Agenda

Ministry of Environment
National Institute of Environmental Research

Science Team Telecon

- Data Archive Status Update
- Data Schedule and Sharing
- Fall AGU 2016
- Research Intentions Update
- Science Team Meeting Update
- Science Presentation (Ben Nault)

Data Archival (1): DC-8 Status

Current data status is shown in the table on the right.

Most recent data merges on 8 November include merges for 1s, 10s, 60s, Whole Air Samples, SAGA Filters, and SAGA mist chamber timelines

Data Received since last webex:

Dibb – SAGA Bulk aerosol ionic composition updated on 10/28
Kim – K-CIMS $ClNO_2$ updated on 11/8
Lee – K-AMS updated (revision C) on 10/30
Schwarz – HDSP2 final data for BC mixing state uploaded on 10/12

Questions or comments?

PI-Group	5/1	5/3	5/4	5/6	5/10	5/11	5/12	5/16	5/17	5/19	5/21	5/24	5/26	5/29	5/30	6/1	6/2	6/4	6/8	6/9
Anderson-LARGE																				
Blake-WAS																				
Brune-ATHOS																				
Cohen-TD-LIF																				
Dibb-SAGA (mist chamber)																				
Dibb-SAGA (filters)																				
DiGangi-AVOCET																				
Diskin-DACOM																				
Diskin-DLH																				
Fried-CAMS																				
Hair-DIAL/HSRL																				
Hall-CAFS																				
Huey-GT-CIMS																				
Jimenez-HR-ToF-AMS																				
Kim-K-CIMS																				
Lee-K-AMS																				
Redemann-4STAR-AOD																				
Redemann-4STAR-Gases																				
Schwarz-HDSP2-BC-Mixing																				
Schwarz-HDSP2-BC-MMR																				
Weinheimer-NOxyO3																				
Wennberg-CIT-CIMS																				
Wisthaler-PTR-ToF-MS																				
Yang-Nav/Housekeeping																				
Yum-K-CCN																				
K-SP2, ACES, PTR-MS																				

Data Archival (2): Hanseo

PI-Group	5/2	5/3	5/4	5/6	5/7	5/10	5/11	5/12	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/25	5/26	5/28	5/29	5/30	5/31	6/2	6/3	6/4	6/5	6/8	6/9	6/10	Comment
Park-Nav	1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	4	1	GPS Lat, Lon, Alt
Park-O3		1				1	2	1	1	2	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	4	1	
Park-NO2	1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	4	1	
Park-CO	1	1	1	1	1	1	2	1	1	2	1		1	1	1	1	1	2	1	1	2	1	1	2	1	1	4	1	
Park-SO2						1	2	1	1	2	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	4	1	
Park-LGR									1	2	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	4	1	CO2, CH4, and H2O
Hanisco-CAFÉ	1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	4	1	HCHO

Current data status is shown in the table above. Numbers of files for each flight date are noted since the aircraft often flew multiple sorties per day. Also remember that on a given local day, sorties could sometimes fall on two different UTC dates.

Data received since last webex: **NO CHANGE**

Current Progress:

-1 sec data merge for the Hanseo aircraft has been completed

-Flexpart trajectories to the Hanseo flight tracks are still desired and needed

Questions or comments?

Data Archival (3): Remote Sensors

NASA King Air status:
-Navigational data is archived **(We are still waiting for missing files for 4/28, 6/8, 6/9 L1 and L2, and 6/10)**
-Geo-TASO and MOS data are not yet archived.

Aeronet:
-Data from the AERONET-DRAGON deployment during KORUS-AQ are accessible independently through their website at:
http://aeronet.gsfc.nasa.gov/new_web/DRAGON-KORUS-AQ_2016.html
-In addition to data products, daily summary maps during the campaign period are also available for download.

Pandora: (also see Jay's presentation at the end of this file)
-Data from the Pandora network have been consolidate on their ftp site and can obtained from:
http://avdc.gsfc.nasa.gov/pub/DSCOVR/Pandora/DATA/KORUS-AQ/
-Converson of Pandora data to ICARTT format is still undergoing some small corrections, but it will soon be available through the KORUS-AQ archive

Questions or comments?

NO CHANGE

Data Archival (4): Olympic Park

Current data status is shown in the table on the right.

New data uploaded on 10/17 by EPA-ORD for O_3, NO, NO_2, NO_x from 5/9-6/14 and for HCHO from 5/16-6/11

New data uploaded on 10/10 by Saewung Kim for PAN, $ClNO_2$, Cl_2 from 5/17-6-10

With these additions, data from this site appears to be complete. It would be helpful to confirm this.

Next steps:

-Flexpart trajectories from Olympic Park are archived and available.
-Merges for ground data are planned.
-We are hoping for higher temporal resolution for final data.

Questions or comments?

PI Group	Resolution	Dates	<----4/21-6/17---->	Variables
Bae, Minsuk	10 min	4/21-6/17		WSOC
Cho, Seogu	1 hr	5/9-6/17		GC VOCs
Cho, Seogu	1 hr	5/9-6/17		HCHO
Cho, Seogu	1 hr	5/9-6/17		CO, O3, SO2, NOx, NO2, NO
Cho, Seogu	1 hr	5/9-6/17		OCEC
Cho, Seogu	1 hr	5/9-6/17		PM10, PM2.5, PM1
Cho, Seogu	1 hr	5/9-6/9		Trace Metals
Cho, Seogu	1 hr	5/9-6/17		Water Soluble Ions
Cho, Seogu	1 hr	5/9-6/17		Met: T, RH, WD, WS, Solar and UV Radiation
EPA, ORD	1 min	5/7-6/11		O3, NO, NO2, Nox
EPA, ORD	1 min	5/16-6/11		HCHO
Han, Jinseok	1 hr	5/9-6/11		Base gases: NH3, DMA, TMA
Jung, Jinsang	1 hr	5/9-6/13		CO, SO2, O3, NOx (photo and moly NO and NO2)
Kang, Kitai	1 min	5/9-6/10		SMPS size distribution: 6-225 nm
Kim, Saewung	10 min	5/17-6/10		PAN, ClNO2, Cl2
Kim, Sunroul	1 min	5/8-6/13		BC: Aethalometer AE33 and AE51
Lee, Dongsoo	1 hr	5/9-6/10		Acid Gases: HCl, HONO, HNO3, H2SO4
Lee, Gangwoong	5 min	5/19-6/17		QCTILDAS: HONO, H2O2, N2O, CH4, CO2, H2O
Lee, Jae	5 min	5/8-6/13		O3 (UVA, CLD, and UVA-small), EC, OC, PM10, PM2.5
Lee, Jeonghoon	1 min	5/8-6/13		BC, Abs (Blue, Green, and Red)
Lee, Meehye	10 min	5/12-6/8		H2O2, CH3OOH
Lee, Meehye	15 min	5/17-6/10		HONO
Ro, Chulun	N/A	5/23-6/11		SPA Particle Images
Kim, Seongheon	1 hr	5/9-6/14		VOCs
Shin, Hye-Jung	not known	5/8-6/12		non-refractory PM1
Shin, Hye-Jung	not known	not known		VOCs
Yum, Seong-Soo	1 s	5/12-6/14		CCN, CPC10, CPC3
Yum, Seong-Soo	3 min	5/18-6/13		HTDMA

Data Archival (5): Taehwa/Other

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Current data status for Taehwa is shown on the top right and for sites archived under Ground-Other on the bottom right.

New data uploaded on 10/17 by EPA-ORD for O_3 and NO_2

New data uploaded on 10/11 by Saewung Kim for NO, NO_2, OH reactivity, PAN, $ClNO_2$, and Cl_2

Data for HCHO from EPA-Aerodyne is still missing. It would be helpful to confirm that this will complete the data set.

Next steps:

-Many sites show data beginning on 5/8, similar to Olympic Park. If data is available for earlier dates, it would be useful.

Questions or comments?

PI Group	Resolution	Dates	<--- 4/25-6/15--->	Variables
EPA-ORD	1 min	4/30-6/10		O3, NO2
Kim, Saewung	10 min	4/30-6/10		NO, NO2
Kim, Saewung	10 min	5/3-6/10		PAN, ClNO2, Cl2
Kim, Saewung	10 min	4/30-6/15		OH reactivity
Kang, Kitai	5 min	5/9-6/12		SMPS size distribution: 7-300 nm
Lee, Meehye	1 hr	5/19-6/11		VOCs
Lee, Meehye	5 sec	5/5-6/15		PAN (from tower at 5 levels from 4-39 m)
Lee, Youngjae	1 hr	5/9-6/11		O3, SO2, CO, Nox
Lee, Youngjae	1 hr	5/9-6/12		CO2, H2O
Lee, Youngjae	1 hr	5/8-6/9		OC, EC
Lee, Youngjae	1 hr	5/7-6/12		Met: WD, WS, T
McGee, Tom	1 min	4/25-6/13		O3, WD, WS, P, T, RH, Solar irradiance
McGee, Tom	not known	5/1-6/10		O3 lidar
Thompson, Anne	1 s	4/30-6/10		Ozonesonde (O3, met)

Site	PI Group	Resolution	Dates	Variables
AirKorea Monitors	NIER	1 hr	4/29-6/11	PM10, PM2.5, O3, CO, NO2, SO2
GIST	Park, Kihong	5 min	5/1-6/15	QAMS aerosol composition
GIST	Park, Kihong	5 min	5/1-6/15	SMPS and OPC size distribution
Gosan	Kim, Sang-Woo	15 min	5/1-6/15	Mie Lidar backscatter and depolarization
Gosan	Kim, Sang-Woo	1 hr	5/8-6/19	SMPS size distribution
Gosan	Kim, Sang-Woo	1 hr	4/30-6/15	Equivalent BC (AE-31 Aeth)
HUFS	Ghim, Young-Sung	1 min	5/8-6/12	BC (MAAP)
HUFS	Ghim, Young-Sung	1 min	5/8-6/12	PM10, PM2.5, PM1 (OPC)
HUFS	Ghim, Young-Sung	5 min	5/8-6/12	SMPS size distribution
KIST	Kim, Hwajin	6 min	5/1-6/11	HR-AMS aerosol composition
KIST	Kim, Hwajin	2 min	5/1-6/11	SMPS number and volumn
Kunsan	Kim, Deug-Soo	5 sec	5/8-6/11	NOx, NO2, NO, NOy
Pyeongtak Power Plant	Kim, Youngj	90 sec	6/2-6/3	MAX-DOAS SO2
SNU	Kim, Sang-Woo	15 min	5/1-6/18	HSRL backscatter and depolarization
SNU	Kim, Sang-Woo	15 min	5/1-6/15	Mie Lidar backscatter and depolarization
Yonsei	Hong, Jinkyu	30 min	5/4-6/9	CRDS CO2, CH4 and carbon isotope ratios
Yonsei	Hong, Jinkyu	30 min	5/1-6/28	Ceilometer BL and Cloud Heights

Data Archival (6): Supersites

Site	PI Group	Resolution	Dates	PM10	PM2.5	Scat	Abs	SMPS	APS	BC-Aeth	OC, EC	Sulfate	Nitrate	Ammonium	Metals	VOCs	O3	CO	NOx	SO2	PAN	NOy	NH3	TMA
Bulkwang	Shin, Hye-Jung	1 hr	5/8-6/12	■	■	■		■	■	■	■	■	■	■	■									
Baengnyeung	Han, Jinseok	1 hr	4/28-6/11																				■	■
Baengnyeung	Kang, Kitai	5 min	5/9-6/13					■																
Baengnyeung	Lee, Mindo	1 hr	5/8-6/12	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■				
Baengnyeung	Lee, Meehye	5 sec	4/30-6/14																		■			
Daejeon	Yu, Jeongah	1 hr	5/8-6/12	■	■	■	■				■	■	■	■	■									
Gwangju	Lim, Cheol-Soo	1 hr	5/8-6/12	■	■	■				■	■	■	■	■	■									
Ulsan	Park, Mikyung	1 hr	5/9-6/12	■	■	■	■				■	■	■	■								■		
Jeju	Ban, Soo-Jin	1 hr	5/8-6/12	■	■	■	■	■	■		■	■	■	■	■									

NO CHANGE

It would help to confirm that this data is complete.

Data Archival (7): Ships and Japanese Data

The archive now has ship data with locations for the RV Kisang that have been archived by Meehye Lee under "All Others"

No ship data has been put into the archive so far for the Onnuri and the Jang Mok.

Ship data are still pending agreements on data for international waters versus inland sea. We will be updated after discussions at the GOCI meeting.

Yugo Kanaya has turned in data for Fukue Island for 4/14-7/26 which includes O3, CO, BC, PM2.5, jNO2, and jO1D.

Data Archival (6): Needs

Data Flags for the DC-8 and Hanseo Merges:

-Data flags are useful for identifying profiles and overflight of ground sites

-Flags become part of the data merges and are useful for filtering specific data

-Current suggestions include flags for the profiles over Seoul and adjacent to Taehwa as well as overflight of the Olympic Park and Taehwa sites. Flags should also be included for overflight of the ships, other ground sites, and point sources.

-Data Flagging is underway, and we are hopeful that it can be completed before Fall AGU.

Plume identification:

-This activity is underway and will be asked to report on progress at Fall AGU.

Model Results:

-WRFChem Model Results from the Carmichael/Emmons group have been recently uploaded. Results have been interpolated to the 10s and 60s merges. Please consider how they might be useful in your research and provide feedback.

-WRF-Chem simulations (with full MOZART-T1 chemistry and MOSAIC aerosol) are expected to be finished before Christmas

Flight kml files:

-ACTION: A request was made for flight track kmls used in the flight summary document to be uploaded to the website.

Data Schedule and Sharing (1)

The following table shows the data schedule discussed at the Science Team meeting in October 2015:

Mission Phase	Data Type	Data Repository	Submission Deadline	Access Control
Field Deployment	Field Data	NASA	24 hour after each flight or cal. Day	Science team and Partners
		NIER		
Post-Deployment	Preliminary Data	NASA	January 15, 2017	Science team and Partners
		NIER		
Public	Final Data	NASA	June 15, 2017	Public
		NIER	June 15, 2018	

As presented during the Science Team meeting in October 2015, the data sharing policy is as follows:

Final data should be submitted to the archive prior to any presentation at scientific conferences (e.g. AGU, AMS) or manuscript preparation, unless explicit authorization is obtained from the program managers

In addition, the following expectations also apply to the professional courtesies expected of the science team:

- **Consult with PIs when using their data in conference/data workshop presentations and/or manuscript**
- **Invite PIs of any data used to be co-authors (particularly during post-deployment research phase)**
- **PIs should be available to answer questions about their data**

Data Schedule and Sharing (2)

It is very important that any intentions for KORUS-AQ presentations be made known to the Science Team.

