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1. Data Set Description:

The **Langley Ecole Lochiel (LEL) site** was at 49.0289 N and -122.6025 W and at 90m a.s.l. The site was surrounded by hobby farms and by relatively few country roads that are lined with both coniferous and deciduous trees, with little change in terrain heights within a radius of 15 km. Nontraditional agricultural practices, such as mushroom and chicken farming and small orchards, are common within this radius of the site. The nearest small urban center, Langley, is about 6 km north of the site. The site was approximately 10 km to the major expressways of Highway 1 in Canada and I-5 in the US, and was approximately 6km to Highway 1A in Canada. Particle sampling was done in the center of an unobstructed field of approximately 30-50m² about 2.5m from ground. On-site measurements were conducted from five temporary labs with inlets about 5m above ground.

Measurements at this site, from August 13th to 31st, were intended to address the unknowns related to particles and ozone, with an emphasis on the transition from the urban mix to a suburban/rural setting, particularly the impact of agricultural sources on the particulate matter formation and evolution. Similar to the instrumentation package at Slocan Park site, the instrumentation package includes measurements in these five categories.

- Measurements related to the precursors of fine PM and the oxidation environment in which the fine PM is formed.
- Measurements related to the characterization of fine PM and the evolution process of PM.
- Measurements related to the emission of fine PM and its precursors in the valley.
- Measurements related to the mapping of fine PM horizontal and vertical distribution in the valley, and
- Measurements of meteorological parameters in the valley.

[Table 1](#) lists the selected measurements carried out at this site that are being archived.

Discussion of all measurements made at the Langley site: Measurements include detailed gas phase measurements of NO_x=NO_y (total and speciated), CO, O₃ (Hayden et al., 2004), SO₂, VOCs, OVOCs, carbonyls, NH₃ (Pryor et al., 2004), HO_x, and NH₃. The large collection of gaseous measurements was intended for a detailed understanding of the oxidation environment and chemical processes in which both O₃ and secondary particulate matter are formed. For particle chemical characterization at this site, detailed measurements were carried out on size distributed inorganic ionic components (Anlauf et al., 2002), organic carbon, elemental carbon, and mass from 0.05 to 18 mm AD twice a day. High-time resolution measurements using a second AMS were carried out, that was capable of measuring the size distribution of inorganic species and homologues of organic species from 0.06 to 0.7 mm (Boudries et al., 2004; Alfarra et al., 2004). Detailed organic carbon speciation measurements (Cheng et al., 2004; McCarry et al., 2002), carbon isotope characterization (Huang et al., 2002; Whiticar et al., 2002), sulfur isotope characterization (Norman et al., 2002), and amorphous carbon (Sloan et al., 2002) were carried out for particles 2.5 mm on 10-h day samples collected twice daily. The gas-particle partitioning of semi-volatile organic compounds was studied using a Hi-cap denuder sampling system and detailed lab organic analyses. Continuous mass measurements for particles 2.5 mm were made using a TEOM with a diffusion dryer on the inlet. Particle number size distributions were measured from 0.01 to 3 mm using a DMA and an optical probe. Hygroscopic properties of particles were measured at two particle sizes using two DMAs in tandem (Prenni et al., 2002). For NH₃, HNO₂, HNO₃, HCHO, and PM 2.5 mm mass measurements and the particle chemical size distributions, more than one technique were deployed at this site. The multiple measurements of these species provided a test of the performance and validation of the different techniques and ensure that instrument biases were corrected. They also provide complementing data of different characteristics, such as better sensitivities versus time resolution. At this site, the diurnal evolution of the boundary layer height was studied using a scanning LIDAR (Strawbridge and Snyder, 2004a) that scanned the north, east and west quadrants. Radiation measurements, both UV and visible, were done using an Eppley and a CIMEL sun photometer (O'Neill et al., 2004).

Vertical distribution of certain parameters, such as O₃ and meteorological parameters, in the lower part of the atmosphere were also assessed from tethered balloons at Langley Poppy High School, 7.9km northeast of the Langley Ecole Lochiel site. Number size distribution between 0.25 and 10 mm were done from ground the Langley Ecole Lochiel site. This was further aided by a scanning lidar that based at the Langley Ecole Lochiel site.

