Aerosol Sources and Processing at the Ganges Valley Aerosol Experiment (GVAX) Pantnagar Supersite

ASR Fall Working Group Meeting
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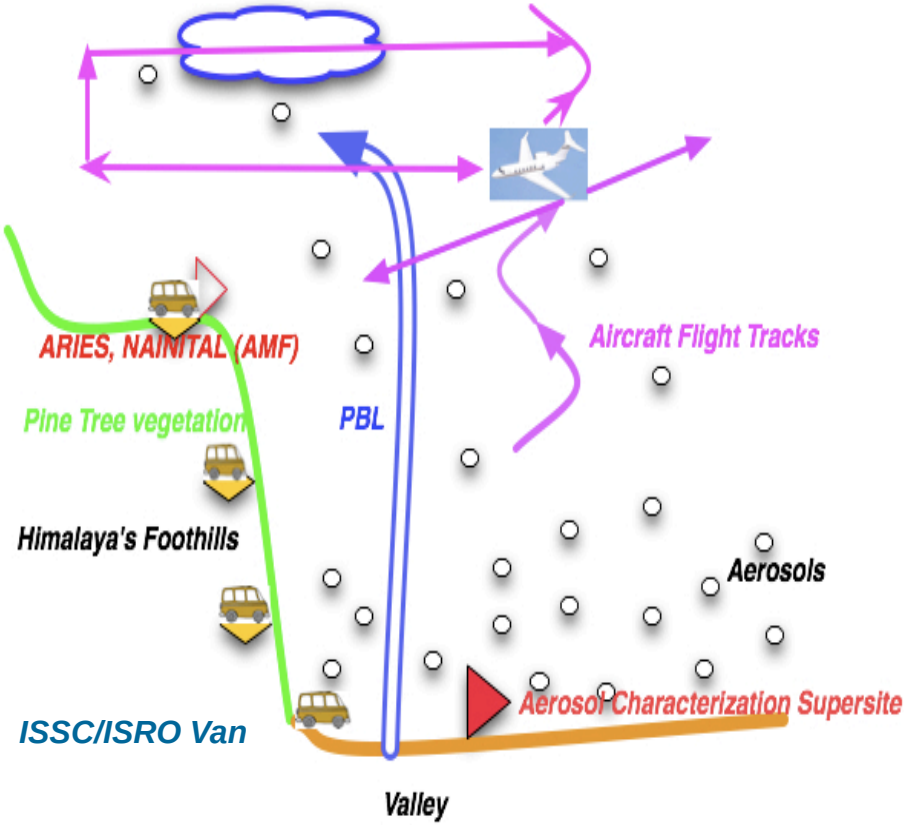
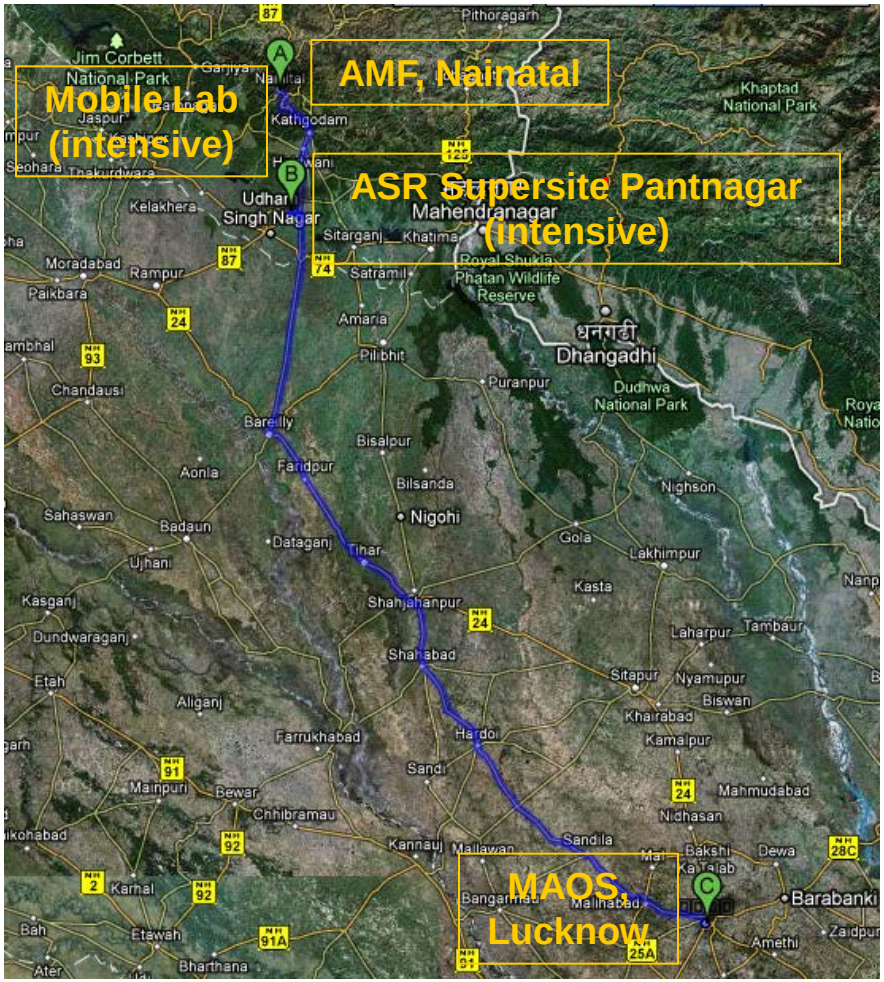
Why India? Ganges Valley?

