



# NW-AIRQUEST Annual State of the Model Report

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NW-AIRQUEST ANNUAL MEETING, JUNE 14-16, 2017  
ST. MICHELLE WINE CENTER, WSU – TRI-CITIES

# Topics

- ▶ Contract review, status and budget balance
- ▶ Ongoing Tasks
- ▶ One-Time Tasks
- ▶ Deliverables
- ▶ Aeolus Cluster Evolution and Status
- ▶ AIRPACT-5 Configuration

## Contract review, status and balance

- ▶ State of the Model Report ~ June 30, 2017 (~ this ppt report)
- ▶ Project Duration: July 1, 2016 – June 30, 2017
- ▶ Contract for this period, between Lane County for LRAPA & WSU, was signed and in place July 14, 2016.
- ▶ Contract #: LRAPA 16-06-02
- ▶ Budget Total: \$109K
- ▶ Balance as of 12/31/2016 was \$76,287
- ▶ Balance as of 5/31/2017 is \$20,262

# Contract review, status and balance

BTD Through: 5/31/2017

14E      3815-5479      NEW AIRQUEST REG AIR QUAL MODELING SYSTEM 2      7/1/2016      6/30/2017      91.8 %

Category	Object	Allocation	Expense	Encumbrance	Balance	Alloc Spent
Salaries	00	54,150.00	35,249.14	8,267.76	10,633.10	80.36 %
Wages	01	0.00	41.00	0.00	-41.00	0.00 %
Consumable Goods And Services	03	15,000.00	17,257.98	0.00	-2,257.98	115.05 %
Travel	04	1,396.00	980.78	0.00	415.22	70.26 %
Equipment - Capitalized	06	5,400.00	0.00	0.00	5,400.00	0.00 %
Employer Contributions	07	23,369.00	16,352.04	904.33	6,112.63	73.84 %
Facilities & Administrative Cost	13	9,685.00	7,078.89	2,606.11	0.00	100.00 %
<b>Account Totals:</b>		<b>109,000.00</b>	<b>76,959.83</b>	<b>11,778.20</b>	<b>20,261.97</b>	<b>81.41 %</b>

