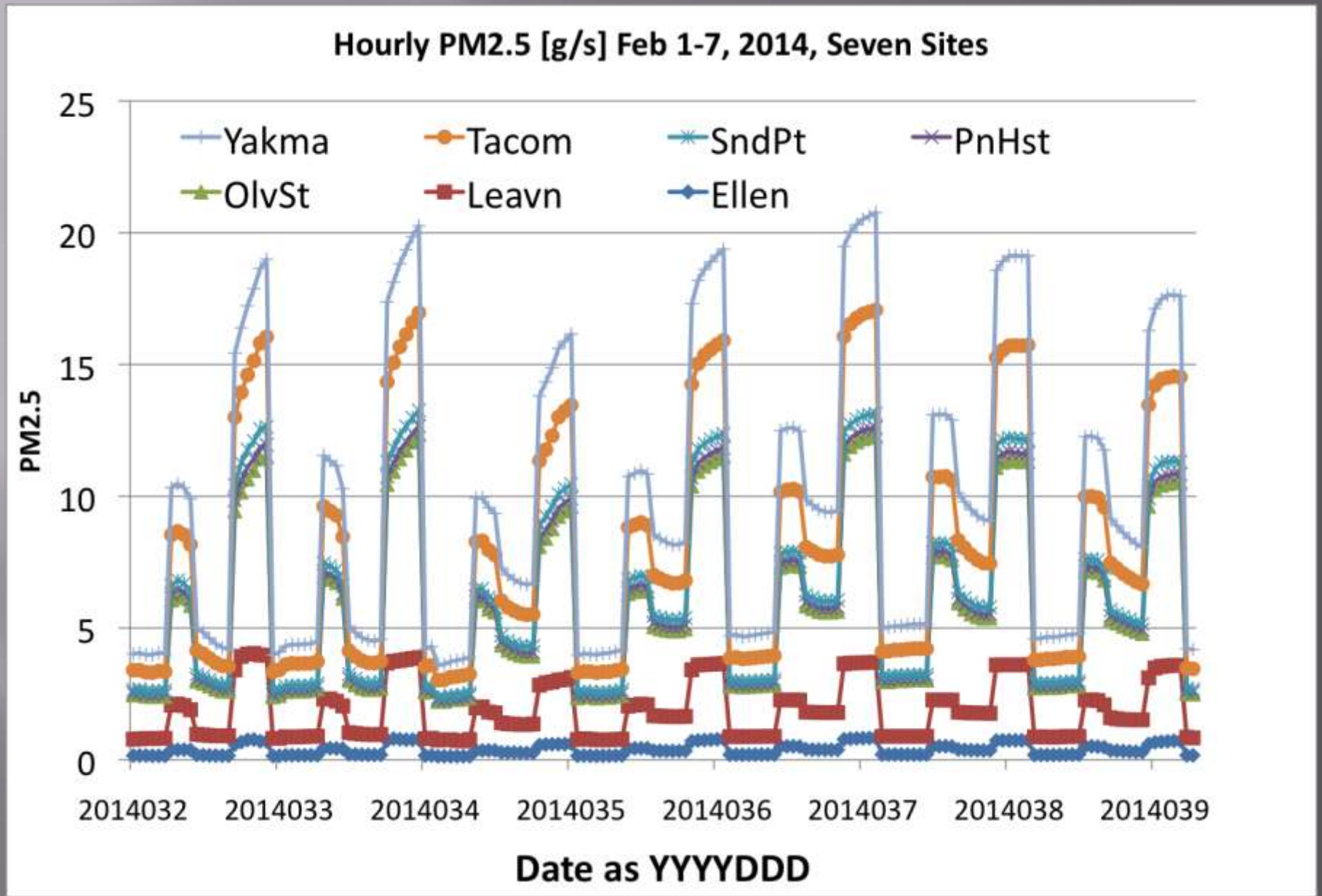
Data flow for applying wood stove emissions temp-adjustment



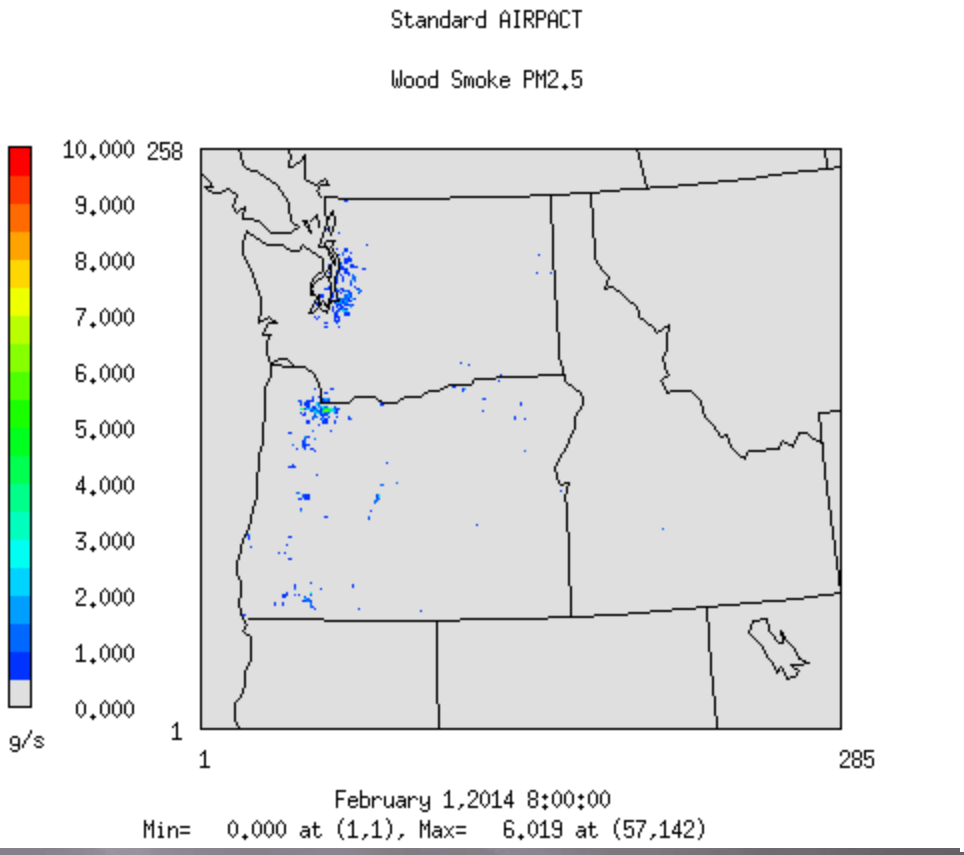
Temperature Adjustment Debugging Output for Cell containing Yakima, WA

