NOAA Climate Prediction Center
Experimental
Water Year Outlook

Emerson LaJoie

Meteorologist at CPC

Emerson.LaJoie@noaa.gov

CPASW

May 23-26 2022

Contributors: Matt Rosencrans, David DeWitt, Arun Kumar, Wanqiu Wang, Dan Collins, Pingping Xie, Greg Jennrich, Mike Charles

Why a Water Year Outlook?

- Filling the need for precipitation forecasts at time scales beyond seasonal, in a format/time-frame that is informative and relevant to western water managers.

- Collaborate with water managers to explore different sources of information and useful methods for correction.
  - Could be updated multiple times throughout the water year (monthly).
  - Combine with other forecast methods to optimize skill.

- First step is to assess the viability of such an outlook using the North American Multi-Model Ensemble (NMME) which delivers up to 6-month leads of realtime precipitation and temperature forecasts each month (common period).
  - NMME also has a robust hindcast for sensitivity testing.

Making the Water Year Outlook

- Defining the Water Year: Water supply forecast information for the Western U.S. is often conveyed on a "water year" basis, with the water year starting on Oct 1. CPC is working on three WYOs:
  - 6-month outlook initializing in October and running thru March → ONDJFM
  - 5-month outlook initializing in the following month, November, and running thru March → NDJFM
  - 4-month outlook initializing in December and running thru March → DJFM

- Skill assessment of the NMME's performance for these outlooks in a hindcast setting: OND 1982 – DJF 2020
  - NMME:
    - CFSv2   24 members
    - GEM_NEMO   10 members
    - CanCM4i   10 members
    - GFDL_FLOR   24 members
    - NASA_GEOS5v2   4   members
    - NCAR_CCSM4   10 members

- Verification dataset: CPC's official precipitation dataset, but expanded, not publicly available
 - Hybrid Sat interpolation over the ocean + Gauge over land, to increase coverage off the coast

Making the Water Year Outlook

- Skill assessment of the ONDJFM NMME's WYO in the common hindcast period 1982-2020

    - All Years

    - **Conditioned on ENSO** years as defined by an ongoing measure of Tropical SSTs → *Ocean Nino Index (ONI) (threshold is + or – 0.5 degrees)*

        - *For example, for DJF in 1992, ONI value of +1.7 → El Nino year so that year is selected for the ONDJFM outlook initializing in 1992. Repeat.*

        - La Nina years (negative ONI years)

    - **ACC: Anomaly Correlation Coefficient**

        - percent the observed standard deviation of the anomalies is captured by the models

    - **HSS: Heidke Skill Score** – 2-category probabilistic skill score

        - the percent improvement/degradation over using climatology of using the NMME

    - **RPSS: Rank Probability Skill Score** – 3-category probabilistic skill score

        - how skillfully the models capture the observed climatological distribution
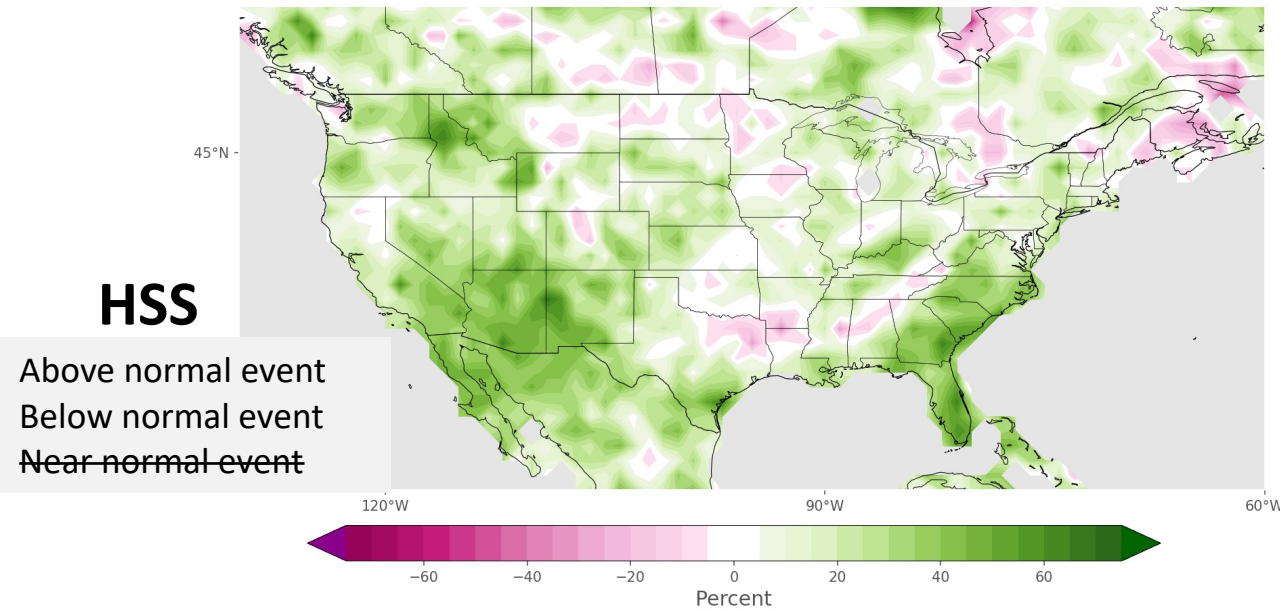
WYO ONDJFM Skill Assessment (Precipitation)

- **All Years** from 1982-2020

  - **ACC:** percent the observed standard deviation of the anomalies is captured by the NMME

  - **HSS:** 2-category probabilistic – the percent improvement/degradation of using the NMME vs climatology

