



AIRQUEST Annual Report and State of the Model

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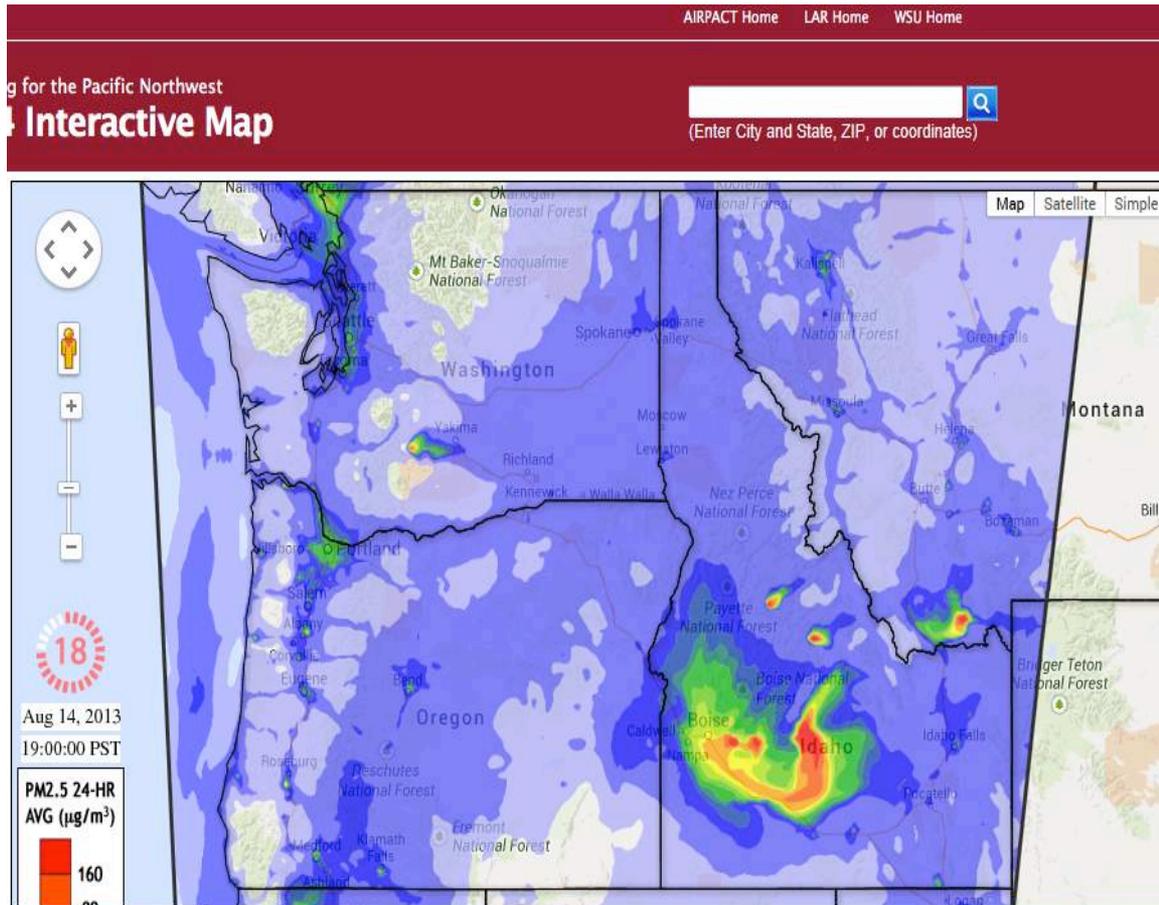
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Ongoing operational tasks--completed

1. Provide daily forecasts of air quality for the three state region that can be used as guidance in daily air quality management.
2. Provide real-time verification statistics of AIRPACT-4 accuracy by pollutant, by month, and provide for user access to AIRPACT-4 results and monitoring data for user-defined periods for download and user analysis.
3. Continue improvements to web graphical display.
4. Maintain the “Change Log”, posted on the AIRPACT website.
5. Archive daily model output and provide access to same upon requests from users.

