

# Appendix C

## Matching Day Analysis

*Exceptional Events Demonstration Addressing the 2015 8-Hour Ozone (O<sub>3</sub>)  
National Ambient Air Quality Standard  
(NAAQS)*

*Lake and Porter Counties, Indiana*

# Lake County Ozone R2

2026-01-09

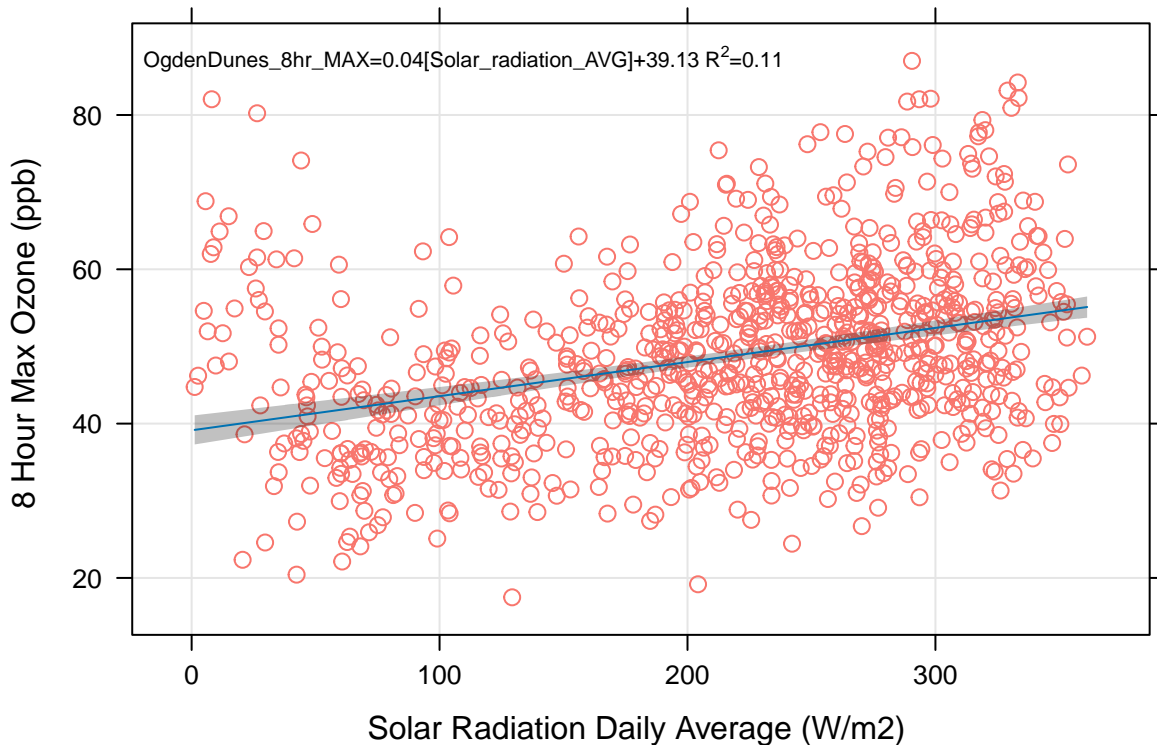
- Gary IITRI AQS Met Data
- Ogden Dunes Ozone
- May - September for 2020 - 2025

