DISCOVER-AQ Telecon Notes

25 April 2013

Need to expand email list (e.g., Gatebe, Holloway, others?) –Action for Mary Kleb

Need to get all new collaborators listed on website (e.g., Gatebe, Herndon, Holloway, Jones, Mead, AQRP researchers, TOLNET – Hardesty and Deyoung) – Action for Mary Kleb

Aeronet group needs hotspots for early site emplacements. 3 are available from Jay Herman. Mary Kleb needs to know how many more are needed – Action for Joel Schafer

TCEQ needs additional information on the NOAA ozone lidar regarding noise levels and its previous location operating on the airfield at LaPorte – Jim Crawford will contact Mike Hardesty

Still need to finalize plans for the West Houston site – Raj Nadkarni will work offline with Jim Crawford

Logistics are still very much tied to the decision on where to base SEAC4RS. More guidance will come very soon after this decision regarding hotels, badging etc.

Ray Hoff requested details on the SEAC4RS Ops Plan. This will be disseminated to the DISCOVER-AQ team after the SEAC4RS Science Team meeting next week – Action for Jim Crawford

Martin Nowicki requested that P-3B inlets be sent early so that they can be installed ahead of time – Action for P-3B Investigators

Details on the integration of the open path nephelometer from UMBC (Vanderlei Martins) need to be added to the integration plan for the P-3B – Action for Martin Nowicki

Integration for the P-3B is compressed (5-21 August) due to flights of EcoSAR on the P-3B through 30 July and maintenance through 2 August. If this schedule changes, would anyone be available to integrate sooner? SEAC4RS integration will last through the end of July and test flights will go through 6 August.

After the transit to Houston on 2 August, a Media Day has been scheduled for Sept 3. This will allow the local press to see the aircraft and get word out about the flights.

R. Clark will have bird migration from Audubon Society by the end of the week. Migration should not be a problem as birds are foraging in Sept. It does help that spiral will be over the water as birds forage on the shore.

For those investigators operating at Smith Point, Rich Clark is the main point of contact and will be negotiating with Spoonbill RV Park (Tracy Woody). Those working there may decide to stay at the RV park or commute. The nearest town is half hour away and there is not much there. Nearest clinic is 23 miles away.

Manuscript titles are being assembled. Please send any papers in progress to Jim Crawford and Ken Pickering, even if the work is still at the topical stage. Team members are encouraged to share analyses during upcoming telecons to reduce the chance for redundant work and ensure that all relevant team members are in the loop.

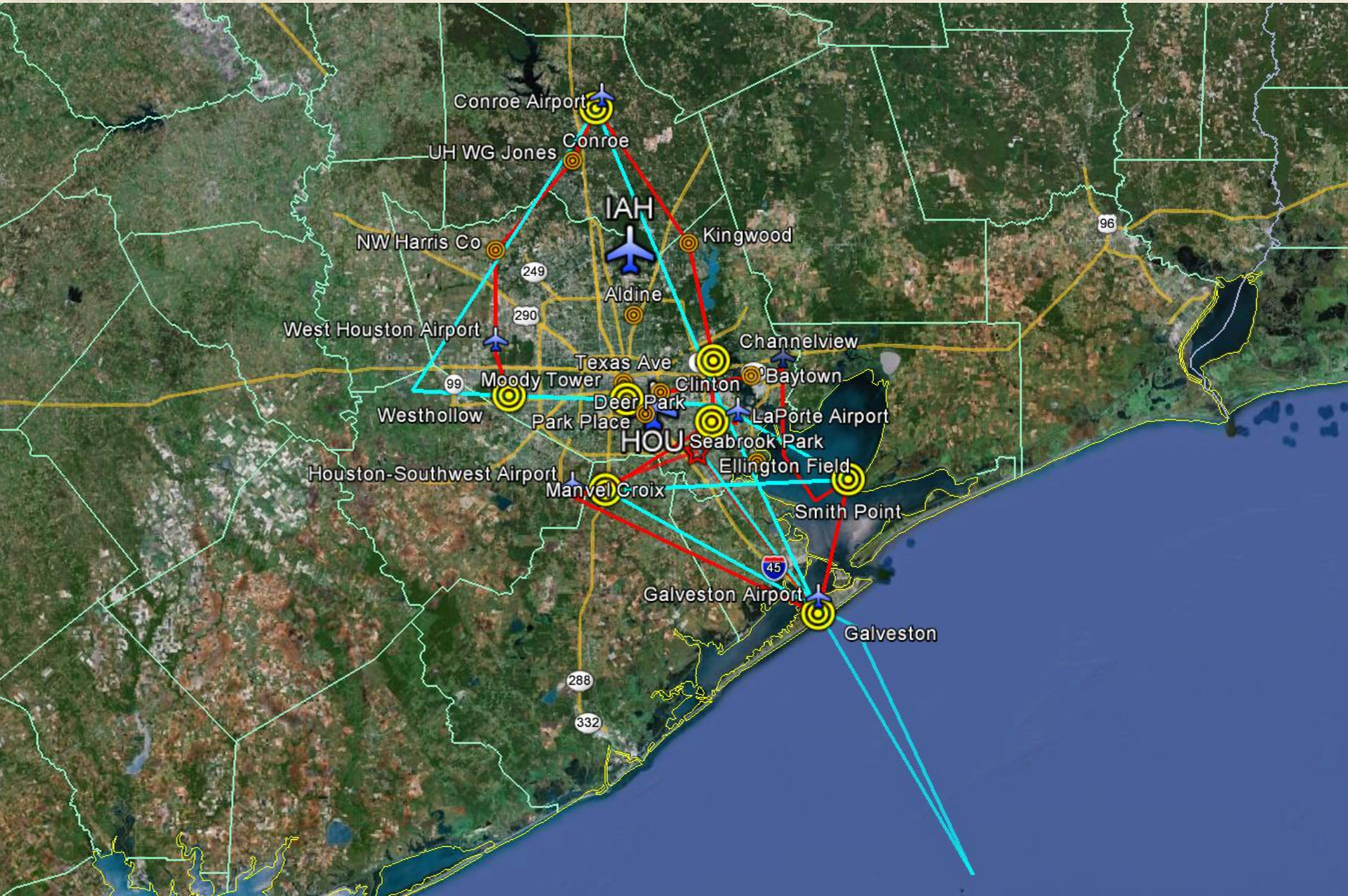
Gao Chen (DISCOVER-AQ Data Manager) needs a point of contact for the TCEQ data. We will want to archive the high resolution measurements from the field intensive – Action for Raj Nadkarni

Webex Agenda, 28 March 2013

1. Houston Deployment Plans
2. Recent publications and plans for future publications
3. California data progress, schedule, and preliminary analysis
4. Ongoing analysis of Maryland observations

DISCOVER-AQ

Observing Strategy for Houston



Ground Site Plans

Updates from last telecon are shown in red

Site Name	Spiral Y/N	Pandora Y/N	Aeronet Y/N	Missed Approach	Mobile Hook-up	other DISCOVER-AQ Augmentation
Channelview	Y	Y	Y	N	Y	
Clinton	N	Y	Y	N	N	
Conroe (Airport)	Y	Y	Y	Y	Y	U. Texas – aerosols and NO2
Deer Park	Y	Y	Y	N	N	
Galveston	Y	Y	Y	Y	Y	NOAA Trace gases
LaPorte Airport	N	N	N	Y	Y	EPA Trailer, NOAA Ozone Lidar
Texas Avenue	N	Y	Y	N	N	EPA NO2
Manvel Croix	Y	Y	Y	N	Y	NOAA NO2, Baylor/Rice –neph and hi-vol samplers, NASA Ozone Lidar
Moody Tower	Y	Y(2)	Y	N	N	
NW Harris Co	N	Y	Y	N	N	
Seabrook Park	N	Y	Y	N	N	EPA NO2
Smith Point	Y	Y(2)	Y	N	N	NATIVE, Millersville, UMBC, EPA-NO2, TCEQ Profiler, NOAA radiation
UH Liberty	N	N	Y	N	N	
UH Sugarland	N	N	Y	N	N	
Westhollow (or West Houston)	Y	Y	Y	N	N	
Baytown Airport	N	N	N	TBD	N	Possible missed approach enroute from Smith Point to Moody Tower
Houston SW Airport	N	N	N	TBD	N	Possible missed approach (8 km west of Manvel Croix)
West Houston Airport	N	N	N	TBD	N	Possible missed approach enroute from Westhollow to NW Harris Co

- *Current requirements have been determined and necessary work defined*
- *LaPorte Airport needs a few more details about the ozone lidar*
- *Moving forward is subject to approval of access agreements*
- *No new work being considered at this time (can pass requirements to Jim and Mary)*

Overlap with SEAC^{4}RS

SEAC^{4}RS is hoping to base in Houston, but there are still a few hurdles to overcome.

This would reduce, but not eliminate, the strain on groups working both projects listed in the table below. Please let me know if there are others.