  - **RPSS:** 3-category probabilistic outlook – how skillfully the NMME captures the observed climatological distribution
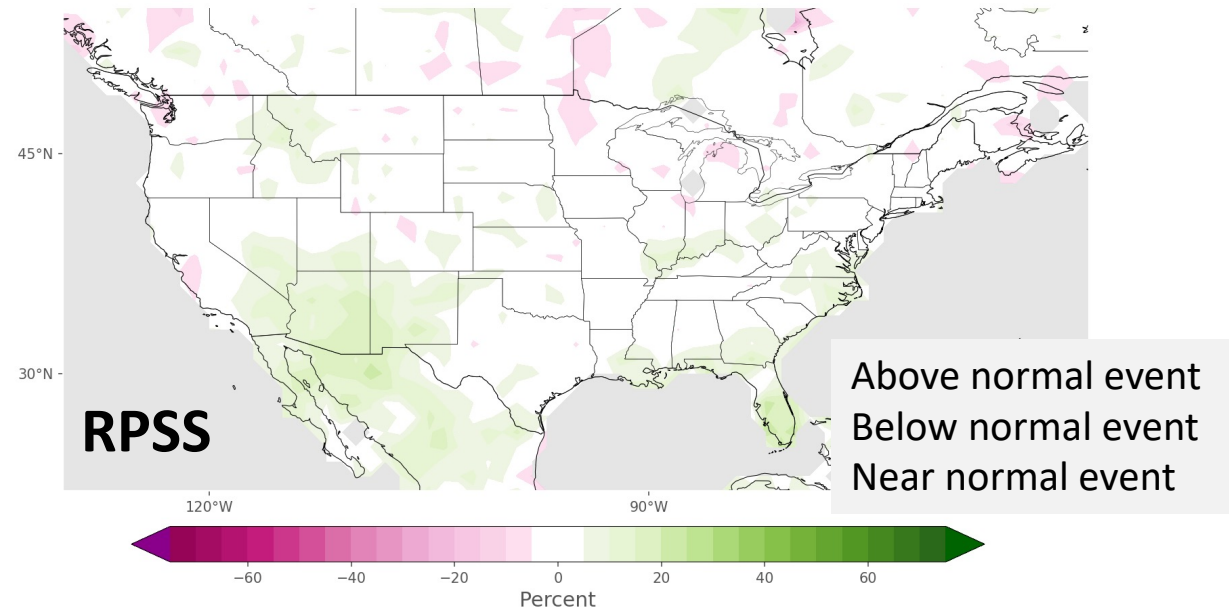
NMME Water Year Outlook Skill: ACC All Years 1982-2020

