NOAA Atlas 15: Climate Informed NOAA Precipitation Frequency Atlas of the United States

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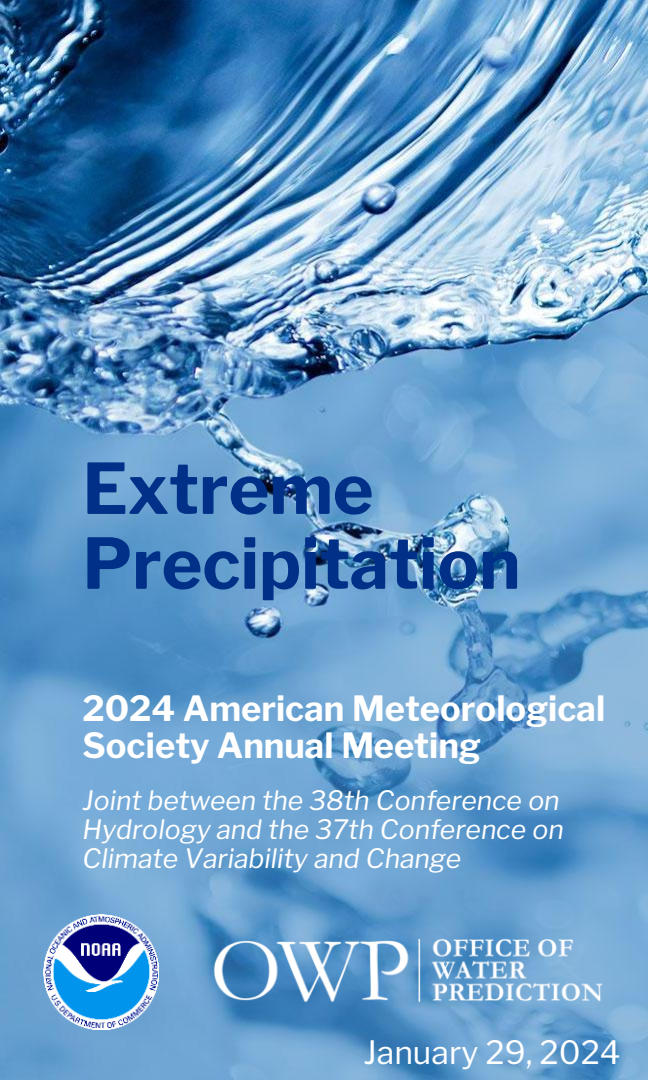


NOAA Atlas 15: Climate Informed NOAA Precipitation Frequency Atlas of the United States

Overview

Sandra Pavlovic, NOAA/NWS Office of Water Prediction

Statistical Methodology and Historical Data Repository

Debbie Martin, RTI International

Climate Projections and Scientific Challenges

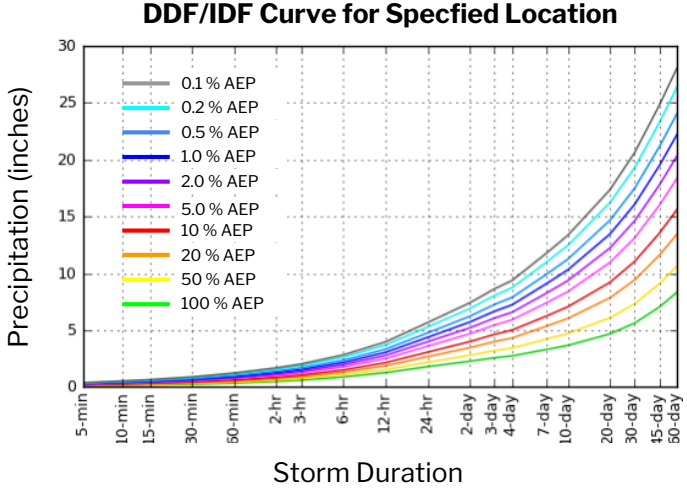
Kenneth E. Kunkel, North Carolina Institute for Climate Studies, North Carolina State Univ., Asheville, NC

CIROH

Cooperative Institute for Research to Operations in Hydrology committed to advancing research and enhancing collaboration in support of NOAA's capacity to provide actionable water resource information for forecasts, watches, warnings and related product.

What are Precipitation Frequency Estimates?