Investigator	Measurement/Role	New Instrument?
Diskin	DACOM and DLH	Yes for DACOM
Anderson	LARGE (aerosols)	No spares
Cohen	TD-LIF (NO_2 and reactive nitrogen)	Upgrades to an older instrument
Fried	DFGAS (CH_2O)	Modifications to an existing instrument
Wisthaler	PTR-MS	
Beyersdorf/Yang	AVOCET (CO_2)	
Ferrare	HSRL (DAQ) / ER-2 lead (SEAC^{4}RS)	

Overlap with SEAC^{4}RS

Logistical Issues and Possible Efficiencies:

Travel - We will need to talk more about how to separate or account for travel in support of each project. More instructions on this will be forthcoming after the SEAC^{4}RS science team meeting next week and a final decision on Houston. The 30-day rule will need to be considered by those working both projects.

Badging – We need to have a more complete picture of who needs badges and for which centers. We also do not want you to have to rely on multiple projects for your badging needs. Many of you will need badges for Wallops, Palmdale, and Houston.

*Start thinking about these issues now and we will address them at the SEAC^{4}RS meeting next week.

Overlap with SEAC^{4}RS

Science considerations (these are no longer a factor in the basing decision, but other ideas are welcome):

1. UV DIAL ozone observations over Houston: 30-45 minutes at the end of a flight

2. Remote sensing validation/ACE observing strategies: Overflight of ER-2 remote sensing payload under appropriate circumstances (e.g., long range transport of dust or smoke) similar to PODEX overflights in California

3. Direct support of SEAC^{4}RS with P-3B: Subject to DISCOVER-AQ priorities, but 10 flights over Houston could be accomplished alongside a couple of additional sorties in support of SEAC^{4}RS.

P-3B Payload Upgrades for Houston

Additions to the payload have been identified:

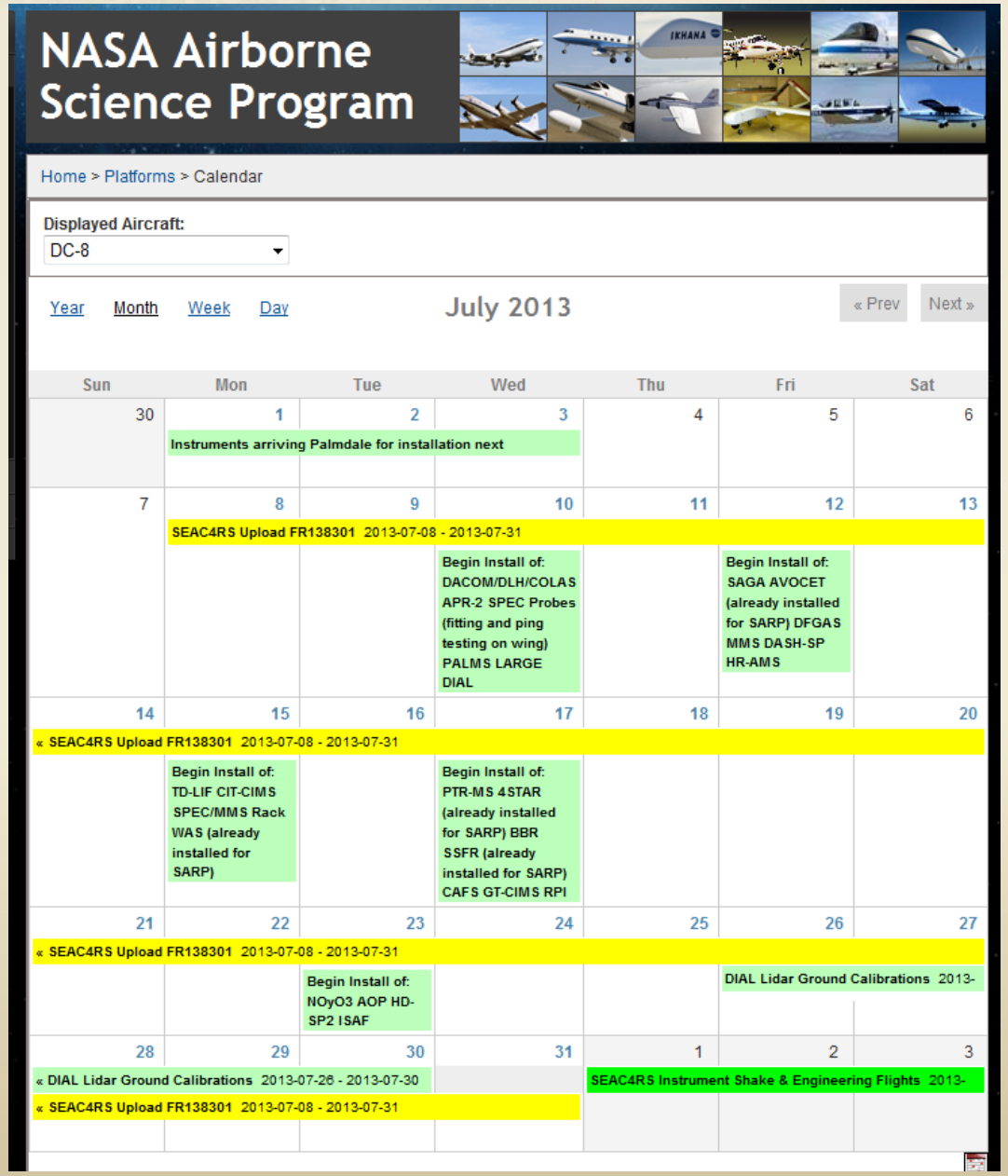
CAR (Charles Gatebe, UMBC) - located in nose of aircraft, rack next to UND

SO2 (John Holloway, NOAA) – we would have to supply an operator (NH3 rack)