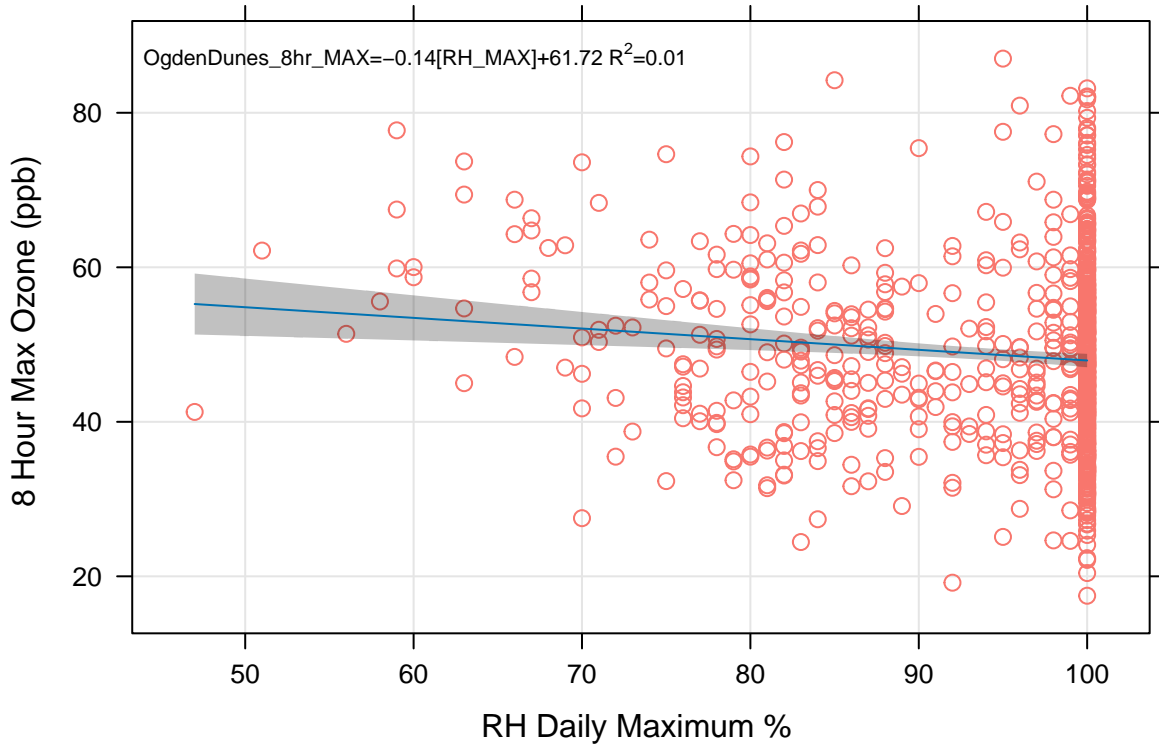
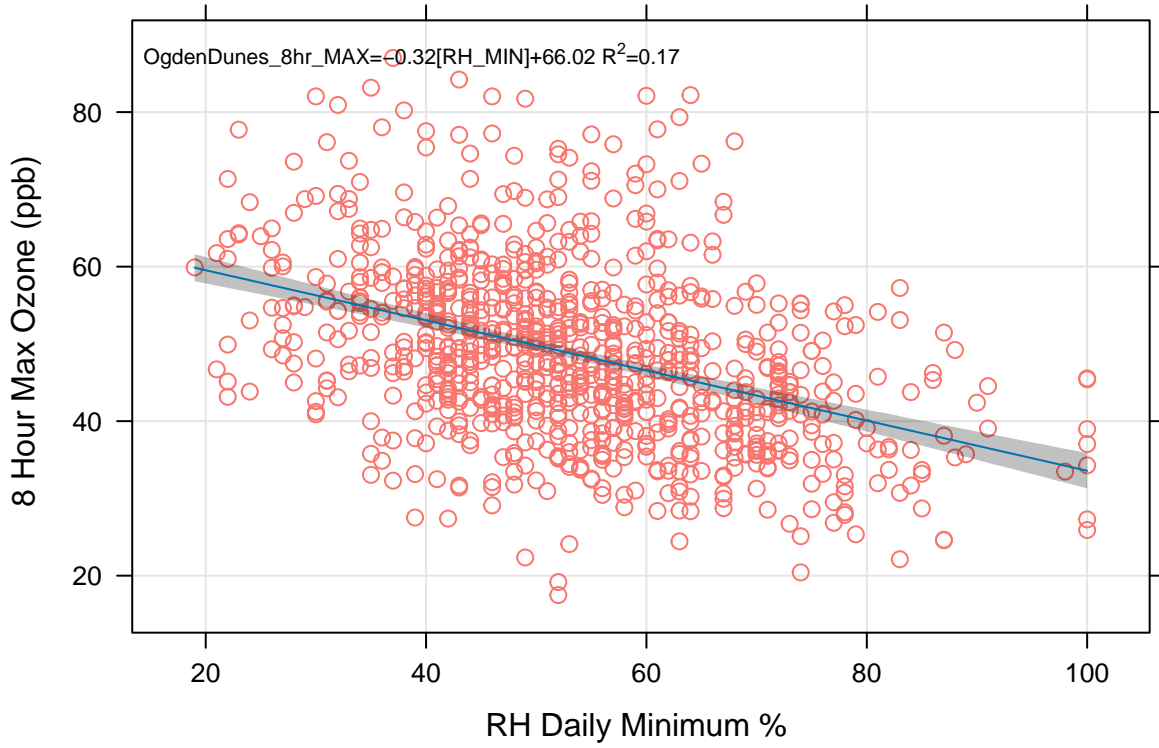
Based on the R2 values, four meteorological parameters were chosen for the matching days analysis. A higher R2 value indicates greater correlation between the met parameter and the daily ozone measurement.

