NOAA's Procedures for Operational Subseasonal and Seasonal Forecasting

Tuesday, 1 October, 2019

Dan Harnos (Daniel.Harnos@noaa.gov)

Thanks: Scott Handel, Jon Gottschalck, Matt Rosencrans

Search the CPC
Go

NCEP Quarterly Newsletter

Climate-Weather
El Niño/La Niña
MJO
Blocking
AAO, AO, NAO, PNA
Climatology
Global Monsoons

Expert Assessments
Index
Products

Outlooks (Forecasts)
Index
Products
Verification

Monitoring and Data
Index
Products

Crosscutting Themes
Ocean Climate
Stratosphere
Pacific Islands
International Desks

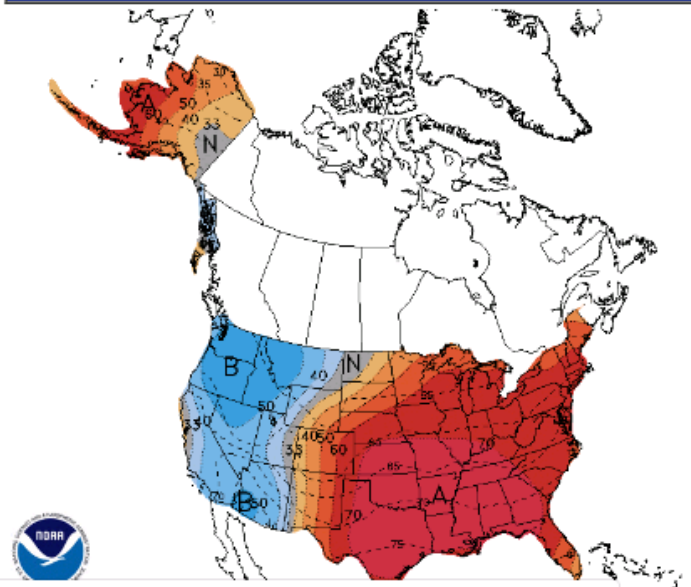
Partnerships
Climate.gov
Climate Test Bed
NOAA
Interagency
JAWF
USAID
Alaska
Others

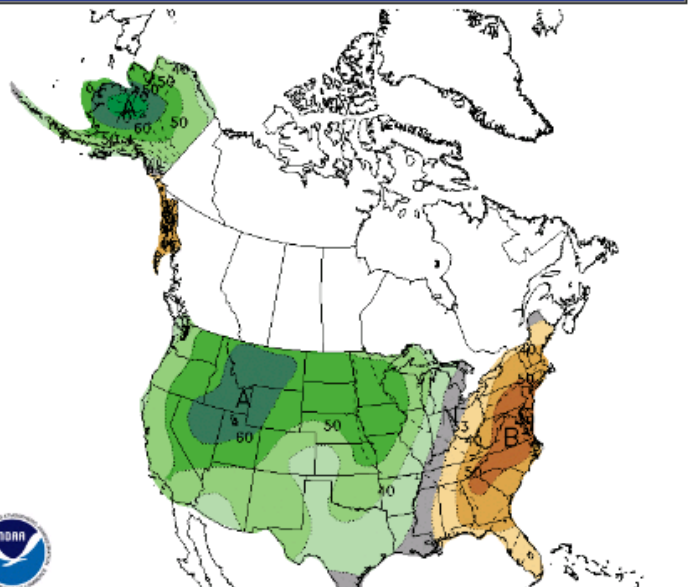
Climate News

- NOAA's 44th Climate Diagnostics & Prediction Workshop, 22–24 October 2019
- NOAA Seasonal Hurricane Outlook Press Release (8 August 2019)
- NOAA 2019 Atlantic Seasonal Hurricane Outlook (8 August 2019)
- 2019 US Drought Monitor Forum 17-19 September 2019 (with Agenda) (9 September 2019)

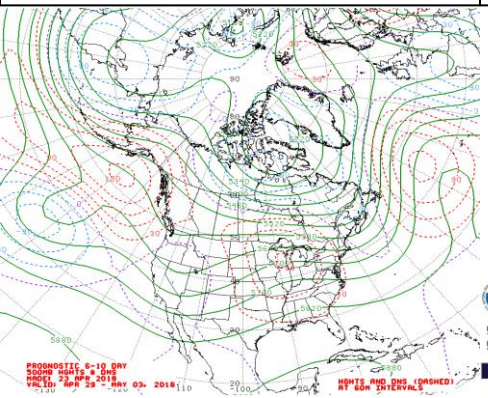
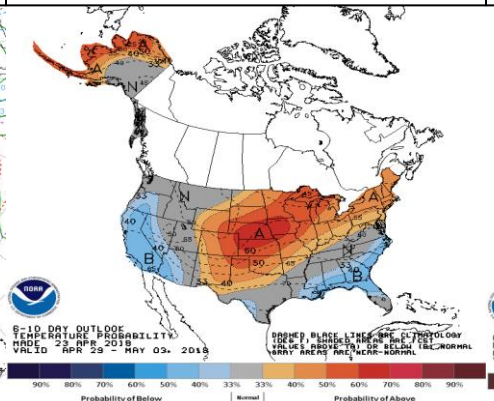
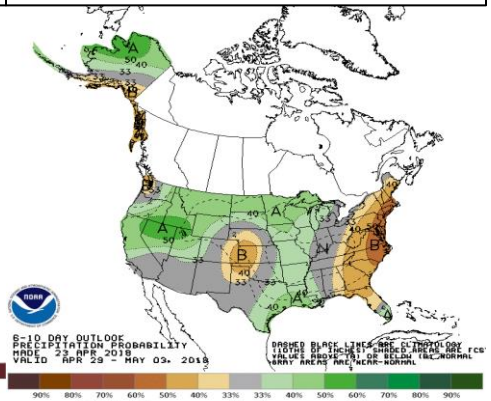
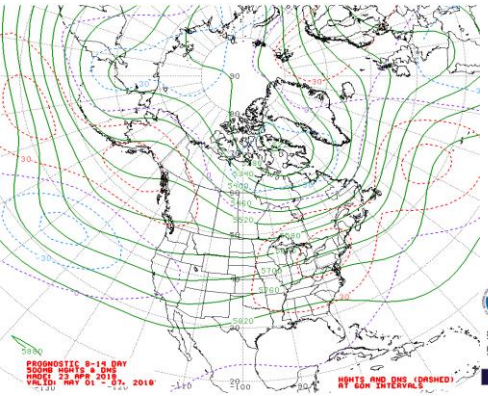
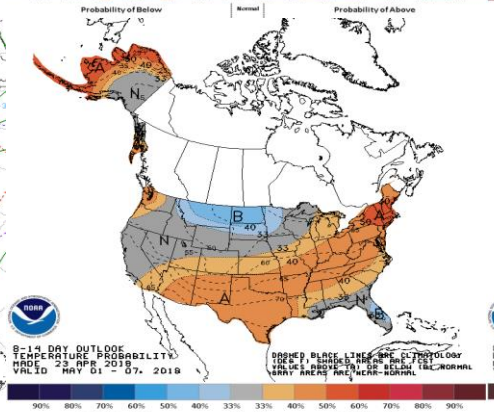
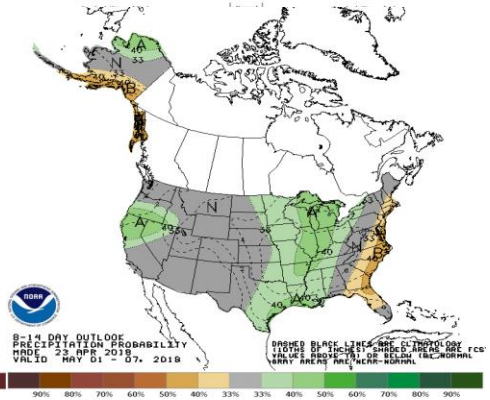
Click on product title to go to product page. Move cursor over product parameter name to display the graphic -- click to enlarge. Links to these same products are also available below.

6-10 Day Outlook (Interactive) Temperature Precipitation	One Month Outlook (Interactive) Temperature Precipitation
8-14 Day Outlook (Interactive) Temperature Precipitation	Three Month Outlook (Interactive) Temperature Precipitation
Week 3-4 Outlooks Temperature Exp. Precipitation	U.S. Hazards Outlook Composite 8-14 Day Probabilistic 8-14 Day: Temp Precip Wind
U.S. Drought Information Monitor Monthly Outlook Seasonal Outlook	Global Tropics Hazards Outlook Weeks 1 and 2





6-10 and 8-14 Day Outlooks (Extended Range Forecast)

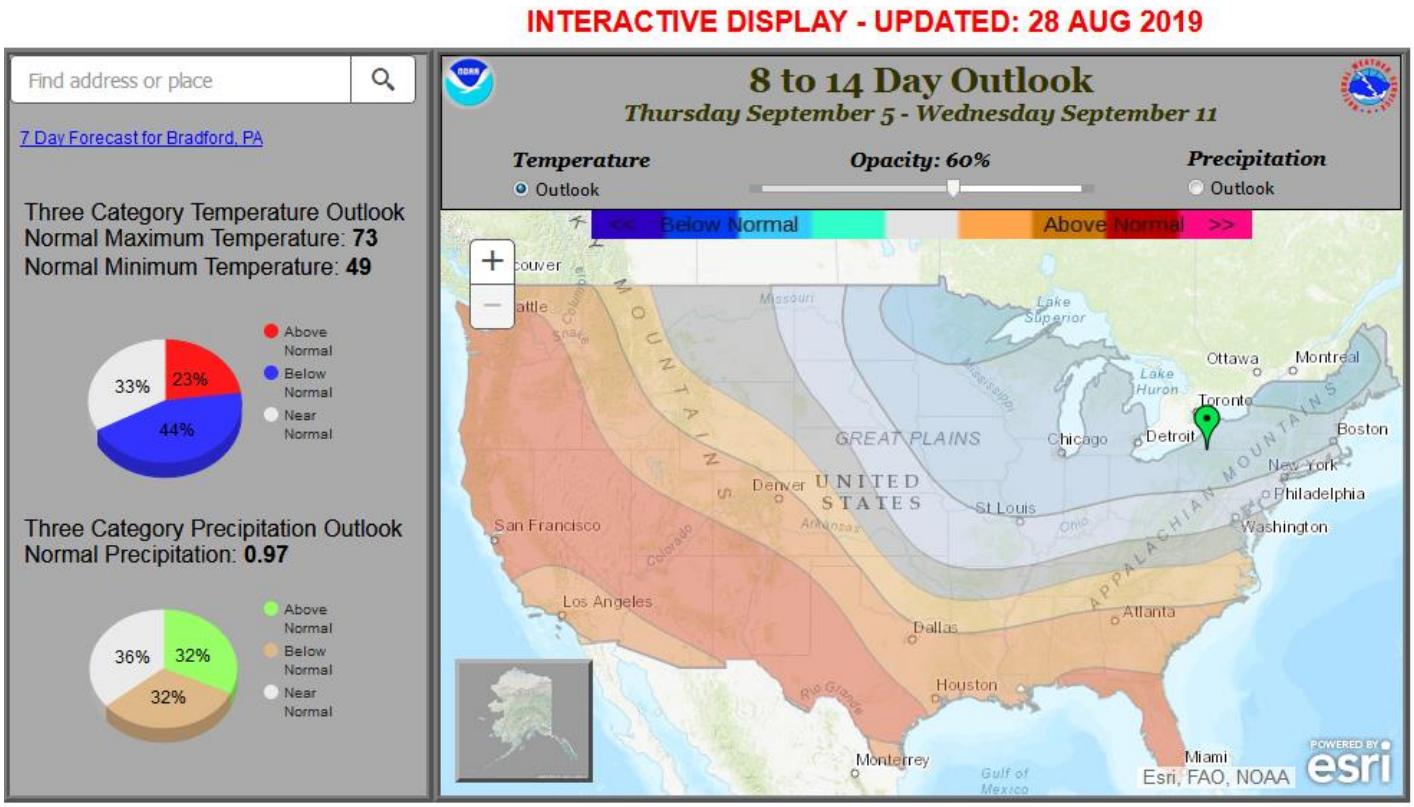
500-hPa Heights / Anomalies	Probabilistic Mean Temperature	Probabilistic Total Precip
		
		

General Information:
- Two outlook periods: 6-10 day and 8-14 day
- Three outlook maps for each period: 1) 500-hPa Heights/Anomalies, 2) Probabilistic Mean Temperature, 3) Probabilistic Total Precipitation
- Climatology Used: 1981-2010
- Product Availability: Daily between 3PM and 4PM Eastern Time (Automated on weekends)

500-hPa Height/Anomaly:
- Solid Lines: Deterministic Heights
- Dashed Lines: Height anomalies

Probabilistic Maps:
- Climos divided into three equal categories (Above, Near, and Below)
- Shaded areas represent probability of most likely category

6-10 and 8-14 Day Interactive Displays



https://www.cpc.ncep.noaa.gov/products/predictions/610day/interactive/index.php

https://www.cpc.ncep.noaa.gov/products/predictions/814day/interactive/index.php

General Information:

- Allows user to select specific locations
- Shows probabilities for all three tercile categories
- Displays normal max and min temperatures and normal precipitation for climatological context

Other Formats:

- GIS Shapefiles
- ASCII text files
- AWIPS maps and text

Prognostic Map Discussion

Prognostic Discussions

Valid: Sep 03 - 07, 2019 (6-10 Day Outlook)
Valid: Sep 05 - 11, 2019 (8-14 Day Outlook)
Issued: Aug 28, 2019

Prognostic Discussion for 6 to 10 and 8 to 14 day outlooks
NWS Climate Prediction Center College Park, MD
300 PM EDT Wed August 28 2019

6-10 DAY OUTLOOK FOR SEP 03 - 07 2019

Today's GFS, ECMWF, and Canadian ensemble means are in good agreement with their predictions of the 500-hPa flow pattern throughout most of the forecast domain during the 6-10 day period. The manual 500-hPa height blend is based on the ensemble means of the above three models, and features a mid-level trough over the Bering Sea and Aleutians, and troughs centered near both the East and West Coasts of the CONUS. A mid-level ridge is predicted over much of mainland Alaska, and the subtropical ridge is well-defined over approximately the southern half of the CONUS.

There are enhanced probabilities of above normal temperatures from the Pacific Coast eastward across the Intermountain West and Rockies to the High Plains, continuing eastward and southeastward across the Lower Mississippi Valley to much of the Atlantic Seaboard. Warmer-than-normal temperatures are also favored for Alaska. Probabilities for above normal temperatures reach in excess of 60% over the Pacific Northwest and the southwestern CONUS, and in excess of 70% over the vicinity of the Alaska Peninsula. These regions of favored anomalous warmth are attributed to such factors as mid-level ridging and/or near to above-normal 500-hPa heights, and (in the case of Alaska) coastal sea surface temperatures. In contrast, below normal temperatures are favored from the northern Plains northeastward across the Midwestern states, the Great Lakes region, and much of the Northeast. This favored area of below normal temperatures is associated with a mid-level trough.

WHO:

- Decision makers for weather / climate sensitive activities

WHAT:

- *Meteorological and climatological basis for 500-hPa, T, and P outlooks
- *Forecast confidence
- *500-hPa components
- Tables
- Analogs to observed pattern
- Glossary

*(weekdays only)

WHY:

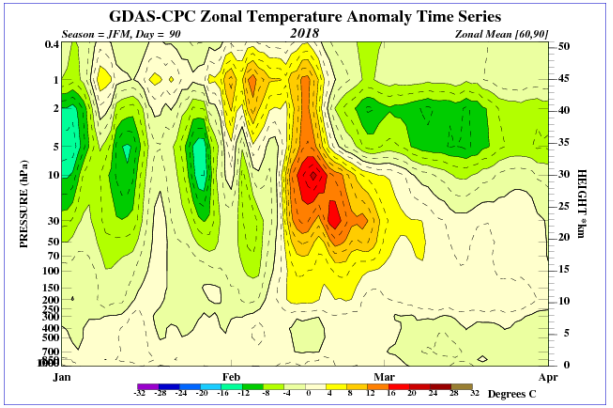
- Technical insight to assist decision making

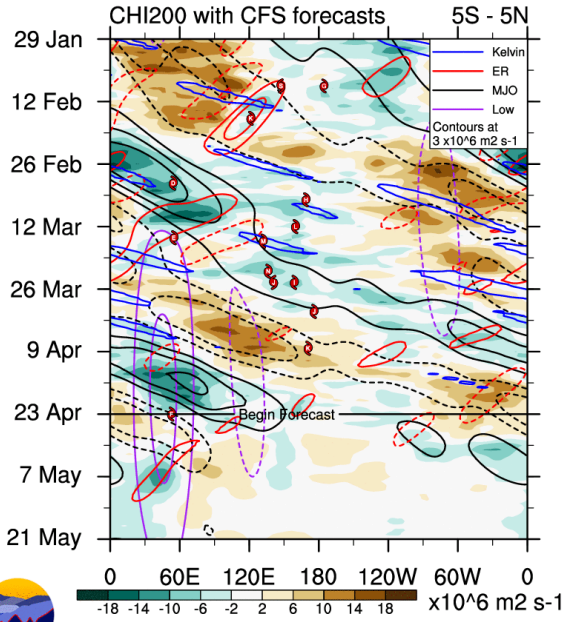
6-10 and 8-14 Day Production Timeline

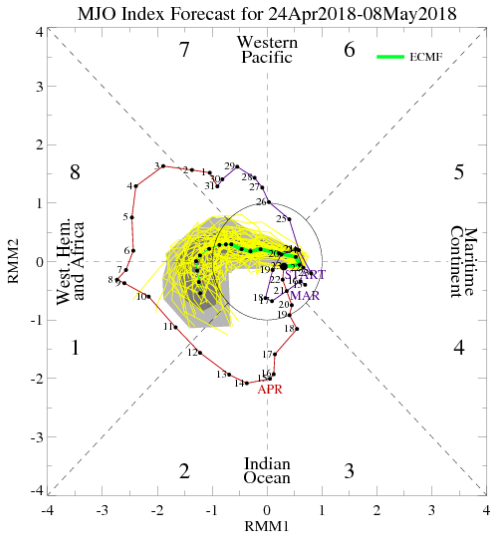
- 09:30: Guidance becomes fully available
- 13:00: Conference call with partners and forecast staff to discuss outlook
  - Feedback provided on areas of concern.
  - Ensures consistency with other products.
- 15:00-16:00: Final outlooks are publicly released

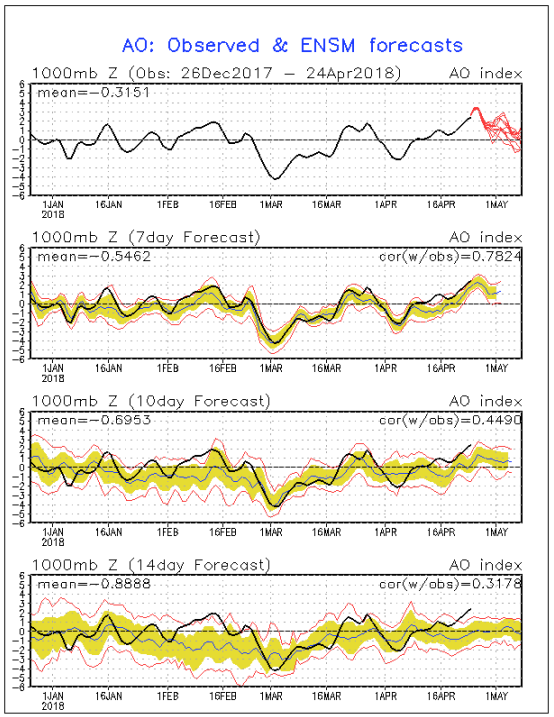
Overview of the climate state

- MJO observations/forecast
- Sudden stratospheric warmings
- AO/NAO observations/forecast



