Summer 2019
Volume 8, Issue 2

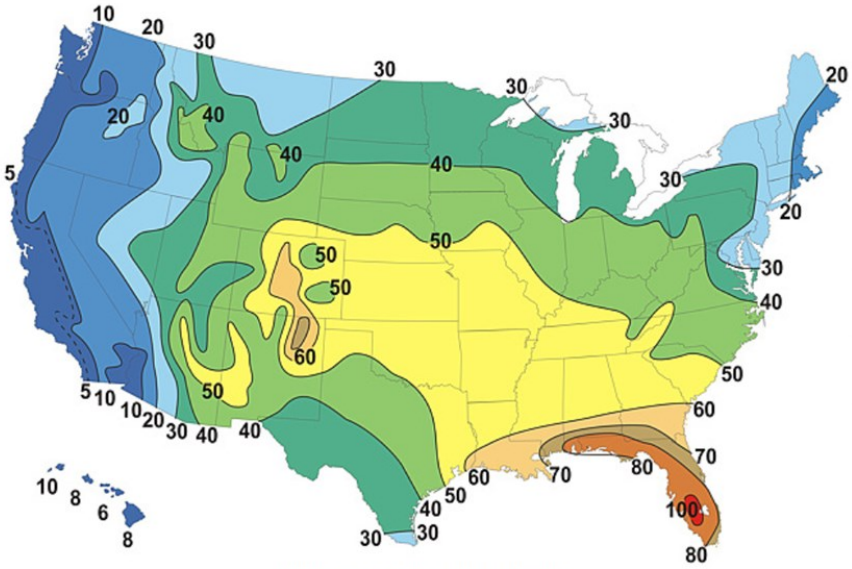
NATIONAL WEATHER SERVICE - MEDFORD, OREGON

THE CRATER CHRONICLE

Thunderstorms, Take 1

Ryan Sandler, *Acting Meteorologist-In-Charge*

Here in southern Oregon and far northern California there are relatively few thunderstorms and even fewer severe storms compared with other areas of the United States (Figure 1). Let's talk about why this is the case by beginning with the necessary ingredients for a thunderstorm: moisture, instability, and lift.



Annual number of thunderstorms the U.S.

Summer begins on June 21st at 8:54 am PDT.

INSIDE THIS

Moisture:

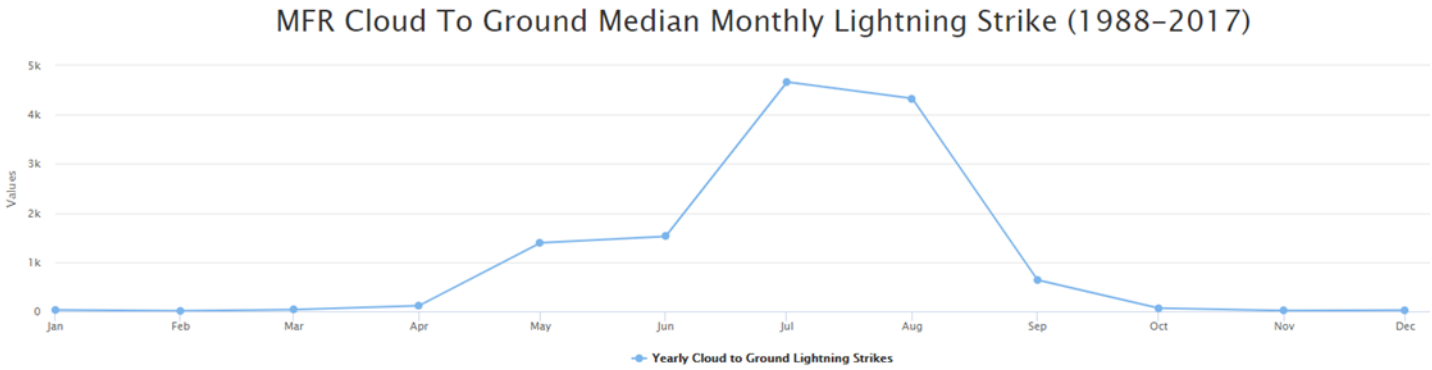
The best source of moisture is a warm ocean. Warm ocean air can blow far distances over land causing humid conditions with lots of potential evaporation to form big clouds. In our neck of the woods, we have very cool ocean temperatures, mainly in the 50s year-round. Ocean water at 80 degrees F. can evaporate more than three times the amount of moisture into the air than water at 50 degrees F.