Fall AGU – Intentions to submit abstracts to Fall AGU were communicated by a few teams. **A current list of abstracts are provided on the following slide. Many presentations highlight observations from the MAPS-Seoul pre-campaign. For presentations highlighting KORUS-AQ observations, the PIs have committed to submitting final data to the archive and to limit their presentation to their own data without showing or discussing data from other instruments.**

Team members should feel free to use any or all of the slides located on the file sharing page when publicizing the campaign.

Fall AGU 2016 Abstracts

MONDAY, 12 DECEMBER 2016			
09:15 - 09:30	Kara Lamb	A11Q-06 HD-SP2 Measurements of Black Carbon Containing Aerosols in South Korea during KORUS-AQ	Moscone West - 3010
TUESDAY, 13 DECEMBER 2016			
08:00 - 12:20	HoJun Rhee	A21C-0067 The formation of high-O3 episodes derived from atmospheric conditions in Seoul	Moscone South - Poster Hall
	Limseok Chang	A21C-0056 Is urban ozone in Korea increasing?	
WEDNESDAY, 14 DECEMBER 2016			
08:00 - 12:20	Yungu Lee	A31I-0178 Analysis of Biogenic VOCs Emissions During the MAPS-Seoul Aircraft Field Campaign	Moscone South - Poster Hall
	Chanjong Bu	A31I-0179 Initial Analysis of VOCs Speciation in CREATE Emissions Inventory using the MAPS-Seoul Aircraft Field Campaign	
16:00 - 16:15	Caroline Nowlan	A34B-01 Trace Gas Measurements from the GeoTASO and GCAS Airborne Instruments: An Instrument and Algorithm Test-Bed for Air Quality Observations from Geostationary Orbit (Invited)	Moscone West – 3002
THURSDAY, 15 DECEMBER 2016			
08:00 - 12:20	Patrick Hillyard	A41F-0114 Using Airborne In-Situ Profiles to Evaluate TCCONData from Armstrong Flight Research Center	Moscone South - Poster Hall
	Seoyoung Lee	A41A-0021 Characteristics of aerosol optical properties and total amount of trace gases over Korea during the 2015 MAPS-Seoul campaign using AERONET and Pandora spectrometer	
	Aubrey Beach	IN41C-1669 Providing Data Management Support to NASA Airborne Field Studies through Streamlined Usability Design	
	Heesung Chong	A41A-0020 NO2 inter-comparison between Pandora spectrometer and in-situ measurements during MAPS campaign in 2015	
13:40 - 18:00	Michelle Kim	A43E-0279 Observational Comparison of Hydroxynitrates from the Southeast United States and the Korean-US Air Quality (KORUS-AQ) Mission	Moscone South - Poster Hall
	Sanghee Lee	A43B-0215 Analysis of cloud base height from ceilometer measurements in Seoul of Korea	
FRIDAY, 16 DECEMBER 2016			
08:00 - 12:20	Jiwon Eom	A51D-0088 Measurements of Water Soluble Acidic Gases in Seoul Metropolitan Area during the Pre-campaign Period of KORUS-AQ	Moscone South - Poster Hall
	Najin Kim	A51D-0079 Urban aerosol hygroscopicity and CCN activity measured during the MAPS-Seoul 2016 campaign	
	Pilho Kim	A51J-0209 Comparison of Aerosol Volume Size Distributions between Surface and Ground-based Remote Sensing Measurements Downwind of Seoul, Korea during MAPS-Seoul	
	Minsu Park	A51D-0080 Airborne measurement of submicron aerosol number concentration and CCN activity in and around the Korean Peninsula and their comparison to ground measurement in Seoul	
11:20 - 11:35	Ed Hyer	A52B-05 How well do satellite observations and models capture diurnal variation in aerosols over the Korean Peninsula?	Moscone West - 3004
14:25 - 14:40	Limseok Chang	A53H-04 An overview of the KORUS-AQ field study (Invited)	Moscone West - 3010

Fall AGU 2016

Instead of having a Science Team telecon in December, we will have a Science Team Meeting (with webex access) during the Fall AGU meeting.

When: Tuesday, 13 December, 8:00 – 9:30 pm (sorry so late, but you can grab dinner before or after)

Where: Marriott Marquis (specific room TBD) adjacent to Moscone Center

Specific details on the location and webex instructions will be sent to the entire mailing list before the meeting. We have a space reserved for at least 100 local participants, so we hope to see you there.

Research Intentions

Please continue to share your research intentions.

A good goal is to have your intentions uploaded in time for the start of the Fall AGU meeting (11 December) so that we can discuss collaborations going forward.

Summary of current entries:

- 19 total entries from 14 research teams
- ~30% of teams have responded
- The table on the right shows that entries are well distributed across the categories, but when looking at the details, there is a LOT of room for more ideas and fundamental analyses that are needed.

Research Category	Primary	Secondary
Remote Sensing: Improvement and Usage	3	5
Factors Controlling Ozone Air Quality	3	5
Factors Controlling Aerosol Air Quality	4	5
Emissions and Source Attribution	3	4
Radiation and Aerosols	4	3
Model Assessment and Improvement	1	8
Validation and Intercomparison	1	5

Science Team Meeting

Dates for the Science Team Meeting have been finalized for the week of 27 February – 3 March 2017

PLEASE MARK YOUR CALENDARS!

Next Steps:

- Secure the venue (candidate locations on Jeju Island are under discussion)
- U.S. investigators need to identify travelers. Funding is available for two per PI group. Names are needed to establish the SSAI support task. **Please send names to Jim Crawford.**
- Wednesday, 1 March, is a Korean National Holiday, so we will try to plan a team activity.
- It is not too soon to make sure that your passport and visa are still valid for travel to the Science Team meeting. You will need to have a passport expiration at least 6 months past your date of return to the U.S.

November KORUS-AQ Telecon

Science Talk

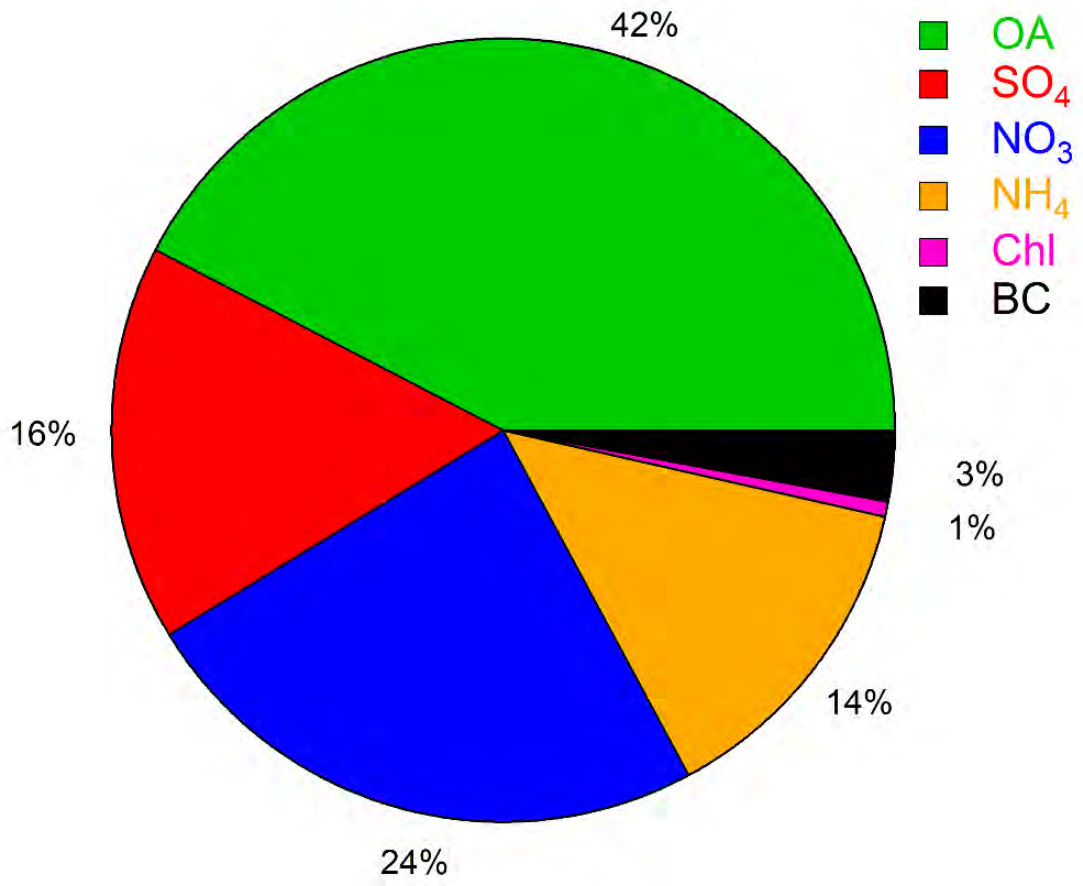
Urban Secondary Organic Aerosol (SOA) Production over Seoul, South Korea

Benjamin A. Nault, Pedro Campuzano-Jost, Jason C. Schroder, Douglas D. Day, Jose L. Jimenez

