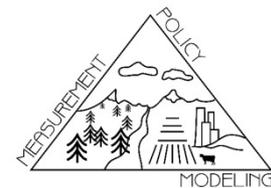


NW-AIRQUEST ANNUAL MEETING 2012
6-8 June 2012, ETRL #101, WSU campus, Pullman, WA

**AIRPACT4/Google Maps Website
Introduction and feedback (30 min)**



Presenter: Farren L. Herron-Thorpe
Date: June 6, 2012



Laboratory for Atmospheric Research

AIRPACT-4 Beta Website:

- Uses Google Maps and custom image overlay of air quality and related variables
- Incorporates the functionality of multiple AIRPACT-3 web-pages into one

GMAPS Site Currently in Graphics Products at:

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

NW-AIRQUEST ANNUAL MEETING 2012
6-8 June 2012, ETRL #101, WSU campus, Pullman, WA

AIRPACT4/AIRPACT3
Emissions review (10 min)



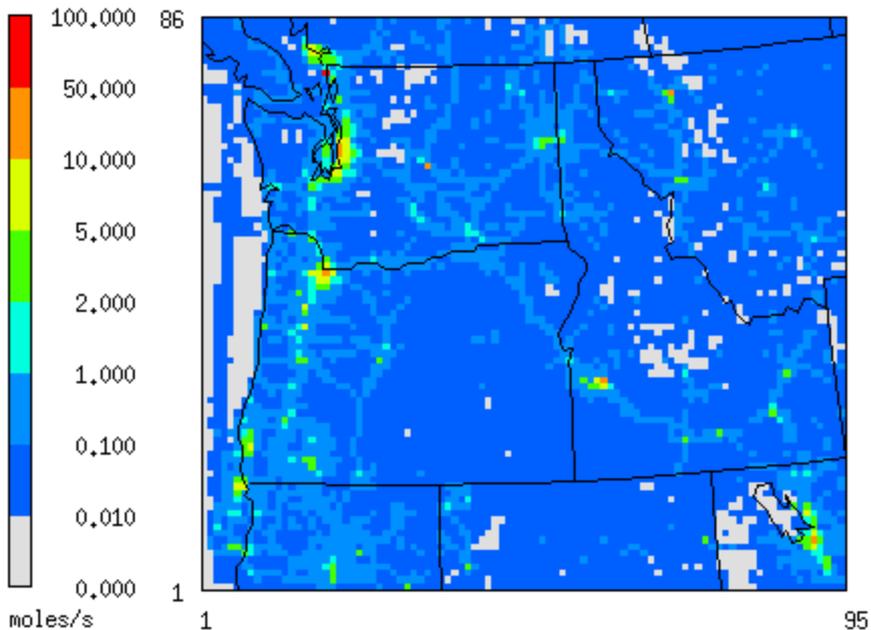
Presenter: Farren L. Herron-Thorpe
Date: June 6, 2012



	AIRPACT-3	AIRPACT-4
Grid cells	95x95 12-km grid cells	285x258 4-km grid cells
Vertical Layers	21 layers	21 layers
MCIP	v3.3 (UW MM5/WRF)	v3.6 (UW WRF)
SMOKE	v2.1 (LAYPOINT v2.4)	v2.7
CMAQ	v4.6 (denrate)	v4.7.1 updated (yamo)
Boundary Conditions	MOZART-2 (2000) monthly averages provided by Horowitz (used until Feb, 2011)	MOZART-4 forecasts with MOPITT-CO assimilation provided by Emmons (NCAR)
Anthropogenic Emissions	2005 from Ecology, IDEQ, ODEQ	2007 from Ecology, IDEQ, ODEQ
Fire Emissions	BlueSky until 10-2008	BlueSky/SmartFire In Testing Phase
Biogenic Emissions	BEIS-3	MEGAN v2.1
Storage Requirement for 24-hour Run		
Emission	1.1 GB	891 MB
MCIP	428 MB	3.6 GB
CMAQ	2 GB	27 GB

AIRPACT-4 Emissions

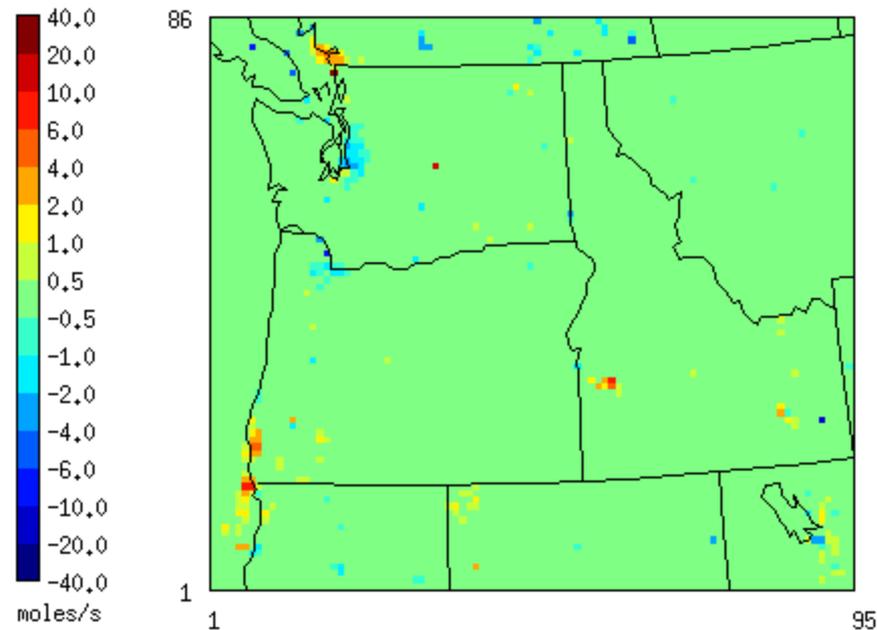
CO Grouped to 12-km grid
Collapsed to 1 Layer



May 31,2012 1:00:00 (PST)
Min= 0,000 at (1,1), Max= 56,757 at (19,78)

Difference of CO Emissions

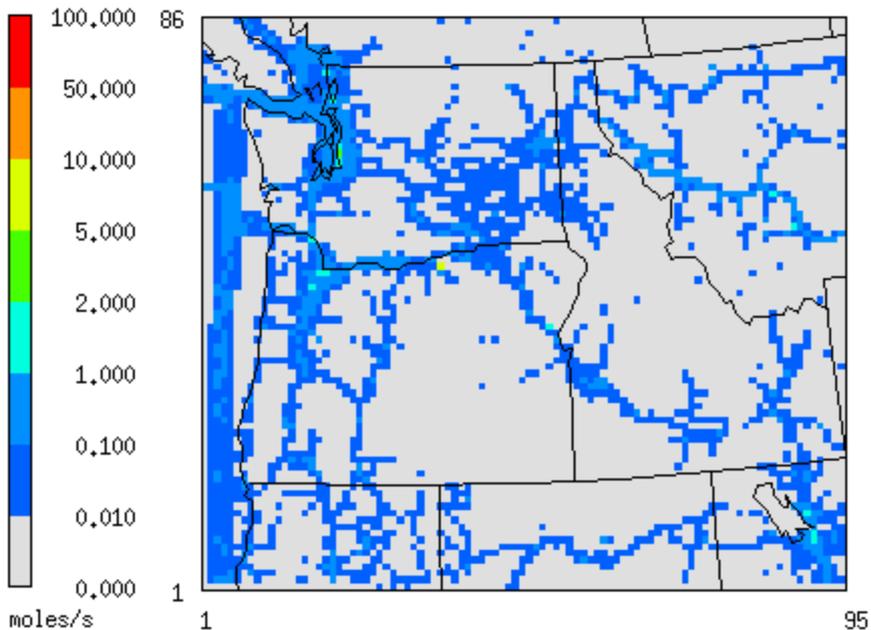
AP4 Emissions minus AP3:
Collapsed to 1 Layer



May 31,2012 1:00:00 (PST)
Min=-12,6 at (91,26), Max=38,6 at (19,78)

AIRPACT-4 Emissions

NO_x Grouped to 12-km grid
Collapsed to 1 Layer

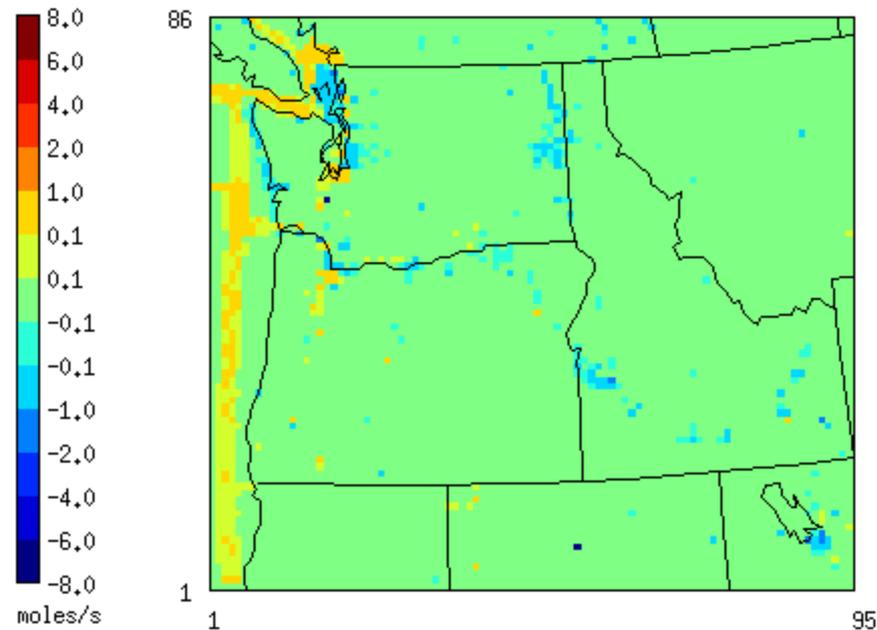


May 31, 2012 1:00:00 (PST)

Min= 0.000 at (1,1), Max= 5.217 at (36,49)

Difference of NO_x Emissions

AP4 Emissions minus AP3:
Collapsed to 1 Layer

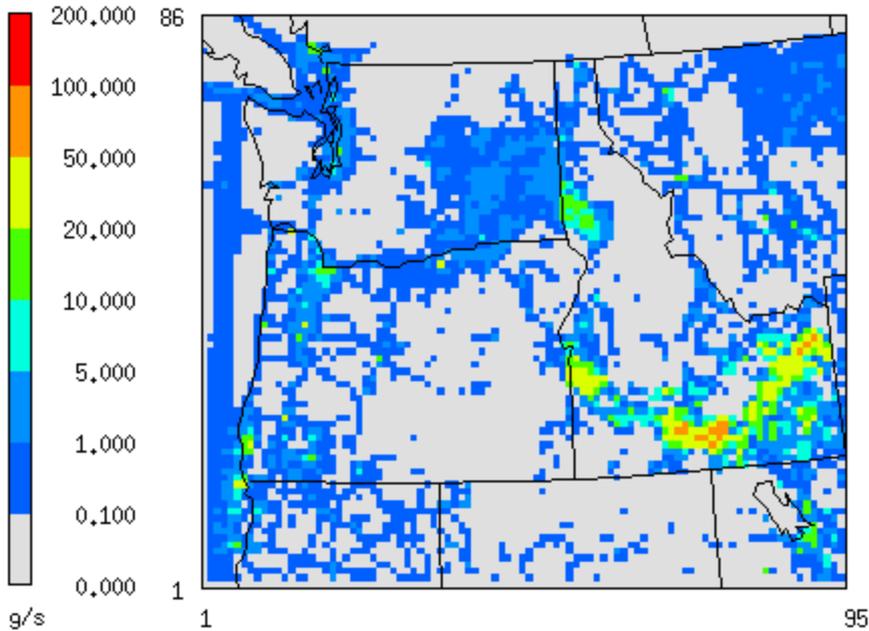


May 31, 2012 1:00:00 (PST)

Min=-9.8 at (55,7), Max=0.9 at (6,75)

