Agenda

Ministry of Environment
National Institute of Environmental Research

Science Team Telecon

- Data Archive Status and Needs
- Data Schedule and Sharing
- Possible Science Team Meeting Dates
- Thoughts on organizing the Science Team's analysis efforts
- Science Presentations (Isobel Simpson and Scott Janz)

Data Archival (1): DC-8 Status

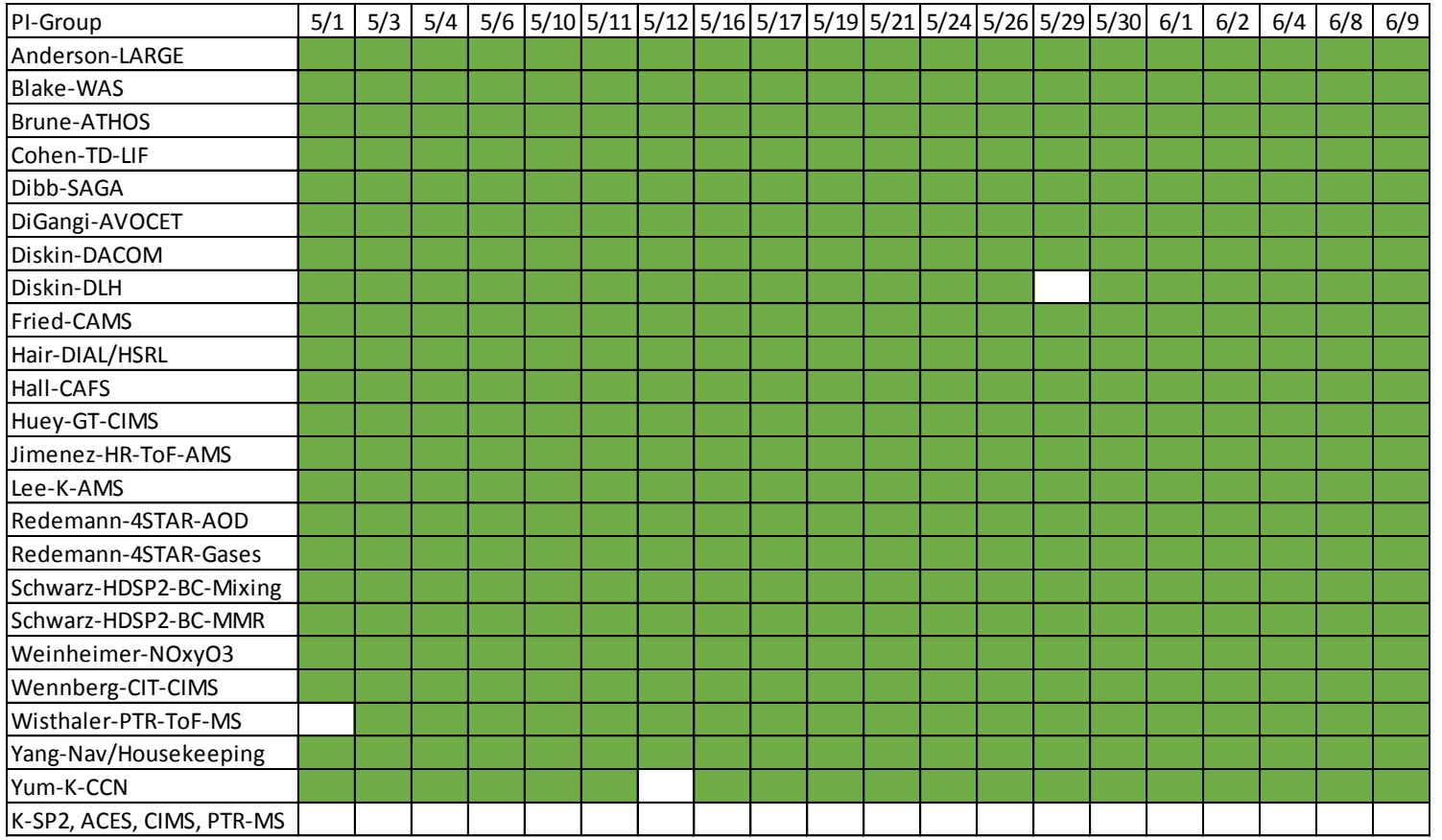
Current data status is shown in the table on the right.

Most recent data merge on 14 July 2016

Data Received since last merge:
Blake – 6/4, 6/8, 6/9
Redemann – 5/30, 6/2, 6/8, 6/9
Anderson – Updated data and cloud flag
Lee – Updated data
Schwarz – 5/4, 5/10, 5/11, 6/8, 6/9

A new merge was completed on 29 August, now includes a cloud flag.

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																				
DiGangi-AVOCET																				
Diskin-DACOM																				
Diskin-DLH																				
Fried-CAMS																				
Hair-DIAL/HSRL																				
Hall-CAFS																				
Huey-GT-CIMS																				
Jimenez-HR-ToF-AMS																				
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, CIMS, 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	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 telecon: CO (5/4), NO2 (5/4), SO2 (6/8, 6/9, 6/10)

Next steps:

-Data merges will be created for the Hanseo aircraft (1s, 10s, 60s)

-Flexpart trajectories to the Hanseo flight tracks will be generated for the 60s merge timeline

Questions or comments?

Data Archival (3): Remote Sensors

NASA King Air status:
-Navigational data is archived **(We have found that files are missing 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 nearly complete and will be available soon through the KORUS-AQ archive

Questions or comments?

Data Archival (4): Olympic Park

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

New data from Seongchon Kim for 5/9-6/14

Next steps:

-We plan to provide merges for ground data.

-Higher temporal resolution if possible would be great for final data.

-Flexpart trajectories from Olympic Park will be provided.

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
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, 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
TBD-EPA				

Data Archival (5): Taehwa/Other

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

The table for Taehwa has been updated to reflect data for McGee and Thompson that were already in the archive.

Next steps:

-Are we missing any groups making measurements at Taehwa? Other sites?

-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
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)
TBD-EPA, UCI				

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	■	■	■	■	■	■		■	■	■	■	■									

This table has been added to account for supersite data. It is not new, but is added for completeness.

Data Archival (7): Ships and Japanese Data

No ship data has been put into the archive so far. The archive has tabs for the Onnuri and the Jang Mok, but not for the Kisang.

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.

Meehye Lee has turned in some ocean data under “All Others” associated with ship measurements. Will we need to get the get ship location data to be able to interpret these measurements?

Data Archival (6): Needs

Daily Flight Summaries

-A document of flight summaries has been uploaded to the KORUS-AQ file sharing page on the data archive at: https://www-air.larc.nasa.gov/cgi-bin/DocXhg/KORUSAQDocs#ShowAll

-The file is located under “Research and Other Docs” and is named “Flight Summaries”

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.

-We will be flagging all spiral profiles, regardless of location.

-While no feedback has been offered, we are still accepting suggestions.

-Flagging will begin soon by a new intern in the data group.

Plume identification:

-In past campaigns, we have performed plume identification and attributed possible source identification. This would need to be accomplished by volunteers from the science team. We could also include metrics for stratospheric influence, dust events, etc. This would be archived and shared to allow discussion and analysis of these plumes or events to be consistent across the science team. **Jason Schroeder and Rebecca Buchholz have volunteered to participate, but we are also hoping for a few young scientists from Korea to help develop this product.**

Other ideas or needs are still welcome?

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.

Upcoming presentations include the following:

KORUS-AQ Overview presentations at AOGS (Aug), IGAC (Sep) and AGU (Dec)

KORUS-AQ Ground Observations were presented and discussed by the Korean science team members in a non-public session at the IUAPPA meeting in Busan. Any significant outcomes from that meeting?

Fall AGU – Intentions to submit abstracts to Fall AGU were communicated by a few teams. **We are still waiting for abstracts to be public.** In these cases, 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.

The KORUS-AQ Overview presented at AOGS has been uploaded to the KORUS-AQ file sharing page on the data archive at: https://www-air.larc.nasa.gov/cgi-bin/DocXhg/KORUSAQDocs#ShowAll

The file is located under “Presentations” and is named “KORUS-AQ Overview at AOGS, Beijing, 5 August 2016”

Team members should feel free to use any or all of these slides when publicizing the campaign.

Science Team Meeting Dates

January 2017						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
★	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

February 2017						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

March 2017						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Conflicts of some sort exist through mid-March:

- U.S. Federal Holidays
- Korean Holidays
- AMS (Jan) and DOE (Mar) meetings
- ATom and ~~ACT America~~ Operations
- ~~ACT-America Operations only~~
- ★ Preliminary Data Deadline

ACT-America is no longer a concern

DOE Annual Meeting has been added

Preferred time is for end of February beginning of March (marked in green on the calendar) and the venue will be Jeju Island.

Science Team Analysis

To organize the analysis efforts of the Science Team and enhance collaboration, we are requesting that investigators provide brief statements of their analysis ideas and intent.

These are NOT paper titles, rather a brief statement to help the team identify areas of overlap that are ripe for collaboration and gaps deserving more attention.

Prompt participation is appreciated, but there is no deadline for entering ideas or contacting other groups. This exercise is only intended to improve collaboration.

Do we need a field for naming potential collaborators, or should that be mentioned in the Research Description?

