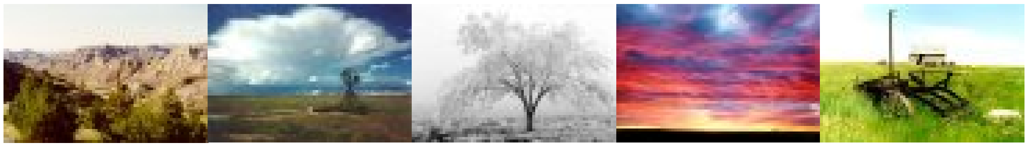
Under the Big Sky



Volume 1, Issue 2 Winter 2003

Inside this issue:

Missouri Breaks Fire in Northeastern Montana

Garfield County had the largest wildfire in the country during the early part of summer of 2003. The Missouri Breaks Complex started on July 16th due to lightning strikes. The complex of fires included four fires in northwest Garfield county.

The four fires that made up the complex included the Germain, Ghost Coulee, Big Coulee and Indian fires, and was approximately 35 miles west of Jordan. The complex threatened 50 residences and 150 outbuildings. The fires were difficult to contain due to the terrain in coulees and tree-filled gorges which made firefighting and fire suppression both dangerous and difficult. The fire remained uncontrolled due to weather that was unusually hot and dry from the 16th through the 24th. Daily highs were in the upper 90sF to around 105ºF, and relative humidity values frequently dropped into the single digits during the afternoon. The complex of fires made its largest run on the 19th due to a combination of hot and dry conditions. A nearby weather observing site had a high temperature of 103ºF and relative humidity of 7 percent on the afternoon of the 19th! In fact, the temperature at that site jumped to 113ºF during the afternoon of the 19th as the fire passed over the recording equipment.

In addition to the hot and dry conditions, strong winds helped to rapidly spread the fire when wind gusts of 40 to 45 mph were reported during the afternoon. The complex of fires was declared under control at 5:50 pm on July 27th after burning 130,927 acres, or 205 square miles. A total of 8 structures were destroyed and one was damaged. The fire also destroyed 610 miles of barb wired fence. In addition, it caused 2.9 million dollars in property damage and 1 million dollars in crop damage.

There were 28 smaller wildfires that burned around 15,000 total acres across northeast Montana during the summer. Forecasters at the local office in Glasgow issued 95 specialized spot forecasts for wildfires in the summer of 2003.

Winter Weather Terminology

by Brad Teymeyer, Intern

A **blizzard** is a storm in which the wind is 35 mph or greater and causes reduced visibilities less than a quarter of a mile. The reduced visibilities may be due to either falling or blowing snow already on the ground.

Chinook winds are strong and gusty winds that occur on the eastern side of the Rocky Mountains. These winds can lead to dramatic temperature changes over a short amount of time.

Freezing rain is precipitation that falls as a liquid, and then freezes on contact with the ground or an object. Freezing rain can produce a coat of glaze or ice on exposed objects or the ground.

Frost is a layer of ice crystals that forms on a cold object.

Heavy snow occurs when over six inches of snowfall occurs within a twelve hour period, or when eight or more inches fall within 24 hours.

Fort Peck after a lake effect snow.

Ice storms occur when freezing rain accumulates to a minimum of a quarter of an inch thick. These storms often times cause extensive damage to trees and power lines.

Sleet is small ice pellets that usually bounce when they come in contact with the ground or a hard surface.

A **Winter Storm Outlook** is issued when there is a potential for hazardous winter weather in three to five days from the time it is issued. This is issued to give people a heads up that a storm may occur, although the exact timing and impact of the storm may still be uncertain.

A **Winter Storm Watch** is issued for the potential of severe winter weather conditions over the next day or two from the time it is issued. Exact timing and location may need to be altered slightly as the event approaches.

A **Winter Weather Advisory** is issued when weather conditions may provide major inconveniences, but if caution is exercised, should not become life threatening.

A **Wind Chill Advisory** is issued when wind chills are expected to be between 20 and 39 degrees below zero with at least a 10 mph wind.

