JET STREAM JARGON

NATIONAL WEATHER SERVICE, BILLINGS, MONTANA

2020 Spring Edition

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From the Desk of the Meteorologist in Charge

Legendary UCLA basketball coach John Wooden has long been known more for his insightful wisdom than his basketball prowess. One of his wise insights has been very timely of late: "Adaptability is being able to adjust to any given situation at any given time."

Over the last 30 to 60 days, these words of wisdom have become very applicable for all of us as COVID-19 expanded its impact across the globe, our country and the Northern Rockies/ Plains. Typically, in our organization, we are rapidly adjusting our staffing, workload and workflow in response to hazardous weather and water events to support our primary mission of protecting lives and property. Most recently, we've needed to adjust to the rapid spread of COVID-19 and how best to balance the health and well-being of our staff while being poised to carry out our mission. As a result, most of our workforce has been dispersed to work from home, while we maintain a small core staff within the Weather Forecast Office 24x7 to carry out the routine services we provide. It has been exciting to watch our dispersed staff interact every morning to coordinate activities for the day and make decisions regarding staff that may be needed within the office in the coming days, whether that is to augment our Operations or to fix equipment.

I'm proud to say that our team has and will continue to provide World Class service as seamlessly as possible despite the challenges that COVID-19 has presented. Resilience is defined as the capacity to recover quickly from difficulties, and it was quickly evident to me that our team demonstrated exceptional resiliency as they made a quick pivot from our long standing routine of reporting for work at the office to quickly adapting to interacting using the variety of technology we have at our disposal. As we move into one of our busier times of the year, our support to our customers and partners will continue at the high level to which they have become accustomed. While we work to minimize the risk of COVID-19 within our community, we will continue to maximize the service we provide.

Keith W. Meier

From the Desk of the Meteorologist in Charge...Cont'd

A Note on Changes to the Cooperative Weather Observing Program

The recent retirement of one of our staff members has presented us with the opportunity to reorganize our approach to the Cooperative Weather Observing Program. Previously, the Cooperative Weather Observing Program had been the responsibility of 1 or 2 individuals. Going forward, we will have a team of individuals working to support this program, leveraging each of their individual skill strengths to best serve our volunteers and the important data they collect for our Nation. Kurt Hooley (Meteorologist) is serving as the overall program manager, focusing on data quality control, conducting annual and semi-annual visits to sites, recruitment and retention of observers and overall coordination of activities within the program. Assisting Kurt will be Linda Brennan (Administrative Support Assistant). With Linda working primarily Monday through Friday, she will be intimately involved with day-to-day interactions with our volunteer observers, ranging from providing them with supplies, receiving incoming data reports and providing some initial troubleshooting tips. Additionally, our Electronics team of Tony Browder, Jeff Bridges and Joe Chilcoat will become more intimately involved in resolving maintenance issues with the Max/Min Temperature System (MMTS), Nimbus and the Fischer-Porter gauges. Tony, Jeff and Joe are well-versed in various electronic systems which makes their involvement in this portion of the Cooperative Weather Observing Program a natural. Should you have any needs in this program area, please reach out using the byz.coop@noaa.gov email address or call the office at 406-652-0851. If you have any concerns or would like to share any examples of the world class service you've received, please don't hesitate to reach out to me directly at keith.meier@noaa.gov or the phone number provided above.

A Recap of Meteorological Winter (December - February)

By Joe Lester, Lead Meteorologist

After a cool and wet fall, the mid-winter months were warm and dry across most of the region. The only real taste of winter in December and January was a week-long cold stretch in the middle of January, when most locations experienced their coldest temperatures of the entire winter. For Billings, that was -11˚. Mizpah dropped to -23˚ on the 15th.

February 1st was a very warm and dry day, and Billings set a daily record high temperature with 68˚. Winds were also quite strong, especially along the western foothills where Livingston recorded a peak gust of 78 mph. A grass fire (Lode Rd Fire) between Harlowton and Judith Gap closed US -191 for a few hours due to windblown smoke and near zero visibility. The fire burned 3680 acres and ran 9 miles, eventually making it to the highway itself.

Lode Road Fire (Courtesy of Conquer the Storm)

Otherwise, February was not as warm as the previous two months, but our region avoided any significant cold snaps. It did turn snowier in February, especially along the southern mountains and foothills. Sheridan actually had its 8th wettest February on record. A weather observer at Story, WY measured a whopping 75.4 inches of snow during the month. Red Lodge received 69.4 inches.