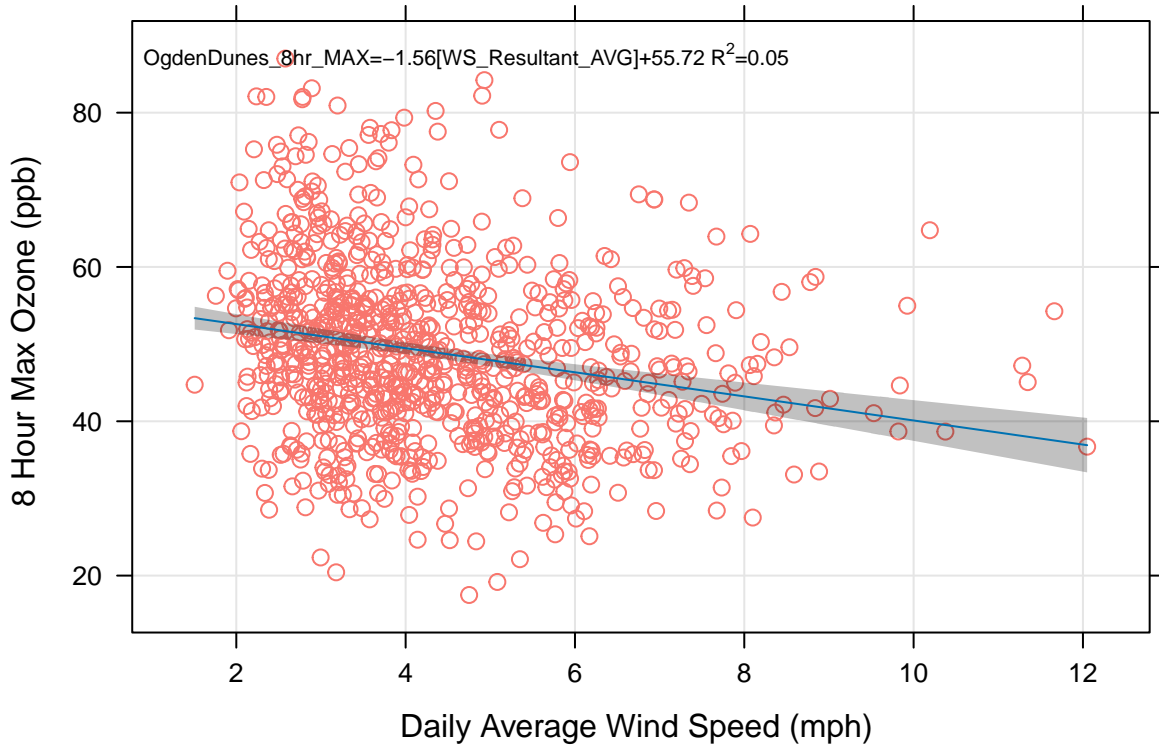
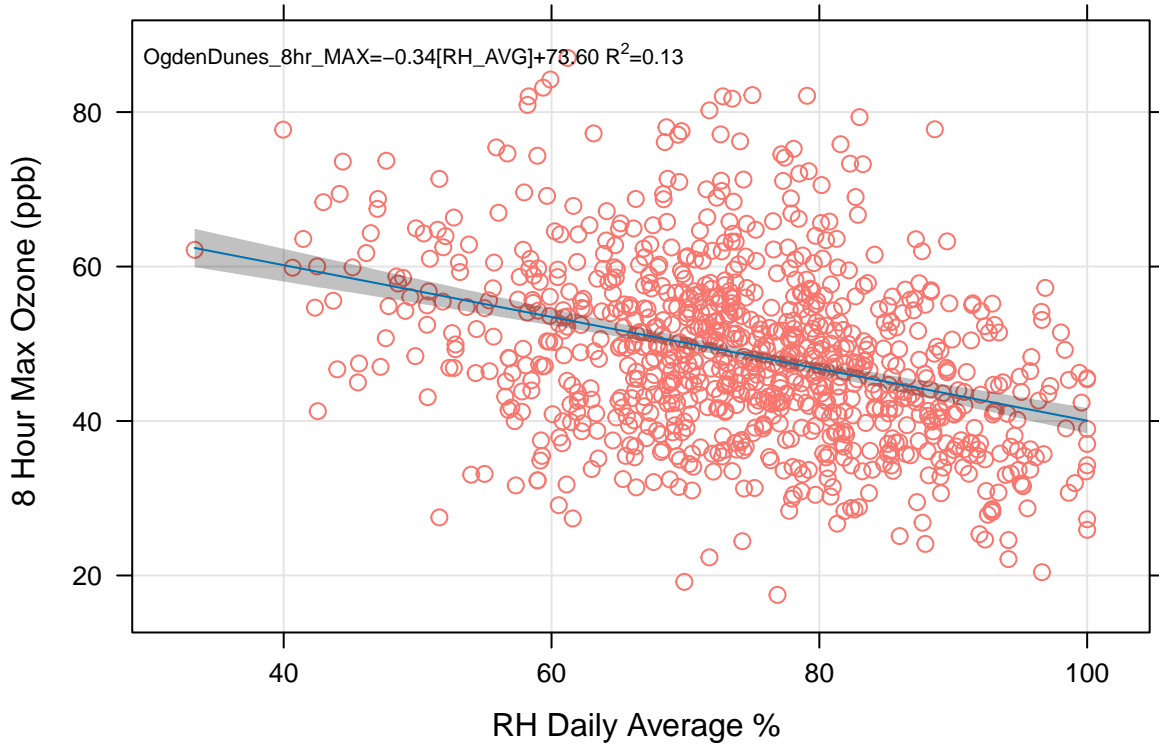
The parameters that were then used to determine which days in the data set had similar conditions to the Exceptional Event day are: Average Solar Radiation ( $R^2 = 0.11$ ), Minimum Relative Humidity ( $R^2 = 0.17$ ), Temperature Change ( $R^2 = 0.21$ ), and Maximum Temperature ( $R^2 = 0.23$ ). Average Relative Humidity also had a high R2 value (0.13) but was not included due to being very similar to another variable already included in the analysis, Minimum Relative Humidity. The R2 charts used to determine these parameters are shown below.

