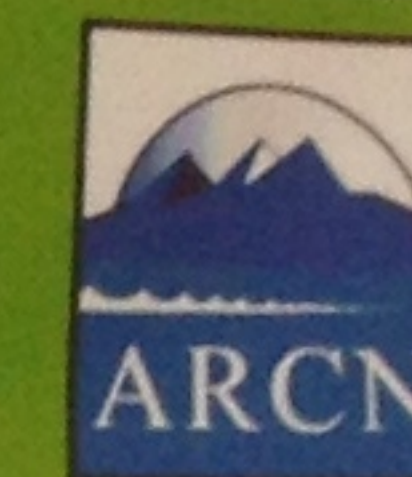




Howard Pass: Extreme weather in the Brooks Range

Ken Hill and Pam Sousanes
National Park Service, Fairbanks, Alaska



Introduction

The Howard Pass climate station in Noatak National Preserve has only been in operation since 2011, and has already recorded some of the lowest wind chills in the country. Was this an anomalous event or is it really one of the most extreme instrumented sites in Alaska? This is a fascinating location from a meteorological, biological, and cultural perspective.

Location

At 68 degrees N and 156 degrees W and an elevation of 628 meters, Howard Pass forms the divide between the Aniuk and Etivluk Rivers in the northwestern Brooks Range (Figure 1). The low Arctic pass is vulnerable to intense winds that are funneled through topographically constrained areas. The cold, dense nature of the air mass facilitates a semi-permanent inversion layer that provides a vertical constraint on the wind movement. The combination of the horizontal constriction and the vertical inversion layer results in tremendous winds when very low temperatures are present and a north-to-south pressure gradient exists (Figure 5).



Figure 1. Map of NPS climate stations; Howard Pass site circled.

Objectives/Methods

The climate station at Howard Pass was installed in the Arctic national parks to monitor climate trends as part of the Arctic Inventory and Monitoring Network's (ARCIN) long-term climate monitoring program. Winter (October-April) data from 2012-2016 were analyzed for periods of persistent cold temperatures < -30 degrees F and high winds > 20 mph to calculate wind chill.

Extreme Conditions

February 21-23, 2013: The average wind chill for this 3-day period was -87.8 F. On February 21 an air temperature of -45.5 F was recorded along with a sustained wind of 54 miles per hour, resulting in a calculated wind chill of -96.9 F.

Feb 12-16, 2014: The average wind chill for this 5-day period was an astonishing -84.5 F. Average hourly temperatures were as low as -41.1 F and peak gusts reached 103 mph. The lowest wind chill recorded during this event was -94.2 F at midnight on February 15. Ultimately, the anemometer failed at a temperature of -38 F and sustained winds of 83 mph.