AIRPACT Air Quality Forecast System



- Daily automated operations
- WRF meteorology
- Dynamic emissions
 - Anthropogenic
 - Biogenic
 - Wildfires
- CMAQ chemical transport model
- 4 km horizontal grid cells

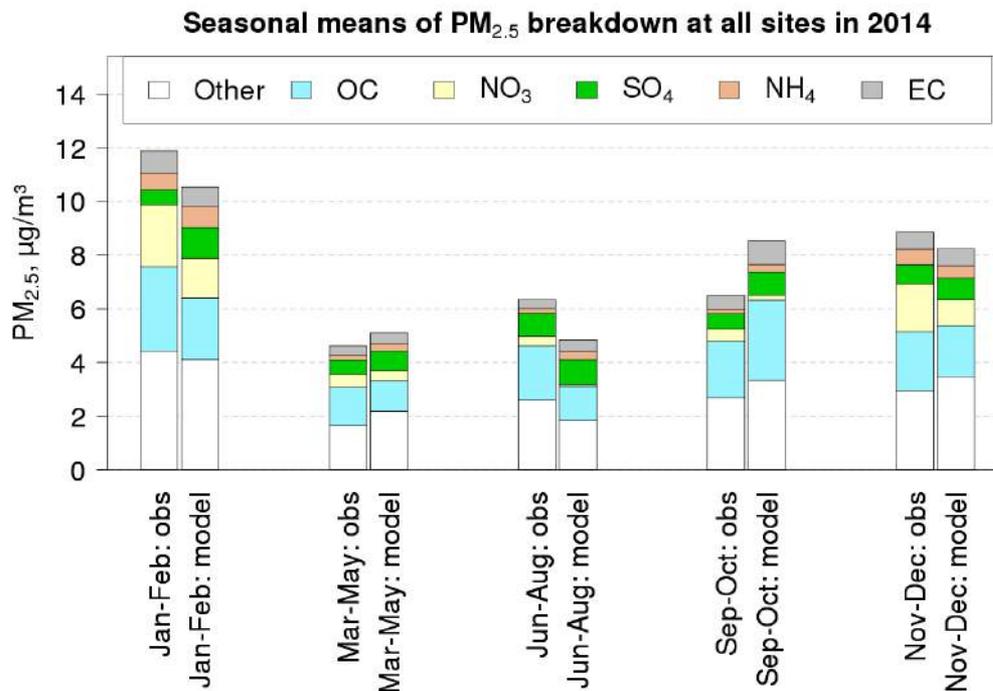
<http://lar.wsu.edu/airpact>



Specific Workplan Tasks

6. Evaluate automated incorporation of speciated $PM_{2.5}$ (nitrate, sulfate, ammonium, OC, and EC) for AIRPACT-4 and provide appropriate model performance statistics with data from EPA's AQS database.

- **Completed, see the performance products web page**





Specific Workplan Tasks

7. Update emission inventories with data supplied by Washington, Oregon, Idaho, and Canada
 - El compilation by states completed
 - **Implementation has been completed—testing has just started this week**
 - Updated MOVES has been implemented
 - New version MEGAN (v2.1) has been implemented
 - Point and area source emissions have been implemented
 - *Fire emissions still being implemented & tested*
 - Initial test runs for July 2012 have been completed



Specific Work Plan Tasks

7b. Potential wood smoke refinements

- A mix of spatial surrogates for wood stove emissions have been identified for testing
- Tests using temperature adjustment plus all temporal factors were completed, but results yielded significant overestimation of PM_{2.5}
- **This task was completed, but results show further work is needed**
- Carry forward to SFY 2015
 - A calibrated mix of surrogates will be tested (see separate presentation). Decisions will be needed as to implementation or further testing.



Specific Workplan Tasks

- 7c. Complete the SMOKE-MOVES integration into AIRPACT
 - **Integration completed using SMOKE v3.5.1**

- 7d. Incorporate BlueSky wildfires in AP4 daily runs. (NASA supported this task)
 - **Integration completed using new SMARTFIRE and BlueSky framework with MCIP meteorology for plume rise**



Specific Work Plan Tasks

8. Continue to develop a 'ClearSky-type' AIRPACT-4 run to include scenarios of prescribed agricultural burns.

- **This task has been completed (See separate presentation)**
 - Building of 21 tracer version of CMAQ completed
 - Building of 30 tracer version of CMAQ completed
 - Scripting of user web interface completed (inactive)
 - Scripting of default emissions completed

Carry forward to SFY2015

- Conduct testing of ClearSky using RARE 2013 Agricultural Burn campaign (scenarios at Nez Perce, ID and Walla Walla, WA)



