Verification of DICAST Temperature Forecasts for Boulder Municipal Airport

Jeffery K. Lazo
Raymond C. Lee
Wei Qing
Zhao Bin
Zhang Xin

Data Provided / Questions to Answer

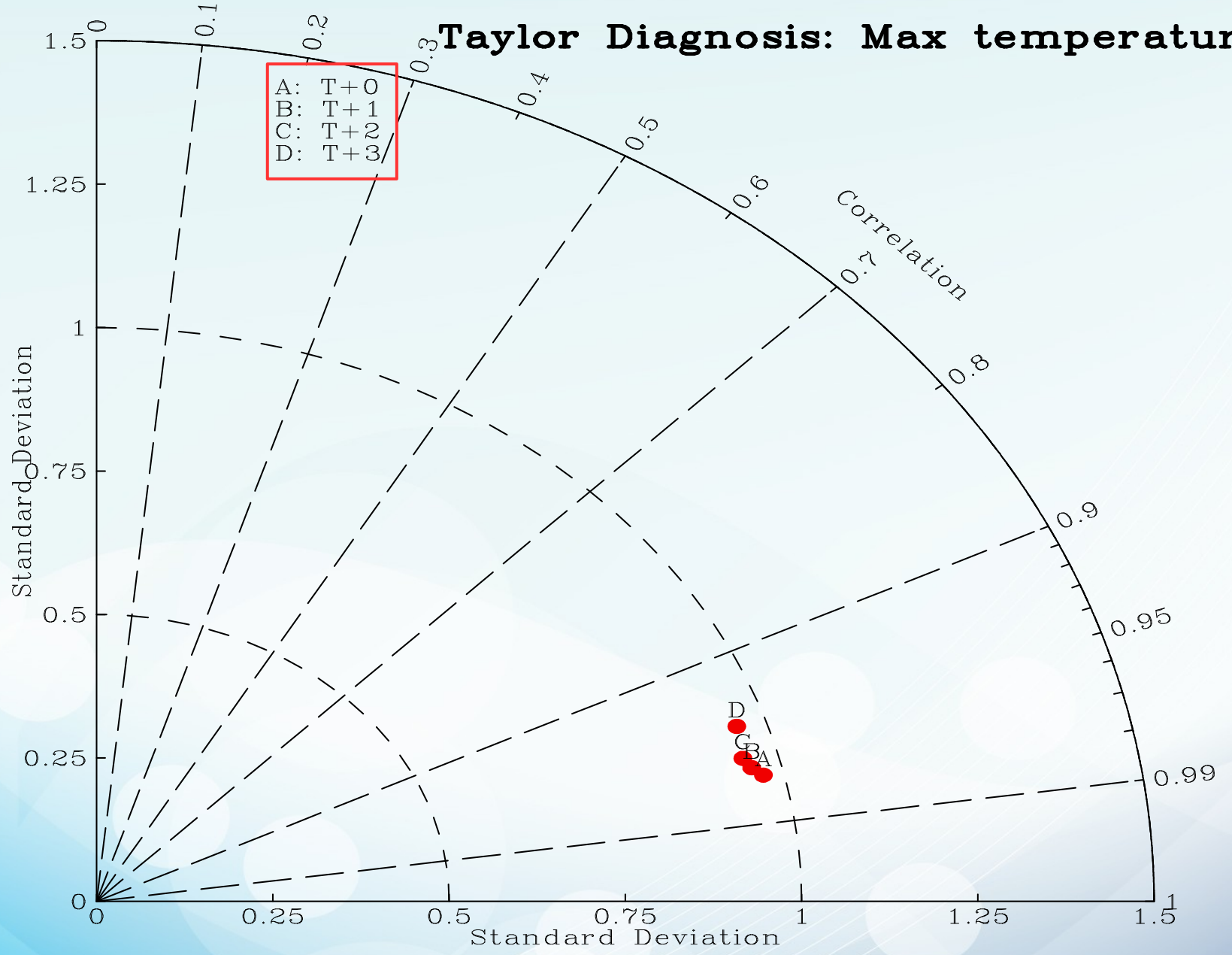
- **Approximately 10 months of Max Air Temperature for 1 station (Boulder)**
- **0, 1, 2, and 3 day forecasts with verifying observation**
- **Data valid: 20160610 to 20170415**

- **What were the general verification results?**
- **What difference occurs in the bias for individual months?**
- **For near freezing events that affect the airport, what is the performance of the model (-3 to +3C)?**
- **For extreme temperatures, what is the relative performance of the model in regards to electrical power production costs?**

General Verification

	Day 0	Day 1	Day 2	Day 3
Mean Error (Bias)	-0.057	-0.056	-0.085	-0.071
ABS Mean Error	1.65	1.74	1.98	2.48
RMSE	2.38	2.53	2.74	3.27
Standard Deviation (Fcst)	10.23	10.05	9.90	9.88
Standard Deviation (Obs)	10.54	10.49	10.42	10.31
Standard Deviation (F-O)	2.38	2.53	2.74	3.27
Correlation Coeffiecient	0.974	0.970	0.965	0.948

