

JET STREAM JARGON

April 2014

Spring Issue

National Weather Service Billings, MT

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From the Desk of the Meteorologist in Charge



Weather Forecast Office Billings, MT December 2013

The winter of 2013-14 will certainly be one many of us remember (but would probably like to forget) due to the numerous cold snaps (remember the early December record cold?) and the numerous snow events across the area. Here in Billings, the winter of 2013-14 has gone down as the snowiest winter on record. Combine that with the number and magnitude of the cold snaps, and this past winter will be referred to many times in the decades to come.

As our office prepares for the warm season, our attention begins to shift towards evaluating the melt of the mountain snowpack, keeping a watchful eye on the spring rainfall of late April through June which can occasionally create flooding issues, preparing for our severe thunderstorm season of late May through August and gearing up for our weather support during the wildfire season of July through September. These next six months typically are very busy for us, depending on how the melt-off, rainfall, severe weather and wildfire concerns sequence themselves.

The success of our efforts relies on the help we get from a number of our partners and volunteers. The dedication of our volunteer weather observers provides us with daily assessments of precipitation, high and low temperatures, snowfall and snow depth. The observations provide the critical observational basis for making our forecasts better and also the bedrock information source for various agricultural assistance programs related to weather extremes and adverse impacts. Additionally, we have over 1000 volunteer weather spotters that provide us with ground truth reports related to various weather events year round. The eyewitness reports are invaluable in augmenting the remote sensing capabilities we have and help us to calibrate each weather event with the technology and indicators we have at our disposal. Nothing is better than firsthand accounts.

Finally, we work closely with other local, state and Federal agencies, as well as our partners in the print and broadcast media, in sharing information to ensure we are providing the maximum public service in our areas of responsibility.

Our staff has always been proud that "Service" is part of our agency's official name. We strive to provide that "Service" at each opportunity. Please don't hesitate to reach out to our office. Our staff is ready to provide world class weather services.

Keith W. Meier



WCM Notes

Tom Frieders—Warning Coordination Meteorologist

It's Time Again to Prepare for Severe Thunderstorms

Severe Thunderstorm season in Montana and Wyoming is right around the corner. After a quiet season in 2012, severe weather ramped back up across the Northern Rockies in 2013; producing hundreds of thousands of dollars in damage and resulting in several injuries. Montana and Wyoming had a combined 14 confirmed tornadoes, over 400 high wind and damaging wind events, over 700 large hail reports and 67 flash floods. **Know your risk and what to do before that warning is issued.** You can learn more at: <u>http://goo.gl/xbljh</u>

Skywarn Spotter Training

Help protect your local communities and assist our forecasters by observing and reporting severe weather through the Skywarn Severe Storm Spotter Network. Training will be conducted through May. We will be visiting locations throughout central Montana and northern Wyoming, or join us for the training via a webinar from the comforts of your home or business. View our entire schedule at: <u>http://www.wrh.noaa.gov/byz/local_news/2014/</u> <u>spotter14.php</u>

Hydrological Outlook

Todd Chambers – Senior Forecaster

Ice Jam Flooding in March, Is More Flooding in Store this Spring?

Back-to-back heavy snow events in the last week of February dropped over two feet of snow across most of Southern Montana and Northern Wyoming. This snowpack contained 2 to 3 inches of water and as temperatures warmed during the first week of March, this heavy snowpack melted quickly.



February 25th Snow at NWS Billings



Ice on the Tongue River at Miles City March 9th 2014 – Courtesy of Greg Forrester

Frozen soil prevented the snowmelt from soaking into the ground and water quickly ran off into area streams and rivers. Most waterways across the region were frozen over with thick ice cover, and the meltwater broke this ice up and shoved it down stream. The jagged nature of the broken ice caused it to hang up on stream bottoms and bends as well as on bridges creating ice jams.