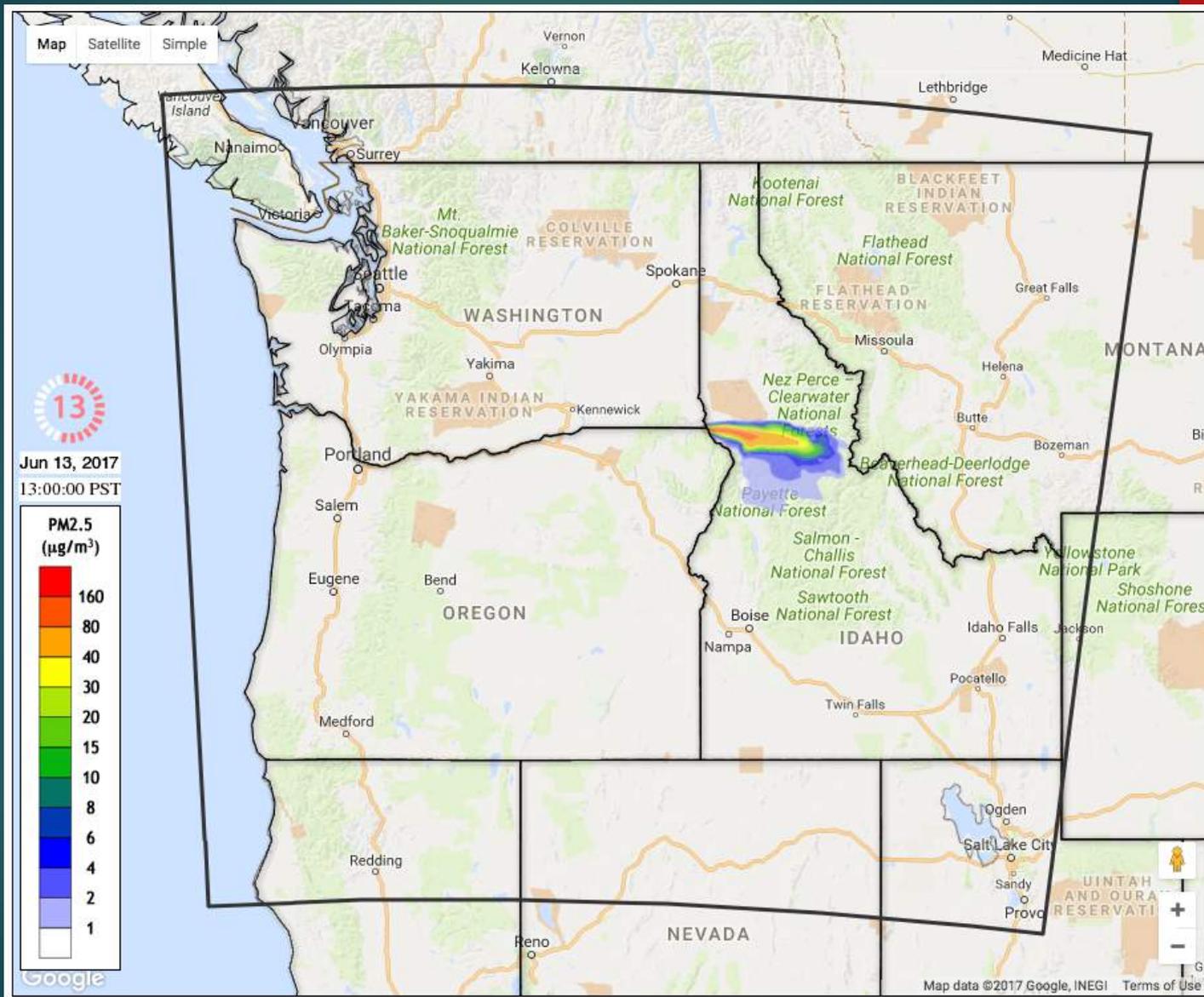
# Ongoing Tasks

1. Provide daily forecasts of air quality	Current and Ongoing
2. Provide real-time verification statistics by pollutant, by month, and provide access.	Current and Ongoing
3. Continue to run ClearSky.	Problems of Sept' 2016 fixed; running since March 16, 2017
4. Track model performance.	Current and Ongoing
5. Maintain data streams from AIRNow & satellites.	Updates made to track changes on AIRNow and NASA websites &/or products. (MOZARi-4 feature to be deprecated.)
6. Continue improvements and requested additions to web graphical display.	Current and Ongoing (e.g. week-long animation out for review, enhanced BCON display)
7. Maintain the "Change Log", posted on the AIRPACT website.	Current and Ongoing.
8. Archive daily model output and provide access. Web-based graphics for the most recent 5 years & model output for at least one month.	Current and Ongoing A webserver crash resulted in loss of online airpact4 imagery (conc, aconc, emis & met) for 2012 and 2013 and imagery (conc & aconc) for April-Dec 2014. Have 3 years of AIRPACT-4 and -5 imagery.
9. Modify AIRPACT as needed for fire emissions produced by other organizations.	Current and Ongoing. Have links to WA DNR burns and looking at integration of emission for planned prescribed burns.
10. As requested by members, make Google Map API map images for PM <sub>2.5</sub> and ozone available...	None requested.
11. Ensure functionality of R server hosting Background Concentrations Lookup tool.	Working as of June 2017.

# One-Time Tasks (1 of 3)

General task description	Details
Correct wildfire plume rise error	Corrected
Modeling of Rare Field Campaign (ClearSky).	<ul style="list-style-type: none"><li>• Successful modeling of RARE 2013 agricultural burns fire near Nezperce, ID and near Walla Walla, WA at 4-km and 1.3-km by REU student in June-July 2016, validating plume rise against Lidar.</li><li>• Ceilometer data provided to Shawn Urbanski.</li></ul>
Public (ClearSky) Page with hypothetical/default fires.	<p><a href="http://www.lar.wsu.edu/clearsky/">http://www.lar.wsu.edu/clearsky/</a> and link to <a href="http://www.lar.wsu.edu/clearsky/sky2_demo.html">http://www.lar.wsu.edu/clearsky/sky2_demo.html</a> displays example current plume.</p>

# ClearSky2 Public Demonstration Page:



# One-Time Tasks (2 of 3)

General task description	Details
Develop NOx & CO performance charts (comparison of modeled versus monitored).	Developed new, improved logic for accessing performance charts; added NOx, CO, and CO/NOx scatter plot. From Perf. Chart link only – not from Monitor site map pins.
Incorporate dust-suppression module for rain days (AFDUST)	The EI is setup but because the EPA/CMAS approach is unlike our processes, coding the MCIP/EI interaction is difficult. Currently we are still turning fugitive dust categories off for winter and back on for summer.
Develop graphics for Smoke Report and implement automatic generation of emission summaries	Smoke Report tables are being generated and shared on the web. LHS menu Graphics Products link shows monthly emissions report for year, month, state, county and pollutant, with table for sector contributions.
Add the north, south, and east boundaries to the “vertical curtain plots” page. Also, add mid-domain cross-sections at state borders.	Vertical curtain plot for West, North, East and South boundaries, all shown over terrain, are now animated for O3 and CO. Cross-sections or elevated layer graphics have yet to be developed.

# Performance charting update (1 of 2):

## 2017 AIRPACT-5 vs AIRNow Performance

2017 Monthly Statistics

AIRPACT Home

Charts may take several moments to appear on initial page load.

