AIRPACT

Air quality forecast system for the Pacific Northwest

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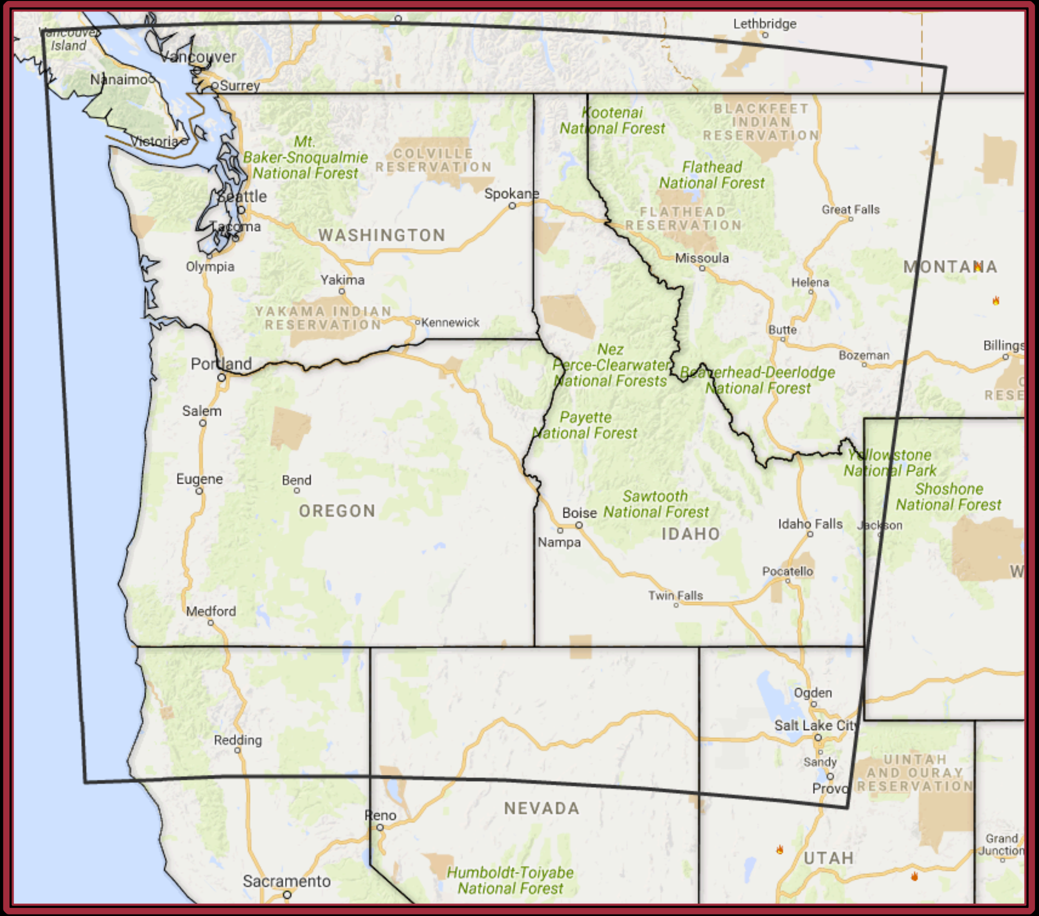
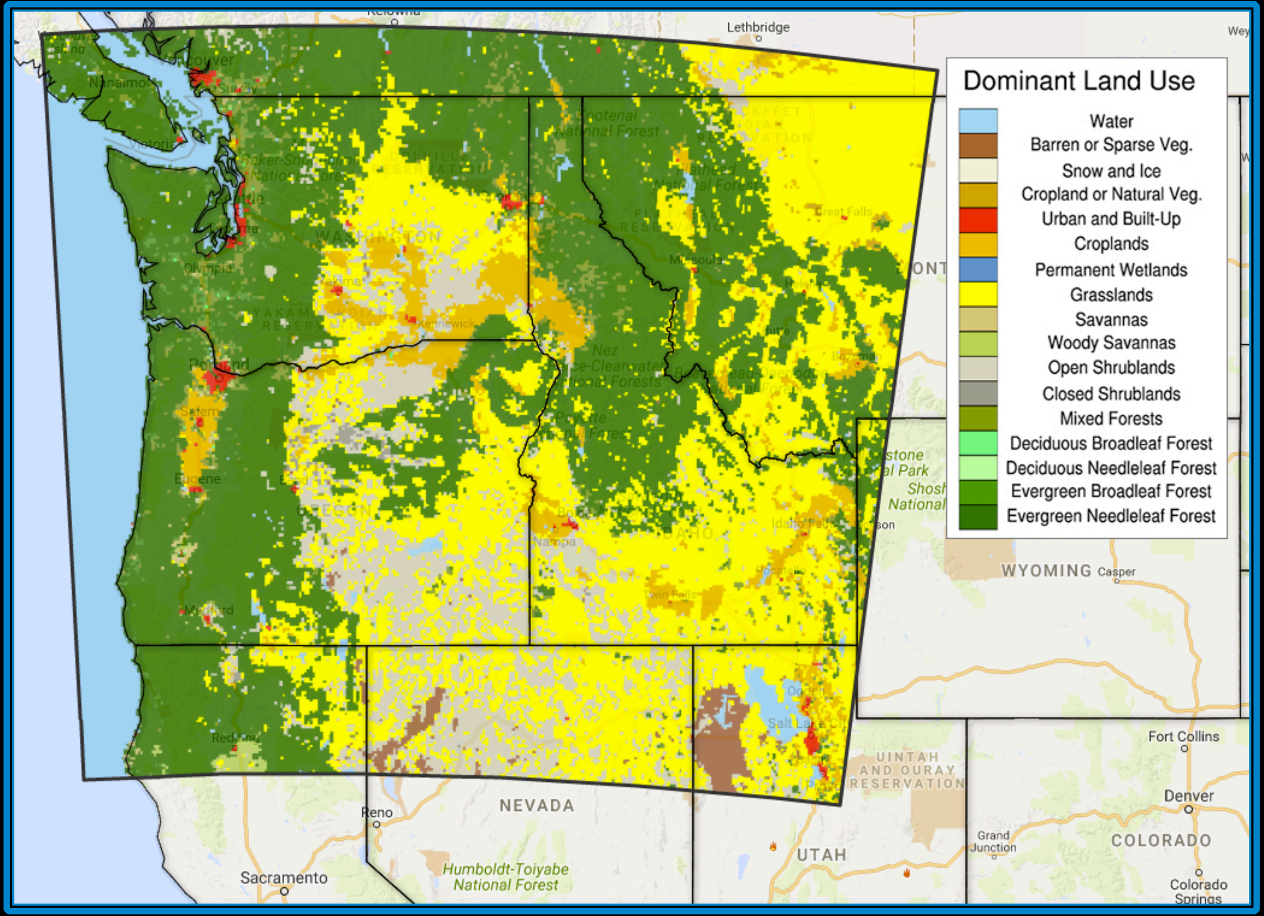
AIRPACT

