WSU FY22 Annual Report

For the NW-AIRQUEST Consortium

Von P. Walden and Amin Vahidi
27 June 2022

Personnel

Personnel

- Dr. Von P. Walden - Principal Investigator / Group Leader
- Dr. Amin Vahidi - Postdoctoral Fellow
- Ana Carla Fernandez-Valdez - Graduate Student
- Matthew Roetcisoender - Former MS student (AQ sensors and sensor network)

- Joe Vaughan - Acclaimed LAR and NW-AIRQUEST colleague (still around!!)

- Mahshid Etesamifard - Graduated with Ph.D. in December 2021

Good News!

- The WSU CEE has been granted approval to fill a faculty position in atmospheric modeling
  - Replacement for Yunha Lee <— Brian Lamb
  - Anticipated start date is summer 2023

Budget Status

Budget Status

- FY22 was the second year of a two-year (biennium) budget
  - WSU and LAR appreciated being able to carry-over $40K from FY21 to FY22
- FY22 budget has now been spent to $0K
- Anticipated budget for FY23 is $110,000 (no equipment $$ this year)

Budget Status

- The carry-over funds and the late arrival of LAR's new postdoc allowed for two investments (discussed below):

1. **Upgrade of the AIRPACT website**
2. **Off-site mass storage system**

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Budget Update for NW-AIRQUEST on 2 February 2022

Balance on 2 February 2022	$131,887.00
Ana Carla	$15347.60
Amin	$26940.00
Von	$12304.23
AIRPACT website (Jen Hinds)	$15000.00
Equipment	$26000.00
F&A	$36187.75
Remaining at 30 June 2022	$107.42

Anticipated budget for FY23

- **Salaries** = $92,000
  - 8 months - Amin Vahidi (postdoc)
  - 6 months (half-time) - Ana Carla Fernandez-Valdes (graduate student)
  - 1 month - Von P. Walden
- **Web maintenance** = $7,000
- **WSU overhead** (12%) = $11,000
- **TOTAL = $110,000**

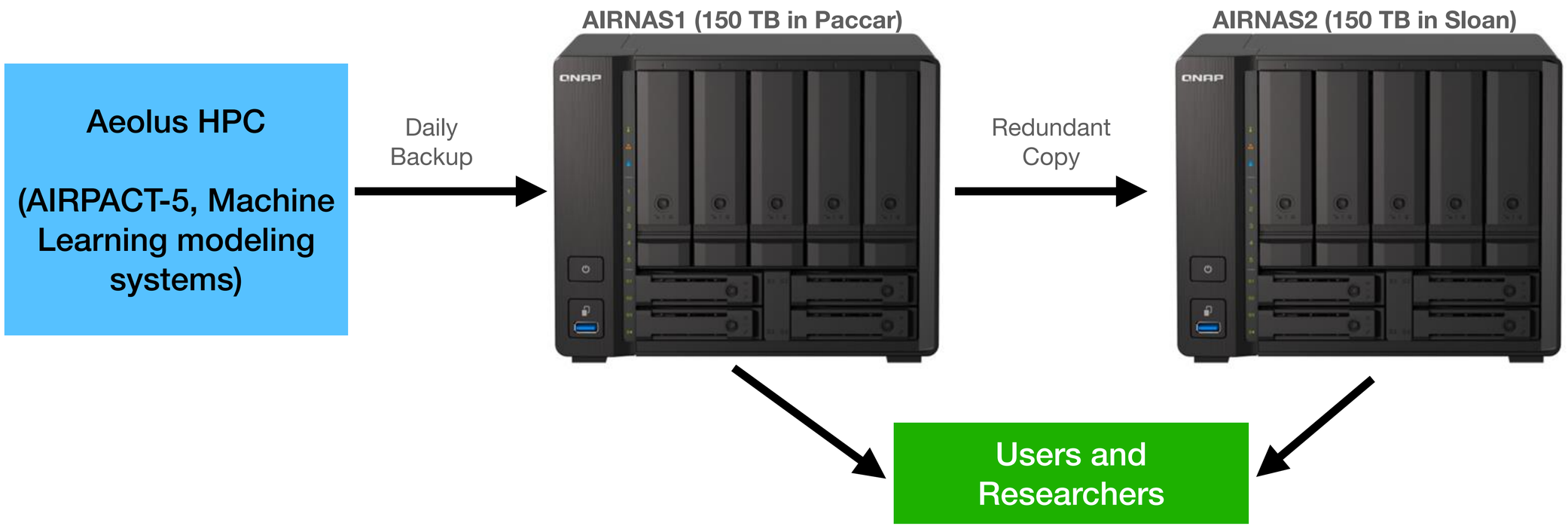
Equipment

Equipment update

- The Aeolus HPC cluster continues to run the AIRPACT5 modeling system each night.
- The new Motley HPC cluster is still not available for our use.
- Technical and User Support remain as issues in our college and at WSU.

