Jet Stream Jargon

National Weather Service
Billings, MT

April 2015 Spring Issue

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From the Desk of the Meteorologist in Charge

One of the things that meteorologists generally find intriguing about our area of expertise is the variety that presents itself each day, week, month, season and year. The old adage typically attributed to Mark Twain, "If you don't like the weather, just wait a few minutes" often is ascribed to be true in particular locations. However, in reality it applies to many locations and more specifically to the fickle behavior of the weather.

Certainly the past six months have presented our area with a wide range of conditions. After an exceptionally mild October (I must say one of my favorite Octobers in my 20+ years in Billings), the conversation quickly changed as the season's first cold snap hit on November 10th. Folks began to worry the winter of 2014-15 would be a repeat of last winter. However, the month closed with temperatures back into the 50s and 60s. As Christmas approached, the weather became wintery, with a several day stretch of what seemed to be non-stop snow (sort of felt like the movie Groundhog Day...shoveling snow every morning). By mid-January, unseasonably warm weather returned in earnest and the good snowpack that was started in the mountains began to erode. Despite a few short cold snaps, the unseasonable warm (and dry) weather has been locked in place since that time, which has now turned our concerns to the threat of wildfires and water supply.

The one lesson meteorologists have learned is weather is changeable and can often do so despite what our minds see as trends and tendencies. The Earth-Atmosphere system is very complex and is impacted by a myriad of factors, some of which we understand well, and others that remain mysteries to us. The staff here at the Weather Forecast Office in Billings are committed to using their skills and understanding of the Earth-Atmosphere system to provide world class forecasts and warnings to support the weather dependent decisions made each day across our area. We will always provide our best assessments on the likelihood and confidence associated with the variety of weather, while striving to carry out our mission to protect lives and property from weather related impacts.

I mentioned last Fall that we had begun filling long standing vacancies in our office. That process continues. We are currently in the process of filling two entry level meteorologist positions within the office and hope to have new staff onboard by early June. This would leave us only 1 position short, after the retirement of one of our long time Lead Forecasters in January. We hope that we will be able to fill this position by the end of this calendar year, but this is dependent upon budgetary constraints.

As I close, I again want to extend my "Thank You" to all of you who volunteer your time as a weather observer, spotter, supporter, Facebook/Twitter follower, etc. Clearly we could not be as successful in our efforts to communicate weather and climate information without your assistance. We can have the most accurate information, but without hearing from you, or getting your assistance in spreading the official forecasts, watches, warnings or advisories...the accurate information would be replaced by fiction or half-truths. Thanks for your continued support and assistance!

Keith W. Meier

WCM Notes

Tom Frieders—Warning Coordination Meteorologist

It's Time Again to Prepare For Severe Thunderstorms

Are you Ready? Although the weather pattern has been fairly quiet late this winter into early spring, we can't let our guard down. The pattern can change quickly and become more active. Active weather in the spring means severe thunderstorms! We know what severe weather can bring. Remember the May 18th hail storm in Billings? What about the EF-3 tornado in southeast Montana, southwest of Camp Crook, SD on June 17th? That's just a sampling of 2014 for our region. A year that brought 21 tornadoes, over 200 damaging wind reports and over 400 large hail reports to just the states of Montana and Wyoming! Don't forget flash floods. Montana and Wyoming experienced 30 flash flood events as well.

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, and thanks to some great hosts willing to sponsor our training this year, we have a full schedule with classes available throughout the region. If you can't make a show in person, we are once again offering a webinar; online training from the comforts of your home or business. View our entire schedule at: http://www.wrh.noaa.gov/byz/local_news/2015/spotter15.php

Severe Thunderstorms Produce

* **Tornadoes**
* **Hail one inch in diameter or larger**
* **Damaging winds in excess of 60mph**

Know the difference:

Funnel Cloud: Rotating Funnel-shaped cloud extending downward from a thunderstorm base, but the rotation is NOT in contact with the ground.

Tornado: A violently rotating column of air, in contact with the ground, that extends from the base of a thunderstorm to the ground. This is often visible with swirling dust or debris at the surface.