Temperature and precipitation stats for December - February at our four main climate stations:

	Average Temp (°F)	Departure from Nomal	Total Precip (inches)	Departure from Normal	Total Snowfall (inches)	Departure from Normal	Period of Record Began
Billings	31.0	+ 3.2	0.98	- 0.48	15.4	- 7.4	1934
Livingston	31.7	+ 3.1	0.82	- 0.69	These stations do not report snowfall		1948
Miles City	25.9	+ 3.9	0.62	- 0.22			1937
Sheridan	27.3	+ 2.5	1.97	+ 0.50			1907

Wildfire Danger Mapping

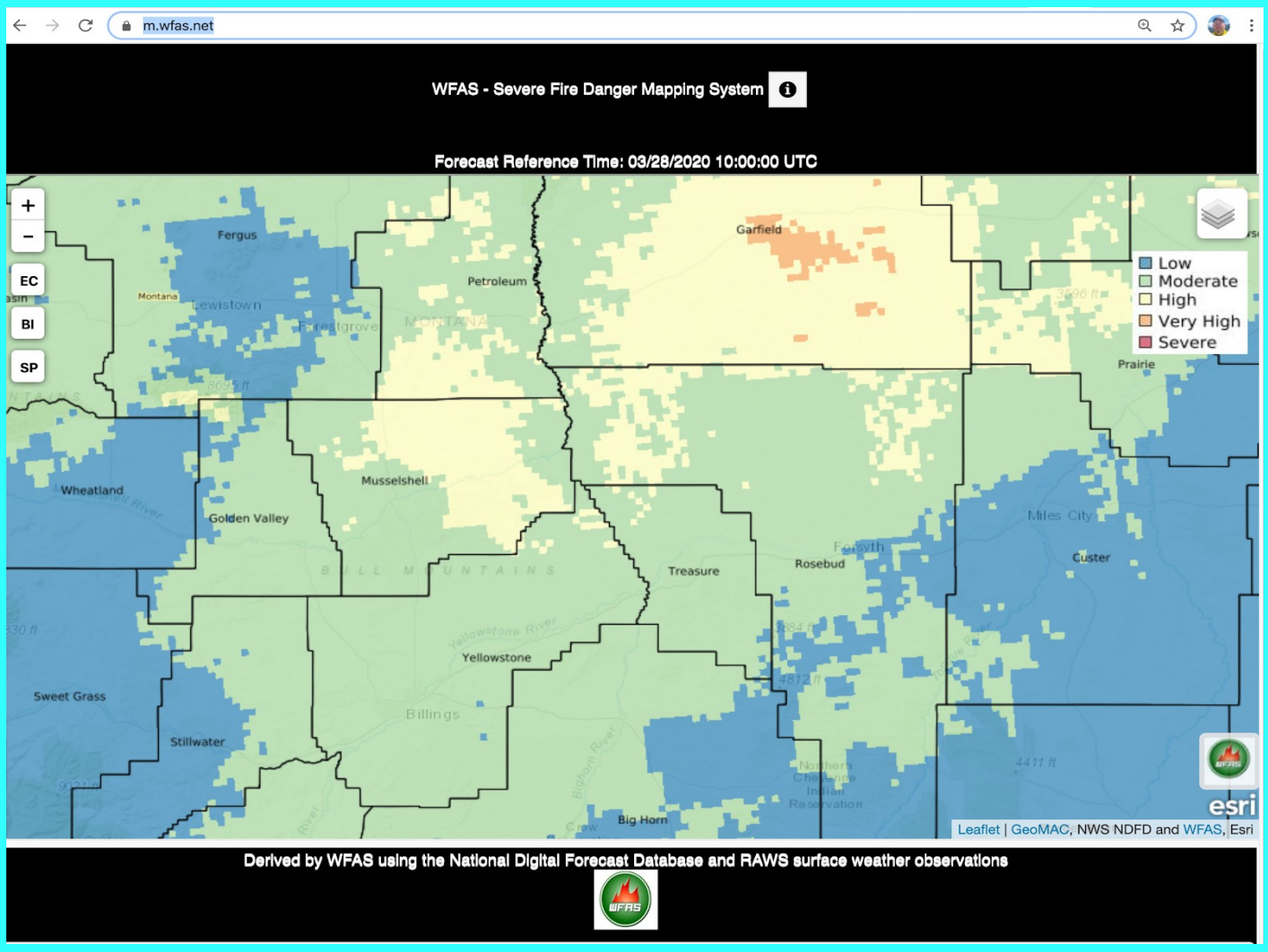
By Dan Borsum
Lead Meteorologist/Incident Meteorologist

New Fire Model Available

Spring brings an increase of open burning, but it can bring hazardous fire conditions. Wildland fire activity responds largely to 2 factors: fuels dryness and current weather conditions. It is important to recognize when these factors line up to cause any fire to be erratic and be prone to rapid spread. This is when preparedness is critical and prevention is even more important.

