

June 13, 2025

National Centers for
Environmental Information (NCEI)

National Oceanic and
Atmospheric Administration (NOAA)

NOAA Atlas 15 Overview

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RIVERSIDE

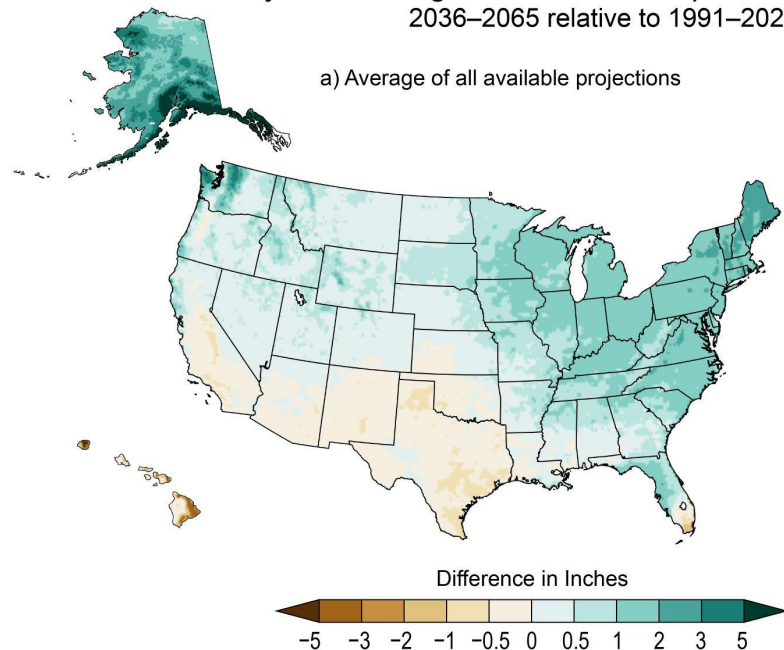
Objectives

- Provide an overview of precipitation in the US and how it is expected to change.
- Demonstrate the NOAA Atlas 15 Pilot website and its major features.
- Answer initial questions and discuss initial feedback on the NOAA Atlas 15 Pilot.

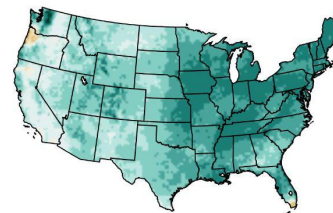
Precipitation Trends

Precipitation Trends in the United States

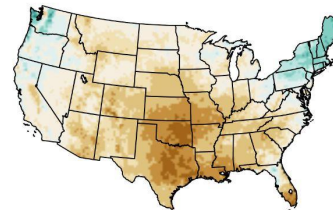
Projected Changes in Annual Precipitation by Midcentury
2036–2065 relative to 1991–2020



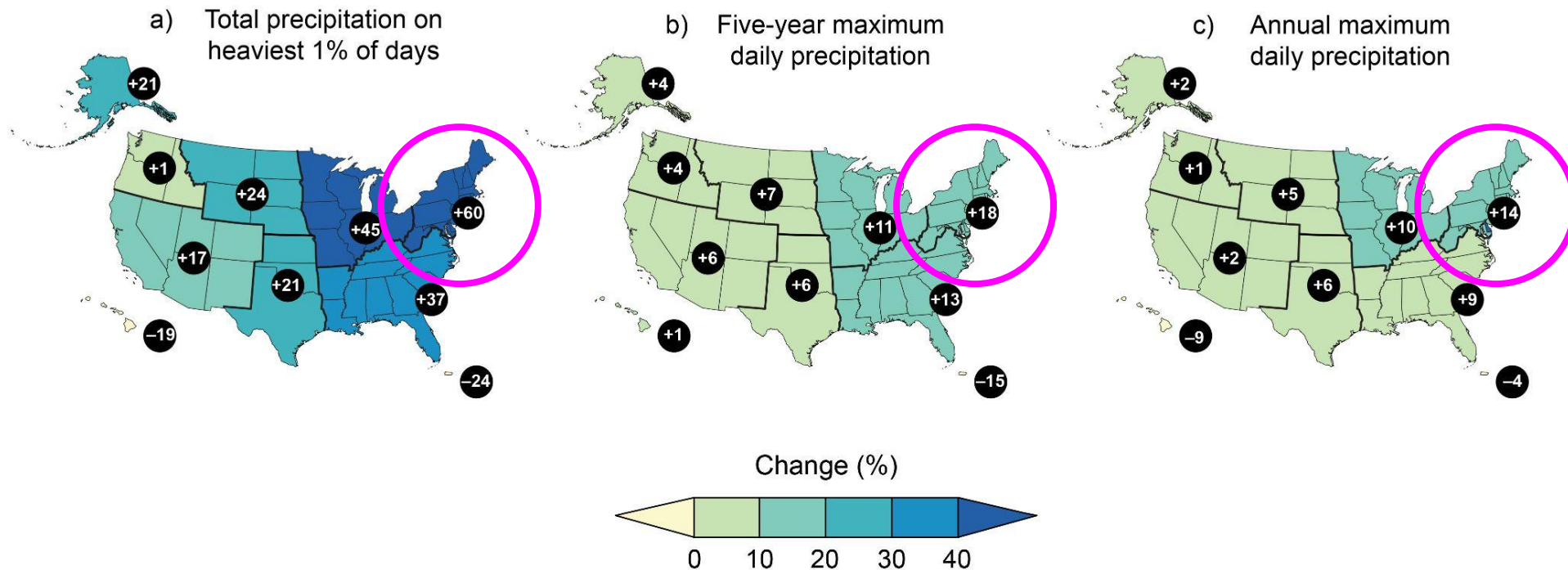
b) Average of wettest 20% of projections



