Ultrafine Particles Near Airports

WA State Proviso

- "… the university of Washington school of public health to study the air quality implications of air traffic at the international airport in the state that has the highest total annual number of arrivals and departures.

- … an assessment of ultrafine particulate matter in areas surrounding and directly impacted by air traffic generated by the airport…

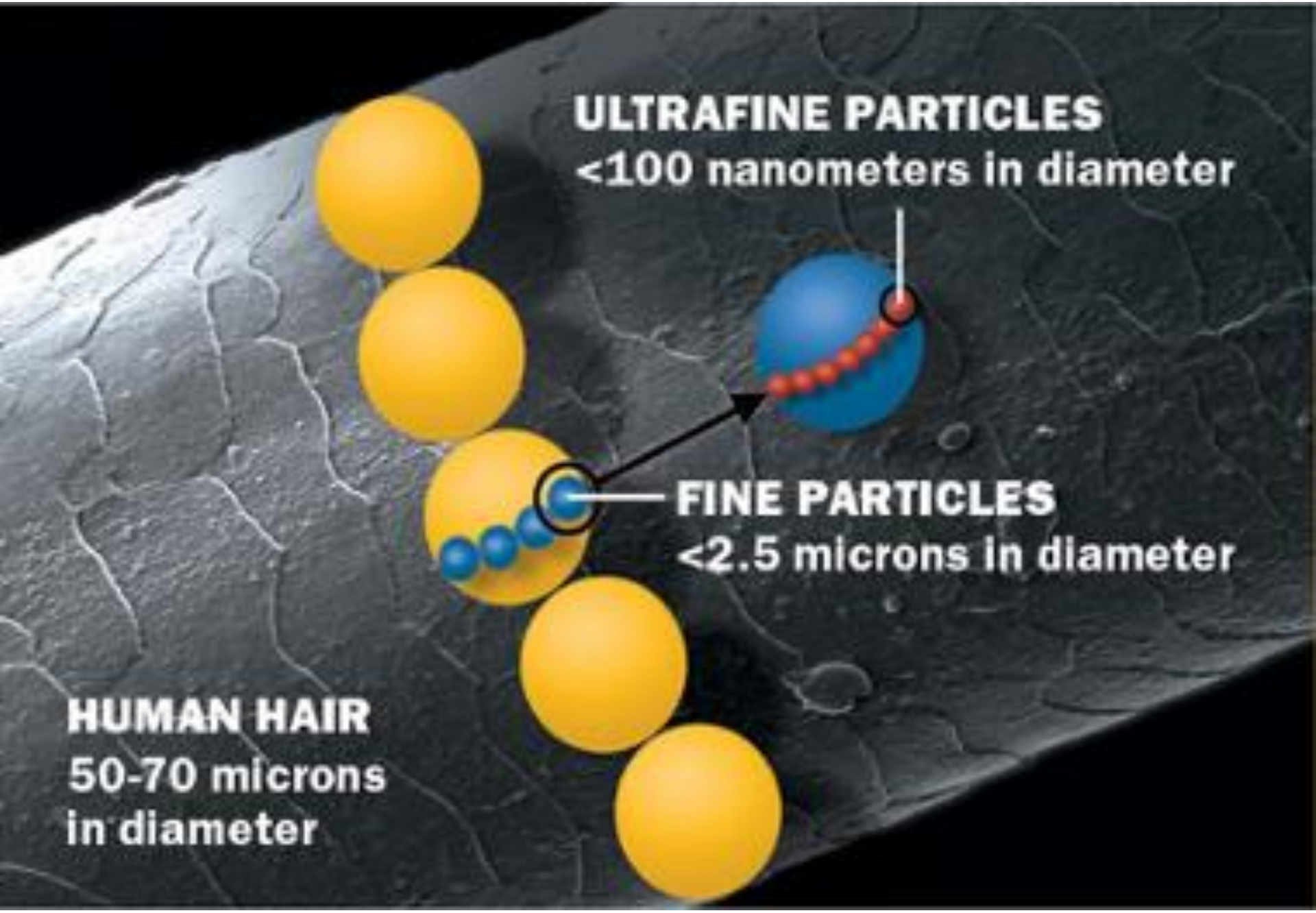
- including areas within 10 miles of the airport in the directions of aircraft flight paths and within 10 miles of the airport where public agencies operate an existing air monitoring station…

WA State Proviso

- … distinguish between aircraft and other sources of ultrafine particulate matter
- … compare concentrations of ultrafine particulate matter in areas impacted by… air traffic with… areas that are not impacted by… air traffic.
- …coordinate with local governments … share results and inclusively solicit feedback from community members.
- December 1, 2019 submit report.

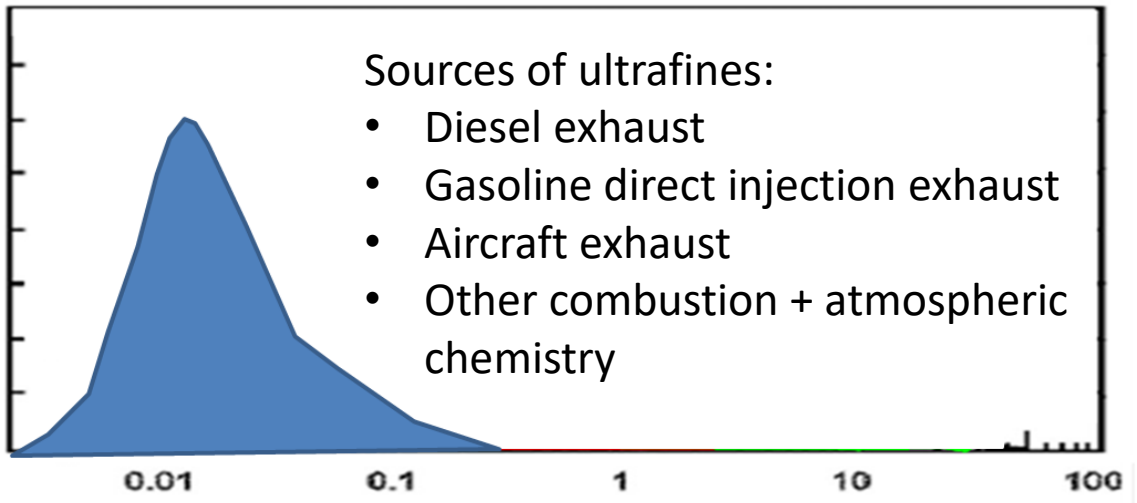
Outline

- Background on Ultrafine Particles
- Previous Airport Studies
- The Mobile ObserVations of Ultrafine Particles (MOV-UP) Study Methods
- Progress to date