: Air-quality Indicator Report for Public Access and Community Tracking



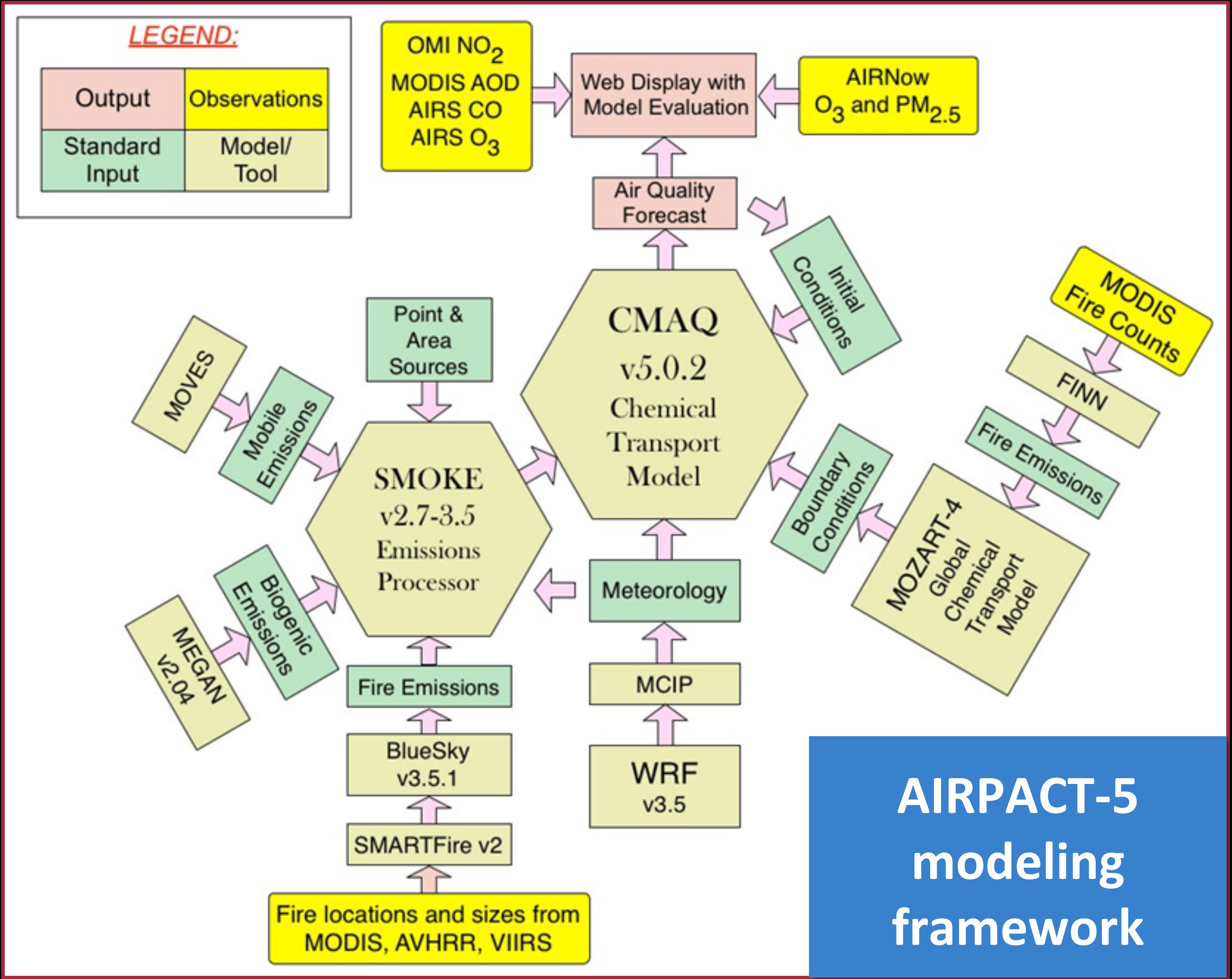


AIRPACT keeps evolving

AIRPACT3:
2008 - 2013

AIRPACT4 :
2013 – 2016

AIRPACT5:
2016-Present



AIRPACT-5 modeling framework

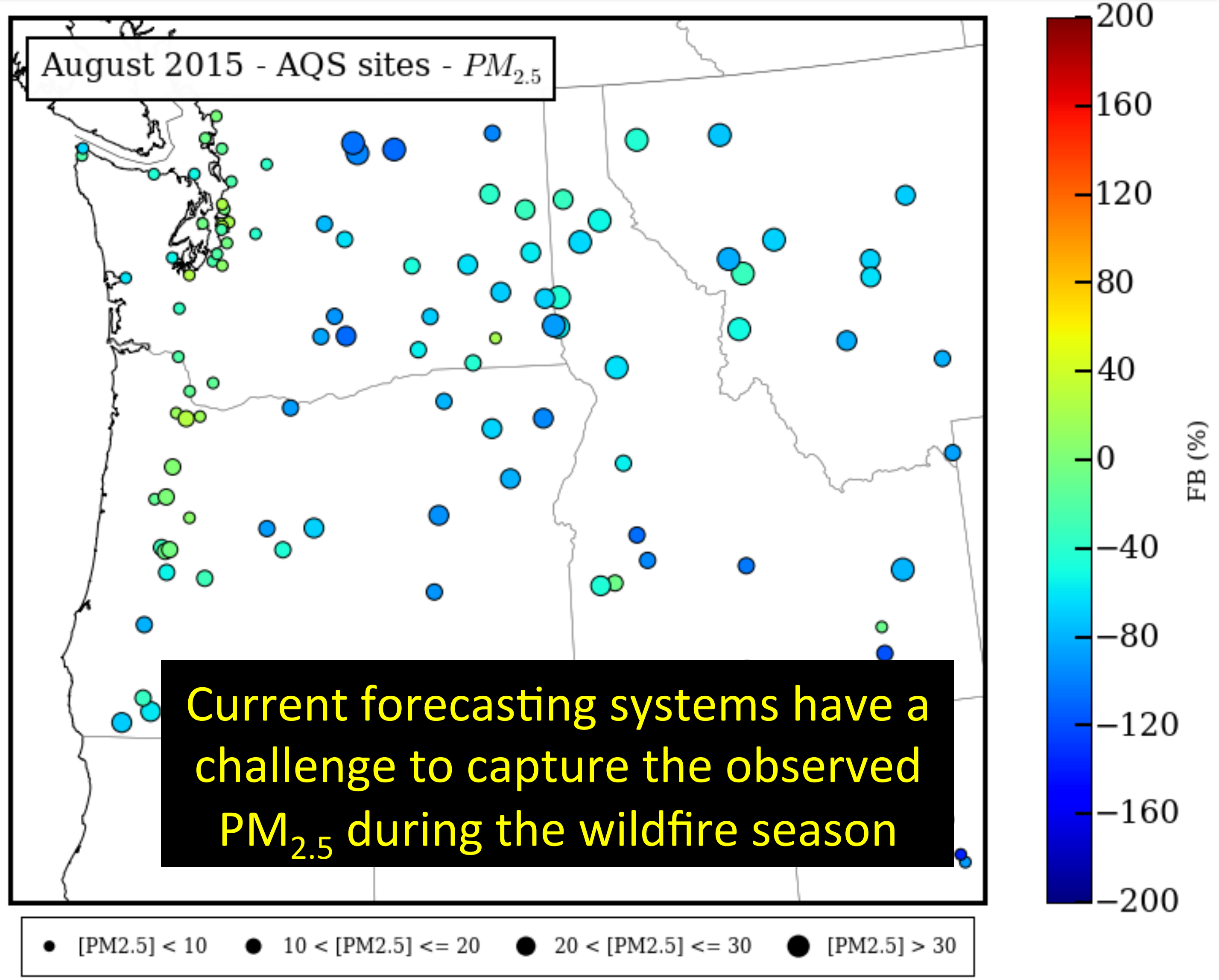
Display AIRPACT-5 webpage

AIRPACT-Fire

Vikram Ravi, Joe Vaughan, Yunha Lee, Brian Lamb - **WSU**
Adam Kochanski, Marry Ann Jenkins - **Univ. of Utah**
Susan O'Neill - **USFS Fire Lab**
Farren Herron-Thorpe, Matt Kadlec - **WA, Dept. of Ecology**