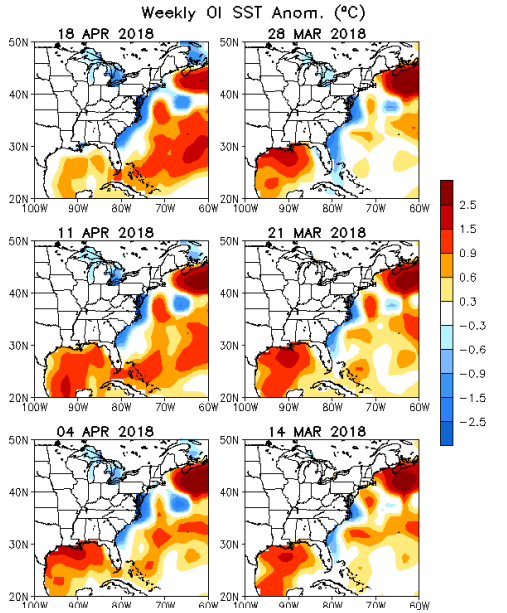


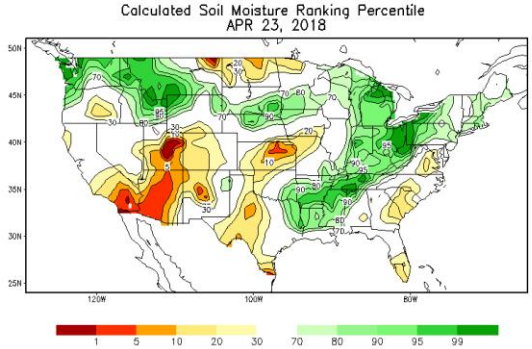


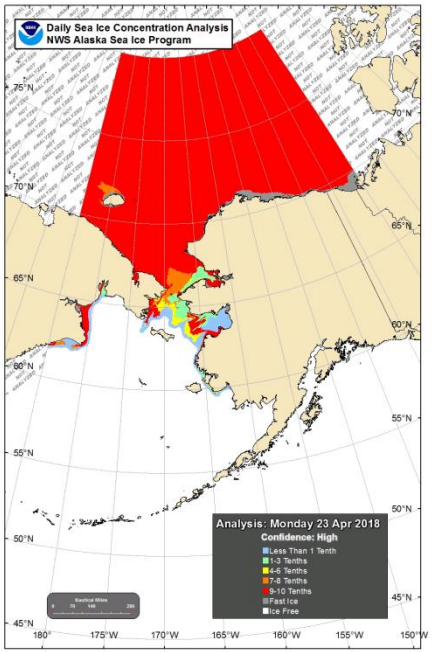


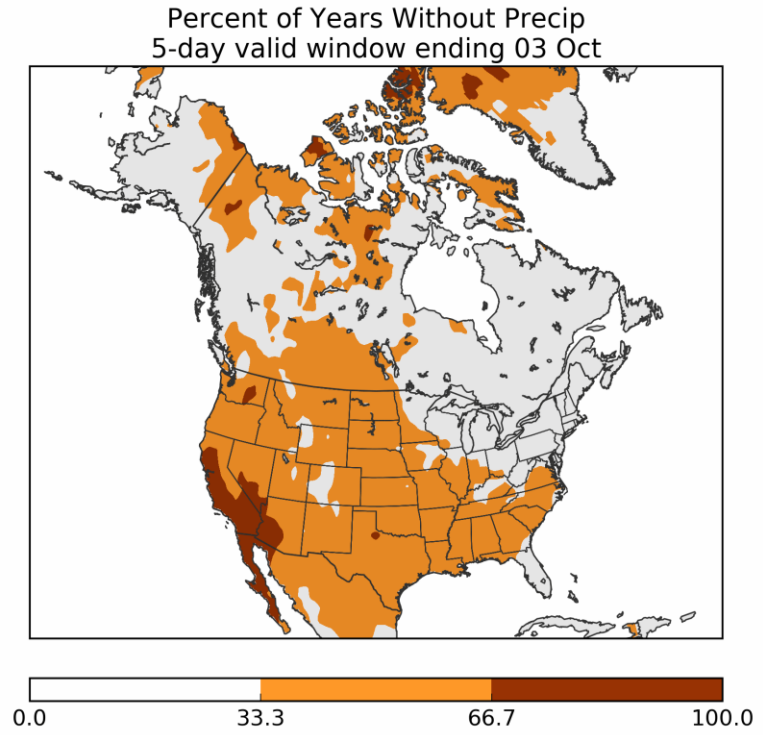
Boundary Condition

- Soil moisture
- Sea surface temperatures
- Sea ice/snow cover
- Arid areas









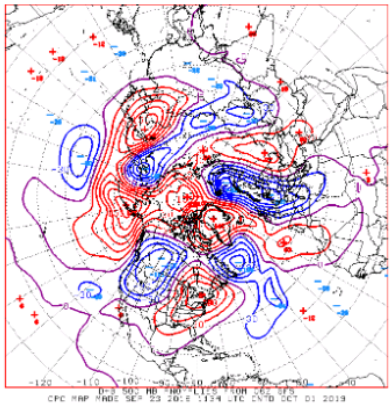
6-10 and 8-14 day Guidance

500 MB Anomalies

- PMSL Maps
- 500 MB Heights
- 500 MB Anomalies
- Auto Blend
- Manual Blend
- Dynamical Model Temperature Forecasts
- Dynamical Model Precipitation Forecasts
- Temperature Consolidation
- Precipitation Consolidation
- Klein Temperatures
- Ensemble Temperature Probabilities
- Ensemble Precipitation Probabilities
- Analog Surface Temperature Probabilities
- Analog Surface Precipitation Probabilities
- Composite Height Analog
- Calibrated Precipitation
- Anomaly Correlations
- Spaghetti Charts
- Reforecast Tool and 2m Temperature
- Heat Index

Select a Forecast Date: 09/23/2019

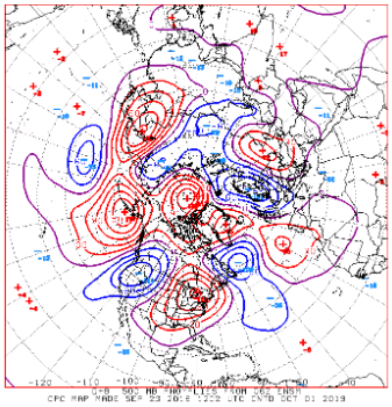
Operational GFS Maps



y12z y18z 00z 06z 12z Animate

Time Animation

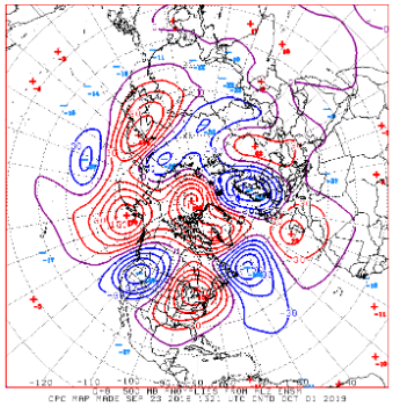
GFS Ensemble Maps



y12z y18z 00z 06z Animate

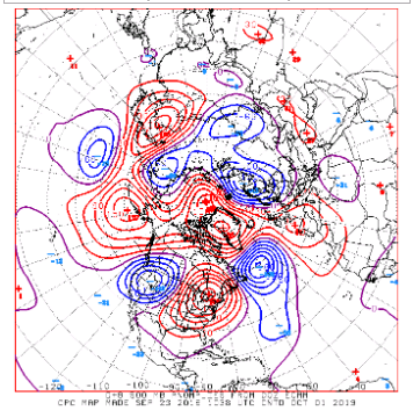
Time Animation

GFS SuperEnsemble

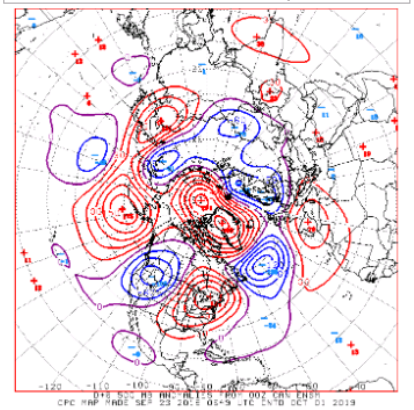


Time Animation

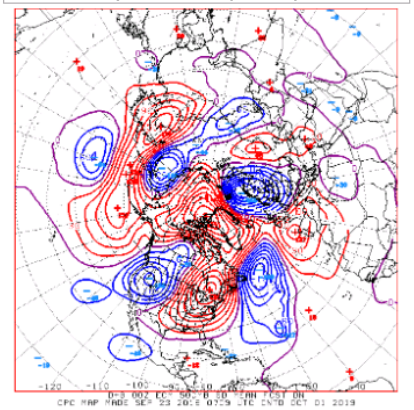
European Ensemble Maps



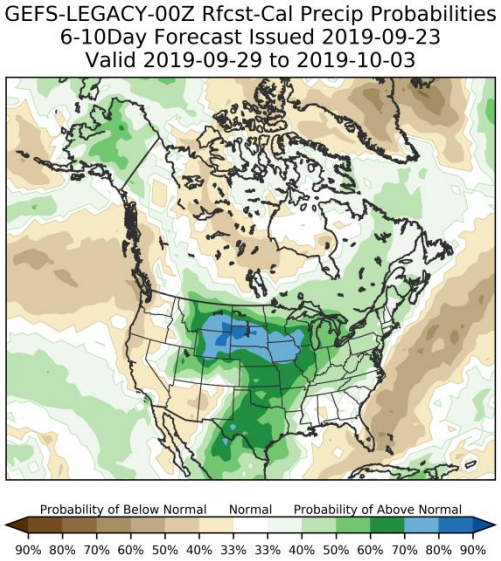
Canadian Ensemble Maps

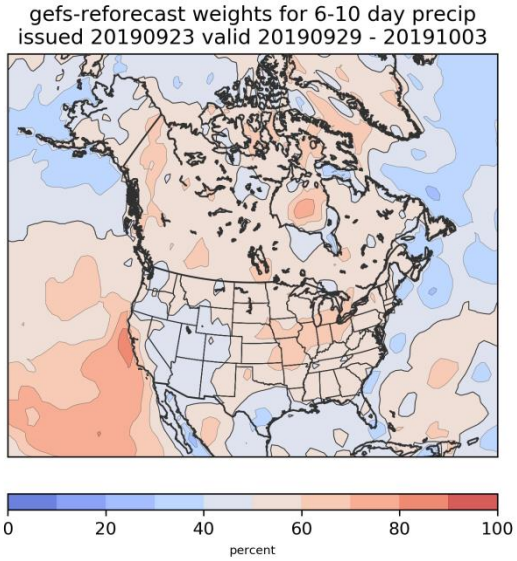


Operational European Maps



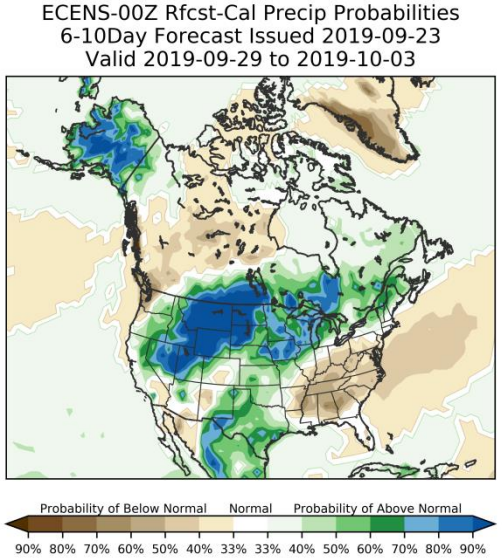
Extended Range Consolidation

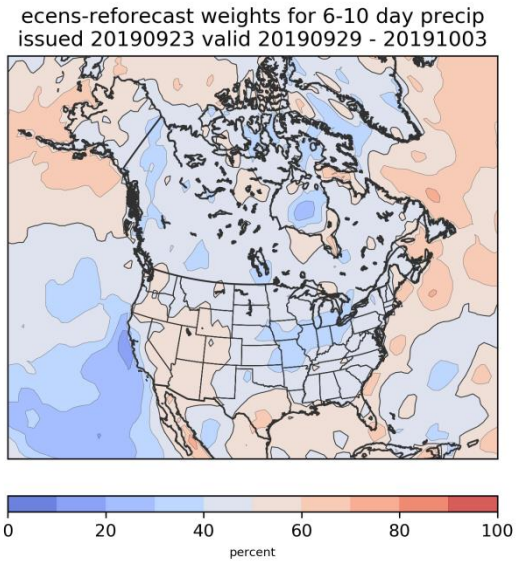


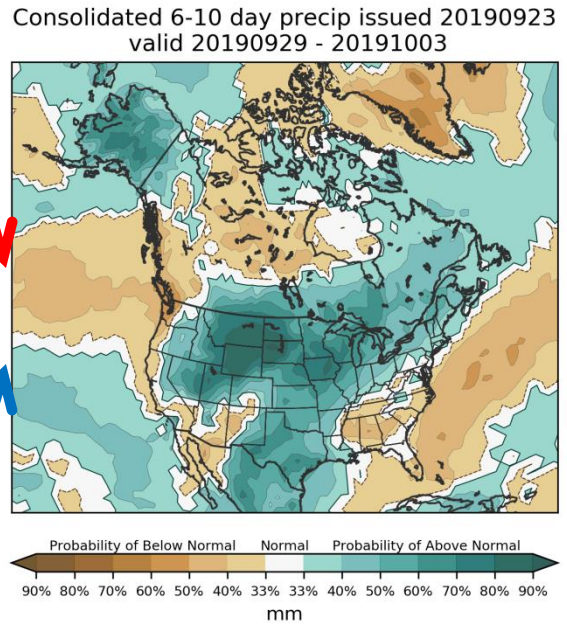


Reforecast probabilities

Weights





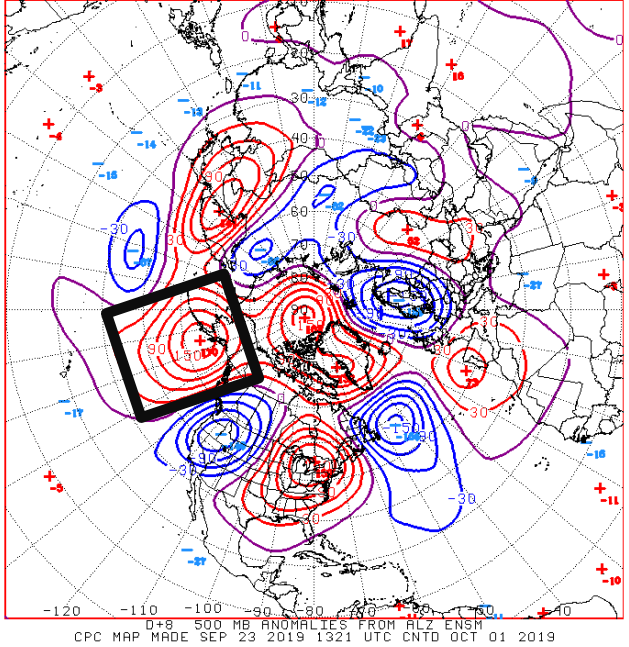


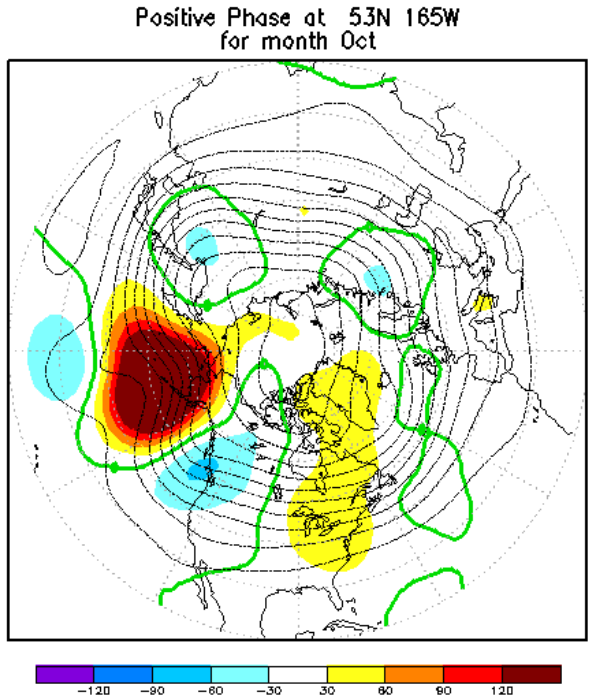
Weights determined by…

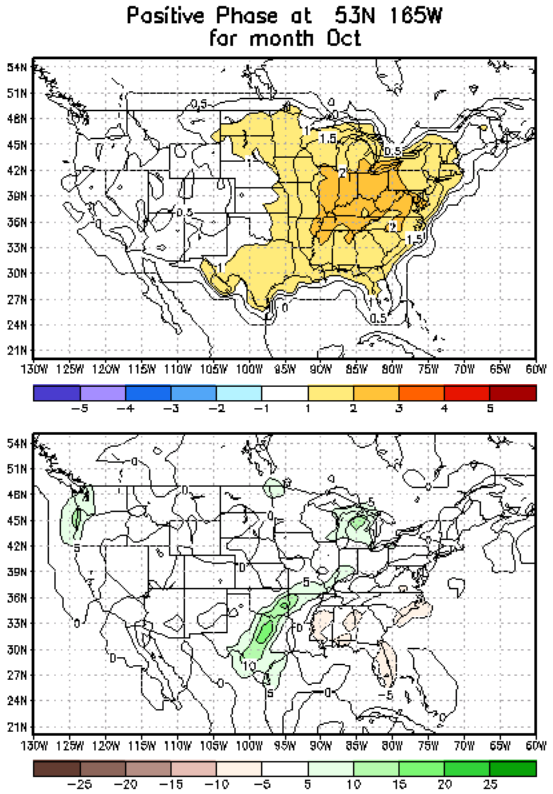
- Prior 45 days
- Surrounding 90 days from prior year

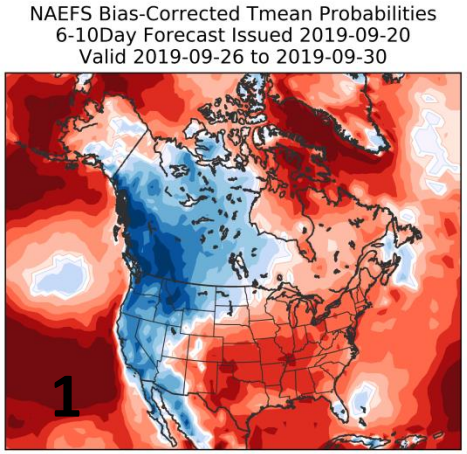
Teleconnection tool

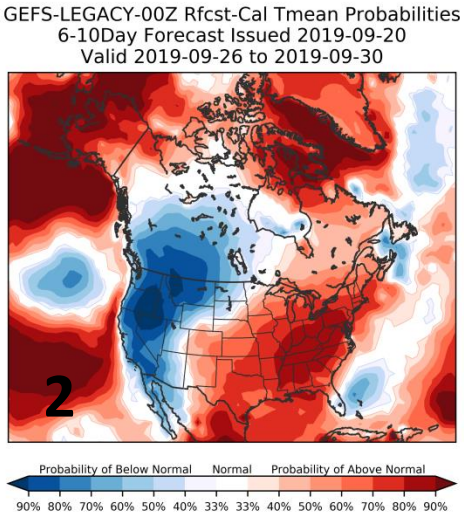
- Note the large ridge in North Pacific (53°N, 165°W).
- What was the past circulation typically like with such a feature?
- How did this impact previously observed temperature and precipitation in such a situation?

