STF Weather Station Selection

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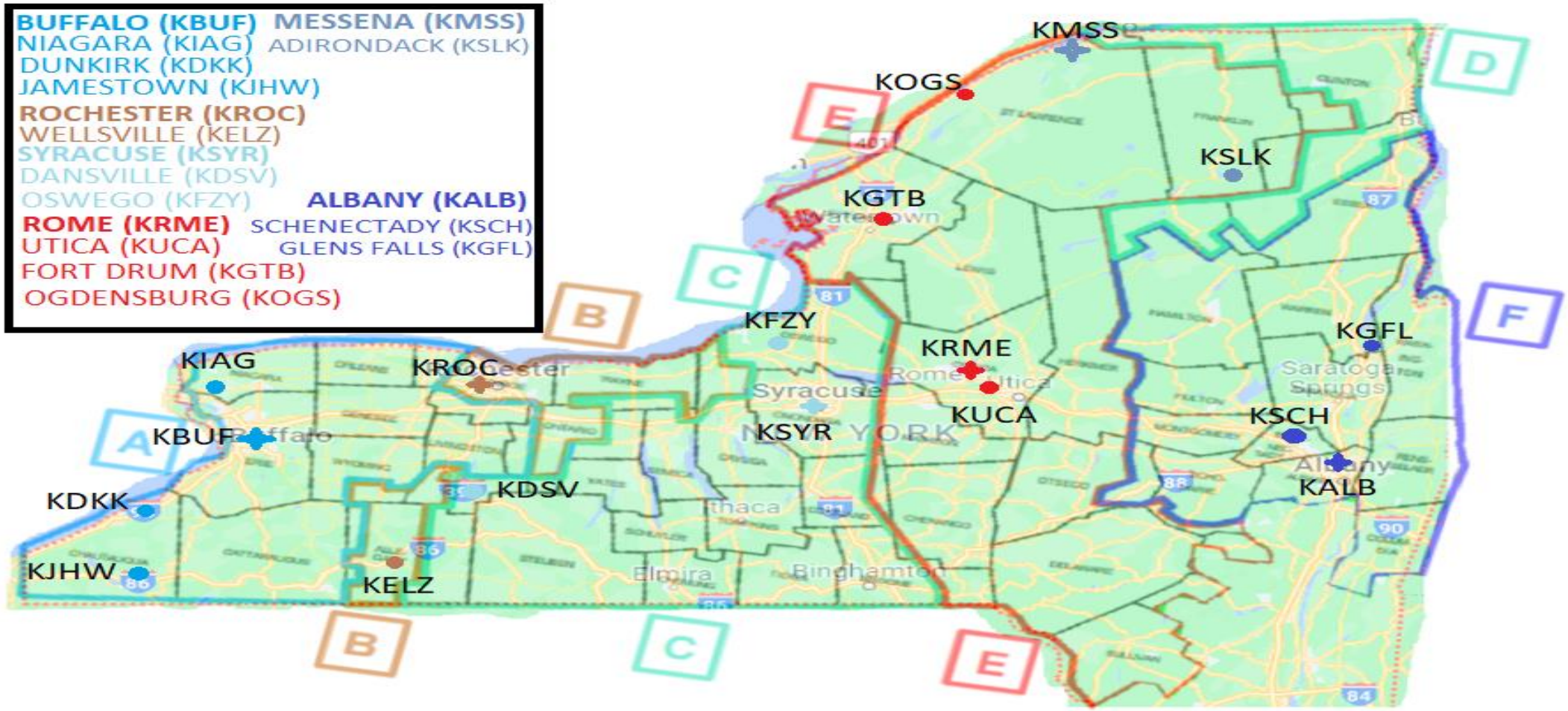
Scope

National Grid currently utilizes 6 weather stations (one per zone) and 4 sensor values (TMP, FLSK, HUM, GHI) for our system-level forecasts. While this produces decent results for our A-F, East, Central, West, and NY Total forecasts, we currently get 18 weather forecasts from DTN in New York and are wondering if using any of these will improve performance.



Project Setup

Data

- Cleaned hourly zonal load data from 2020-01-01 to 2023-06-01
  - From Excel and PI
- Weather from DTN extracts and DMA DB
  - 2020-01-01 to 2022-06-30 – DTN Histories from Dale Nelson
  - 2022-07-01 to 2023-06-01 – Observed weather from DMA

While scoring performance and choosing weather stations, we took a train/test split:

- Train: 2020-01-01 to 2022-06-01 (when possible)
- Test: 2022-06-01 to 2023-06-01 (full year)

Modeling

Our approach to start was to hold the modeling methodology constant and change stations (or how we use station information)