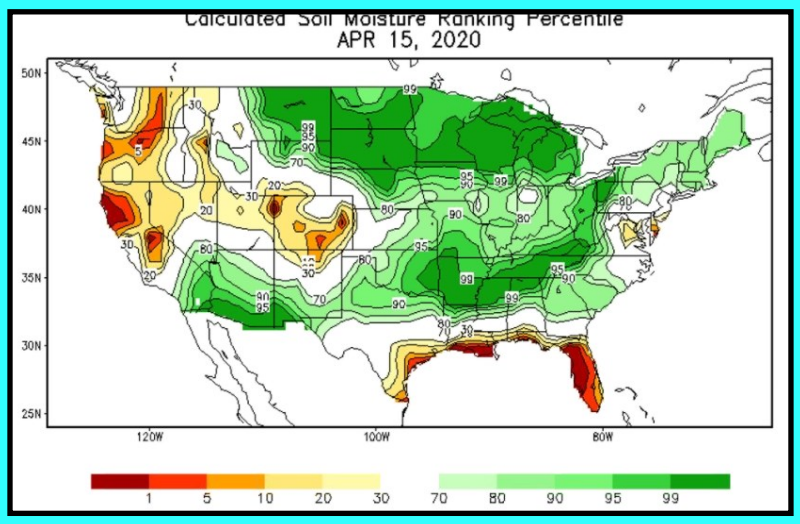
The Severe Fire Danger Mapping Page from the Missoula Fire lab can be used to identify days when the weather and fuels dryness can lead to dangerous situations. It starts with fire danger models, which have weather and dryness inputs, and then analyzes the output based on fire history. It is designed to indicate clearly the most threatening conditions.

Our office has found this to be a useful threat analysis when looking at today and tomorrow. Dr. Matt Jolly, the research ecologist from the Missoula Fire Lab who developed the tool has said when the Severe Fire Danger indicates "Severe," firefighters need to be even more cautious than normal. It can be found here: https://m.wfas.net/.