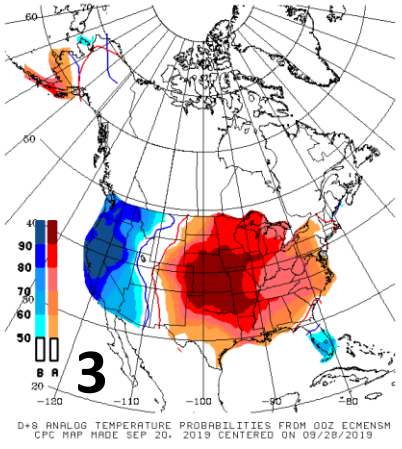


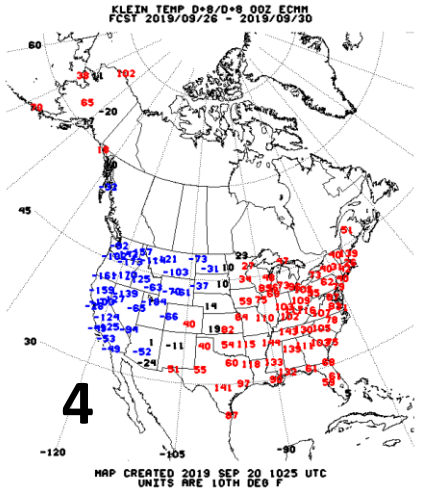


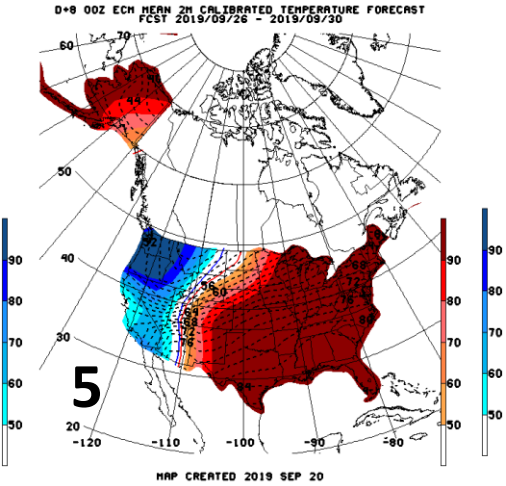


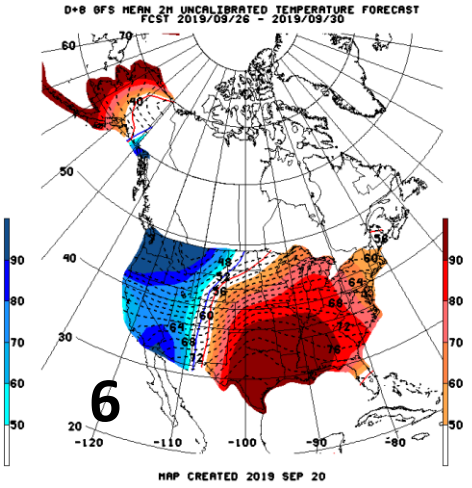


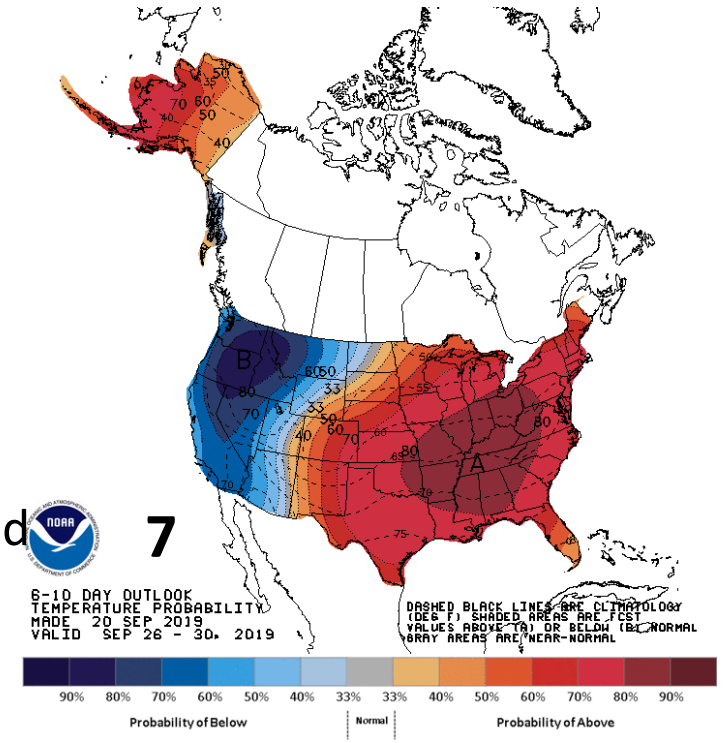




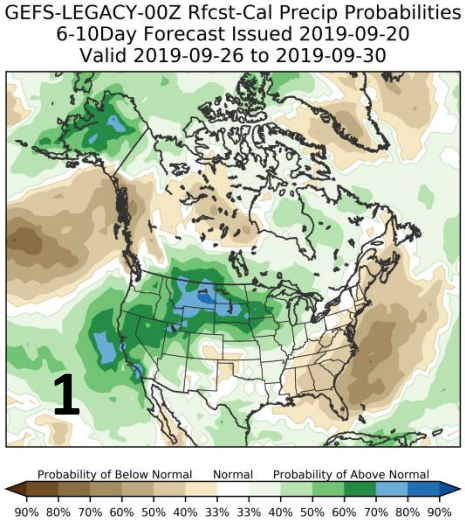


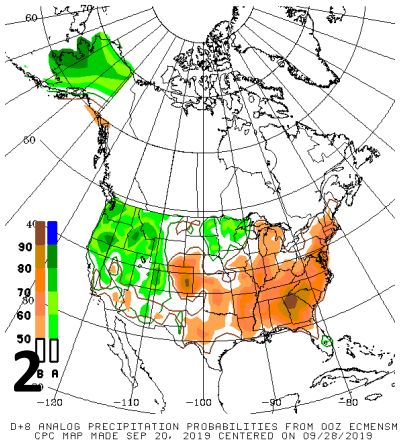


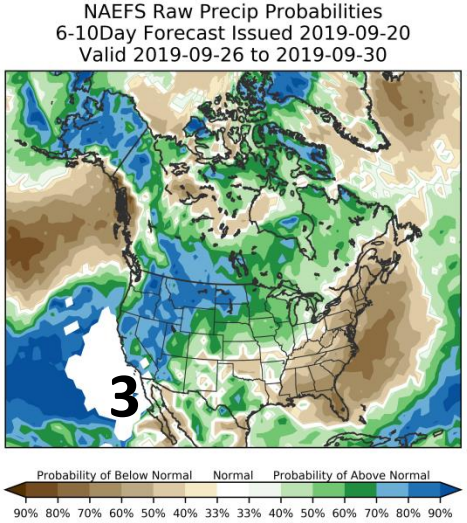


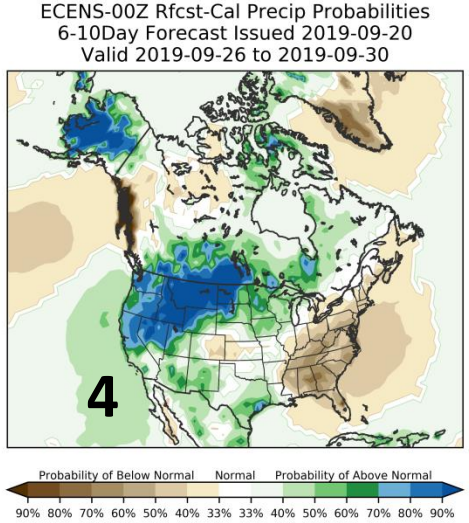


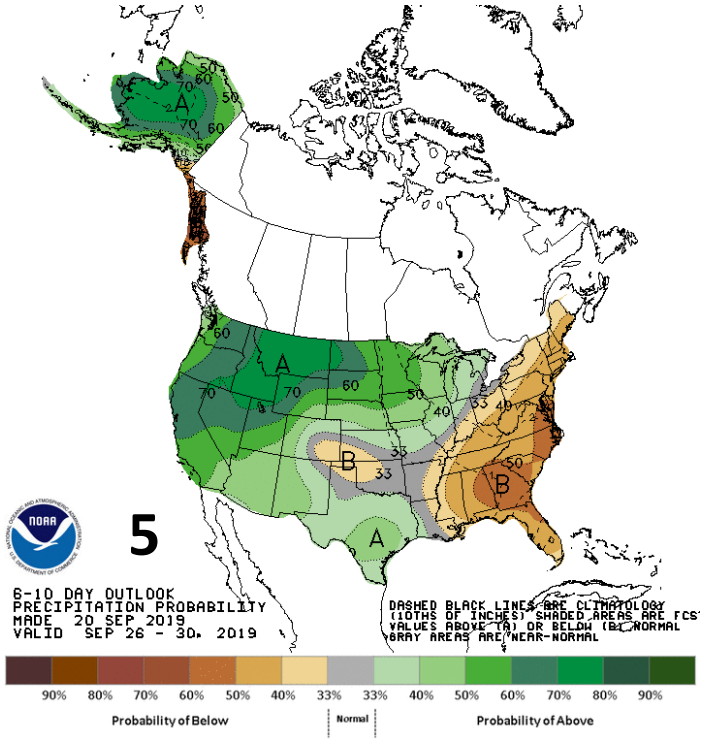
1) NAEFS (25%)
2) GEFS reforecast (25%)
3) ECMWF analogs (8.3%)
4) ECMWF Kleins (8.3%)
5) 45-day bias-corrected calibrated ECMWF (25%)
6) GEFS 45-day bias-corrected, uncalibrated (8.3%)
7) Autoblend (forecast starting point)







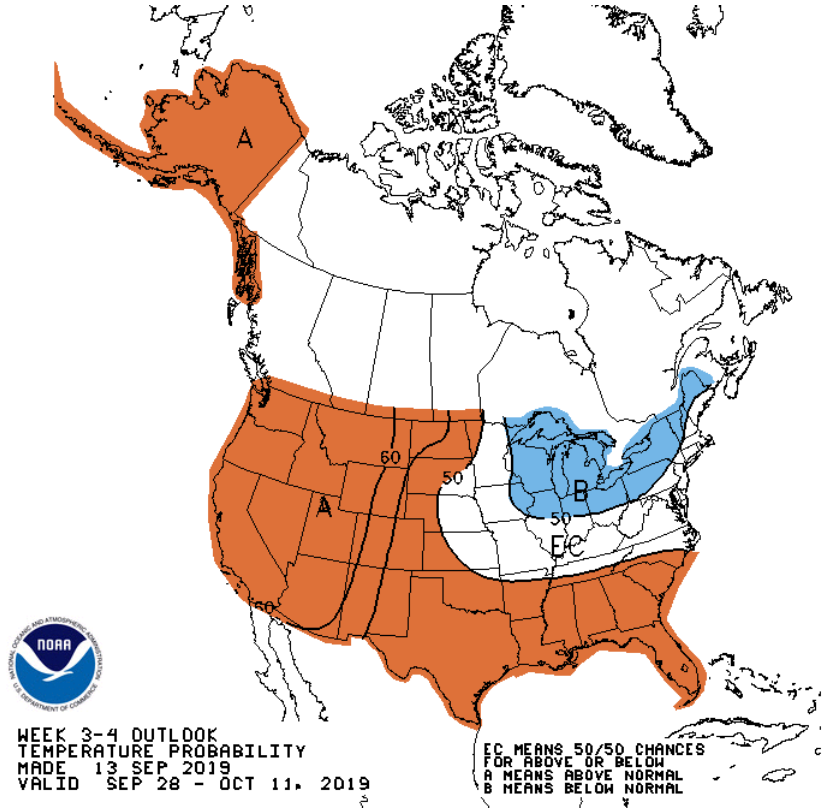


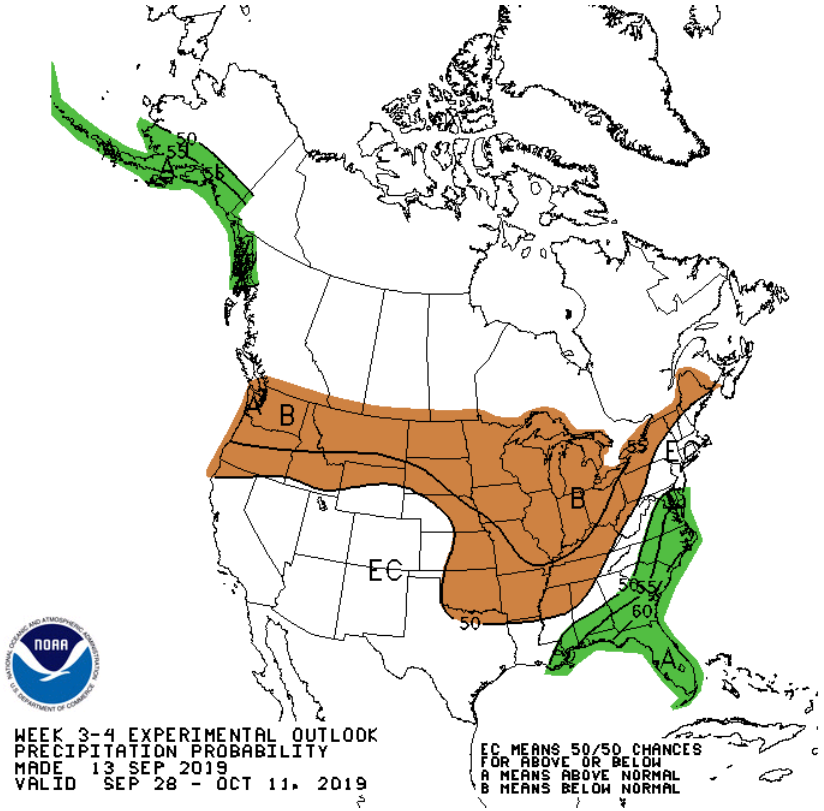


1) GEFS reforecast (40%)
2) ECMWF analogs (10%)
3) NAEFS (20%)
4) ECMWF reforecast (30%)
5) Autoblend (forecast starting point)

Weeks 3-4 Outlook

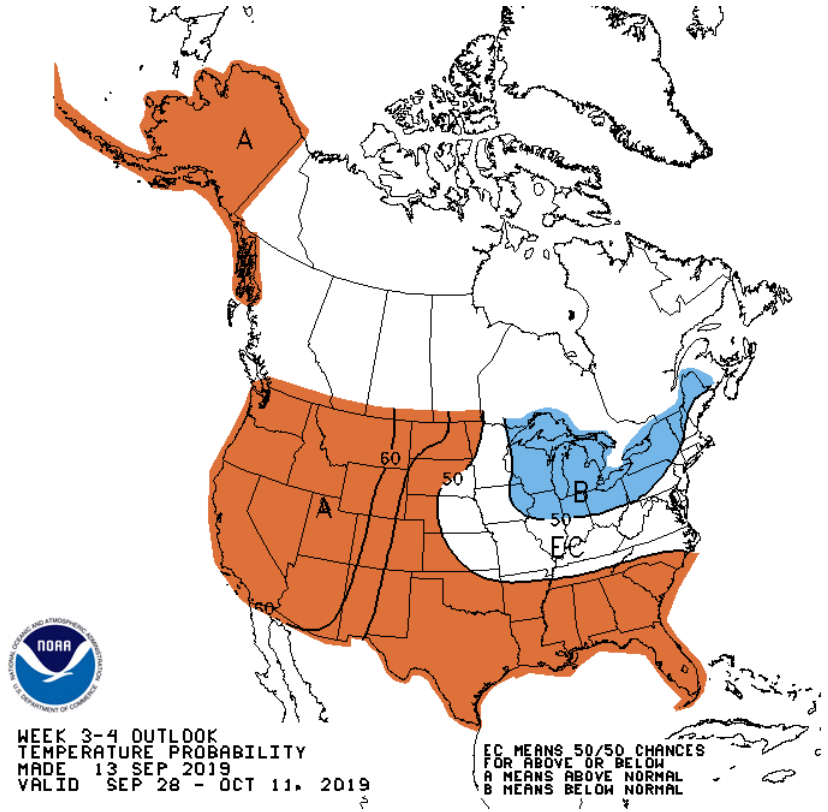
- Issued weekly on Friday after 15:00.

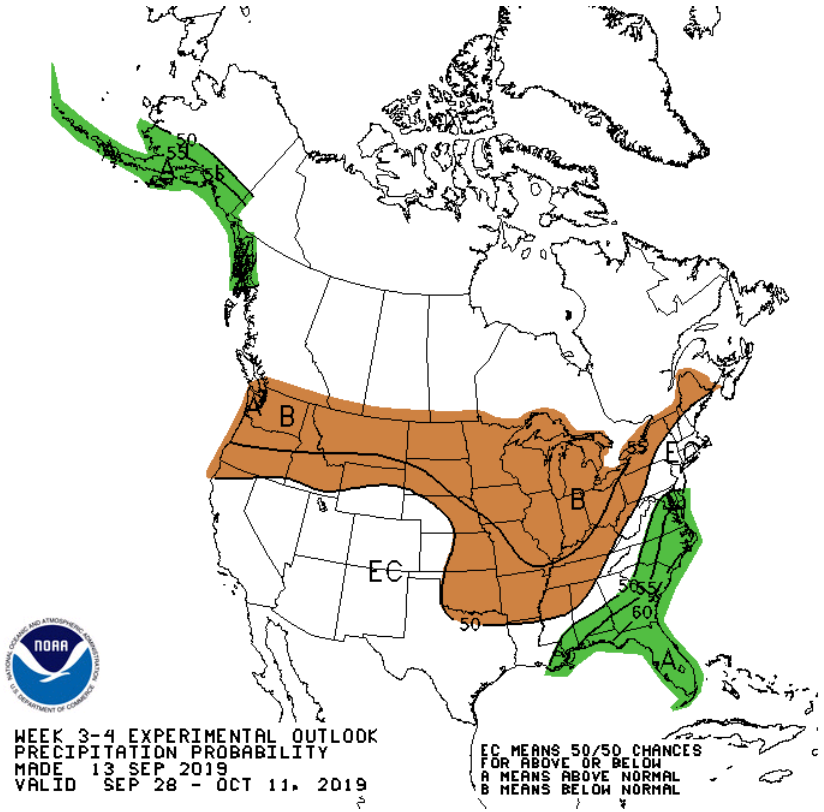




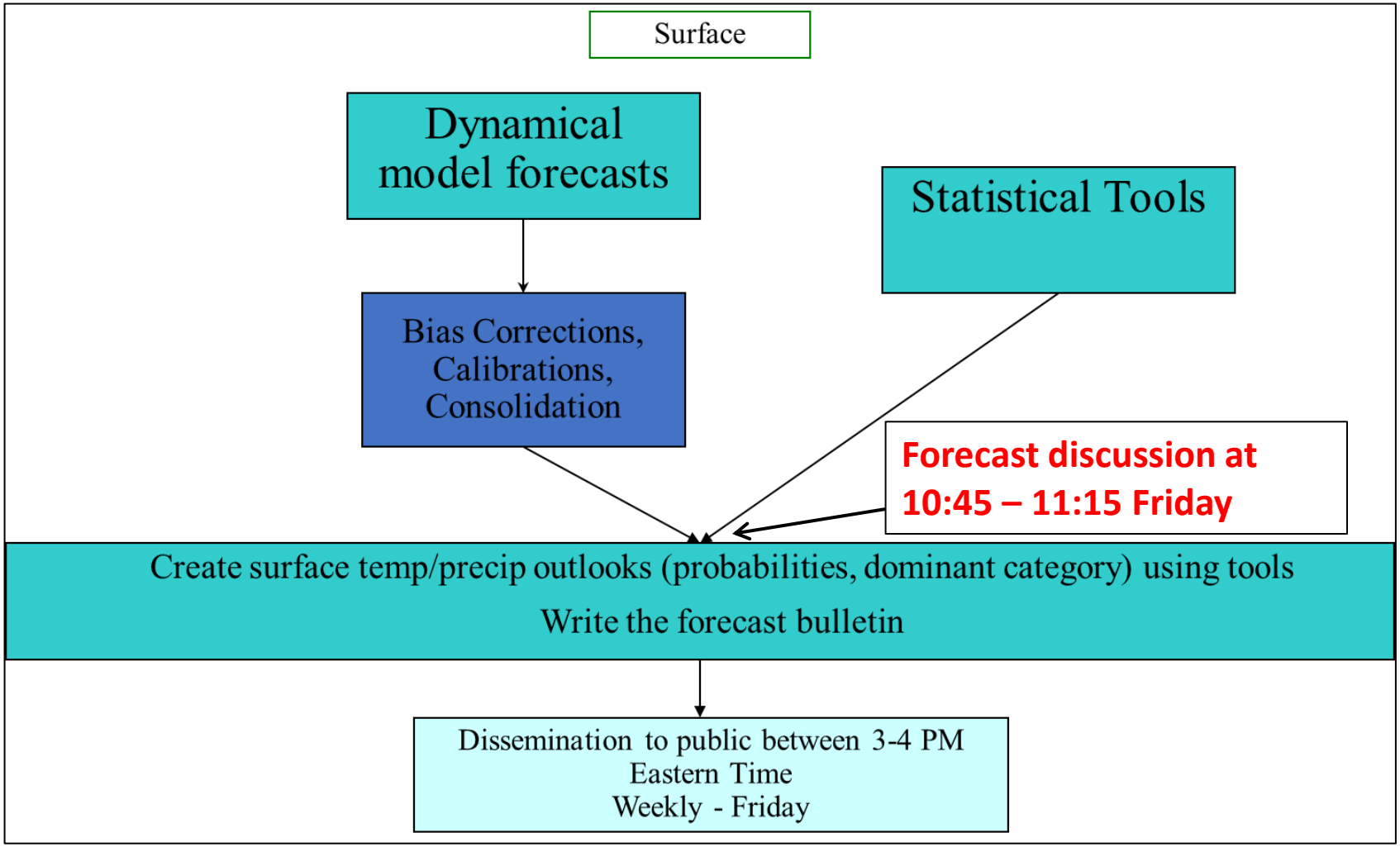
Weeks 3-4 Outlook

- Two-class forecast (above-, below-normal)
  - Areas of low confidence are given equal chances (EC).





