Wildfire updates

Quick recap of Nov 2017
wildfire modeling meeting

Erik Saganic

Workshop slides here

- http://dl.pscleanair.org/2017WildfireWorkshop

Rick Graw – Smoke model comparison table

Table 1. Operational Daily Smoke Models – Purpose, Products, Websites, and Contacts

Model Component	Blue Sky Daily Operational Runs (v3.5.1)	HRRR Smoke	FireWork	AIRPACT 5	NOAA/NWS National Air Quality Forecast	Comments
Purpose	Simulate the emissions, transport, and concentration of smoke from wildfire and prescribed fire.	Addresses the need for a coupled meteorological-wildfire smoke forecast model.	To provide numerical guidance (PM2.5 concentrations) to forecasters for inclusion of biomass burning.	Provide timely air quality information to people in the Pacific Northwest region.	Provide next day operational predications for ground level ozone, smoke, and dust	
Products	Surface levels of PM2.5: • hourly • 3-hr • 24-hour: • daily 1 hr max Daily Emissions (tons) Fuel Bed Fire Growth (acres)	• Fire radiative power • Near-surface smoke • Vertically-integrated smoke • 10m wind • 1hr precipitation • 2 m temperature	PM2.5 (from biomass burning emissions) Ground level: • 24 and 48 hour avg. • 1-hr max Total column	Surface PM2.5 Surface Ozone N and S Deposition	HYSPLIT Smoke and Dust • Surface • Vertical Integration CMAQ : • Surface Ozone (does not include gaseous emissions from wildfires). • 1-hr and 24-hr total PM2.5 (& bias corrected):	Daily average PM2.5 is helpful for comparison with EPA AQI which is also 24-hr avg.
Domain	Variable from Canada and CONUS, to sub-regions.	Continental US (CONUS)	North America	Washington, Oregon, Idaho, and parts of MT, CA, NV, UT, and WY	HYSPLIT smoke: North America CMAQ PM2.5 with smoke emissions: CONUS,	
Frequency of runs	Once a day for WRF. Twice a day for the NAM domains (00z and 12Z) Up to 4x/day for the NAM 1 km domains	Four times a day Every 6 hours (00, 06, 12 and 18 Z)	Twice daily: 00z and 12z April – October only	Once per day.	HYSPLIT: 1/day (06Z) CMAQ: 2/day (06Z, 12Z)	
Forecast period	36 hours (1 km variable) 60 hours (1.33 km PNW) 72 hours (4 km PNW) 84 hours (12 km CONUS) 48 hours (3 km CONUS) 5 days for 0.5 degrees	36 hours	48 hours	48 hours	48 hours	
Website	https://www.airfire.org/data/bluesky-daily/	https://rapidrefresh.noaa.gov/hrrr/HRRRsmoke/	http://weather.gc.ca/firework Development site (pw)	http://www.lar.wsu.edu/airpact/gmap/ap5/ap5smoke.html	http://airquality.weather.gov/ CMAQ PM: http://www.emc.ncep.noaa.gov/mmb/aq/	

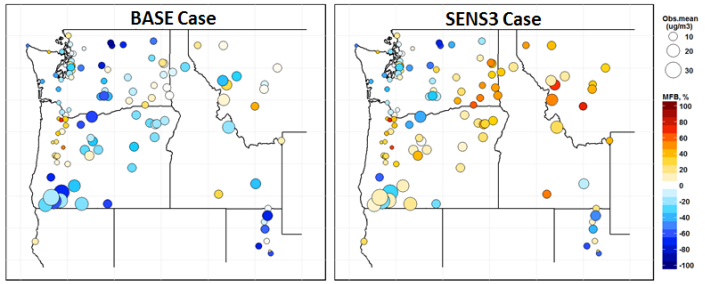
DEPARTMENT OF ECOLOGY
State of Washington