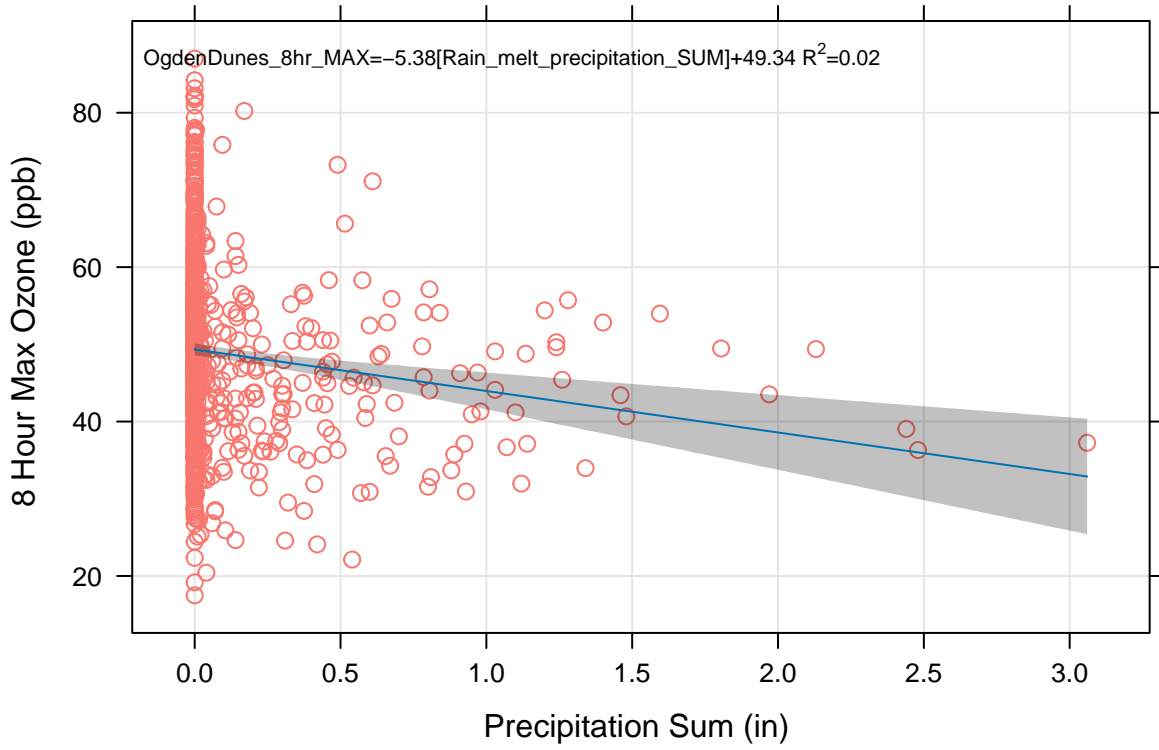
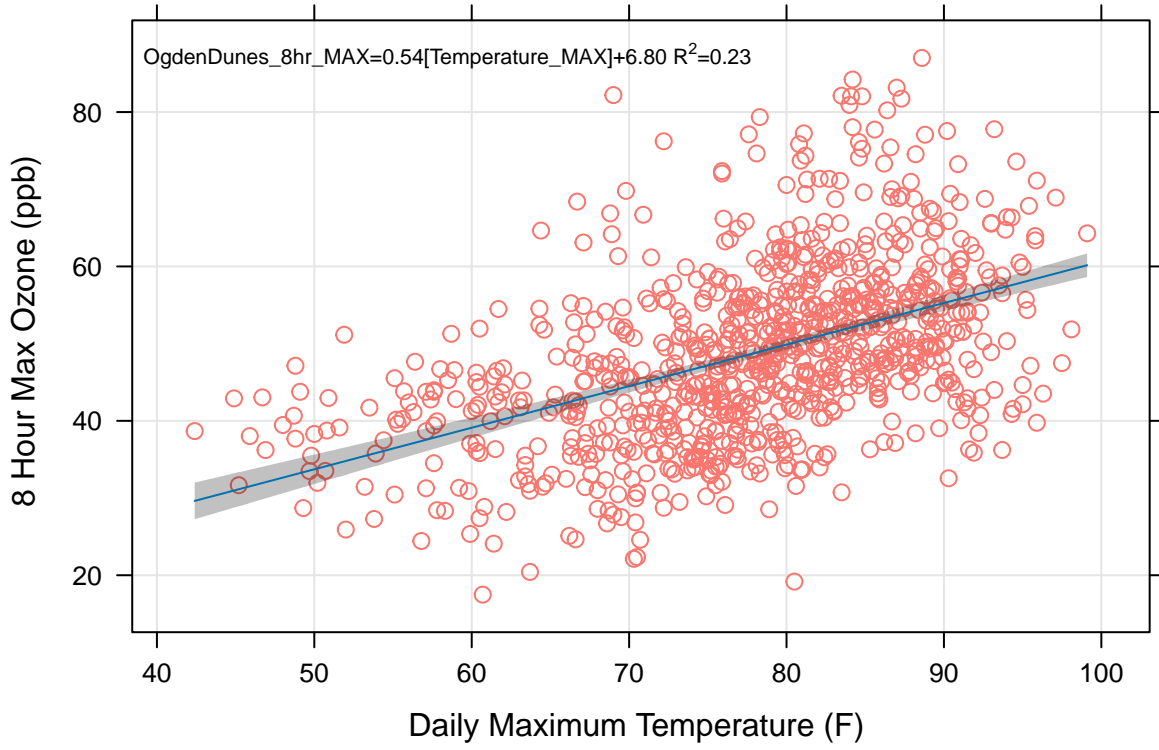
Using these parameters, matching days were calculated based on the following thresholds:

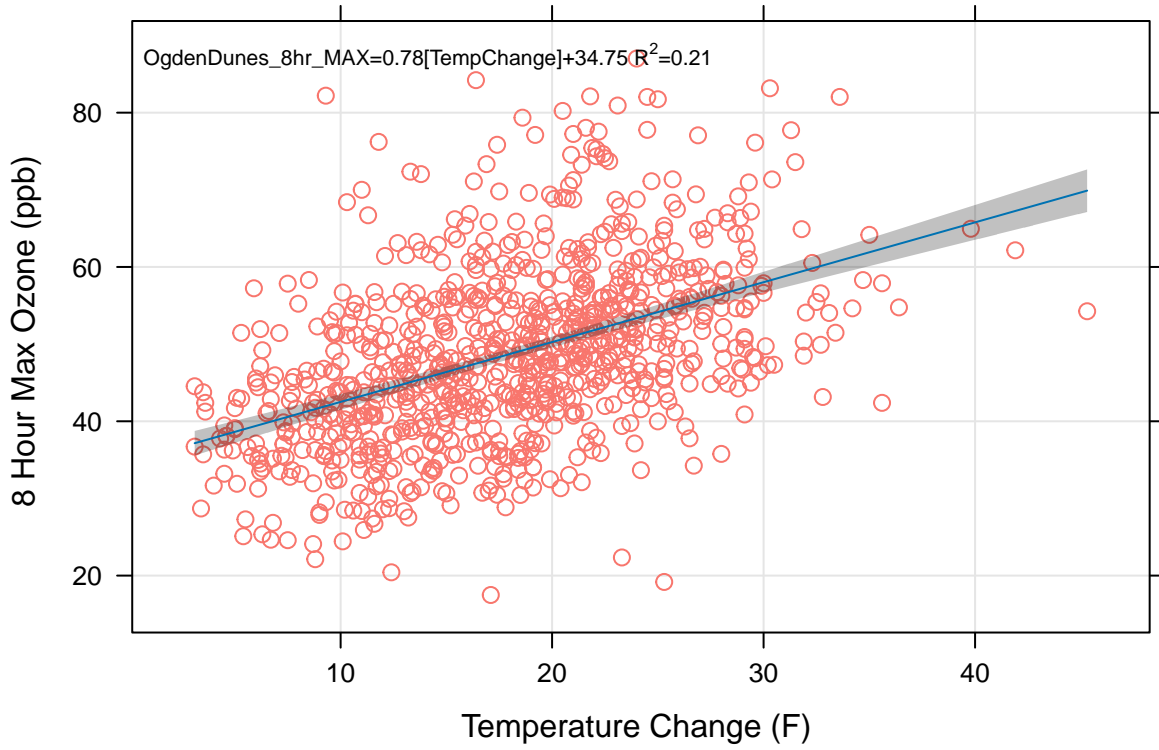
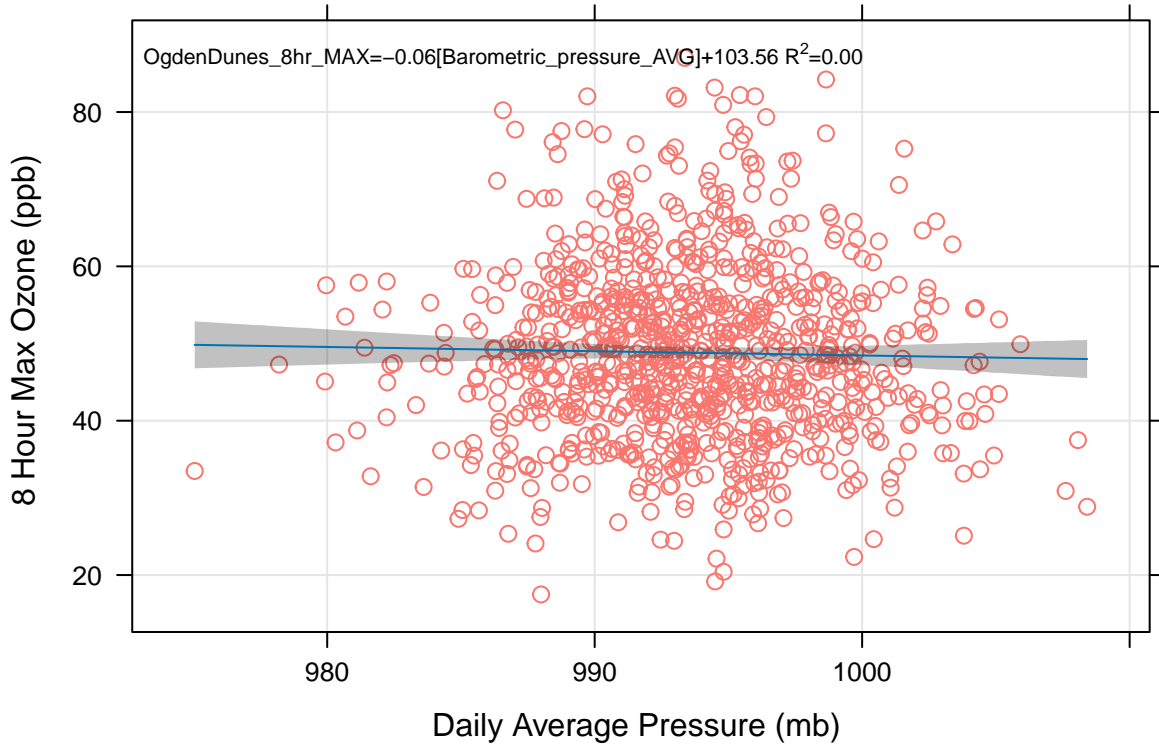
- Solar Radiation  $\pm 35$  W/m<sup>2</sup>
- Relative Humidity  $\pm 10\%$
- Temperature Change (difference between daily minimum and maximum):  $\pm 2$  F
- Temperature Maximum  $\pm 2$  F