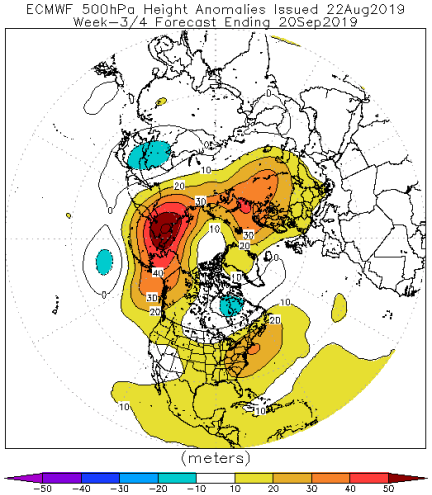
Forecast Process

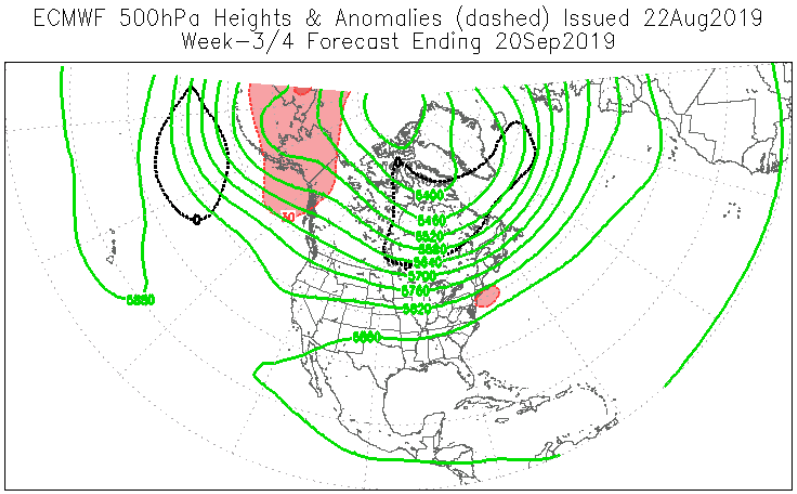


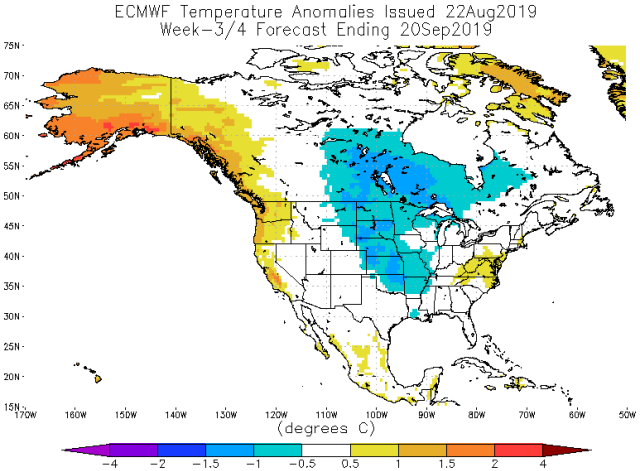
- Forecast is created in NMAP (GEMPAK); black screen at left above.
- There is no “first guess” for the forecast, it is left to forecaster discretion.
- There is a 10:45 AM discussion on Friday to…
  - Facilitate discussion between operationally/developmentally focused staff
  - Share knowledge to refine the newly constructed outlooks

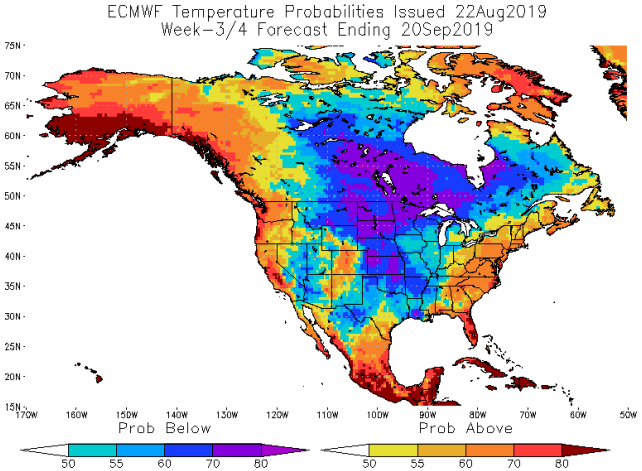
Dynamical Guidance

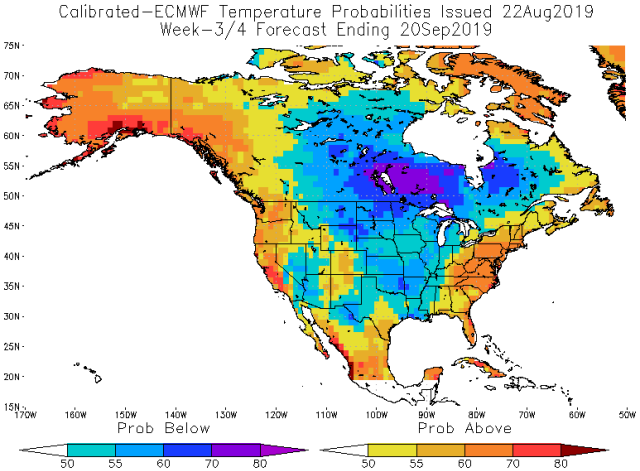
- Available for Weeks 3&4 (combined) or individual weeks.
- Calibration via ensemble regression (Unger, et al. 2009).

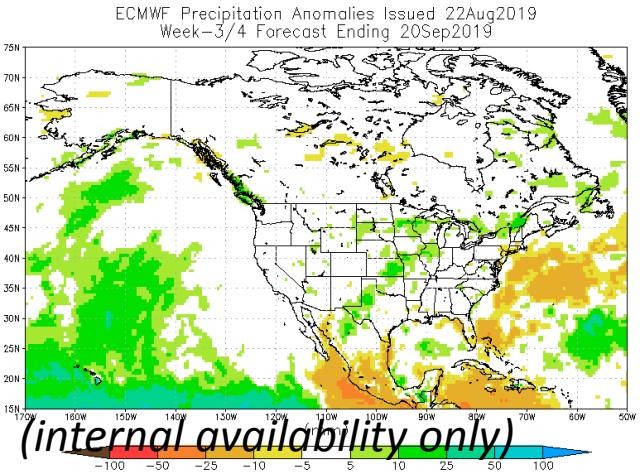


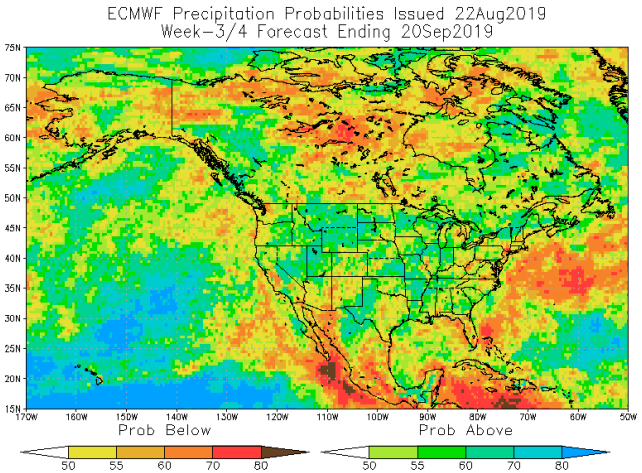


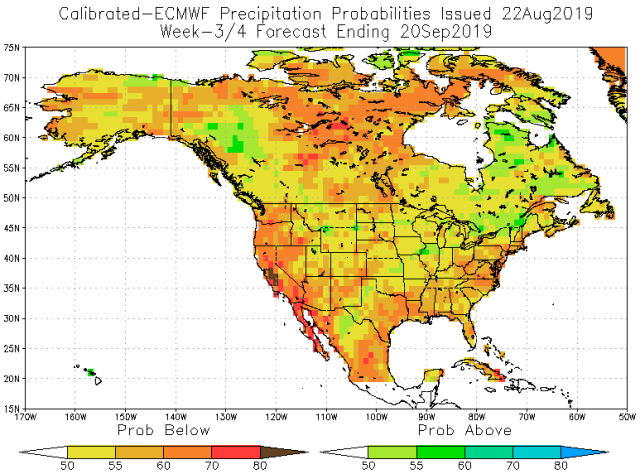








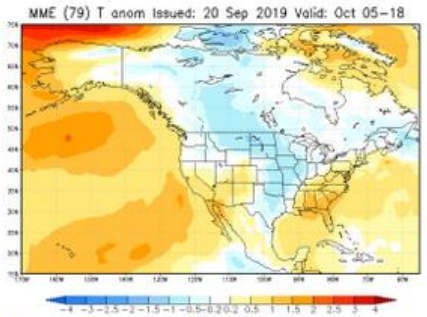




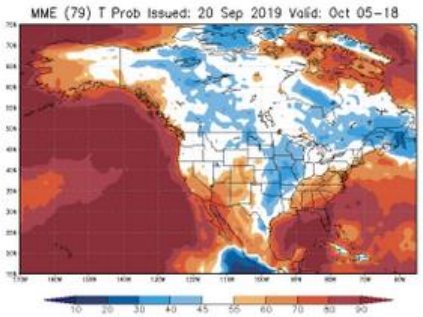
(internal availability only)

Subseasonal Experiment MME (SubX)

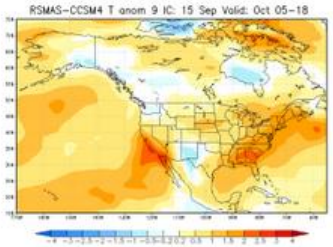
MME Anomalies



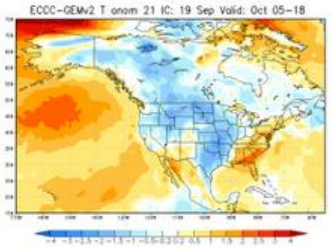
MME Probabilities



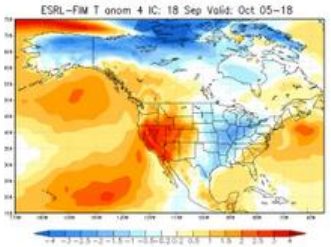
RSMAS_CCSM4 Anom



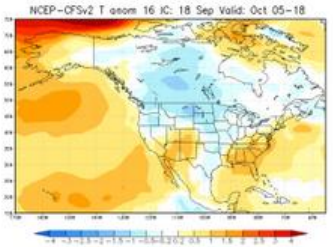
ECCC Anom



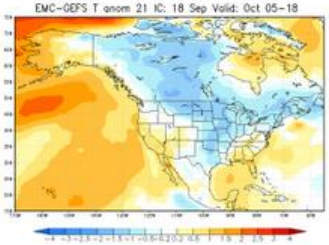
FIM Anom



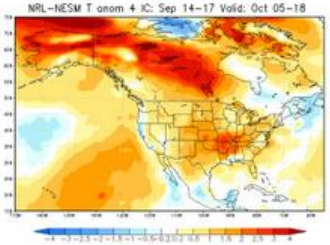
CFSv2 Anom



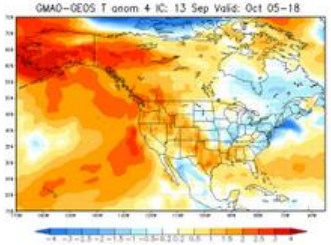
GEFS Anom

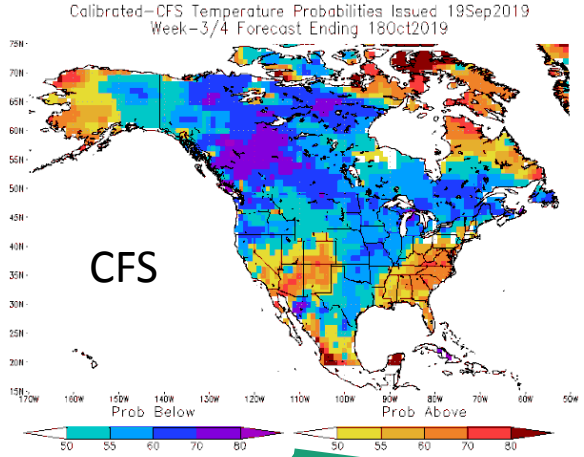


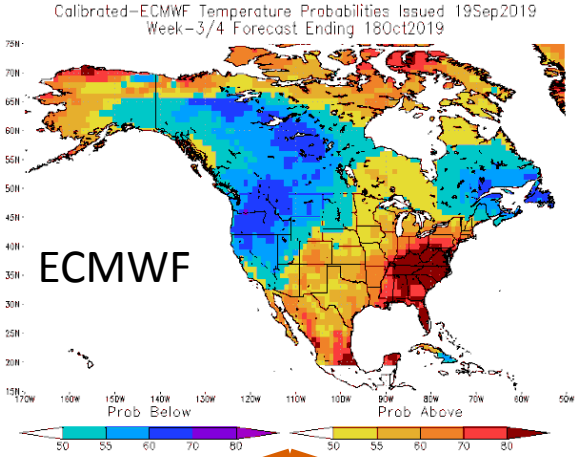
NESM Anom

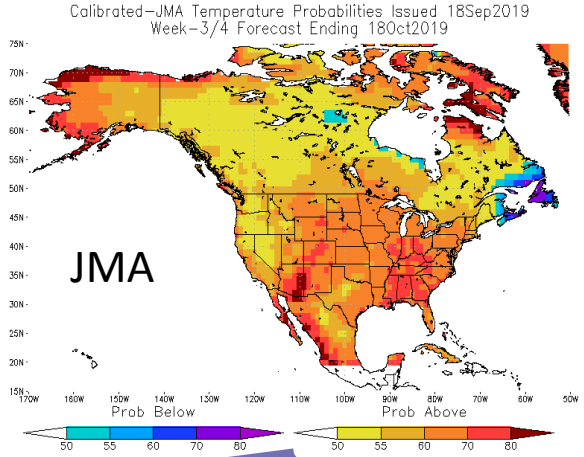


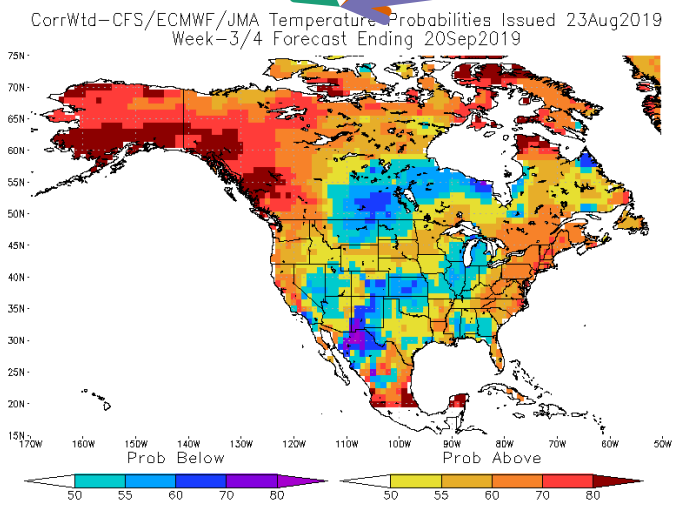
GEOS Anom



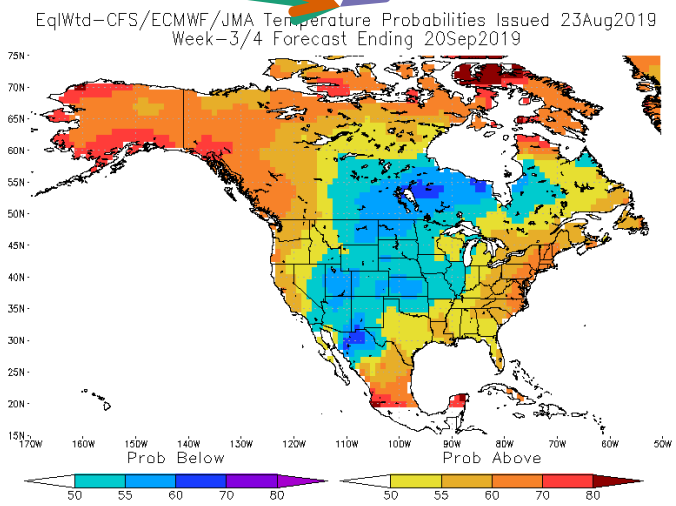








Weights determined by anomaly correlations from model hindcasts



All weighted 33.3%

Weeks 3-4 Dynamical Model Blends

Phase Model

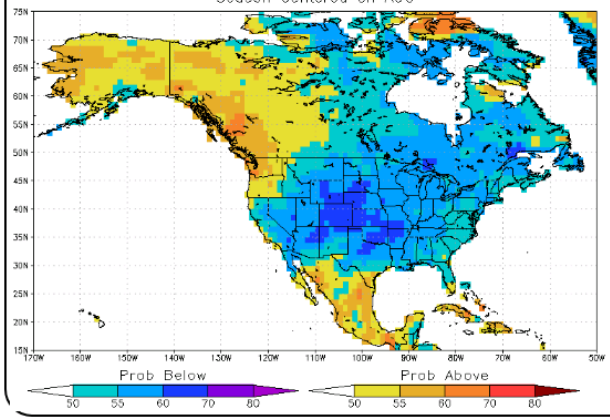
Phase Model (Trend, ENSO, MJO)