KORUS-AQ Research Intentions:

- The success of KORUS-AQ depends heavily on international collaboration in the analysis of the observations, blending perspectives gained from the ground, the air, and models.
- This site catalogs research intentions by members of the Science Team to facilitate effective exchange of ideas before the Science Team meeting. This information supports both self-organization and input from the leadership team.
- This list will help the Science Team to identify areas of collaboration as well as research gaps and opportunities.

Instructions:

- Please enter your data below.
- In choosing a Primary Research Category, please select that area where your analysis is most likely to lead to new understanding.
- You may choose as many Secondary Categories as you need as this will allow your contribution to be sorted in the table below.
- We are not looking for paper titles, rather a brief one paragraph description of how you intend to explore the data.
- These statements of research intent are not binding and can change or evolve.

*** If an existing entry needs to be changed or replaced, please contact Ali Aknan (ali.a.aknan@nasa.gov) ***

* Name	* Institution / Affiliation	PI Group / Instrument	* Primary Research Category
			Remote Sensing: Improvement and Usage

Secondary Research Category (check all that apply)

- ☐ Remote Sensing: Improvement and Usage
- ☐ Factors Controlling Ozone Air Quality
- ☐ Factors Controlling Aerosol Air Quality
- ☐ Emissions and Source Attribution
- ☐ Radiation and Aerosols
- ☐ Model Assessment and Improvement
- ☐ Validation and Intercomparison
- ☐ Other (*please specify*)

Research Description Text ..... (Max 1500 char's)

Submit *Required

For help, please conatct Ali Aknan | Last Updated: September 2016 | Ver 1.0 – Beta

Science Team Analysis

<u>A couple of example research descriptions</u>:

1) Jason Schroeder, NASA Langley, PI-Crawford, Primary – Factors Controlling Ozone Air Quality, Secondary – Model Assessment and Improvement

We will be exploring net ozone production rates using a photochemical box model constrained by KORUS-AQ observations from the aircraft and ground sites. Model predictions will be compared to observed ozone changes, particularly for locations visited multiple times per day. We will also compare ozone production rates along the flight tracks for the observed conditions in comparison to conditions extracted from regional and global models. The model will be evaluated by comparing observed and predicted values for radicals, formaldehyde, peroxides, nitrogen dioxide, etc. Model calculations will be archived for use by the Science Team.

2) Jason Schroeder, NASA Langley, PI-Crawford, Primary – Remote Sensing: Improvement and Usage, Secondary – Factors Controlling Ozone Air Quality

We will be exploring relationships between surface measurements and column quantities to build on previous work in DISCOVER-AQ suggesting that formaldehyde correlation with ozone can serve as an important indicator of ozone production from satellites. We will focus on Pandora observations at all locations, but expect to emphasize observations at Olympic Park and Taehwa, where ground observations of formaldehyde are also available.

VOC measurements using Whole Air Sampling (WAS) aboard the DC-8 during KORUS-AQ

Photo credit: Barry Lefer

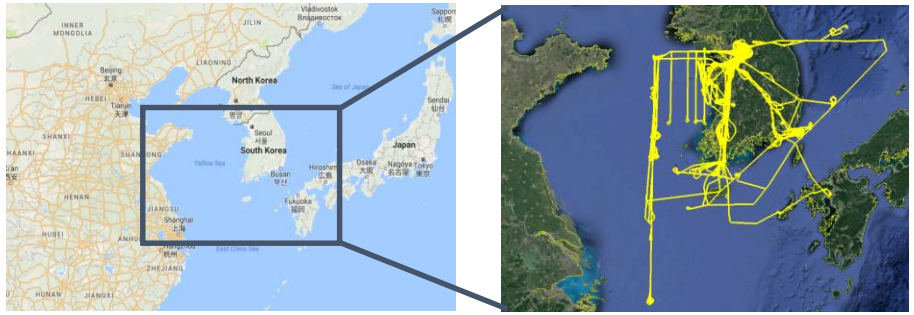
Photo credit: Jim Crawford

Don Blake (PI), Isobel Simpson*, Nicola Blake, Simone Meinardi, Barbara Barletta, Stacey Hughes, Lauren Fleming, Nick Vizenor, Brent Love, Gloria Liu, Jason Schroeder[1], Louisa Emmons[2], Jerome Barre[2], et al.

+ thanks to the KORUS-AQ science team and crew

Department of Chemistry
University of California, Irvine
Irvine, CA, USA 92697
**isimpson@uci.edu; drblake@uci.edu*