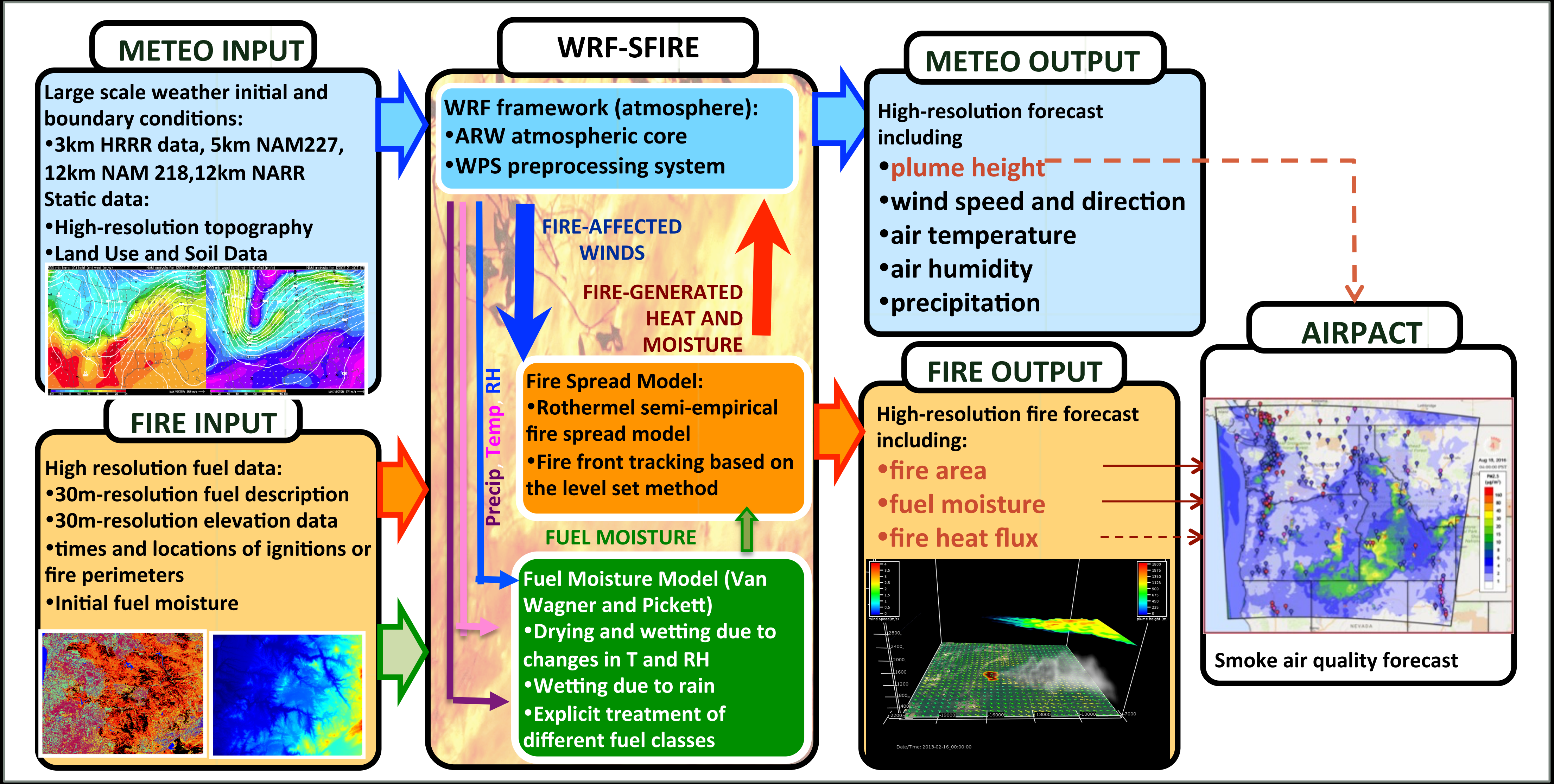
Objectives of this study

1) to improve the accuracy of forecasts by more explicit treatment of fire behavior, fire emissions, and plume rise
2) to improve the timeliness of our forecasts through the introduction of a nowcast capability for smoke transport
3) to develop and implement new public health information for the forecast system



Current forecasting systems have a challenge to capture the observed $PM_{2.5}$ during the wildfire season

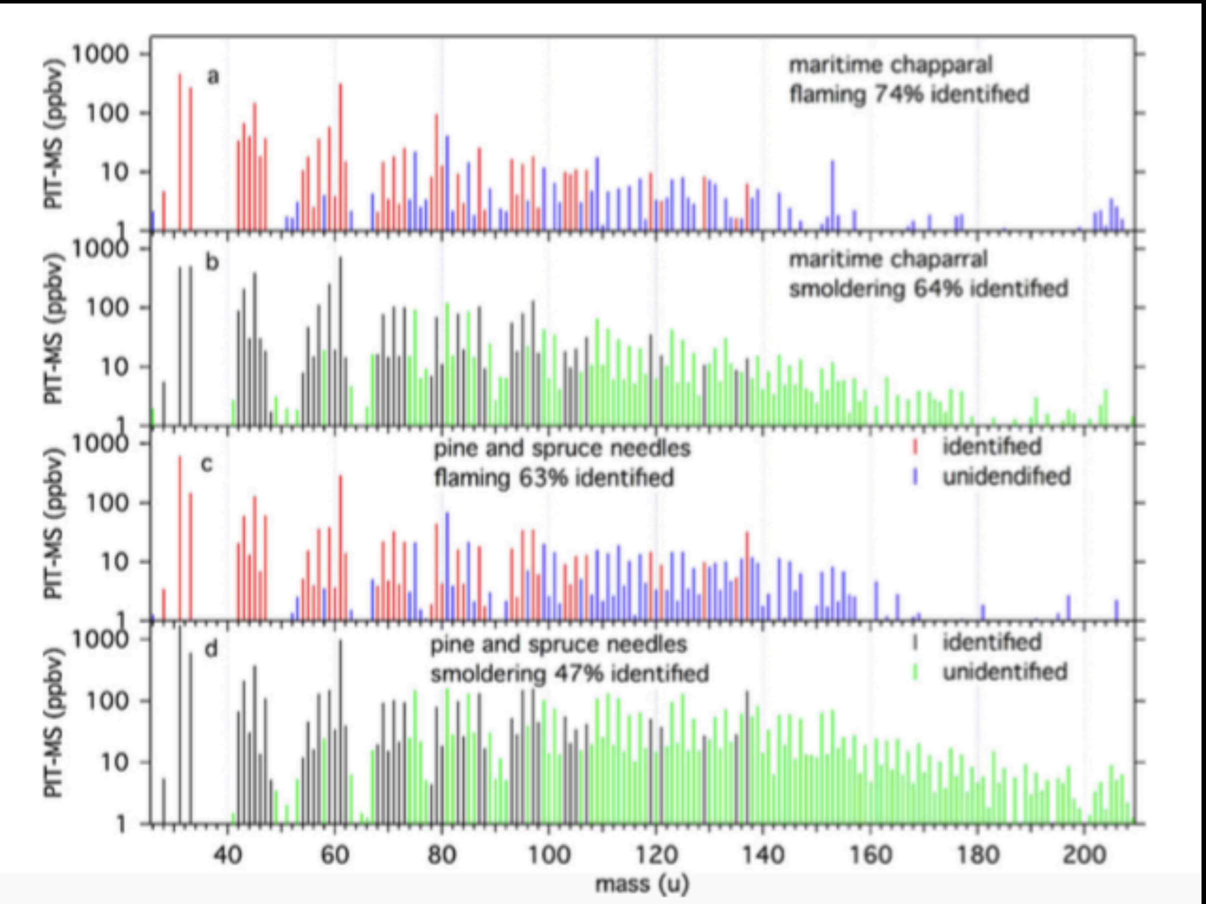
Coupled fire-atmosphere model (WRF-SFire) feeding AIRPACT