General Verification



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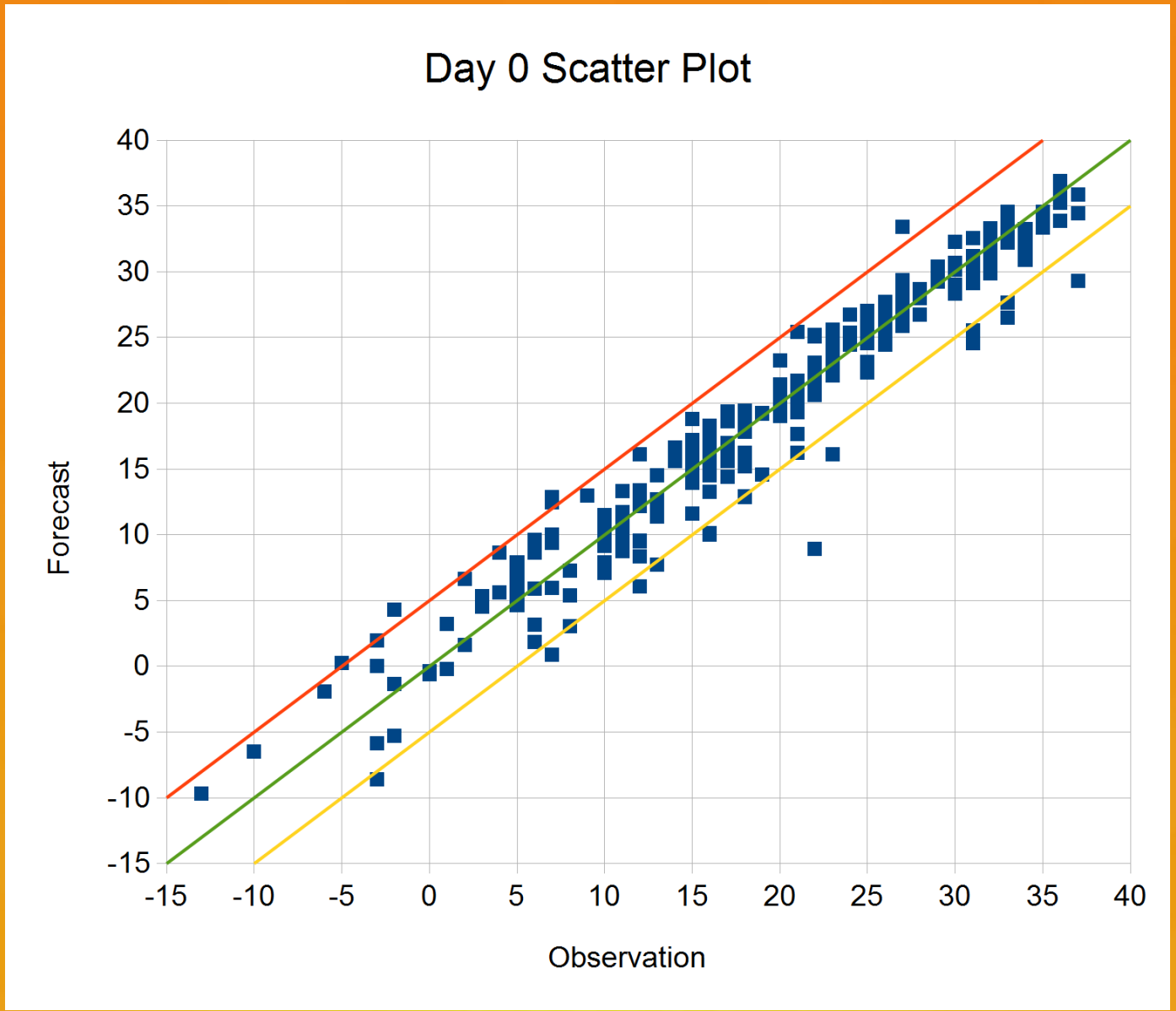

