



Center for Western Weather
and Water Extremes

SCRIPPS INSTITUTION OF OCEANOGRAPHY
AT UC SAN DIEGO

CW3E Subseasonal Outlook: 12 November 2024

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UC San Diego



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CW3E Subseasonal Outlooks: Glossary & Context

- The outlooks are based on CW3E subseasonal forecast products that can be found here: https://cw3e.ucsd.edu/s_and_s_forecasts/
- CW3E subseasonal (2–6 weeks lead time) atmospheric river, ridging, and circulation regime products use three different global ensemble prediction systems to create these products:
 - NCEP CFSv2 (US Model): Weeks 2–6
 - ECCO (Canadian Model): Weeks 2–3
 - ECMWF (European model): Weeks 2–6
- *On the following slides, the term confidence refers to the forecasters' interpretation of the magnitude of the anomalies, the level of ensemble agreement, and the skill of the products used to generate the forecasts. All the tools used are shown in the outlook presentation.*
- *The thresholds for below-normal, near-normal, and above-normal conditions are determined by forecast product and noted on each forecast product slide*

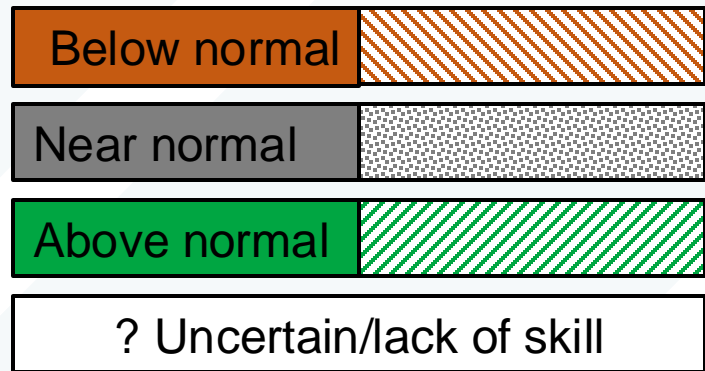
Summary: Subseasonal Precipitation Outlook by Model

This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 11 Nov 2024

Region	Week 2 (18–24 Nov)			Week 3 (25 Nov–1 Dec)			Week 4 (2 – 8 Dec)		
	NCEP ^{1,2,3}	ECCC ¹	Multi-Model Forecast	NCEP ^{1,2,3}	ECCC ¹	Multi-Model Forecast	NCEP ^{1,2,3}	ECCC ¹	Multi-Model Forecast
WA/OR	Higher Confidence	Lower Confidence	?	?	Higher Confidence	?	?	Higher Confidence	?
Northern CA	Higher Confidence	Lower Confidence	?	?	Higher Confidence	?	?	Higher Confidence	?
Central CA	Lower Confidence	Lower Confidence	?	?	Higher Confidence	?	?	Higher Confidence	?
Southern CA	Lower Confidence	Lower Confidence	?	?	Higher Confidence	?	?	Higher Confidence	?

Higher Confidence | Lower Confidence



- Large uncertainty in precipitation forecasts in CA during Weeks 2-4

Subseasonal products included in this Outlook:

¹CW3E/JPL Atmospheric River Activity Forecasts ([DeFlorio et al. 2019](#), [Zhang et al. 2023](#))

²CW3E/JPL Ridging Forecasts ([Gibson et al. 2020](#))

³IRI North American Weather Regime Forecasts ([Robertson et al. 2020](#))

Summary

Week 2 forecasts (18–24 Nov):

- Models disagree on AR activity in CA
 - NCEP is forecasting above-normal AR activity over Northern and Central CA, and near-normal AR activity over Southern CA; ECCC is generally forecasting below-normal AR activity over CA
- NCEP ridging outlooks show high likelihood of above-normal South-ridge activity and moderate likelihood of above-normal West-ridge activity during Weeks 1–2 (both patterns are associated with dry conditions over Southern CA)
- IRI weather regime tool shows high likelihood of Pacific Ridge during the beginning of Week 2 (near-normal precipitation in CA) and more uncertainty in late Week 2

Week 3 Forecasts (25 Nov–1 Dec):

- Models generally agree on above-normal AR activity in Northern CA, but disagree somewhat on AR activity in Central and Southern CA
 - NCEP is forecasting near-normal AR activity in Central and Southern CA, but ECCC is forecasting above-normal AR activity
- NCEP shows potential for ridging activity near the US West Coast during Weeks 3–4, but there is uncertainty in the location of ridging activity
- IRI weather regime tool shows uncertainty in weather regime forecasts

Summary

Week 4 Forecasts (2 – 8 Dec):

