CPC Weeks 3-4 Temperature and Precipitation Outlooks -- 2015-2025

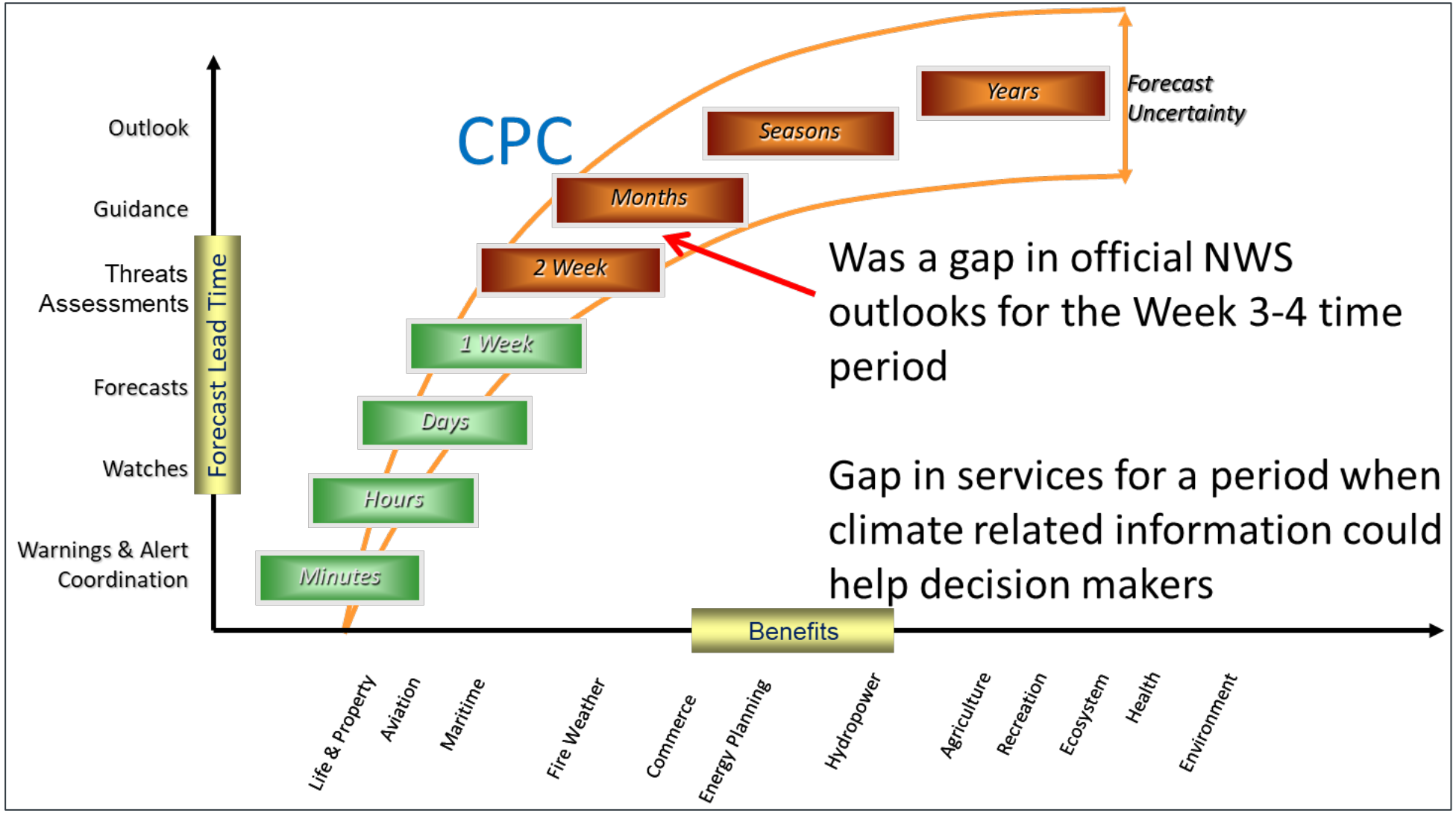
Jon Gottschalck et al.
Operational Prediction Branch
NOAA / NWS / Climate Prediction Center

NOAA S2S Analysis, Predictions and Services Webinar Series
April 29, 2026

Outline

- ❑ Origin, Background and Initial Considerations
- ❑ Outlook Depiction, Preparation and Interpretation
- ❑ Forecast Process and Guidance Utilized
- ❑ Verification of 2-class outlook (2015-2025)
  - ➢ Spatial Heidke Skill Score (HSS)
  - ➢ Forecast Reliability
- ❑ IDSS Applications
- ❑ Ongoing Development and Summary

Origin, Background and Initial Considerations

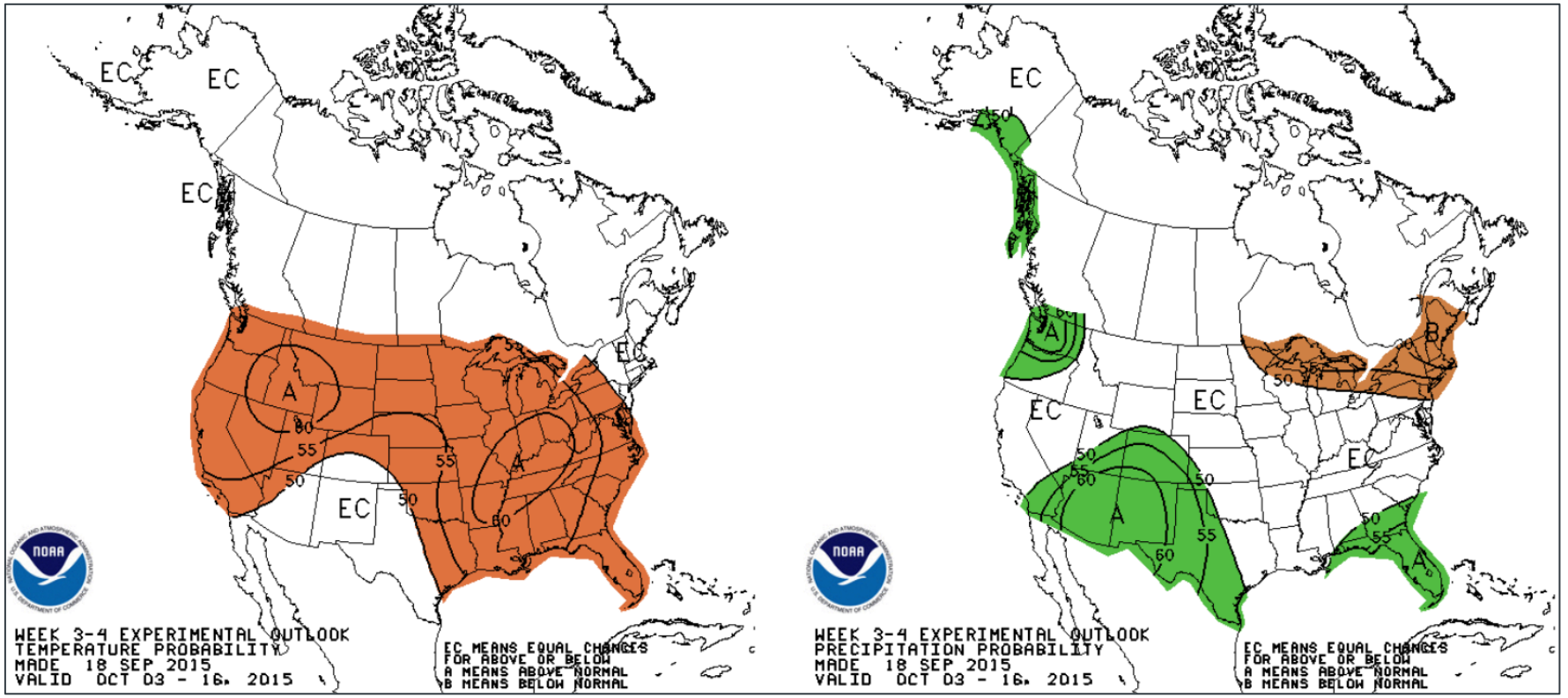


Origin, Background and Initial Considerations

- Initiation of an activity targeting Week 3-4 period was made a goal in the CPC 5-year strategic plan in 2013 based on discussion at CPC and stakeholder feedback
- NWS and NOAA leadership as well as the Office of Science Technology Policy (OSTP) at the White House urged making development in this area a high priority during FY15
- FY15 saw the organization of a working group within CPC to determine the path and goals to work toward the development of Week 3-4 T/P experimental outlooks
- First experimental Week 3-4 temperature/precipitation outlook was released on September 18, 2015
- Requirement further strengthened by the “Weather Research and Forecasting Innovation Act” of 2017

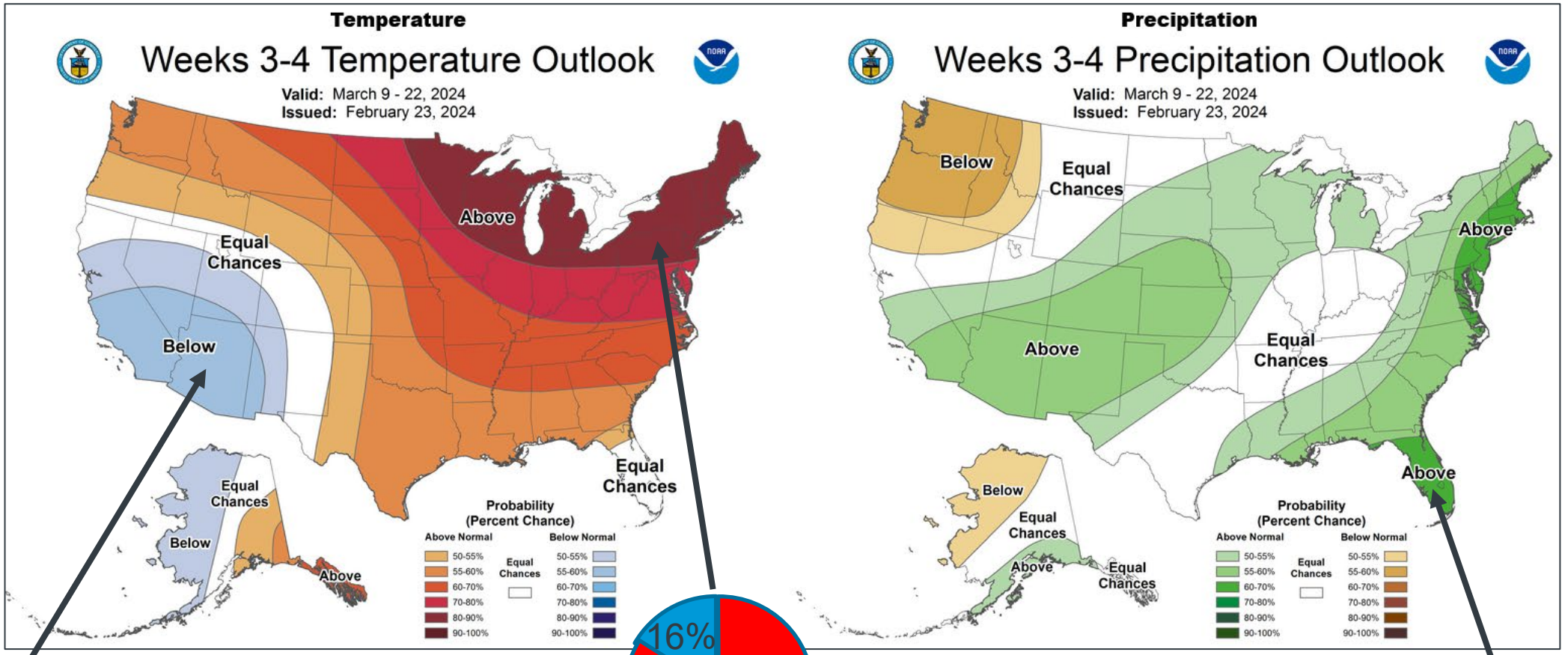
Origin, Background and Initial Considerations

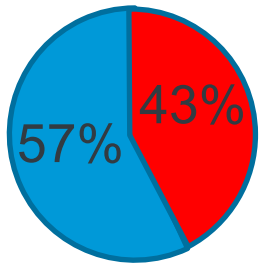
September 18, 2015 – First experimental realtime release

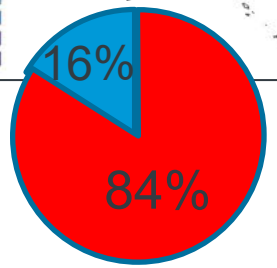


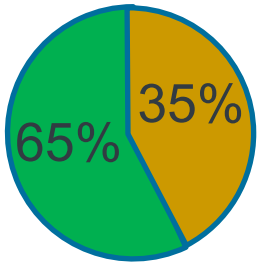
- ❑ Two-class outlook [above- and below-normal as defined by mean/median (1981-2010)]
- ❑ Initial outlook design – 1 shade of color for each category with contours
- ❑ Given S2S nature – EC included similar to the CPC monthly and seasonal outlooks

Outlook Depiction and Interpretation









- ❑Graphical depiction improvement implemented on 1/2022
- ❑Based on social science project (1st of its kind at CPC, 2019)

Outlook Preparation and Forecast Guidance Utilized

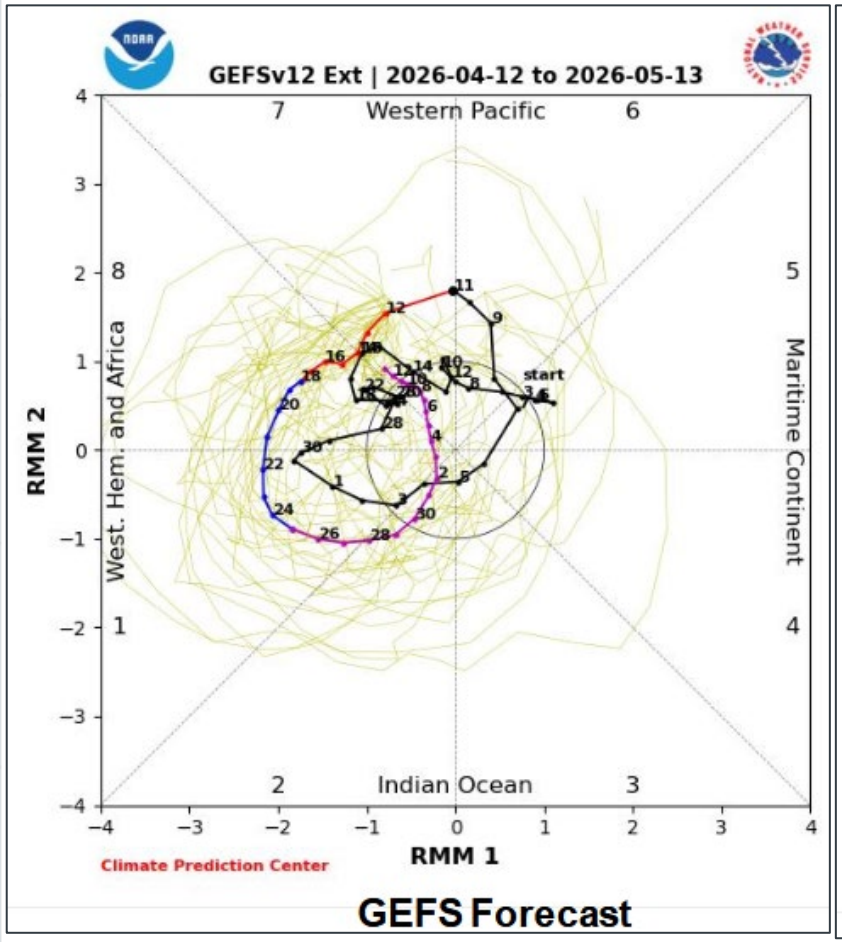
1. Status of key S2S climate drivers
   - ❑ ENSO, MJO
   - ❑ Stratosphere
   - ❑ Land surface states (soil moisture, snowpack)

