Forecast verification study for McMurdo and Palmer Stations: Preliminary Results

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Forecast Sources
McMurdo Forecast Sources

• Resident SPAWAR Forecasters
  – Antarctic Mesoscale Prediction System (AMPS)
• FORECA provides forecasts for MSN.com
  – Finnish Company → Largest in Nordic Countries
  – Data source not listed
• The Weather Channel (weather.com)
  – US company → Data source not listed
• Weather Underground (wunderground.com)
  – International forecasts → NCEP AVN model run
Palmer Forecast Sources

• SPAWAR Forecasters in Charleston
  – AMPS → send out “Town” forecasts daily

• Qwikcast.com
  – National Weather Service .5° GFS model for international forecasts
  – METAR’s from nearest location (Falkland Islands)

• Weather Underground
  – International forecasts → NCEP AVN model run
**Palmer/McMurdo Town Forecast**

**Regional Weather Summary**
- The low in the eastern Bellingshausen Sea continues to dominate the weather pattern through tonight as a ridge of high pressure will begin to build into the area. The ridge will begin to dominate the weather pattern by midday tomorrow.

<table>
<thead>
<tr>
<th>Today 25 December</th>
<th>Tonight</th>
<th>Tomorrow 26 December</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sky:</strong> Clear with light flurries.</td>
<td><strong>Sky:</strong> Clear with snow.</td>
<td><strong>Sky:</strong> Mostly clear with light snow.</td>
</tr>
<tr>
<td><strong>Visibility (mi):</strong> Unrestricted with periods of less than 3 km by early afternoon.</td>
<td><strong>Visibility (mi):</strong> 2-4 in light snow with short periods of less than 1 after midnight. Improving by morning.</td>
<td><strong>Visibility (mi):</strong> 3-5 in light snow becoming unrestricted by late morning.</td>
</tr>
<tr>
<td><strong>Wind (kt):</strong> NW 8 to 13</td>
<td><strong>Wind (kt):</strong> NW 8 to 13</td>
<td><strong>Wind (kt):</strong> SW 8 to 13</td>
</tr>
<tr>
<td><strong>Max Temp:</strong> 3°C / 33°F</td>
<td><strong>Min Temp:</strong> 0°C / 32°F</td>
<td><strong>Max Temp:</strong> 1°C / 34°F</td>
</tr>
<tr>
<td><strong>Min Wind Chill:</strong> -3°C / 21°F</td>
<td><strong>Min Wind Chill:</strong> -6°C / 21°F</td>
<td><strong>Min Wind Chill:</strong> -5°C / 23°F</td>
</tr>
</tbody>
</table>

**Astronomical Data**

<table>
<thead>
<tr>
<th>Date</th>
<th>Sunrise</th>
<th>Sunset</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 December 2007</td>
<td>0226L</td>
<td>2600L</td>
</tr>
<tr>
<td>26 December 2007</td>
<td>0236L</td>
<td>2700L</td>
</tr>
</tbody>
</table>

Forecaster: Bill Brown

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**Scott Base 24-Hr Temperature:** High: -2°C/12°F Low: -12°C/10°F

**Yesterdays Extremes**
- Maximum Temperature: +3°C/+3°F
- Minimum Temperature: -6°C/-21°F
- Peak Wind: 15 Knots
- Lowest Wind Chill: -5°C/-23°F

Forecaster: Al
Method
Method

- Compared High and Low Temperature forecasts versus the McMurdo/Palmer Station monthly climatologies
  - Temperature → Universally forecasted across sources
- Statistical analysis performed
  - Computed the Error, Accumulated Error, Average Error, Root Mean-Squared Error (RMSE), Accumulated MSE, Maximum Error, and Correlation Coefficient
  - Produced scatter plots to visualize error
Results
McMurdo High/Low Temperatures
McMurdo Station Forecasts: High Temperatures

**Obs vs. MCM High Temp (C)**
- Correlation = 0.9122547

**Obs vs. MSN High Temp (C)**
- Correlation = 0.7462791

**Obs vs. WX Channel High Temp (C)**
- Correlation = 0.30630229

**Obs vs. Wx Underground High Temp (C)**
- Correlation = 0.8527524
McMurdo Station Forecasts: High Temperatures (148 days)

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</thead>
<tbody>
<tr>
<td>MCM</td>
<td>292°</td>
<td>1.98°</td>
<td>7.12°</td>
<td>2.50°</td>
<td>0.9122</td>
</tr>
<tr>
<td>Wx Und.</td>
<td>540°</td>
<td>3.65°</td>
<td>12.18°</td>
<td>4.43°</td>
<td>0.8527</td>
</tr>
<tr>
<td>Wx Channel</td>
<td>884°</td>
<td>5.97°</td>
<td>19.71°</td>
<td>7.52°</td>
<td>0.3063</td>
</tr>
<tr>
<td>MSN Wx</td>
<td>1000°</td>
<td>6.76°</td>
<td>18.97°</td>
<td>8.19°</td>
<td>0.7462</td>
</tr>
</tbody>
</table>
McMurdo Station Forecasts: Low Temperatures

- **Obs vs. MCM Low Temp (C)**
  - Correlation = 0.808511

- **Obs vs. MSN Low Temp (C)**
  - Correlation = 0.7244098

- **Obs vs. Wx Channel Low Temp (C)**
  - Correlation = 0.4851495

- **Obs vs. Wx Underground Low Temp (C)**
  - Correlation = 0.834095
## McMURDO STATION FORECASTS: LOW TEMPERATURES (164 DAYS)

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<thead>
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</thead>
<tbody>
<tr>
<td>MCM</td>
<td>464°</td>
<td>2.83°</td>
<td>14.02°</td>
<td>3.72°</td>
<td>0.8085</td>
</tr>
<tr>
<td>Wx Und.</td>
<td>505°</td>
<td>3.08°</td>
<td>11.29°</td>
<td>3.81°</td>
<td>0.8341</td>
</tr>
<tr>
<td>MSN Wx</td>
<td>1121°</td>
<td>6.84°</td>
<td>18.61°</td>
<td>8.02°</td>
<td>0.7244</td>
</tr>
<tr>
<td>Wx Channel</td>
<td>1268°</td>
<td>7.74°</td>
<td>26.84°</td>
<td>9.47°</td>
<td>0.4851</td>
</tr>
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</table>
Palmer High/Low Temperatures
Palmer Station Forecasts: High Temperatures

Obs vs. PAL High Temp (C)

Correlation = 0.806663

Obs vs. Qwikcast High Temp (C)

Correlation = 0.714855

Obs vs. Wx Underground High Temp (C)

Correlation = 0.720408
Palmer Station Forecasts:
High Temperatures (178 days)

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<tbody>
<tr>
<td>PAL</td>
<td>315°</td>
<td>1.77°</td>
<td>7.20°</td>
<td>2.36°</td>
<td>0.8067</td>
</tr>
<tr>
<td>Wx Und.</td>
<td>347°</td>
<td>1.95°</td>
<td>20.68°</td>
<td>2.88°</td>
<td>0.7204</td>
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<tr>
<td>Qwikcast</td>
<td>480°</td>
<td>2.70°</td>
<td>13.11°</td>
<td>3.49°</td>
<td>0.7148</td>
</tr>
</tbody>
</table>
Palmer Station Forecasts: Low Temperatures

Obs vs. PAL Low Temp (C)
Correlation = 0.762566

Obs vs. Qwikcast Low Temp (C)
Correlation = 0.840359

Obs vs. Wx Underground Low Temp (C)
Correlation = 0.690919
## Palmer Station Forecasts: Low Temperatures (187 days)

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</thead>
<tbody>
<tr>
<td>PAL</td>
<td>359°</td>
<td>1.92°</td>
<td>7.67°</td>
<td>2.45°</td>
<td>0.7626</td>
</tr>
<tr>
<td>Qwikcast</td>
<td>403°</td>
<td>2.20°</td>
<td>11.00°</td>
<td>2.77°</td>
<td>0.8403</td>
</tr>
<tr>
<td>Wx Und.</td>
<td>394°</td>
<td>2.11°</td>
<td>20.57°</td>
<td>3.11°</td>
<td>0.6909</td>
</tr>
</tbody>
</table>
Conclusions/Future Work
Conclusions

• SPAWAR forecasters most accurate
  – Accumulated Error, Average Error, and Mean Squared Error
  – Despite forecast “hiccups”
• Average Error and Mean Squared Error most significant indications of accuracy
  – Correlation Coefficient not the best indicator of forecast accuracy
Future Work

• Perform similar study but:
  – Use longer dataset
    • preferably an entire year
  – Compare multiple parameters
    • Wind direction/speed, precipitation, cloud cover
  – Compare more forecast sources
    • Other private forecast companies
    • i.e. AccuWeather
Acknowledgements

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