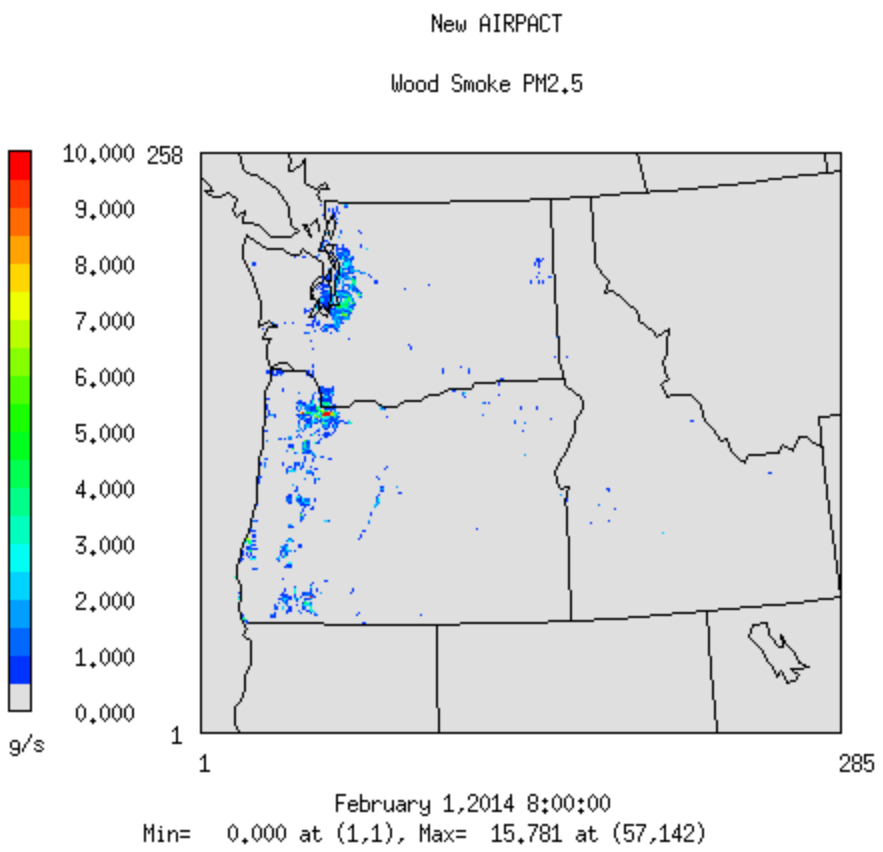


= (T/HDHr)
x $HDH_{(20\text{-}50)}$
x f(DoW)
x f(HoD, DoW)

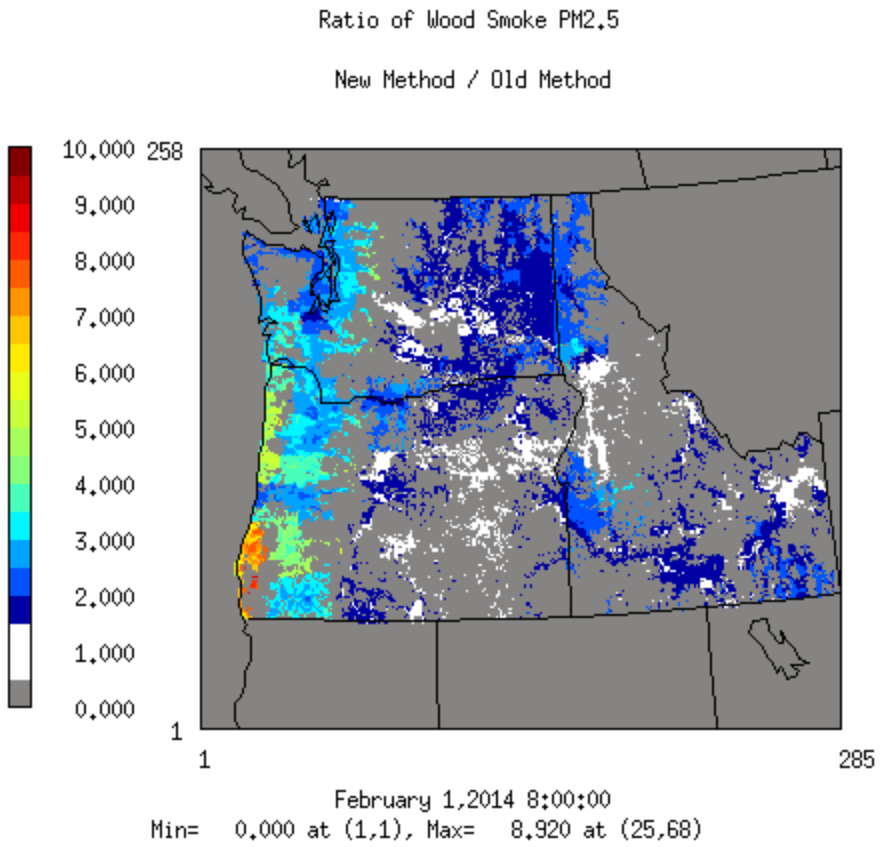

Hourly PM2.5 [g/s] Feb 1-7, 2014, Seven Sites
Yakma
Tacom
SndPt
PnHst
OlvSt
Leavn
Ellen
PM2.5
25
20
15
10
5
0
2014032
2014033
2014034
2014035
2014036
2014037
2014038
2014039
Date as YYYYDDD

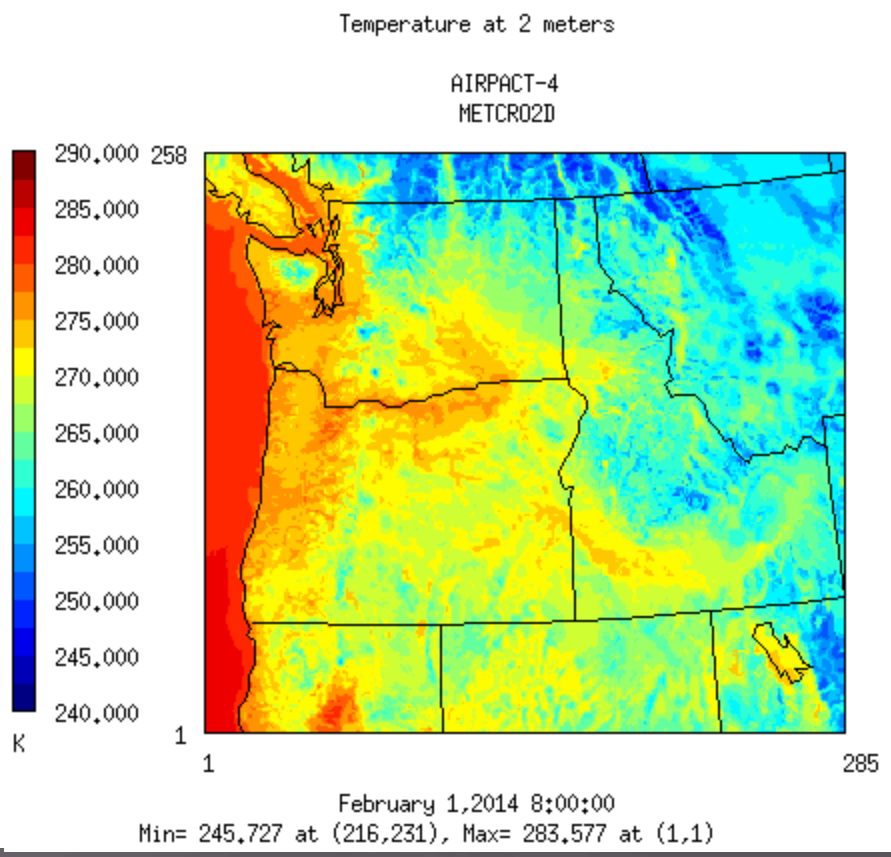
AIRPACT4 and WSTA14 emissions for February 1 & 2 (Sat- Sun)