Picarro CH4 (Melissa Yang) – added to AVOCET rack

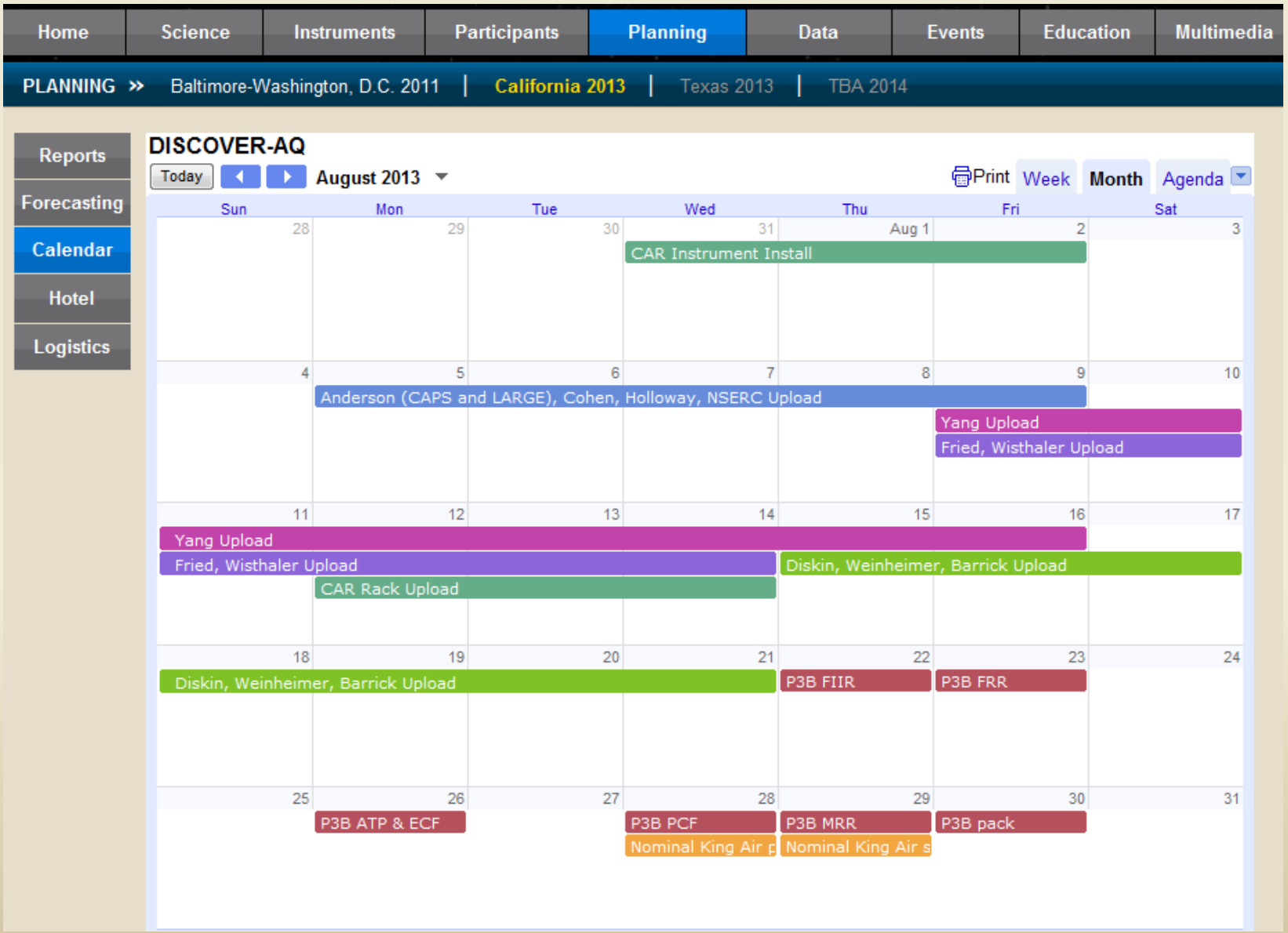
DC-8 Integration Schedule

http://airbornescience.nasa.gov/aircraft_detailed_cal/2013-07?aircraft_id=3

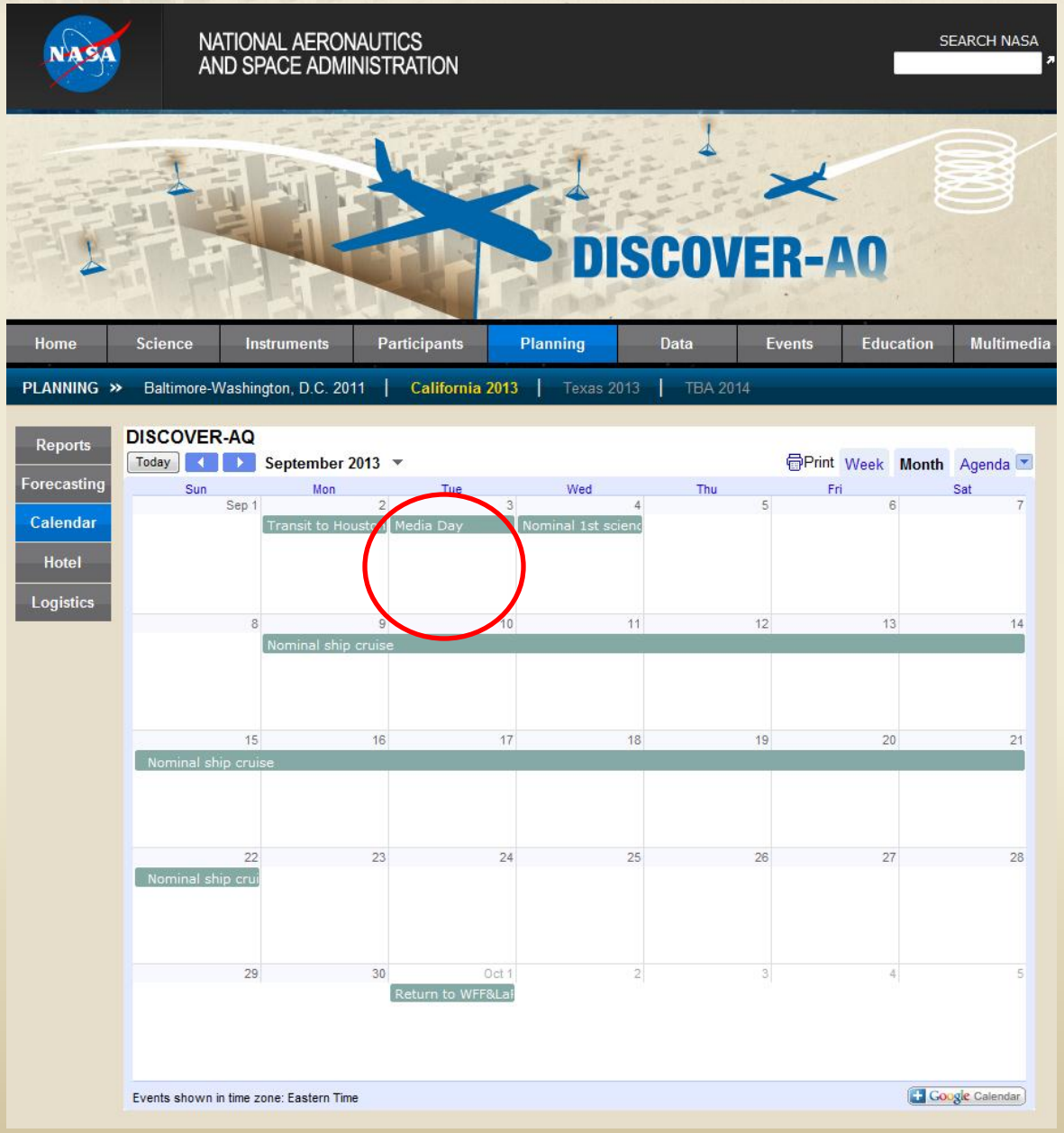


- AVOCET – Already installed
- DACOM – 10 July
- LARGE – 10 July
- DFGAS – 12 July
- TD-LIF – 15 July
- PTR-MS – 17 July
- Test flights begin – 1 August
- Deploy – 8 August

P-3B Integration Schedule



Houston Deployment Schedule



- Unlike California, we will not need to introduce margin into the schedule for fog. Therefore, we have a much firmer schedule.
- 2 Sep - Transit to Houston
- 3 Sep - Media Day
- 4 Sep - First possible science flight
- 1 Oct - Return to WFF
- The rest of the calendar will be constructed around these key dates.

Journal of Atmospheric Chemistry
Processes Impacting NEar-Surface Atmospheric Pollutants (PINESAP)

Article Title	Current Status	Author name
Nocturnal isoprene declines in a semi-urban environment	Final decision accept	David Doughty
Bay Breeze Influence on Surface Ozone at Edgewood, MD During July 2011	Final decision accept	Ryan Michael Stauffer
Estimating surface NO2 and SO2 mixing ratios from fast-response total column observations and potential application to geostationary missions	Editor Assigned	Travis Knepp
Chemical composition and concentration of particulate matter and volatile organic compounds during a bus strike in Ottawa, Canada	Revise	Jose D Fuentes
Processes controlling the vertical distribution of biogenic hydrocarbons and oxidants within a mixed deciduous forest	Revise	Wai-Yin Stephen Chan
Modeling the fate of biogenic volatile organic compounds, their reaction products, and oxidants in a forest canopy	Revise	Wai-Yin Stephen Chan
Evaluation of NAQFC Model Performance in Forecasting Surface Ozone during the 2011 DISCOVER-AQ Campaign	Final decision accept	Gregory George Garner
Ozone Correlations Between Upper Air Partial Columns and the Near-Surface at Two Mid-Atlantic Sites during the DISCOVER-AQ Campaign in July 2011	Under review	Douglas K. Martins
Effects of Local Meteorology and Aerosols on Ozone and Nitrogen Dioxide Retrievals from OMI and Pandora Spectrometers in Maryland, USA during DISCOVER-AQ 2011	Final decision accept	Andra Jenn Reed
Bay Breeze Climatology at Two Sites along the Chesapeake Bay from 1986-2010: Implications for Surface Ozone	Under review	Ryan Michael Stauffer
Spatial and temporal variability of ozone and nitrogen dioxide over a major urban estuarine ecosystem	Final decision accept	Maria Tzortziou
Ozonesonde Climatology and Satellite Product Evaluation: Tropospheric Ozone in the Mid-Atlantic U.S. from 2005-2010	Under review	Caroline P. Normile
Ozone Profiles in the Baltimore-Washington Region (2006-2011): Satellite Comparisons and DISCOVER-AQ Observations	Revise	Anne M Thompson

