

# South Pole Temperature Forecasting: Issues and Impacts

**ISSUE** – Temperature forecasts from AMPS 20km NZSP South Pole table exhibit a significant warm bias and sometimes misses trends.

# South Pole Temperature Forecasting: Issues and Impacts

## **BACKGROUND**

- Ending the operating season is determined in large part due to projected temperatures approaching -50C at NZSP
- In February, we routinely provide an outlook of max/min temperature out to 72 hours. Our goal is a forecast error of 1C degree error at 24 hours, with a trend within 1-3C degrees from 25-72 hrs. Use AMPS 20km NZSP South Pole table for guidance; forecast hour 21 thru 96 (initialized at 0000 UTC)

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## IMPACT

- Impact on LC130 operations when temperatures are between -40C and -50C
  - Hydraulic system performance degraded
  - Two available fuel types restricted to only one type at -43C
  - Wind chill affects on personnel can inhibit/prevent cargo movement and aircraft maintenance

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- Engine exhaust can restrict prevailing visibility i.e., surface contrail formation and camp fog that may prevent cargo offload and flight operations

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- An unforeseen cooling trend (relative to scheduled end of season) to  $\sim 50^{\circ}\text{C}$  may require Twin Otter aircraft to transport personnel to/from South Pole. This aircraft has far less ACL than a LC130 and will require more flights for transitional summer-winter staffing at NZSP prior to end of the season

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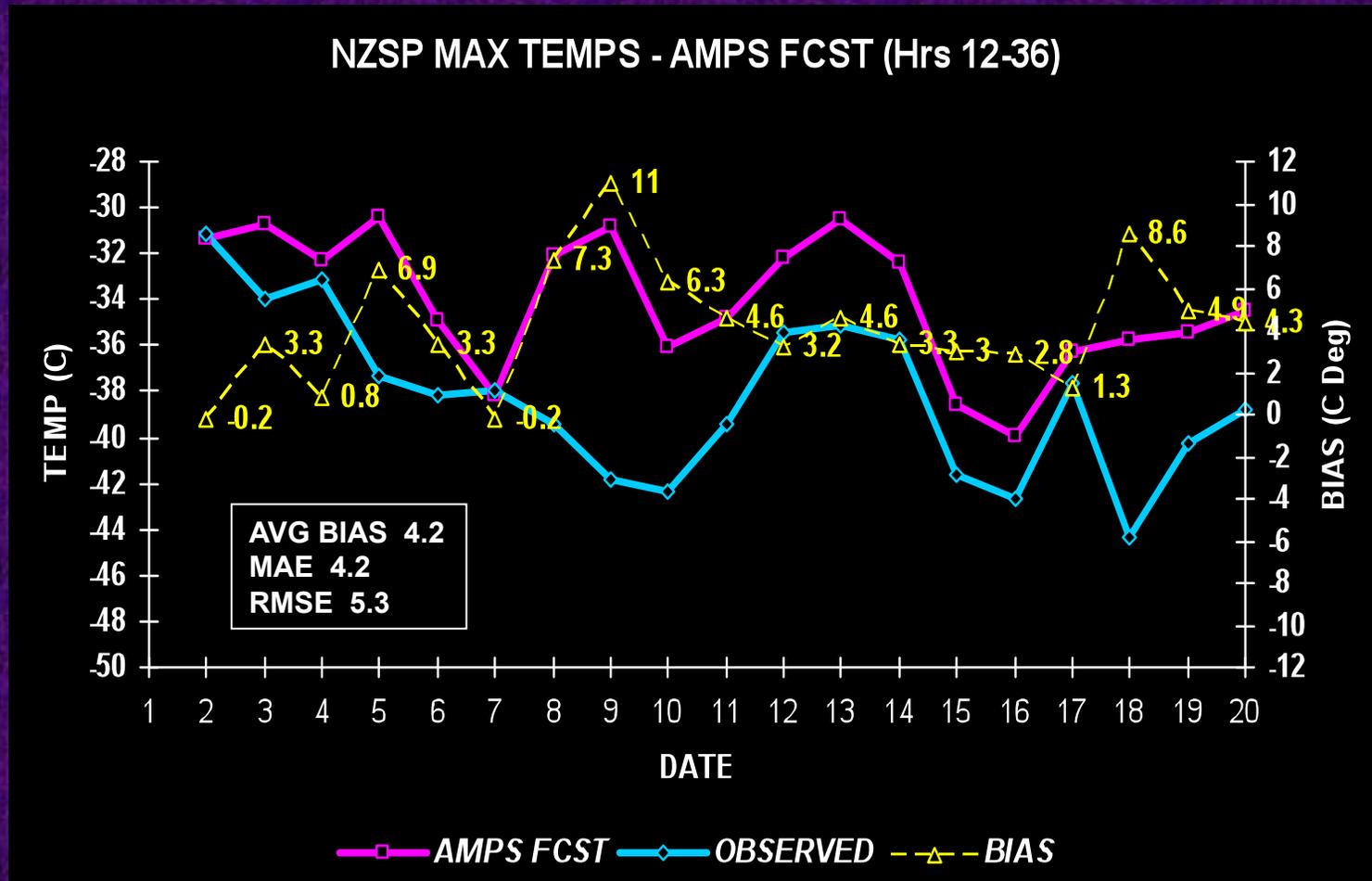
- An LC130 that breaks down at NZSP during an unforeseen cooling trend to ~50C (relative to scheduled end of season) may become stranded if temperatures fall below thresholds for maintenance actions
- The opportunity cost of an unforeseen warming trend from ~50C (relative to scheduled end of the season) is the additional LC130 flights that could have been performed to NZSP

