Real-time Ozone Measurements During the 2015 Great Salt Lake Summer Ozone Study (GSLSO3S)

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THE UNIVERSITY OF UTAH

Introduction and Motivation

- Two contrasting air quality concerns impact greater Salt Lake region
  - Winter: secondary PM2.5 formation over several days
  - Summer: diurnal buildup of boundary layer ozone

- September 2015: National Ambient Air Quality Standard (NAAQS) changed from 75 to 70 ppbv for 8h average ozone

- Previous studies indicated elevated ozone readings near vicinity of Great Salt Lake during summer

- Field study to further examine distribution of boundary layer ozone near the Great Salt Lake and assess atmospheric conditions during elevated periods

2015 Great Salt Lake Summer Ozone Study

- Primary Campaign Period: 1 Jun 2015 – 31 Aug 2015
- University of Utah (UofU), Utah Division of Air Quality (DAQ), Utah State University (USU) and Weber State University (WSU)

Joint Session 1: Air Pollution Meteorology in the Urban Environment
Wednesday: 10:30 AM-12:00 PM - Room 243

J1.3: The 2015 Great Salt Lake Summer Ozone Study
John Horel and coauthors – 11:00 AM

J1.4: WRF Simulation of a Summer Ozone Event in the Salt Lake Valley Initialized from HRRR Analyses
Brian Blaylock and coauthors – 11:15 AM

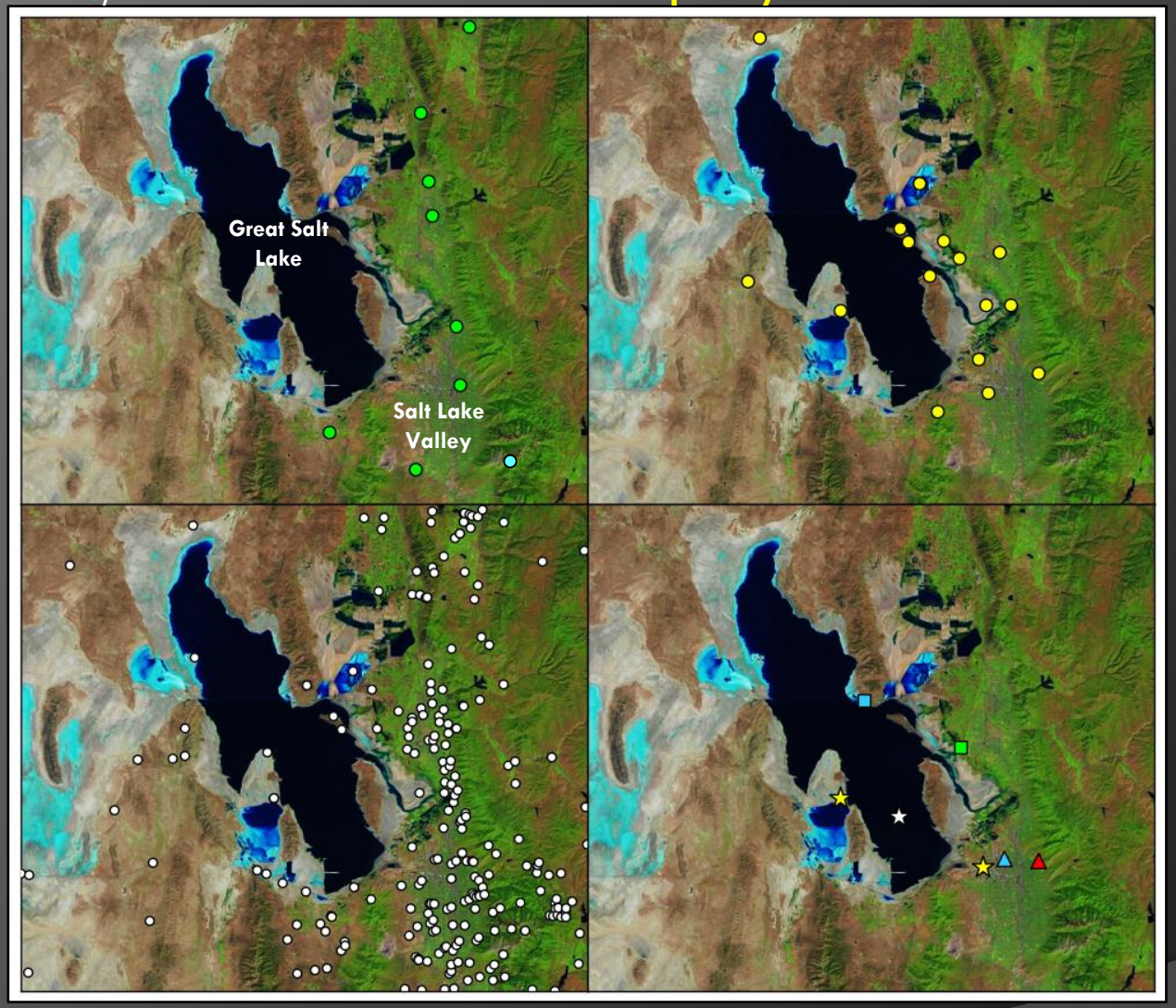
Leveraging Existing Resources

- Low-budget campaign - leveraging existing resources important

Instruments	Resource
DAQ/USFS Fixed Site Ozone Monitors	DAQ Regulatory Ozone Monitors USFS Ozone Monitor at Snowbird Ski Resort
Temporary Fixed Site 2B Technologies Ozone Monitors	DAQ and UofU temporary deployments, some adjacent to existing UofU weather stations and available in real-time
Weather Observations	MesoWest (http://mesowest.utah.edu) MesoWest API (http://mesowest.org/api)
Mobile 2B Technologies Ozone Monitors	UTA TRAX Light Rail Car (continuous) KSL-TV "Chopper" 5 (often late afternoon) UofU Nerdmobile (IOPs) UofU Additional Vehicles (IOPs)
Boundary Layer Air Quality Observations	USU UAV WSU Tethersonde
Boundary Layer Remote Sensing	UofU Sodars, Lidar, and Ceilometer