Data Used: Diskin, Schwarz, Weinheimer, Wisthaler

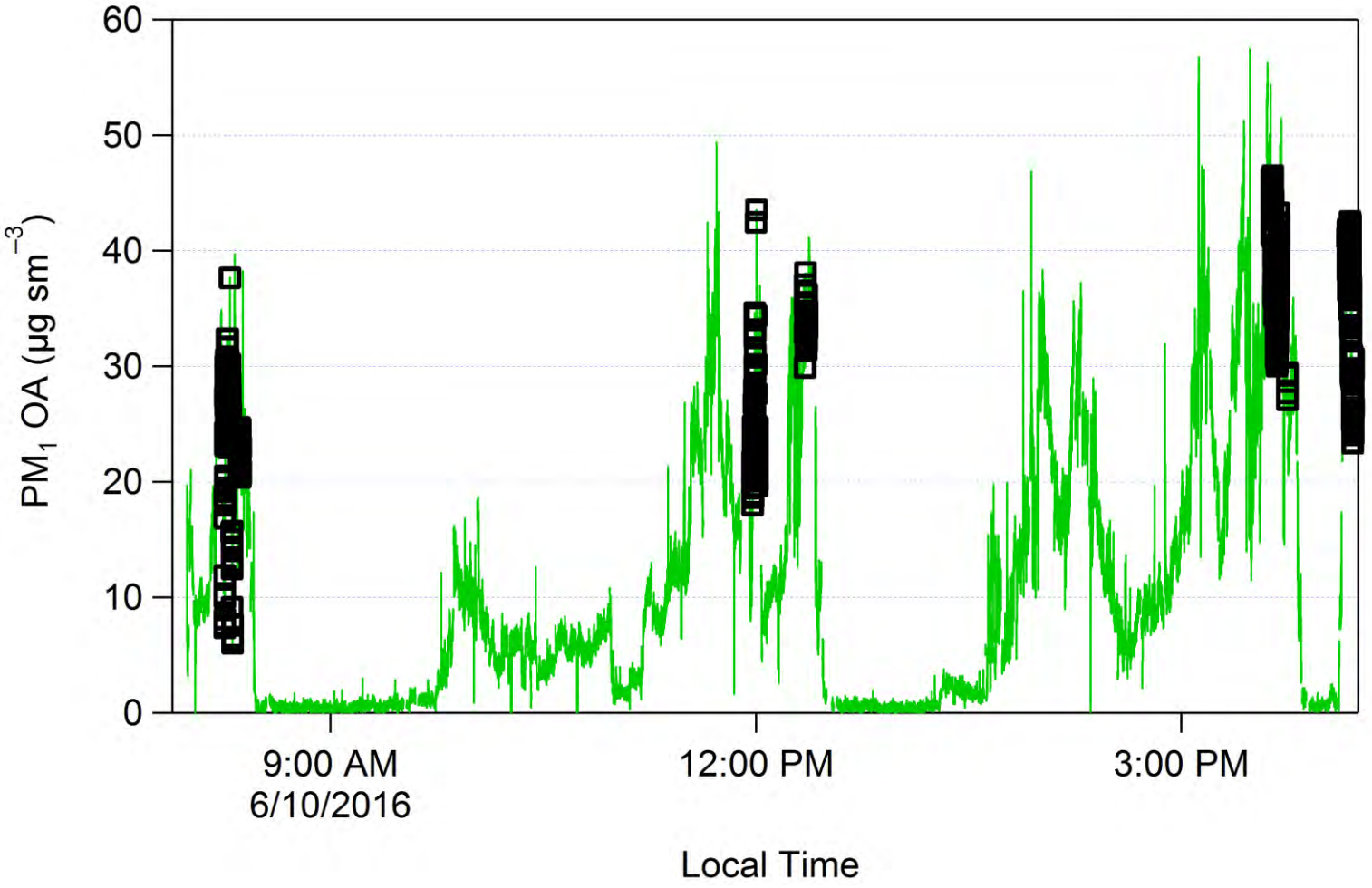
November 14, 2016

Organic Aerosol (OA): Large Fraction of PM_1 Mass over Seoul during KORUS-AQ



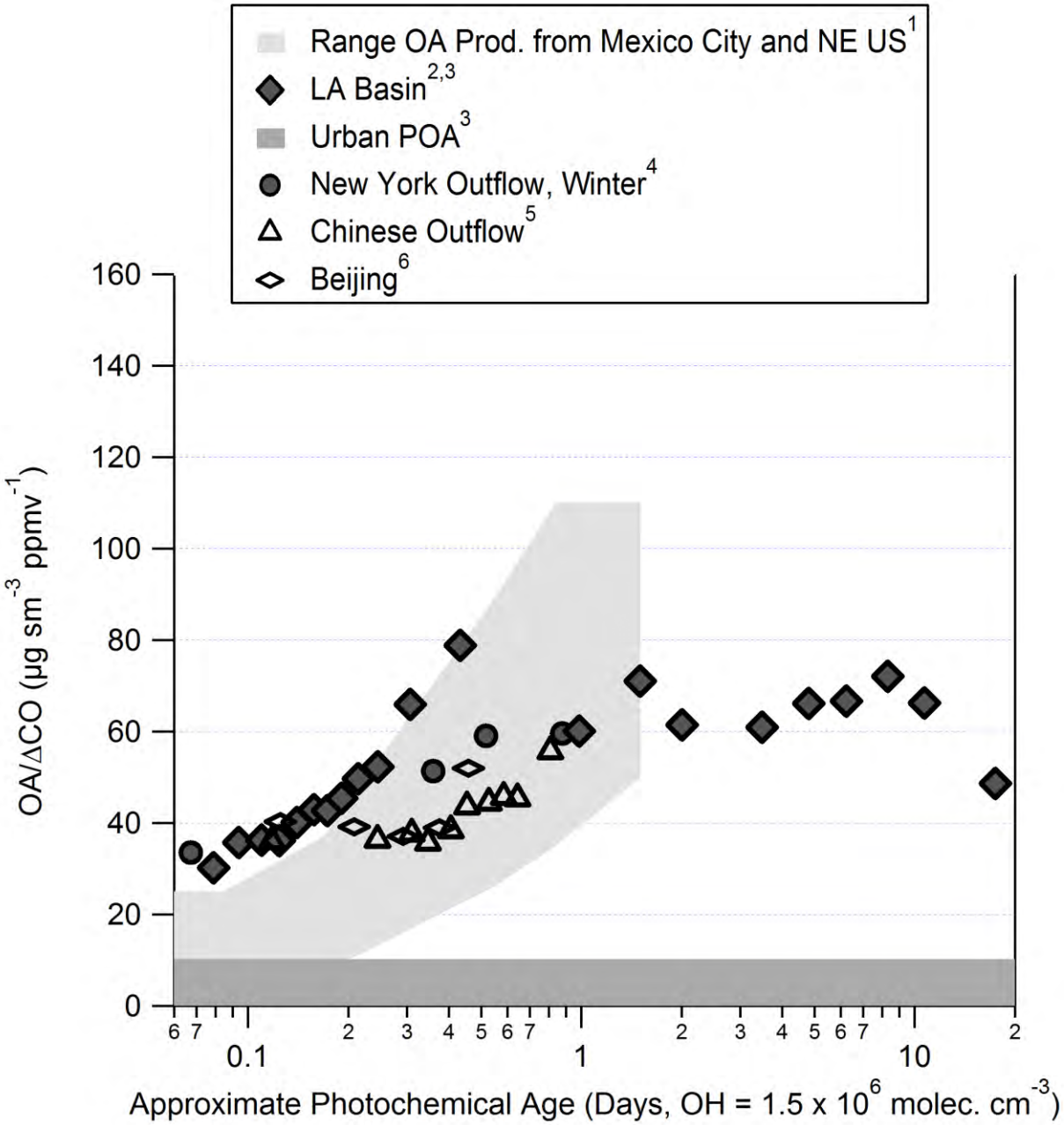
- Average PM_1 mass over Seoul during KORUS-AQ ~30 µg sm^{-3}
- POA = direct emissions of OA (e.g. cars, trucks)
- SOA = formed by chemistry in the atmosphere (from gases)
- What is their relative importance in Seoul?
- How do they compare to other locations?

Observations Suggest Urban SOA Production over Seoul



- Time series from RF20
- Seoul overpass highlighted by black squares
- OA increases during each overpass, suggesting potential photochemical production
- We will apply two well-established literature techniques to study this question

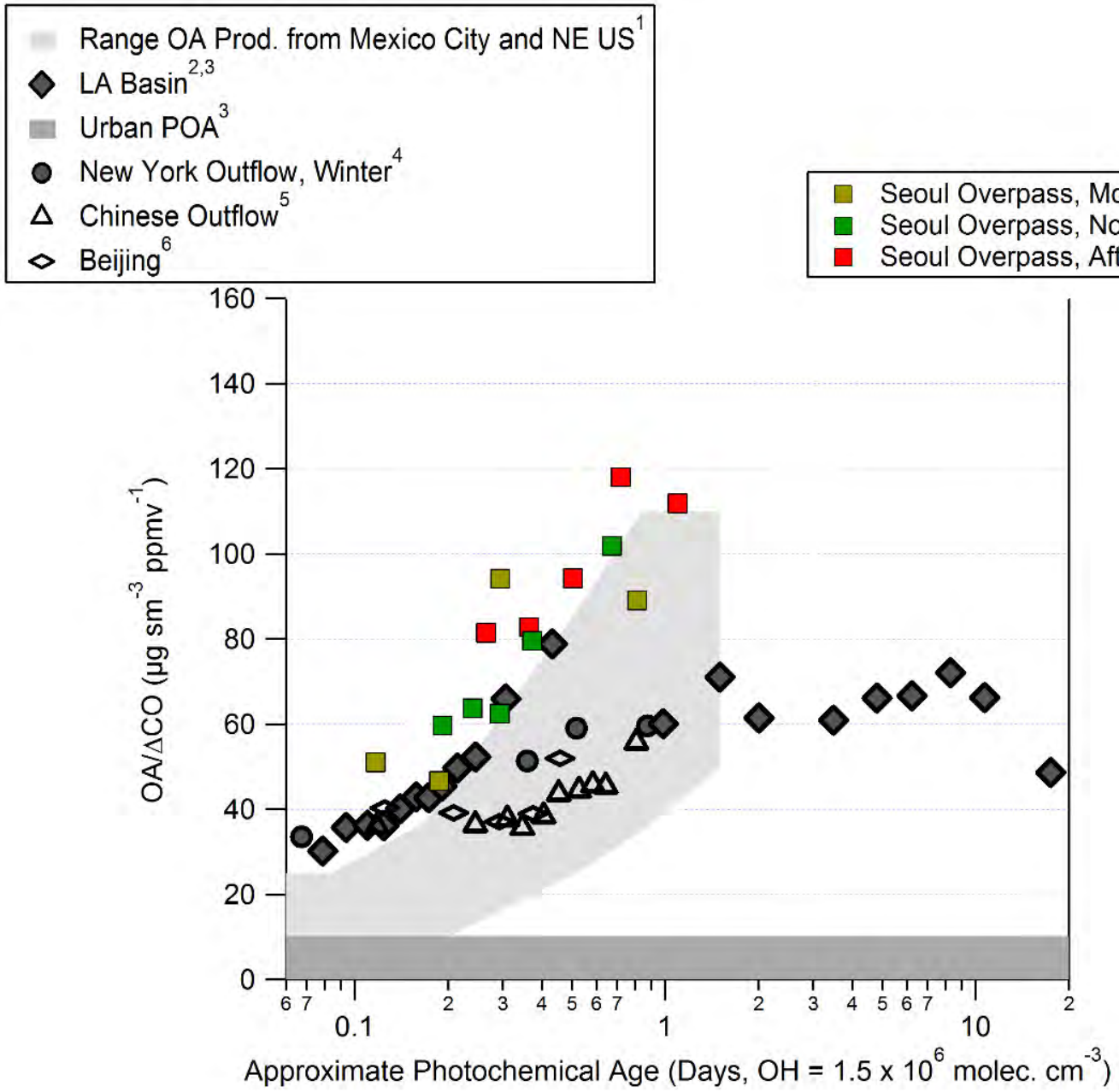
Measured Urban SOA Production around the World



- Photochemical age estimated using NO_x/NO_y or VOC ratios
- Substantial production observed at all locations, SOA >> POA after 1 day
- Beijing and Chinese outflow: within the range of previous observations
- Where does KORUS-AQ fall?

(1) DeCarlo et al., 2010, ACP; (2) Hayes et al., 2013, JGR;
(3) Ortega et al., 2016, ACP; (4) Schoder et al., in prep.
(5) Hu et al., 2013, JGR; (6) Hu et al., 2016, JGR

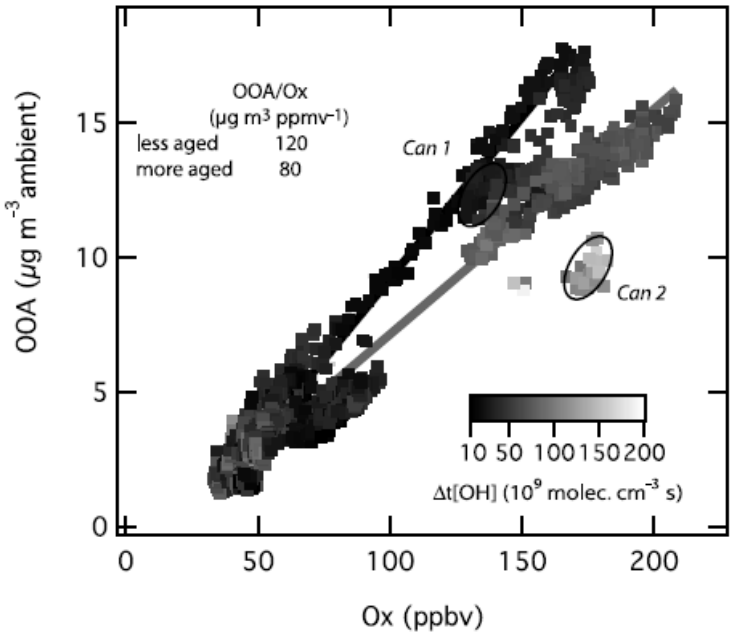
KORUS-AQ: High SOA Production over Seoul



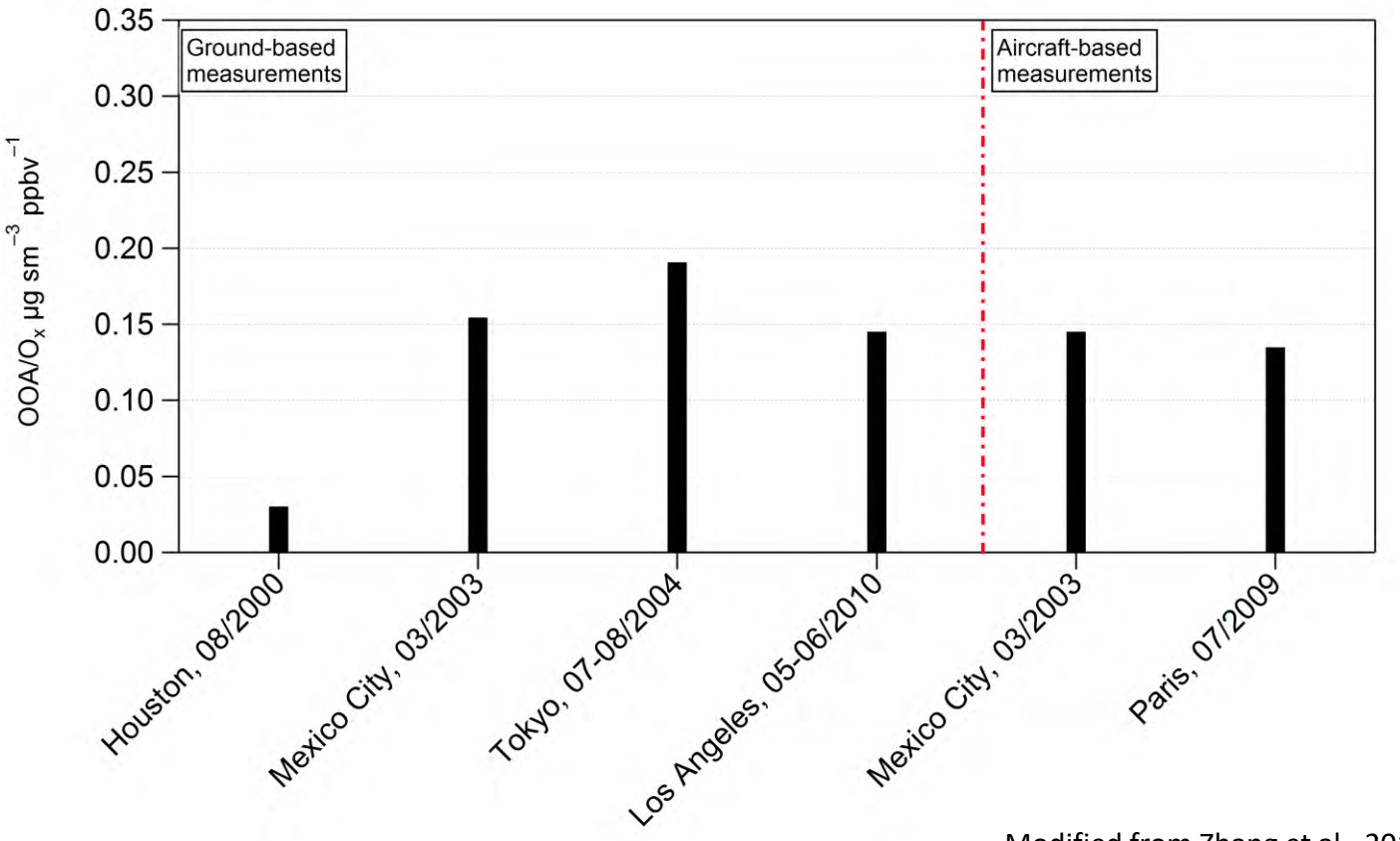
- SOA production over Seoul is higher (per this metric) than what has been observed in Los Angeles, Mexico City, Northeast United States (both summer & winter) and Chinese air
- Further work: investigate SOA production over rest of South Korea and investigating what precursors may lead to the high organic aerosol production

(1) DeCarlo et al., 2010, ACP; (2) Hayes et al., 2013, JGR;
(3) Ortega et al., 2016, ACP; (4) Schroder et al., in prep.
(5) Hu et al., 2013, JGR; (6) Hu et al., 2016, JGR