Instability:

Air is unstable if it continues to rise when given a nudge upward . An unstable air mass is characterized by warm moist air near the surface and cold dry air aloft. In other words, less dense air below more dense air is inherently unstable. In summer, the cool and dense ocean sea breeze off the Oregon and northern California coasts creates more stability. A strong summer sea breeze can send stable air well inland.

In our region the primary mechanism for lift is simply the mountains. On a typical summer afternoon, the air heats up and the wind blows up the mountains creating lift. Paragliders on Woodrat Mountain, near the Applegate Valley, know a lot about this lift (left figure). This is why thunderstorms typically form over the mountains and can sometimes drift over the valleys. Fronts and low pressure centers are also mechanisms of lift but these are less common here in the summer because the jet stream and clash of air masses typically occurs well north of our area in Canada.

The figure below shows the median number of cloud to ground lightning ground strikes by month over the nine counties in our forecast area (Coos, Curry, Douglas, Josephine, Jackson, Klamath, Lake, Siskiyou, and Modoc counties). July and August stand out with around three times the number of strikes compared with May and June. There are very few ground strikes between September and April due to less heating and more stable air masses.



Our region is a good place to live if you have astraphobia, a fear of thunder and lightning. Astraphobia is the 6th most common phobia and may affect 2% of Americans. It's natural to fear lightning and nearly 30 people in the United States are killed by lightning each year and many more are injured. This is the reason the National Weather Service has the safety message ***"When Thunder Roars, Go Indoors!"*** National Lightning Safety Awareness Week is June 23 - 29 this year and a great website is https://www.weather.gov/safety/lightning

Science Factoid: Moist air more or less dense than dry air?