AIRPACT-5

Fire Emissions Processing Methodology

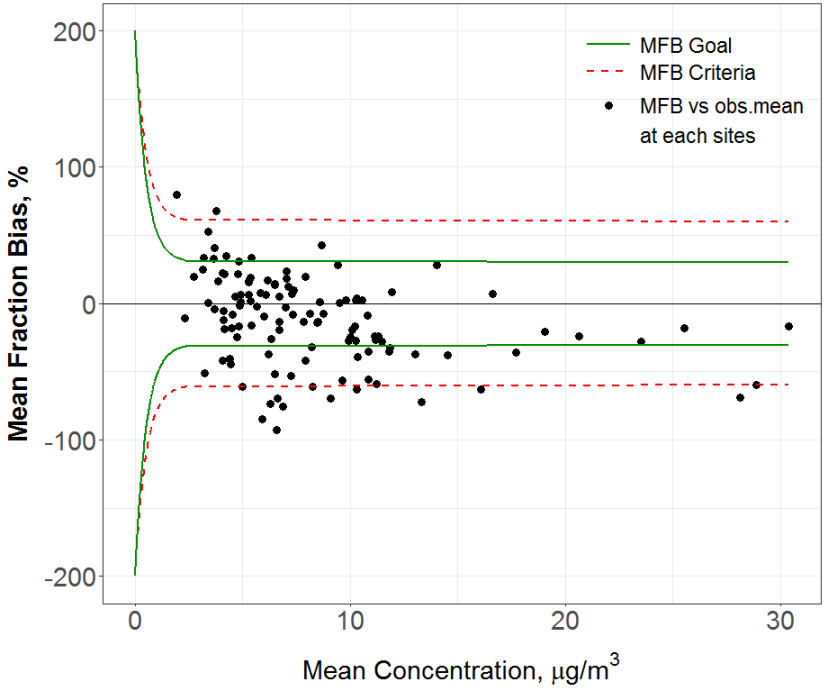
Farren Herron-Thorpe
WF Smoke and AQ Forecasting Workshop
Nov. 28, 2017

Mean Fractional Biases for $PM_{2.5}$

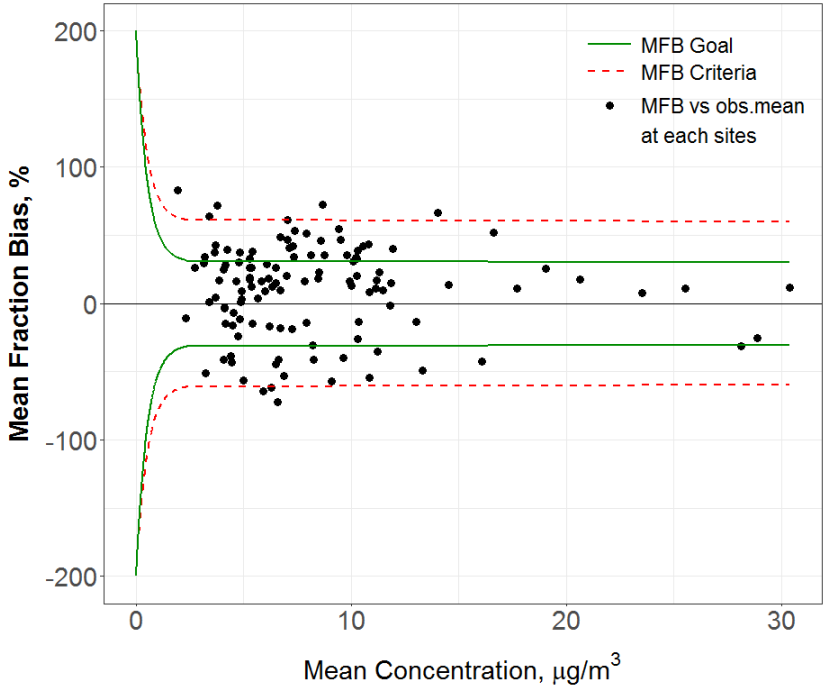


Sensitivity Runs	Obs. Mean (ug/m3)	Mod. Mean (ug/m3)	Mean Bias (ug/m3)	Mean Error (ug/m3)	RMSE (ug/m3)	Correl.	MFB, %	MFE, %
BASE	8	10	2	8	14	0.33	-12%	68%
SENS3	8	18	10	14	29	0.32	9%	74%