AIRPACT-4 Emissions

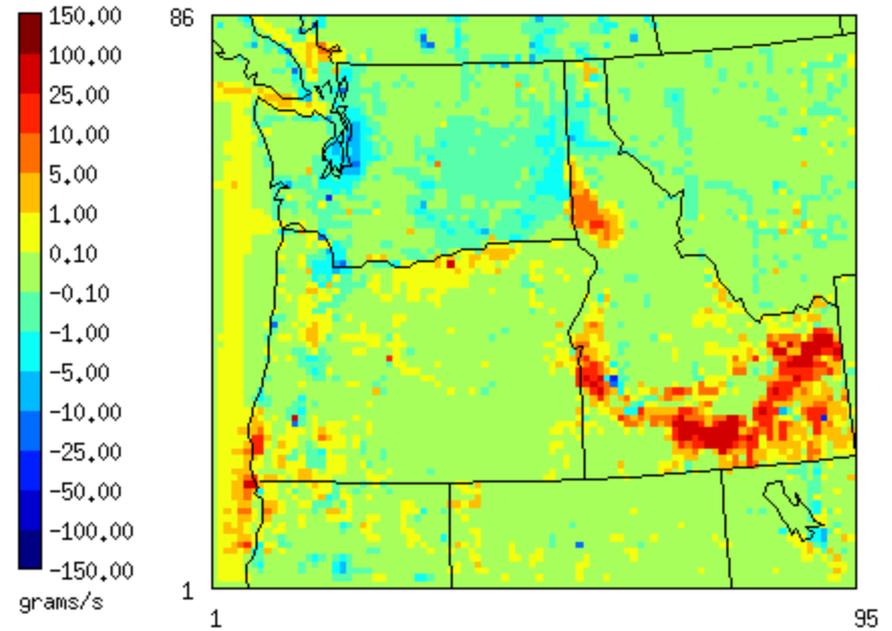
PM2.5 Grouped to 12-km grid
Collapsed to 1 Layer



May 31,2012 1:00:00 (PST)
Min= 0.000 at (1,1), Max= 80,582 at (77,24)

Difference of PM2.5 Emissions

AP4 Emissions minus AP3:
Collapsed to 1 Layer

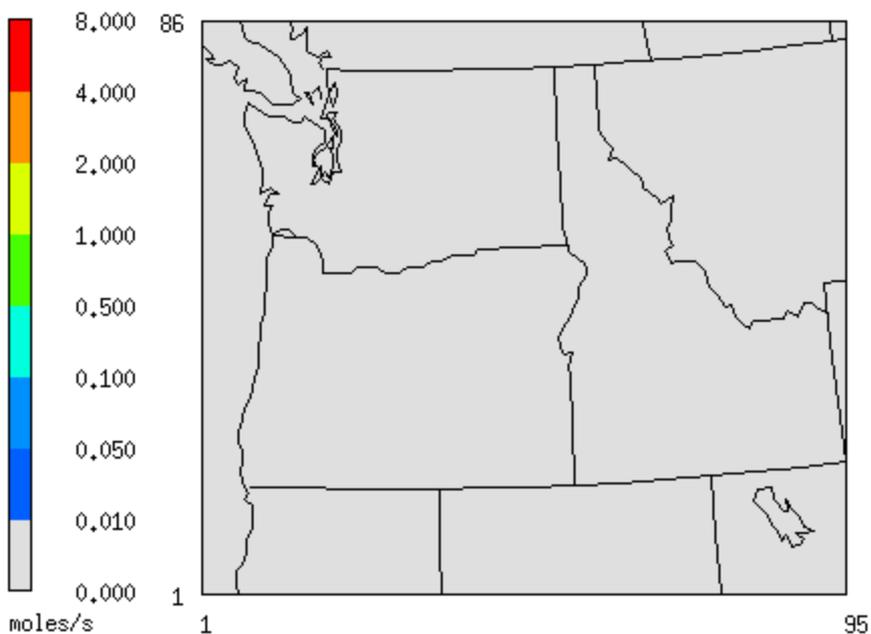


May 31,2012 1:00:00 (PST)
Min=-46.81 at (60,32), Max=68.87 at (77,25)

$$\text{PM 2.5} = \text{P(FINE)} + \text{P(NO3)} + \text{P(EC)} + \text{P(SO4)} + \text{POA}$$

AIRPACT-4 Emissions

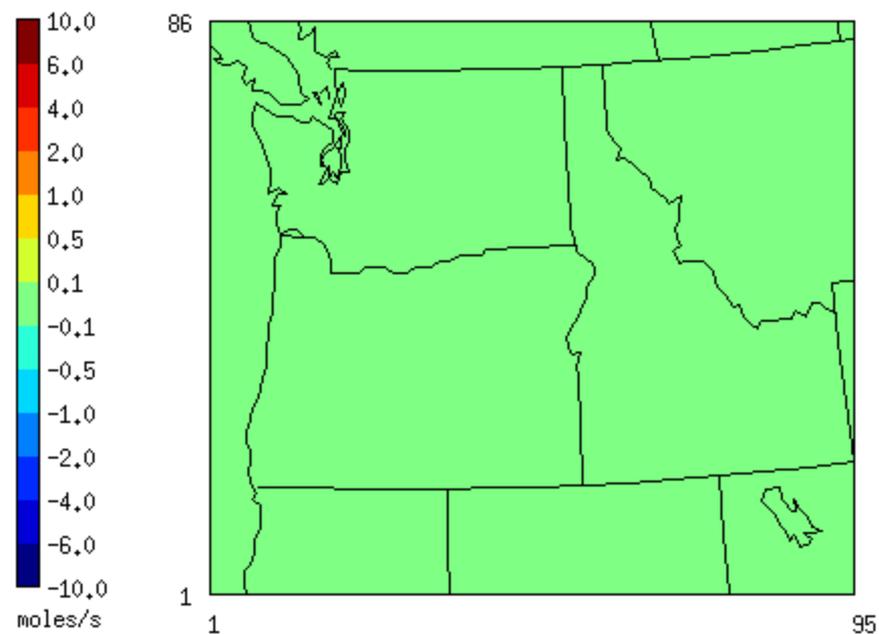
ISOPRENE Grouped to 12-km grid
Collapsed to 1 Layer



May 31,2012 1:00:00 (PST)
Min= 0,000 at (1,1), Max= 0,003 at (18,81)

Difference of ISOPRENE Emissions

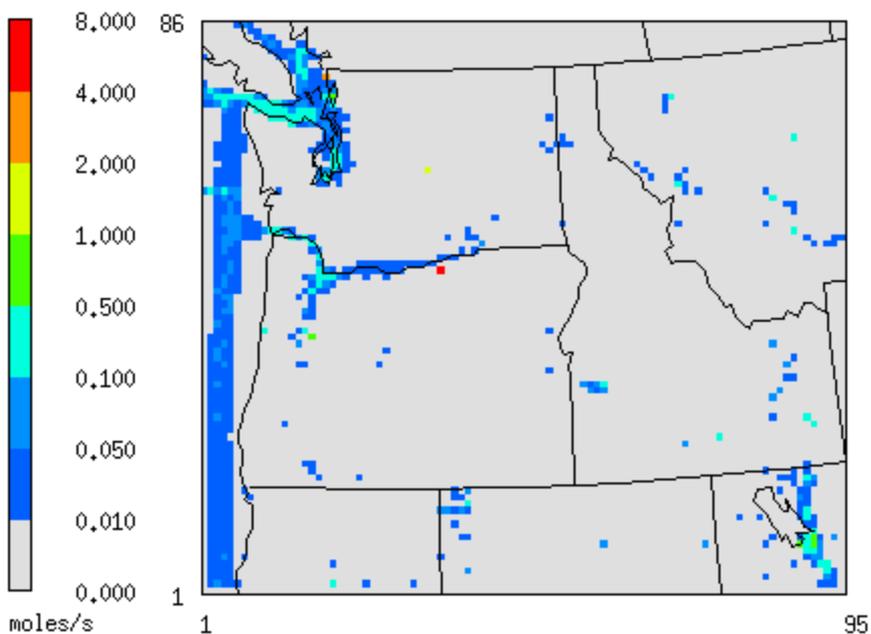
AP4 Emissions minus AP3:
Collapsed to 1 Layer



May 31,2012 1:00:00 (PST)
Min=-0,0 at (13,25), Max=0,0 at (18,81)

AIRPACT-4 Emissions

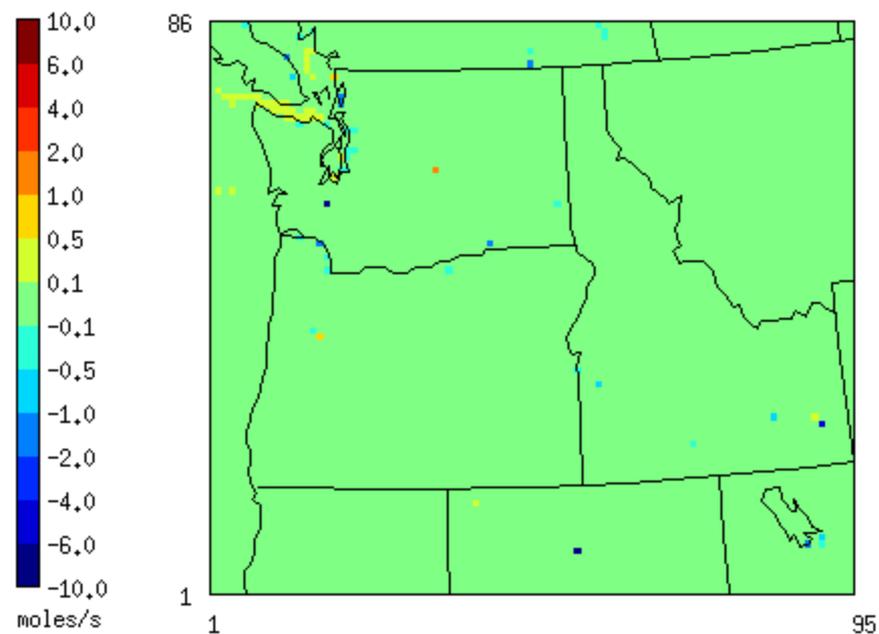
S02 Grouped to 12-km grid
Collapsed to 1 Layer



May 31, 2012 1:00:00 (PST)
Min= 0.000 at (1,1), Max= 5.404 at (36,49)

Difference of S02 Emissions

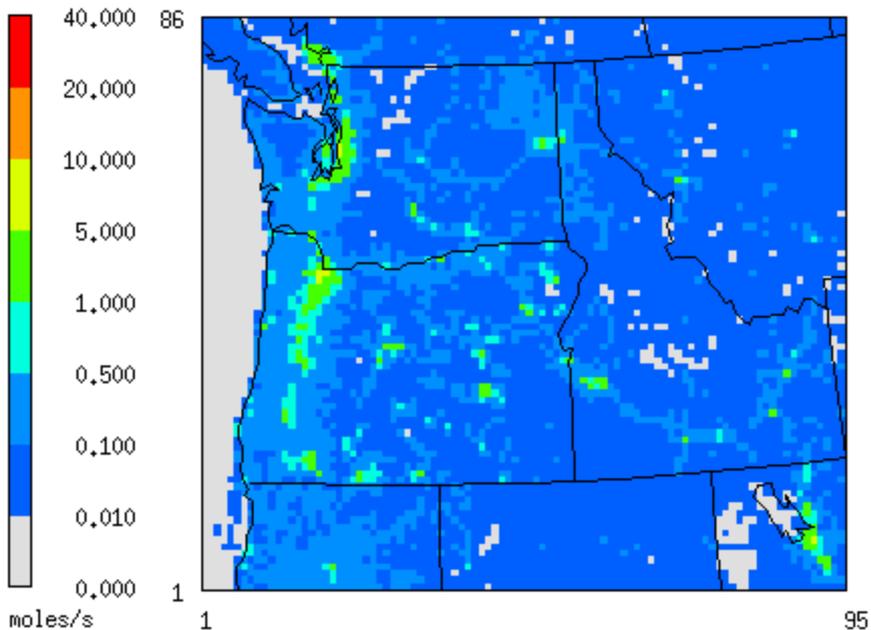
AP4 Emissions minus AP3:
Collapsed to 1 Layer



May 31, 2012 1:00:00 (PST)
Min=-8.6 at (18,59), Max=1.6 at (34,64)