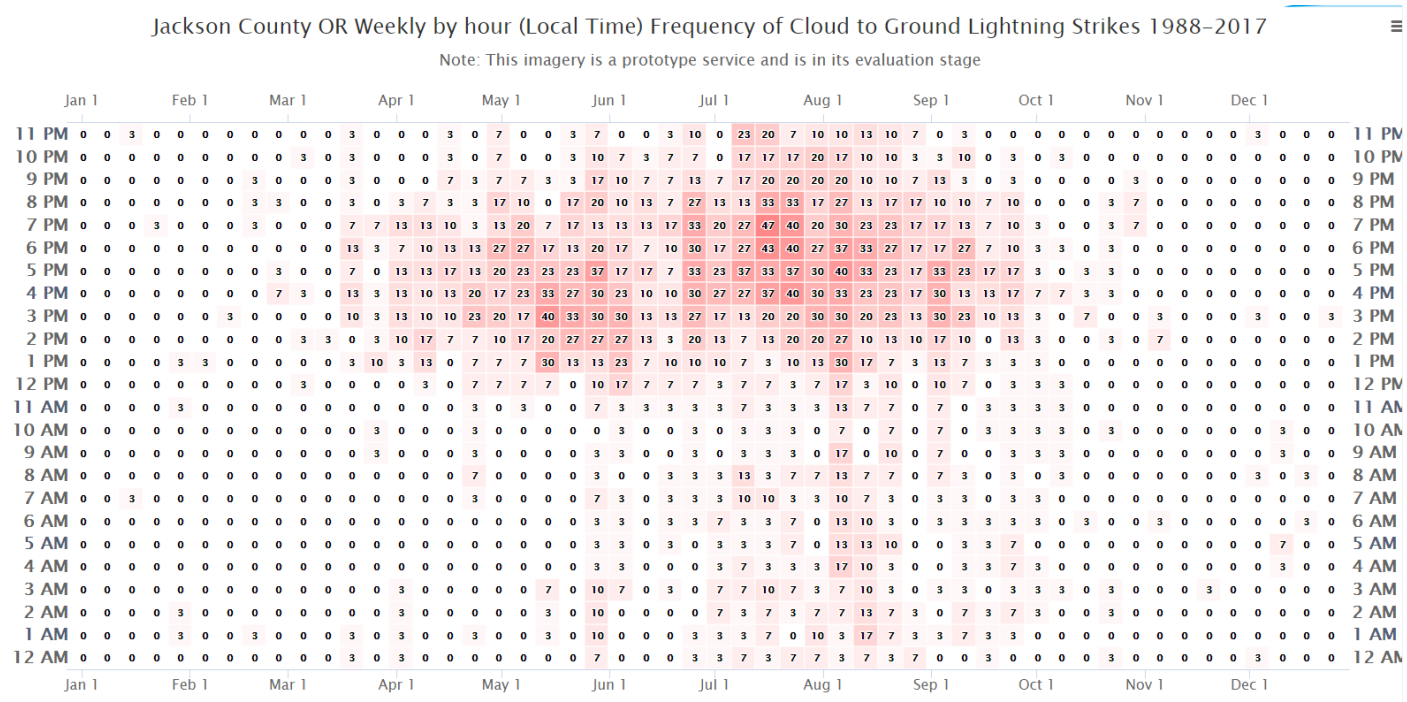
Moisture-laden air is actually less dense than dry air. The atomic weight of water vapor (water in a gaseous phase) is 18—two hydrogen atoms total 2 and one oxygen atom at 16. The atomic weight of dry air is mostly due to Nitrogen and Oxygen and is about 29. Therefore, when water vapor is added to dry air, it makes that gas less dense than totally dry air. In a practical sense, if you hit a baseball in completely dry air, and hit another baseball exactly the same way in moist air, the baseball would travel farther in moist air! So why does moist air feel heavy to some? It's likely because your body has a harder time cooling itself in humid conditions and it can sap one's energy.

Thunderstorms and Lightning, Take 2

Shad Keene, *Meteorologist*

More lightning and thunderstorm information! Since last sharing some of our office's work with lightning, we've come a long way. We've fine-tuned our heatmaps imagery so they better communicate the most/least likely weeks of the year and hours that a given area can expect thunderstorms. To review, we've stored hundreds of millions of lightning strikes from 1988-2018 in a database and have created queries that summarize this data for different types of geographic areas. Each area, whether it's a county, fire weather zone, or airport boundary, has a unique image, kind of like a thunderstorm fingerprint. Let's take a look at Jackson County lightning frequency and total lightning through the year.

If you look closely at this small image, you can see two "hotspots". The first is in late May and early June, and the second is July through early August. These represent relative maximums in thunderstorms occurrence.



