AQS Conference 2012

Integrating United States
And
Canadian Air Monitoring Data

Bill Sukloff

Computer Systems Analyst
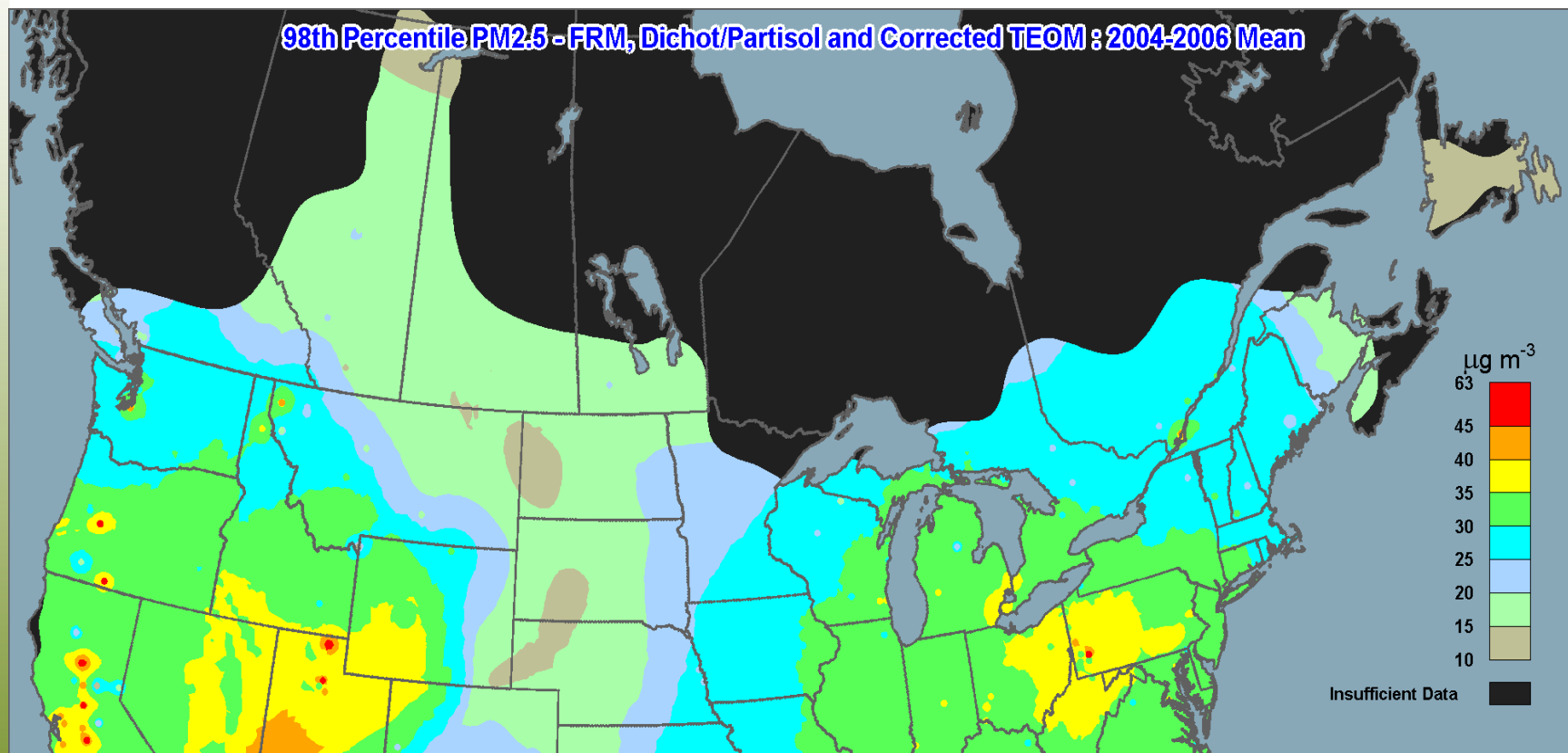Environment Canada