Leveraging Existing Resources

DAQ/USFS Fixed Ozone Monitors Temporary Fixed Ozone Monitors



Weather Stations via MesoWest

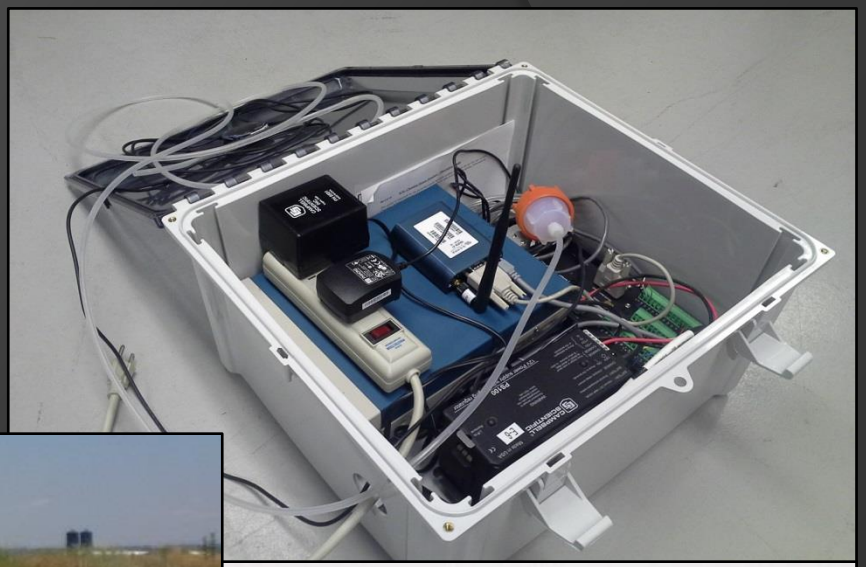
- Sodar, Lidar, Tethersonde
- USU UAV Launch Point
- Sodar
- Ceilometer
- KSLC RAOB Sounding
- Great Salt Lake Buoy

Mobile Ozone Observations

- Continuous real-time monitoring via instrument deployment on Utah Transit Authority (UTA) TRAX Light Rail Car
- Ozone and PM2.5 data: http://meso1.chpc.utah.edu/mesotrax

Mobile Ozone Observations

- Mobile units with real-time cellular communications deployed in vehicles and on KSL-TV “Chopper 5” helicopter