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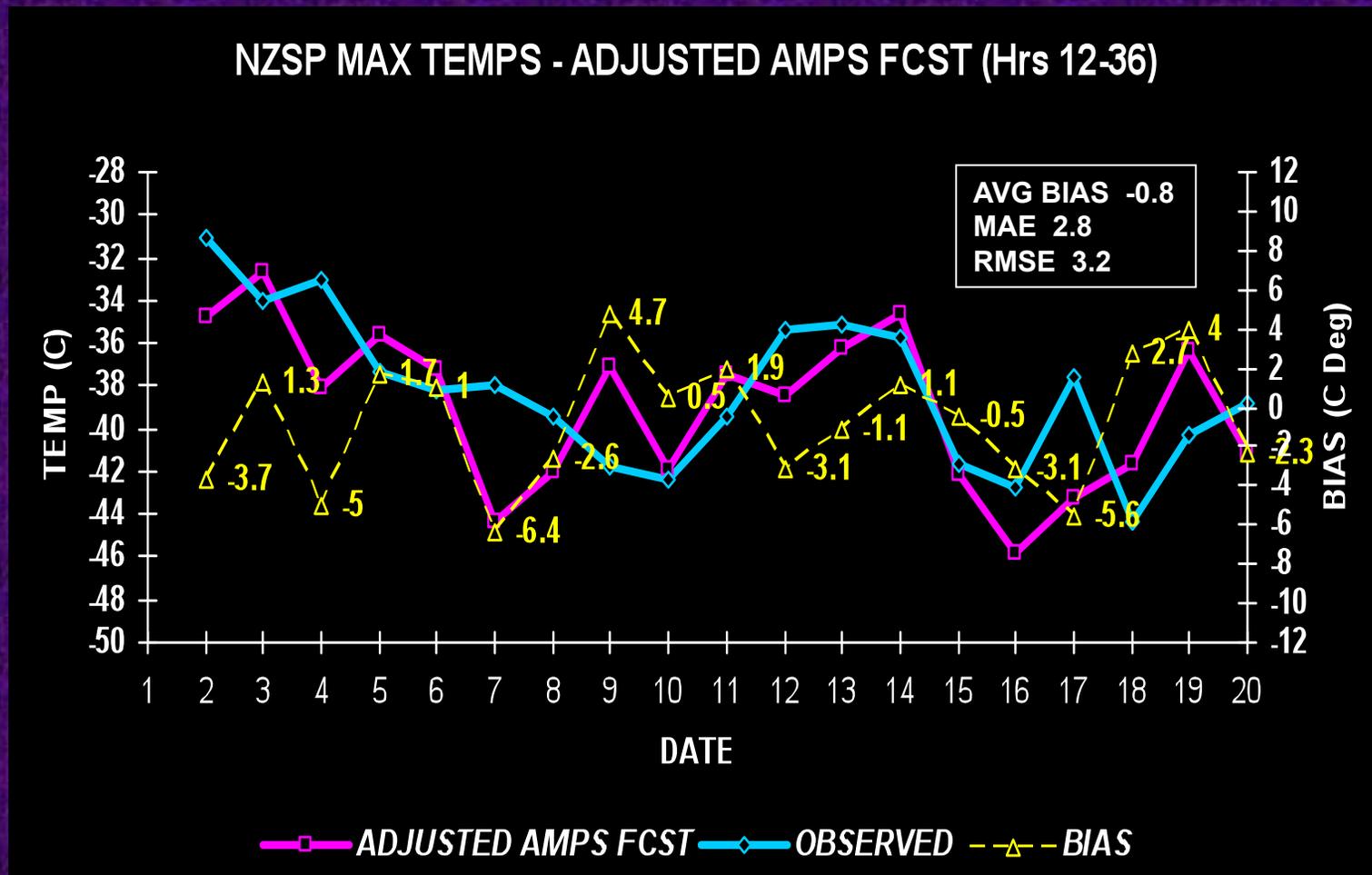
## CONSIDERATIONS