Environment Canada   Environnement Canada

Canada

Reports and Publications

98th Percentile PM2.5 - FRM, Dichot/Partisol and Corrected TEOM : 2004-2006 Mean

Source: 2012 Canadian Smog Science Assessment (Environment Canada / Health Canada)
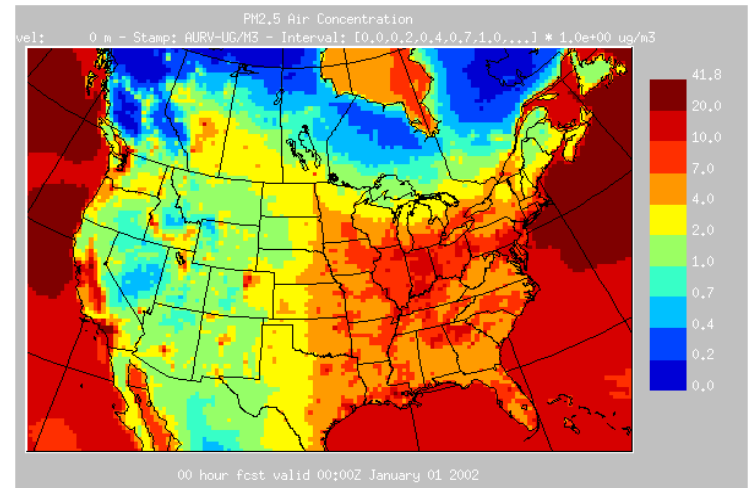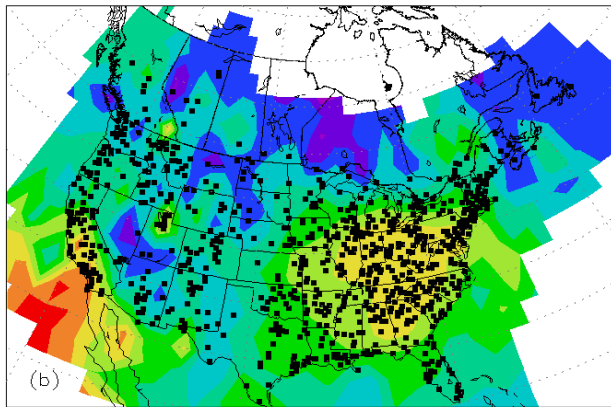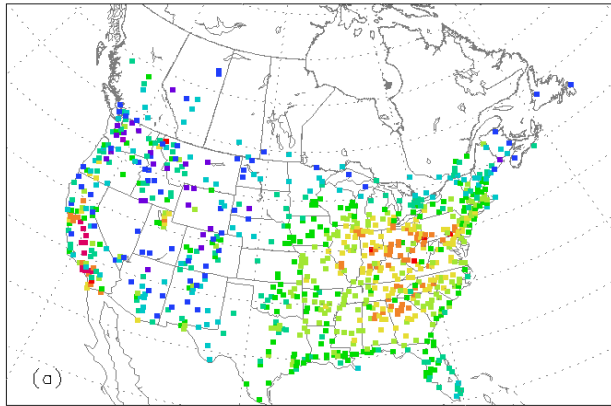
Environment Canada