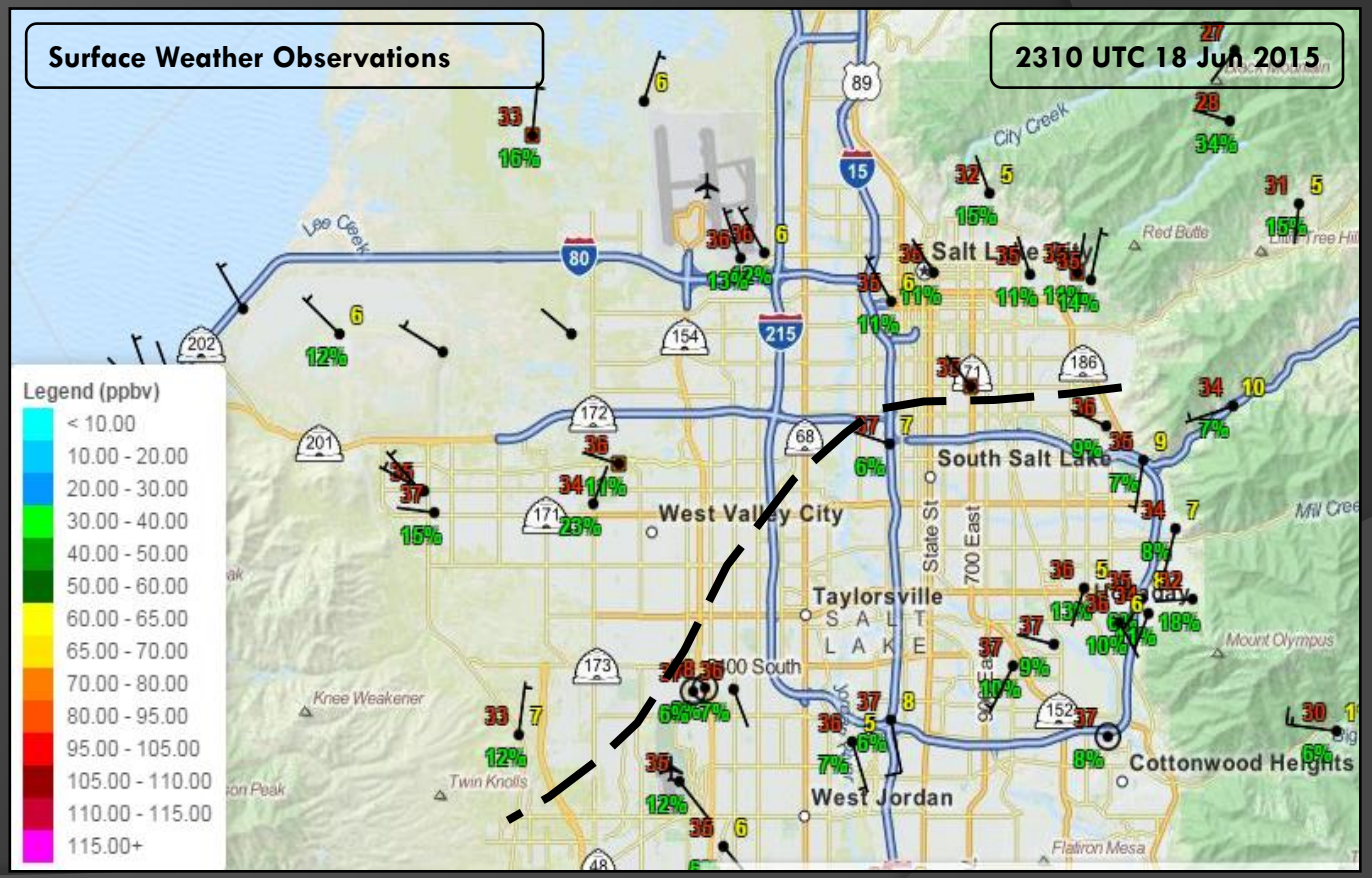


Real-Time Ozone Processing and Display

- Data collected from logging devices in real-time
- Processed into MesoWest database (fixed sites) or HDF5 (mobile)
- Data synthesized on website: http://meso2.chpc.utah.edu/gslso3s

Case Events – 18 Jun 2015 Lake Breeze

- Lake breeze convergence zone propagating southward from Great Salt Lake through Salt Lake Valley



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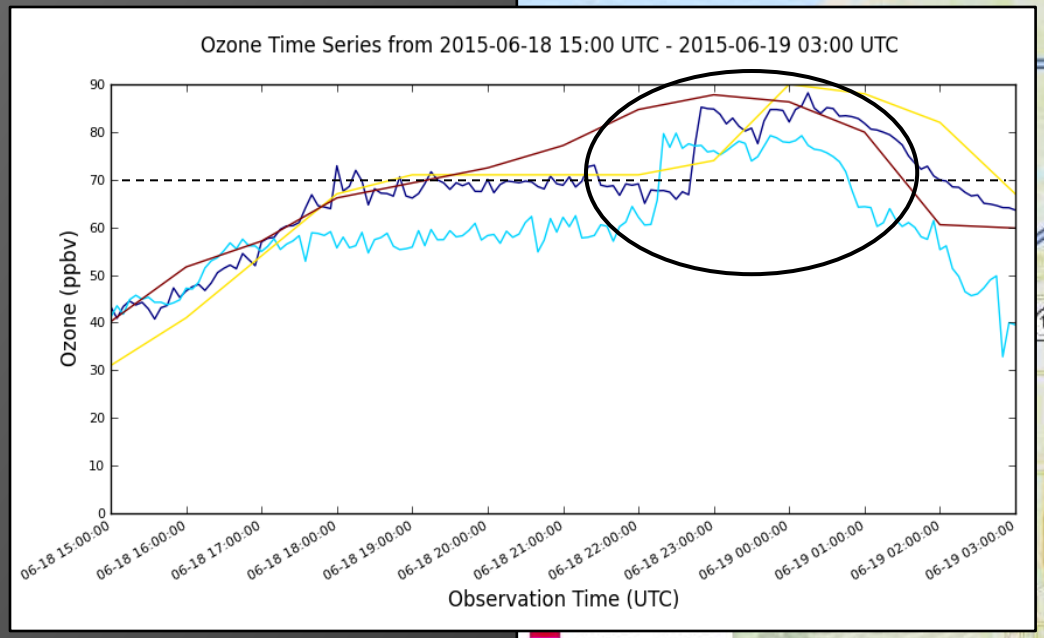
- Lake breeze convergence zone propagating southward from Great Salt Lake through Salt Lake Valley
- Fixed and mobile observations depicted sharp increase in ozone concentrations as the convergence zone passed



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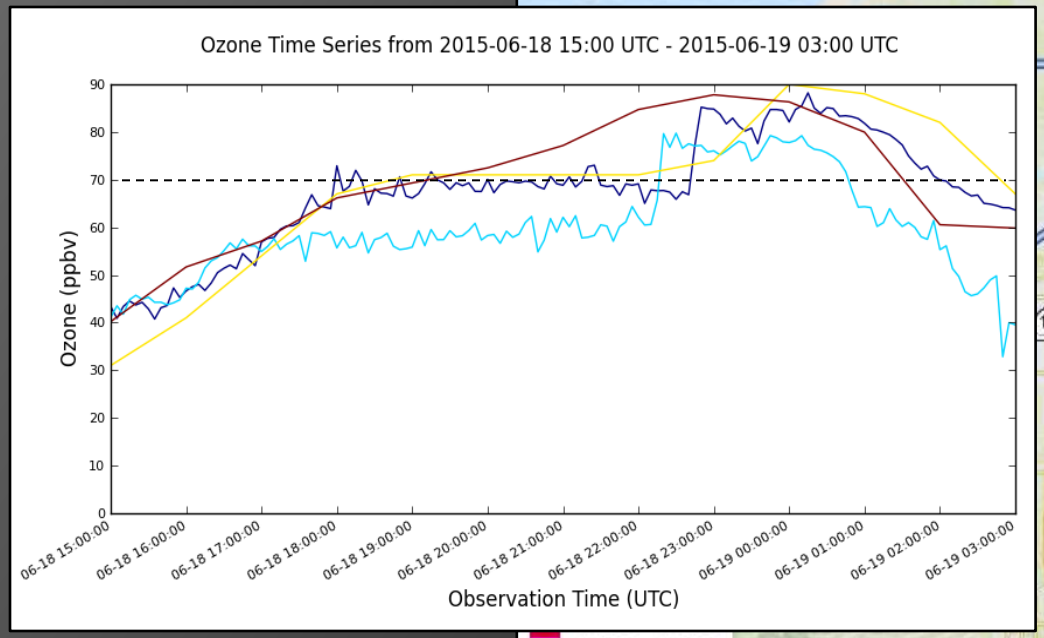