Uncertainty in Secondary Organic Aerosol (SOA) from Wildfires

Kelley Barsanti, Lindsay Hatch -**UC Riverside**
Serena Chung, Yunha Lee, Brian Lamb - **WSU**
Christine Wiedinmyer -**NCAR**
Robert Yokelson -**Univ. of Montana**

Unidentified species (blue or green)



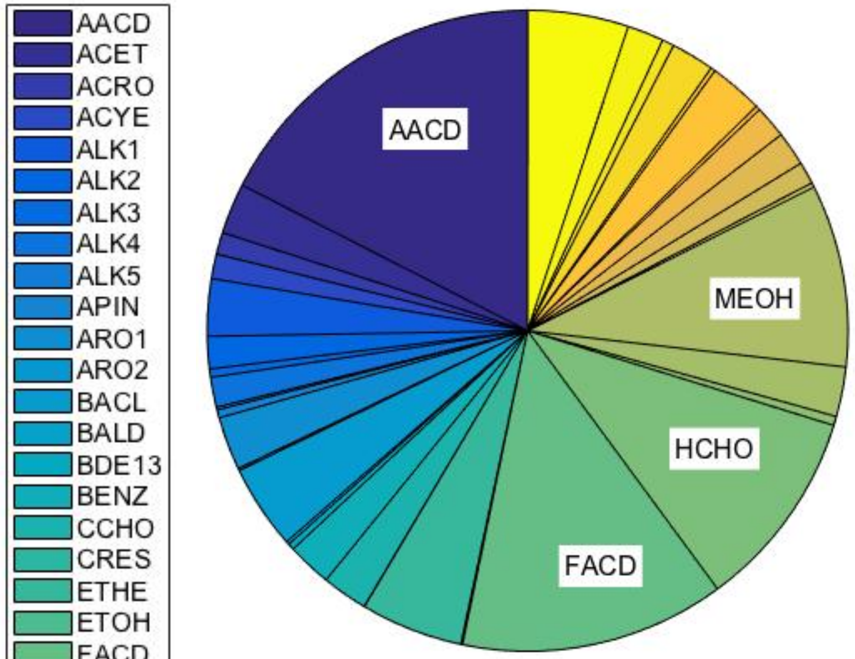
From: Warneke et al., *IJMS*, 2011

Goal: Determine the extent to which characterization at the molecular-structure level improves model representation of secondary pollutants from biomass burning, focus on SOA

1. Use data from FLAME-4 (Fourth Fire Lab at Missoula Experiment) to calculate emissions factors and build an updated emissions inventory for 'boreal forest' land cover type
2. Run regional air quality model (CMAQ) with default and updated emissions
3. Evaluate changes in SOA and $PM_{2.5}$ formation; compare model predictions with observations

Modified from the ppt from Kelley Barsanti

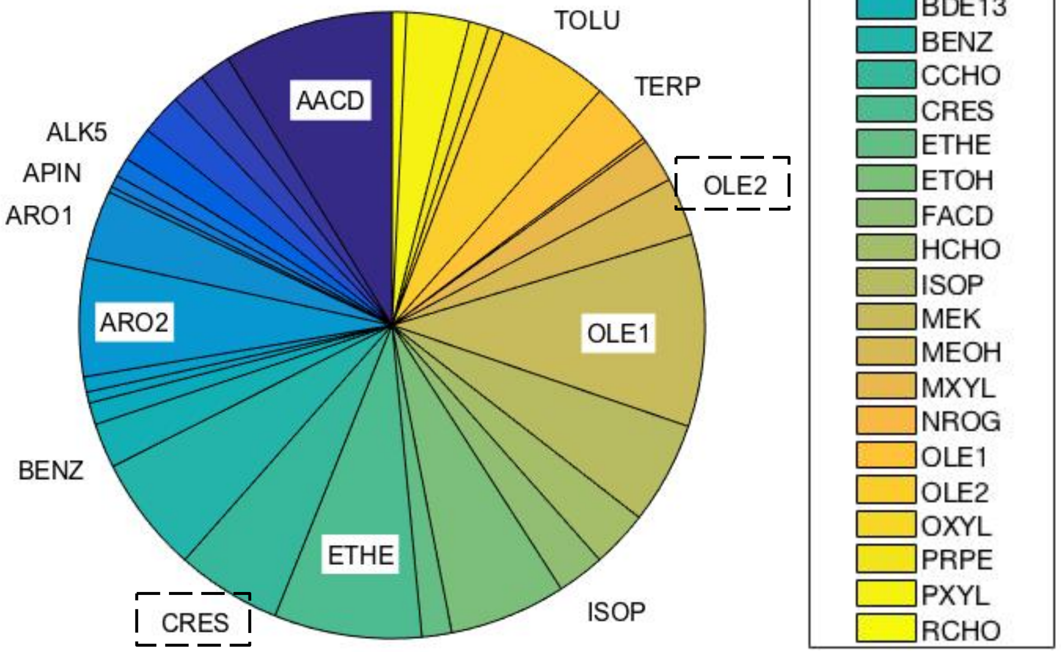
Surrogate SAPRC Profiles: Default vs. Updated