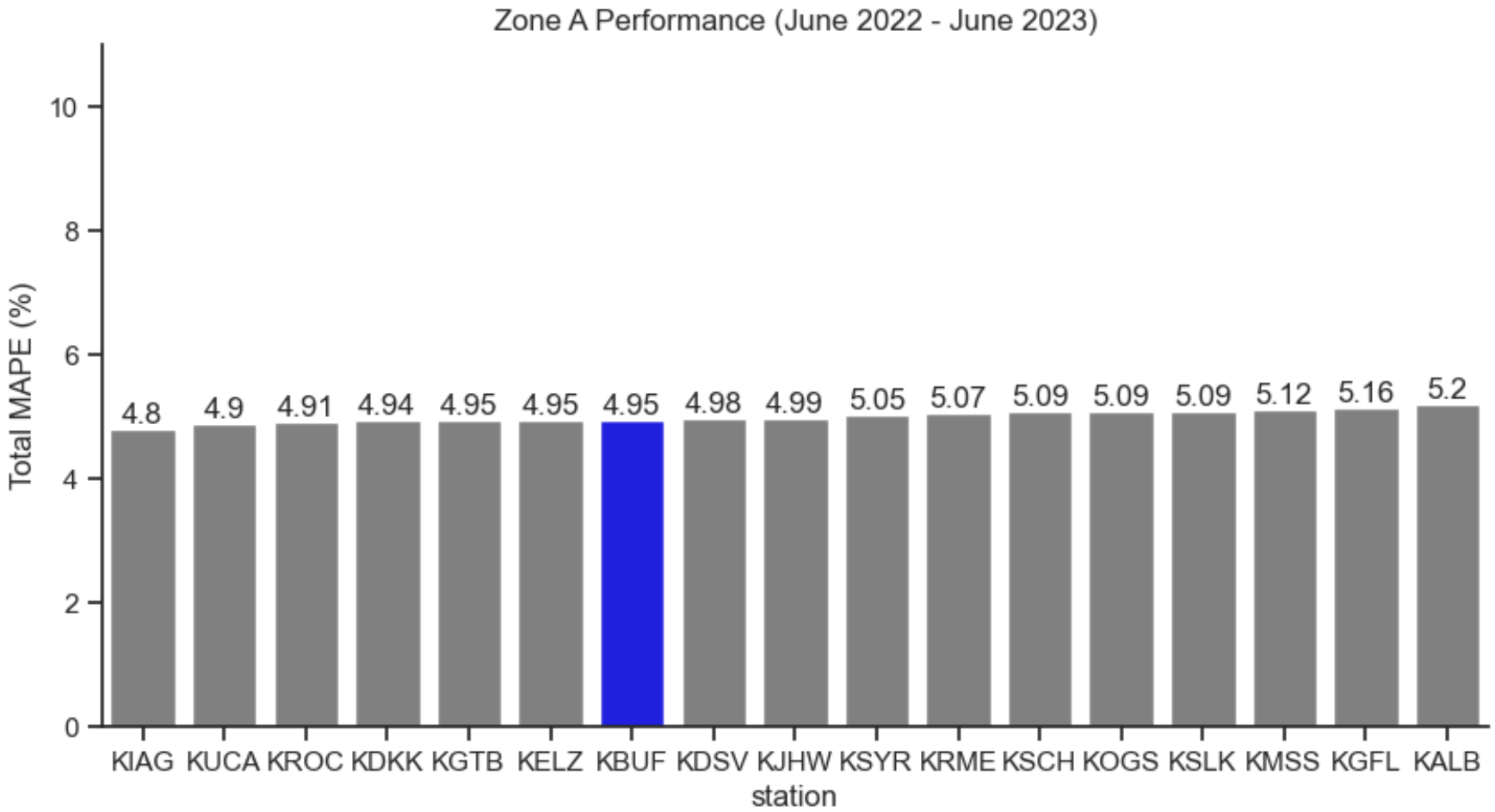
- Current model with generally best configuration
  - HDD, CDD, FLSK, HUM, GHI
  - EWMA cleaning
  - 1st order polynomials
  - 24-hour lags
  - Last hour (11 PM) available

Performance Measures

- Overall MAPE
- Overall MPE (bias)
- Extreme MAPEs (thresholds = 90 high, 20 low)
- Summer MAPE
- Winter MAPE
- Fall MAPE
- Spring MAPE

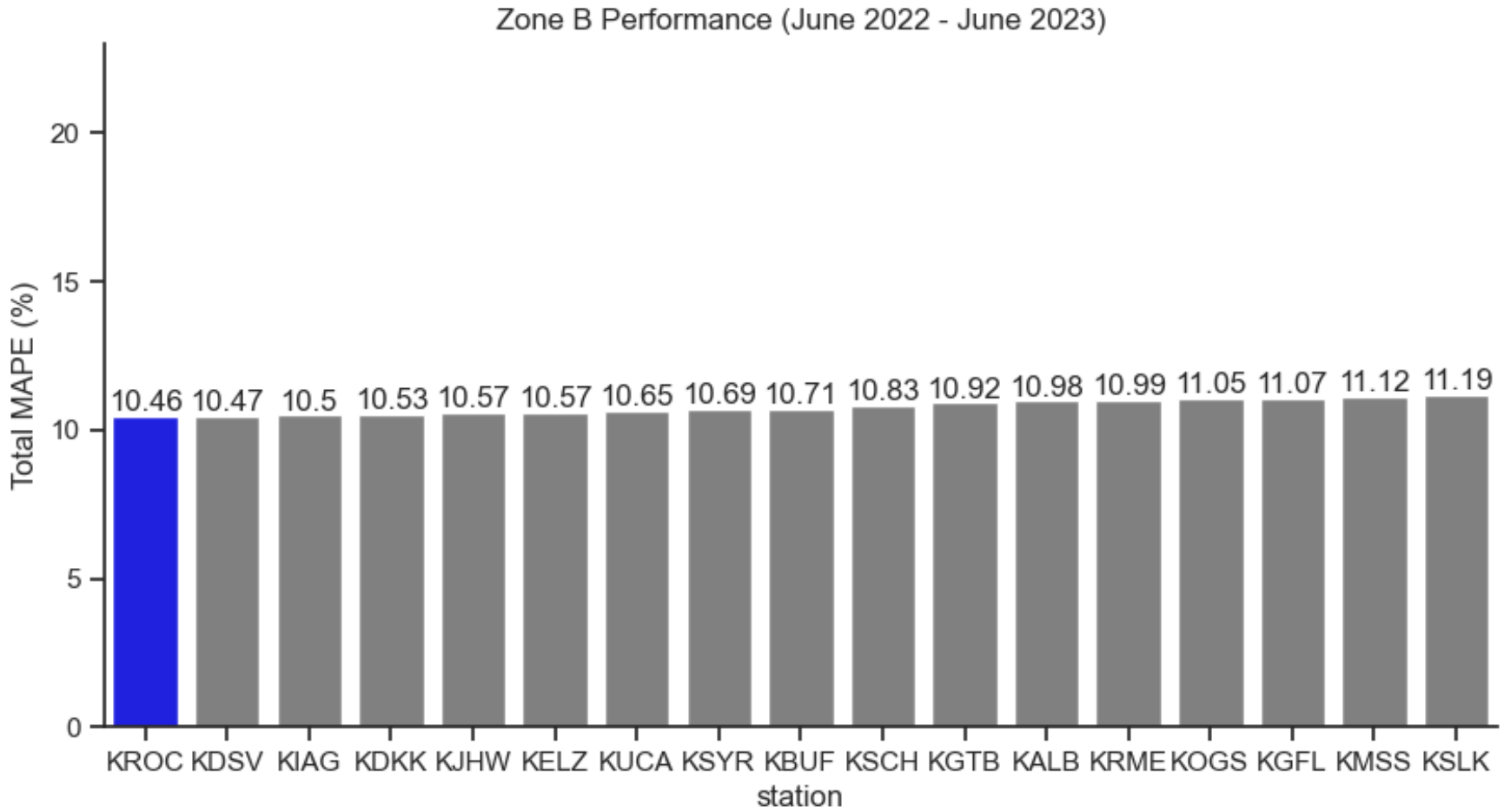
Zone A Performance

Buffalo (KBUF) station performed well in the forecasting model. The MAPE is 4.95%, which is not too far off from the top performed station Niagara (KIAG) at 4.8%.