- Precipitation amounts for a specified storm duration and an annual exceedance probability (or average annual recurrence interval).
- Precipitation **D**epth (or **I**ntensity) for a specified **D**uration and **F**requency (ARI or AEP).



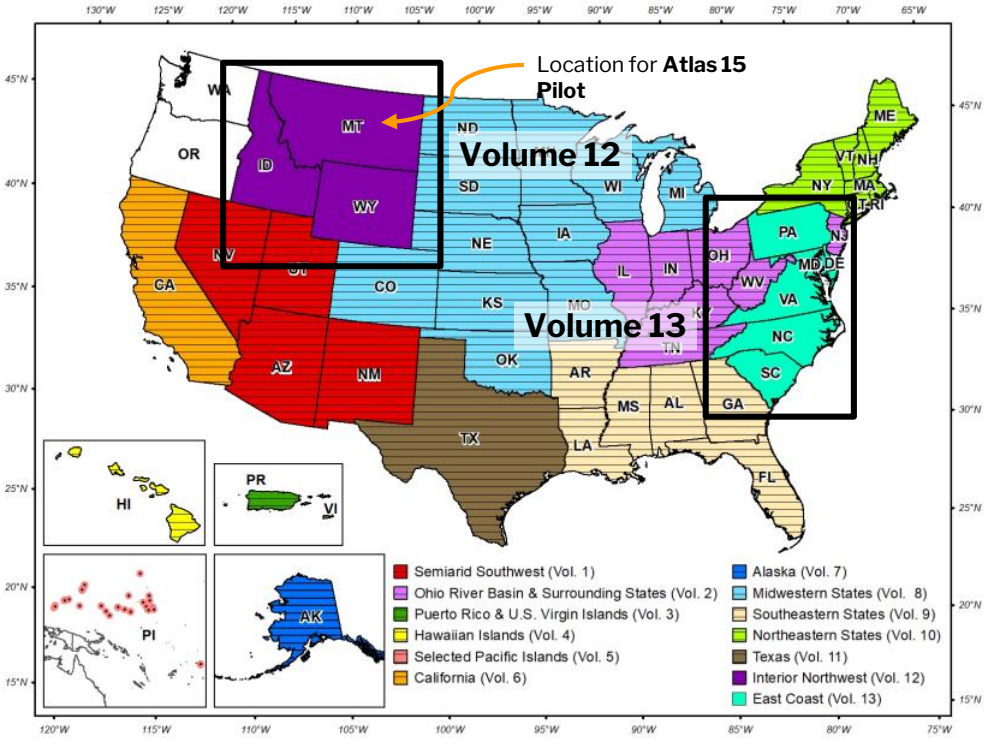
Depth-**D**uration-**F**requency (DDF) curves

Intensity-**D**uration-**F**requency (IDF) curves

How much precipitation would be expected for a storm event that is 10 days in duration and has a 1% chance of being observed?

How rare is it to observe 5 inches of precipitation over 2 days?

NOAA Atlas 14 Product Suite



Majority of built infrastructure leverages precipitation frequency data for design and planning under federal, state and local regulations

https://www.weather.gov/owp/hdsc

Volumes

- Volume 1 (2004): Semi arid Southwest
- Volume 11 (2018): Texas
- **Volume 12 (2024) :** Montana, Idaho, and Wyoming
- **Volume 13 (2025):** Mid-Atlantic

Performed at request of states and funded through FHWA

Assumption: stationary statistics

NOAA Atlas 14: The Generation of Authoritative Data Requires a Rigorous Development Process and Quality Control