Default

	% EF by Mass	
ALK5	0.1%	0.6%
ARO1	0.5%	0.9%
ARO2	0.1%	6.1%
BENZ	2.3%	2.3%
TERP	1.0%	3.6%
ISO	0.5%	2.5%

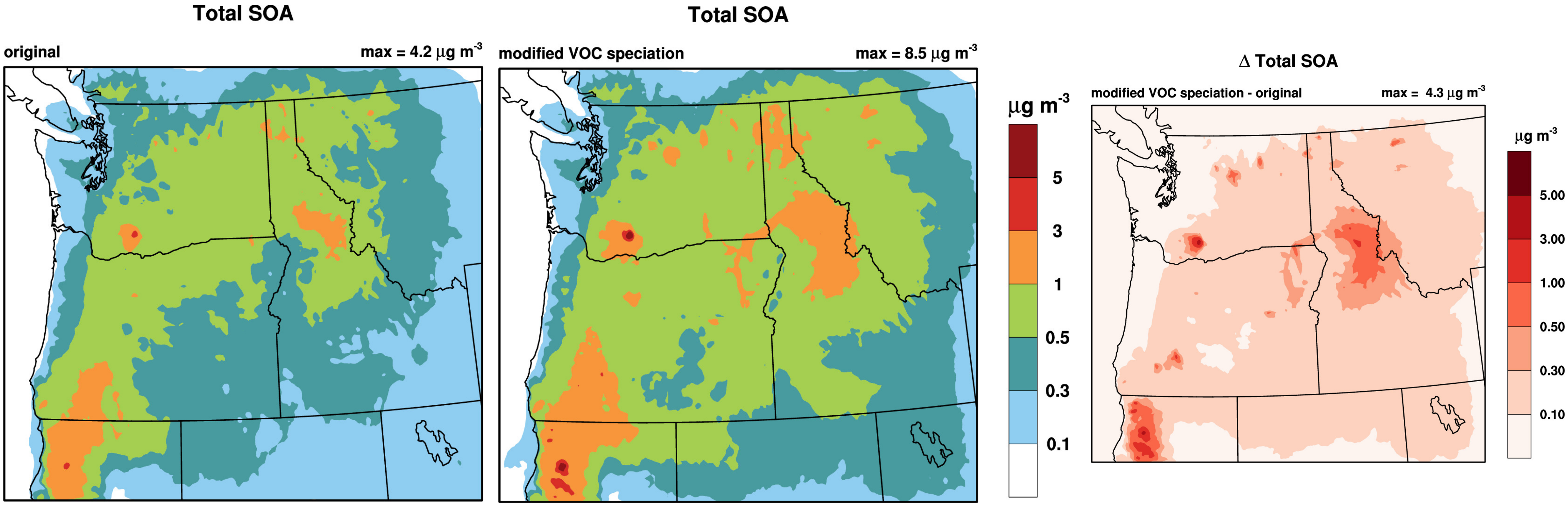
Updated



SOA precursors: ALK5, ARO1 (incl. toluene), ARO2 (incl. xylene), BENZ, ISO, TERP (incl. a-pin.), SESQ

Modified from the ppt from Kelley Barsanti

Model Results: Changes in Total SOA



Modified from the ppt from Kelley Barsanti

Satellite products used for AIRPACT

Farren Herron-Thorpe - WA, Dept. of Ecology
Brian Lamb, Joe Vaughan, George Mount - WSU

OMI Ozone profiles comparison to AIRPACT

- showed the benefit of using MOZART (BCON) in Asian Transport cases

AIRS CO comparison to AIRPACT

- showed the benefit of including MOPITT CO in the MOZART runs

OMI NO2 comparisons to AIRPACT

- confirmed spatial distribution of NOx in AIRPACT domain
- showed the effects of mixing an old EI with a new EI in the model (e.g. Canada and Utah were under-predicted).

MODIS AOD comparisons to AIRPACT

- Useful for evaluating smoke predictions

MISR and CALIPSO plume height comparisons to AIRPACT

- Showed the effect of coarse grids on plume transport (e.g. flat mountains)
- highlighted the need for taking the appropriate height for surface predictions