Ice Jam Flooding con't

In some cases, behind these jams water backed up at a rate of over a foot per minute, creating major flooding. Significant flooding was reported on the Musselshell, Yellowstone, Tongue, Clarks Fork of the Yellowstone, and Powder Rivers, as well as on Pryor Creek near Billings. While ice jam flooding is not at all uncommon across the area in February and March, the scope and magnitude of the flooding this year was unusually severe. This flooding was entirely due to the frozen ground conditions and the low elevation snowmelt, no mountain snow melted during this time.







(cfs)

So, What is the Flooding Potential Going into this Spring and Summer?

Current snowpack across our mountains is above to well-above normal. In some locations the amount of snow at this time is already above the normal peak snowfall for an entire season, and we typically still see significant snowfall in April and into early May each year. Given the current snowpack there is certainly the potential for flooding of rivers and streams across the region this Spring and Summer.



Whether flooding develops and how significant the flooding becomes will depend on several factors over the next few months. How much additional snow and rain falls during this time as well as temperature trends will both have a big impact on how fast the mountain snowpack melts. This will ultimately dictate the flooding of rivers and streams. For the latest information on flooding potential see: <u>Montana</u> <u>Wyoming</u>



Winter Recap

Joe Lester – General Forecaster

2013-2014 Winter in Review

The most remarkable aspect of the 2013-14 winter was the amount of snowfall that occurred across areas along and a little east of the mountains, including Billings and Sheridan. The reasons for this included a persistent weather pattern supportive of northwest flow disturbances along with frequent cold surges out of Canada that impacted not only eastern Montana and north central Wyoming, but all of the north central United States.

Snowfall at Billings during the December through February period was a staggering 79.1 inches, which was more than 4 feet above the normal 3-month total of 22.8 inches. February was the snowiest month with a total of 37 inches, a record for February and the 2nd snowiest month on record for any month of the year at Billings, behind only April 1955. The last week of February was a particularly snowy period across the region, with two major snow events, which led to a significant amount of snow cover for the west half of our forecast area and, eventually, widespread flooding in early March when this snow cover finally melted. Billings' snow depth of 15 inches on March 2nd was the city's highest observed snow depth in over 30 years.

Temperatures during the 3-month period were also colder than normal but not in the extreme sense that occurred with snowfall. December and February were colder than normal, but January was actually a relatively warm month. Three distinct cold periods occurred during the course of the winter. The first was in early December, the second in early February and the third in late February into early March. Each of these cold snaps saw a brief period of significantly cold temperatures occur, with Billings observing at least 20 below zero on three separate occasions. Prior to this winter, Billings had not reached 20 below since January 1997. The coldest temperature recorded across our area was a whopping 42 below at Mizpah on December 7th.

What does the cold and snowy winter mean for the upcoming spring and summer months? Honestly, very little. Lower elevation snow in the winter does not necessarily translate to wet weather in the warm season.

Dec - Feb Stats	Avg. Temp (deg F)	Departure from normal	Precipitation (inches)	Departure from normal	Snowfall (inches)	Departure from normal
Billings	23.9 (25th coldest)	- 3.9	5.06 (2nd wettest)	+ 3.60	79.1 (snowiest)	+ 56.3
Miles City	16.6 (19th coldest)	- 5.4	0.86 (30th driest)	+ 0.03	-	-
Sheridan	20.9 (28th coldest)	- 3.9	2.97 (12th wettest)	+ 1.29	-	-
Livingston	25.5 (17th coldest)	- 3.1	1.88 (16th wettest)	+ 0.38	-	-

Statistics from meteorological winter (December 1st through February 28th):

Spring and Summer Data Tables

Sean Campbell– Meteorologist Intern

Spring Averages

Meteorological spring is classified as the months of March, April and May. Here are the average temperatures and precipitation for the Billings Airport, the Miles City Airport, and the Sheridan Airport for the spring season. Averages are calculated using a 30-year period of record: 1981 to 2010. All temperatures are in degrees Fahrenheit and all precipitation amounts are in inches.