Hydrological Outlook

Todd Chambers – Senior Forecaster

Spring-Summer 2015: Runoff and Water Supply Outlook

Spring and summer runoff across this part of the country is dominated by mountain snowpack and the number and intensity of large precipitation systems that move across the area during the March-June time frame. For example, mountain snowpack last spring was well above average. However, few large scale storm systems arrived during the March-June time to add heavy rain to the lower elevations, and thus the runoff season was mild. In 2011, the mountain snowpack started out near to below average in the early spring which hinted at a mild runoff season. However, a successive series of very wet systems brought heavy rain to the lower elevations and added to mountain snowpack through early summer, and resulted in severe flooding.

So far this spring we are looking at below normal snowpack across area mountains, given some prolonged warm and dry conditions across the lower elevations this winter and early spring. Provided spring and early summer precipitation patterns turn out near average, the current projections are for a normal to slightly below normal runoff season this year, along with slightly below to normal water supply levels. The key for any river/stream flooding this year will be the frequency of strong large scale storms that could bring heavy precipitation, or lack thereof. At this point, keep an eye out for any prolonged periods of precipitation that might lead to enhanced river and stream flows. With a weak El-Nino pattern in the Pacific Ocean there could be some extra energy available for a few of these stronger systems.

Winter Recap

Joe Lester – General Forecaster

2014-2015 Winter in Review

Though the 2014-15 season will be remembered for its warm temperatures, our winter did not begin that way. A snow event on Christmas Eve began a 3-week stretch of fairly cold and snowy weather. In fact, the snow depth at the Billings airport reached a maximum of 14 inches on the 6th of January, and the string of 10 consecutive days with a snow depth of at least 10 inches from the 5th through the 14th, was the longest since 1979.

In mid January our weather turned quite warm and it remained that way through mid February. Warm spells during the mid winter are not unusual for our region, but what was remarkable was the magnitude of warmth that we experienced. From January 15 to February 14, Billings and Livingston were their warmest on record for the 31-day period. Also, during the course of the entire winter, Billings had a whopping TEN 60 degree days, the 2nd most on record (11 occurred in 1980-81). Was this the warmest winter on record? No, but we certainly had a large number of very warm days!

The second half of February turned cooler with a series of snow events along the foothills of the mountains. Places like Red Lodge and Story received significant amounts of snowfall.

Why was our weather mild this winter? One reason for the extended period of warmth in our region, as well as the entire western United States, was the warm sea surface temperatures across the eastern Pacific Ocean. This helped lead to persistent high pressure aloft over the western states (i.e. warm & dry), while much colder air from Canada affected the eastern half of the country.

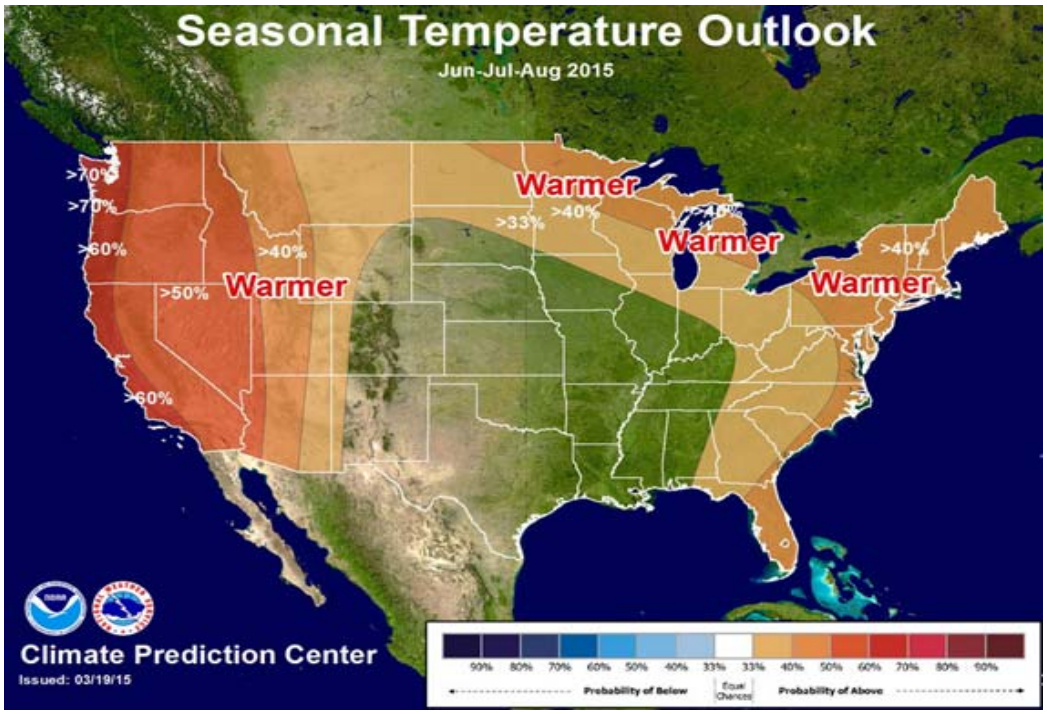
The following is a table of 2014-15 winter statistics at our four main climate sites. Records go back to 1934 at Billings, 1937 at Miles City, 1907 at Sheridan and 1948 at Livingston.