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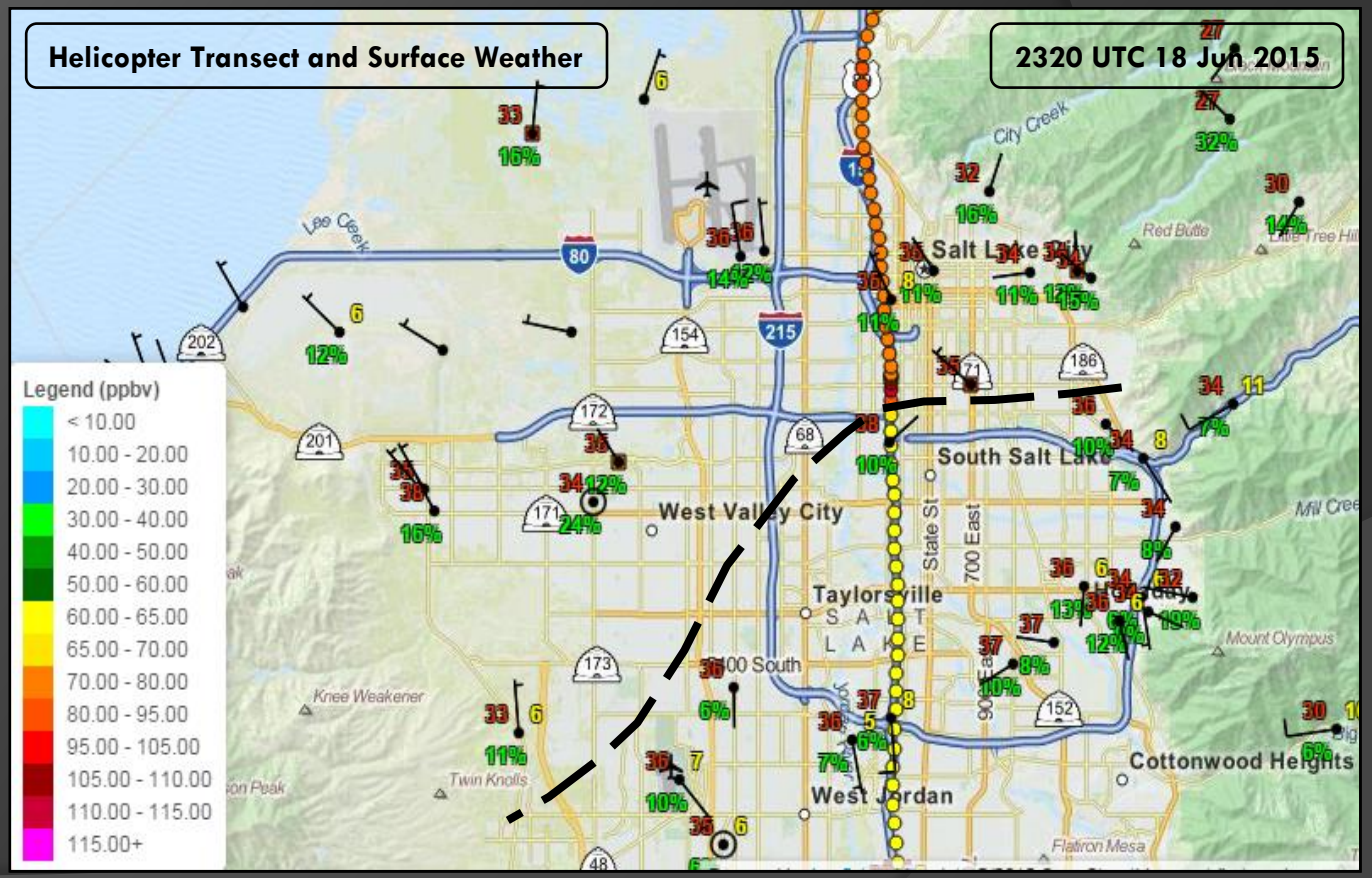

