15.2 A NATIONAL TEMPERATURE RECORD AT LOMA, MONTANA

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1. Introduction

On January 14th-15th, 1972, a National Weather Service (NWS) cooperative observer (COOP) site located in Loma, Montana recorded a 103F degree temperature change (-54F to 49F) within twenty-four hours, thereby breaking the previous record of 100F recorded on January 23rd-24th, 1916 in Browning, Montana. The record is discussed at this time because: 1) Neither the NWS Forecast Office in Great Falls, MT (WFO-GTF) nor the cooperative observer were aware a national record had occurred, and 2) Until recent years, there was no official mechanism in place to determine the validity of the Loma record.

This paper will present the synoptic conditions which resulted in the extreme temperature rise, describe the siting, instrument, and observer standards at the location as well as discuss the evaluation process the National Climatic Extremes Committee utilizes to determine a potential record.

NWS COOP Observer Jim Wood with Mercury-in-Glass Thermometer in Background
Photo courtesy of WFO-GTF

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2. Location

Loma, Montana is located downwind from the Continental Divide approximately 50 miles northeast of Great Falls, MT. Geologists believed this area was covered by glaciers (about a mile high and hundreds of miles wide) which stopped its southern movement in Loma about 10,000 years ago. The melting of this immense volume of ice helped establish the present river valleys of the Missouri, the Teton, and the Marias rivers. The area has historical significance as the Lewis and Clark expedition reached Loma in 1805 exploring the area (Loma, J. Wood 1999).

The COOP site is located in a valley, elevation 2580 feet surrounded by 100 to 200 foot ridges. This location is the lowest elevation with an official surface reporting station in the surrounding area. The site is called the “Wood Ranch” and covers close to 3,000 acres. The Marias and Teton rivers flow through the ranch and intersect the Missouri River about one-half mile downstream from the ranch.

3. Synoptic Conditions

An arctic high (1048 mb) was centered in eastern Montana at 12 z GMT on January 14, 1972 with 850 mb temperatures as low as -35F. After more than seventeen hours of radiational “cooling” , (clear skies and light winds) along with ample snow cover (snow depth 12") resulted in rapidly falling temperatures. The COOP site recorded a minimum temperature of -54F at 9:00 AM MST. The observer noted, “I was well aware that number one stove fuel will congeal at -50F, since it happened a few years before. When the temperature drops to -40F, you don’t sleep well in the country”.

By evening conditions changed rapidly as chinook conditions enveloped the area. The arctic high had move well east of Montana (centered over Wisconsin) and a rapid westerly flow at 850 mb developed. While 850 mb winds were not strong (20 knts), the critical change in direction from arctic air to Pacific Maritime air down sloping over the mountains and into the valley resulted in consistent 30-40 mph winds in Loma. The observer noted, “shortly after midnight I woke to the sound of a howling wind. I

dressed and read the temperature and could not believe it read 34 degrees above. The severe southwest wind continued and by 6:00 AM MST, the temperature was in the mid 40s. By 8:00 AM MST, it had reached 49 F and never raised the rest of the day".

Across central and western Montana, surrounding locations recorded rapid rises in temperature, although none compared with the 103F change at Loma. Great Falls recorded a 62F change (-29F to 33F). However, no official observing site was ideally situated to feel the full impact of chinook conditions as the Loma COOP site.

4. Equipment

The COOP observer used a liquid-in-glass thermometer as his official measurement. The equipment met NWS standards for siting exposure of at least five feet in height and representative of the surrounding location. The NWS WFO in Great Falls visited the site annually. In June 1970, the calibration was corrected as a 4F degree separation error was noted. Their next two site visits, March 1971 and June 1972, indicated the calibration of the thermometer was accurate to within NWS standards of 1F degree. No emergency visits were necessary between the visits in 1971 and 1972.

5. Observer

The COOP observer received a Length of Service of Award from the WFO-GTF in July, 2002 for completing forty years of accurate, reliable observations. The observer additionally was honored with the John Campanius Holm Award in 1997 from the WFO-GTF for outstanding service and reliable observations. The observer was diligent and keenly aware of his surroundings. The observer indicated he read the thermometer every two hours whenever it fell below -40F. His comments describing the event are noted above in Section Three. He has also written a book on the history of Loma, including its history and climate.

6. National Climate Extremes Committee

The National Climate Extremes Committee (NCEC) was formed in 1997 to evaluate the validity of climate extremes that challenge existing national records and provide a recommendation to the National Oceanic and Atmospheric Administration (NOAA) regarding acceptance of the observations in question. The NCEC is comprised of several permanent members: National Climatic Center (chair); National Weather Service and American Association of State Climatologists. The Committee is responsible for providing the documentation and supporting evidence and come to a consensus to accept or reject a recommendation. The recommendation is then provided to the Director, NCDC for a final decision. This is the third extreme event the Committee has reviewed. The Committee rejected a 24-hour record snowfall at Montague, New York in 1997 and accepted a new seasonal snowfall record at Mt. Baker, Washington, Ski Area (1,140 inches) in 1999.

7. Why Now?

The previous twenty-four hour temperature record occurred in Browning , MT. on January 23-24, 1916, when a 100F temperature fall was recorded. When the extreme event occurred in 1972, neither the COOP observer nor the WFO-GTF were aware a national record had taken place. However, by the time the observer received the Holm Award in 1998, both the observer and WFO-GTF were aware of the potential record but were unaware of the NCEC to validate national records. In April 2002, the WFO-GTF contacted the NCEC whom evaluated the data and equipment, and visited the observer and surrounding location.

8. Committee Findings and Recommendations

The NCEC provided the following findings in their recommendation to the Director, NCDC. They are as follows:

☛ Observer knowledgeable in recording temperature observations and had been honored with a forty year Length of Service Award, 2002, and John Campanius Holm Award in 1997, for outstanding service and reliable observations. Observer also published book on the history and climate of Loma;
☛ Observation form describing temperatures and weather conditions were accurate and representative of climate divisions in WFO-GTF county warning area;
☛ COOP site lowest elevation (2580') in area with 100' to 200' ridges surrounding station, providing an optimal environment for extreme temperature changes;
☛ Marias and Teton rivers flow near COOP site but were frozen at time of event and played no significant role;
☛Mercury-in-glass thermometer measuring maximum and minimum temperature was calibrated during regular site visits before and after the event and within accuracy specifications with no emergency visits necessary;
☛ No obstructions present to affect measurements at observer location. Location met NWS standards for proper siting and exposure with sensor mounted five feet above ground with an opening clearing and representative of surrounding location. The sensors were more than 100 feet from any paved or concrete surface;
☛ Potential record not known by observer nor WFO-GTF when it occurred 1972.

9. NOAA Decision

On September 13, 2002 citing a unanimous recommendation from the National Climate Extremes Committee, The Director of NCDC accepted the Loma, Montana 24-hour temperature change of 103F degrees, making it the new official national record.

References

Wood, J. , 1999: Loma, 1pp.

National Weather Service, Cooperative Observer Program,
http://www.nws.noaa.gov/om/coop/standard.html