ACC
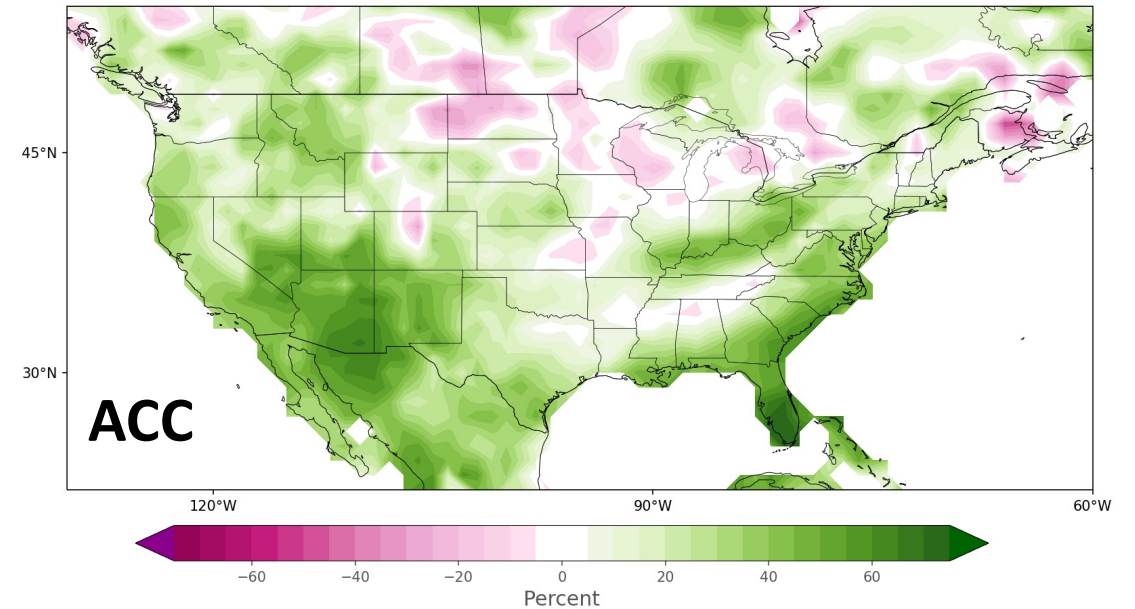
Percent

NMME Water Year Outlook Skill: HSS All Years 1982-2020

HSS

Above normal event
Below normal event
~~Near normal event~~

Percent

NMME Water Year Outlook Skill: RPSS All Years 1982-2020

RPSS

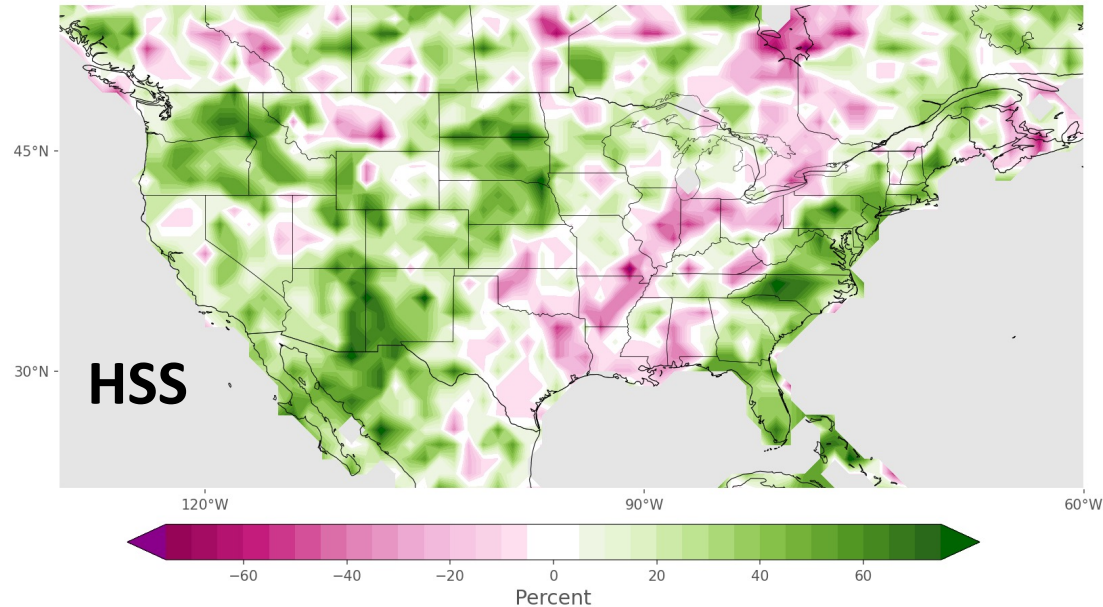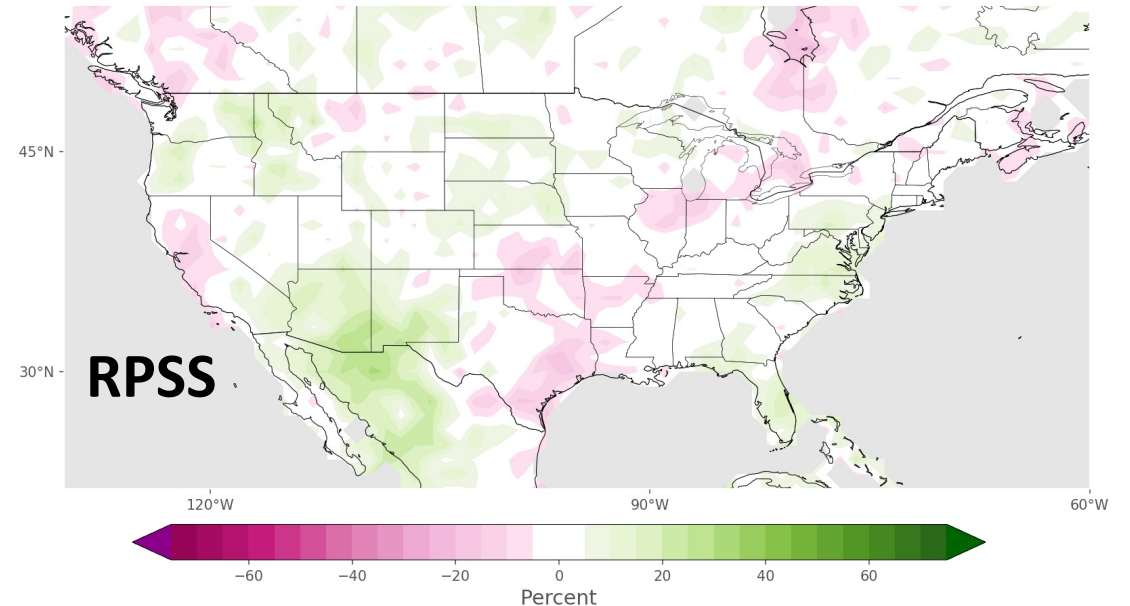Above normal event
Below normal event
Near normal event

Percent

WYO ONDJFM Skill Assessment (Precipitation)

- **La Nina years** within 1982-2020 -- about 12
  - **ACC:** percent the observed standard deviation of the anomalies is captured by the NMME
  - **HSS:** 2-category probabilistic – the percent improvement/degradation of using the NMME vs climatology
  - **RPSS:** 3-category probabilistic outlook – how skillfully the NMME captures the observed climatological distribution

NMME Water Year Outlook Skill: ACC La Nina Years 1982-2020
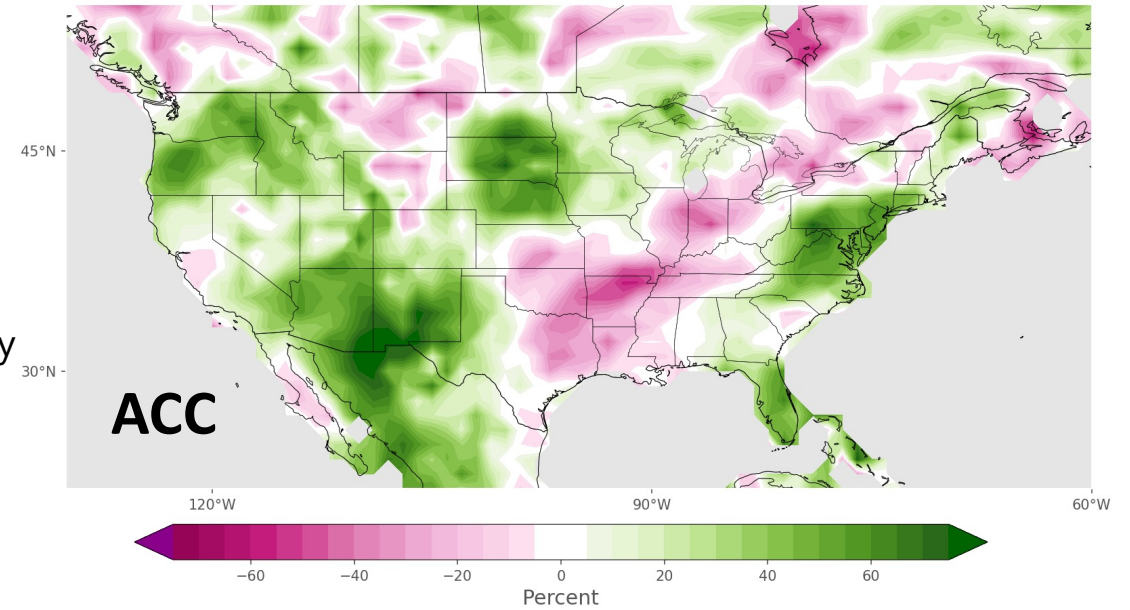
NMME Water Year Outlook Skill: HSS La Nina Years 1982-2020