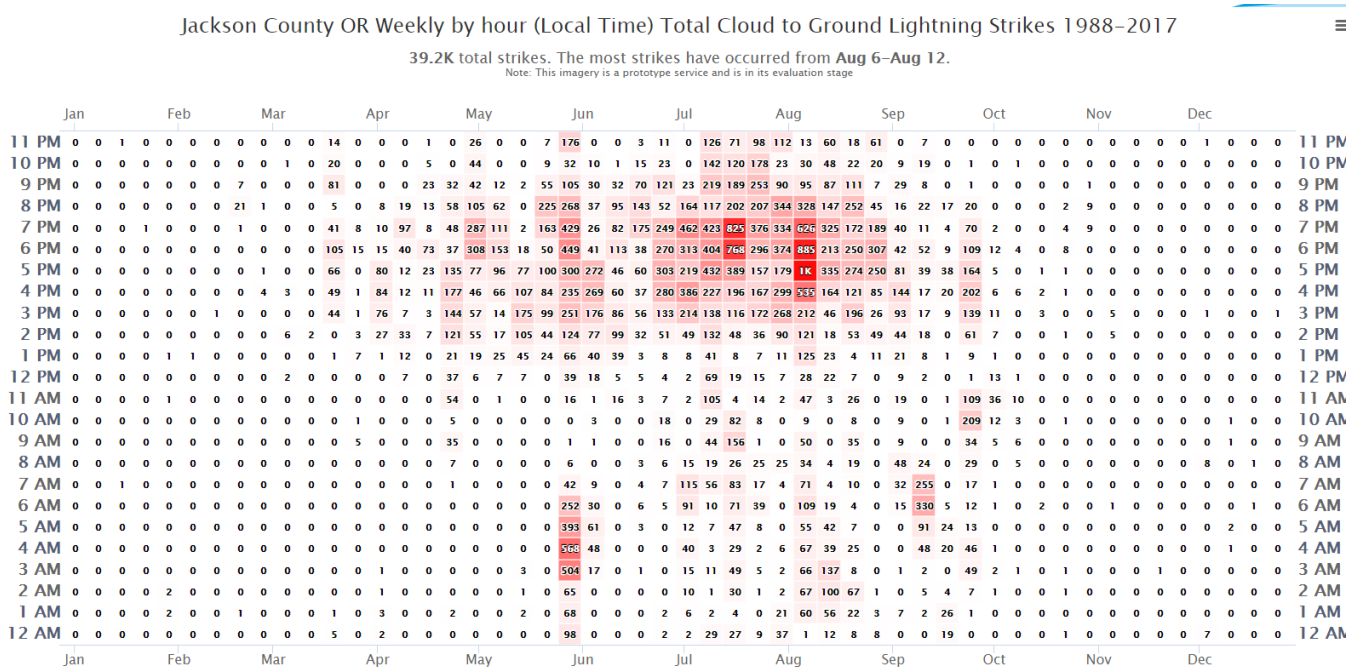
Lightning climatology heatmap that shows percent of years between 1988 and 2017 where at least one lightning strike was observed in a given hour and week of year for Jackson County.

The numbers represent the percentage of years from 1988-2017 where at least one lightning strike was observed in a given hour and week of the year. The first maximum represents the time of the year when we still have some cold fronts moving through the forecast area, bringing in some cold air aloft and increasing instability. This cold air aloft combines with increased surface heating due to the May sun angle to generate thunderstorms. The next maximum represents the time of year when we see increasing moisture from the south and east, commonly referred to as monsoonal moisture. This moisture supports thunderstorm development.

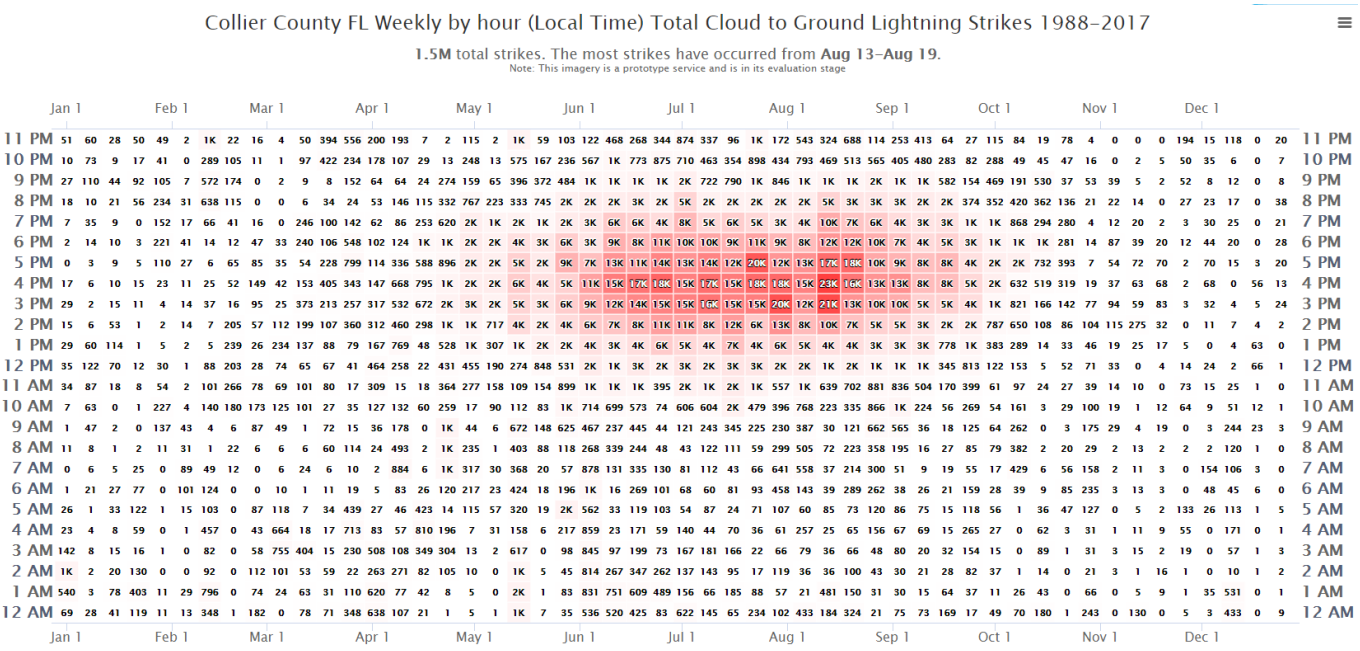
Thunderstorms and Lightning, Take 2 Cont.