Equipment update

- Invested in two redundant off-site Network Access Storage (NAS) devices.
  - Basically, personal cloud storage



Equipment update

- Advantages of NAS devices
  - All of the AIRPACT and ML modeling data on one storage system.
  - Decoupled from HPC; avoids local storage issues
  - Flexible storage that won’t depend on a single HPC; no data transfers
  - Quick and easy access to data from all users and researchers

On-going Tasks

ONGOING TASKS

Task	Status June 2022	
1. Provide daily forecasts of air quality for the three state region that can be used in daily AQ management.	DAY-ONE runs for Jan 2022 thru June 2022: (Success rate: 100%) DAY-TWO runs for Jan 2022 thru June 2022: (Success rate: 100%)	

ONGOING TASKS

Task	Status June 2022	
2. Provide near real-time verification statistics of the current AIRPACT system accuracy by pollutant, by month, and Provide for user access to AIRPACT results and monitoring data for user-defined periods for download & analysis.	Statistics continue to be maintained. Filled data requests: Rong Li (Idaho DEQ) requested rolling 8-hour ozone data from AIRPACT5 for Pocatello and Idaho Falls for 2021	

ONGOING TASKS

Task	Status June 2022	
3. Track and continue to improve model performance so that model predictions provide useful guidance for air quality forecasting.	Continuing; no issues.	

ONGOING TASKS

Task	Status June 2022	
4. Maintain ambient air monitoring data streams from AIRNow.	Continuing; no issues.	
5. Maintain satellite retrievals that are still functioning (except for MODIS and OMI).	Continuing; no issues.	
6. Continue improvements and requested additions to web graphical display.	“visual range” (VR) was added	

ONGOING TASKS

Task	Status February 2022	
7. Maintain the “Change Log”, posted on the AIRPACT website.	Ongoing. Now stored at GitHub; https://github.com/wsular/airpact	
8. Archive daily model output of the first 24 hours. Web-based graphical displays for each day’s first 24 hours of forecast should be available for the most recent 5 years & gridded files for at least one month.	Ongoing. Forecast graphics available beginning December 2015.	

ONGOING TASKS

Task	Status June 2022	
9. Modify AIRPACT as needed to respond to changes in fire emissions produced by other organizations. 10. Continue hosting the link to the latest background concentration lookup tool.	Ongoing as needed Hosted by IDEQ: http://lar.wsu.edu/nw-airquest/lookup.html has link	

ONGOING TASKS

Task	Status February 2022	
11. Modeling infrastructure maintenance and updates.	Continuing; no issues.	

FY22 Tasks

TASKS CARRIED FORWARD TO 2021-2022

FY 2021 Task		Comments

1. Create updated AIRPACT6 forecasting framework to accommodate changes in computation platform and implement component updates/ upgrades		Proceeding with creation of a “Singularity container” (like Docker, but for HPCs):
		• Singularity container was created with Linux Centos 7
		  • Development is being tracked on GitHub
		  • https://github.com/wsular/airpact6/blob/main/singularity/cmaq.def

TASKS CARRIED FORWARD TO 2021-2022

FY 2021 Task		Comments
2. Update biogenics to MEGAN v3 in AIRPACT6 (possibly with HPC parallelization)		Ana Carla and Amin are working on MEGAN compilation; currently an issue with netCDF libraries
3. Switch to running with updated emissions and SMOKE 4.5, in AIRPACT6.		Current versions of CMAQ and SMOKE are installed in the Singularity container
4. Extend the AIRPACT forecast period from 48 h (2 days) to 72 h (3 days), in AIRPACT6.		This will be tested once the AIRPACT-6 Singularity container is complete

TASKS CARRIED FORWARD TO 2021-2022

FY 2021 Task		Comments
5. Implement the Simple Air Quality Model (PSCAA) for PM2.5 in Tacoma, in AIRPACT6.		Corresponded with Phil S about this. Amin and I now understand more about the Python code that runs this model. So, it should be possible to run the model over any desired domain.