BASE Case

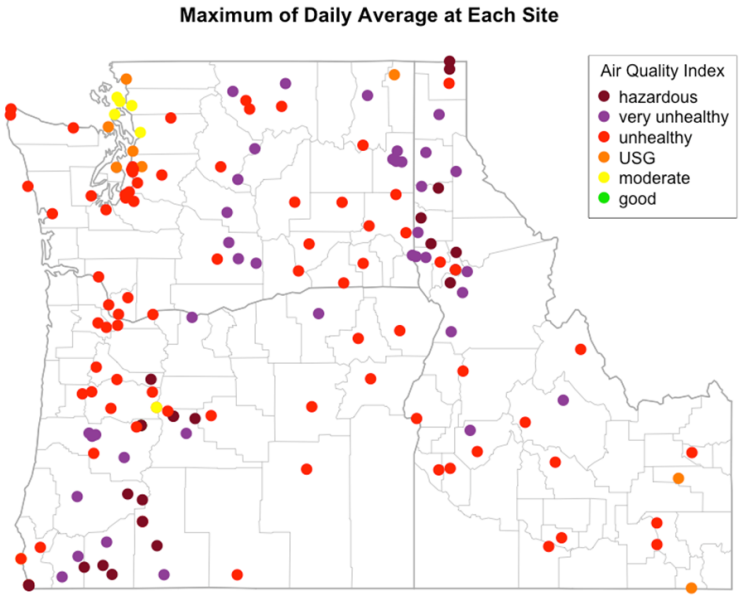


SENS3 Case



R Package for Smoke Monitoring Data

Jonathan Callahan - Mazama Science
Pacific Wildland Fire Sciences Lab (PWFSL)



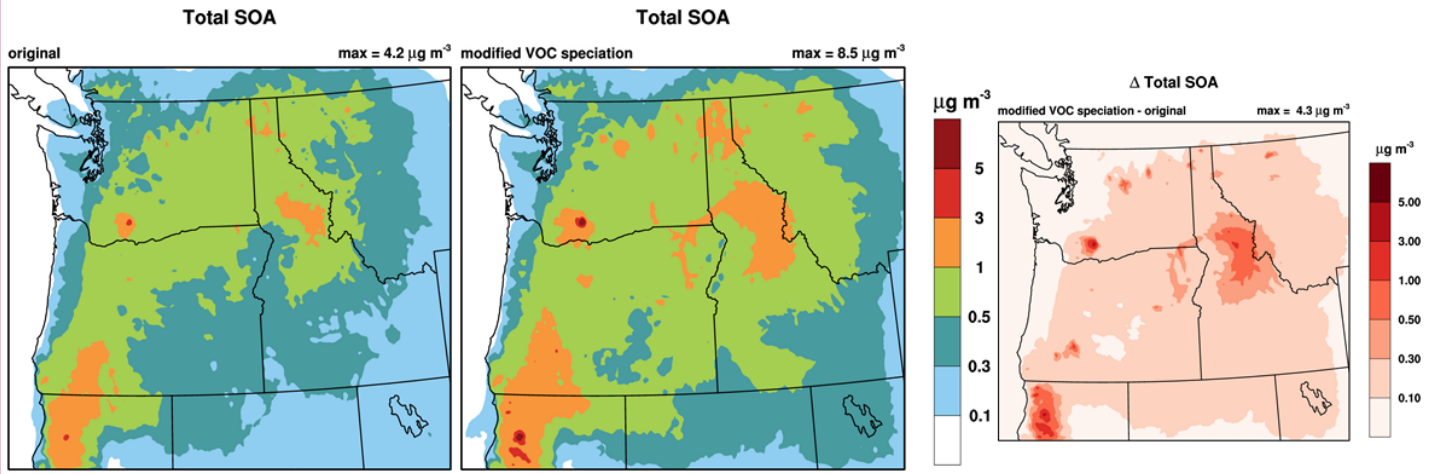
- **PWFSLSmoke package for R**
- **Processes AirNow, AIRSIS, and WRCC data**
- **Sets to same timezone**
- **Plot options**

Improving Emission Profiles of Secondary Organic Aerosol Precursor gases from Wildfires

Yunha Lee, Serena Chung*, Tsengel Nergui, Brian Lamb -Washington State University
Kelley Barsanti, Lindsay Hatch -University of California Riverside
Robert Yokelson -University of Montana
* Now with U.S. EPA