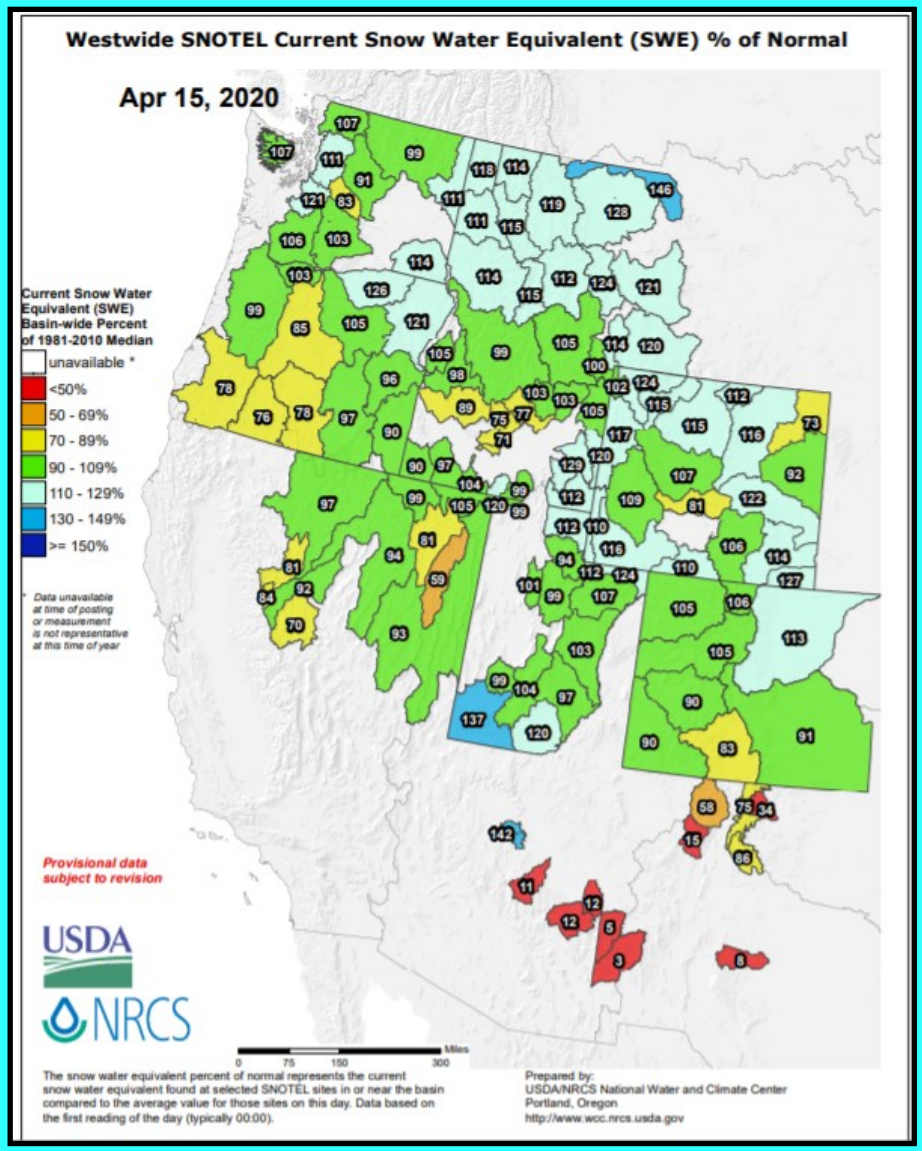
Spring Flood Potential

By Julie Arthur & Todd Chambers, Meteorologists



Good moisture from the Fall of 2019 resulted in ample soil moisture for our area. Here is a map of the percentile of soil moisture from April 15, 2020, courtesy of the Climate Prediction Center (CPC).

As far as mountain snowpack, the latest Snow Water Equivalent percentages from the Natural Resources Conservation Service (NRCS) indicate slightly above normal snowpack conditions, mostly ranging from 110 to 120 percent of normal across Southern MT and N. Central WY.



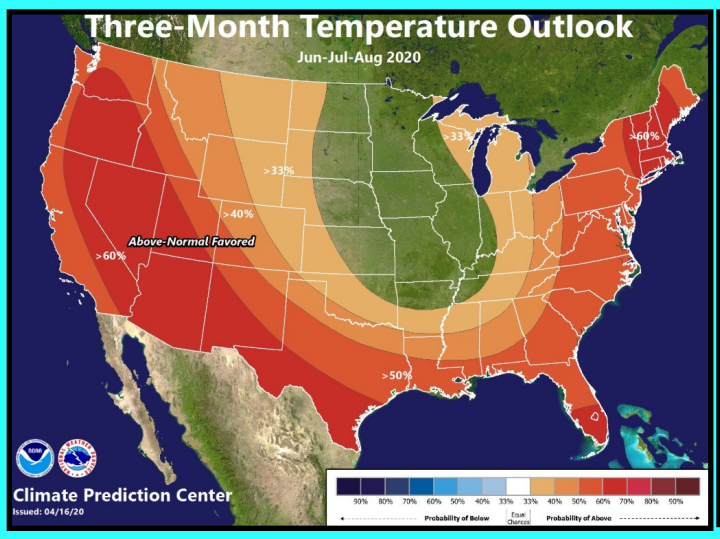
Spring/Summer river flooding will, as usual, depend on the development of heavy rainfall producing storm systems. Rivers most times can hold the snowmelt on their own. It's the heavy spring rains on top of swollen rivers (during the peak snowmelt runoff) that will typically increase the flood potential. This could especially be true this season given the high soil moisture conditions. The key timeframe to watch for this combination will be from mid May to mid June. Please see the "2020 Summer Outlook" article for our summer temperature and precipitation outlooks.