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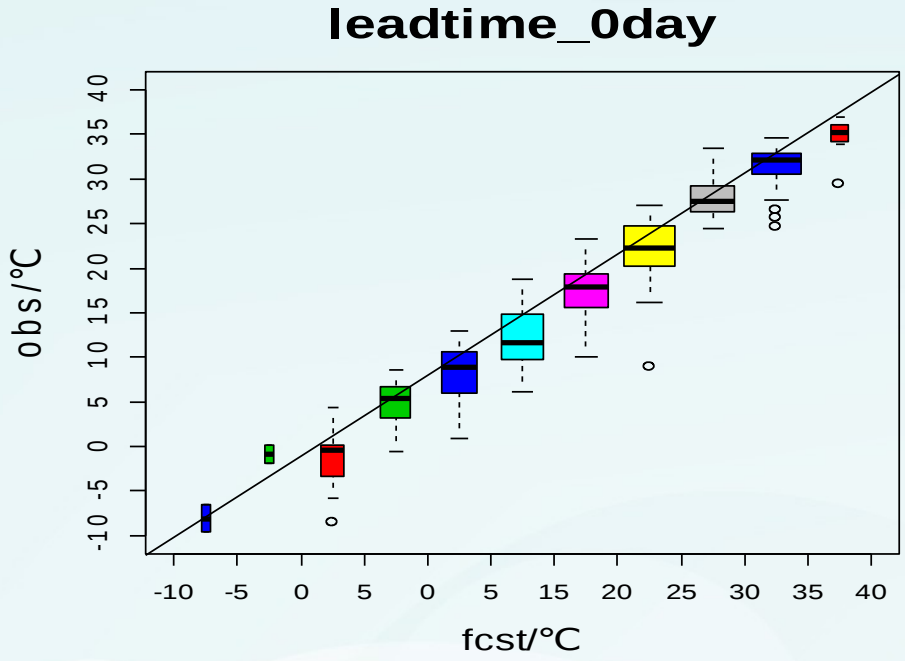
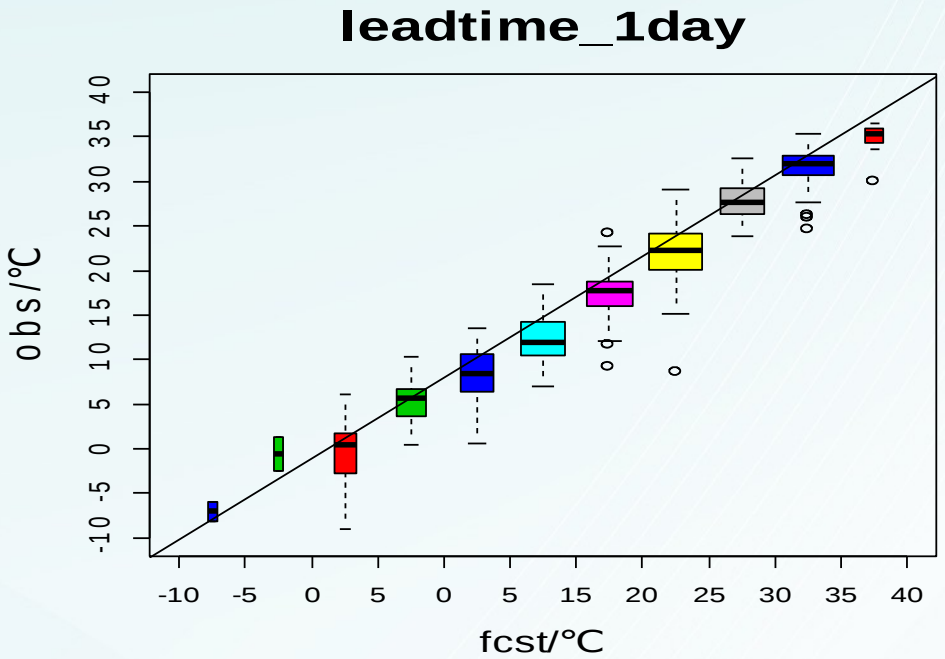