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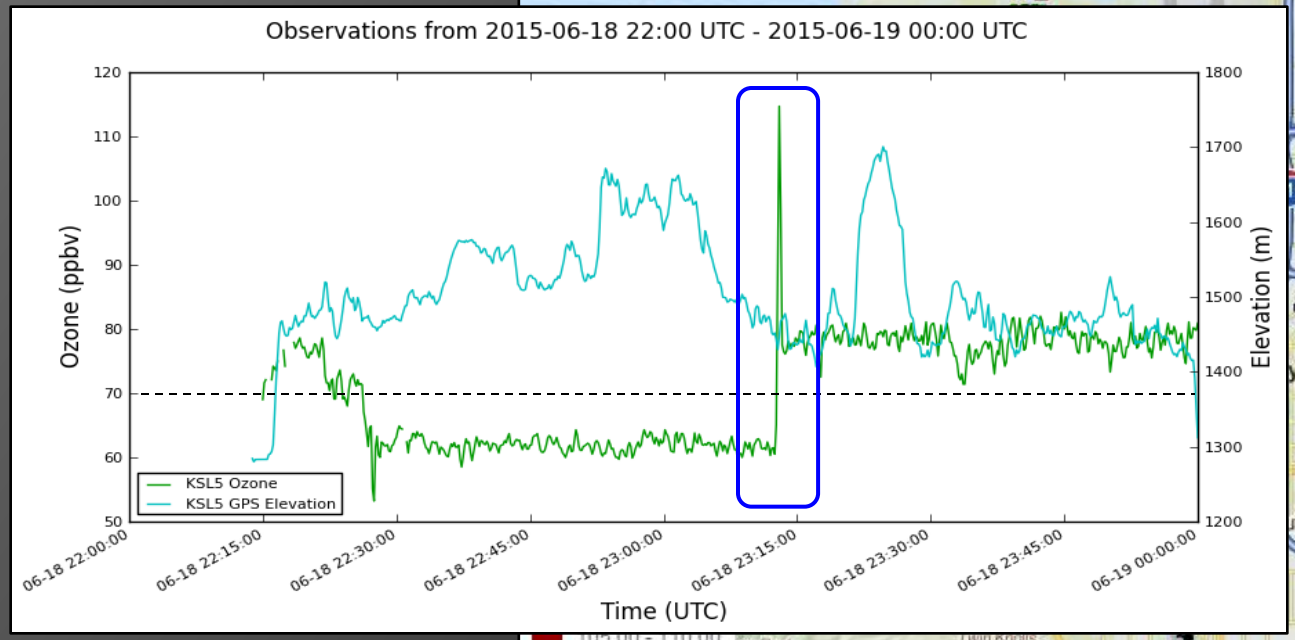
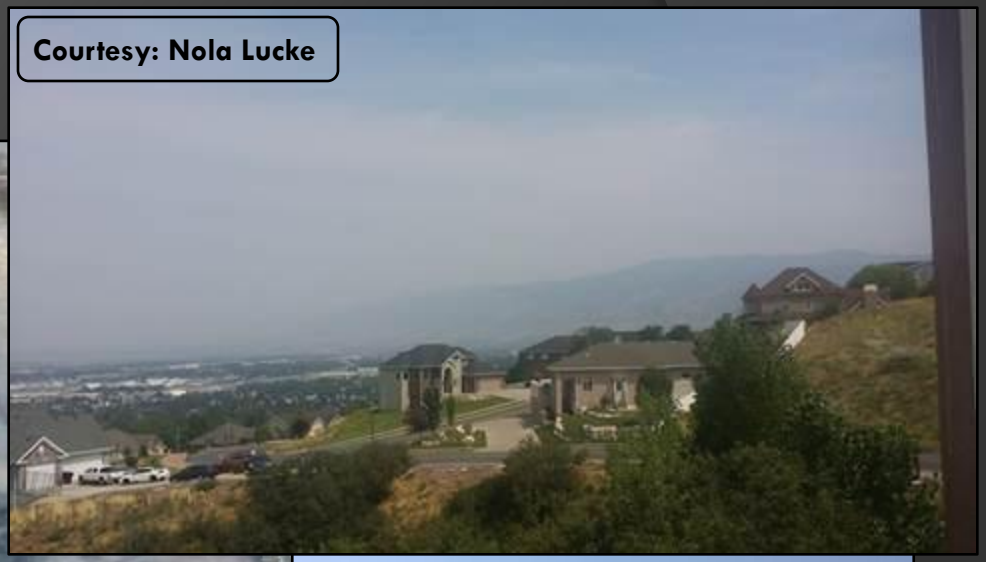
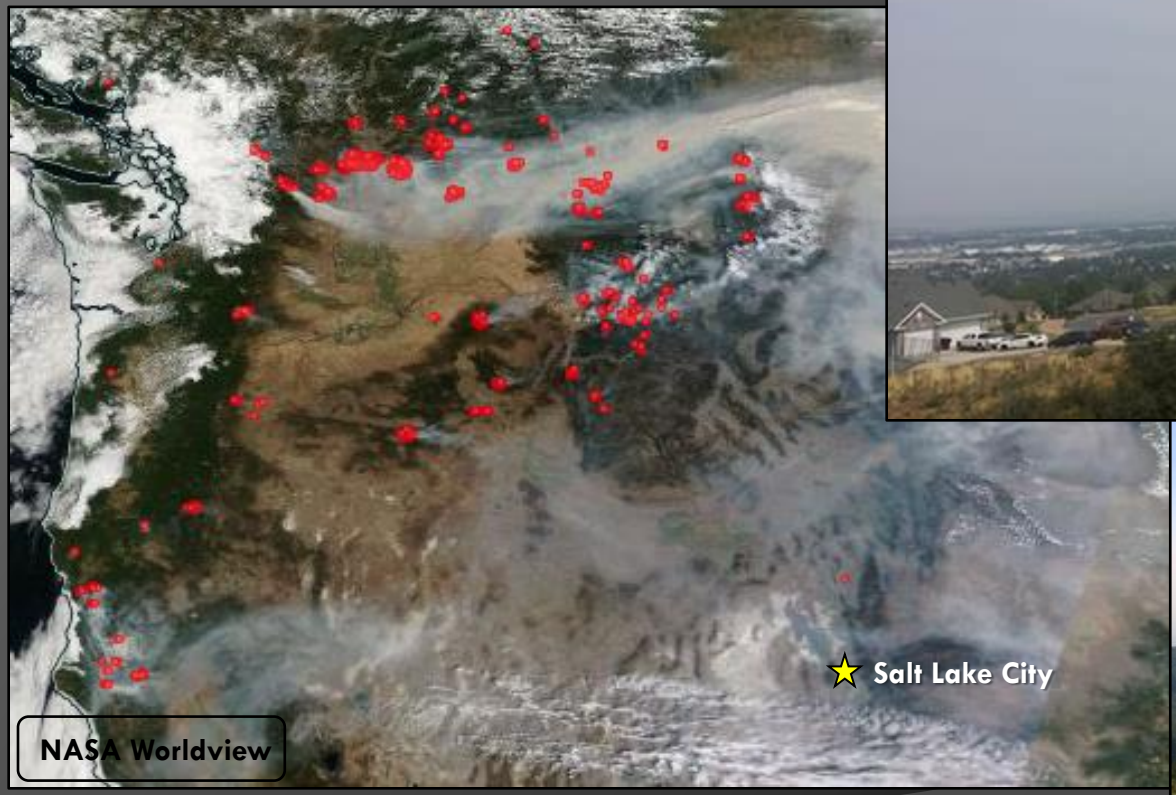
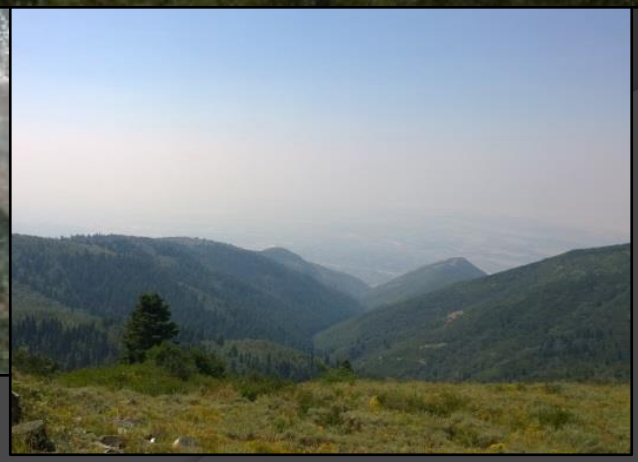