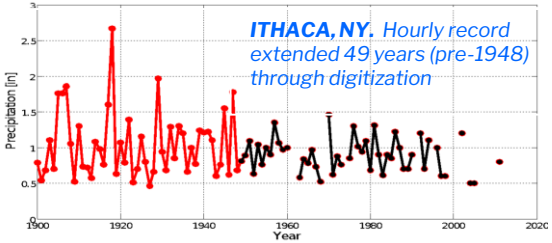
Data

- Period of record
- Missing data
- Quality Control
- Spatial Coverage

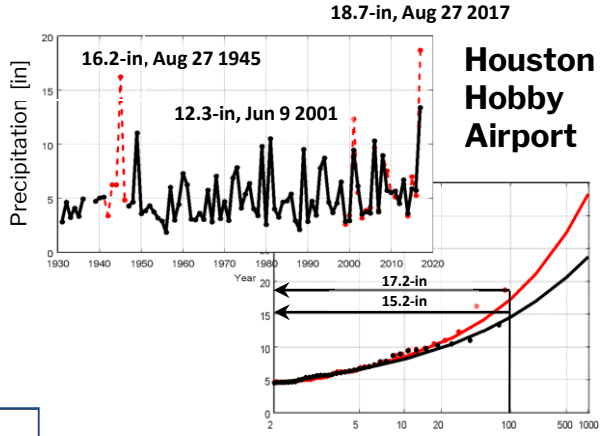
Methods

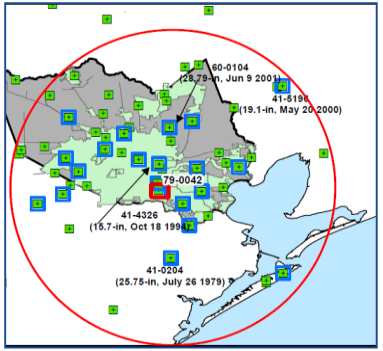
- Distribution selection
- Parameterization method
- Stationary vs non-stationary methodology
- Regionalization
- Interpolation
- Optimization & consistency checks

Missing data and digitization

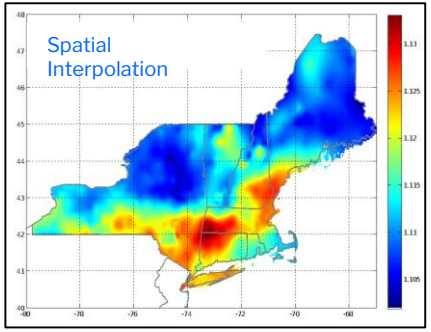


1% AEP
1.6 vs 2.5 in



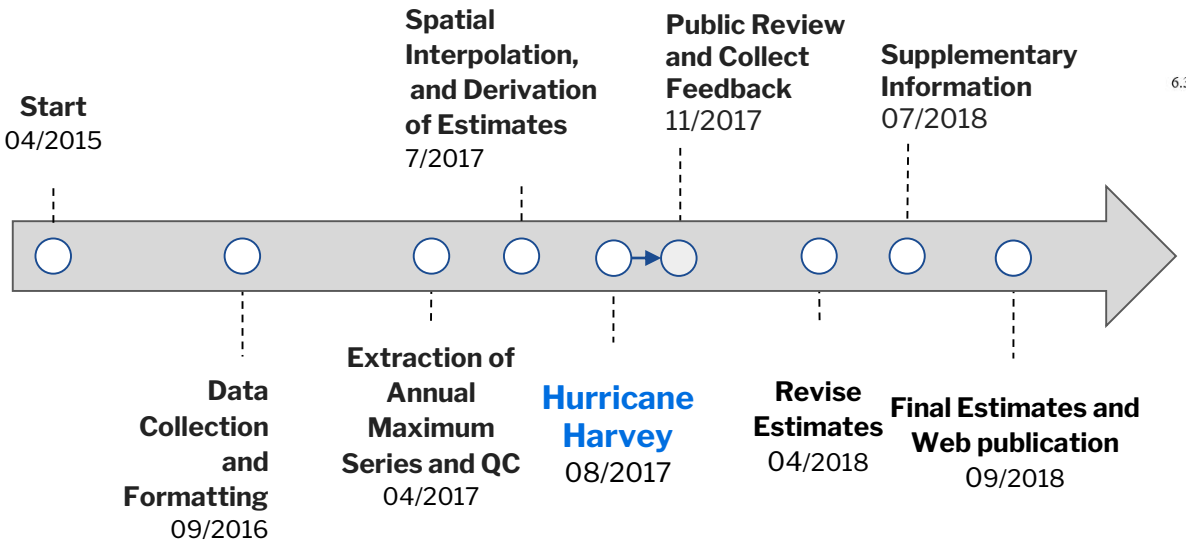


Regionalization



NOAA Atlas 14: The Generation of Authoritative Data Requires Public Review

During the production of Atlas 14 Volume 11 (Texas), the **quality control and public review process was essential** to delivering a reliable precipitation frequency product. Stakeholders deemed it necessary to include data from **Hurricane Harvey,** which **increased the product's value**.