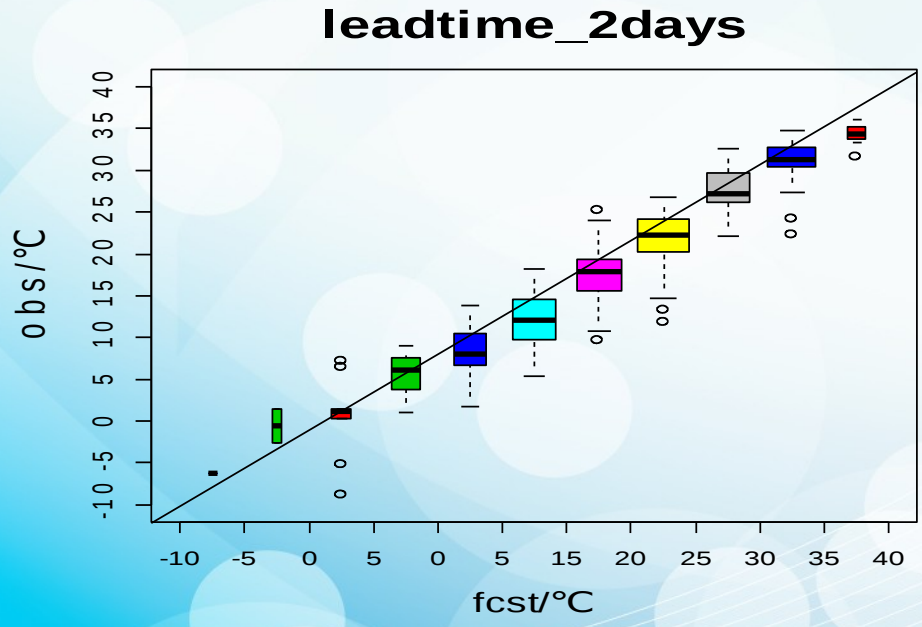
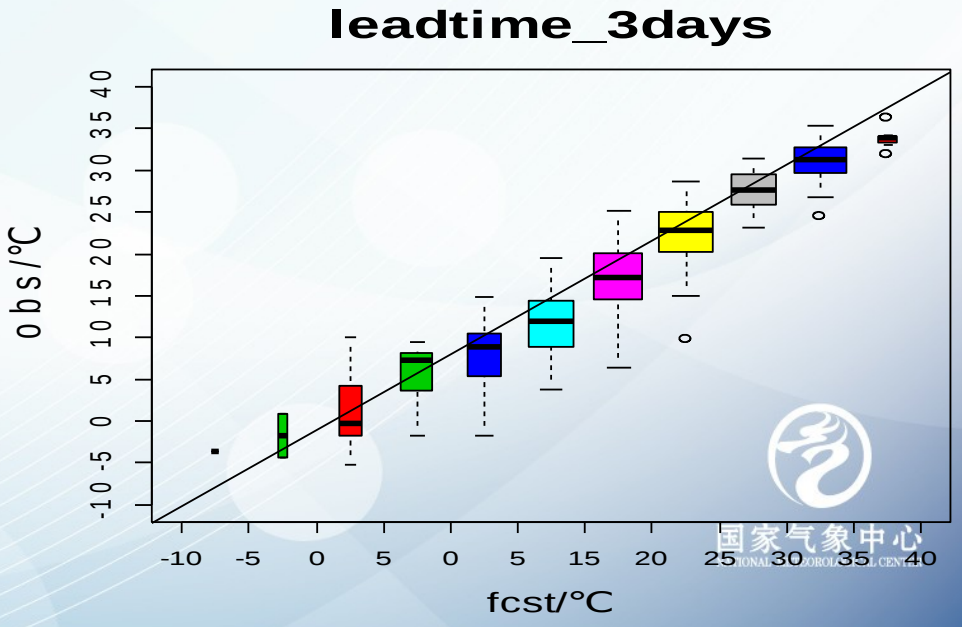
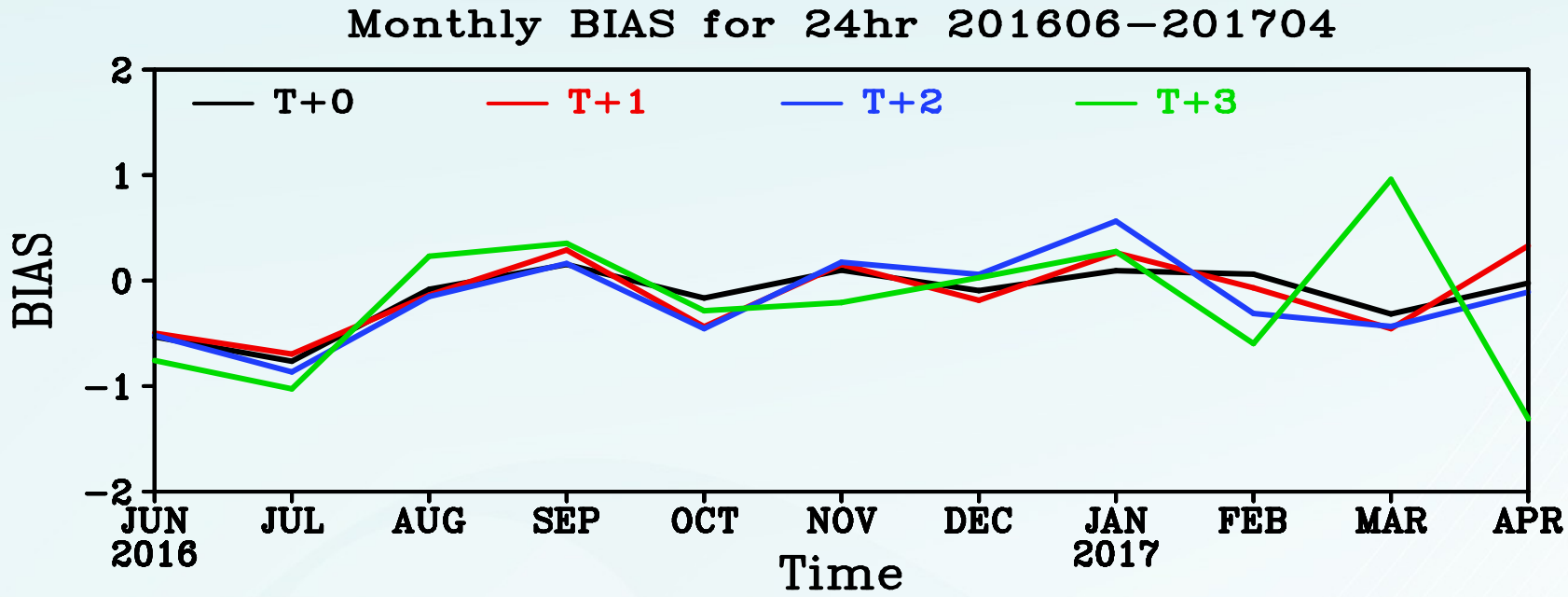