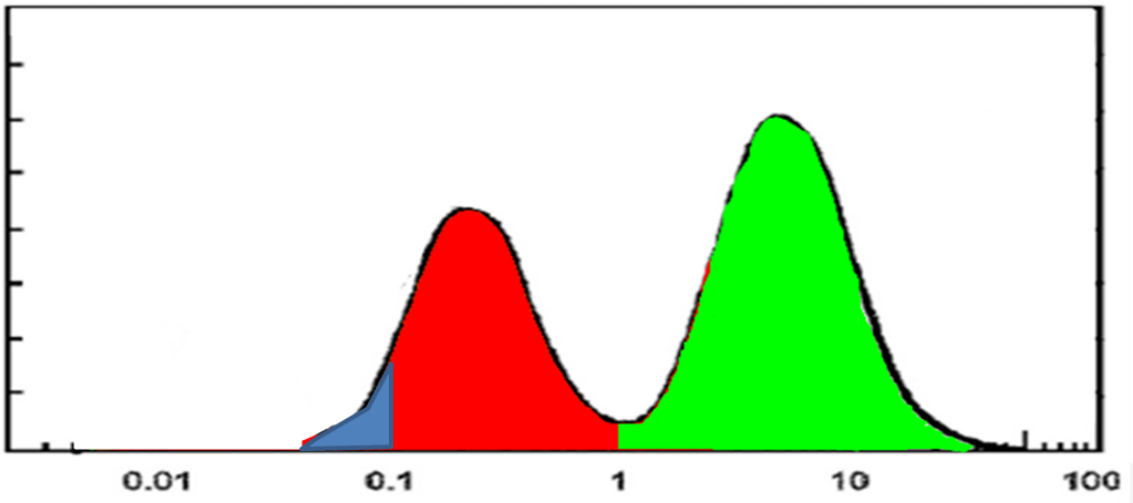

ULTRAFINE PARTICLES
<100 nanometers in diameter
FINE PARTICLES
<2.5 microns in diameter
HUMAN HAIR
50-70 microns
in diameter

‘Ultrafine’ Particles

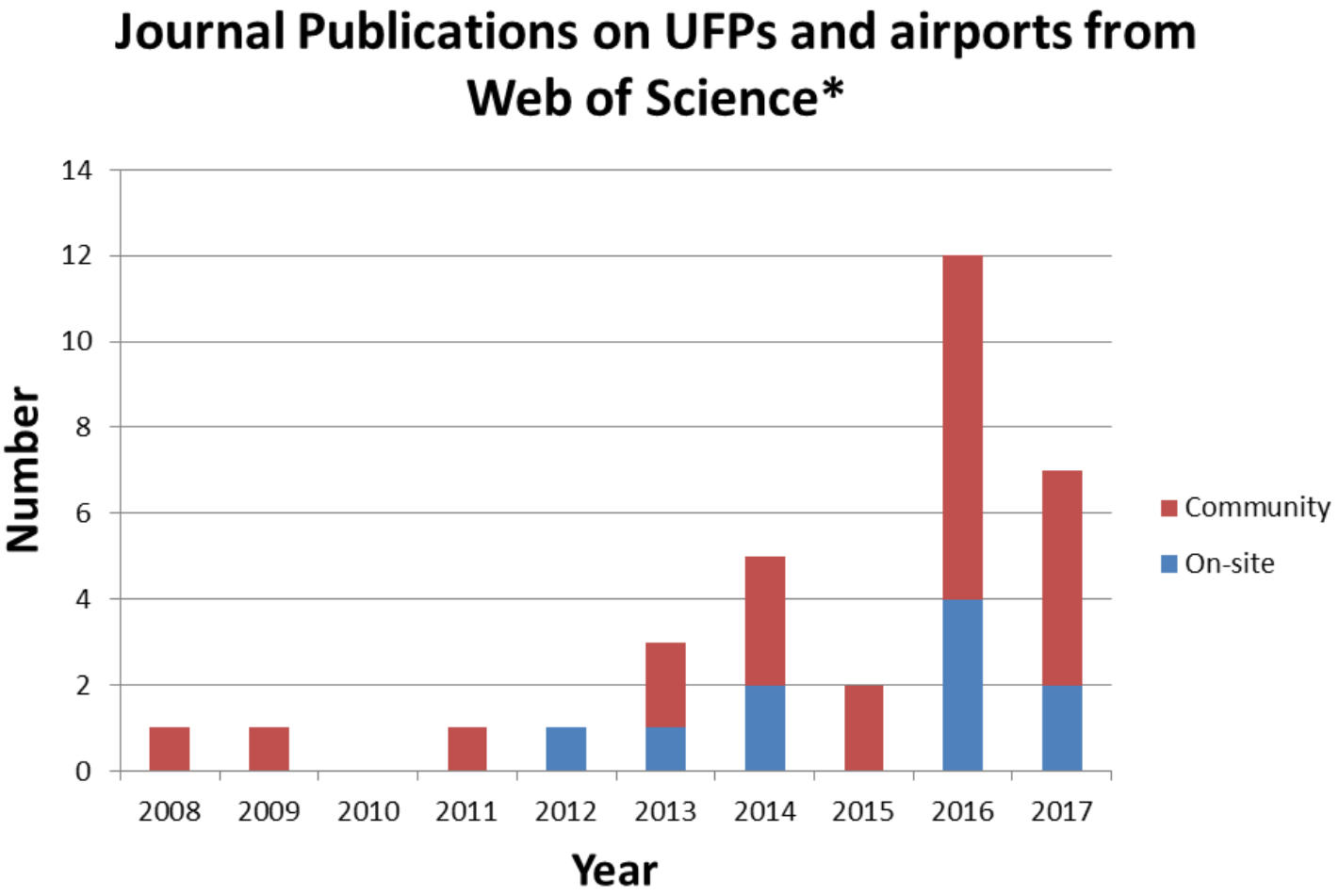
Relative Number



Relative Mass



Particle Diameter (micrometers)



