Monitoring Air Quality in Northern Utah Using Fixed and Mobile Sensors

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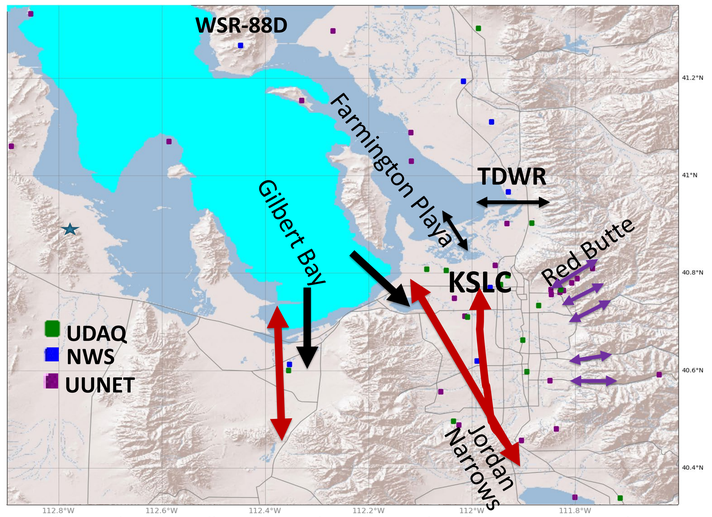
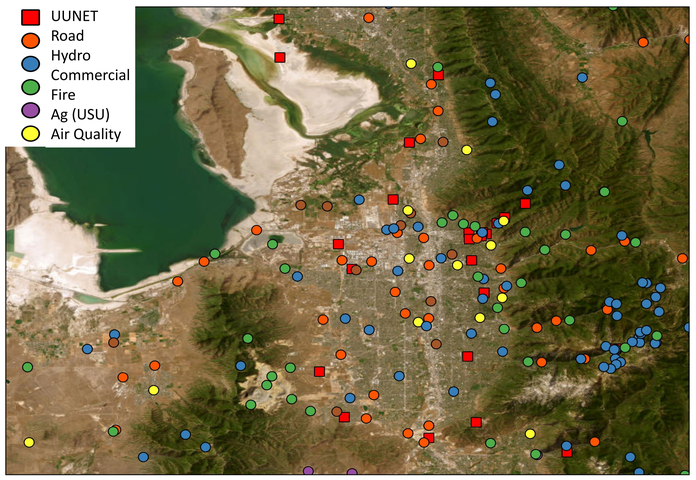
Wasatch Front Networks



- Understanding air pollution episodes requires data from air quality and meteorological sensors at the surface and aloft
- Utah Division of Air Quality (UDAQ) has an extensive network of meteorological and air quality monitoring stations equipped at many sites with Photochemical Assessment Monitoring Stations (PAMS) and ceilometers
- National Weather Service (NWS) provides many meteorological towers, continuous radar (WSR-88D and TDWR) scans and twice-daily rawinsonde launches at KSLC
- Our research team supports sensors at over two dozen sites in the region with many equipped with ozone and particulate sensors
- Quasi-regular diurnal flows are common that affect air quality, including:
  - Mountain-valley exchange (red arrows)
  - Afternoon lake breezes from Gilbert Bay (heavy black arrows)
  - Flows towards/away from Farmington Playa (black arrows)
  - Canyon flows entering and exiting the Salt Lake Valley (purple arrows)
  - Slope flows down and up all terrain features

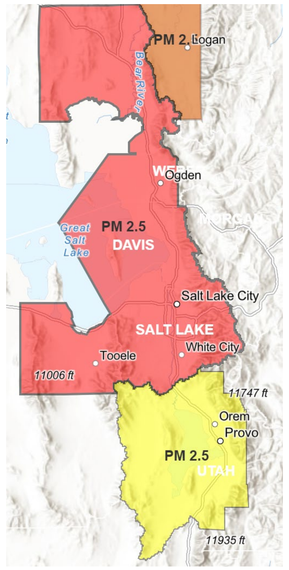
Salt Lake City Urban Region



Air Quality Issues

- Four-season air quality and health issues
- Winter
  - Ridging aloft; cold air pools trapped in basins
  - Particulates
- Summer
  - Ridging aloft; local circulations dominate
  - Particulates, ozone
- Spring – Fall Dust Events
  - Strong frontal winds or outflow boundaries
  - Dry playa or tilled fields
  - Particulates
- Summer – Fall Wildfires
  - Smoke transport from regional or local wildfires
  - Particulates, ozone