[1] NASA Langley
Hampton, VA 23631
[2] NCAR
Boulder, CO 80307



UCIrvine University of California, Irvine

KORUS-AQ

NASA

NASA DC-8 research aircraft

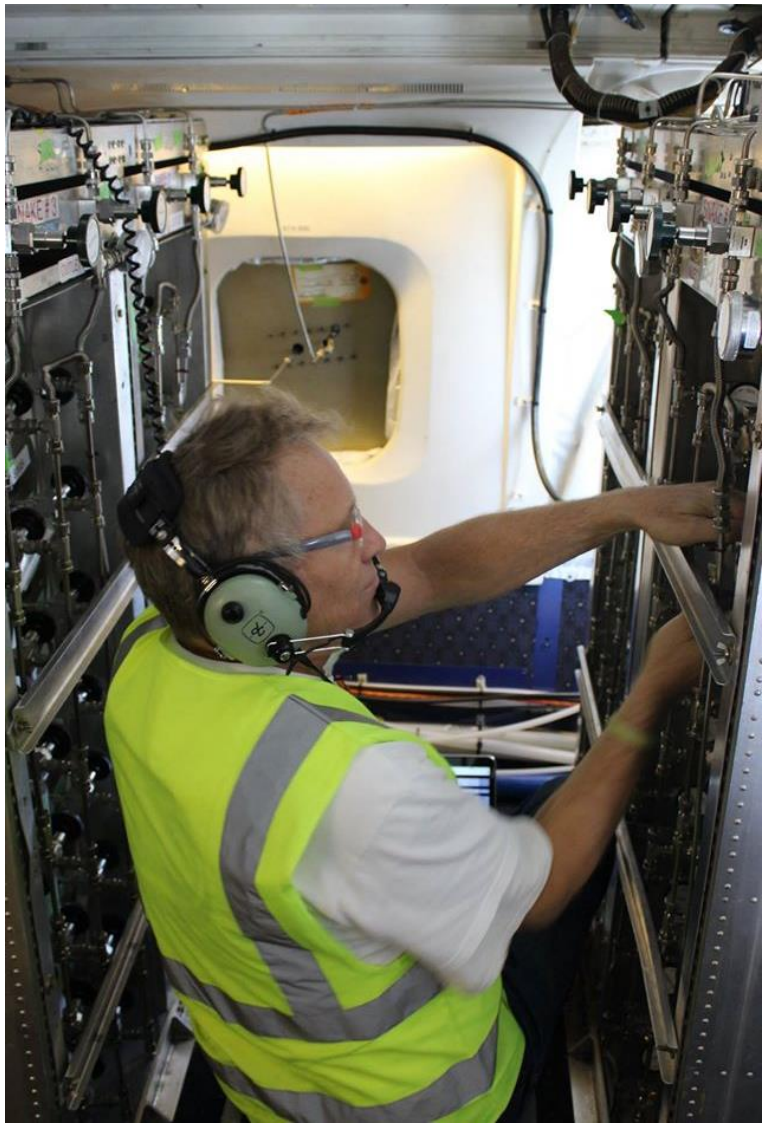


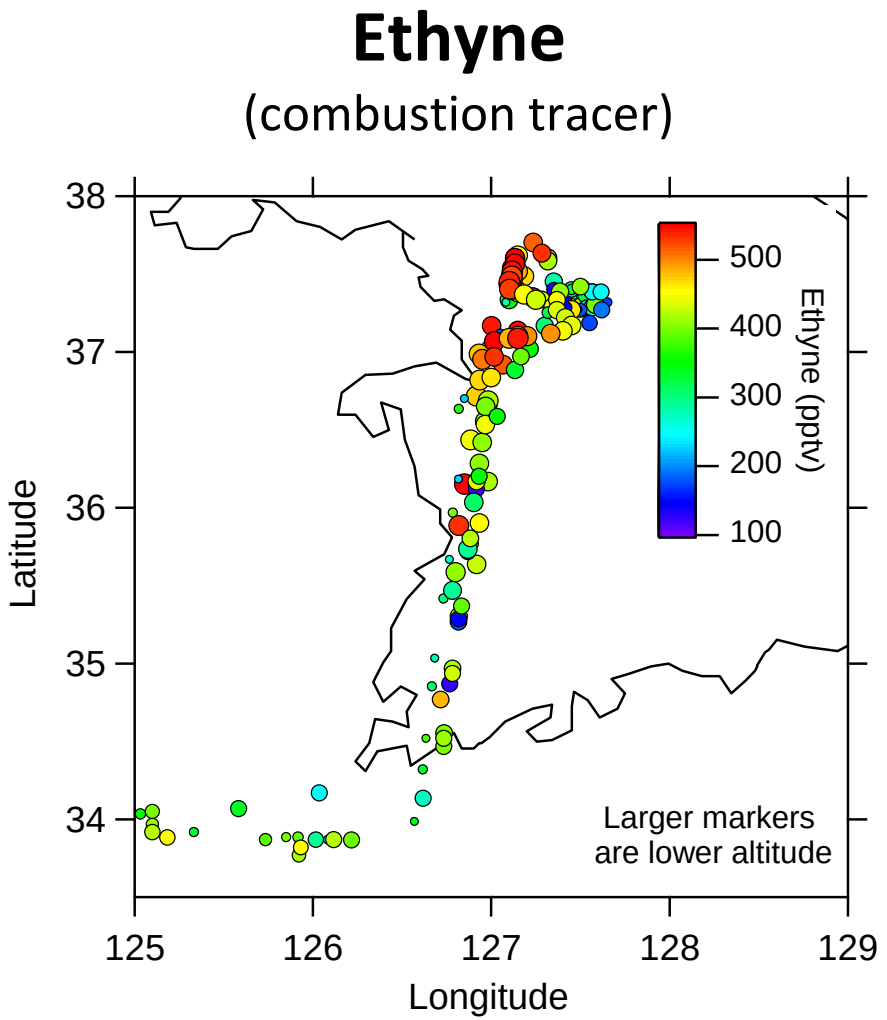
Photo credit: Rebecca Hornbrook

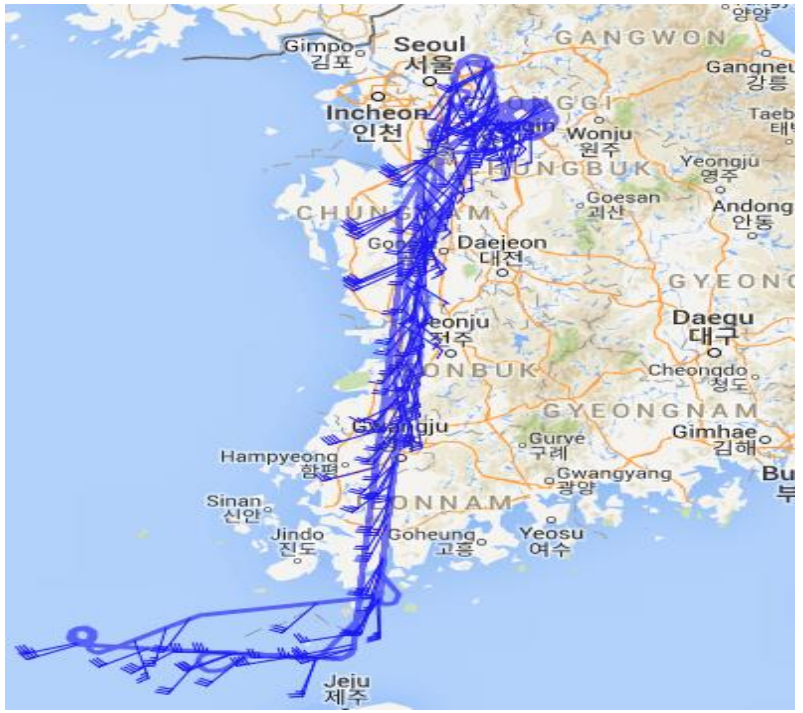
Whole air sampling (WAS)

- 30-60 s sampling time
- Up to 168 samples/flight
- 2602 total samples
- Analyzed at UC Irvine for ~80 VOCs
- **Preliminary data** and **early interpretations** presented here

Photo credit: Rebecca Hornbrook

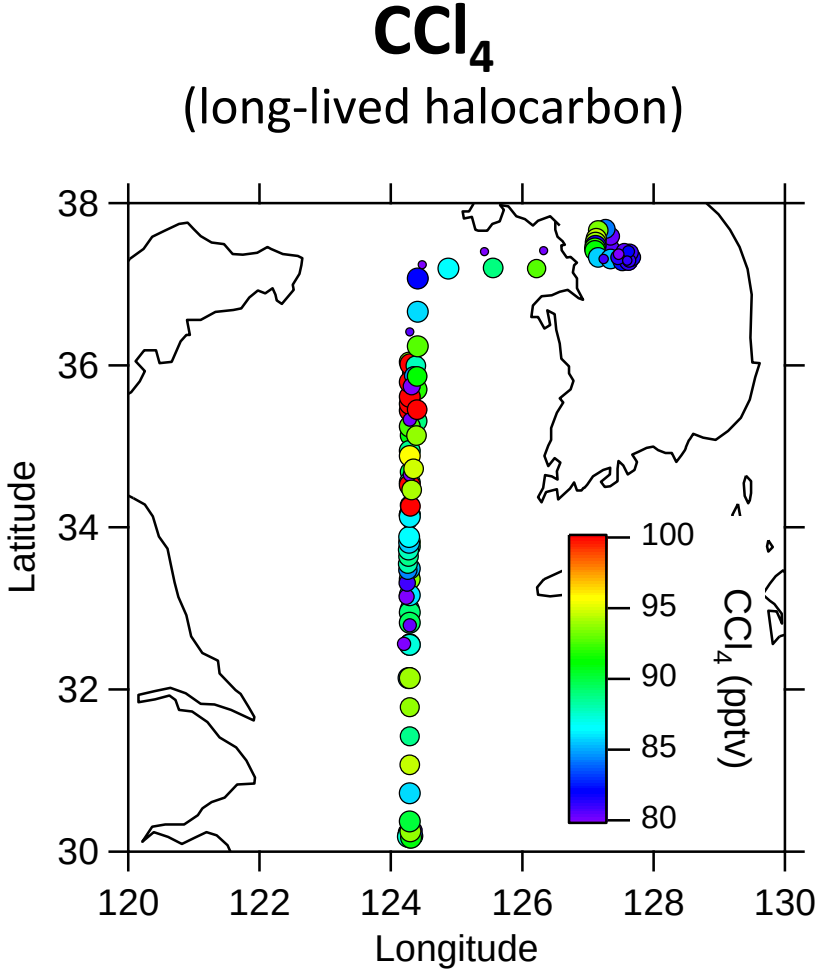
1. Urban sampling (May 2)

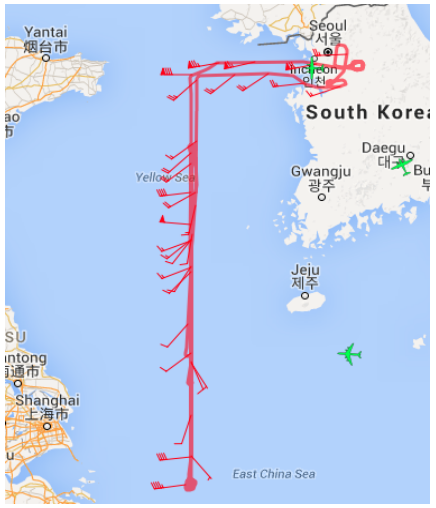




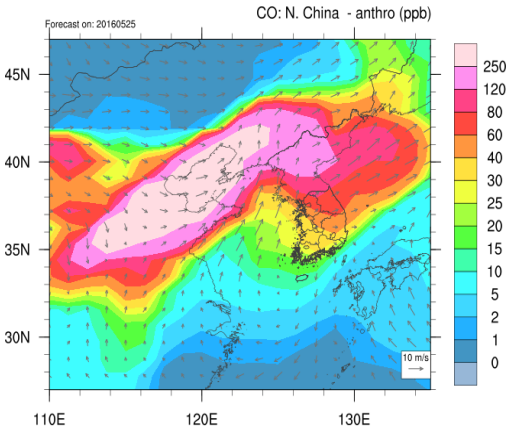
Example of urban influence in the Seoul region

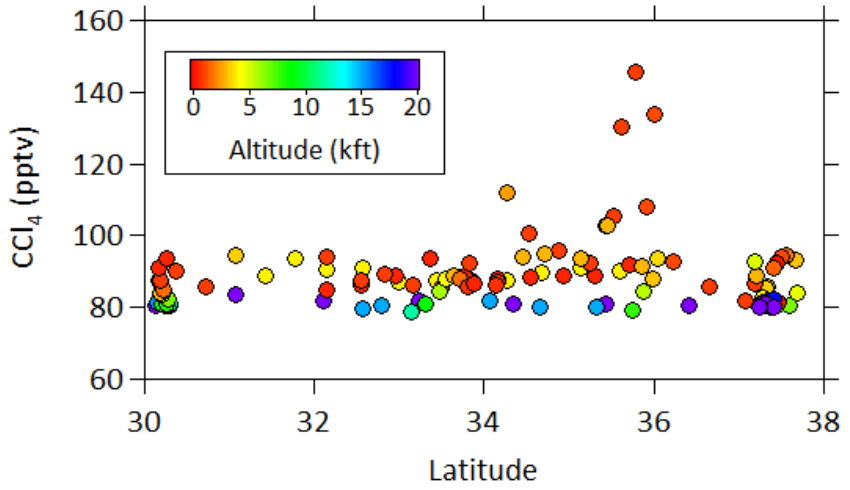
2. Transport from China (May 25)