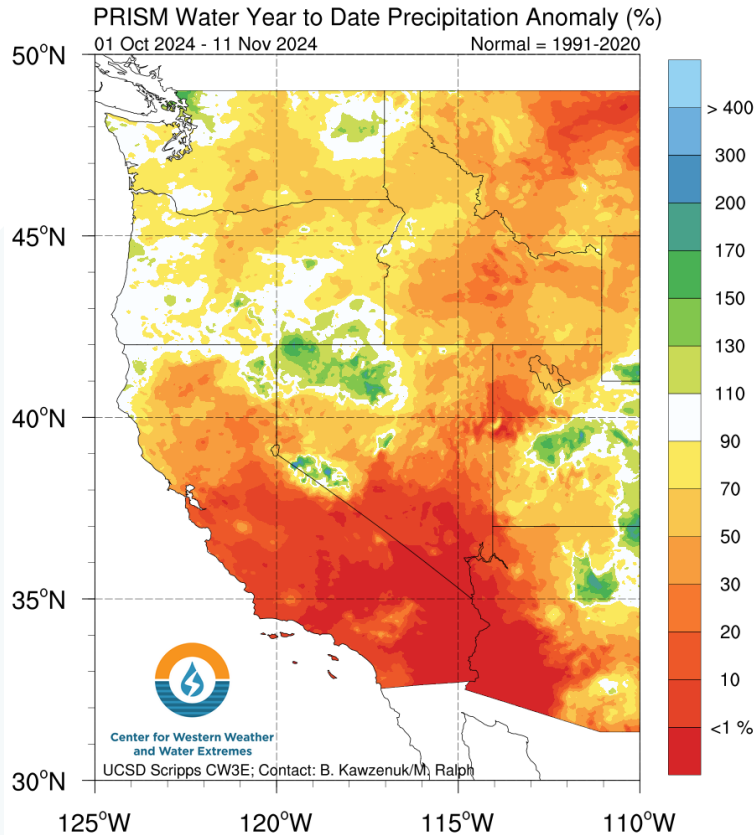
- Models generally agree on above-normal AR activity in Southern CA, but disagree on AR activity in Northern and Central CA
 - NCEP is forecasting near-normal AR activity in Northern and Central CA, but ECCO is forecasting above-normal AR activity
- IRI weather regime tool shows low likelihood of West Coast Ridge (dry conditions in CA)

MJO/QBO Conditions

- MJO convection is currently located over the Western Hemisphere with weak amplitude; QBO is in the westerly phase
 - Forecasts based on MJO and QBO conditions are unavailable due to weak MJO activity
- Models agree on MJO convection propagating to the Indian Ocean during Weeks 1–2, but disagree on its amplitude
 - ECMWF is forecasting MJO convection to weaken and remain weak while NCEP shows possibility of intensified MJO convection in Week 2

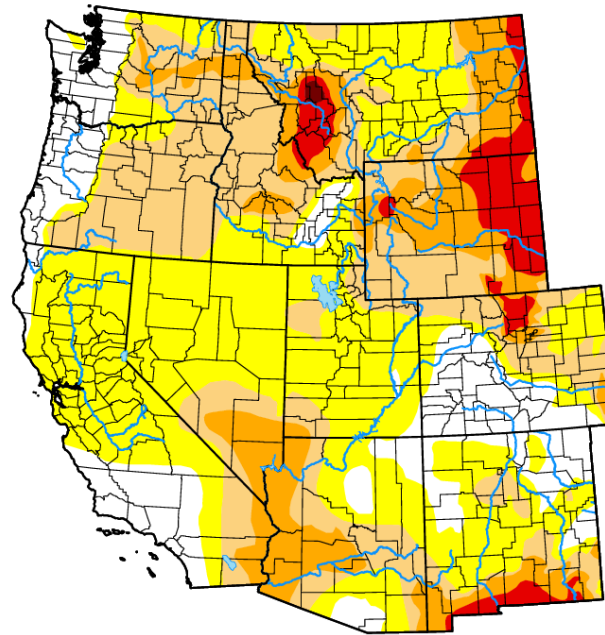
Hydrologic Summary

Precipitation



Drought Conditions

U.S. Drought Monitor West



November 5, 2024
(Released Thursday, Nov. 7, 2024)
Valid 7 a.m. EST

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	15.80	84.20	44.34	18.50	4.99	0.11
Last Week 10-29-2024	15.18	84.82	44.14	18.52	5.01	0.18
3 Months Ago 08-06-2024	22.97	77.03	32.65	7.69	1.69	0.11
Start of Calendar Year 01-02-2024	51.19	48.81	25.08	13.17	4.67	0.66
Start of Water Year 10-01-2024	20.06	79.94	37.38	9.85	2.47	0.11
One Year Ago 11-07-2023	57.24	42.76	30.28	17.67	5.69	0.76