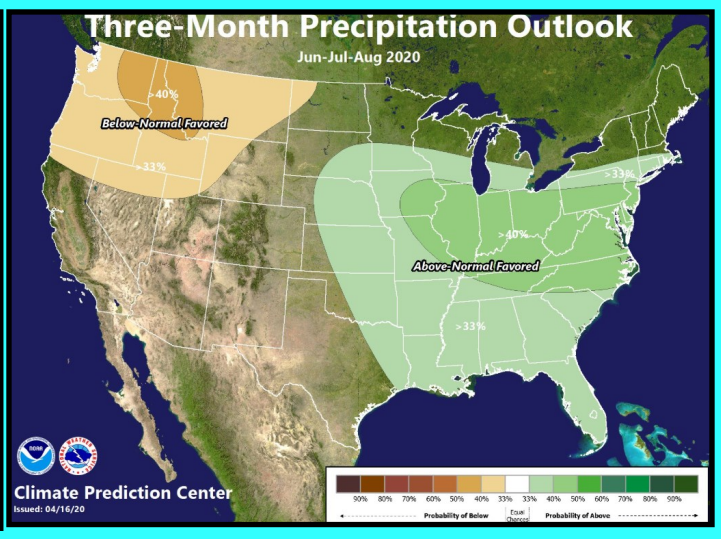
2020 Summer Outlook

By Joe Lester, Lead Meteorologist

After a winter that was warmer and drier than the previous few, we are rapidly approaching the summer season. Take comfort in knowing that warmer and drier winters do NOT correlate to similar conditions in the summer. Temperature and precipitation predictions for the summer are actually quite difficult. Temperatures tend to be cooler after wet springs, and warmer when the spring months are dry. Nearly half of our region's annual precipitation occurs during the months of April-May-June, so it's important for agriculture and recreation to receive those spring rains. Cooler and wetter conditions also help to suppress wildfire potential in the mid to late summer as grasses become cured. Precipitation during the summer months is driven by thunderstorm activity as opposed to dynamic weather systems, so summer precipitation predictions can be even more challenging.

Seasonal temperature and precipitation outlooks are made by the Climate Prediction Center (CPC) in College Park, MD. CPC uses the El Nino Southern Oscillation (ENSO, which is currently neutral), recent climate trends, and several dynamic and statistical models to assist in their seasonal predictions. Here are the latest temperature and precipitation outlooks for June-July-August, issued on April 16, 2020. As you can see from the maps below, our region has a slightly increased likelihood of above normal temperatures and below normal precipitation.





Finally, if you are planning to have a garden or outdoor plants, keep in mind that our region can see a frost or freeze well into the spring. Here are normal and extreme frost and freeze dates at a few locations. Frost is based on 36˚, freeze 32˚, and hard freeze 28˚.

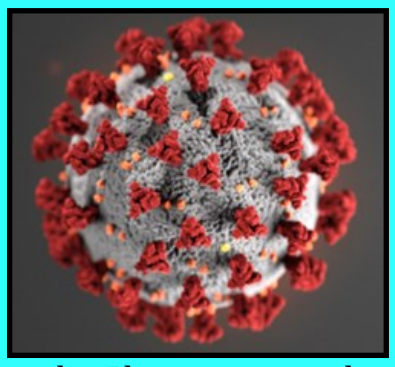
	Normal Last Hard Freeze	Latest Hard Freeze	Normal Last Freeze	Latest Freeze	Normal Last Frost	Latest Frost
Billings	April 23	May 28	May 7	June 13	May 18	June 13
Livingston	May 13	June 5	May 28	June 29	June 10	June 30
Miles City	April 27	May 28	May 9	June 8	May 18	June 18
Sheridan	May 8	June 3	May 19	June 24	June 5	June 30

COVID-19 Preparedness/Partner Interaction

By Tom Frieders, Warning Coordination Meteorologist

COVID-19: Changes in NWS Preparedness Messaging

The National Weather Service (NWS) has been doing what it can to help delay the spread of COVID-19. We have continued to find unique ways to maintain top-notch weather communications, while also decreasing the staff footprint in the office. The NWS has been relying heavily on video communications with our staff and core partners while still maintaining a 24/7 office presence. A day-to-day presence that varies depending on the level of support needed for forecast and warning operations. A change that will be transparent to the public!



One big change for the spring and summer will be the way we bring you our preparedness messaging in these days of social distancing. While nothing beats our face-to-face presence in your local communities, this year's public outreach and preparedness events will be enhanced through the use of social media. Please stay tuned to our social media networks and webpage for the very latest on what we are offering. Despite the current health crisis, we still need to be prepared for the hazards of severe weather that lie ahead!

Hosting a Flood Tabletop Exercise To Enhance Public Safety Into the Future

The National Weather Service (NWS) is continually meeting with our core partners in an effort to build relationships and learn more about what we can do to better support emergency operations and communications in our local communities. Conducting exercises to simulate a potential threat to the public is an ideal way to integrate communications between various emergency response agencies. On March 9, 2020, our Billings NWS office hosted a tabletop exercise in Hardin, MT to discuss the preparedness, response and recovery efforts for a simulated flood event in the foothills of the Bighorn Mountains. The foothills of the Bighorn Mountains is an area that has a potential for flooding each spring during heavy rain and snowmelt conditions.