A **Winter Storm Warning** is issued for locations where severe winter conditions are likely. Winter storm warnings are issued for life threatening weather conditions that include heavy snow, significant accumulations of freezing rain or drizzle, and/or dangerous wind chills.

A **Wind Chill Warning** is issued for areas where wind chills are expected to be colder than 40 degrees below zero with at least a 10 mph wind.

A **Blizzard Warning** is issued when snow combined with strong winds create near zero visibilities, deep drifts and life threatening wind chills. Seek shelter immediately!!!

A **High Wind Warning** is issued when sustained winds of 40 mph are expected for a minimum of one hour, or wind gusts are expected to exceed 58 mph.

Incident Meteorologists (IMETs) by Jennifer Stroozas, General Forecaster

National Weather Service offices across the country have specially trained weather forecasters called Incident METeorologists (IMET). This specially trained individual, usually 1 to 2 per office, is available to agencies outside of the National Weather Service that have a need for specialized forecasts. Currently, primary use of the IMET is on wildfire incidents across the nation. However, natural and other disasters can also require an IMET to be dispatched.

An IMET gives a weather briefing at the Boles Meadow fire in the summer of 2003, near Missoula, MT.

The fire community uses the specialized and detailed forecast provided by the IMET in order to understand fire behavior, and estimate where the fire will go and how much it will spread. Forecasts are also used for planning purposes through the next week so officials can best place different resources where they will be needed most. Shorter fused forecasts are used to keep firefighters safe in the field.

So how does this mobile forecaster obtain weather information in the middle of an incident away from the weather forecasting office? Each IMET is trained to set up and operate a mobile satellite dish which hooks up to a laptop computer. Real-time weather information is transmitted and received through this equipment, allowing the forecaster to have a mobile forecast office.

Montana Winds by Ted Jamba, Lead Forecaster

Seven and half years ago, I moved to northeast Montana from the East Coast as a new forecaster. Forecasting the wind here was a big challenge to me. I had lived my entire life there up until that point and was used to the way the weather behaved in that part of the country. Wind was typically forecasted by the surface or ground level air pressure patterns in the area. In other words, if the isobars (lines of equal pressure) were close together on a typical weather map, it would be windy. However, I have found this doesn't always work here in Montana. The main difference may be as easy as knowing that warm air rises and cool air sinks.

Weather systems often move through the area from west to east, but a lot of them lose their "surface characteristics" when passing over the high elevations in the Rocky Mountains. This means that when meteorologists look at a weather chart that depicts weather at the surface, there may be something different going on just a couple of thousand feet above the ground. We then have to look at the weather that's happening higher up in the atmosphere to get an indication of what might happen here at the ground. Often times, an intense weather system seen on a surface weather chart near Seattle may look very weak when it is near northeast Montana, assuming it travels from west to east. If this system travels over southern Saskatchewan, the initial weak surface winds from the west may be weak, but could increase rapidly, especially if it becomes sunny, or if the air aloft cools quickly. If the winds at a couple of thousand feet above the ground are moving at a good clip, the cool air that is aloft will sink while the warm air rises and allows the strong winds to reach the surface. Meteorologists call this atmospheric mixing.

So next time you are out and about and notice a light west wind blowing during the early morning hours with cloudy skies giving way to a sunny sky, the atmosphere may be becoming mixed. It could be windy soon!

The Science of Snow

by Tom Salem, Science Operations Officer

Snow may occur in Northeast Montana beginning in late September until May. This usually means it is cold outside, but does it tell us anything else? Yes; you can learn about the origin of the snow, just by looking at the snow. So what should you look for?

Snow or more properly snow crystals come in different shapes and sizes. The size of snow depends on the wind speeds of different layers of the atmosphere from which the snow crystals are falling through. Usually, the lighter the winds, the larger the falling snow crystals can become. So from the size of the snow we can infer how strong the winds may be over our heads.

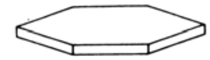


Figure 1. Schematic of a hexagonal plate.