### Select Parameter

O3  PM2.5  CO  NOx

### Select State or Province

WA

### Select Site Name

Seattle-Beacon Hill

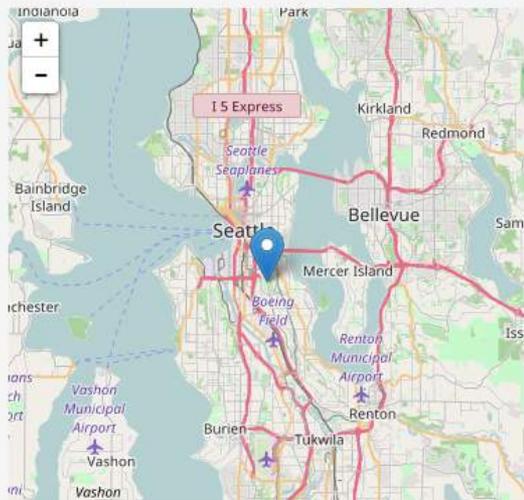
### Enter date range

2017-06-02

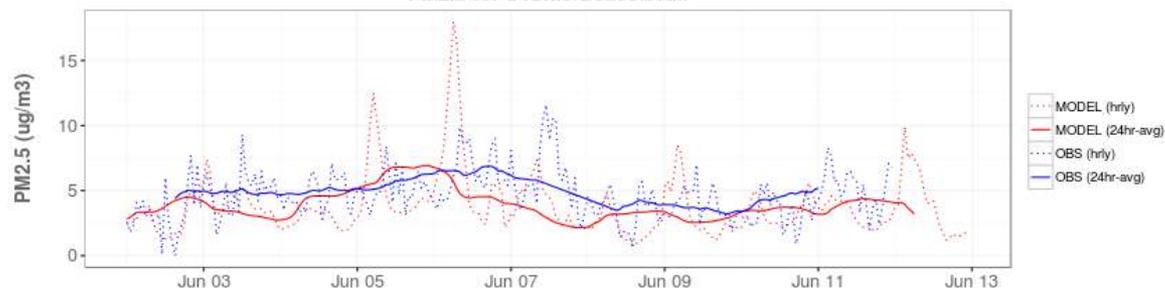
to

2017-06-14

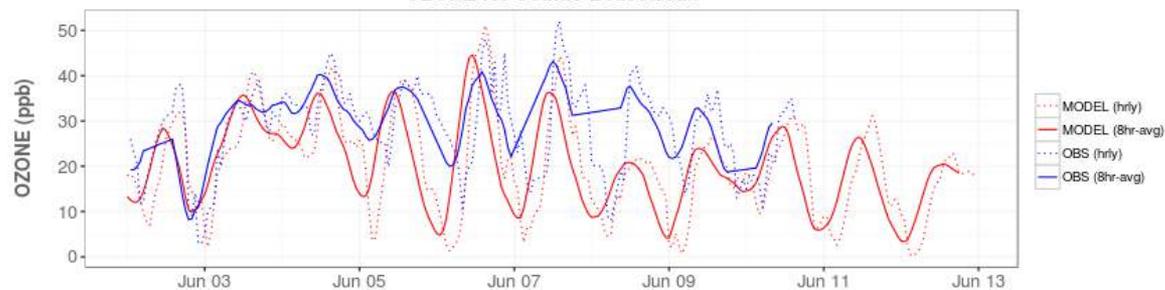
Download Data



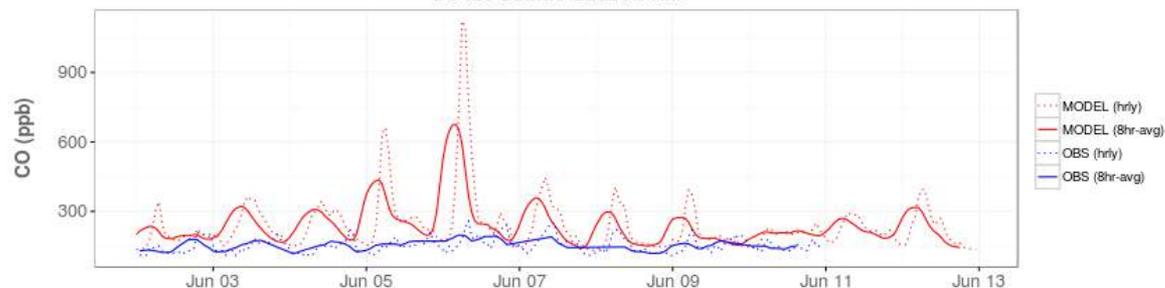
### PM2.5 for Seattle-Beacon Hill



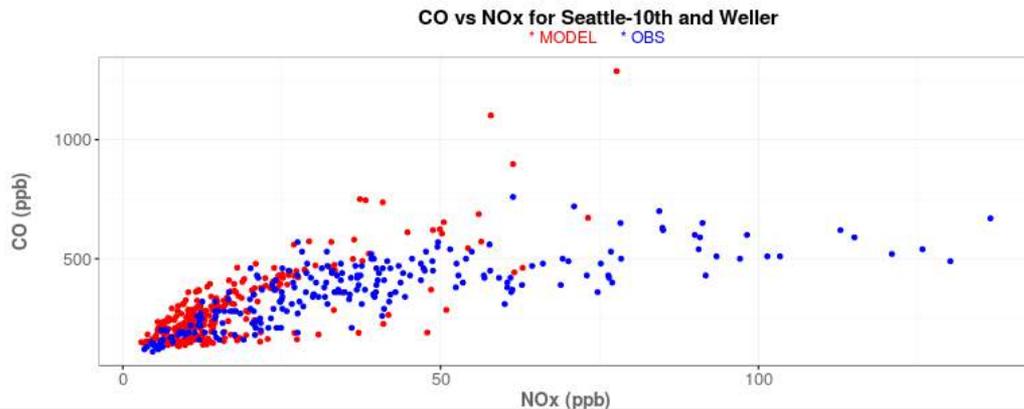
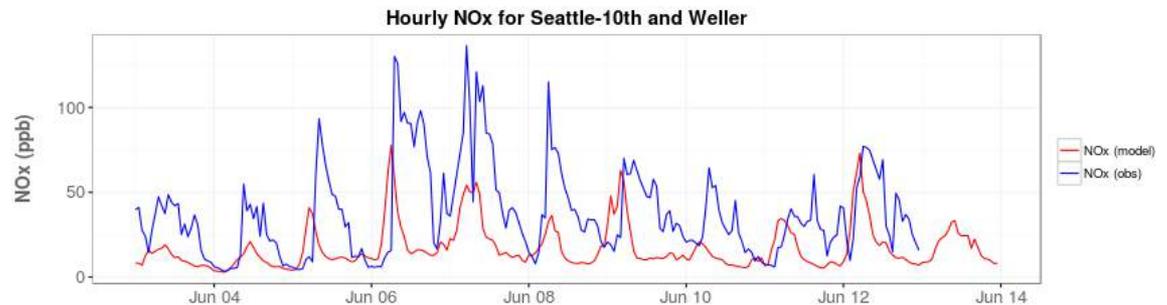
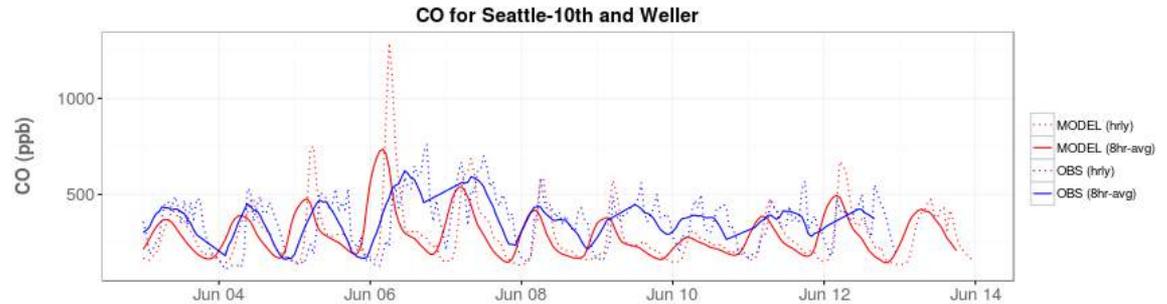
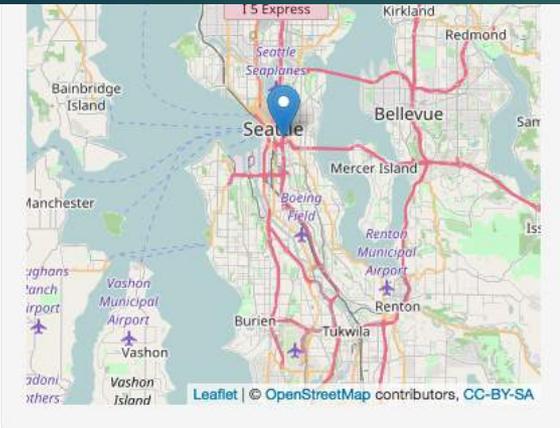
### OZONE for Seattle-Beacon Hill



### CO for Seattle-Beacon Hill



# Performance charting update (2 of 2):



# Emissions Reporting:

## Monthly AIRPACT-5 Emissions Summaries

All Values Represent Daily Average Emissions in Tons/Day