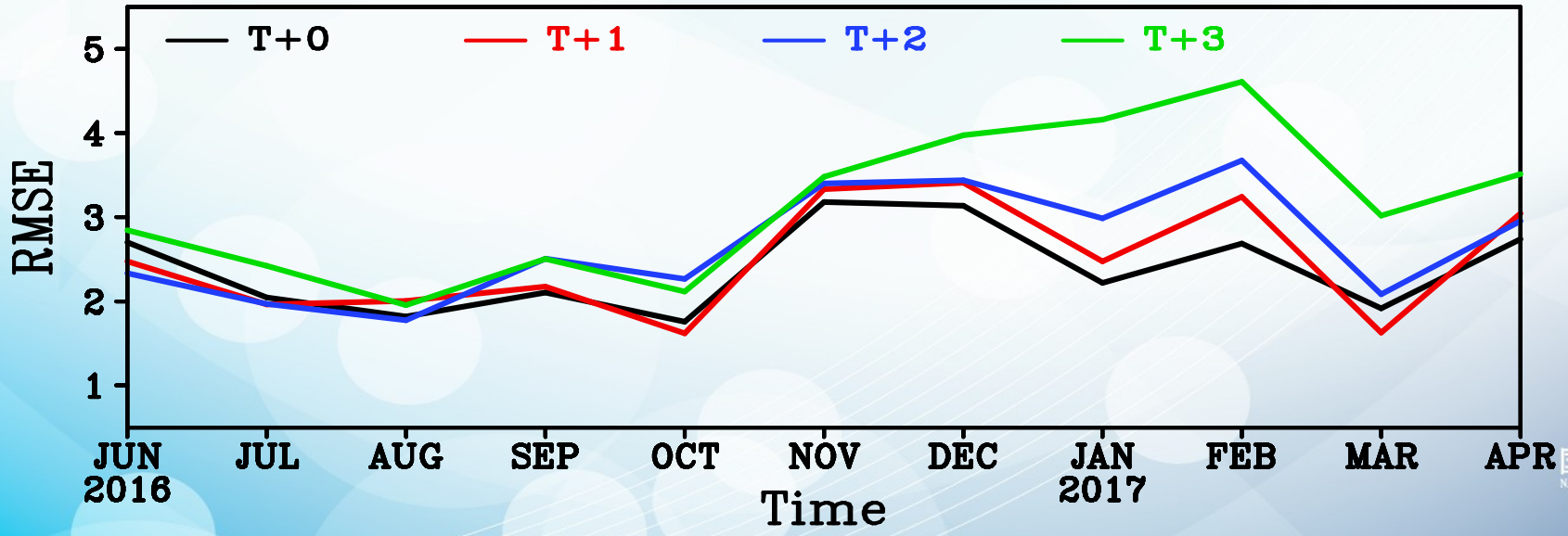






Does the bias differ per month





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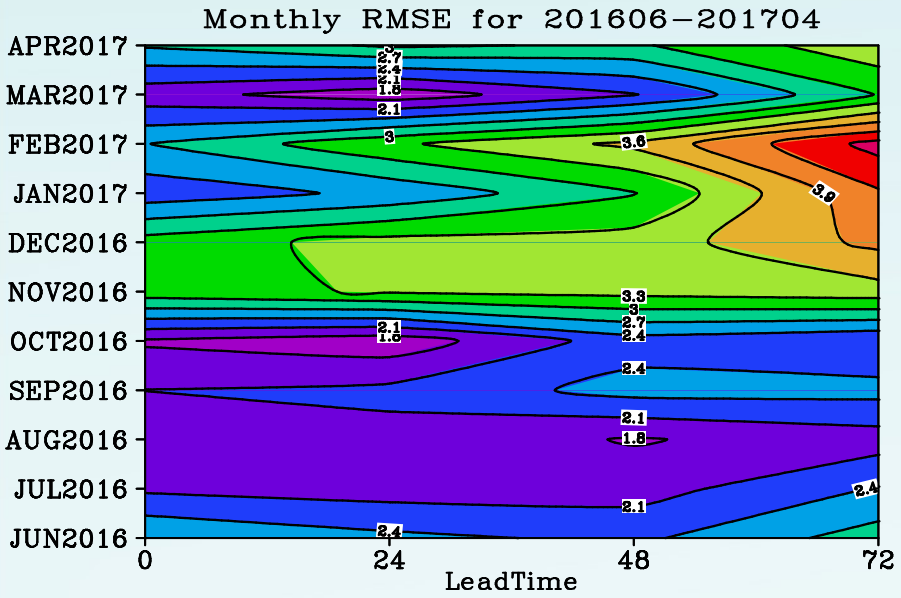