Case Events – 15-23 Aug 2015 Smoke Period

- Dry synoptic NW flow advected smoke from Pacific Northwest and California wildfires into greater Salt Lake region
- Elevated ozone and particulate levels obscured visibility







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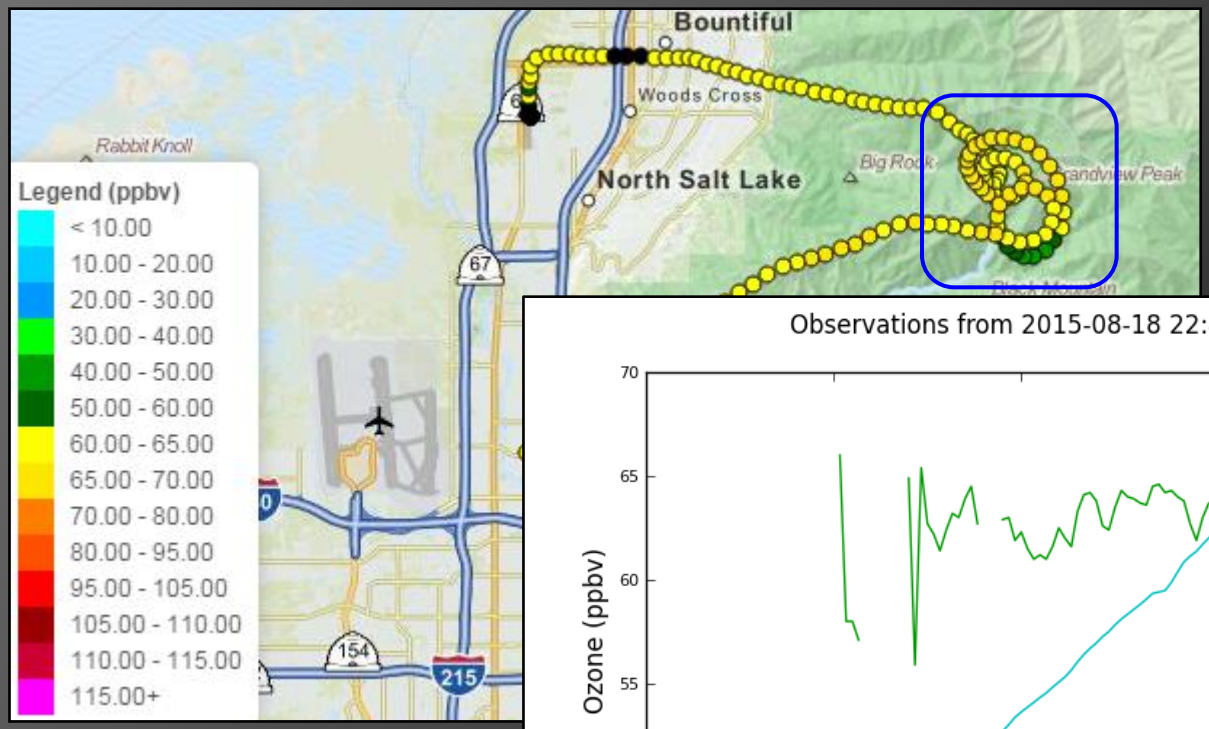