- Combustion sources → black carbon aerosol particles.
- Absorb sunlight. Warm atmosphere. Decrease precipitation.
- Deposit on Himalayan glaciers. Glaciers melt faster.
- Undersampled part of the world.
- Ganges Valley has some of highest, most-persistent AODs on planet.
- **Goal:** Understand interactions between aerosol particles and clouds over the Ganges Valley plain, and impact on regional climate.

Overview of GVAX





- Intensive February 1 to March 31, 2012
- Winter: moderate temperatures, lower BLH, fog, maximum pollution
- Characterize chemical, optical and hygroscopic properties of aerosol particles at Pantnagar groundsite during intensive, before particles lofted into clouds
- Cloud and aerosol properties characterized at Nainital (summer 2011 – summer 2012)
- IISc/ISRO van will link the two measurement locations

7 SUPERSITE (PANTNAGAR) SITE WORKS AND INFRASTRUCTURE

ASR Supersite (Pantnagar University)

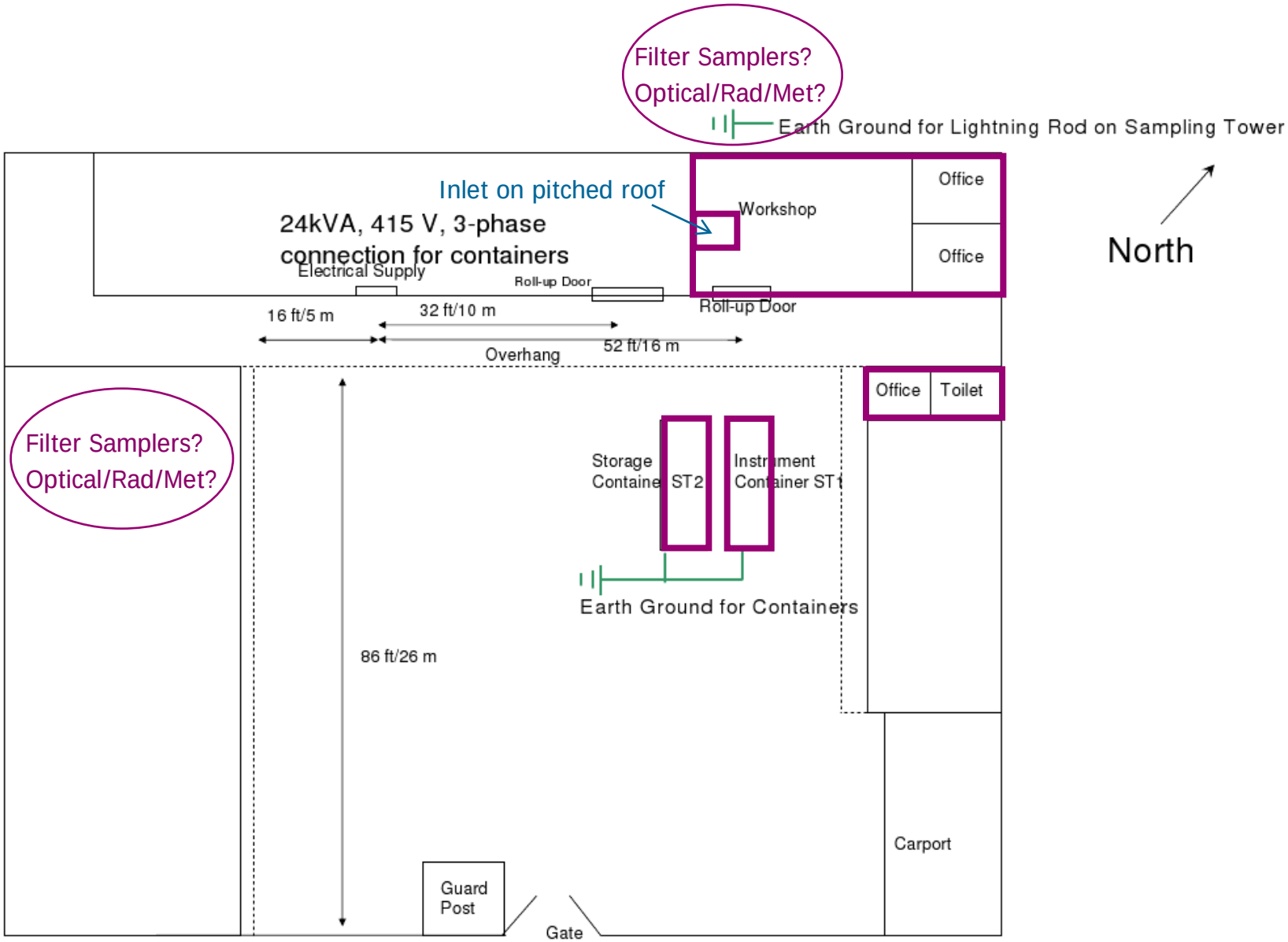
Elevation:	234m
Latitude:	E 079 29.485
Longitude:	N 29 01.497