NW-AIRQUEST meeting
June 15, 2017

Model Results: Changes in Total SOA



Environment and Climate Change Canada | Environnement et Changement climatique Canada

Canada

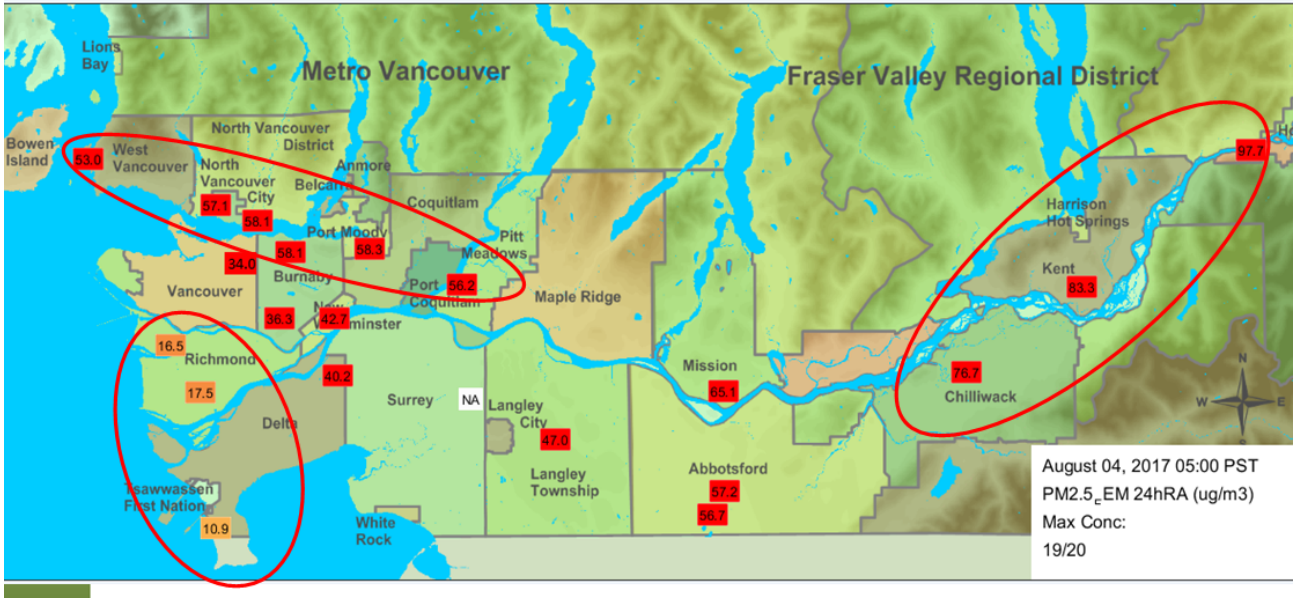
Environment and Climate Change Canada's Operational FireWork System – Air Quality Forecast System with Near-real-time Wildfire Emissions

Wildfire Smoke and Air Quality Forecasting Meeting - WA Department of Ecology
Nov. 28, 2017

Presented by: Jack Chen[2]
R. Pavlovic[1], P.-A. Beaulieu[1], H. Landry[1], S. Ménard[1], R. Munoz-Alpizar[1], D. Davignon[1]
M.D. Moran[2],
K. Anderson[3], P. Englefield[3]
1. Air Quality Modeling Applications Section, Environment and Climate Change Canac
2. Air Quality Research Division, Environment and Climate Change Canada
3. Canadian Forest Service, Natural Resources Canada

Part of problem could be strong concentration gradients seen in Vancouver, BC (LFV) with 24-hr average PM25 (ug/m3) varying from:

- ~11-18 near coast;
- ~50-60 near North shore mountains and;
- ~77-100 in the Eastern part of the valley.