c) Average of driest 20% of projections



Observed Changes in the Frequency and Severity of Heavy Precipitation Events

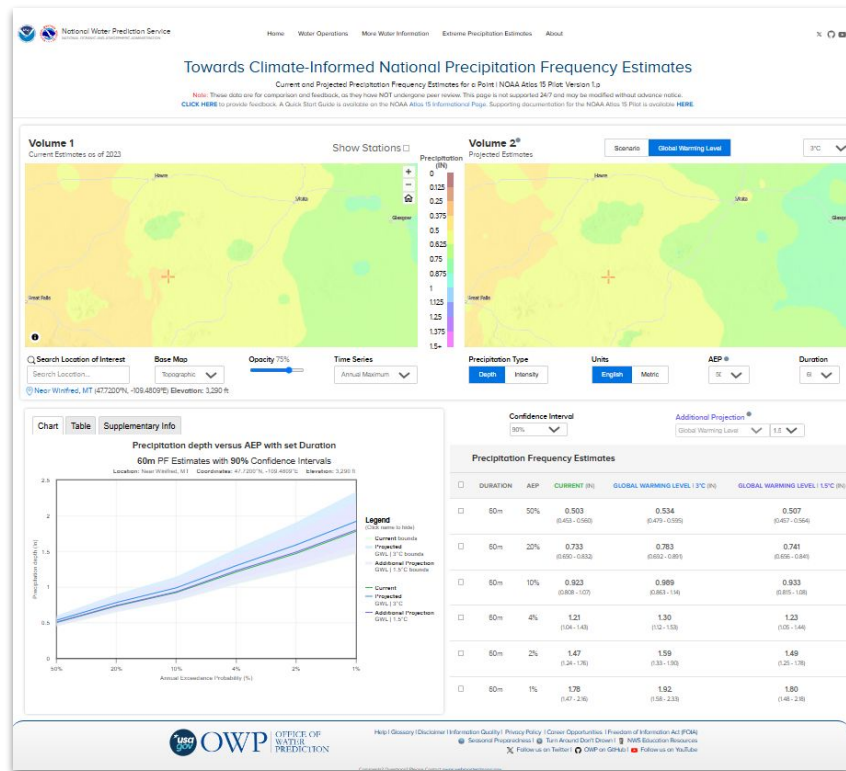


Source: Fifth National Climate Assessment

Introduction to Atlas 15

Atlas 15: New Precipitation Frequency Estimates

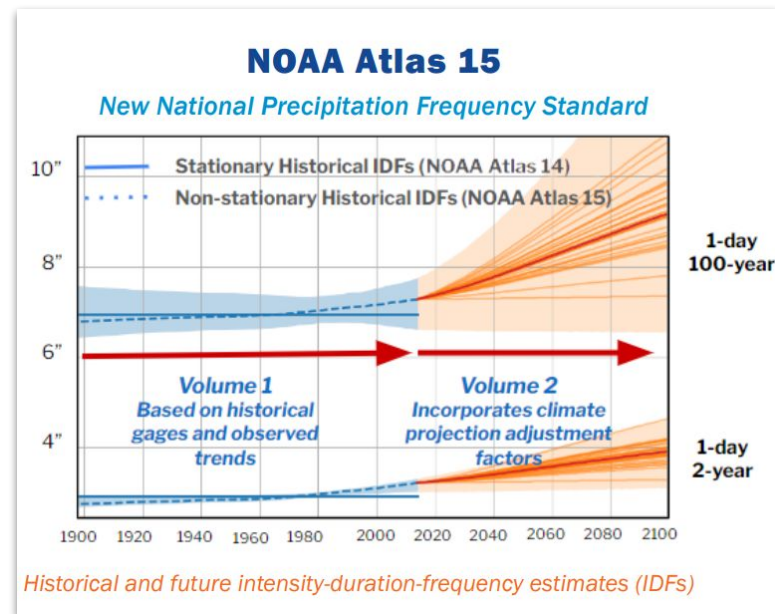
- A next-generation precipitation frequency (PF) study by NOAA's Office of Water Prediction
- NOAA Atlas 15 will:
 - Update the NOAA Atlas 14 precipitation frequency standard while **accounting for changing environmental conditions**
 - Provide estimates for the **entire U.S. and its territories**



Montana Pilot: Presented in Two Volumes

- **NOAA Atlas 15, Volume 1** updated precipitation frequency estimates for the entire country based on historical data and observed trends.
- **NOAA Atlas 15, Volume 2** provided precipitation frequency estimates projected into the future, utilizing climate model information.

Note: At this time, the full release of NOAA Atlas 15 will contain one volume that will be based on best available historical precipitation data, will include a nonstationary statistical methodology, and will deliver spatially consistent, present day, precipitation frequency estimates, nationwide.