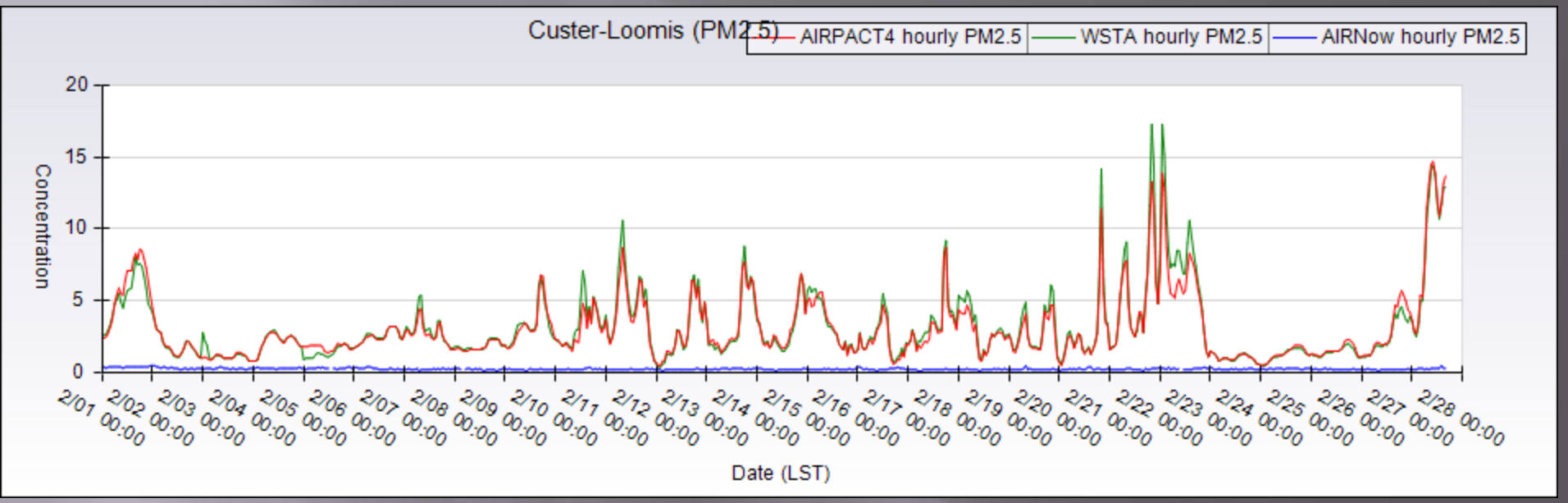
AIRPACT4 and WSTA14 Wood Stove PM for February 1 & 2 (Sat- Sun)

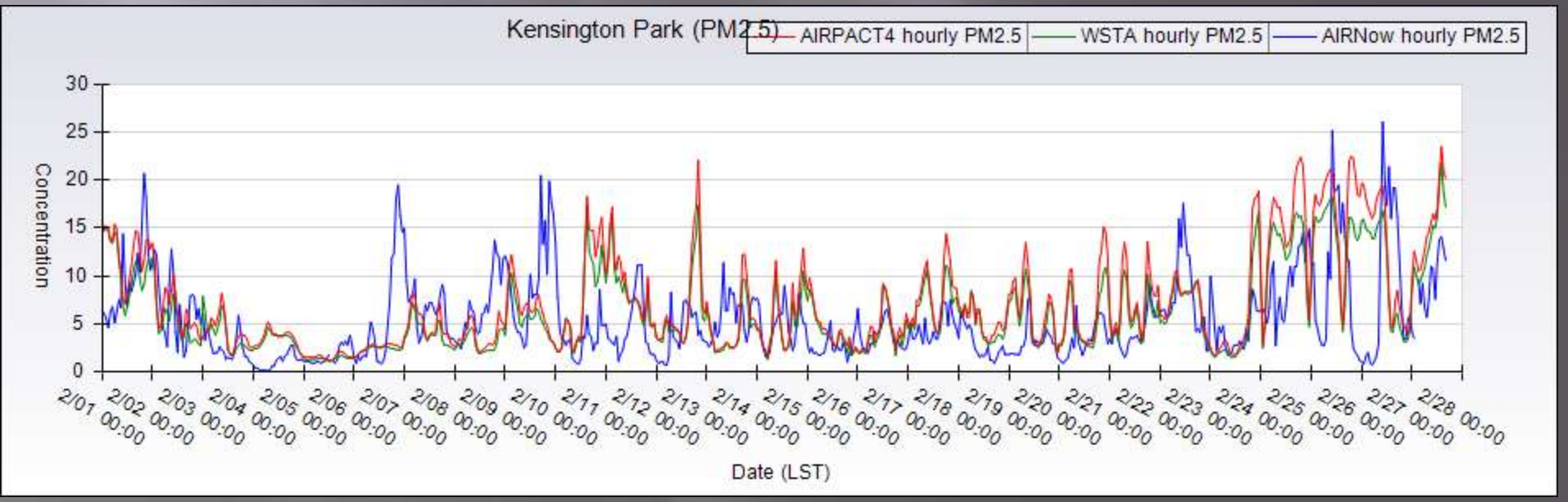




CANADA (Watch out for sites where units may be mishandled?)