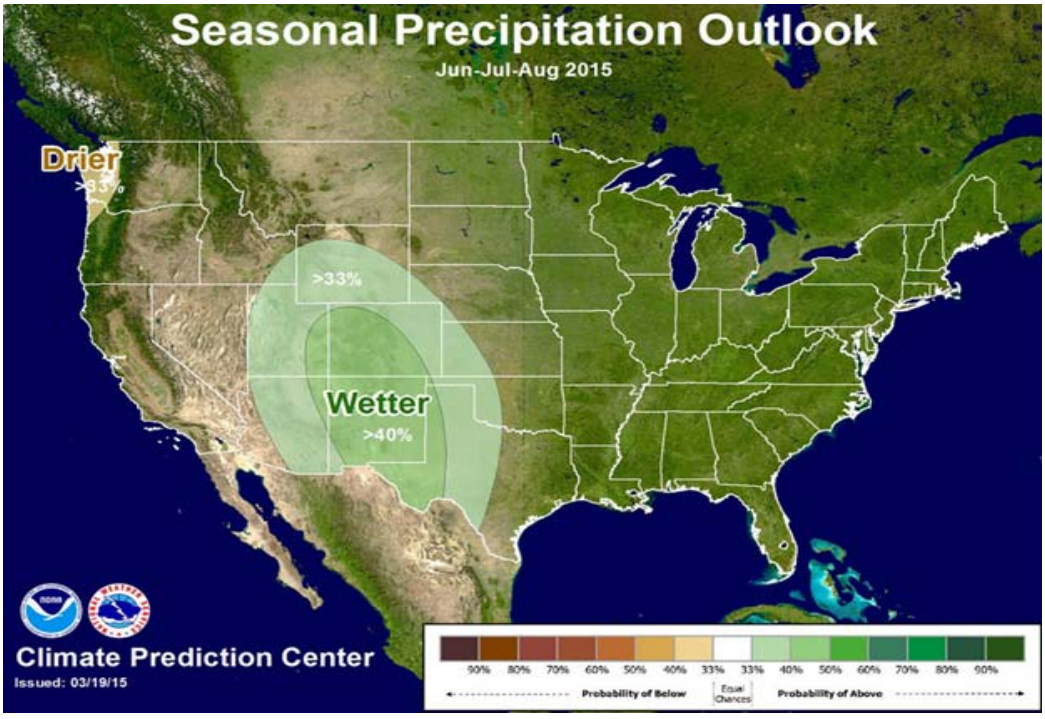
Statistics from meteorological winter (December 1st through February 28th):

Dec - Feb Stats	Avg. Temp (deg F)	Departure from normal	Precipitation (inches)	Departure from normal	Snowfall (inches)	Departure from normal
Billings	31.0 (13th warmest)	+ 3.2	1.97 (31st wettest)	+ 0.51	30.9 (22nd snowiest)	+ 8.1
Miles City	24.3 (20th warmest)	+ 2.3	0.53 (13th driest)	- 0.31	-	-
Sheridan	26.9 (24th warmest)	+ 2.1	2.47 (28th wettest)	+ 0.81	-	-
Livingston	32.8 (7th warmest)	+ 4.2	1.60 (25th wettest)	+ 0.09	-	-

Outlook for the 2015 Summer

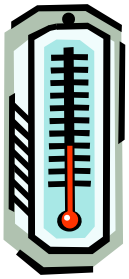
Here are the temperature and precipitation outlooks for June-July-August from the Climate Prediction Center, issued March 19th. In our region, there is a slight hedge toward above normal temperatures, while there is no climate signal to suggest either above, below or near normal precipitation.