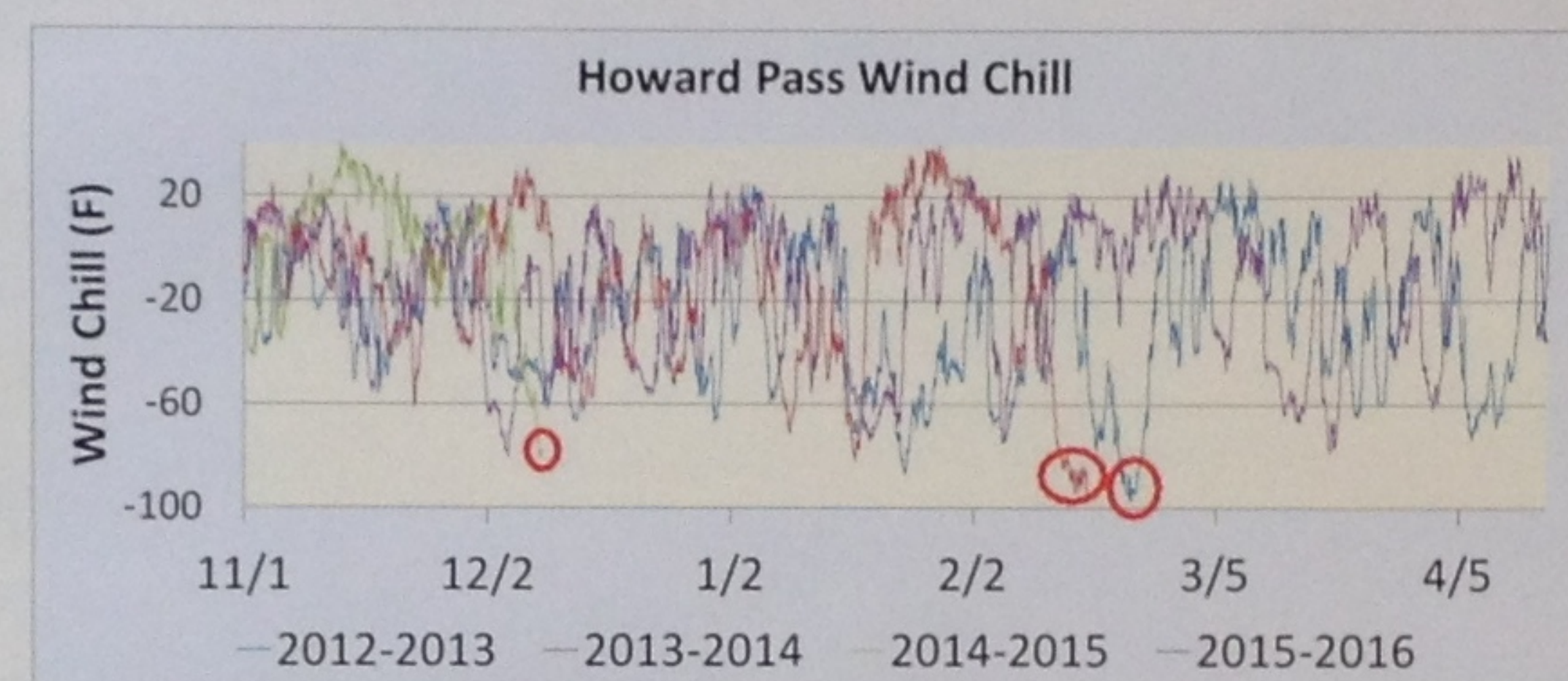


Figure 2. Wind Chill time series for Howard Pass for winter months 2012-2016. Red circles indicate notable events and/or sensor failures.

These are not isolated events; persistent wind chills of -70 F or colder have been recorded each year since the station was installed (Figure 2). The persistence of very cold temperatures and high winds during the winter months make this site unique compared to other instrumented sites in Alaska (Figure 3). Gaps in the record indicate how tough it is to record extremes. The wind sensor has been replaced every year and has sometimes shattered under the extreme conditions (Figure 2). The pock marks on the steel mast that support the station indicate the speed and intensity of flying ice and rock debris (Figure 4). Technical modifications and improved sensors have improved data reliability, with a continuous record since July 2015.