- AMPS 20km domain NZSP South Pole tables initialized at 0000 UTC
- Warm bias in the model due to first  $\Sigma$  level (~12m) in the radiation inversion
- Air mass / upper wind flow
- Cloud cover
- Surface pressure trend

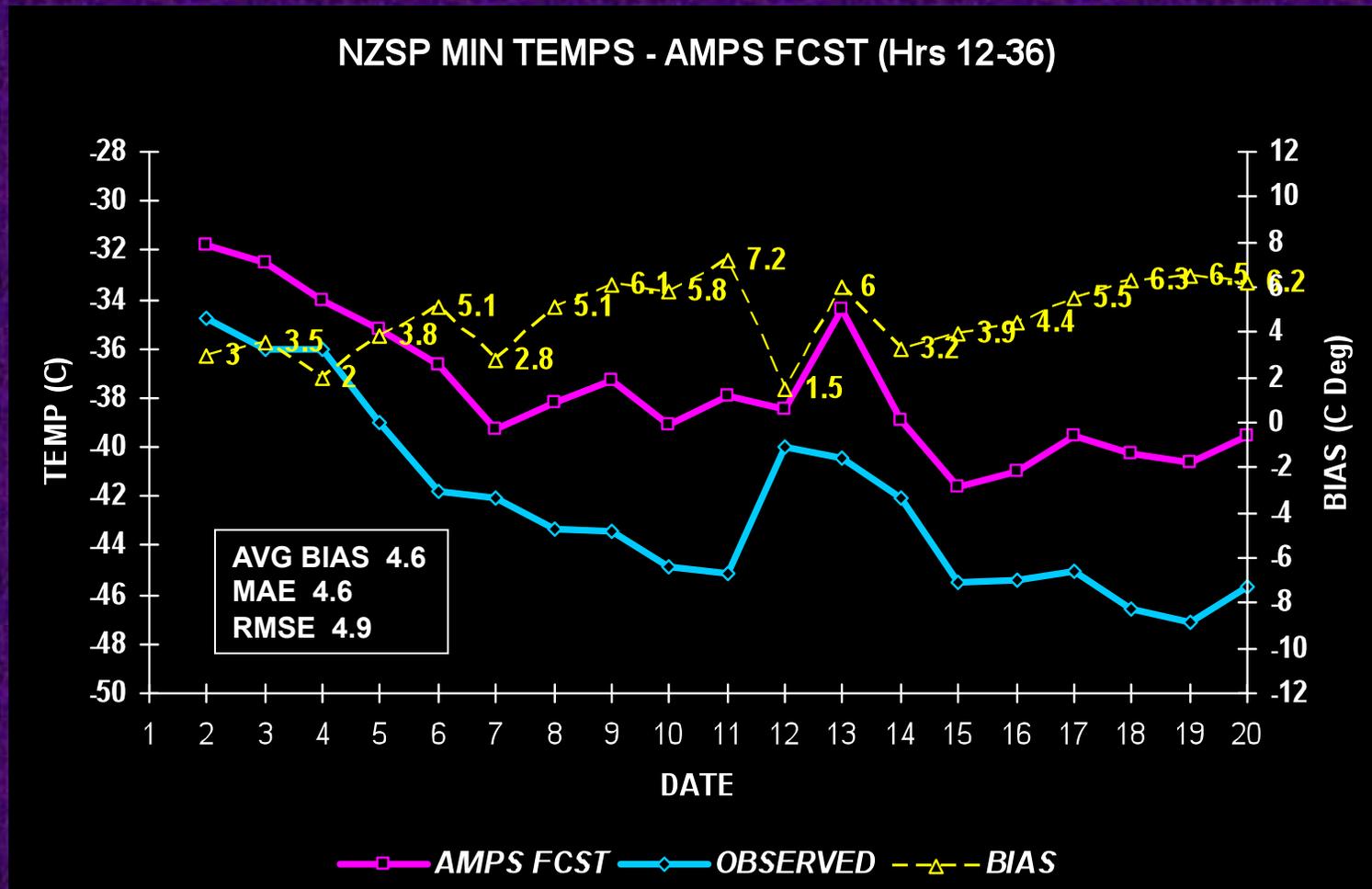
