BIAS CORRECTON OF MOS TEMPERATURE AND DEWPOINT FORECASTS

Decaying Average

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FORECAST BIAS

$$1/T \sum_{i=1}^{i=T} (F - O)_i$$

ISSUE

- Most forecasts have some bias—long or short or both.
- Questions:
  - Is the bias large enough to worry about (and try to correct)?
  - How might the forecasts be corrected for bias?
  - If the bias is corrected, how does this affect other performance metrics?

BIAS CORRECTION

$$F'_t = F_t + d_t$$

- Delta d_t = a function of past errors
  - Varies by forecast projection and location

DECAYING AVERAGE ALGORITHM

- History of errors carried in d according to a decay factor "a"

$$d_{t+1} = (1 - a)d_t + a(F - O)_t$$

d_t = delta (correction) at time t

a = the decay factor

F = the forecast at time t

O = the verifying observation at time t

d_{t+1} = the delta to use at time t+1

Decaying average used at NCEP to bias correct GEFS raw model forecasts since 2006 with a = 0.02.

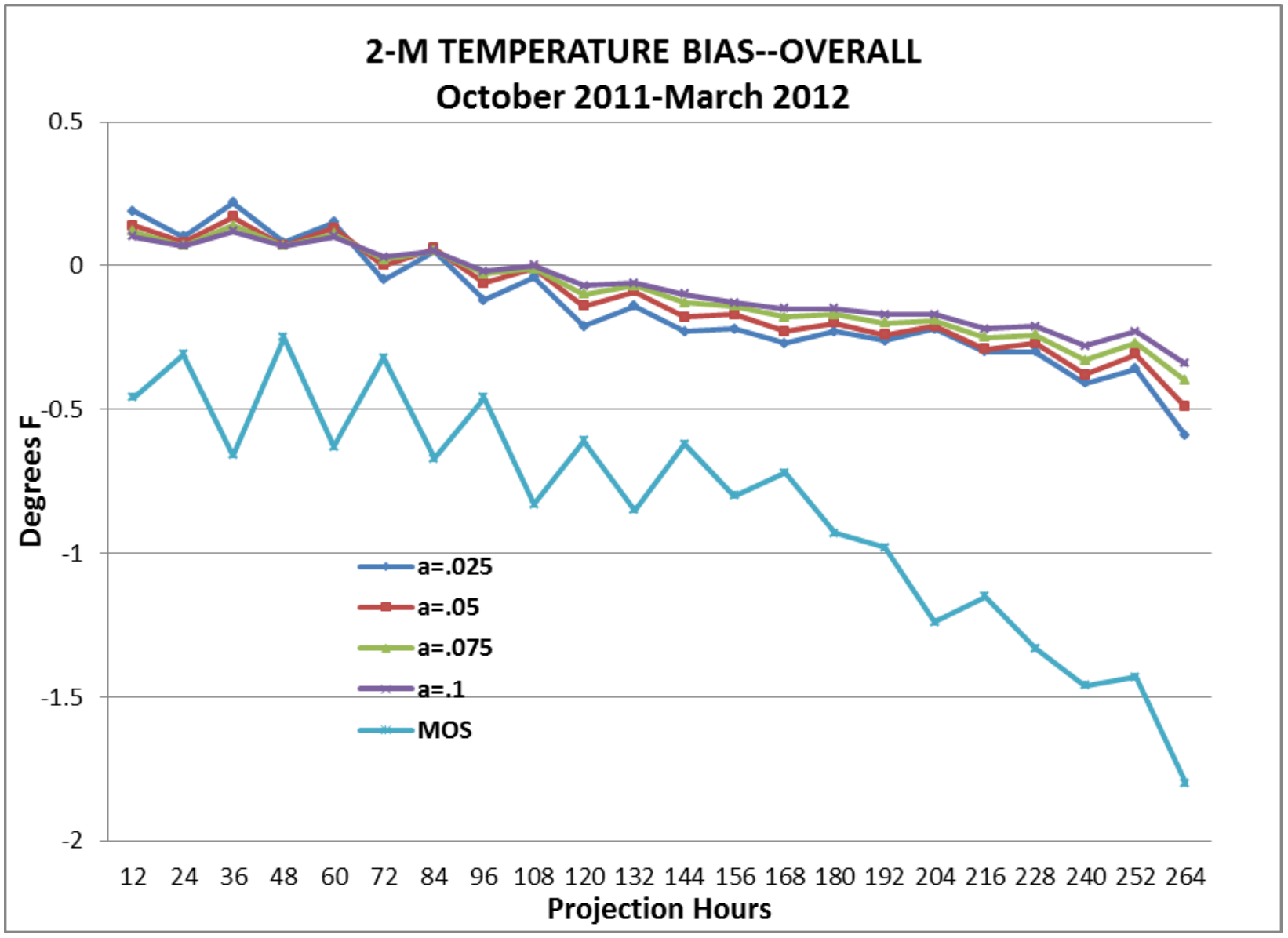
DATA SAMPLE

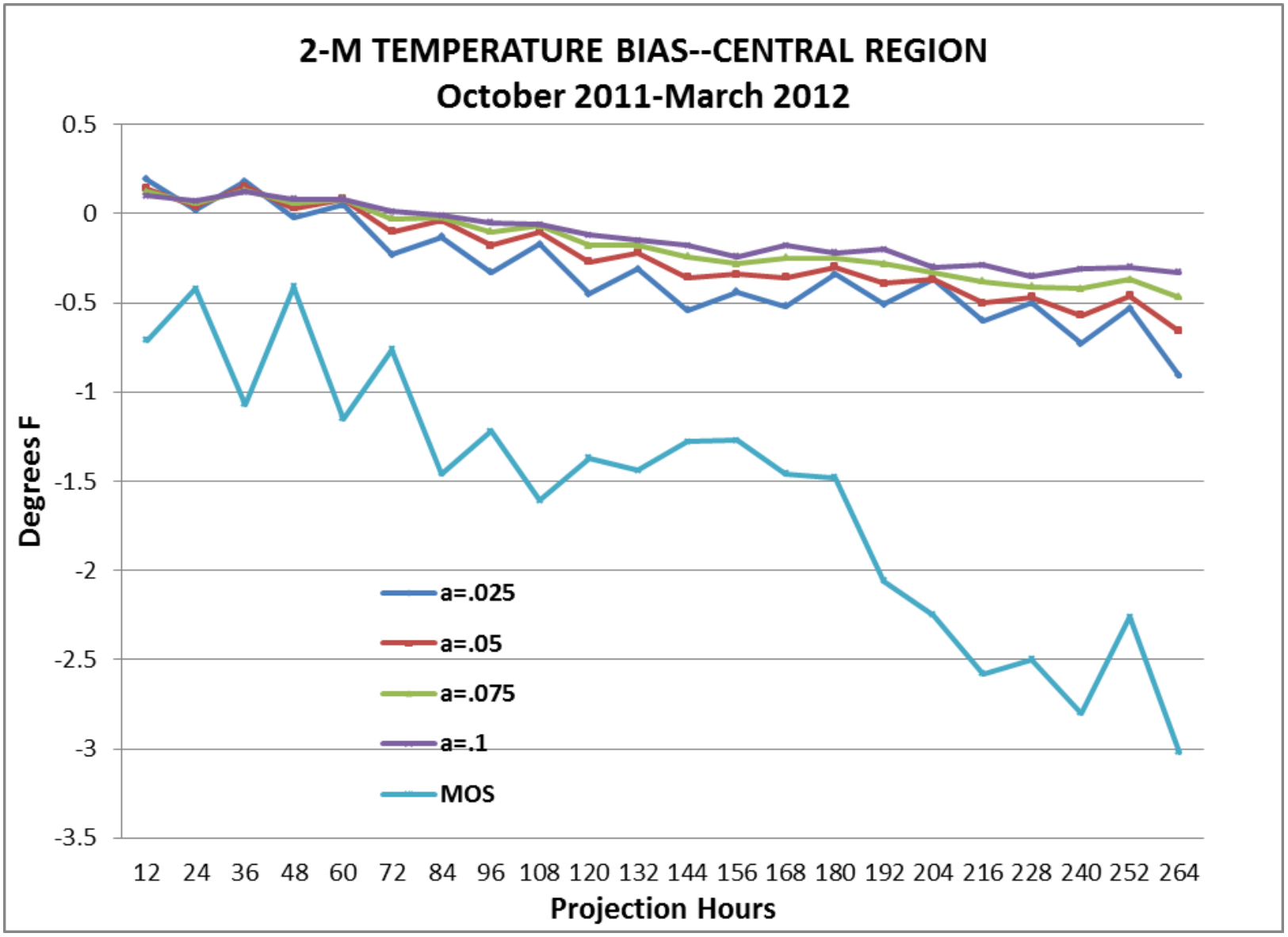
- 0000 UTC GFS-based MOS forecasts of temperature and dewpoint at 1,319 locations in the CONUS
- 1 January 2011 to 31 May 2012
- Projections 12 to 264 hours at 12 h intervals
- Temperature divided into 6-month “cool” and “warm” seasons, same as MOS development
  - Cool = October-March; Warm = April-September