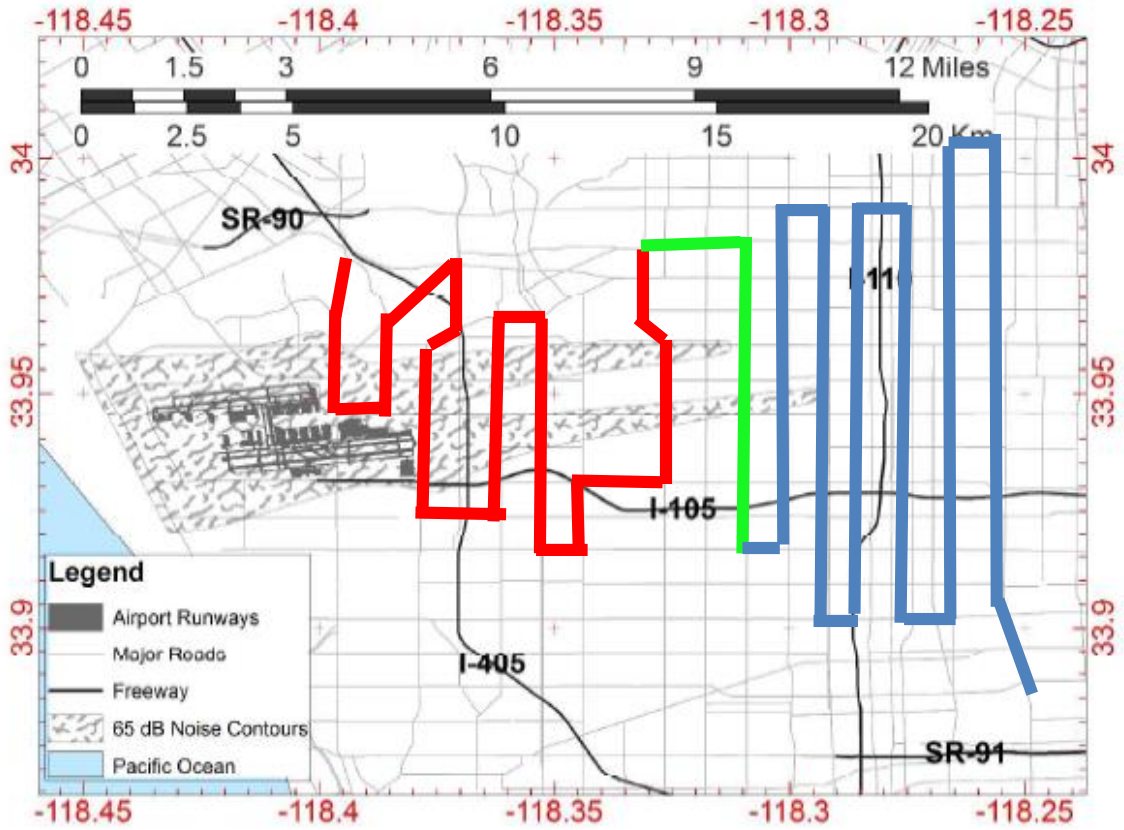
*search terms: “airports”& “ultrafine particles”

A selection of cities with published studies of airport UFP impacts

Distance from airport to monitoring site		
< 1km	1 to 10 km	> 10 km
Tianjin, China	London, England	Los Angeles, CA
Rome, Italy	Los Angeles, CA	Amsterdam, NL
Venice, Italy	Norwich, England	Atlanta, GA
Taipei, Taiwan	Boston, MA	New York, NY*
Oakland, CA	Warwick, RI	
Santa Monica, CA		