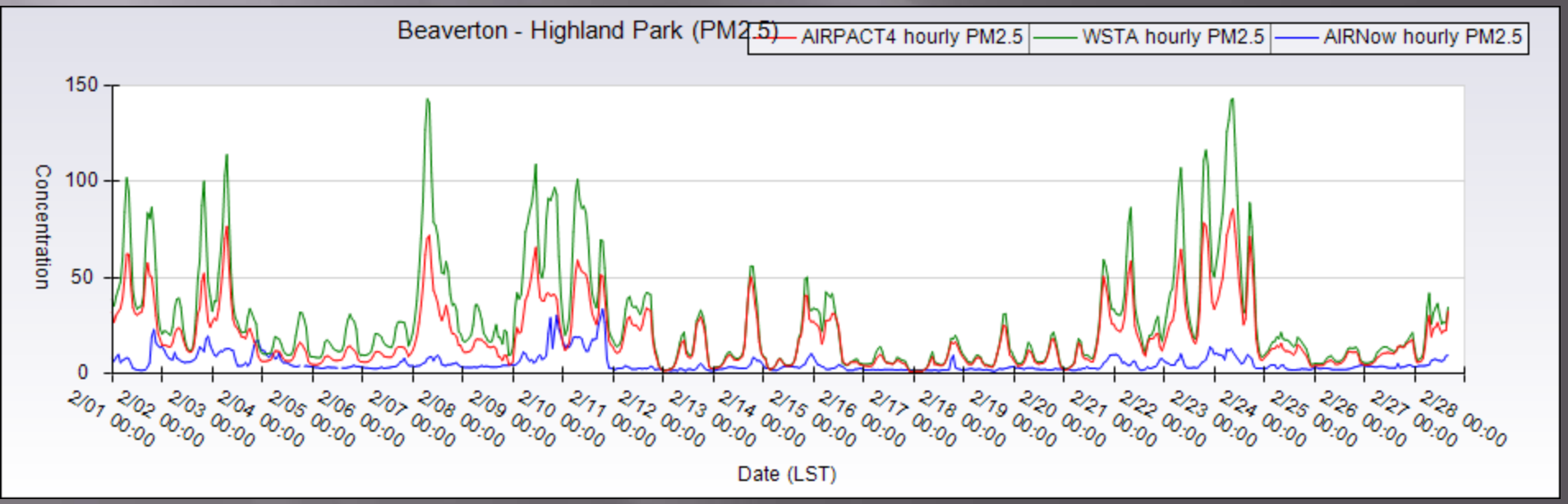
STD AIRPACT4 is RED AIRNow is BLUE WSTA14 is GREEN





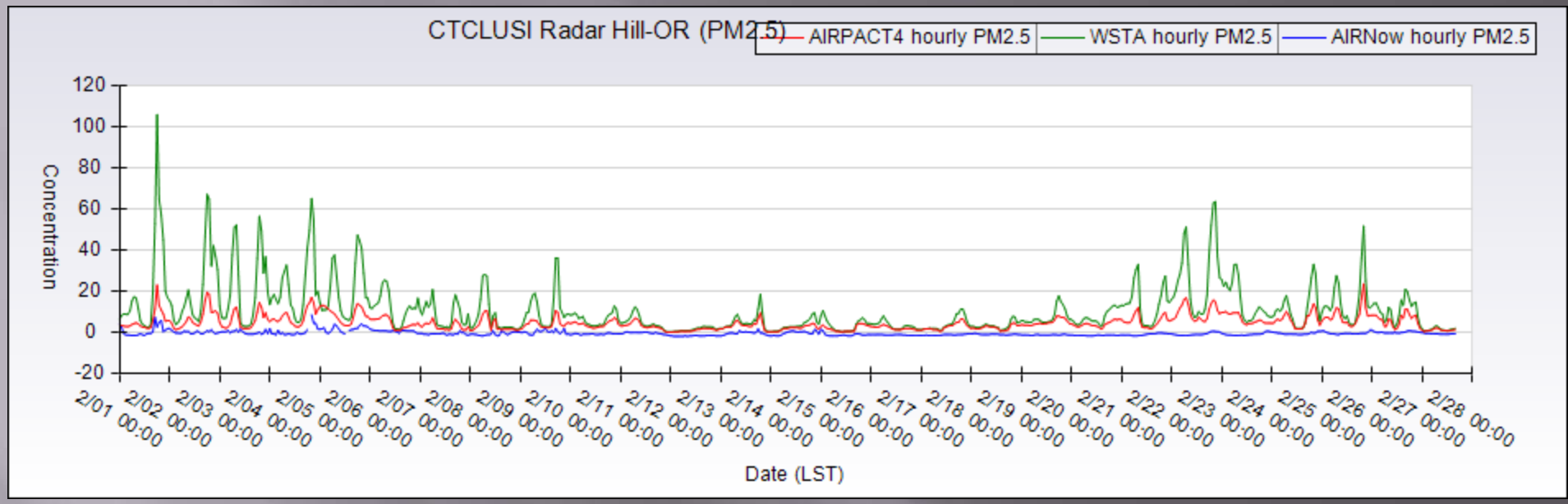
OREGON (near Portland)

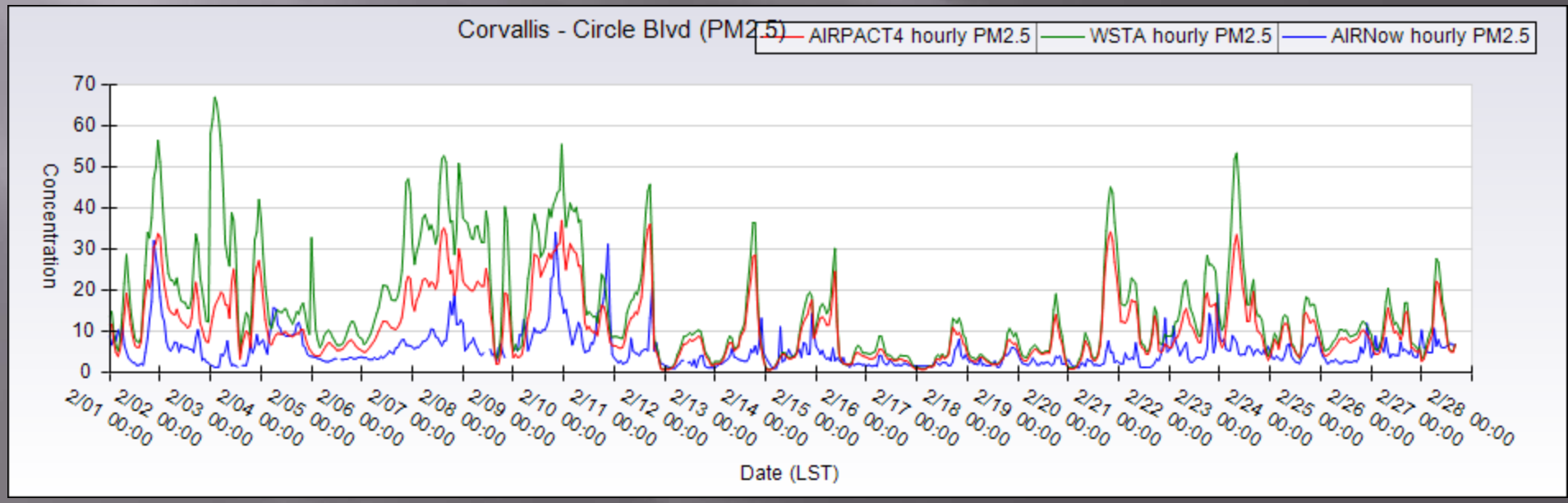
STD AIRPACT4 is RED AIRNow is BLUE WSTA14 is GREEN