2. Empirical / Statistical model guidance
   - ❑ Multi Linear Regression (MLR) – ENSO, MJO, trend as predictors, other experimental types
   - ❑ Natural Analogs
   - ❑ Teleconnection Maps

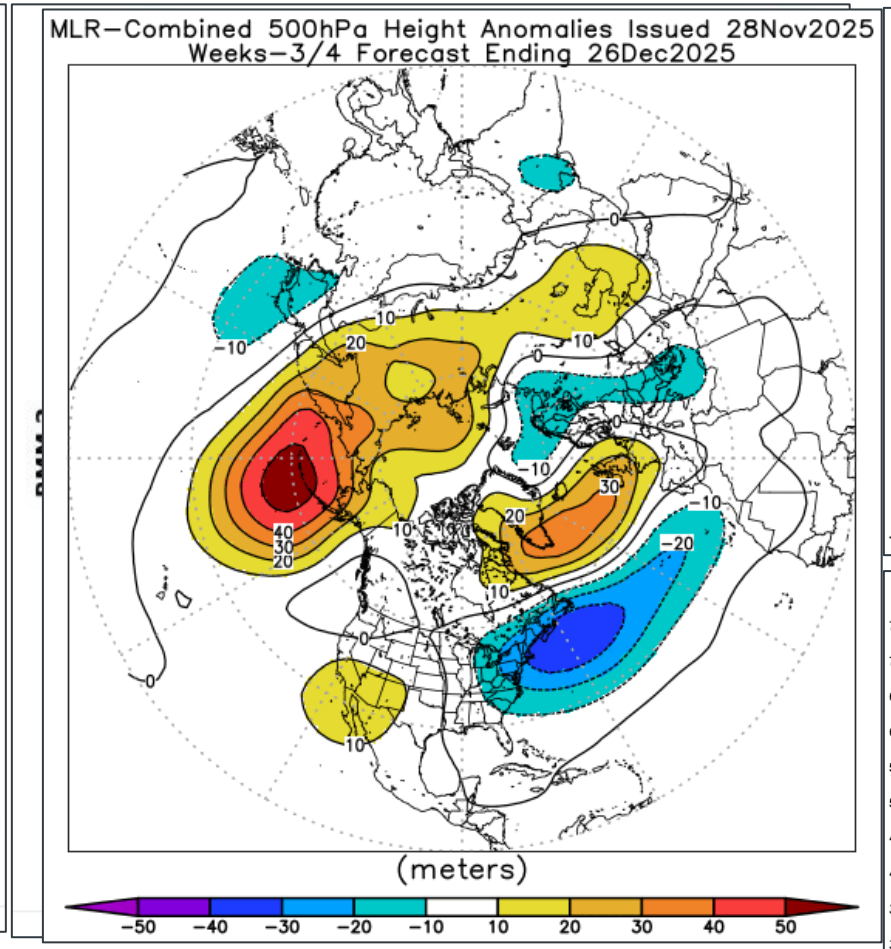
3. Dynamical model guidance
   - ❑ CFS, GEFS, ECMWF, JMA, ECCC ensemble prediction systems
   - ❑ Bias-corrected and calibrated

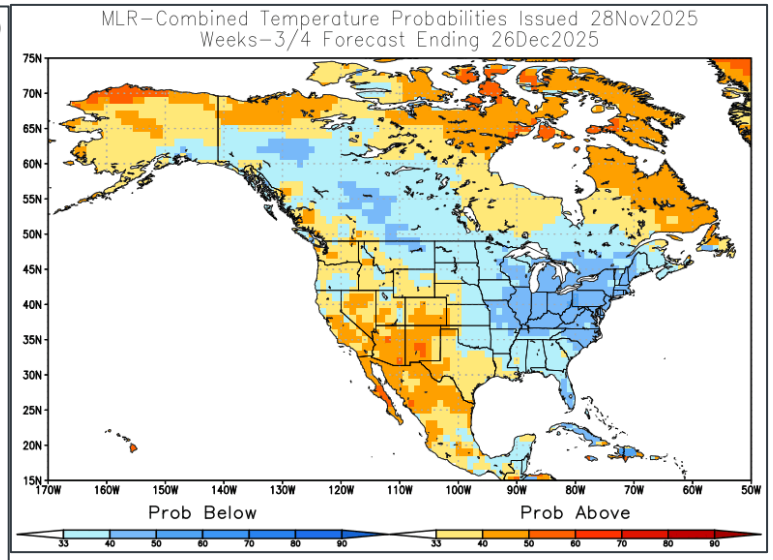
4. Objective consolidation forecast tools
   - ❑ Equal Weights
   - ❑ Historical skill weighted

