

# MAXIMUM AND MINIMUM TEMPERATURE FORECAST VERIFICATION AT PALMER AND MCMURDO STATIONS

Billy C. Tate

Space and Naval Warfare (SPAWAR) Systems Center, Atlantic  
Joint Base Charleston, South Carolina

## 1. OVERVIEW

SPAWAR Office of Polar Programs (SOPP) forecasters produce two-day forecasts for two United States Antarctic Program research stations daily: Palmer Station on Anvers Island and McMurdo Station on Ross Island. Each two-day forecast provides detail on maximum and minimum temperatures, sky condition, visibility, wind, and minimum wind chill values. Maximum and minimum temperature forecast accuracy was evaluated for this study.

## 2. METHODOLOGY

Maximum and minimum temperature forecasts at Palmer and McMurdo Stations were evaluated for accuracy using four metrics: mean algebraic error (bias), mean absolute error (MAE), root-mean-square error (RMSE), and percentage of forecasts with absolute error of less than 1.67°C. The same metrics were applied to a climatological forecast that employed only the daily mean maximum and minimum temperatures as a predictor. Observed daily maximum and minimum temperature observations from monthly climatology spreadsheets were used as the basis of examination. A total of 484 two-day temperature forecasts from the period spanning January 1<sup>st</sup>, 2017 to April 30<sup>th</sup>, 2018 were evaluated for this study.

## 3. RESULTS

Analysis of two-day forecasts at Palmer Station revealed that SOPP forecasters had a MAE of 1.71°C for maximum temperature forecasts and 1.55°C for minimum temperature forecasts. A distinct low bias was noted for maximum temperature forecasts, in order of -1.19°C for day one and -1.48°C on day two of the forecast period. Climatology as a predictor

had a MAE of 2.15°C, with no significant bias. Forecasters had a MAE of 1.55°C and negligible bias for minimum temperature forecasts; climatology has a MAE of 1.99°C and a bias of -0.33°C respectively.

At McMurdo Station, forecasters had a MAE of 2.09°C for maximum temperatures with a bias of -0.49°C on day one and -0.76°C on day two. Climatology had a MAE of 3.50°C with a bias of -0.66°C respectively. For minimum temperatures, forecasters had a MAE of 2.23°C with a bias of 0.69°C, while climatology had a MAE of 3.57°C and a bias of -0.54°C.

## 4. OBSERVATIONS AND DISCUSSION

A low bias was noted for all forecasters with respect to maximum temperature forecasts at both locations evaluated for this study. The low bias is likely a reflection of model bias, as several models have been noted to exhibit a low bias with respect to maximum temperatures. It was also observed that climatology as a predictor had a lower MAE during the months of December and January at both locations and will prove to be a good tool for use in the austral summer.

When compared against a similar study conducted by Jonas Asuma (2008), it was noted that slight improvement has occurred in all metrics at Palmer Station over the last decade. At McMurdo Station, the MAE for maximum temperature forecasts has increased, though minimum temperature forecast performance has improved.

## 5. FUTURE WORK

Evaluation of individual model performance began in May 2018 to determine biases and develop a bias-corrected blend for maximum

and minimum temperature forecasts and reduce the MAE for SOPP forecasters to less than 1.67°C. Models under evaluation include the European Center for Medium Range Weather Forecasts (ECMWF), Global Forecast System (GFS), NOAA Environmental Modeling System (NEMS [meteoblue]), and multiple spatial resolutions of the Antarctic Mesoscale Prediction System (AMPS). The introduction of detailed station climatology data and the release of metrics to individual forecasters will enable improvement as well.

## **6. ACKNOWLEDGEMENTS**

Climatological data utilized by this study was archived by SOPP, Antarctic Meteorological Research Center (AMRC), Scripps Institution of Oceanography, and the National Climatic Data Center (NCDC).

## **7. REFERENCES**

Asuma, J., 2008: Forecast Verification Study for McMurdo and Palmer Stations: Preliminary Results, 3<sup>rd</sup> Workshop on Antarctic Meteorological Observation, Modeling, and Forecasting, Madison, WI, June 9-12

Friday, 01 December 2017  
**PALMER STATION WEATHER FORECAST INFORMATION**

**THIS INFORMATION IS FOR OFFICIAL USE ONLY  
 AND IS LIMITED TO ACTIVITIES SPONSORED OR RECOGNIZED  
 BY THE UNITED STATES ANTARCTIC PROGRAM**

**REGIONAL WEATHER SUMMARY**

Westerly flow continues be the dominant factor and bringing waves of weather to the Antarctic Peninsula with clouds, snow and wind over the next couple of days...

<b>Today</b> 01 Dec	<b>Tonight</b>	<b>Tomorrow</b> 02 Dec
		

<p><b>Sky:</b> Cloudy</p> <p><b>Visibility:</b> 1-3 in snow, mist, occasional periods of unrestricted</p> <p><b>Wind (kts):</b> NW 15-25, decreasing to NW 10-20 by evening</p> <p><b>Max Temp:</b> 1°C / 34°F</p> <p><b>Min Wind Chill:</b> -10°C / 14°F</p>	<p><b>Sky:</b> Cloudy</p> <p><b>Visibility:</b> 1-3 in snow, mist</p> <p><b>Wind (kts):</b> NW 10-20</p> <p><b>Min Temp:</b> -2°C / 28°F</p> <p><b>Min Wind Chill:</b> -10°C / 14°F</p>	<p><b>Sky:</b> Cloudy</p> <p><b>Visibility:</b> 1-3 snow, mist, becoming 4-6 in snow, mist during afternoon, becoming unrestricted overnight</p> <p><b>Wind (kts):</b> NW 10-20 becoming SW 18-33 before noon</p> <p><b>Max Temp:</b> 0°C / 32°F</p> <p><b>Min Wind Chill:</b> -10°C / 14°F</p>
---	---	---

**ASTRONOMICAL DATA**

Date	Sunrise	Sunset
01 Dec	2:55 a.m.	11:18 p.m.
02 Dec	2:52 a.m.	11:22 p.m.

**Forecaster:** *Trish Bednarczk*