The shape of snow crystals depends mainly on the air temperature of where the snow crystal grows. But first we must talk about how snow crystals form. Snow crystals start out as a single ice crystal. Most ice crystals start from a super-cooled water droplet that comes in contact with a small dust particle or some other particle in the atmosphere--referred to as the ice nucleus. When the water droplet freezes the molecules in the droplet are all "packed" together in the shape of a hexagon. This shape is the beginning of a snow crystal.

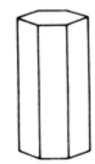


Figure 2. Schematic of a hexagonal column.

Once an ice crystal is formed, it will grow and form into a snow crystal. Snow crystals come in three basic shapes, hexagonal plates (Fig. 1), hexagonal columns (Fig. 2), and dendrites (Fig. 3, more commonly referred to as a 6 sided snowflake). These three types indicate the temperatures of the air which they formed or grew.

Temperatures of a cloud above 25ºF (-4ºC) will grow snow crystals in the form of hexagonal plates (Fig. 1). Snow crystals that grow between 25ºF and 14ºF (-10ºC) will be in the shape of hexagonal columns (Fig. 2). Some of these columns may be in form of needles, especially between 25ºF to 21ºF (-6ºC). Below 21ºF the columns will tend to be hollow.

Figure 3. Schematic of a dendrite.

Temperatures of a cloud between 14ºF to -8ºF (-22ºC) will grow snow crystals in flat plates, however, these are not like the plates at warmer temperatures (Fig. 1). These plates have different shapes; with temperatures between 10ºF to 3ºF (-12ºC to -16ºC) dendrites will grow--the traditional snowflakes. At temperatures between 14ºF to 10ºF and 3ºF to -8ºF, snow crystals in the form of sector plates (Fig. 4) will grow.

At temperatures below -8ºF the snow crystals grow in the form of hexagonal columns (Fig. 2) again.

It should be noted that if a cloud is growing snow crystals at different levels, as the snow crystals fall, the snow crystal may not have one of the standard shapes. For example, a hexagonal column may have plates that grow on the edges of the column.

Figure 4. Schematic of a sector plate.

So the next time it snows, you can look at the snow crystals and tell what the temperatures are like overhead where the snow crystal was formed.

2003 Climate Summary for Glasgow, MT by Don Simonsen, General Forecaster

The winter of 2002-03 began warmer and drier than normal, especially December which had only .05 precipitation, was 8.1 degrees above normal, and had a record high of 51 on the 13th. Colder weather did arrive during the last half of January, as cold as -30 on the 22nd. February and March were both colder than normal, with the last half of February and first half of March unusually cold and snowy. That 30 period was the coldest since 1969 and snowiest since 1952. Several record cold highs that were below zero occurred during this time. Lows of -25 occurred as late as the March 8th. Much of December and the first half of January were bare of snow cover. The rest of the winter had snow cover most of the time until mid-March, peaking at a depth of 5 inches. Strongest wind of the year was 66 mph on the third of January, but each of the winter months averaged less than average wind speed.

After the unusually cold start to March, spring weather arrived suddenly at mid-month, with the remainder of the month averaging 10 degrees above normal and ending with a record high of 71 on the 31st. Three record warm lows were also set, including the low of 44 on the 31st, which was the 2nd warmest low ever recorded so early in the season. The remainder of spring was a mixed bag; April warmer and wetter than normal, May quite close to normal. The last measurable snow of the season occurred during the last week of April, followed by a rapid warm-up to a record 81 degrees on the 9th. Mild weather and a record 14 nights with lows of 40 or higher followed for the rest of the month. While May was mainly on the cold and wet side, a turn to very warm and dry weather occurred the last week, including 7 straight days with highs in the 80s. Last freezes of the season occurred on May 18th and 19th.

Summer started on the cool and wet side the first half of June, but the extreme heat of July and August would make 2003 one of the hottest summers ever recorded. A record low of 39 occurred on June 25th, but the rest of the summer featured many record heat-related temperatures. There were 46 days with highs over 90 for the summer, double the normal. 9 days exceeded 100 degrees, including a record 6 in a row. Records were set for 39 days in a row with highs 85 or higher, and for long strings of lows warmer than 70, 65, and 60 respectively. August turned out to be the 3rd hottest ever. July and August combined temperatures were second only to the record hot summer of 1936. Rainfall, thunderstorms, and severe weather for the summer were all well below the normal.