Improving Service Delivery for NOAA Products

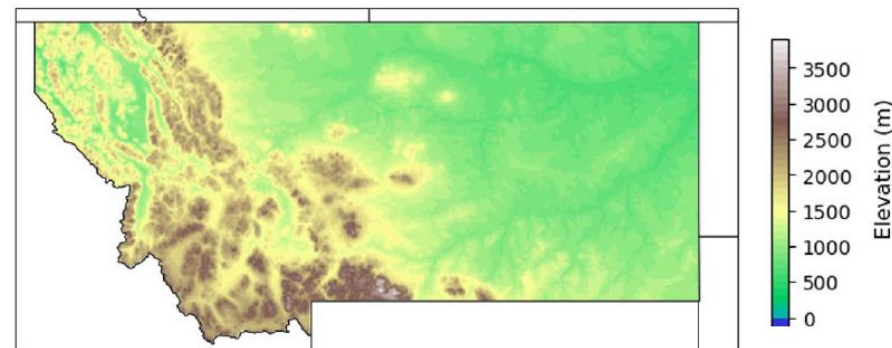
- Since early 2023, NOAA has been working to **update some of its extreme precipitation products**, such as NOAA Atlas 15 and Probable Maximum Precipitation estimates.
- NOAA was challenged to incorporate the Service Delivery Framework and **continuous engagement** to ensure products are delivered in a way that addresses user needs.



Graphic from [A Model of Service Delivery for the NOAA Water Initiative](#) (2020)

NOAA Atlas 15 Pilot: Montana

- Montana was selected for the NOAA Atlas 15 pilot due to its diverse terrain and availability of high-quality precipitation data from Atlas 14.
- The pilot provides high-resolution PF estimates on a 30-arc second grid ($\sim 0.9 \text{ km} \times 0.6 \text{ km}$) for 1-hour to 10-day durations and 1% to 50% exceedance probabilities.



NOAA Atlas 15 pilot domain

NOAA Atlas 15 Pilot vs. Full Release

	Pilot	Full Release
Spatial Coverage	Montana	United States and Territories
Storm Durations	1-hour to 10-days	5-minutes to 60-days
Exceedance Probabilities (AEPs)	50% to 1%	63% to 0.1%
Methods	Preliminary	Fully Developed

Methods: Atlas 15 Vol. 1 Pilot

Datasets

- Atlas 14 Vol. 12
- Annual Maximum Series (AMS) data
- Gridded Climate Data (MAM, MAP)
- Global Temperature Anomalies
- Digital Elevation Models

Results in more accurate and reliable estimates

Statistical Modeling

- Nonstationary techniques
- Extreme value statistical techniques (GEV and MLE)

Enhances estimates and incorporates changing conditions

Regionalization

- The values in each area use regional data (from nearby stations)
- That station data is weighted based on a variety of factors (e.g., elevation, distance)

Fully automated, meaning more efficient and objective

Interpolation

- Used to translate data from point-based (individual stations) to gridded
- Based on linear relationship between PRISM-based MAM and estimates at the consecutive exceedance probabilities.

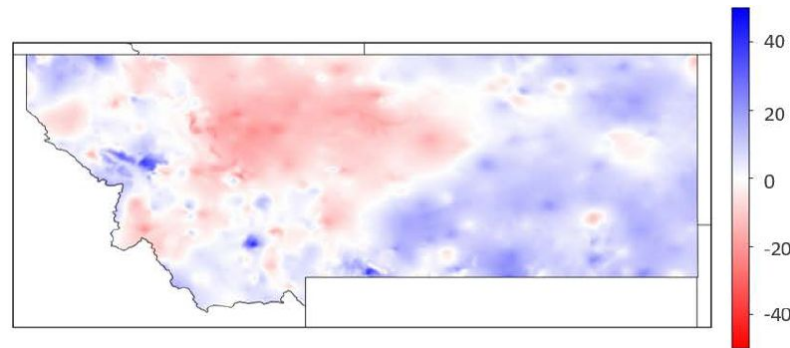
Uses best available historical data

Output

- A gridded dataset that incorporates statistical nonstationarity
- An update to the entire nation using historical data through 2023

Comparison of Atlas 15 and Atlas 14 Models

- Atlas 15's nonstationary models provide more reliable PF estimates than Atlas 14's stationary models, especially in regions with changing rainfall patterns
- Atlas 15 estimates differ by up to 20% compared to Atlas 14
- Largest variations occur in areas experiencing climate-driven precipitation changes



Relative differences (%) between Atlas 15 and 14 PF estimates (60-min durations and AEP = 1%). Blue indicates areas of higher Atlas 15 values and red indicates areas of higher Atlas 14 values.

Atlas 15 Website Demonstration



Towards Next Generation National Precipitation Frequency Estimates

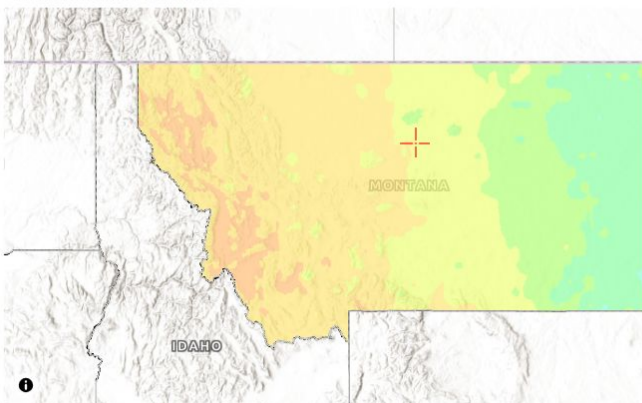
Current and Projected Precipitation Frequency Estimates for a Point | NOAA Atlas 15 Pilot: Version 1.p

Note: These data are for comparison and feedback, as they have NOT undergone peer review. This page is not supported 24/7 and may be modified without advance notice.

Supporting documentation for the NOAA Atlas 15 Pilot is available [HERE](#).