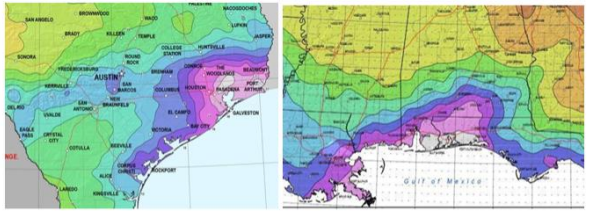


An excerpt from:

Atlas 14 Volume 11 Appendix A.4. Peer review comments and responses

6.3.8. There's absolutely no basis why Houston should be 17-18 while El Campo is 13-14. Or why Austin has a local maxima probably related to the high rain gage density there.

In fact, these spurious local maxima can be seen elsewhere too. For example, southern Alabama.



The only way to fix these issue would involve a substantial re-working of the whole method. The current method is simply: Precipitation Frequency Curve (PF) = function (gages within 50 or 100 miles around a gage of interest). Whereas the more rigorous method should be: PF Curve = function (gages within 50 or 100 miles, topography, distance from coastline, local/regional atmospheric enhancement). If you were to do that, the whole coast from Corpus Christ through Wilmington or Cape Hatteras would probably be 16+ inches for a 100-year 24-hour event, a significant increase over current values.

In NA14 we rely on regional frequency approaches to calculate estimates at one station. We use a so-called region-of-influence approach where each station has its own region with a potentially

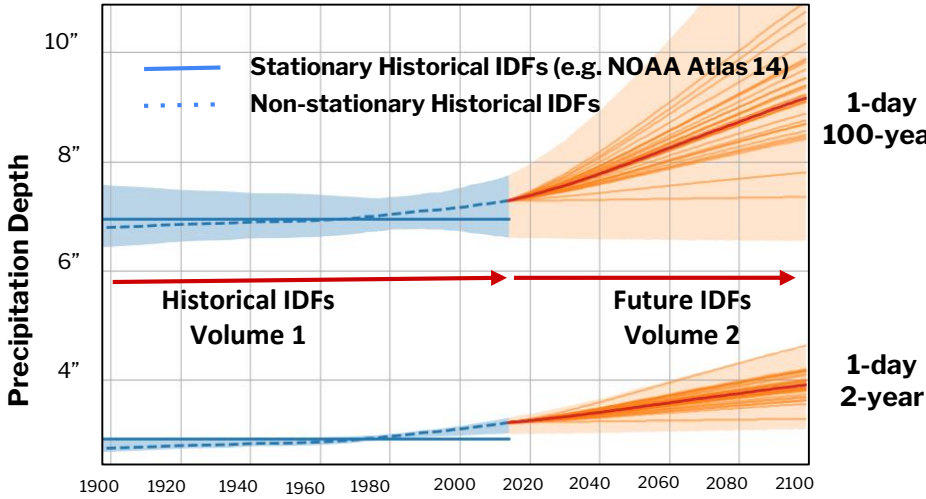
Public informed on development through HDSC Quarterly Progress Reports

NOAA Atlas 15 Methodology Accounting for Nonstationarity

"Analysis Of Impact Of Nonstationary Climate On NOAA Atlas 14 Estimates : Assessment Report"

Objective 1: Assess the suitability of state-of-the-science methodologies for nonstationary precipitation frequency analysis.

Objective 2: Evaluate downscaled global projections' ability to mimic extreme precipitation at the temporal and spatial scales needed for the engineering application.



- Result of extensive, multi-year study conducted with Penn State University, University of Illinois Urbana-Champaign and University of Wisconsin-Madison
- Testing done for Atlas 14 Volume 10 project area (Northeastern States)
- Development of methodology conducted in coordination with, and funded by DOT FHWA

The NOAA Atlas 15 Product

Volume 1: Based on historical gages and observed trends

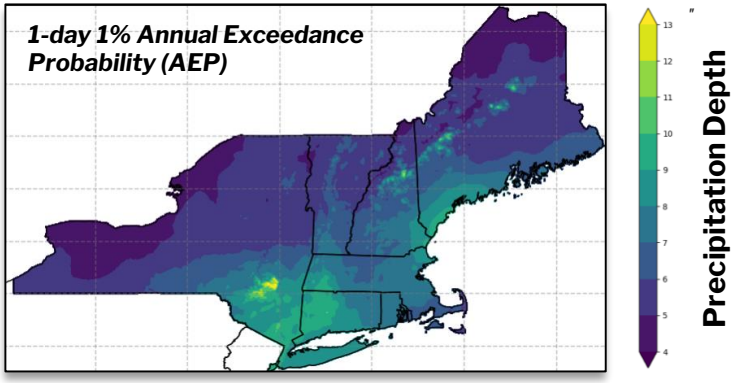
- First-ever, nationally-consistent, precip frequency data that serves as the basis for Volume 2
- Integrated terrain information
- Accounts for trends in historical observations (when it exists)
  - Non-stationary trends represents a major enhancement from Atlas 14