Measured Urban SOA vs. O_x around the World



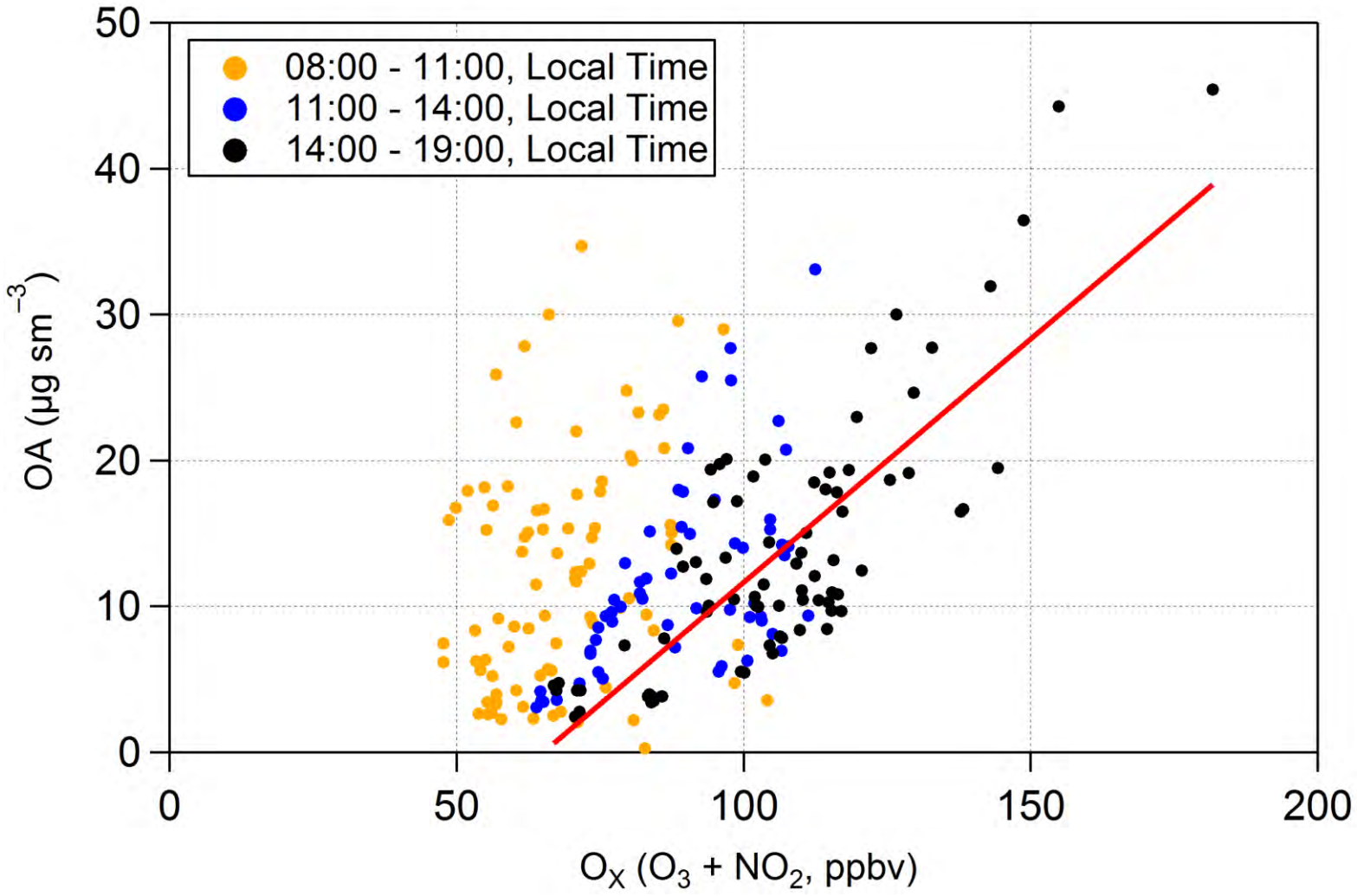
Herndon et al., 2008, GRL



Modified from Zhang et al., 2015, ACP

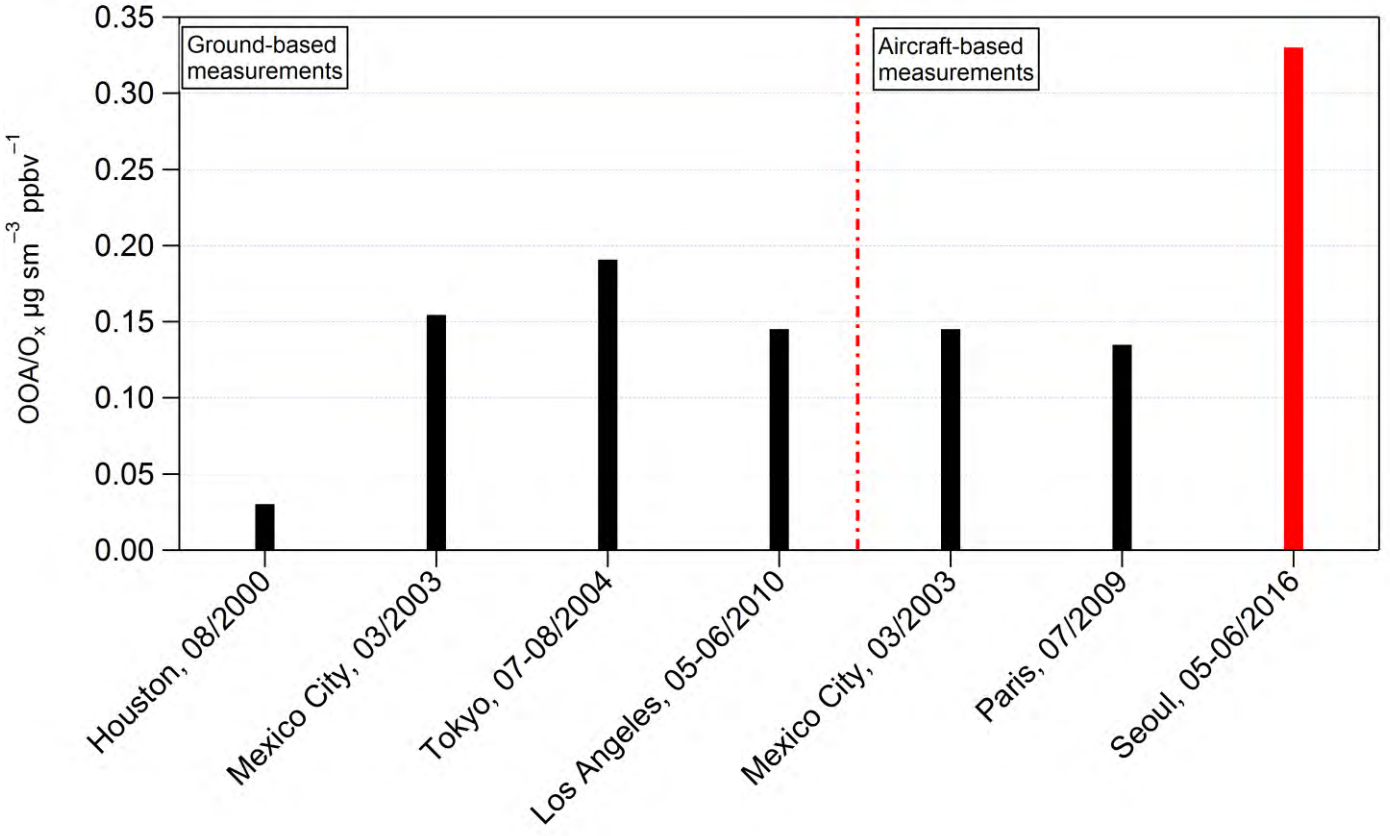
SOA is produced in parallel to O_3, and their production rates are observed to correlate (Herndon et al., 2008, GRL; Wood et al., 2010, ACP).

OA vs O_x over Seoul Binned by Overpass Time



- Best correlation occurs for the afternoon, when O_x and OA production is highest
- Slope for total OA vs O_x is 0.33 µg sm^{-3} ppbv^{-1}

Slopes of OOA vs O_x around the World and Seoul

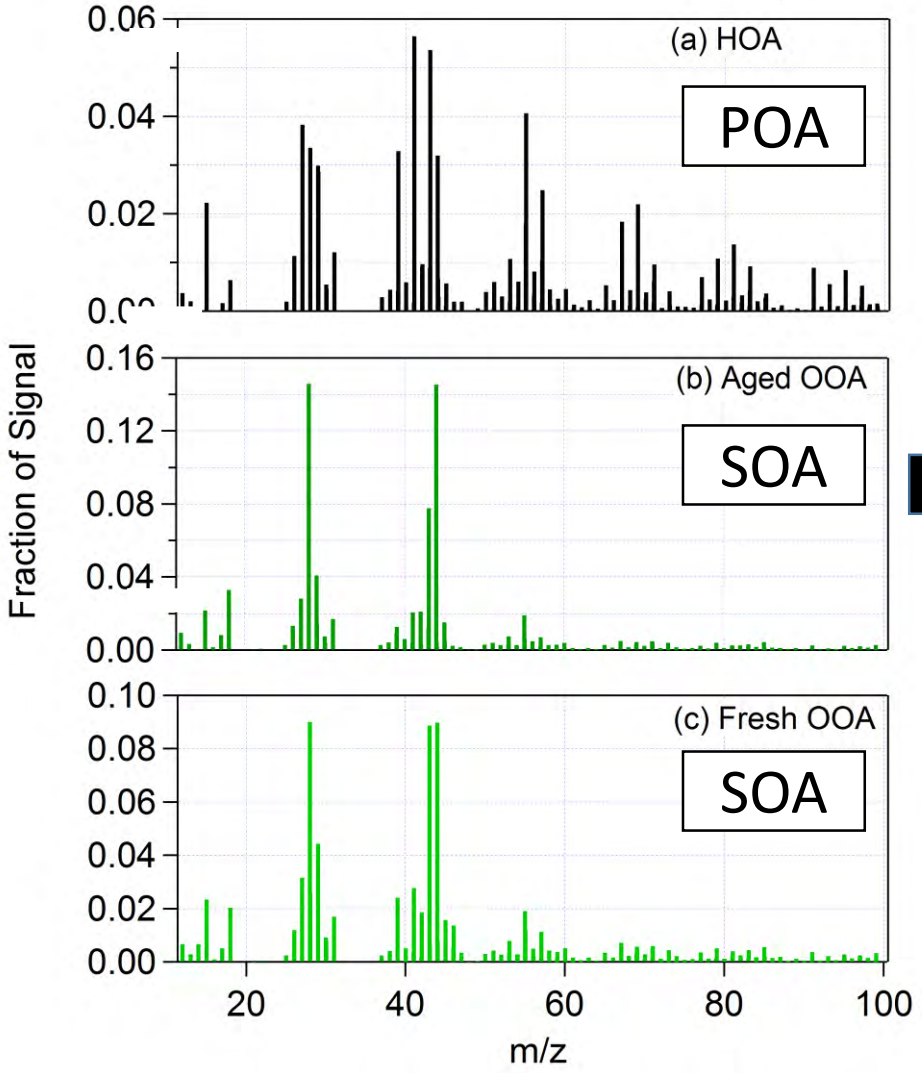


- Further supports strong SOA production over Seoul than in other campaigns.
- *KORUS-AQ datapoint includes POA: Could the high slope be driven by primary OA emissions?*

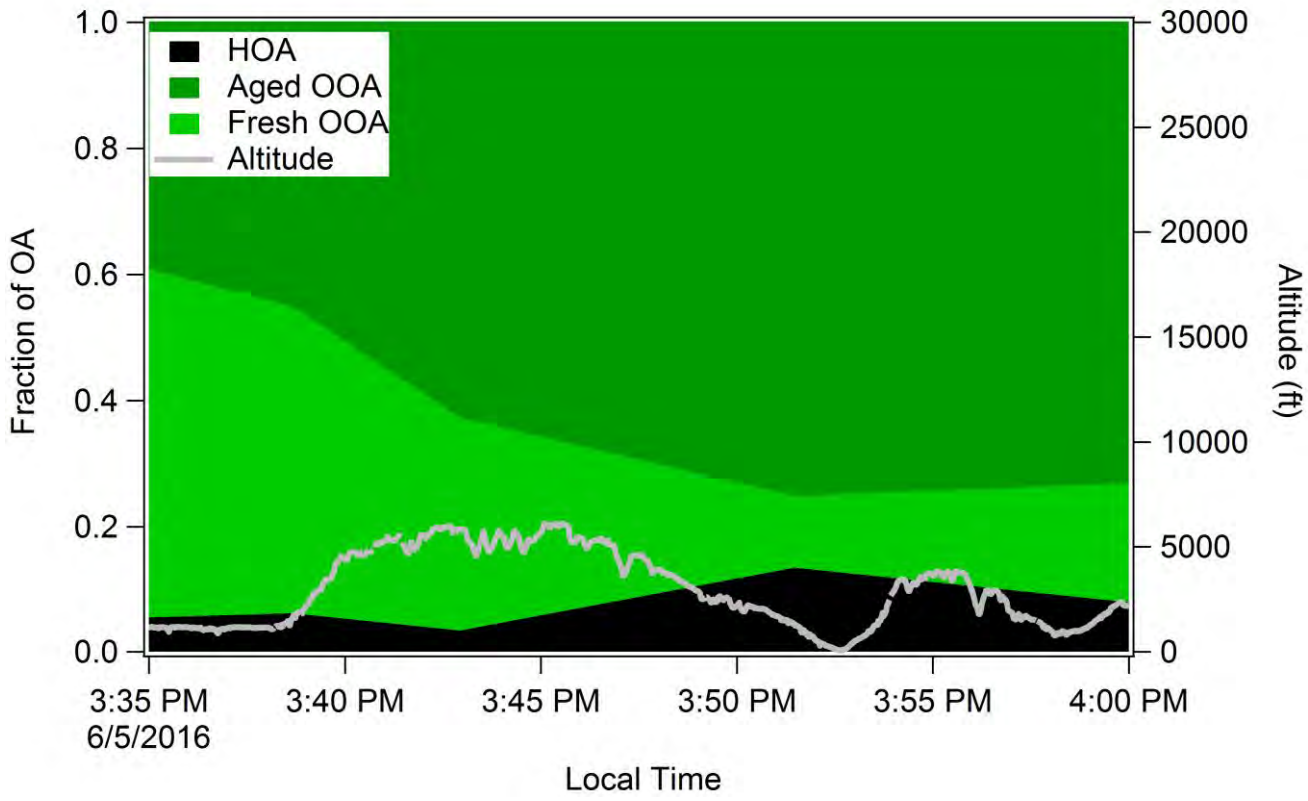
Modified from Zhang et al., 2015, ACP

High SOA Formation is Real and ***not*** Related to POA

OA Factorization during Afternoon Overpass of Seoul during RF18



Average OOA:Total Organic during afternoon overpass on RF18 (06/05/2016) **~90%**



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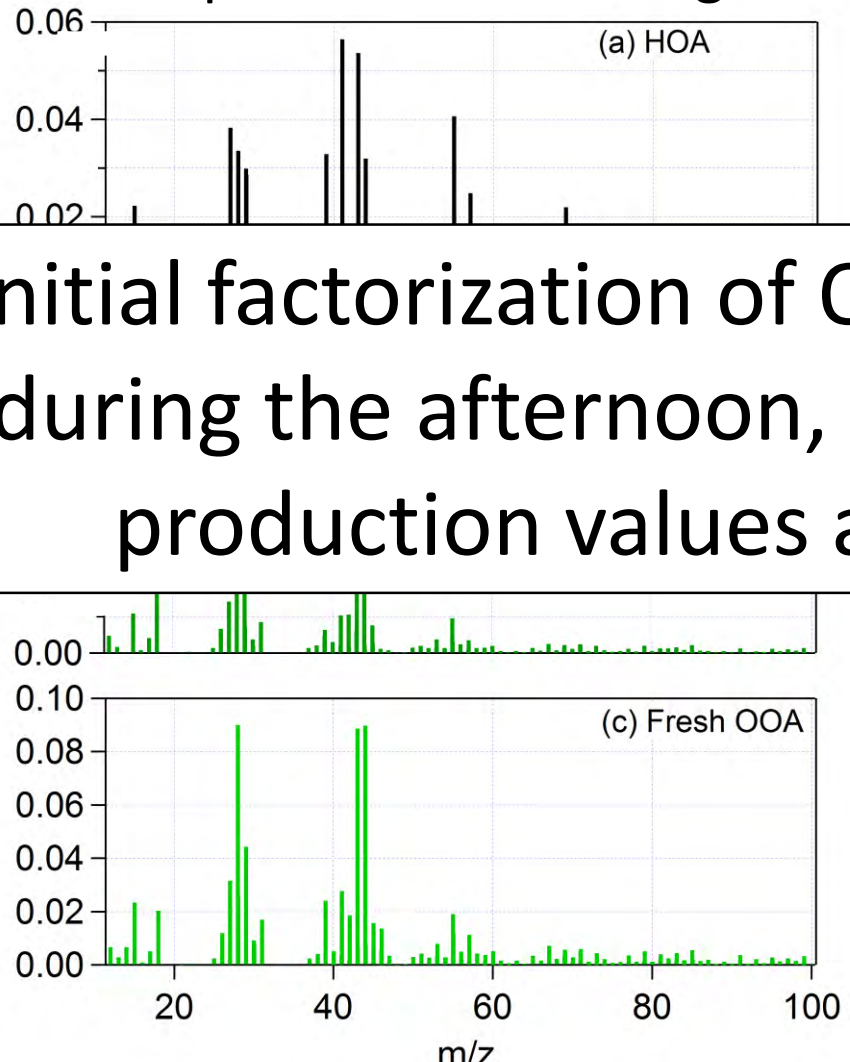