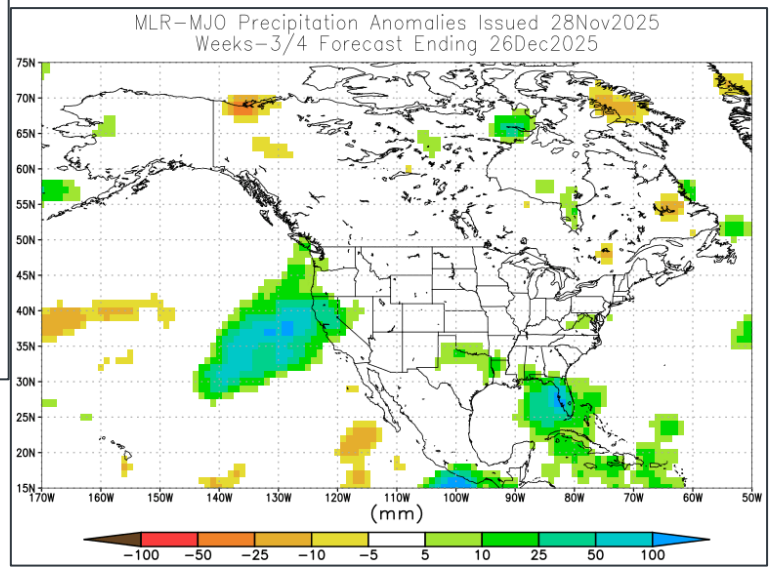
Outlook Forecast Guidance Utilized



MJO RMM model forecasts

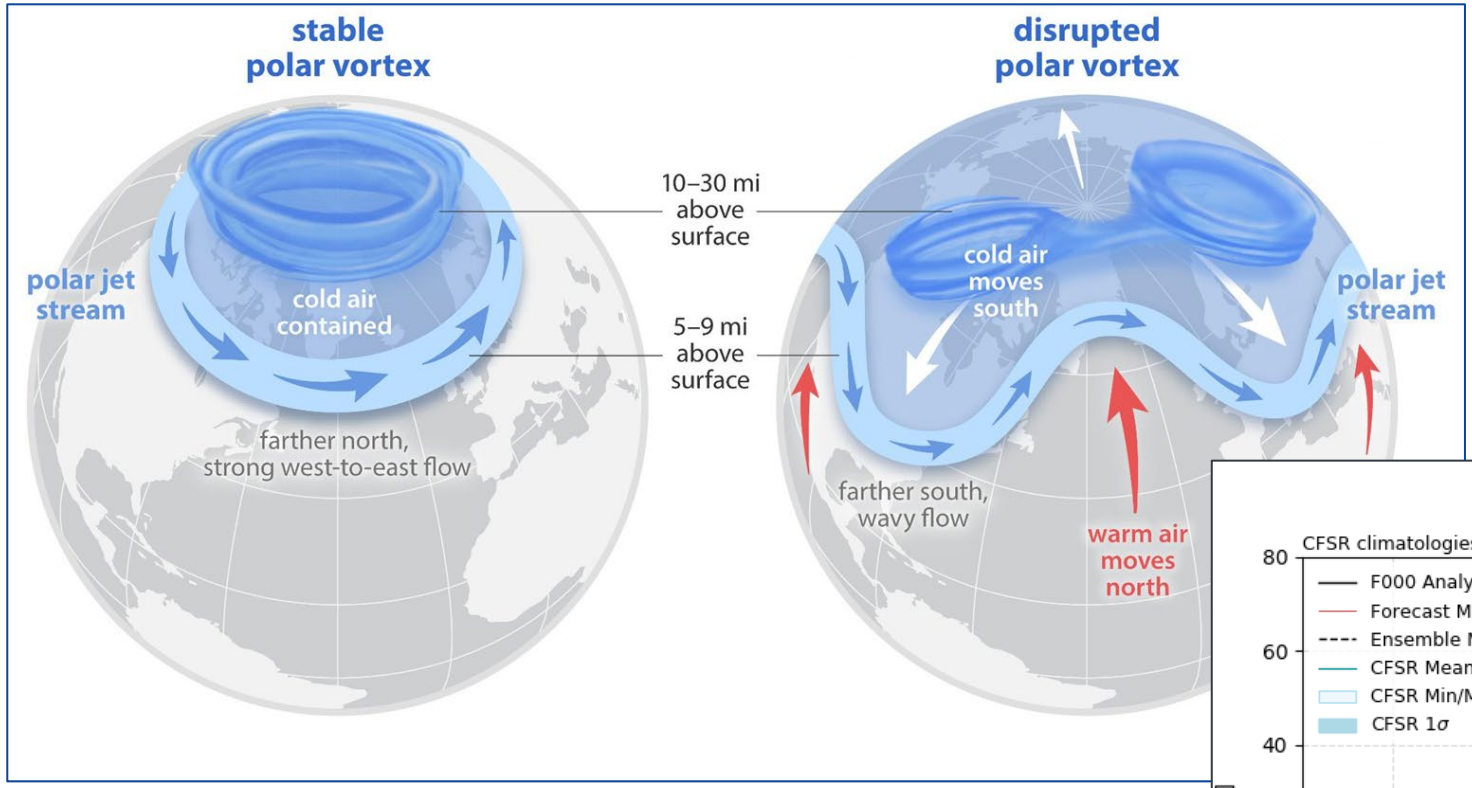


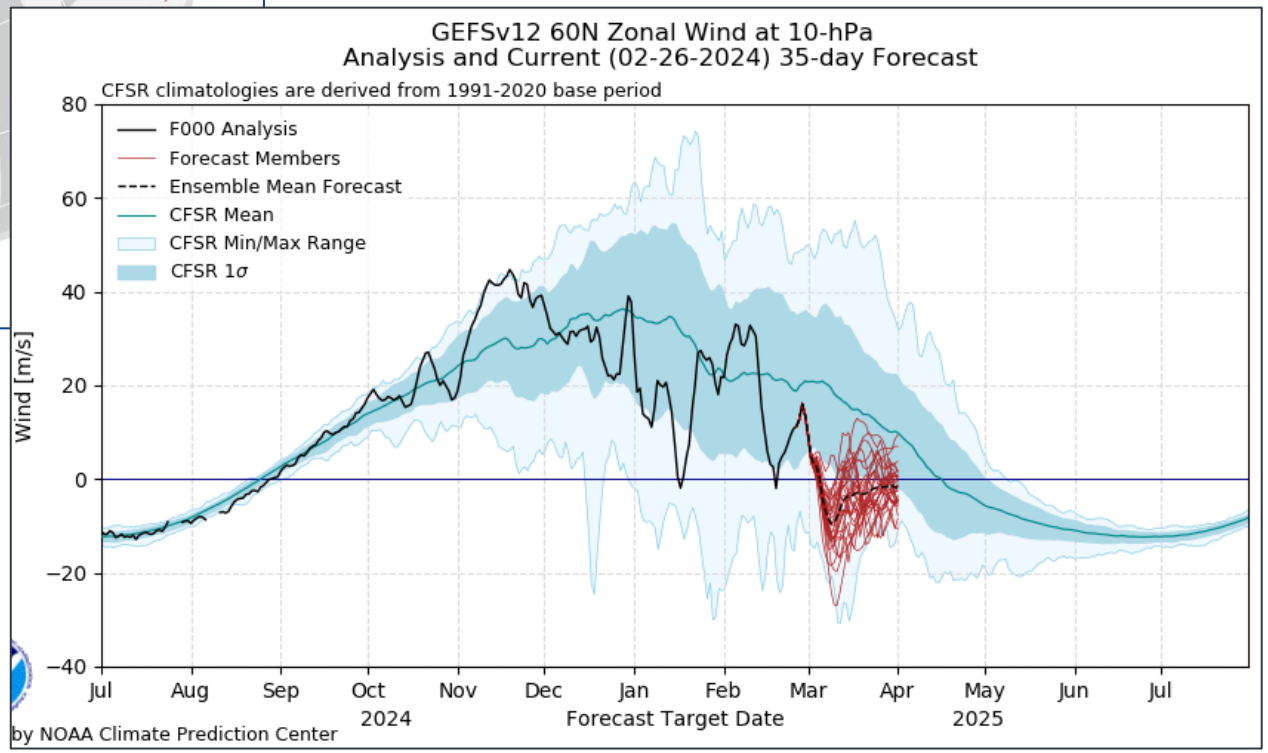




MLR tool

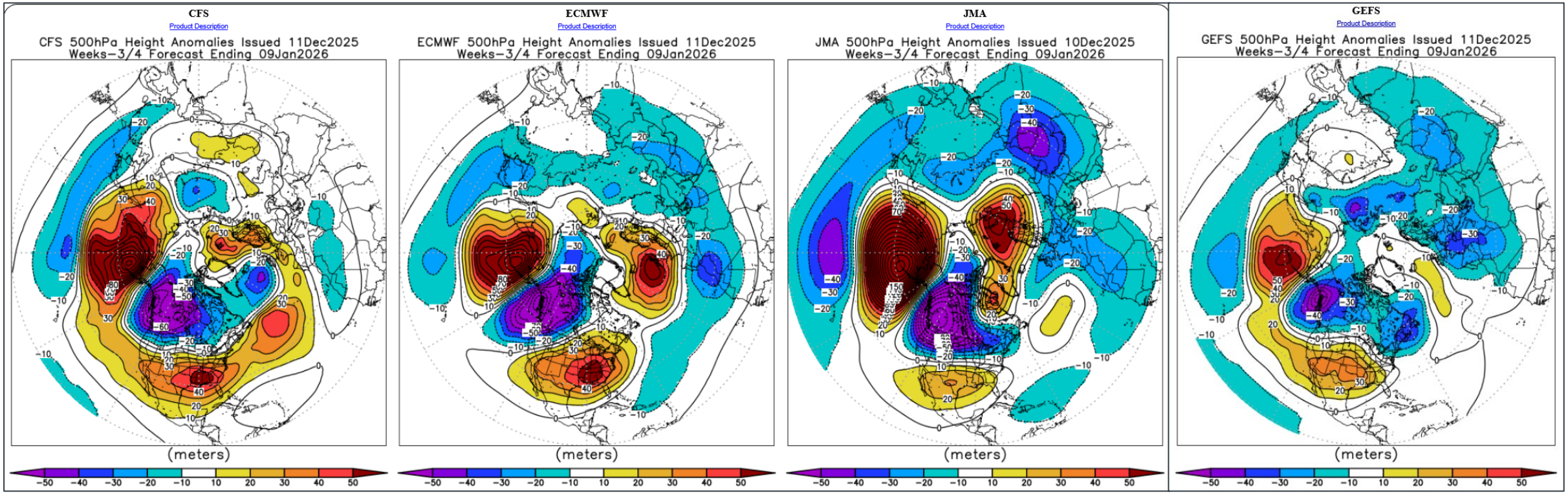
Outlook Forecast Guidance Utilized





- ❑ Stratospheric polar vortex strength
- ❑ Model forecasts of key indicators

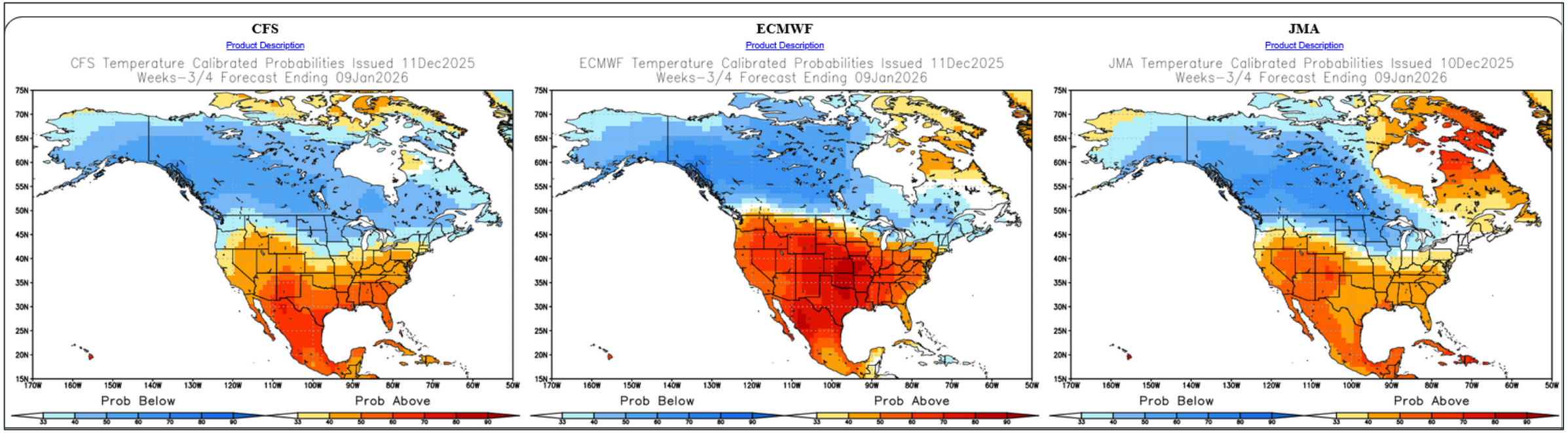
Outlook Forecast Guidance Utilized



CFS **ECMWF** **JMA** **GEFS**

Dynamical model guidance – 500-hPa height anomalies

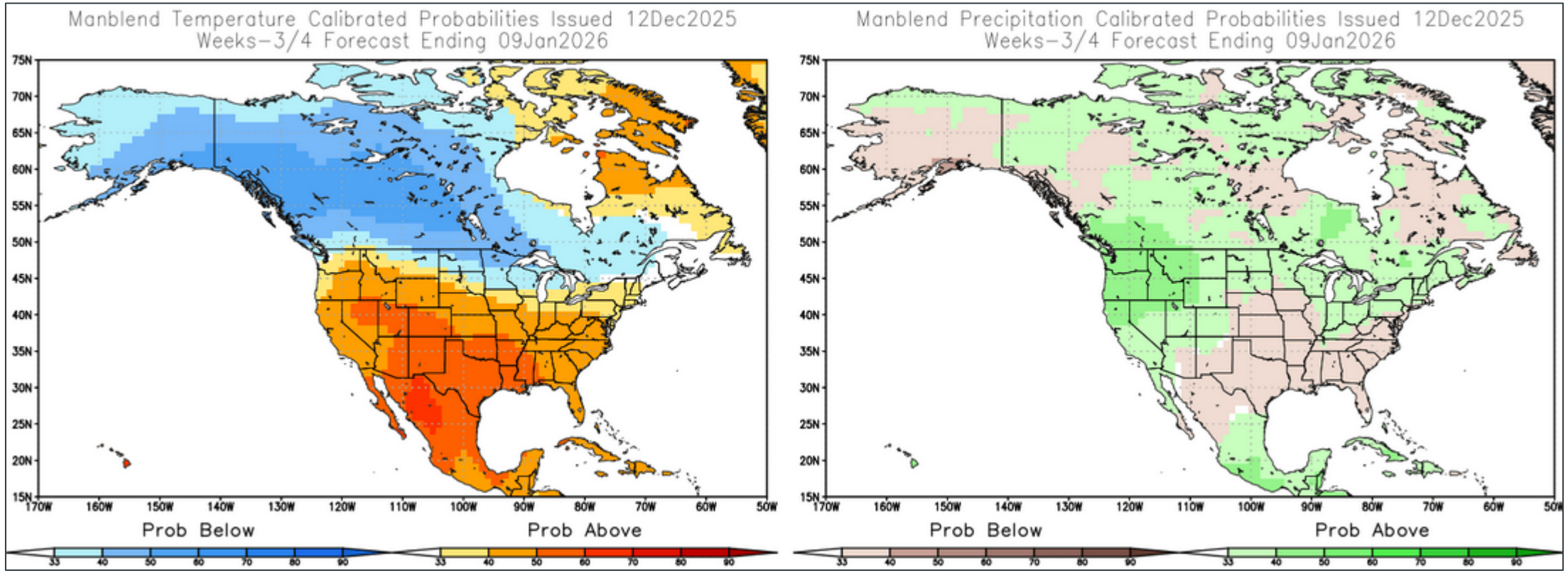
Outlook Forecast Guidance Utilized



CFS **ECMWF** **JMA**

Dynamical model guidance – Bias-corrected and Calibrated temperature probabilities

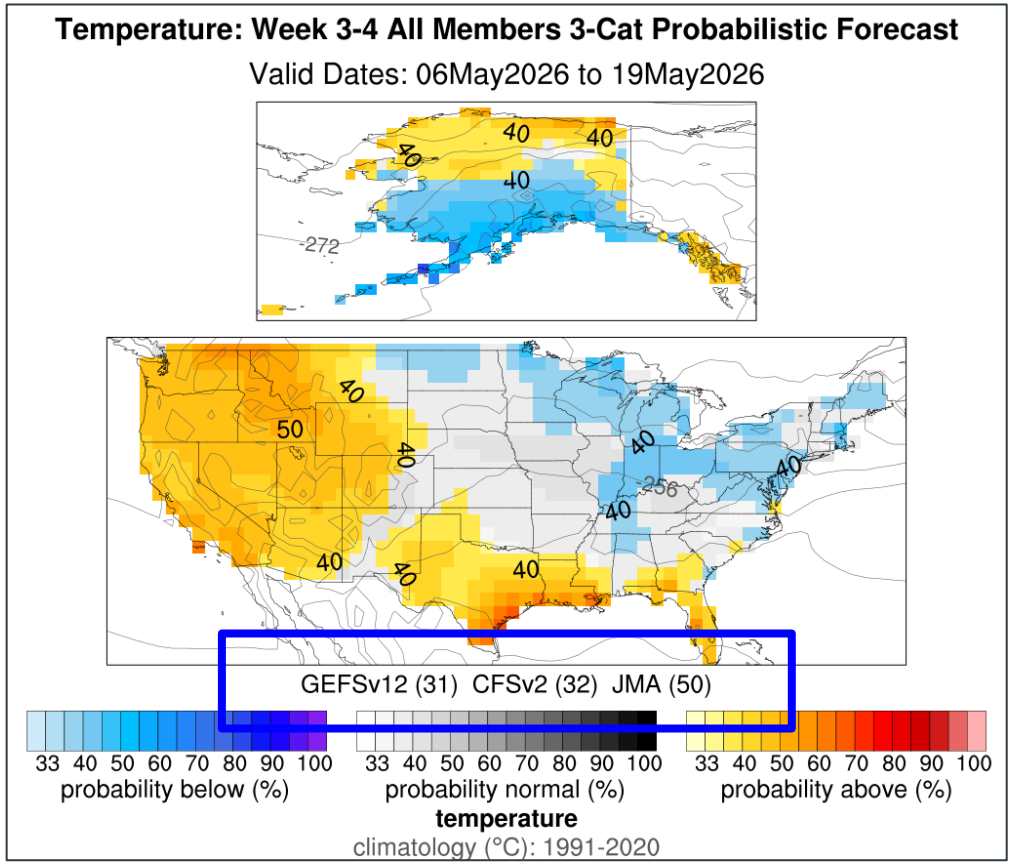
Outlook Forecast Guidance Utilized



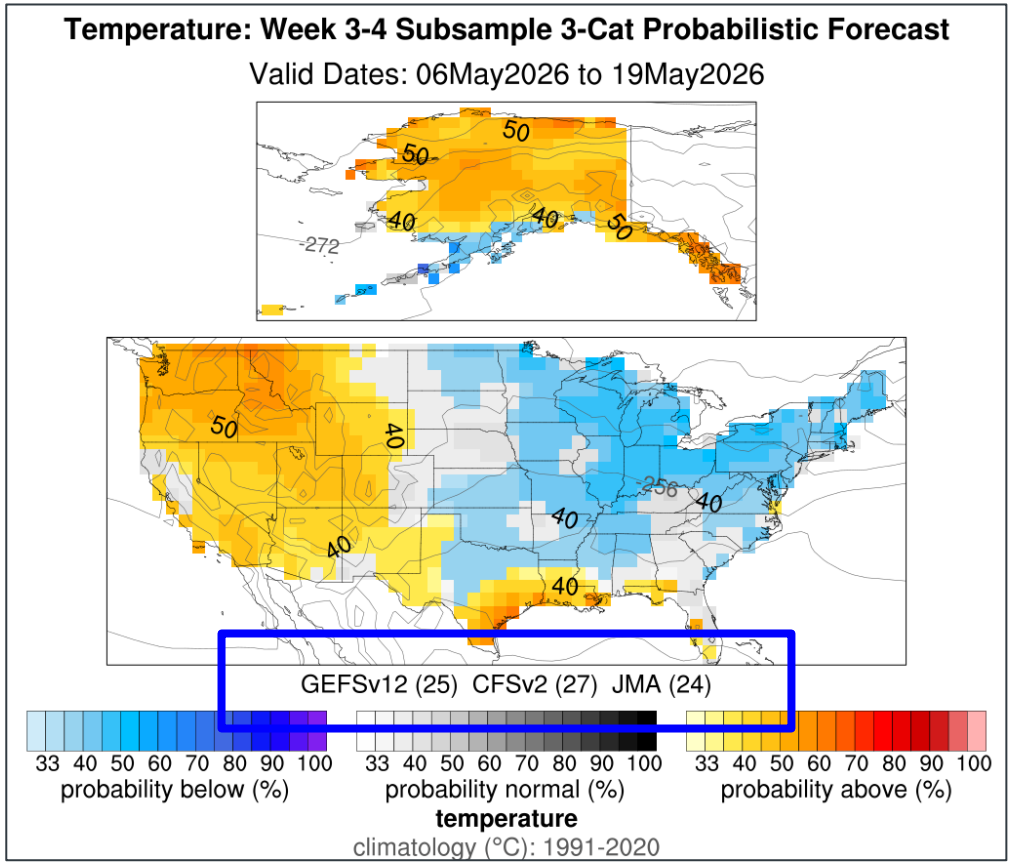
Manual Blend – Calibrated temperature and precipitation probabilities

Outlook Forecast Guidance Utilized

- ❑ Subsampling of dynamical model forecasts
- ❑ Keyed to best ensemble members across models for current Week 2 height forecast