A tabletop exercise is an exercise where the various agencies sit in a group setting and exchange information on response and how we can all work together during a real event in an effort to save lives. This particular exercise included participants from Sheridan County Wyoming, Big Horn and Rosebud Counties in Montana; including the Crow and Northern Cheyenne tribal reservations. There was a diverse group of partners in attendance, including representatives from Emergency Management, Law Enforcement, Transportation Departments, and many other state and federal partners.

Community, Collaborative, Rain, Hail and Snow Network (CoCoRaHS)

By Kurt Hooley, Meteorologist

The CoCoRaHS Network in the Billings service area continues to thrive through our dedicated and reliable observers. We currently have about 120 observers in our area, of whom 50-60 submit data to us most every day, including days with NO precipitation! This is an awesome number because ZERO IS an observation. I wish to thank you all very much for your dedication.

Spring is here, with summer just around the corner, which means severe weather, i.e. thunderstorms. There are "Significant Weather" & "Hail" report forms on the left hand menu on your CoCoRaHS Home screen, used for heavy rain/hail/snow and flooding information. Feel free to use these forms to alert us of such *real time* issues in your area. Once submitted, the NWS office forecasters receive an alarm immediately. These immediate reports help us provide timely warnings to the public as events unfold. These reports also help forecasters to establish a good lead time for the protection of life and property. Both forms have space for comments, so you can add information that you think would be helpful to our forecasters. You can get as detailed as you like, but be aware that your comments may be seen by the general public. If you are unaware of these features, please peruse through them on the CoCoRaHS website at www.cocorahs.org, or feel free to contact me for assistance at kurt.hooley@noaa.gov.

Shop the CoCoRaHS.org website store, located at the bottom of the Resources link from the home page on the left hand side of the webpage. There are many items, including new rain gauges and pieces and parts, if you don't need the whole thing replaced! Lots of fun stuff, too! Ever heard of a "Snow Swatter"?

We are always looking for volunteers to take "backyard" weather observations. Please spread the word and if you are already a Skywarn Weather Spotter and are interested, I would love to hear from you. Run through the cocorahs.org website and see what you think.

I look forward to seeing all of your reports and hope to meet some new observers this summer! If you have questions or concerns, please feel free to contact Kurt Hooley, kurt.hooley@noaa.gov or Tom Frieders, tom.frieders@noaa.gov at the Billings National Weather Service office at (406) 652-0851 or your provided 800 number. We are happy to be your first contact if you have concerns about the website or the program itself. And once again, thank you for your commitment and dedication!

Cooperative Observer Program (COOP)

By Kurt Hooley, Meteorologist

It will soon be time to insert the inner tube and funnel back into your rain gauges. The last week of May is the best time to do this. I will be out to visit your stations within the calendar year and will be calling you to set approximate times for my visits. Feel free to contact me if you have questions, concerns, or need repairs. You may call 406-652-0851, ext 225, or email kurt.hooley@noaa.gov .

Recognition for many years of service is part of the culture of a successful organization. Awards are a time honored, tangible method of showing appreciation for many years of dedication. The awards may be given to individual observers, families, and/or institutions for length of service or in recognition of significant achievements. Congratulations to this year's National Weather Service, Billings Coop Observers, who will be recognized for their years of dedication and receive awards for their continued outstanding service!

Alex G. Collie	Mackenzie	70 years
Perry Anderson	Melville	60 years
Bill Schwarzkoph	Fosyth	45 years
Brice Lambert	Ekalaka	35 years
Ingrid Brown	Powderville	35 years
David Paugh	Ryegate	30 years
Sharon F. Higgins	Ridgeway	25 years
Russell and Bonnie Lode	Harlowton	15 years
Bill Biastoch	Big Horn	15 years
David and Connie Wolff	Belltower	10 years
Don Blyton	Joliet	10 years
Randy Wegner	Yellowtail Dam	10 years

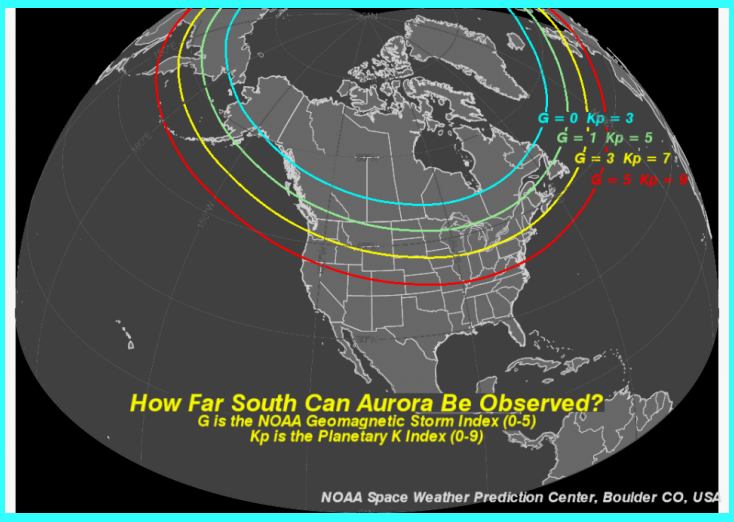
Thanks to each and every one of you. You play a very large role in the success of our mission of protecting life, property and the enhancement of the national economy. For more information about the NWS Cooperative Observer Program please visit:

http://www.weather.gov/coop

Space Weather Prediction & The Aurora

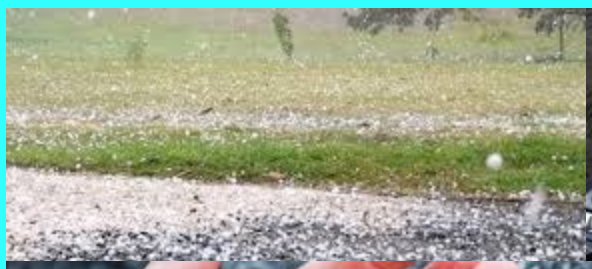
By Nick Vertz, Meteorologist

While it's the National Weather Service's (NWS) job to forecast the weather that occurs in our atmosphere, it's the Space Weather Prediction Center's (SWPC) job to forecast the weather that, as the name implies, occurs in space! While space weather seems like a daunting phenomenon to talk about, a relatively simple example exists that tends to light up the sky at night, the Aurora Borealis, or Northern Lights. The aurora occurs when electrons brought in by the solar wind (a movement of electrons and protons from the sun) enter the upper parts of the Earth's atmosphere. Then, just as a compass always points to the poles (due to the magnetic field), these electrons are also brought to the poles. Once they arrive, they collide with oxygen and nitrogen, and this collision brings about the aurora. What helps to cause this is called a Geomagnetic Storm. A stronger geomagnetic storm helps to produce a bright and farther reaching aurora, but at a price. Just as severe thunderstorms have plenty of impacts on society, so do geomagnetic storms, as they can cause interference, and even outages, with GPS systems, as well as in power grids and pipelines.



However, the important question remains, when is the best time to view the aurora? It's quite common to view the aurora when located closer to the poles, but larger aurora events can reach the U.S., and sometimes even be seen in Billings! When a large aurora event occurs, the best time to view it is usually around midnight, away from city lights, and with little to no clouds present. The longer the night is, the better the chances as well - hence late fall, winter, and early spring periods are also more favorable for viewing the aurora. Lastly, you get larger aurora events as more electrons are brought to Earth through the solar wind, which has its own (solar) cycle. Unfortunately, we are at a low point in the solar cycle, so bigger aurora events are more rare. However, this cycle usually peaks every 10 years, and between 2024-2026 is when the next peak is expected, so in the mid 2020's, you can expect to see a lot more and brighter auroras!

https://www.swpc.noaa.gov/content/tips-viewing-aurora






How Does Hail Form?

- Inside a thunderstorm are strong updrafts of warm air and downdrafts of cold air.
- If a water droplet is picked up by the updrafts...it can be carried well above the freezing level. With temperatures below 32F...our water droplet freezes.
- As the frozen droplet begins to fall...carried by cold downdrafts...it may thaw as it moves into warmer air toward the bottom of the thunderstorm.
- But...our little half-frozen droplet may also get picked up again by another updraft...carrying it back into very cold air and re-freezing it. With each trip above and below the freezing level our frozen droplet adds another layer of ice.
- Finally...our frozen water droplet...with many layers of ice - much like the rings in a tree...falls to the ground - as hail!