OREGON (near Coast)

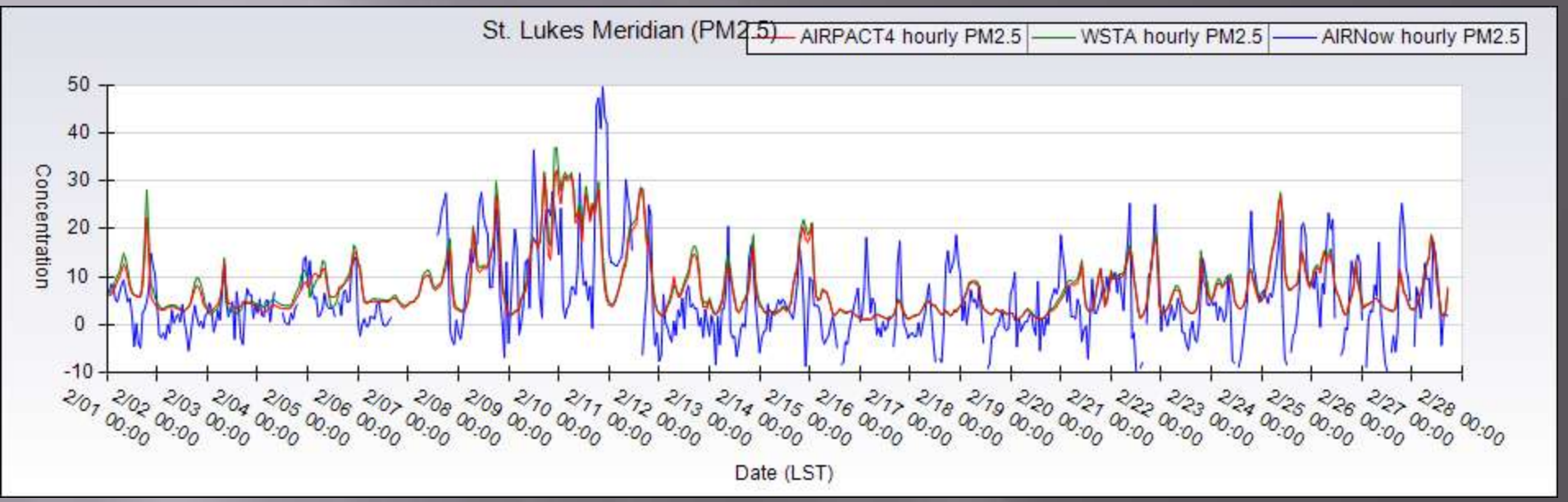
STD AIRPACT4 is RED AIRNow is BLUE WSTA14 is GREEN

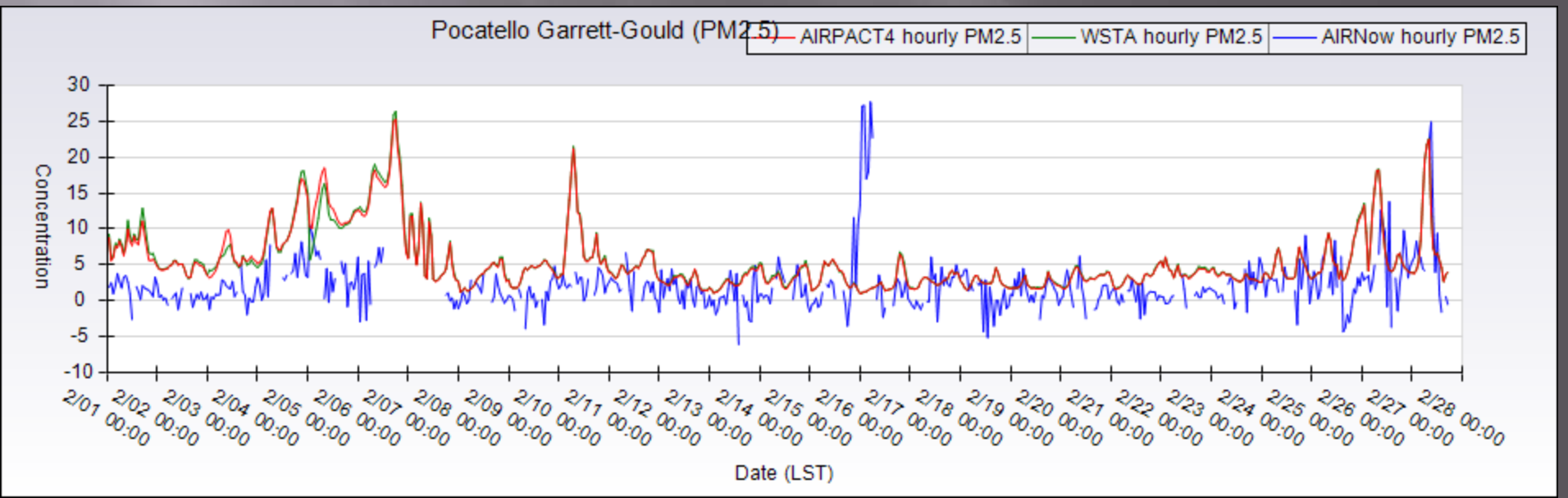




IDAHO (STD AIRPACT4 and WSTA14 agree mostly?)