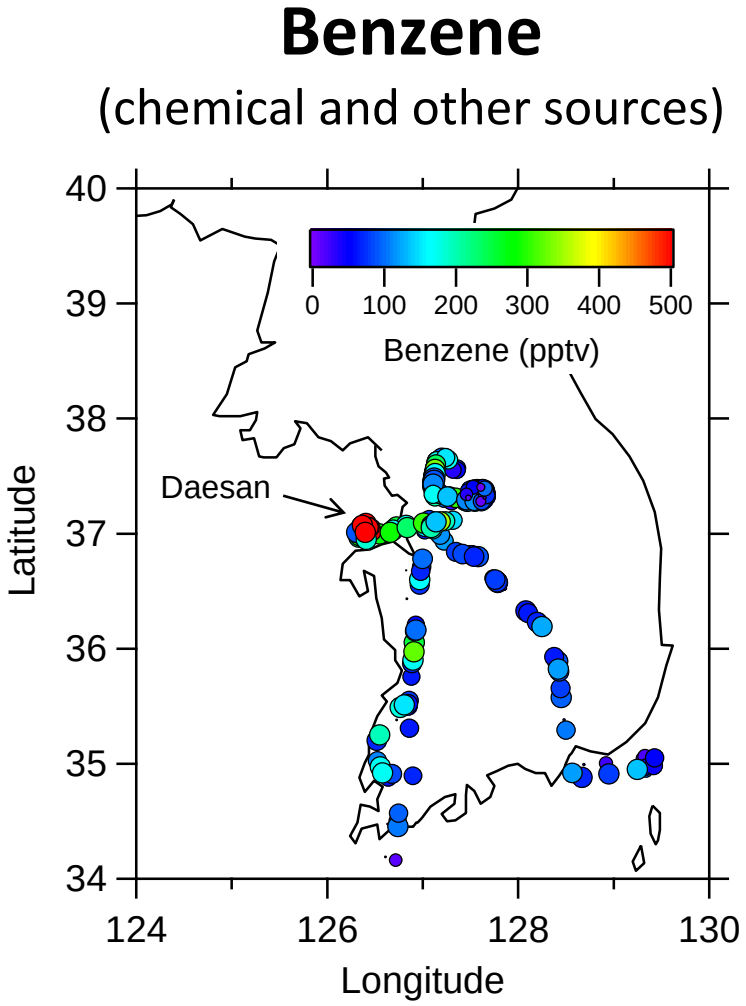
KORUS CAM-chem CO: N. China anthro
Surface, May 25, 09:00 KST