# Days

Table 1: 2023-05-23

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
<b>2023-05-23</b>	<b>314.423</b>	<b>33</b>	<b>22.70</b>	<b>80.90</b>	<b>73.700</b>
2024-05-22	324.168	28	22.80	80.10	54.975
2024-06-07	312.419	30	21.50	79.20	48.100
avg w/out EE:	318.293	29	22.15	79.65	51.537

[1] "Number of Days: 3"

[1] "Average 8 Hour Max Ozone without EE Days: 51.5375"

Table 2: 2023-05-30

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-06-16	314.657	54.0	23.60	77.40	65.825
2021-08-16	293.608	48.0	22.00	78.40	53.600
2022-06-09	323.111	40.0	23.20	76.20	53.625
2022-08-10	312.853	52.0	22.40	79.40	50.688
<b>2023-05-30</b>	<b>321.625</b>	<b>44.0</b>	<b>22.40</b>	<b>78.10</b>	<b>74.637</b>
2023-07-31	297.441	45.0	21.80	79.20	48.575
2024-05-23	324.613	34.0	24.10	77.00	56.038
2024-07-19	324.575	47.0	21.30	76.30	51.850
2024-08-10	302.526	36.0	22.10	77.40	37.875
2025-08-02	301.260	44.0	20.50	77.20	47.650
2025-08-03	295.294	48.0	21.10	77.20	55.263
avg w/out EE:	308.994	44.8	22.21	77.57	52.099

[1] "Number of Days: 11"

[1] "Average 8 Hour Max Ozone without EE Days: 52.09875"

Table 3: 2023-06-02

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-06-18	330.636	32.0	23.100	84.00	80.925
2020-07-14	291.123	41.0	23.500	84.60	54.938
2022-05-29	314.615	41.0	22.900	84.30	54.525
2022-07-03	337.332	45.0	23.300	83.40	65.600
2022-07-31	296.725	46.0	22.100	84.60	44.587
<b>2023-06-02</b>	<b>320.125</b>	<b>36.0</b>	<b>21.600</b>	<b>84.20</b>	<b>78.037</b>
2025-07-22	309.095	44.0	21.700	85.80	53.062
avg w/out EE:	313.254	41.5	22.767	84.45	58.940

[1] "Number of Days: 7"

[1] "Average 8 Hour Max Ozone without EE Days: 58.93958333333333"

Table 4: 2023-06-03

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
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2020-07-13	328.893	60.0	13.3	76.8	35.413
<b>2023-06-03</b>	<b>327.688</b>	<b>55.0</b>	<b>13.3</b>	<b>75.9</b>	<b>72.350</b>
2023-06-23	324.309	59.0	13.8	75.9	72.038
2023-07-03	333.161	58.0	12.1	76.1	40.775
2024-06-14	341.593	57.0	13.6	75.6	56.600
avg w/out EE:	331.989	58.5	13.2	76.1	51.206

[1] “Number of Days: 5”

[1] “Average 8 Hour Max Ozone without EE Days: 51.20625”

Table 5: 2023-06-10

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2022-06-19	333.802	27	32.3	84.6	60.525
<b>2023-06-10</b>	<b>317.481</b>	<b>23</b>	<b>31.3</b>	<b>85.6</b>	<b>77.725</b>
<b>2023-06-18</b>	<b>298.915</b>	<b>31</b>	<b>29.6</b>	<b>84.6</b>	<b>76.112</b>
avg w/out EE:	333.802	27	32.3	84.6	60.525

[1] “Number of Days: 3”

[1] “Average 8 Hour Max Ozone without EE Days: 60.525”

Table 6: 2023-06-18

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-08-20	279.501	38.0	28.700	84.7	49.550
2022-09-09	265.150	41.0	29.500	84.3	48.338
2023-05-11	328.023	22.0	30.400	82.7	71.350
<b>2023-06-10</b>	<b>317.481</b>	<b>23.0</b>	<b>31.300</b>	<b>85.6</b>	<b>77.725</b>
<b>2023-06-18</b>	<b>298.915</b>	<b>31.0</b>	<b>29.600</b>	<b>84.6</b>	<b>76.112</b>
2023-09-01	276.058	41.0	30.100	83.1	49.725
avg w/out EE:	287.183	35.5	29.675	83.7	54.741

[1] “Number of Days: 6”

[1] “Average 8 Hour Max Ozone without EE Days: 54.740625”

Table 7: 2023-06-19

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-05-29	280.663	49.000	19.700	75.600	58.312
2021-09-06	262.562	47.000	18.200	77.500	41.912
2022-07-26	262.979	51.000	18.600	78.800	51.325
2022-07-29	264.024	52.000	17.600	77.700	50.687
2022-08-16	290.742	65.000	17.200	77.500	49.450
<b>2023-06-19</b>	<b>286.302</b>	<b>55.000</b>	<b>19.200</b>	<b>77.600</b>	<b>77.112</b>
<b>2023-06-21</b>	<b>318.947</b>	<b>63.000</b>	<b>18.600</b>	<b>78.300</b>	<b>79.350</b>
2023-07-17	299.939	56.000	17.500	75.600	46.388
2023-07-30	312.543	56.000	19.100	78.200	37.537
2024-05-17	288.358	53.000	17.900	76.600	57.862
2024-07-20	273.288	50.000	19.800	77.700	55.988
2025-07-18	287.589	59.000	17.300	77.800	49.150