Environnement Canada

Canada

Model Evaluation

Observed PM2.5, ug/m^3, 2002 annual

International Agreements

Publications
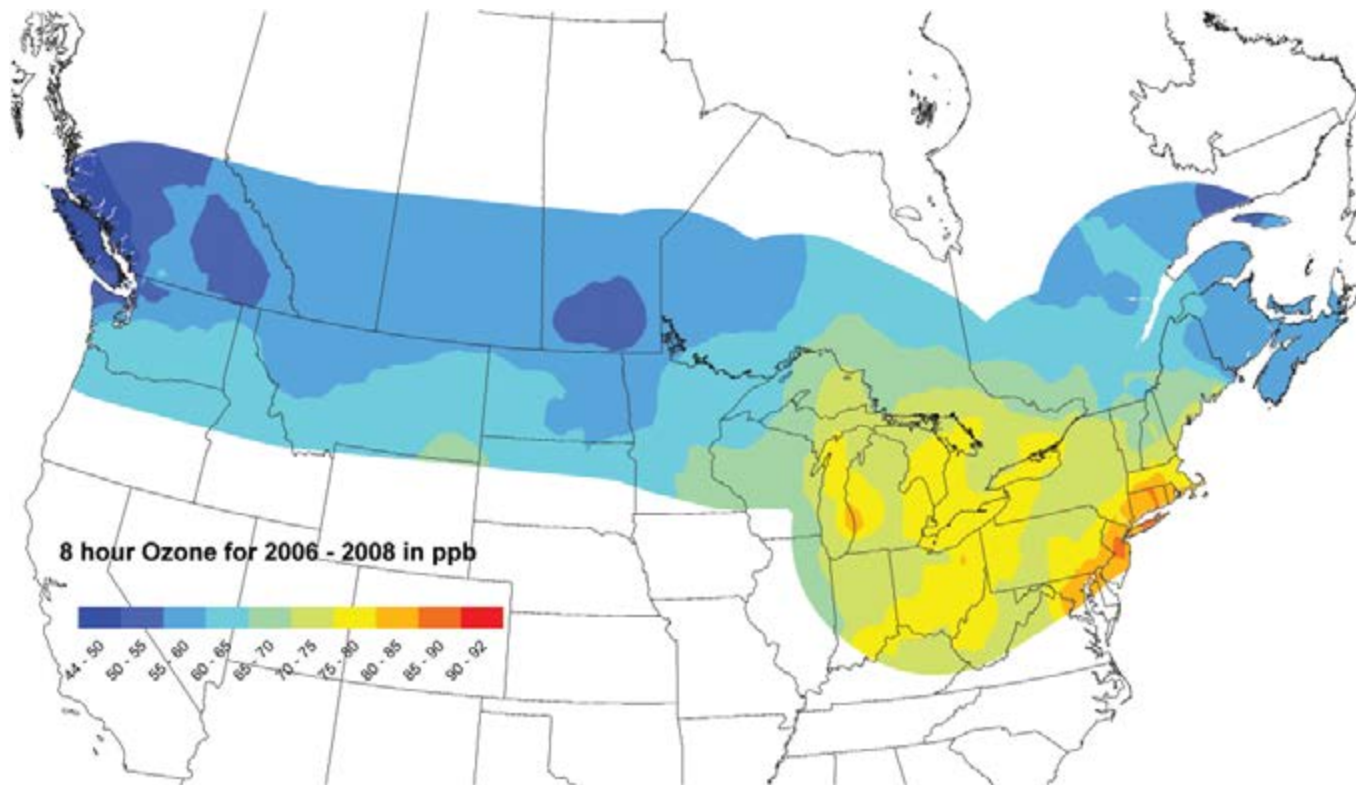

8 hour Ozone for 2006 - 2008 in ppb

44 - 50 | 50 - 55 | 55 - 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | 80 - 85 | 85 - 90 | 90 - 92

Ozone Concentrations along the Canada–U.S. Border
(Three-Year Average of the Fourth-highest Daily Maximum 8-hour
Average), 2006–2008

Environment Canada   Environnement Canada

Canada

Data Sources: Particulate Matter & Toxics Networks

Network	Sampling Period	Start & End Time	STP	Blank Corrected	Flow Rate	Date	Size cut
AIRMoN	7days	0900-0900	STP (21°C)	yes	3l/min	1984	ND
AMODES	24hr	Var.	STP (25°C)	yes	20l/min	1988 - 1990	ND
AQS	24hr	Var.	Var.	yes & no		1995	2.5μm, 10μm
APIOS-C	28days	0800-0800	Amb.	no	2l/min	1981 - 1993	ND
APIOS-D	24hr	0800-0800	Amb.	no	20l/min	1980 - 1993	ND
CAACP	7 days	Var.	STP (0°C)	yes	1m**3/min	1980	ND
CAAMP	24hr	0800-0800	STP (0°C)	no	16.7l/min	1992 - 1996	2.5μm, 10μm
CAMNet	24hr	Var.	Amb.	no	0.75/min	1995	ND

Environment Canada   Environnement Canada
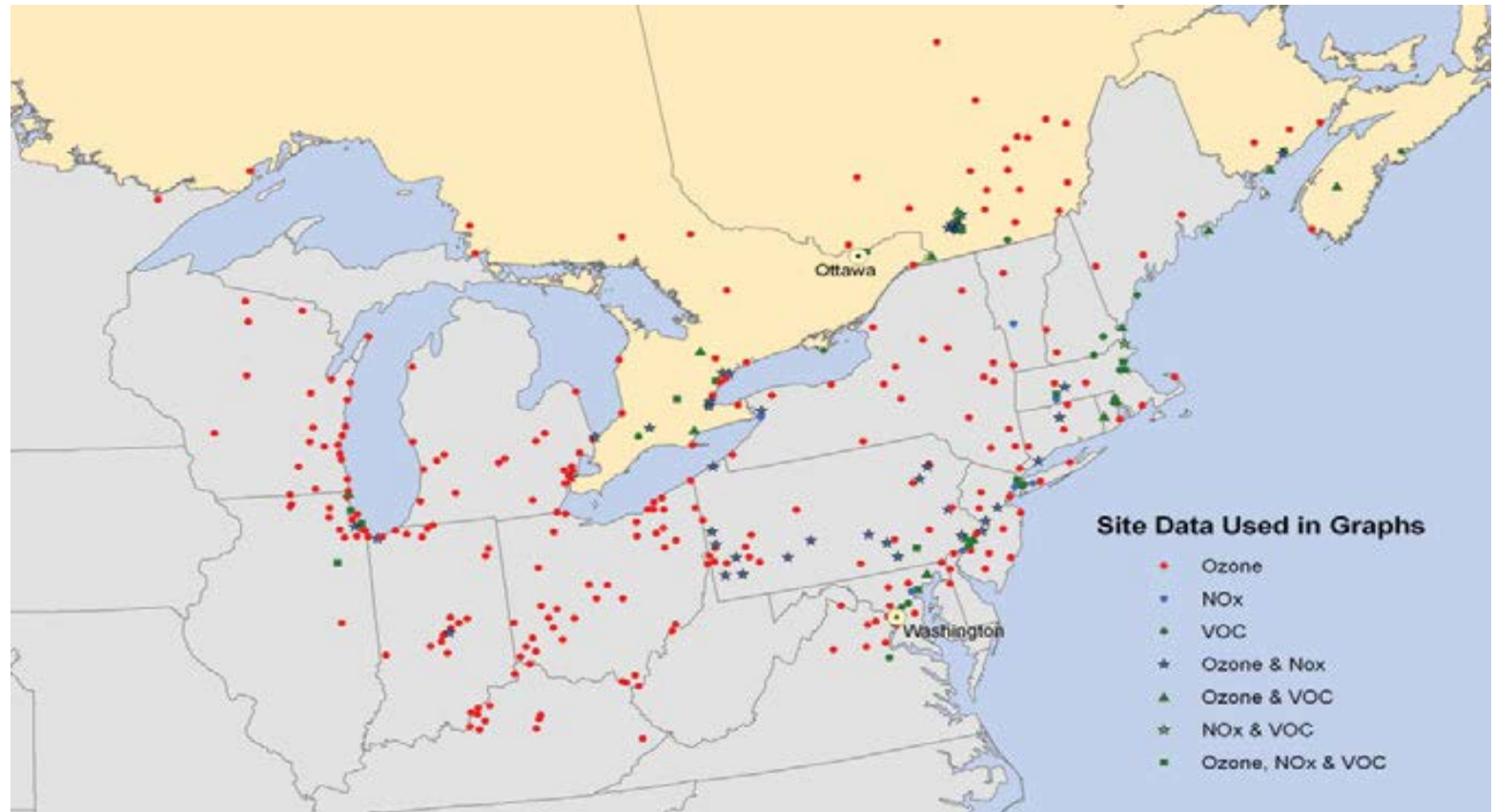
Canada

