DISCOVER-AQ

FRAPPÉ
July-August 2014

Monthly Webex Tag-up, 13 November 2014

Agenda

1. Announcements and opportunities

2. Fall AGU

3. Science Team Meeting

4. Analysis Plans

CMAS Meeting, Oct. 27-29, Chapel Hill, NC

DISCOVER-AQ was well represented with presentations from NASA/GSFC (3), UMD (2), U. of Houston (2), and EPA (4)

Pickering, K., et al. **The July August 2014 DISCOVER-AQ and FRAPPE Field Campaigns in the Front Range Region of Colorado: Summary of Experiment Design and Preliminary Findings**

Loughner, C., et al. **Bay breeze enhanced air pollution event in Houston, Texas during the DISCOVER-AQ field campaign**

Follette-Cook, M., et al. **Comparisons between CMAQ and in-situ trace gas observations during the Houston, TX deployment of DISCOVER-AQ**

Hembeck, L., et al. **Ozone Production Efficiency in the Baltimore-Washington Urban Plume**

Goldberg, D., et al. **Evaluating the Cross State Transport of Ozone using CAMx & DISCOVER-AQ Maryland Observations**

Choi, Y., et al. **Underestimation of isoprene emissions in Houston during Texas 2013 DISCOVER-AQ campaign**

Choi, Y., et al. **The impact of the observational meteorological nudging and nesting on the simulated meteorology and ozone concentrations from WRF-SMOKE-CMAQ during DISCOVER-AQ 2013 Texas campaign**

Kang, D., et al. **Evaluation of Air Quality Models Using the DISCOVER-AQ Field Measurements**

Dolwick, P., et al. **Three-dimensional evaluation of CAMx modeled ozone during the 2011 DISCOVER-AQ period in the mid-Atlantic**

Beaver, M., et al. **DISCOVER-AQ SJV surface measurements and initial comparisons with photochemical model simulations**

Appel, W., et al. **Evaluation of regional and fine-scale applications of the two-way coupled WRF-CMAQ modeling system for the 2011 Baltimore-Washington D.C. DISCOVER-AQ campaign**

AQAST Newsletter, November 2014

NASA Air Quality Applied Sciences Team
Quarterly Newsletter

AQAST

November 2014 "Earth science serving air quality management needs"

Register Today for AQAST8 in Atlanta!

AQAST's 8th biannual meeting (AQAST8) will be held December 2-4, 2014 (Tuesday-Thursday) at Georgia Tech University in Atlanta. Go to the meeting website for more detailed information and to register. Air quality managers are encouraged to attend as the meeting will feature a special session on air quality management issues in Southeastern states. We look forward to seeing you in Atlanta in December!

AQAST Spotlights: Russell Dickerson & Daniel Cohan p. 4

This month's AQAST spotlight is focused on the collaborative efforts of Russell Dickerson in Maryland, and Daniel Cohan in Texas. These AQAST members have assisted state air quality managers with a variety of complex issues that have improved their understanding of the factors that contribute to poor air quality.

FRAPPÉ Enjoys Media Support p. 2

The Front Range Air Pollution and Photochemistry Experiment (FRAPPÉ) enjoyed sustained media coverage and public interest during the summer of 2014. Read more here.

Produced by
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Air & Waste Management Association
em
THE MAGAZINE FOR ENVIRONMENTAL MANAGERS
SEPTEMBER 2014
DISCOVER-AQ
Advancing Strategies for Air Quality Observations in the Next Decade

EM September Issue Features AQAST Work

Environmental Manager, the monthly magazine of the Air & Waste Management Association, devoted its September 2014 issue (available here) to AQAST's involvement with the DISCOVER-AQ project. The issue features a cover story co-authored by Russell Dickerson and other articles written by AQAST members Bryan Duncan, Anne Thompson, Pius Lee, and James Syzkman. It is the second time this year that *EM* has dedicated an issue to AQAST's research activities.

DISCOVER-AQ has helped scientists improve the accuracy of satellite data to create better estimates of emissions sources, inventories, and forecasts. The first campaign took place in the Baltimore-Washington metro area in July 2011, followed by campaigns in California's San Joaquin Valley, and the Houston-Galveston region in October 2013.

Story continued on page 3

DISCOVER-AQ and FRAPPE are prominent topics in the recent AQAST newsletter. The full document can be viewed or downloaded from the following link:

http://www.aqast-media.org/#!newsletters/c1dde

Recommendation for Creating DISCOVER-AQ Model Evaluation Products

Given that the data archive can be intimidating to people from outside the project, Jim Szykman has proposed that we consider bringing together a small group of people to create an excel spread sheet that can help modelers understand what is available for each location, and provide some mapping of the measurement/variable to the what can be evaluated within the model.

This has been done by other groups, such as AQMEII. Something similar to this would help guide users of the data find what they are looking for in the archive, and potentially prevent misuse of the data.

Contact Gao Chen if you are interested in contributing to this effort.

DISCOVER-AQ Colorado
July-August 2014

CIRES Education Outreach: Making Broader Impacts

Citizen-Science Front Range air monitoring hike with Boulder Open Space & Mountain Parks

'Know Your AQ: Discover Air Quality' Educator Workshop

Increasing public awareness and action about air quality issues in Colorado's Front Range:

- Utilized CairClips on a series of public air monitoring hikes (64 hikers on 6 hikes with NPR coverage)
- Coordinated weekly air monitoring hikes & meetings with AQ researchers in Rocky Mountain National Park for NCAR interns & staff (4 hikes, 2 meetings, 4 interns & 2 staff)
- Hosted an air quality educator workshop at NCAR with interactive sessions & site visits led by mission partners (22 educators, 24 presenters)
- Promoted DISCOVER-AQ goals via participation at public events (DMNS Free Day & NCAR RAF Open House - over 2100 total attendees)
- Developed curricula for UCAR Center for Science Education's Air Quality Teaching Box
- Contributor to the NOAA & CIRES project awarded the Colorado Governor's Award for High-Impact Research by CO-LABS

CIRES Cooperative Institute for Research in Environmental Sciences

NASA

DISCOVER-AQ

Dr. Susan Buhr Sullivan, Director CIRES EO
Susan.Buhr@colorado.edu

Ongoing Curriculum Development

Thanks to additional funding, CIRES is continuing its campaign education outreach work for curriculum development.

The plan is to create an interactive, online, modular curriculum focusing on the joint DISCOVER-AQ & FRAPPE campaign and the researchers who conducted it.

The curriculum goal is to provide students with interactive, real-world lessons that compare and contrast air quality data on days with high and low levels of air pollution through basic analysis of suitable campaign data. Plus, the science, technology, and engineering used by researchers to conduct atmospheric research will also be featured.

Looking for researchers to assist with communicating the mission's goals via AQ curriculum?

Looking for basic data that demonstrates "good vs. bad" air quality days. Need recommendations and assistance with access.

Please contact Jennifer Taylor if you are interested. jennifer.l.taylor@colorado.edu

DISCOVER-AQ

FRAPPÉ
July-August 2014

AGU FALL MEETING

San Francisco | 15–19 December 2014

76 abstracts (I found a few more) reference DISCOVER-AQ and/or FRAPPÉ

Our proposal for a press briefing was not accepted.

The following slides provide the schedule of presentations and posters throughout the week.

Shortly after the last telecon, I learned that our usual pool hall is booked solid for the week and there are no nearby alternatives. If someone else has another suggestion, let me know. Otherwise, we will have to save it for the Science Team meeting in May.