*La Guardia

Non-freeway Sampling Routes near LAX



USC platform

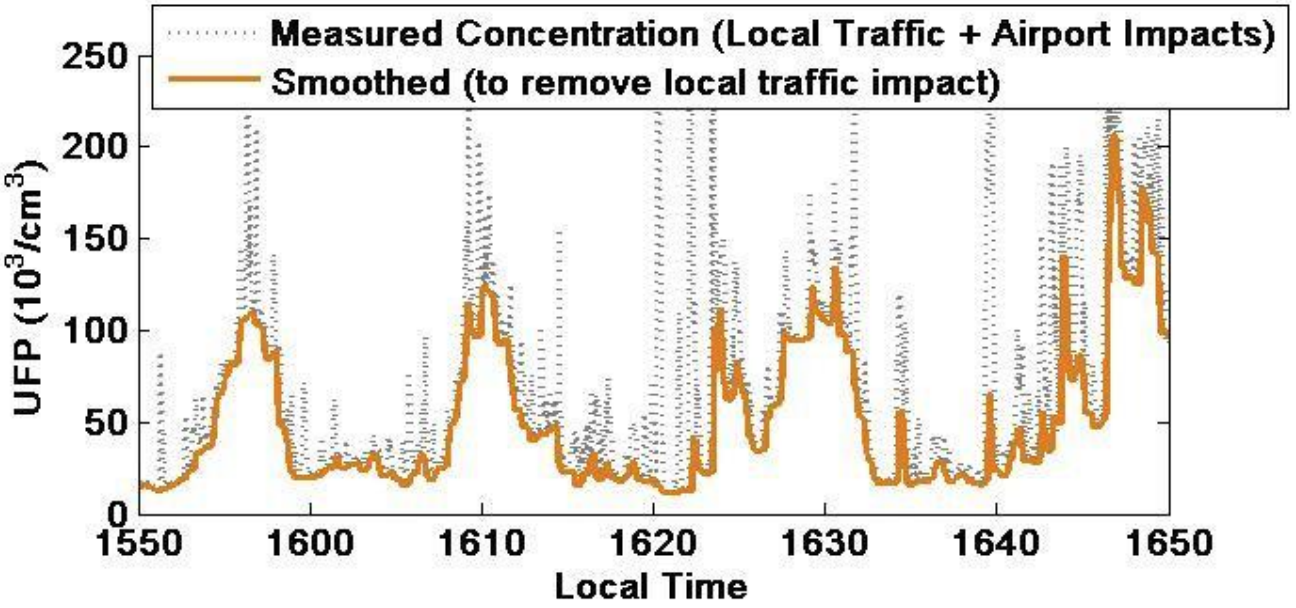
UW platform

both

Hudda et al, 2014

Examining Local Background Values Reveals the Aircraft Impacts

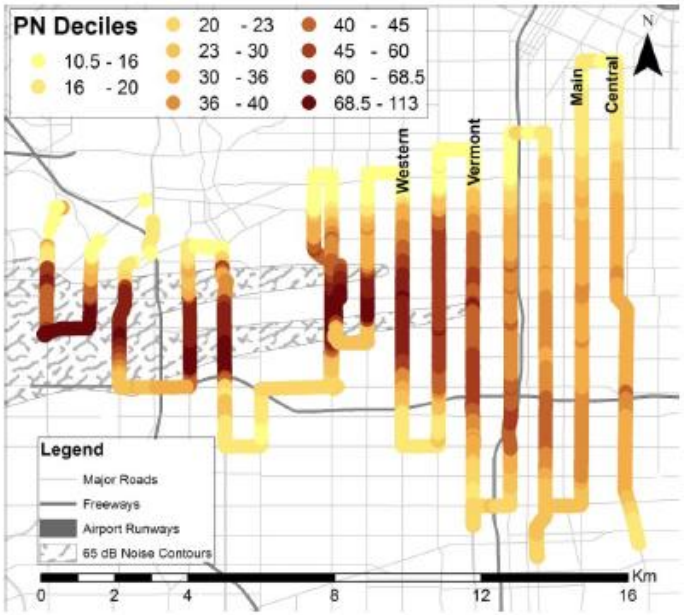
- Apply rolling 5th percentile of 1 second data using a 30 second window
- This removes local scale impacts



Hudda et al, ES&T 2014

Area-weighted number concentration equivalent to ~ half the freeways in LA!

10^3/cc



Particle size between ~10 and 30 nm diameter are present at high concentrations at ground level

Hudda et al, ES&T 2014

Review of Health Effects

- The goal of the current phase of the project is to conduct air monitoring to assess ultrafine particle levels near the airport.
- This current phase is not a health effects study.
- For a brief review of health effects associated with ultrafine particles, see slides from our presentation at the Highline Forum on Nov 15, 2017.

Summary

- High concentrations of UFP downwind of busy airports (<20km), but no prior measures at SeaTac.
- The mobile monitoring methodology has been able to reveal downwind footprint in other studies.
- Health effects of UFPs is limited largely to roadway traffic studies, which are suggestive of associations with cardiovascular, respiratory, and possibly cancer health effects.
- Only one airport UFP health effect study that we're aware of, conducted in Los Angeles on a group of asthmatic adults, which observed an increase in inflammatory blood markers and a reduction in lung function with short-term exposures.

MOV-UP Study

Mobile ObserVations of Ultrafine Particles (MOV-UP) Study

Process

- Form a Study Advisory Group made up of government and non-governmental stakeholders that meets regularly to provide input on the study methods and interpretation of findings.
- Also, meet regularly with the public to provide updates on progress.
- Create a project website to provide updates on study goals, methods, and findings.
- Collect ultrafine particle measurements as directed by the proviso.
- Summarize findings, and make recommendations to the Legislature whether sufficient information is available to proceed with a second phase of the study.