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

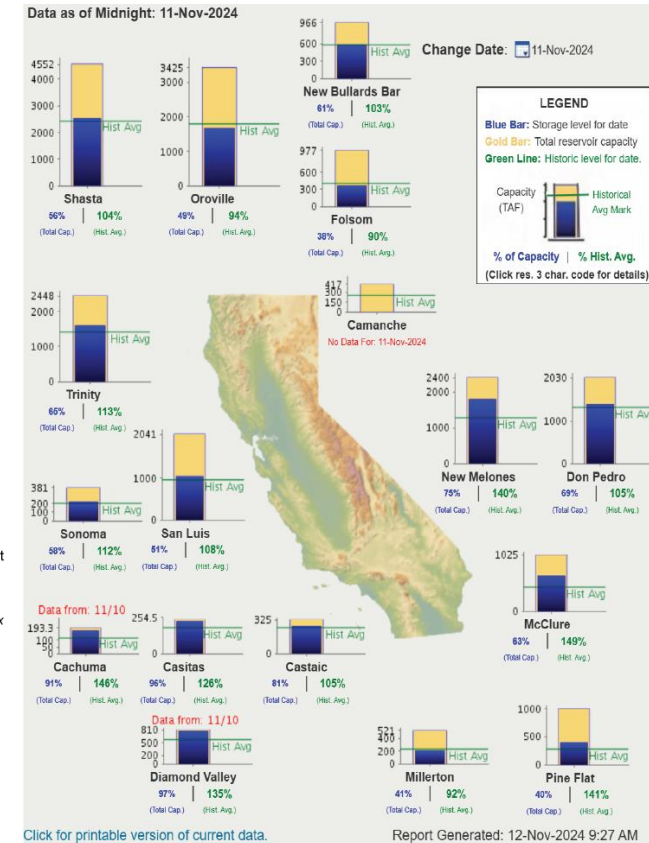
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:
Brian Fuchs
National Drought Mitigation Center



droughtmonitor.unl.edu

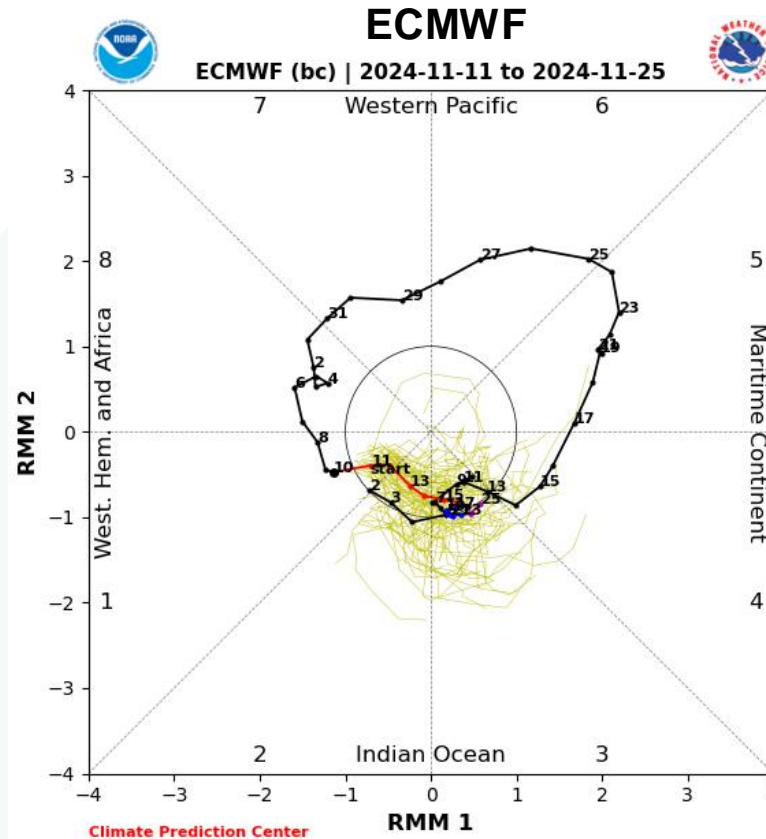
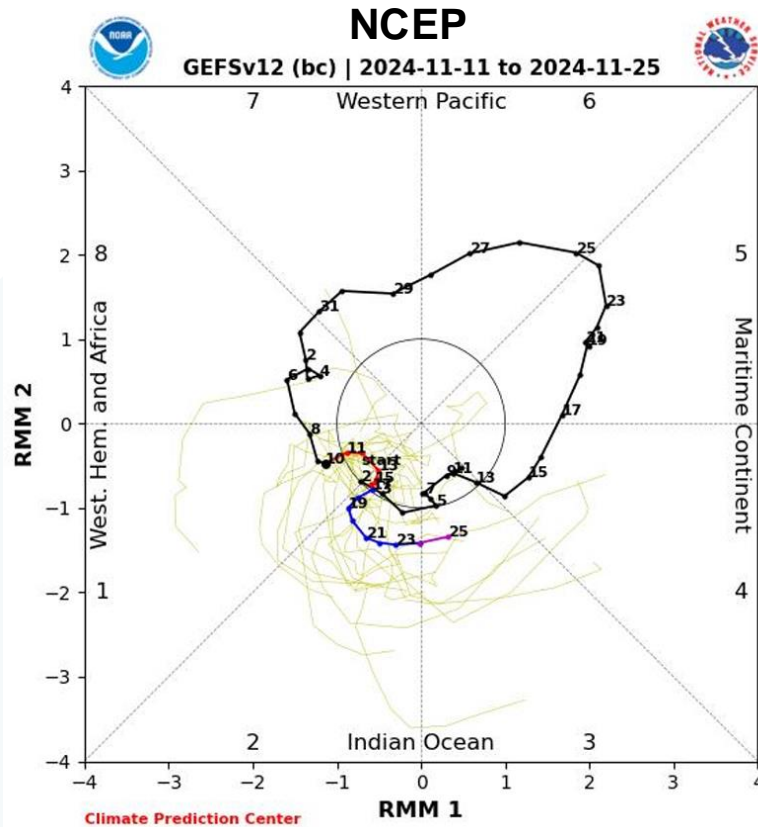
Reservoir Storage