			Billings		
Date	High	Low	Average	Precipitation	Snowfall
3/1-3/31	48.6	26.9	37.7	1.06	10.2
4/1-4/30	57.6	34.7	46.2	1.66	8.3
5/1 - 5/31	67.5	43.6	55.6	2.18	2.0
3/1 - 5/31	57.4	35.1	46.3	4.90	20.5

Miles City							
Date	High	Low	Average	Precipitation			
3/1-3/31	46.5	22.8	34.7	0.60			
4/1-4/30	58.8	33.2	46.0	1.37			
5/1 - 5/31	68.6	43.1	55.9	2.18			
3/1 - 5/31	58.4	34.2	46.3	4.15			

Sheridan								
Date	High	Low	Average	Precipitation				
3/1-3/31	48.4	22.0	35.2	0.98				
4/1-4/30	57.4	29.8	43.6	1.60				
5/1 - 5/31	66.7	38.2	52.5	2.35				
3/1 - 5/31	57.8	31.4	44.1	4.93				

"In the Spring, I have counted 136 different Kinds of weather inside of 24 hours."

Mark Twain





Summer Averages

Meteorological summer is classified as the months of June, July and August. Here are the average temperatures and precipitation for the Billings Airport, the Miles City Airport, and the Sheridan Airport for the summer season. Averages are calculated using a 30-year period of record: 1981 to 2010. All temperatures are in degrees Fahrenheit and all precipitation amounts are in inches.

Billings						Mile	s City		
Date	High	Low	Average	Precipitation	Date	High	Low	Average	Precipitation
6/1 - 6/30	77.2	52.1	64.7	2.12	6/1 - 6/30	78.6	52.6	65.6	2.51
7/1 – 7/31	86.8	58.8	72.8	1.32	7/1 – 7/31	88.3	59.5	73.9	1.64
8/1-8/31	85.7	57.3	71.5	0.75	8/1-8/31	87.2	58.0	72.6	0.91
6/1-8/31	83.3	56.1	69.7	4.19	6/1-8/31	85.2	57.8	71.5	5.06

"The storm starts, when the
drops start dropping
When the drops stop
dropping then the storm
starts stopping."
— <u>Dr. Seuss</u>

Sheridan							
Date	High	Low	Average	Precipitation			
6/1-6/30	76.7	46.4	61.6	2.12			
7/1-7/31	87.1	53.0	70.0	1.18			
8/1-8/31	86.3	51.6	69.0	0.72			
6/1-8/31	83.3	51.4	67.4	4.02			

Last Hard Freeze, Freeze and Frost Dates in the Spring/Summer

Many people will start planting their crops and gardens over the next few months. To keep crops and plants protected from the cold, it is important to know when the **average** last hard freeze, freeze and frost typically occur in the spring/summer. It is also important to know the dates of the **latest** hard freeze, freeze and frost. The following are the **average** last hard freeze, freeze and frost dates for **Billings, Miles City and Sheridan**. The hard freeze temperature is based on 28 degrees Fahrenheit, the freezing temperature is based on 32 degrees Fahrenheit and the frost temperature is based on 36 degrees Fahrenheit. Averages are based on a 30 year period of record: 1981 to 2010. Record-keeping began at the Billings Airport in 1934, at the Miles City Airport in 1937 and at the Sheridan Airport in 1907.

City	Average Last Hard Freeze	Latest Hard Freeze on Record	Average Last Freeze	Latest Freeze on Record	Average Last Frost	Latest Frost on Record
Billings	Apr 23	May 28	May 7	Jun 13	May 18	Jun 13
Miles City	Apr 27	May 28	May 9	Jun 8	May 18	Jun 18
Sheridan	May 8	Jun 3	May 19	Jun 24	Jun 5	Jun 30

Fire Weather

Dan Borsum- Incident Meteorologist/Senior Forecaster

Does a Wet Year Mean No Fire Season?

The inevitable question people ask meteorologists is whether a current weather trend is an indicator of weather months down the road. Another question people like to ask August a series of fires flared in the Northern Rockies this time of year is "what will fire season be like?"

While it is hard to pinpoint an answer about the weather, we can look to recent history to talk about the upcoming fire season. We had a wet year going through spring 2011, and this really kept fire activity quiet through early July. However, August brought 2 fire events which are worth remembering because it's a reminder of how different fire seasons can still have tragic results.