…A few (~4) more papers will be submitted by the deadline

Deadline for submission: March 31, 2013

Open Source Articles: http://link.springer.com/journal/10874/onlineFirst/page/1

Other Planned Publications

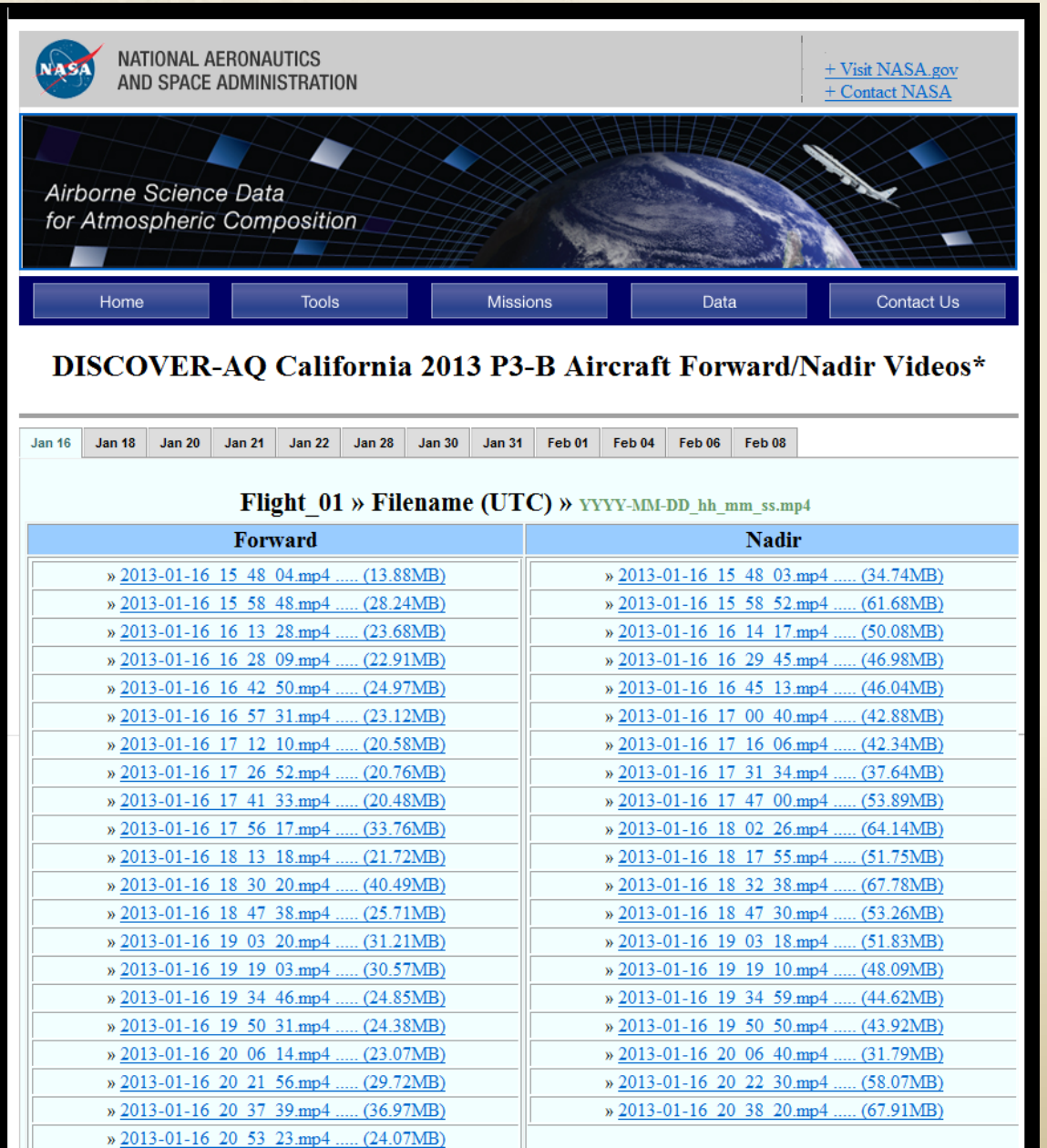
Title	Authors	Journal	Status
Evaluation of Extinction Profiles and Aerosol Optical Depth from Multisensor Data in the Baltimore-Washington DISCOVER-AQ Experiment and Comparison with WRF/CHEM	Ray Hoff, Melanie Follette-Cook, Ken Pickering, Richard Ferrare, Raymond Rogers, Mike Obland, Chris Hostetler, John Hair, Brent Holben, Timothy Berkoff, Ruben Delgado, and Patricia Sawamura	TBD	In prep
Impact of bay breeze circulations on surface air quality and boundary layer export	Loughner, C. P., M. Tzortziou, M. Follette-Cook, K. E. Pickering, D. Goldberg, C. Satam, A. Weinheimer, J. H. Crawford, D. J. Knapp, D.D. Montzka, G. S. Diskin, and R. R. Dickerson	Atmospheric Environment	Submitted
The relationship between column-density and surface mixing ratio: Statistical analysis of O_3 and NO_2 data from the July 2011 Maryland DISCOVER-AQ mission	Flynn, C. M., K. E. Pickering, J. H. Crawford, L. Lamsal, N. Krotkov, J. Herman, A. Weinheimer, G. Chen, X. Liu, J. Szykman, S.-C. Tsay, C. Loughner, J. Hains, P. Lee, R. R. Dickerson, J. Stehr, L. Brent	Atmospheric Environment	In prep
Surface ozone concentrations over the Chesapeake Bay during DISCOVER-AQ	D. L. Goldberg, C. P. Loughner, M. Tzortziou, J. W. Stehr, K. E. Pickering, L. T. Marufu, J. H. Crawford, A. Mannino, and R. R. Dickerson	Atmospheric Environment	In prep
Spatial and Temporal Variability of Trace Gases and Aerosols Derived from Regional Model Output during the Mid-Atlantic Pollution Events of July 2007 and the 2011 DISCOVER-AQ mission: Planning for GEO-CAPE	M. Follette-Cook, K. Pickering, Y. Yoshida, J. Crawford, B. Duncan, C. Loughner, S. Janz, A. Weinheimer, A. Fried, B. Anderson, G. Diskin, E. Yegorova, D. Allen, C. Satam	Atmospheric Environment	In prep
Impact of historical air pollution emissions reductions on surface ozone during extreme heat	Loughner, C.P., B. Duncan, M. Follette-Cook, J. Hains, K.E. Pickering, and M. Tzortziou	TBD	In prep
Spatial variability of nitrogen deposition near coastlines	Loughner, C.P., M. Tzortziou, S. Shroder, and K.E. Pickering	TBD	In prep
An elevated reservoir in a six-day pollution event over the Mid-Atlantic States: a case study from airborne measurements and numerical simulations	He, H., C.P. Loughner, J. Stehr, H. Arkinson, L. Brent, M. Cook, A. Thompson, G. Diskin, B. Anderson, J. Crawford, A. Weinheimer, R. Cohen, P. Lee, J. Hains, and R. Dickerson	TBD	In prep

Other Planned Publications

Title	Authors	Journal	Status
Observed Enhancements in Aerosol Optical Depth in the Vicinity of Cumulus Clouds in Maryland during DISCOVER-AQ	T. F. Eck , B. N. Holben, J. S. Schafer, T. A. Berkoff, J. S. Reid, K. E. Pickering, C. P. Loughner, A. Arola, R. A. Ferrare, C. A. Hostetler, D. M. Giles, E. J. Welton, S. N. Crumeyrolle, B. E. Anderson, K. L. Thornhill, R. A. Remer, L. A. Munchak, R. C. Levy, S. Matoo, N. T. O'Neill, A. Lyapustin, Y. Wang, S. Platnick1	TBD	In prep
MODIS 3 km aerosol product: applications over land in an urban/suburban region	L. A. Munchak, R. C. Levy, S. Mattoo, L. A. Remer, B. N. Holben, J. S. Schafer, C. A. Hostetler, and R. A. Ferrare	Atmospheric Meas. Tech.	In press
Regional Characteristics of the Relationship between columnar AOD and surface PM2.5 derived during DISCOVER-AQ over Baltimore-Washington Region	Chu D. A., Richard Ferrare, Judd Welton, James Szykman, Jennifer Hains, Gao Chen, Tzuchin Tsai, Chris Hostetler, John Hair, Brent Holben, James Crawford	JGR	In prep
Airborne observations of aerosol extinction by in situ and remote-sensing techniques: Evaluation of particle hygroscopicity	L. D. Ziemba, K. L. Thornhill, R. Ferrare, J. Barrick, A. J. Beyersdorf, G. Chen, S. N. Crumeyrolle, J. Hair, C. Hostetler, C. Hudgins, M. Obland, R. Rogers, A. J. Scarino, E. L. Winstead, B. E. Anderson[1]	GRL	Published
Mixed Layer Heights and Aerosol Products derived fro the NASA LaRC Airborne High Spectral Resolution Lidar during the 2011 DISCOVER-AQ Field Campaign	A. J. Scarino, R. Ferrare, S. Burton, C. Hostetler, J. Hair, M. Obland, R. Rogers, R. Hoff, T. Berkoff, R. Delgado, A. Thompson, A. DaSilva, and B. Holben	TBD	In prep
DISCOVER-AQ Overview	Crawford, Pickering et al.	TBD	
BL structure (vertical and horizontal) in DISCOVER-AQ soundings	Chen and Crawford (1 or 2 papers?)	TBD	

P-3B Videos

http://www-air.larc.nasa.gov/missions/discover-aq/video.ca2013/



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DISCOVER-AQ California 2013 P3-B Aircraft Forward/Nadir Videos*

Jan 16 | Jan 18 | Jan 20 | Jan 21 | Jan 22 | Jan 28 | Jan 30 | Jan 31 | Feb 01 | Feb 04 | Feb 06 | Feb 08

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» 2013-01-16_20_37_39.mp4 ..... (36.97MB)	» 2013-01-16_20_38_20.mp4 ..... (67.91MB)
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- Thanks to John Barrick and Ali Aknan for getting these posted.
- Video separated into easily downloadable segments