Source: California DWR

- Water Year (WY) 2025 is off to a dry start in CA, particularly in Central and Southern CA
- As of 5 Nov, abnormally dry conditions (D0) had developed over much of Northern and Central CA, with severe drought (D2) in southeastern CA
- As of 11 Nov, most large reservoirs in CA were still operating at near or above-normal storage

Dynamical Model MJO Forecasts (NCEP vs. ECMWF)



Black: Last 40 days of observations (2 Oct – 10 Nov); Red: Week 1 (11–17 Nov) ensemble mean; Blue: Week 2 (18–24 Nov) ensemble mean; Yellow: Ensemble members

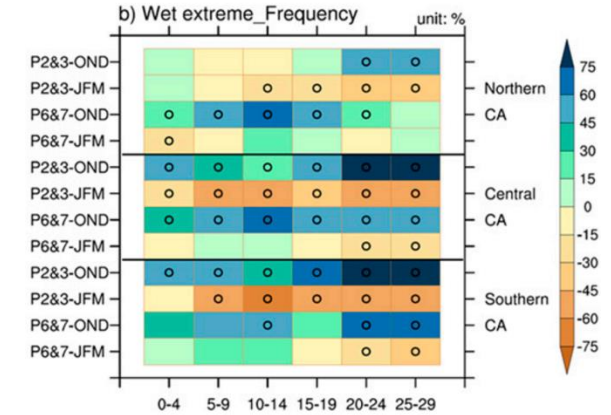


Figure 8 from Wang et al. (2023)