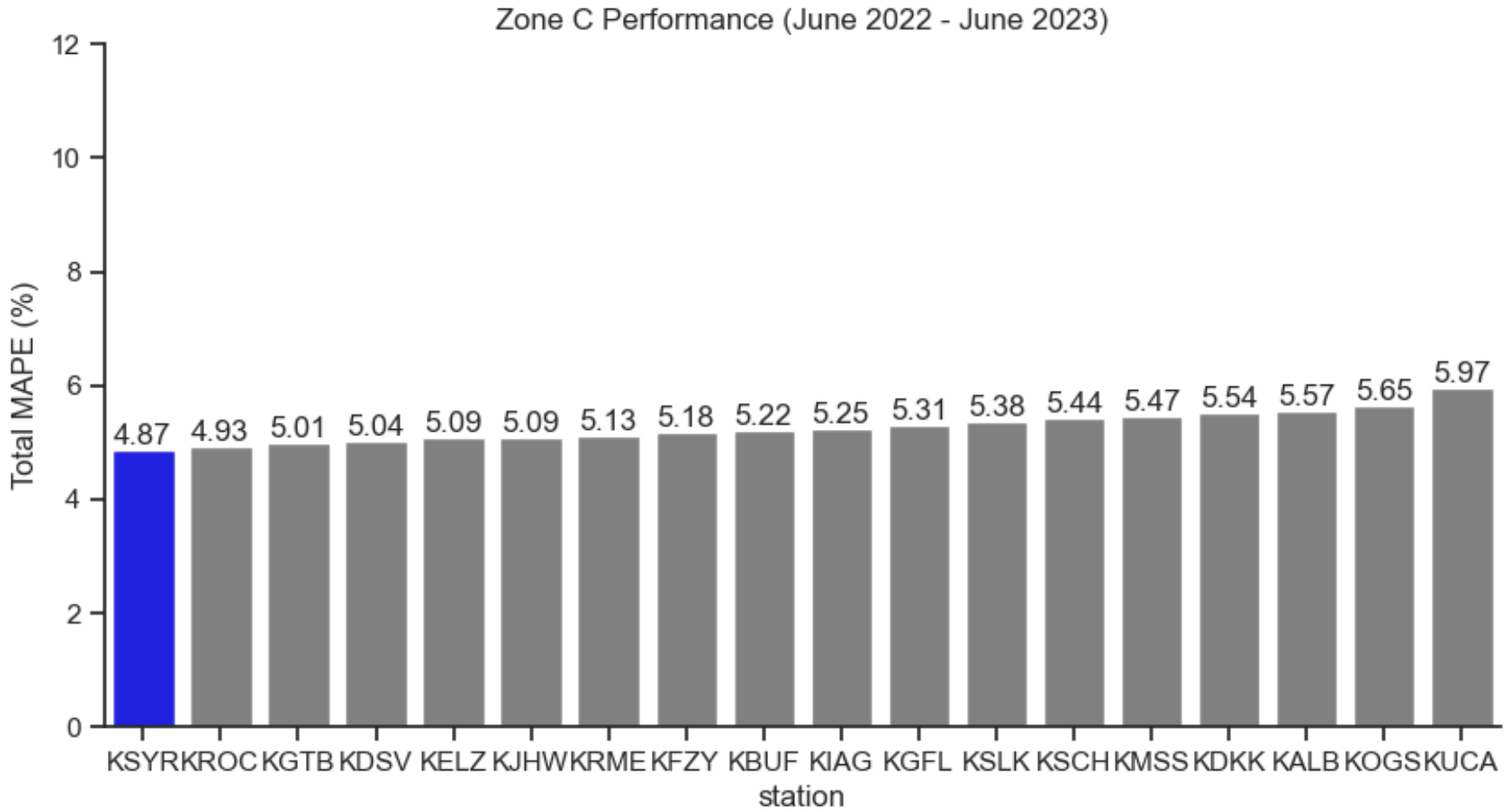
Zone B Performance

Rochester (KROC) station is ideal for Zone B as it results in the lowest Total MAPE percentage.