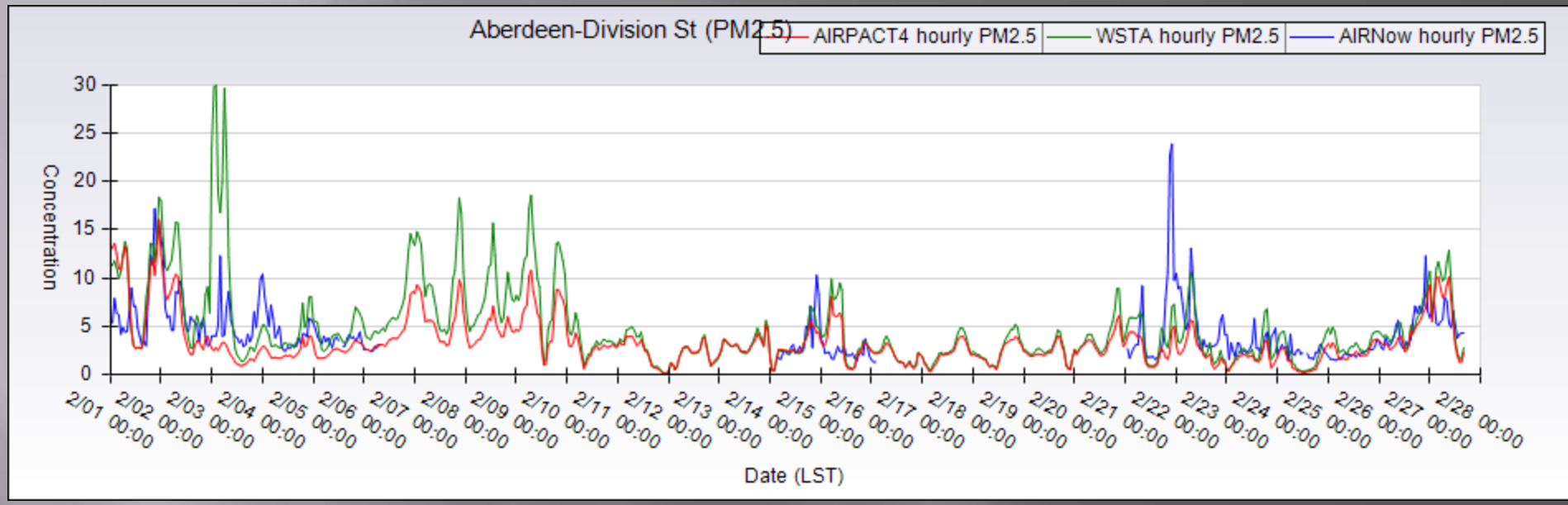
STD AIRPACT4 is RED AIRNow is BLUE WSTA14 is GREEN

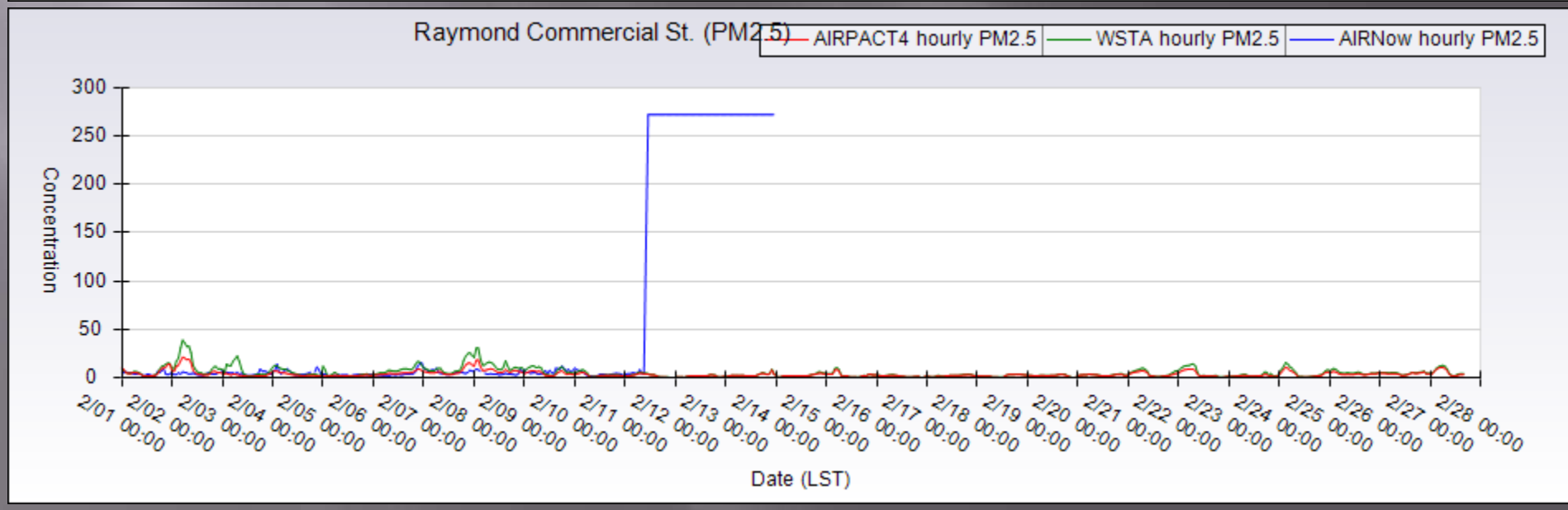




WASHINGTON Olympic Peninsula: scary missing & bad values from AIRNow...

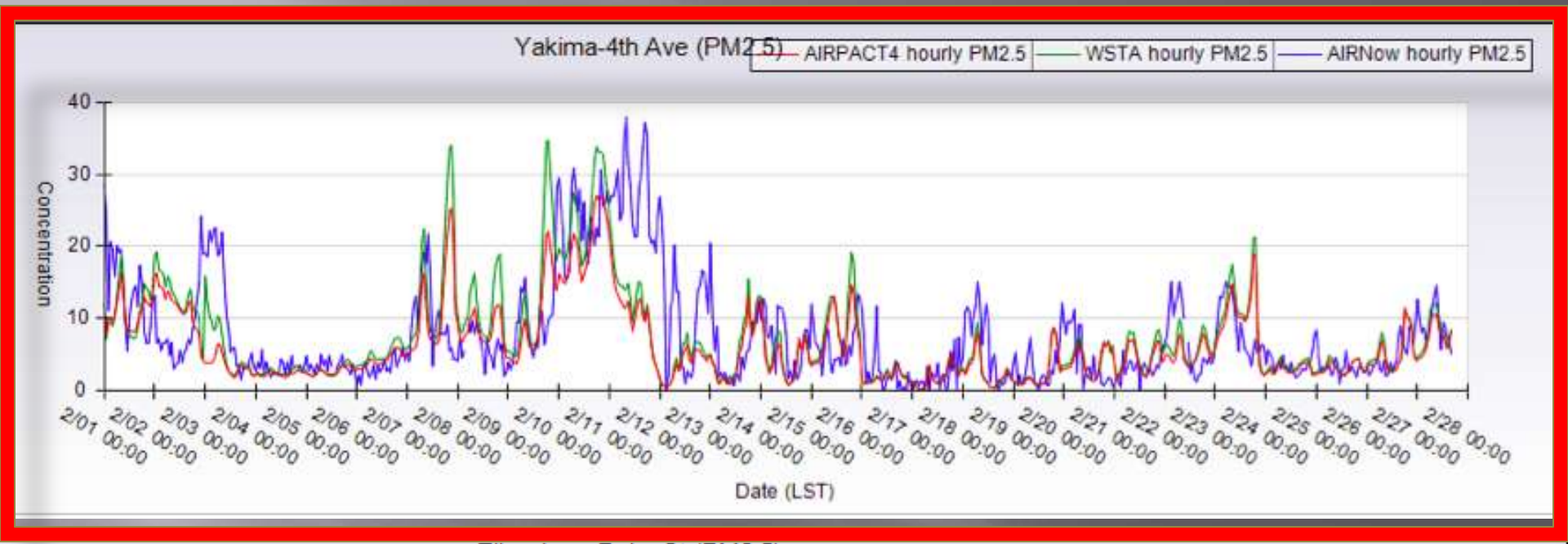
STD AIRPACT4 is RED AIRNow is BLUE WSTA14 is GREEN