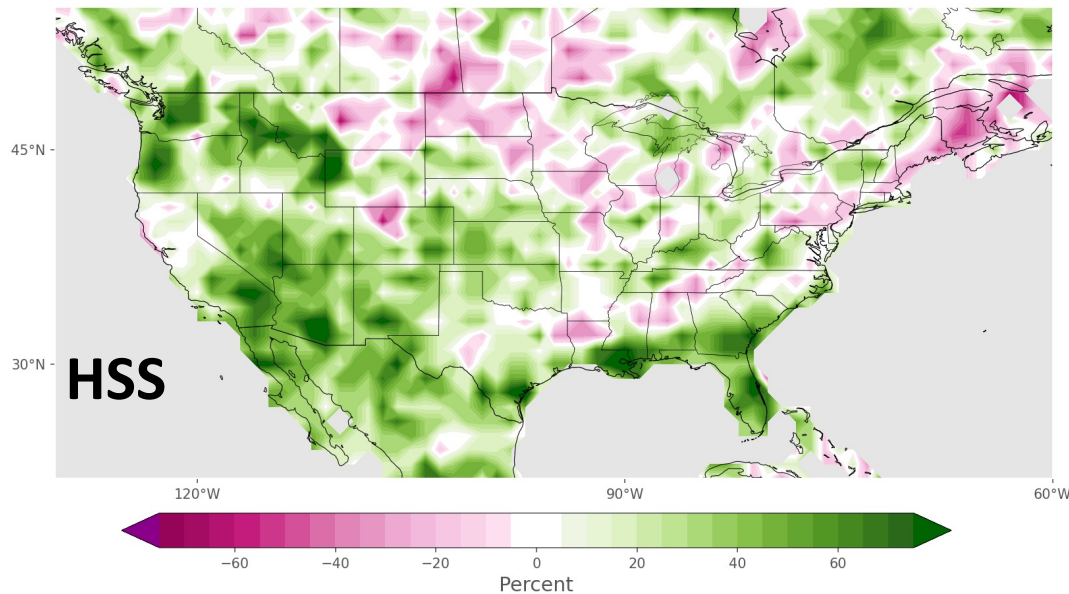NMME Water Year Outlook Skill: RPSS La Nina Years 1982-2020

WYO ONDJFM Skill Assessment (Precipitation)

- **El Nino years** within 1982-2020 -- about 12
  - **ACC:** percent the observed standard deviation of the anomalies is captured by the NMME
  - **HSS:** 2-category probabilistic – the percent improvement/degradation of using the NMME vs climatology
  - **RPSS:** 3-category probabilistic outlook – how skillfully the NMME captures the observed climatological distribution
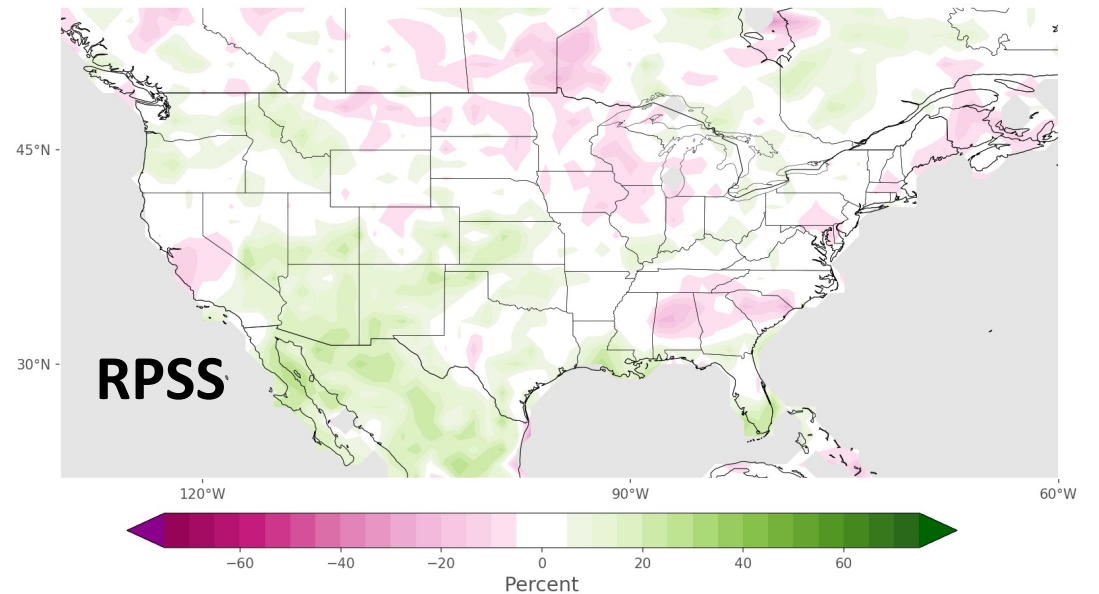