Spring and Summer Data Tables

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

Spring and Summer Data Tables con't

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				
Date	High	Low	Average	Precipitation
6/1 – 6/30	77.2	52.1	64.7	2.12
7/1 – 7/31	86.8	58.8	72.8	1.32
8/1 – 8/31	85.7	57.3	71.5	0.75
6/1 – 8/31	83.3	56.1	69.7	4.19

Miles City				
Date	High	Low	Average	Precipitation
6/1 – 6/30	78.6	52.6	65.6	2.51
7/1 – 7/31	88.3	59.5	73.9	1.64
8/1 – 8/31	87.2	58.0	72.6	0.91
6/1 – 8/31	85.2	57.8	71.5	5.06

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 and the ***latest*** 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 It Feel Like the 60s?

If you think the weather has been exceptionally warm the latter half of the winter, you are right. As of March 26th the high temperature in Billings has reached 60 or higher 24 times since 2015 started. This is 6 more times than any other year with 1992 having the second most at 18 times. By comparison, in 2014 we had only hit 60 one time by March 26th, and 5 times in 2013.

This ranks as the 6th warmest start to a year, with 1992 leading the pack with 39.1 degree for an average daily temperatures. (2015 is at 35.3 degrees). Our 1.67 inches of moisture to start the year is not remarkably dry, but it is fair to assume the amount of evaporation that has been going on with the warm temperatures means much of that moisture has not stuck around.

We look for April, May and June to bring our real moisture, and the years that have been warmer than 2015 up to this point, 1999, 1992, 1983, 1981 and 1961, had an average of 6 inches of moisture during those 3 months. There is reason to be hopeful as the wet months approach.

One area of the country that is far more pessimistic about their moisture outlook is California which is in the midst of a severe 4 year drought. Our office sent Incident Meteorologist (IMET) Dan Borsum (in blue on image to the right) to Yreka California in August to support their wildfire fighting personnel. Dan got to see first hand the impacts of the drought, and the hazardous conditions the firefighters were facing. The IMET supports teams by being a portable weather office onsite. New in 2014 was the ability to launch weather balloons carrying instruments which help detect dangerous atmospheric conditions overhead which can bring rapid changes to the fire environment.

While IMETs cannot bring the needed moisture to alleviate the drought, they can bring the tools to help make firefighting efforts safer.

CoCoRaHS

Vickie Stephenson– CoCoRaHS Coordinator

Community Collaborative Rain, Hail & Snow Network

Happy Spring Everyone!

Big news has come to our CoCoRaHS community! It appears that March Madness 2015 has yielded a surprising new CoCoRaHS observer! The **WHITE HOUSE** Kitchen Garden, planted by Michelle Obama, will have an official CoCoRaHS rain gauge installed! Nolan Doesken presented the rain gauge at the 4th Annual National Science Fair activity at the White House. I look forward to seeing their reports on the web site!

Locally, I would like to thank you all for your continued tireless efforts in reporting every day, even zero reports, which are just as important to our climate records as extreme amounts of snow or rain. You should know that our CoCoRaHS Network in southeast Montana has the best reporting record across the state. Sheridan County, Wyoming has been very consistent as well. For that, I thank you very much!

Spring is upon us and you can return your tubes and funnels to your rain gauges around the end of May, since we may still have some snow in the months ahead! But, if you return them to the gauge and snow piles up, don't fret, just remove them again and measure the best you can.

CoCoRaHS con't

Our summer season will be here before we know it, so please take a moment to brush up on "Significant Weather" and "Hail" forms on the CoCoRaHS website to refresh/familiarize yourselves with them. You can also send us a quick report through our homepage at weather.gov/billings "Submit Report", which is the third item on the left blue strip of links. It's very user friendly and has about every hazard you could encounter.

Plus we get it instantly! Then go ahead & submit your normal daily report on the web site at your observation time.

THANKS AGAIN FOR ALL YOU DO!

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COOP Corner

Vickie Stephenson—Cooperative Program Manager

Please join me in welcoming our new Observing Program Leader, Larry Dooley! Larry's bio was featured as a newcomer in the Jargon's Fall Issue. I know a lot of you have heard from Larry by phone, email, and a few have met him in person, as he has already been out on several visits! He hopes to get out and meet all of you this first year, so you should see him before the end of 2015! Larry comes to us from Springfield Missouri, where he had served since 1989. Larry is very knowledgeable about the COOP program and will be a great help to me, as well as a great asset to the office and the Observing programs in our area.