AIRPACT-4 Emissions

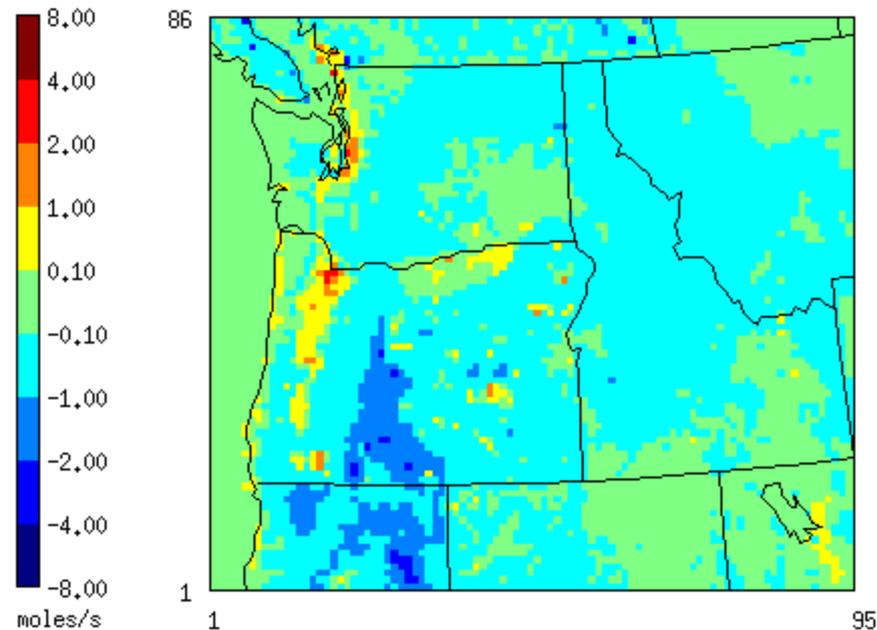
Alkanes/Alkenes/Benzene Grouped to 12-km grid
Collapsed to 1 Layer



May 31, 2012 1:00:00 (PST)
Min= 0.000 at (1,1), Max= 7.883 at (19,48)

Difference of ALKANES/ALKENES/BENZENE Emissions

AP4 Emissions minus AP3;
Collapsed to 1 Layer

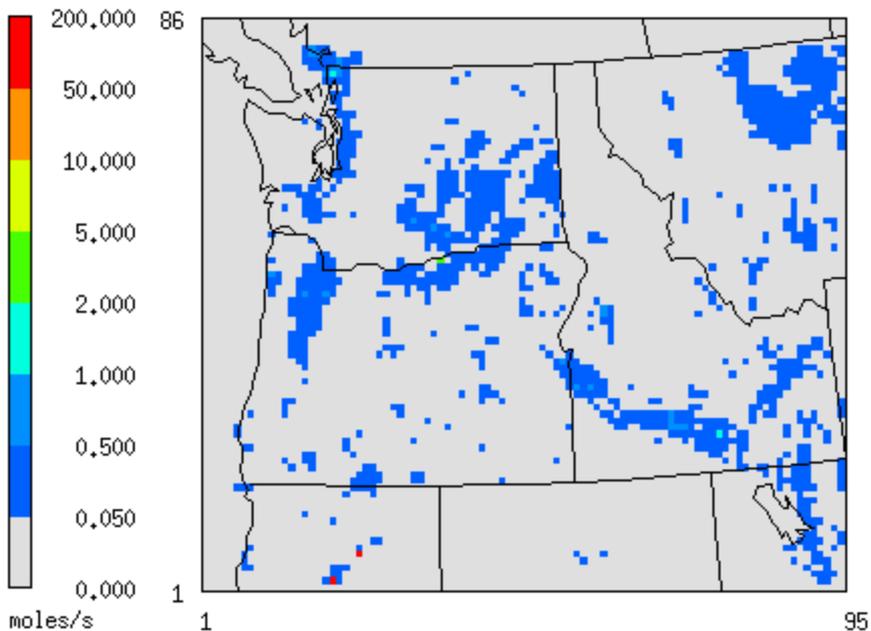


May 31, 2012 1:00:00 (PST)
Min=-3.09 at (21,80), Max=2.54 at (19,48)

Alkanes= $ALK1 \times 2 + ALK2 \times 3 + ALK3 \times 4 + ALK4 \times 5 + ALK5 \times 8$
 ALKENES= $OLE1 \times 5 + OLE2 \times 5$
 Benzene $\times 6$

AIRPACT-4 Emissions

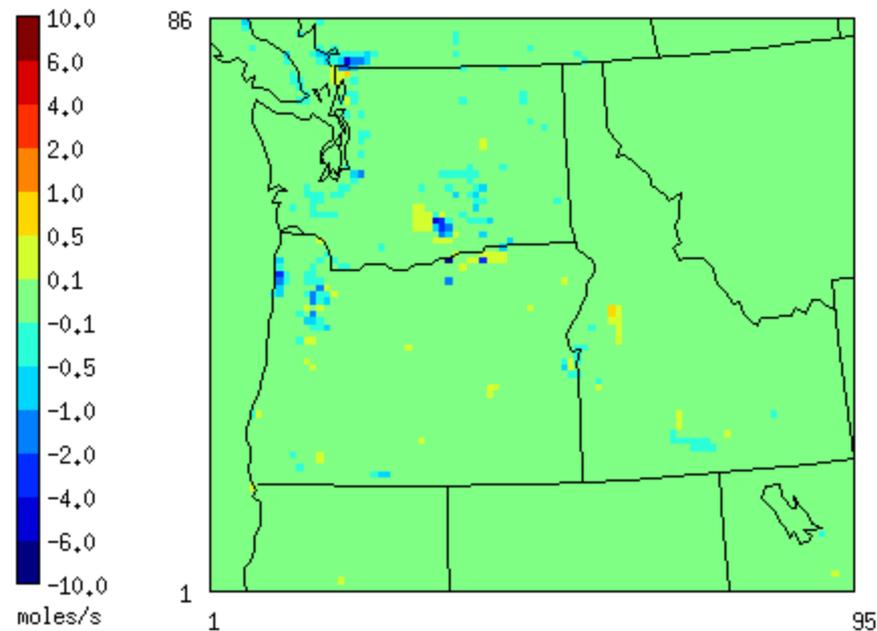
NH3 Grouped to 12-km grid
Collapsed to 1 Layer



May 31, 2012 1:00:00 (PST)
Min= 0.000 at (1,1), Max= 380.753 at (24,6)

Difference of NH3 Emissions

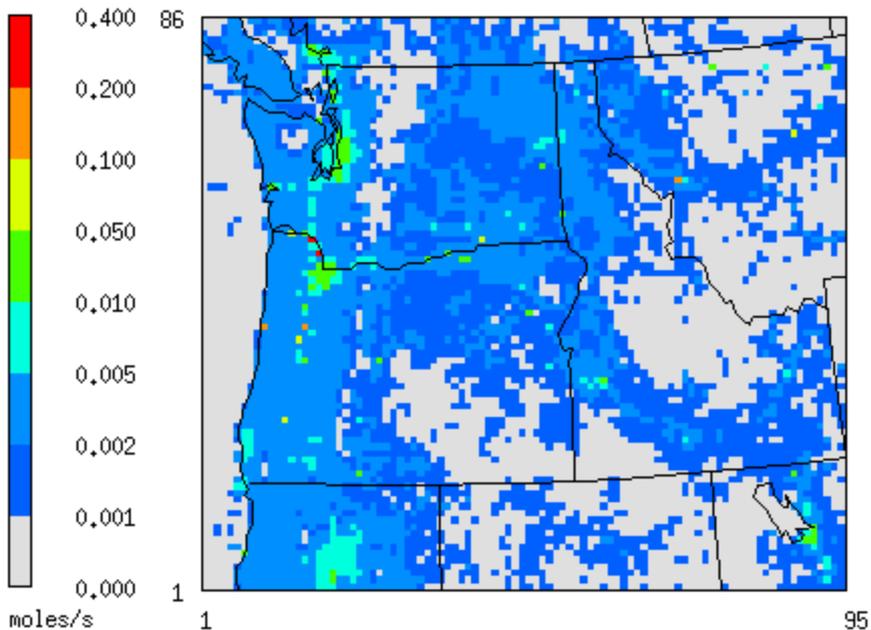
AP4 Emissions minus AP3:
Collapsed to 1 Layer



May 31, 2012 1:00:00 (PST)
Min=-10.7 at (36,50), Max=0.8 at (21,78)

AIRPACT-4 Emissions

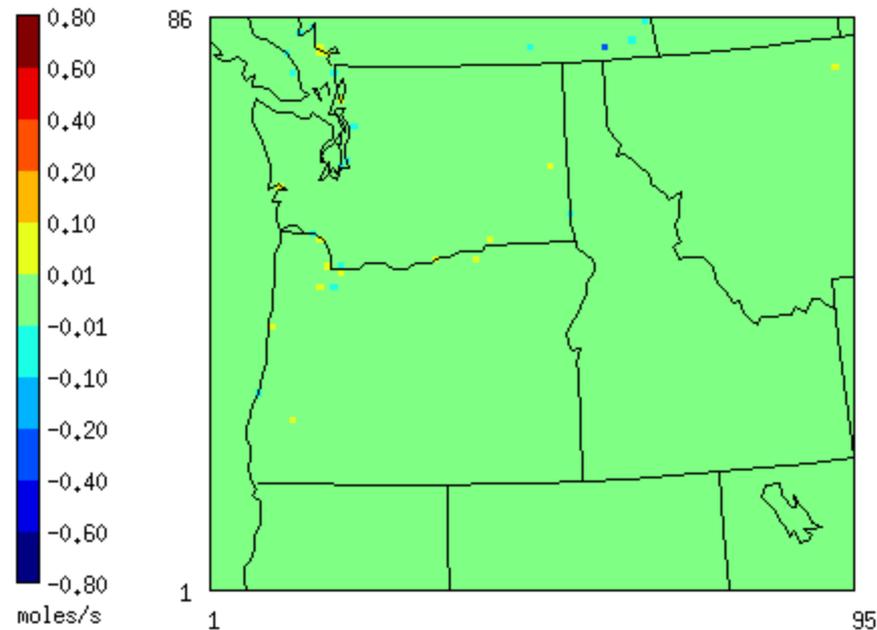
HCHO Grouped to 12-km grid
Collapsed to 1 Layer



May 31, 2012 1:00:00 (PST)
Min= 0.000 at (1,1), Max= 0.340 at (18,51)

Difference of HCHO Emissions

AP4 Emissions minus AP3:
Collapsed to 1 Layer



May 31, 2012 1:00:00 (PST)
Min=-0.26 at (59,82), Max=0.09 at (17,53)

AP4 vs AP3 Emissions Summary

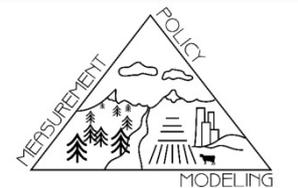
- AP4 shows significantly more ship channel & port emissions
- less NO_x along interstates in Idaho
- more NO_x in I-5 Corridor, especially major cities.
- more VOCs along I-5 corridor and other major interstates
- less VOCs in central OR / N. CA
- more pm_{2.5} in most of Idaho (except the north & city centers)
- less pm_{2.5} in nearly all of Washington.
- more pm_{2.5} in nearly all of Oregon
- significant isoprene differences in western Oregon and N. CA
- SO₂ from Centralia is gone
- Nevada site (mine?) is gone
- many ammonia emissions sources not present in AP4 but some new ones evident as well

NW-AIRQUEST ANNUAL MEETING 2012
6-8 June 2012, ETRL #101, WSU campus, Pullman, WA

**WSU-EPA-GEOSS update
(10 min)**



Presenter: Farren L. Herron-Thorpe
Date: June 6, 2012



Laboratory for Atmospheric Research

GEOSS Project Goals

- Display recent daily satellite retrievals of air quality on the AIRPACT website
- Allow users to retrieve timelines of satellite data at site locations
- Use OMI, AIRS, MODIS, and GOES products
- Display ozone at surface, ozone columns, AOD, NO₂ tropospheric columns, SO₂ columns, and clouds
- Provide profile information for ozone
- Use Google Maps framework to allow zoom and panning and AIRPACT-4 overlays