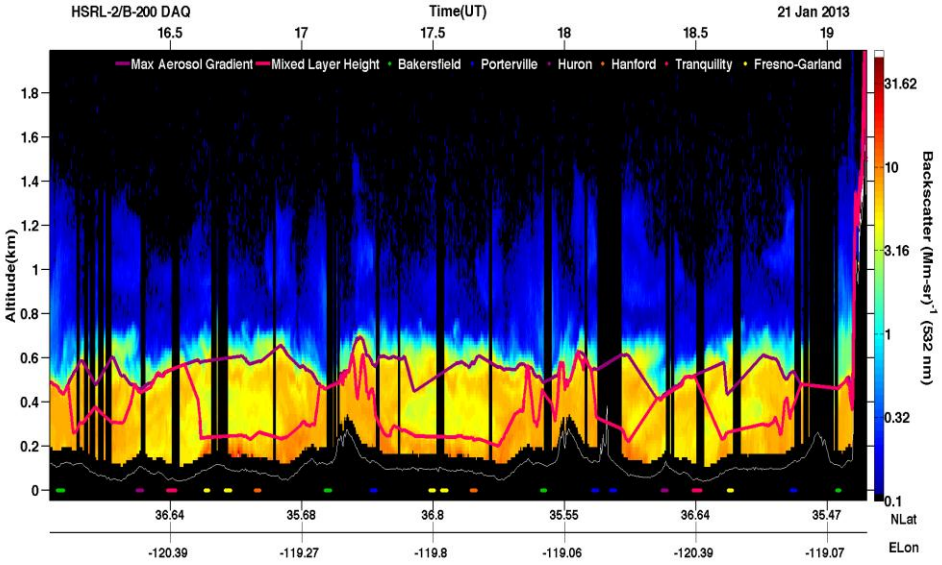
HSRL-2 Analysis during DISCOVER-AQ 2013

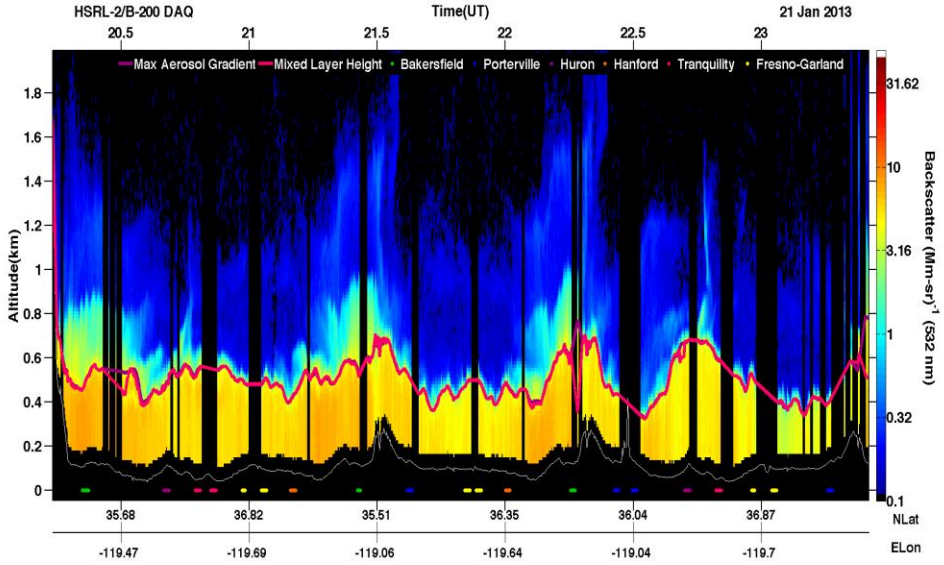
Mixed Layer Heights and Applications

Amy Jo Scarino (amy.jo.scarino@nasa.gov)

HSRL data used to find height of Mixed Layer

- Mixed Layer (ML) heights derived from daytime-only cloud-screened aerosol backscatter profiles measured by the airborne HSRL; ML heights are a good proxy for PBL heights during the daytime
- Automated technique uses a Haar wavelet covariance transform with multiple wavelet dilations to identify sharp gradients in aerosol backscatter at the top of the ML (adapted from Brooks, JAOT, 2003)
- HSRL ML heights combine results from automated algorithm and manual inspection of HSRL backscatter profiles
- Height of maximum aerosol gradient also identified to provide an alternative height to describe the depth of the aerosol layer
- These heights often correspond to gradients in potential temperature

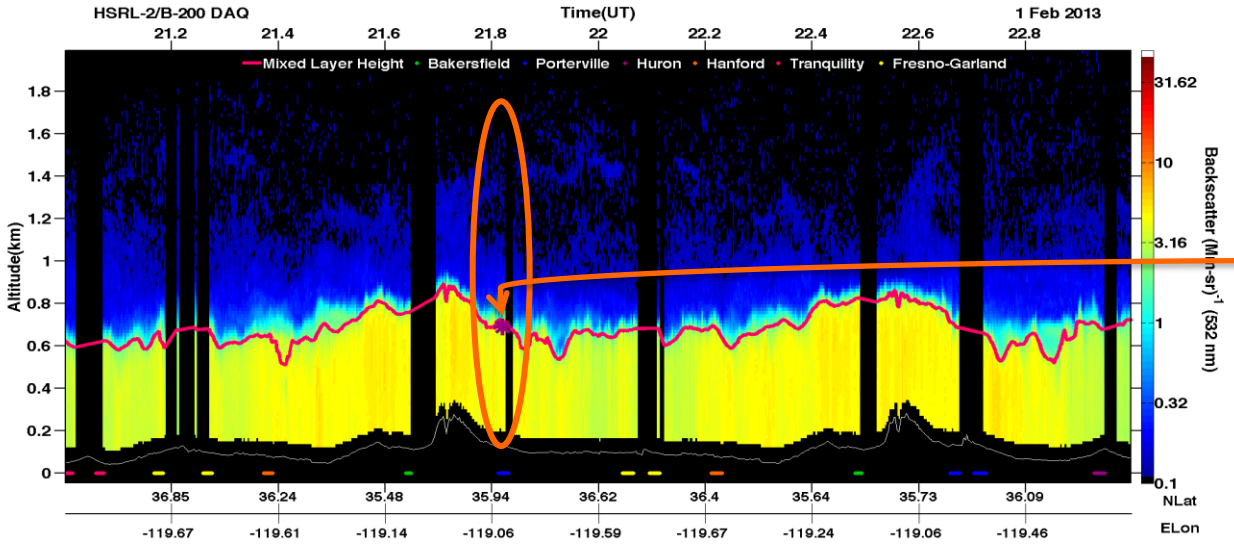


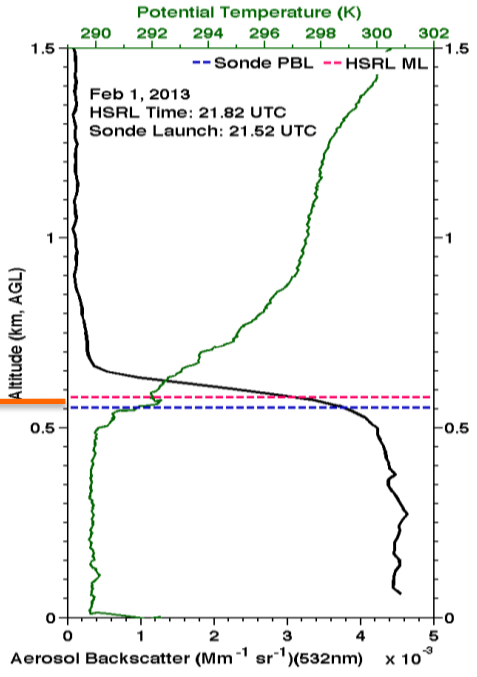


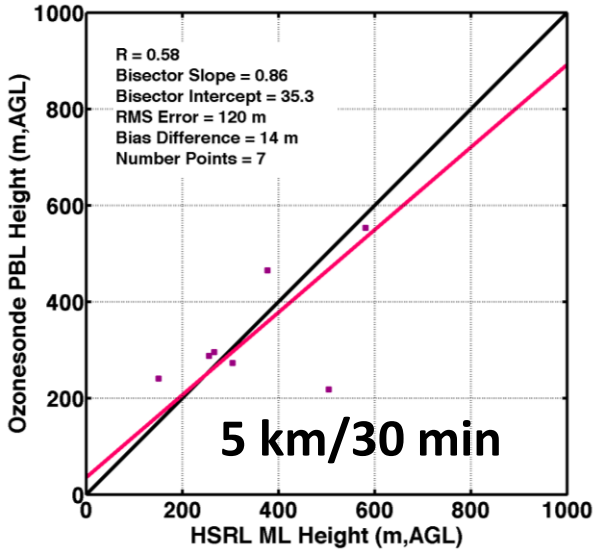
- Mixed Layer Height product is complete and files and quick plots will be submitted soon to the archive
- Paper on method used to derive MLH from HSRL backscatter has been submitted to ACPD (CARES Special Issue)
- Starting paper on MLH work for DISCOVER-AQ 2011

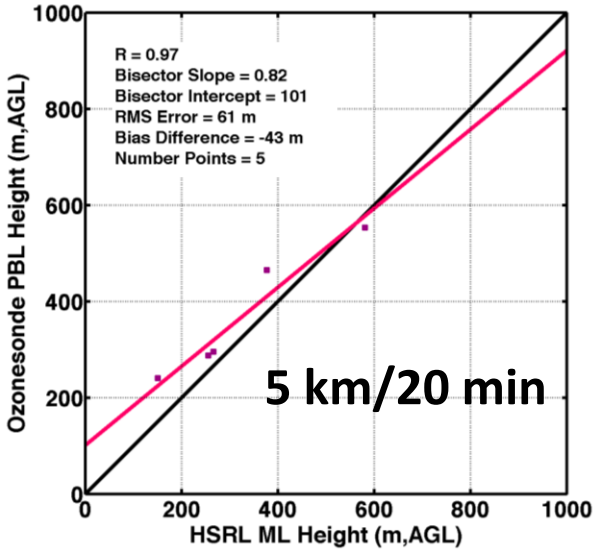
HSRL MLH compared to Ozonesonde PBLH at Porterville

- Good agreement between HSRL (Bsc gradient) MLH and ozonesonde (Potential Temperature gradient) derived PBLH when HSRL was within .47 km of the Porterville site and ~18 minutes from when the ozonesonde was launched



