Distributed Water Networks in Dome A, East Antarctica

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Introduction

Setting - Ice Surface

Known Lake

Kunlon
Introduction

Setting - Bed Elevation

- Known Lake
- Kunlon

North
Introduction

Setting- Accretion Plumes

Bed Elevation (m) with Valley Head Accretion Overlain

Bell et al, 2011

- Known Lake
- Kunlon
- "Valley Head"
- Ice Flow Direction
- North
Mark I Eyeball

Criteria

• Brightness relative to reflectors of similar depth
• Flatness
• In local topographic minimum
• Vertically thin
• Receiver ringing (especially below 3000-3500m)
Mark I Eyeball

Examples

- East

- North

Clear Water Body

Unclear Water Body
Mark I Eyeball
Size Distribution of Picked Water Bodies

Clear Picks

Unclear Picks
Mark I Eyeball

Picking Results

Bed Elevation (m) with Manual Picks Overlaid

- Known Lake
- Clear Picks
- Kunlon
- Unclear Picks

North
Reflectivity Anomalies

Geometrically corrected bed returned power

Best-fit slope: 11.67 dB/km (one way)
Reflectivity Anomalies

Long-Wavelength Signal

Gaussian Distance Weighting
($\sigma=25\text{km}$, min wavelength $\sim50\text{km}$)
Reflectivity Anomalies

Short-Wavelength Residual

Wavelengths \( \sim \) [5km, 50km]
But most water bodies are smaller than this!
Reflectivity Anomalies

Individual Bright Points (4σ=+26 dB)
Coincident Points
Size Distribution of Coincident Points

- **All Clear Picks**
- **Clear Picks Containing \( \Delta R \geq 4\sigma \)**

- **All Unclear Picks**
- **Unclear Picks Containing \( \Delta R \geq 4\sigma \)**

<table>
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<th>Minimum Length (km)</th>
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Coincident Points

Areas of Agreement Between Both Methods

Bed Elevation (m) with Manual Picks Satisfying $\Delta R \geq 4\sigma$ Overlain

Clear Picks

Unclear Picks
Discussion: Water Network Detail

L350A Network Fence Diagram of L310-L310, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

L350A Network Fence Diagram of L310-L320, Plot is $\Delta R$ (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

L350A Network Fence Diagram of L310-L330, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

L350A Network Fence Diagram of L310-L340, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

L350A Network Fence Diagram of L310-L350, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

L350A Network Fence Diagram of L310-L360, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

L350A Network Fence Diagram of L310-T10120, Plot is $\Delta R$ (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

Beehive Network Fence Diagram of L510-L510, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

Beehive Network Fence Diagram of L510-L530, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

Beehive Network Fence Diagram of L510-L540, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

Beehive Network Fence Diagram of L510-T10150, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

Beehive Network Fence Diagram of L510-L550, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

Beehive Network Fence Diagram of L510-L560, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

Beehive Network Fence Diagram of L510-L570, Plot is $\Delta R$ ($4\sigma$ cutoff), Map is Ice Thickness (100m contours)
Discussion: Water Network Detail

Beehive Network Fence Diagram of L510-L580, Plot is ΔR (4σ cutoff), Map is Ice Thickness (100m contours)
Conclusion
Acknowledgements

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