[AIRPACT Home](#)

Select Year:

2017

Select Month:

04

Select State/Province:

Washington

Select County/Region:

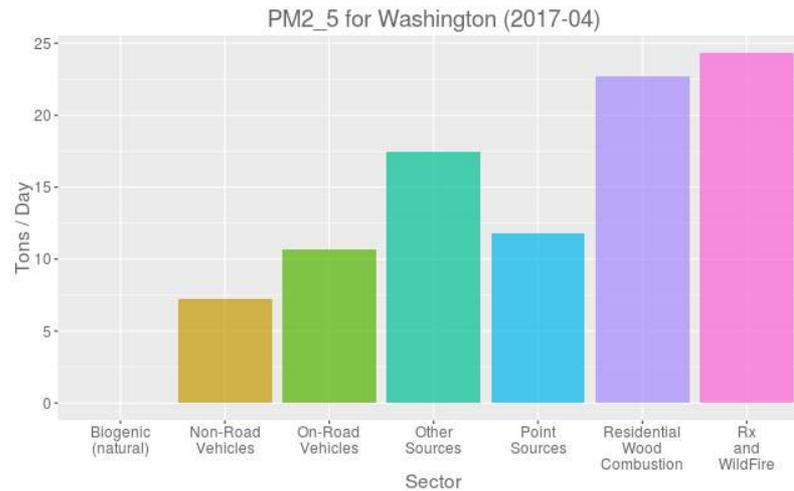
Adams

Select Pollutant:

PM2\_5

Plot summary for:

State/Province  County/Region



Select Sector:

Point Sources

Table below shows results for:

Year-Month: 2017-04

Location: Washington, Adams

Sector: Point Sources

[Download 2017-04 CSV file for all sources](#)

Show 10 entries

Search:

	SourceDescription	CO	NH3	SO2	NOX	VOC	PM10	PM2_5
1	Aircraft	0.323	0.0	0.000778	0.003856	0.0080246	0.00674	0.005174068
2	Agriculture Production - Livestock	0.000	1.8	0.000000	0.000000	0.8233890	0.00000	0.000000000