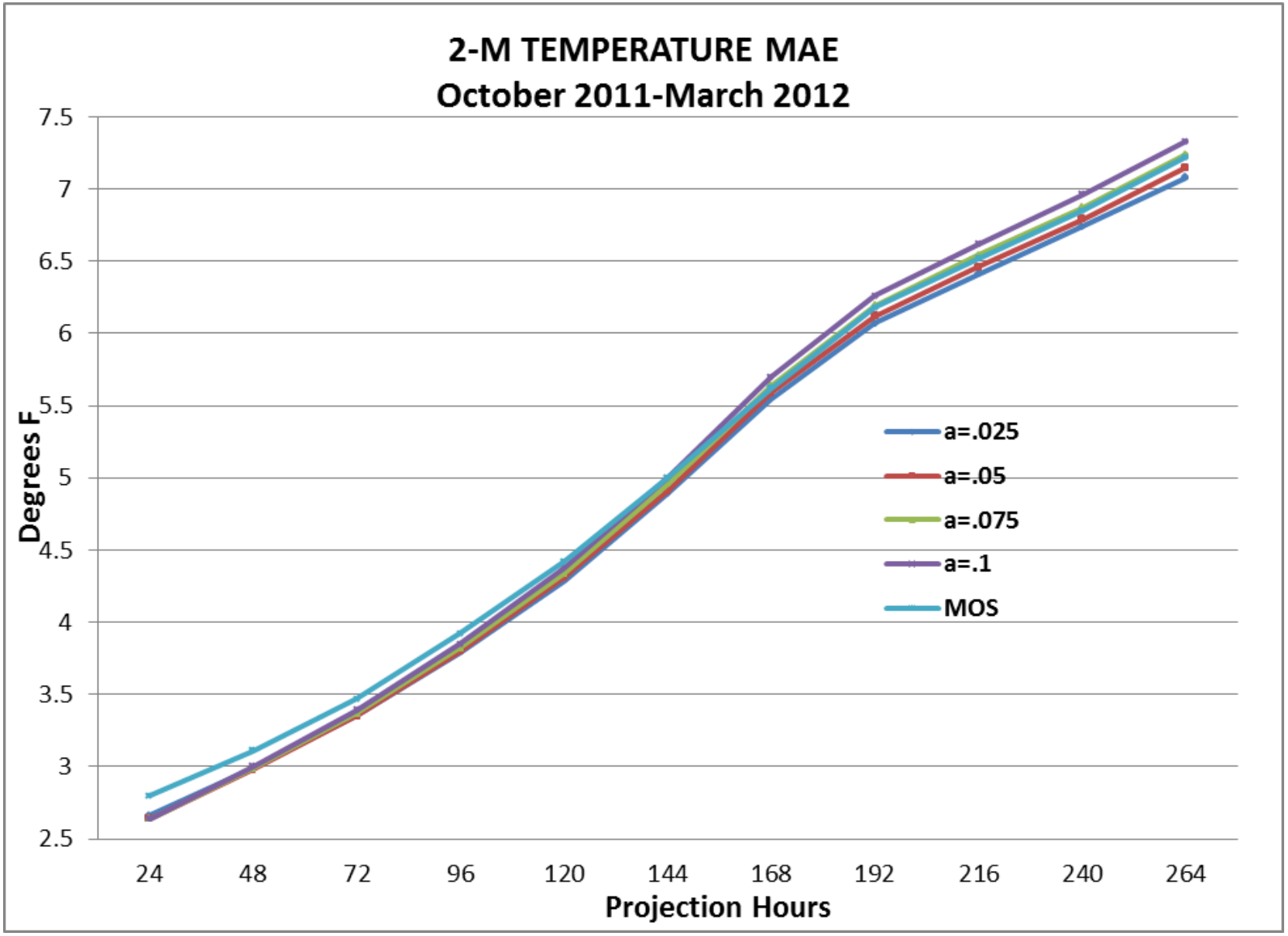
RESULTS

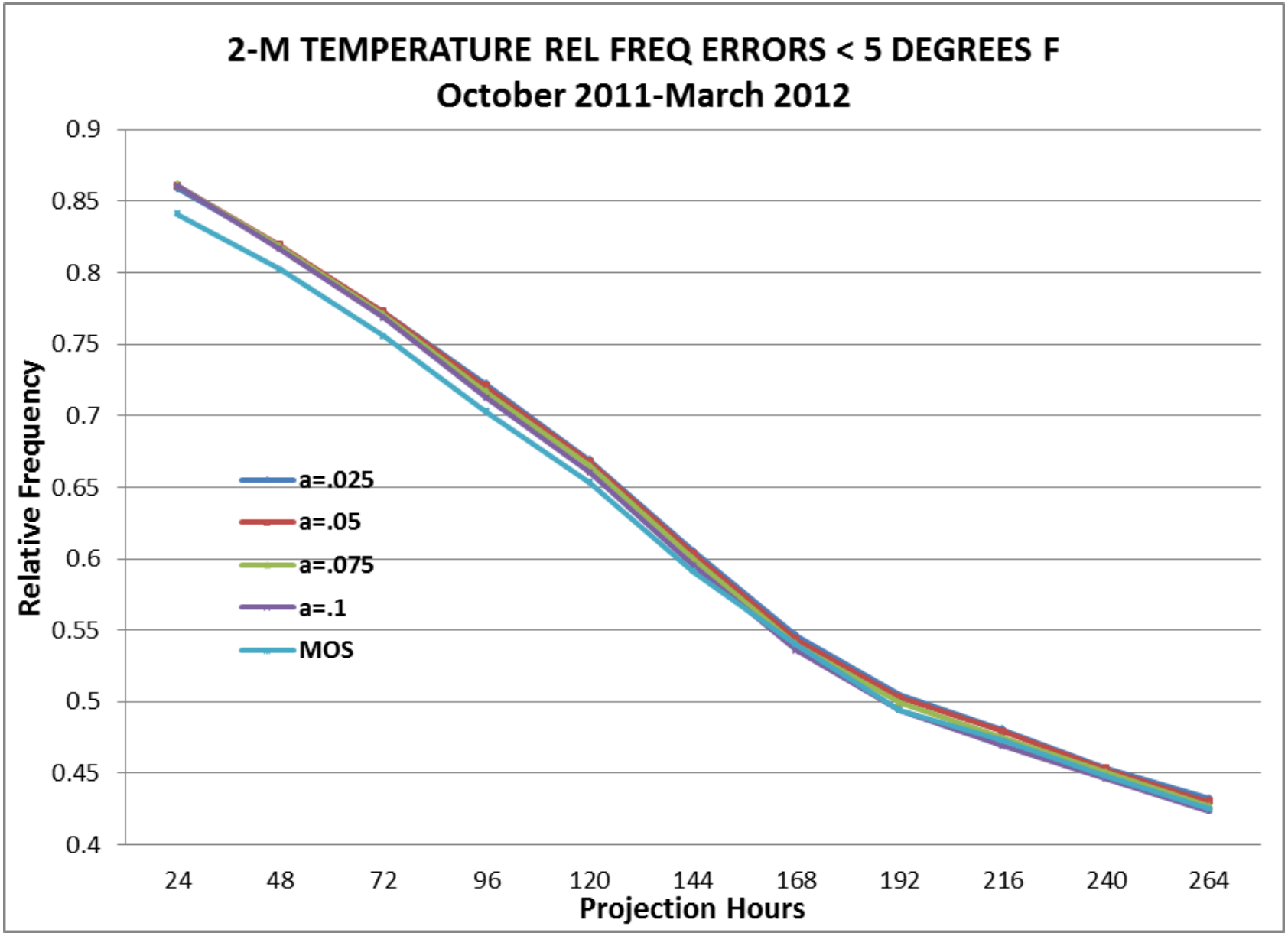
- Cool season results for temperature will be shown
  - others are in the paper
- Metrics shown for decay factors of:

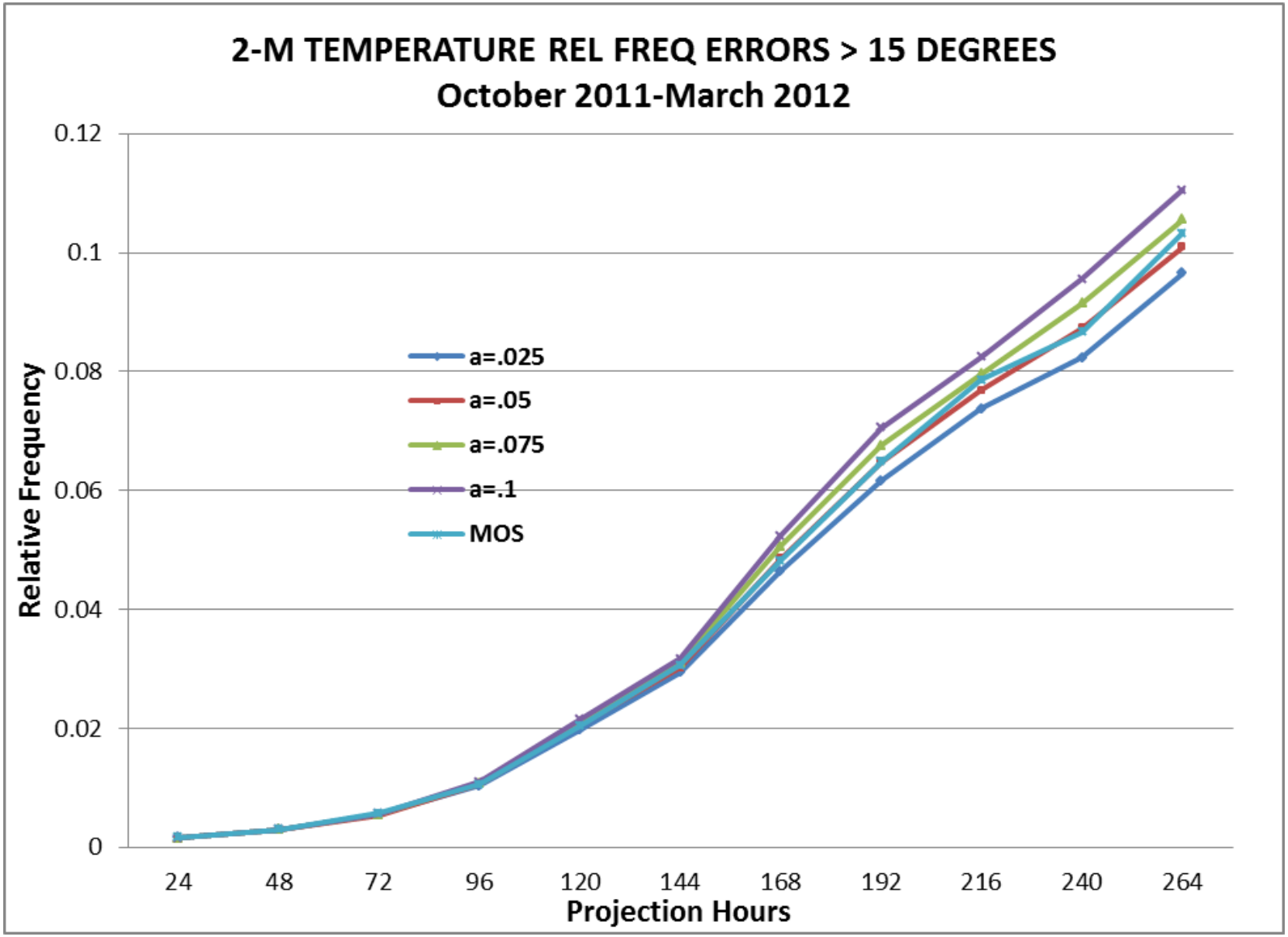
  0.025, 0.05, 0.075, and 0.10
  - Bias
  - MAE
  - Relative frequency of small errors
  - Relative frequency of large errors
  - Convergence score
  - Bias by averaging time
  - Volatility