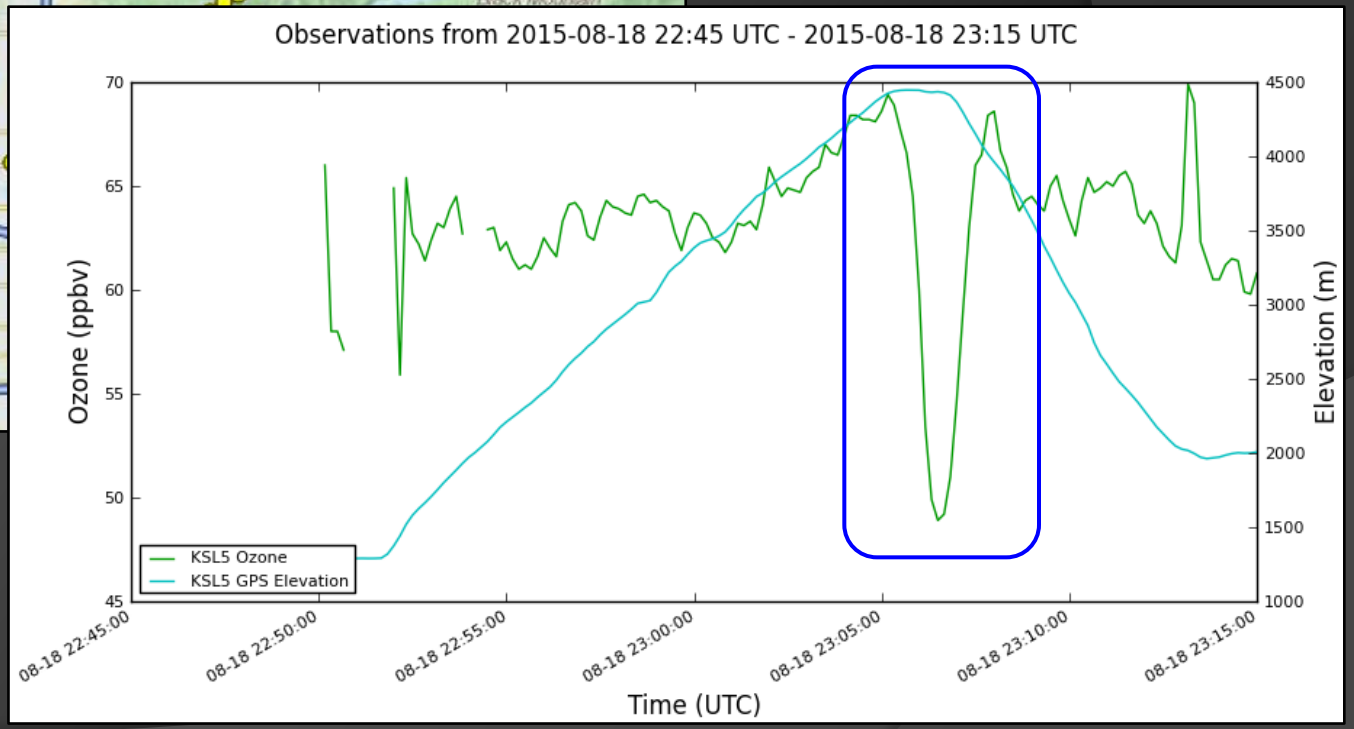

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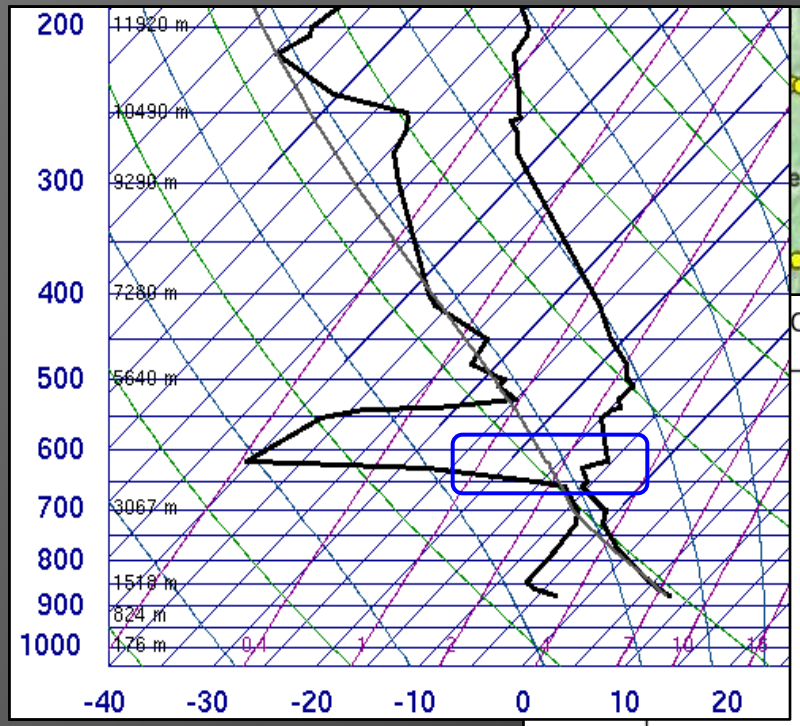