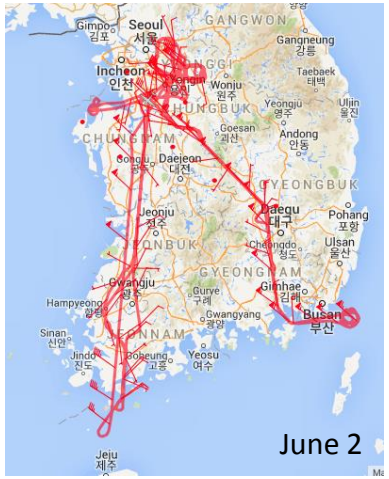


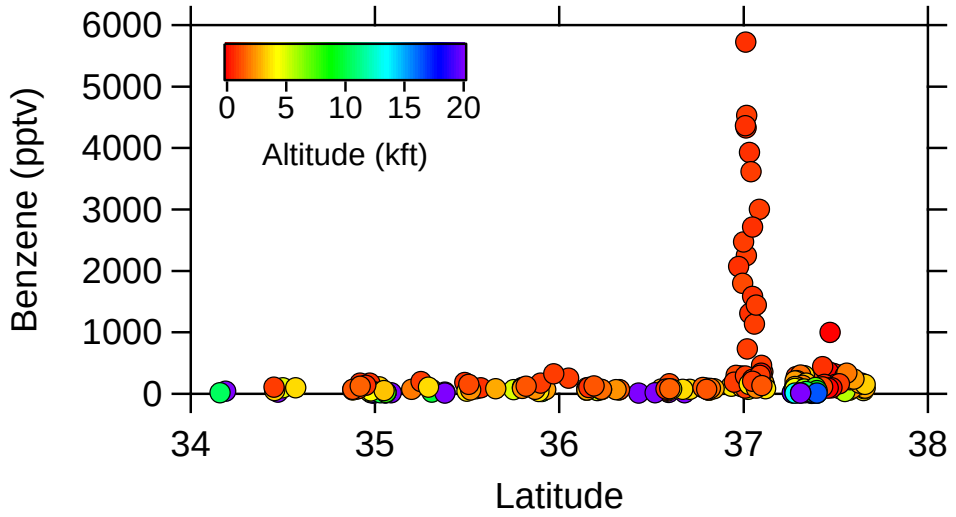


Example of pollution transport from China

3. Chemical facilities (June 2, 3)





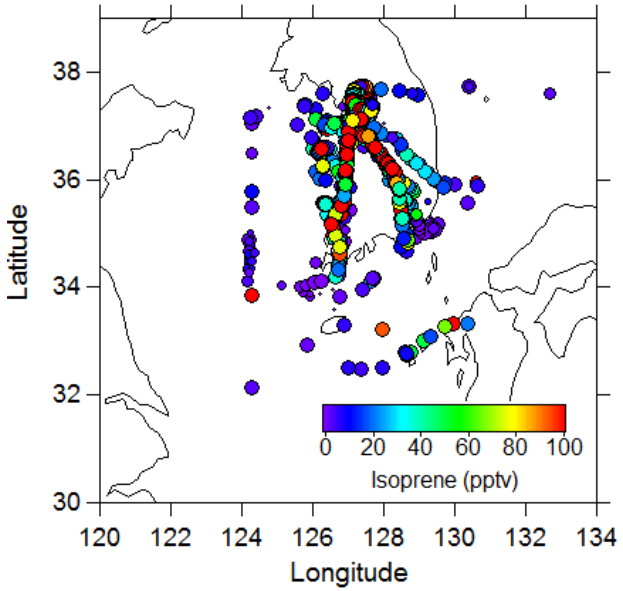


Example of point source sampling

KORUS-AQ: All flights

Isoprene

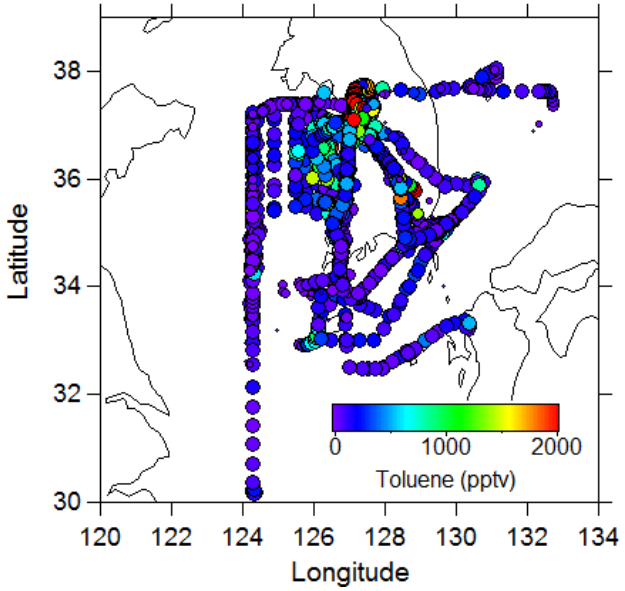
Biogenic tracer
Lifetime ~ 3 hrs



Useful indicator of recent contact with Korean peninsula

Toluene

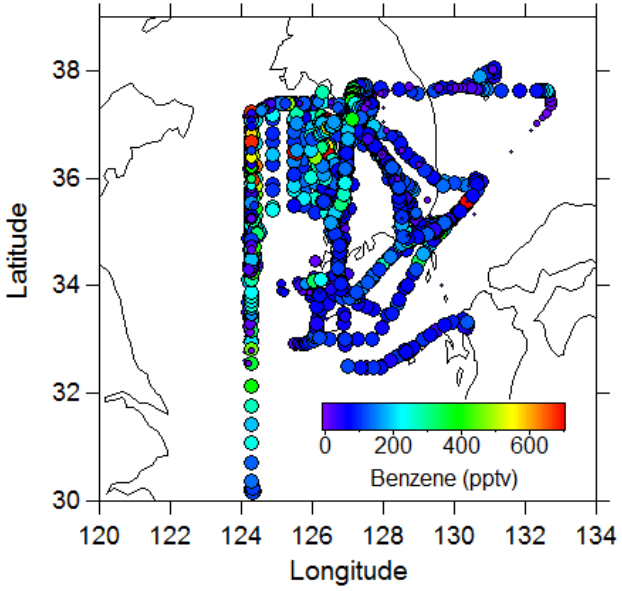
Urban and chemical
Lifetime ~ 2 days



Elevated in Seoul region, chemical plumes

Benzene

Urban and chemical
Lifetime ~ 10 days

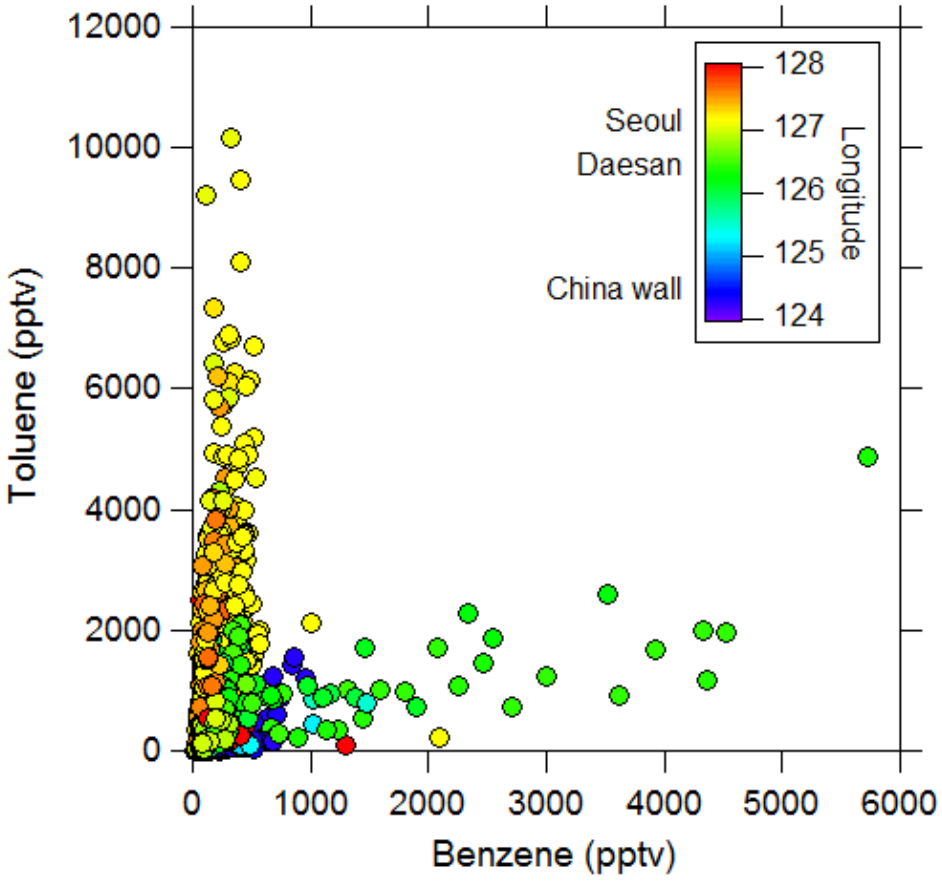


Elevated in chemical plumes, Seoul region, air masses from China

** KORUS-AQ data are preliminary*

Toluene and benzene

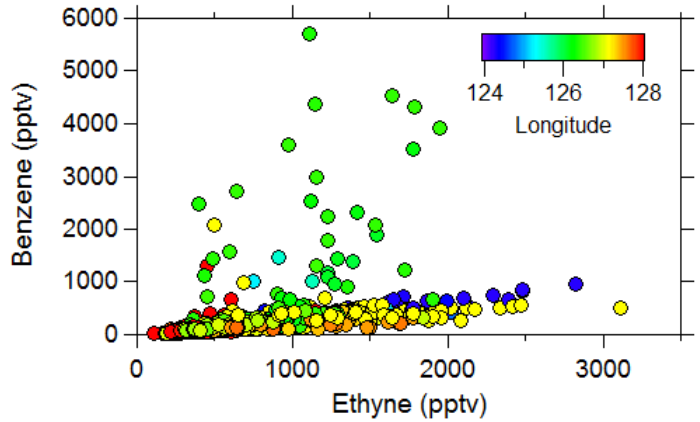
Altitude < 1 km; All KORUS-AQ flights

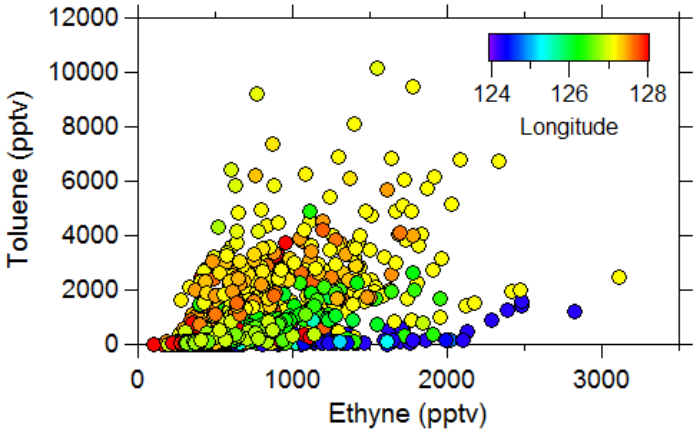


** KORUS-AQ data are preliminary*

Toluene/benzene

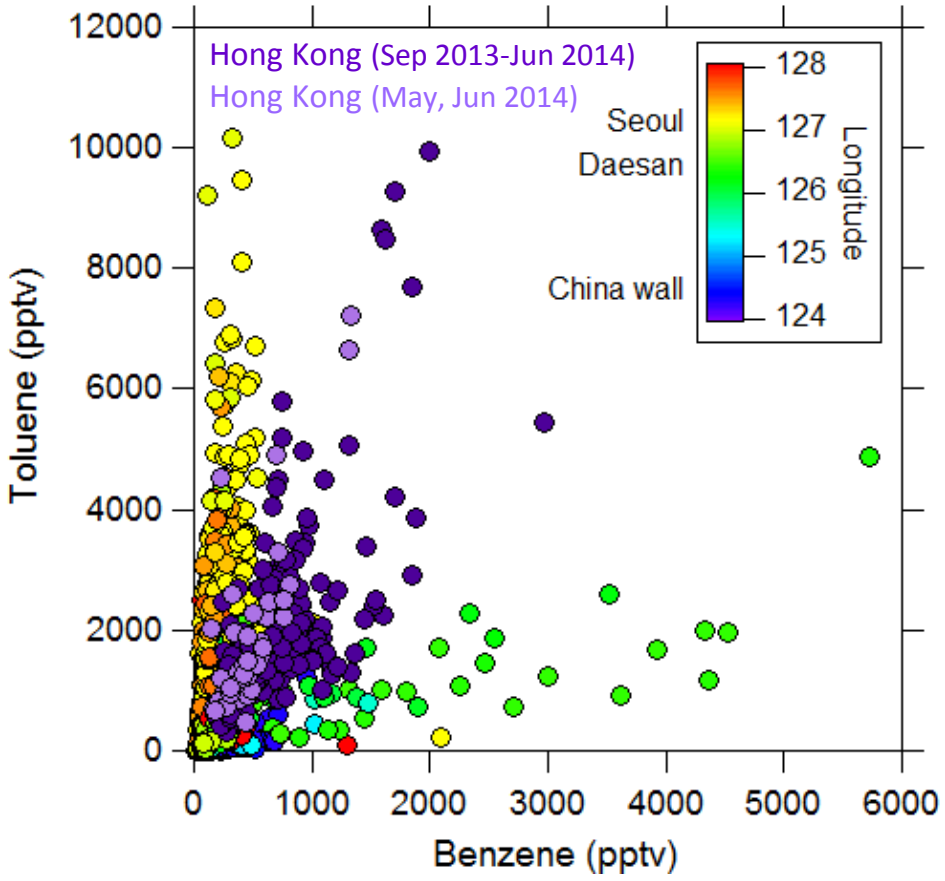
- Benzene-rich **chemical** signal
- Toluene-rich **urban** signal