2025-08-03	295.294	48.000	21.100	77.200	55.263
2025-09-02	255.276	51.000	21.100	76.600	54.700
avg w/out EE:	281.105	53.083	18.758	77.233	50.715

[1] “Number of Days: 14”

[1] “Average 8 Hour Max Ozone without EE Days: 50.71458333333333”

Table 8: 2023-06-21

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2022-08-16	290.742	65.00	17.200	77.500	49.450
<b>2023-06-19</b>	<b>286.302</b>	<b>55.00</b>	<b>19.200</b>	<b>77.600</b>	<b>77.112</b>
<b>2023-06-21</b>	<b>318.947</b>	<b>63.00</b>	<b>18.600</b>	<b>78.300</b>	<b>79.350</b>
2023-07-30	312.543	56.00	19.100	78.200	37.537
2024-05-17	288.358	53.00	17.900	76.600	57.862
2025-07-18	287.589	59.00	17.300	77.800	49.150
avg w/out EE:	294.808	58.25	17.875	77.525	48.500

[1] “Number of Days: 6”

[1] “Average 8 Hour Max Ozone without EE Days: 48.5”

Table 9: 2023-07-04

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-05-24	312.913	50.000	23.000	88.200	50.617
2020-07-17	312.332	49.000	23.100	87.400	50.863
2020-07-25	301.001	47.000	23.100	88.200	57.600
2020-08-22	271.656	43.000	26.500	87.200	49.400
2020-08-23	254.224	42.000	25.400	89.100	49.688
2022-08-02	271.634	57.000	24.100	87.800	46.475
2022-09-01	263.872	42.000	24.100	88.200	47.375
2023-06-01	314.043	43.000	25.300	87.400	65.350
<b>2023-07-04</b>	<b>288.615</b>	<b>49.000</b>	<b>25.000</b>	<b>87.300</b>	<b>81.738</b>
<b>2023-07-25</b>	<b>280.894</b>	<b>43.000</b>	<b>26.900</b>	<b>88.800</b>	<b>77.062</b>
2024-07-07	277.752	42.000	26.200	88.900	52.938
avg w/out EE:	286.603	46.111	24.533	88.044	52.256

[1] “Number of Days: 11”

[1] “Average 8 Hour Max Ozone without EE Days: 52.2560185185185”

Table 10: 2023-07-23

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-08-13	288.508	50.000	17.700	80.100	60.438
2020-08-14	282.116	61.000	16.800	81.000	63.412
2022-07-26	262.979	51.000	18.600	78.800	51.325
<b>2023-07-23</b>	<b>290.727</b>	<b>57.000</b>	<b>17.400</b>	<b>80.800</b>	<b>75.837</b>
2023-08-04	292.346	61.000	15.500	81.600	63.587
2025-06-19	267.497	53.000	17.300	81.700	55.100
2025-07-10	303.681	52.000	15.600	82.100	42.375

2025-08-14	294.146	58.000	16.300	80.200	41.963
avg w/out EE:	284.468	55.143	16.829	80.786	54.029

[1] “Number of Days: 8”

[1] “Average 8 Hour Max Ozone without EE Days: 54.0285714285714”

Table 11: 2023-07-25

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-08-22	271.656	43	26.500	87.2	49.400
2020-08-23	254.224	42	25.400	89.1	49.688
2023-05-31	269.032	34	27.200	90.8	54.063
2023-06-01	314.043	43	25.300	87.4	65.350
<b>2023-07-04</b>	<b>288.615</b>	<b>49</b>	<b>25.000</b>	<b>87.3</b>	<b>81.738</b>
<b>2023-07-25</b>	<b>280.894</b>	<b>43</b>	<b>26.900</b>	<b>88.8</b>	<b>77.062</b>
2024-05-21	274.661	41	28.100	89.0	59.650
2024-07-07	277.752	42	26.200	88.9	52.938
2024-07-13	307.847	49	26.000	90.4	55.888
2024-09-05	249.280	42	27.800	88.4	56.750
avg w/out EE:	277.312	42	26.562	88.9	55.466

[1] “Number of Days: 10”

[1] “Average 8 Hour Max Ozone without EE Days: 55.465625”

Table 12: 2023-08-03

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2023-06-24	325.210	51.00	23.000	83.100	68.713
2023-07-24	269.752	55.00	21.400	83.100	61.025
<b>2023-08-03</b>	<b>298.070</b>	<b>60.00</b>	<b>21.800</b>	<b>83.500</b>	<b>82.112</b>
2024-08-14	273.254	53.00	23.600	81.700	52.062
2025-08-06	272.632	52.00	22.100	84.800	75.250
avg w/out EE:	285.212	52.75	22.525	83.175	64.262

[1] “Number of Days: 5”

[1] “Average 8 Hour Max Ozone without EE Days: 64.2625”

