

RECLAMATION

Managing Water in the West

Sub-Seasonal Climate Forecast Rodeo

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Bureau of Reclamation

Bureau of Reclamation

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

- **Manage water in 17 western states**
- **Operate 337 reservoirs**
- **Largest wholesaler of water in the country; provides 1 out of 5 Western farmers with irrigation water for 10 million farmland acres**
- **Second largest hydropower producer; 53 hydroelectric powerplants providing 14000+ MW capacity; generate enough electricity to power 3.5M U.S. homes**



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Presentation Overview

- Prize Competitions 101
- Sub-Seasonal Forecasting
- The “Rodeo”

What are Prize Competitions?

Prize competitions are a form of crowd sourcing and a way to reach a broader group of thinkers to address difficult topics.



The screenshot displays the Challenge.gov website. At the top, the logo features a stylized starburst with the text "Challenge.gov" and the tagline "Government Challenges, Your Solutions". To the right are social media icons for Facebook, Twitter, and Email. The navigation menu includes "CHALLENGES", "PRIZEWIRE", "ABOUT" (highlighted with an upward-pointing triangle), and "CONTACT". Below the menu are "LOG IN" and "SEE HOW IT WORKS" links. A secondary navigation bar contains "ABOUT CHALLENGE.GOV" and "HOW IT WORKS". The main content area is titled "About" and includes a section "Introduction to Challenge.gov" with the text: "Welcome to the hub for federal incentive prize and challenge competitions! You can look through hundreds of open competitions and if anything catches your attention, you may register to 'follow' a competition or enter one and submit your own solution."

How Competitions Work

- Issue a national challenge to solve a specific, typically difficult problem.
- Establish monetary and/or non-monetary incentive prizes.
- Winners must achieve predetermined performance metrics established by sponsors.
- Anyone can compete at their own risk.

R&D Water Prize Competition Center

The screenshot shows the Reclamation website's R&D Water Prize Competition Center page. The header features the Reclamation logo "RECLAMATION Managing Water in the West" and a search bar. A navigation menu includes "Water & Power", "Resources & Research", "About Us", "Recreation & Public Use", and "News & Multimedia". The main content area has a banner image of a mountain range with the text "Research and Development Office". Below the banner, the breadcrumb "Reclamation / R&D / Water Prize Competition Center" is displayed. A sidebar on the left contains a "RESEARCH AND DEVELOPMENT OFFICE" header, followed by "Research and Development Office", "Science and Technology (S&T) Program", "Desalination and Water Purification Research (DWPR) Program", "Water Prize Competition Center", "Current", and "Upcoming". The main content area features the heading "Water Prize Competition Center" and the sub-heading "Share your expertise and ideas!". The text below reads: "You can help solve some of the most critical water and water-related resource problems facing our Nation." and "You can also help us think of problem topics especially well-suited to solve through prize competitions. Review the [Prize Competition Candidate Topics](#) to learn more about Reclamation's problem spaces." At the bottom of the main content area, there is a section titled "Follow Reclamation's Competitions".

Sub-Seasonal Forecasting – Relevance to Reclamation

During the past eight years, every state in the Western United States has experienced drought that has affected the economy both locally and nationally through impacts to agricultural production, water supply, and energy.

Improved sub-seasonal forecasts for temperature and would allow water managers to better prepare for shifts in hydrologic regimes, such as the onset of drought or occurrence of wet weather extremes.

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Sub-Seasonal Forecasting – Relevance to Reclamation

In addition to managing for drought, improved sub-seasonal forecast would enhance other aspects of Reclamation's operations including:

- Water Allocations
- Flood Management
- Stakeholder Planning
- Environmental Compliance



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Forecast Rodeo

A year long, real-time sub-seasonal forecasting competition



WATER
PRIZE COMPETITION CENTER

\$800,000 in prize \$\$\$!

March 2, 2016 Forecast (in) .01 .10 .25 .50 1 2 3 4 5 7.5 10 15

Saddle up for the Sub-Seasonal Climate Forecast Rodeo!

usbr.gov/research/challenges

Competition Sponsor: **RECLAMATION** *Managing Water in the West*

Competition Partners: NOAA, US Army Corps of Engineers, USGS *science for a changing world*

- Genesis: Drought
 - Definition
 - Agricultural
 - Meteorological
 - Hydrological
 - Others
 - Common Ground
 - Temperature
 - Precipitation
- Objectives
 - Advance Science
 - Raise Awareness
 - Provide Evaluation Platform

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Competition Partners



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Forecast Rodeo Structure

- Forecasts
 - Resolution: a 1x1 grid
 - Variables: Temperature and Precipitation
 - Outlooks: Weeks 3&4 and 5&6
 - Frequency: 2 Weeks
 - Duration: 13 Months
 - Domain: 17 Western States
- Benchmarks
 - CFSv2 (32 member ensemble)
 - Damped persistence
- Schedule
 - Announced: Dec 12, 2016
 - Pre Season: Mar 21, 2017
 - Regular Season: Apr 18, 2017
 - Final Submission: May 3, 2018
 - Winners Announced (est): Sep 8, 2018



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Forecast Rodeo Structure

- Final Submission
 - Code
 - Documentation
 - Hind-Cast*
- Scoring
 - Spatial Anomaly Correlation
 - Drought.gov Leader Board
- Prizes
 - 4 Forecast Categories
 - 1st: \$100,000
 - 2nd: \$50,000
 - 3rd: \$25,000
 - An additional \$25,000 prize may be awarded per category based on hind-cast performance solely



*Hind-cast is period is 1999-2010. Performance must be equal to or better than the CFSv2 to be eligible for prizes.