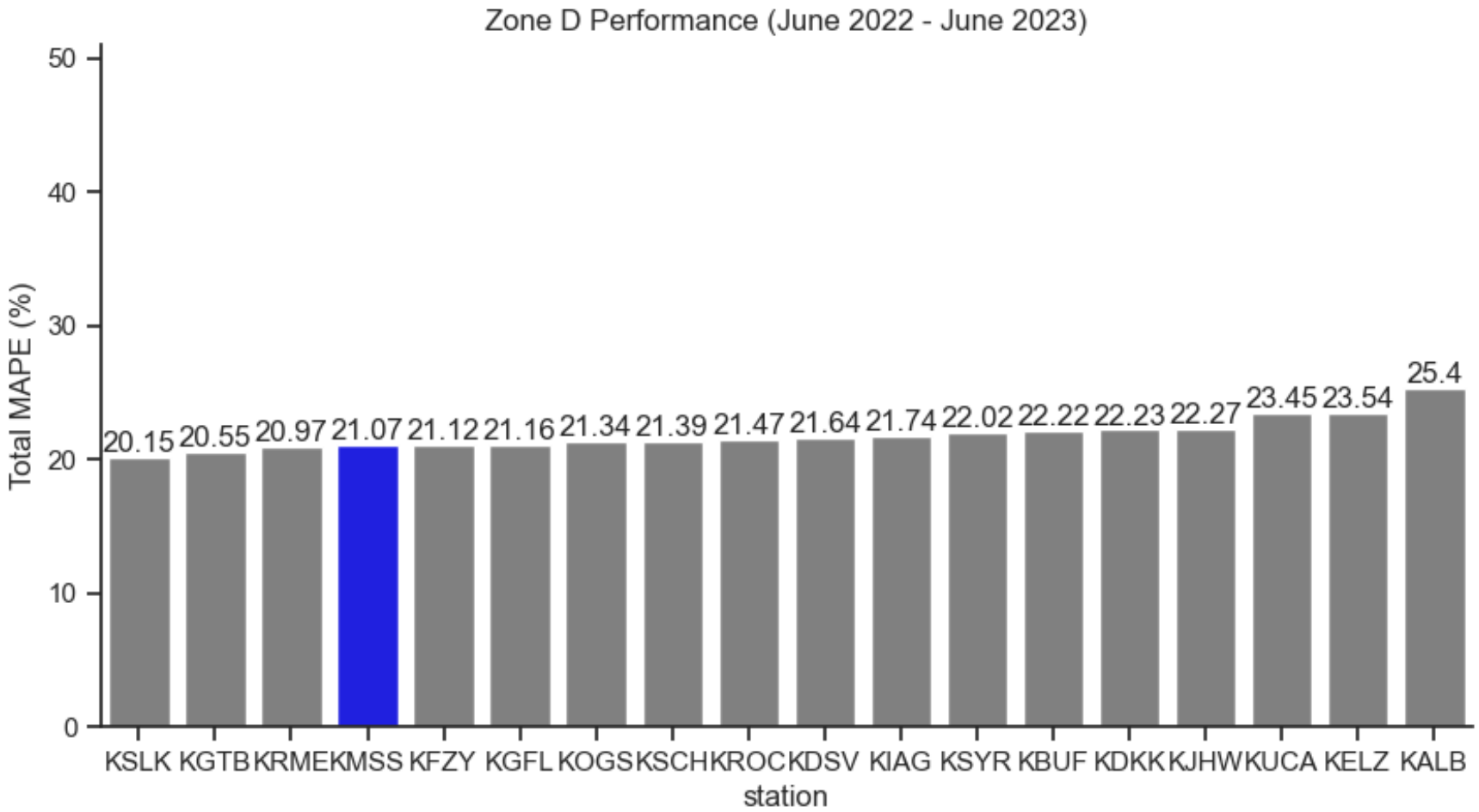
Zone C Performance

Syracuse (KSYR) station is ideal for Zone C as it results in the lowest Total MAPE percentage.



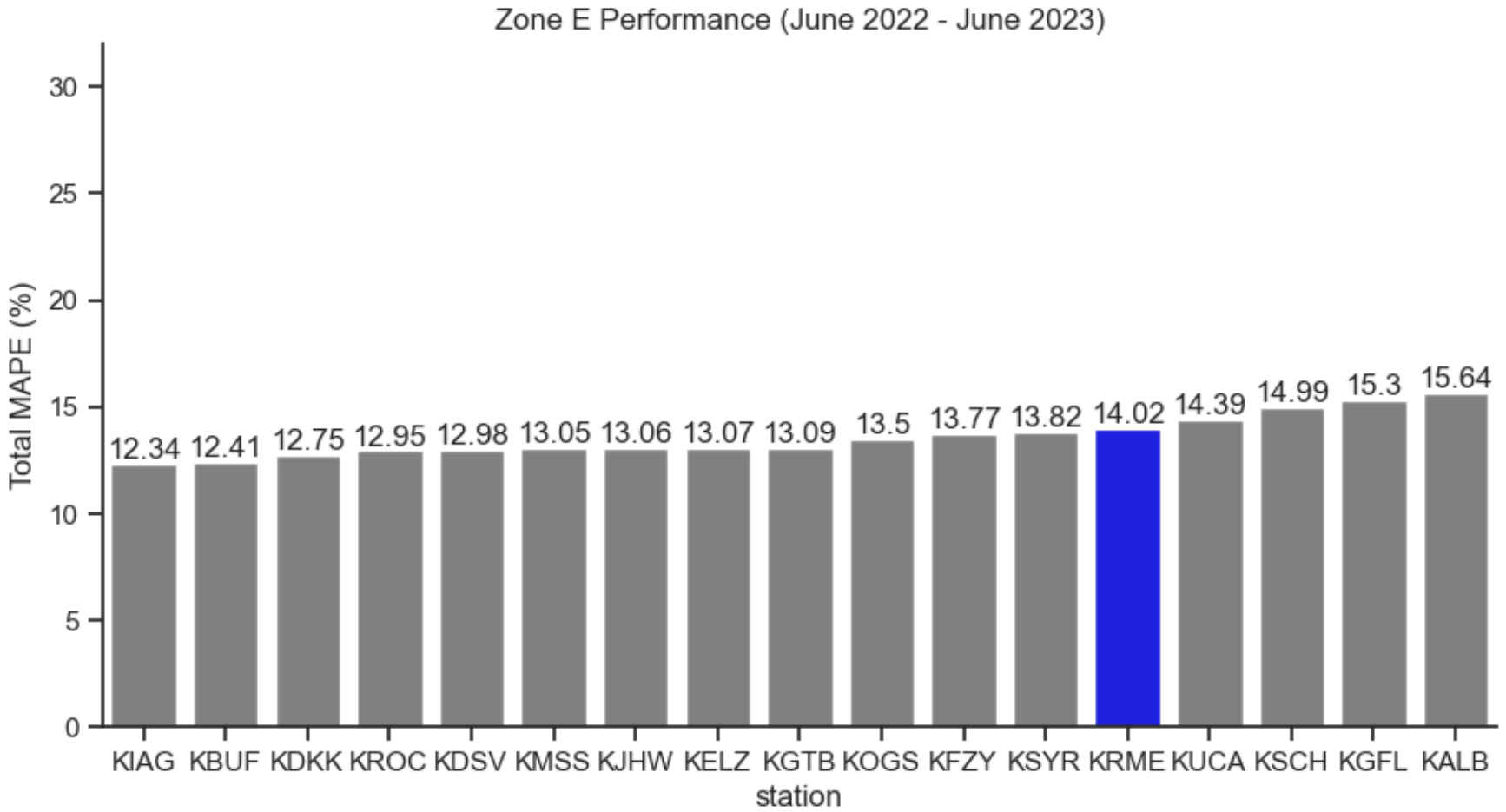
Zone D Performance

Massena (KMSS) station performed well when compared to the other stations available. Though the percentage is high, KMSS should remain the primary station for Zone D. Adirondack (KSLK) can be considered as an alternative.