Toluene and benzene

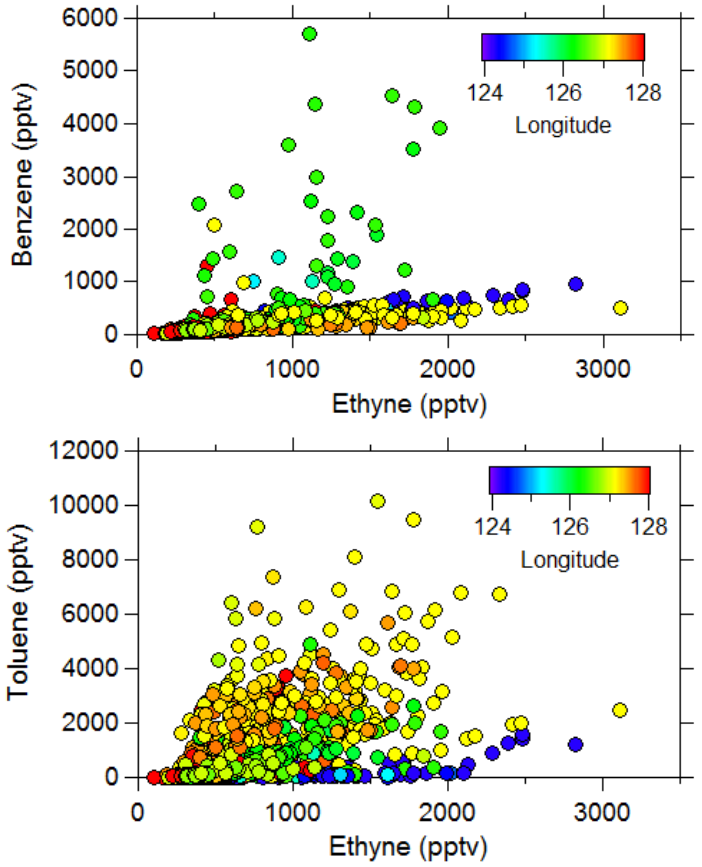
Altitude < 1 km; All KORUS-AQ flights



** KORUS-AQ data are preliminary*

Toluene/benzene

- Benzene-rich **chemical** signal
- Toluene-rich **urban** signal



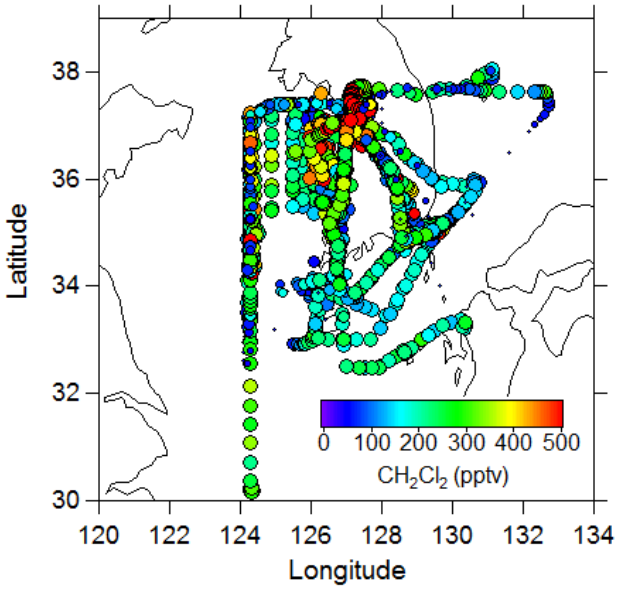
Lyu et al., 2016; unpublished UCI data

KORUS-AQ: All flights

CH_2Cl_2

Solvent

Lifetime ~ 5 mo



Background ~ 100 pptv

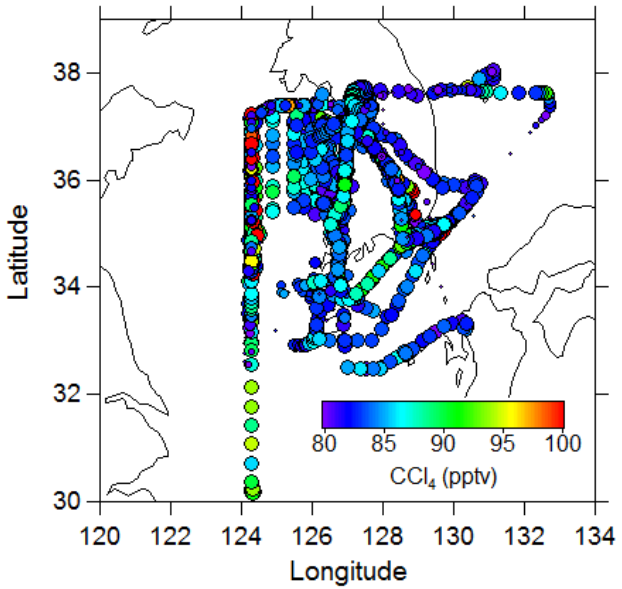
Max = 7500 pptv (Korea)*

Max = 830 pptv (China)*

CCl_4

Feedstock

Lifetime ~ 33 yrs*



Background ~ 80 pptv

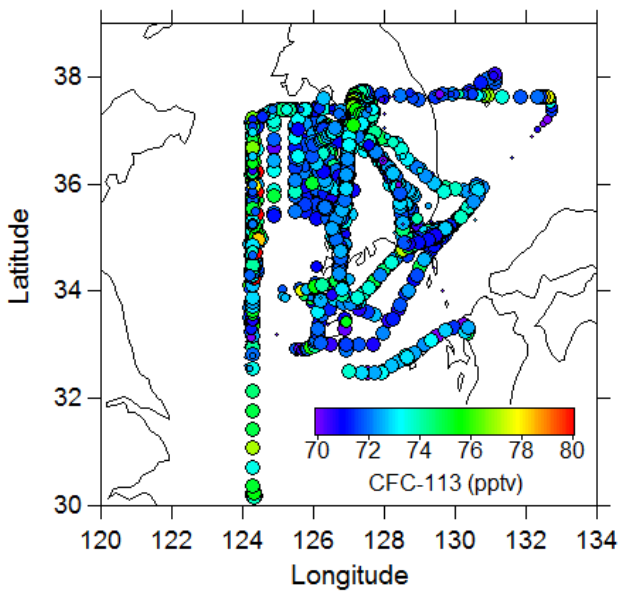
Max = 106 pptv (Korea)*

Max = 145 pptv (China)*

CFC-113

Urban and chemical

Lifetime ~ 85 yrs



Background ~ 72 pptv

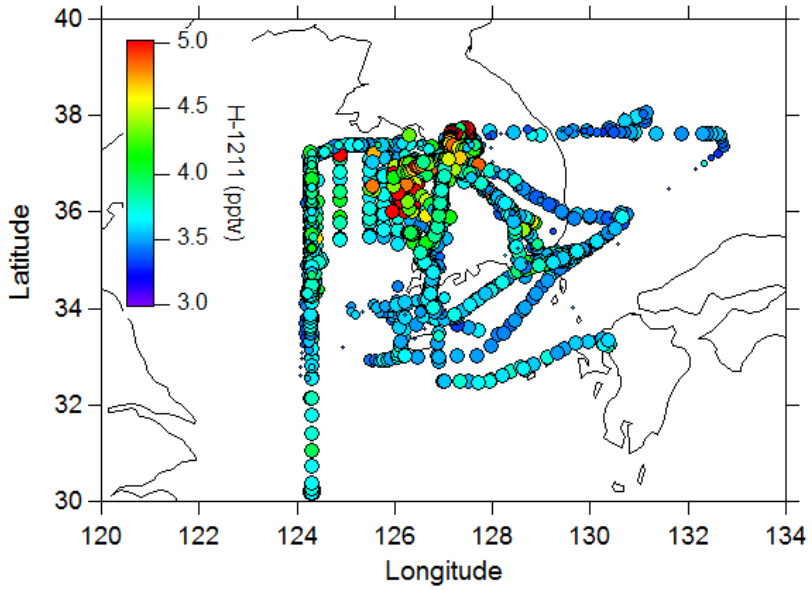
Max = 82 pptv (Korea)*

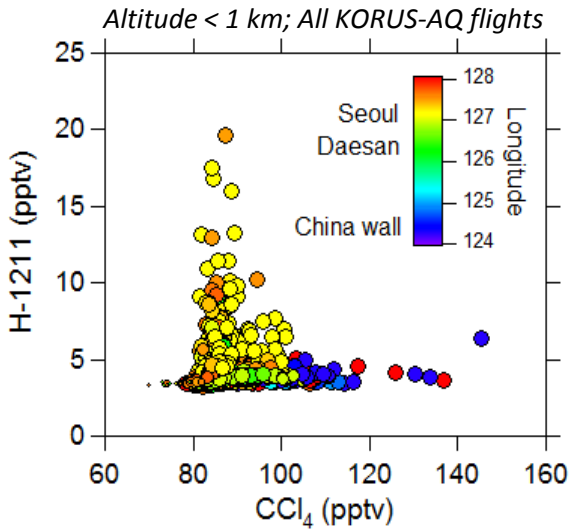
Max = 280 pptv (China)*

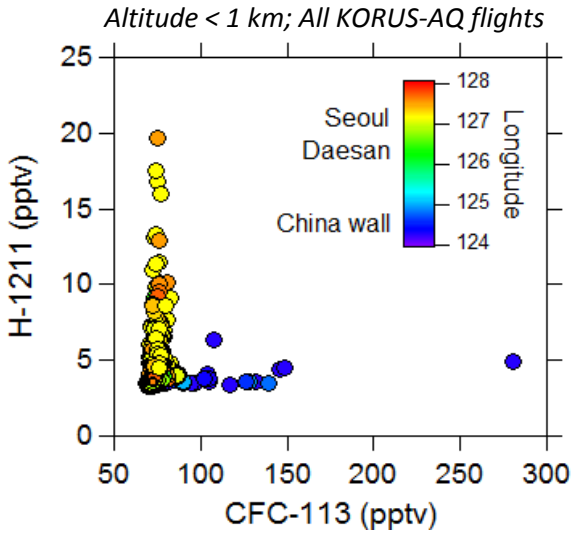
** KORUS-AQ data are preliminary*

** SPARC (2016)*

Halon-1211: Clear Korean signal







H-1211

- Fire extinguishing agent
- Lifetime 16 yrs
- Background ~ 3.5 pptv
- Globally declining

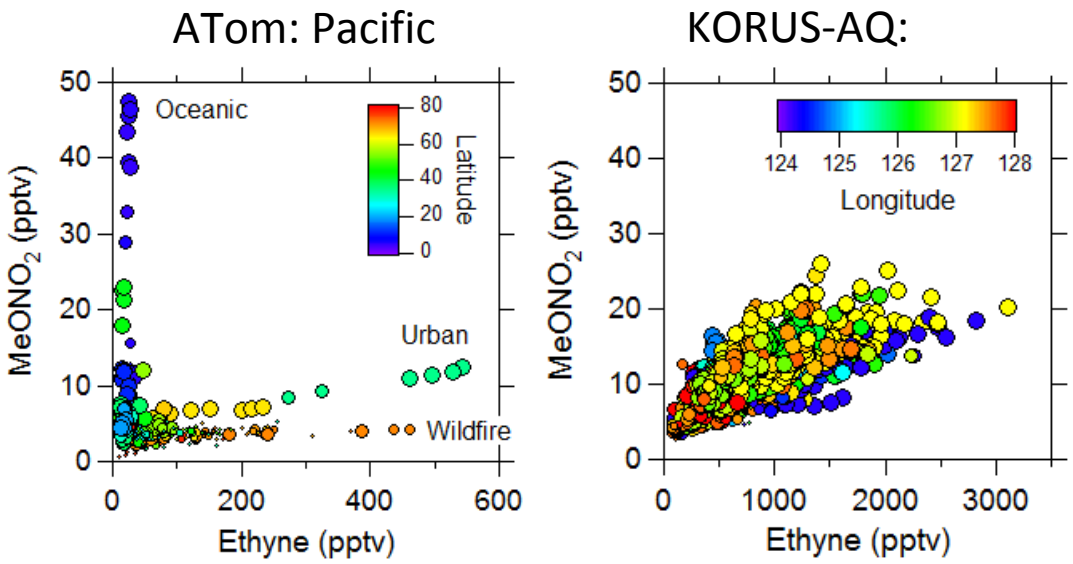
- Tracer of air from China in previous missions (TRACE-P[a], INTEX-B[b])