PM and Wild-fire Smoke Prediction Systems for the NOAA Air Quality Forecasting Capability

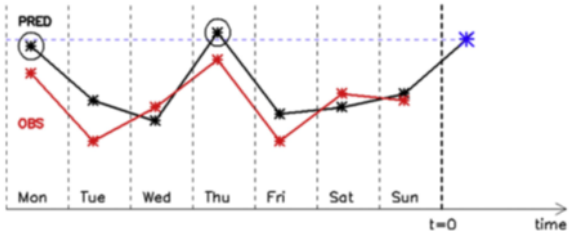
http://www.emc.ncep.noaa.gov/mmb/aq

Jeff McQueen,, Ho-Chun Huang, Jianping Huang, Perry Shafran– NCEP/EMC
Pius Lee, Li Pan, Daniel Tong –NOAA/ARL
Sarah Lu –SUNY/Albany
Ivanka Stajner, Sikchya Upadhaya – NWS/STI

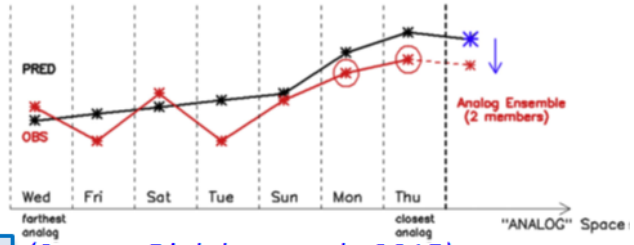
Analog Ensemble for $PM_{2.5}$ Bias Correction

- **Analog metric is determined by (Monache et al. 2011)**

$$\|F_t, A_{t'}\| = \sum_{i=1}^{N_v} \frac{w_i}{\sigma_{f_i}} \sqrt{\sum_{j=-\tilde{t}}^{\tilde{t}} (F_{i,t+j} - A_{i,t'+j})^2},$$



where F_t is current NWP forecast valid at future time t, $A_{t'}$ is analog at past time t', N_v is the number of variables , $\tilde{t}$ is half the number of additional computation time, w_i weight, σ_{f_i} standard deviation



(Source: Djalalova et al., 2015)

Implementation in NAQFC
- **Variables for Analog search: $PM_{2.5}$, T_2, WS/WD**
- **Ensemble members: 5**
- **Training period: one year**