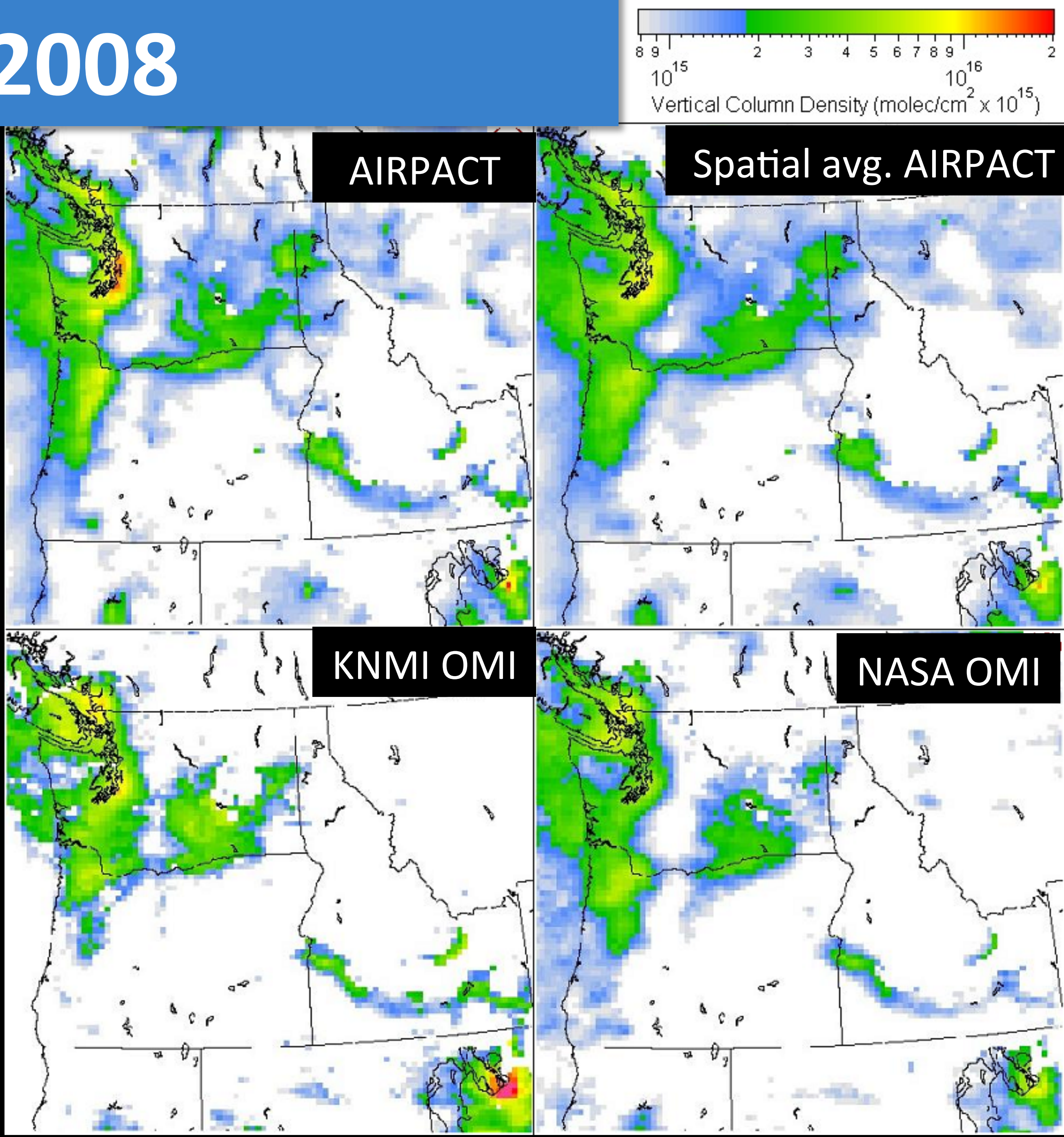
IASI NH3 comparisons to AIRPACT

OMI NO2: Jan 2008

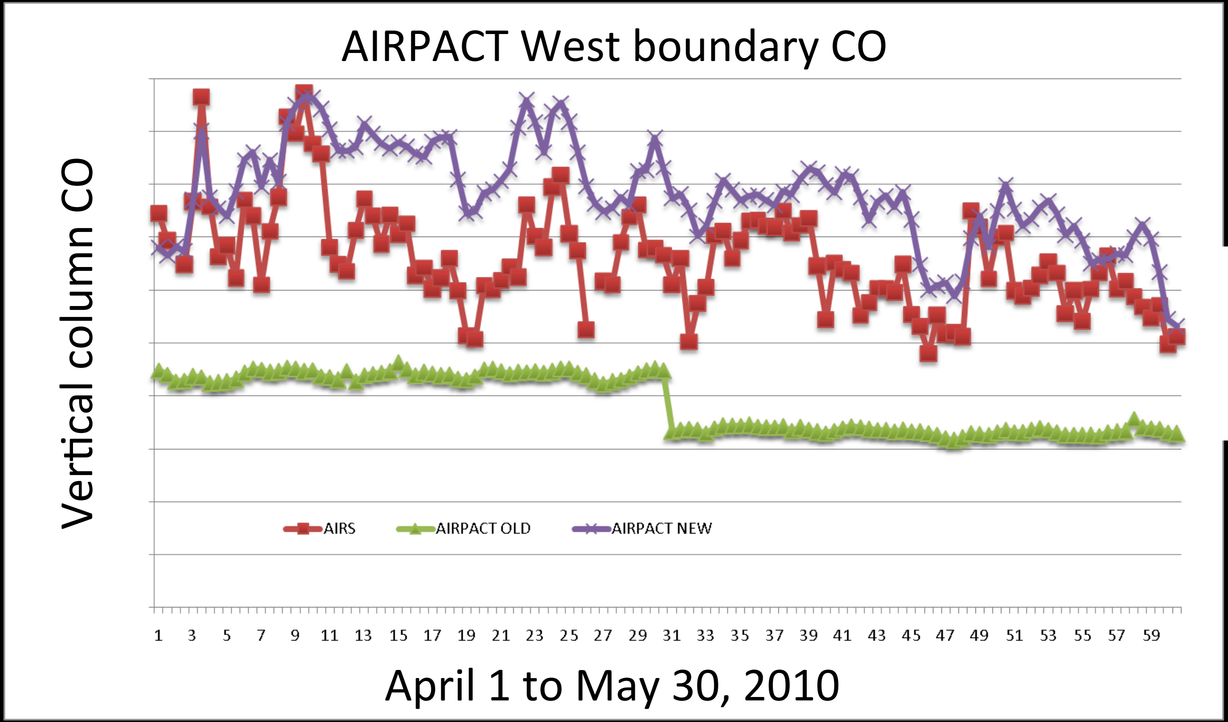
- Good spatial correlation to OMI NO2
- Importance of updated emissions inventories

Annual % differences between AIRPACT-3 and OMI (Collection 3). Representing relative trends in needed model emissions adjustments.