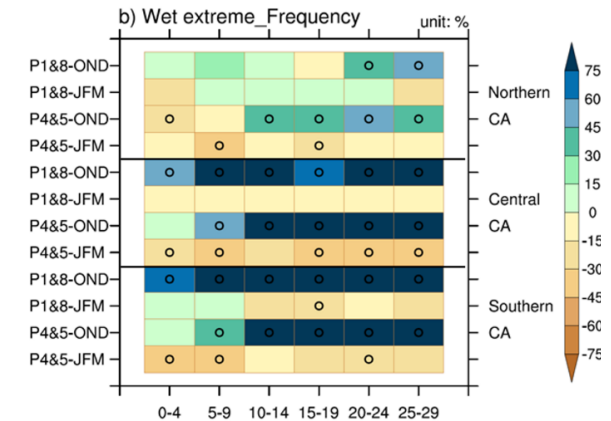
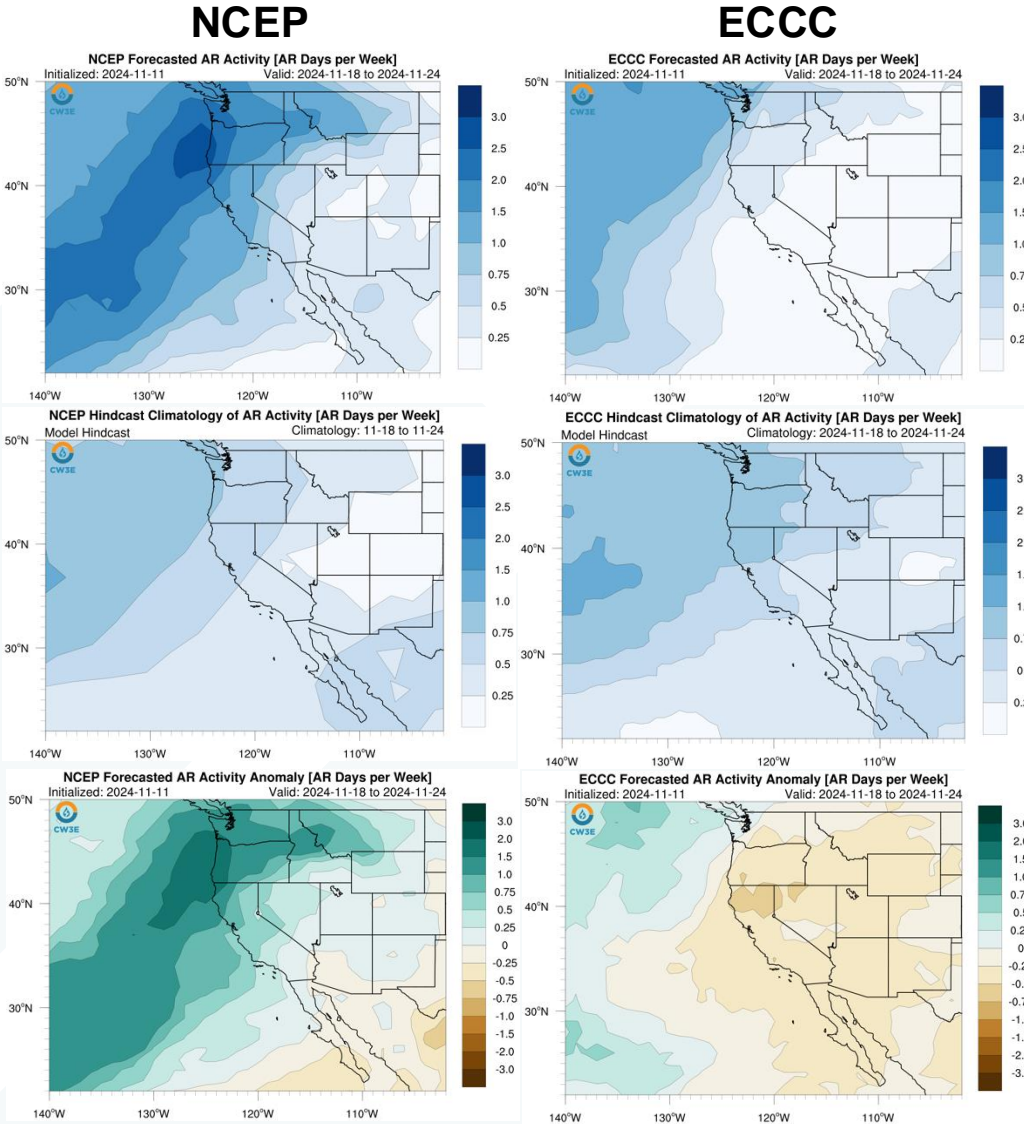


Figure S6 from Wang et al. (2023)

- MJO convection is currently located over the Western Hemisphere (Phase 1) with weak amplitude
- Both models forecast MJO will propagate to the Indian Ocean (Phases 2&3) in the following two weeks
- Both models are forecasting MJO convection to weaken in Week 1 which remains weak in ECMWF but intensifies in NCEP in Week 2
- Statistical relationships between MJO and extreme precipitation are invalid when the MJO is in weak condition

Week 2 AR Activity (NCEP vs. ECCC)