Data Sources: Particulate Matter & Toxics Networks

Network	Sampling Period	Start & End Time	STP	Blank Corrected	Flow Rate	Date	Size cut
CANCP	7 days	1100-1100	STP (25° C)	no	1.1m**3/min	1993	10μm
CAPMoN	24hr	0800-0800	STP (0°C)	yes	25l/min	1979	ND
CASTNet	7 days	0800-0800	STP (25°C)	yes	1.5l/min (E), 3l/min (W)	1987	ND
FPNT	24hr	0800-0800	STP (25°C)	no	8.8l/min	1988 - 1990	2.5μm
GAViM	24hr	0001-2359	Amb.	no	22.9l/min,	1994 - 2001	2.5μm
IADN-A	24hr	0800-0800	STP (0°C)	yes & no		1988	ND, 10μm
IMPROVE	24hr	0000-0000	Amb.	no	22.8l/min, 16.9l/min	1988	2.6μm, 10μm
NAPS	24hr	0000-0000 or 0800-0800	STP (25°C)	no	16.7l/min.	1992	2.5μm

Data Sources: Example

Network of Monitoring Sites Used to Create Graphs
of Ambient Ozone, NOx and VOC Levels

NAtChem

US Data Source: AQS

http://www.epa.gov/ttn/airs/airsaqs/detaildata/downloadaqsdata.htm   aqs data

File   Edit   View   Favorites   Tools   Help

Convert ▾   Select

AQS Data for Downloading | TTN AIRS AQS ...