MOV-UP Study

Mobile ObserVations of Ultrafine Particles (MOV-UP) Study

Instruments used in mobile and fixed location sampling

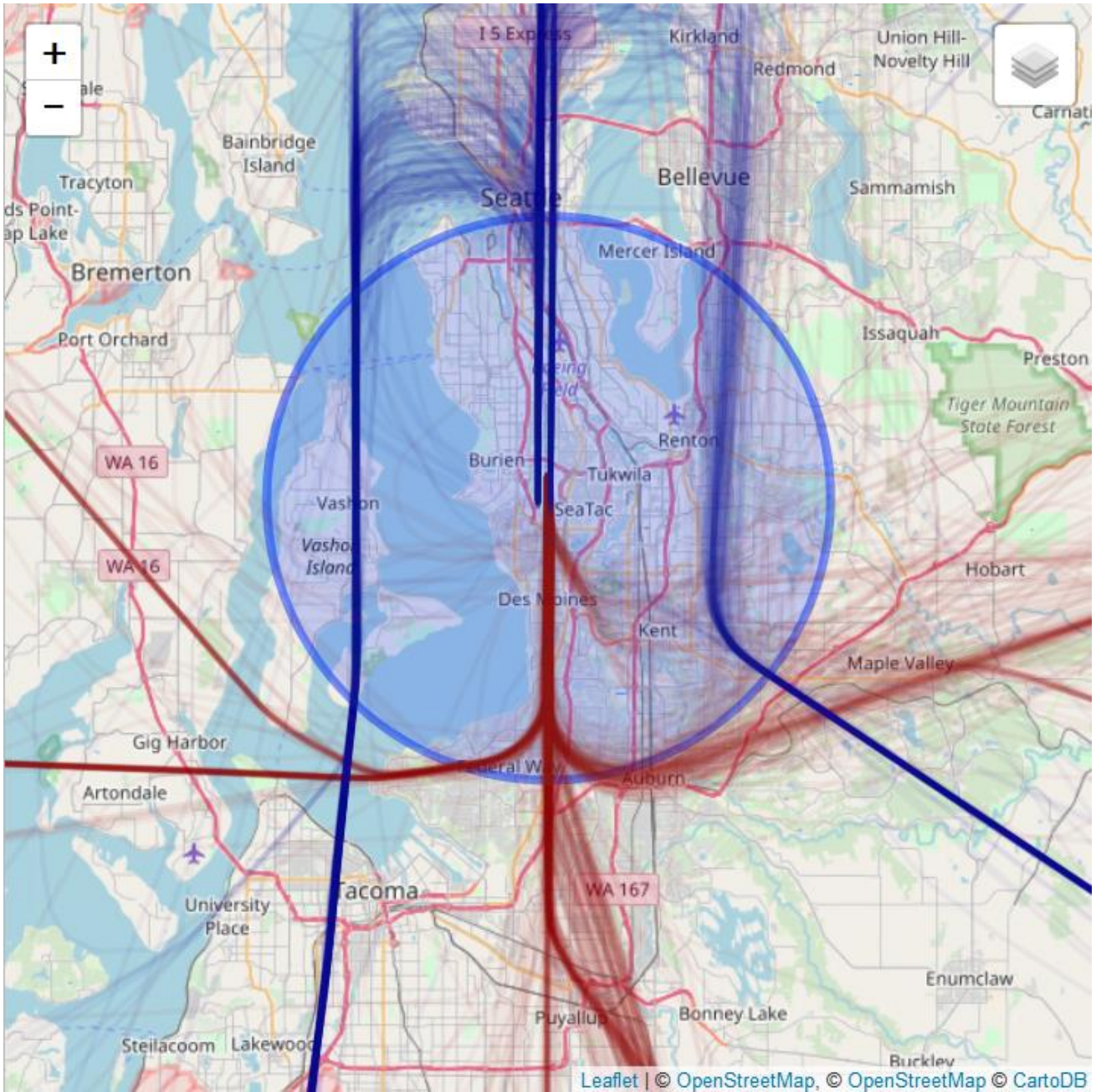
Parameter	Instrument
Ultrafine Particle number concentration	P-Trak 8525 Condensation Particle Counter 3007 NanoScan 3910
Black Carbon mass concentration	Micro-Aethalometer AE51
CO_2 concentration	LI-850 Gas Analyzer
Temperature & Humidity	Hobo T, RH datalogger
Position & Time tracking	GPS Receiver DG-500

TSI, Inc. model 3007 CPC

Mobile Sampling Strategy

- Goal of this work: Can we see the UFP footprint?
- Therefore select sampling days when we expect to see an impact (i.e. no high wind days).
- Sample in all four seasons to ascertain the impact of meteorology on the UFP footprint.
- Evaluate impacts: Do we see footprint at both take-off and landing locations?
- Compare results with measurements taken on the same day at ‘background sites’