Specific Work Plan Tasks

9. Continue to evaluate AIRPACT-4 performance.
 - Statistical evaluation for winter 2013 and summer 2012 with and without fires (A. Arroyo, MS student)
 - WRF (MCIP) and CMAQ statistical evaluation completed
 - AP3 Wildfires evaluation (NASA supported)
 - Paper published (Herron-Thorpe et al., 2014)
 - Boise Wintertime Field Program Evaluation
 - Analysis completed, draft paper in progress (Zhang et al., 2014)
 - YAWNS Field Program Evaluation (D. Polley, MS student)
 - Various aspects of evaluation have been completed
 - Results will be summarized in MS Thesis this summer
 - Regional Haze 2009-2010 Evaluation completed (V. Ravi, PhD student)
 - Results presented in Regional Haze report
 - Ozone performance evaluation completed during spring based on combination of analyses
 - AIRPACT-4 had good overall performance statistics
 - Max O₃ concentrations were significantly overpredicted
 - A wide range of factors were tested
 - No single factor could explain the overprediction
 - Decision: wait for Airpact-5
 - **Overall, this task has been completed**



Specific Work Plan Tasks

10. Provide support to Washington, Oregon, and Idaho as they evaluate spatial surrogates for the 4-km AIRPACT-4 grids, including a review of land use based emissions, like isoprene and pinene over forest zones, SO₂ over waterways, NH₃ over agricultural zones, wood smoke over residential areas, and NO_x over industrially zoned areas.
 - No requests received
 - Corrected error in NH₃ emissions in California
 - Modified land-use data to treat isoprene emissions from Boardman and Columbia River poplar plantations
 - **This task has been completed**
- Carry forward to SFY 2015
 - As needed



Specific Work Plan Tasks

11. Update model code to CMAQ v 5.0.2 when emission inventory updates are completed.
- The Airpact-5 framework (CMAQ 5.0,2) with updated emissions has been constructed
 - Testing has just been initiated
 - **This task is partially completed**

Carry forward to SFY 2015

- Conduct initial tests using 2012 summer and winter periods
- Implement Airpact-5 as an operational system
- Conduct evaluations of Airpact-5 in operation using summer/winter 2015-2016 forecast results



Specific Work Plan Tasks

12. Incorporate a BCON operational tracer product for ozone to assess contributions of long range transport and stratospheric ozone to surface ozone concentrations in the AP-4 domain. (NASA supported task)
 - Evaluating effects of adding more layers to AP4 in the boundary layer and also in the free troposphere
 - Analysis of BCON ozone tracer underway for draft paper
 - **This task has not been completed**
- Carry forward to SFY 2015
 - Evaluate layer effects
 - Complete analysis of BCON tracer to decide whether to implement as an operational product, TBD



State of the Model

- AIRPACT-3 has been deactivated (Breezy cluster failure and removal)
- AIRPACT 4 status
 - SMOKE version 2.7
 - MCIP version 3.6
 - BlueSky version 3.5.1 .with SMARTFire 2
 - CMAQ version 4.7.1
 - AIRNOW obs automatically ingested and used for automated evaluation
 - By station and pollutant
 - Monthly summaries available
 - Data can be downloaded
 - Range of satellite products routinely ingested for display and analysis



Forecast Completion Statistics

Airpact performance	total days delayed	UW delay	WSU delays
July '14	14	1	13
Aug '14	0	0	0
Sept '14	0	0	0
Oct '14	4	0	4
Nov '14	7	1	6
Dec '14	6	3	3
Jan '15	2	1	1
Feb '15	2	1	1
Mar 15	4	0	4
Apr '15	10	0	10
May '15	6	0	6
Jun 15	3	0	3
Totals	58	7	51
% delayed	~16%	~2%	~14%



Various AIRPACT-4 Failure Modes

- Either BlueSky server fails to deliver fires or SMOKE processing fails. (runs...)
- File transfer to webserver fails (runs but results are unavailable!)
- I/O error on overloaded /data storage
- /data storage goes offline and must be rebooted
- Maui/Torque *enqueues* jobs but does not start them, affecting CMAQ or post-processing
- Resources (libraries, name-server, etc.) go missing
- System discombobulated by upgrade to InfiniBand!



AIRPACT-4 runs on Linux Cluster Aeolus)

Upgrade Purchase of June 2015

Two 400 GB Solid State Drives for Fast Storage Servers, for L2ARC and SLOG cache to enhance the performance of the storage

HASWELL CPU for High Speed Storage Server

Twenty-five 10K RPM disks for fast storage server

Internal SFF 8087 servers for attaching SAS HBA to SAS Expander

RAM for High Speed Servers

Forty-eight 4TB enterprise hard disks



State of the Model (cont)

- AIRPACT-5 framework has been constructed and testing has started
 - Updated Emission Inventory
 - CBO5 as the chem mechanism
 - MOVES 2010b
 - MEGAN 2.10
 - SMOKE 3.5.1
 - MCIP version 3.6
 - BlueSky version 3.5.1 .with SMARTFire 2
 - CMAQ version 5.0.2
 - Post-processing being modified to track CB05



Questions



AIRPACT-4 Timing