Page ▾   Tools ▾

Yearly Raw Data Files Retrieved From AQS

Year of data, zipped file size, (unzipped file size), Date of extraction

Pollutant (Parameter Code) File name (substitute year for "yyyy")	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
Carbon Monoxide (42101) RD_501_42101_yyyy.ZIP	42101_2012 1045 KB (18445KB) 05/12/12	42101_2011 11267 KB (19627KB) 05/12/12	42101_2010 10763 KB (199577KB) 05/12/12	42101_2009 10431 KB (206445KB) 05/12/12	42101_2008 10566KB (218168KB) 05/12/12	42101_2007 10649KB (224159KB) 05/12/12	42101_2006 11021KB (232867KB) 05/12/12	42101_2005 11771KB (248359KB) 05/12/12	42101_2004 12176KB (256346KB) 05/12/12	42101_2003 12603KB (262955KB) 05/12/12	42101_2002 13248KB (247597KB) 05/12/12	42101_2001 14703KB (296633KB) 05/12/12	42101_2000 14576KB (298284KB) 05/12/12	42101_1999 16114KB (29428KB) 05/12/12	42101_1998 15125KB (303718KB) 05/12/12	42101_1997 16700KB (305235KB) 05/12/12	42101_1996 15371KB (307367KB) 05/12/12	42101_1995 16889KB (305667KB) 08/8/11
Lead - PB - daily (12128) RD_501_12128_yyyy.ZIP	12128_2012 1k (3KB) 05/14/12	12128_2011 14k (180KB) 05/14/12	12128_2010 221k (293KB) 05/14/12	12128_2009 35KB (521KB) 05/14/12	12128_2008 64KB (949KB) 05/14/12	12128_2007 66 KB (975KB) 05/14/12	12128_2006 75KB (1138KB) 05/14/12	12128_2005 73KB (1136KB) 05/14/12	12128_2004 70KB (1105KB) 05/14/12	12128_2003 65KB (1032KB) 05/14/12	12128_2002 67KB (1065KB) 05/14/12	12128_2001 65KB (1008KB) 05/14/12	12128_2000 60KB (999KB) 05/14/12	12128_1999 65KB (1070KB) 05/14/12	12128_1998 76KB (1261KB) 05/14/12	12128_1997 92KB (1546KB) 05/14/12	12128_1996 105KB (1752KB) 05/14/12	12128_1995 109KB (1809KB) 05/14/12
Lead from TSP-(PB TSP) daily (14129) RD_501_14129_yyyy.ZIP	14129_2012 6KB (90KB) 05/14/12	14129_2011 77KB (1115KB) 05/14/12	14129_2010 71KB (1039KB) 05/14/12	14129_2009 43 KB (650KB) 05/14/12	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported	no data reported
Nitrogen Dioxide (42602) RD_501_42602_yyyy.ZIP	42602_2012 1431 KB (24240KB) 05/16/12	42602_2011 13122 KB (231692KB) 05/16/12	42602_2010 13424 KB (240929KB) 05/16/12	42602_2009 12670KB (237792KB) 05/16/12	42602_2008 12507KB (242042KB) 05/16/12	42602_2007 12539KB (245258KB) 05/16/12	42602_2006 12782KB (248502KB) 05/16/12	42602_2005 12881KB (249648KB) 05/16/12	42602_2004 13063KB (253753KB) 05/16/12	42602_2003 12980KB (250133KB) 05/16/12	42602_2002 13175KB (253309KB) 05/16/12	42602_2001 13155KB (252212KB) 05/16/12	42602_2000 13076KB (250374KB) 05/16/12	42602_1999 12811KB (243985KB) 05/16/12	42602_1998 12603KB (240956KB) 05/03/10	42602_1997 13357KB (234150KB) 05/16/12	42602_1996 11822KB (224943KB) 05/16/12	42602_1995 11786KB (223379KB) 05/16/12
Ozone (44201) - hourly RD_501_44201_yyyy.ZIP	44201_2012 3481 KB (59658KB) 05/16/12	44201_2011 38737KB (654805KB) 05/16/12	44201_2010 11311 KB (193234KB) 05/16/12	44201_2009 34823KB (606589KB) 05/16/12	44201_2008 33408KB (596563KB) 05/16/12	44201_2007 32857KB (593365KB) 05/16/12	44201_2006 32017KB (577963KB) 05/16/12	44201_2005 31673KB (571826KB) 05/16/12	44201_2004 34293KB (576694KB) 03/17/11	44201_2003 31813KB (573405KB) 05/15/12	44201_2002 31380KB (564171KB) 05/15/12	44201_2001 30788KB (553675KB) 05/15/12	44201_2000 29797KB (536082KB) 05/15/12	44201_1999 28755KB (516593KB) 05/15/12	44201_1998 28134KB (506173KB) 05/03/10	44201_1997 29536KB (492660KB) 05/16/12	44201_1996 28350KB (475202KB) 05/03/10	44201_1995 28307KB (473813KB) 05/03/10
Oxides of Nitrogen - NOX (42603) RD_501_42603_yyyy.ZIP	42603_2012 1221 KB (20325KB) 05/14/12	42603_2011 12310 KB (209879KB) 05/14/12	42603_2010 12309 KB (215677KB) 05/14/12	42603_2009 11578 KB (209020KB) 05/14/12	42603_2008 11262KB (210332KB) 05/14/12	42603_2007 11079KB (208599KB) 05/14/12	42603_2006 9794KB (182248KB) 05/14/12	42603_2005 9661KB (178325KB) 05/14/12	42603_2004 9644KB (178711KB) 05/14/12	42603_2003 10413KB (175607KB) 05/05/10	42603_2002 10409KB (174900KB) 05/05/10	42603_2001 9979KB (166840KB) 05/05/10	42603_2000 9901KB (164951KB) 05/05/10	42603_1999 9866KB (163132KB) 09/16/10	42603_1998 9416KB (156798KB) 09/16/10	42603_1997 9129KB (151451KB) 09/16/10	42603_1996 8989KB (14357KB) 09/16/10	42603_1995 8813KB (145045KB) 09/16/10
