Ozone Suppression: Analysis of Ozone Concentrations During High Temperature Conditions

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Background

- In 2022, the **Wasatch Front** and parts of the **Uinta Basin** were designated as Marginal nonattainment areas for ozone – a **harmful air pollutant** - by the Environmental Protection Agency.
- **Temperature** has been used as a predictor for **ozone concentrations** due to its influence on the kinetic rates of ozone generation.

Objectives

- **Characterize** the relationship between **ozone** concentrations and extremely high air **temperatures** (**>36 °C**).
- **Analyze** the **meteorological** and **chemical factors** contributing to ground level **ozone** concentrations in the GSL Valley

Data Collection & Methods

Time Period: Meteorological Summers of 2014 – 2022

Sources: Utah Division of Air Quality (DAQ) and University of Utah Reporting Sites

Method: Raw data processed into **maximum daily averages** and **diurnal averages**. All visualizations were generated with Python.

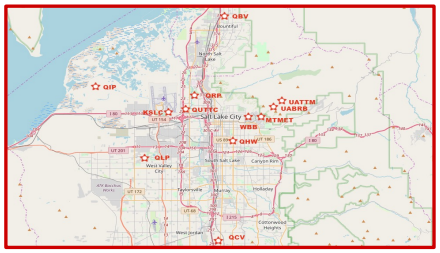


Fig 1. Salt Lake City with labelled UU and DAQ weather stations utilized in this study.

Results

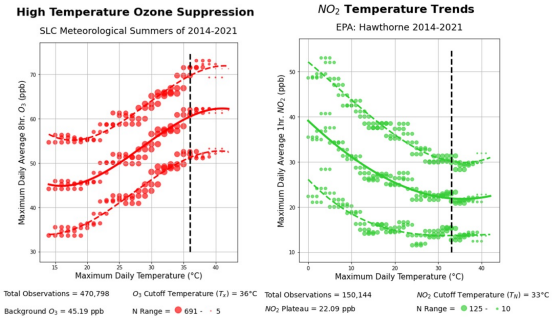
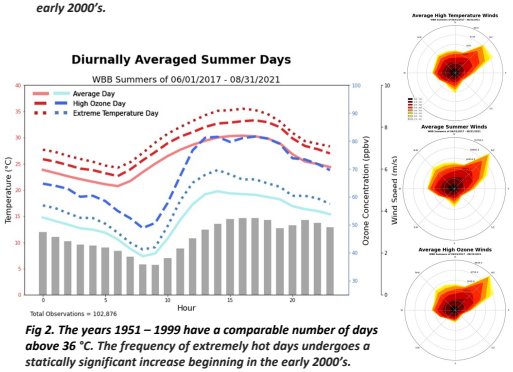


Fig 2. The years 1951 – 1999 have a comparable number of days above 36 °C. The frequency of extremely hot days undergoes a statically significant increase beginning in the early 2000's.



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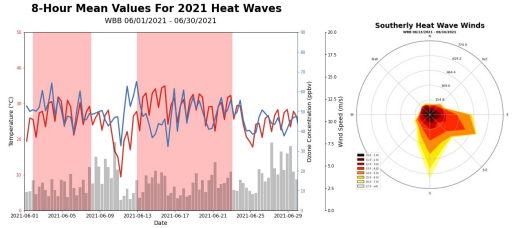

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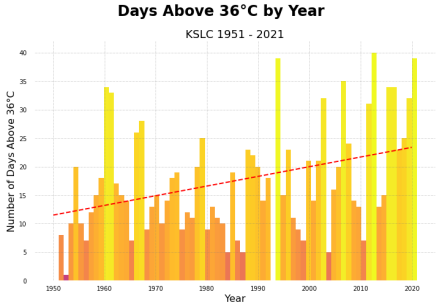

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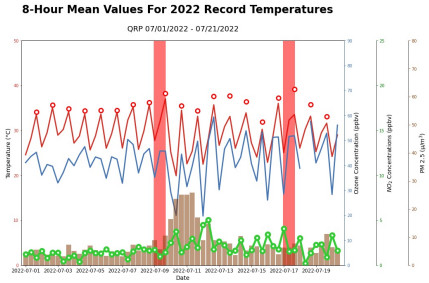

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Summary & Future Work

- **Ozone** concentrations are generally **lower** on extremely **hot days**.
- Under **locally** driven **diurnal wind** conditions, **ozone** may be more affected by **NOx** concentrations as extreme **temperatures** may **reduce** the biogenic **emissions** of volatile organic compounds (**VOC**).
- **Lower ozone** peak values were also observed during record **high temperature** days due to strong **synoptically**-dominated surface winds and enhanced vertical mixing.
- These results highlight that the assumption that **higher temperatures** correlate **to higher ozone** concentrations **may not be valid**. Additionally, more atmospheric observations of **NOx** and **VOC** emissions are needed in the Salt Lake Valley.

Acknowledgements

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- Steiner, A. L., Davis, A. J., Sillman, S., Owen, R. C., Michalak, A. M., & Fiore, A. M. (2010). Observed suppression of ozone formation at extremely high temperatures due to chemical and biophysical feedbacks. *Proceedings of the National Academy of Sciences*, *107*(46). https://doi.org/10.1073/pnas.1008336107

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