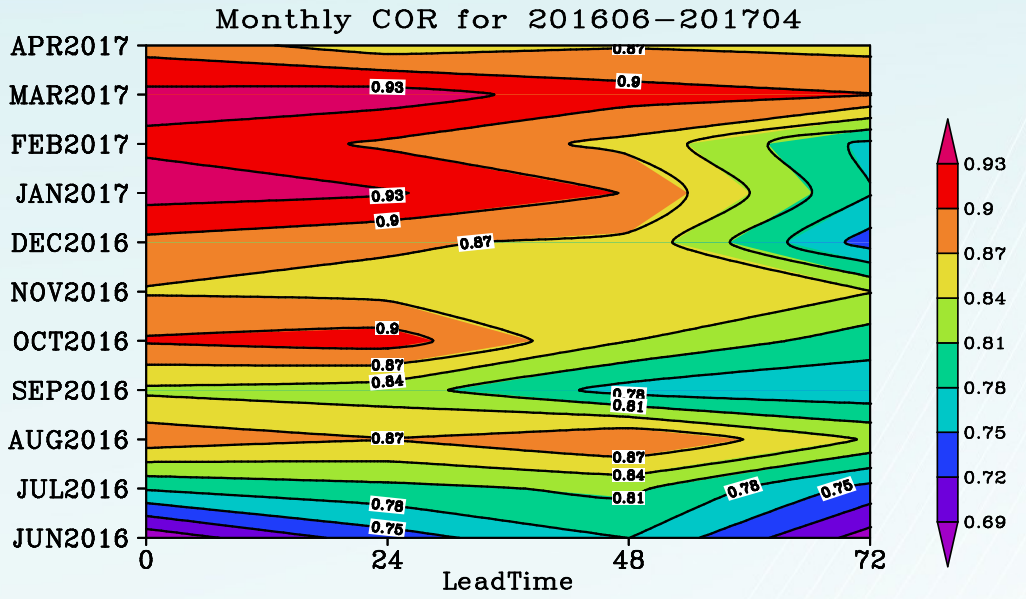

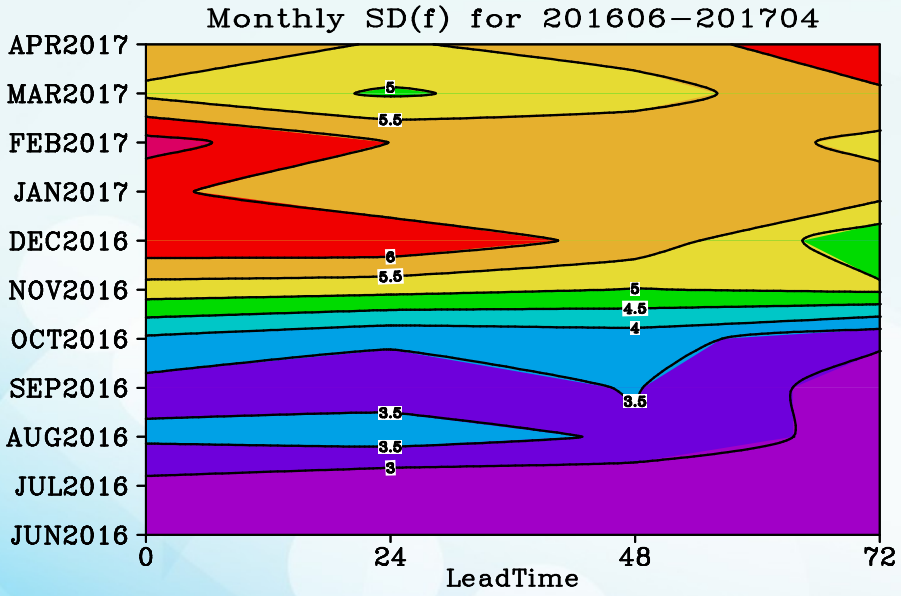

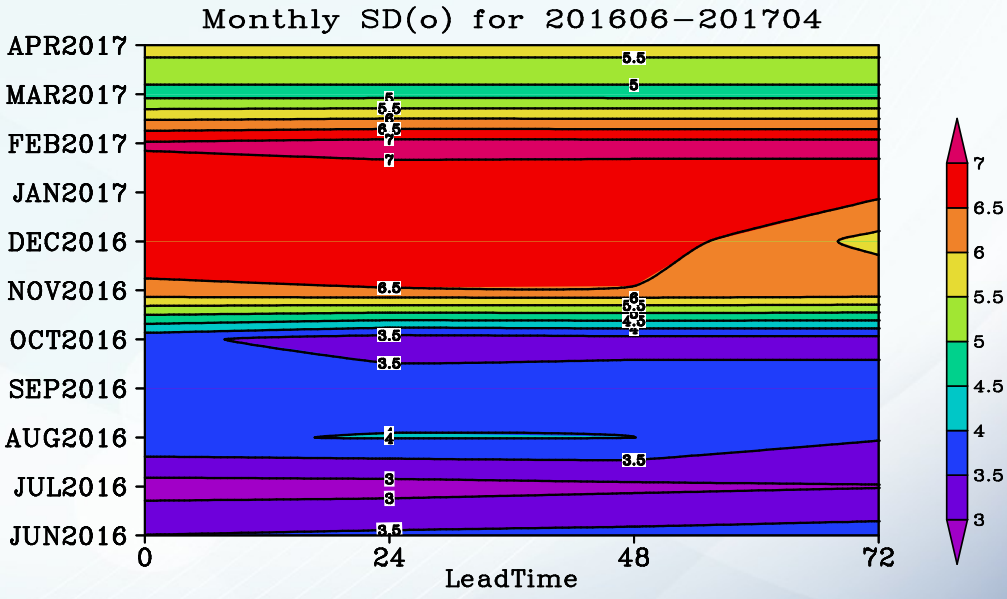

Largest spread of observation shows in winter

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Icing at Boulder Airport

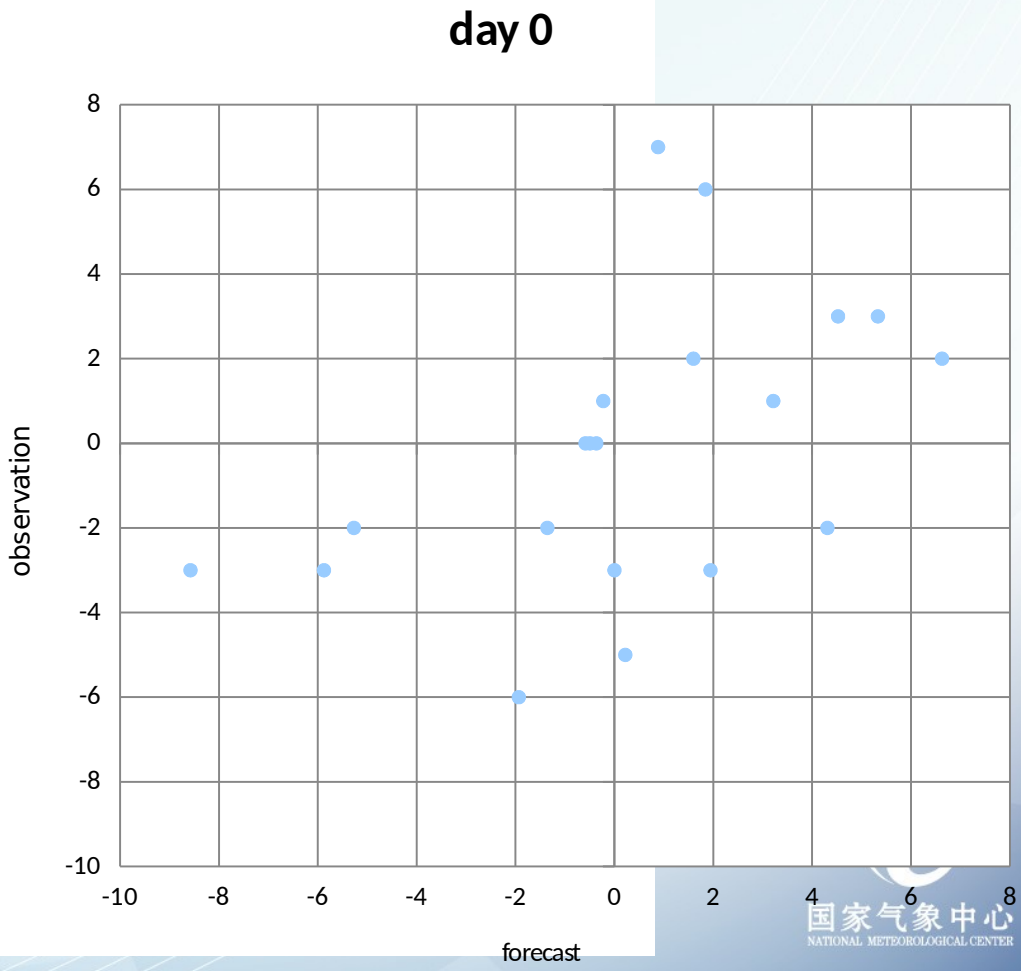
- Performance of the model for days where the temperatures were between -3 and +3C
- Icing critical to plane safety and airport operations

- Most focus on forecasts for day of (day 0) and 24 hour lead time (day 1)