PAMS VOC[1] RD_501_PAMS VOC_yyyy.ZIP	PVOC_2012 2994 KB (49350KB) 05/16/12	PVOC_2011 38826 KB (670693KB) 05/16/12	PVOC_2010 37098 KB (639619KB) 05/16/12	PVOC_2009 36215KB (616406KB) 05/16/12	PVOC_2008 36213KB (613060KB) 05/16/12	PVOC_2007 39874KB (664006KB) 05/16/12	PVOC_2006 37882KB (627441KB) 05/16/12	PVOC_2005 35216KB (577851KB) 05/16/12	PVOC_2004 32004KB (526190KB) 05/16/12	PVOC_2003 31405KB (511644KB) 05/15/12	PVOC_2002 33726KB (565594KB) 05/15/12	PVOC_2001 30967KB (507904KB) 05/15/12	PVOC_2000 30031KB (492765KB) 05/15/12	PVOC_1999 28841KB (471919KB) 08/18/11	PVOC_1998 27994KB (386472KB) 08/18/11	PVOC_1997 25102KB (300425KB) 08/18/11	PVOC_1996 19572KB	PVOC_1995 14472KB (223349KB)
PM $_{2.6}$ - Local Conditions[4] (88101) RD_501_88101_yyyy.ZIP	88101_2012 957 KB (16010KB) 05/16/12	88101_2011 8768 KB (149980KB) 05/16/12	88101_2010 6345 KB (105668KB) 05/16/12	88101_2009 3397KB (56876KB) 05/16/12	88101_2008 1078KB (16396KB) 05/16/12	88101_2007 784KB (11187KB) 05/16/12	88101_2006 747KB (10680KB) 05/16/12	88101_2005 791KB (11257KB) 05/16/12	88101_2004 791KB (11408KB) 05/16/12	88101_2003 803KB (11594KB) 05/16/12	88101_2002 888KB (12913KB) 05/16/12	88101_2001 884KB (12797KB) 05/16/12	88101_2000 835KB (12056KB) 05/16/12	88101_1999 624KB (8392KB) 10/1/10	88101_1998 4KB (48KB) 6/04/09	88101_1997 4KB (9KB) 4/2/10	no data reported	no data reported
PM Fine Speciation[2,3,5] RD_501_SPEC_yyyy.ZIP	SPEC_2012 739 KB (8275KB) 05/16/12	SPEC_2011 5801 KB (70667KB) 05/16/12	SPEC_2010 5475 KB (66692KB) 05/16/12	SPEC_2009 6240KB (68605KB) 08/19/11	SPEC_2008 6915KB (80947KB) 08/19/11	SPEC_2007 7085KB (80666KB) 08/19/11	SPEC_2006 86013KB 08/19/11	SPEC_2005 8999KB (99430KB) 08/19/11	SPEC_2004 9178KB (103442KB) 08/19/11	SPEC_2003 8762KB (97091KB) 08/19/11	SPEC_2002 7568KB (86644KB) 08/19/11	SPEC_2001 3555KB (42552KB) 08/19/11	SPEC_2000 1197KB (14330KB) 09/17/10	no data reported	no data reported	no data reported	no data reported	no data reported
PM Fine Speciation-Blanks[6] RD_503_Blanks_yyyy.ZIP	BLANKS_2012 34KB (471KB) 05/14/12	BLANKS_2011 377KB (5551KB) 05/14/12	BLANKS_2010 754KB (11047KB) 05/14/12	BLANKS_2009 652KB (9262KB) 05/14/12	BLANKS_2008 669KB (9261KB) 05/14/12	BLANKS_2007 908KB (12036KB) 05/14/12	BLANKS_2006 1100KB (14060KB) 05/14/12	BLANKS_2005 1314KB (16784KB) 05/14/12	BLANKS_2004 1498KB (20115KB) 05/17/12	BLANKS_2003 1333KB (17148KB) 05/17/12	BLANKS_2002 952KB (11994KB) 05/17/12	BLANKS_2001 478KB (6262KB) 05/17/12	BLANKS_2000 117KB (1658KB) 05/17/12	no data reported	no data reported	no data reported	no data reported	no data reported
PM Fine Speciation-IMPROVE[7] RD_501_IMPROVE_yyyy.ZIP	No Data Reporte	No Data Reported	IMPROVE_2010 4647KB (47378KB) 08/19/11	IMPROVE_2009 7106 KB (72400KB) 08/19/11	IMPROVE_2008 7226KB (72858KB) 08/19/11	IMPROVE_2007 8854KB (85581KB) 08/19/11	IMPROVE_2006 8566KB (81956KB) 08/19/11	IMPROVE_2005 8765KB (91827KB) 05/16/12	IMPROVE_2004 10911KB (104936KB) 08/19/11	IMPROVE_2003 9991KB (94935KB) 08/19/111	IMPROVE_2002 9090KB (85601KB) 08/19/11	IMPROVE_2001 7651KB (71484KB) 09/17/10	IMPROVE_2000 4960KB (47694KB) 08/19/11	IMPROVE_1999 3668KB (37661KB) 08/19/11	IMPROVE_1998 3757KB (38032KB) 08/19/11	IMPROVE_1997 3816KB (38172KB) 08/19/11	IMPROVE_1996 3642KB (36436KB) 08/19/11	IMPROVE_1995 3554KB (35289KB) 08/19/11
	81102_2012	81102_2011	81102_2010	81102_2009	81102_2008	81102_2007	81102_2006	81102_2005	81102_2004	81102_2003	81102_2002	81102_2001	81102_2000	81102_1999	81102_1998	81102_1997	81102_1996	81102_1995