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Current Standings

- 10 of 26 weeks 3&4 forecasts scored
- 9 of 26 weeks 5&6 forecasts scored
- Both temperature outlooks are very competitive
- Precipitation scores significantly lower

Weeks 3&4 Temperature

Team	Newest Score	Average Score ▼
StillLearning	0.604	0.4292
DampedPersistence	0.0824	0.4244
bgzimmerman	0.5456	0.388
CFSv2	0.515	0.291
lupoa13	0.6788	0.2363
prwx	0.1402	0.232
asanteko2000	0.3623	0.0456
ping_liu_sbu	0	0.0402
Salient	-0.6102	-0.2094

Weeks 3&4 Precipitation

Team	Newest Score	Average Score ▼
Salient	0.7395	0.1775
lupoa13	-0.2978	0.0781
prwx	0.4575	0.0266
bgzimmerman	-0.3908	0.0143
ping_liu_sbu	0	-0.0058
CFSv2	0.0753	-0.1062
asanteko2000	-0.7366	-0.1334
StillLearning	0.5748	-0.1411
DampedPersistence	-0.4314	-0.1902

Weeks 5&6 Temperature

Team	Newest Score	Average Score ▼
StillLearning	0.4628	0.4236
bgzimmerman	0.4932	0.42
CFSv2	0.2325	0.3938
lupoa13	0.6738	0.2782
prwx	0.0365	0.272
asanteko2000	0.5032	0.0703
ping_liu_sbu	0	-0.0313
DampedPersistence	-0.4391	-0.1406
Salient	-0.6062	-0.2085

Weeks 5&6 Precipitation

Team	Newest Score	Average Score ▼
Salient	0.7432	0.1291
bgzimmerman	-0.322	0.0881
lupoa13	-0.32	0.0767
prwx	0.0692	0.0035
StillLearning	0.516	-0.0148
asanteko2000	-0.6811	-0.0349
ping_liu_sbu	0	-0.0519
CFSv2	-0.1953	-0.1174
DampedPersistence	-0.4253	-0.1618

Track Results at NIDIS' Leader Board

- Leader Board is live! [LINK](#)
- Features
 - Rankings by forecast category
 - Time series plots of forecast scores for top 5 teams and benchmark forecasts
 - Individual team pages
 - Visualize forecast with corresponding observations and benchmark forecasts
 - Time series plots of forecast scores
 - Tabular forecast scores
 - Competition “news feed”

NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM **NIDIS** **Drought.gov**
U.S. Drought Portal

Home Data, Maps & Tools Regions Research Resources What is NIDIS? News Calendar Contact Us

Sub-Seasonal Climate Forecast Rodeo

And they're off: Solvers compete for up to \$800,000 in prizes

The Rodeo is a year-long, real-time forecasting competition, focused on western U.S. temperature and precipitation for weeks 3&4 and weeks 5&6. The Bureau of Reclamation is sponsoring the competition in partnership with NOAA, USGS, and the U.S. Army Corps of Engineers. Forecasts are issued every other week and evaluated as observed data become available. To be eligible for cash prizes, teams must outperform benchmark existing forecasts.

Improved sub-seasonal forecasts for weather and climate conditions (lead-times ranging from 15 to 45 days and beyond) would allow water managers to better prepare for shifts in hydrologic regimes such as the onset of drought or occurrence of wet weather extremes. The challenge with sub-seasonal weather and climate forecasting is that it encompasses the time frame where initial state or condition information and slowly varying long-term states, such as sea surface temperature, soil moisture, and snowpack, become more important to predictions. In addition, the relative importance of the initial state or condition, versus the longer term state, depends on the lead time, region of interest, and time of year.

Winners are anticipated to be announced in September of 2018. Check back for new scores and other updates over the next year!

Category	First Place	Second Place	Third Place
Weeks 3&4 Temperature	\$100,000	\$50,000	\$25,000
Weeks 3&4 Precipitation	\$100,000	\$50,000	\$25,000
Weeks 5&6 Temperature	\$100,000	\$50,000	\$25,000
Weeks 5&6 Precipitation	\$100,000	\$50,000	\$25,000

FORECAST RODEO LEADER BOARD

Weeks 3&4 Temperature
Weeks 5&6 Temperature
Weeks 3&4 Precipitation
Weeks 5&6 Precipitation

Anomaly Correlation Scores for Weeks 3&4 Temperature for Top 5 Teams Based...

Team	Average Anomaly Correlation Score
DampedPers...	0.000
CF sv2	0.125
StillLearning	0.250
bgzimmerman	0.375
lupoa13	0.500
prave	0.000
asantekc2000	0.000

Checkout the Forecast Rodeo Leader Board

FORECAST RODEO UPDATES

Dry Out West and Hurricane Harvey in Texas

Another warm and dry couple of weeks over most of the competition region for the period ending on September 4th. However, the southeast area and especially Texas was cool and wet. This was largely due to Hurricane Harvey, which dumped upwards of 50 inches of rain in th

Questions?

Links:

<https://www.usbr.gov/research/challenges/forecastrodeo.html>

<https://www.drought.gov/drought/utility-type/forecast-rodeo-update>

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