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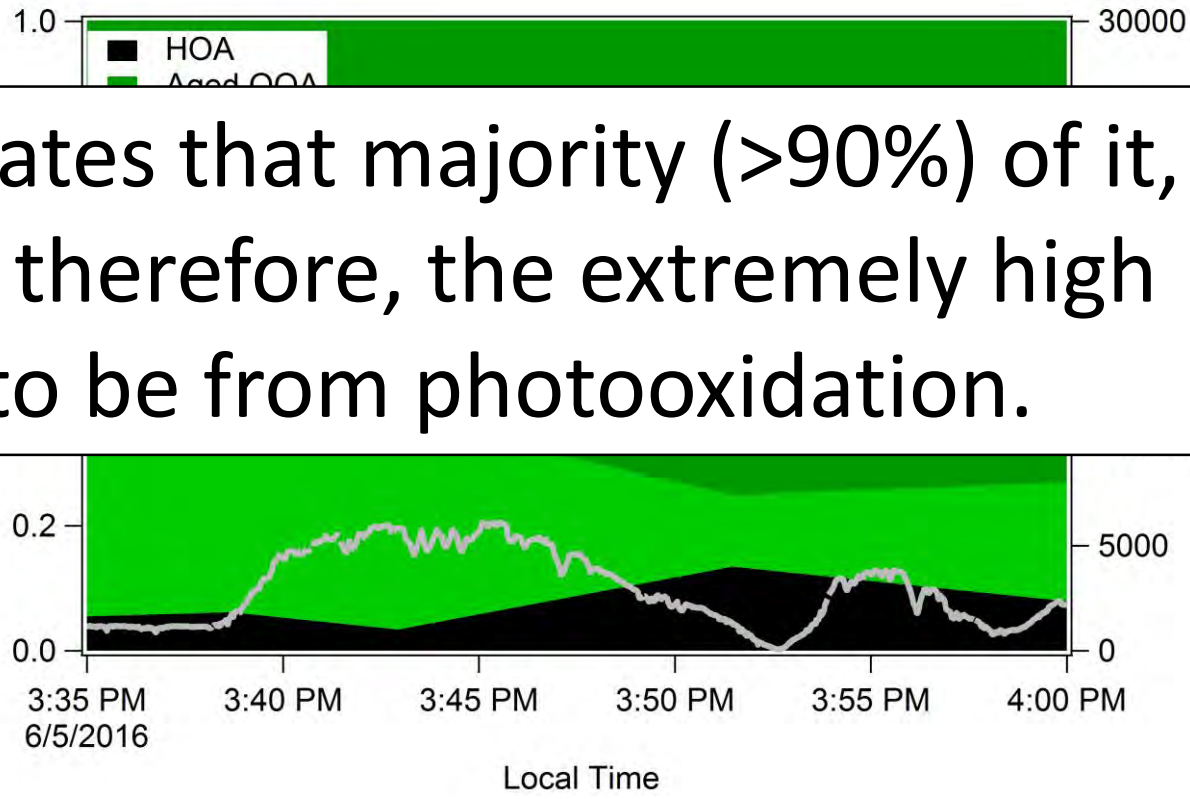
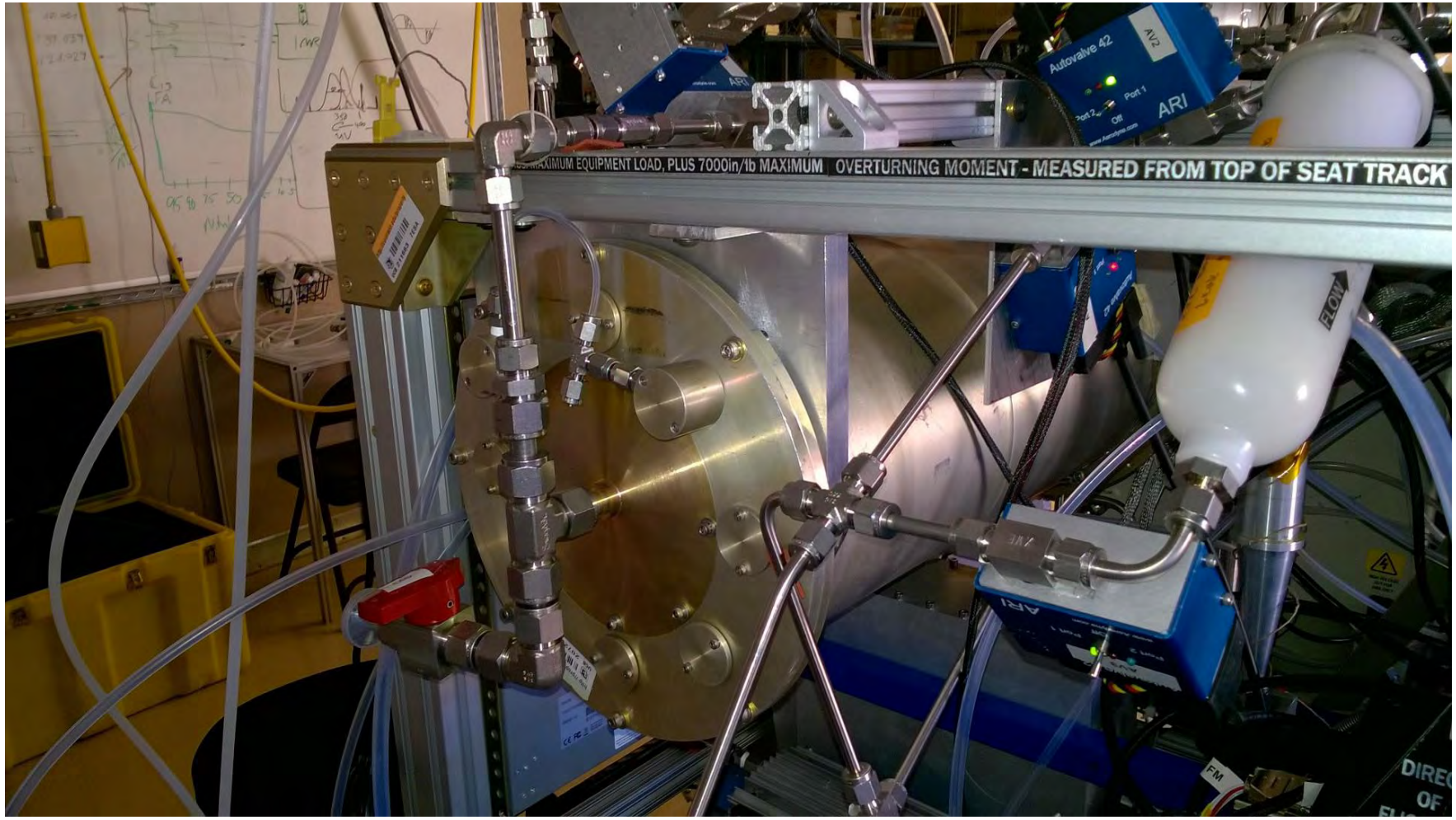


Initial factorization of OA indicates that majority (>90%) of it, during the afternoon, is OOA; therefore, the extremely high production values appear to be from photooxidation.

Oxidation Flow Reactor (OFR) in the DC8



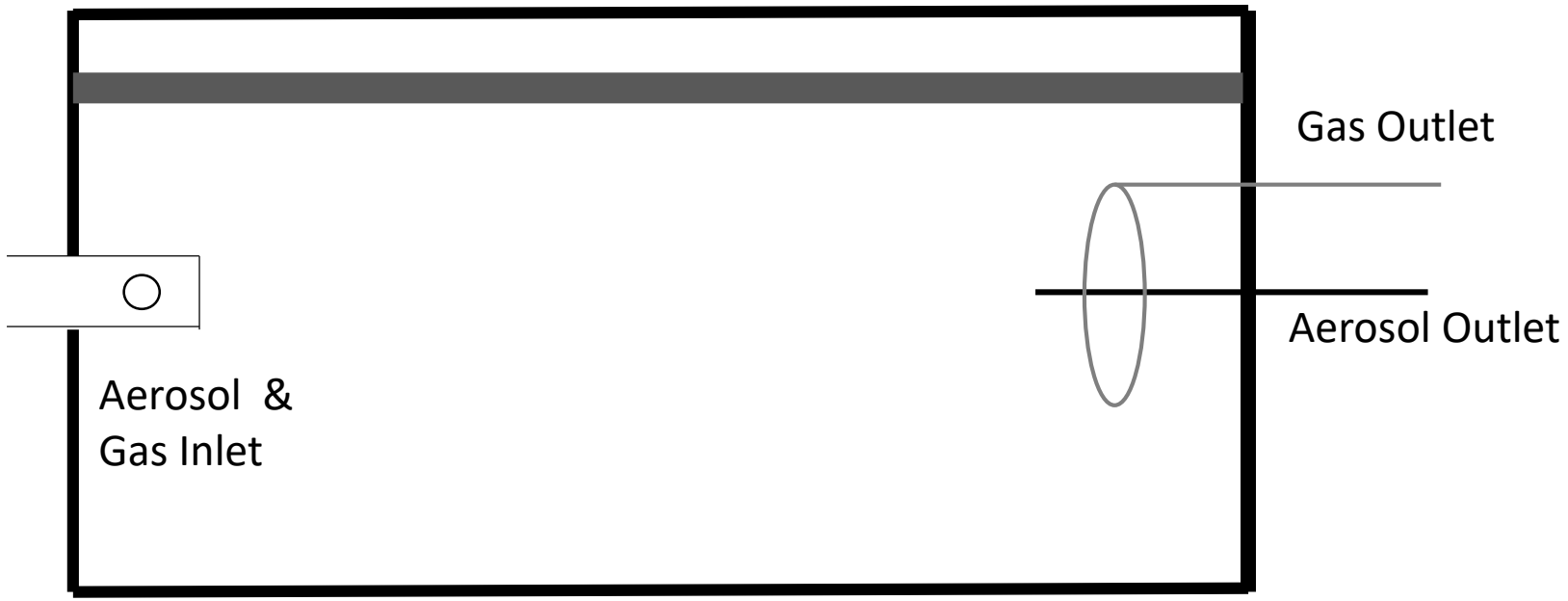
Used to mimic atmospheric aging and SOA production under field conditions, over a relevant range of photochemical ages

The air in the OFR has a residence time of ~3 minutes, requires careful data processing.

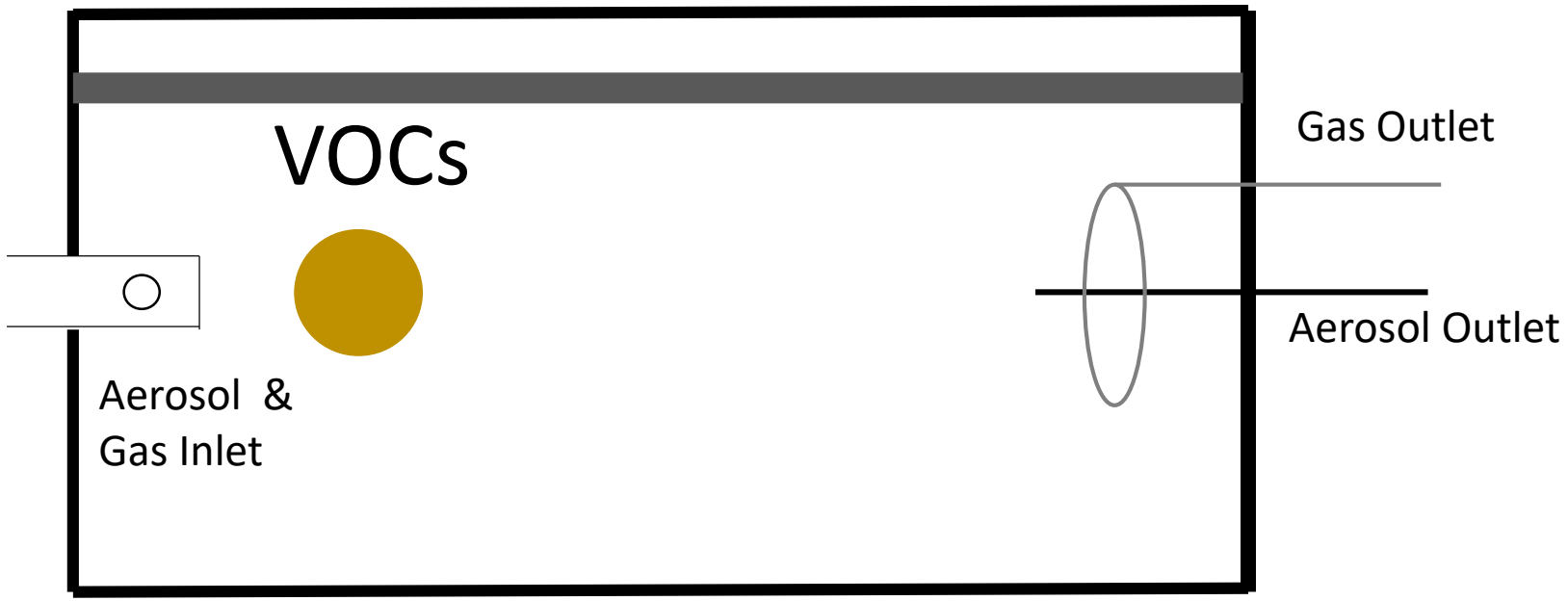
- Used in many previous field campaigns: Missoula Fire Lab (Ortega et al., ACP 2013); Los Angeles (Ortega et al. ACP 2016); Manitou Forest, CO (Palm et al., ACP 2016a, 2016b)
- Radical chemistry modeled in detail: Li et al. (JPCA 2015); Peng et al. (ACP 2015); Peng et al. (ACP 2016); Peng et al. (in prep.)