2-M TEMPERATURE BIAS--OVERALL
October 2011-March 2012
0.5
0
-0.5
-1
-1.5
-2
Degrees F
a=.025
a=.05
a=.075
a=.1
MOS
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204 216 228 240 252 264
Projection Hours

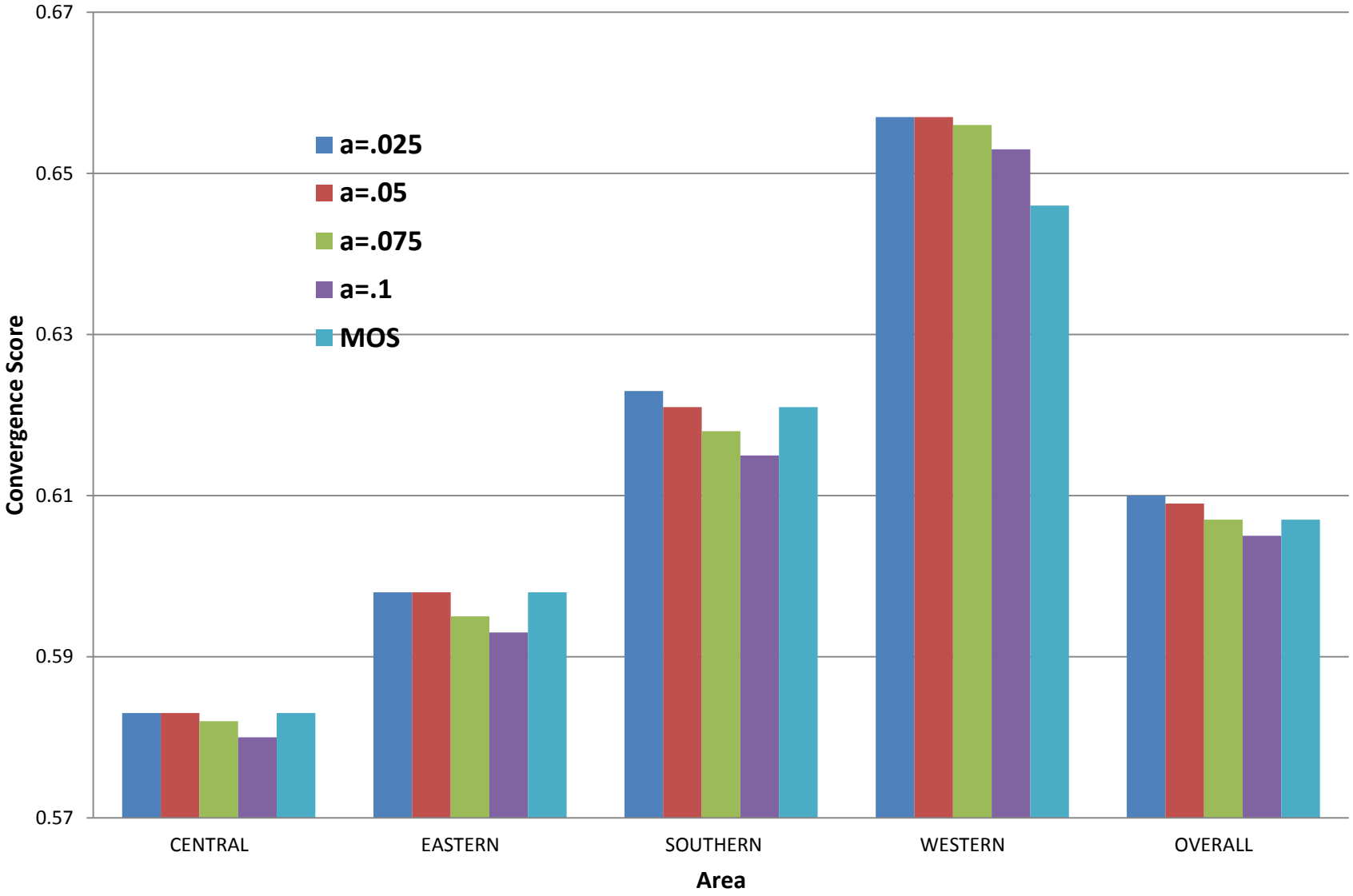

2-M TEMPERATURE BIAS--CENTRAL REGION
October 2011-March 2012
Degrees F
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
12 24 36 48 60 72 84 96 108 120 132 144 156 168 180 192 204 216 228 240 252 264
Projection Hours
a=.025
a=.05
