Arctic Sea Ice Observations

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Introduction

Arctic sea ice broadly represents atmosphere-ocean interactions (Meier et al., 2014).
The Arctic is especially vulnerable:

- 2022 has seen a continuing of the long-term downward trend in sea ice coverage and is among the lowest in the modern satellite record (Meier et al., 2022).
- 2022 marked the sixth warmest water year (October 2021 to September 2022) for land areas and the Arctic Ocean north of 60 °N since 1900 (Ballinger et al., 2022).

Materials and Methods

Time lapses for Arctic sea ice are created by stitching webcam images together. Images from the following organizations/buoys appear in the time-lapse videos:

- Applied Physics Laboratory (APL)
- U.S. Navy Arctic Submarine Laboratory (ASL)
- Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
- The Collaborative O-Buoy Project (O-Buoy)
- International Arctic Buoy Programme (USIABP)
- Warming and Irradiance Measurement (WARM) Buoy

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WARM Buoy

Shadow of Sidekick webcam
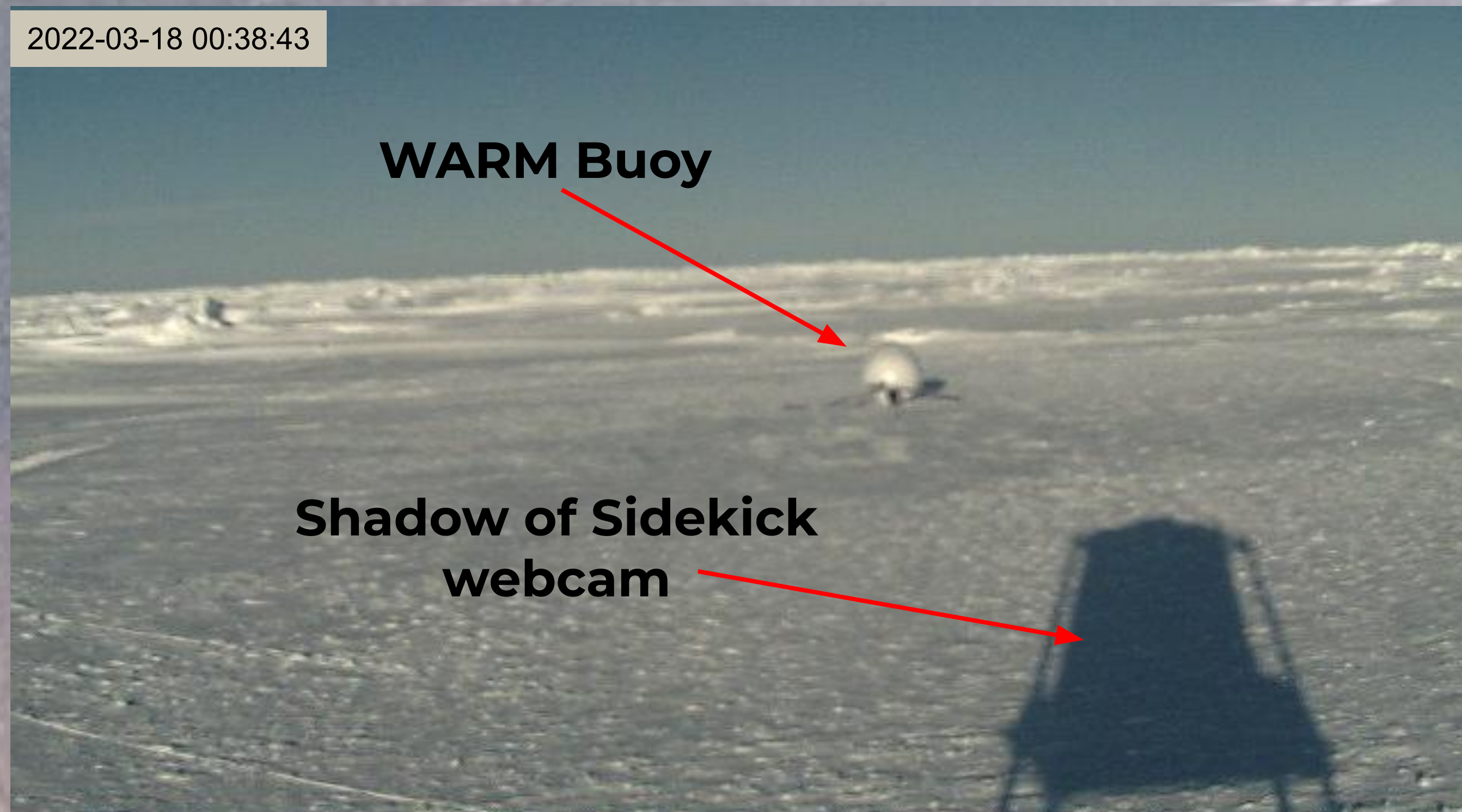
Figure 1. WARM Buoy and JAMSTEC Sidekick camera deployed during the 2022 Arctic Ice Exercise (ICEX). Photo from JAMSTEC Sidekick 3 and JAMSTEC WARM Buoy 4 (Satoshi Kimura and Victoria Hill).


Figure 2. DOT-3 Buoy deployed during ICEX 2022. Photo credit: Ann Hill, ASL

2-m air temperature sensor

Figure 3. IceBall Buoy (this particular buoy wasn't deployed at ICEX 2022). Photo credit: Mario Hoppmann, Alfred Wegener Institute

Surface temperature sensor
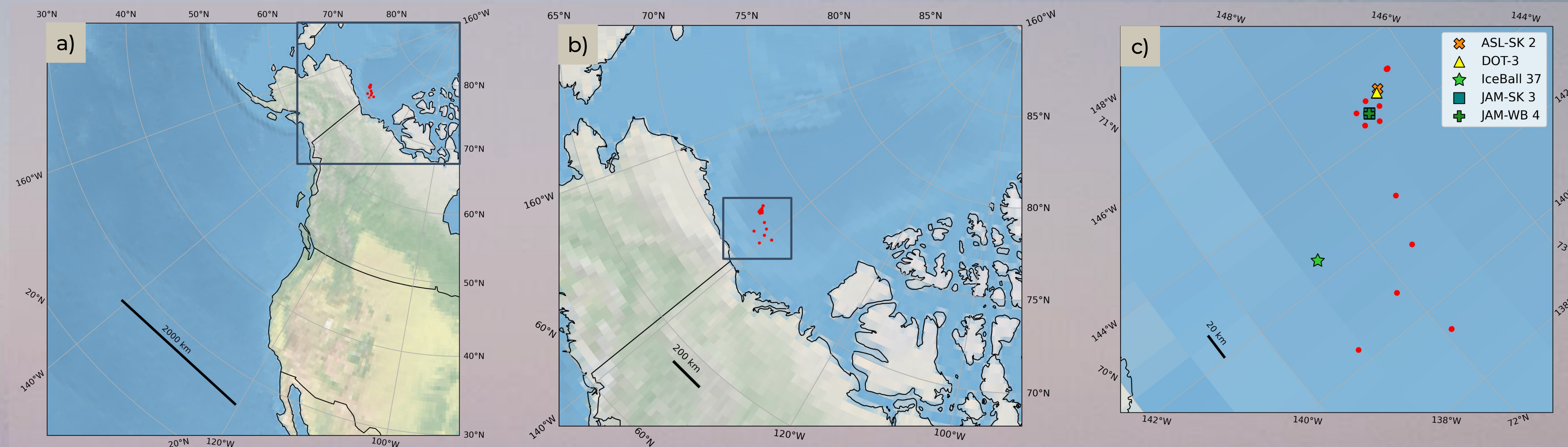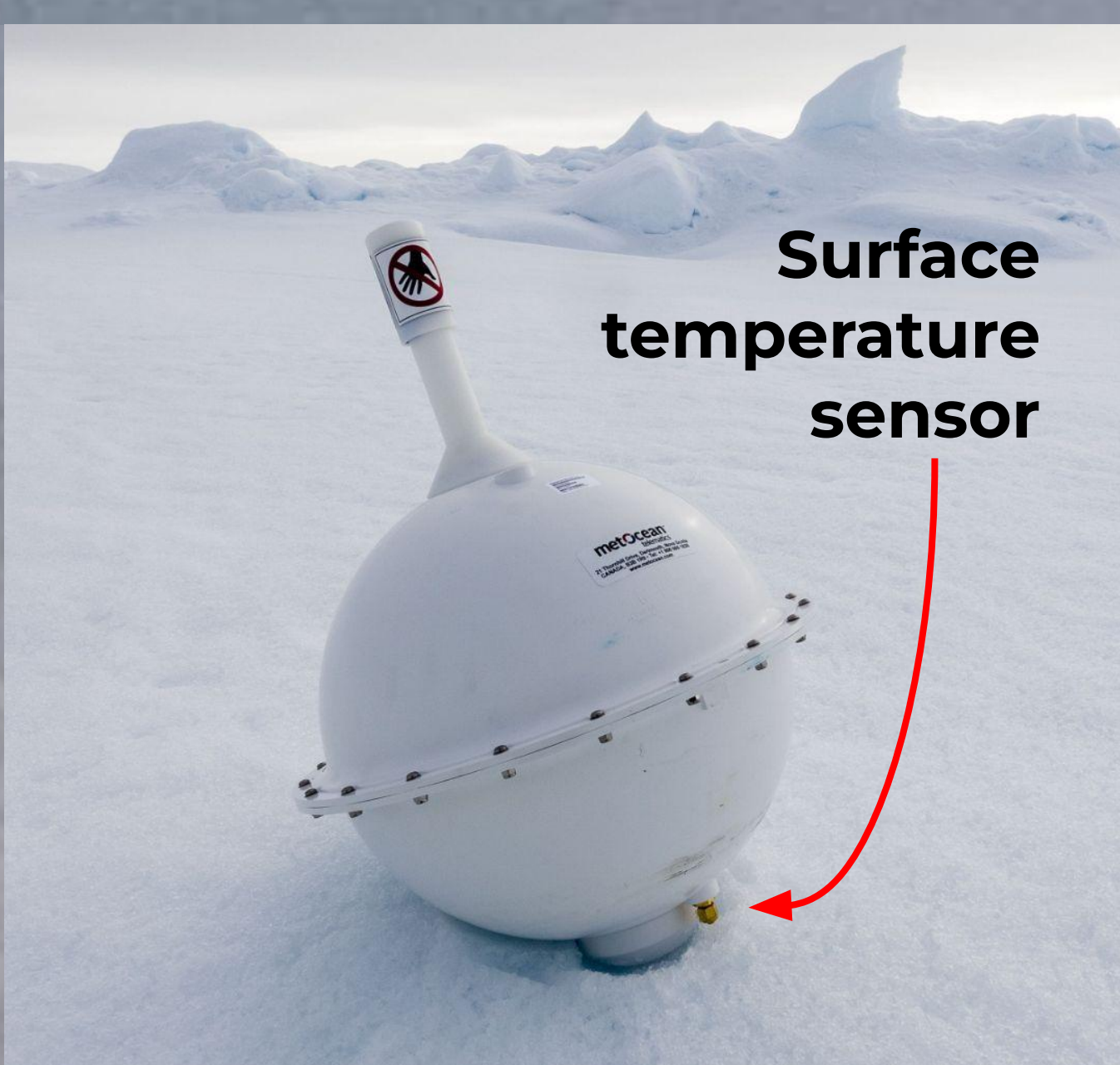
Figure 4. Three-panel map showing the starting locations of the 29 ICEX 2022 buoys. a) Red dots show buoys north of Alaska. b) Zoom in of the previous map. c) Buoys shown in three clusters based on deployment date and base camps. The non-circles indicate buoys/webcams on this poster: ASL Sidekick 2 (webcam), DOT-3 (temperature), IceBall 37 (temperature), JAMSTEC Sidekick 3 (webcam), and JAMSTEC WARM Buoy 4 (webcam).
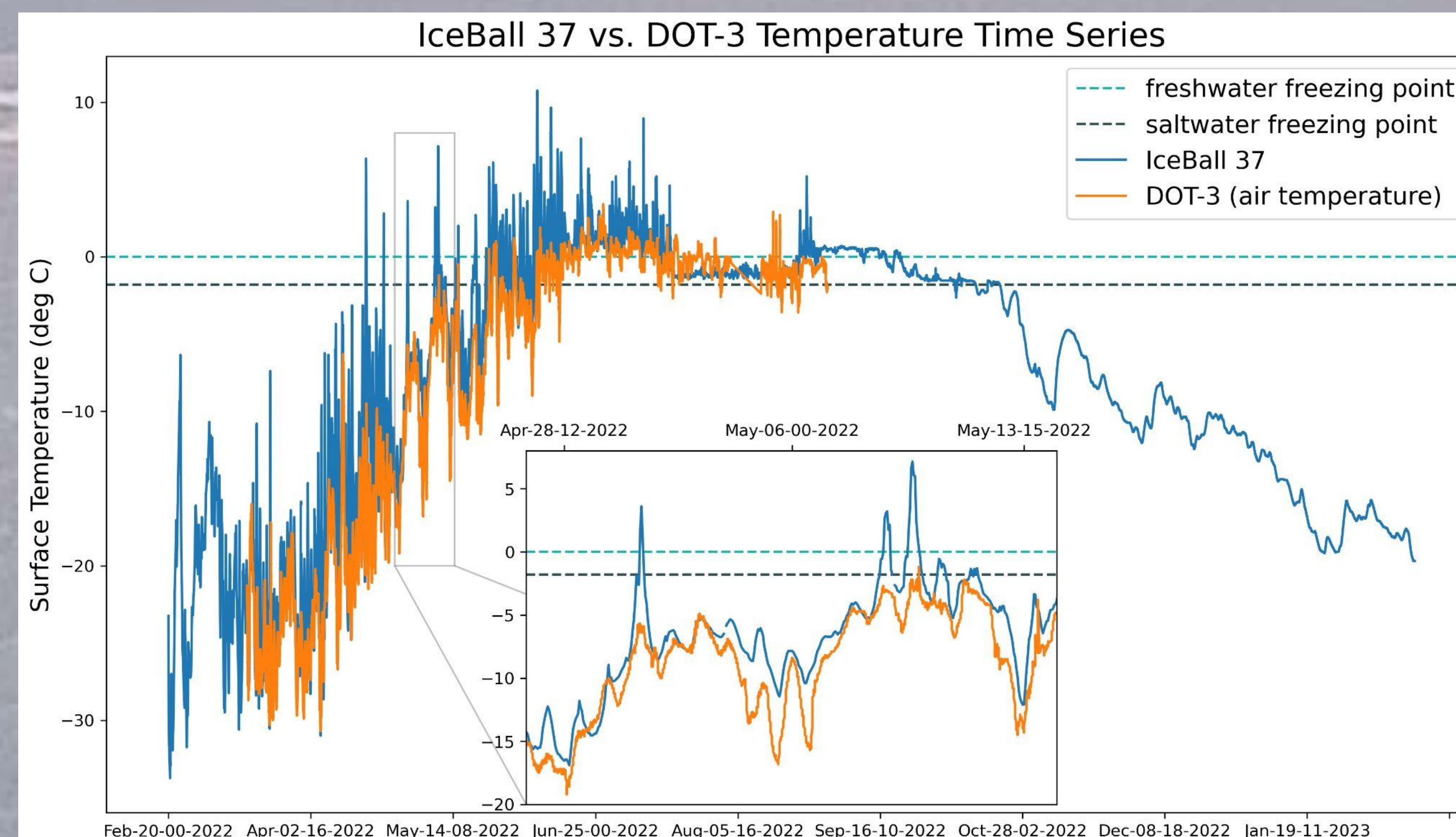
Figure 5. Temperature time series of IceBall 37 (surface) and DOT 3 (air) buoys with water freezing points.
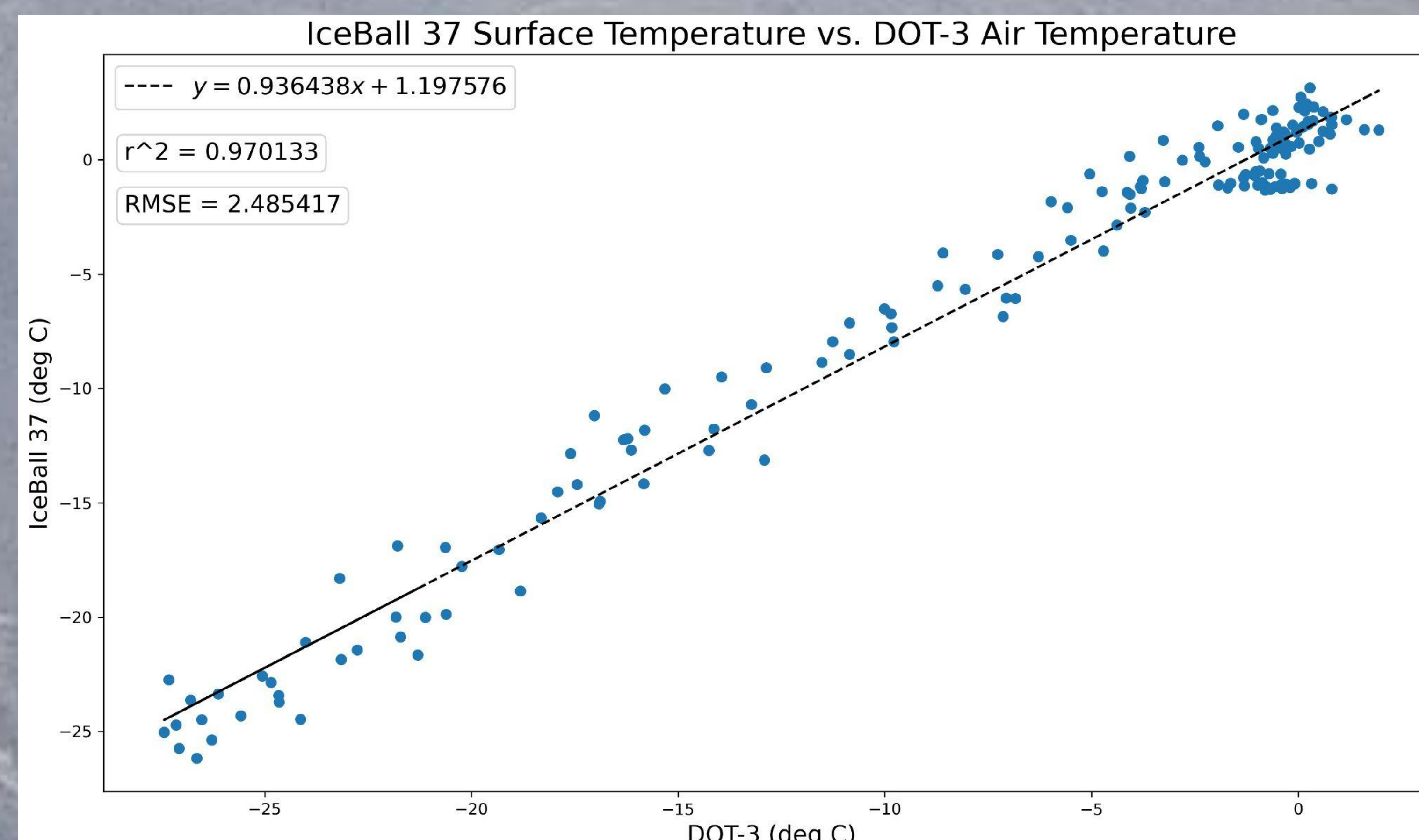
Figure 6. Scatter plot of IceBall 37 surface temperature versus DOT 3 air temperature. The linear regression, r^2 and root mean square error are shown on the graph.

Discussion and Future Work

Time lapses can visually verify data received from buoys

- JAM_SK3 and ASL_SK2 webcams are within the IceBall and DOT-3 time series
- Less variation = cloudy skies; more variation = clear skies

Saltwater vs. Freshwater

- Ocean density changes during the melt season and growth seasons of sea ice (post-July)

Instrument Comparisons and Complications

- The scatter plot intercept is positive, indicating that IB37 is warmer (sensor is closer to warm ocean surface)
- Temperatures have a strong correlation, but relationship begins to break down monthly (especially during the melt months)
- Camera lifetimes and data loss (pixel loss and errors)
- Resolution issues

Future Work

- Time lapses to go on the NOAA website
- More work with buoy and webcam data from other Arctic deployments

Time Lapses

YouTube Playlist

- 48 videos
- Did you spot any polar bears?

Website

- Favorite images from webcams
- Dataset references
- More buoy analyses

References and Acknowledgements

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