How the OFR Works

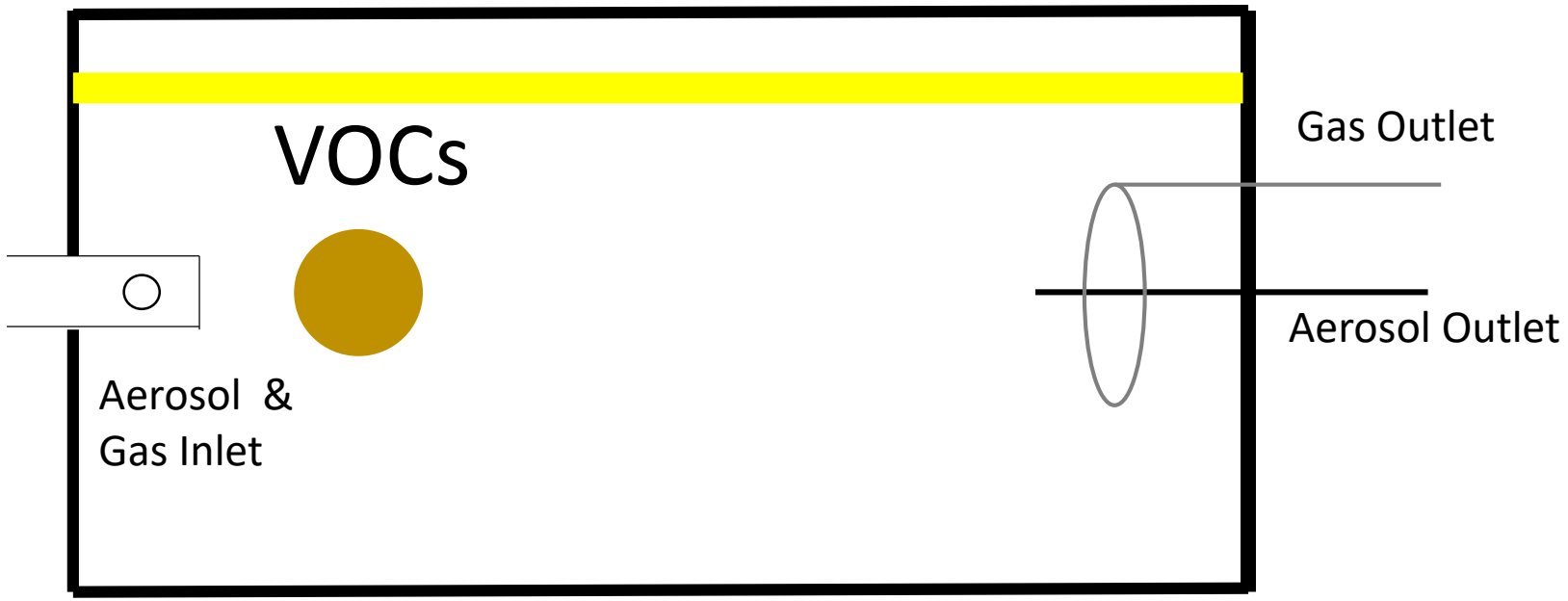
VOCs



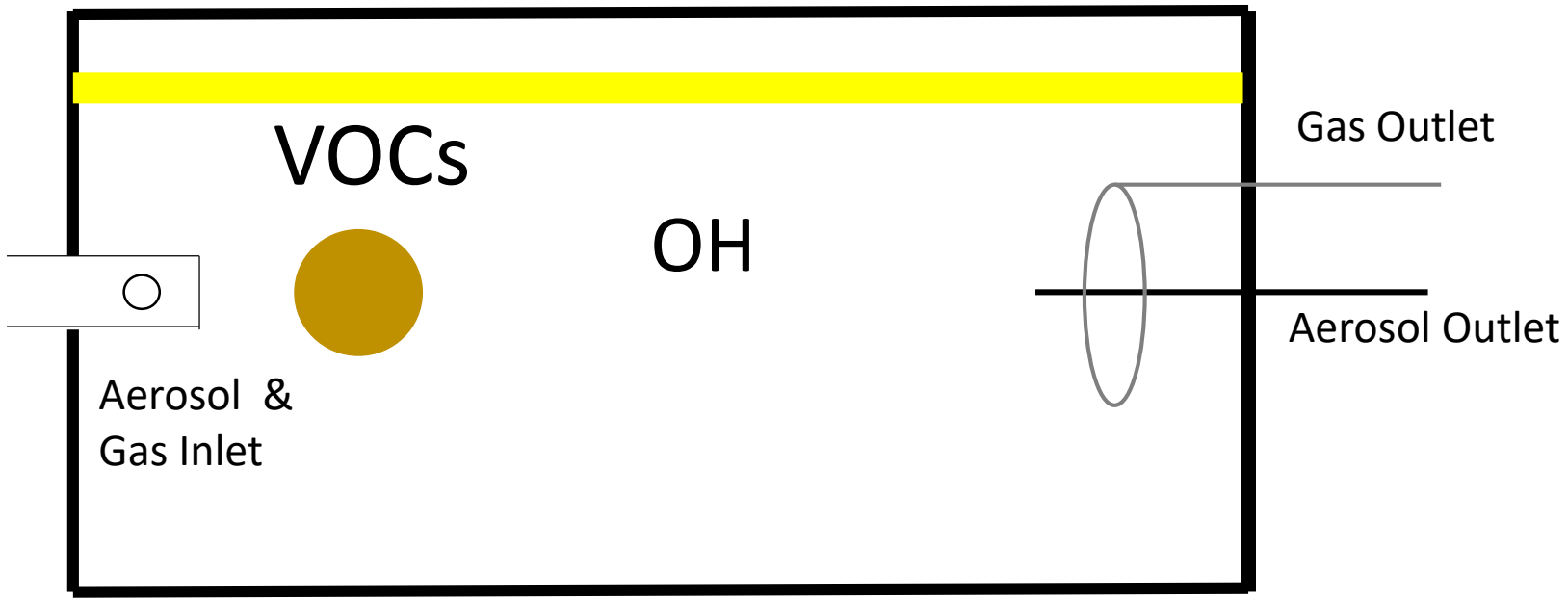
How the OFR Works



How the OFR Works

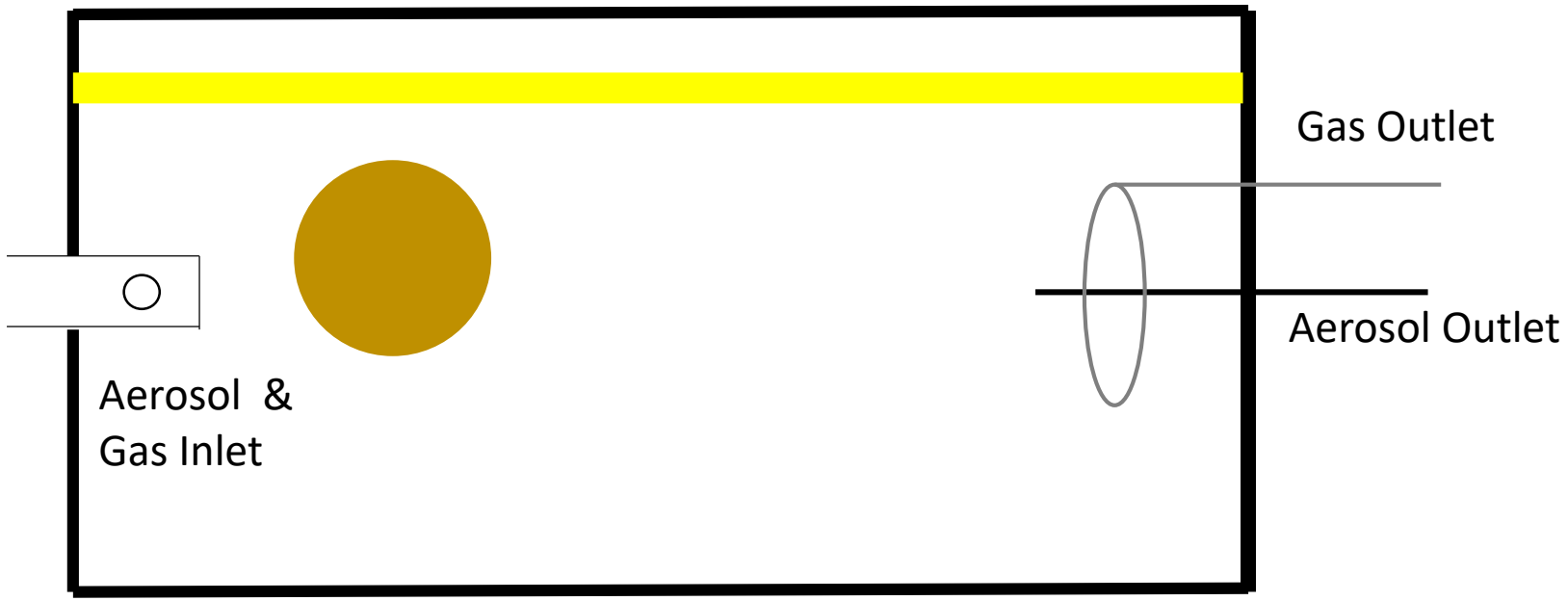


How the OFR Works

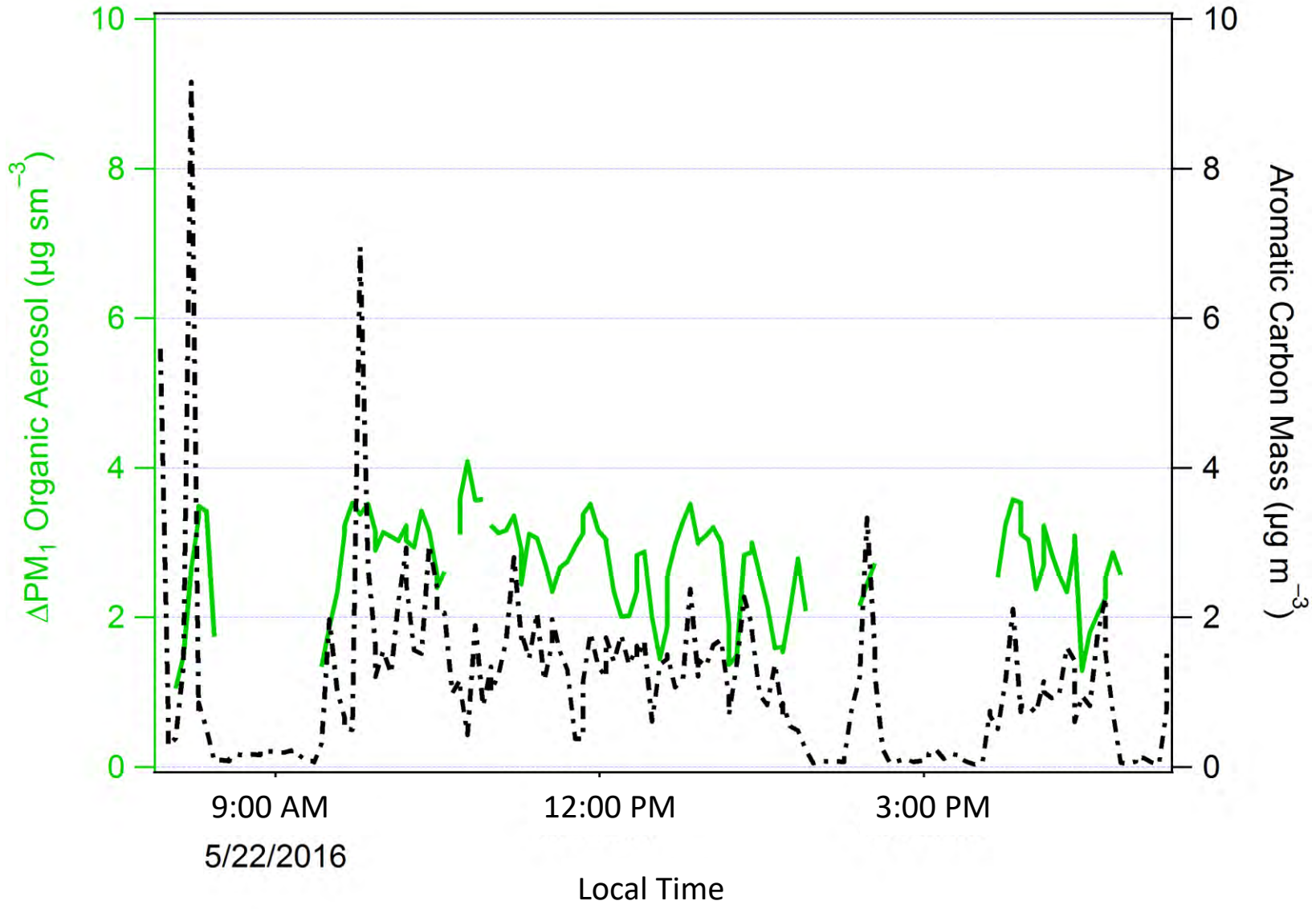


How the OFR Works

How the OFR Works

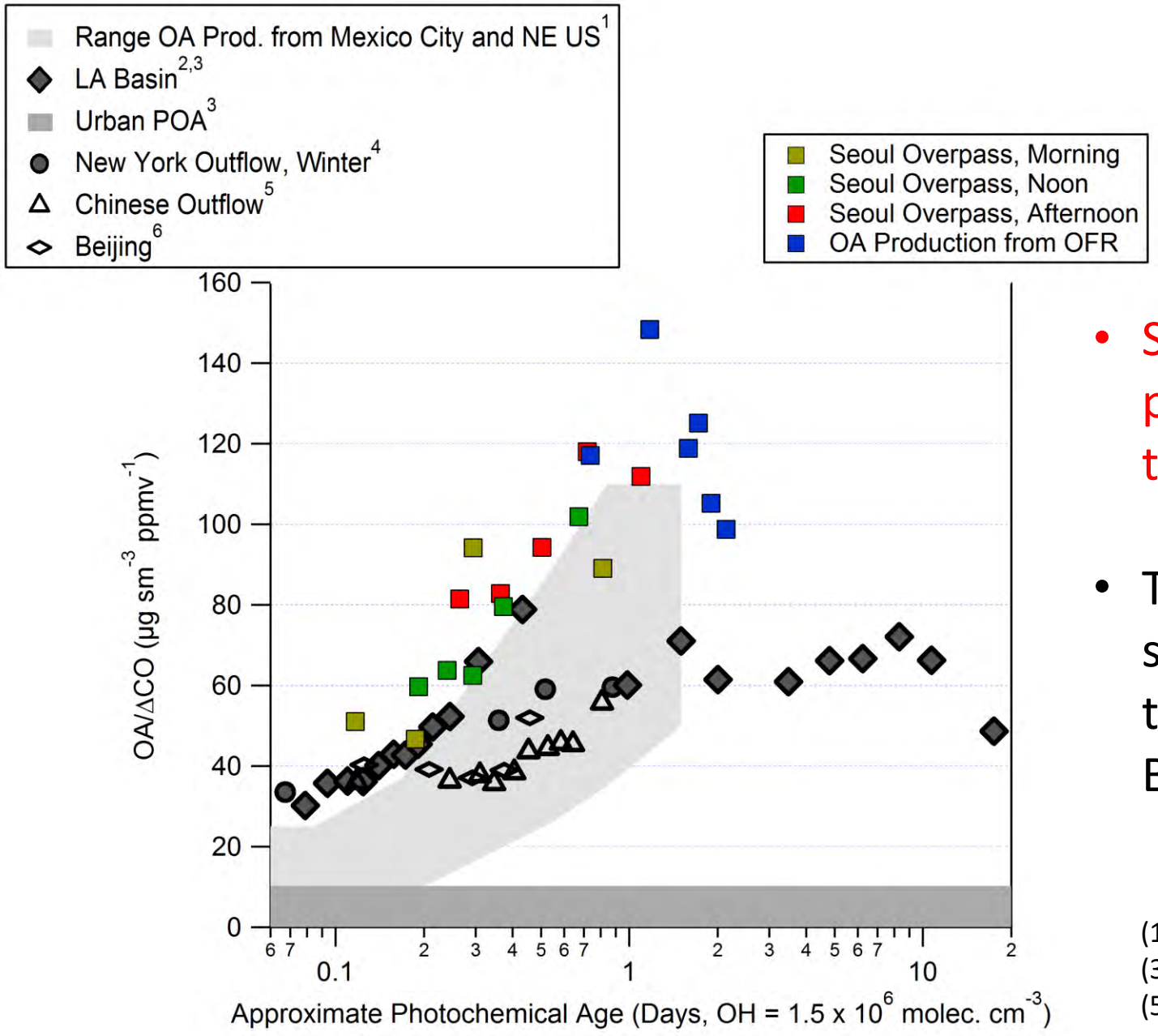


SOA Formation in the OFR Corresponds to Aromatic Hydrocarbon Enhancements



- Example time series from the industrial outflow flight (RF11)
- Clearly see OA production where there are enhancements in the aromatic hydrocarbon mass
- x15 times too much SOA formation to be explained by aromatic yields (~10%)