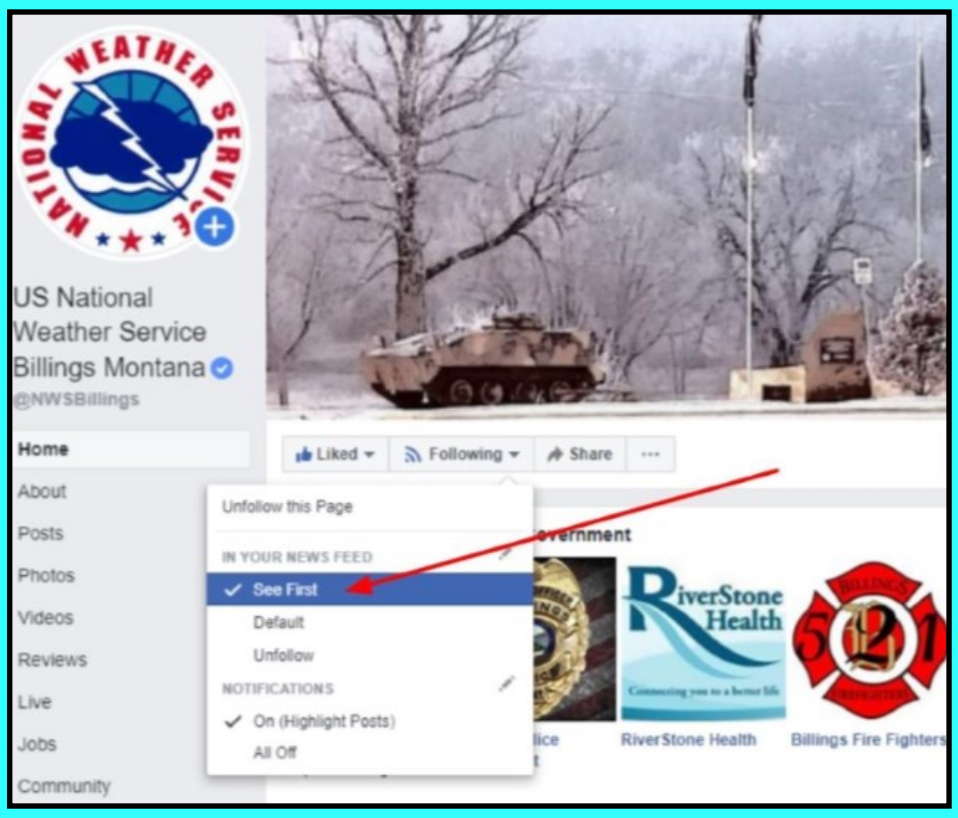



Social Media

By Nick Vertz, Meteorologist

Facebook & Twitter

On top of receiving our forecasts and watches, advisories, or warnings through our website, the T.V., or weather radio, we are also very active on both Facebook and Twitter, and use it as another avenue of getting information out to the public. Everyday, our meteorologists strive to use social media to get information out to even more people, whether it be some of our more important products (such as tornado warnings), to letting people know of slick roads for their morning commute, or even as simple as a 7 day outlook to let people know about the upcoming week's weather. Whether you use Facebook or Twitter through a website or an app, you'll see the same information from us! However, you should know that Facebook will sometimes not immediately show you our posts, but there is a solution to fix this. Go to our facebook page, click on "Following", then click on "See First". Just like that, you will always see our posts first!



Besides our forecasts and current conditions, we also use social media for fun and informative reasons as well! If the weather is slow, we'll use it to show cool weather images from the area and introduce fun weather tidbits such as unique temperature or precipitation records for southeast Montana and northern Wyoming and summarize the past month or year's weather. We also do a photo contest, where anyone can submit their favorite weather photos, and the winners become our cover photos for the next month! Arguably our favorite thing to use Facebook and Twitter for is to interact with all of you. If you ever have questions regarding current or upcoming weather, or would like to report any weather, we encourage you to message us, and we'll be in touch with you right away!

Facebook: https://www.facebook.com/NWSBillings/

Twitter: https://twitter.com/NWSBillings

Severe Weather Watches, Warning, and Advisories

NATURE'S MOST VIOLENT STORMS

Tornado Watch

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

Tornado Warning

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

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.

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.

Significant Weather Advisories 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 Weather Safety Tips

Are you prepared for Spring/Summer Weather Hazards?

https://www.weather.gov/wrn/

Flash Flood

A sudden inundation of water in low-lying areas, usually brought on by heavy rain, dam breaks, rapid snowmelt or ice jams.

- 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.
- Avoid rising creeks, streams and rivers.

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 your home is prepared.

Lightning

There is no safe place outside when thunderstorms are in the area. **When thunder roars, go indoors!**

Wind & Hail

Move indoors away from windows.

Weather Education

Are you looking for at-home weather education materials?

We can help!

Check out our education resources at:
https://www.weather.gov/learning

INFORMATION STOP

Stay Informed During Hazardous or Severe Weather

Severe Weather Preparedness:

http://www.nws.noaa.gov/om/thunderstorm/

Lightning Safety:

http://www.weather.gov/safety/ligthning-safety

Flood Safety:

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

Advanced Hydrologic Prediction Services (Rivers and Lakes):

http://water.weather.gov/

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