Read AQS Data

```
INFILE "&rawfile.\*.txt"  lrecl=300  delimiter="|" missover
dsd;

INPUT trantype $
    actcode $
    state
    county $
    site $ @;
```

Read AQS Data

```
…
SELECT;
 WHEN (trantype="RD") DO;
  INPUT parameter_code :$char5.
     poc :$char1.
     sampdur :$char1.
     unit_code :$char3.
     method_code :$char3.
     date :yymmdd10.
     start :time5.
     sampval
     nullcode :$char2.
     collfreq :$char1.
     altmpid :$char1.
     qual1: $char2. qual2: $char2. qual3: $char2. qual4: $char2. qual5: $char2.
     qual6: $char2. qual7: $char2. qual8: $char2. qual9: $char2. qual10: $char2.
     methdl
     uncert ;
        …
```

Read AQS Data

```
SELECT;
    WHEN(sampdur EQ '1') DO; * Hourly;
     smdtend = smdtstr + 3600;
     END;
    WHEN(sampdur EQ 'H') DO; * 5 minute ;
     smdtend = smdtstr + 300;
     END;
    WHEN(sampdur EQ '7') DO; * Daily;
     smdtend = smdtstr + 86400;
     END;
    OTHERWISE DO;
     IF   sampdur NE _prev_sampdur
     THEN PUT 'WARNING: Excluding non-standard sampling period: '
             sampdur= 'hrs, ' orgstnid= method_code = ;
     DELETE;
     END;
   END;   * end select;
…
```

Assign Metadata Fields

- Parameter code & description
- Method code & Sample analysis description
- Unit code & description
- Sample duration
- Sample collection description
- Method detectable limit
- Unit and/or STP conversion: description
- Unit and/or STP conversion: equation / constant
- NAtChem variable name / unit

Environment Canada   Environment Canada

Canada

Assign Metadata and Transform Data

Map to NAtChem Metadata Fields

- Station ID
- Sample start date/time (local standard time)
- Sample end date/time
- Variable name
- Instrument type
- Sampling media or principle
- Coating or absorbing solution / media
- Humidity or temperature control

… continued

Environment Canada   Environnement Canada

Canada

Map to NAtChem Metadata Fields

- Inlet type
- Size cut
- Sample analysis method
- Solubility type
- Standard temperature and pressure
- Blank correction
- Value
- NAtChem flag

Environment Canada   Environnement Canada
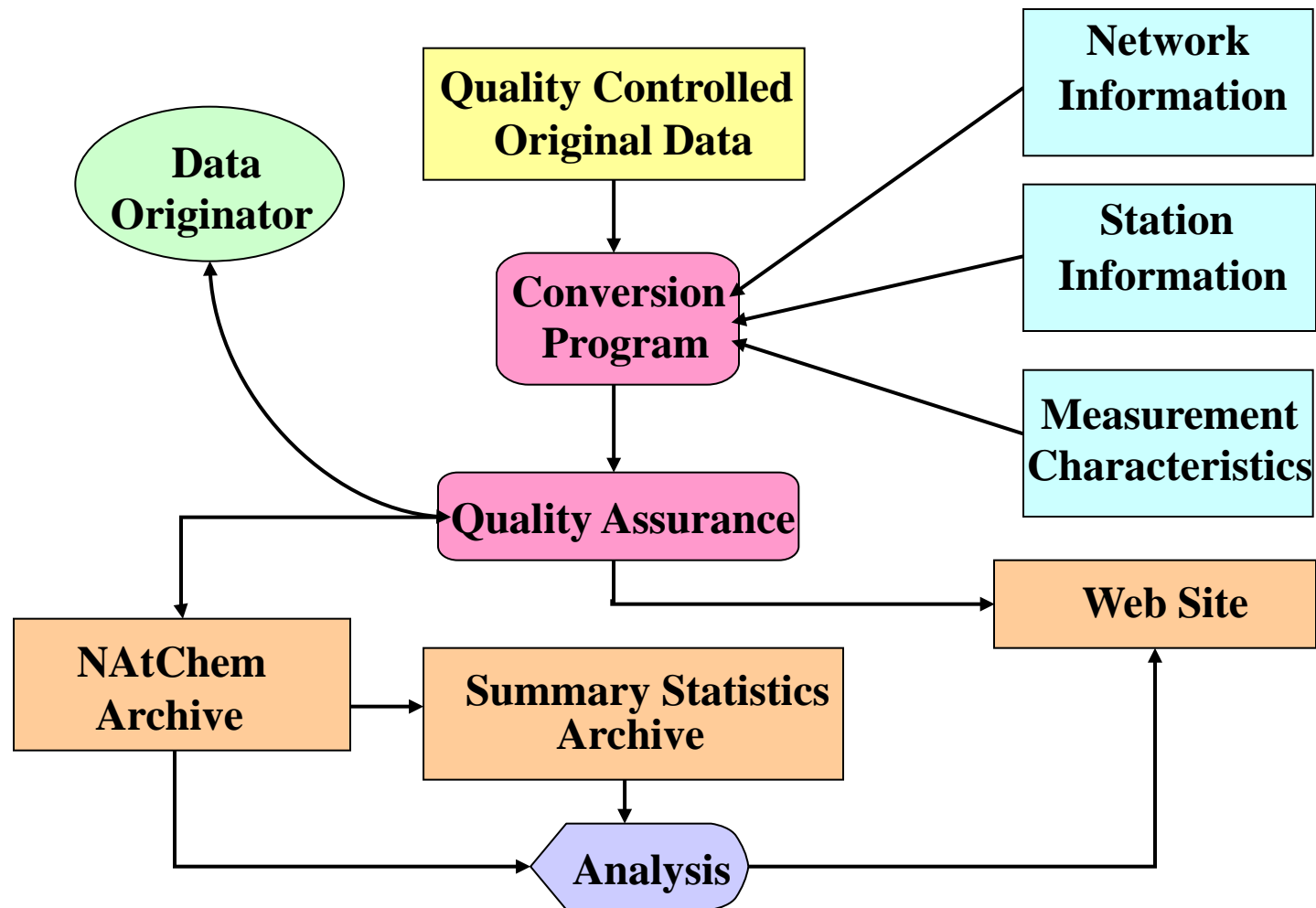
Canada