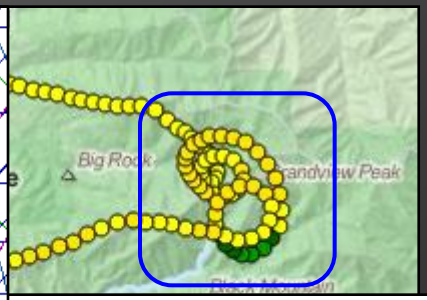

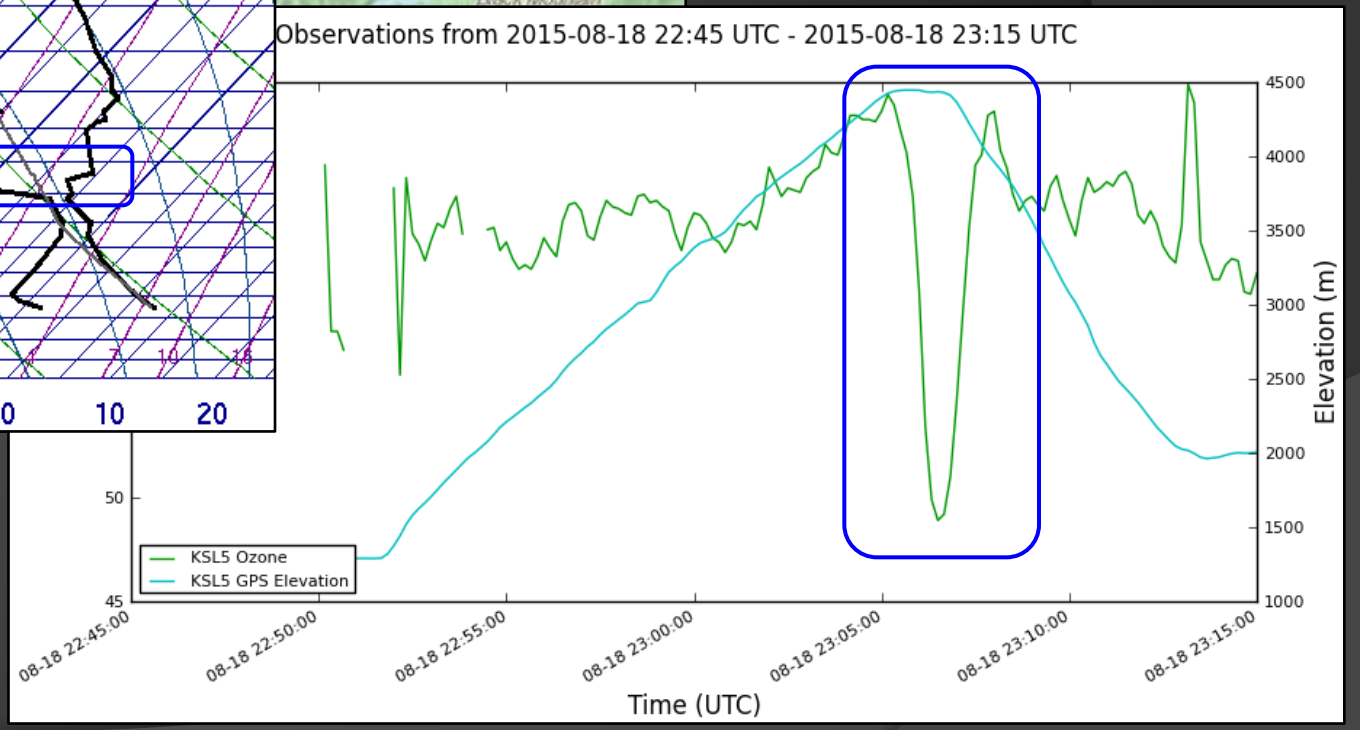

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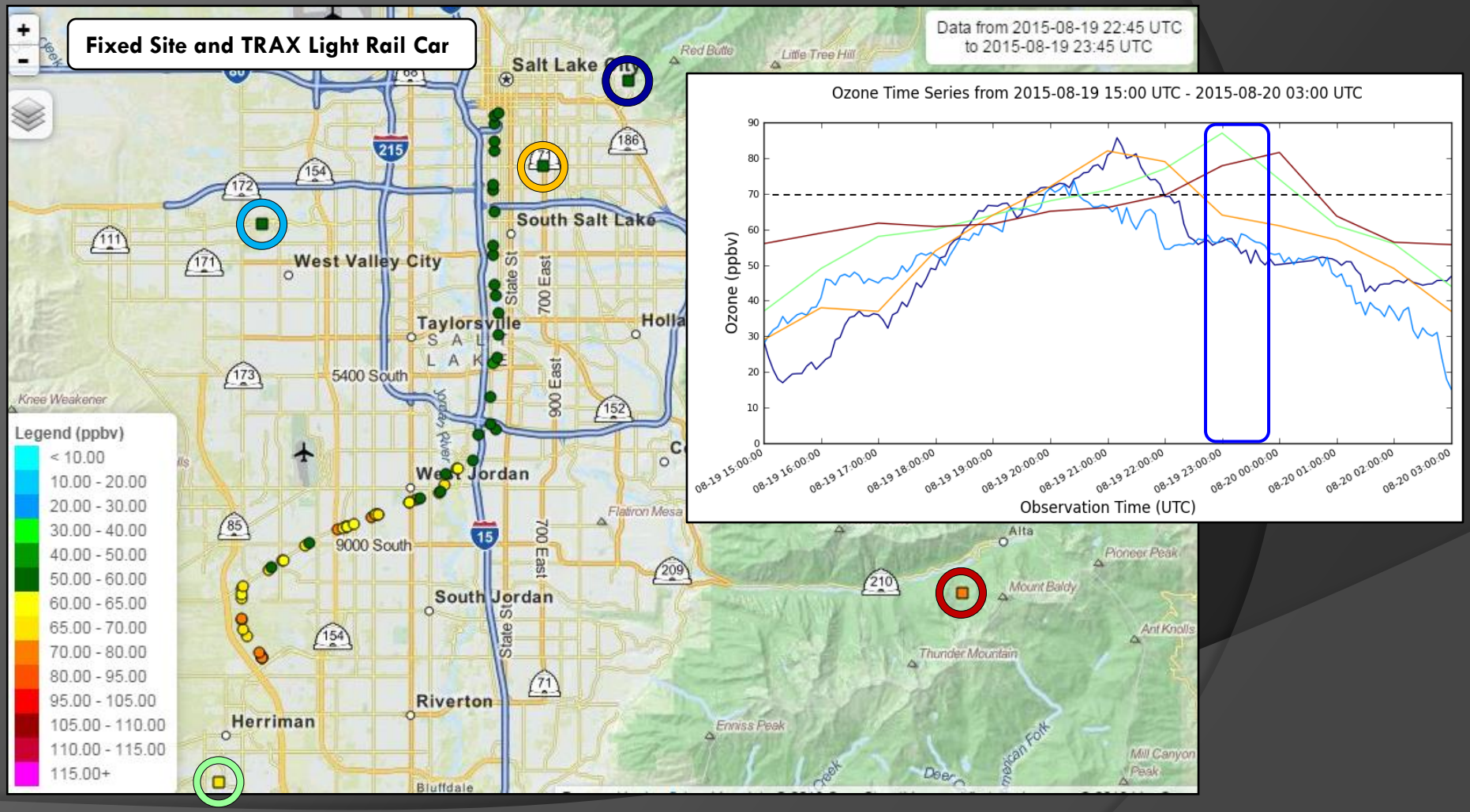

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Summary

- Real-time data collected from fixed sites extremely useful
  - IOP planning and go/no-go decisions
  - Identification of faulty equipment during study
- Mobile observation platforms helped assess spatial distribution
  - 81 of 92 days (88%) had mobile data
  - Some vehicles could change strategies based on conditions
- Developed web tools key for real-time assessment and statistics
  - Present surface ozone and weather conditions
  - 8h average ozone calculations for fixed sites
  - Ozone "roses" to assess ozone based on wind direction

Acknowledgements

- Primary funding courtesy Utah Division of Air Quality

- Deployment of some mobile instrumentation made possible by:
  - Helicopter: KSL Broadcasting and pilot Ben Tidswell
  - Light Rail Car: Utah Transit Authority and Siemens USA

- Participation in data collection and analysis by undergraduate students, graduate students, and staff from participating universities