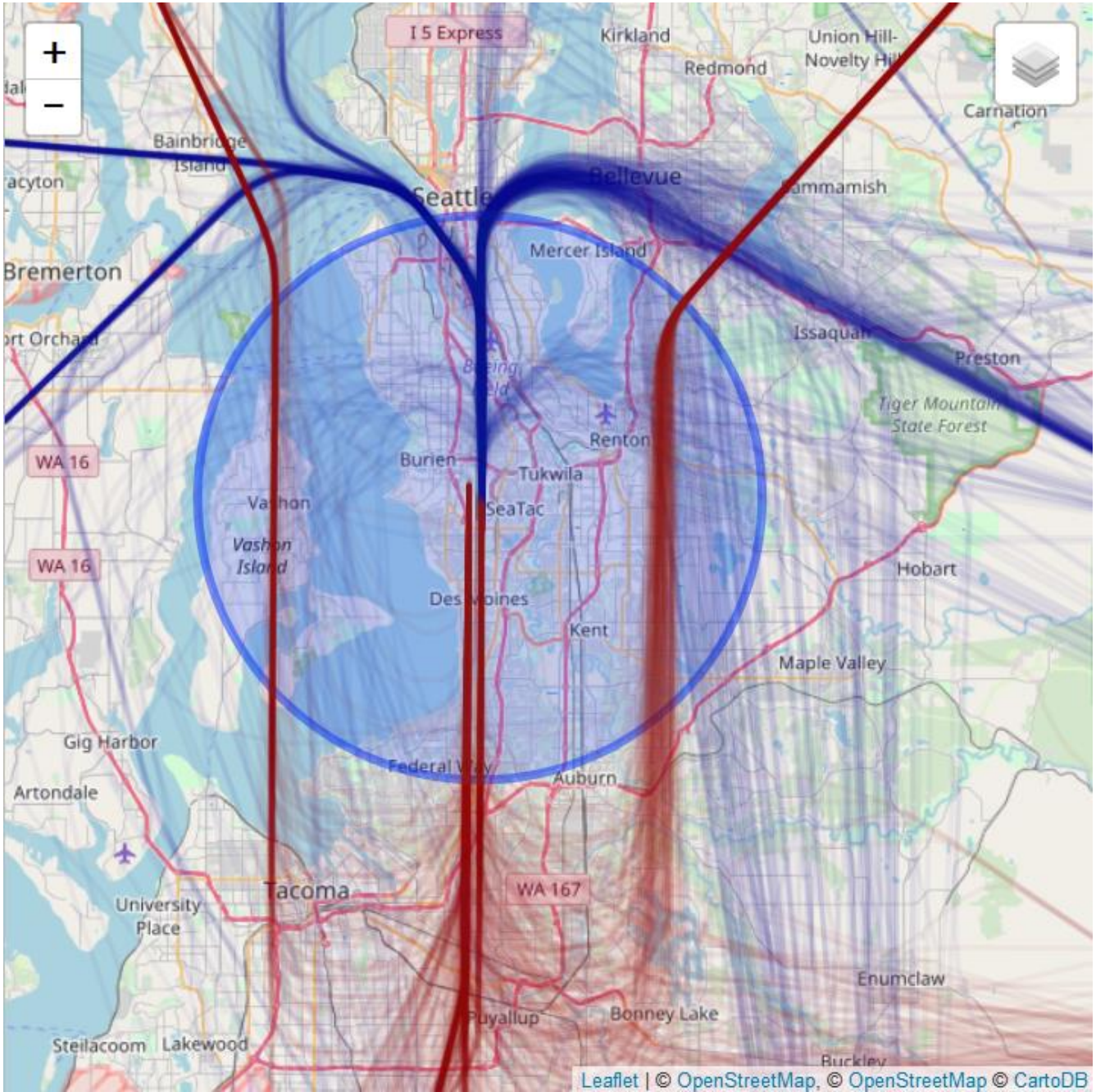
Southerly Winds



Wind (majority)