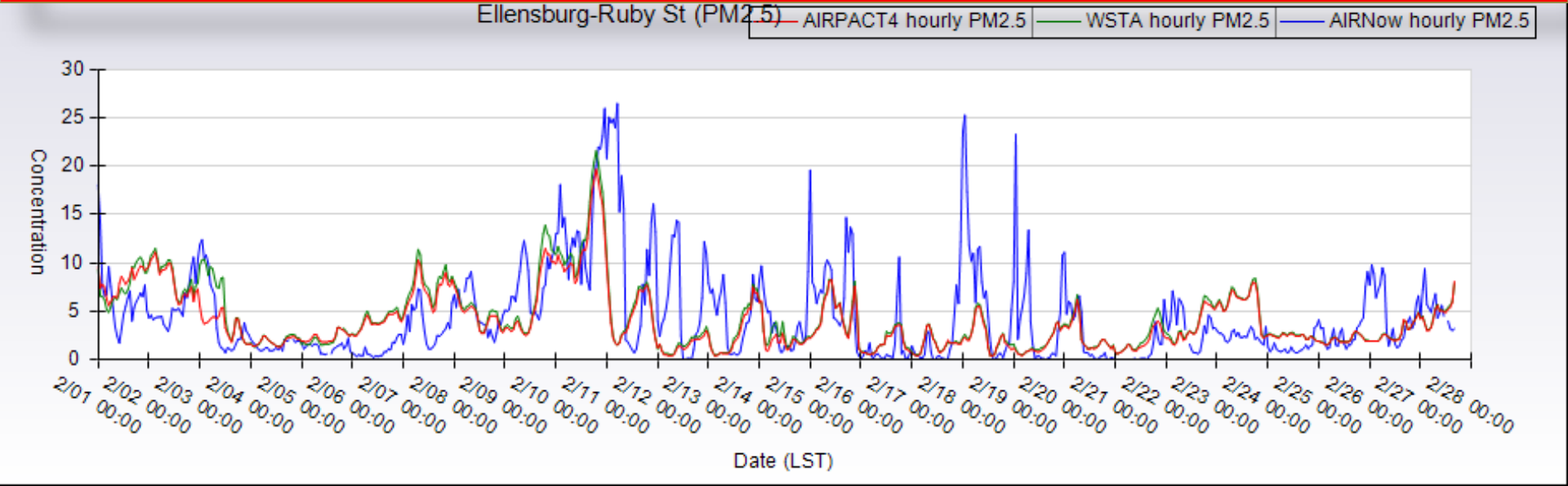


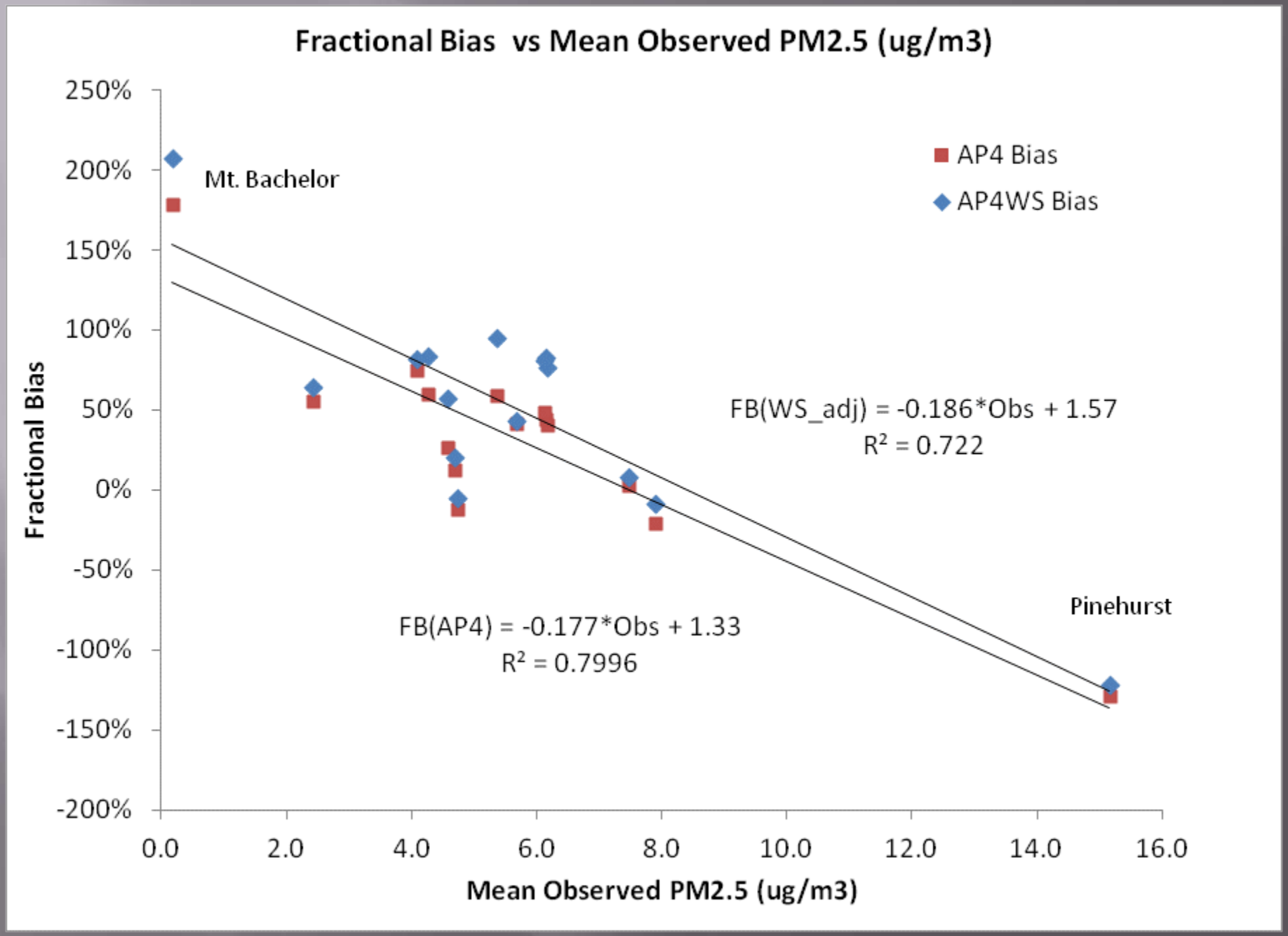


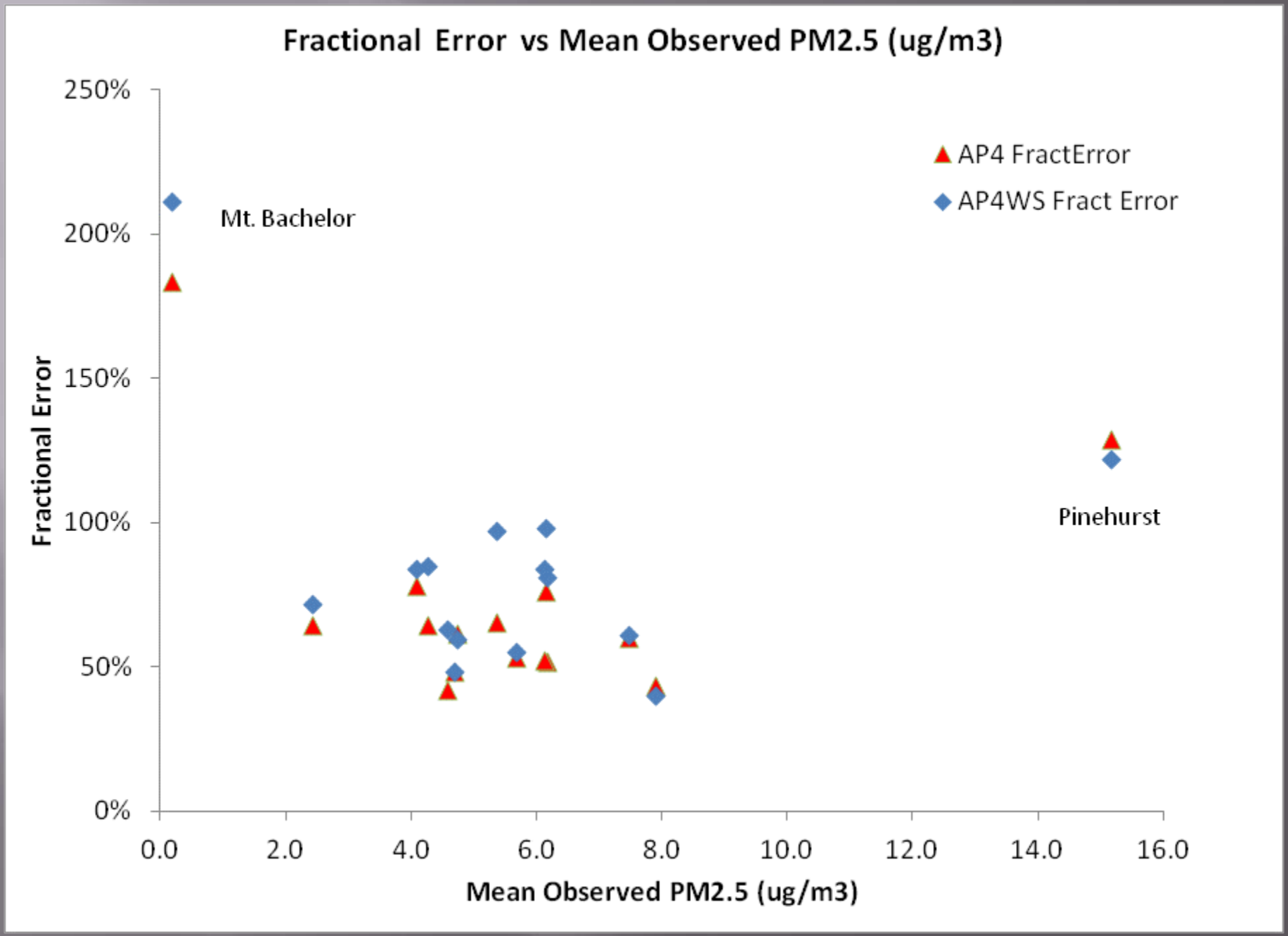
CENTRAL WASHINGTON (AIRPACT4 and WSTA14 are both low)

STD AIRPACT4 is RED AIRNow is BLUE WSTA14 is GREEN






Fractional Bias vs Mean Observed PM2.5 (ug/m3)
250%
200%
150%
100%
50%
0%
-50%
-100%
-150%
-200%
Fractional Bias
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Mean Observed PM2.5 (ug/m3)
AP4 Bias
AP4WS Bias
Mt. Bachelor
Pinehurst
FB(WS_adj) = -0.186*Obs + 1.57
R² = 0.722
FB(AP4) = -0.177*Obs + 1.33
R² = 0.7996


Fractional Error vs Mean Observed PM2.5 (ug/m3)
250%
200%
150%
100%
50%
0%
Fractional Error
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Mean Observed PM2.5 (ug/m3)
AP4 FractError
AP4WS Fract Error
Mt. Bachelor
Pinehurst

	Obs	AP4 Frac.Bias	AP4WS Frac. Bias	AP4 Frac.Error	AP4WS Frac. Error