Fall 2003 was noted for large fluctuations in temperatures. The hot summer weather continued in early September with 6 of the first 8 days above 90 degrees, but the remainder of the month was on the cool side, including a high of only 48 on the 17th. October found a return to summery weather again, the warmest October since 1965, including 8 days with highs in the 80s. Several record warm highs and lows were set. Both September and October were slightly drier normal, continuing the summer's dry pattern. A sudden turn to Cold weather occurred the last week of October, producing the first snow of the season and a record cold high of 20 on Halloween. The cold lasted through much of November which averaged 7.6 degrees below normal, and was the 11th coldest on record. The first 10 days were especially cold, including a record low of -9 on the 5th and several record cold highs. Precipitation was a little above normal for a change, and snowfall was double the normal.

Measuring Snow **by Matt Moorman, HMT/COOP Program Manager**

It is essential for all observers to understand the importance of taking standard measurements in the prescribed manner. Inconsistent observing and reporting methods result in data which can result in profoundly incorrect differences between stations and observers.

Each season before the first snows come, *review these instructions for measuring snow*. It is easy to forget what needs to be measured, especially in those areas where snow falls infrequently:

24 hr snowfall that has accumulated on your wooden deck or ground since the previous snowfall observation: This measurement should be taken minimally once-a-day (but can be taken up to four times a day, once every six hours) and should reflect the greatest accumulation of new snow observed (in inches and tenths, for example, 3.9 inches) since the last snowfall observation. If you are not available to watch snow accumulation at all times of the day and night, use your best estimate, based on a measurement of snowfall at the time of observation along with knowledge of what took place during the past 24 hours. It is essential to measure snowfall (and snow depth) in locations where the effects of blowing and drifting are minimized. Finding a good location where snow accumulates uniformly simplifies all other aspects of the observation and reduces numerous opportunities for error. In open areas where windblown snow cannot be avoided, several measurements may be necessary to obtain an average depth, and they should not include the largest drifts.

Determine the total depth of snow, sleet, or ice on the ground: This observation is taken once-a-day at the time of observation with a measuring stick. It is taken by measuring the total depth of snow on exposed ground at a permanently-mounted snow stake or by taking the average of several depth readings at or near the normal point of observation with a measuring stick. When using a measuring stick, make sure the stick is pushed vertically into the snow until the bottom of the stick rests on the ground. Do not mistake an ice layer or crusted snow as "ground". The measurement should reflect the average depth of snow, sleet, and glaze ice on the ground at your usual measurement site (not disturbed by human activities). Measurements from rooftops, paved areas, and the like should not be made. Report snow depth to the nearest whole inch, rounding up when one-half inch increments are reached (example 0.4 inches gets reported as a trace (T), 3.5 inches gets reported as 4 inches). Frequently, in hilly terrain, you will be faced with the situation where no snow is observed on south-facing slopes while snow, possibly deep, remains in shaded or north-facing areas. Under these circumstances, you should use good judgment to visually average and then measure snow depths in exposed areas within several hundred yards surrounding the usual measurement site. For example, if half the exposed ground is bare and half is covered with six inches of snow, the snow depth should be entered as the average of the two readings, or three inches. When in your judgment less than 50 percent of the exposed ground is covered by snow, even though the covered areas have a significant depth, the snow depth should be recorded as a trace (T). When no snow or ice is on the ground in exposed areas (snow may be present in surrounding forested or otherwise protected areas), record a "0." When strong winds have blown the snow, take several measurements where the snow was least affected by drifting and average them. If most exposed areas are either blown free of snow while others have drifts, again try to combine visual averaging with measurements to make your estimate.

If you are a Skywarn Spotter and would like a ruler to measure snowfall, contact Tanja Fransen at 406-228-2238 or tanja.fransen@noaa.gov.

