

**Overview of
SFY2017 Air Quality
Work with UW**

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NW-AIRQUEST
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Scope of Workplan

- **WRF forecast model**
- **Daily ensemble modeling**
- **Aggregating observations**

SFY17 WORK PLAN

Project title: Northwest Regional Prediction Model-2 (MM5 and WRF)

Project Duration: July 1, 2016 – June 30, 2017

Description and scope of project:

1 The Northwest Regional Prediction effort has three major components: high-resolution weather predictions made twice daily using the MM5 and WRF mesoscale atmospheric models, 2 daily ensemble forecasting providing probabilistic and uncertainty information, 3 and real-time collection of observations from all available sources throughout the region.

Work Plan:

The University of Washington will:

1. Provide a suite of meteorological analyses and forecast products to air quality agencies in Washington, Idaho and Oregon twice daily, using operational runs from the current and future regional versions of NCEP's Weather Research and Forecasting model (WRF) at 36, 12, 4, and 4/3 km grid resolution. Continue running NAM-MM5 model at 36 and 12 km grid spacing. Products are to be available via the University of Washington's Department of Atmospheric Sciences website (<http://www.atmos.washington.edu/mm5rt/>) at approximately 8AM/8PM Pacific Standard Time (36, 12, 4 km domains) or approximately 1PM/1AM (1.3 km grid) following the 1200 or 0000 UTC initialization times of the modeling system. Forecast products shall extend out to 180 hours for the 36 and 12 km resolutions, 84 hours for 4 km resolution, and 60 hours for the 4/3 km resolution. This suite of products will be referred to as the University of Washington Environmental Prediction System (ENVPREDSYS). Products shall include:
 - a. Surface and upper air charts
 - b. Ventilation products
 - c. Upper air soundings
 - d. Meteograms
 - e. Time height series

Air quality products, including all the ventilation indices, will be generated as the forecast progresses, rather than when the entire forecast is complete.

- **For next year:**
 - **Remove NAM-MM5**
 - **Update 4/3 km to 72 hours**
 - **Revise for ensemble system**

Ensemble Modeling

2. The UW ensemble system will be maintained and run twice daily. Graphics and air quality products similar to the WRF production will be developed as the ensemble system becomes more reliable. Move to running an expanded ensemble set at 12 or 4 km resolution, including initialization perturbations,

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physics perturbations, and versions of WRF optimized for stagnant air conditions.

- **We would like this to be more of a focus, but there is not extra funding at this point.**
- **One member could be optimized for stagnant air.**

“Things Will Come Up”

3. Maintain and improve the dissemination of the Northwest regional forecasts through the web and other means. Continual improvement will be made to the regional prediction web site, including improved graphics, color schemes and additional products. Specific elements will be determined in collaboration with the NW Regional Modeling Consortium partners who are providing funding. Priority for graphics additions and improvements will be based on the relative contributions of participating agencies.

- **Please coordinate with me on these.**

Improve the Model for Our Applications

4. Provide periodic assessments of which aspects of model science, if any, are deficient for meteorological modeling needs. Recommend methods for resolving deficiencies and provide written analytical assessments of model science improvements as needed. Make needed improvements in the modeling system, including updating to new versions when verification statistics indicate a positive impact.

Model Verification

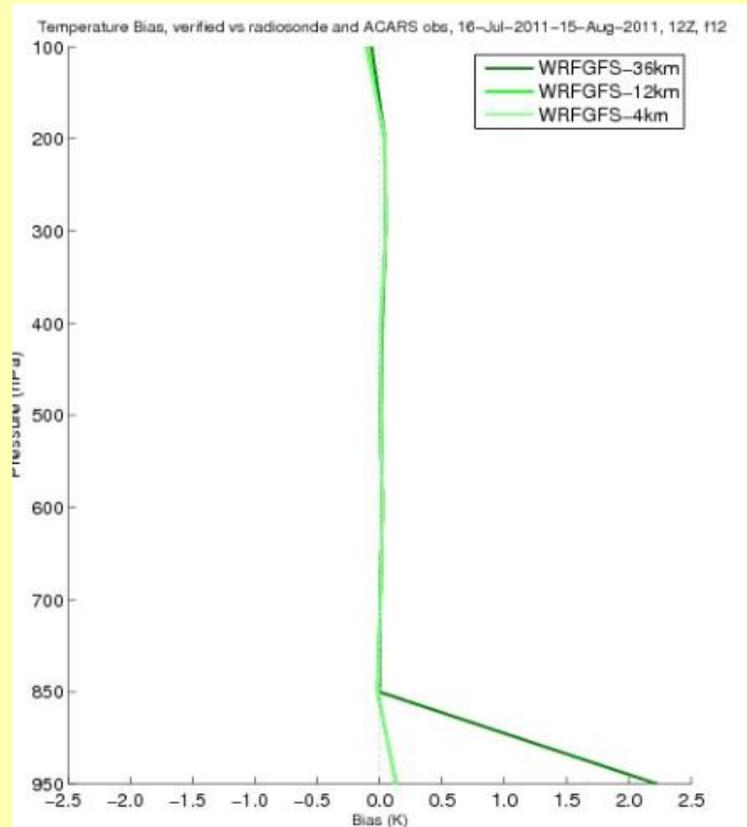
5. Provide on-going automated statistical comparisons and verification of the various forecast systems within the ENVPREDSYS. Perform upper-air verification at as many near-surface levels as possible.