Forecasts Initialized 11 Nov 2024



ECMWF
Unavailable

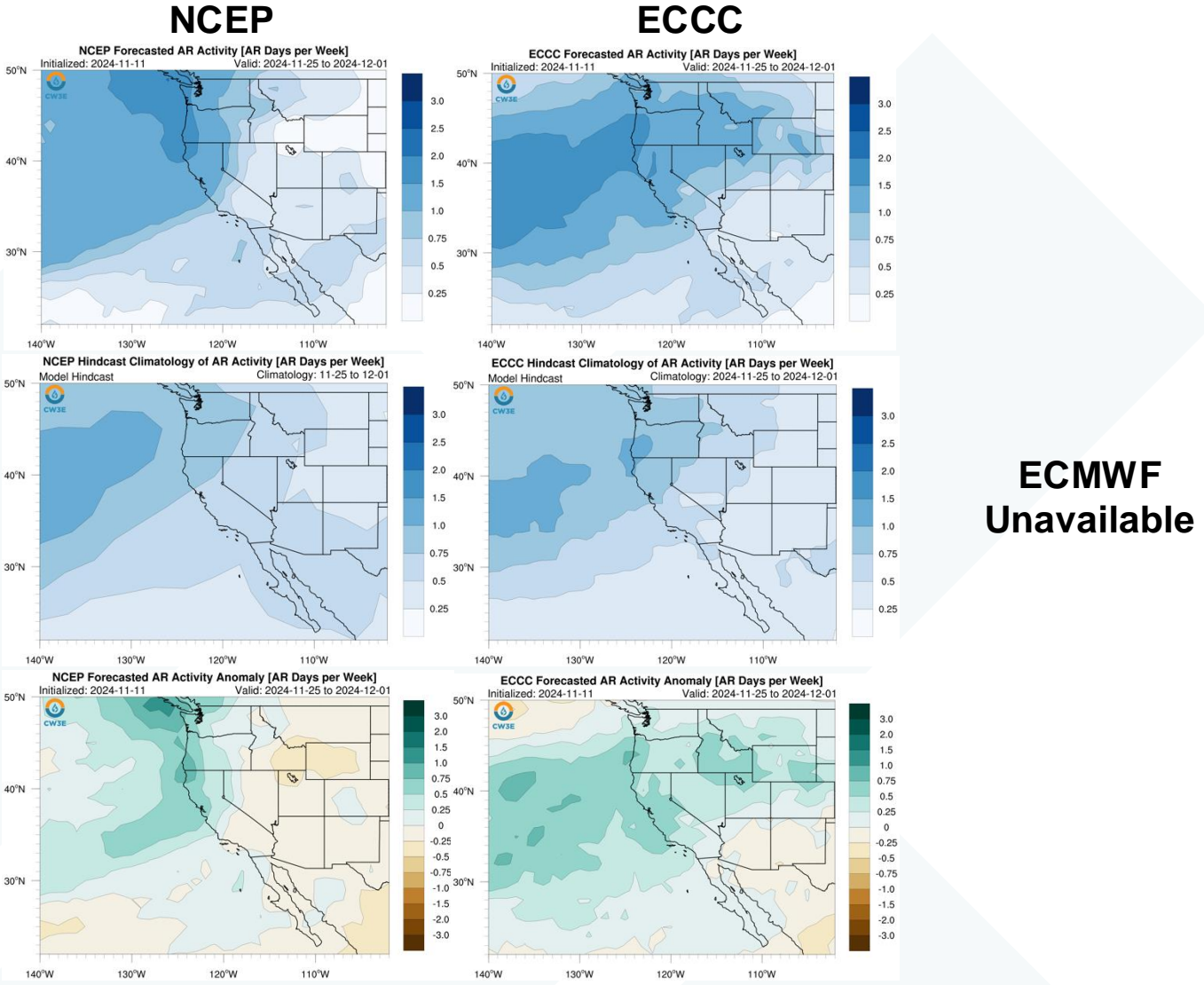
- NCEP is forecasting above-normal AR activity over Northern and Central CA, and near-normal AR activity over Southern CA during Week 2 (18–24 Nov)
- ECCC is generally forecasting below-normal AR activity over CA, especially in Northern CA

Models disagree on AR activity in CA during Week 2 (18–24 Nov)

Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

Week 3 AR Activity (NCEP vs. ECCC)

Forecasts Initialized 11 Nov 2024



- NCEP is forecasting above-normal AR activity over Northern CA, and near-normal AR activity over Central and Southern CA during Week 3 (25 Nov–1 Dec)
- ECCC is generally forecasting above-normal AR activity over CA, especially in Northern and Central CA

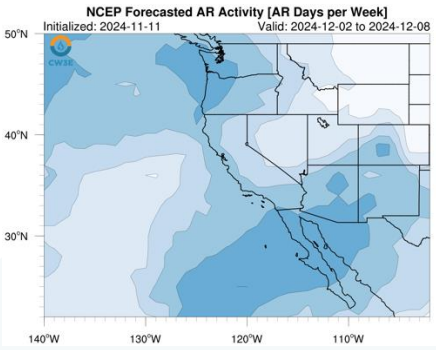
Models generally agree on above-normal AR activity in Northern CA during Week 3 (25 Nov–1 Dec), but disagree somewhat on AR activity in Central and Southern CA

Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

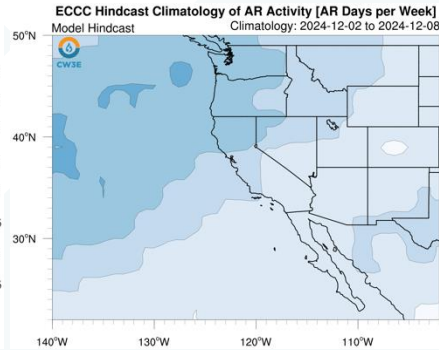
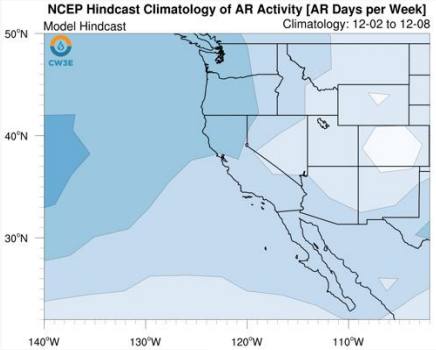
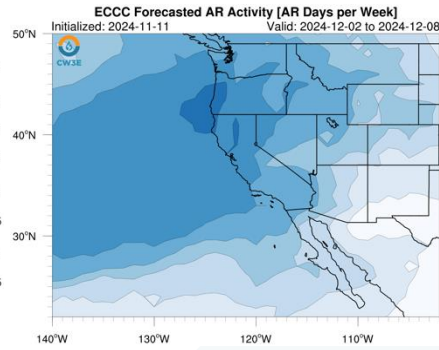
Week 4 AR Activity (NCEP vs. ECCC)

Forecasts Initialized 11 Nov 2024

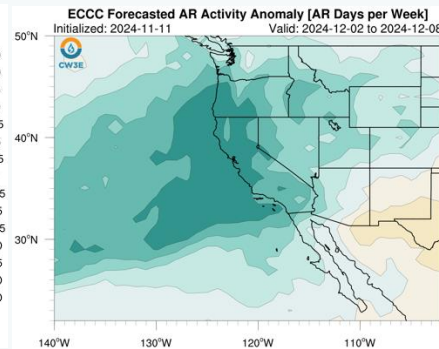
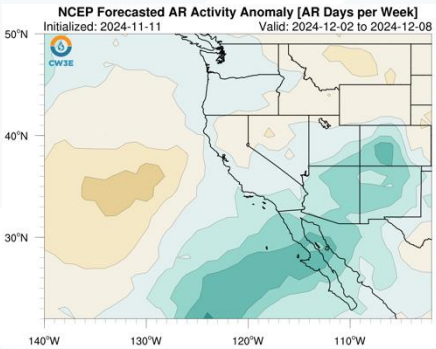
NCEP



ECCC



ECMWF
Unavailable

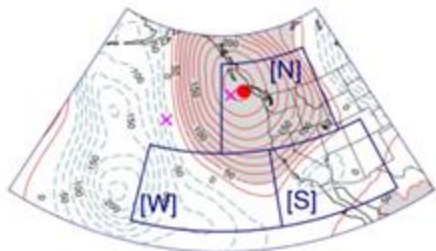


- NCEP is forecasting near-normal AR activity in Northern and Central CA, and slightly above-normal AR activity in Southern CA during Week 4 (2 – 8 Dec)
- ECCC is forecasting above-normal AR activity over all of CA

Models generally agree on above-normal AR activity in Southern CA during Week 4 (2 – 8 Dec), but disagree on AR activity in Northern and Central CA

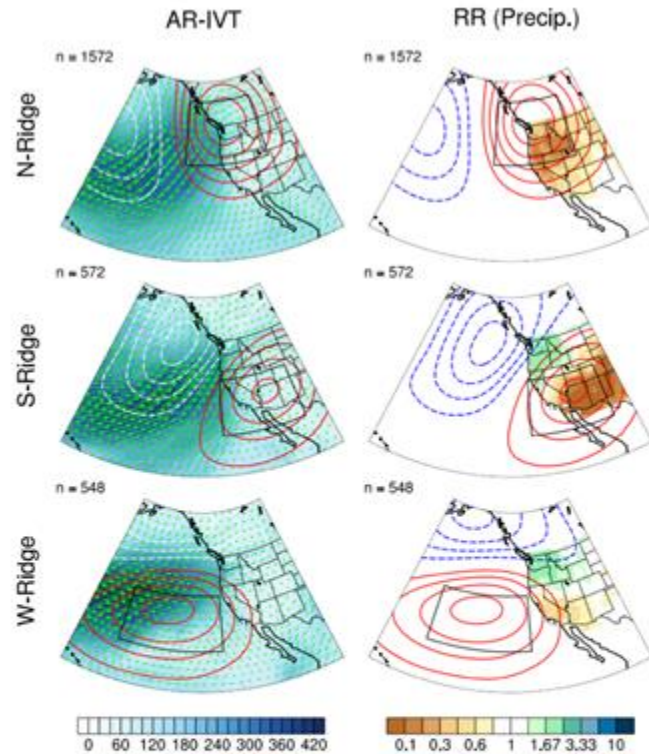
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