Volume 1

Current Estimates as of 2023



Search Location of Interest

Base Map

Topographic

Opacity 75%



Time Series

Annual Maximum

[Near Winifred, MT \(47.7200°N, -109.4809°E\)](#) Elevation: 3,290 ft

Show Stations ☐



Precipitation (IN)

0
0.125
0.25
0.375
0.5
0.625
0.75
0.875
1
1.125
1.25
1.375
1.5+

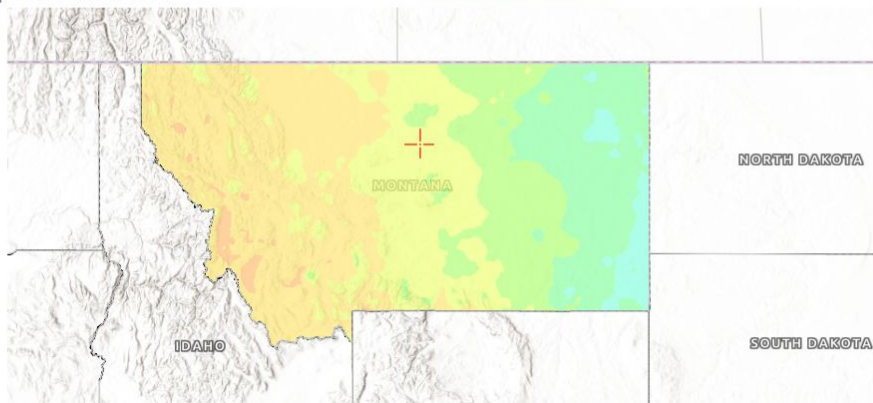
Volume 2

Projected Estimates

Scenario

Global Temperature Index

3°C



Precipitation Type

Depth

Intensity

Units

English

Metric

AEP

50%

Duration

60-min

Towards Next Generation National Precipitation Frequency Estimates

Current and Projected Precipitation Frequency Estimates for a Point | NOAA Atlas 15 Pilot: Version 1.p

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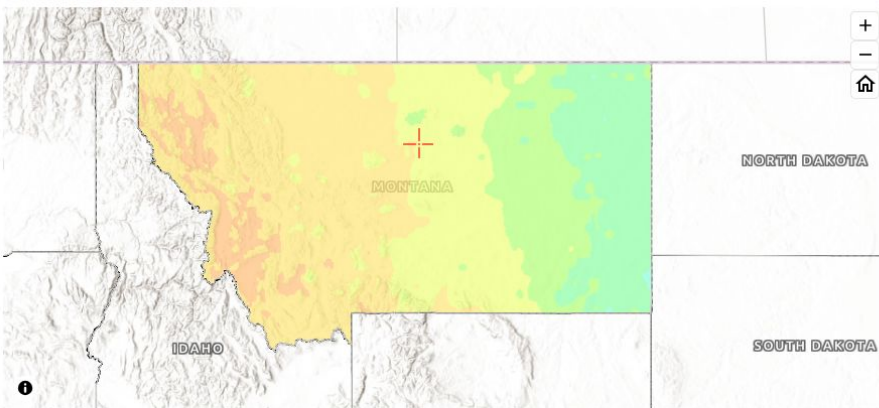
Volume 1

Current Estimates as of 2023

Show Stations ☐

Precipitation (IN)

0
 0.125
 0.25
 0.375
 0.5
 0.625
 0.75
 0.875
 1
 1.125
 1.25
 1.375
 1.5+



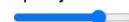
Search Location of Interest

Search Location...