The **Pacific 2001 Air Quality Study (PAC2001)** was conducted from 1 August to 31 September, 2001 in the Lower Fraser Valley (LFV), British Columbia, Canada. The study consisted of individual research projects organized to address several issues on ambient particulate

matter and ozone that are important to policy makers. A special issue of Atmospheric Environment [Vol. 38(34), Nov 2004] describes specific study objectives (Li, 2004) and presents a series of results papers from the field study. The ground sampling sites during the study were (1) Cassiar Tunnel, (2) Slocan Park, (3) Langley Ecole Lochiel, (4) Sumas Eagle Ridge, and (5) Golden Ears Provincial Park and aloft measurements were taken from a Convair 580 and a Cessna 188. Selected measurement data have been compiled for each site and aircraft and are archived as site-specific data sets.

Table 1. Selected measurements at the Langley Lochiel Ecole site during the Pacific 2001 field study that are being archived. Time resolutions of the measurements are also listed.

Species	Technique	Time Resolution	Frequency	PI
Gas Phase Measurements				
O ₃	UV-photometry	1-min	Continuous	Anlauf - MSC
NO, NO ₂	Chemiluminescence	1-min	Continuous	Hayden - MSC
NO _y	Chemiluminescence	1-min	Continuous	Anlauf - MSC
PAN/PPN	GC	5-min	Continuous	Bottenheim - MSC
HNO ₃	Annular denuder	4-hour	5/day	Anlauf - MSC
HNO ₂	Annular denuder	4-hr	5/day	Anlauf - MSC
Speciated NMHC	Canister-capillary GC	Integrated 5-30 min	Every 3 hrs Every hour intensive	Bottenheim - MSC Wang - EPS
Non-particle forming biogenic VOC (isoprene, OVOCs)	On-site GC/MS/FID	2-hr	Continuous	Bottenheim - MSC
Particle-forming biogenic VOCs (mono-terpenes)	On-site GC/MS/FID	2-hr	Continuous	Bottenheim - MSC
NH ₃	coil-fluorescence	5-min	Continuous	Pryor - U. Indiana
SO ₂	Pulse fluorescence	1-min	Continuous	Anlauf - MSC
CO	IR-absorption - gas correlation	1-min	Continuous	Anlauf - MSC
HCHO	Coil-Hantz reaction-fluorescence	1-min	Continuous	Macdonald - MSC
CH ₃ CHO	DNPH cartridge	4-hr	6/day	Wang - EPS
Solar radiation	Eppley	1-min	Continuous	Anlauf - MSC
HO ₂ /RO ₂	Radical amplifier	1-5 min	Continuous	Mihele - MSC
Particle Chemical Characterization Measurements				
Size distribution (<0.05 - 15 µm) of inorganic species and mass	MOUDI Impactor - IC and micro-balance	10 hour	2/day	Anlauf/Li/Brook - MSC
Size distributed speciation	Aerodyne Aerosol Mass Spectrometer	1-min	Continuous	Worsnop - Aerodyne
Black carbon	Optical absorption	1-hr	Continuous	Sharma - MSC
Mass (<2.5 µm)	TEOM	1-min	Continuous	Anlauf - MSC
Mass (<2.5 µm)	Regular FP - microbalance	4-hrs	5/day	Brook - MSC
Mass (<2.5 µm)	URG ADS	4-hrs	5/day	Brook - MSC
Sulfur isotope (<2.5 µm)	Hivol FP - MS	24-hrs	One/day	Norman - U. Calgary
Trace organics species - polar (<2.5 µm)	Hivol FP - solvent extraction - derivatization - GCMS/GC FID	10-hrs	2/day	McLaren - York U.
Air toxics	Hivol - solvent extraction - GC/MS	24-hrs	1/day	Harner - MSC
Trace organics species - aromatic acids (<2.5 µm)	Hivol FP - solvent extraction - derivatization - Capillary electrophoresis	12-hrs	2/day	Rudolph - York U.
PAHs - vapour phase	Hivol - Quartz filter - GC/MS, Daylight hours	Daylight hours	1/day	Shoeib - MSC
PAHs - particle phase	Hivol - Quartz filter - GC/MS, Daylight hours	Daylight hours	1/day	Shoeib MSC
Particle Physical Characterization Measurements				
Ultrafine particle number size distribution (6 - 300 nm)	DMA	10-min	Continuous	Leaitch - MSC
H ₂ O, Hygroscopicity	Thermal method	10-min	Continuous	Leaitch - MSC
Meteorological Measurements and Vertical Profiling				