Monday Morning

Oral Presentations

08:00 AM - 08:15 AM (Moscone West 3004)

A11K-01 Field test of a new instrument to measure UV/Vis (300-700 nm) ambient aerosol extinction spectra in Colorado during DISCOVER-AQ

09:45 AM - 10:00 AM (Moscone West 2006)

B11L-08 Fresh Insights into the Sources and Distribution of Peroxyacetyl Nitrate (PAN) from New In Situ and Satellite Observations

12:05 PM - 12:20 PM (Moscone West 3010)

A12C-08 Satellite Observations of Trace Gases and Their Application for Studying Air Quality Near Oil and Gas Operations

Posters

08:00 AM - 12:20 PM (Moscone South Poster Hall)

A11H-3091 Sources of Ozone in the Free Troposphere in Houston During DISCOVER-AQ 2013

A11H-3093 Variability of O3 and NO2 Profile Shapes during DISCOVER-AQ July 2011

A11H-3094 Evaluating NO2 Variability of In-Situ and Remote Sensing Observations from Aircraft and Ground Sites During DISCOVER-AQ

A11H-3095 Urban-Scale Boundary Layer and Lower Free Tropospheric Ozone Variability in Houston During DISCOVER-AQ (September 2013)

A11H-3097 Ozone Production Efficiency in the Baltimore-Washington Urban Plume

A11H-3098 Sensitivity of regional meteorology and atmospheric composition during the DISCOVER-AQ period to subgrid-scale cloud-radiation interactions

A11H-3099 Using Source Apportionment to Evaluate the Cross State Transport of Ozone in the Eastern United States

ED11C-3431 NASA Mission Tools Suite for Education

Virtual Poster - Utilizing Portable Air Quality Monitors to Asses the Significance of Air Pollution along the Northern Front Range

Monday Afternoon

Oral Presentations (Moscone West 3001)

01:40 PM ***A13Q-01 An Overview of Ozone and Precursor Temporal and Spatial Variability in DISCOVER-AQ Study Regions***

01:55 PM ***A13Q-02 The Essential Role of Tethered Balloons in Characterizing Boundary Layer Structure and Evolution during Discover-AQ***

02:10 PM ***A13Q-03 Ozone Transport and Mixing Processes in the Boundary Layer Observed with Lidar during Discover-AQ***

02:25 PM ***A13Q-04 The Spatial and Temporal Variability of Ozone in the Houston Metropolitan Area during DISCOVER-AQ and its' Relation to Meteorological Conditions***

02:40 PM ***A13Q-05 The role of bay breezes and regional transport on a high surface ozone episode during the Houston, Texas DISCOVER-AQ field campaign***

02:55 PM ***A13Q-06 The vertical distribution of volatile organic compounds in the atmosphere as measured during DISCOVER-AQ***

03:10 PM ***A13Q-07 The influence of local circulations on vertical profiles of NO2 and O3 at semi-rural sites during DISCOVER-AQ campaigns in California, Texas, and Colorado***

03:25 PM ***A13Q-08 Using aircraft and satellite observations to improve regulatory air quality models***

05:30 PM ***A14E-07 Comparison of CMAQ Modeling Study with Discover-AQ 2014 Aircraft Measurements over Colorado***

Posters - 01:40 PM - 06:00 PM (Moscone South Poster Hall)

A13E-3219 PAN Among the Peaks: A preliminary analysis of new peroxyacetyl nitrate (PAN) measurements in Rocky Mountain National Park

A13E-3229 PTR-MS Measurements of Oil and Gas Related VOCs in the Denver-Julesburg Basin as Part of NASA's DISCOVER-AQ Campaign

A13E-3233 Survey of Emissions Associated with Enclosed Combustor Emission Control Devices in the Denver-Julesburg Basin

A13E-3236 Influence of Oil and Gas Emissions on Ambient Atmospheric Volatile Organic Compounds in Residential Areas of Northeastern Colorado

A13F-3242 Ground based mobile isotopic methane measurements in the Front Range, Colorado

A13F-3255 Summertime Relationships Between NOx, NOy, and O3 in the Denver-Julesburg Basin

Tuesday

Orals

11:35 AM - 11:50 AM (Moscone West 3008)

A22A-06 Comparisons of Airborne HSRL and Modeled Aerosol Profiles

02:40 PM - 02:55 PM (Moscone West 3012)

A23O-05 Real-time aerosol data assimilation experiments during the 2014 FRAPPE/DISCOVER-AQ field mission

04:00 PM - 04:15 PM (Moscone West 3008)

A24B-01 Relating Aerosol Profile and Column Measurements to Surface Concentrations: What Have We Learned from Discover-AQ?

05:00 PM - 05:15 PM (Moscone West 3008)

A24B-05 Vertical profiles of cloud condensation nuclei, aerosol hygroscopicity, water uptake, and scattering across the United States

Posters

08:00 AM - 12:20 PM (Moscone West Poster Hall)

B21H-0176 Quantifying nitrogen and carbon emissions from large-scale cattle feeding operations through the use of a mobile measurement platform.

B21H-0175 Rapid Ammonia Deposition Measured Near Concentrated Animal Feeding Operations

B21H-0180 Vertical Profiles of Ammonia in the Colorado Front Range: Impacts of Source Region and Meteorology

08:00 AM - 12:20 PM (Moscone South Poster Hall)

A21J-3165 Reconciling Organic Aerosol Volatility, Hygroscopicity, and Oxidation State During the Colorado DISCOVER-AQ Deployment

A21F-3106 Analysis of the Interaction and Transport of Aerosols with Cloud or Fog during Dragon Campaigns from Aeronet and Satellite Remote Sensing

Virtual Poster - Utilizing Portable Air Quality Monitors to Asses the Significance of Air Pollution along the Northern Front Range

01:40 PM - 06:00 PM (Moscone South Poster Hall)

A23D-3272 Spatiotemporal Variability of Trace Gases in the San Joaquin Valley during DISCOVER-AQ.

A23J-3372 Stray light corrections to actinic flux measurements during CONTRAST

Wednesday Morning

Orals
09:30 AM - 09:45 AM (Moscone West 3004)
A31J-07HOx Radical Behavior in Urban, Biogenic and Mixed Environments

Posters
08:00 AM - 12:20 PM (Moscone South Poster Hall)
A31C-3038 Comparison of Aerosol Optical and Microphysical Retrievals from HSRL-2, AERONET, and In-situ Measurements During DISCOVER-AQ 2013 (California and Texas)
A31C-3039 Spatial Variability in Black Carbon Mixing State Observed During The Multi-City NASA DISCOVER-AQ Field Campaign
A31C-3040 Assessing Aerosol Mixed Layer Heights from the NASA Larc Airborne High Spectral Resolution Lidar (HSRL) during the Discover-AQ Field Campaigns
A31C-3041 Comparing ground-based and airborne aerosol measurements during the Houston and Colorado DISCOVER-AQ field deployments
A31C-3042 Comparative Study of AOD and PM2.5 Relationship with Different Mixing Layer Heights during Discover-AQ Field Campaigns
A31C-3043 Hygroscopic Measurements of Aerosol Particles in Colorado during the Discover AQ Campaign 2014
A31C-3044 On the Mechanisms Linking Nitrogen Oxides to Trends in Ammonium Nitrate Aerosol over the Last Decade in the San Joaquin Valley
A31C-3046 Temporal and Spatial Variations of Black Carbon Concentration during DISCOVER-AQ Houston Texas 2013 Campaign
A31C-3047 Assessing Vertical Distribution of Trace Species as related to Transport and Emissions
A31C-3048 Vertical Profiles of Light-Absorbing Aerosol: A Combination of In-situ and AERONET Observations during NASA DISCOVER-AQ
A31C-3050 Determination of Water Soluble Organic Carbon Collected ~1 km above the Earth's Surface during a Mid-Atlantic Air Quality Episode and Comparison to Aerosol Optical Properties
A31C-3051 Using NASA Earth Observations as a Tool to Examine PM2.5 Levels in Houston, Texas
A31C-3052 Open Imaging Nephelometer Scattering Measurements from the 2014 Discover-AQ Field Mission
Virtual Poster - Utilizing Portable Air Quality Monitors to Asses the Significance of Air Pollution along the Northern Front Range

Wednesday Afternoon

Orals
02:10 PM - 02:25 PM (Moscone West 3012)
A33N-03 Modeling Air Quality in the San Joaquin Valley during the 2013 DISCOVER-AQ Field Campaign