In early August, the Coal Canyon fire in the Black Hills was responsible for the death of a State of South Dakota firefighter. Later in around Lame Deer forcing evacuations. These 5 fires, known as the Black Springs Complex burned over 24,000 acres and had a response from nearly 500 firefighters and support personnel.

The lesson is no matter what the winter and spring weather, fire danger does creep up in late July and August if the weather turns hot and dry. In wet years, grass growth is usually more abundant, providing a fuel source if it turns dormant in the latter half of the summer.

Do we see major fire activity in wetter years? Usually not, but the fires we do get can be every bit as dangerous.

"When fire weather is combined with the two other factors influencing fire behavior topography and fuel - a basis for judgment is formed." P.2 Fire Weather: A guide for Application of Meteorological Information to Forest Fire Control Operations, By: Mark J. Schroeder, USDOC and Charles C.Buck, USDA; 1970

CoCoRaHS

Vickie Stephenson– CoCoRaHS Coordinator

Community Collaborative Rain, Hail & Snow Network

I would like to express my appreciation to those Co-CoRaHS observers out there who have tirelessly sent in reports throughout this very snowy winter across Montana. Thanks for all you do for YOUR National Weather Service.

You can return your tubes and funnels to your rain gauges around the end of May, since we still have some cold and snowy months ahead! Our summer season will be upon us before we know it. Please take a look at your significant weather and hail forms on the website to refresh/familiarize yourself with them. You can always send us a quick report through CoCoRaHS Significant weather, such as flash flooding, hail, torrential rains, etc., and we get it instantly. Then you can submit your normal daily report on the website at your observation time. KEEP THOSE RE-PORTS COMING & THANKS AGAIN!

"There's an App for that!" The wait is over! There is now a mobile app for the iPhone! The CoCoRaHS Observer Android app has been functional for some time, however, now Apple users can enjoy this convenience as well. A dedicated CoCoRaHS observer developed the app himself and it is free and publicly available now. For more information go to your iTunes App Store on your phone and search "Cocorahs observer".

Contact Information:

CoCoRaHS coordinator - Vickie Stephenson 800-240-4596 - vickie.stephenson@noaa.gov

CoCoRaHS additional contact - Tom Frieders - 406-652-0851 ext 2 - tom.frieders@noaa.gov

COOP Corner

Vickie Stephenson—Cooperative Program Manager

Hello Everyone! Well, another winter has come and "almost" gone! What a winter it has been! I would like to thank all of our Cooperative Observers for the great work that was done during this very snowy winter. Many records were broken this season, including temperature, precipitation and snowfall.

I will be out for my spring visits soon, if I haven't seen you already. I am anxious to finally meet the last of you that I have yet to meet face-to-face! There are, again, a number of stations to be moved this summer, as well as a handful of stations that need rewiring and to remove the gray box from your homes/buildings. The original intent for this box was as a lightning suppressant for your home. Now we wire straight to the Nimbus without a break in the wire, for better continuity, and provide you with surge protectors.

As always, thank you all for your dedication to the COOP program. You are all so very much appreciated! Have a great summer and remember to give us a call if you have any questions or concerns. See you soon!

"It has been a pleasure meeting and working with all of our Coop Observers throughout the years." **Carolyn Willis**

2014 Length of Service

To those dedicated observers receiving length of service recognition this year we thank you! You have helped make this program what it is today! Congratulations to the following observers:

Lee Howard - Hysham 25 SSE – 10 years	Dutch Weenum – Ryegate – 15 years
Jodi Christensen - Gibson – 10 years	Powder River County Sheriff – 20 years
Nancy Anderson – Roundup – 10 years	Wes Hill – Roberts – 20 years
Dianne Giesick – Bridger – 15 years	Bob Moore – Clearmont, WY – 20 years
Joyce Sarrazin - Clyde Park – 15 years	Clint Dietz – Plevna - 35 years
50-YEAR FAMILY AWARDS:	
Davis Family – Livingston 12S	
Brown Family - Powderville	