Species	Technique	Time Resolution	Frequency	PI
T, P, RH WS, WD at surface	Typical met package	1-min	Continuous	Anlauf - MSC
Met Sounding	Typical met package	Langley Poppy High School	4/days	Froude - MSC

The data set should be cited as follows:

Li, Shao-meng. 2004. NARSTO PAC2001 Langley Site Gaseous, Particle, and Meteorological Data. Available on-line via [NARSTO Data and Information](#) at the Atmospheric Science Data Center at NASA Langley Research Center, Hampton, Virginia, U.S.A.

2. Sample Data Record/Data Format:

Data files are in the NARSTO Data Exchange Standard (DES) format that is described in detail on the NARSTO Quality Systems Science Center (QSSC) web site [<http://cdiac.esd.ornl.gov/programs/NARSTO/>]. The files follow a tabular layout and are stored as ASCII comma-separated values files (.csv). The DES does not rely on row position to identify specific information, but uses a tag to describe the information contained in the row. The DES is a self-documenting format with three main sections: the header contains information about the contents of the file and the data originator; the middle section contains metadata tables that describe/define sites, flags, and other codified fields; and the final section is the main data table that contains key sampling and analysis information and the data values. Descriptions of the standardized metadata fields are also available on the QSSC web site.

Archived Langley Lochiel Ecole Site and Langley Poppy High School Site Data Files

Data File Names	Link to Time Series Plots of Reported Variables (PDF)
NARSTO_PAC2001_LNEL_ALN_S+O-ISOT-PM2.5_HIVOL_20010814D16_V1.csv	View LNEL ALN S+O-ISOT-PM2.5 HIVOL 20010814D16
NARSTO_PAC2001_LNEL_AMM_HCHO_HANTZSCH_20010814D17_v1.csv	View LNEL AMM HCHO HANTZSCH 20010814D17
NARSTO_PAC2001_LNEL_C-M_GAS-ROX_20010814D18_V2.csv	View LNEL C-M GAS-ROX 20010814D18
NARSTO_PAC2001_LNEL_DKW_CARBOXYL_PART1_OF_1_20010813D19_V1.csv	View LNEL DKW CARBOXYL PART1 OF 1 20010813D19
NARSTO_PAC2001_LNEL_DKW_VOC_PART1_OF_2_20010813D19_V1.csv	View LNEL DKW VOC PART1 OF 2 20010813D19
NARSTO_PAC2001_LNEL_DKW_VOC_PART2_OF_2_20010813D19_V1.csv	View LNEL DKW VOC PART2 OF 2 20010813D19
NARSTO_PAC2001_LNEL_J-R_AROM-ACIDS_HIVOL_20010820D12_V1.csv	View LNEL J-R AROM-ACIDS HIVOL 20010820D12
NARSTO_PAC2001_LNEL_J-R_PAH_HIVOL_20010820D12_V1.csv	View LNEL J-R PAH HIVOL 20010820D12
NARSTO_PAC2001_LNEL_JRB_PM25_ADS_20010813D20_V1.csv	View LNEL JRB PM25 ADS 20010813D20
NARSTO_PAC2001_LNEL_JRB_PM25_TEOM_20010816D17_V1.csv	View LNEL JRB PM25 TEOM 20010816D17
NARSTO_PAC2001_LNEL_JRB_PM25-OC+EC_FP-CYCLONE_20010814D19_V2.csv	View LNEL JRB PM25-OC+EC FP-CYCLONE 20010814D19
NARSTO_PAC2001_LNEL_JWB_PAN_GC-PDD_20010813D20_V1.csv	View LNEL JWB PAN GC-PDD 20010813D20
NARSTO_PAC2001_LNEL_KGA_GAS_PHASE_20010810D22_V1.csv	View LNEL KGA GAS PHASE 20010810D22
NARSTO_PAC2001_LNEL_KGA_GAS-PART-DENUD+FILTER_20010814D19_V1.csv	View LNEL KGA GAS-PART-DENUD+FILTER 20010814D19
NARSTO_PAC2001_LNEL_KGA_MET_TOWER_20010813D19_V2.csv	View LNEL KGA MET TOWER 20010813D19
NARSTO_PAC2001_LNEL_KGA_PART-IONS_MOUDI_20010814D18_V1.csv	View LNEL KGA PART-IONS MOUDI 20010814D18
NARSTO_PAC2001_LNEL_M-S_GAS-OCS_20010814D17_V1.csv	View LNEL M-S GAS-OCS 20010814D17
NARSTO_PAC2001_LNEL_M-S_GAS-PAH_20010814D17_V1.csv	View LNEL M-S GAS-PAH 20010814D17
NARSTO_PAC2001_LNEL_M-S_PART-PAH_20010814D17_V1.csv	View LNEL M-S PART-PAH 20010814D17
NARSTO_PAC2001_LNEL_PCB_OVOC_GC-FID_20010815D18_V1.csv	View LNEL PCB OVOC GC-FID 20010815D18
NARSTO_PAC2001_LNEL_R-M_PART-ORG_HIVOL_20010816D16_V1.csv	View LNEL R-M PART-ORG HIVOL 20010816D16
NARSTO_PAC2001_LNEL_SCP_GAS-NH3_20010816D18_V1.csv	View LNEL SCP GAS-NH3 20010816D18