Present GEOSS Status

- Recent daily satellite retrievals of air quality are on the GMAPS website (currently some are set to 7 day lag)
- Timelines of AIRS ozone at site locations is currently being tested
- OMI, AIRS, and MODIS images are available for most days in 2012.
- GOES cloud product is currently in development (file sizes are too large)
- Profile information for ozone is not yet available on the GMAPS site

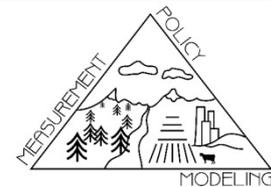
GMAPS Site Currently in Graphics Products at:
<http://lar.wsu.edu/airpact/>

NW-AIRQUEST ANNUAL MEETING 2012
6-8 June 2012, ETRL #101, WSU campus, Pullman, WA

**AIRPACT-3/NASA update
(10 min)**



Presenter: Farren L. Herron-Thorpe
Date: June 6, 2012



Laboratory for Atmospheric Research



NASA Grant Project Goals:

Funded to utilize Aura/OMI data products

Primary project objectives:

- Quantify the significance of long range transport on AIRPACT performance
- Integrate satellite products and global modeling to update AIRPACT BCON
- Concentrates on the time period of 2007-2009

Overall approach :

- develop correlation relationships between CO and other satellite detected species including NO₂, O₃, SO₂, and HCHO
- investigate methods as described by Paton-Walsh et al. (2010) where excess AOD (above background levels) detected by MODIS were used to estimate excess CO attributed to wildfires to correct for CO that remained in the region for multiple days so that the emission estimates only account for fresh CO emissions.
 - The method was also applied to estimate a number of other trace gas emissions from fires including ammonia, formaldehyde, and a number of other VOCs.
- Application of the excess method using the AOD from OMI and/or MODIS in conjunction with AIRPACT modeling results for evaluation of AIRPACT wildfire emissions
- Investigate use of the excess AOD method for application to urban plumes

NASA Grant Project Status:

- Using inert tracer CMAQ build to model flow from intrusion/transport to ground level
- Use satellite data to watch the intrusion/transport
 - NO₂ and trop O₃ (Ziemke and Liu) from OMI
 - O₃ and CO from AIRS and MOPITT
- Mt Batchelor data – dates identified by Dan Jaffe
- Presentations on the BCON/MOZART effects on the AQ model will be presented at the Aura meeting in October (publication in ACP, 2012)
- A summer REU student will be working on comparison of the Ziemke/Xiong trop ozone data sets and applications of those data sets for intrusions/transport

IASI CO

- Louisa is currently doing IASI CO/tracers for the DC3 campaign
- IASI CO coverage is much better than MOPITT – could change CO in the model. Louisa will be comparing at some point in the future (IASI has a wider swath)

Collaboration with MBO/Jaffe:

high ozone (>70 ppbv) from subsidence of UT/LS air masses at MBO:

8 March 2005

23 July 2005

22 April 2006

14 June 2008

25 June 2008

26 March 2009

5 April 2009

16 May 2009

high ozone (>70 ppbv) due to a combination of subsidence of UT/LS air masses and long-range transport of Asian emissions at MBO:

13 May 2006

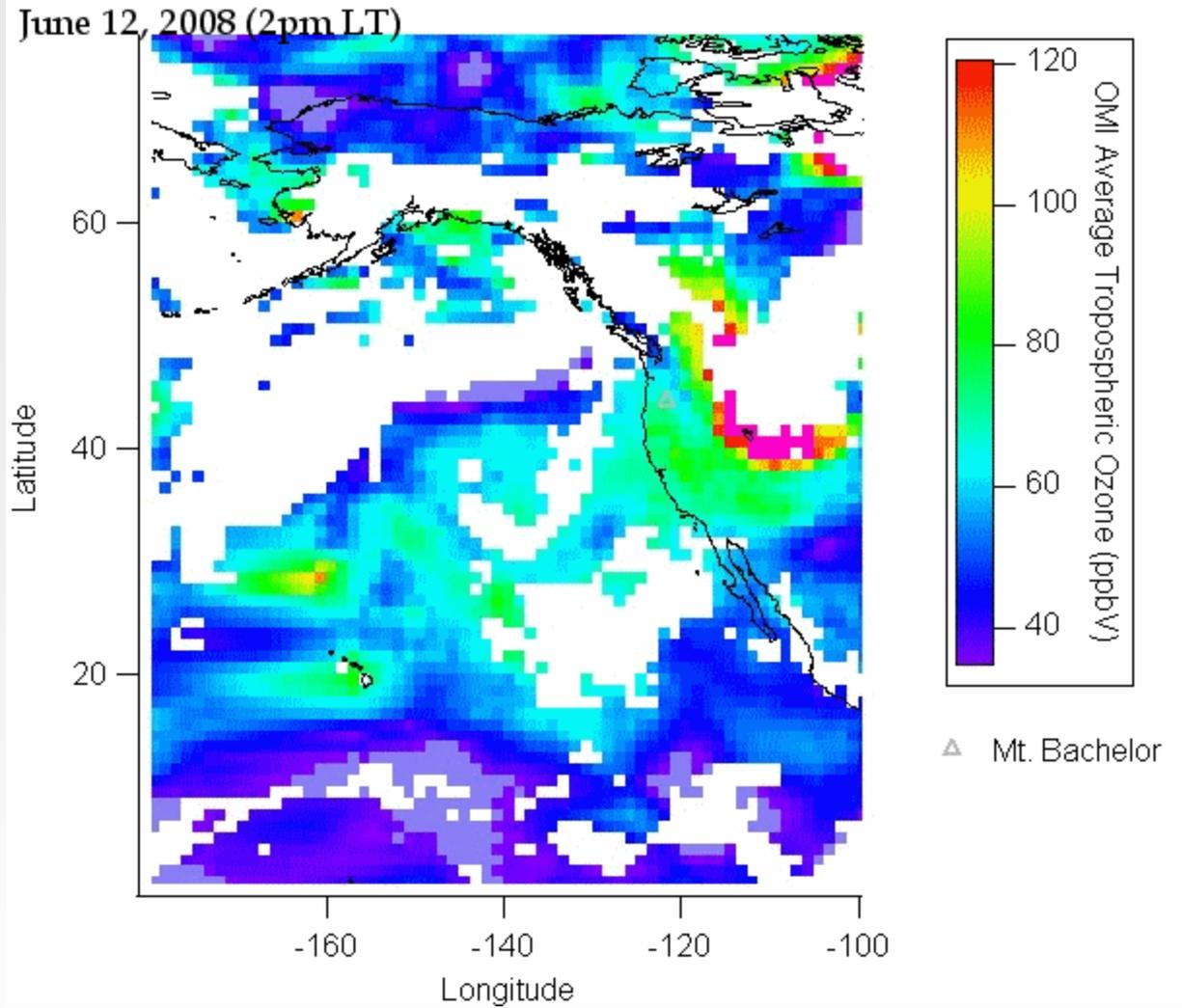
28 April 2007

15 June 2008

7-8 July 2008

15 May 2009

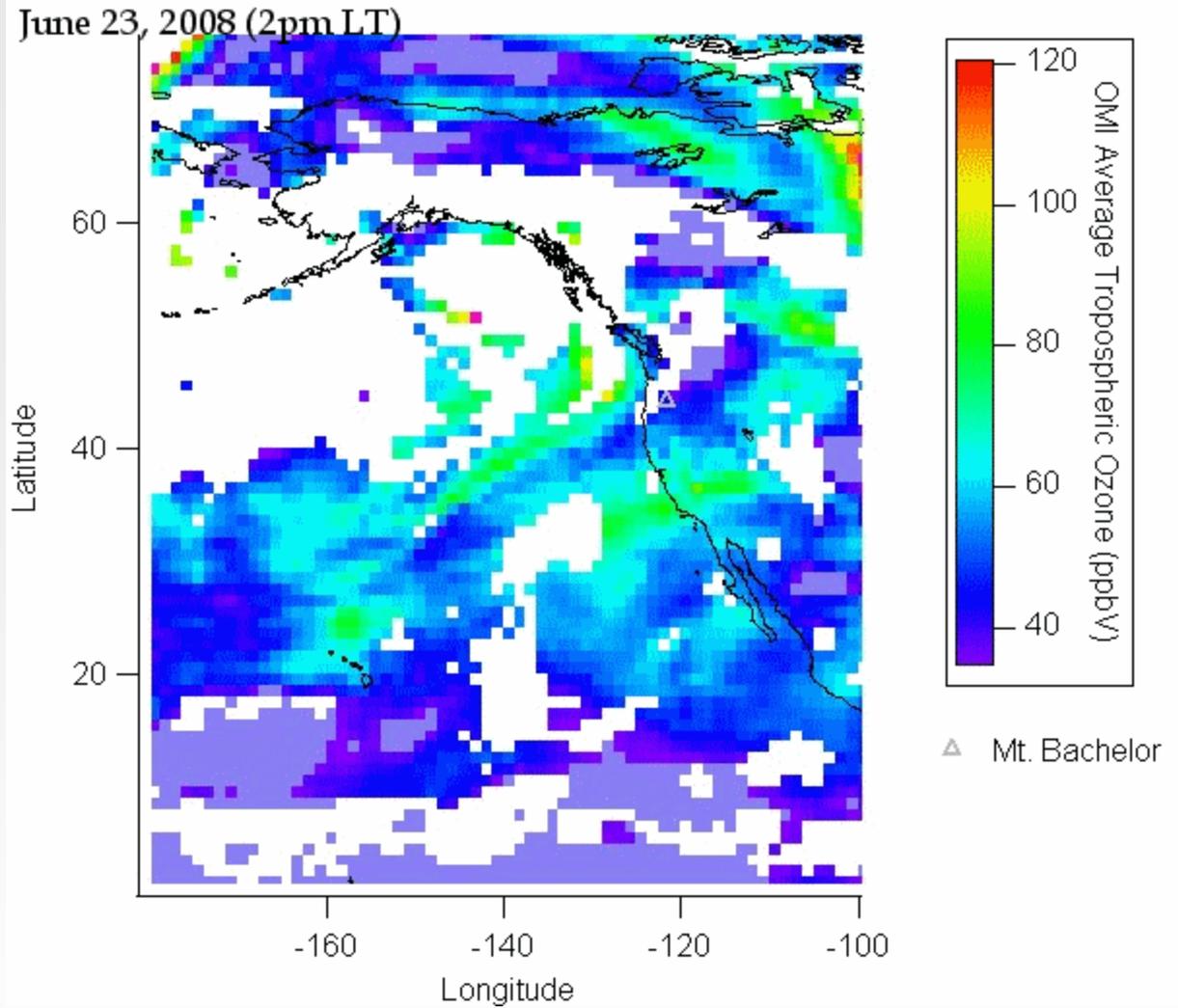
from (Ambrose et al., 2011)



OMI Trop. Ozone

(developed by Jerry Ziemke)