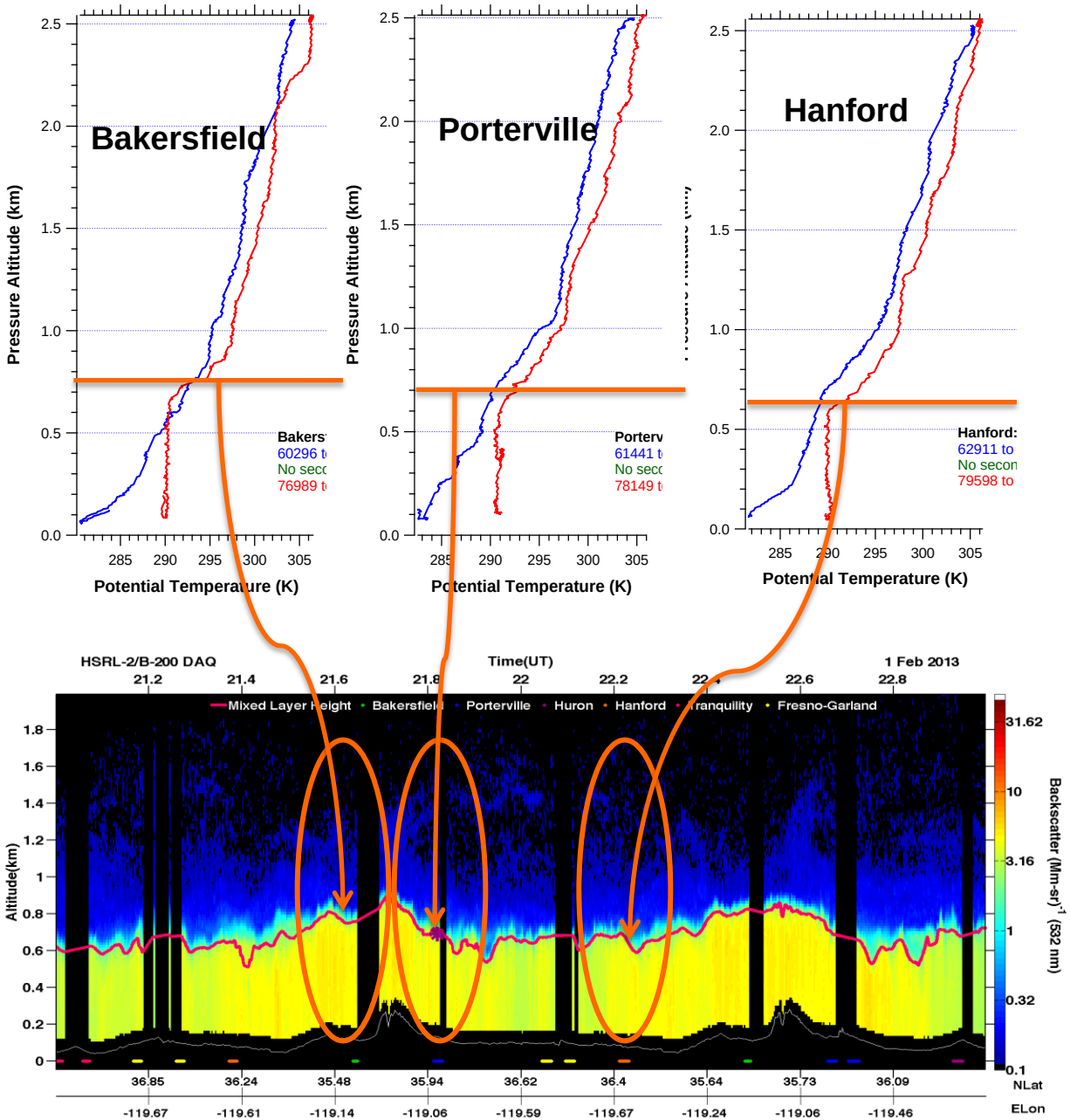






- Comparison of HSRL MLH and ozonesonde PBLH is done when HSRL was within 5 km of the Porterville ground site and 20 and 30 min from the sonde launch time
- Improvement in R (0.58 to 0.97) when changing time window from 30 to 20 minutes

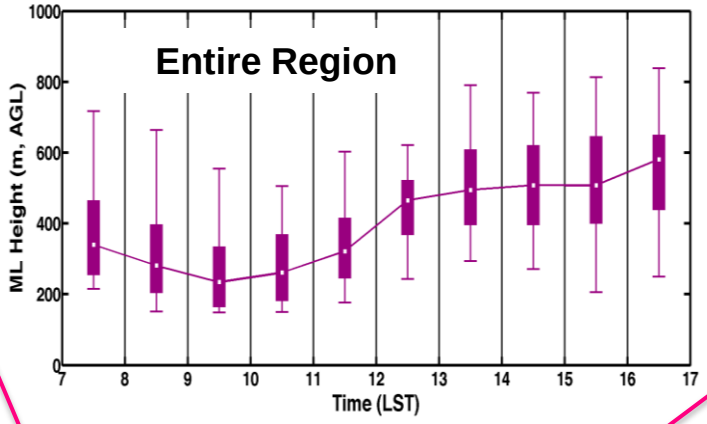
P-3 vertical profiles to determine PBLH



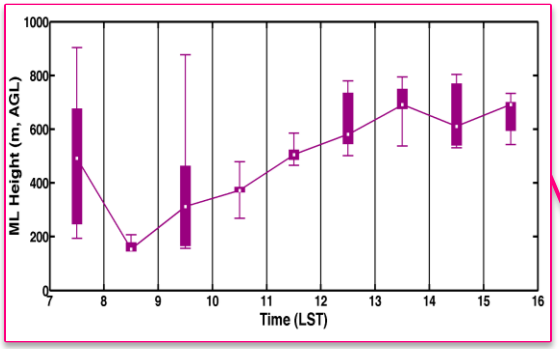
HSRL afternoon flight on 2/1

- Within 5km of Hanford, Bakersfield and Porterville ground sites when P-3 spirals
- Will do coincidence match-ups for all flights at the six ground sites where vertical profiles are available (Bakersfield, Fresno, Hanford, Huron, Porterville, Tranquility)
- May also look at using data from the missed approaches