NMME Water Year Outlook Skill: ACC El Nino Years 1982-2020
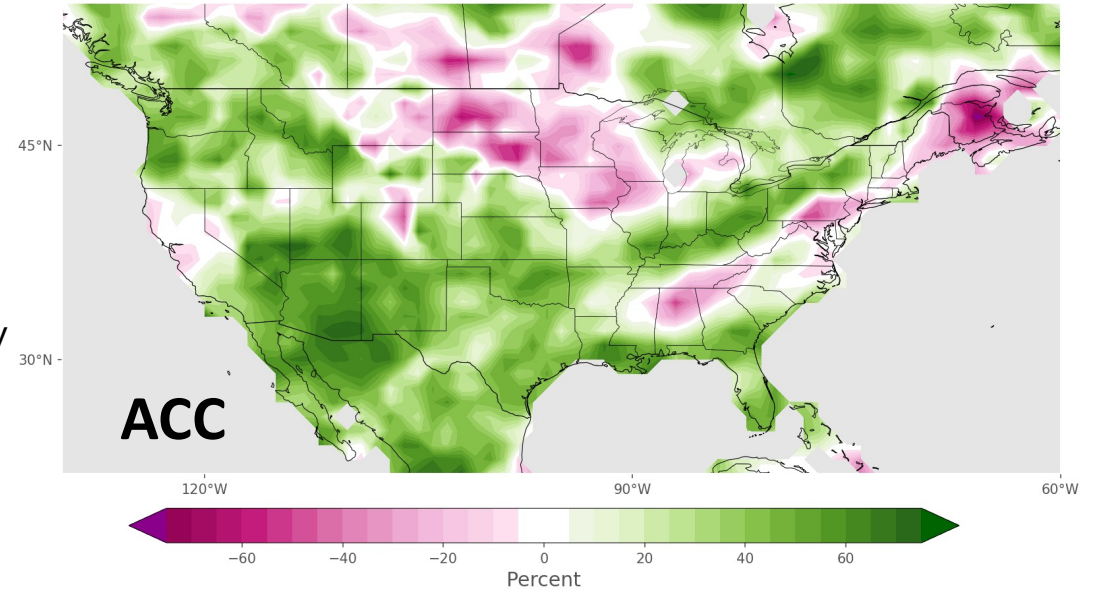
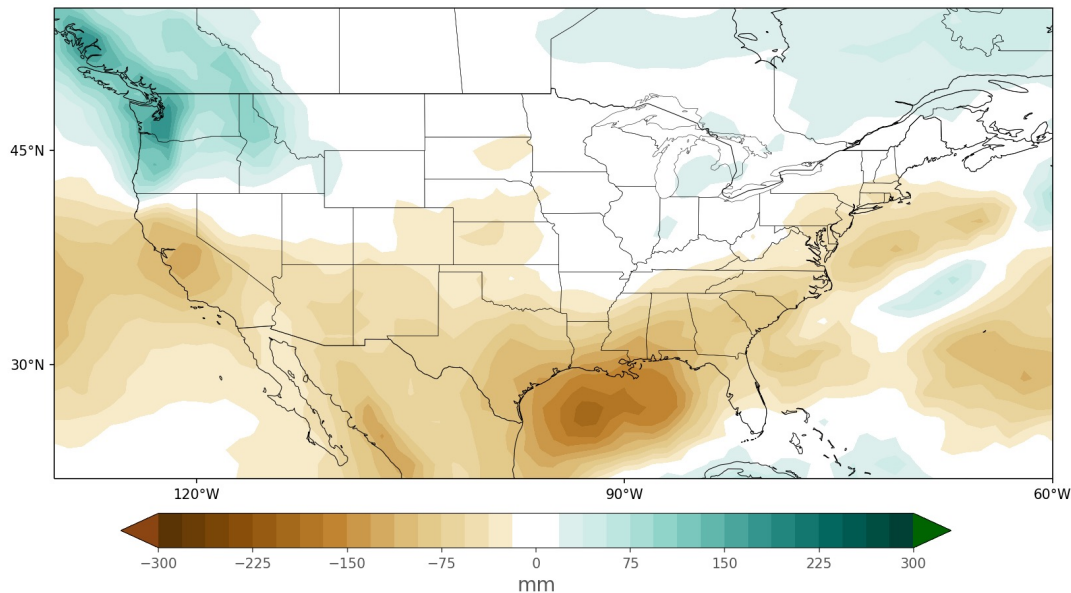NMME Water Year Outlook Skill: HSS El Nino Years 1982-2020

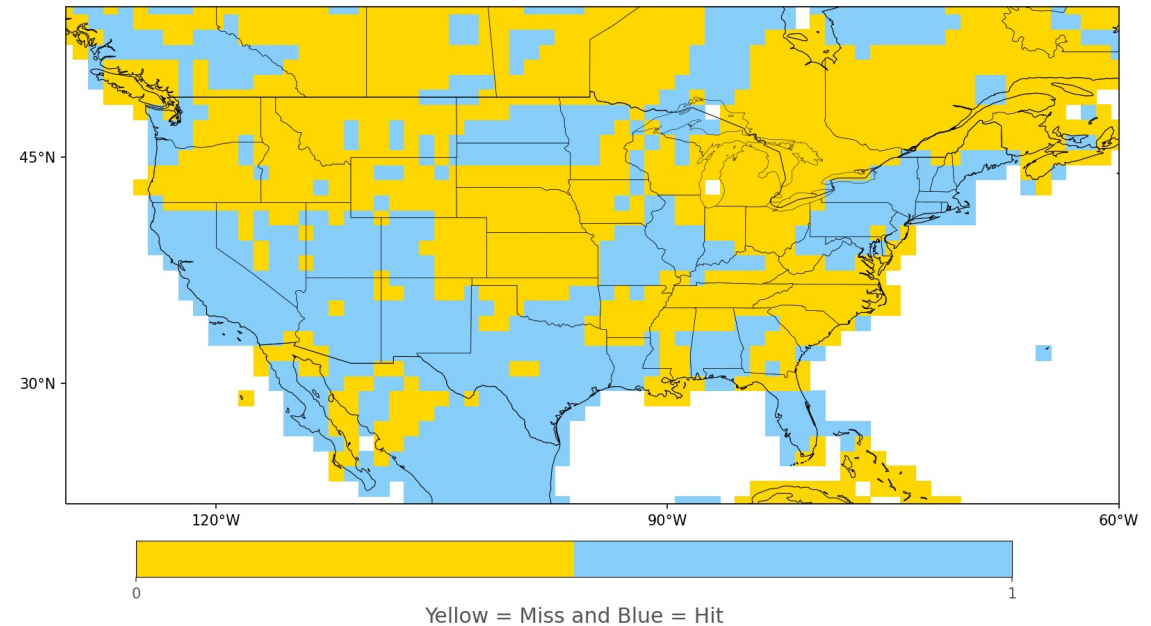NMME Water Year Outlook Skill: RPSS El Nino Years 1982-2020

Reviewing the 6-mth WYO
October 2020 – March 2021

NMME Experimental Water Year Outlook: Anomaly Precipitation Forecast
Initialized 2020 ONDJFM