Base Map

Topographic

Opacity 75%



Time Series

Annual Maximum

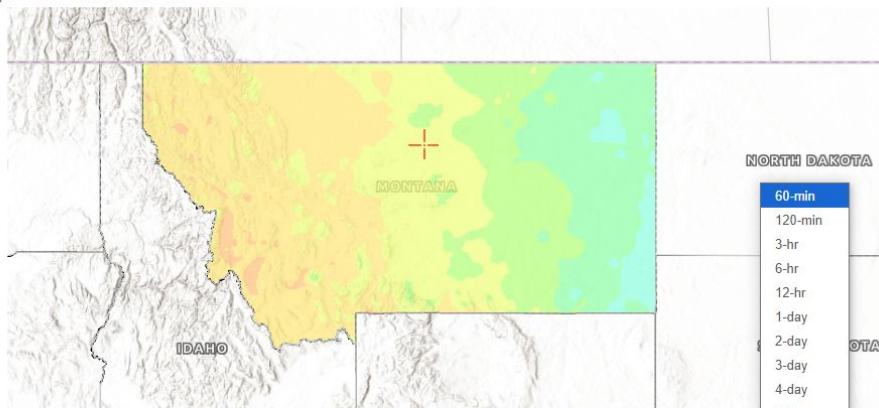
Volume 2

Projected Estimates

Scenario

Global Temperature Index

3°C



Precipitation Type

Depth

Intensity

Units

English

Metric

AEP

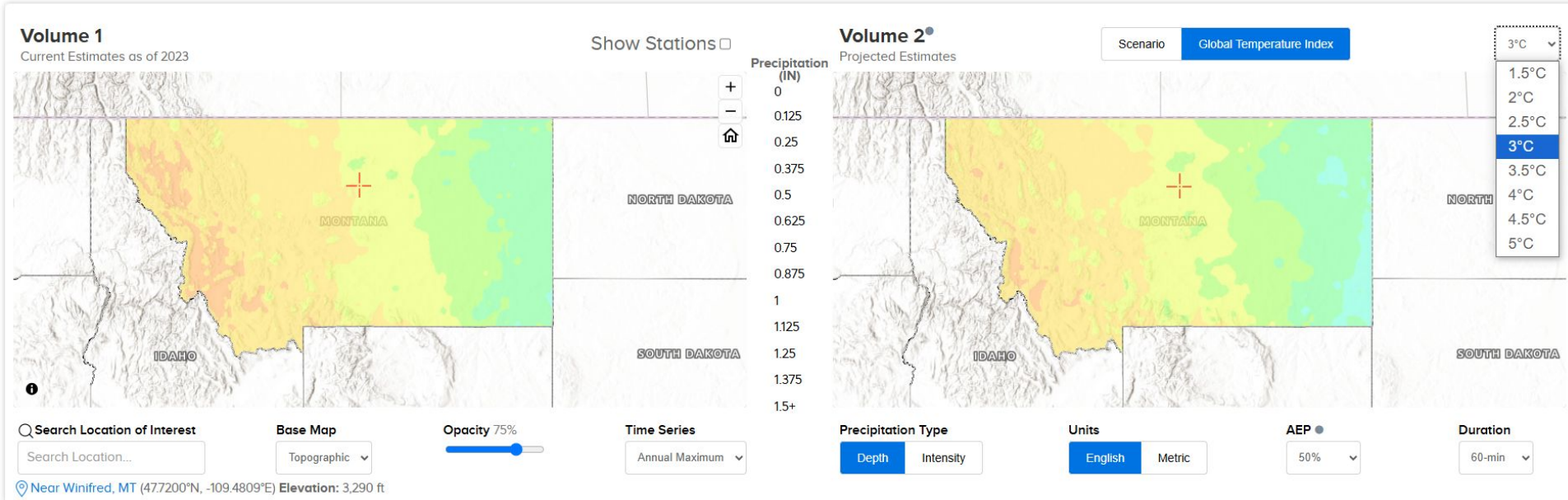
50%

Towards Next Generation National Precipitation Frequency Estimates

Current and Projected Precipitation Frequency Estimates for a Point | NOAA Atlas 15 Pilot: Version 1.p

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Towards Next Generation National Precipitation Frequency Estimates

Current and Projected Precipitation Frequency Estimates for a Point | NOAA Atlas 15 Pilot: Version 1.p

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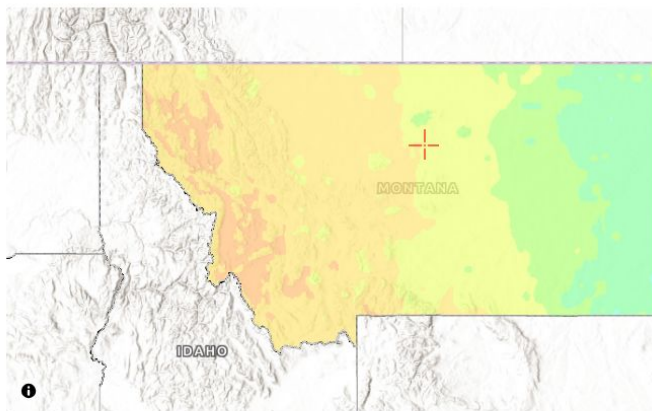
Volume 1

Current Estimates as of 2023

Show Stations ☐

Precipitation (IN)

0
0.125
0.25
0.375
0.5
0.625
0.75
0.875
1
1.125
1.25
1.375
1.5+



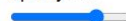
Search Location of Interest

Search Location...

Base Map

Topographic

Opacity 75%



Time Series

Annual Maximum

[Near Winifred, MT \(47.7200°N, -109.4809°E\)](#) Elevation: 3,290 ft

Volume 2

Projected Estimates

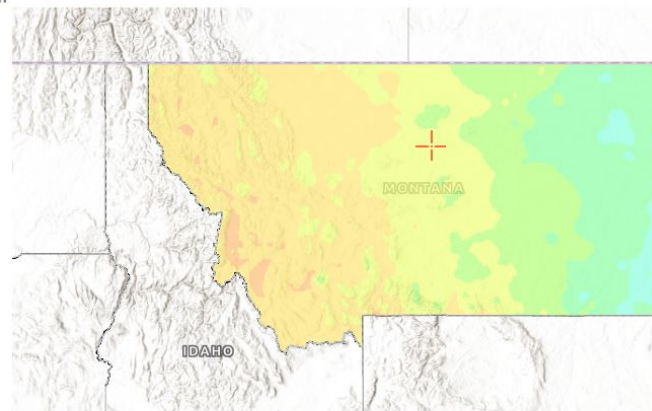
Scenario

Global Temperature Index

SSP-245

2030

2030
2040
2050
2060
2070
2080
2090
2100



Precipitation Type

Depth

Intensity

Units

English

Metric

AEP

50%

Duration

60-min

Search Location of Interest

Search Location...

