



Air Quality Measurements in Ephraim, UT

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Introduction:

Ephraim, UT is located in the rural county and valley of Sanpete. Sanpete county has a growing population with an estimated 28,948 residents as of July 2021 (Gardner Institute). With growing population and inflow from neighboring valleys and other regional inputs, we have sought to understand what is influencing air quality in this rural environment by measuring O₃, NO_x, SO₂, PM_{2.5}, and CO starting in December of 2020.

Experimental

The air sampling station consists of a shed located on the Snow College main Campus. Hourly averaged concentrations were recorded for six measured species. Meteorology was retrieved from MESOWest for the Ephraim airport station. HYSPLIT backtrajectories were calculated for selected dates.



Species	Instrument
O ₃	TECO 49i
NO/NO _x	TECO 42i-TLE
CO	TECO 48i
SO ₂	TECO 43i-TLE
PM 2.5	Sharp PM
Dilution Calibrator	Teledyne

Results

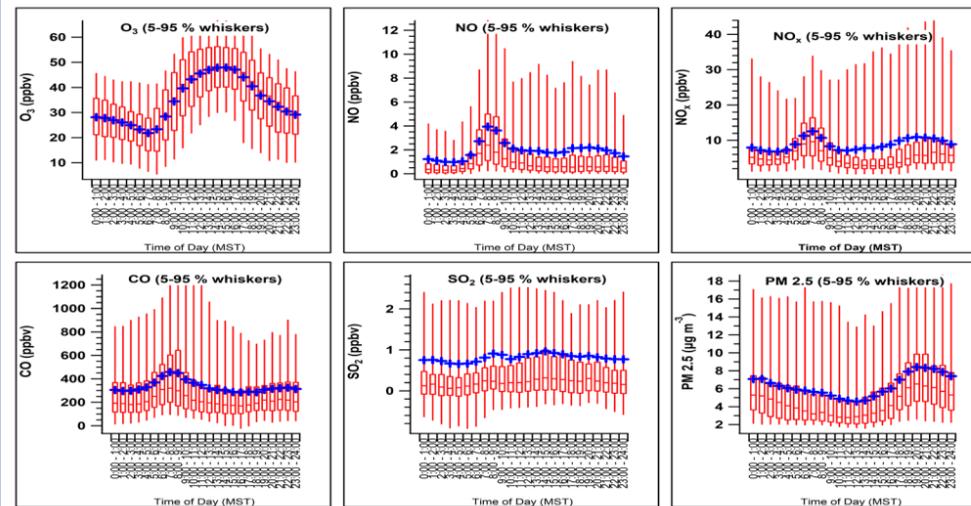


Figure: Daily Average Hourly Profiles for all species (above) and seasonal for O₃ and NO_x.

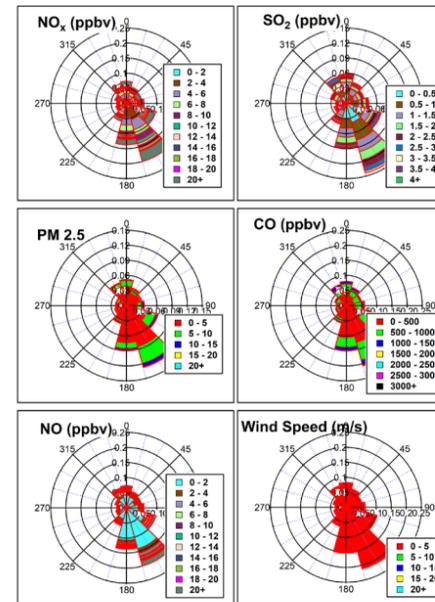
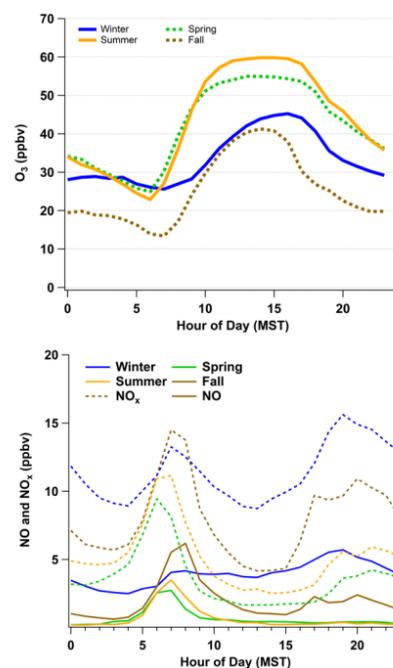
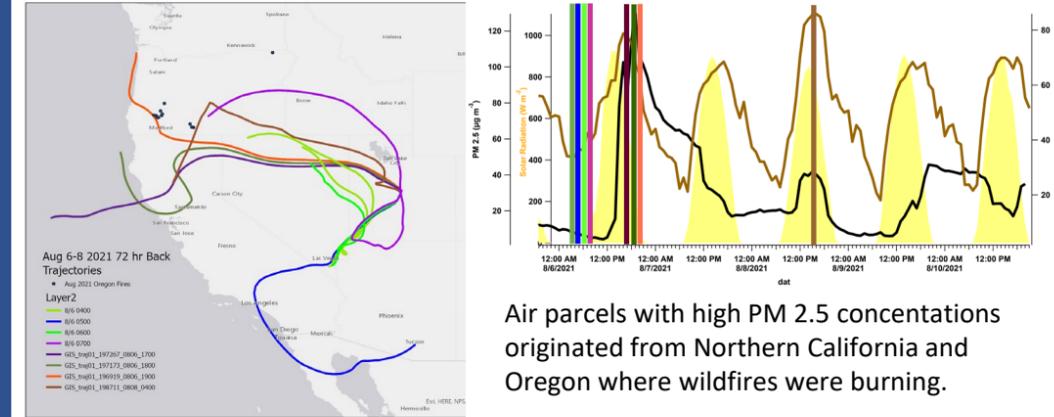