June 12 – 16 (2 pm LT), 2008

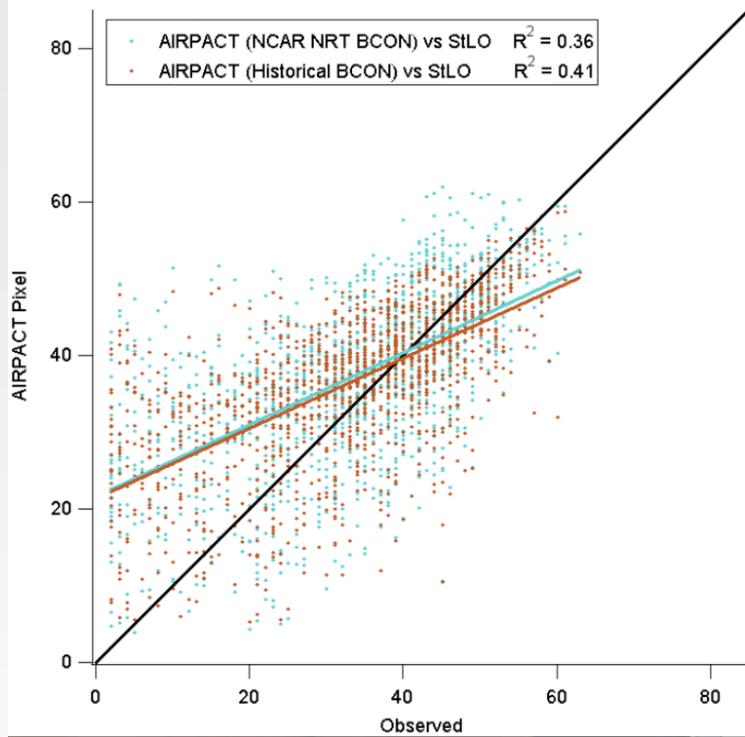


OMI Trop. Ozone

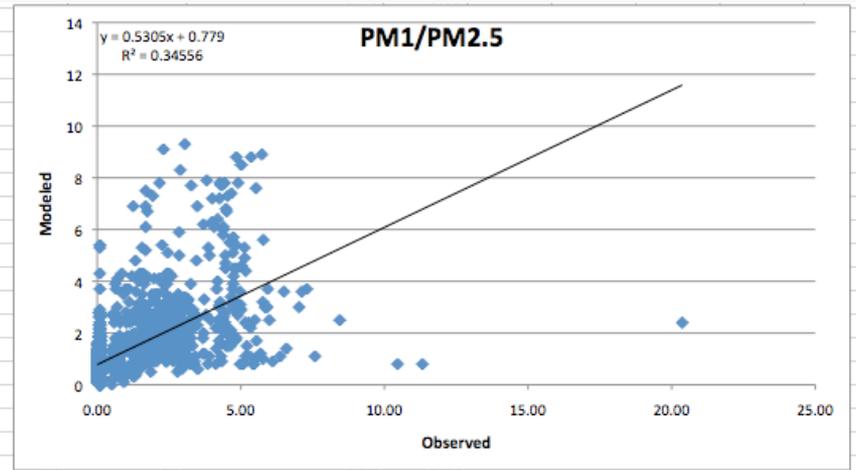
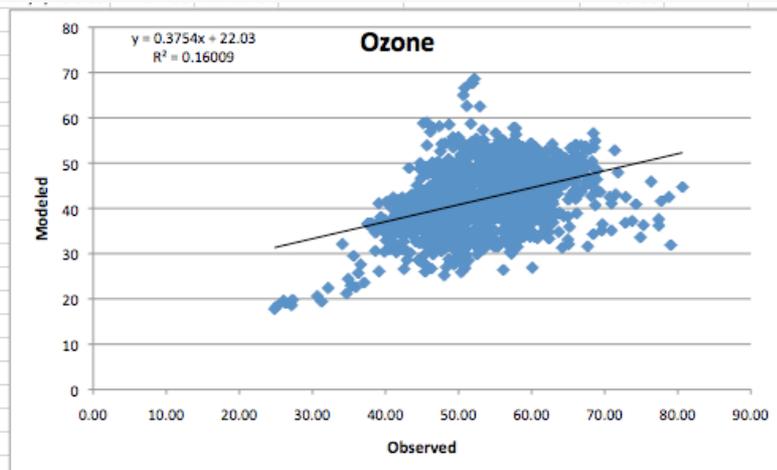
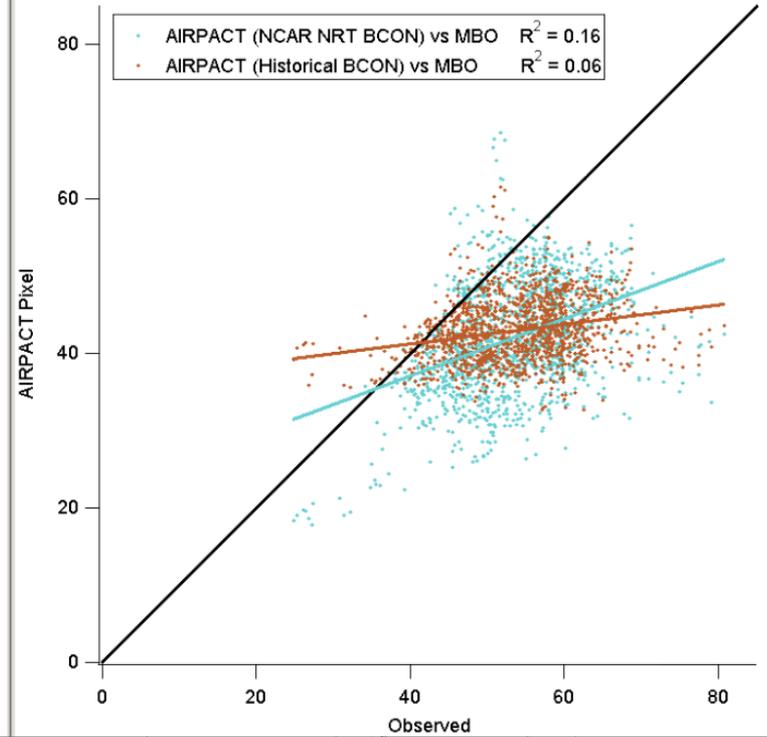
(developed by Jerry Ziemke)