Base Map

Topographic

Opacity 75%

Time Series

Annual Maximum

Precipitation Type

Depth

Intensity

Units

English

Metric

AEP

50%

Duration

60-min

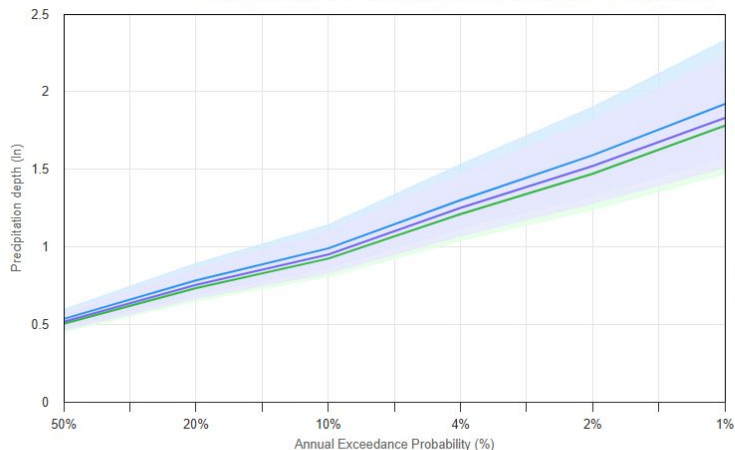
Near Winifred, MT (47.7200°N, -109.4809°E) Elevation: 3,290 ft

Chart Table Supplementary Info

Precipitation depth versus AEP with set Duration

60m PF Estimates with 90% Confidence Intervals

Location: Near Winifred, MT Coordinates: 47.7200°N, -109.4809°E Elevation: 3,290 ft



Legend

(Click name to hide)

- Current bounds
- Projected GTI | 3°C bounds
- Additional Projection GTI | 2°C bounds
- Current
- Projected GTI | 3°C
- Additional Projection GTI | 2°C

Confidence Interval

90%

Additional Projection

Global Temperature Index (GTI)

2°C

- 1.5°C
- 2°C
- 2.5°C
- 3°C
- 3.5°C
- 4°C
- 4.5°C
- 5°C

Precipitation Frequency Estimates

<input type="checkbox"/>	DURATION	AEP	CURRENT (in)	GLOBAL TEMPERATURE INDEX 3°C (in)	GLOBAL TEMPERATURE INDEX 2°C (in)
<input type="checkbox"/>	60m	50%	0.503 (0.453 - 0.560)	0.534 (0.479 - 0.595)	
<input type="checkbox"/>	60m	20%	0.733 (0.650 - 0.832)	0.783 (0.692 - 0.891)	0.754 (0.667 - 0.855)
<input type="checkbox"/>	60m	10%	0.923 (0.808 - 1.07)	0.989 (0.863 - 1.14)	0.949 (0.830 - 1.10)
<input type="checkbox"/>	60m	4%	1.21 (1.04 - 1.43)	1.30 (1.12 - 1.53)	1.25 (1.07 - 1.47)
<input type="checkbox"/>	60m	2%	1.47 (1.24 - 1.76)	1.59 (1.33 - 1.90)	1.52 (1.28 - 1.81)
<input type="checkbox"/>	60m	1%	1.78 (1.47 - 2.16)	1.92 (1.58 - 2.33)	1.83 (1.51 - 2.22)



Help | Glossary | Disclaimer | Information Quality | Privacy Policy | Career Opportunities | Freedom of Information Act (FOIA)

Seasonal Preparedness | Turn Around Don't Drown | NWS Education Resources

Follow us on X | OWP on GitHub | Follow us on YouTube

Comments? Questions? Please Contact nwps.webmaster@noaa.gov.



Chart

Table
Supplementary Info

Compare

Current AMS-based Precipitation Frequency Estimates (IN) with 90% Confidence Intervals

Annual Exceedance Probability (%)							
<input type="checkbox"/>	Duration	50% <input type="checkbox"/>	20% <input type="checkbox"/>	10% <input type="checkbox"/>	4% <input type="checkbox"/>	2% <input type="checkbox"/>	1% <input type="checkbox"/>
<input type="checkbox"/>	60 minutes	0.503 (0.453 - 0.560)	0.733 (0.650 - 0.832)	0.923 (0.808 - 1.07)	1.21 (1.04 - 1.43)	1.47 (1.24 - 1.76)	1.78 (1.47 - 2.16)
<input type="checkbox"/>	120 minutes	0.630 (0.575 - 0.692)	0.857 (0.767 - 0.961)	1.03 (0.912 - 1.18)	1.32 (1.13 - 1.53)	1.57 (1.33 - 1.86)	1.87 (1.55 - 2.25)
<input type="checkbox"/>	3 hours	0.724 (0.663 - 0.792)	0.972 (0.872 - 1.08)	1.16 (1.03 - 1.32)	1.45 (1.26 - 1.68)	1.70 (1.45 - 2.00)	1.99 (1.67 - 2.38)
<input type="checkbox"/>	6 hours	0.906 (0.833 - 0.988)	1.21 (1.09 - 1.34)	1.43 (1.28 - 1.61)	1.75 (1.53 - 2.00)	2.00 (1.73 - 2.33)	2.28 (1.94 - 2.69)
<input type="checkbox"/>	12 hours	1.14 (1.05 - 1.24)	1.57 (1.42 - 1.74)	1.89 (1.69 - 2.12)	2.34 (2.07 - 2.65)	2.71 (2.38 - 3.11)	3.12 (2.70 - 3.62)
<input type="checkbox"/>	1 days	1.41 (1.28 - 1.53)	1.99 (1.80 - 2.20)	2.43 (2.18 - 2.72)	3.06 (2.71 - 3.46)	3.59 (3.15 - 4.10)	4.16 (3.61 - 4.81)
<input type="checkbox"/>	2 days	1.64 (1.50 - 1.81)	2.33 (2.10 - 2.58)	2.84 (2.53 - 3.18)	3.55 (3.13 - 4.02)	4.13 (3.60 - 4.74)	4.76 (4.12 - 5.53)
<input type="checkbox"/>	3 days	1.79 (1.63 - 1.98)	2.53 (2.28 - 2.82)	3.07 (2.74 - 3.46)	3.83 (3.37 - 4.35)	4.43 (3.85 - 5.11)	5.09 (4.39 - 5.93)
<input type="checkbox"/>	4 days	1.92 (1.75 - 2.12)	2.70 (2.43 - 3.01)	3.27 (2.91 - 3.69)	4.06 (3.57 - 4.63)	4.70 (4.07 - 5.42)	5.37 (4.63 - 6.28)
<input type="checkbox"/>	7 days	2.21 (2.00 - 2.45)	3.11 (2.79 - 3.48)	3.75 (3.33 - 4.24)	4.64 (4.07 - 5.33)	5.34 (4.63 - 6.22)	6.09 (5.22 - 7.17)
<input type="checkbox"/>	10 days	2.48 (2.24 - 2.74)	3.47 (3.11 - 3.88)	4.17 (3.70 - 4.72)	5.13 (4.50 - 5.91)	5.89 (5.10 - 6.88)	6.70 (5.73 - 7.90)