NMME Experimental Water Year 2020 ONDJFM Outlook
Precipitation Forecast Verification: Hit Miss

mm

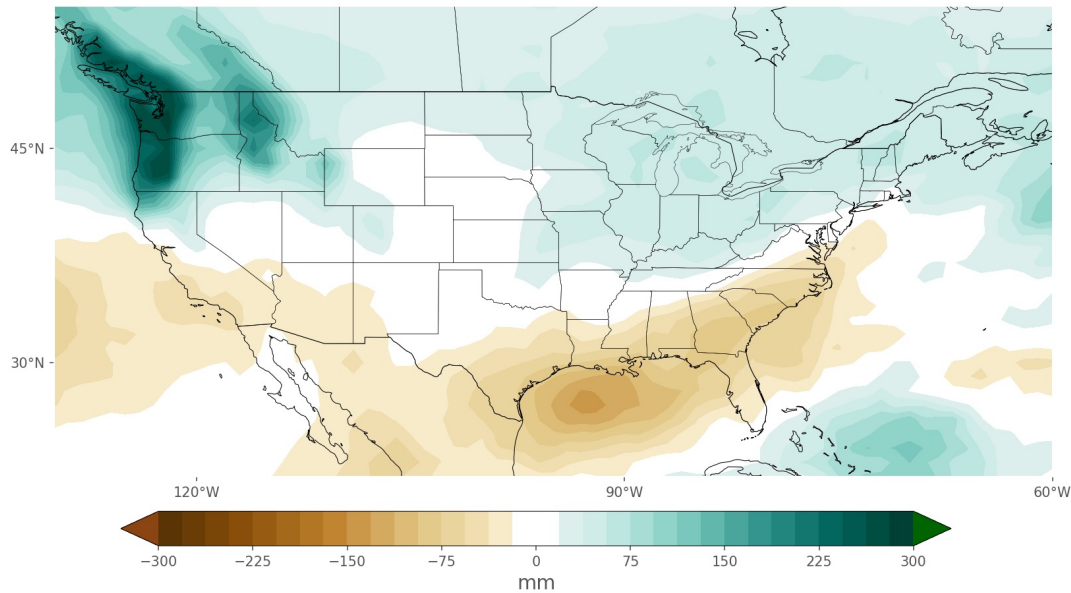Yellow = Miss and Blue = Hit

WYO → ONDJFM

"Hit Miss" verification: *Captures the skill of the direction of the forecast anomalies relative to the observed anomaly.* Hit *→ NMME forecasted a positive (negative) anomaly and a positive (negative) anomaly was observed.*
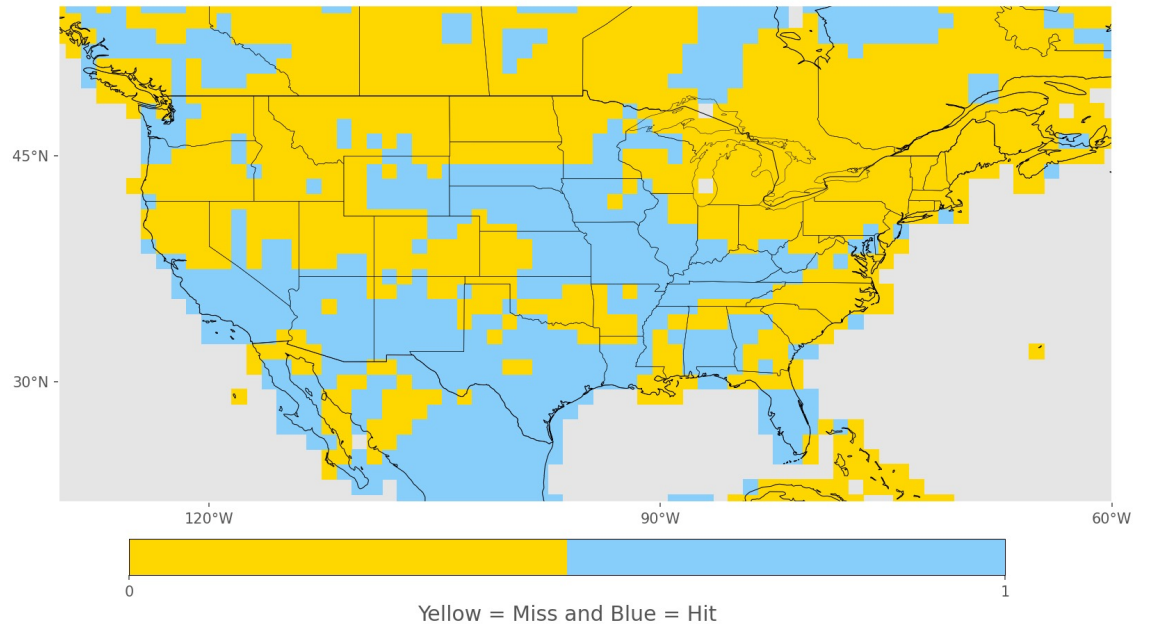
Reviewing the 5-mth WYO November 2020 – March 2021

NMME Experimental Water Year Outlook: Anomaly Precipitation Forecast
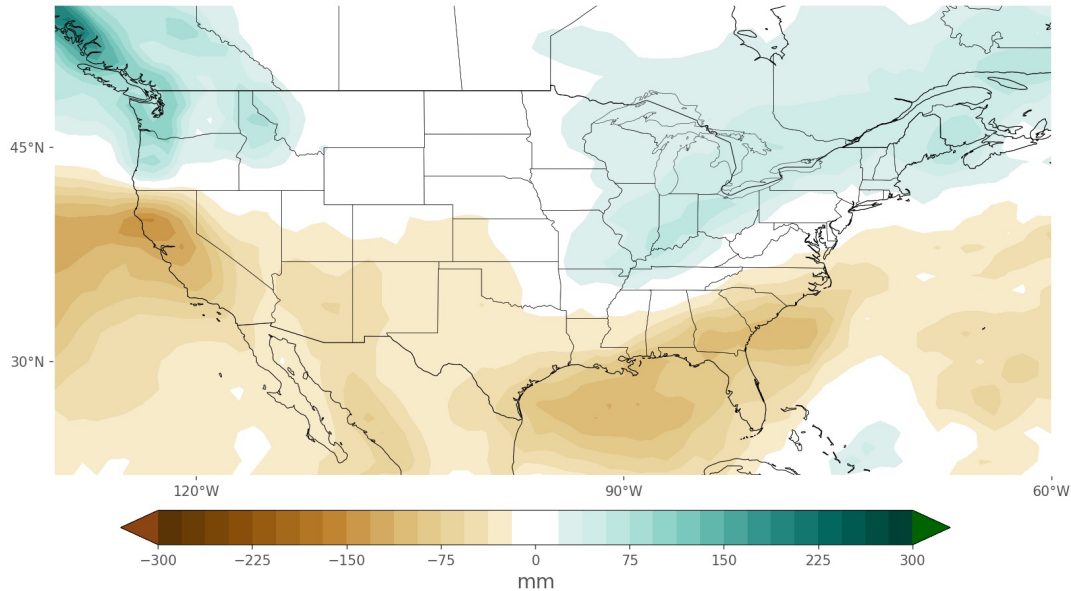Initialized 2020 NDJFM