NARSTO_PAC2001_LNEL_S-L_PART-FATTY-ACIDS_20010816D15_V1.csv	View LNEL_S-L_PART-FATTY-ACIDS_20010816D15
NARSTO_PAC2001_LNEL_S-L_PART-KETONES_20010816D15_V1.csv	View LNEL_S-L_PART-KETONES_20010816D15
NARSTO_PAC2001_LNEL_S-L_PART-OHSSTEROLS_20010816D15_V1.csv	View LNEL_S-L_PART-OHSSTEROLS_20010816D15
NARSTO_PAC2001_LNEL_S-S_BC_AETHALOMETER_20010814_D18_V1.csv	View LNEL_S-S_BC_AETHALOMETER_20010814
NARSTO_PAC2001_LNEL_WRL_HYGGRO_HTDMA_20010816D16_V1.csv	View LNEL_WRL_HYGGRO_HTDMA_20010816D16
NARSTO_PAC2001_LNEL_WRL_PART_DMA_20010817D16_V1.csv	View LNEL_WRL_PART_DMA_20010817D16
NARSTO_PAC2001_LPHS_FAF_MET_SONDE_20010813D5_V1.csv	View LPHS_FAF_MET_SONDE_20010813D5
NARSTO_PAC2001_LPHS_FAF_MET_SONDE_20010817D6_V1.csv	View LPHS_FAF_MET_SONDE_20010817D6
NARSTO_PAC2001_LPHS_FAF_MET_SONDE_20010823D5_V1.csv	View LPHS_FAF_MET_SONDE_20010823D5
NARSTO_PAC2001_LPHS_FAF_MET_SONDE_20010828D4_V1.csv	View LPHS_FAF_MET_SONDE_20010828D4
NARSTO_PAC2001_LPHS_FAF_WINDS_SONDE_20010813D21_V1.csv	View LPHS_FAF_WINDS_SONDE_20010813D21
NARSTO_PAC2001_WPF_FAF_MET_SONDE_20010808D23_V1.csv	
NARSTO_PAC2001_CWK_FAF_MET_SONDE_20010808D22_V1.csv	View CWK_FAF_MET_SONDE_20010808D22

CWK = Chilliwack

Data File Name Syntax

Pacific 2001 data file names are comprised of nine sections, defined as follows:

Model file name: **NARSTO_PAC2001_SLPK_JRB_MET_TOWER_200108D75_V1.csv**

1. Archive project: **NARSTO**
2. Study acronym: **PAC2001**
3. Site ID / Aircraft ID: **4-character abbreviation**

Study site and aircraft abbreviations

Abbreviation	Site Name
BNDDB	Boundary Bay
CSRT (CSTN, CSTS)	Cassiar Tunnel
GEPP	Golden Ears Provincial Park
LNEL	Langley Ecole Lochiel
LPHS	Langley Poppy High School
SLPK	Slocan Park
SLPS	Slope Study
SMMT	Sumas Mountain
CSNA	CFS Cessna 188
CNVR	NRC-IAR Convair 580

4. Principal Investigator ID: **Initials (3 characters)**

Principal Investigator's initials and affiliation

Initials	Name	Affiliation
AMM	Anne Marie Macdonald	Environment Canada
ANL	Anna Lise Norman	University of Calgary