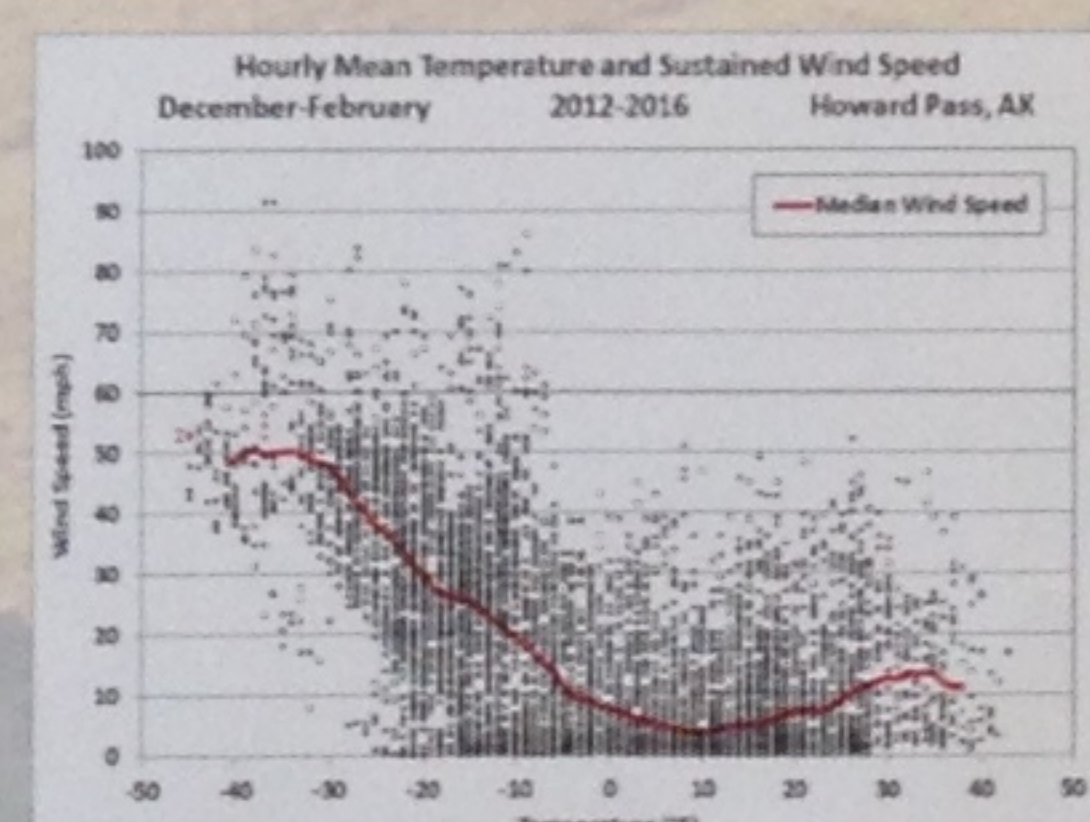


Figure 3. Hourly mean temperature and sustained wind speed. Graph courtesy of Richard James (ak-wx.blogspot.com).



Figure 4. Evidence of high winds and flying debris/ice on station. Photo by Ken Hill - NPS.

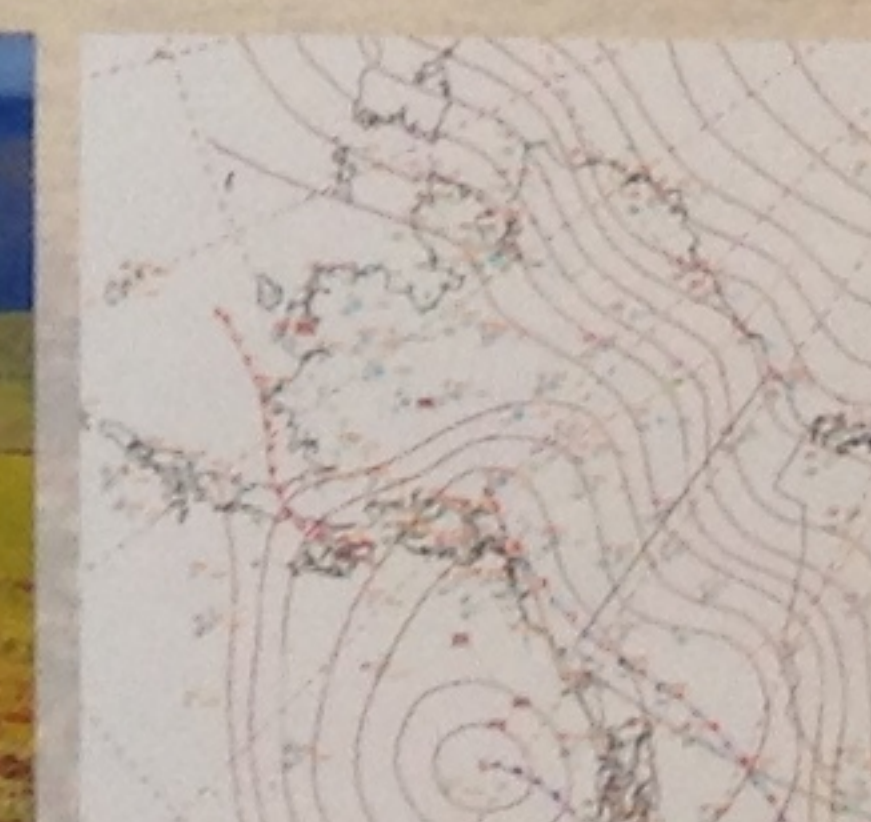


Figure 5. The north to south pressure gradient from Feb. 2013.

Record-breaking?

The city of McGrath, Alaska reported an air temperature of -72 F and a wind speed of 7 mph in January 1989, resulting in a wind chill of -99.8 F. Interestingly, a wind chill of -99.8 F was also reported by the Howard Pass station during the February 2013 event (Brettschneider, 2016). Recent data corrections from National Park Service stations in interior and arctic Alaska National Parks, however, have affected air temperature data (Hill and Sousanes, 2016). A programming error was found which resulted in a cold bias at very low temperatures (Figure 6). After data corrections, the February 2013 wind chill was adjusted from -99.8 F to -96.9 F at Howard Pass. There are also some differences in station configuration: the Howard Pass anemometer is located 2 meters above ground and the McGrath sensor is at a 10 meter height.