NMME Experimental Water Year 2020 NDJFM Outlook
Precipitation Forecast Verification: Hit Miss

Yellow = Miss and Blue = Hit

WYO → NDJFM

"Hit Miss" verification: *Captures the skill of the direction of the forecast anomalies relative to the observed anomaly.* **Hit** *→ NMME forecasted a positive (negative) anomaly and a positive (negative) anomaly was observed.*
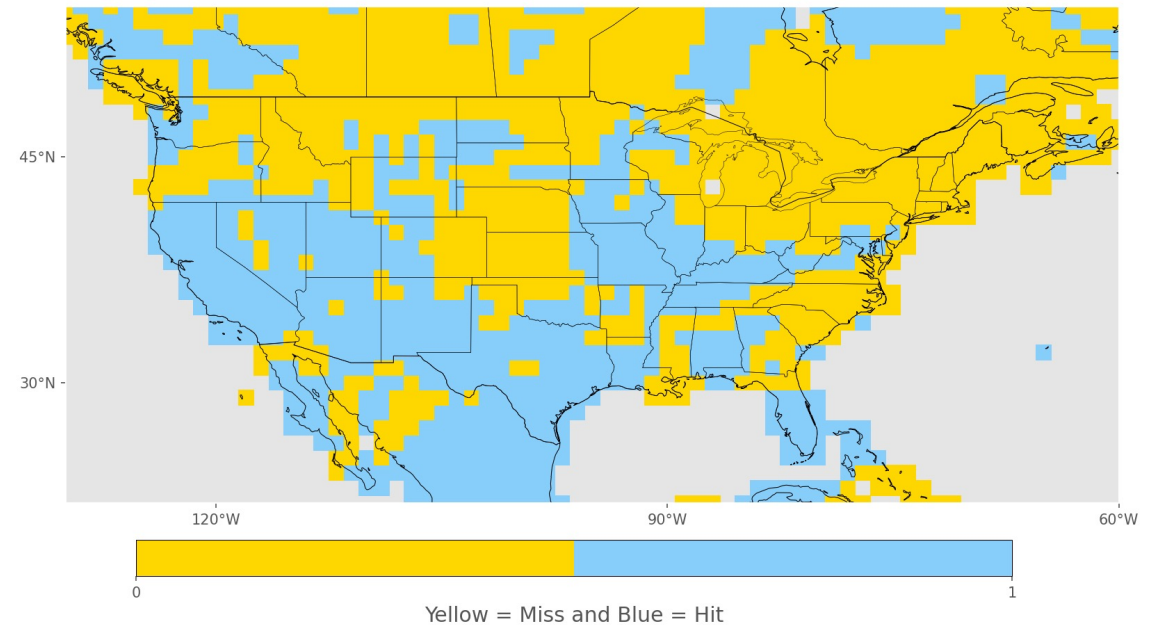
Reviewing the 4-mth WYO December 2020 – March 2021

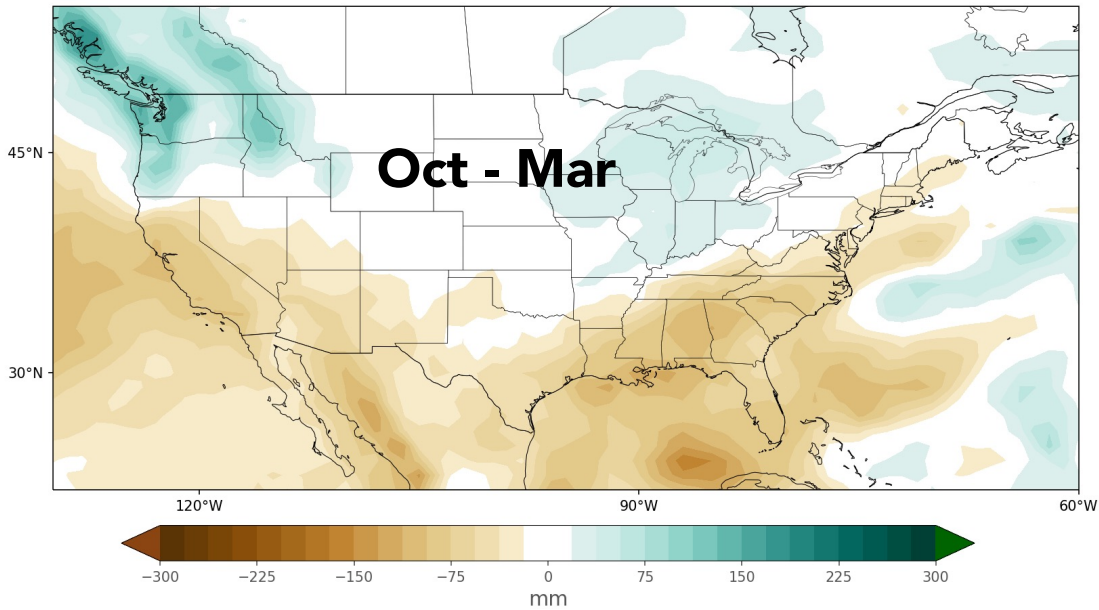NMME Experimental Water Year Outlook: Anomaly Precipitation Forecast
Initialized 2020 DJFM