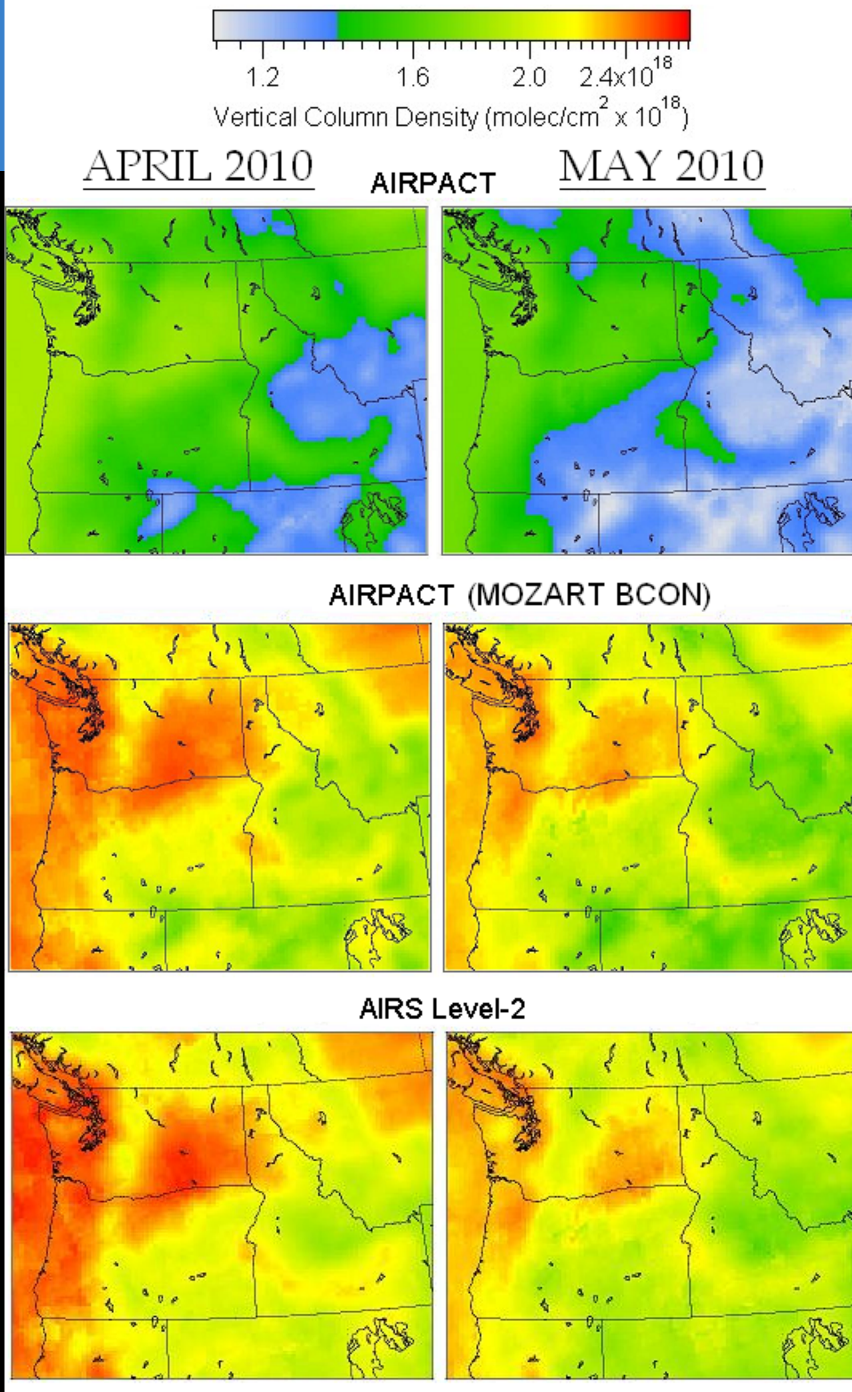
Location	2007	2008	2009	2010
Seattle, WA	-17%	-3%	-55%	-80%
Tacoma, WA	-8%	5%	-23%	-31%
Renton, WA	20%	-13%	-45%	-65%
Portland, OR	5%	-37%	-61%	-54%
Hillsboro, OR	-7%	-52%	-110%	-57%
Vancouver, WA	30%	-90%	-53%	-140%
Salt Lake City, UT	72%	42%	-5%	-3%
Vancouver, BC	62%	43%	21%	5%



AIRS CO



AIRAPCT-NEW
AIRPACT-OLD
AIRS



The boundary conditions derived from MOZART helped to fix both CO and Ozone biases in AIRPACT:

- AIRPACT-OLD: used boundary conditions from Horowitz (2000)
- AIRPACT-New: uses MOZART forecasts from NCAR (Emmons)

Summary

Satellite products have been useful for **identifying large errors** in a model (e.g., missing emissions) and **evaluating pollution events** (e.g., Asian transport and Wildfires)

- Biases for aerosol, CO, and NO_2 in AIRPACT are generally detectable using NASA instruments

However, the **coarse temporal and spatial resolution of satellite data** and large boundary layer errors leave much to be desired for those interested in surface chemistry.

- Additional challenges for the PNW regions due to relatively low pollution levels and persistent clouds

Successfully integrating satellite products into AIRPACT **requires collaboration**

- NASA ⇔ NCAR ⇔ LAR ⇔ NW-AIRQUEST⇔EPA and coupling with surface monitors

Geostationary satellite products would be very beneficial to AIRPACT