Product Description

Week-3/4 Week-3 Week-4 Show All

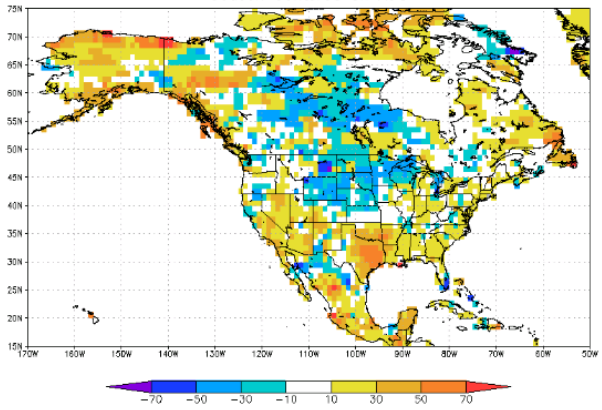
Forecast

Week−3/4 2m Temperature Probabilities for ONI=nino and RMM=0
Season Centered on AUG



Historical Skill

Week−3/4 2m Temperature HSS for ONI=nino and RMM=0
Season Centered on AUG



Manual Forecast Selector

Select an ENSO (ONI) Phase

ENSO Neutral

Select an MJO (RMM) Phase

0 (i.e., no MJO)

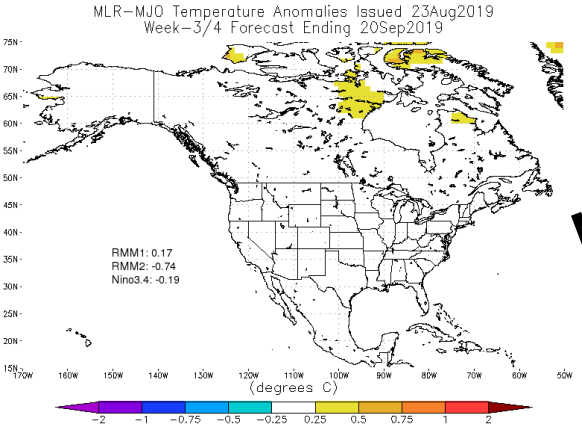
Select a month

Current Month

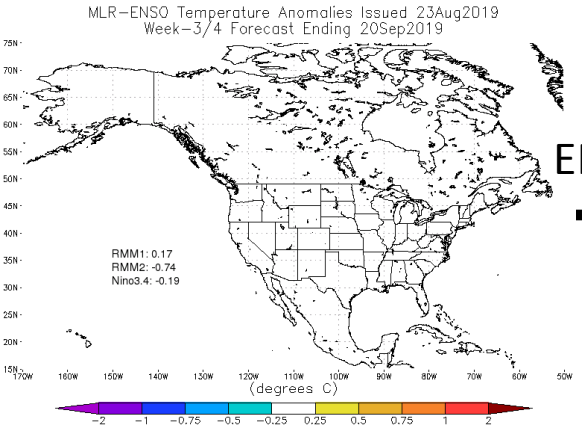
Submit Reset

Multiple Linear Regression

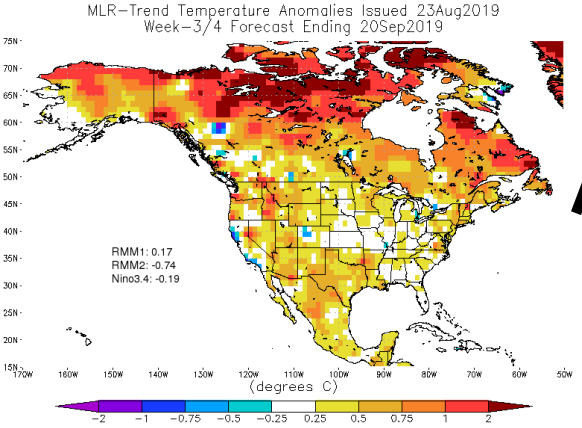
ANOMALIES BY COMPONENT



MJO

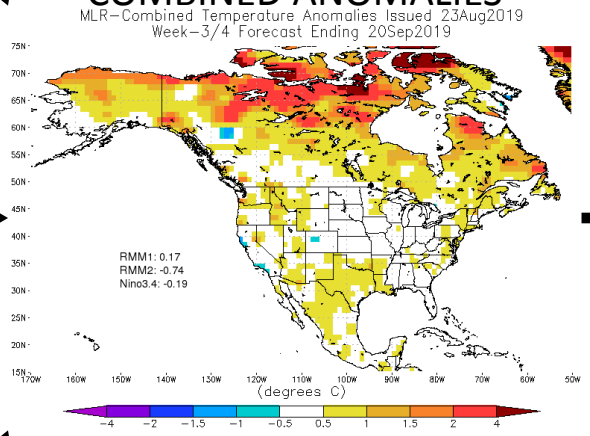


ENSO

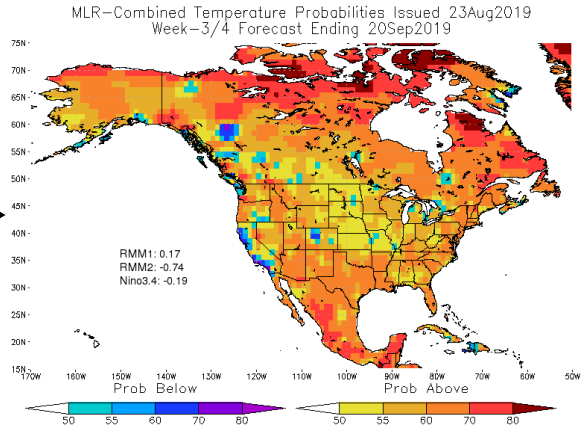


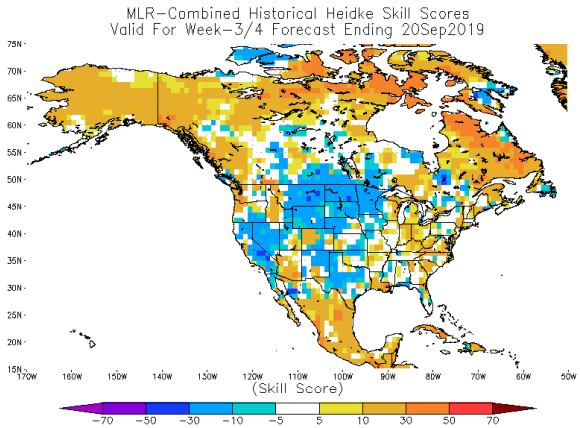
Trend

COMBINED ANOMALIES



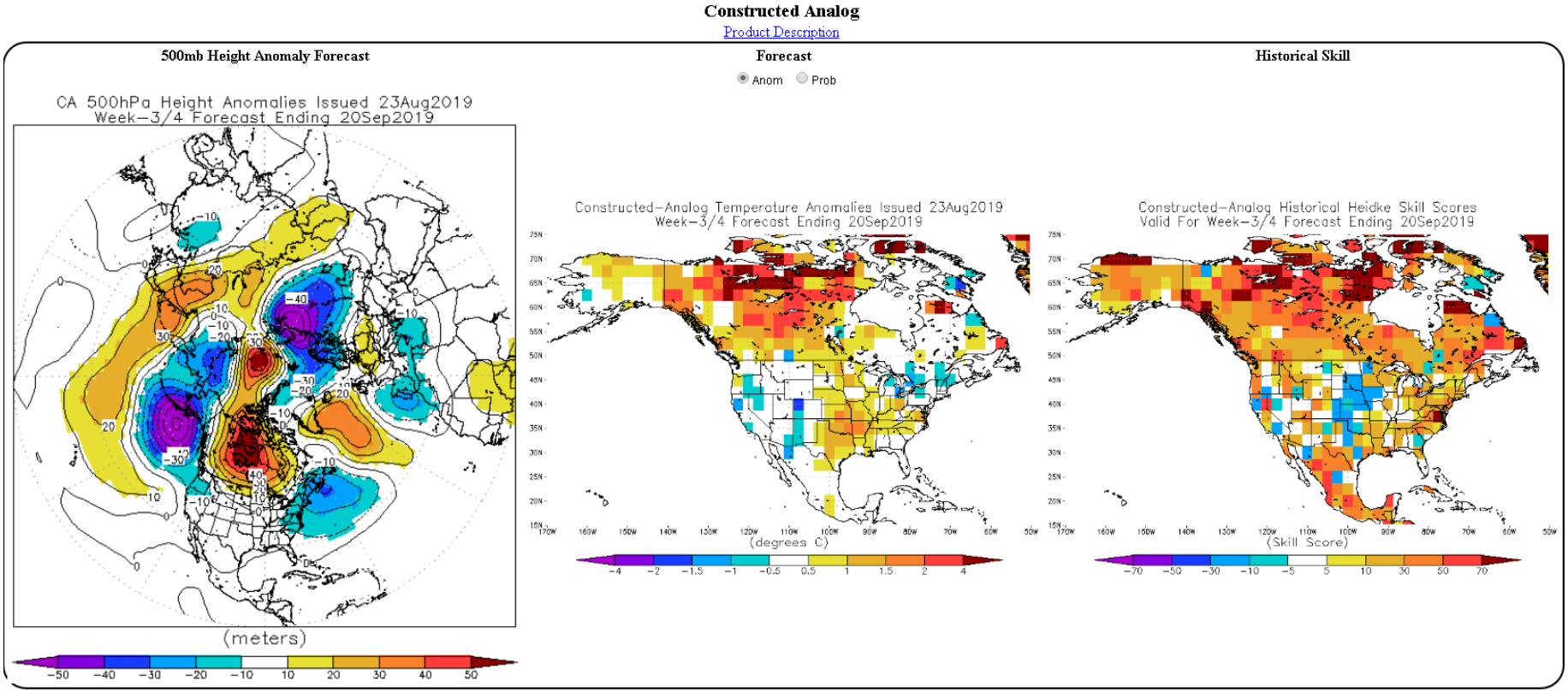
COMBINED PROBABILITIES

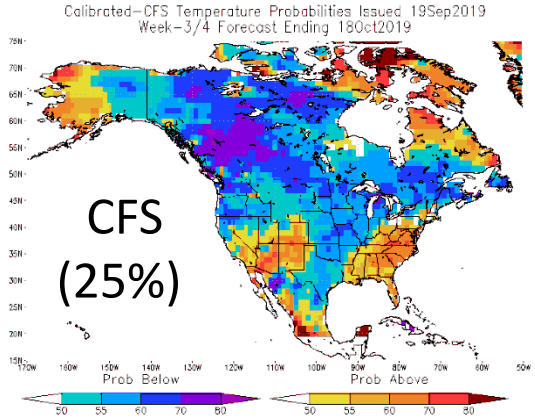


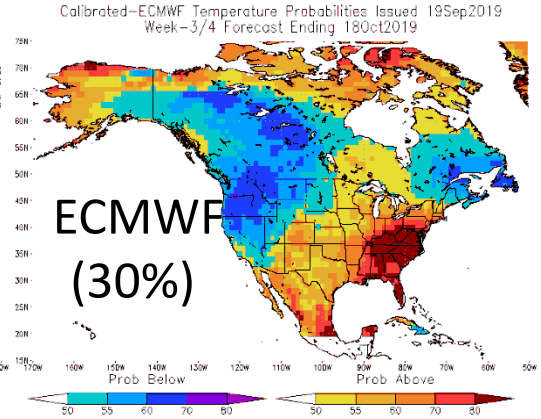


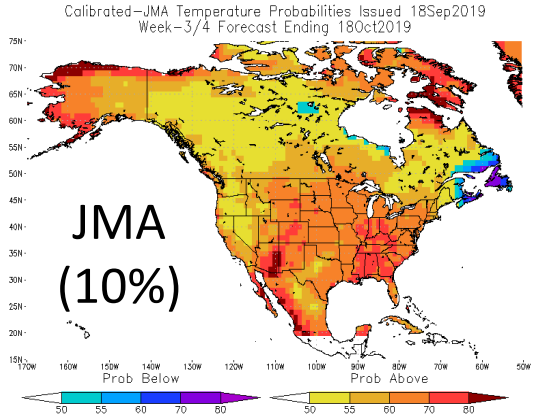
Statistical Guidance: Constructed Analog

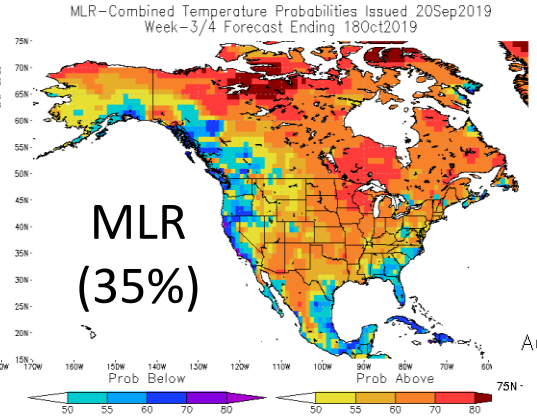
- Analog constructed on 200-hPa streamfunction from 20S through North Pole.

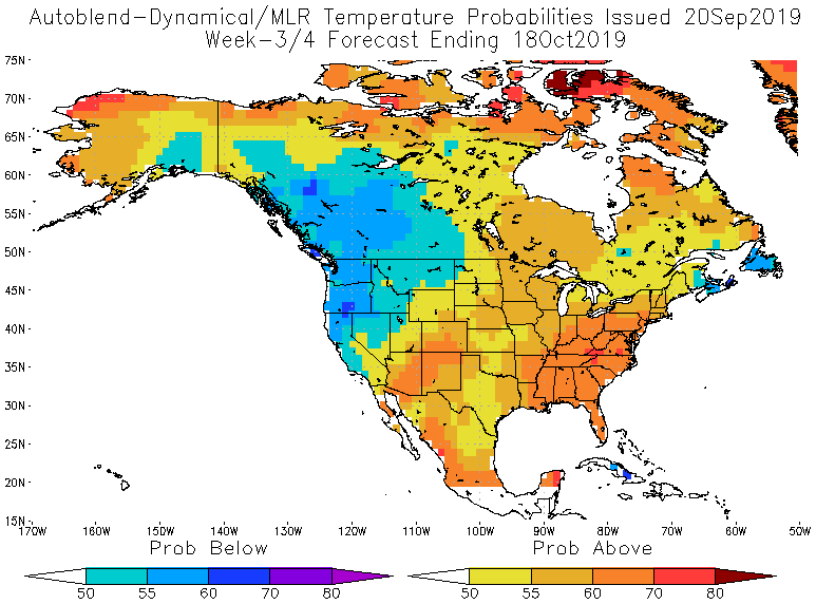










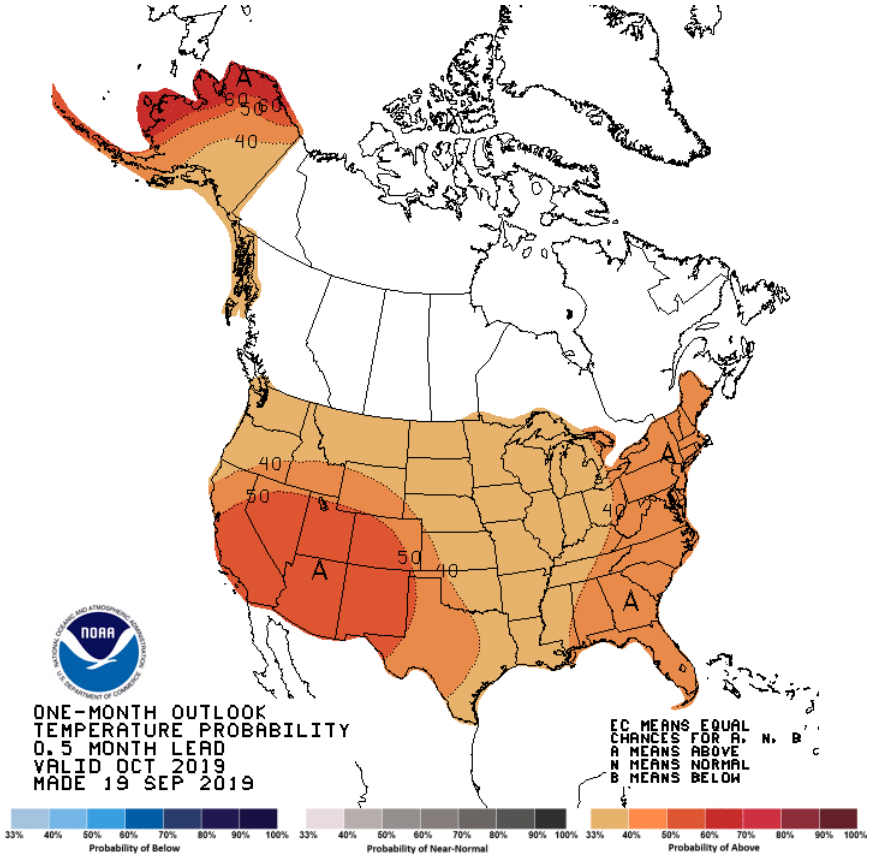


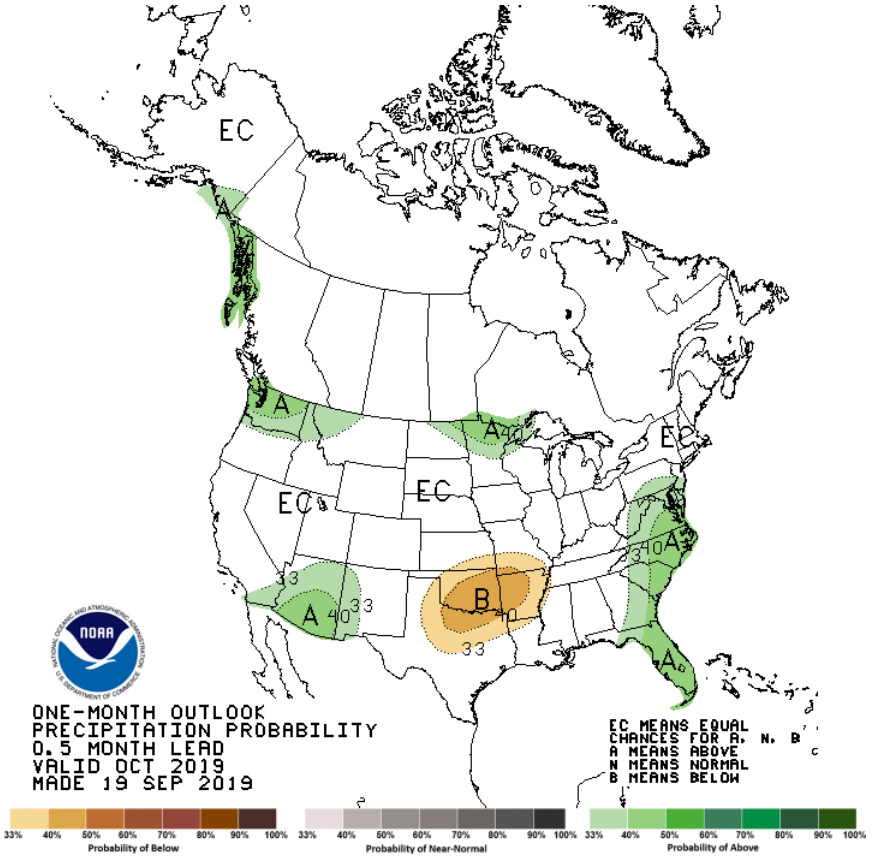
Weeks 3&4 Consolidation

- Eventual goal is to have this be the starting point for the forecaster to work from.
- Refining of weights is currently ongoing.