Figure 7 - Pantnagar University main entrance gate

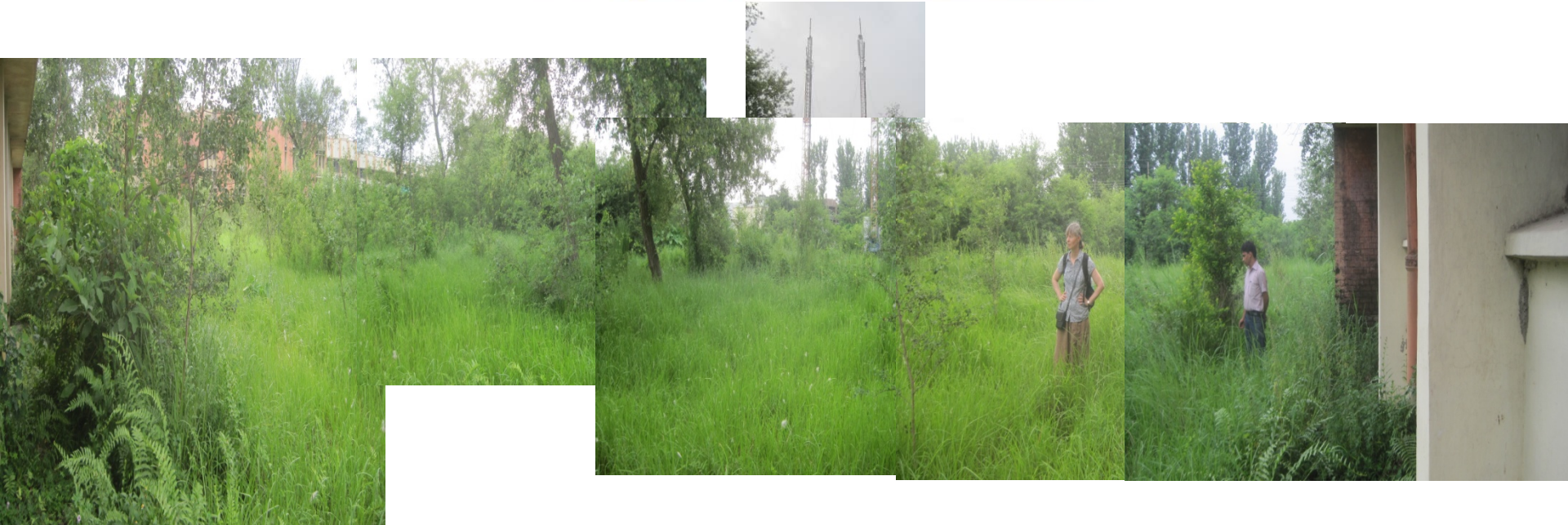
Pantnagar: City/University

Pantnagar Supersite

Pantnagar Measurement Site



Filter Samplers, Optical/Rad/Met Location



Master Inlet Location

Master Inlet Location

Will mount 8 ft (2.4 m) tower on peak of roof (near 4th rib from N end of building) for sampling inlets for container and building.