PM2.5 Nonattainment Areas



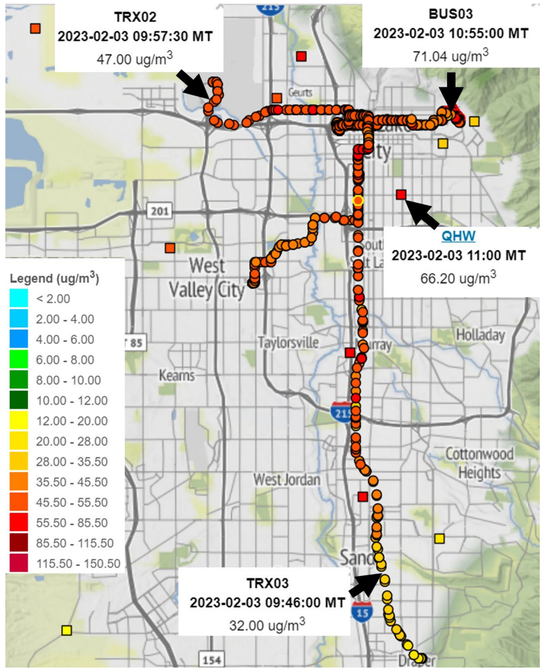
Ozone Nonattainment Areas

Source: https://utahdeq.maps.arcgis.com

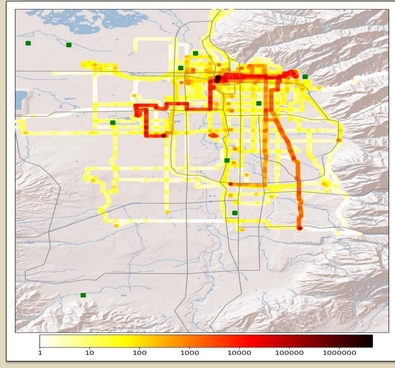
Objective

- To better understand air quality along Utah's Wasatch Front
- Builds on successful UTA TRAX Air Quality Monitoring Project
  - First research grade air quality observations using light rail cars
  - TRAX measures air pollution primarily on commercial corridors
- Expansion to eBuses in Salt Lake County provides measurements across a wide range of urban and suburban areas
- Flexibility of eBus routing allows monitoring and analysis of cases affecting different parts of Salt Lake Valley
- By Spring 2024, air quality sensors will continue to be onboard 3 light rail cars and over a dozen eBuses
- Mix of sensor packages: Ozone, PM_1, $PM_{2.5}$, PM_4, PM_{10}

Winter $PM_{2.5}$

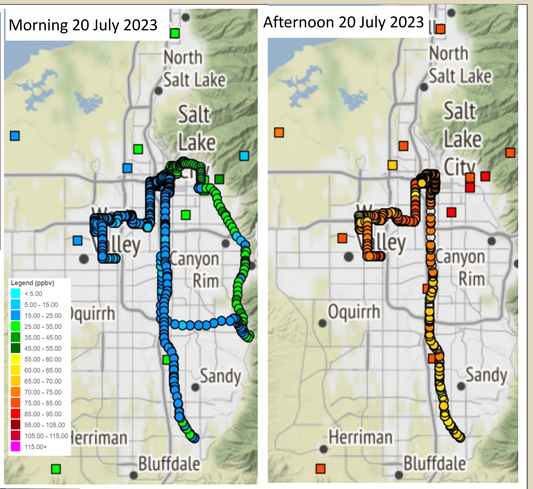


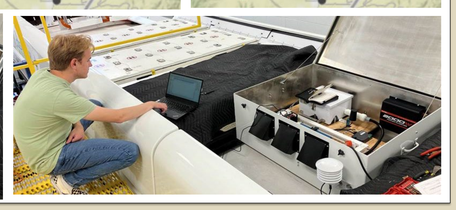
UTA Bus Route Observations



- Number of bus reports per 0.001˚ x 0.001˚ cell during the period from Oct 2021 – July 2023
- Highest number of reports are at the bus depot and the lunch area for the drivers
- The most traveled routes have been UTA routes 2, 209, 220, and 519

Summer Ozone





Challenges

- Limited number of possible routes due to the need to charge at only a few locations (e.g., Central Garage)
- Limited number of drivers trained on eBuses impacting operations
- eBus downtime for maintenance or critical repairs leads to data gaps. As fleet expands, individual eBus downtime will impact overall coverage less
- Mobile observations more frequent during commute periods
- Route updating occasionally affects long-term comparisons
- On-going operations and maintenance funding

Team Members and Supporters

- Partnering Agencies
  - Salt Lake County, Utah Division of Air Quality (UDAQ), Utah Transit Agency (UTA), University of Utah, Salt Lake City Corporation

Collaborating Partner
- Healthy Environment Alliance Of Utah (HEAL)

- Project Supporters
  - Utah State Legislature, Rocky Mountain Power, Utah Clean Air Partnership (UCAIR), Wasatch Front Regional Council (WFRC), Sustainable Campus Initiative Fund (SCIF)