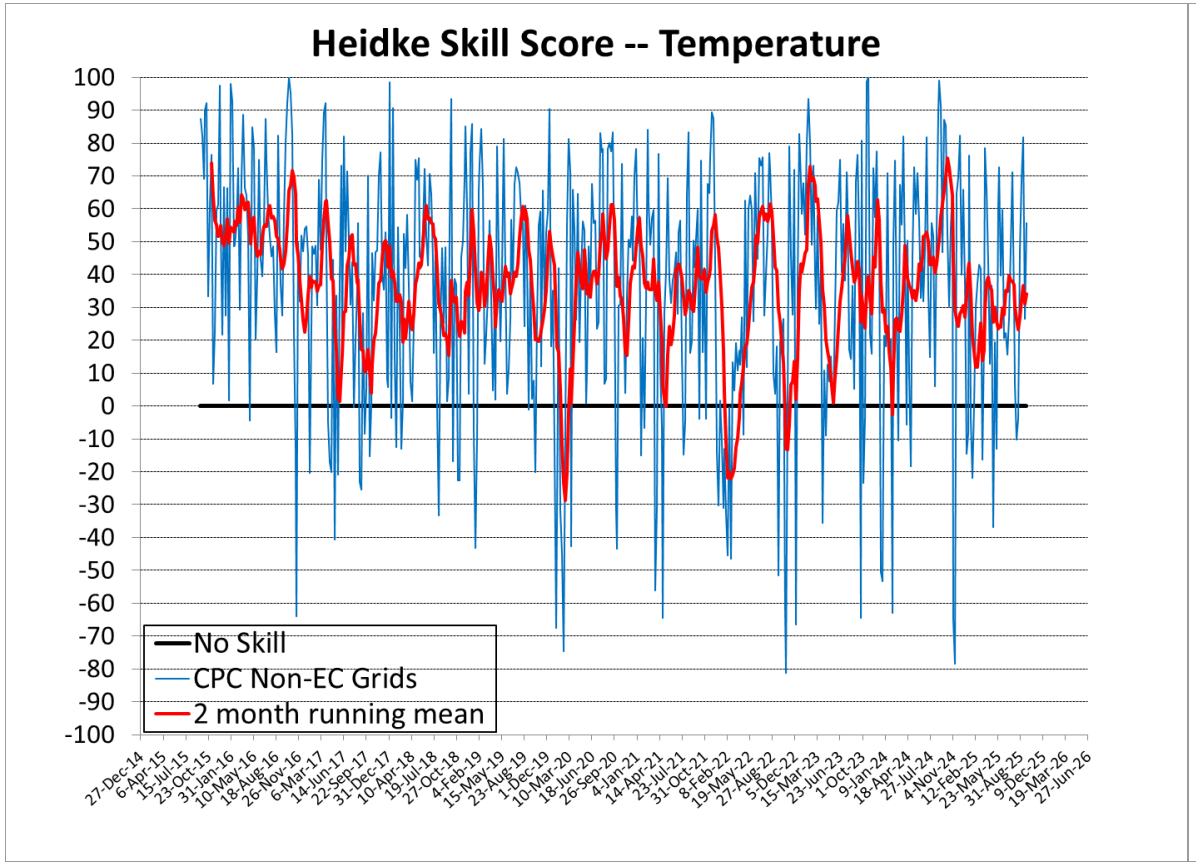


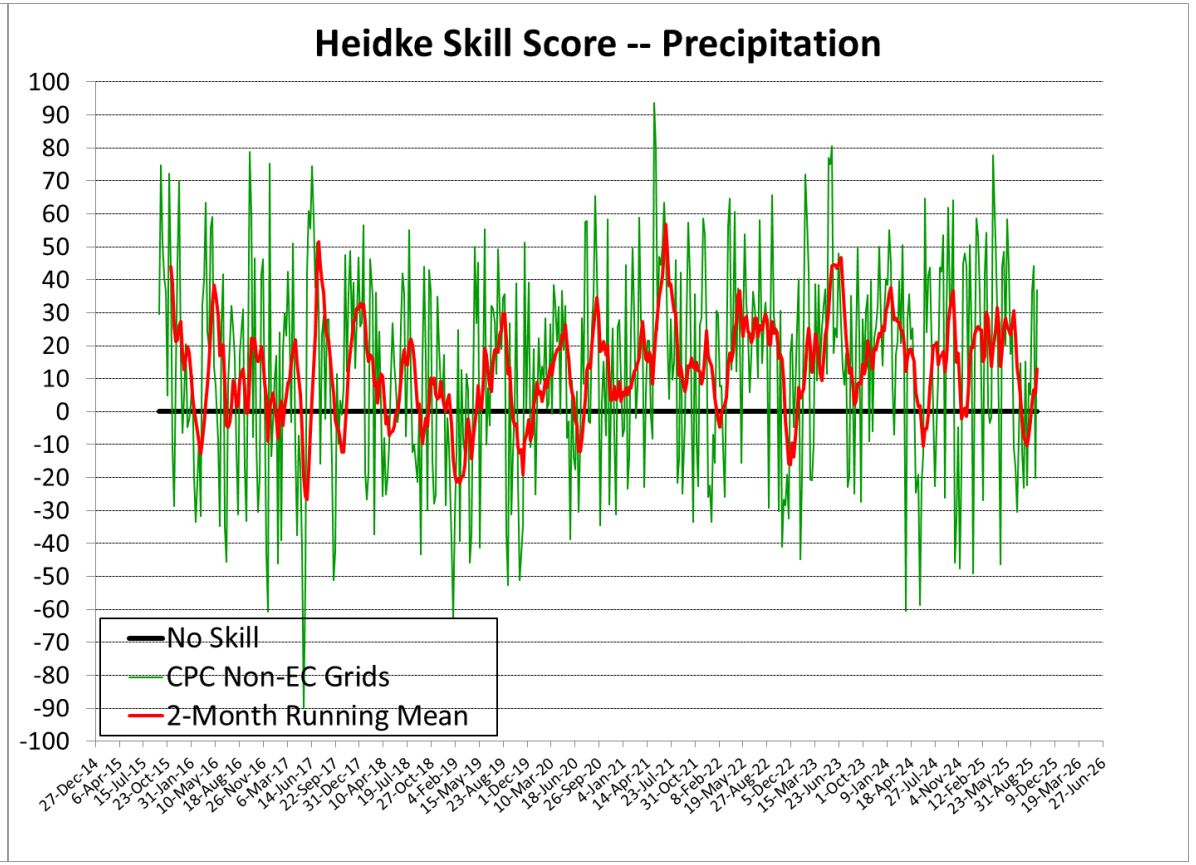
All members



Select members

Outlook Verification – Spatial Domain Time Series





Temperature

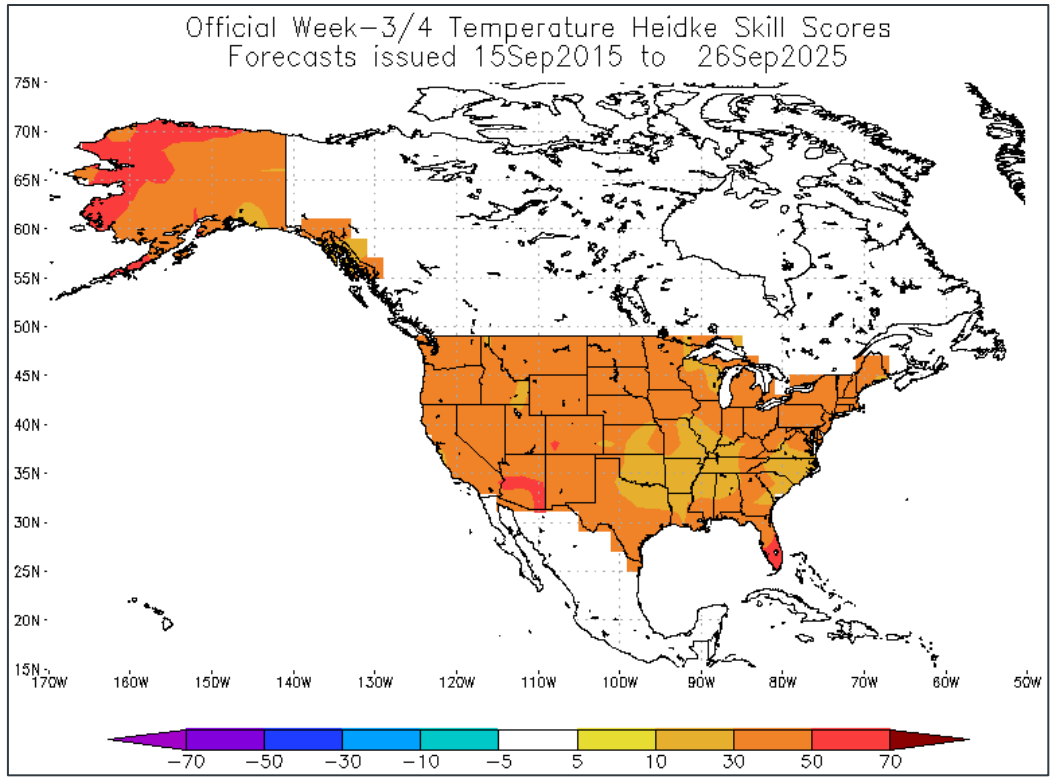
Period mean ➔ +37

Precipitation

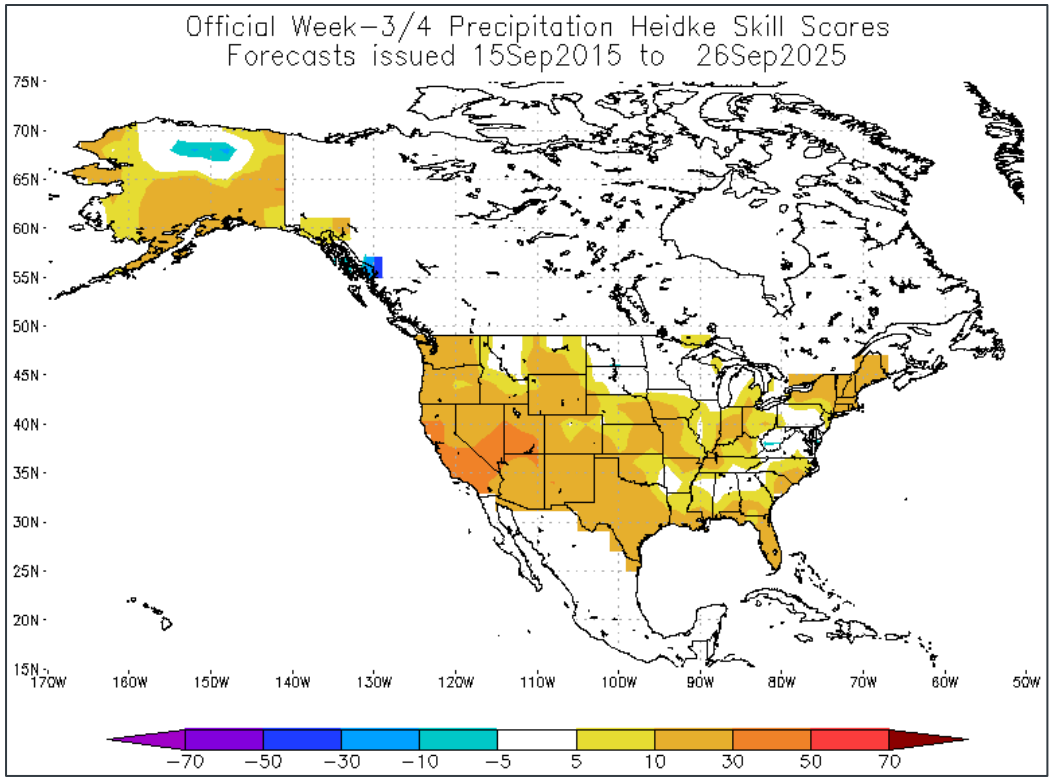
Period mean ➔ +13

9/18/2015 – 9/26/2025

Outlook Verification – All Forecasts

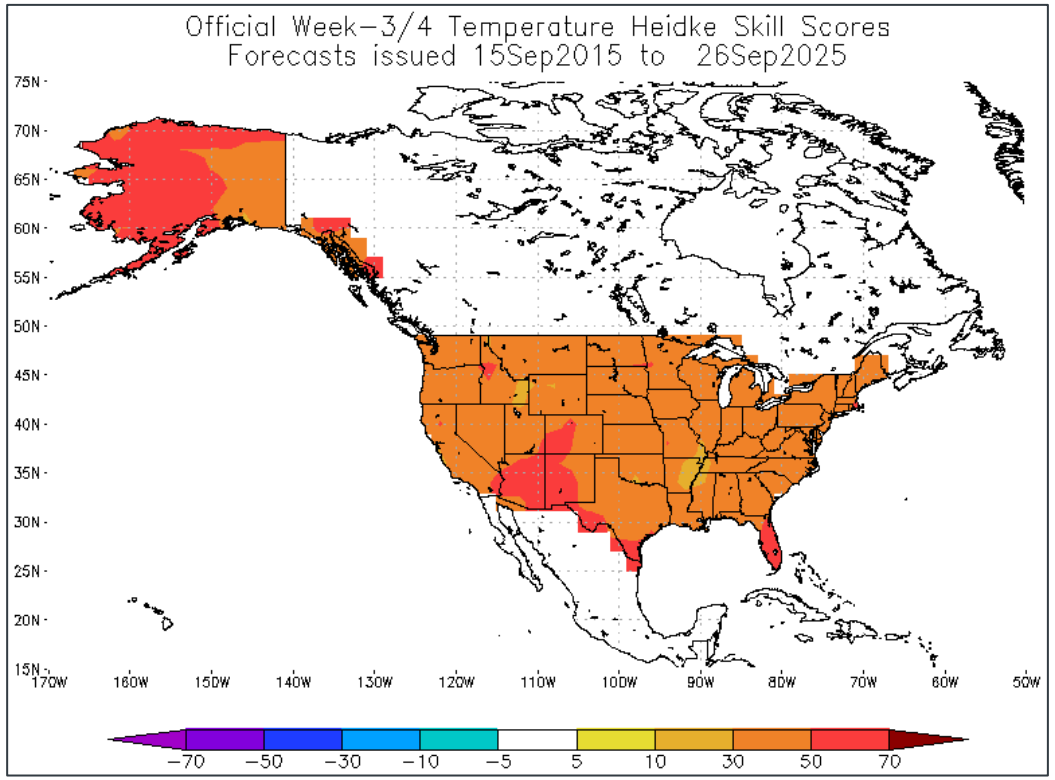


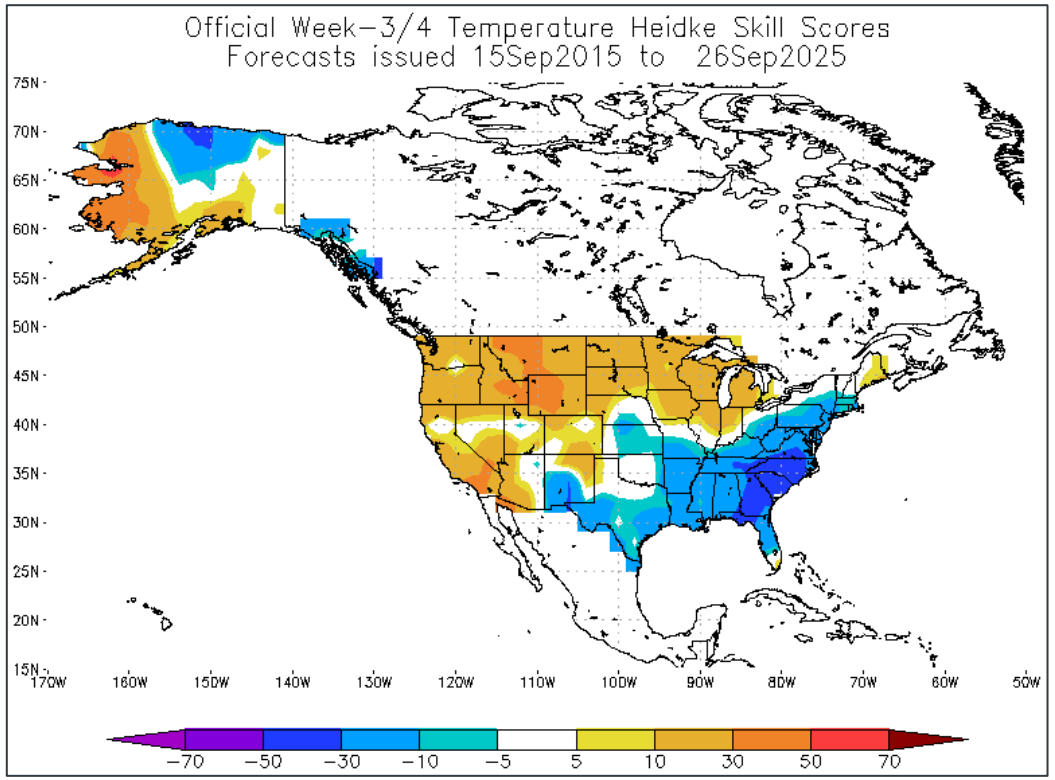
Temperature Only



Precipitation Only