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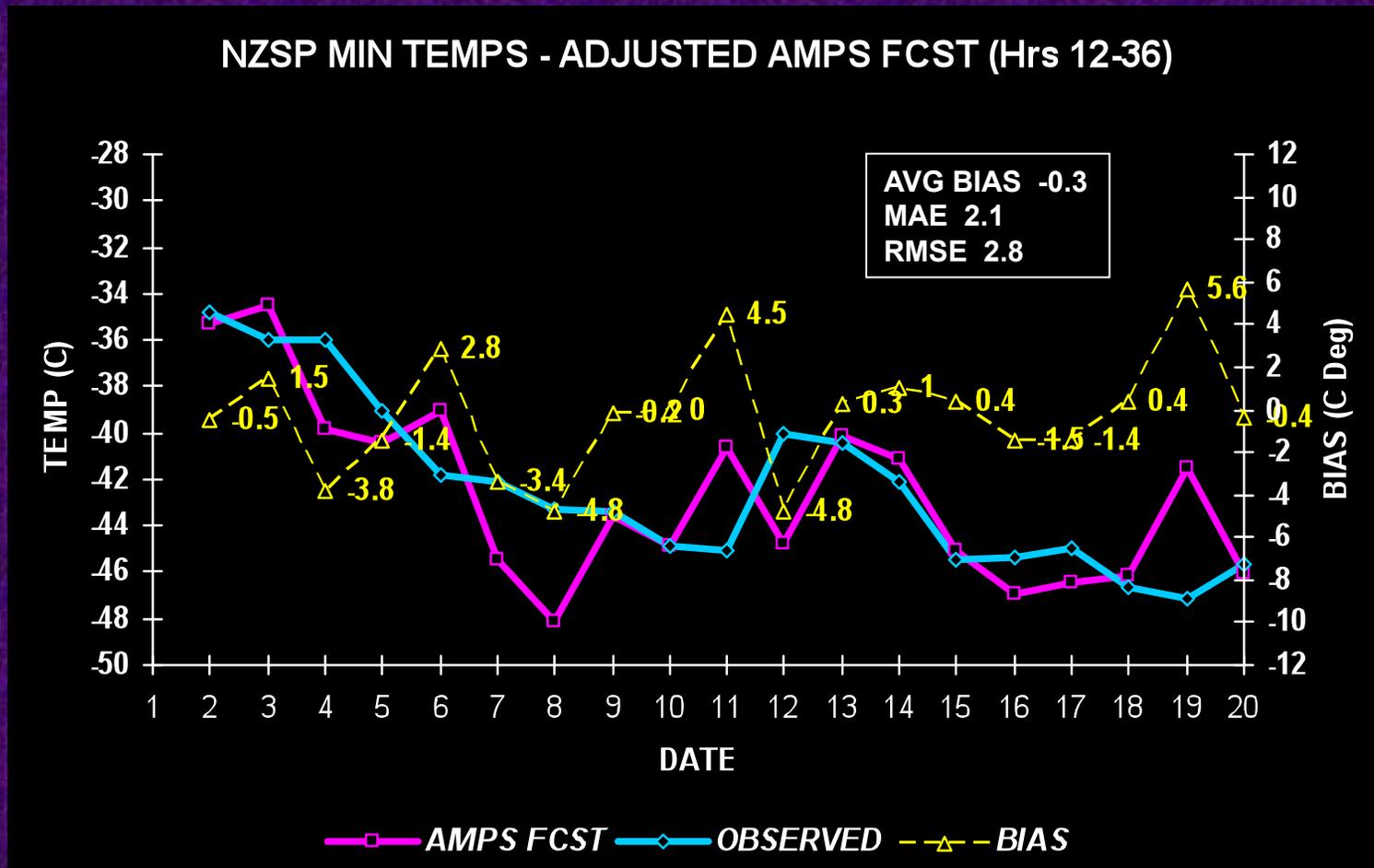
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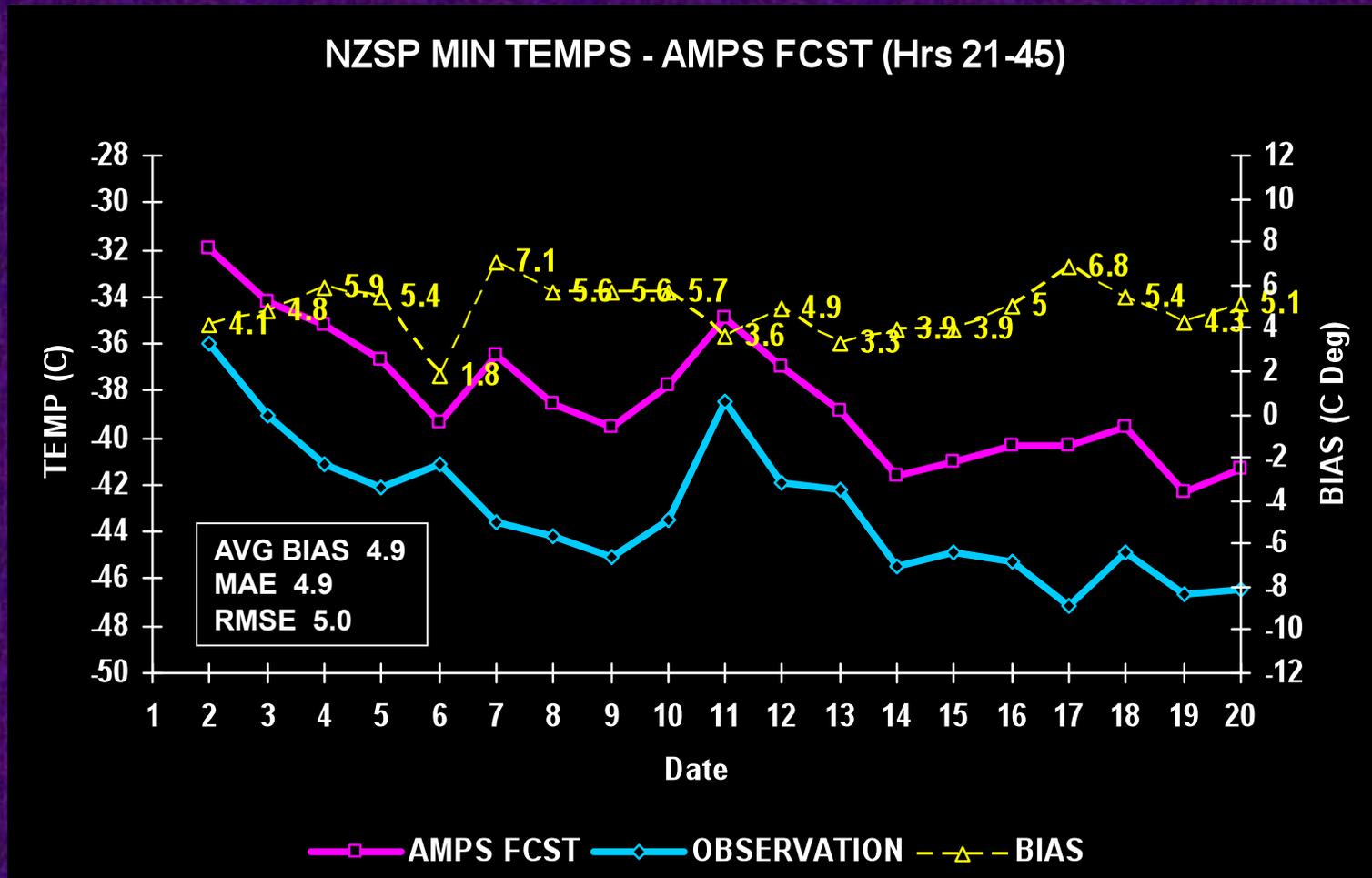
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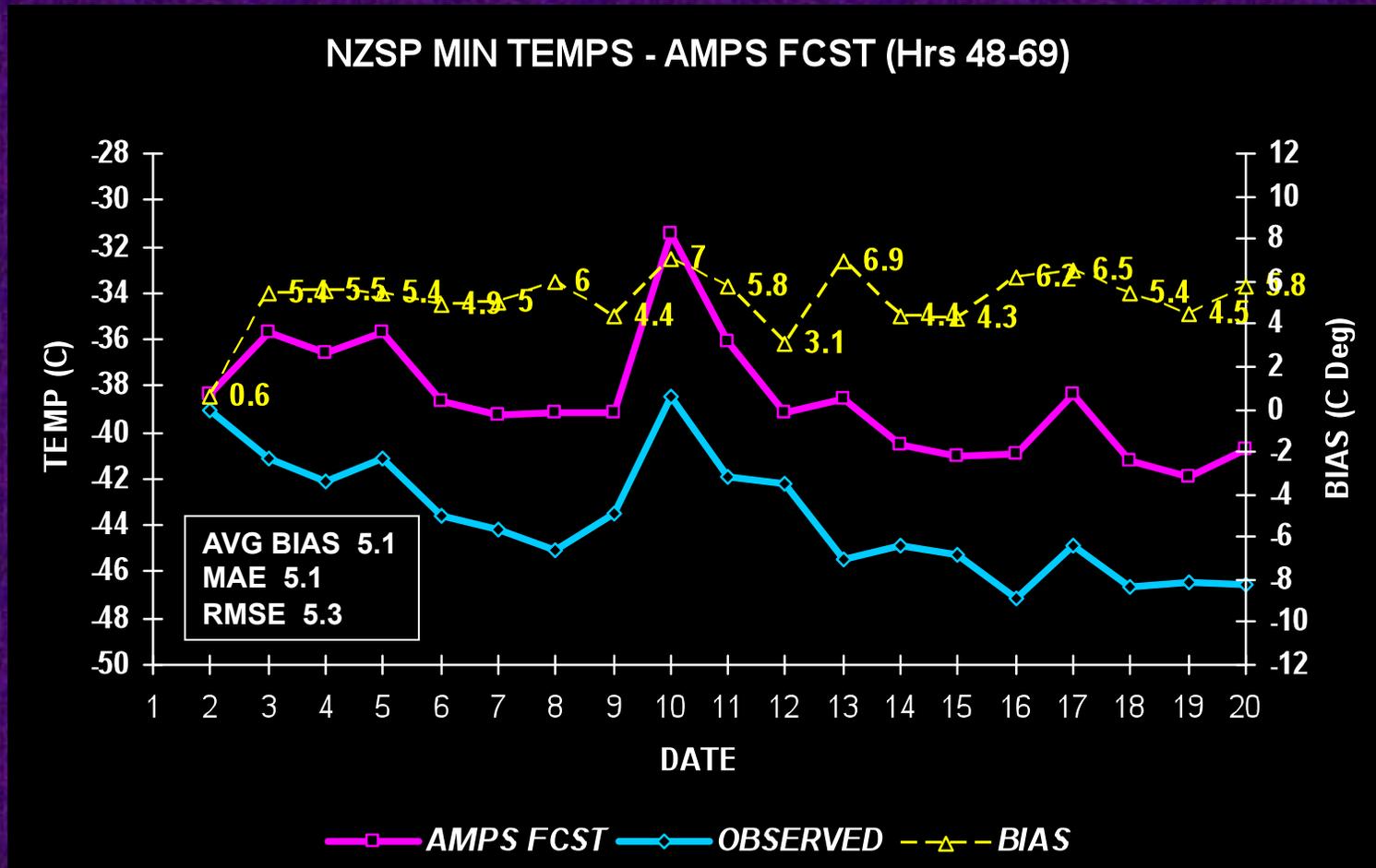