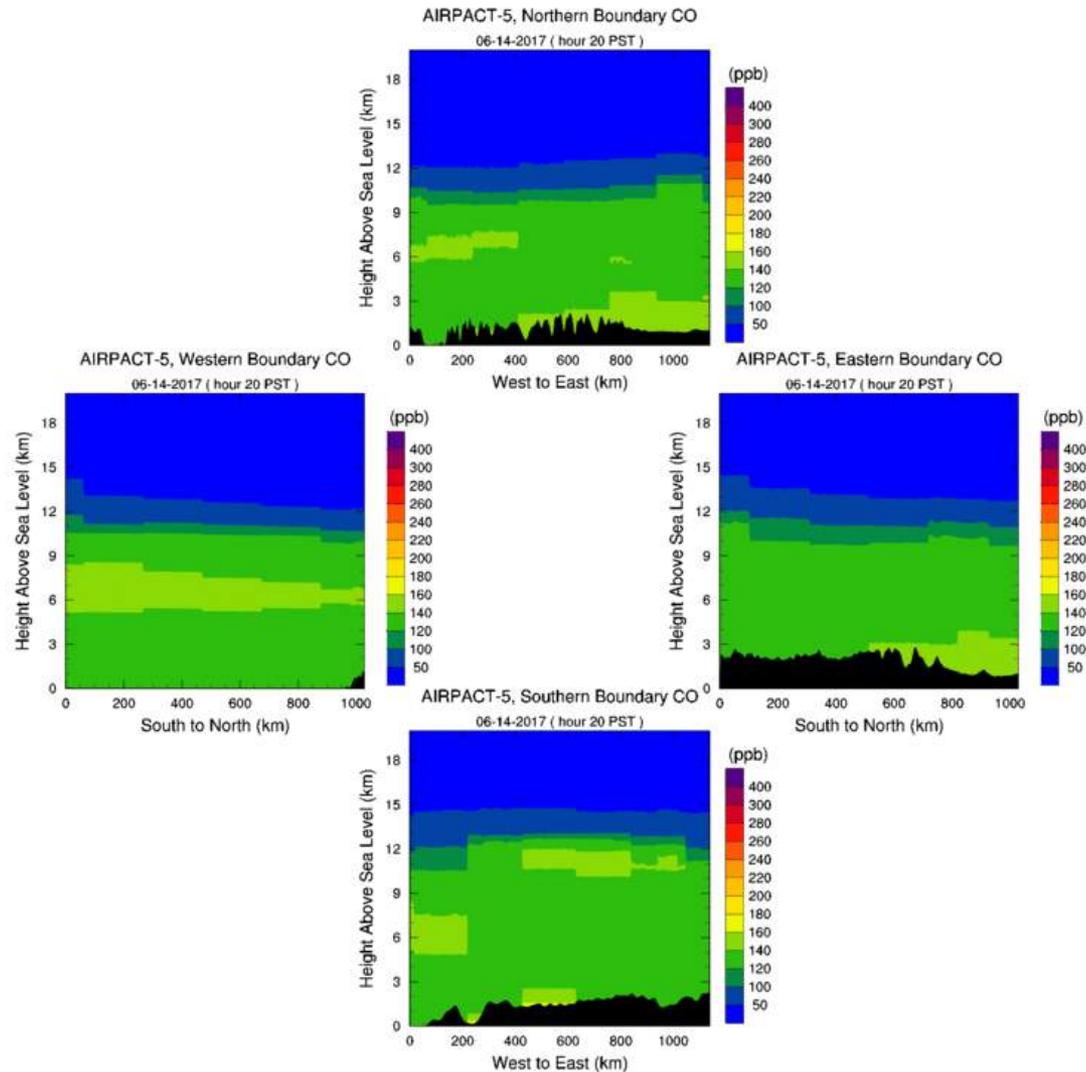
Showing 1 to 2 of 2 entries

Previous 1 Next

# Four-panel BCON animation:

Select CO or OZONE:

Select Image Date:



# One-Time Tasks ( 3 of 3)

General task description	Details
Add modeling evaluation for DAY2	Files are extracted for monitor site & matching DAY2 AIRPACT-5 cells.
Investigate Direct Decoupled Method for source attribution for selected case studies	Mahshid Etesamifard is working on implementation of CMAQ-DDM & application to the Tri-Cities Ozone and Particulates Study (TCOPS)
Hosting wood smoke PM forecast models from formulas shared by the state and local agencies	No such formulas have been received.

# Deliverables

## Status

The 1<sup>st</sup> day forecast products will be produced and updated to the website by 6am Pacific/7am Mountain local time every day with a reliability goal of 95%

The 2<sup>nd</sup> day forecast products will be produced and updated to the website within 6 hours after the 1<sup>st</sup> day products with the same reliability target as the 1<sup>st</sup> day forecast.

Auto-logging of images available on AIRPACT Website for 4 Months of Feb–May:

Feb. 2017: Day1: 2 Missed, 1 Late  
Day2: 4 Missed, 2 Late

Mar. 2017: Day1: 2 Missed, 3 Late  
Day2: 5 Missed, 1 Late

Apr. 2017: Day1: 1 Missed, 2 Late  
Day2: 6 Missed, 3 Late

May 2017: Day1: 0 Missed, 2 Late  
Day2: 0 Missed, 0 Late

**DAY1: 89%**      **DAY2: 82%**

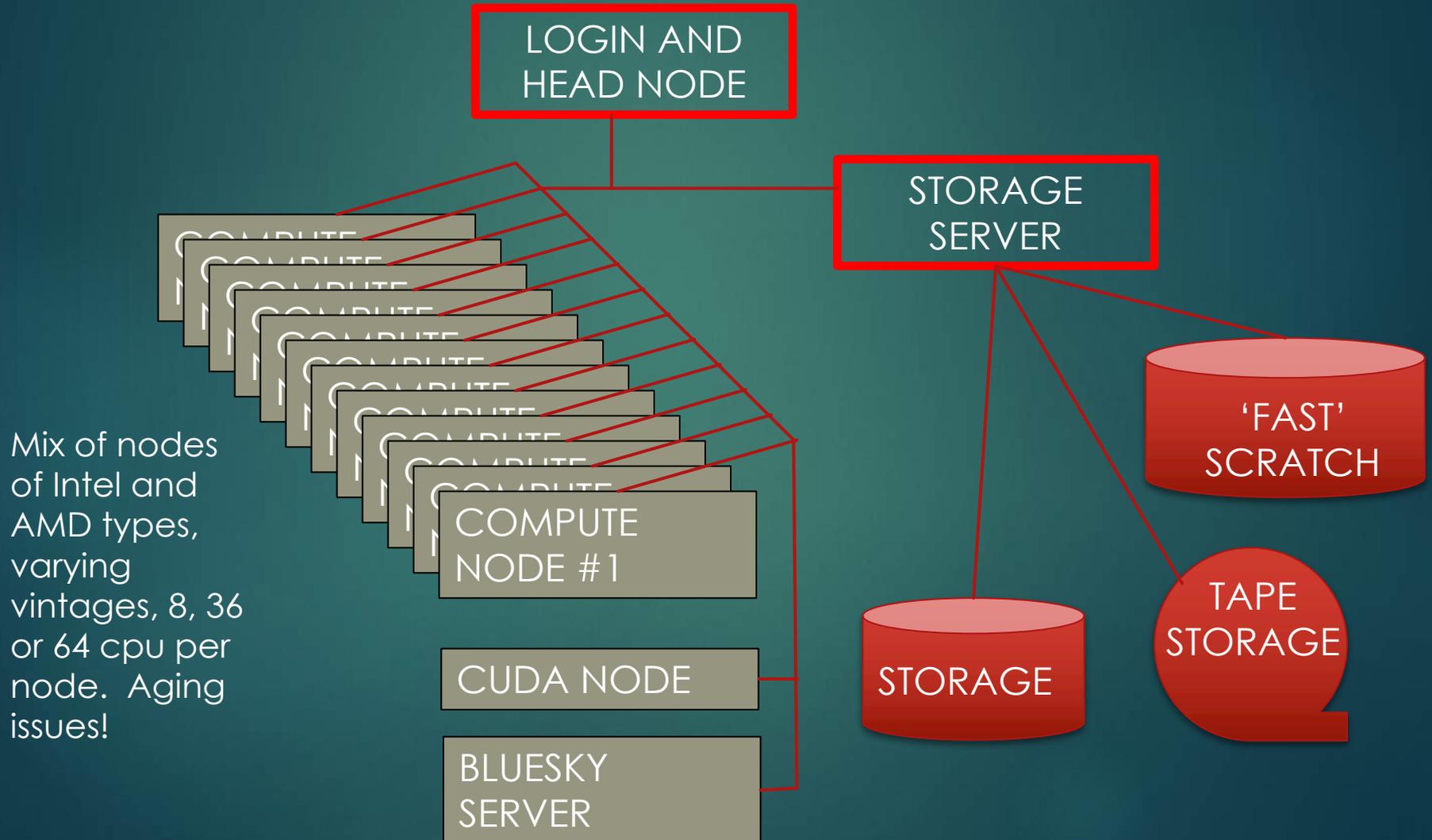
# Aeolus Status:

- ▶ As of June 2017:
- ▶ 20 compute nodes (heterogeneous: Intel, AMD, CUDA)
- ▶ Total of 1128 processors
- ▶ Total of 2.6 TB of RAM
- ▶ Parallel connection via Mellanox 40 Gigabits-per-second (Gb/s) QDR Infiniband.
- ▶ Disk storage, in multiple tiers, totals over 800 TeraBytes.
- ▶ Running CentOS Linux
- ▶ Connected at 10 Gb/s to the campus backbone and is ready to accommodate WSU's High Speed Scalable Research Network at 40 Gb/s.