Outlook Verification – Above/Below T Forecasts



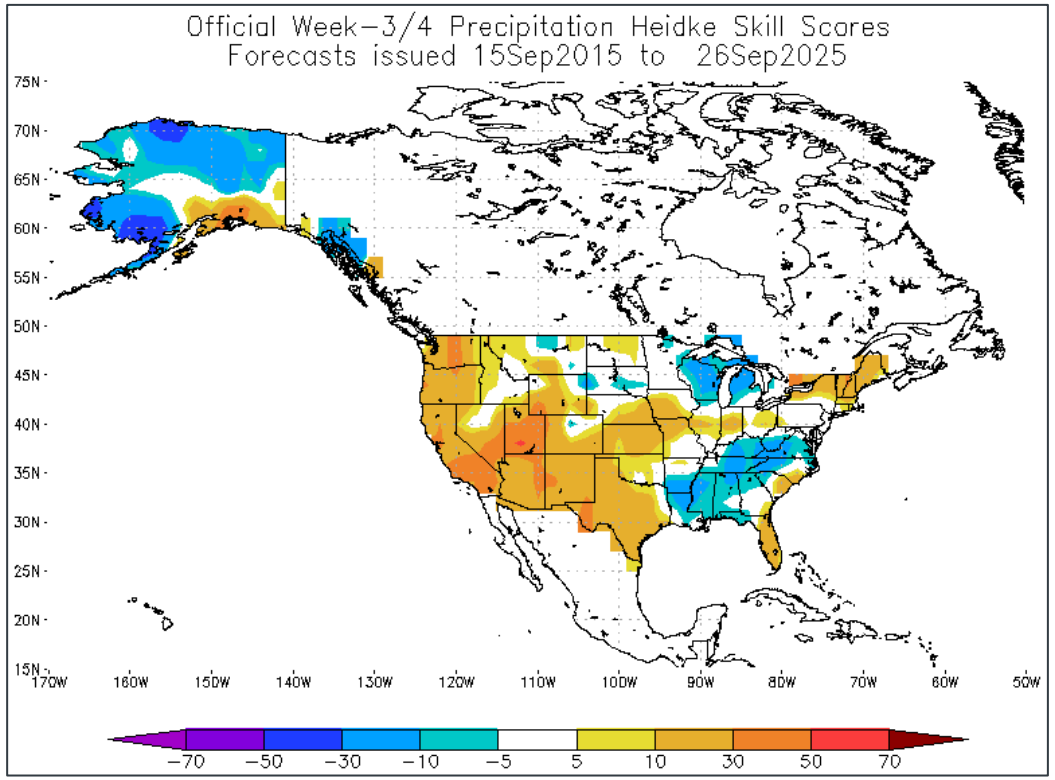


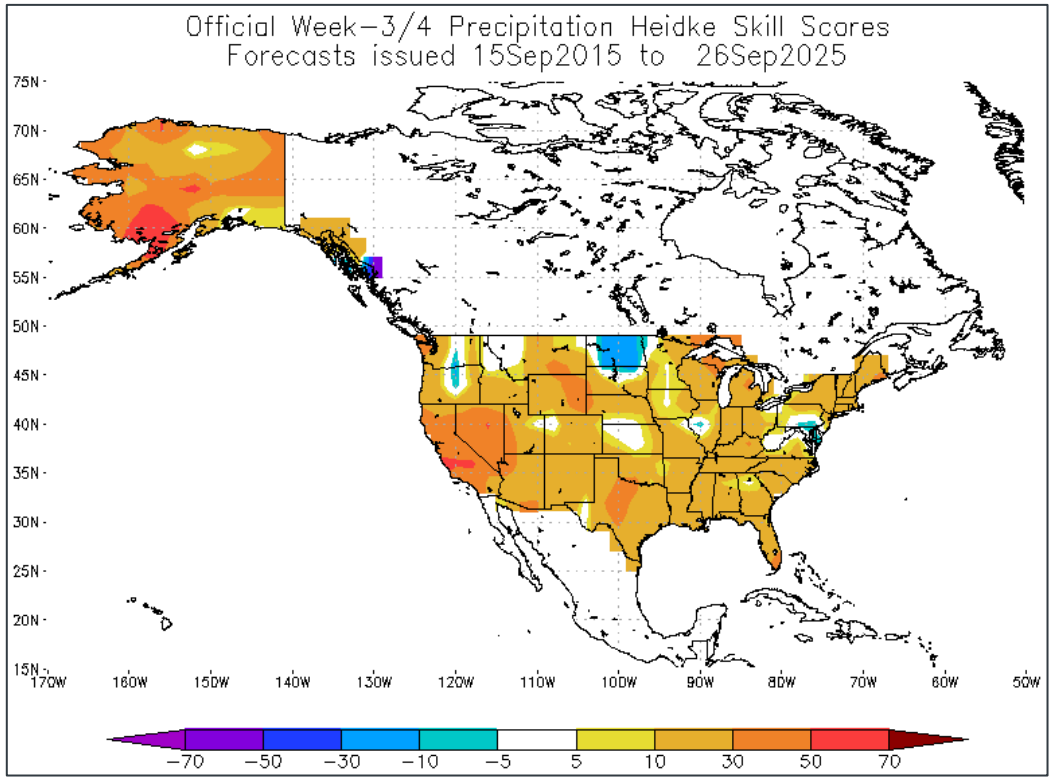
Temperature Only

Above-normal Category

Below-normal Category

Outlook Verification – Above/Below P Forecasts



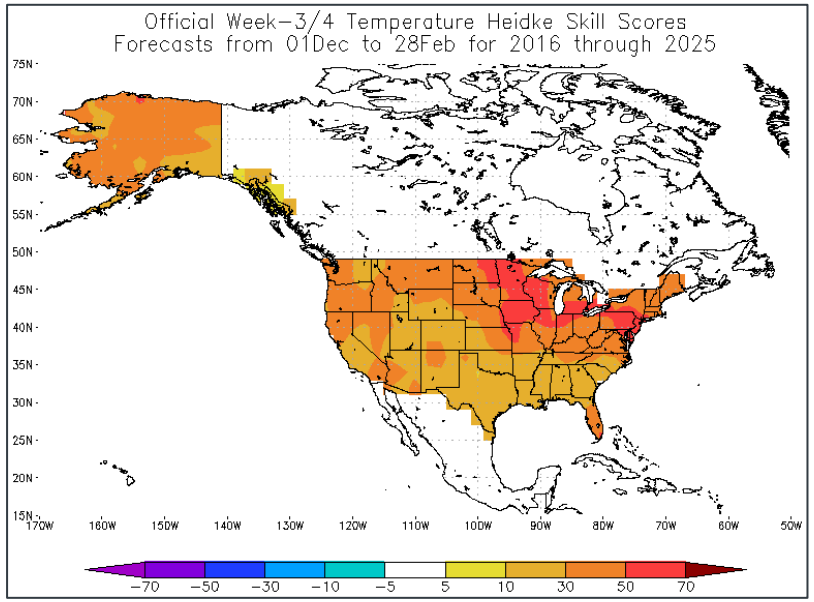


Precipitation Only

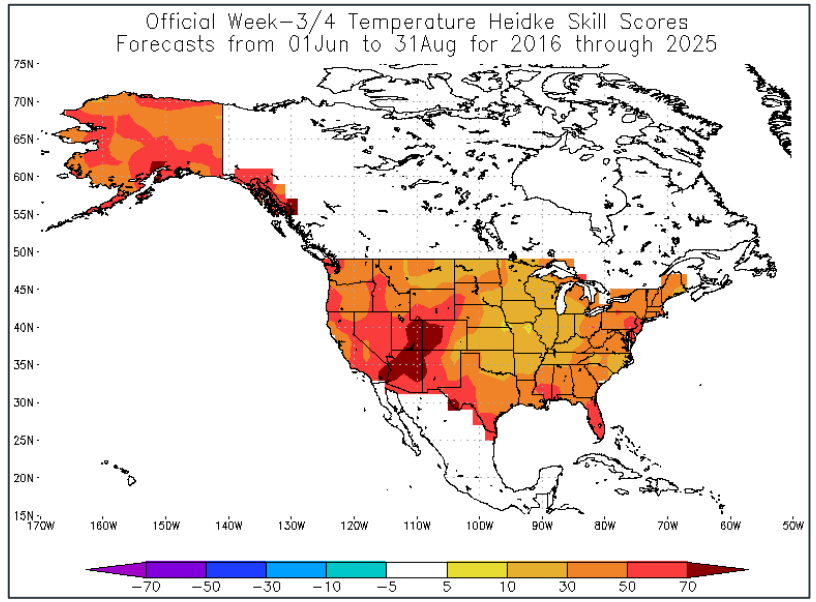
Above-normal Category

Below-normal Category

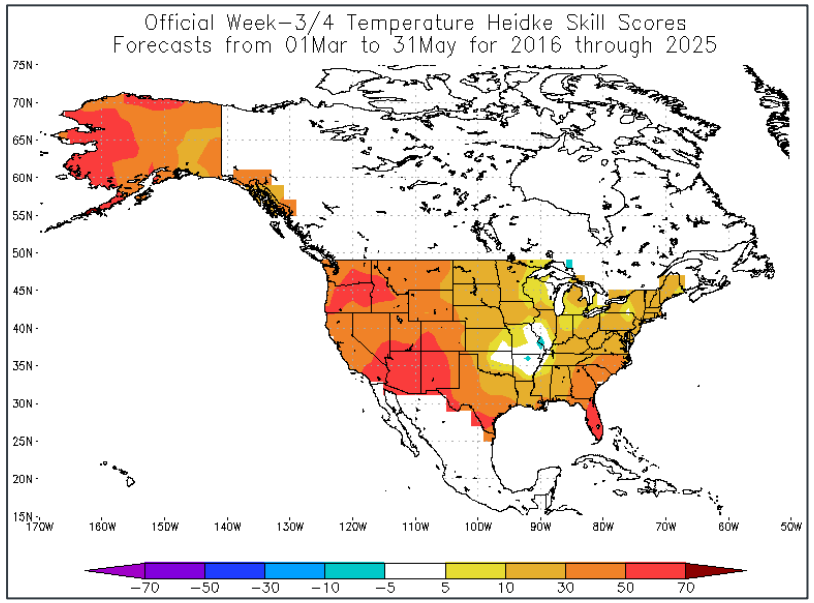
Outlook Verification – T Forecasts - Season