Shad Keene, *Meteorologist*

The frequency imagery doesn't really tell us which of these maximums brings us the highest number of cloud to ground lightning strikes. For that insight, we've created heatmaps that show the total number of lightning strikes per hour per week of the year over the 30 year period. It's clear from this imagery that the bulk of lightning strikes occur in the second maximum, during late July and early August.

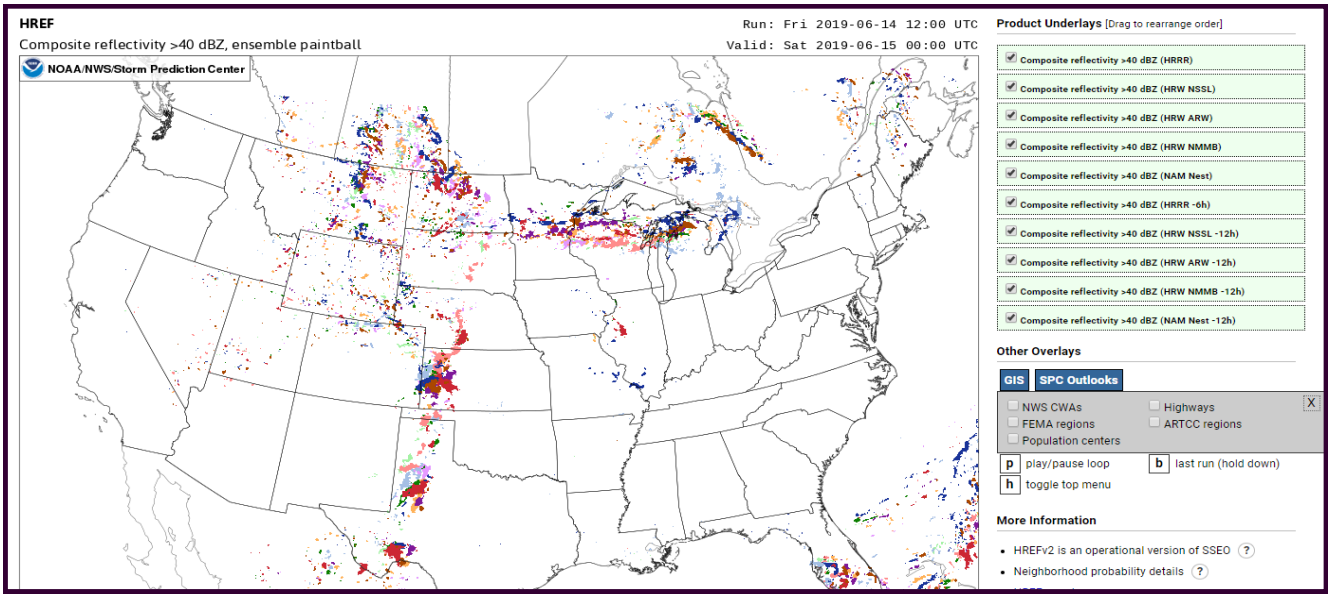


And just for fun, here's the totals heatmap for Collier County, FL, an area with one of the highest lightning strike densities in the country. We hope to be able to share all this imagery and more with you in the coming weeks, after its been through the full approval process.