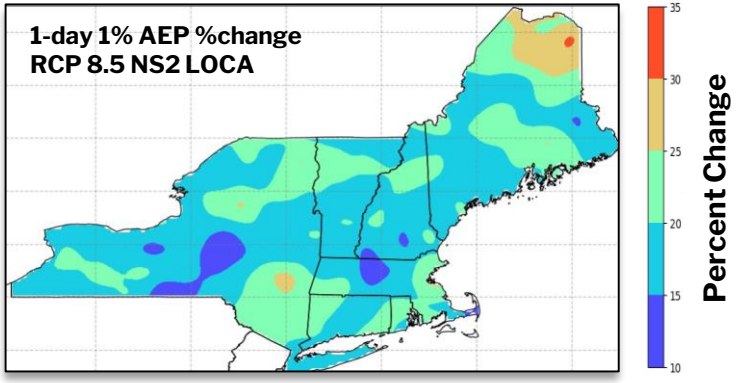
Volume 2: Incorporates climate projection adjustment factors

- Future precipitation informed by global climate models, modeled non-stationary temporal changes
- Provides adjustment factors to Volume 1 to calculate future estimates

1930 1940 1950 1960 1970 1980 1990 2000 2010 2020

2030 2040 2050 2060 2070 2080 2090 2100 2110 2120





Note: Derived from Multiple Models

Stakeholders and Partners - A Coordinated and Endorsed Path Forward

Plan for NOAA Atlas 15 has been presented to…

- Association of State Floodplain Managers (ASFPM)
- American Society of Civil Engineers (ASCE)

and federal partners on January 18 during a technical workshop moderated by the DOT Federal Highway Administration (FHWA); **federal partners validated methodology**.

The NWS issued a **Public Notification Statement (PNS)** on September 15, 2022, **soliciting public feedback** on NOAA Atlas 15 and the proposed national update; **90% validated proposal.**

Bipartisan Infrastructure Law (BIL): First Direct Federal Funding

Bipartisan Infrastructure Law summary: *"Shall be for coastal and inland flood and inundation mapping and forecasting, and next-generation water modeling activities,* ***including modernized precipitation frequency*** *and probable maximum studies."*

"To support the design, development, and operation of our nation's built infrastructure, from new power plants to transportation systems, NOAA ***will update and revise precipitation frequency atlases for the United States that account for climate change***…"

For the first time, NOAA now will apply a nationwide update for precipitation frequency data – a long standing and highly sought need for the future of our nation's infrastructure

NOAA Atlas 15 Road Map

2022/2023

- **Feb. - Aug. 2022** - Published methodology and briefed stakeholders
- **Sept. 2022** - Distributed Public Notification Statement (PNS) and collect public feedback.
- **Jan. 2023** - Hosted technical workshop with federal partners.
- **Apr. - June 2023** - Awarded contracts and grants and initiated dataset development.

2024

- **Development** - Evolve framework. Create Quality Controlled National Precipitation Database. Evaluate Climate Model Projections
- **Pilot** - Deliver Atlas 15 Vol. 1 and Vol. 2 pilot over Montana.

  Collect and adjudicate feedback on preliminary estimates and Web dissemination strategies.

2025

- **CONUS -** Publish preliminary data
- **CONUS** - Initiate 60-day peer review for Atlas 15 Vol. 1 and Vol. 2 for CONUS (lower 48 states).

  Collect feedback and adjudicate comments on product.