a=.075
a=.1
MOS


2-M TEMPERATURE MAE
October 2011-March 2012
Degrees F
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
24
48
72
96
120
144
168
192
216
240
264
Projection Hours
a=.025
a=.05
a=.075
a=.1
MOS

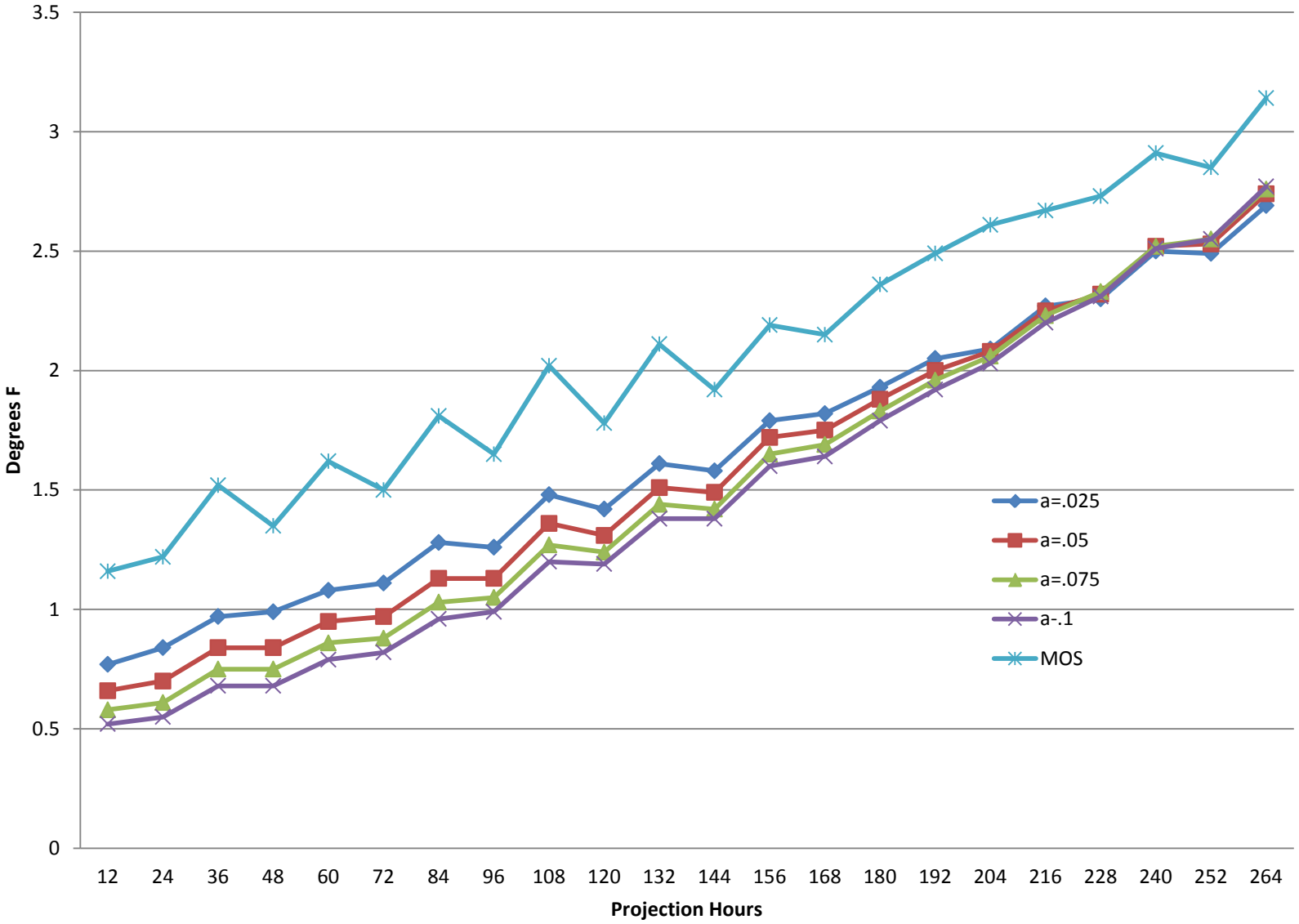

2-M TEMPERATURE REL FREQ ERRORS < 5 DEGREES F
October 2011-March 2012
Relative Frequency
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
a=.025
a=.05
a=.075
a=.1
MOS
24
48
72
96
120
144
168
192
216
240
264
Projection Hours