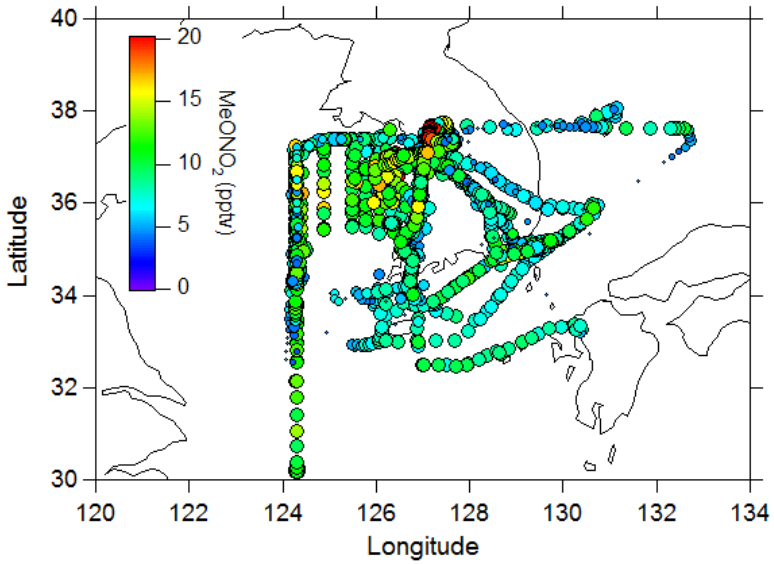
- Highest concentrations in Korean samples during KORUS-AQ

** KORUS-AQ data are preliminary*

[a] *Blake et al., 2003;* [b] *Barletta et al., 2009*

Methyl nitrate: Signal looks urban





$MeONO_2$

- Equatorial ocean source
- Slow photochemical source
- Lifetime ~ 1 month

- Previously our group has seen high $MeONO_2$ levels in urban Hong Kong (>25 pptv)
  - Explained by photochemistry[a, b]

- $MeONO_2$ during KORUS-AQ also looks urban based on correlation with ethyne and other secondary $RONO_2$

** All data are preliminary*

[a] Simpson et al., 2006; [b] Archibald et al., 2007

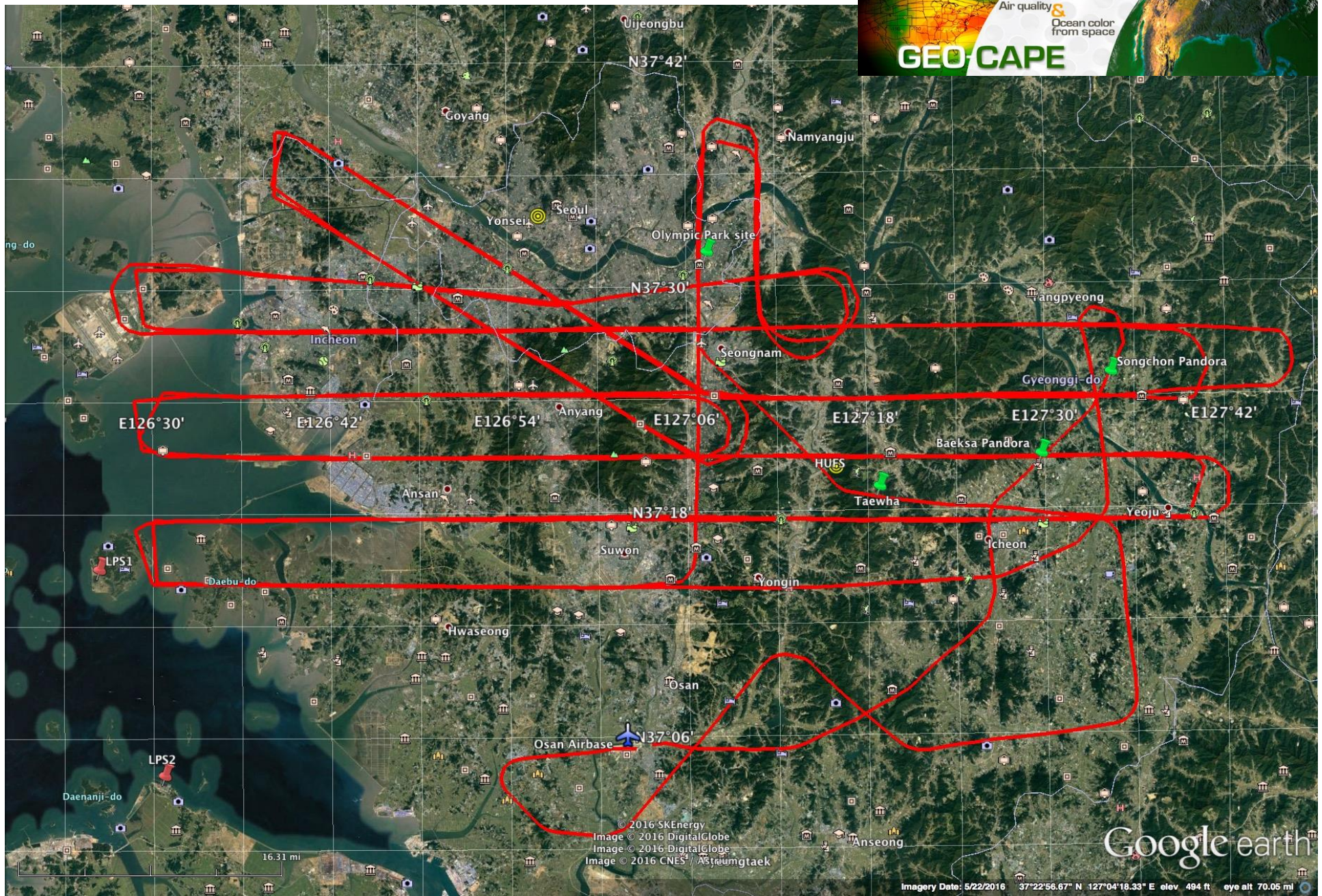
Thank you!

UCIrvine University of California, Irvine

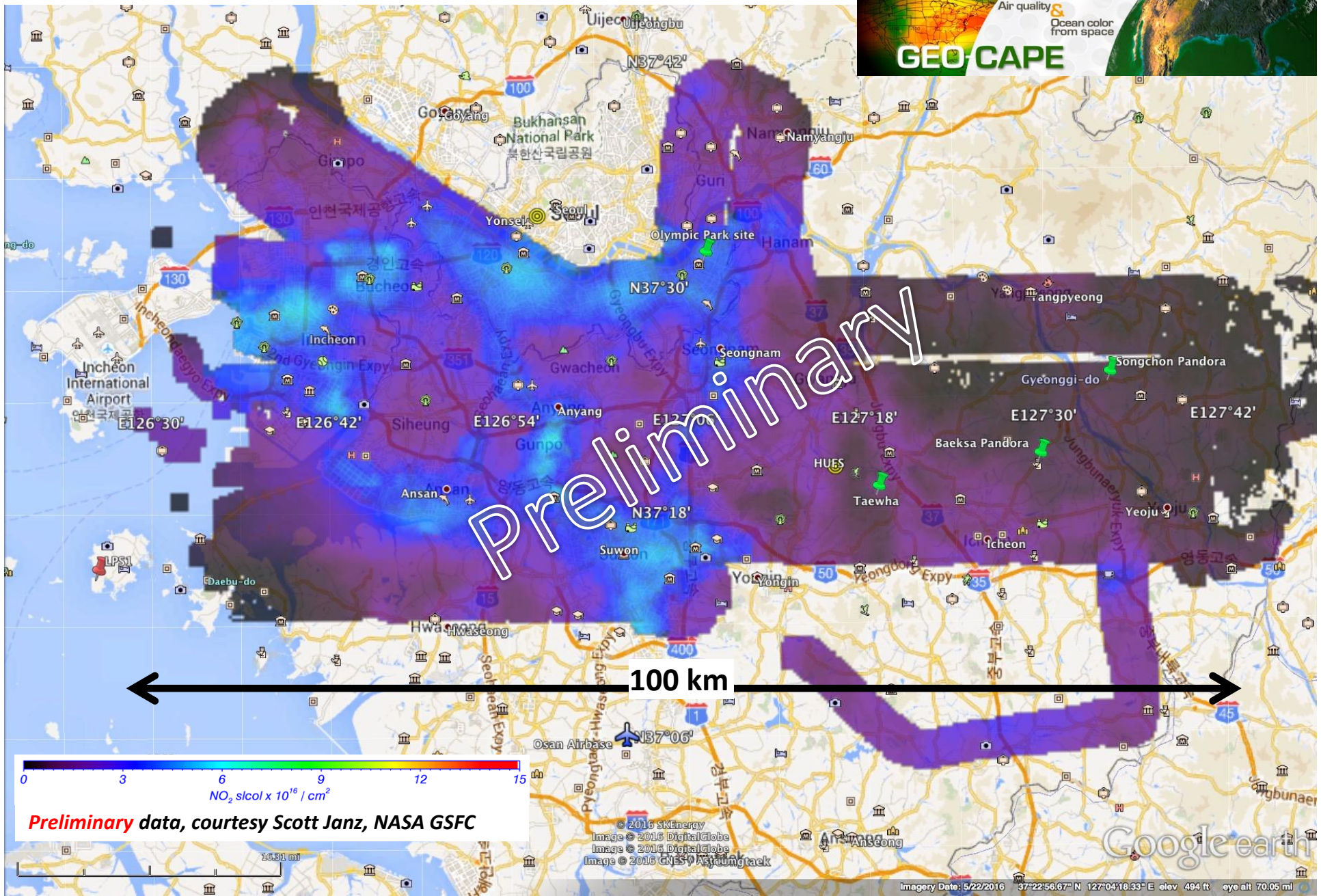
KORUS-AQ

NASA

NASA King Air with GeoTASO and MOS onboard: 2016/06/09 ground track for morning flight (2 circuits)