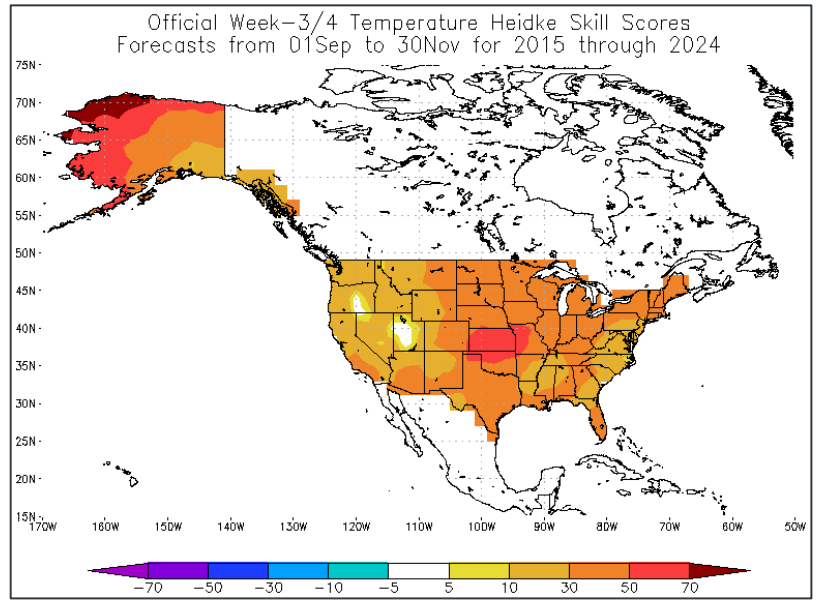
DJF



JJA

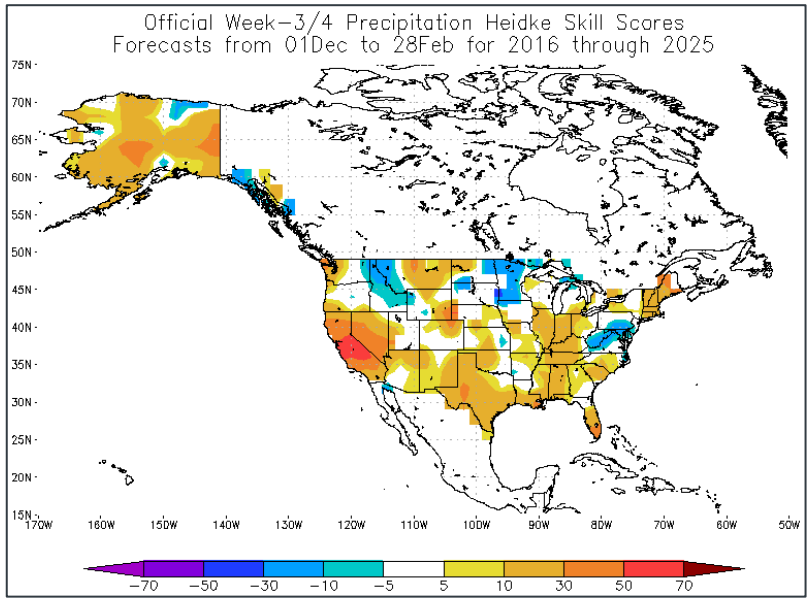


MAM

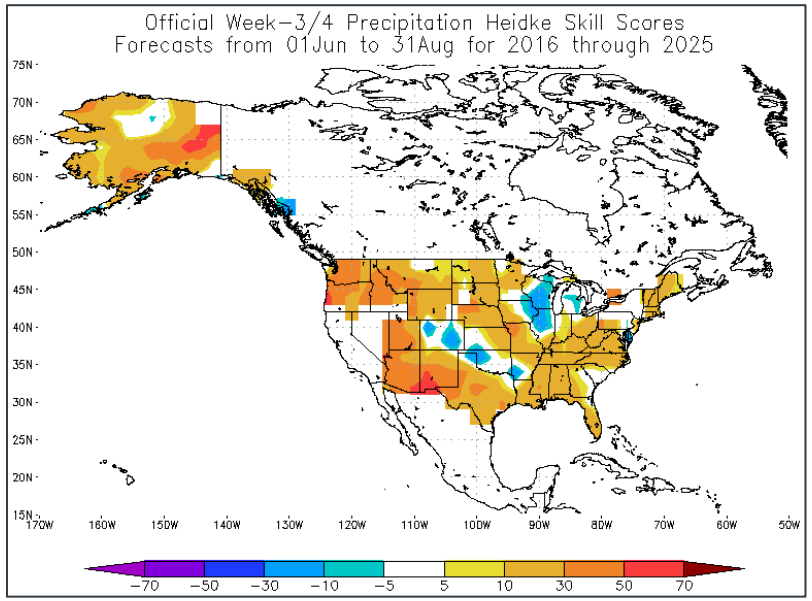


SON

Outlook Verification – P Forecasts - Season



DJF



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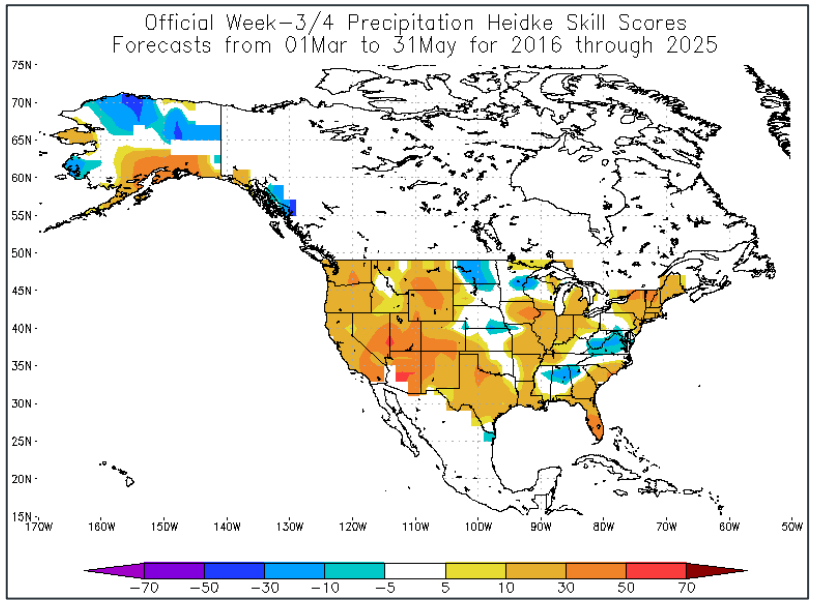
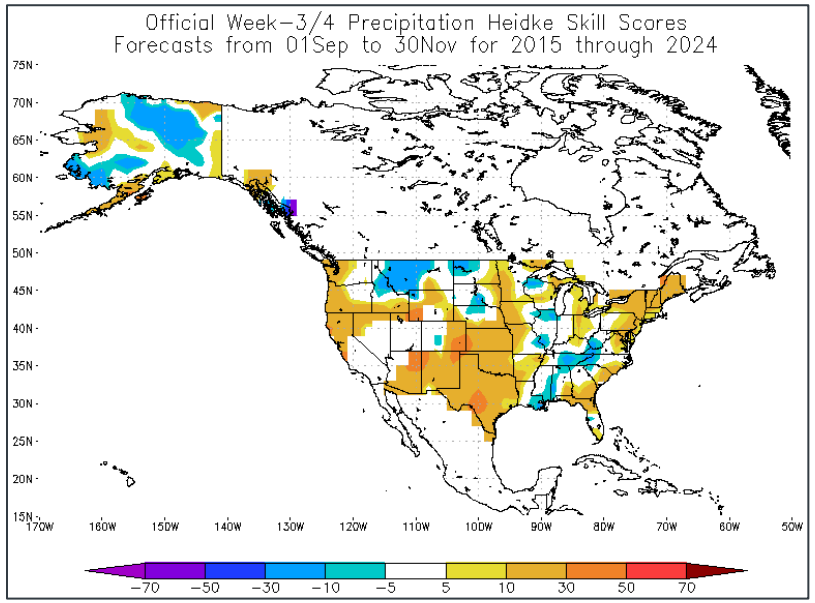
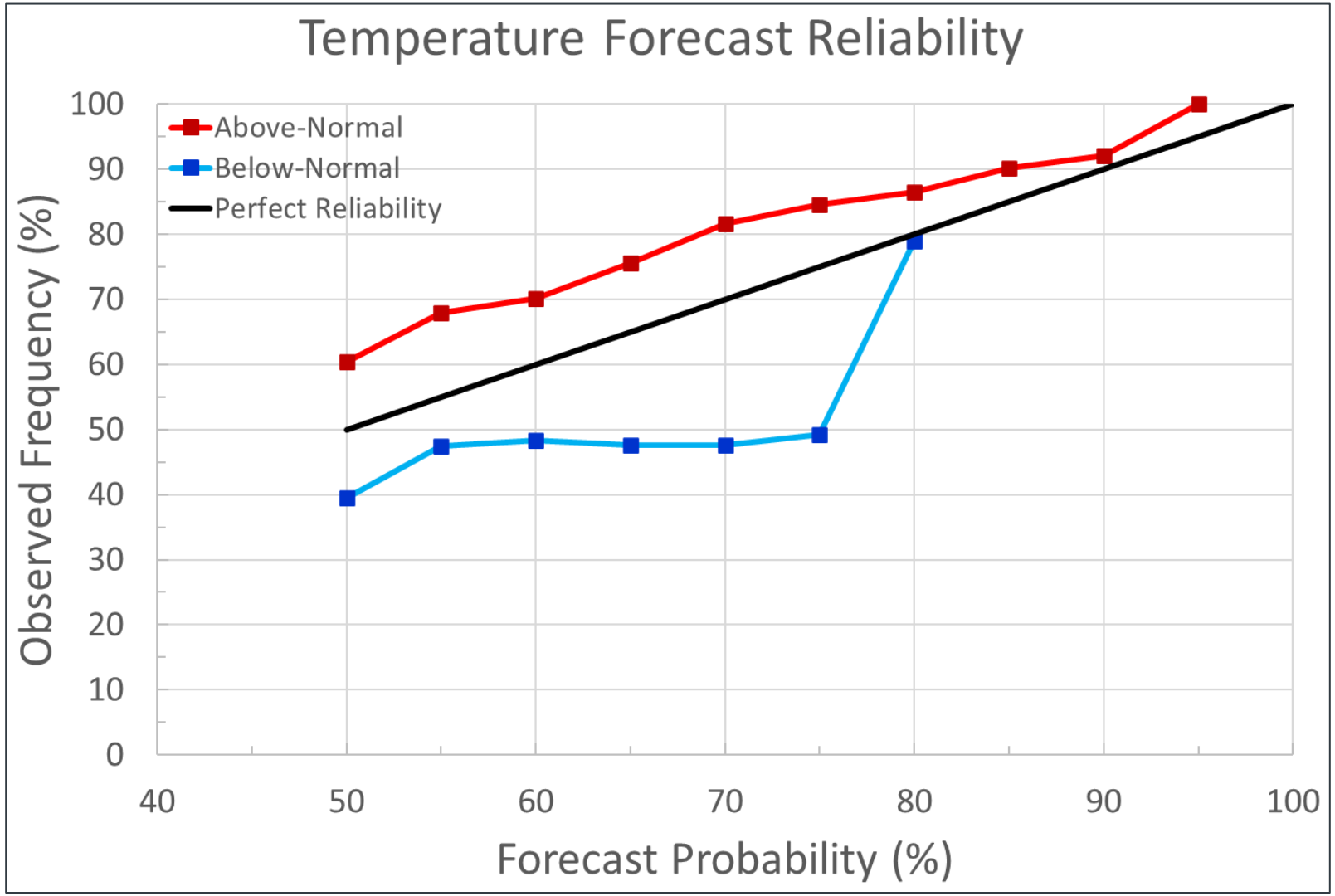


MAM

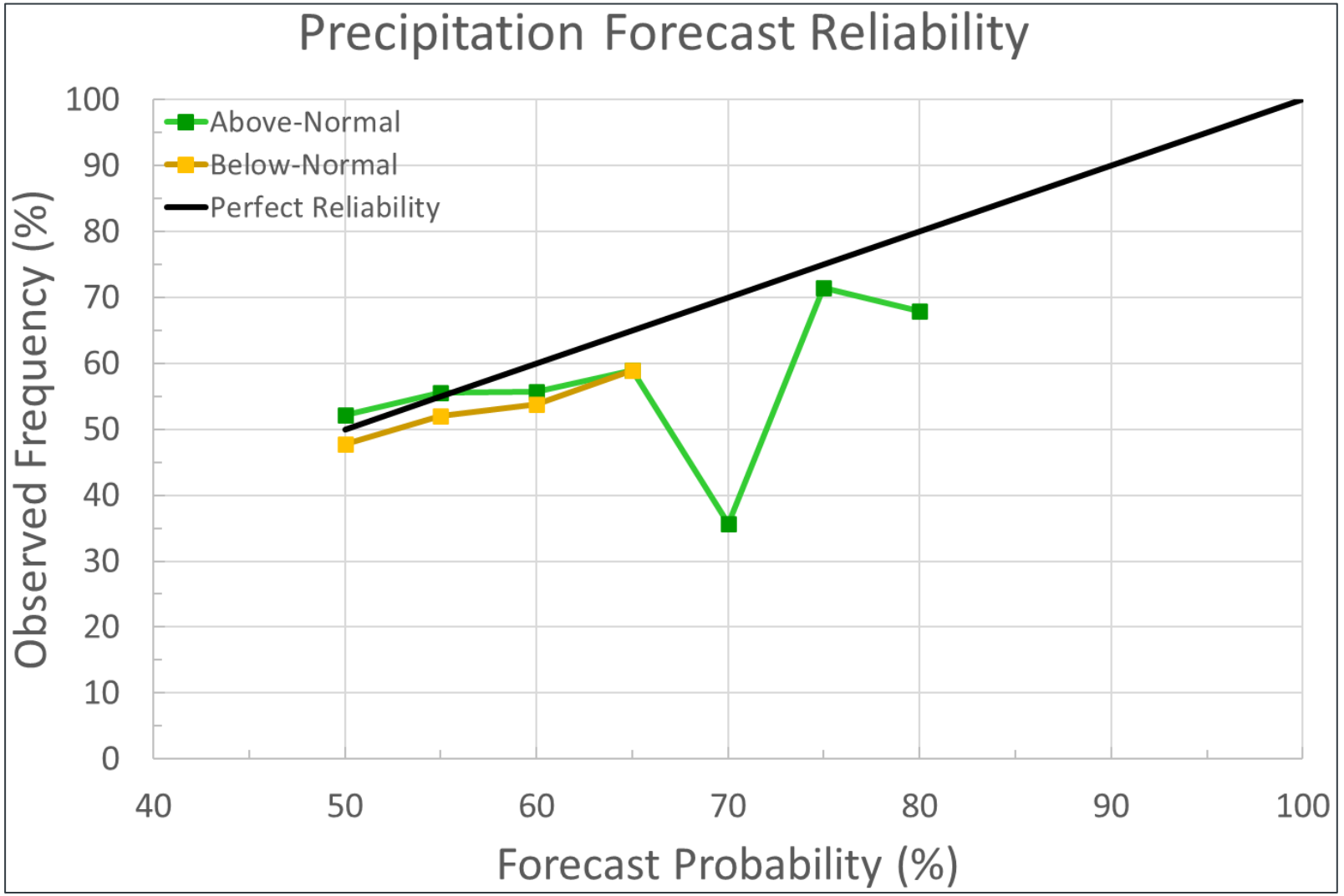


SON

Outlook Verification – T Forecast Reliability



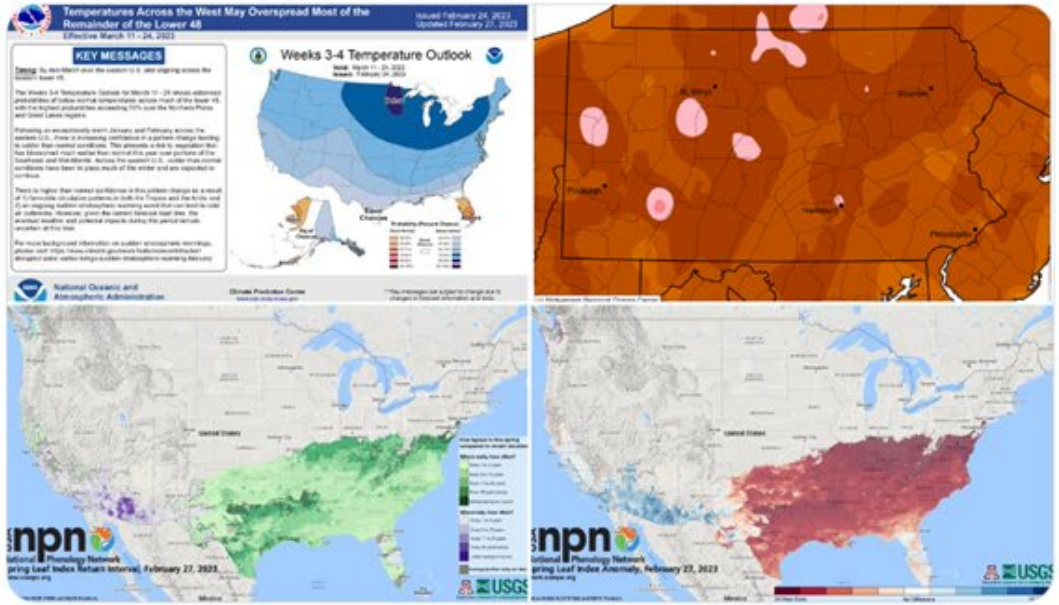
Outlook Verification – P Forecast Reliability