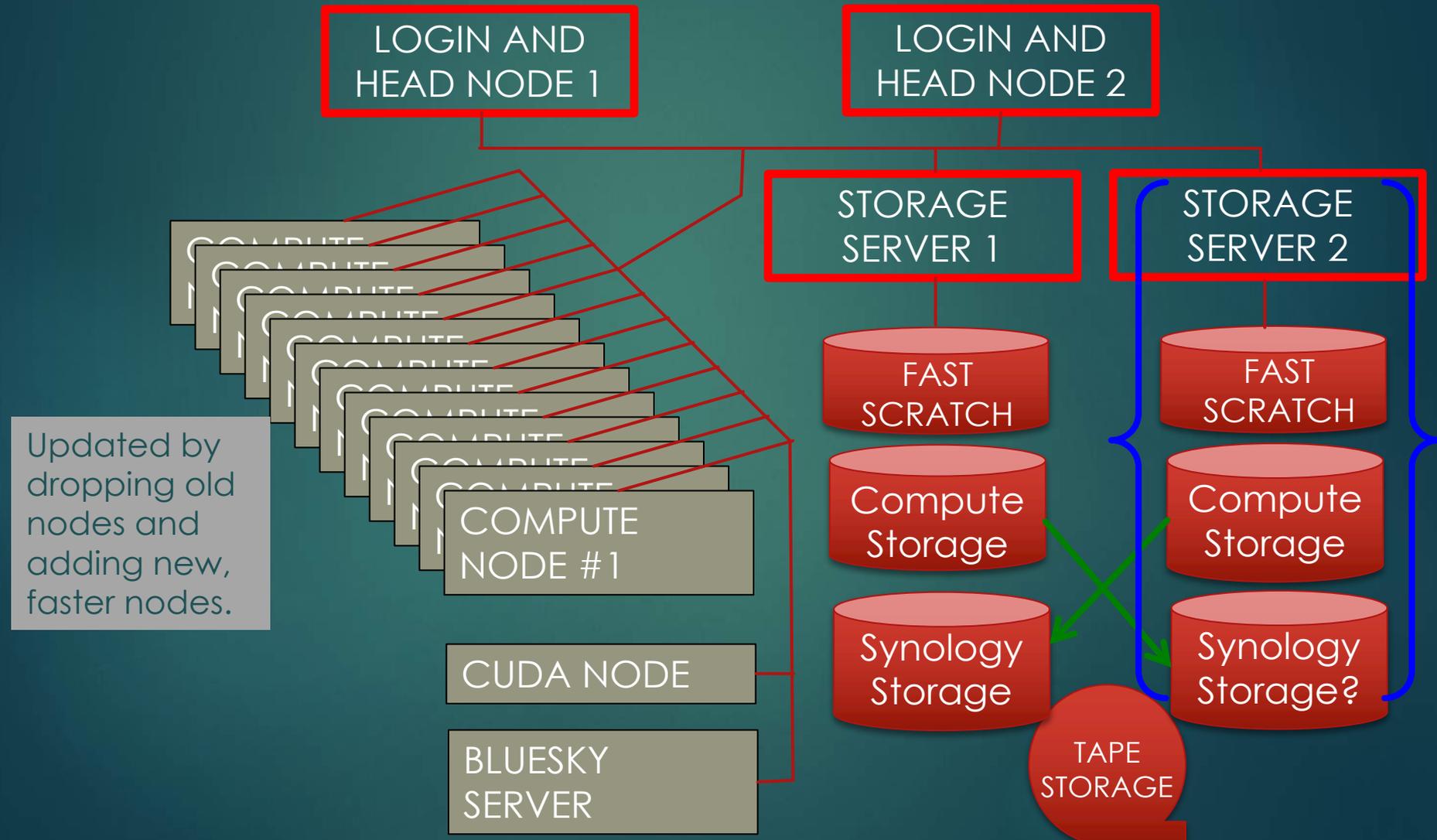
# Aeolus Cluster Evolution

- ▶ May 2017: new queue reservations set up for AIRPACT5 runs:
  - ▶ Two nodes
  - ▶ 60 processors per node
  - ▶ 5 hrs for DAY1 CMAQ
  - ▶ 6 hrs for DAY2 CMAQ
  - ▶ Reservations from 9 PM – 8 AM and 9 AM – 8 PM.
- ▶ Adding storage with purchase of a rack and 48 8-TB disks.
- ▶ Preparing to apply for Cost Recovery Center status to address issues with funding system maintenance.