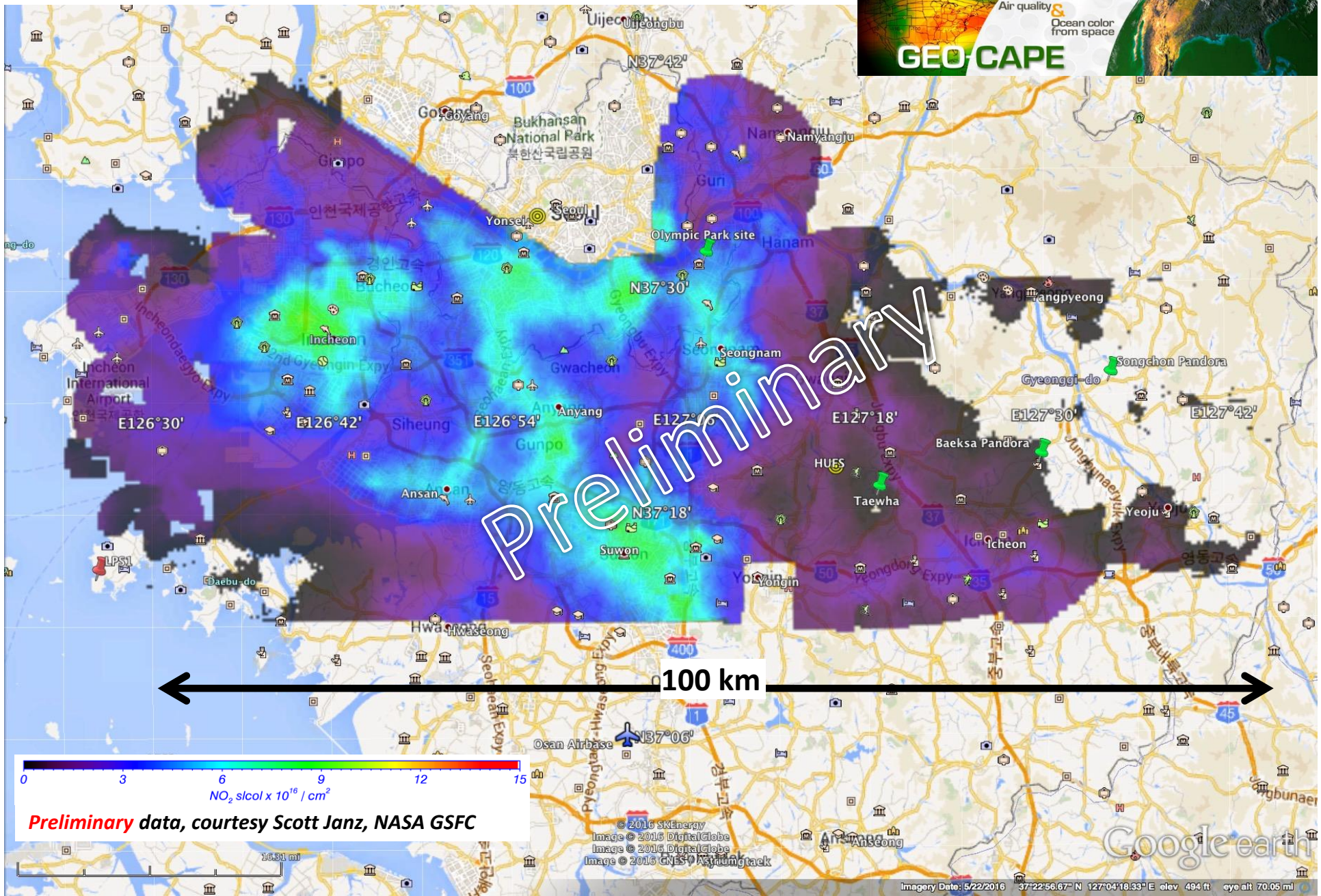
GeoTASO Quick-look differential slant column NO_2
2016/06/09, 8:00-10:00 AM local time



GeoTASO Quick-look differential slant column NO_2
2016/06/09, 10:00 AM-12:00 PM local time

KORUS-AQ

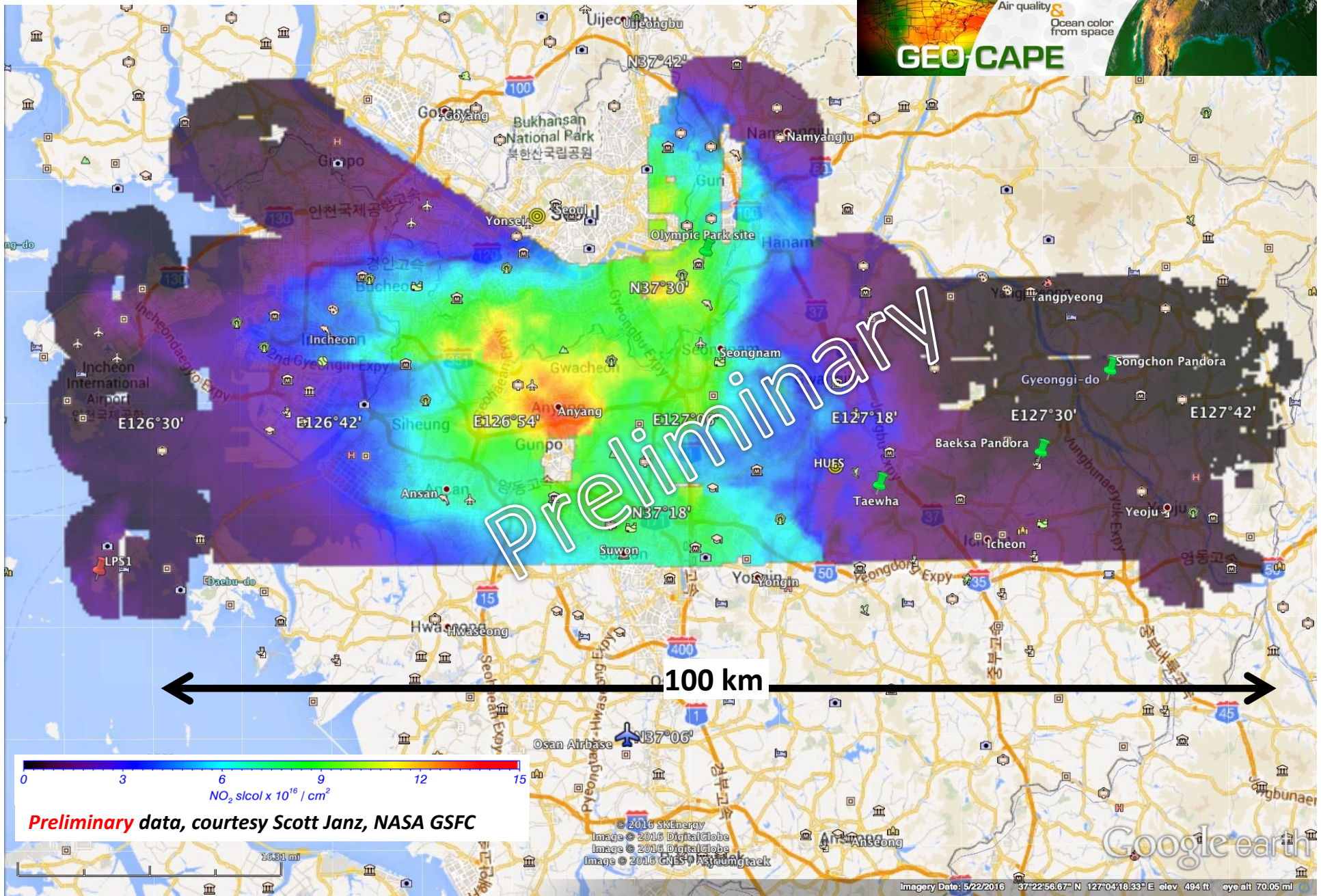
GEO-CAPE: Air quality & Ocean color from space



GeoTASO Quick-look differential slant column NO_2
2016/06/09, 2:00-4:00 PM local time

KORUS-AQ

GEO-CAPE: Air quality & Ocean color from space



GeoTASO Quick-look differential slant column NO_2
2016/06/09, 4:00-6:00 PM local time

KORUS-AQ

GEO-CAPE: Air quality & Ocean color from space