Aircraft

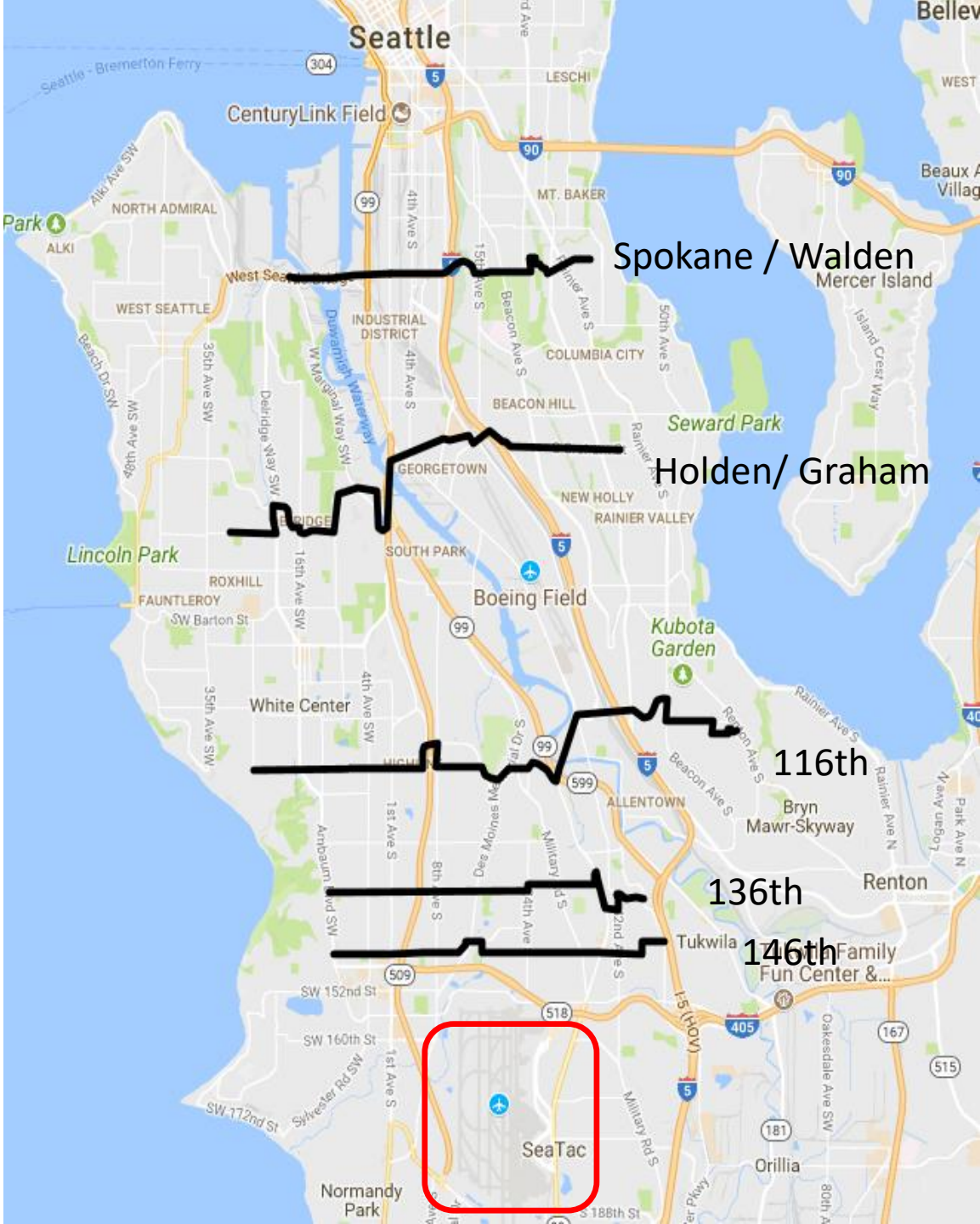
Northerly Winds



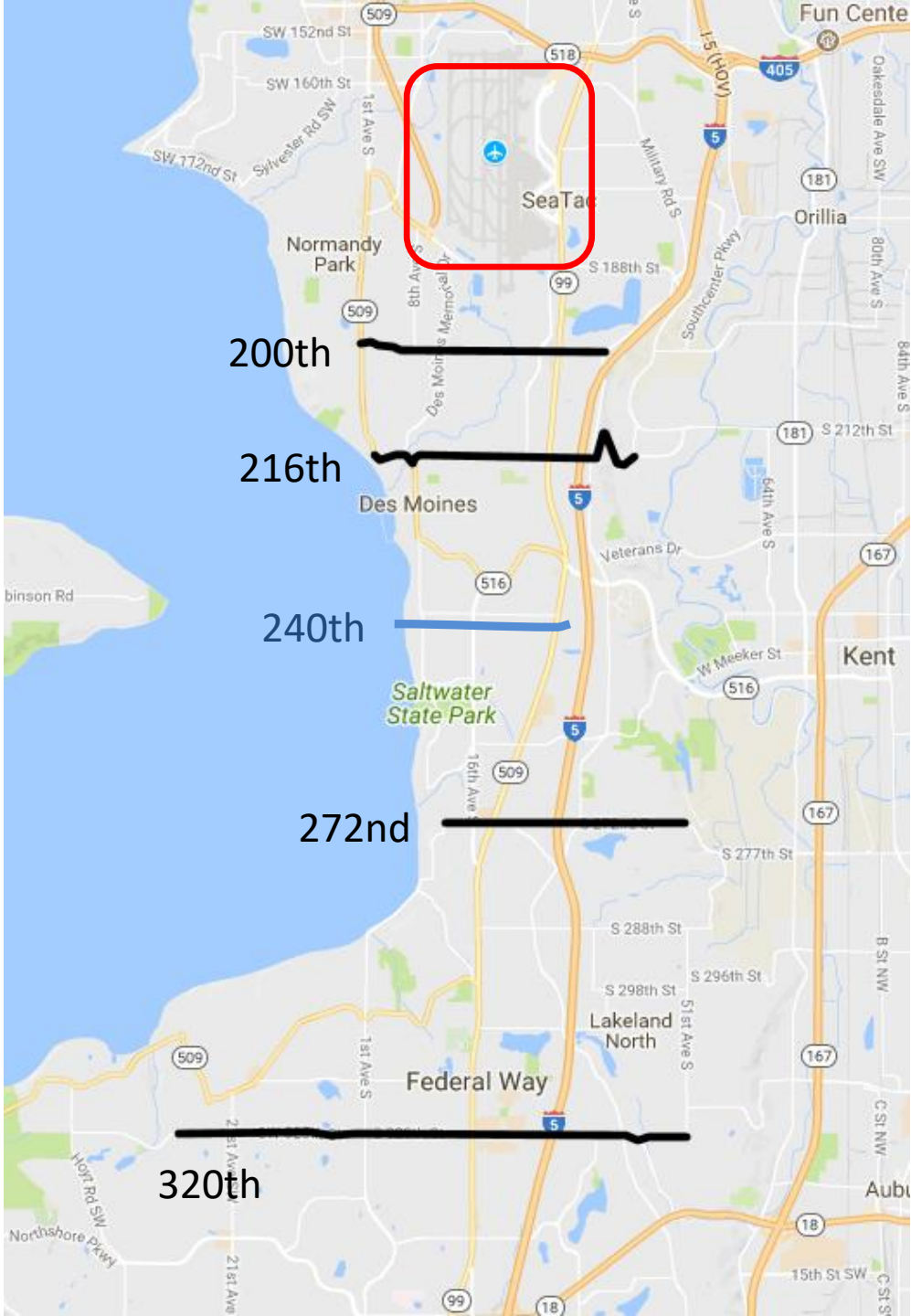
Wind

Aircraft

Proposed Sampling Routes <u>North of Airport</u>

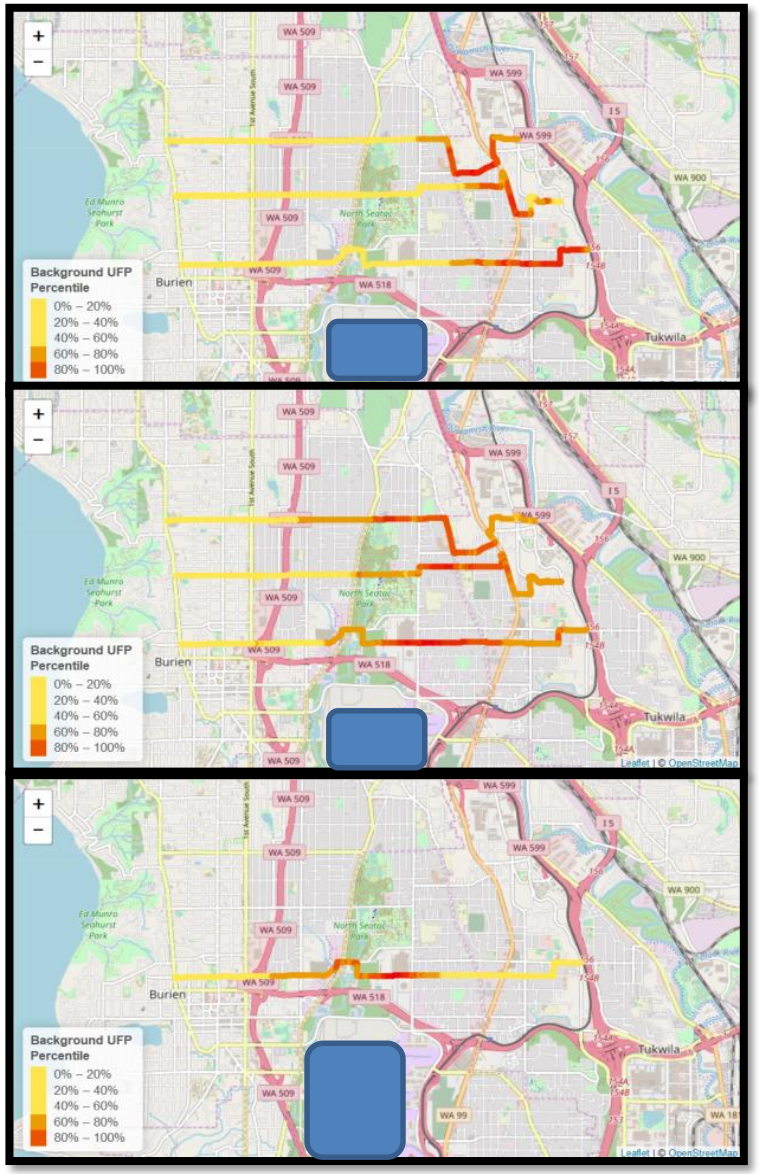


Proposed Sampling Routes <u>South of Airport</u>



Local Background UFP

(Hudda 2014 Method)
(Nov 21) Plume Shifting



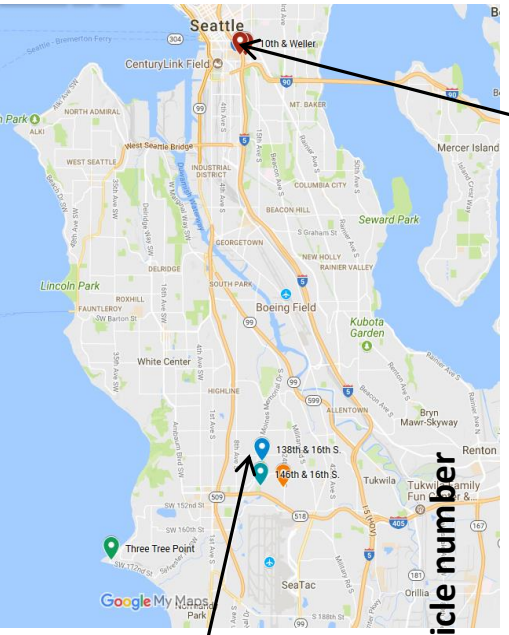
1st Drive

2nd Drive

3rd Drive
(146th only

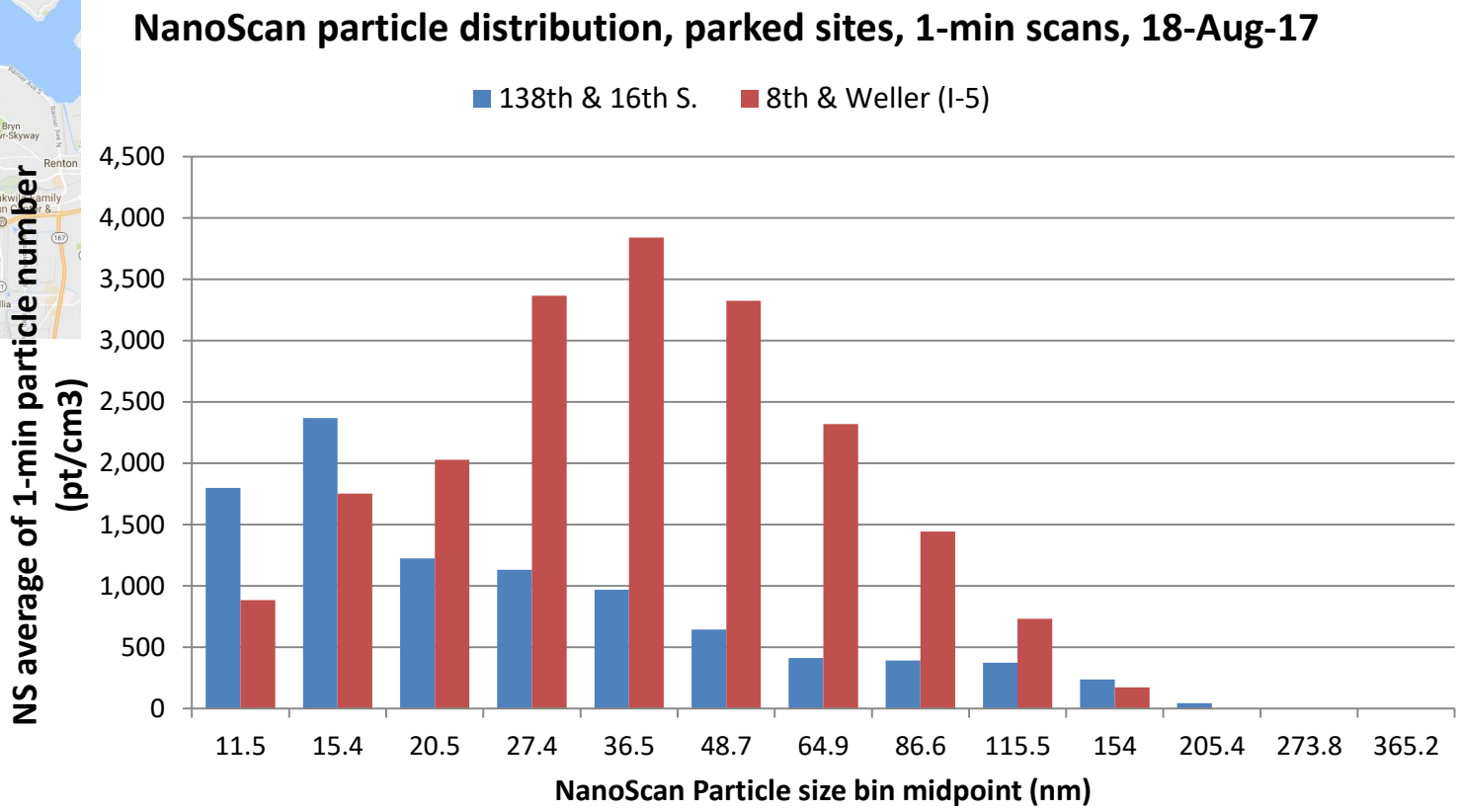
Predominant
wind directions
on this day

UFP size distribution, high traffic site vs. airport site



near I-5, 8th & S. Weller

138th & 16th



Recent Monitoring Progress

- 16 days of sampling in February-March 2018
- On 8 days, we utilized two cars simultaneously
- Currently processing the data and running quality assurance protocols
- Refining the methodology for identifying aircraft-related ultrafine particles

Timeline

- Website available: http://deohs.washington.edu/mov-up
- Study Advisory Group meeting held in January (slides and notes available on website)
- Public Meeting at Highline Forum March 28, 2018.
- Continuing monitoring in April-May, July-August, October-November.
- Next Study Advisory Group meeting will be in July 2018 to discuss preliminary results, followed by another Public Meeting.
- Solicit feedback from meetings, and draft the report in August 2019.
- Final report by December 2019.

Questions?