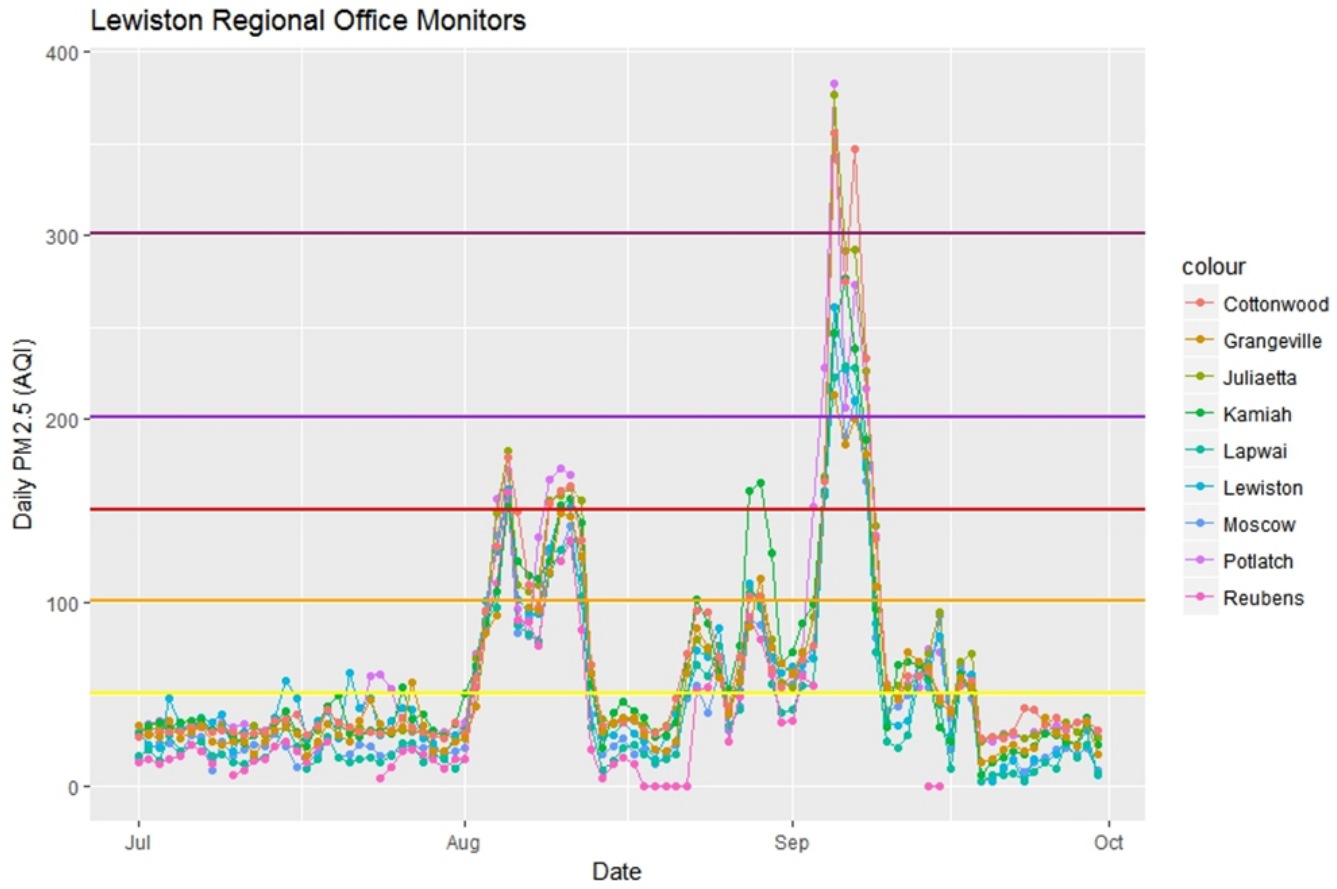
Kalman Filter: adds temporal changes

Courtesy Jianping Huang, EMC

IDAHO MONITORING DATA SUMMARY

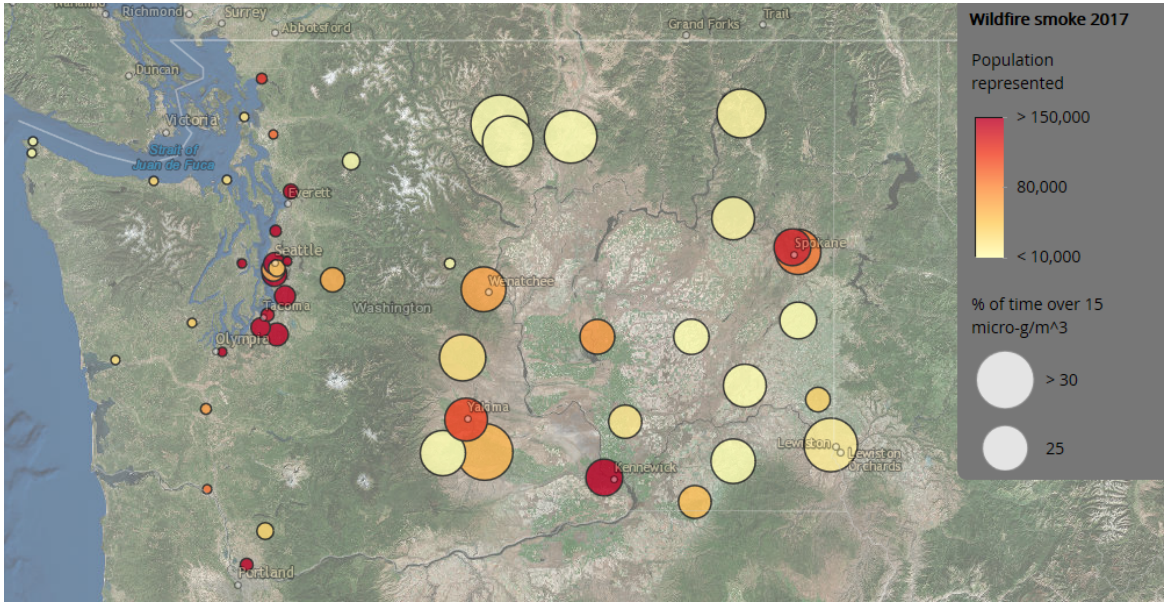
2017 Wildfire Season

Sara Strachan, Idaho Dept. of Environmental Quality
sara.strachan@deq.idaho.gov



Ranil Dhammapala

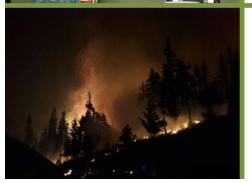
WILDFIRE SEASON AQ DATA SUMMARIES



http://arcg.is/1b5uOC

pscleanair.org
Puget Sound Clean Air Agency

2017 Puget Sound Wildfires Case Study

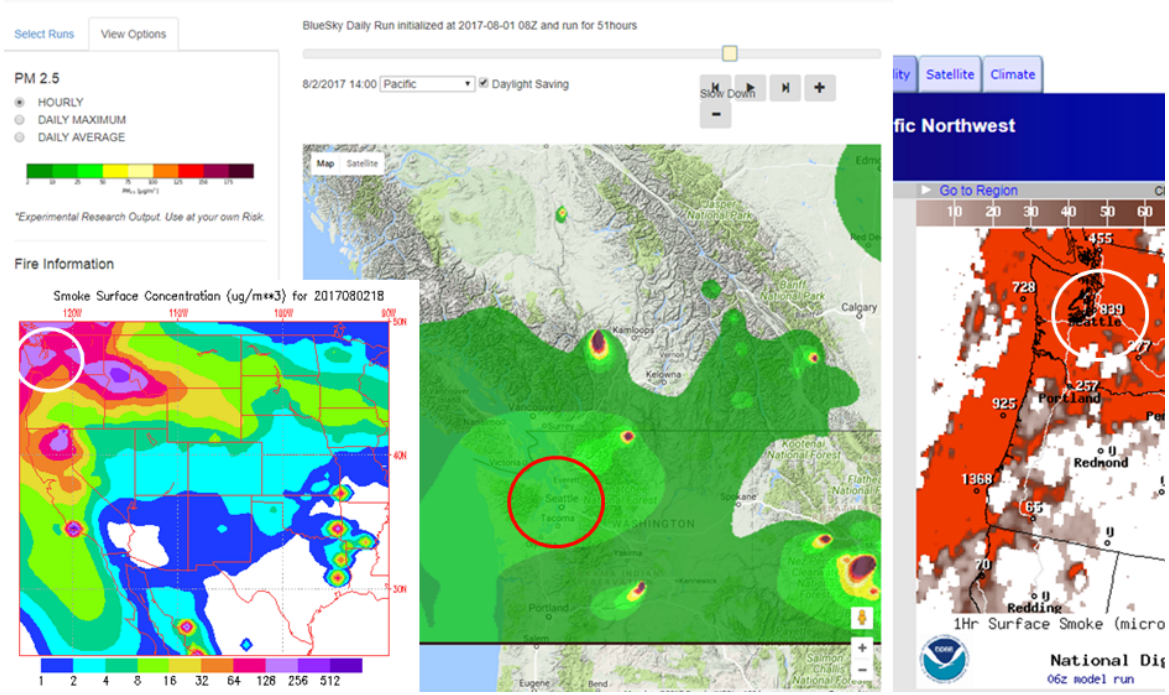


Erik Saganić
NW Wildfire AQ meeting
November 2017

pscleanair.org
Puget Sound Clean Air Agency

Other tools ok, but not order of magnitude

moke Forecasts



Smoke Model Needs and Improvements Ideas and Wish List

1. Forecasts periods: local time midnight to midnight
2. Forecast period, the longer the better to consider distant weekends or holidays (48-72 hours)
3. Model evaluation metrics from developers/ accessible user analytics – systematic archival of monitoring/model runs for testing
4. Fix for missing fires, unrealistic changes in fire sizes
5. Adjust meteorology for fire effects
6. Accommodate fire growth predictions
7. Simple model intercomparisons
8. Public access to smoke forecast tools (caution, still need the intermediary/expert interpretation)
9. Need a better language to describe smoke esp. short term vs. 24-hr

USFS Airfire --- Multi-model-viewer

- Provides users the ability to directly compare predictions from various models

- Still draft and in development
  - Other priorities at the moment but will get back to it

- Link