When changes to the model are made, model performance will be assessed. In addition, the changes will be tested for recent periods and locations as provided by the air quality agencies. It is incumbent upon the air quality agencies to provide specifics on these episodes in order for this task to be completed.

- **Much discussion and effort on this topic last year.**

Upper Air Model Verification

http://www.atmos.washington.edu/~qcreport/verification_plot.psp?plot=upper&var=temp&itime=12



- **New product**
- **Need members to weigh in on what would be useful.**

PBL Modeling

6. Continue assessment of PBL, LSM, and convective schemes in WRF. Assessment will be made for all areas of the domain and times of the year, but particular attention will be paid for performance during wintertime stagnant conditions.

Update the Graphics to the 21st Century

7. Research and test new systems for displaying web graphics. One goal would be to allow users to zoom into a particular area and have the labels, wind barbs, etc. scale appropriately. Another is to give the viewer the ability to zoom in, at full resolution, for an area of interest.
8. Until the new web display system is in place, implement graphical subdomains for the 1.33 km domain as requested by the air quality agencies. Implement emergency graphical subdomains and trajectories (e.g., for areas with wildfires), as requested.

- **It is otherwise hard to interpret 4/3 km model output, limiting its usefulness.**
- **This is not a trivial task for the number of graphics we produce every model run.**
- **http://www.atmos.uw.edu/wrfprt/on_the_fly_plots/**

4/3 km Domain Expansion

9. Expand the 4/3 km domain to include all of Oregon and make this expansion fully operational. Add 4/3 km graphical subdomains for Boise, the SW Oregon, and the

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eastern slopes of the Oregon Cascades. Referring to the following document for Klamath Falls, Oakridge, and Medford, <http://www.deq.state.or.us/aq/forms/2015aqMonPlan.pdf>, add back trajectories for Bend (town center, not airport), Klamath Falls (see page 80), Oakridge (see page 76), Medford (see page 78), and Boise (Boise International Airport).

- **USFS is paying for a domain expansion.**
- **We want to make sure some of our standard products are added.**

Some Things We Want to Make Sure Get Done

10. Implement the Air Stagnation Advisory graphic.

11. Implement a form of drag parameterization to improve wind speed performance during stagnant wintertime episodes without sacrificing accuracy during high wind events.

- **Lingering issues that have not gone much attention.**

Deliverables

Deliverables:

1. ENVPREDSYS products will be produced and updated to the website 365 days a year with a reliability measure of at least 97%.
2. Provide ENVPREDSYS gridded data fields from the 00 UTC operational runs to Washington State University- AIRPACT and ClearSky predictions systems by 08Z. If Airpact-4 switches to the 12 UTC operational run, work with Washington State University to provide them that dataset instead.
3. Annual “state of the model” report must be provided to Project Sponsor for the contract period ending June 30, 2015. This report can be in the form of a presentation to the Consortium. The report must detail progress made against specific deliverables, status of performance measures, problems encountered and or resolved, and future direction/recommendations. Include status of ENVPREDSYS work including progress on goals, specific deliverables, and status as to performance measures.

What is the environmental outcome? This project provides for the underlying data needed to drive a suite of air quality prediction and forecasting tools. These tools are used for forecasting air quality in the Pacific Northwest and also for assessing the impacts to air quality resulting from direct emission reduction activities (e.g. burn bans, smoke management, daily air quality forecasts). As a result, this project provides critical data essential to air quality planning and daily operations of air quality management programs. These activities will result in improved air quality as well as improved warnings to allow protection of vulnerable populations.

Project Period: July 1, 2016 through June 30, 2017

Project Sponsor: Jerry Boyum, Lane Regional Air Protection Agency

Project lead or technical lead/number: Dr. Clifford Mass, University of Washington

Future Work

- **Revise #1**
 - Remove NAM-MM5
 - Update 4/3 km to 72 hours
 - Revise for ensemble system
- **Ideas on the issue of verification?**
- **Continue making user-useful products**
- **Push for 21st century graphics**
- **Ensemble modeling**
- **Modeling for stagnant air episodes**