NMME Experimental Water Year 2020 DJFM Outlook
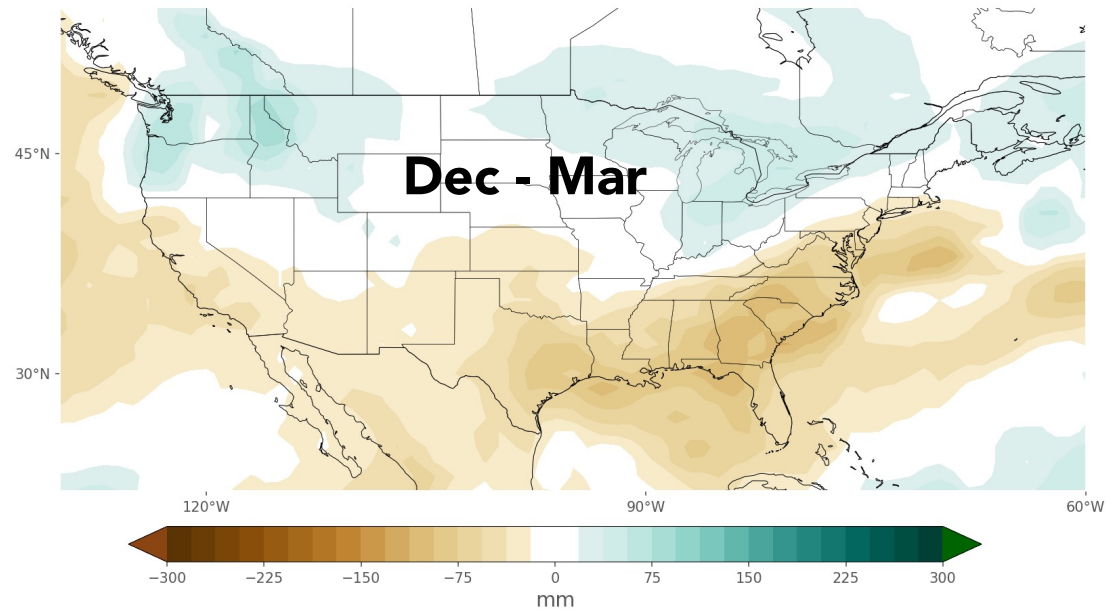Precipitation Forecast Verification: Hit Miss

mm

WYO → DJFM

Yellow = Miss and Blue = Hit

"Hit Miss" verification: *Captures the skill of the direction of the forecast anomalies relative to the observed anomaly.* *Hit* *→ NMME forecasted a positive (negative) anomaly and a positive (negative) anomaly was observed.*

Experimental Water Year Outlooks: 2021 - 2022
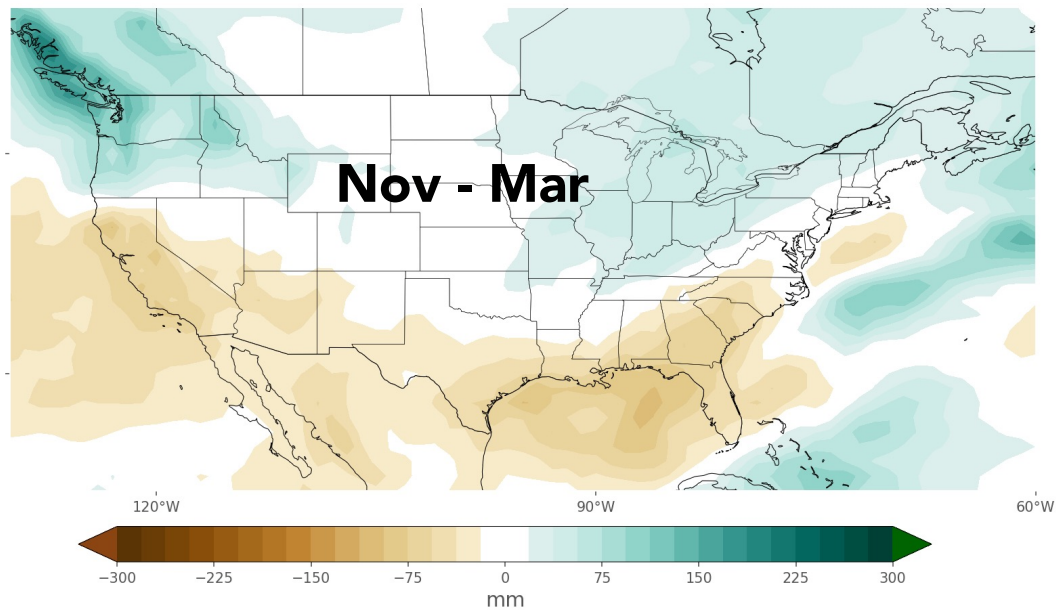
Next steps…

- Skill of the 5- and 4-mth outlooks

- NMME Bias-correction/calibration

  - Exploring up/down scaling

  - Calibration typically brings the model inline with climatology – if climatology is not as useful in the face of anthropogenic forcing/other trends, what other signals or model parameters can be developed to better capture what's happening in localized areas?

- Explore sensitivity in criteria of ONI years – add lags, choose different months, other measures of ENSO, etc.

- Explore hybrid methods – statistical + dynamical tools

- Engagement with the hydrology and water resources community to fine tune product(s)

  - Long lead temperature outlooks

  - Peak Melt

  - Dry Season Outlook

NMME Forecasts of Precipitation

← Back to the NMME Main Page

Multi-month spatial totals and anomalies			
	4-Month	**5-Month**	**6-Month**
Anomalies 2021			
Anomalies 2020			
Hit/Miss 2020			

NOAA/ National Weather Service
NOAA Center for Weather and Climate Prediction
Climate Prediction Center
5830 University Research Court
College Park, Maryland 20740
Page Author: Climate Prediction Center Internet Team
Page last modified: March 15, 2012

Disclaimer
Information Quality
Credits
Glossary

Privacy Policy
Freedom of Information Act (FOIA)
About Us
Career Opportunities