NAtChem Database

NAtChem Database Facility

NAtChem Database

- Read program for each data source
- Standard names, units, date/time, metadata
- Combining of data
  - Select parameters
  - Determine metadata criteria
  - Obtain latest version of data from source
  - Read data into NAtChem
- Perform analysis

Integrating US and Canadian air monitoring data: sources

MAJOR ROUTINE OPERATING AIR MONITORING NETWORKS: State / Local / Tribal / Federal Networks				
Network[1]	Sites	Initiated	Measurement Parameters	Source of Information and/or Data
Urban/Human-Health Monitoring				
NCore – National Core Monitoring Network	~80 planned	2011	O_3, NO/NO_y, SO_2, CO, $PM_{2.5}/PM_{10-2.5}$, $PM_{2.5}$ speciation, surface meteorology	http://www.epa.gov/ttn/amtic/ncore/index.html
SLAMS – State and Local Ambient Monitoring Stations	~3000	1978	O_3, NO_x/NO_2, SO_2, $PM_{2.5}/PM_{10}$, CO, Pb	http://www.epa.gov/airexplorer/
CSN – $PM_{2.5}$ Chemical Speciation Network	~200 currently active	1999	$PM_{2.5}$ mass, $PM_{2.5}$ speciation, major ions, Metals	http://www.epa.gov/airexplorer/
PAMS – Photochemical Assessment Monitoring Network	75	1994	O_3, NO_x/NO_y, CO, speciated VOCs, carbonyls, surface meteorology, upper air	http://www.epa.gov/ttn/amtic/pamsmain.html
Rural/Regional Monitoring				
IMPROVE – Interagency Monitoring of Protected Visual Environments	110 plus 67 protocol sites	1988	$PM_{2.5}/PM_{10}$, major ions, metals, light extinction, scattering coefficient	http://vista.cira.colostate.edu/IMPROVE/
CASTNET – Clean Air Status and Trends Network	80+	1987	O_3, weekly concentrations of SO_2, HNO_3, SO_4^{2-}, NO_3^-, Cl^-, $NH4^+$, Ca^{2+}, Mg^{2+}, Na^+, K^+ for dry and total deposition, surface meteorology	www.epa.gov/castnet/
GPMP – Gaseous Pollutant Monitoring Program	33	1987	O_3, $NO_x/NO/NO_2$, SO_2, CO, surface meteorology, enhanced monitoring of CO, NO, NO_x, NO_y and SO_2, canister samples for VOC at three sites	www.nature.nps.gov/air/Monitoring/network.htm#data

Environment Canada

Environnement Canada

Canada

Summary

- The key to successfully integrating US and Canadian air monitoring data is in the metadata.
    - Taxonomies
    - Key characteristics
    - Quality assurance
    - Data versioning

Environment Canada

Environnement Canada

Canada

References

- The Canadian National Atmospheric Chemistry (NAtChem) Database and Analysis Facility (www.ec.gc.ca/natchem)
- 2012 Canadian Smog Science Assessment Highlights and Key Messages (http://www.ec.gc.ca/air/default.asp?lang=En&n=72F82C27-1)
- 2010 Canada—United States Air Quality Agreement: Progress Report ISDM-444 (http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=4B98B185-7523-4CFF-90F2-5688EBA89E4A)
- AQS Data: http://www.epa.gov/ttn/airs/airsaqs/detaildata/downloadaqsdata.htm

Environment Canada   Environnement Canada

Canada