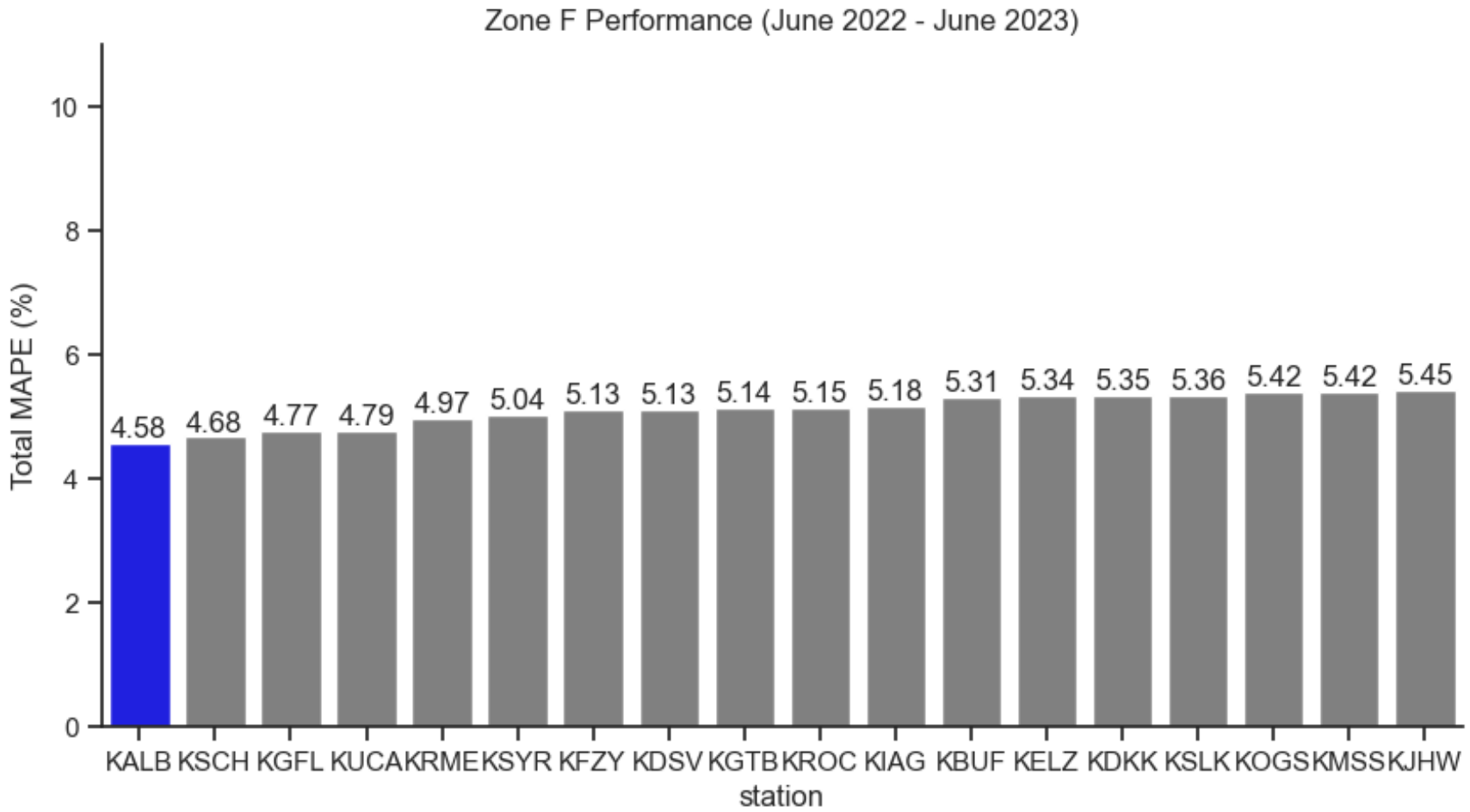
Zone E Performance

Rome (KRME) station underperformed in the forecasting model when compared to the alternative stations. KRME ranked the 5th worst with a MAPE of 14.02%. Utilizing an alternative may be beneficial according to the MAPE rankings.