Posters
01:40 PM - 06:00 PM (Moscone South Poster Hall)
A33B-3167 Spatial trends in surface-based carbonaceous aerosol, including organic, water-soluble and elemental carbon, during DISCOVER-AQ in Houston, TX
A33B-3179 Development and Application of a new DACOM Airborne Trace Gas Instrument based on Room-Temperature Laser and Detector Technology and all-Digital Control and Data Processin
A33C-3187 The Application of a Novel Pressurized Liquid Extraction Method to Quantify Organic Tracers Combined with Historic and Novel Organic Contaminants for the Discover-AQ Houston Field Experiment
A33G-3270 Constraining ammonia dairy emissions during NASA DISCOVER-AQ California: surface and airborne observation comparisons with CMAQ simulations
A33H-3287 The Underestimation of Isoprene in Houston during the Texas 2013 DISCOVER-AQ Campaign
A33I-3310 Validation of the Updated SAO OMI Formaldehyde Retrieval
A33I-3318 Comparison of Pandora spectrometer NO2 measurements to aircraft, satellite, and ground measurements during the DISCOVER-AQ Texas campaign

Thursday

Orals
03:10 PM - 03:25 PM (Moscone West 3010)
A43J-07 Ammonia and methane emissions from cattle and dairy feedlots in Colorado

Posters
08:00 AM - 12:20 PM
Virtual Poster - Utilizing Portable Air Quality Monitors to Asses the Significance of Air Pollution along the Northern Front Range
01:40 PM - 06:00 PM (Moscone South Poster Hall)
A43B-3267 Study of near surface layers in Coastal Texas and their correlation with PBL heights using LIDAR during the NASA 2013 Discover AQ Campaign
A43C-3276 Surface and Column Variations of CO2 using Weighting Functions for Future Active Remote CO2sensors and Data from DISCOVER-AQ Field Campaign
A43F-3340 The impact of the observation nudging and nesting on the simulated meteorology and ozone concentrations from WRF-SMOKE-CMAQ during DISCOVER-AQ 2013 Texas campaign

Friday

Orals
09:30 AM - 09:45 AM (Moscone West 2022-2024)
A51K-07 First Airborne PTR-ToF-MS Measurements of VOCs in a Biomass Burning Plume: Primary Emissions and Aging
01:55 PM - 02:10 PM (Moscone West 3010)
A53N-02 Challenges and opportunities for remote sensing of air quality: Insights from DISCOVER-AQ

Posters
08:00 AM - 12:20 PM (Moscone South Poster Hall)
A51A-3010 Trace Gas Retrievals from the GeoTASO Aircraft Instrument During the DISCOVER-AQ Campaigns
A51A-3011 Improvement and validation of trace gas retrieval from ACAM aircraft observation
A51A-3015 Air Quality Campaign Results from the Langley Mobile Ozone Lidar
A51B-3023 Aerosol Retrieval over Urban Area in MODIS Dark Target Land Algorithm: Implication to Surface Air Quality Monitoring
A51D-3068 Fine-scale WRF-CMAQ Modeling for the 2013 DISCOVER-AQ Campaign in California
Virtual Poster - Utilizing Portable Air Quality Monitors to Asses the Significance of Air Pollution along the Northern Front Range
01:40 PM - 06:00 PM (Moscone South Poster Hall)
A53A-3187 The Effects of Long-Range Transport of Agricultural Smoke on AOD in Houston, TX: Insights from NASA SEAC4RS and DISCOVER-AQ
A53M-3392 Monitoring Tropospheric Ozone Enhancement in the Front Range Using the Gsfc Tropoz DIAL during Discover - AQ 2014
A53M-3411 Understanding Spatial and Temporal Variability in Ozone Levels within a Remote-sensing Scale Grid Cell using Data Collected with Low-cost, Next Generation Monitoring Systems
A53M-3412 Spatial Variability in Ozone and CO2 Flux during the Front Range Air Pollution and Photochemistry Experiment
A53M-3413 An Airborne Investigation of Boundary Layer Dynamics, Entrainment, and Ozone Photochemical Production During DISCOVER-AQ in California's Central Valley

DISCOVER-AQ

FRAPPÉ
July-August 2014

AGU FALL MEETING

San Francisco | 15–19 December 2014

The invited overview presenters are still very interested in hearing from you. It is important that we broadly represent the collective work of the science team:

Challenges and opportunities for remote sensing of air quality: Insights from DISCOVER-AQ (Jim Crawford)

An Overview of Ozone and Precursor Temporal and Spatial Variability in DISCOVER-AQ Study Regions (Ken Pickering)

Relating Aerosol Profile and Column Measurements to Surface Concentrations: What Have We Learned from Discover-AQ? (Ray Hoff)

Science Team Meeting

Dates: 4-8 May 2015

Location: Center Green, Boulder, CO

Accommodations: This is affected by CU graduation on the weekend following the meeting. Hotel rooms at the government rate are very difficult to find.

We are working on one room block in Broomfield, but will need another. It is important that we get an accurate count of who will attend the meeting so that we can set up these room blocks.

If you have not already RSVPed, please do so ASAP.

http://goo.gl/forms/Vl0sKZBx07

Science Team Analysis Plans

DISCOVER-AQ GSFC Science Meeting
Work Plan Discussions

October 16, 2014

DISCOVER-AQ

Main Objectives:

1) Column vs. surface relationships – Flynn, Mazzuca/Stein, Chu, Lamsal, Duncan, Halliday/Thompson

2) Diurnal variation of column and surface – Flynn, Mazzuca/Stein, Chu, Cede/Spinei, Janz, Loughner

3) Horizontal scales of variability affecting satellites and models Chu, Follette-Cook, Janz, Lamsal, Duncan

Supporting Objectives:

1) Conduct statistical analyses – Flynn, Mazzuca/Stein, Follette-Cook, Chu

2) Improve retrieval algorithms – Cede/Spinei, Janz, Liu, Lamsal, Duncan

3) Evaluate regional air quality models – Flynn, Follette-Cook, Spinei, Loughner

4) Conduct ancillary science/instrumentation activities – Stein, Janz, Duncan, Loughner, Thompson, Abuhassan/Herman

Crawford, Pickering, et al. - DISCOVER-AQ Overview Paper

Description of D-AQ sampling strategy, observations types
Air quality and meteorological conditions for the campaigns
Significant findings with regard to D-AQ objectives
Ancillary science

- **Clare Flynn - FY15 DAQ Research Plans:** Everything on my list of PhD prospectus goals/objectives!
  - Get coupled WRF/CMAQ compiled and running for Maryland campaign; evaluate PBL schemes
  - Examine diurnal variation of column abundances from various data sets for each campaign
  - Determine under what conditions good/poor correlation may be expected between column and surface for each campaign
    - Analysis of profile shapes and regression models

- Potential papers:
  - Hierarchical cluster analysis of the Maryland campaign O3 and NO2 P3B/Sonde profiles as well as analysis of profile shapes for these species
  - Analysis of the performance of the 6 PBL schemes in WRF/CMAQ for Maryland 2011 and any improvements that could be made

Deb Stein-Zweers
FY15

- **Finalize Smith Point, TX NO_2-sonde data**
- **Finalize analysis of Sept. 25 pollution event**

- **Paper in preparation:**

"The deployment of the KNMI NO2-sonde: a reliable instrument used for measurement of high vertical resolution NO_2 profiles in the troposphere"

- **Likely begin KNMI employment 1 December 2014**

  Finalize Colorado sonde data

Gina Mazzuca, AOSC/UMD

DISCOVER-AQ research activities for FY15

- Provide complete set of vertical profiles of O_3 and NO_x from the maximum altitude of the P-3B spiral to the surface from Edgewood, MD and Smith Point, TX using tethersonde (and NO_2 sonde when available) data.