Monthly Outlook

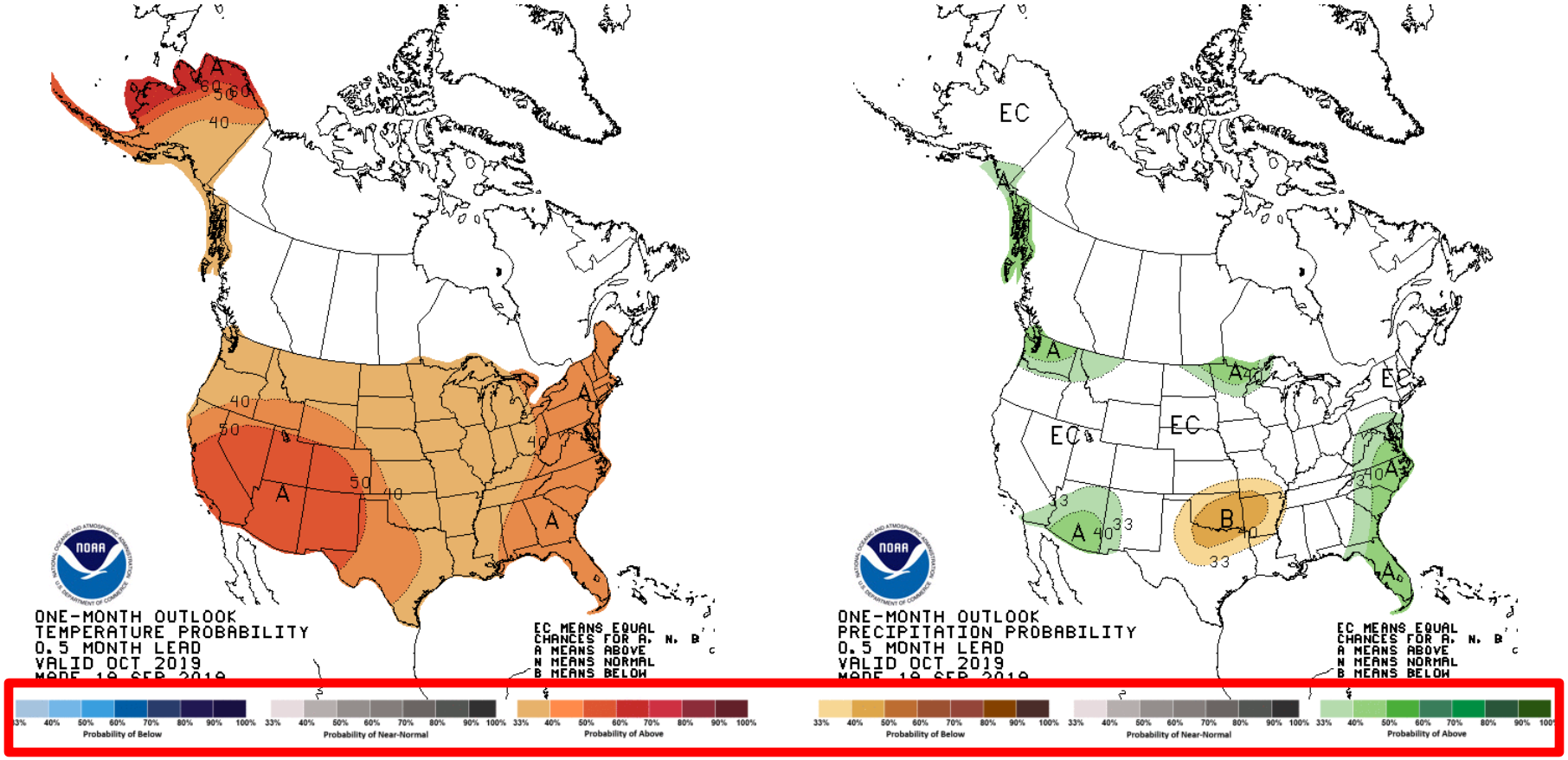
- Issued for the *first time* on the third Thursday at 09:00.
  - Released at the same time as the seasonal outlook.





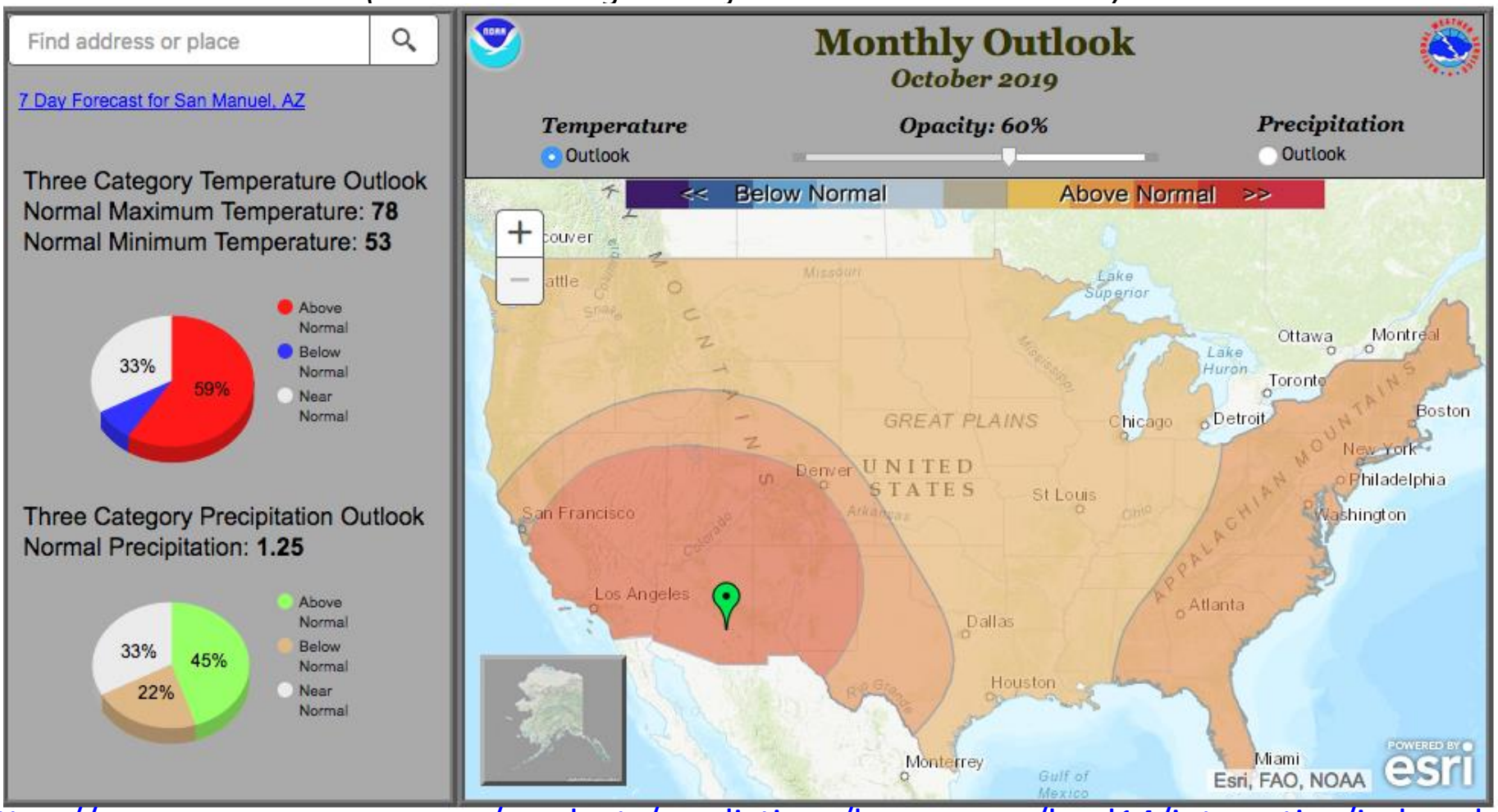
Monthly Outlook

- Three-class forecast (above-, near-, below-normal)
  - Areas of low confidence are given equal chances (EC).



Monthly Outlook Interactive Display

(The same thing exists for the seasonal outlook)

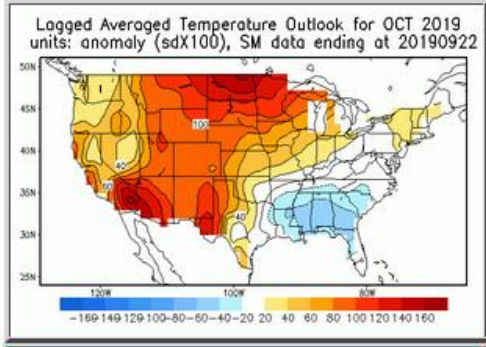


https://www.cpc.ncep.noaa.gov/products/predictions/long_range/lead14/interactive/index.php

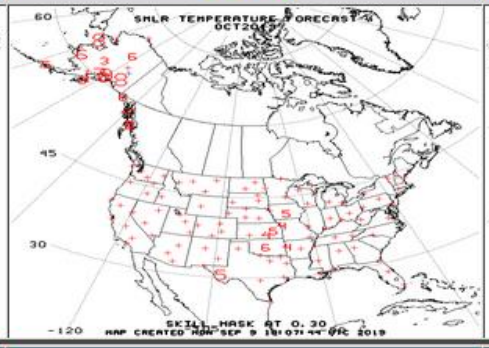
https://www.cpc.ncep.noaa.gov/products/predictions/long_range/interactive/index.php

October 2019 Temperature

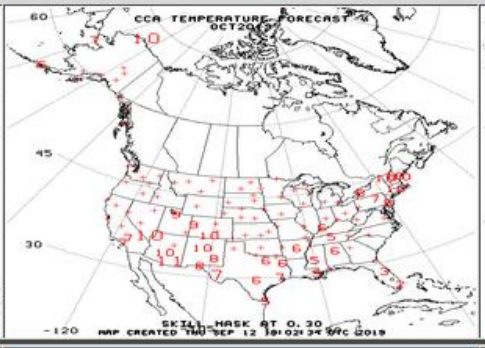
CA-SMT



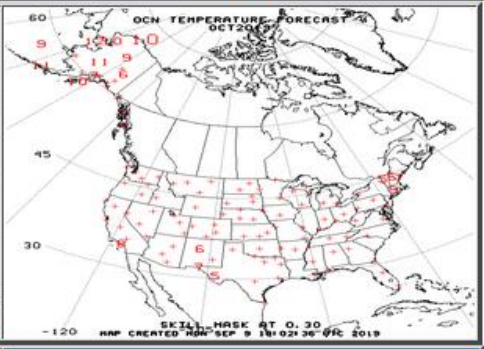
SMLR



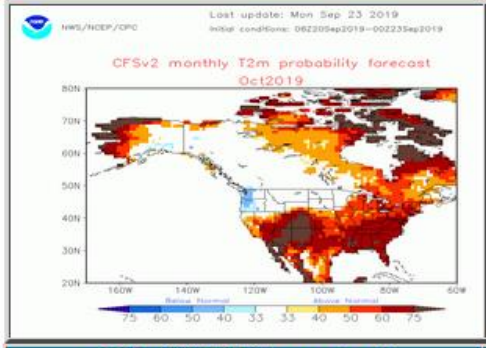
CCA



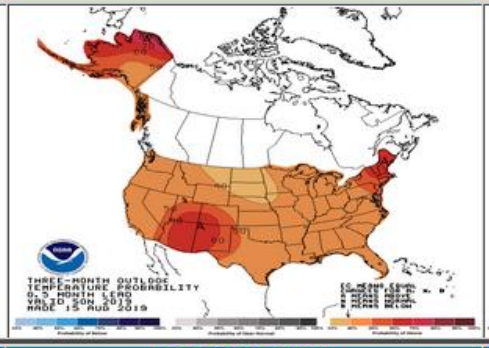
OCN



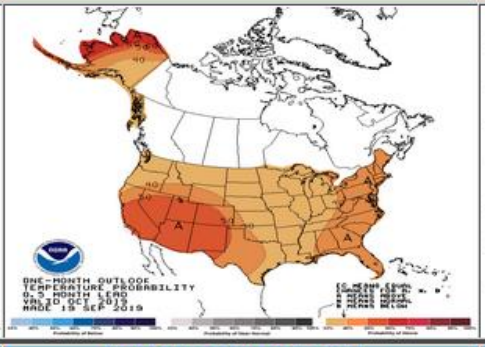
CFS (PROB)



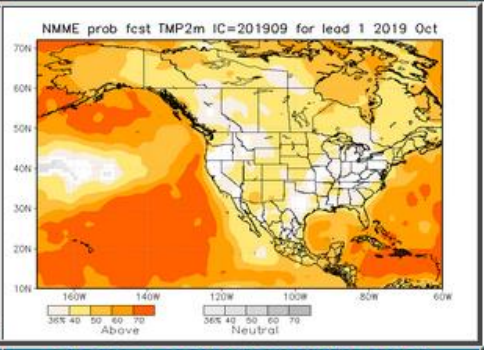
PREV-SNL



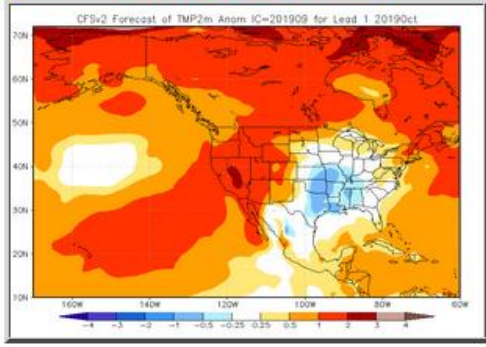
NEW-OTLK



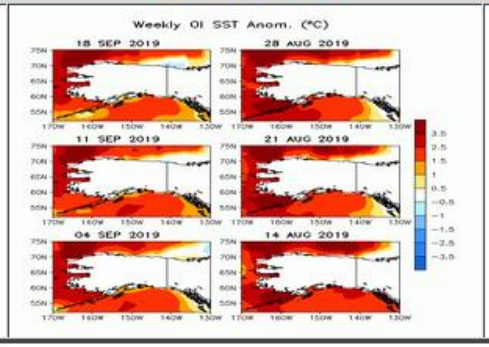
NMME (PAC)



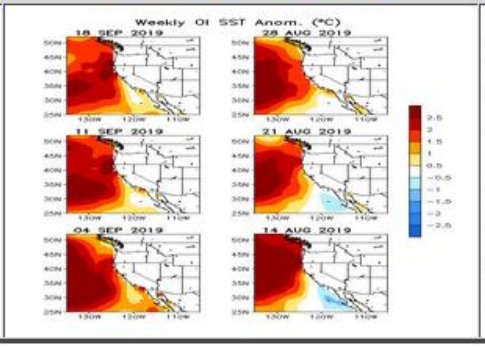
CFS (NMME version)