2-M TEMPERATURE REL FREQ ERRORS > 15 DEGREES
October 2011-March 2012
Relative Frequency
0.12
0.1
0.08
0.06
0.04
0.02
0
a=.025
a=.05
a=.075
a=.1
MOS
24
48
72
96
120
144
168
192
216
240
264
Projection Hours

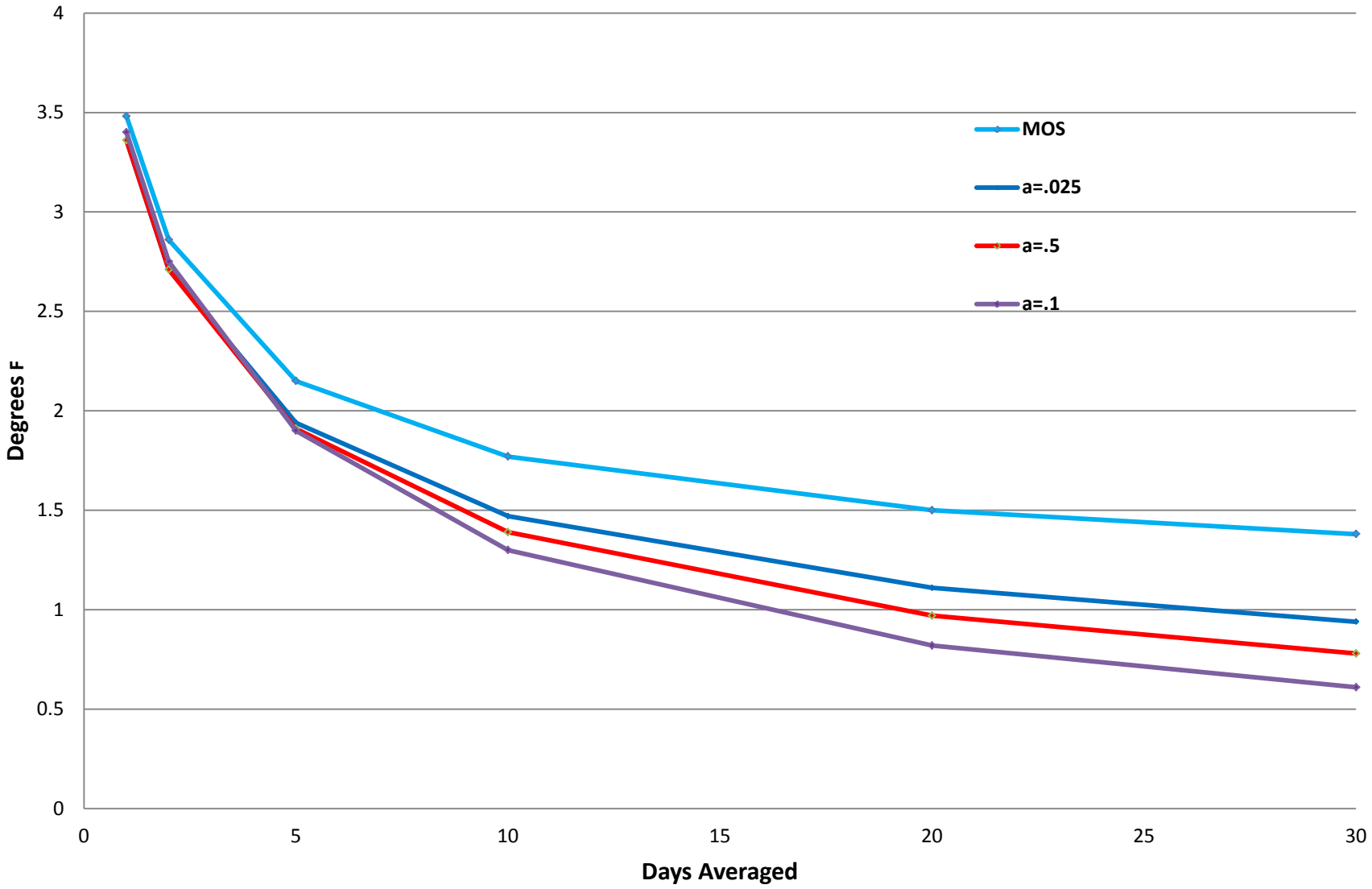
2-M TEMPERATURE CONVERGENCE SCORE--3 DEG NO OB
October 2011- March 2012