Confidence Interval

90%

Additional Projection

Global Temperature Index (GTI)
2°C

Precipitation Frequency Estimates

<input type="checkbox"/>	DURATION	AEP	CURRENT (IN)	GLOBAL TEMPERATURE INDEX 3°C (IN)	GLOBAL TEMPERATURE INDEX 2°C (IN)
<input type="checkbox"/>	60m	50%	0.503 (0.453 - 0.560)	0.534 (0.479 - 0.595)	0.516 (0.464 - 0.573)
<input type="checkbox"/>	60m	20%	0.733 (0.650 - 0.832)	0.783 (0.692 - 0.891)	0.754 (0.667 - 0.855)
<input type="checkbox"/>	60m	10%	0.923 (0.808 - 1.07)	0.989 (0.863 - 1.14)	0.949 (0.830 - 1.10)
<input type="checkbox"/>	60m	4%	1.21 (1.04 - 1.43)	1.30 (1.12 - 1.53)	1.25 (1.07 - 1.47)
<input type="checkbox"/>	60m	2%	1.47 (1.24 - 1.76)	1.59 (1.33 - 1.90)	1.52 (1.28 - 1.81)
<input type="checkbox"/>	60m	1%	1.78 (1.47 - 2.16)	1.92 (1.58 - 2.33)	1.83 (1.51 - 2.22)

Near Winifred, MT (47.7200°N, -109.4809°E) Elevation: 3,290 ft

ChartTableSupplementary Info

Compare

Current AMS-based Projections

Duration	50%	20%	10%	4%	2%	1%
60 minutes	0.503 (0.453 - 0.560)	0.630 (0.575 - 0.692)	0.724 (0.663 - 0.792)	0.906 (0.833 - 0.988)	1.14 (1.05 - 1.24)	1.41 (1.28 - 1.53)
120 minutes	0.630 (0.575 - 0.692)	0.724 (0.663 - 0.792)	0.906 (0.833 - 0.988)	1.14 (1.05 - 1.24)	1.41 (1.28 - 1.53)	1.79 (1.63 - 1.98)
3 hours	0.724 (0.663 - 0.792)	0.906 (0.833 - 0.988)	1.14 (1.05 - 1.24)	1.41 (1.28 - 1.53)	1.79 (1.63 - 1.98)	2.21 (2.00 - 2.45)
6 hours	0.906 (0.833 - 0.988)	1.14 (1.05 - 1.24)	1.41 (1.28 - 1.53)	1.79 (1.63 - 1.98)	2.21 (2.00 - 2.45)	2.48 (2.24 - 2.74)
12 hours	1.14 (1.05 - 1.24)	1.41 (1.28 - 1.53)	1.79 (1.63 - 1.98)	2.21 (2.00 - 2.45)	2.48 (2.24 - 2.74)	
1 days	1.41 (1.28 - 1.53)	1.79 (1.63 - 1.98)	2.21 (2.00 - 2.45)	2.48 (2.24 - 2.74)		
2 days	1.64 (1.50 - 1.81)	1.92 (1.75 - 2.12)	2.21 (2.00 - 2.45)			
3 days	1.79 (1.63 - 1.98)	2.21 (2.00 - 2.45)				
4 days	1.92 (1.75 - 2.12)					
7 days	2.21 (2.00 - 2.45)					
10 days	2.48 (2.24 - 2.74)					

Compare Current to Projected Precipitation Frequency Estimates.

Location: Near WinifredCoordinates: 47.7200°N, -109.4809°EElevation: 3,290 ftProjection: GTI 3°C

AMS-based Precipitation Frequency Estimates (IN) with 90% Confidence Intervals2023AMS-based Precipitation Frequency Estimates (IN) with 90% Confidence IntervalsGTI 3°C