- High value of statistical life (~$6M) greatly skews cost/lost equation to always de-icing the aircraft

Airport Results Day 0

Contingency table			
	ob(>-3|<3)	ob(>3|<-3)	Total
fcst(>-3|<3)	8	4	12
fcst(<-3|>3)	8	268	276
Total	16	272	288

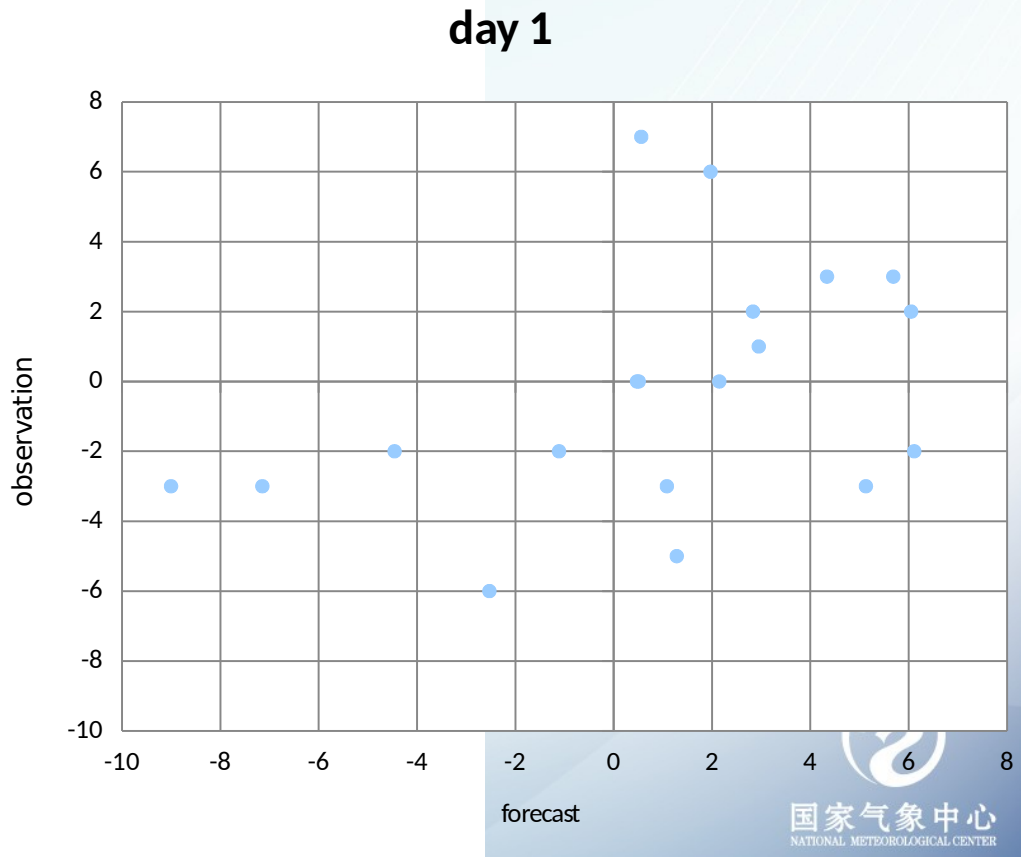
Scores	
Percent Correct	0.9583
Hit Rate	0.5000
False Alarm Rate	0.0147
Bias (Frequency)	0.7500
False Alarm Ratio	0.3333
Threat Score	0.4000
ETS	0.3793
# correct (Random)	261.33
Fraction correct (Random)	0.9074
Heidke Skill	0.5500
Hanssen-Kuipers	0.4853
Extreme Dependency Score	0.6131
SEDS	0.6419
EDI	0.7148
SEDI	0.7481



