Evaluation of AIRS V6 Temperature Profiles and Surface-Based Inversions over Antarctica using Concordiasi Dropsonde Data

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Motivation & Research Questions

• How well do available satellite products capture the temperature profile over Antarctica?

• Can these satellite products be used to detect surface-based temperature inversions (SBI)?

• If so, can we identify annual trends in SBIs over Antarctica?
Observations in Antarctica are hard to come by...
The Process

- AIRS 100 level L2 support product
- Surface air temperature necessary for SBI detection
- Used QC flag of Best and Good
- Dropsonde – vertical scale of meters
- Two methods for comparison
  - Full-resolution sonde data
  - AIRS kernel averaging applied to sonde
- 6 hr, 150 km co-location threshold
- 1486 available profiles
Temperature Comparison - AIRS vs Sonde

Potential Confounding Factors:
- Surface type
- Cloud cover
- Surface elevation
- Matching distance/time
- Lat/Lon

![Graph showing temperature comparison between AIRS and Sonde with potential confounding factors.](image)
Temperature Comparison – 500 hPa
Sea Ice - 20%

Snow - 77%
Temperature Comparison by Elevation over Snow
Temperature Evaluation Highlights

- Over Antarctica, AIRS Version 6 reduces the bias and RMSE compared to version 5.

- Version 6 bias dependent on surface type and surface elevation.

- Matching distance / time is not a factor - not true globally.

- Can AIRS profiles be used to detect surface-based temperature inversions?
  - What about the surface air temperature?
Surface-Based Inversions

3 Characteristics:
Frequency - Occurrence
Depth (m)
Intensity (°C)
Surface-Based Inversions

Agreement: 79%

<table>
<thead>
<tr>
<th>Kerned Sonde</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIRS</td>
<td>57%</td>
<td>10%</td>
<td>999</td>
</tr>
<tr>
<td>No</td>
<td>11%</td>
<td>22%</td>
<td>487</td>
</tr>
<tr>
<td>Total</td>
<td>1007</td>
<td>479</td>
<td>1486</td>
</tr>
</tbody>
</table>

Discrete layers for SBI depth:
Agree: 79%
+/- 1 level: 97%

Sonde intensities larger ...
Differences between depth and intensity
Inversion Temperatures

Surface

A) AIRS vs Kerned Sonde Surface Temperature (°C)

Top

B) AIRS v6 Top of Inversion Temperature (°C) vs Kerned Sonde Top of Inversion Temperature (°C)
AIRS SBI detection

- AIRS is doing the best it can to detect SBIs, given its limited vertical resolution.
- Both SBI occurrence and depth show high agreement ~80%.
- AIRS underestimates SBI intensity by ~40%.
- Low SBI detection agreement over the ocean.

Full-Sonde
- 59% occurrence agreement
- 70% w/ surface air temp change
Future Work

- Accurate surface air temperature is critical for SBI detection.
- ERA-Interim and new version of IASI are being utilized.
- Use of AIRS based SBIs for future research depends on objective/accuracy required.