2003 COOP Observer Awards

by Matt Moorman, HMT/COOP Program Manager

COOP awards continue to be an important part of the COOP observation network. Due to sparse weather observations throughout northeast Montana, climatological weather data is of the utmost importance. The data that all the COOP stations provide is used throughout the community, from WFO Glasgow to the local radio stations, to the water and land resources agencies for proving farming and ranching claims for disaster relief and insurance. Recognizing COOP observers with awards for length of service or special recognition awards is a small way for the Weather Service to show their appreciation for the service that each COOP observer provides to the National Climate Program. Six awards were given to observers in WFO Glasgow's twelve county responsibility area for the year 2003.

Left to Right: Axel Larsen, Holm Award Recipient; Julie Adolphson, Meteorologist-in-Charge; Mike Rawles, Data Acquisition Program Manager

Jim and Karen Tande located 4 miles NW of Scobey, Frank Bailey and the Raymond Border Station located north of Plentywood, and Robert Huber located 6 miles NE of Vida, were each given a 15 year service award. Larry Petersen located 4 miles ENE of Mosby was presented with a 20 year service award. Their stations report daily rain and snowfall amounts, snow levels, and max and min temperatures. In addition, Jim and Karen report daily weather observations to the Glasgow weather office and maintain a monthly mechanical Fisher Porter rain gauge. Axel Larsen received the prestigious Holm award for his station located near Bredette.

The John Campanius Holm award is an award given annually to COOP observers for consistent and continuous outstanding service. Only 19 Holm awards were given out in 2003 from the 11,000 COOP observers nationwide. Axel's station was established in 1939 at a nearby location and moved to its present location in 1966 where Axel has been faithfully reporting the weather for 37 years. The station consists of daily rain and snow fall amounts, snow levels, and max and min temperatures along with a Fischer Porter rain gauge. Daily reports are made to the Glasgow weather office via the ROSA reporting system.

WIND CHILL CHART

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

FROSTBITE OCCURS IN: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

T = Air Temperature (°F) V = Wind Speed (mph)

Left: Use this handy chart to calculate wind chill using a temperature and wind speed.

National Weather Service
Glasgow, MT

101 Airport Road
Glasgow, MT 59230

Phone: 406-228-4042
http://www.wrh.noaa.gov/
Glasgow

Get a detailed forecast with just one click of the mouse! Check out our new prototype digital forecasts on our website, http://www.wrh.noaa.gov/Glasgow. Click on "Prototype Digital Forecast" in the left-hand menu.

Climate Services from Your National Weather Service

by Julie Adolphson, Meteorologist in Charge

How much rain have we received this month? This year? Ever wonder about the highest temperature ever recorded in your area? What is the annual average snowfall? The National Weather Service in Glasgow, Montana can answers these, and many more questions about our weather and climate. For the attention to detail types, "Climate" is a long term record of things like temperature, precipitation, weather types, etc., and there are many sources of climate information and even more uses of the information.

Every year, the National Oceanic and Atmospheric Administration's (NOAA's) western US-serving climate center, the Western Region Climate Center (WRCC) in Reno, NV, gets 10,000 phone calls asking for climate information. Some of their customers include architects, engineers, utilities, farmers, and ranchers. The information provided by the center (www.wrcc.dri.edu) is used for a variety of purposes, from designing buildings to applying for federal aid in times of natural disaster (e.g., drought).

In northeast Montana, over 70 private citizens and public servants volunteer their time to take daily observations of temperature and precipitation to complete the climate record. Some of these observers have been doing this for multiple generations. This is critical since climate is a "long term" record. These observations are used to improve our weather and climate forecasting computer models and to study climate change.

One important thing to keep in mind is that the official records of weather and climate are kept at the National Climatic Data Center, in Asheville, NC (www.ncdc.noaa.gov), and at the WRCC. So, if you need some information that is certified, you will need to contact them. If you don't need certified information, please feel free to call the National Weather Service Forecast Office that serves you; in northeast Montana you can call 24-hours-per-day: (406) 228-4042.

Articles contributed by WFO Glasgow staff. Edited by Jennifer Stroozas and Tanja Fransen.