2026

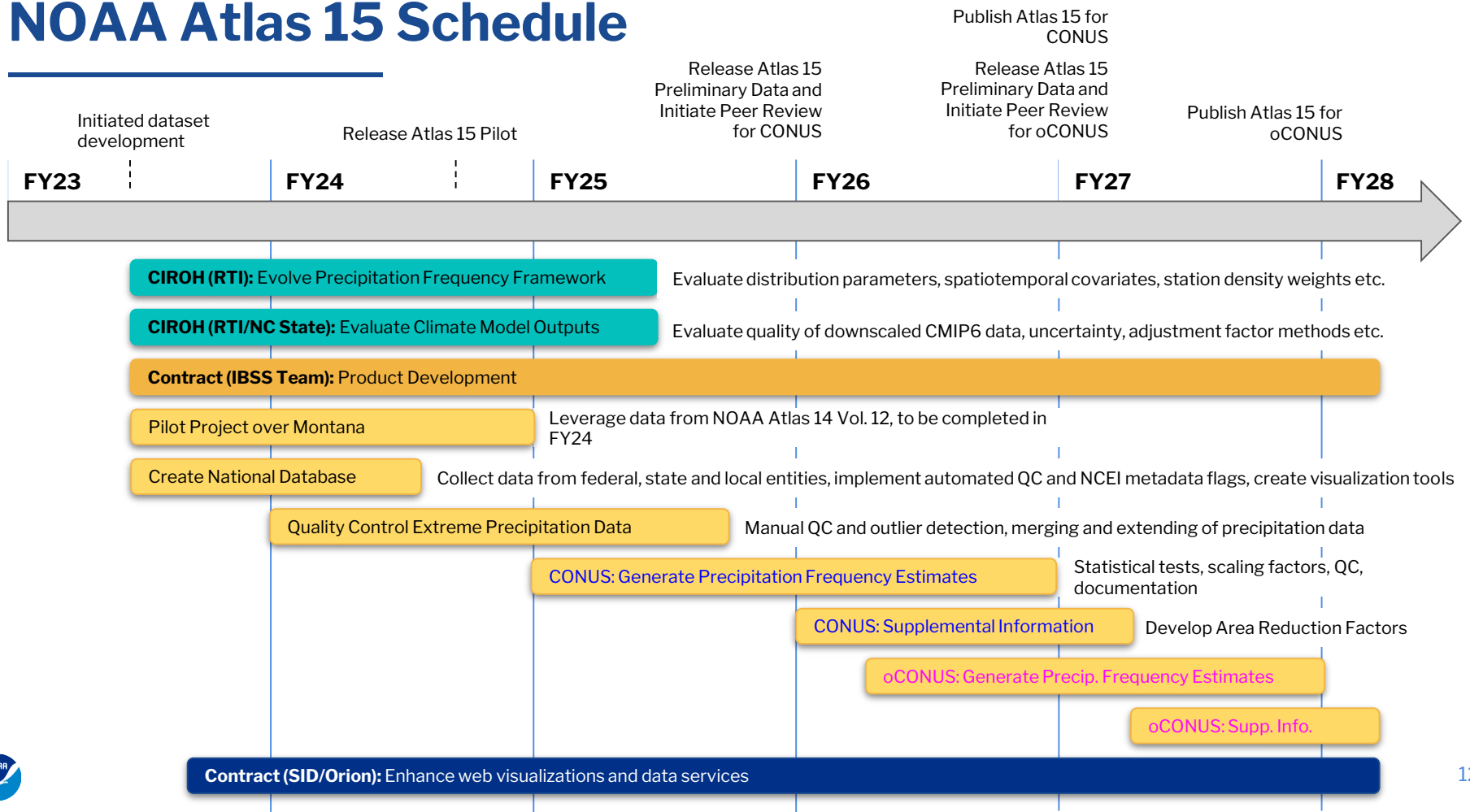
- **CONUS** - Complete Atlas 15 Vol. 1 and Vol. 2 and publish final estimates, documentation and supplementary products to stakeholders.
- **oCONUS** - Initiate peer review for oCONUS (e.g. Hawaii, Alaska, Puerto Rico, U.S. Virgin Islands, Guam).

  Collect feedback and adjudicate comments on product.