June 23 – 26 (2 pm LT), 2008

OZONE: AIRPACT forecast vs St. Lukes Observations
April 1 to May 30, 2010

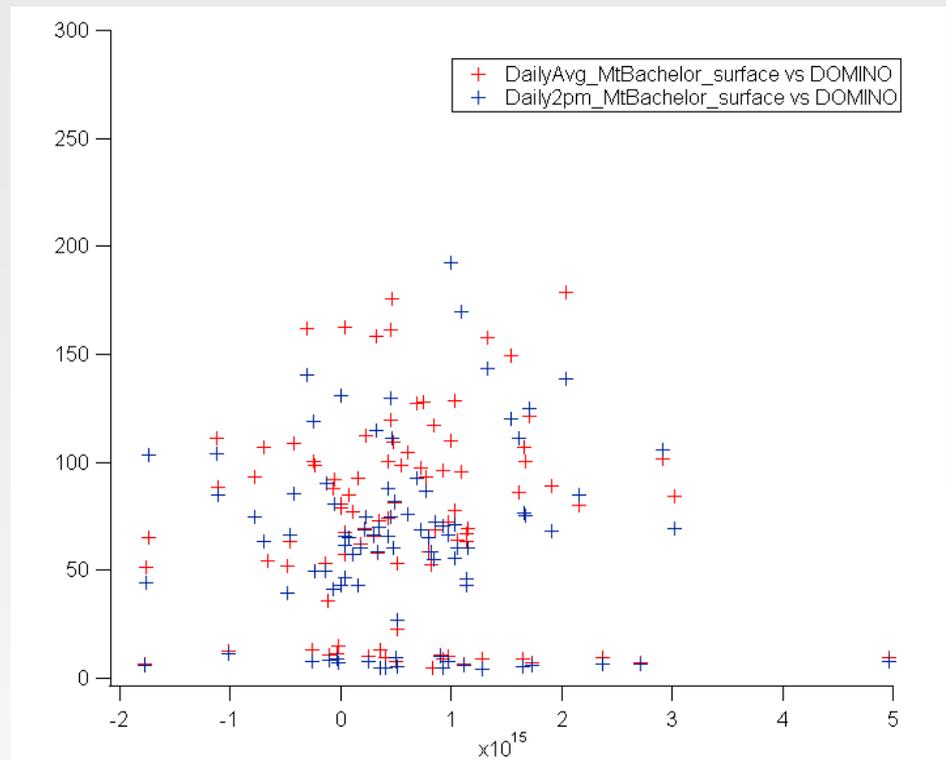


OZONE: AIRPACT forecast vs Mt. Bachelor Observations
April 1 to May 30, 2010

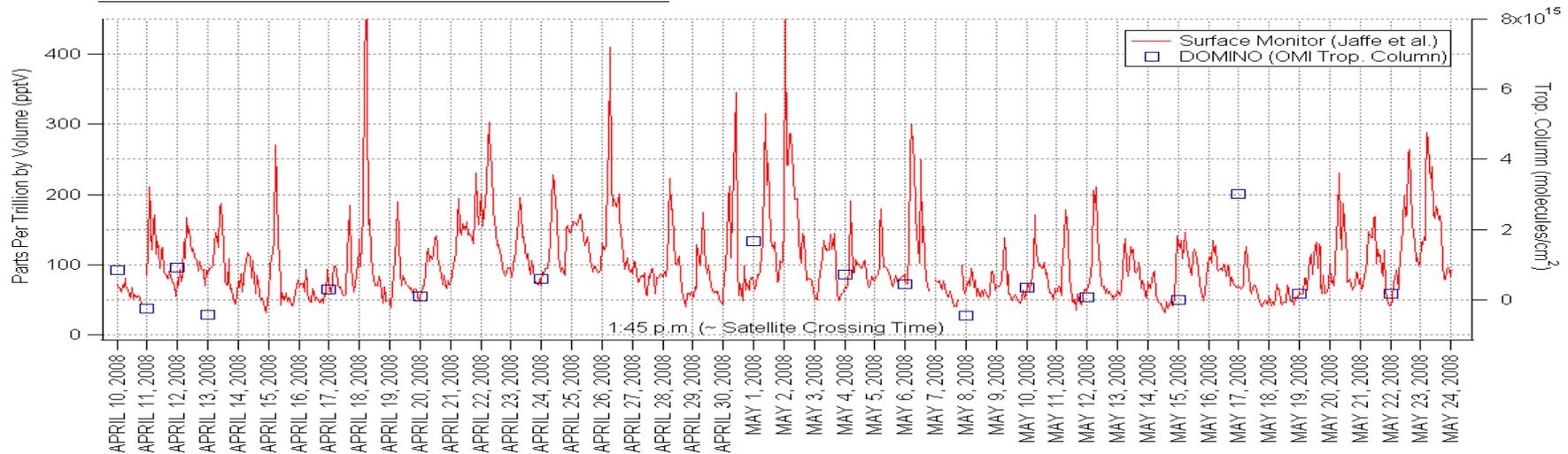


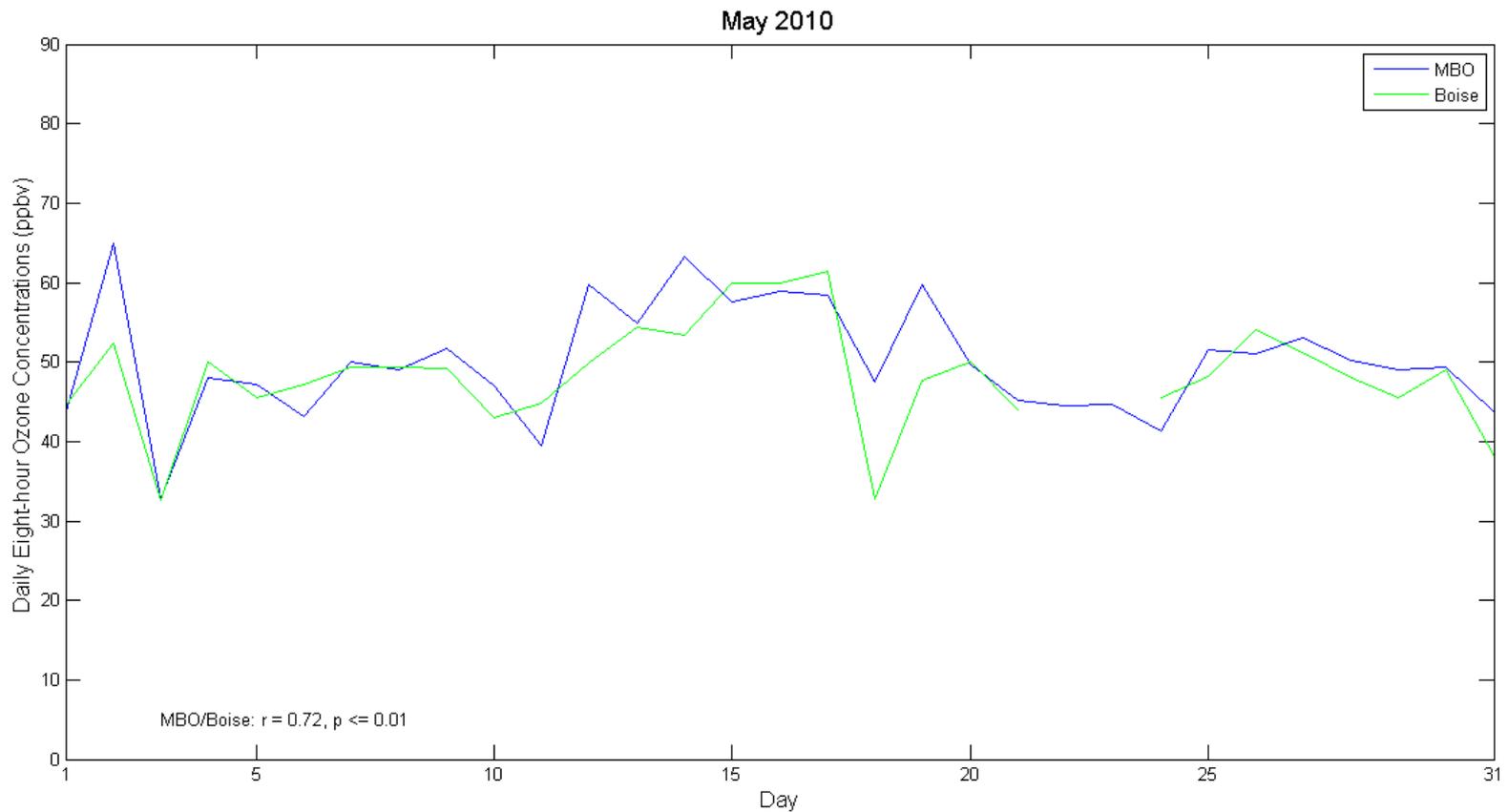
April 10 to June 18, 2008

OMI Trop NO2 vs MBO NO2



Nitrogen Dioxide at Mount Bachelor, OR





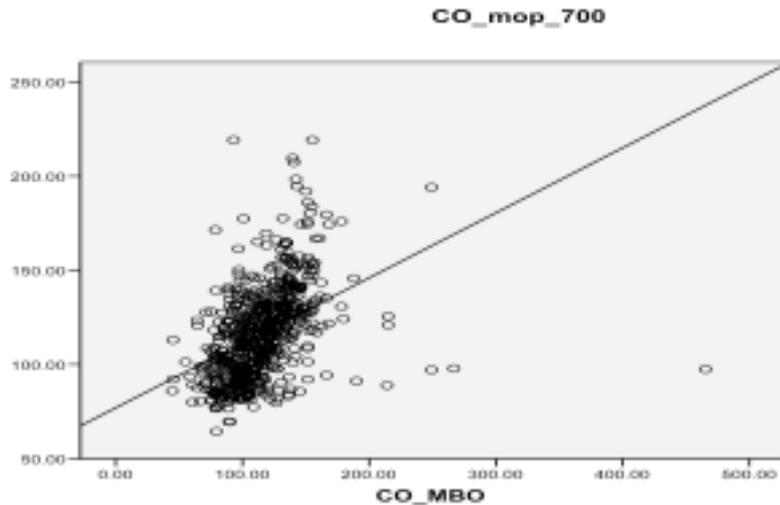
Dan Jaffe– Mt Bachelor

looking at the relationship of Mt. Bachelor data to satellite data and regional AQ. Boise AQ site, May 2010, MDA8

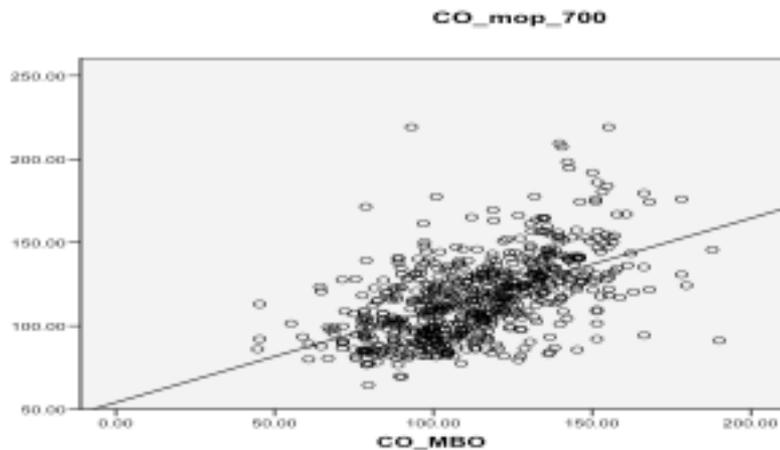
For MBO this is at night and for Boise this is in the afternoon.

So this correlation reflects an approx 12 hour lag/transport time.

MOPITT CO, 2007 vs Mt. Bachelor Observations (from Louisa Emmons, NCAR)



○ Observed
— Linear



○ Observed
— Linear

The second plot eliminates points with MBO > 200 ppbv. This gives an R^2 of around 0.3. But most of the correlation is driven by the seasonal cycle, rather than daily variations.

NW-AIRQUEST ANNUAL MEETING 2012
6-8 June 2012, ETRL #101, WSU campus, Pullman, WA

BlueSky Fire Emissions review

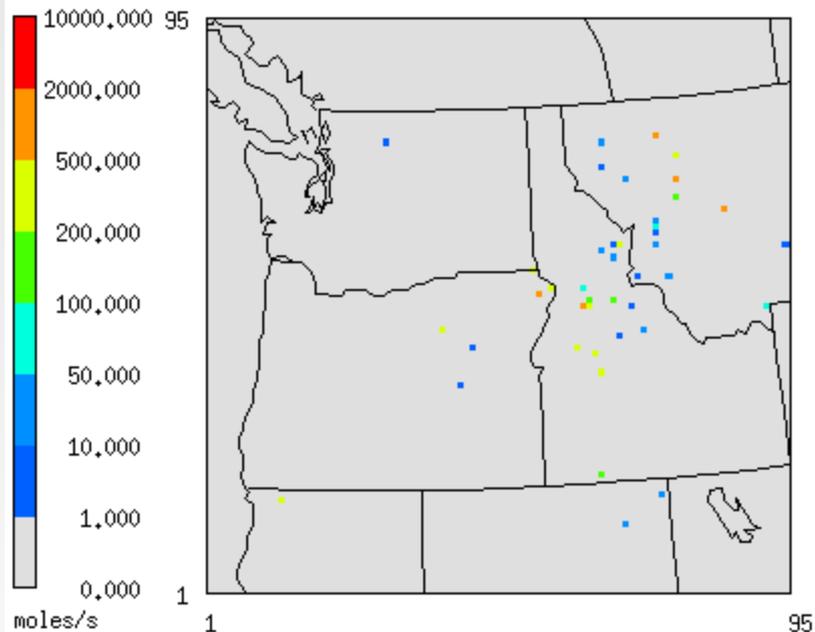


Presenter: Farren L. Herron-Thorpe
Date: June 6, 2012



Original BlueSky

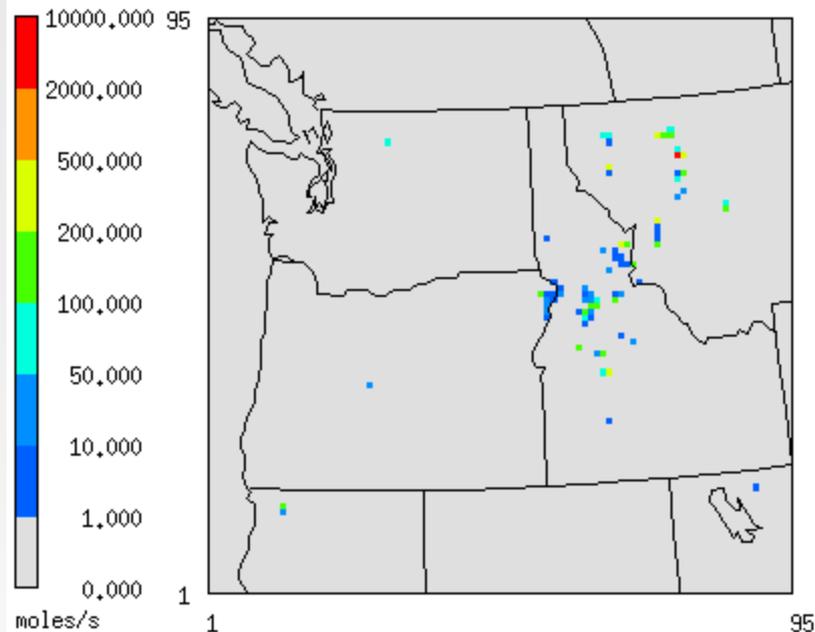
CO Emissions
Layers Collapsed



August 1,2007 1:00:00 (PST)
Min= 0,000 at (1,1), Max=1400,596 at (77,69)

New BlueSky-SMARTFIRE

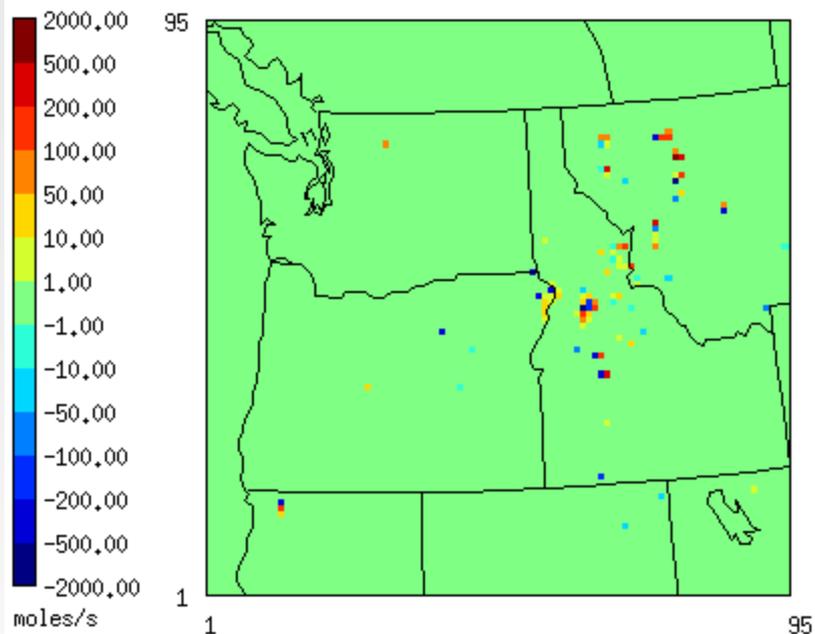
CO Emissions
Layers Collapsed



August 1,2007 1:00:00 (PST)
Min= 0,000 at (1,1), Max=2079,818 at (77,73)

Difference of CO Emissions

New BlueSky Emissions minus Original:
Layers Collapsed

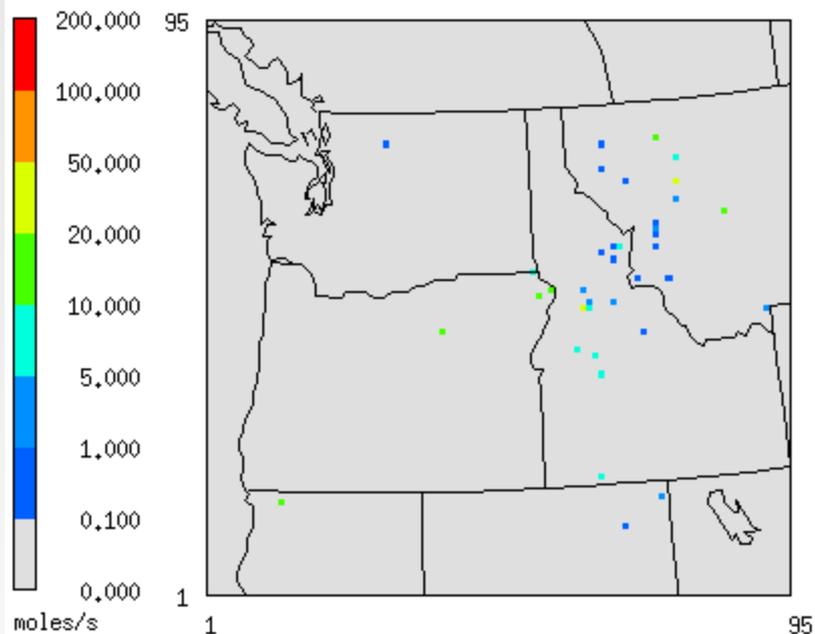


August 1, 2007 1:00:00 (PST)