Chase Family – Leiter, WY

In the News

Carolyn Gurney Willis Retires A Tribute to 40 Years of Government Service



Carolyn Gurney Willis retired on March 31, 2014 with 40 years in the National Weather Service (NWS)! Carolyn started her journey with the National Weather Service in 1973, just out of high school, in Great Falls, Montana. At that time the NWS was implementing a new program by hiring Summer Aides. She was hired on as an Aide, worked as a Clerk Typist, and was eventually selected as a Meteorological Technician. Word has it that Carolyn made

history by being the first person to ride her horse to work to a weather service office. Her co-workers have expressed that Carolyn was very dedicated to learning all that she could, working extra hours, etc. In 1979, Carolyn was reassigned to Bismarck, ND, moving on to Pocatello, ID in 1980, then reassigned to Billings, MT in 1982. To better her family life, she accepted a position in Colorado Springs, CO in 1985 where her daughters were born. In 1993, Carolyn moved to Eugene, OR as the Officer in Charge, then moved on to Anchorage, Alaska in 1995, and ended her nomadic career with her return to Billings in 1996, where she has been an integral part of the NWS Billings Team ever since.

Carolyn left her mark in various venues across the National Weather Service, but was best known for her creation of a children's weather storybook, called Weather Woodles.





These little furry creatures were created by the hand of Carolyn for kids to learn about the weather. This creation was recognized and well received across the National Weather Service and Carolyn won a national award for her work, the NOAA Administrator's Award.

In her later years here in Billings, many spotters and weather observers got the opportunity to get to know Carolyn in her role as the Cooperative Program Manager from 2004 - 2014.

We would like to wish Carolyn and her husband, Steve, a fond farewell with best wishes for a healthy and happy retirement in California, where Carolyn will start her new career as a self-employed Hypnotherapist! Between the Hypnosis business and her photography business, Carolyn won't feel retired at all!

Good-Bye & Good Luck, Carolyn!

Did You Know....

Summer Solstice

Kurt Hooley– General Forecaster

You know it as the first day of summer. Others refer to it as the longest day of the year. So, what makes this day, the solstice, special? To understand, you will need a little background about the Sun and the Earth.

Solstice comes from the Latin word "sol" which means "sun" and "sistit" which means stand. For several days before and after each solstice, the sun appears to stand still in the sky, that is, its noontime elevation does not seem to change.

In the summer, days feel longer because the Sun rises earlier in the morning and sets later at night. When the North Pole is tilted toward the Sun, we in the Northern Hemisphere receive more sunlight and it's summer. As the Earth moves in its orbit, the tilt of the North Pole changes. When it is tilted away from the Sun, it is Winter in the Northern Hemisphere. In between we have Autumn and Spring.

The day that the North Pole is tilted closest to the sun is called the Summer Solstice. This is the longest day (most daylight hours) of the year for people in the Northern Hemisphere. It is also the day that the Sun reaches its highest point in the sky.

When the North Pole is tilted toward the Sun, we receive more sunlight and the days are longer. In addition, the Sun rises higher in the sky, so the sunlight is more direct; that is, it comes down from above. This increases the amount of light that a given area on the Earth receives. More sunlight means more warmth, or summer. When the North Pole is tilted away from the Sun, the days are shorter and the Sun does not rise as high in the sky. Less sunlight means less warmth, or winter.

One may ask "Doesn't the distance of the Earth from the Sun cause the seasons?" Many people think so, but this is not the main reason. The Earth is closest to the Sun in late December, but this is definitely not the warmest time of the year for people living in the northern hemisphere! It has more to do with the direction of the tilt of the Earth.

Another popular question is "Why are the hottest days after the first day of summer, and the coldest days after the first day of winter?" Even though there is more sunlight in the summer, it takes time to warm up the Earth and the atmosphere. This is just like heating up food in the oven, it doesn't happen in a second. So the heating and cooling effects from greater and lesser sunlight have a delay of almost two months!