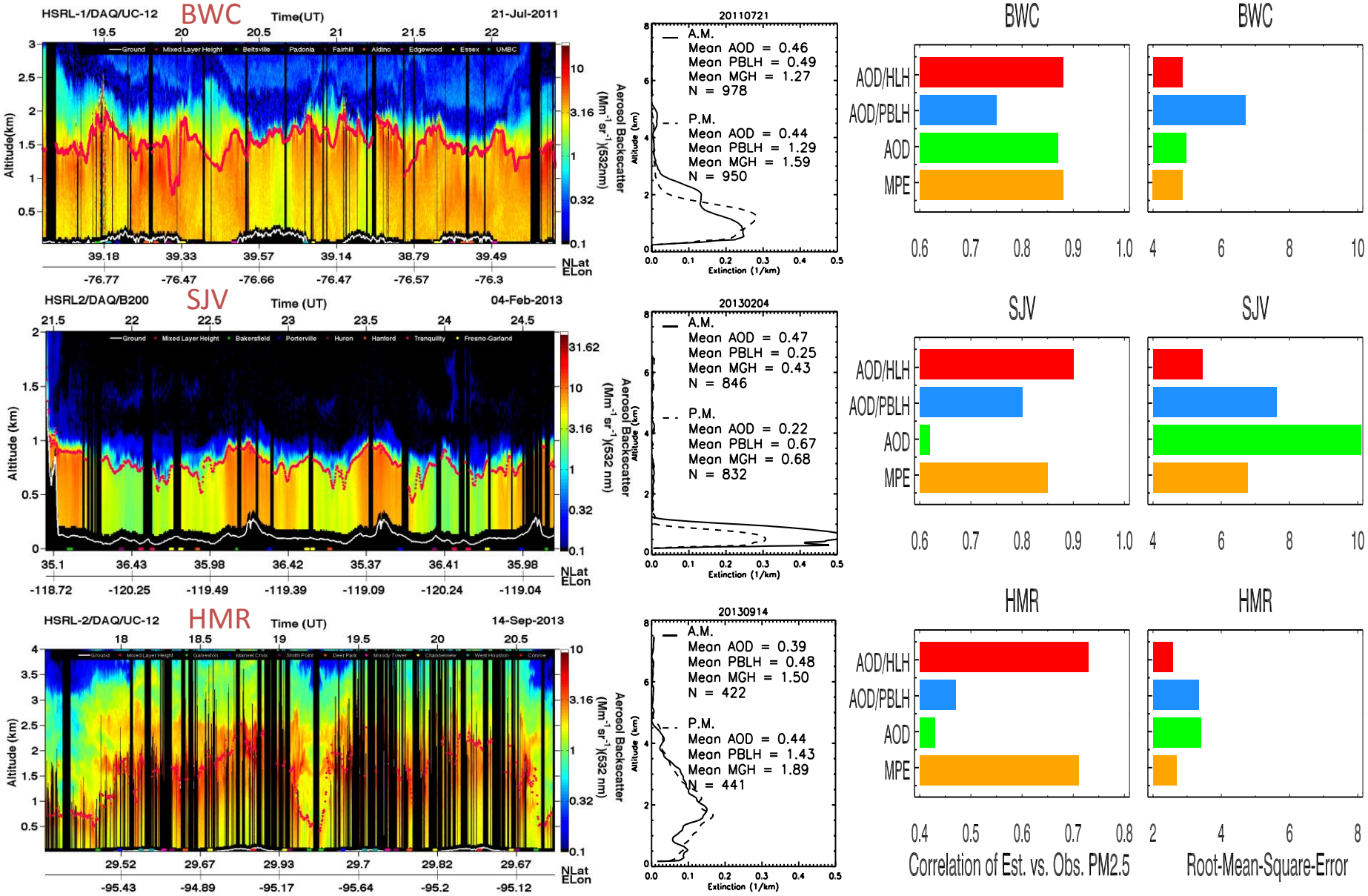
- Compute statistical agreement between the P-3B and the tethersonde measurements in regions of profile overlap.

- Provide examples of the importance of having data from the lowest altitudes of the boundary layer – especially in the vicinity of coastal regions where there is a convergence zone for pollutants

- Use the complete vertical profiles to compare with CMAQ and CAMx vertical profiles of O_3 and NO_x

Comparative Study of AOD and $PM_{2.5}$ Relationship in DISCOVER-AQ Field Campaigns

D. Allen Chu (JCET/UMBC-NASA GSFC), HSRL Team (NASA LaRC),…….



BWC: Baltimore-Washington Corridor; SJV: San Joaquin Valley; HMR: Houston Metropolitan Region

HLH: Haze Layer Height; PBLH: PBL Height; MPE: Mean PBL Extinction

- Paper #1 – Variability paper summarizing variability of all D-AQ campaigns using P-3B and ACAM observations
- Paper #2 – Houston, TX pollution episode analysis
- Paper #3 – Houston, TX model evaluation?
- Other ideas/activities –
  - NOAA CMAQ model evaluation?
  - Colorado simulation

Melanie Follette-Cook

Alexander Cede, Elena Spinei, Nader Abuhassan, Jay Herman
Main DAQ research activities FY 2015

Only activities related to possible publications are shown. The name in parenthesis is the suggested task leader.

O3 and NO2 profiles and surface concentrations

Develop profile algorithms (Elena), incorporate them in the Pandora operation software, and apply them to the DAQ data base (Alex).

HCHO measurements

Investigate the possibilities and limitations of the HCHO data from Pandora sun and sky measurements (Elena or Alex).

ACAM versus Pandora

Compare ACAM and Pandora data (Matt) .

Moon observations

Investigate the possibilities and limitations of the direct moon observations (Nader).

Scott Janz
Ongoing/Potential ACAM Research Activities

- Ongoing HCHO comparisons with integrated profiles ACAM/GCAS (DC, Houston) – Fried,Janz
- Overview instrument paper (all deployments) – Janz, Kowalewski
- Pandora/ACAM/GCAS NO2 VCD – Cede, Herman, Janz, Kowalewski, Lamsal
- GCAS/Geo-TASO – Nowlan, Leitch, Janz, Al-Saadi
  - Geo-mission based (intercomparison/cross-validation plus spatial resolution modeling/implications using raster scan flights)
- Coastal water leaving radiance/NO_2 interference – GCAS Houston GoMEX overflights. Maninno, Tzortziou, Janz, Kowalewski
- UV/Visible band O_3 – Xiong
- Aerosols? (Unique high resolution database, HSRL co-located for validation)