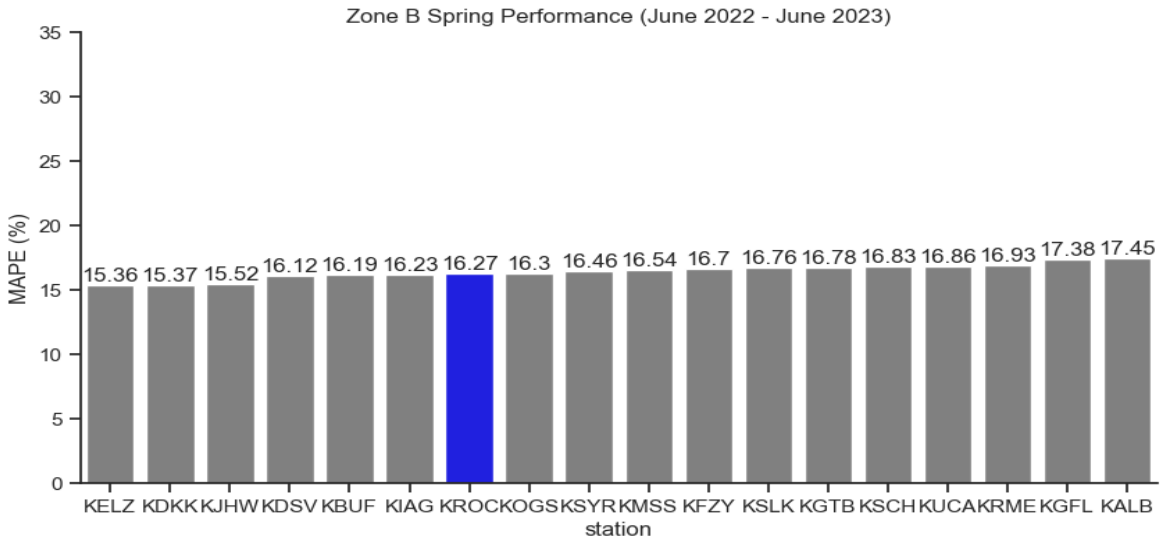


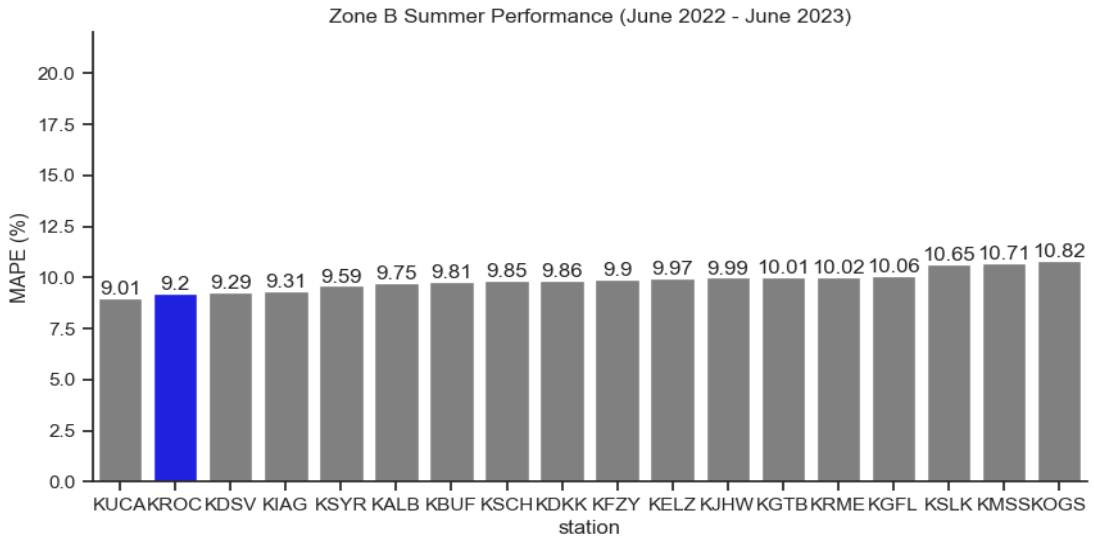
Zone F Performance

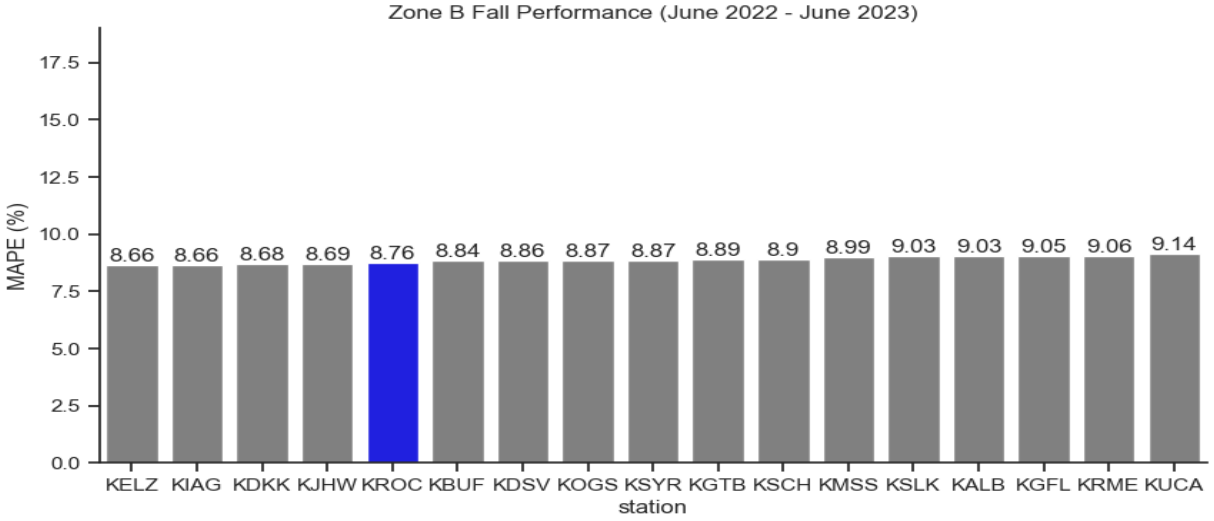
Albany (KALB) station is ideal for Zone F as it results in the lowest Total MAPE percentage.