Min=-1346.97 at (77,69), Max=1706.26 at (77,73)

Original BlueSky

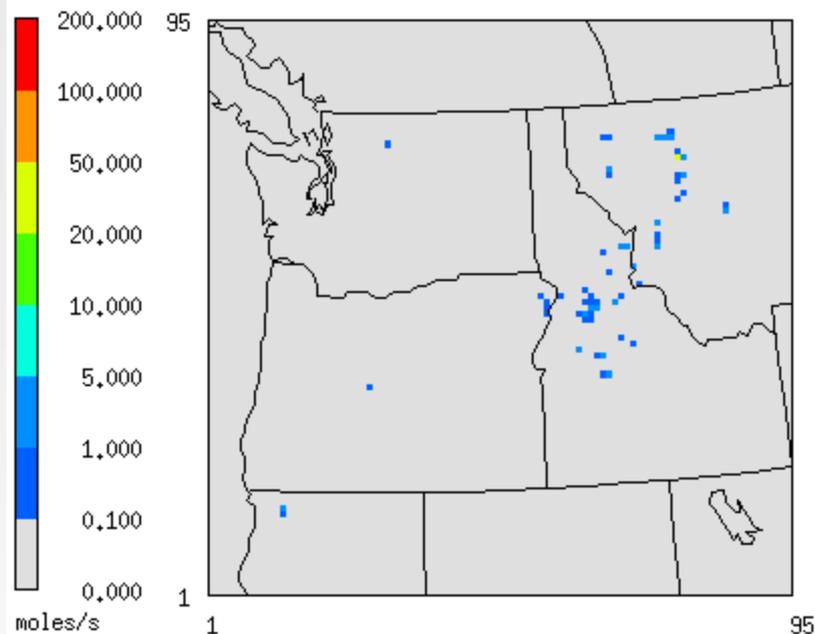
NOx Emissions
Layers Collapsed



August 1,2007 1:00:00 (PST)
Min= 0,000 at (1,1), Max= 25,149 at (77,69)

New BlueSky-SMARTFIRE

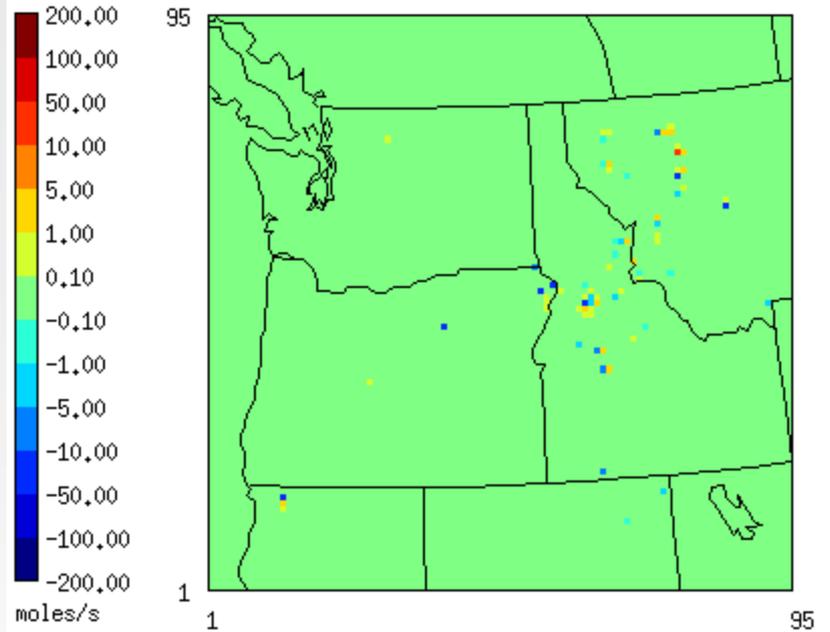
NOx Emissions
Layers Collapsed



August 1,2007 1:00:00 (PST)
Min= 0,000 at (1,1), Max= 22,729 at (77,73)

Difference of NOx Emissions

New BlueSky Emissions minus Original:
Layers Collapsed

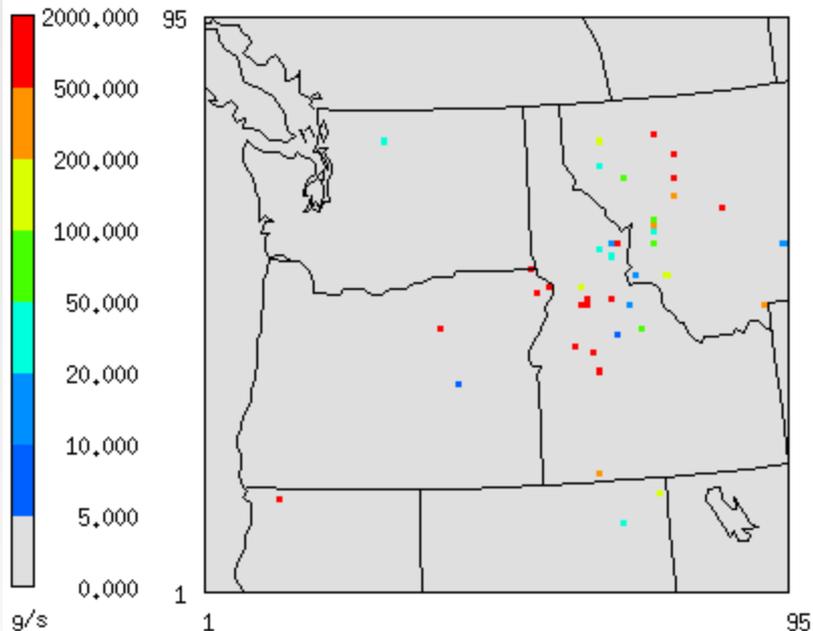


August 1, 2007 1:00:00 (PST)

Min=-24.57 at (77,69), Max=14.69 at (77,73)

Original BlueSky

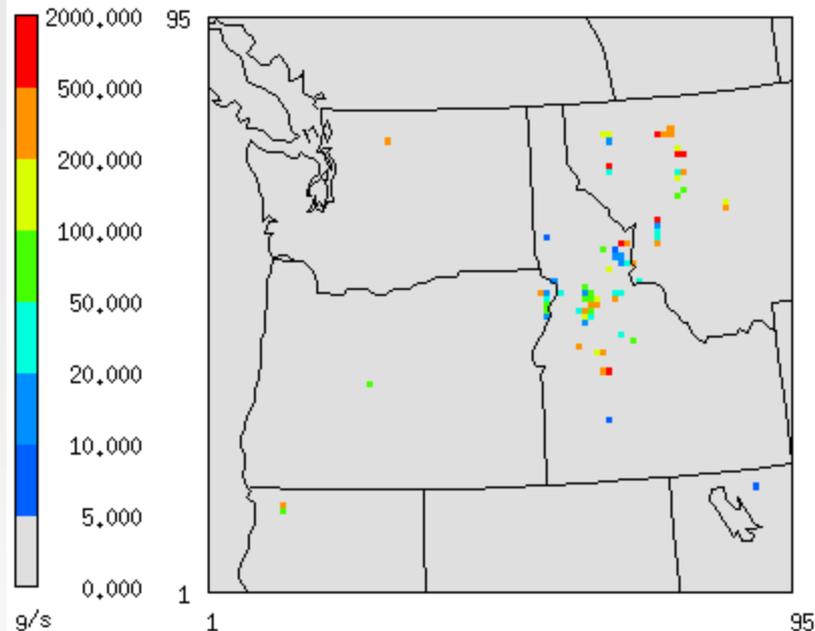
PM2.5 Emissions
Layers Collapsed



August 1,2007 1:00:00 (PST)
Min= 0,000 at (1,1), Max=4660,749 at (77,69)

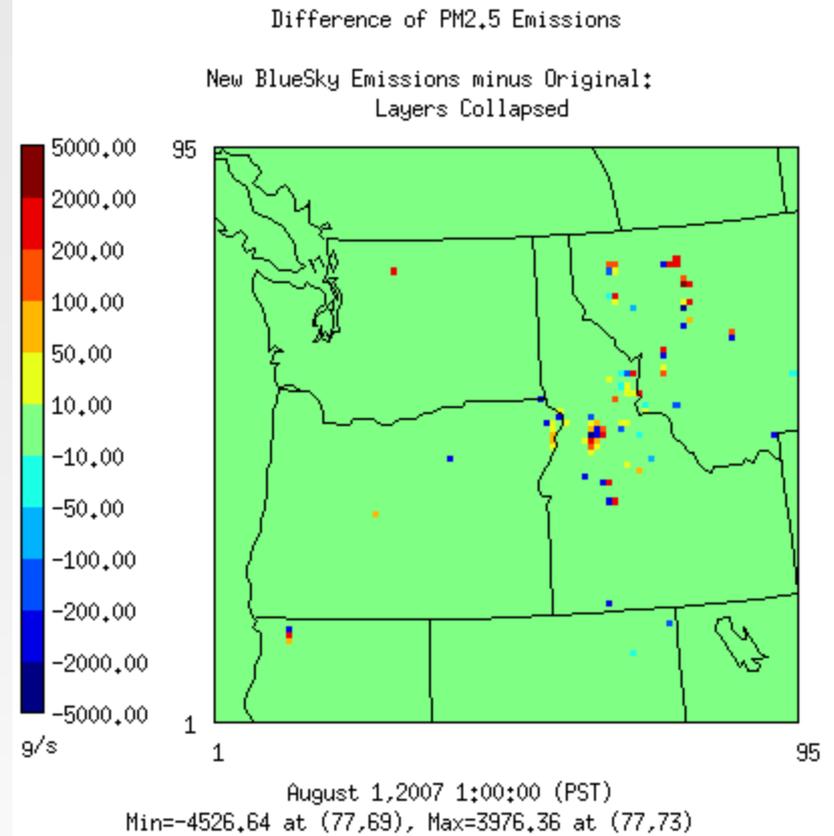
New BlueSky-SMARTFIRE

PM2.5 Emissions
Layers Collapsed



August 1,2007 1:00:00 (PST)
Min= 0,000 at (1,1), Max=5209,887 at (77,73)

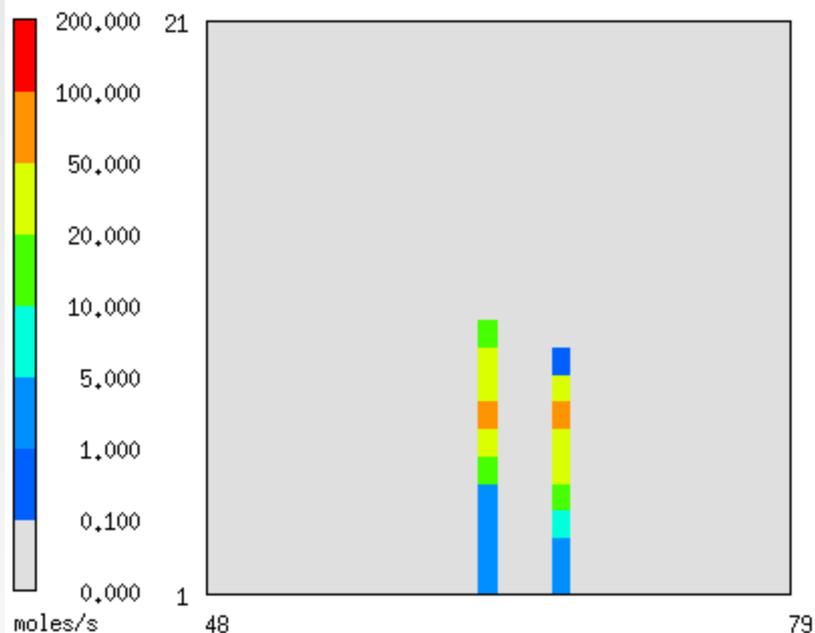
$$\text{PM 2.5} = \text{P(FINE)} + \text{P(NO3)} + \text{P(EC)} + \text{P(SO4)} + \text{POA}$$



$$\text{PM } 2.5 = \text{P(FINE)} + \text{P(NO}_3\text{)} + \text{P(EC)} + \text{P(SO}_4\text{)} + \text{POA}$$