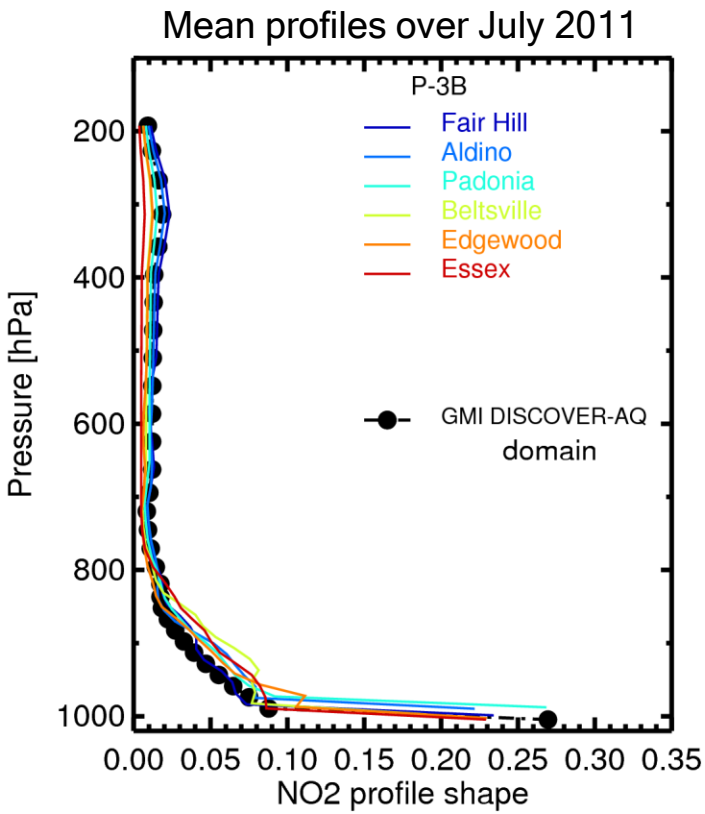
DISCOVER-AQ Activities For FY15 at SAO

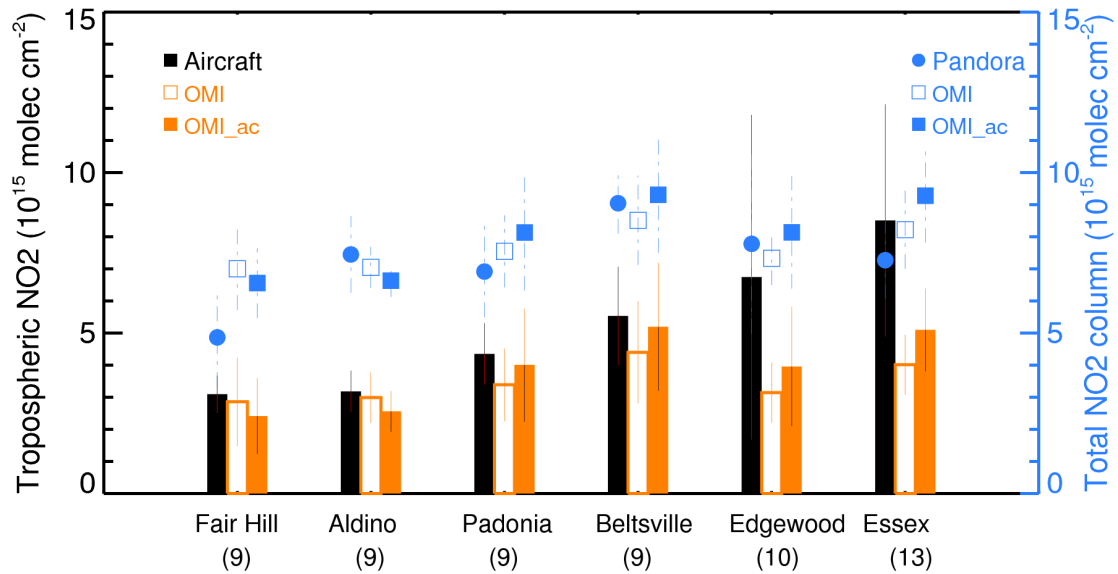
Xiong Liu, Cheng Liu, Caroline Nowlan, new Postdoc

- **List of Research Activities**
  - Comparison of NO_2, HCHO, and O_3 SCDs/VCDs with NASA GSFC Retrievals during the 2011 Maryland Campaign
  - Validate ACAM NO_2, HCHO, and O_3 VCDs with Pandora O_3/NO_2 VCDs, OMI NO_2/HCHO/O_3, and P3B NO_2/HCHO
  - Retrievals and Analysis of NO_2, HCHO, and O_3 SCDs and VCDs during the Houston and Colorado Campaigns
  - Comparison of ACAM and GEO-TASO Retrievals for Houston and Colorado Campaigns

- **Manuscript to be prepared**
  - Validation of ACAM NO_2, HCHO, and O_3 SCDs/VCDs during the 2011 Maryland Campaign

DISCOVER-AQ data for evaluation of OMI standard NO_2 product [2013-2014]

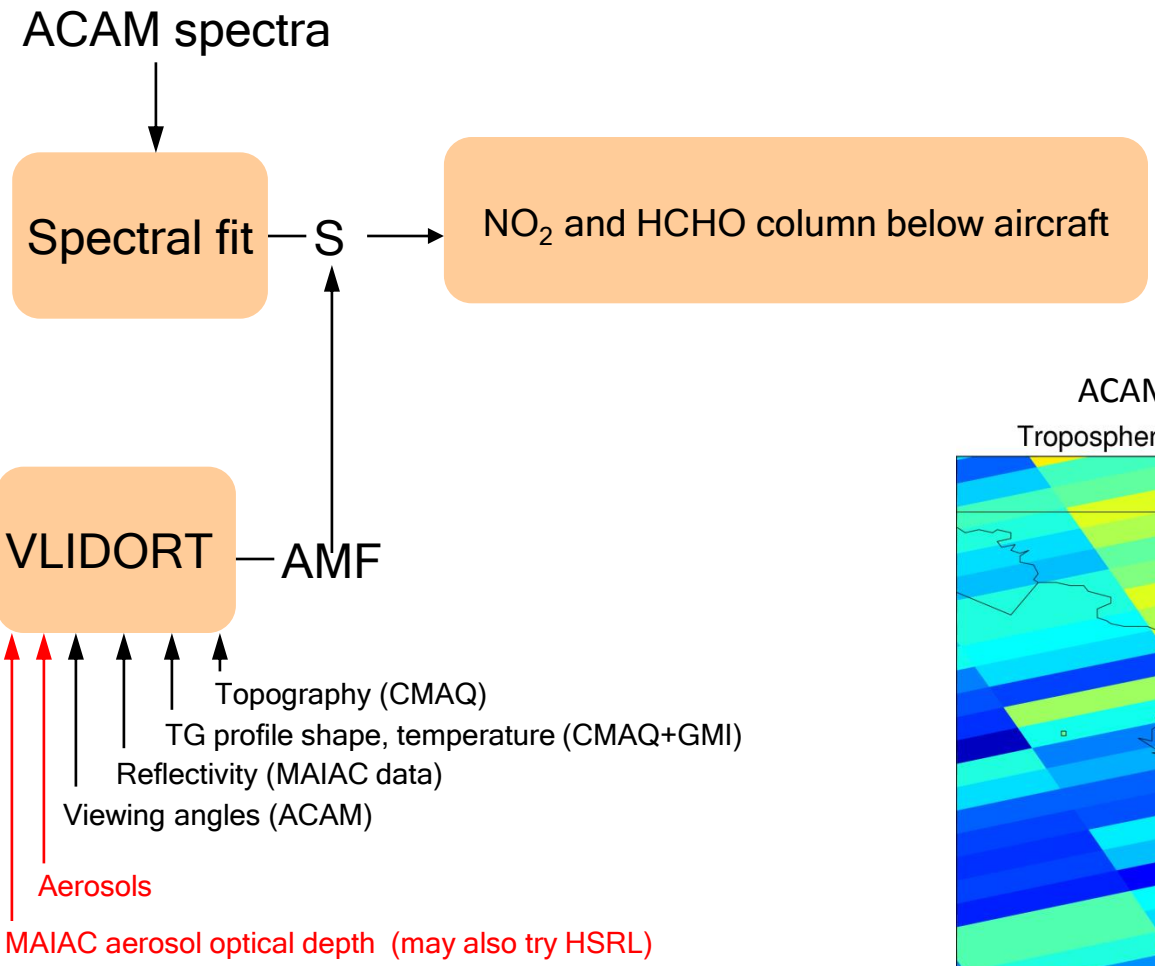




Use of P-3B (ac) profiles in OMI retrievals

L. N. Lamsal, N. A. Krotkov, E. A. Celarier, W. H. Swartz, K. E. Pickering, E. J. Bucsela, R. V. Martin, S. Philip, H. Irie, A. Cede, J. Herman, A. Weinheimer, J. J. Szykman, and T. N. Knepp, Evaluation of OMI operational standard NO_2 column retrievals using in situ and surface-based NO_2 observations, ACP, 2014 (in press).