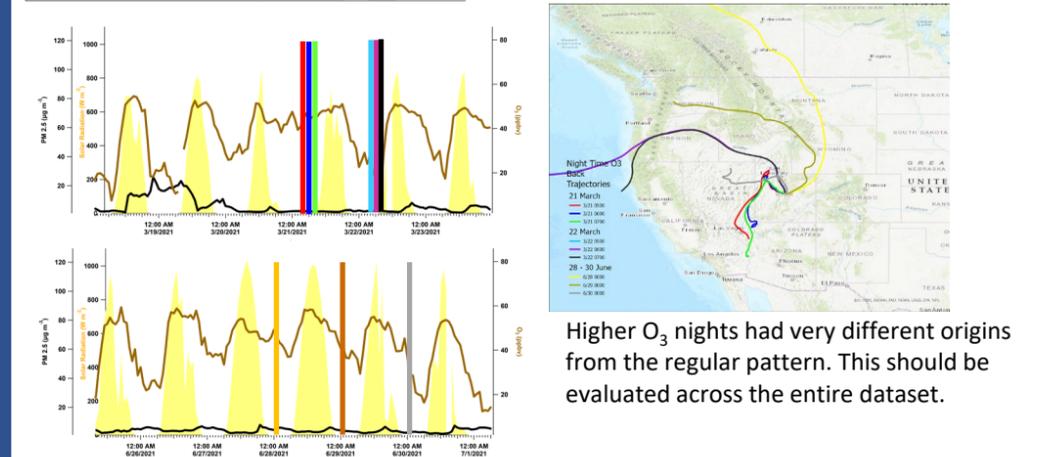
Figure: Windrose plots for Winter 2021

Daily averages show the peak in NO and NO_x in the morning as the sun rises as well as the daily peak in O₃. Seasonally, the peak in O₃ broadens as the days lengthen and the NO_x peak shifts with the changing dawn. Other species (PM, SO₂, CO) show less defined daily profiles. An evening peak in NO_x increases in the fall and winter as home heating likely contributes NO_x emissions.

Sample Back Trajectories



Air parcels with high PM_{2.5} concentrations originated from Northern California and Oregon where wildfires were burning.



Higher O₃ nights had very different origins from the regular pattern. This should be evaluated across the entire dataset.

Conclusions:

Sanpete County is a growing county with a growing possibility of issues related to air quality. Many of the outstanding days in the last year are connected to regional pollution events as seen in the Back trajectory analysis.

Acknowledgements:

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References:

Horel, J., and Coauthors, 2002: MESOWEST: COOPERATIVE MESONETS IN THE WESTERN UNITED STATES. Bull. Amer. Meteor. Soc., 83, 211–226, [https://doi.org/10.1175/1520-0477\(2002\)083<0211:MCMITW>2.3.CO;2](https://doi.org/10.1175/1520-0477(2002)083<0211:MCMITW>2.3.CO;2).

Species	NAAQS Standards	Ephraim 2021
O ₃	70 ppbv	70.2 ppbv
NO ₂	100/53 ppbv	38.4/7.0 ppbv
CO	9/35 ppmv (8 and 1 hr)	3.6/4.3 ppmv
PM 2.5	12.0/35.0 µg/m ³	6.3/ µg/m ³
SO ₂	75 ppb/0.5 ppm	8.7/ ppbv