TASKS CARRIED FORWARD TO 2021-2022

FY 2021 Task		Comments
6. Interpolate ML forecasts for ozone and PM2.5 to provide domain-wide forecasts, in AIRPACT6.		Ana Carla added more robust error-checking to Kai Fan's ML model; LAR is currently running a version along side Kai's version Interpolation will be implemented into LAR's version of the ML model; still in-progress.

TASKS CARRIED FORWARD TO 2021-2022

FY 2021 Task		Comments
7. Incorporate existing sensor networks (Urbanova, Purple Air, etc.) into ML forecasting system, in AIRPACT6.		Ana Carla is working on this. • Purple Air recently changed their data API • She can now access both current and historic data from Purple Air • Plan is to incorporate these data into LAR's ML model

TASKS CARRIED FORWARD TO 2021-2022

FY 2021 Task		Comments
8. Case studies for ozone and PM2.5 for events using new AIRPACT6 system (rerunning previous events for evaluation and study).		Work will begin after the completion of AIRPACT6.

TASKS CARRIED FORWARD TO 2021-2022

FY 2021 Task		Comments
9. Experimental drone flights of opportunity to study wintertime inversion conditions (e.g., Pinehurst, ID).		Work on hold due to Covid-19 pandemic. But drone, camera (visible, near-infrared, infrared), and some sensors (met, PM) are available for future experiments.

New FY22 Tasks

NEW 2022 TASKS

FY 2022 Task		Comments
Migration of AIRPACT scripts and code to GitHub repository		Completed. AIRPACT Operations (public) https://github.com/wsular/airpact AIRPACT6 Development (private) https://github.com/wsular/airpact6 ML Model Development (private) https://github.com/wsular/aq-ml-model-kai_fan

NEW 2022 TASKS

FY 2022 Task		Comments
Collaborate with Ecology to develop internal website to extend long-term 3- to 5-day ensemble forecasts, to cover ID and OR.		Waiting for AIRPACT-6 development.

NEW 2022 TASKS

FY 2022 Task		Comments
Further development of AIRPACT Forecast Modeling System		• “Containerize” AIRPACT6 for potential remote deployment (in progress) • Test use of cloud storage for long-term AIRPACT data archival (Done)

NEW 2022 TASKS

FY 2022 Task		Comments
Upgrade of AIRPACT website		• Invested in upgrades using carry-over and salary savings • https://lar-new.vcea.wsu.edu/map.html

lar-new.vcea.wsu.edu

AIRPACT

Air-quality forecasting for the Pacific Northwest

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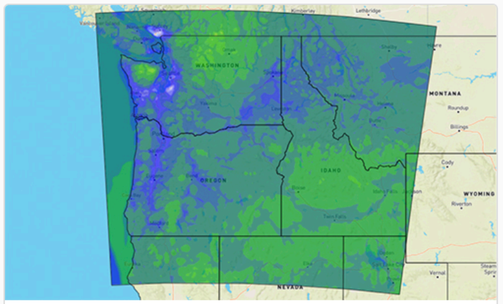
Welcome to AIRPACT

Air-quality forecasting for the Pacific Northwest

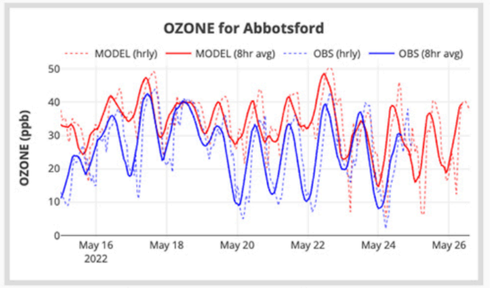
The goal of the AIRPACT (Air Indicator Report for Public Awareness and Community Tracking) project is to provide timely air quality forecasts for the Pacific Northwest.



Air Quality Forecast Map

Species concentrations, emissions, meteorology

Go to Tool



Performance Charts

Compare AIRPACT forecast to AIRNow observations

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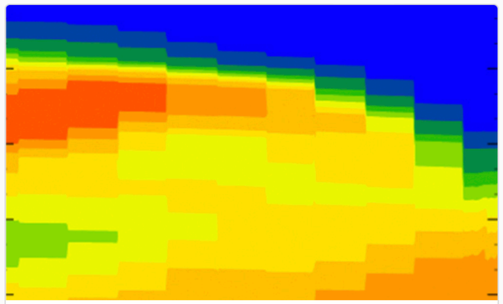