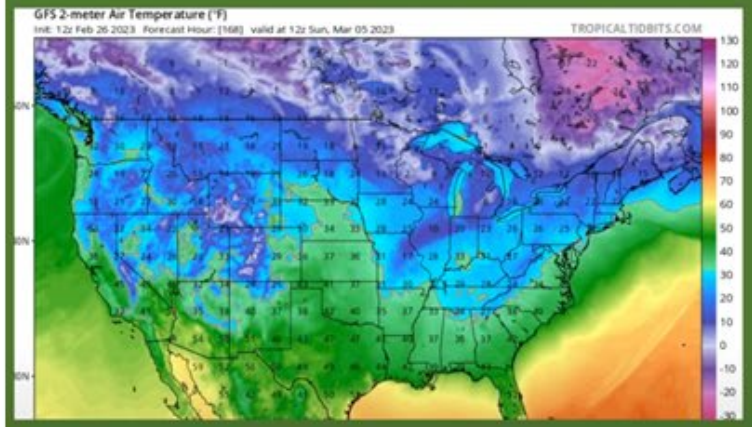
Impact Decision Support Services - Application

NWS State College
@NWSStateCollege

☝ Increased Potential for Major Pattern Change From Warm to Cold Across the Eastern U.S. by mid-March
📉 Temp Outlook: 60-80% chance of below normal temperatures in CPA
🌷 Risk to vegetation leafing-out much earlier than normal due to exceptionally mild Jan-Feb.
@NWSCPC @USANPN

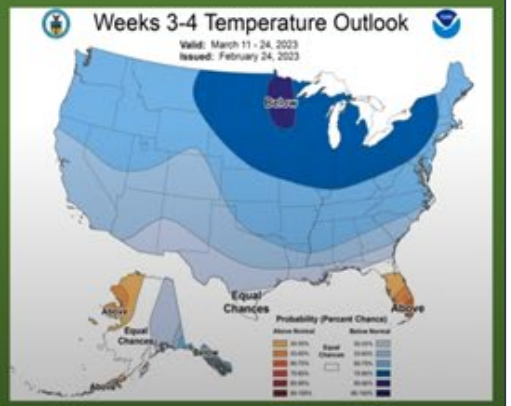


Freeze Probability



For the next few weeks, the most likely chance of frost is around March 5 (this map shows one model for one run)

On the 3-4 week time scale, the Climate Prediction Center is indicating a swing to colder than normal temperatures, so chance of frost could go up.



Information was picked up and disseminated via social media and partner briefings

National Oceanic and Atmospheric Administration
U.S. Department of Commerce

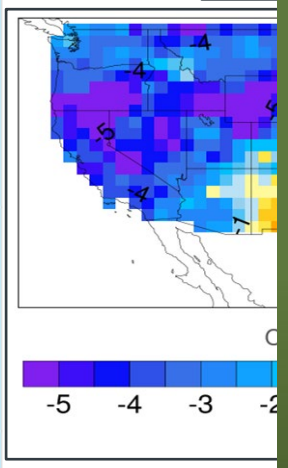
Climate Prediction Center
www.cpc.ncep.noaa.gov

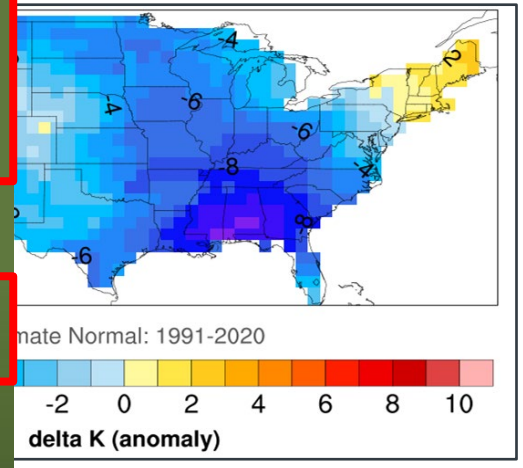
****Key messages are subject to change due to changes in forecast information and tools.*

Impacts of Recent Conditions on Agriculture

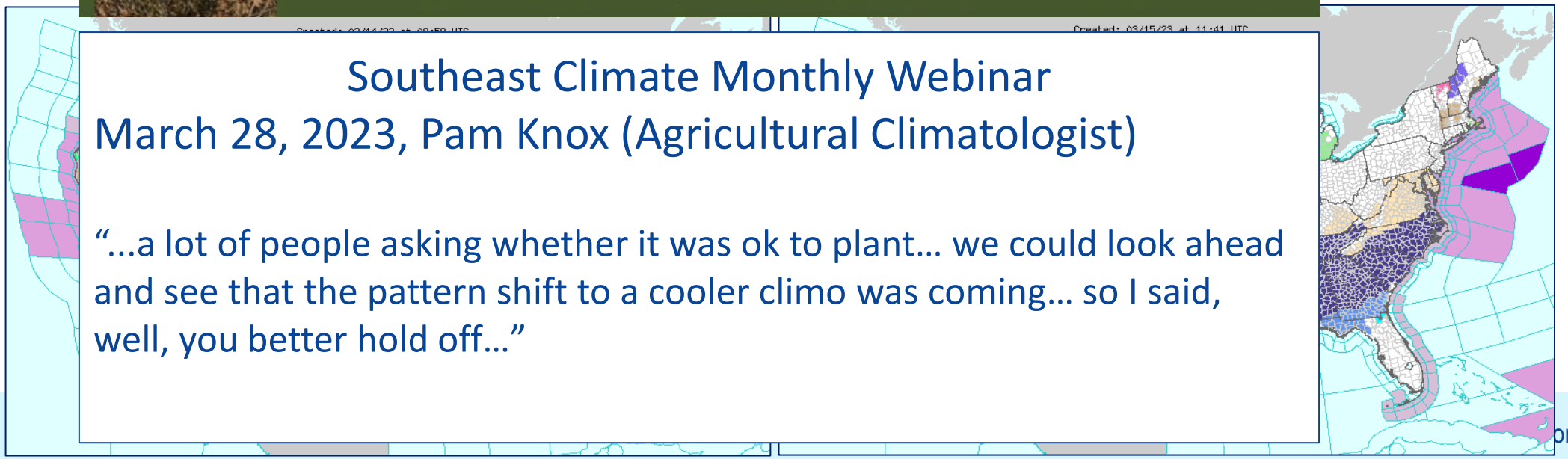
Sunny Hill Farm, NC Georgia

- Many areas in full bloom hit by multiple frosts
- Peach loss of early varieties in central GA estimated at near 100%, overall about 60% loss, may get some late blooms due to lack of winter chillCommercial blueberries in SE Georgia did not get as cold as the farm to the right but losses still estimated at up to 70%
- Early-planted corn lost leaves but growing point below ground in many cases, so should grow out of it
- Many farmers opted to wait until late in month to plant due to chance of frost and cold temps (good choice!)
- Drought in FL has resulted in widespread irrigation, pasture issues
- Vidalia onion yields predicted to be down due to December frost, official pack date April 17





Signifi ... h 11-24 periods

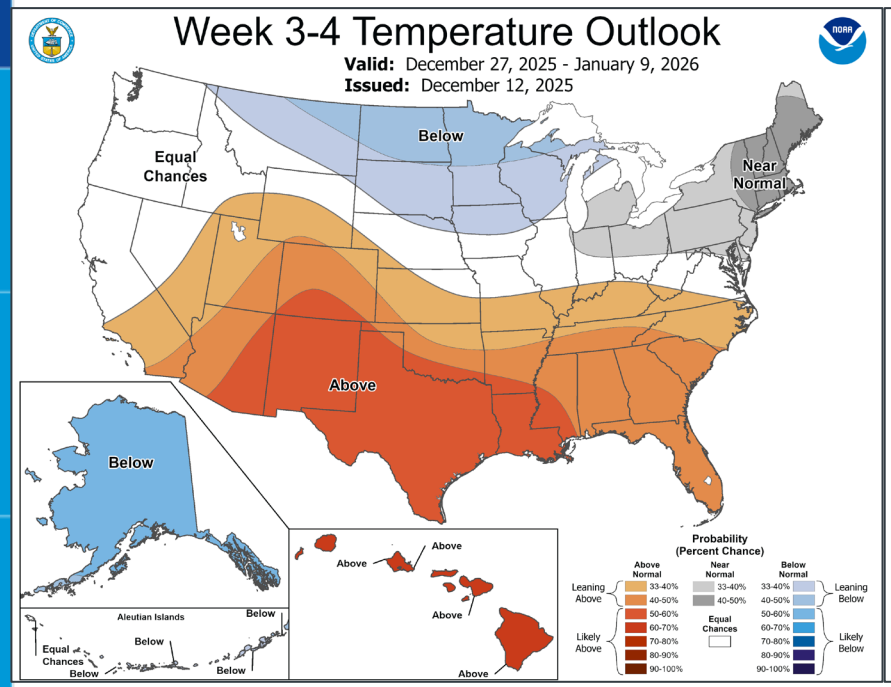


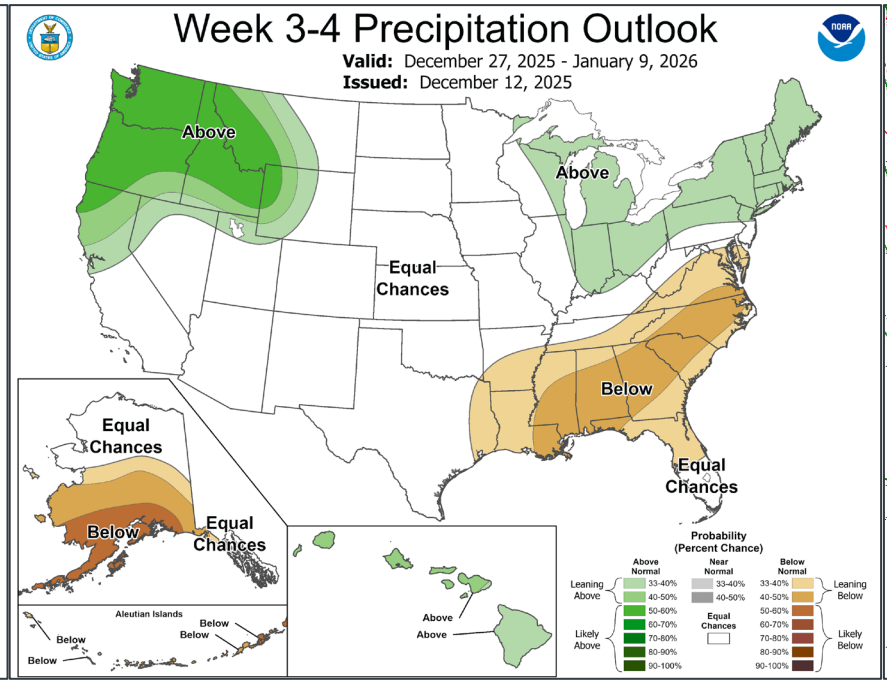
Southeast Climate Monthly Webinar

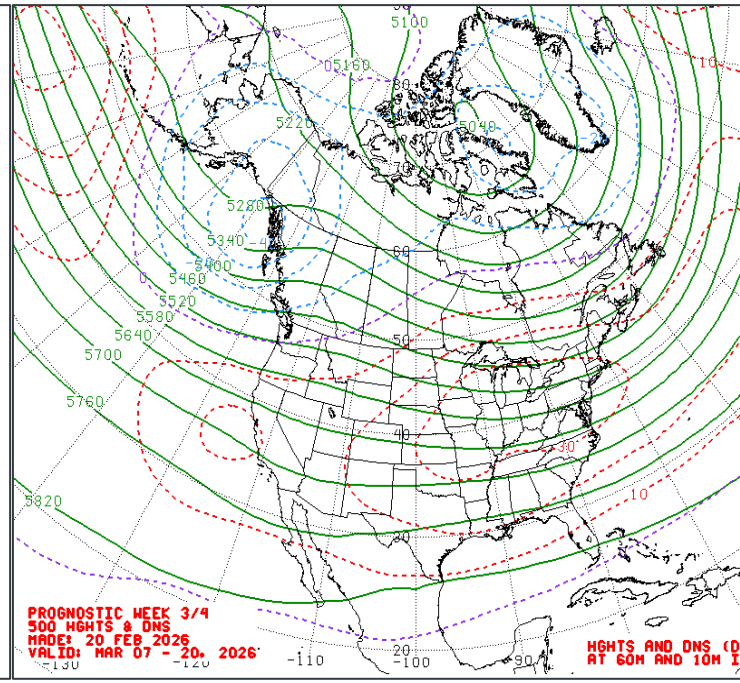
March 28, 2023, Pam Knox (Agricultural Climatologist)

"...a lot of people asking whether it was ok to plant… we could look ahead and see that the pattern shift to a cooler climo was coming… so I said, well, you better hold off…"

Conversion to 3-class system on October 3, 2025







- ❑ Live web briefing as part of outlook preparation every Friday at 11:15 AM ET
- ❑ Outlook released approximately around 3:00 PM ET

Ongoing Development

- Forecast consolidation for temperature and precipitation outlooks based on historical forecast skill to serve as an objective first guess outlook
- Application of AI methods to both outlook inputs and objective consolidation first guess outlook
- Probability of exceedance information for the complete outlook distribution
- Continued application of Week 3-4 outlooks to provide early watch for potential impacts spanning several sectors of the U.S. economy