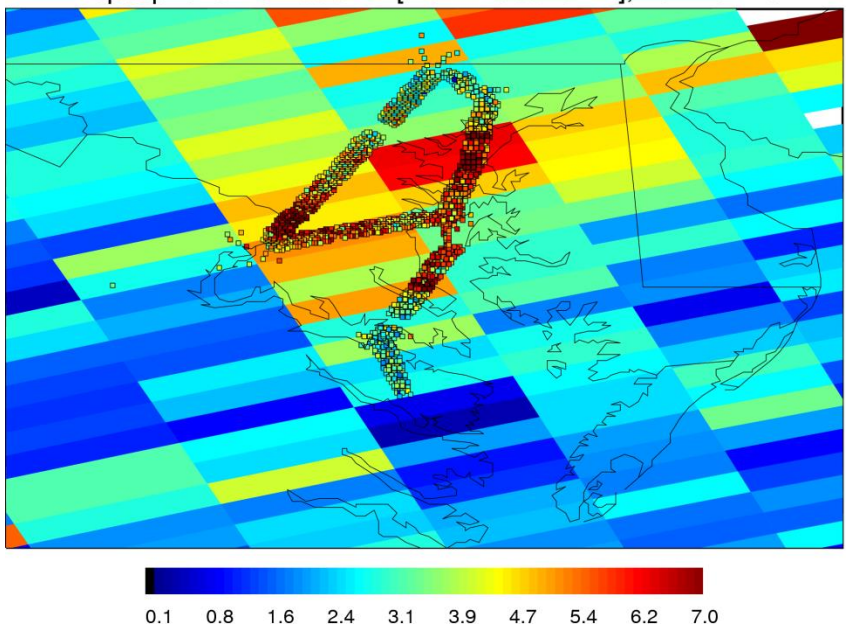
Retrieval of NO_2 and HCHO from ACAM [Plan for 2015]



Uses different spectral fitting and AMF inputs than Liu et al.

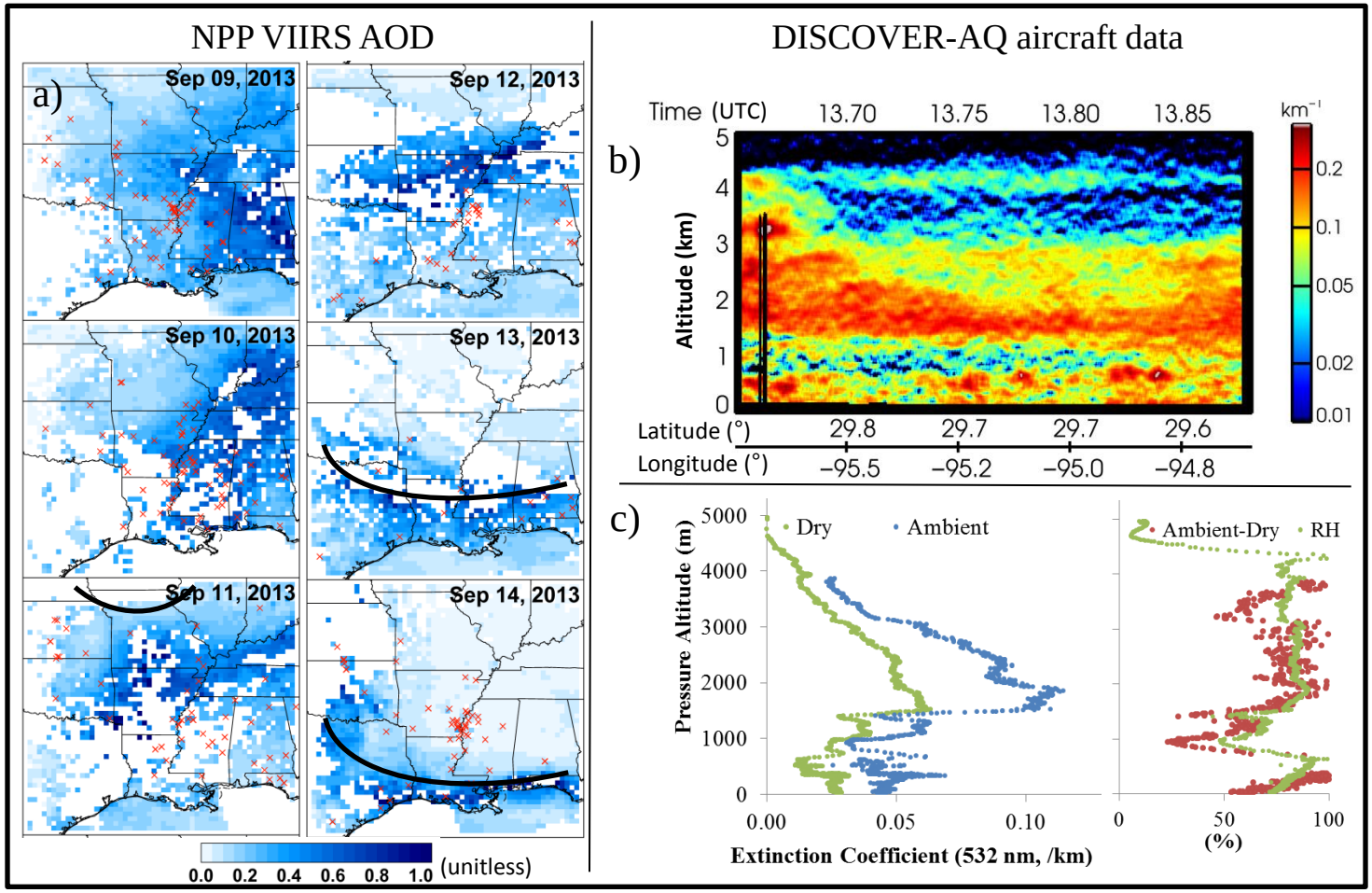
ACAM retrievals superimposed on OMI

Tropospheric NO2 column [10^{15} molec. cm^{-2}], 2011-07-29



Lok Lamsal, Scott Janz, Nickolay Krotkov, Matt Kowalewski …

DISCOVER-AQ: Houston: September 2013



Proposed Project: Perform a sensitivity analysis of the ACAM NO_2 retrieval to various assumptions (e.g., height of aerosol layer). The D-AQ data provide information on the layering of the aerosols and level of humidification, for example, which are typically gotten from coarsely-resolved models. This information is invaluable to understand the impacts of various assumptions on the NO_2 retrievals in cities with high aerosol loading or areas impacted by biomass burning pollution.

Proposers: Bryan Duncan & Lok Lamsal

Chris Loughner's DAQ related research plans over the next year:

- DAQ-Texas:
  - CMAQ simulations for the DAQ-Texas campaign are underway.
  - Investigate the role of local and regional emissions and sea and bay breezes on Houston air quality.
  - Assess formaldehyde concentrations due to primary emissions, secondary sources, and regional transport.
- DAQ-Maryland papers currently finishing:
  - Role of historical emissions reductions on surface air quality and human health.
  - Nitrogen dry deposition gradient along the Chesapeake Bay coastline.

FY15 DISCOVER-AQ ANALYSES FROM GSFC/PSU NATIVE TEAM*

- Thompson (with G. Morris et al): Complete analysis of Houston ozone vertical structure from 9/13 in 10-year context
- Halliday (with A. Wisthaler, A. Thompson): VOCs from ground and P-3 PT-RMS, primarily from Houston and Colorado Oil & Gas activity
- Thompson et al: Methane variability and influences at Platteville, CO

Co-funded with AQAST Support

- Kollonige et al: CH4 and other tracers of ONG activity from satellite (TES, IASI)

Co-funded with ACCDAM Support

- Fasnacht et al: Analysis of Stratospheric intrusions (SI) from sondes and aircraft throughout the DISCOVER-AQ campaign
- * Other analyses in collaborative mode as requested, e.g. TOLNET with McGee group

Science Team Analysis Plans

Cohen Group:

-Synthesizing and describing the observed NO2 profiles

-Examining the role of aerosol in NO2 retrievals using these obs

-Chemistry of ANs and HNO3 and the insight these give us into O3 in the different locations

(Also Sally has a paper on aerosol in the central valley that is nearly ready to submit.)