Tracking the Summer Solstice

Try this experiment to observe how the Sun reaches a higher point in the sky as the summer solstice approaches. Just follow these steps:

- 1. Starting at noon on any day, measure the length of a shadow cast by a fixed object (like a flagpole). Be sure to make your measurements carefully at the same time each day. 12 noon is best, but other times will work.
- 2. At noon the next day, measure the same shadow again.
- 3. Continue to measure the shadow each day at noon (weather and weekend interruptions are ok) for a couple of weeks.
- 4. Are your measurements the same each day or do they differ?
- 5. If the shadow is shorter each day, does that mean that the Sun is higher in the sky or lower?

Weather Watch

Severe Weather Watches, Warning, and Statements

Severe Thunderstorm Warning

Issued when there is evidence based on radar or a reliable spotter report that a thunderstorm is producing, or forecast to produce, wind gusts of 58 mph or greater, structural wind damage, and /or hail 1 inch in diameter or greater.

Severe Thunderstorm Watch

Issued by the Storm Prediction Center when conditions are favorable for the development of severe thunderstorms over a larger-scale region within the next 8 hours. Tornadoes are not expected in such situations, but isolated tornado development can also occur.

Tornado Warning

Issued when there is evidence based on radar or a reliable spotter report that a tornado is imminent or occurring.

Tornado Watch

Issued by the Storm Predication Center when conditions are favorable for the development of severe thunderstorms and multiple tornadoes over a larger-scale region within the next 8 hours.

Special Weather Statement for Near Severe Thunderstorms

Issued for strong thunderstorms that are below severe levels, but still may have some adverse impacts. Usually issued for the threat of wind gusts of 40-58 mph or small hail less than 1 inch in diameter.

Severe Thunderstorms Produce	REPORTING CRITERIA					
 * Tornadoes * Hail one inch in diameter or larger * Damaging winds in excess of 58mph Know the difference: 	Tornado, Funnel Cloud, or Water Spout Heavy Rain Accumulating Snow Wind—at least 40 mph, sustained or gusts Damage, Deaths, Injuries - weather related		Hail—any size Freezing Rain/ Icy Road Flooding—any type Visibility—1/4 mile or h			
Funnel Cloud: A funnel-shaped cloud, ex- tended outward or downward from a thun- derstorm, that corresponds to a rotating column of air. If the rotation is violent and reaches the ground, the funnel cloud is as-		REPORT - Please don't hesitate to call us. Never we know or someone else has called in. Every penefits our warnings and statements. Delayed also help us with storm reports.	HAIL SIZE ESTIM	1ATES (Diam) 1/4		
		WIND SPEED ESTIMATES (MPH)		7/8		
sociated with a tornado.	25-31	Large branches in motion	Quarter Half Dollar	1 1 1/4		
Tornado: A violently rotating column of air, in contact with the ground, that extends	32-38 39-46	Whole trees in motion Twigs break off trees, walking impeded	Ping Pong Ball	1 1/2		
from the base of a thunderstorm to the ground. This is often visible as a funnel	47-54	Slight structure damage, branches break	Golf Ball Hen Egg	1 1/2 2		
cloud with swirling dust or debris near the	55-63 64-74	Trees uprooted, structural damage Widespread structural damage	Tennis Ball Baseball	2 1/2 2 3/4		
	75+	Peels surface off roofs, windows broken,	Coffee Mug Softball	3 4 1/4		

Information Stop

Advanced Hydrologic Prediction Services (Rivers and Lakes):

http://water.weather.gov/ahps2/index.php?wfo=byz

Severe Weather Preparedness:

http://www.wrh.noaa.gov/byz/severe/index.php?wfo=byz

Lightning Safety for You and Your Family:

http://www.nws.noaa.gov/os/lightning/resources/lightning-safety.pdf

NOAA Weather Radio:

http://www.wrh.noaa.gov/byz/nwrhome.php

Play Time For Kids:

http://www.nws.noaa.gov/om/reachout/kidspage.shtml

Flood Safety:

http://www.nws.noaa.gov/floodsafety/

Lighting Safety:

http://www.lightningsafety.noaa.gov/



Jeff Bridges-Electronics Technician