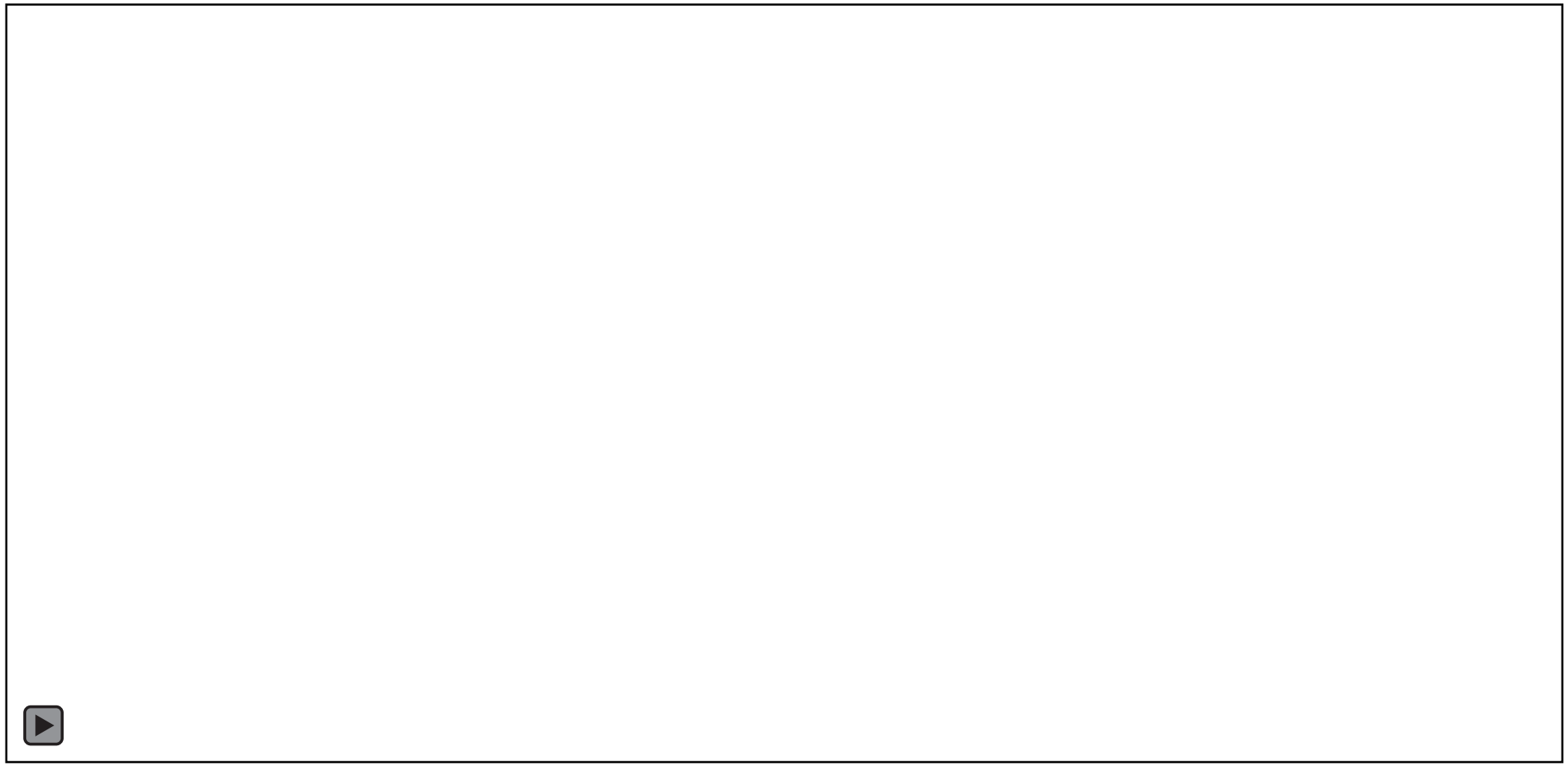
Summary

- CPC initiated Week 3-4 temperature and precipitation outlooks in 2015 and were originally 2-class forecasts, during a time when realtime forecast guidance was limited
- Dramatic increase of interest in subseasonal (e.g. Week 3-4) outlooks and availability of associated dynamical model guidance and accompanying reforecast datasets over the last several years
- CPC operational temperature and precipitation outlooks are both skillful on average over the forecast domain and period of record
  - Temperature forecast skill, on average, is about 3x that of precipitation
  - Notable areas do exist, however, where no skill is indicated depending on forecast category and season
- The CPC operational Week 3-4 outlooks have contributed to the NWS IDSS mission
- AI techniques are being explored and experimentally implemented with the hope to aid Week 3-4 outlook forecast skill

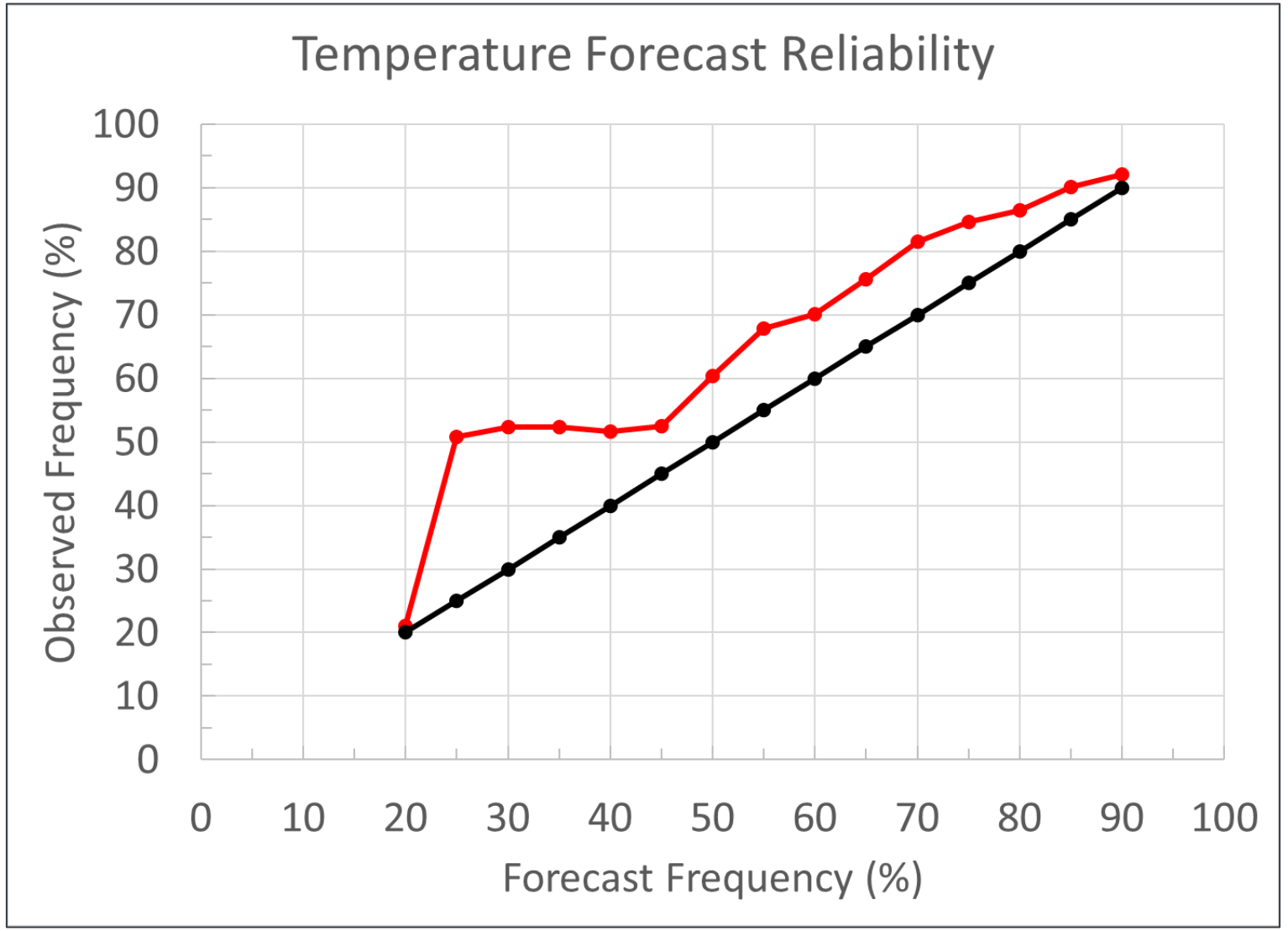
Thank you for your time and attention
Questions, Discussion

Jon.Gottschalck@noaa.gov

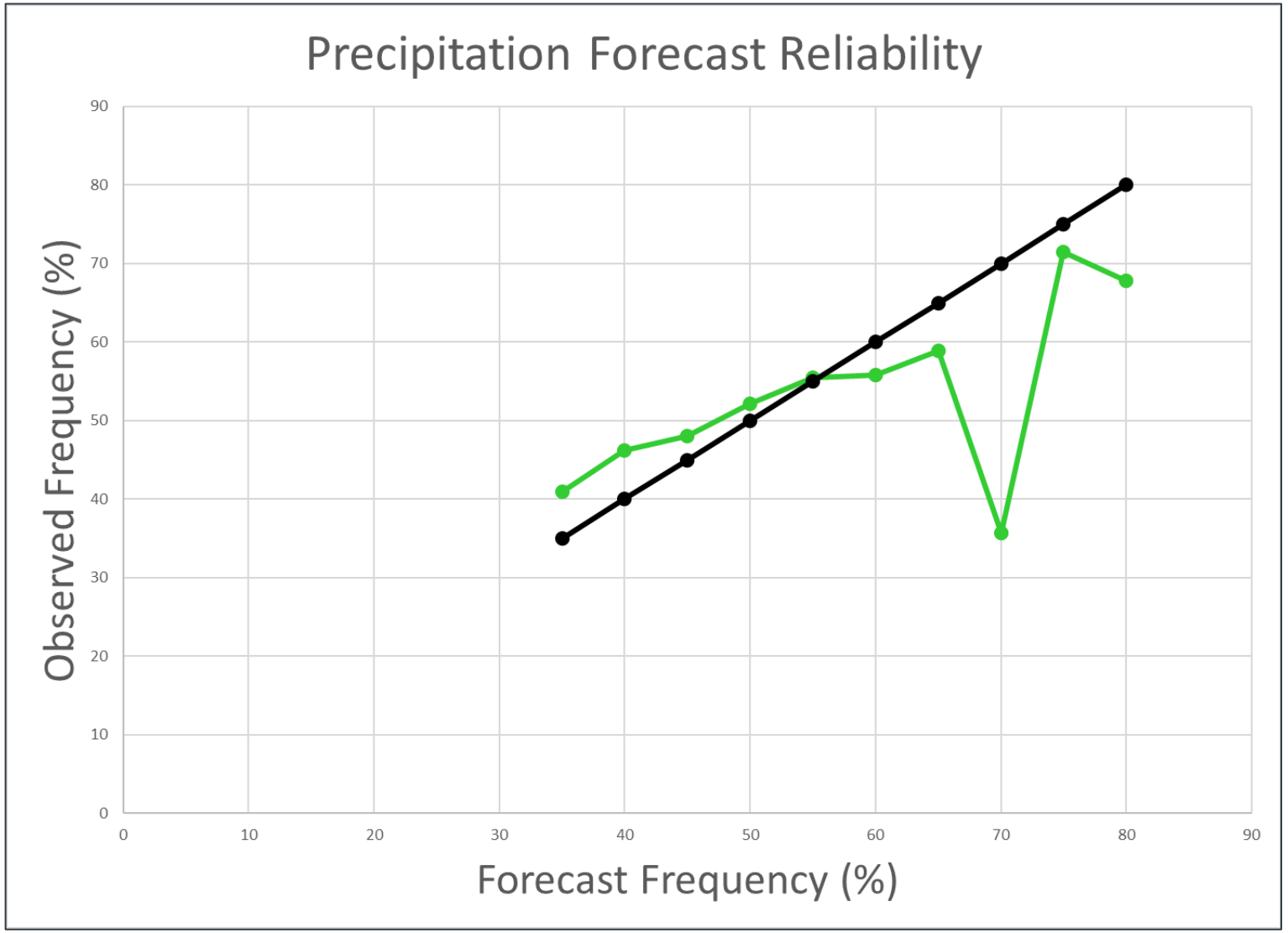
Outlook Forecast Guidance Utilized



Outlook Verification – T Forecast Reliability



Outlook Verification – P Forecast Reliability



Impact Decision Support Services - Application

Atmospheric Rivers affecting the Pacific Northwest and northern California into late December

Issued December 9, 2025
Updated December 10, 2025

December 18, 2025 - January 2, 2026

A mid-level ridge over the Bering Sea and downstream trough across the northeastern Pacific increases the chance for additional atmospheric river events to affect the Pacific Northwest and northern California. Periods of heavy rain, high winds, and high elevation heavy snow are most likely across Oregon and northern California from December 18 to 21.

Given the significant river flooding across western Washington and northwest Oregon that is ongoing, the currently elevated rivers and saturated soils will most likely linger into late December. This will increase the risk of flooding impacts continuing through the wet season. Landslide vulnerability will continue to be elevated.

(a) The flooding risk is expected to persist into late December and may expand southward into Oregon.

(a) The highest confidence for heavy precipitation is across southwestern Oregon and northwestern California where a high risk (> 60%) is posted in the Week-2 U.S. Hazards Outlook, December 18-21. A moderate risk (40-60%) of heavy precipitation includes more of the West Coast, while a moderate risk (40-60%) of heavy snow is designated for the Cascades and northern Sierra Nevada Mountains.

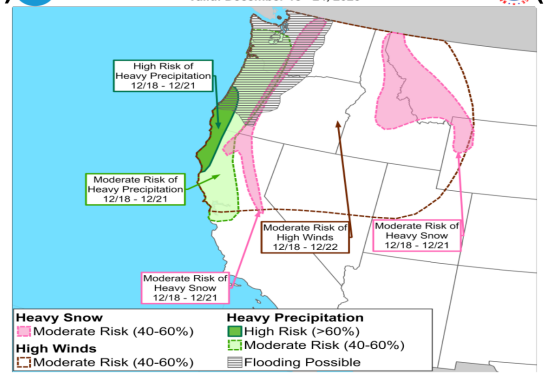
(a) Enhanced onshore flow supports a moderate risk (40-60%) of high winds from the West Coast to the interior West with the highest gusts expected along the coast and at higher elevation.

(b) During a wet time of year, there is more than a 50 percent chance of above normal precipitation for the Pacific Northwest and northern California.

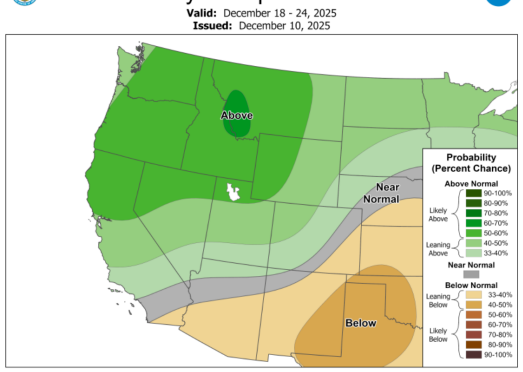
(c) The La Niña pattern with periods of enhanced onshore flow is favored to persist

** For short-term forecasts (prior to December 18), visit www.wpc.ncep.noaa.gov and weather.gov.*

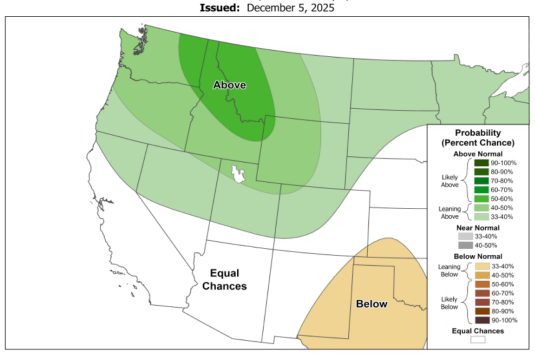
(a)



(b)



(c)



National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Climate Prediction Center
www.cpc.ncep.noaa.gov

****Key messages are subject to change due to changes in forecast information and tools.*