Diskin Group:

-Analysis of the temporal and spatial variability of methane, nitrous oxide, and carbon monoxide emissions in multiple urban areas

(3 papers)

Science Team Analysis Plans

Fried Group:

Working on a continuation of efforts to compare ACAM and DFGAS CH2O columns over the 4 study areas. Will identify time periods where clouds impart horizontal structure on the vertical profiles and see if this affects the comparisons. In addition, have been in contact with Kelly Chance's group on their new OMI data product for CH2O columns that incorporate a number of improvements over their previous product. As the comparisons look reasonable, at least for the Washington DC study, this will be included in the final comparison mix.

Science Team Analysis Plans

Fried Group (cont.):

Working with Chris Loughner and Ken Pickering to focus on the Houston study using comparisons of CH2O observations to WRF-CMAQ results to:

a) arrive at updated CH2O emission inventories

b) examine the CMAQ model output runs with the Process Analysis Mode to quantify the relative importance of primary, secondary, and regional transport sources of CH2O in the Houston Metropolitan area

c) Employing the model time dependence of CH2O together with observations, we will derive a 24-hour synthesized airborne CH2O data sets for sampling sites over Clinton, Deer Park and Channelview. These are sites where DNPH ground-based cartridge samplers have been collecting CH2O data for many years and our synthesized data sets will attempt to assess the accuracy of these measurements.

Science Team Work Plans

Aerodyne (Yacovitch):

- High Emitters: source characterization and comparison of ground and flight data point sources

-VOC Ratios: Is ethane/methane a predictor for other VOCs and HAPs?

Mead (Small Sensors):

TX data: Looking for gradients in a satellite pixel and also to show efficacy and utility of this type of network. Using EPA data as calibrated tie points.

CO data: Focus on tall tower analysis to intercompare with in situ tower calibrated data. Look at Golden data for transect away from the supersite. Denver downtown spatial distribution study.

Science Team Work Plans

EPA:

Melinda Beaver is soon moving from the EPA/ORD to EPA/OAQPS, where she and Kirk Baker will be doing more modeling and comparisons with the DISCOVER-AQ observations first for the SJV, and then for the later campaigns. So, both OAQPS and the Atmospheric Modeling and Analysis group (Wyat Appel, etc.) in ORD will be actively working on simulations for our campaign periods.

Russell Long will be analyzing the NO2 observations from all deployments to assess performance of true NO2 versus traditional monitoring with molybdenum converters.

Jim Szykman will be evaluating ceilometer performance to determine mixed layer depth.

Science Team Work Plans

Chatfield:

1) DISCOVER-AQ Airborne Measurements Quantify How Satellite-Retrievable Becomes Health-Relevant Smog Ozone And Its Formation (Robert. B Chatfield, Robert F. Esswein, Andrew Weinheimer, James H Crawford, Alan Fried)

Expand from MD to Denver, probably not Houston, but maybe, research 0.75 done for MD; see poster in AGU 2012 (Esswein et al.)

2) Maps of Wintertime San Joaquin AOD and PM2.5 relationships, 2005-2013 (Robert B. Chatfield, Meytar Sorok-Hamer, Alexei Lyapustin, Yujie Wang, Robert F. Esswein)

May expand to algorithm-improvement title, research will restart with new MAIAC dataset, see February 2014 presentation to Science Team, Busan presentation Sept 2014 (will send this.)

Science Team Work Plans

Chatfield (cont.):

3) Exposure to toxic air pollutants from roadways: empirical description and best methodology for epidemiological assessment (Hyung Joo Lee, Robert B. Chatfield)

Mostly Baltimore and Denver, research just starting.

Doug Martins (Penn State):

Working with Gary Morris, Barry Lefer and Alex Kotsakis on vertical and horizontal ozone variability in Houston. A paper is in preparation and might be submitted by the end of the year.

Science Team Work Plans

AVOCET in-situ CO2 Measurement Group:

Melissa, Susan, and Yonghoon are working on the Surface and Column variability of CO2 in all of the DAQ sites.

To see the column (0 - 3.5 km) variability at each urban site, we calculate the column OD using three different CO2 weighting functions for potential future active remote CO2 sensors (ASCENDS) operating at 1.57 μm and 2.05 μm wavelength. We will examine the difference in weighting functions in the column variability, and will relate the column variability with surface emissions using combustion tracers. We will also explore the measurement requirement needed for future remote sensors in order to capture urban variability.

Science Team Work Plans

NOAA lidar group: DAQ Houston and Denver data sets

- Characterize the vertical distribution and temporal evolution of ozone in the boundary layer (BL) and lower free troposphere.

- Compare lidar-derived column measurements of ozone with ozone observations at the surface.

- Study the effect of transport and mixing processes on boundary layer ozone concentrations by combining ozone lidar measurements with Doppler lidar and wind profiler observations. For Houston, we will look at the role of the land-sea breeze circulation in shaping the observed ozone distributions, while for the Colorado Front Range we will focus on the effect of the diurnal upslope/downslope wind pattern as well as thunderstorm outflows on ozone concentrations. We also plan on deriving turbulent ozone flux profiles in the BL from collocated, vertically-pointed ozone and Doppler lidar observations.

Science Team Work Plans

NOAA lidar group (cont.):

- Study the dynamics and evolution of the residual layer along the Front Range using ozone, HSRL, Doppler, and water vapor lidar measurements from the BAO.

- For these studies, we plan on including data from other DAQ investigators, such as the P3 observations, ozone sonde data, in situ measurement at the BAO tower, and observations from the other two TOLNET ozone lidars.

Science Team Work Plans

GSFC TOLNet (McGee) Group:

John Sullivan has been investigating two cases during the campaign.

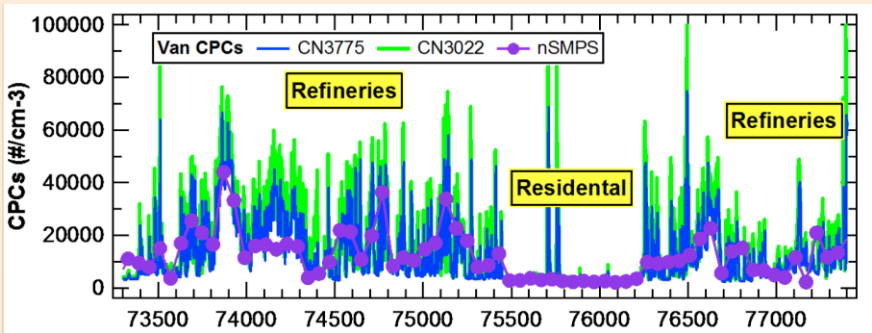
The first involves the interaction with wildfire smoke aloft and ozone production around 07/17. We see an increase in ozone from the ozone lidar aloft resting directly above the smoke plume. Unfortunately it was at an altitude that was above the P3B, so I am using mostly lidar, sonde and HSRL data.

The second involves a stratospheric ozone intrusion event that occurred around 08/06. With the Ft. Collins O3 lidar (and potentially the Golden LaRC O3 Lidar) we noticed a strong increase in ozone aloft. This ozone is associated with dry and cold air, which points to STE. I have identified the intrusion as occurring off the coast of California on 08/05 and trajectories match the altitude of the O3 lidar data. Ft. Collins and Platteville sondes both also add nice complements to the analysis.

NASA LARGE DISCOVER-AQ Analysis (Nov. 14, 2014)

Synthesis

- Chelsea Corr - importance of UV optical properties in optical aerosol typing schemes
  - P-3B, ground-based and AERONET data; plus data from ARCTAS, SEAC4RS,INTEX-B & TRACE-P
- Jack Lin - modelling of aerosol hygroscopicity & cloud condensation nuclei based on aerosol size and composition measurements
  - P-3B data from all campaigns, SEAC^{4}RS, SENEX
  - talk at AGU (A24B-05, Tuesday 5PM)
- Rich Moore - spatial variability in black carbon mixing state
  - determine the externally mixed fraction of particles containing BC and the internally mixed volume fraction of BC relative to the total particle volume
  - poster at AGU (A31C-3039, Wednesday afternoon)
- Michael Shook - assessing vertical distribution of trace species as related to transport & emissions
  - DAQ-MD & DAQ-TX; P-3B measurements of CO_2, CO, O_3, NO_x, CH_2O & aerosol properties
  - poster at AGU (A31C-3047, Wednesday afternoon)
- Lee Thornhill - comparing ground-based and airborne aerosol measurements
  - DAQ-TX & DAQ-CO
  - poster at AGU (A31C-3041, Wednesday afternoon)



Mobile Van Measurements in Houston: Near refineries, highly variable particle concentrations were observed. Measurements in a residential area were much lower but might be occasionally influenced by refinery emissions (spikes).