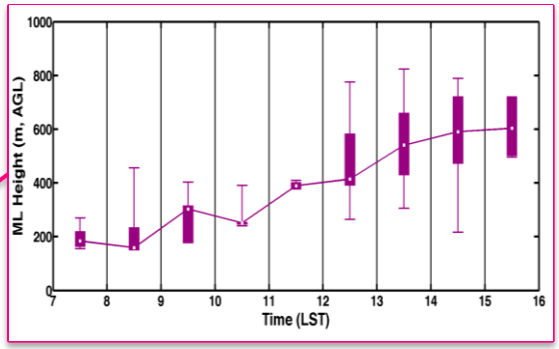
Diurnal Variability of MLH



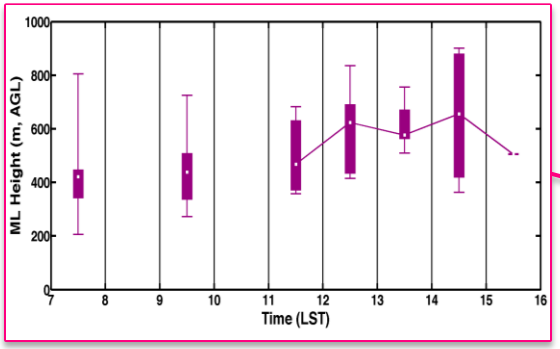
Tranquility



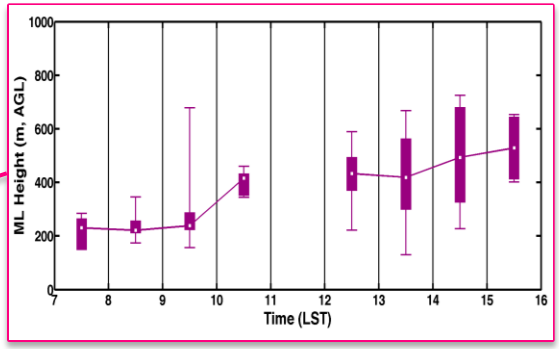
Fresno-Garland

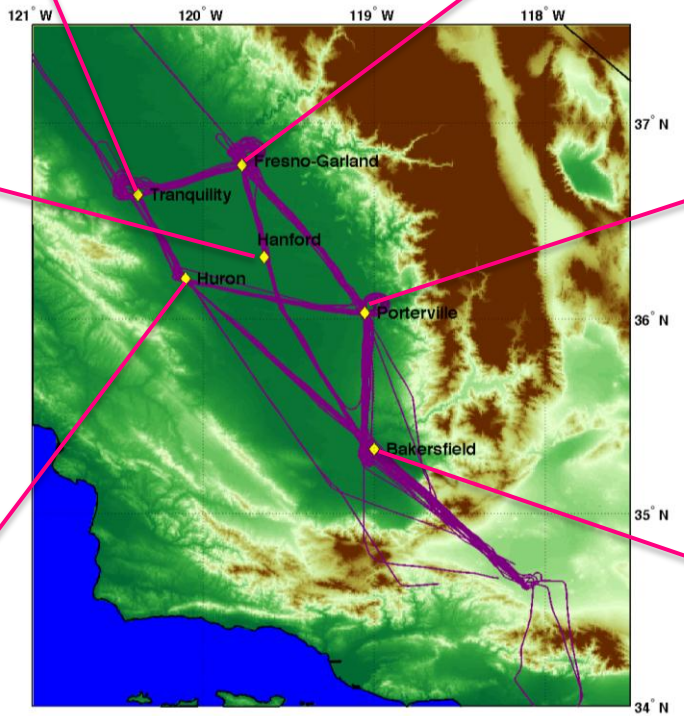


Hanford

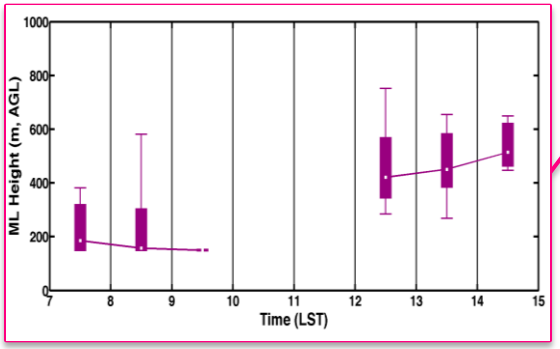


Porterville

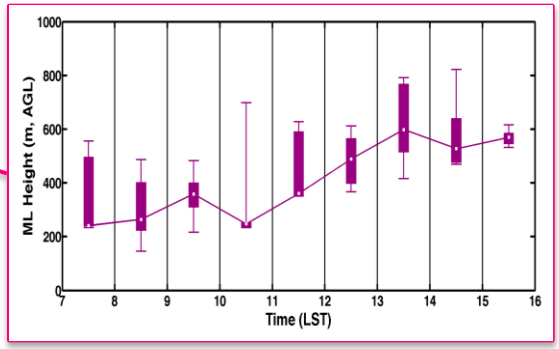




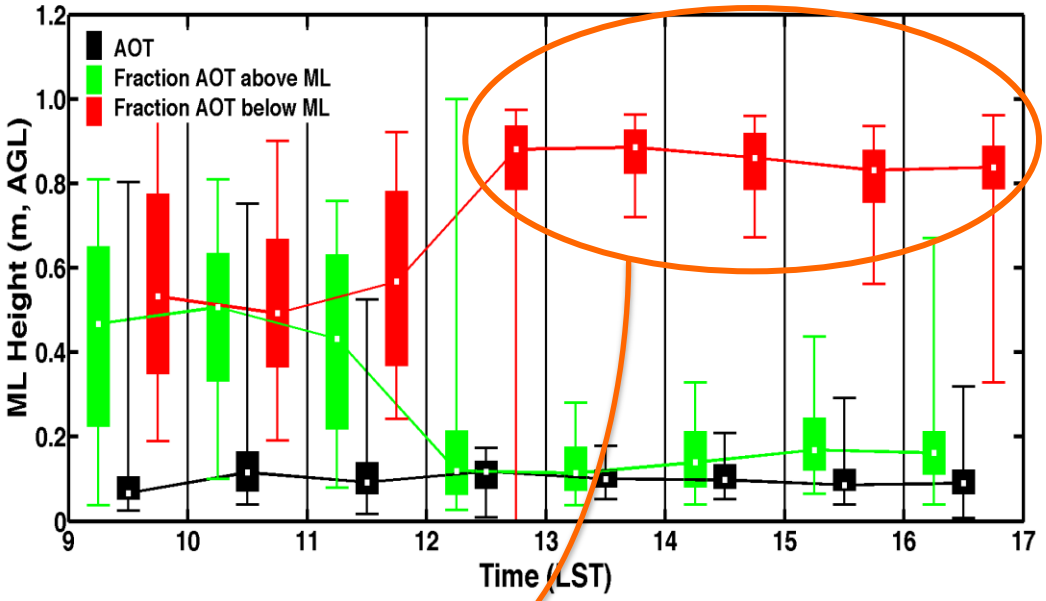
Huron

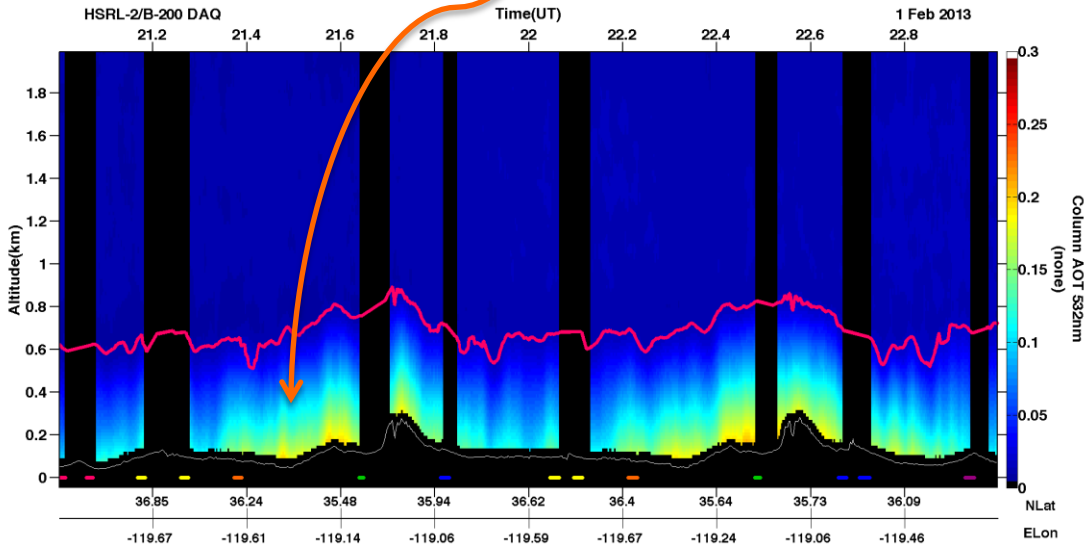


Bakersfield



AOT above and within ML





- HSRL measurements are used to determine the fraction of AOT in 0-7 km layer that is below and above the ML height
- Before about local noon, the amount of AOT below and within the ML is the same
- After local noon, there is more AOT within the ML than above
- Significant increases in AOT after 12 LST (20 UTC)
- Can do similar plots for locations of ground sites

Other AOT work

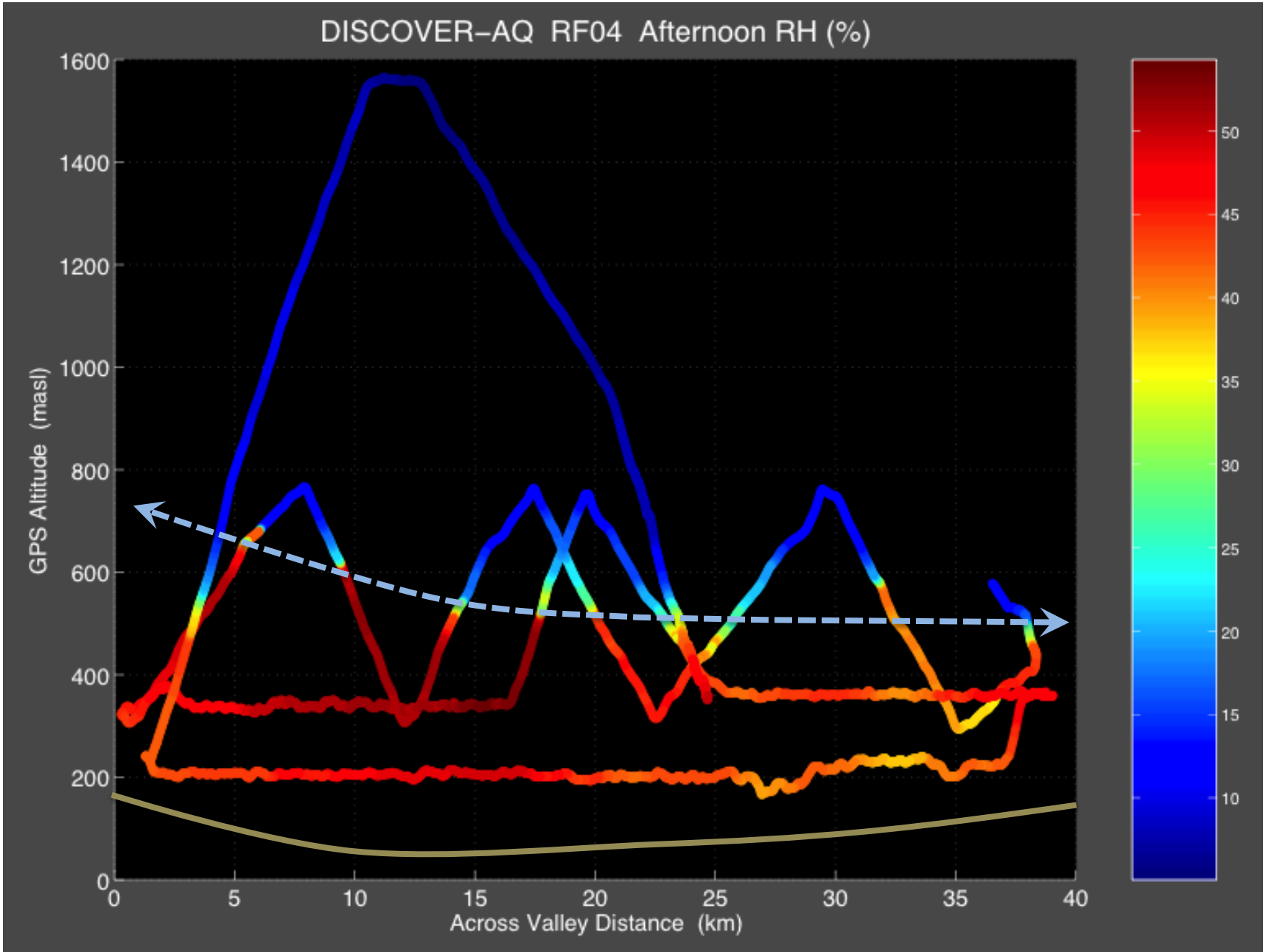
- Comparisons of HSRL AOT and AERONET AOT need to updated with latest AERONET files

DISCOVER-AQ, California:
UC Davis Airborne Boundary Layer Investigation

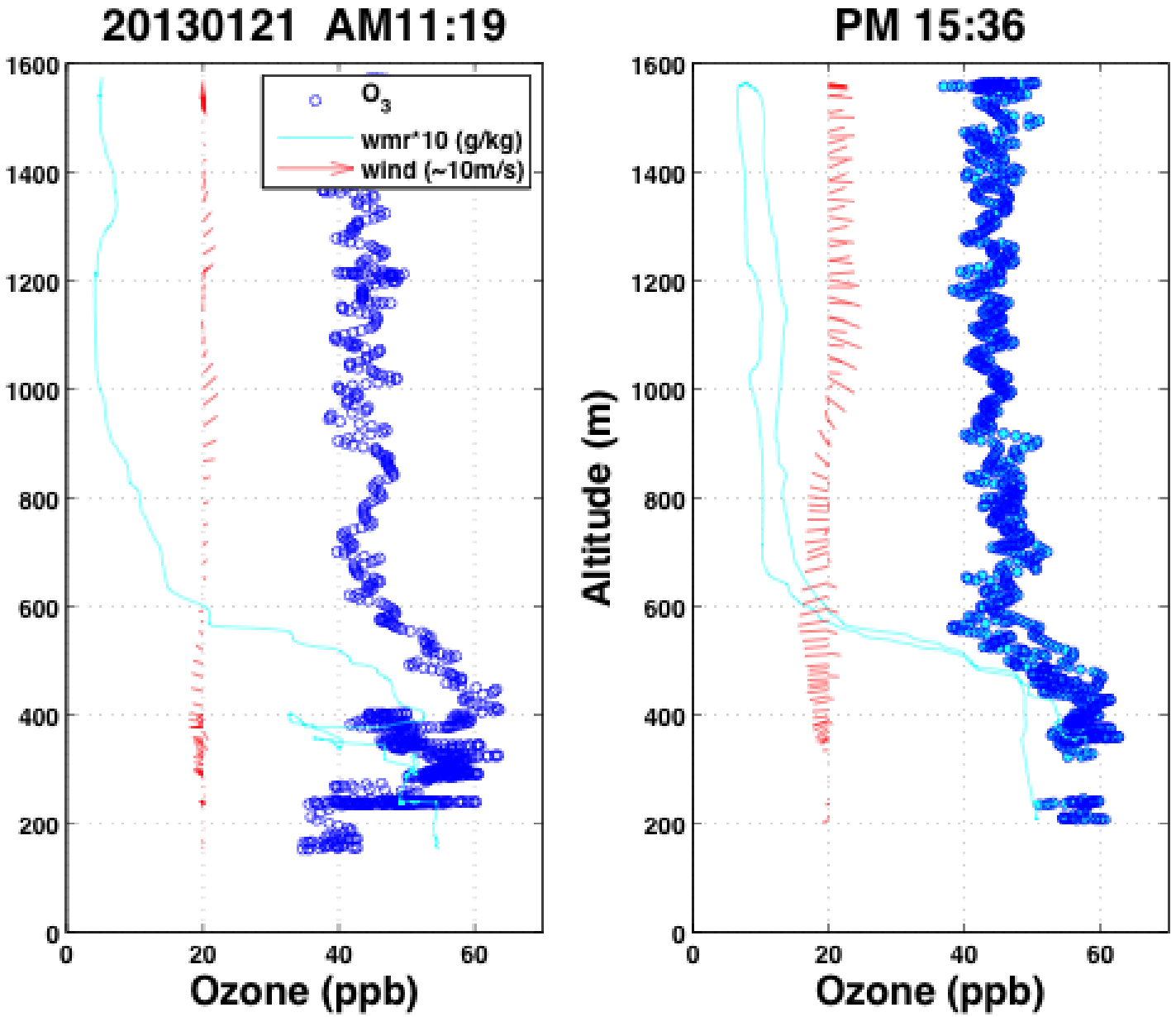
Chews Ridge UCDavis Monitoring Station (1550 masl : O_3, aerosol size & composition)

UCDavis Aircraft Flight Domain (~3.5 hrs on station: O3, CH4, CO2, T, RH, & winds)

Cross-Valley Boundary Layer Depth Variation



RF04 Ozone Profiles



Boundary Layer Budgeting

$$\frac{\partial S}{\partial t} = \frac{\langle w's' \rangle_0 - \langle w's' \rangle_{z_i}}{z_i} - U\frac{\partial S}{\partial x} + P$$

Observed temporal trend

(Surface Flux) – (Entrainment Flux)

Horizontal Advection

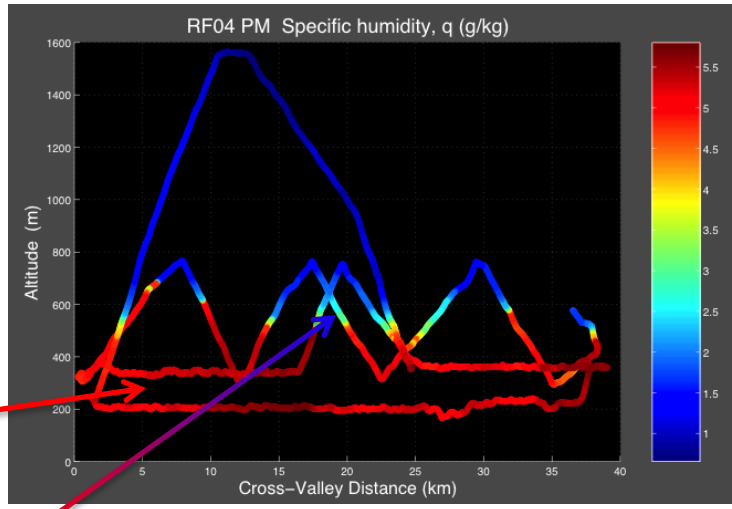
In-situ Prod/Loss

We parameterize the entrainment flux, $\langle w's' \rangle_{zi}$, with an entrainment velocity and the jump in the scalar from the free troposphere to the ABL (measured by plane). This parameter, in principle, can be applied to all scalars (e.g. water vapor, ozone, CH_4, etc.)

$$\langle w's' \rangle_{z_i} = w_e \Delta S$$

Boundary Layer Budgeting: Water Vapor

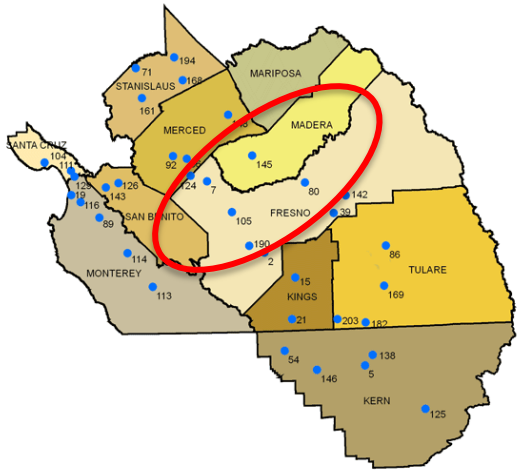
$$\frac{\partial \bar{q}}{\partial t} = \frac{\langle w'q' \rangle_0 - \langle w'q' \rangle_{z_i}}{z_i} - U\frac{\partial \bar{q}}{\partial x}$$



$$\frac{\partial \bar{q}}{\partial t} \cong 0 \quad \& \quad U\frac{\partial \bar{q}}{\partial x} \cong 0 \quad \& \quad \langle w'q' \rangle_{z_i} = w_e \Delta_{FT-ABL}\bar{q}$$

$$\Rightarrow \quad w_e = \frac{\langle w'q' \rangle_0}{\Delta_{FT-ABL}\bar{q}} \cong \frac{0.046 \ \ g/kg \cdot m/s}{3 \ \ g/kg} = 1.5 \ \ cm/s$$

CIMIS – California Irrigation Management Information System: hourly reference evapotranspiration (ie. <w'q'>$_0$) average of 7 stations in the region from 12:00-16:00 = 0.215 mm/hr = 0.046 g/kg m/s



Applying w_e to Ozone Budget

$$P_{O3} = \frac{\partial O_3}{\partial t} + \frac{\langle w' O_3' \rangle_{z_i} - \langle w' O_3' \rangle_0}{z_i} + U\frac{\partial O_3}{\partial x}$$

$$\frac{\partial O_3}{\partial t}_{obs} \approx 2.7 \ ppb/h$$

$$\langle w' O_3' \rangle_0 = -v_d O_3 \approx (0.004 m/s)(52 ppb) = -1.9 ppb/h$$

$$\langle w' O_3' \rangle_{z_i} = w_e \Delta_{FT-ABL} O_3 \approx (0.015 m/s)(10 ppb) = 1.35 ppb/h$$

$$U\frac{\partial O_3}{\partial x} \leq 0.2 \sim 0 \ \& \ z_i \cong 400 m \ (agl) \Rightarrow P_{O3} \approx \underline{6 \ ppb/h}$$