Comparison of OA Production from OFR with Seoul Overpasses



- SOA production in OFR at higher photochemical ages is comparable to the direct observations over Seoul
- The OA production appears to be stabilizing at approximately the same time as what was observed in the LA Basin

(1) DeCarlo et al., 2010, ACP; (2) Hayes et al., 2013, JGR;
(3) Ortega et al., 2016, ACP; (4) Schroder et al., in prep.
(5) Hu et al., 2013, JGR; (6) Hu et al., 2016, JGR

Conclusions and Future Work

- Conclusions
  - Strong urban SOA production over Seoul
  - Magnitude is at the upper end of observations elsewhere in the world, according to 2 different methods
    - Still need to subtract a small OA background contribution
  - OFR results appear consistent with the ambient Seoul data and show high, rapid OA production as well
- Future Work
  - Can the ground-based and aircraft VOC measurements explain the rapid OA production?
  - What does the outflow of Seoul look like, in comparison to the Seoul overpasses?

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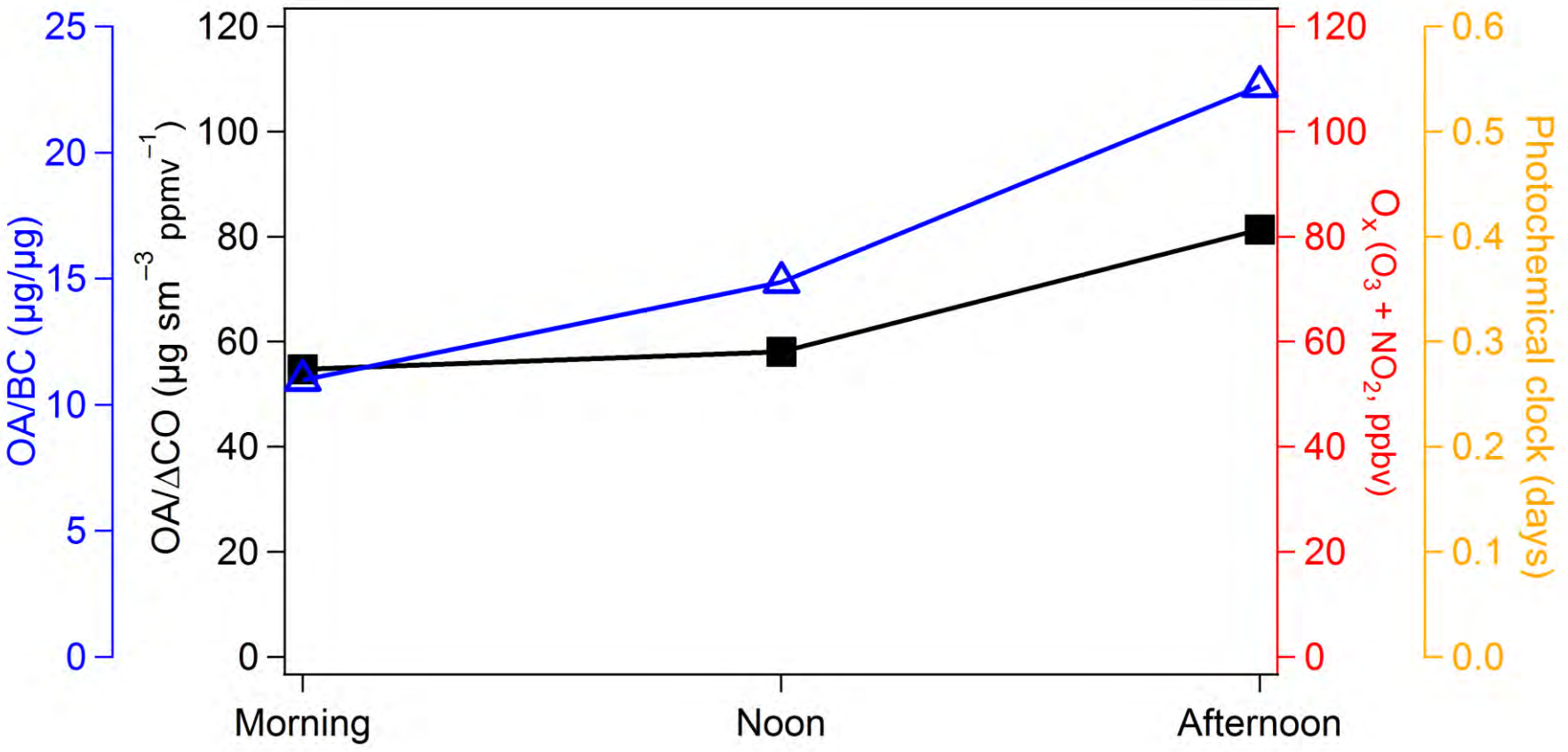
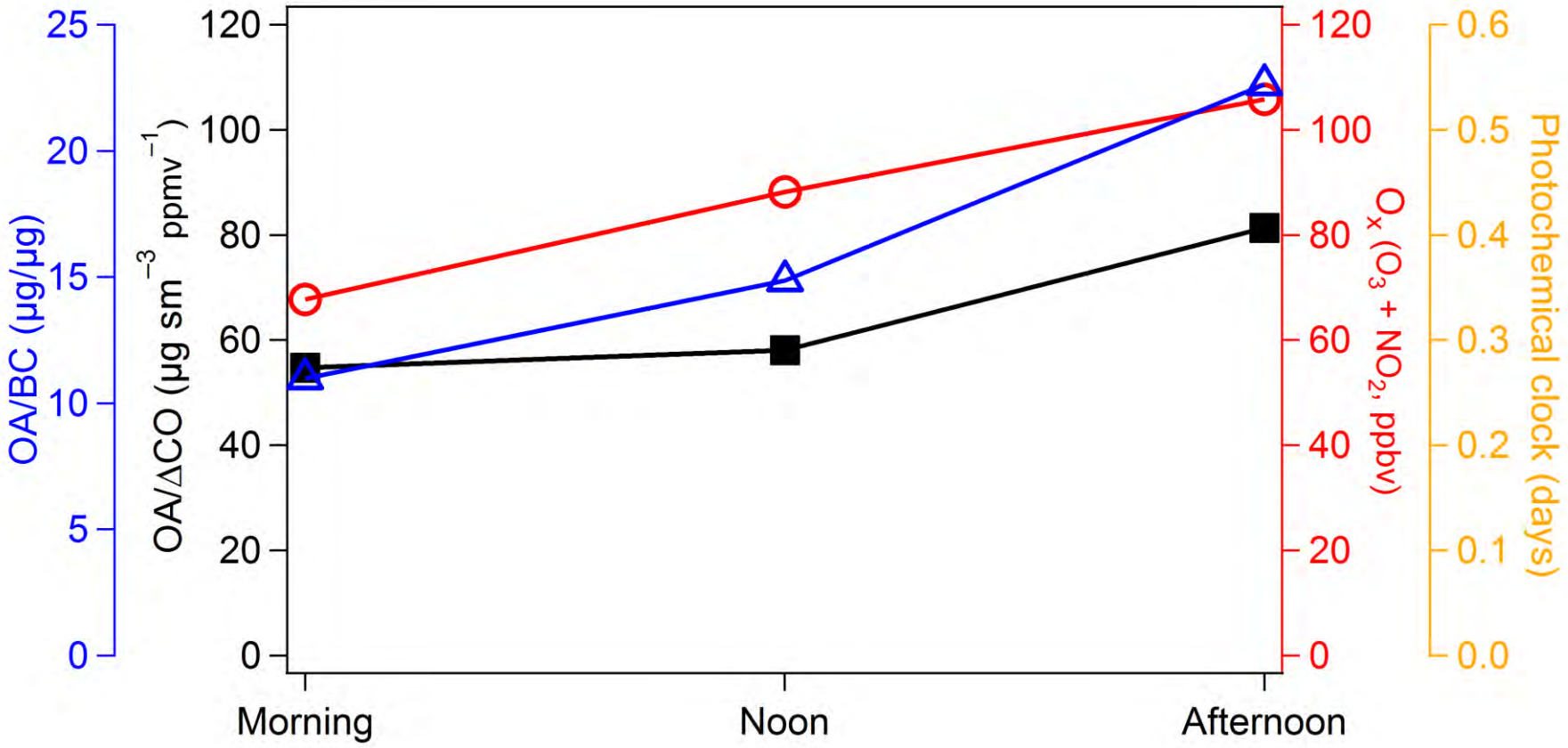
Supplemental Slides

OA Production over Seoul Binned by Overpass Time



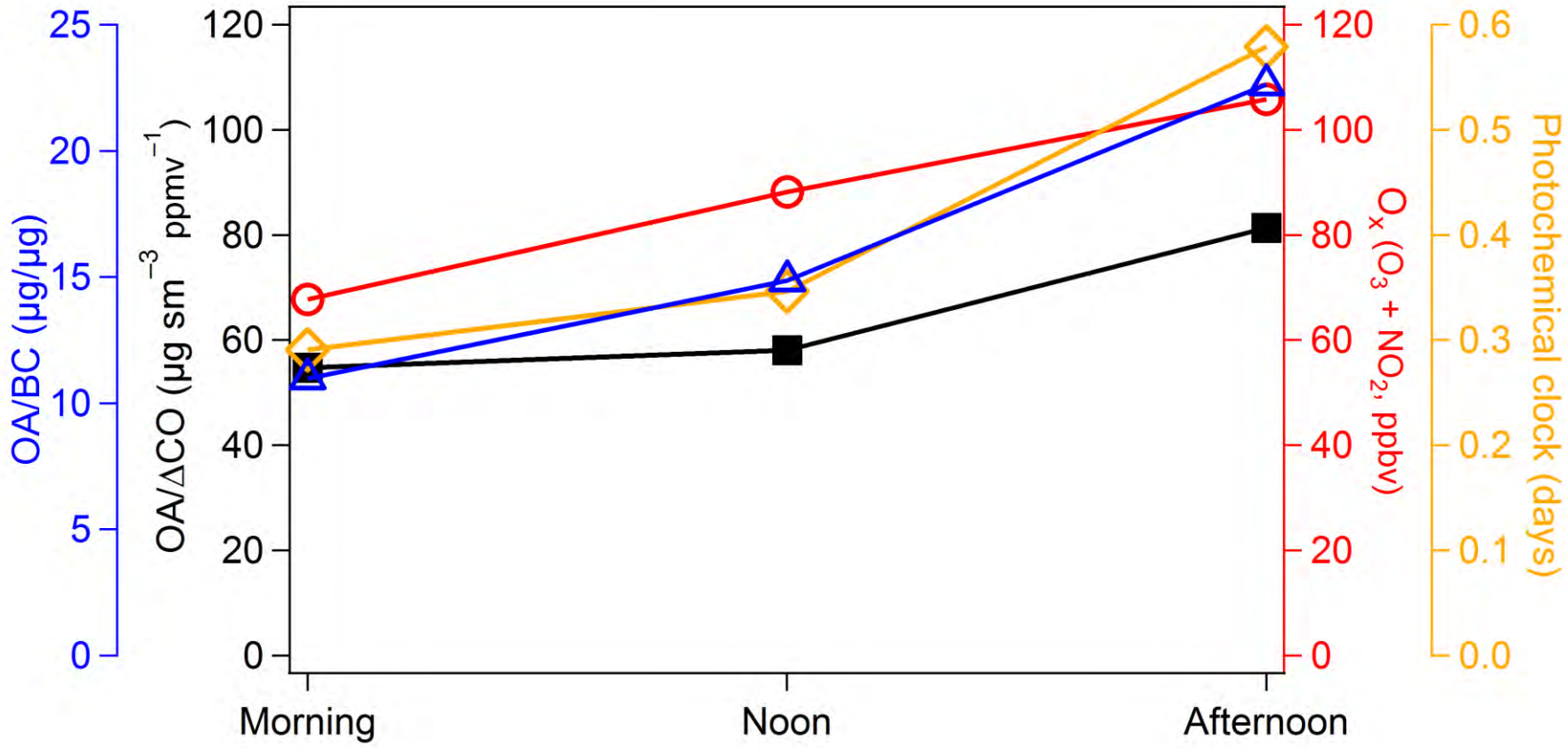
- Rapid OA production during the afternoon Seoul overpasses, especially compared to the other two overpass times
- Increasing OA production throughout the day over Seoul
- Using BC as a dilution correction, instead of CO, shows more rapid OA production. Why?