# OLD AEOLUS CLUSTER



# NEW AEOLUS CLUSTER



# AIRPACT-5

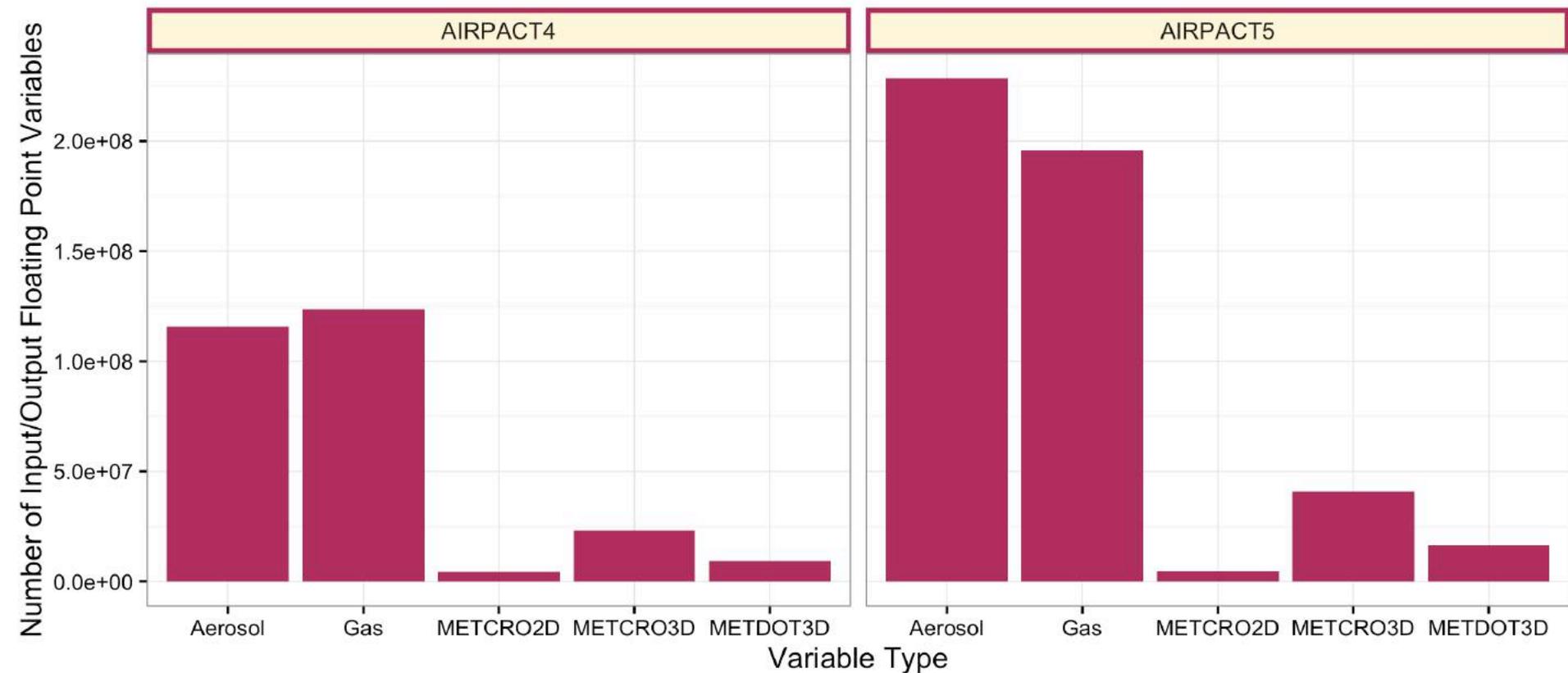
- ▶ Upgrade to CMAQ 5.02 using the CB05 chemical mechanism with improved toluene treatment.
- ▶ Updated Emission Inventory via contributions from AIRQUEST partners
  - ▶ MOVES 2010b (with state-specific activity data)
  - ▶ MEGAN 2.10
  - ▶ SMOKE 3.5.1 (smoke reports are running)
  - ▶ BlueSky version 3.5.1.with SMARTFire2
  - ▶ 2011 NEI + Updates to 2014 for point sources and RWC (WA + OR )
- ▶ Followed UW change to WRF 3.7.1 in Nov. 2015
- ▶ MCIP 3.6 (and working toward 4.2)

# AIRPACT-4 VS AIRPACT-5

	AIRPACT-4	AIRPACT-5
Grid cells	285x258 4-km	285x258 4-km (same)
Vertical Layers	21 layers	37 layers
MCIP	v3.6	v3.6 ( <b>ready for 4.2</b> )
SMOKE	v2.7, v3.5	v3.5.1
CMAQ	v4.7.1	v5.0.2
Gas-Phase Mechanism	SAPRC99	CB05
Aerosol Module	AERO5	AERO6
Anthropogenic Emissions	~2008	~2014
Fire Emissions	SMARTFire v2, BlueSky 3.5.1 (2014 and later)	SMARTFire v2, BlueSky 3.5.1
Biogenic Emissions	MEGAN v2.0.4	MEGAN v2.1

Discussion?

# AIRPACT-4 VS AIRPACT-5



# Inventory Elements:

Element	Old AIRPACT-4	AIRPACT-5
Domain	ID, OR, WA, southern BC and AB	No change
Grid	4-km	4-km
Pollutants	See earlier slide	No change
Speciation	SAPRC99	CB05
Temporal Allocation	EPA CAIR (2001), some local data 1996-2005	EPA 2011v2 platform, some local data 1996 – 2014
Spatial Allocation	Census 2000, LC 1992, VMT 2000-2010, other	Census 2010, LC 2006, FEMA Hazus v2.1 2006, EPA 2003&2010 surrogates, VMT 2002– 2014, other
SMOKE Version	Several: 2.7 – 3.5.1	3.5.1

# Emissions Estimates

Category	Current	New
Point	2007 – WA 2005 – other areas	2011 – USA 2010 – Canada Major updates since 2011 included for ID, OR, WA
Onroad	2009 – MOBILE6.2	2014 – MOVES2010
Nonroad	2009 – NONROAD2005	2014 – NONROAD2008
Nonpoint	2009 – OR 2005 – other areas	2011 – USA 2010 – Canada More categories incl.
Biogenic	WSU-MEGAN2.04 w/ MODIS LCLU	WSU-MEGAN2.10 w/ MODIS LCLU
Large Fires	WSU -SF2/BlueSky for USA	WSU -SF2/BlueSky for USA and Canada

# Emissions Updates

- Aerosol plume propagation: AIRPACT-4 had 3-D gaseous emissions but only (effectively) 2-D for aerosols, limiting plume modeling. This 'bug' has been corrected.
- AIRPACT-4 was carrying fires forward from previous 48 hours, using *persistence*. Now we are only carrying fire forward from previous 24 hours, resulting in fewer short lived fires being projected forward.
- Running BlueSky at 7 pm now (instead of 10 pm) so that it is always ready for the forecast immediately (no pausing airpact to wait for fire emissions)
- MEGAN is now run in parallel, cutting MEGAN's (serial time) delay in forecast run emissions processing from ~ 50 min to ~8 min.
- AFdust: modification of road dust emissions to reflect moisture effects, pending.

# AIRPACT-5 Operation

- 1<sup>st</sup>-day forecast: operational on 12/01/2015
- 2<sup>nd</sup>-day forecast: operational on 04/24/2016
- Ideally:

