Extreme Wind Event in the Black Island Region of Antarctica

Isabella Onsi[1], Matthew Lazzara[1,2]
[1.] University of Wisconsin-Madison, [2.]Madison Area Technical College
onsi@wisc.edu

Introduction

- Extreme wind event occurring on the Ross Ice Shelf from August 31 to September 3, 2020.
- Starting on August 31st, 2020, with winds increasing drastically from around 10 knots to a peak wind speed of 166.6 knots in the span of just a few hours. The area then experienced sustained winds over 50 knots for two and a half days.
- This study will investigate some of the environmental factors surrounding this event to better understand how the accumulation of these components led to the sustained extreme winds.
- Uses data collected from an Automatic Weather Stations (AWS) on Black Island, which is located on the Ross Ice Shelf in Antarctica. The Black Island AWS is maintained by private contractors hired by NIWC.
- By gaining a better understanding of these events, we can make sure that all equipment (AWS, communications, buildings, etc.) are durable enough to withstand similar weather conditions.

Methods

- The time frame investigated during this event is from August 30 to September 4, 2020 to include the day before and after the main extreme wind event
- The Black Island Automatic Weather Station (AWS) data was the primary tool used to quantify the severity of this event.
- Only two radiosonde launches occurred during the investigative period, both from McMurdo Station.
- The satellite images used in this study are created using both polar orbiting satellites and geostationary satellites
  - These satellite composites are then overlaid with AMPS data to view the mean sea level pressure (MSLP) to gain a better understanding of the large scale dynamic features contributing to the event.

Results

The high wind event (late August 30 through middle of September 3, 2020) is associated with a local low pressure system moving onto the Antarctic continent. The lower portion of this large air mass got blocked by the Transantarctic Mountains while the upper portion is able to pass over towards East Antarctica. The lower air then gets swept with the curvature of the mountain range along the edge of the Ross Ice Shelf. As the air mass approaches the Black and White Island region, it has enough speed to move over Minna Bluff and then gets funneled through Herbie Alley which increases the already strong wind speed. This air mass is associated with a low pressure moving through the area during this event can be identified in both the satellite composites as well as the data collected by the Black Island AWS. These high winds are then sustained by a second air mass that passes through the region that could potentially have influenced the duration of this event.

Data

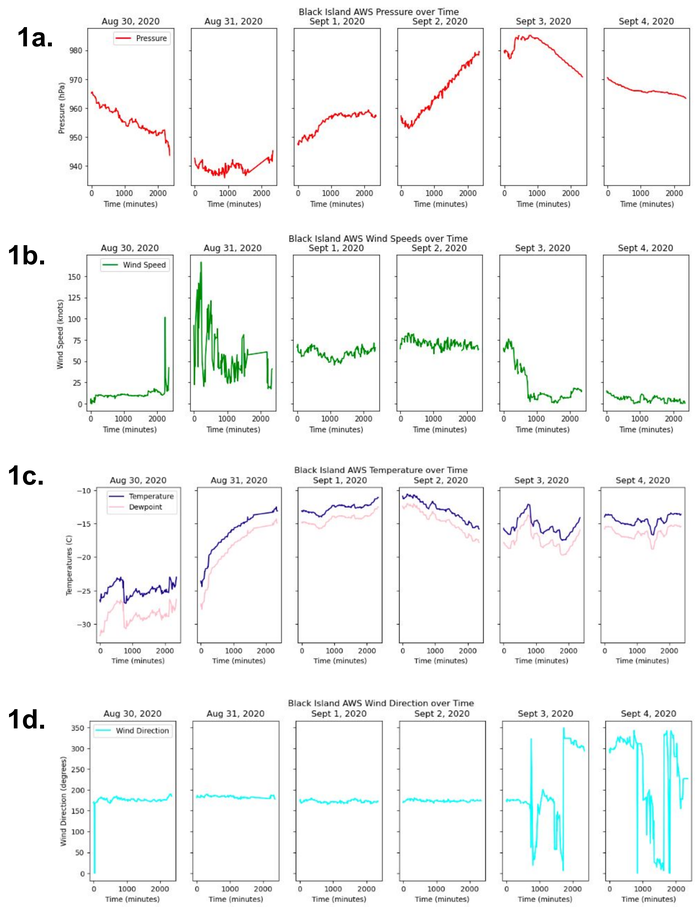

Figure 1: Data collected from the Black Island AWS from August 30 to September 4, 2020. The top plot in red shows the pressure (in hPa), the middle plot shows wind speed (in knots), the third plot shows both temperature and dewpoint (in degrees Celsius), and the bottom plot shows wind direction in degrees.These plots were created using Python.

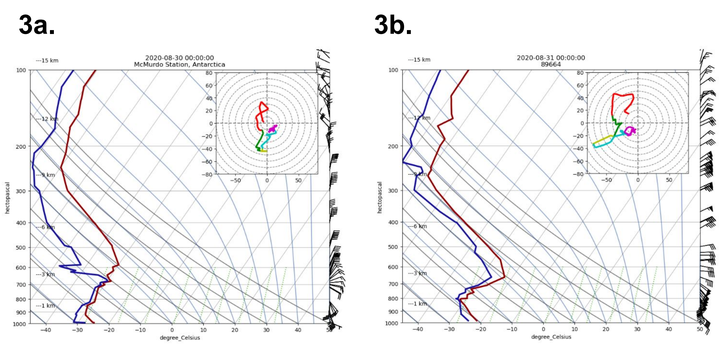

Figure 3: Soundings were created using data from radiosondes that were launched from McMurdo Station, Antarctica. 3a was launched on August 30, 2020 at 00Z and 3b was launched on August 31, 2020 at 00Z.

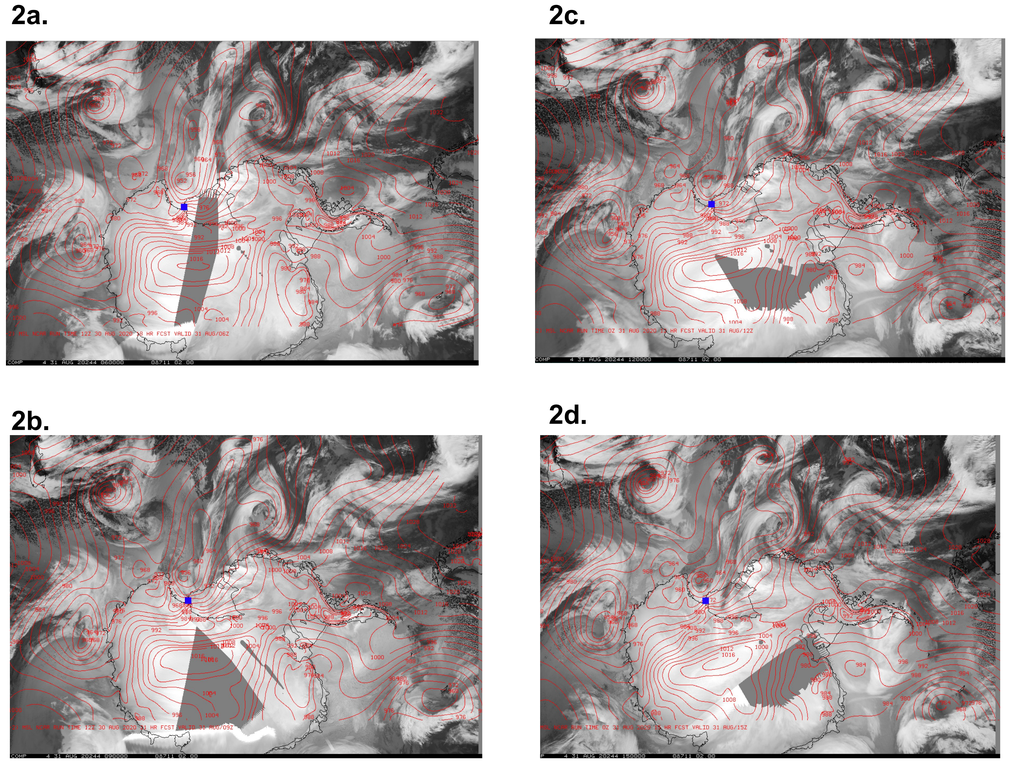

Figure 2: This is a satellite image created at the University of Wisconsin-Madison using a combination of polar-orbiting and geostationary satellite imagery. The red lines represent mean sea level pressure and are AMPS data that has been overlaid onto the satellite composite. The blue dot depicts where Black Island is located. In figure 2a, the satellite composite is from August 31, 2020 at 06Z. Figure 2b, 2c, and 2d depicts August 31, 2020 at 09Z, 12Z, and 15Z respectively.

Future Work

This study so far has mainly focused on the conditions involved in this specific event. Further work would include looking at different parameters using the AMPS data to gain a better understanding of some of the preexisting environmental conditions during the course of this event. This could also be complemented by investigating the data collected from surrounding AWS stations and the climatological averages to see how anomalous this event was. Additionally, looking at other similar cases and their conditions in order to better understand the conditions that lead up to these events.

References

1. Weber, N. J., Lazzara, M. A., Keller, L. M., & Cassano, J. J. (2016). The Extreme Wind Events in the Ross Island Region of Antarctica. *American Meteorological Society*. https://doi.org/https://doi.org/10.1175/WAF-D-15-0125.1
2. Perkins, L. (2009, April 7). *NASA Scientific Visualization studio - guided tour of Lima Flyover*. NASA. Retrieved April 17, 2023, from https://nasaviz.gsfc.nasa.gov/10416
3. *AMRC & AWS*. AMRC / AWS. (n.d.). Retrieved April 17, 2023, from http://amrc.ssec.wisc.edu/aws/index.html

Acknowledgements

Support for this project from the Office of Polar Programs, Geoscience Directorate, National Science Foundation via grants #1924730, #1951720, and #1951603 is appreciated.

I would like to thank David Mikolajczyk for helping acquire the AMPS data used in this study.