OA Production over Seoul Binned by Overpass Time



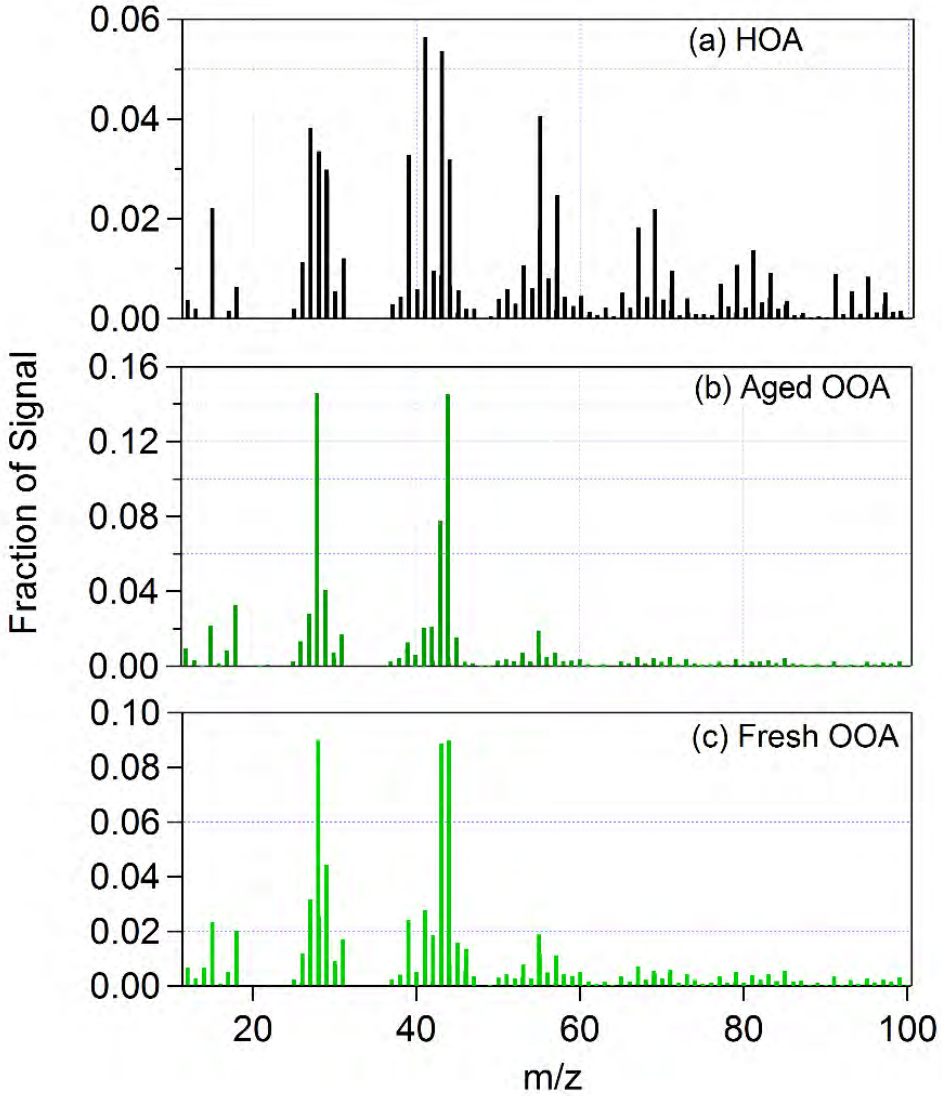
- Observed increasing and rapid O_x ($O_x = O_3 + NO_2$) throughout the day over Seoul
- O_x correlates with the increasing OA, indicating that the OA is mostly produced from photochemistry

OA Production over Seoul Binned by Overpass Time



- Observed increase in photochemical clock throughout day. Photochemical clock, here, is defined as $\ln(NO_x/NO_y)*k[OH]$, where I'm assuming [OH] = $1.5x10^6$ molec./cm^3
- Photochemical clock correlates well with increase OA, further indicating the OA is produced from photochemistry

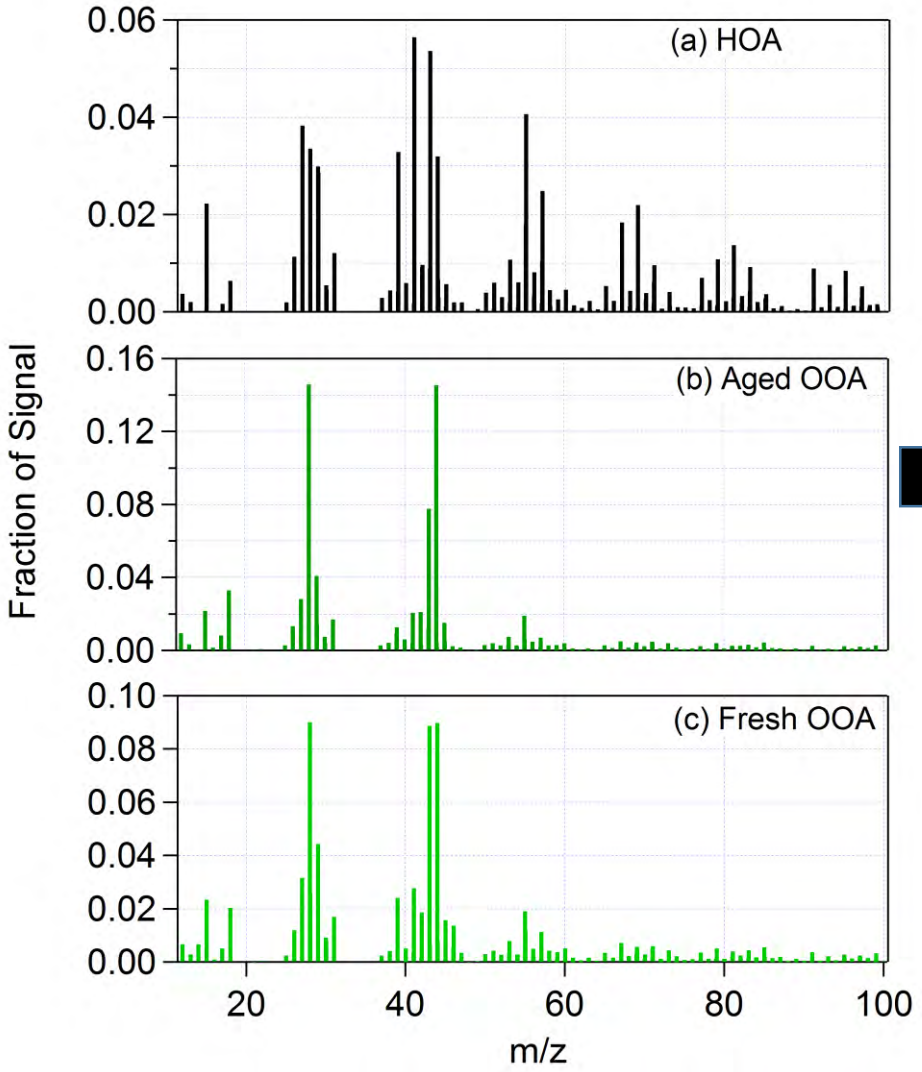
Example Factor Analysis of Organic Aerosol from RF18 (2016/06/05)

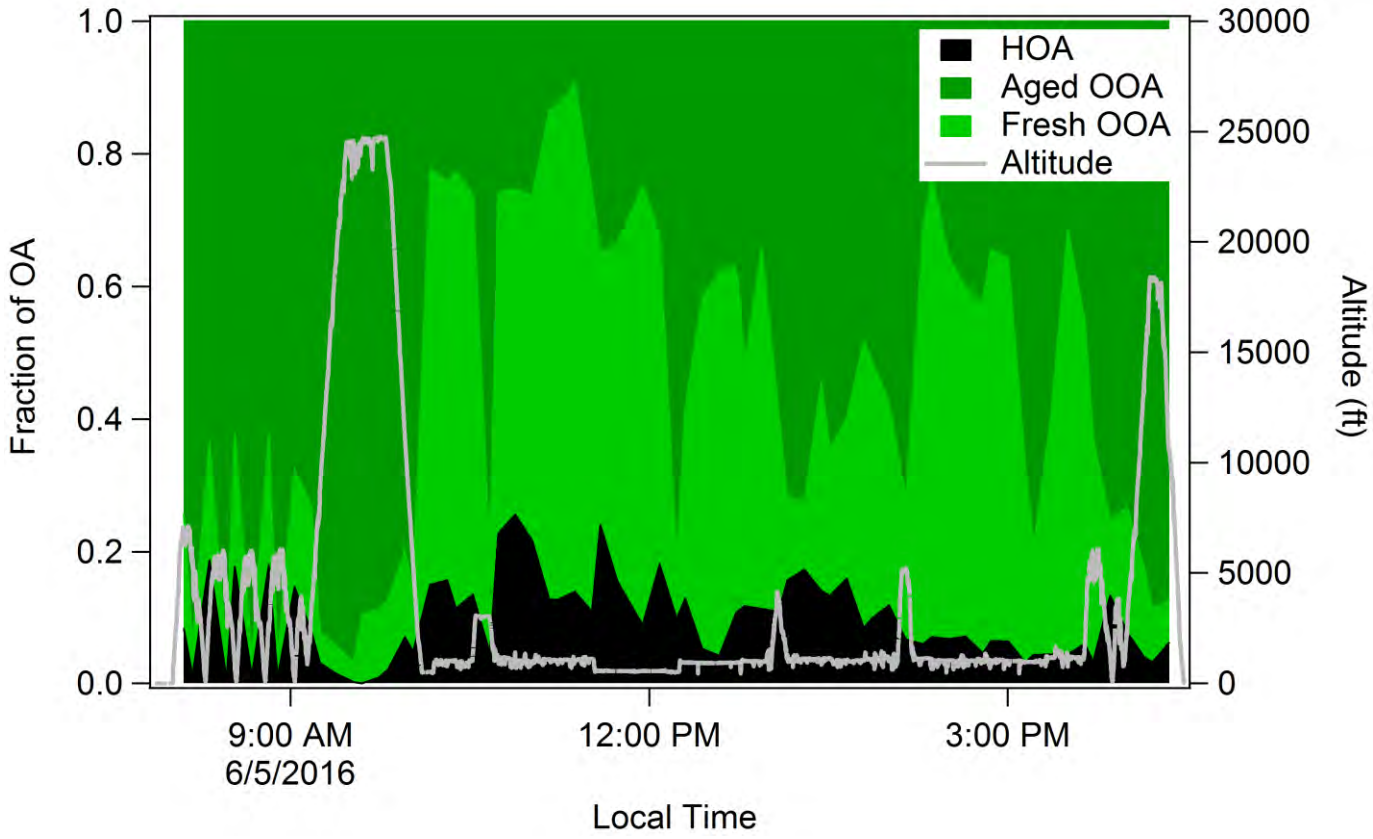


HOA = Hydrocarbon-like OA, surrogate of primary OA

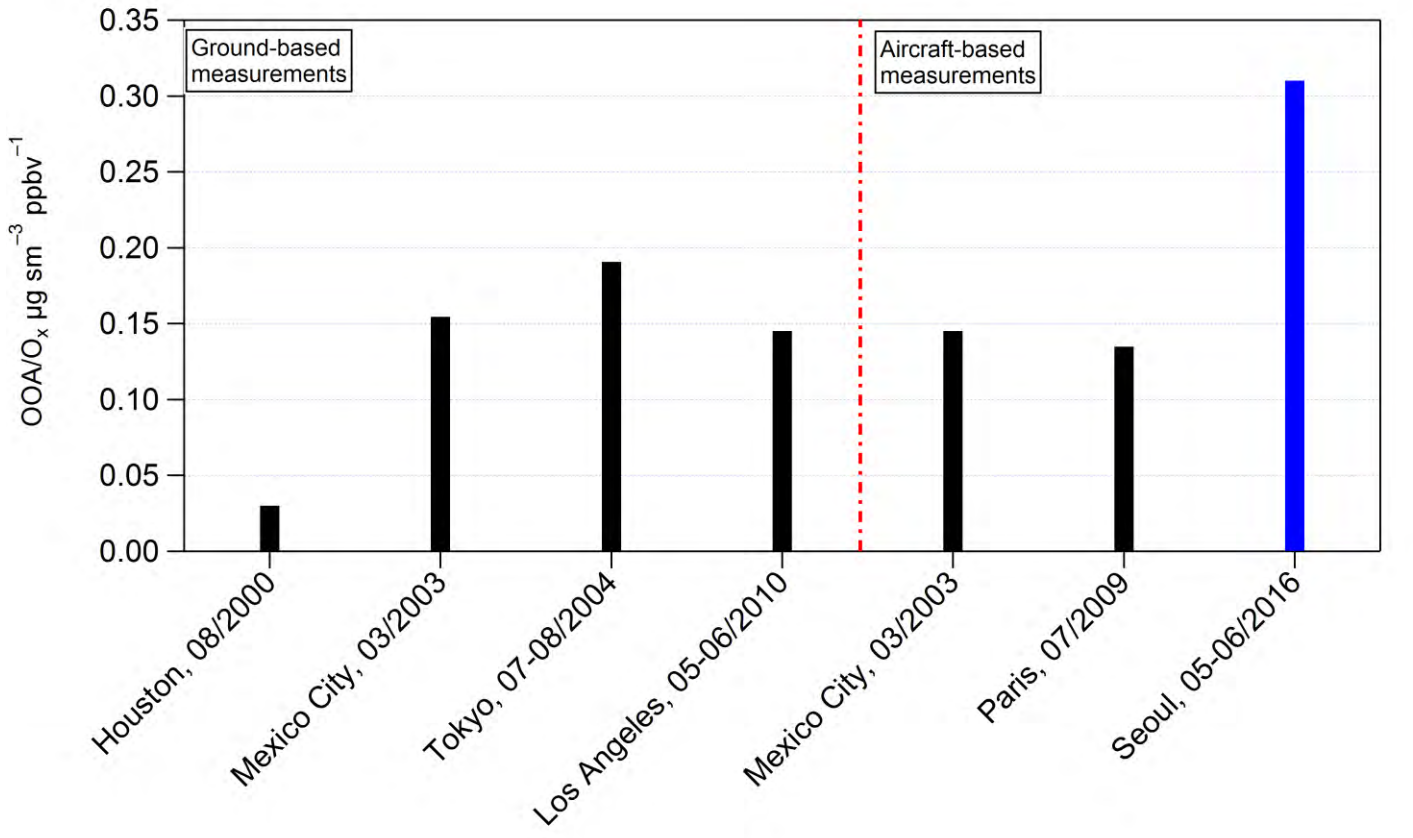
OOA = Oxygenated OA, surrogate of secondary OA

Time Series of the OA Factorization during RF18





Correlation with Afternoon Production of OOA vs O_x



- Blue bar represents assuming ~90% of OA is OOA for entire campaign
- Slope is 0.31 μg sm^{-3} $ppbv^{-1}$
- Slope is still the highest observed, indicating very rapid.
- Further analysis, including PMF for each flight, will be done.

Modified from Zhang et al., 2015, ACP