Boundary Conditions

Vertical curtain plots for the north, south, east, and west boundaries of AIRPACT for OZONE, PM2.5 and CO

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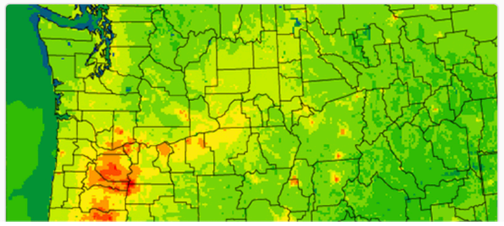

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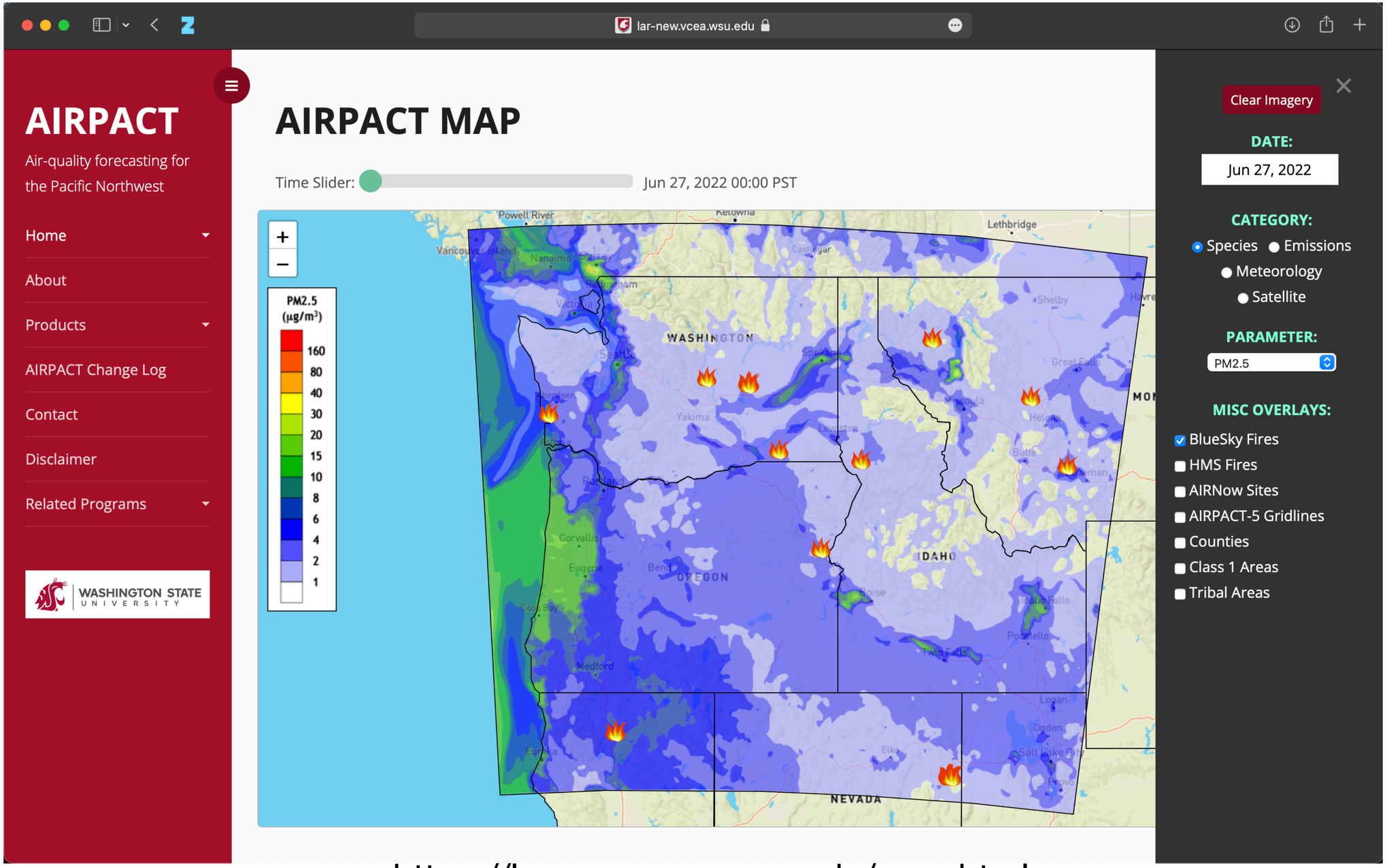

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Thank You!!

Questions?