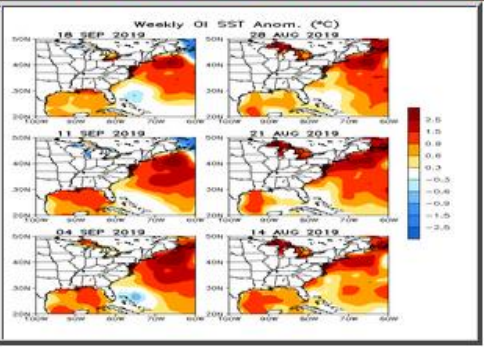
ALASKA SSTs



WEST COAST SSTs

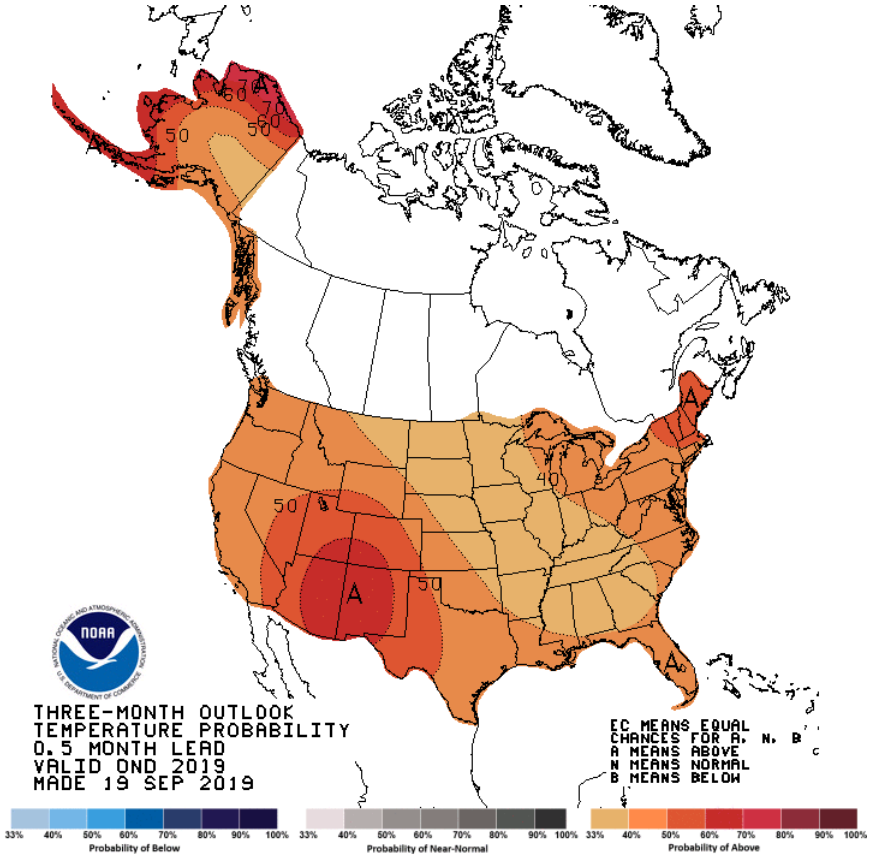


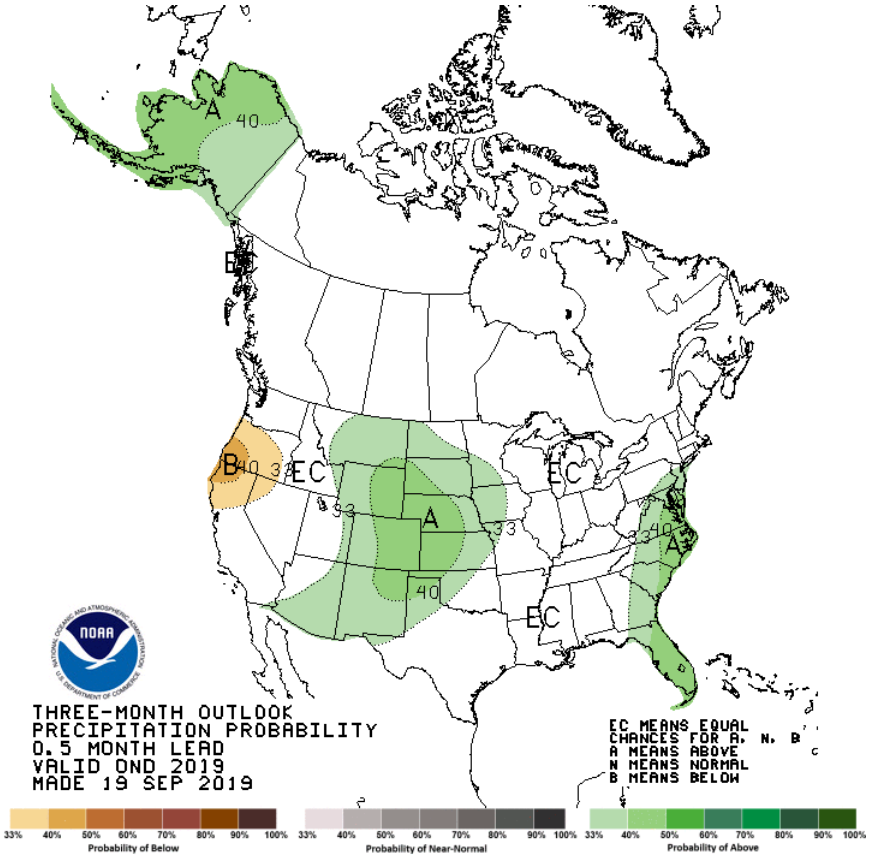
EAST & GULF COAST SSTs



Seasonal Outlook

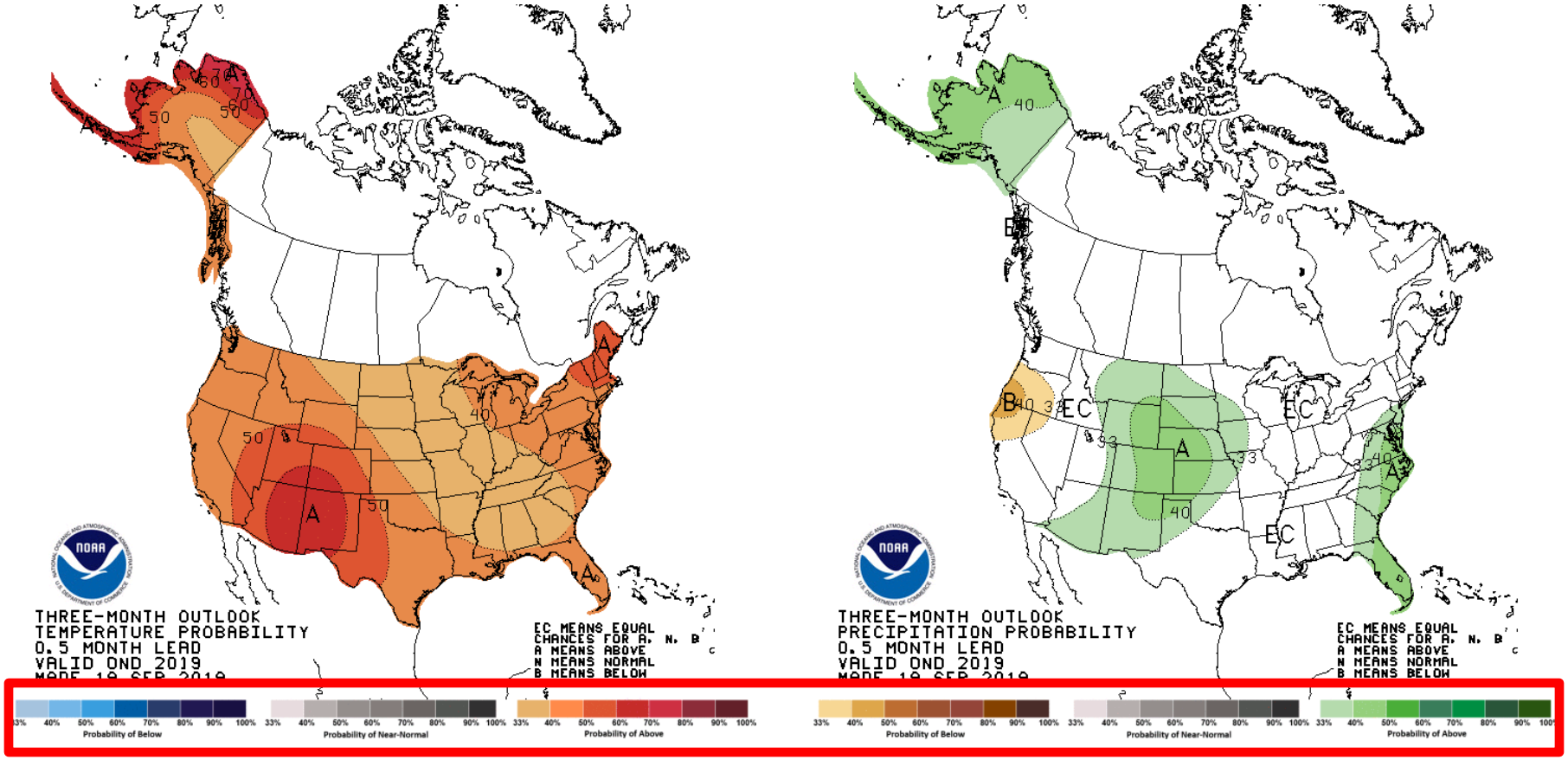
- Issued once per month on the third Thursday at 09:00.

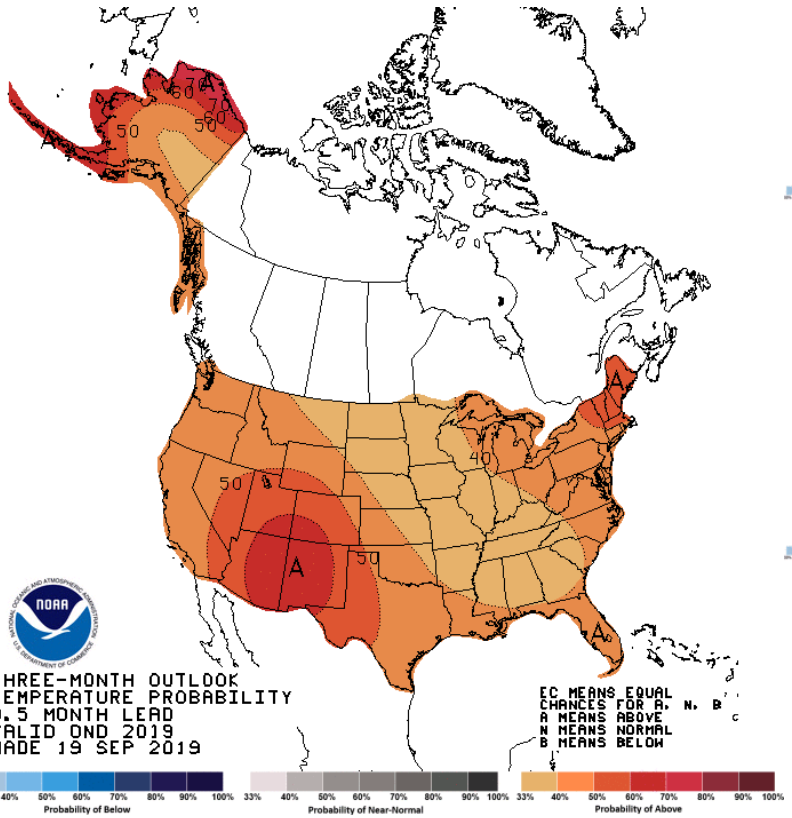


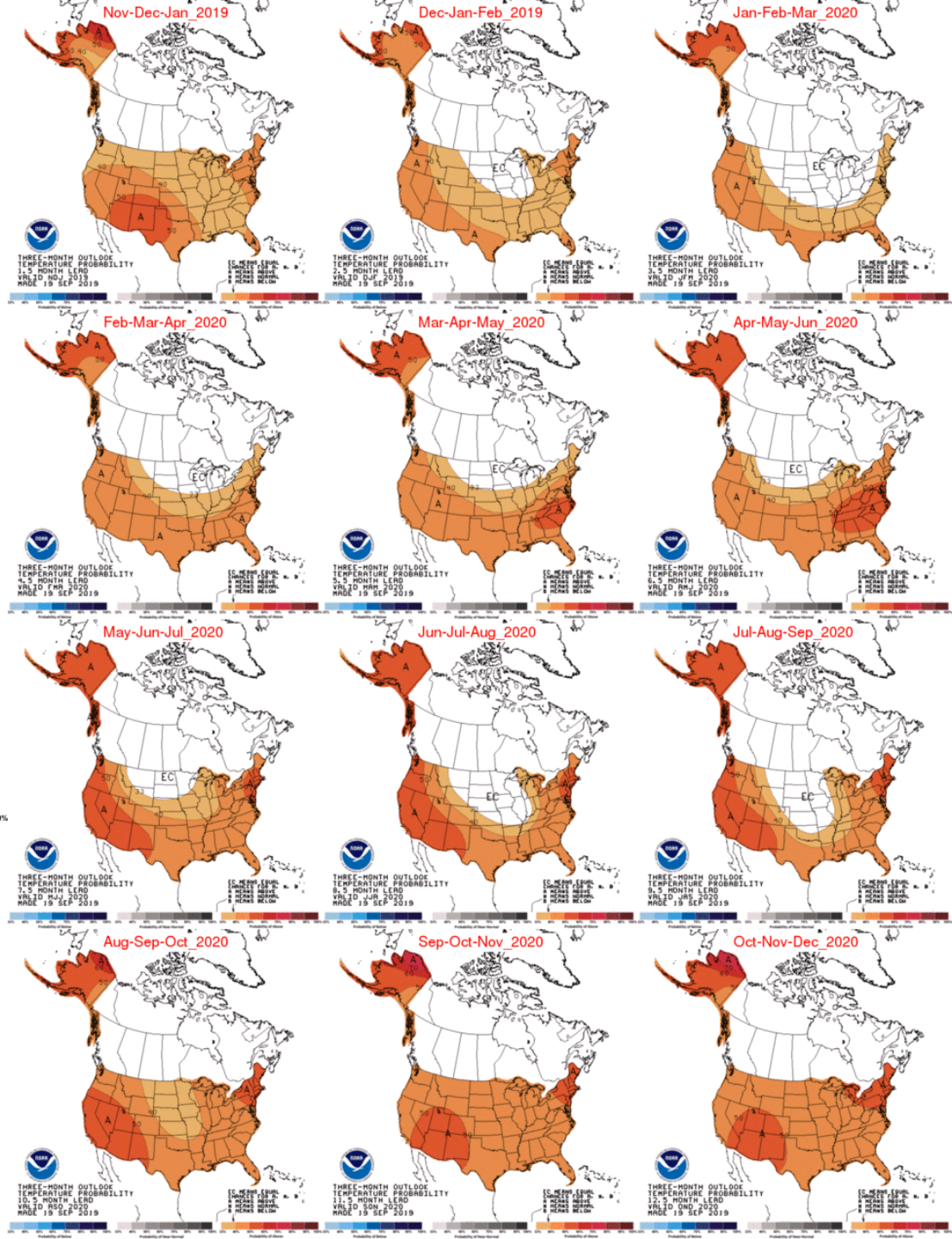


Seasonal Outlook

- Three-class forecast (above-, near-, below-normal)
  - Areas of low confidence are given equal chances (EC).

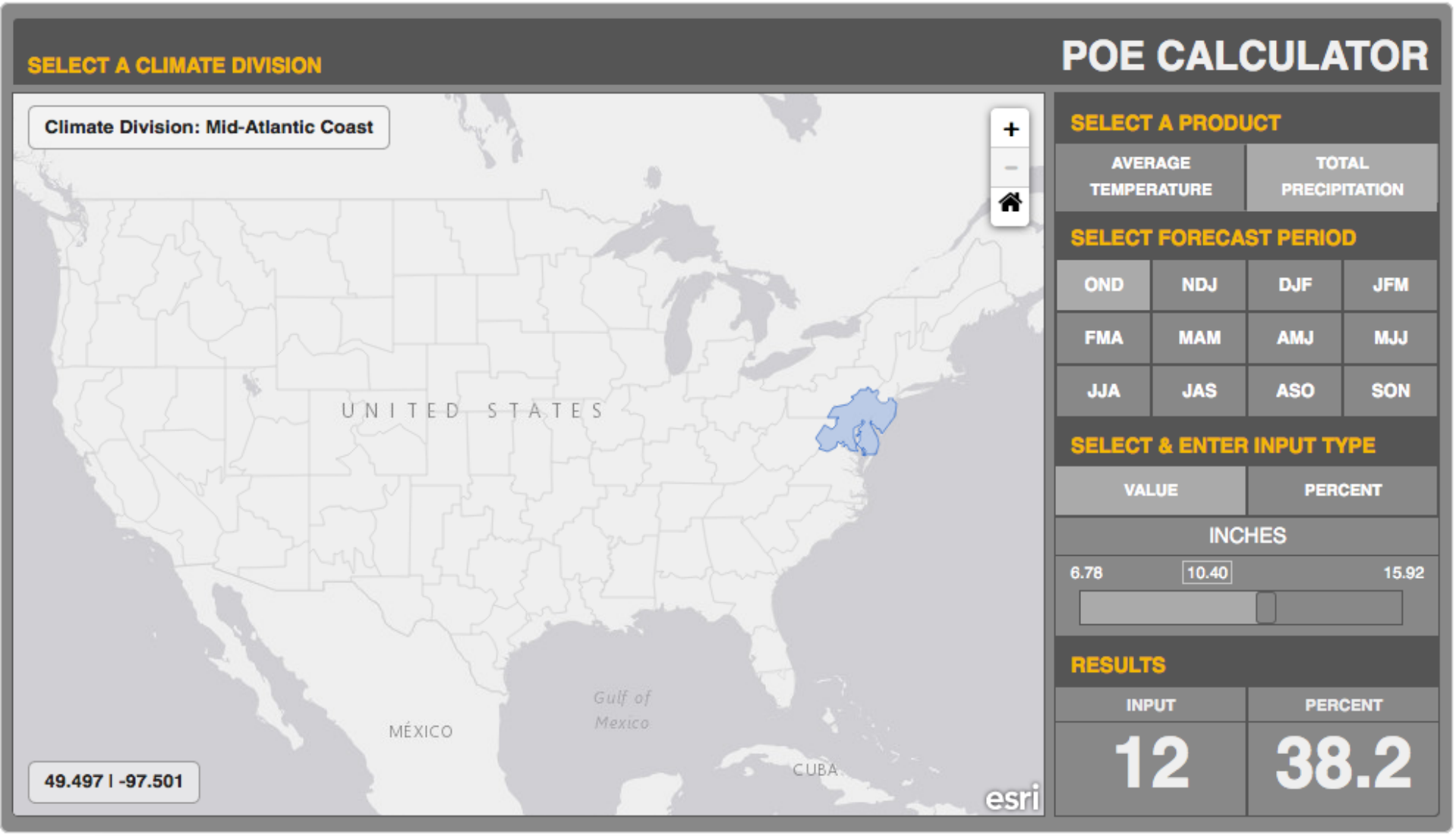






Forecasts are made for the next 13 running three-month periods.

Seasonal Probability of Exceedance

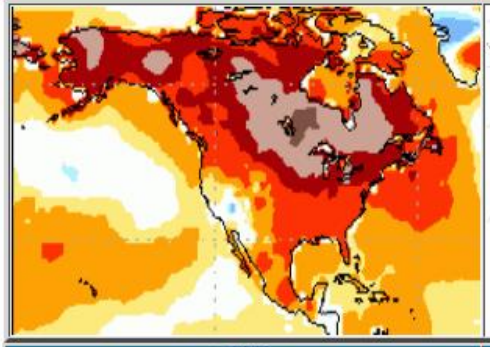
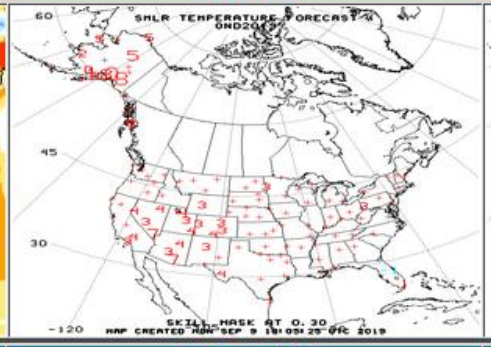
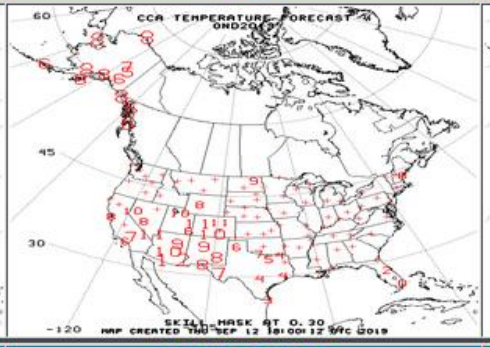
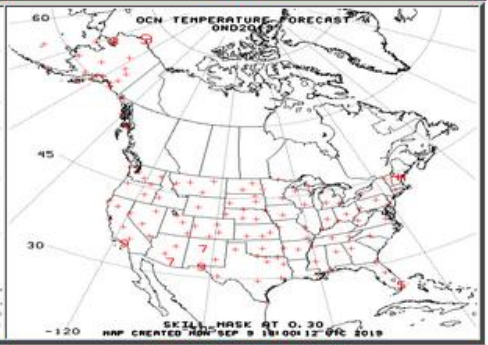


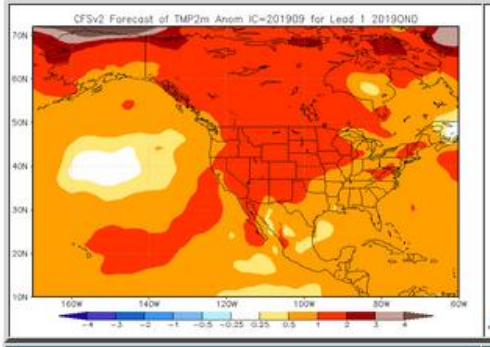
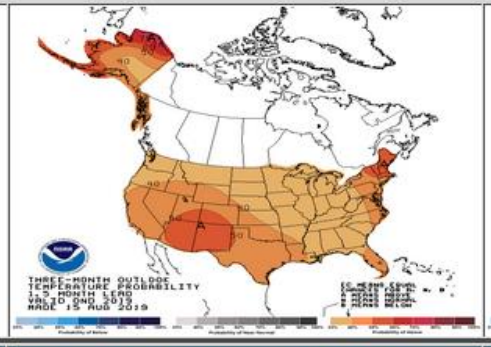
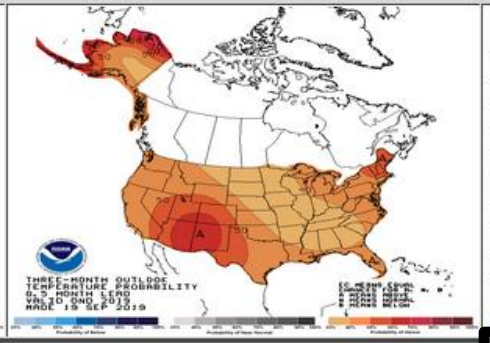
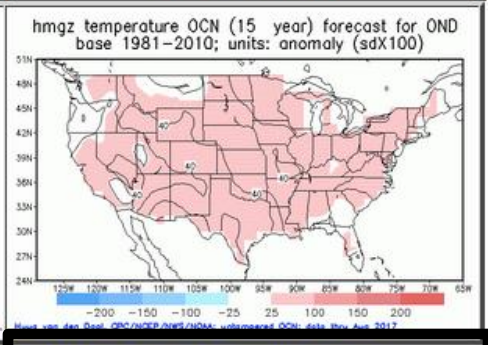
https://www.cpc.ncep.noaa.gov/products/predictions/long_range/POECalc/index.php

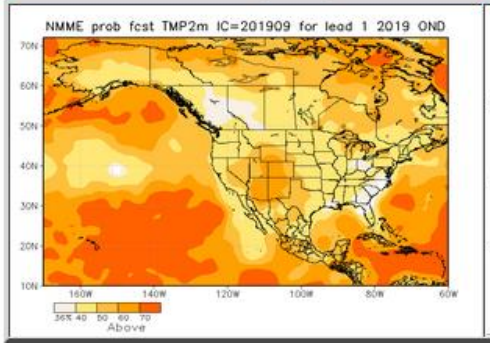
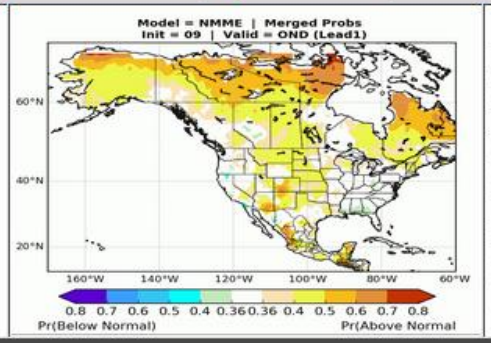
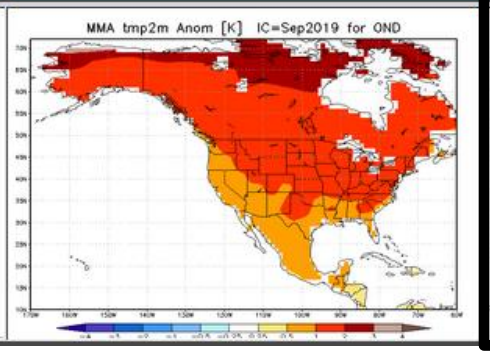
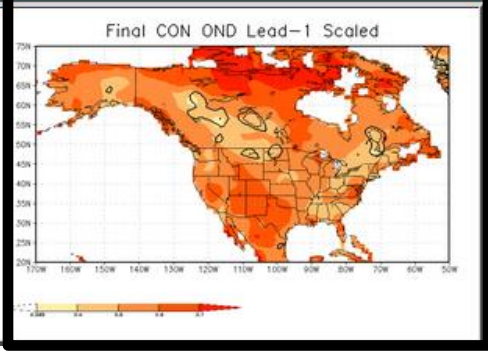
Monthly and Seasonal Production Timeline

- Friday prior to release 09:30-10:45: Three forecasters draw initial seasonal outlook maps and share their thoughts.
- Tuesday 13:00-14:30: conference call to discuss guidance and draft outlooks with partners.
  - To participate, please contact Scott.Handel@noaa.gov or Jon.Gottschalck@noaa.gov.
- Thursday at 09:00: Products released.