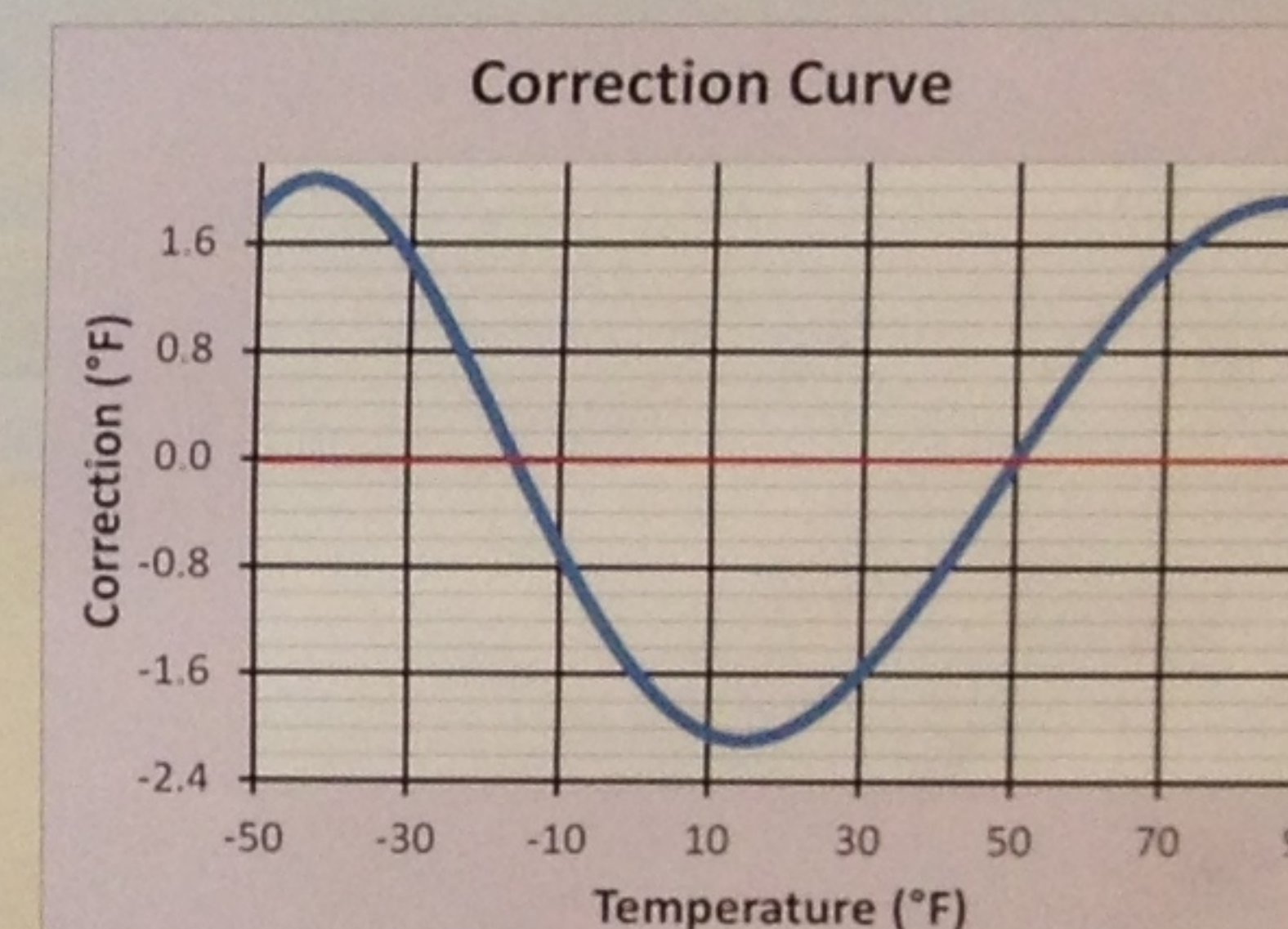


Figure 6. Data correction curve for NPS RAWs stations in interior and Arctic Alaska.

Challenges with wind chill records

- The National Climate Extremes Committee does not track wind chill records.
- Sensor heights differ between stations and networks.
- Remote automated stations are subject to data corrections after field visits and manual data collection.

Despite these challenges, the Howard Pass site has experienced multiple near record-breaking conditions, even during the recent warm years 2012-2016.

Acknowledgements

Rick Thoman, Brian Brettschneider, Richard James

References

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- Brettschneider, B. 2016. *Brian's Climate Blog*. U.S. and Alaska Wind Chill Record. <http://us-climate.blogspot.com/2014/12/us-national-wind-chill-record.html>
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"Much of the time the wind is so strong that travel is impossible; there is no shelter in the pass itself. The wind chill can be so severe as to freeze to death caribou caught there by a winter storm; after every bad blow the Eskimos used to go into the pass to look for well-preserved caribou carcasses. In summer and fall the wind reportedly sometimes gets so strong that it blows the water out of the shallow lakes in the pass." - Ernest Burch (2005)