Pinehurst, ID	15.2	-129%	-122%	129%	122%
Yakima	7.9	-21%	-8%	44%	40%
St Lukes, ID	7.5	3%	8%	60%	61%
Tacoma L St	6.2	41%	77%	52%	81%
Puyallup	6.2	45%	83%	76%	98%
tacoma-Alexander	6.1	48%	81%	52%	84%
Nampa Fire Station, ID	5.7	41%	44%	53%	55%
Puyallup_tribe	5.4	60%	96%	65%	97%
Ellensburg	4.7	-12%	-5%	61%	60%
Lewiston, ID	4.7	13%	20%	48%	48%
Seattle_QueenAnneHill	4.6	27%	57%	42%	63%
Portland Sauvie Is.]	4.3	60%	84%	64%	85%
Bend	4.1	75%	82%	78%	84%
Moscow, ID	2.4	56%	65%	65%	72%
Mt. Batchelor	0.2	179%	208%	183%	212%
	Overall MEAN	32%	51%	72%	84%

Next...?

Analyze site/cell - periods with best and worst performance and evaluate 'met' effects?

Try a modified surrogate treatment for wood stoves?

Try HDD instead of HDHr?

Check on possible issues with AIRnow Obs we're using for evaluation?

Rerun the same period and reanalyze...