Airport Results Day 1

Contingency Table			
	ob(>3|<3)	ob(>3|<-3)	total
fcst[-3,3]	5	6	11
fcst(>3|<-3)	10	261	271
total	15	267	282

Scores	
Percent correct	0.9433
Hit rate	0.3333
False Alarm Rate	0.0225
Freq bias	0.7333
False alarm ratio	0.5455
Threat Score	0.2381
Equitable threat score	0.2163
# Correct by chance	257.1702
Fraction correct by chance	0.9120
Heidke Skill	0.3556
Hanssen-Kuipers score	0.3109
Extreme Dependency Score	0.4551
Stable Extreme Dependency Score	0.4940
Extremal Dependency Index	0.5510
Symmetric Extremal Dependency Index	0.5786



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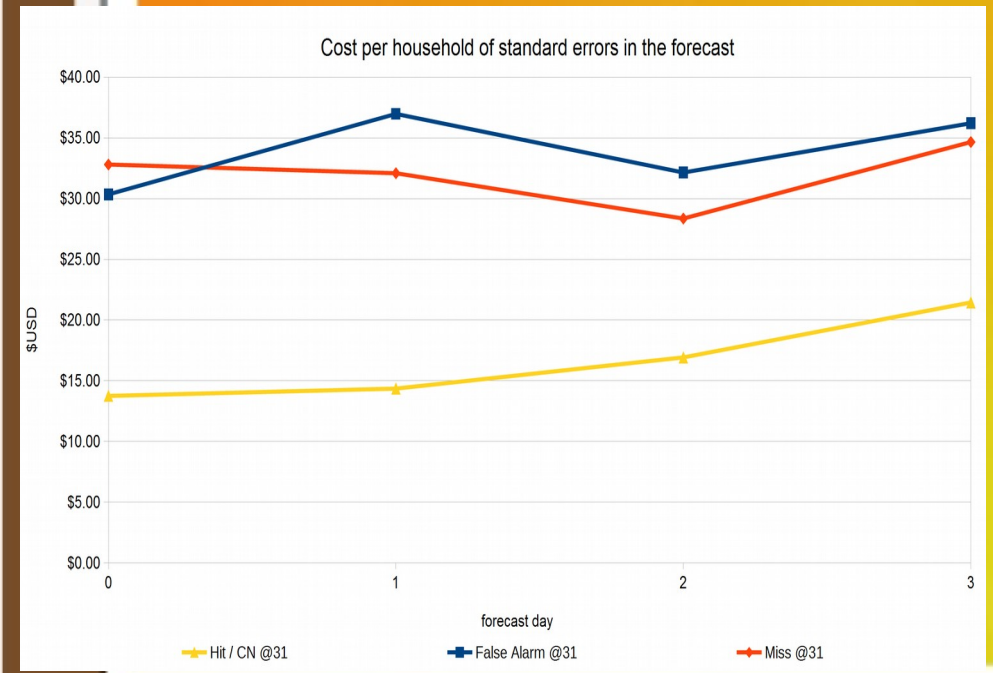
Electric Power Production

- Temperatures above 31C and below 0C show large increases in power usage for cooling or heating
- Every degree means about 100kWh extra per household
- Power cost per kWh in Boulder is about 9 cents (USD)



	Day 0	Day 1	Day 2	Day 3
Hit/CN $	$13.75	$14.35	$16.92	$21.45
Miss $	$32.81	$32.09	$28.36	$34.66
FA $	$30.35	$36.98	$32.15	$36.21
POFD	0.0779	0.0948	0.0996	0.1004
FAR	0.0526	0.04	0.0638	0.0870
POD	0.7500	0.6857	0.6567	0.6462
Bias	0.7917	0.7143	0.7015	0.7077
CSI	0.72	0.6667	0.6286	0.6087
ETS	0.6543	0.5972	0.5569	0.5355
OR	35.5	20.82	17.30	16.35
SR	0.9474	0.96	0.9362	0.9130

Questions?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