Thunderstorms and Lightning Take 3!

Shad Keene, *Meteorologist*



Storm Prediction Center High Resolution Ensemble Forecast (HREF) Web Page

---

Thunderstorms and lightning have a huge impact on our area and society in general. They're also very difficult to forecast in the varied terrain of our forecast area. There's been a surge of data that we can use to track and analyze thunderstorms in real-time, and there's also been an uptick in tools that help us forecast thunderstorms out to 48 hours.

To help forecast thunderstorms, some newer computer models have higher resolution to help allow for convection. We call these Convection Allowing Models or CAMs. Convection is the rising of air in response to heating at the surface or cooling of air aloft. In order to allow for convection in a computer model, the model has to resolve features of less than or equal to 4km (2.5 miles). Commonly-known global models like the GFS have higher resolutions of about 13km. To learn more about CAMs, check out this document.

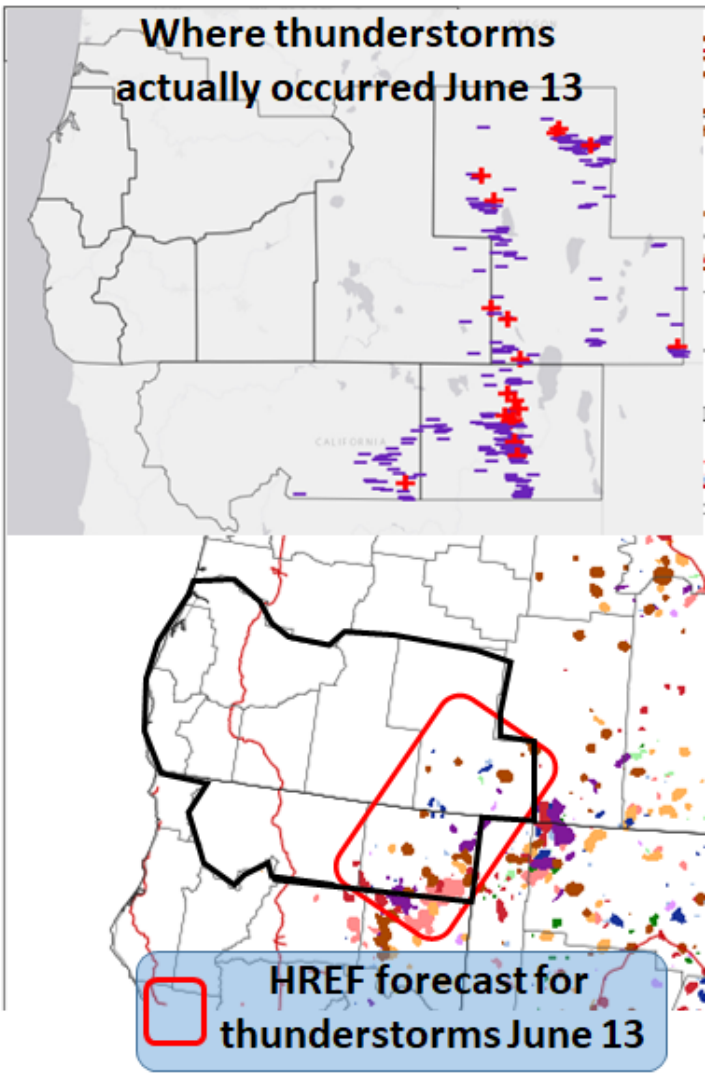
https://www.weather.gov/media/crp/CAMs_Collins_2019.pdf

Moving forward from all that technical stuff, we now have a suite of CAMs to view. This not only can help us identify if thunderstorms will form, but it can help us determine the coverage and even the strength of storms. As with all additional data that are available to us, one of the challenges is viewing and analyzing all this additional data. This is where some really smart developers at the Storm Prediction Center in Normal, OK have saved the day! Their High Resolution Ensemble Forecast (HREF) web page (above image) is chock full of amazing imagery. They've developed a "paintball" graphic that depicts expected thunderstorm activity from all 5 CAMs in one image.