Workshop → Instrument Room

Particle-Phase Chemistry at Pantnagar

Measurements:

- High Resolution Aerosol Mass Spectrometer (HR-ToF-AMS), Jimenez, CU
  Chemical composition and size, elemental analysis
- Micro-Orifice Volatilization Impactor-Chemical Ionization-High Resolution Time-of-Flight Mass Spectrometer (MOVI-CI-HToF-MS), Thornton, UW
  Molecular level chemical composition of both gas-phase and particle-phase
- Potential Aerosol Mass (PAM), Jimenez, CU
  Secondary aerosol formation
- Soot Particle Aerosol Mass Spectrometer (SP-AMS), Williams et al., ARI
  Black carbon mass loading and size, plus organic/inorganic coatings
- Single Particle Soot Photometer (SP2), Dubey, LANL
  Black carbon
- Other Particle Measurements: MAAP (BC concentration), Optical particle counter (size), SMPS (size), Thermodenuder (volatility of coatings), aethalometer (BC concentration)
- Filters: 14C, metals (Jimenez, CU, Prevot, PSI), composition (U Wisc, National Physical Laboratory, Delhi), SEM (LANL)

Gas-Phase Chemistry at Pantnagar

Gas-Phase Chemistry

- Secondary organic aerosol (SOA) formed from oxidized volatile and semi-volatile organic compounds (VOC, SVOC).
- Contributions from aqueous processing.
- Tracers, sources.
- Odd oxygen (O_3+NO_2) correlates with SOA.

Gas-Phase Measurements

- Differential Optical Absorption Spectroscopy (DOAS), Volkamer, CU
  - Glyoxal, formaldehyde, NO_2
- Quantum Cascade Laser Differential Absorption Spectroscopy (QCL), Herndon, ARI
  - HONO, NO, NO_2, NO_y, N_2O, NH_3, formaldehyde
- Gas-phase Tracers, Dubey, LANL
  - O_3, CO, CO_2, SO_2, CH_4
- MOVI-CI-HToF-MI, Thornton, UW
  - Organic acids
- Q-CIMS, Thornton, UW
  - N_2O_5 chemistry
- PTRMS, deGouw-NOAA (VOCs)

Optical and Hygroscopic Properties at Pantnagar

Optical and Hygroscopic Properties

- Determine direct and indirect effects on climate
- Impact cloud-aerosol interactions

Optical Properties

- Cavity Attenuated Phase Shift Instruments (CAPS), Freedman, ARI
  - aerosol extinction
- Differential Optical Absorption Spectroscopy (DOAS), Volkamer, CU
  - aerosol optical depth, surface area
- PASS-3, LANL
  - absorption

Hygroscopic Properties

- Cloud Condensation Nuclei Counter (CCN) – **Need to find one!**

Radiation, Met Profiles, AOD

- Micro Pulse Lidar (cloud base, aerosol ext.), BBSS (wind, temp, moisture profiles), SPN-1(diffuse radiation), SODAR (wind field <500m), radiometer, MFRSR? (radiation, AOD), Coulter, ANL
- AERONET? (AOD, etc.), NASA

Overview of IISc/ISRO Van Instrumentation

Existing Instrumentation

- Chemical composition:
  - PILS, filter samples
- Particle sizing:
  - SMPS
- Particle concentration:
  - nephelometer (total), aethalometer (black carbon), micro pulse LIDAR (aerosol column)
- Cloud height
- Radiation:
  - radiometer, sun photometer

Proposed Instrumentation

- Chemical composition:
  - Aerosol Chemical Speciation Monitor (ACSM, real-time chemical composition of non-refractory aerosol)
  - Multi Angle Absorption Photometer (MAAP, black carbon concentration)
- Particle Sizing:
  - Optical Particle Counter (size 300 nm to 15 micron)
- Optical properties:
  - Cavity Attenuated Phase Shift Spectroscopy (CAPS PMex)
- Gas phase tracers:
  - CO_2, CO, NO, CAPS NO_2, O_3, SO_2

Timeline

June 2011	Recon trip to India (Leah, Doug, Rao, Tim, Pete).
August 2011	Containers arrive at ARI.
September 2011	Integration of instruments in laboratory container, packing of 2nd container.
October 6, 2011	Containers leave ARI.
January 1, 2012	Containers arrive after sea voyage to Mumbai and truck to Pantnagar.
February 1, 2012 – March 31, 2012	Measurements in Pantnagar.
June 2012	Containers arrive back in US, Dis-integration.

More Information

GVAX_Pantnagar_InstrumentList (with many tabs)

https://docs.google.com/spreadsheet/ccc?authkey=CLDDjsgH&key=0AqugTdrkYvCNdEE5UlZqQmxoakpfd2ZtaVFYZWlvcHc&authkey=CLDDjsgH#gid=3

GVAX Pantnagar Site Drawings

https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0B6uqTdrkYvCNMTE2ZjY0MjYtZWI3OS00MDQ1LThmZmItNDM1OTk3NjE3MTJk&hl=en_US\

Pictures from June 2011 Recon Trip:

https://picasaweb.google.com/103806884733971442452/GVAX_recon?authuser=0&authkey=Gv1sRgCKi_18PVmdyIdA&feat=directlink

Google Groups E-mail List

Contact Leah Williams

Questions?

Suggestions?

Discussion?