C-M	Cris Mihele	Environment Canada
DKW	Danny Wang	Environment Canada
FAF	Frank Froude	Environment Canada
GVRD	Greater Vancouver Regional District	Greater Vancouver Regional District
HAB	H. A. Weibe	Environment Canada
J-R	Jochen Rudolph	York University
JRB	Jeff Brook	Environment Canada
JWB	Jan Bottenheim	Environment Canada
KGA	Kurt Anlauf	Environment Canada
LAG	Lisa Graham	Environment Canada
M-M	Mike Mozurkewich	York University
M-S	Mahiba Shoeib	Environment Canada
PCB	Peter Brickell	Environment Canada
R-M	Robert McLaren	York University
S-L	Shoa-meng Li	Environment Canada
S-P	Sara Pryor	University of Indiana
S-S	Sangeeta Sharma	Environment Canada
WOR	Douglas Worsnop	Aerodyne Research Inc.
WRL	Richard Leaitch	Environment Canada

5. Measurement activity: **General measurement type**

6. Instrument name or analysis method: **General analysis method**

7. Sampling date with sampling days or flight number:

◦ **For Ground-based measurements:**

The first date in the data file (YYYYMMDD), followed by the letter "D" and the total number of sampling days.

▪ Examples:

- 20010801D1 (starting August 1, 2001, total of 1 day)
- 20010815D61 (starting August 15, 2001, total of 61 days)

◦ **For Aircraft measurements:**

The first date in the data file (YYYYMMDD), followed by the letter "F" and the flight number for the date.

▪ Examples:

- 20010815F1 (first flight on August 15, 2001)
- 20010815F2 (second flight on August 15, 2001)

8. Archive data file version number: The file version number starts at "**V1**". The version number is incremented if the archive data file is replaced.

9. Suffix: **.csv** (comma separated values)

3. References:

- Alfarra, et al., 2003. Characterization of organic aerosols in the Lower Fraser Valley during the Pacific 2001 using two Aerodyne aerosol mass spectrometers. *Atmospheric Environment*, this issue, doi:10.1016/j.atmosenv.01.054
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- McCarry, B.E., Rosati, M., Yang, R., 2002. PAH and nitro-PAH analyses of air particulate material collected during Pacific 2001 study. Presentation at the Symposium on Atmospheric Aerosols and Pacific 2001 Field Study, 85th CSC Conference, Vancouver, Canada, June 1-5, 2002.
- Norman, A.L., Belzer, W., Barrie, L., Wang, D., 2002. Sulphate in PM2.5: results from the Pacific 2001 field campaign. Presentation at



the American Geophysical Union Fall Meeting, December 2002, San Francisco, CA, USA.

- Pryor, et al., 2004. Spatial and temporal variability of reduced nitrogen concentrations in the Fraser Valley. Atmospheric Environment, this issue, doi:10.1016/j.atmosenv.2003.12.045.
- Wang, D., Fuentes, J.D., Dann, T., Travers, D., Connolly, T., Arktas, Y., 2002. Non-methane hydrocarbon measurements in the Vancouver region during Pacific 2001. Presentation at the American Geophysical Union Fall Meeting, December 2002, San Francisco, CA, USA.

4. Contact Information:

Investigator(s) Name and Title:

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Data Center:

The User and Data Services Office at the Langley Atmospheric Science Data Center is involved throughout the system to monitor the quality of data on ingest, to ensure prompt replies to user questions, to verify media orders prior to filling them, and to ensure that the needs of the users are being met.

If you have a problem finding what you need, trouble accessing the system, or need an answer to a question concerning the data or how to obtain data, please contact the User and Data Services staff.

Telephone: (757) 864-8656
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E-mail: support-asdc@earthdata.nasa.gov
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5. Acknowledgement:

When data from the Langley Atmospheric Science Data Center are used in a publication, we request the following acknowledgment be included: "These data were obtained from the NASA Langley Research Center Atmospheric Science Data Center".

The Langley Data Center requests a reprint of any published papers or reports or a brief description of other uses (e.g., posters, oral presentations, etc.) of data that we have distributed. This will help us determine the use of data that we distribute, which is helpful in optimizing product development. It also helps us to keep our product-related references current.

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