I would like to take this opportunity to express my gratitude for all of our Cooperative Observers out there! Your dedication to the stations you maintain is commendable, and the very important data you collect will contribute to our nation's climate in the future. Additionally, you all have been so receptive to our new data entry by computer in WxCoder, and for some this hasn't been easy, so thank you!

If you have an 8" rain gage with a funnel, it will soon be time to insert the inner tube and funnel back into the gauge. However, don't do this too early, because if water freezes in the tube, it will break the plastic tubes, and pop the weld on the metal ones. The last week of May is the best time to put the tube/funnel combination in your gage. Larry and I will continue to get out and visit your stations within the calendar year. Fischer Porter Rebuild (FPR-D) rain gage sites expect to be visited in mid-May for Sheridan County, WY, and our western stations. Those eastern FPR-D stations, we expect to see you in early June to get you ready for summer. We will be calling you to set approximate times for our visits.

Feel free to contact Larry or myself if you have questions, concerns, or need repairs, as we are here to help! Use the spotter 800 number or 406-652-0851.
larry.dooley@noaa.gov or vickie.stephenson@noaa.gov

In the News

Emergency Alerts for Severe Weather for Your Cell Phones

Did you know that most smart phones are now equipped to receive Wireless Emergency Alerts? Look on your smartphone under Settings. If your phone is "Wireless Emergency Alert capable", then you will see a section called Government Alerts. If you are unsure if this service is available on your phone, contact your local cell provider.

With this service, you will receive alerts from authorized government alerting authorities only. The main alerts you will receive are: Tornado Warnings, Flash Flood Warnings, Amber Alerts, or critical Presidential Alerts during national emergencies.

More from FEMA on their Wireless Emergency Alert FAQ webpage:

https://www.fema.gov/frequently-asked-questions-wireless-emergency-alerts

Our partners with the American Red Cross have numerous free cell phone apps that can be utilized to send alerts for various natural hazards. Check out their full app website at:

http://www.redcross.org/prepare/mobile-apps

Specifically for severe weather, two apps of interest for weather are the Tornado and Flood Apps. The Tornado App can be set up to alert you for both Tornado and Severe Thunderstorm watches and warnings in your area. The Flood App can be set to alert you of flash floods in your area. For either of these, an audible alarm will sound, even when the app is closed! Check out their website for a full suite of apps and the functions they provide.

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 of the Earth 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 Earth's 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 of the Earth 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 Awareness Week April 20-24, 2015

Follow us on Facebook and Twitter to learn more about severe weather!

Know Your Risk, Take Action and Be a Force of Nature.

Severe Weather Definitions and Safety:

WATCH - Potential exists for severe weather to occur within the next several hours but the exact location and timing aren't known. **Action can be taken to protect property such as putting your vehicle in the garage, putting away patio furniture, etc.**

WARNING - Severe weather is occurring or will occur shortly. **Immediate action should be taken to protect yourself by going to the lowest portion of a sturdy building, or into a closet, hallway or room without windows. When Thunder Roars, Go Indoors!**

NWS warns the public about severe weather through Wireless Emergency Alerts on your cell phone and NOAA Weather Radio.

Tornado: A violently rotating column of air, in contact with the ground, that extends from the base of a thunderstorm to the ground. This is often visible with swirling dust or debris near the surface.

- You may have only minutes to find shelter before a tornado strikes. Practice a family tornado drill at least once a year.
- In 2014, Montana had 8 tornadoes confirmed.

Severe Thunderstorm: A thunderstorm that produces hail of 1 inch or larger (quarter size) and/or a wind gust to 58 mph or higher.

- In 2014, Montana had 129 high wind and damaging wind events, 236 large hail reports.
- Sheridan County, WY had 6 high wind reports and 5 large hail reports.
- In 2014, there were 26 lightning fatalities nationwide.
- Plan outdoor activities to avoid thunderstorms.
- Check to see if officials in charge of sports have a written lightning safety plan.

Flash Flood: A sudden inundation of water in low-lying areas, usually brought on by heavy rain, dam break, rapid snow-melt or ice jams.

- In 2014, Montana had 8 Flash Floods.
- It only takes 12 inches of water to carry off a small vehicle.
- Whether driving or walking, any time you come to a flooded road, Turn Around Don't Drown®.
- Get to higher ground as quickly as possible.

Extreme Heat:

During a heat wave, reschedule strenuous outdoor activities for the coolest time of the day.

Wildfires:

If you live near wildland areas, make sure you home is Firewise and fire-safe.

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/