Table 13: 2025-06-11

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-06-20	257.129	34.000	24.90	91.700	62.763
2020-08-23	254.224	42.000	25.40	89.100	49.688
2021-08-23	231.704	42.000	26.90	89.400	56.838
2023-05-31	269.032	34.000	27.20	90.800	54.063
2024-05-21	274.661	41.000	28.10	89.000	59.650
2024-07-07	277.752	42.000	26.20	88.900	52.938
2024-09-05	249.280	42.000	27.80	88.400	56.750
2024-09-16	230.670	28.000	28.30	88.500	66.963
<b>2025-06-11</b>	<b>255.876</b>	<b>32.000</b>	<b>26.80</b>	<b>90.400</b>	<b>69.412</b>
avg w/out EE:	255.557	38.125	26.85	89.475	57.456

[1] “Number of Days: 9”

[1] “Average 8 Hour Max Ozone without EE Days: 57.45625”

Table 14: 2025-06-12

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-09-13	233.886	62.0	13.30	72.0	30.675
2021-09-28	216.887	61.0	13.10	70.8	46.562
2023-07-06	215.859	74.0	11.50	72.4	40.850
2024-07-11	276.354	77.0	10.90	74.2	35.038
<b>2025-06-12</b>	<b>248.378</b>	<b>68.0</b>	<b>11.80</b>	<b>72.2</b>	<b>76.212</b>
2025-08-21	244.276	72.0	11.90	74.1	44.488
avg w/out EE:	237.452	69.2	12.14	72.7	39.522

[1] “Number of Days: 6”

[1] “Average 8 Hour Max Ozone without EE Days: 39.5225”

Table 15: 2025-06-16

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-06-17	317.272	46.000	21.000	81.1	77.238
2020-08-07	272.238	45.000	23.500	81.6	58.212
2020-08-12	296.352	57.000	21.800	79.8	51.713
2020-08-21	273.109	45.000	23.800	83.1	60.763
2021-05-02	274.720	41.000	21.300	82.7	47.212
2022-08-10	312.853	52.000	22.400	79.4	50.688
2022-08-23	282.732	45.000	20.700	81.0	43.125
2023-06-24	325.210	51.000	23.000	83.1	68.713
2023-07-24	269.752	55.000	21.400	83.1	61.025
2023-07-31	297.441	45.000	21.800	79.2	48.575
2024-08-13	290.415	48.000	23.900	81.7	50.900
2024-08-14	273.254	53.000	23.600	81.7	52.062
2025-06-08	275.618	47.000	23.100	82.0	59.688
<b>2025-06-16</b>	<b>302.822</b>	<b>48.000</b>	<b>22.100</b>	<b>81.2</b>	<b>74.350</b>
avg w/out EE:	289.305	48.462	22.408	81.5	56.147

[1] “Number of Days: 14”

[1] “Average 8 Hour Max Ozone without EE Days: 56.1471153846154”

Table 16: 2025-07-02

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2021-09-13	193.124	46.000	21.300	88.300	49.100
2022-07-04	196.570	46.000	22.300	87.700	56.000
2022-09-17	195.865	44.000	21.000	86.000	52.113
2023-07-11	214.451	50.000	22.200	87.000	50.438
2024-09-14	237.307	49.000	22.000	85.700	45.500
2024-09-15	225.439	42.000	21.900	86.200	52.488
2025-06-20	205.305	49.000	20.900	85.400	52.213
<b>2025-07-02</b>	<b>212.576</b>	<b>40.000</b>	<b>21.900</b>	<b>86.600</b>	<b>75.425</b>
avg w/out EE:	209.723	46.571	21.657	86.614	51.121

[1] “Number of Days: 8”

[1] “Average 8 Hour Max Ozone without EE Days: 51.1214285714286”

Table 17: 2025-07-14

date	Solar_radiation_AVG	RH_MIN	TempChange	Temperature_MAX	OgdenDunes_8hr_MAX
2020-07-14	291.123	41	23.50	84.60	54.938
2020-08-21	273.109	45	23.80	83.10	60.763
2021-08-04	296.671	44	25.70	82.10	71.362
2022-05-29	314.615	41	22.90	84.30	54.525
2022-07-30	263.783	44	24.40	82.60	45.025
2023-06-24	325.210	51	23.00	83.10	68.713
2023-08-02	270.938	48	22.70	83.90	55.987
2024-06-15	291.842	39	26.40	84.70	59.712
2024-06-24	325.278	47	22.80	85.40	54.425
2024-07-27	312.101	40	24.30	84.60	50.225
<b>2025-07-14</b>	<b>293.489</b>	<b>46</b>	<b>24.50</b>	<b>84.10</b>	<b>82.038</b>
avg w/out EE:	296.467	44	23.95	83.84	57.567

[1] “Number of Days: 11”

[1] “Average 8 Hour Max Ozone without EE Days: 57.5675”

Table 18: Summary

date	EE_value	Matching_Day_Average
2023-05-23	73.7000	51.53750
2023-05-30	74.6375	52.09875
2023-06-02	78.0375	58.93958
2023-06-03	72.3500	51.20625
2023-06-10	77.7250	60.52500
2023-06-18	76.1125	54.74063
2023-06-19	77.1125	50.71458
2023-06-21	79.3500	48.50000
2023-07-04	81.7375	52.25602
2023-07-23	75.8375	54.02857
2023-07-25	77.0625	55.46563
2023-08-03	82.1125	64.26250
2025-06-11	69.4125	57.45625
2025-06-12	76.2125	39.52250
2025-06-16	74.3500	56.14712
2025-07-02	75.4250	51.12143
2025-07-14	82.0375	57.56750