Original BlueSky

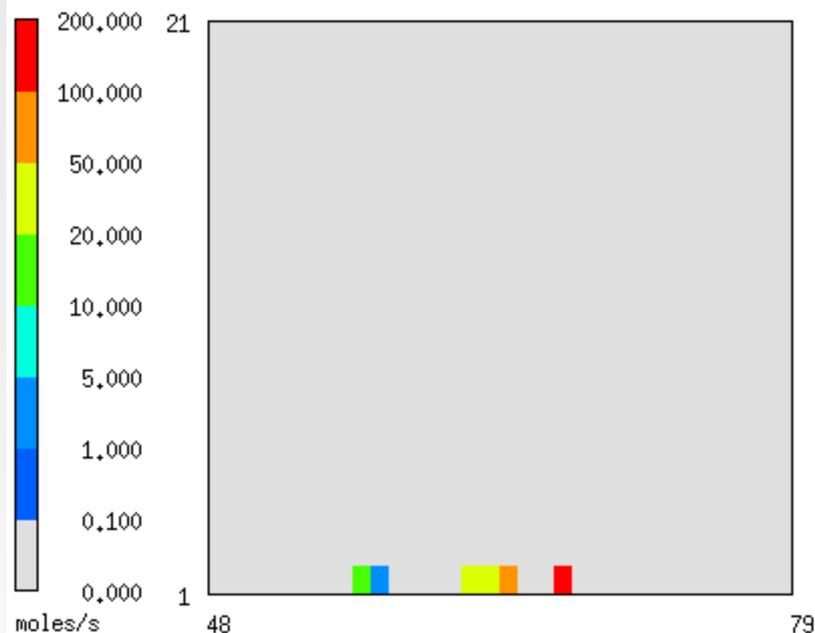
CO Emissions
Idaho Fires



August 1, 2007 1:00:00 (PST)
Min= 0,000 at (48,1), Max= 52,353 at (67,7)

New BlueSky-SMARTFIRE

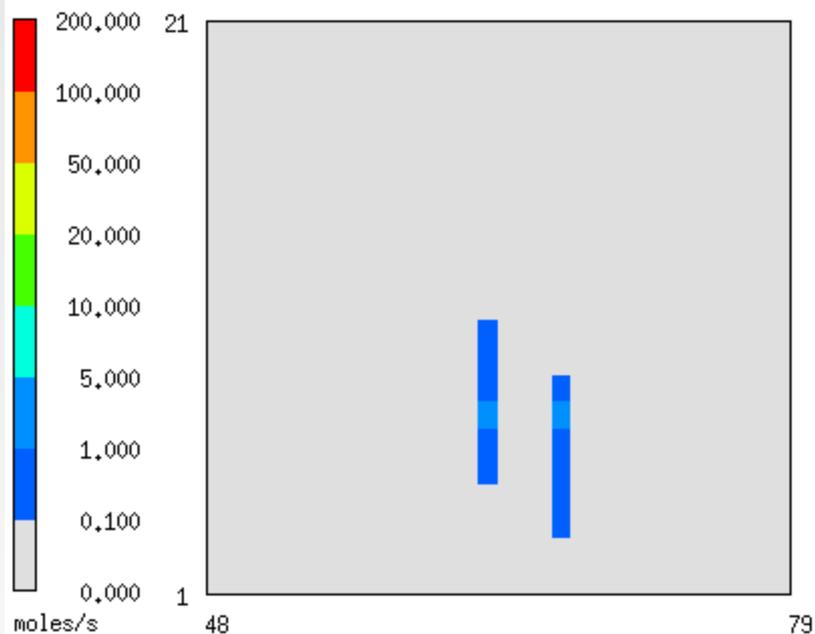
CO Emissions
Idaho Fires



August 1, 2007 1:00:00 (PST)
Min= 0,000 at (48,1), Max= 144,403 at (67,1)

Original BlueSky

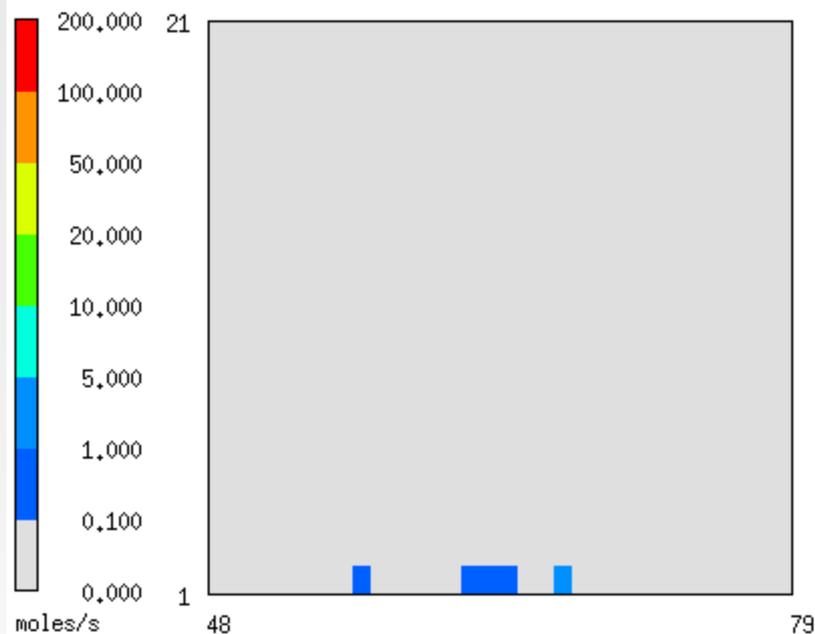
NOx Emissions
Idaho Fires



August 1, 2007 1:00:00 (PST)
Min= 0,000 at (48,1), Max= 1,075 at (67,7)

New BlueSky-SMARTFIRE

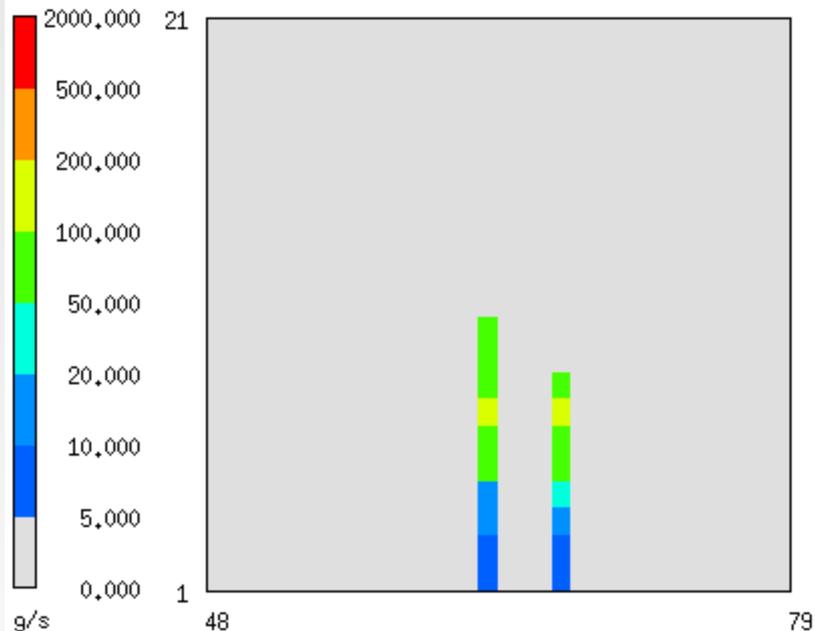
NOx Emissions
Idaho Fires



August 1, 2007 1:00:00 (PST)
Min= 0,000 at (48,1), Max= 1,057 at (67,1)

Original BlueSky

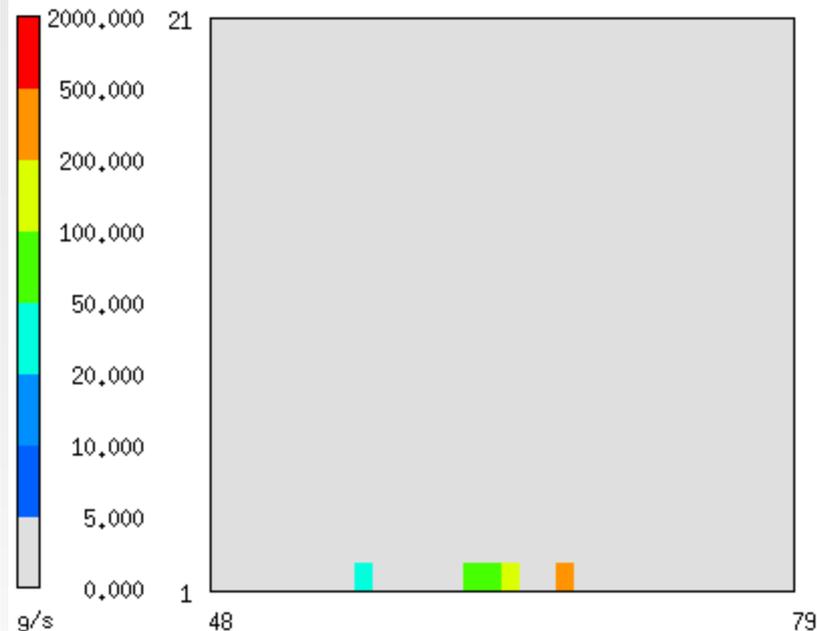
PM2.5 Emissions
Idaho Fires



August 1,2007 1:00:00 (PST)
Min= 0,000 at (48,1), Max= 173,250 at (67,7)

New BlueSky-SMARTFIRE

PM2.5 Emissions
Idaho Fires



August 1,2007 1:00:00 (PST)
Min= 0,000 at (48,1), Max= 343,621 at (67,1)

$$\text{PM 2.5} = \text{P(FINE)} + \text{P(NO3)} + \text{P(EC)} + \text{P(SO4)} + \text{POA}$$

One mid-day time-step collapsed emissions (Aug 1, 2007)

Mean Emissions Per Grid Cell (including pixels w/o fires)

	<u>Old BlueSky</u>	<u>New BlueSky</u>		<u>Old BlueSky</u>	<u>New BlueSky</u>
ACET	NONE	0.05	MEOH	NONE	0.09
ALK1	0.22	0.15	MGLY	NONE	0.0006
ALK2	0.21	0.25	NH3	0.35	0.84
ALK3	0.004	0.22	NO	0.56	0.23
ALK4	0.008	0.18	NO2	0.03	0.01
ALK5	NONE	0.38	NR	0.33	0.22
ARO1	NONE	0.12	OLE1	0.07	0.17
ARO2	NONE	0.07	OLE2	0.02	0.07
BALD	NONE	NONE	PEC	15	10
CCHO	NONE	0.04	PHEN	NONE	0.01
CCO_OH	NONE	0.02	PM10	DNE	88
CH4	0.39	0.94	PM2_5	NONE	DNE
CO	28	31	PMC	8.4	NONE
CRES	NONE	0.01	PMFINE	4.4	15
ETHENE	0.44	0.21	PNO3	0.18	0.13
GLY	NONE	0.0007	POA	71	49
HCHO	NONE	0.11	PROD2	NONE	0.01
HCN	NONE	DNE	PSO4	1.8	1.3
HCOOH	NONE	0.02	RCHO	NONE	0.05
IPROD	NONE	NONE	RCO_OH	NONE	0.03
ISOPRENE	NONE	0.01	SO2	0.14	0.1
MACR	NONE	0.03	SULF	NONE	NONE
MEK	NONE	0.02	TRP1	NONE	0.01

Bolded numbers indicate larger value (where both have non-zero)

DNE = Variable DOES NOT EXIST

Units are moles/s for gases and g/s for particles

Summary

- New Bluesky has significantly larger number of species with emissions factors
- New BlueSky has most of the bulk emissions in the surface layer with significant plume rise in day hours. This contrasts to Old BlueSky where bulk emissions are aloft.
- New BlueSky has significantly larger fire locations and growth dynamics. However, some fires that were identified with Old BlueSky do not appear at all with the new BlueSky.