NASA LARGE DISCOVER-AQ Analysis (Nov. 14, 2014)

Synthesis

- Luke Ziemba - vertical profiles of light-absorbing aerosol
  - combines in-situ P-3B aerosol measurements with AERONET retrievals of absorption AOD
  - poster at AGU (A31C-3048, Wednesday afternoon)

Maryland

- 2 papers published (Ziemba, GRL '13 & Crumeyrolle, ACP '14)
- Andreas Beyersdorf - aerosol composition and variability
  - manuscript in preparation

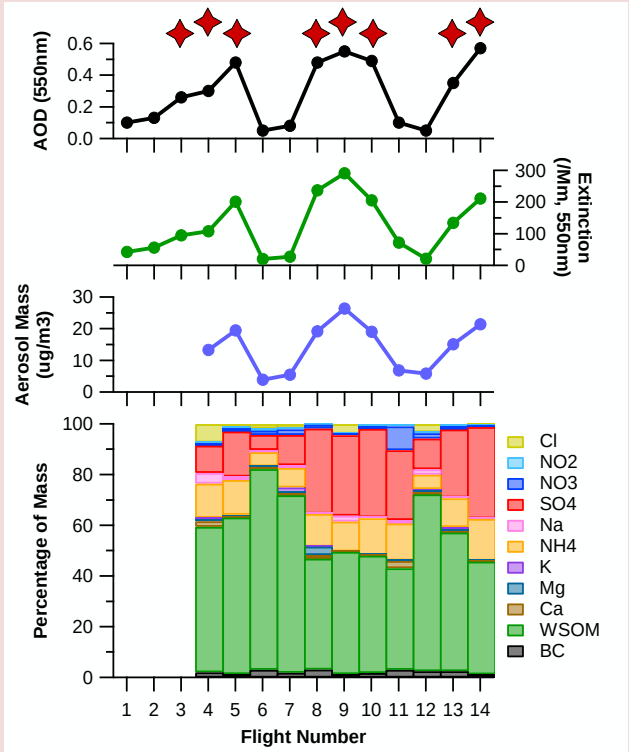
Texas

- Andreas Beyersdorf - effects of transported smoke on AODs
  - P-3B data, HSRL, AERONET & SEAC^{4}RS measurements of fresh smoke
  - poster at AGU (A53A-3187, Friday afternoon)
- Chelsea Corr – in situ and remote measurements of single scattering albedo & absorption angstrom exponents
  - P-3B data and AERONET
  - manuscript to be submitted to AMT in Spring 2015

Colorado

- Carolyn Jordan - UV/Vis (300-700 nm) ambient aerosol extinction spectra
  - field test of new instrumentation (SpEx)
  - in situ UV extinction measurements are rare and could be used to identify organic species
  - talk at AGU (A11K-01, Monday 8AM), manuscript in preparation

Maryland: variability in aerosol loading & composition; days with identified long-range transport (starred) had higher aerosol loadings and more ammonium sulfate leading to higher aerosol hygroscopicities



Science Team Work Plans

Hoff Group:

Hennigan lead - Speciation of the NREL-Golden aerosol and relationship to PM2.5 mass and extinction at the surface, including the potential for hygroscopic growth

Orozco lead - Measurements of hydration of the aerosol at the surface, measurements of aerosol phase function and relationship to speciation results

Potential:

Hoff lead - extinction profile retrievals at 532 and 355 nm and comparison to aircraft profiles (HSRL and LARGE) and AOD from Aeronet

Delgado lead - flow characterization at NREL-Golden using Leosphere Wind Lidar and MetOne met station and comparison with Millersville sonde data.

Science Team Work Plans

Hennigan Group: Sources and processing of aerosol in Denver. This will include analysis of regional vs. local sources, as well as effects of meteorology on fine particle composition and concentrations. I will focus on ground-based measurements but plan to integrate the LIDAR data heavily in the analysis. Depending on where the analysis takes us, it's likely we'd look at some of the aircraft data as well.

Bahreini Group:

- influence of O&G emissions on SOA formation
- characterizing the relation between aerosol composition and optical extinction in the Front Range
- influence of meteorology associated with the Denver cyclone on aerosol composition

Science Team Work Plans

HSRL Group:

Patricia Sawamura is focused on evaluating the microphysical and optical retrievals obtained from the HSRL-2 dataset by comparing them to similar measurements and/or retrievals obtained from ground-based AERONET sunphotometers and airborne in-situ instruments during DISCOVER-AQ . The parameters that are currently being evaluated are: number, surface-area and volume concentrations, effective radius, complex index of refraction, and single scattering albedo. Her focus so far has been in developing protocols and algorithms that take such differences into account in order to help us better understand the limitations of such comparisons when evaluating the HSRL-2 retrievals. This type of detailed analysis will enable us to systematically compare the performance of different retrieval algorithms, to ensure quality-assured microphysical retrievals from the HSRL-2 in the near future.

Science Team Work Plans

HSRL Group:

Sharon Burton is analyzing a case study in which HSRL2 provides detailed characterization of the evolution of vertical structure of aerosol layers due to both boundary layer diurnal evolution and transport from outside the region. Comparisons are being made with the WRF-Chem model results from Pablo Saide of University of Iowa (which were run for the SEAC4RS domain). The model provides back-trajectories and tracers for further understanding the case study, and the comparison gives insight into how well chemical transport models capture observed vertical variability, aerosol type, and evolution in a case with elevated layers. The high horizontal and vertical resolution of HSRL2 and the unique sampling pattern of DISCOVER-AQ with at least four observations per day for several days in a row provide a unique opportunity for such comparisons.

Science Team Work Plans

HSRL Group:

Amy Jo Scarino is analyzing the mixed layer (ML) heights derived from the airborne HSRL-2 data during the four DISCOVER-AQ missions. These studies examine the temporal and horizontal variability of ML heights and notes the large variability between land and water (e.g. Chesapeake Bay and Galveston Bay). This analyses also determine the distribution of aerosol optical thickness (AOT) relative to the ML height. The HSRL ML heights are also used to evaluate the performance in simulating the temporal and spatial variability of ML heights from both regional chemical models and global forecast models.

Science Team Work Plans

HSRL Group:

Rich Ferrare is using data from Houston to evaluate GEOS-5 aerosol profiles. HSRL-2 measurements of aerosol backscatter, extinction, and depolarization are being used to assess corresponding GEOS-5 profiles of aerosol extensive and intensive properties. The HSRL-2 measurements acquired during all deployments likely will be used to assess additional GEOS-5 results as well as aerosol profiles produced by the NRL and ECMWF aerosol assimilation models.

Rich is also examining HSRL-2 and AERONET measurements from California, in particular during a case of high relative humidity on February 4, 2013. This case is of interest as the HSRL-2 and AERONET measurements and aerosol retrievals show considerable variation in aerosol properties throughout the domain and between the morning and afternoon flights.

Science Team Work Plans

HSRL Group:

The HSRL group will also plans to continue examining the relationships between aerosol extinction, surface PM2.5, aerosol optical thickness, and boundary layer heights during the various DISCOVER-AQ deployments. The HSRL-2 measurements will be used to examine how the extent to which aerosol extinction near the surface and within the mixed layer can be used to infer PM2.5 and how the HSRL-2 extinction profiles relate to the column AOT measurements.