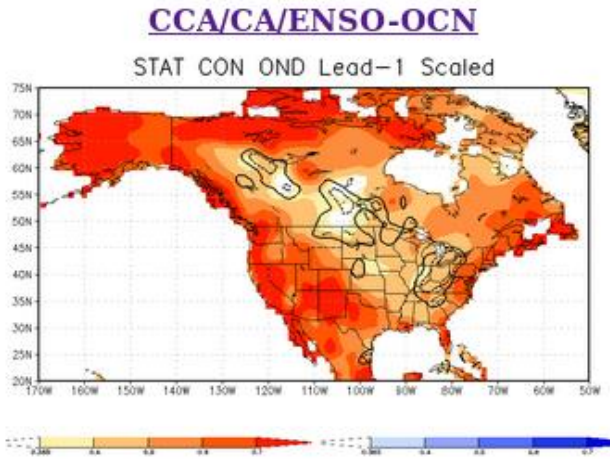
OND 2019 Temperature.....(Lead 1)

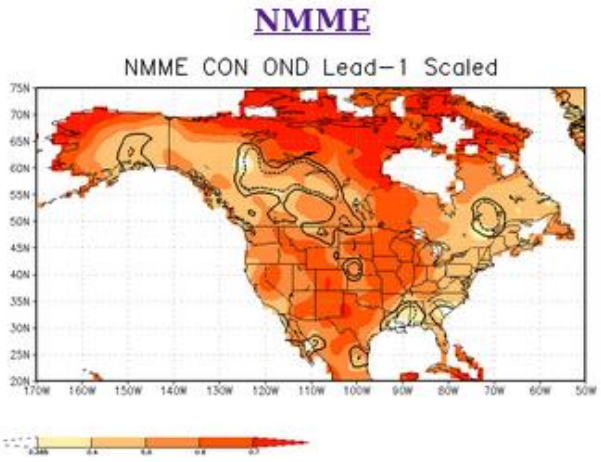
SST-CA	SMLR	CCA	OCN
			

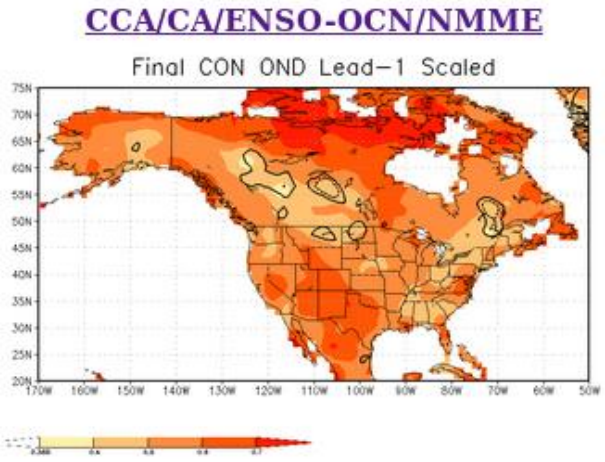
CFS	OLD-OTLK	NEW-OTLK	OCN (HMGZ)
			

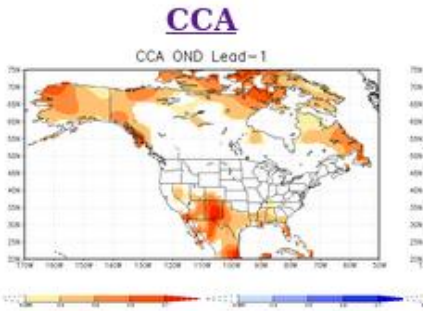
NMME (PAC)	CBaM (experimental)	IMME	FINAL CON
			

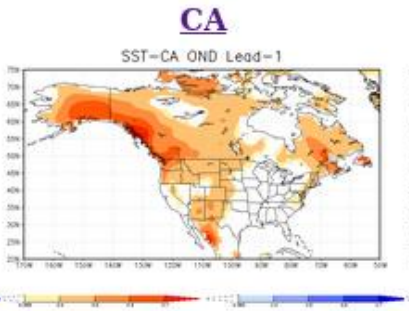
Tools background: https://www.cpc.ncep.noaa.gov/products/predictions/long_range/tools.php

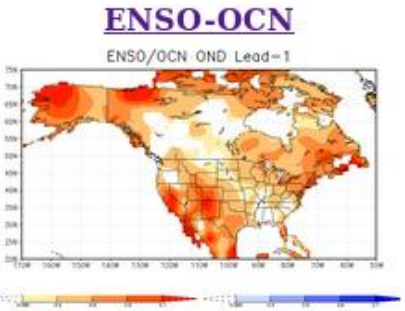












CCA: Canonical correlation analysis

CA: SST constructed analog

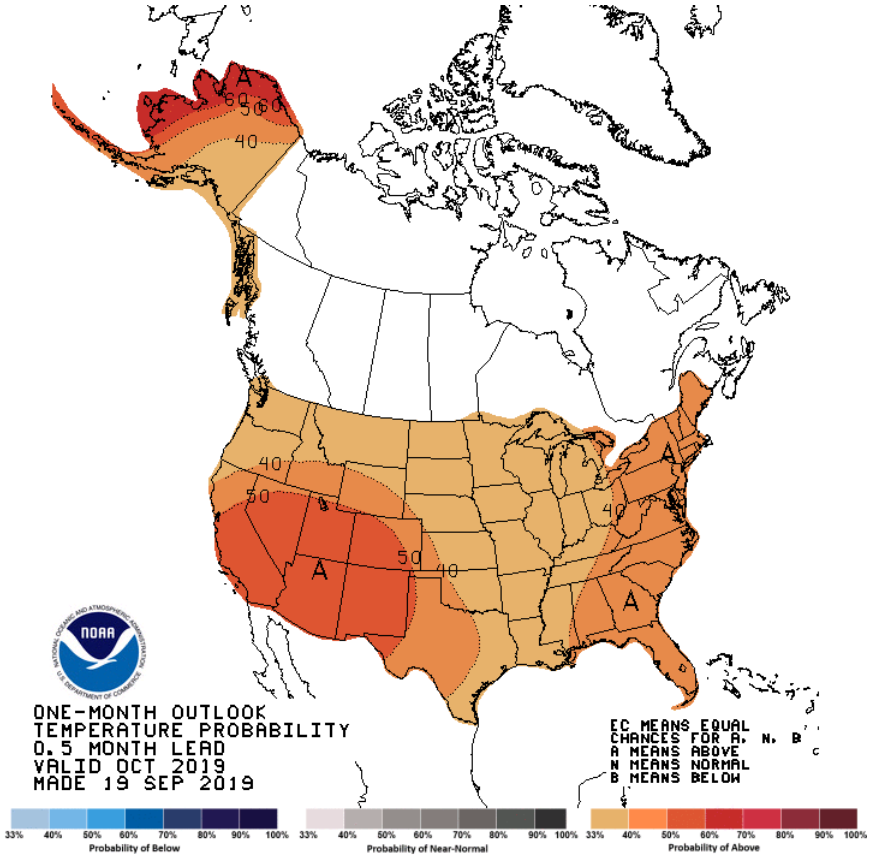
ENSO-OCN: Combination of ENSO and Optimal Climate Normals (long-term trend)

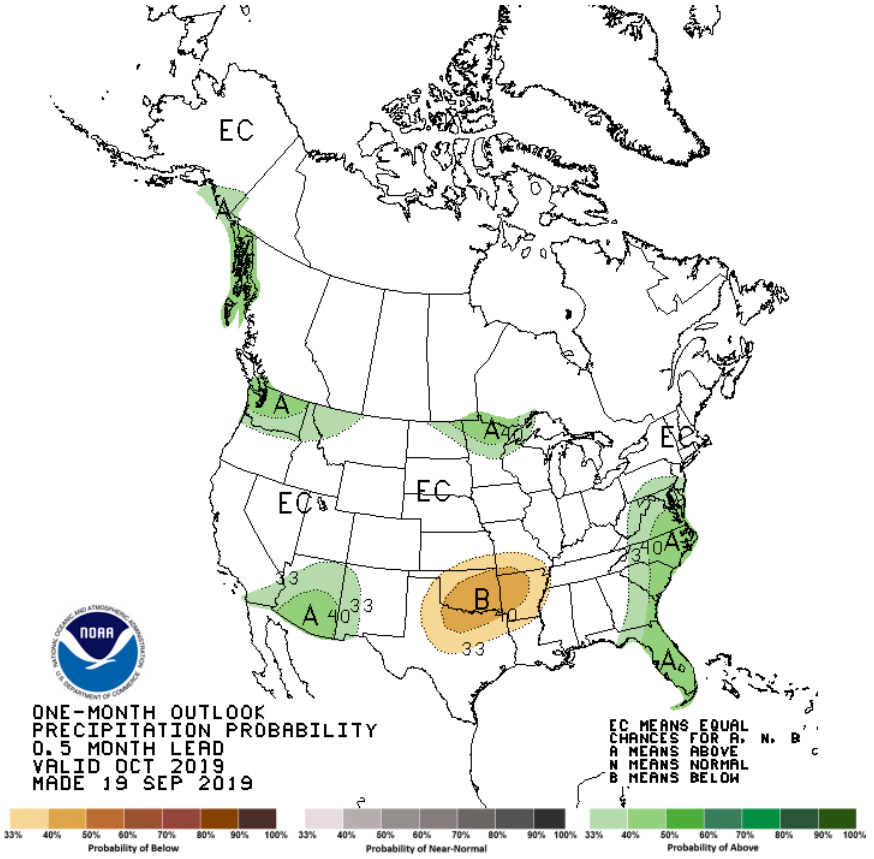
NMME: North American Multi-model Ensemble

Weights are derived from Probability Anomaly Correlation (as with the NMME).

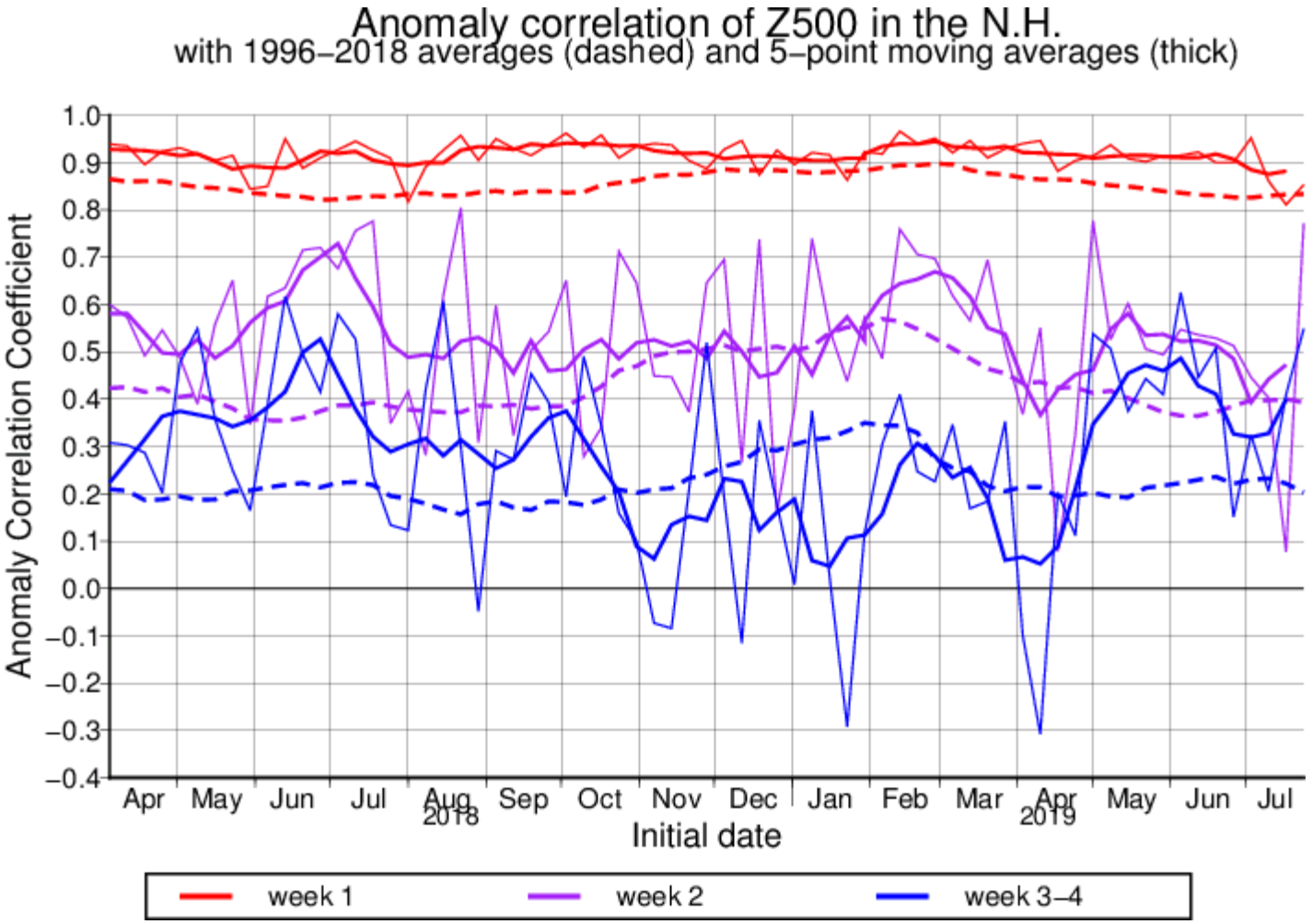
Updated Monthly Outlook

- Issued for the *second time* on the last day of the month at 15:00.





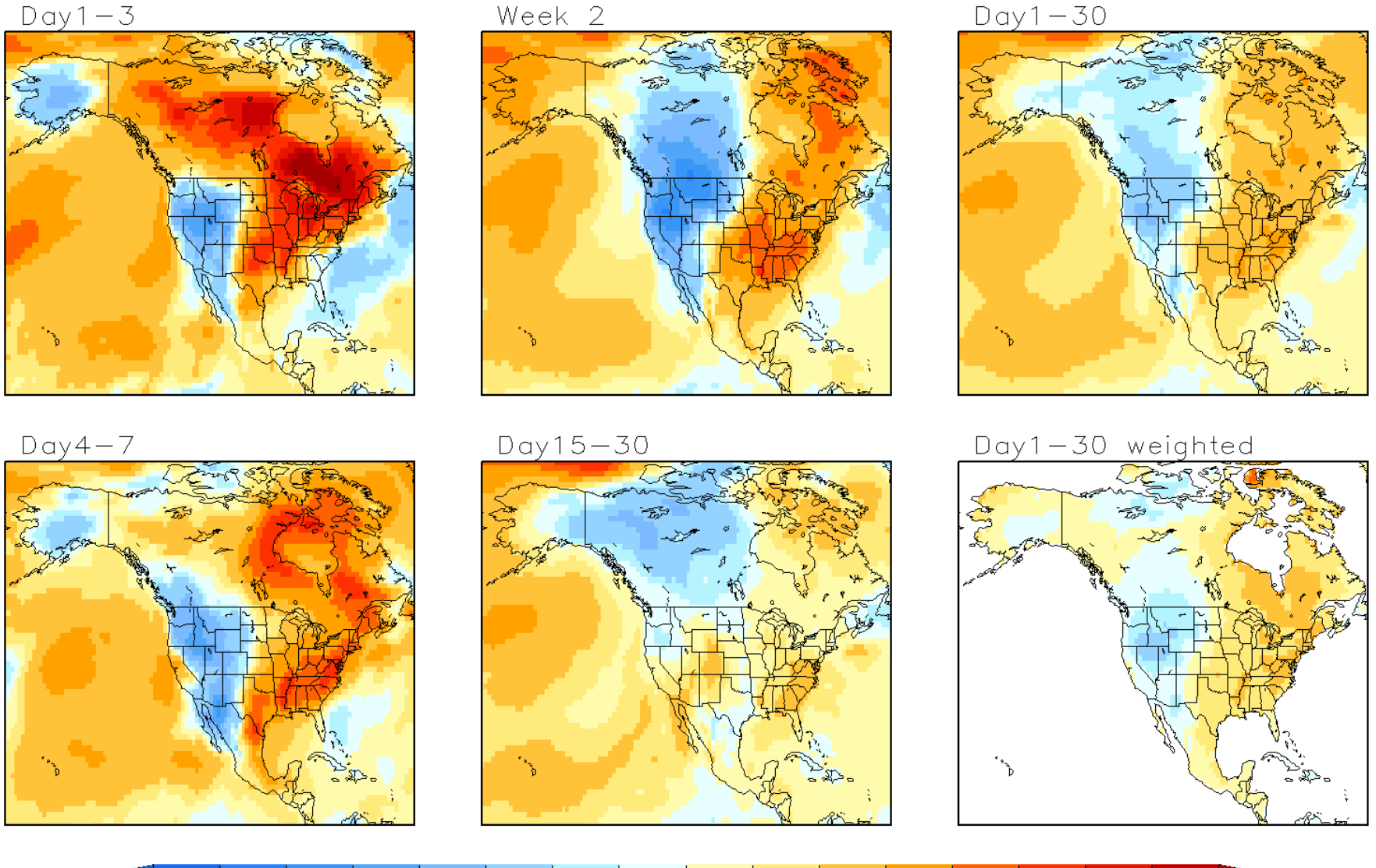
Why issue a second monthly outlook?



Mean values:
Week-1: ~0.9
Week-2: ~0.4
Weeks 3-4: ~0.2

Source:
https://ds.data.jma.go.jp/tcc/tcc/products/model/verif/1mE/Map_discussion/ACOR/vrfmap_acc_z500_nh_recent.e.html

CFSv2 tmp2m(C) Ensemble-Mean Subseasonal Forecast
IC Date:20190919; Valid Start Date: 20190921



Additional Considerations for the Monthly Update

- WPC Temperature and Precipitation forecasts through the early part of the month.
- Current 6-10 and 8-14 day outlooks.
- Current Weeks 3-4 outlook.