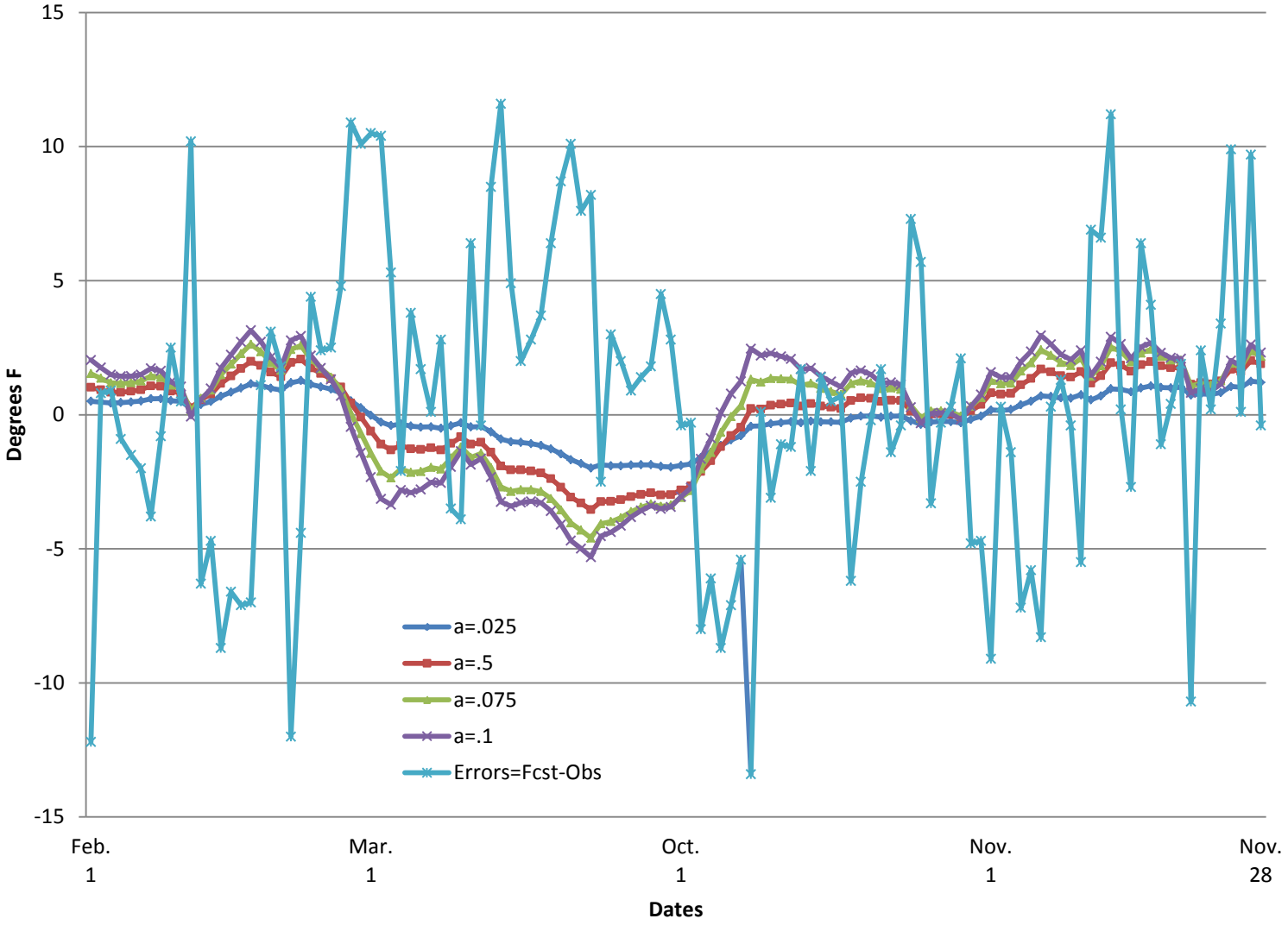
2-M TEMPERATURE 20-DAY RUNNING MEAN ABSOLUTE ERROR
October 2011-March 2012



2-M TEMPERATURE 72-H PROJECTION MAE OF MEANS
October 2011-March 2012



2-M, 48-H TEMPERATURE FORECAST ERRORS COMPARED WITH DELTAS FOR KAQP APPLETON, MN Starting Feb. 1, Ending Nov. 28, Sans Apr.-Sept.



CONCLUSIONS

- MOS forecasts of temperature and dewpoint have some bias over both short and long periods that vary by station and projection
- Much of this bias can be removed by the decaying average method
- The larger values of the decay factor remove more bias, but tend to deteriorate other performance metrics

CONCLUSIONS

- Values of decay factor of 0.025 and 0.05 perform at about the same overall level for temperature and dewpoint, and for both seasons.
- A factor of 0.04 would be a good compromise
- The decaying average method is very easy to implement and is quite robust (has few error modes)