The image below, a forecast made the afternoon of June 12, suggests that out of our 9 county forecast area, thunderstorms would be focused over Modoc and Lake Counties on the afternoon of June 13 (red outline). What actually happened on June 13 was similar. The observations didn't match the model output exactly, but it was close, and this is extremely beneficial when forecasting when and where thunderstorms will form during fire season. This is a tool that can help us communicate timing, locations, and coverage of lightning for the public and partner agencies that are most affected by summer lightning, such as ODF, CalFire, USFS, BLM, and others.

If you're interested in CAMs and exploring the latest data, I encourage you to take a look at the SPC HREF ensemble viewr here: https://www.spc.noaa.gov/exper/href/ The most recent paintball graphics for the Pacific Northwest can be found here:

https://www.spc.noaa.gov/exper/href/?model=href&product=cref_pb40&sector=nw



Hot and Cold: Lighting and Cold Water Myths and Facts

Myth: If it's not raining or there aren't clouds overhead, you're safe from lightning.
Fact: Lightning often strikes more than three miles from the center of the thunderstorm, far outside the rain or thunderstorm cloud. "Bolts from the blue" can strike 10-15 miles from the thunderstorm.

Myth: Strong swimmers are fine if they fall into cold water.

Fact: Even strong swimmers will lose muscle control in 10 minutes in cold water. Life jackets significantly increase the chance for survival in cold water.

Fact: Lightning is hotter than the surface of the Sun and can reach temperatures around 50,000° Fahrenheit.

Myth: Area waters become warm in the summer.

Fact: River and coastal water temperatures can stay in the 50s through the summer.

Data sources: https://www.weather.gov/safety/lightning, https://www.weather.gov/safety/lightning-myths, https://maps.waterdata.usgs.gov/mapper/index.html

National Weather Service - Medford, Oregon

National Weather Service
Medford Weather Forecast Office
4003 Cirrus Drive
Medford, OR 97504-4198

Phone: (541) 773-1067
Email: ryan.sandler@noaa.gov

Newsletter Editor:
Shad Keene, Meteorologist
Email: noel.keene@noaa.gov

Visit Our Website!

http://www.weather.gov/medford

Find us on Facebook

www.facebook.com/NWSMedford

twitter

www.twitter.com/NWSMedford

Our Vision

Professionals focusing on science, teamwork, and customer service to design and deliver the best decision-support information to our community.

Our Mission

Our team at the National Weather Service Office in Medford strives to deliver the best observational, forecast, and warning information through exceptional customer service, extensive training and education, maintaining quality electronic systems, and relying upon an outstanding team of weather spotters and cooperative observers. We do this within the overall mission of the NWS to build a Weather-Ready Nation:

To provide weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community.

Our Values

Trust, Integrity, Professionalism, Service, Teamwork, Ingenuity, Expertise, and Enthusiasm.

About Us

The Weather Forecast Office in Medford, Oregon, is one of more than 120 field offices of the National Weather Service, an agency under the National Oceanic and Atmospheric Administration and the United States Department of Commerce. The Weather Forecast Office in Medford serves 7 counties in southwestern Oregon and 2 counties in northern California, providing weather and water information to more than a half-million citizens. We are also responsible for the coastal waters of the Pacific Ocean from Florence, Oregon, to Point St. George, California, extending 60 miles offshore. The office is staffed 24 hours a day, 7 days a week, and 365 days a year by a team of 26 meteorologists, hydrologists, electronic technicians, hydrometeorological technicians, and administrative assistants.