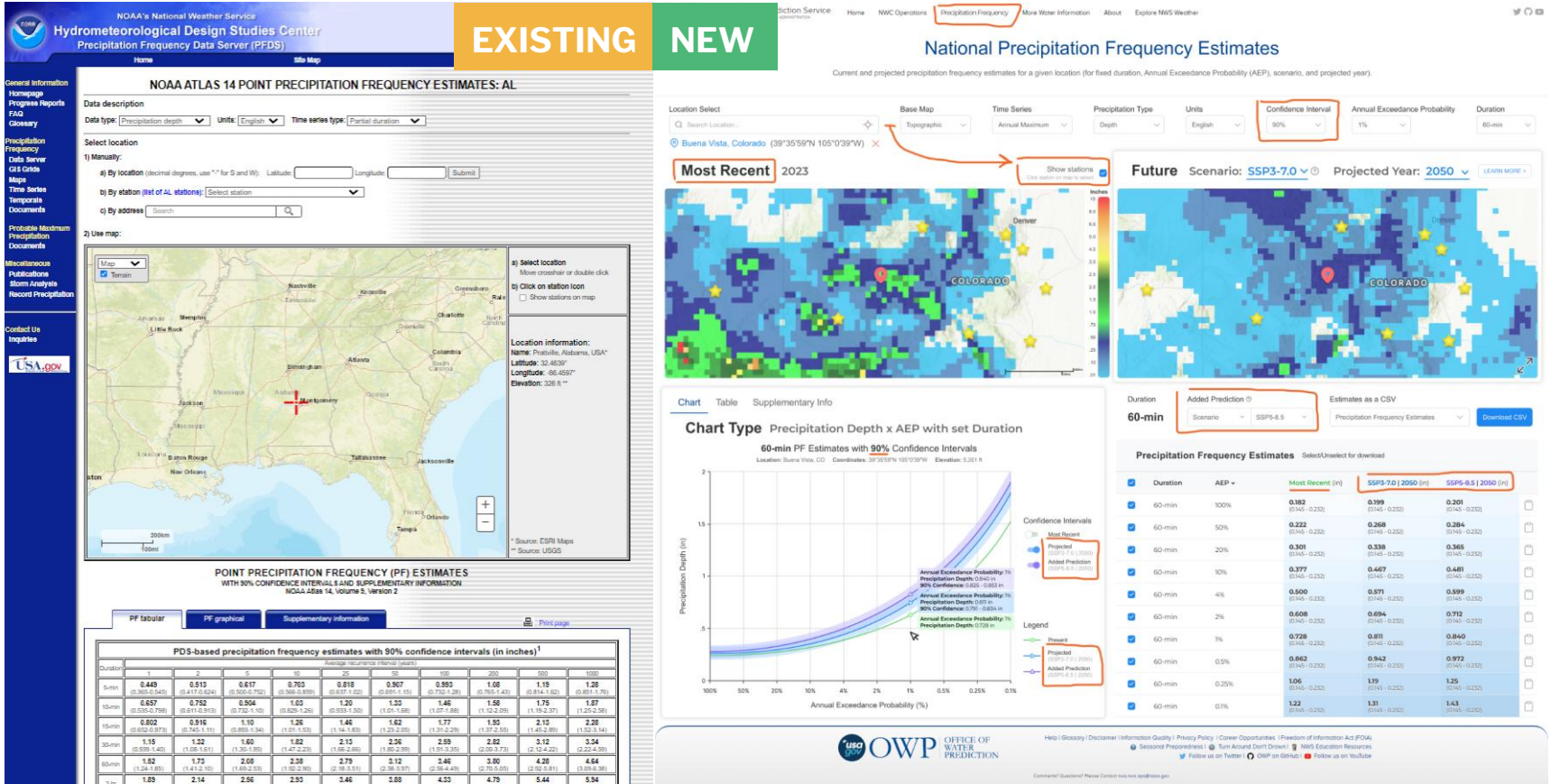
2027

- **oCONUS** - Complete Atlas 15 Vol. 1 and Vol. 2 and publish final estimates, documentation and supplementary products to stakeholders.

NOAA Atlas 15 Schedule



NOAA Atlas 15 Pilot for Montana: Web



Acknowledgements - Technical Team

NOAA Atlas 14

- **NOAA -** Greg Fall
- **IBSS -** Austin Jordan, Sridhar Mantripragada
- **CIROH / RTI -** Michael St. Laurent, Carl Trypaluk, Dale Unruh
- **Oregon State -** Chris Daly

NOAA Atlas 15

- **IBSS / RTI / Lago -** Brian Beitler, Maria Bravo, Ryan Clare, Victoria Clear, Jacquelyn Crowell, Nestor Hernandez, Marcelo Lago, Jennifer Lake, Sydney Lybrand, Sanja Perica, Cody Polera, Kevin Sanchez, Alana Shuvalau, David Tedesco, Lynne Trabachino, Danielle White
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Thank You!

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