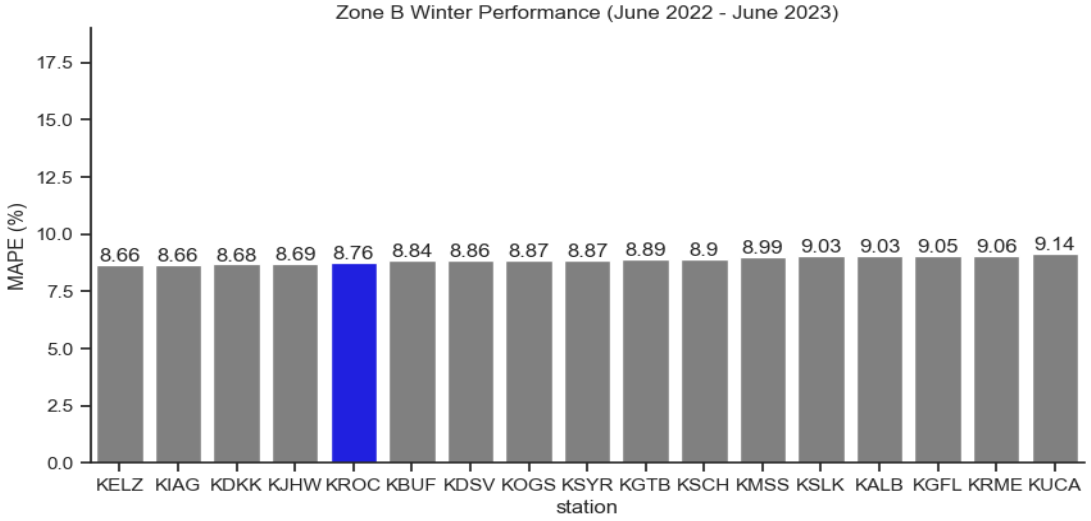


Seasonal Performance

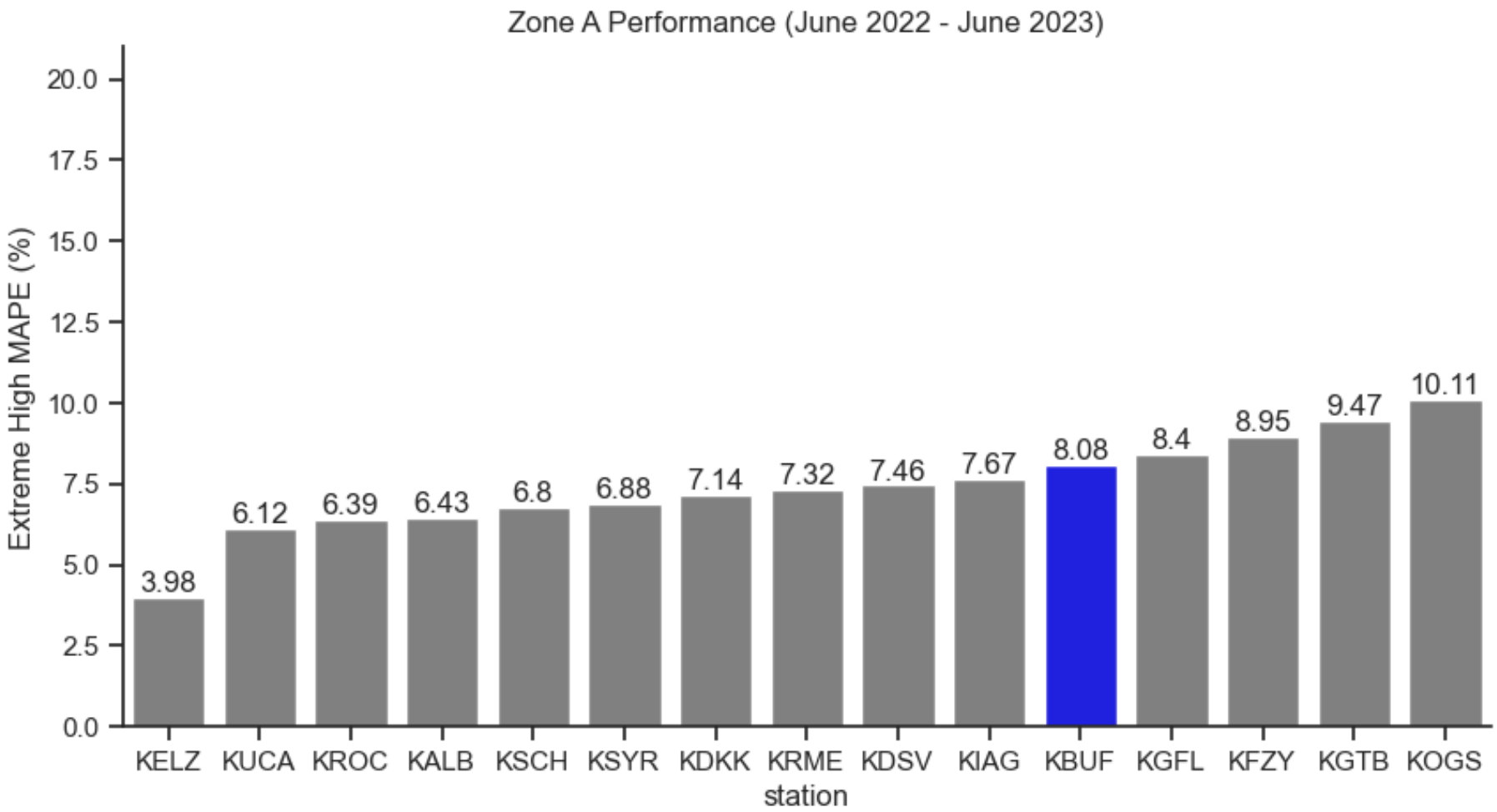




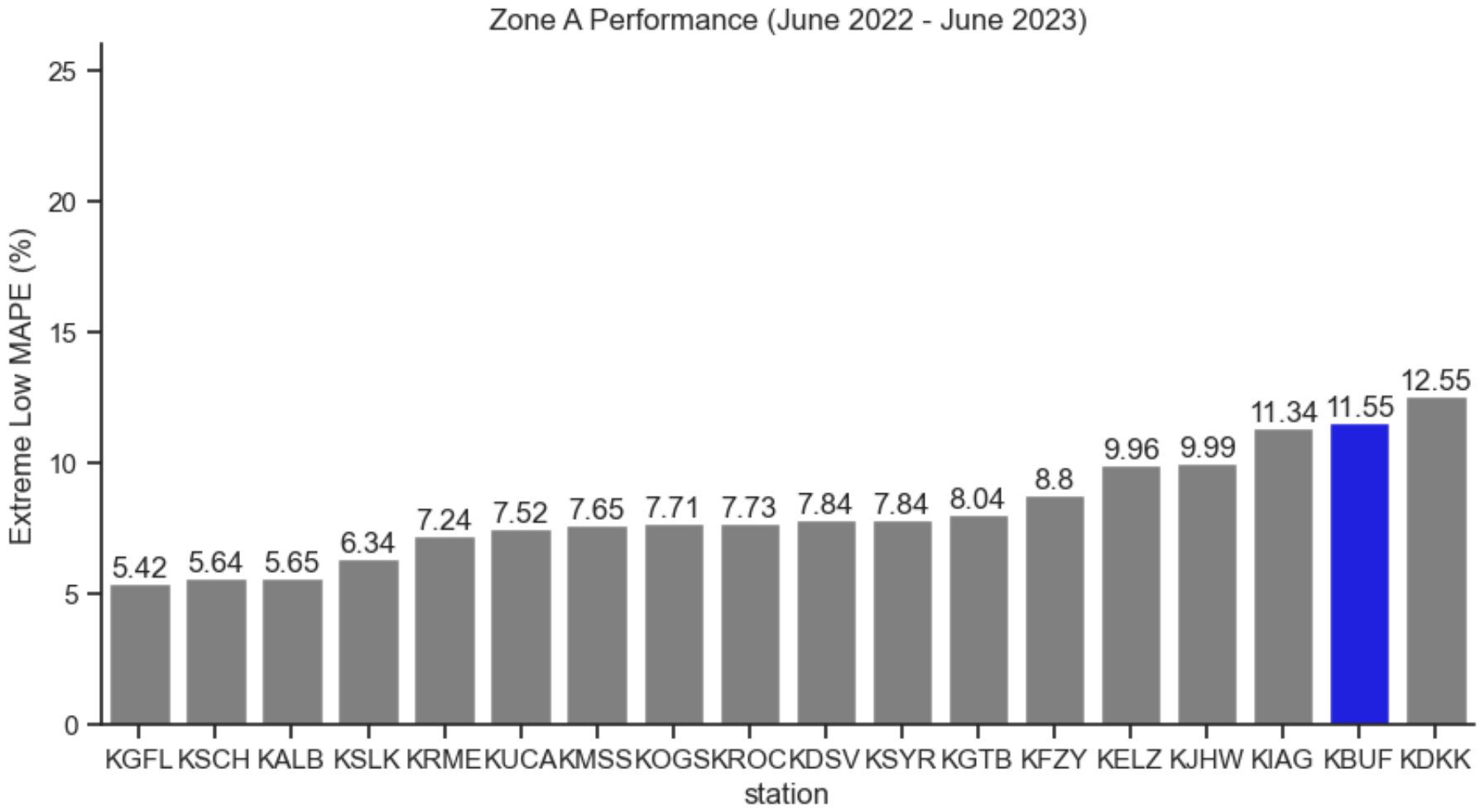




Extreme Hot Condition Performance



Extreme Cold Condition Performance



Conclusions

	zone_letter	station	MAPE_Total
4	A	KIAG	4.8
6	A	KUCA	4.9
7	A	KROC	4.91
9	A	KDKK	4.94
10	A	KGTB	4.95
11	A	KELZ	4.95
12	A	KBUF	4.95
14	A	KDSV	4.98
15	A	KJHW	4.99
19	A	KSYR	5.05
20	A	KRME	5.07
21	A	KSCH	5.09
24	A	KOGS	5.09
25	A	KSLK	5.09
26	A	KMSS	5.12
32	A	KGFL	5.16
35	A	KALB	5.2

	zone_letter	station	MAPE_Total
53	B	KROC	10.46
54	B	KDSV	10.47
55	B	KIAG	10.5
56	B	KDKK	10.53
57	B	KJHW	10.57
58	B	KELZ	10.57
59	B	KUCA	10.65
60	B	KSYR	10.69
61	B	KBUF	10.71
62	B	KSCH	10.83
63	B	KGTB	10.92
64	B	KALB	10.98
65	B	KRME	10.99
66	B	KOGS	11.05
67	B	KGFL	11.07
68	B	KMSS	11.12
69	B	KSLK	11.19

Conclusions (cont.)

	zone_letter	station	MAPE_Total
5	C	KSYR	4.87
8	C	KROC	4.93
16	C	KGTB	5.01
17	C	KDSV	5.04
22	C	KELZ	5.09
23	C	KJHW	5.09
28	C	KRME	5.13
33	C	KFZY	5.18
36	C	KBUF	5.22
37	C	KIAG	5.25
39	C	KGFL	5.31
43	C	KSLK	5.38
46	C	KSCH	5.44
48	C	KMSS	5.47
49	C	KDKK	5.54
50	C	KALB	5.57
51	C	KOGS	5.65
52	C	KUCA	5.97

	zone_letter	station	MAPE_Total