Annual Exceedance Probability (%)						Annual Exceedance Probability (%)							
Duration	50%	20%	10%	4%	2%	1%	Duration	50%	20%	10%	4%	2%	1%
60 minutes	0.503 (0.453 - 0.560)	0.733 (0.650 - 0.832)	0.923 (0.808 - 1.07)	1.21 (1.04 - 1.43)	1.47 (1.24 - 1.76)	1.78 (1.47 - 2.16)	60 minutes	0.534 (0.479 - 0.595)	0.783 (0.692 - 0.891)	0.989 (0.863 - 1.14)	1.30 (1.12 - 1.53)	1.59 (1.33 - 1.90)	1.92 (1.58 - 2.33)
120 minutes	0.630 (0.575 - 0.692)	0.857 (0.767 - 0.961)	1.03 (0.912 - 1.18)	1.32 (1.13 - 1.53)	1.57 (1.33 - 1.86)	1.87 (1.55 - 2.25)	120 minutes	0.669 (0.608 - 0.736)	0.915 (0.815 - 1.03)	1.11 (0.974 - 1.27)	1.41 (1.21 - 1.65)	1.69 (1.43 - 2.01)	2.01 (1.67 - 2.43)
3 hours	0.724 (0.663 - 0.792)	0.972 (0.872 - 1.08)	1.16 (1.03 - 1.32)	1.45 (1.26 - 1.68)	1.70 (1.45 - 2.00)	1.99 (1.67 - 2.38)	3 hours	0.768 (0.701 - 0.842)	1.04 (0.928 - 1.16)	1.24 (1.10 - 1.41)	1.55 (1.34 - 1.80)	1.83 (1.56 - 2.15)	2.14 (1.79 - 2.56)
6 hours	0.906 (0.833 - 0.988)	1.21 (1.09 - 1.34)	1.43 (1.28 - 1.61)	1.75 (1.53 - 2.00)	2.00 (1.73 - 2.33)	2.28 (1.94 - 2.69)	6 hours	0.961 (0.880 - 1.05)	1.29 (1.16 - 1.43)	1.53 (1.36 - 1.73)	1.87 (1.63 - 2.14)	2.15 (1.86 - 2.50)	2.45 (2.09 - 2.90)
12 hours	1.14 (1.05 - 1.24)	1.57 (1.42 - 1.74)	1.89 (1.69 - 2.12)	2.34 (2.07 - 2.65)	2.71 (2.38 - 3.11)	3.12 (2.70 - 3.62)	12 hours	1.21 (1.11 - 1.32)	1.67 (1.51 - 1.85)	2.02 (1.81 - 2.26)	2.51 (2.21 - 2.85)	2.91 (2.54 - 3.34)	3.35 (2.89 - 3.90)
1 days	1.41 (1.28 - 1.53)	1.99 (1.80 - 2.20)	2.43 (2.18 - 2.72)	3.06 (2.71 - 3.46)	3.59 (3.15 - 4.10)	4.16 (3.61 - 4.81)	1 days	1.48 (1.35 - 1.62)	2.12 (1.91 - 2.34)	2.59 (2.32 - 2.90)	3.27 (2.89 - 3.70)	3.83 (3.36 - 4.39)	4.45 (3.86 - 5.16)
2 days	1.64 (1.50 - 1.81)	2.33 (2.10 - 2.58)	2.84 (2.53 - 3.18)	3.55 (3.13 - 4.02)	4.13 (3.60 - 4.74)	4.76 (4.12 - 5.53)	2 days	1.74 (1.58 - 1.91)	2.47 (2.22 - 2.75)	3.02 (2.69 - 3.39)	3.79 (3.33 - 4.30)	4.41 (3.84 - 5.07)	5.09 (4.40 - 5.92)
3 days	1.79 (1.63 - 1.98)	2.53 (2.28 - 2.82)	3.07 (2.74 - 3.46)	3.83 (3.37 - 4.35)	4.43 (3.85 - 5.11)	5.09 (4.39 - 5.93)	3 days	1.88 (1.71 - 2.08)	2.67 (2.40 - 2.98)	3.25 (2.89 - 3.67)	4.06 (3.57 - 4.63)	4.71 (4.09 - 5.44)	5.42 (4.66 - 6.32)
4 days	1.92 (1.75 - 2.12)	2.70 (2.43 - 3.01)	3.27 (2.91 - 3.69)	4.06 (3.57 - 4.63)	4.70 (4.07 - 5.42)	5.37 (4.63 - 6.28)	4 days	2.01 (1.82 - 2.22)	2.84 (2.55 - 3.18)	3.45 (3.07 - 3.90)	4.29 (3.77 - 4.91)	4.97 (4.30 - 5.75)	5.70 (4.89 - 6.66)
7 days	2.21 (2.00 - 2.45)	3.11 (2.79 - 3.48)	3.75 (3.33 - 4.24)	4.64 (4.07 - 5.33)	5.34 (4.63 - 6.22)	6.09 (5.22 - 7.17)	7 days	2.32 (2.09 - 2.57)	3.27 (2.92 - 3.66)	3.96 (3.50 - 4.48)	4.90 (4.28 - 5.64)	5.65 (4.88 - 6.59)	6.45 (5.52 - 7.60)
10 days	2.48 (2.24 - 2.74)	3.47 (3.11 - 3.88)	4.17 (3.70 - 4.72)	5.13 (4.50 - 5.91)	5.89 (5.10 - 6.88)	6.70 (5.73 - 7.90)	10 days	2.58 (2.33 - 2.86)	3.62 (3.24 - 4.07)	4.37 (3.87 - 4.95)	5.39 (4.71 - 6.22)	6.20 (5.35 - 7.25)	7.05 (6.02 - 8.33)

Additional Projection

Global Temperature Index (GTI) 2°C

EX 3°C (IN)GLOBAL TEMPERATURE INDEX 2°C (IN)

0.516 (0.464 - 0.573)
0.754 (0.667 - 0.855)
0.949 (0.830 - 1.10)
1.25 (1.07 - 1.47)
1.52 (1.28 - 1.81)
1.83 (1.51 - 2.22)

Questions?

Provide feedback
on Atlas 15!



Thank you!
Bridget Smith | bridget.smith@noaa.gov

Connect with NCEI and the Atlas 15 Engagement Effort



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