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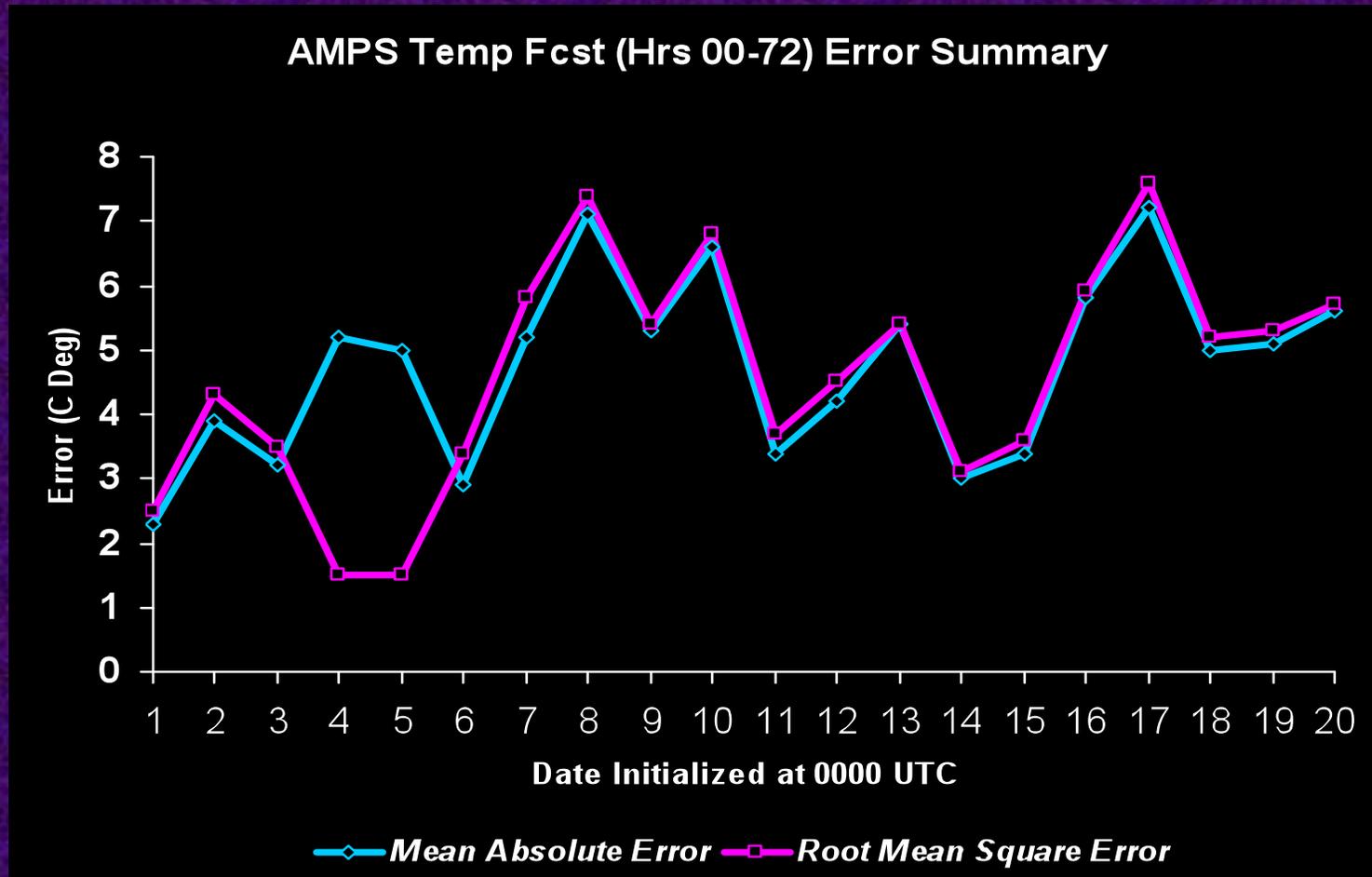
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Date	MAE	RMSE
1	2.3	2.5
2	3.9	4.3
3	3.2	3.5
4	5.2	1.5
5	5	1.5
6	2.9	3.4
7	5.2	5.8
8	7.1	7.4
9	5.3	5.4
10	6.6	6.8

Date	MAE	RMSE
11	3.4	3.7
12	4.2	4.5
13	5.4	5.4
14	3	3.1
15	3.4	3.6
16	5.8	5.9
17	7.2	7.6
18	5	5.2
19	5.1	5.3
20	5.6	5.7

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## POSSIBLE EXPLANATIONS

- Forecast increments in AMPS table in 3-hour increments, therefore max/min temps may be observed “between categories”
- The first  $\Sigma$  level is in the radiation inversion
- Inaccurate cloud cover forecasts

## ACKNOWLEDGEMENTS

- NZSP observations courtesy of *AMRC at SSEC, University of Wisconsin-Madison*
- AMPS 20km NZSP South Pole tables courtesy of *MMM Division at National Center for Atmospheric Research*