87	D	KSLK	20.15
88	D	KGTB	20.55
89	D	KRME	20.97
90	D	KMSS	21.07
91	D	KFZY	21.12
92	D	KGFL	21.16
93	D	KOGS	21.34
94	D	KSCH	21.39
95	D	KROC	21.47
96	D	KDSV	21.64
97	D	KIAG	21.74
98	D	KSYR	22.02
99	D	KBUF	22.22
100	D	KDKK	22.23
101	D	KJHW	22.27
102	D	KUCA	23.45
103	D	KELZ	23.54
104	D	KALB	25.4

Conclusions (cont.)

	zone_letter	station	MAPE_Total
70	E	KIAG	12.34
71	E	KBUF	12.41
72	E	KDKK	12.75
73	E	KROC	12.95
74	E	KDSV	12.98
75	E	KMSS	13.05
76	E	KJHW	13.06
77	E	KELZ	13.07
78	E	KGTB	13.09
79	E	KOGS	13.5
80	E	KFZY	13.77
81	E	KSYR	13.82
82	E	KRME	14.02
83	E	KUCA	14.39
84	E	KSCH	14.99
85	E	KGFL	15.3
86	E	KALB	15.64

	zone_letter	station	MAPE_Total
0	F	KALB	4.58
1	F	KSCH	4.68
2	F	KGFL	4.77
3	F	KUCA	4.79
13	F	KRME	4.97
18	F	KSYR	5.04
27	F	KFZY	5.13
29	F	KDSV	5.13
30	F	KGTB	5.14
31	F	KROC	5.15
34	F	KIAG	5.18
38	F	KBUF	5.31
40	F	KELZ	5.34
41	F	KDKK	5.35
42	F	KSLK	5.36
44	F	KOGS	5.42
45	F	KMSS	5.42
47	F	KJHW	5.45

Next Steps

- To improve on Zone D performance, consider Adirondack (KSLK)
- To improve on Zone E performance, consider Fort Drum (KGTB)
- Consider exploring combinations of stations for each zone
- Determine if purchasing additional weather stations can yield better predictions