Background Info: Subseasonal Ridging Outlooks



N = North Ridge
S = South Ridge
W = West Ridge

This slide contains background information about the three different ridge types in CW3E's subseasonal ridging outlook tool



How each ridge type typically influences precipitation

Left: Maps showing the average influence of each ridge type (red contours) on integrated vapor transport (IVT, blue shading indicates greater moisture transport, arrows indicate direction) during atmospheric river events

Right: Maps showing the 'Relative Risk' (RR) of precipitation under each ridge type. Brown shading indicates a reduced chance of precipitation when ridging occurs. For example, a RR value of 0.2 indicates a 5-fold reduction in the likelihood of precipitation

- The North-Ridge type is typically associated with widespread dry conditions across the entire western US
- The South-Ridge type is typically associated with dry conditions in Southern CA and the Colorado River Basin and wet conditions in the Pacific Northwest
- The West-Ridge type is typically associated with dry conditions over Central and Southern CA and wet conditions over the Pacific Northwest



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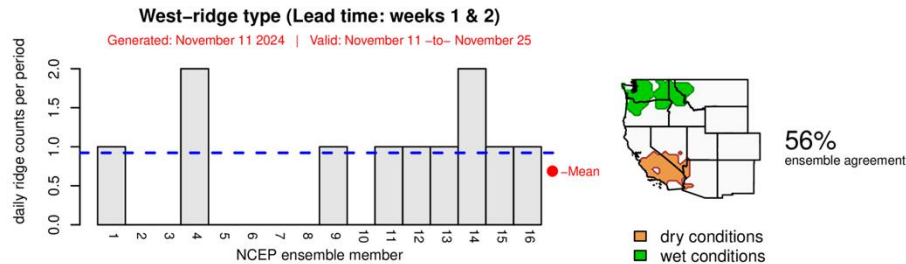
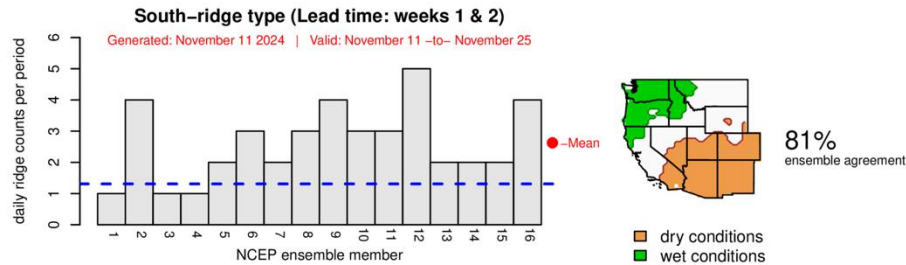
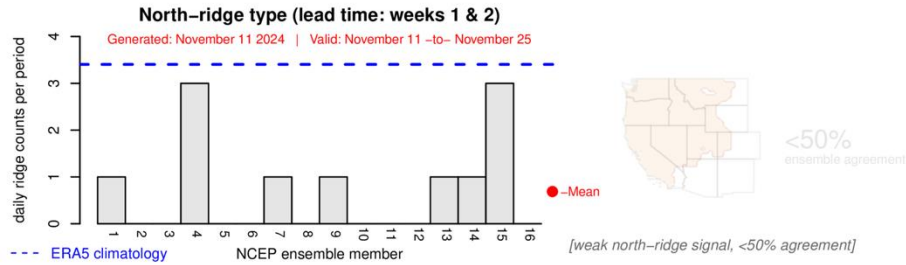
Contact: pgibson@ucsd.edu
Reference: Gibson et al. (2020)
Journal of Climate

Weeks 1–2 Ridging Forecasts (NCEP)

Forecasts Initialized 11 Nov 2024

NCEP

CW3E Subseasonal Ridging Forecast (Uses NCEP CFSv2 model)



ECMWF
Unavailable

- NCEP is forecasting a high likelihood (81% probability) of above-normal South-ridge activity during Weeks 1–2 (11–25 Nov)
- NCEP is also forecasting a moderate likelihood (56% probability) of above-normal West-ridge activity



NCEP is forecasting high likelihood of ridging activity south of CA during Weeks 1–2 (11–25 Nov)



Weeks 3–4 Ridging Forecasts (NCEP)

Forecasts Initialized 11 Nov 2024

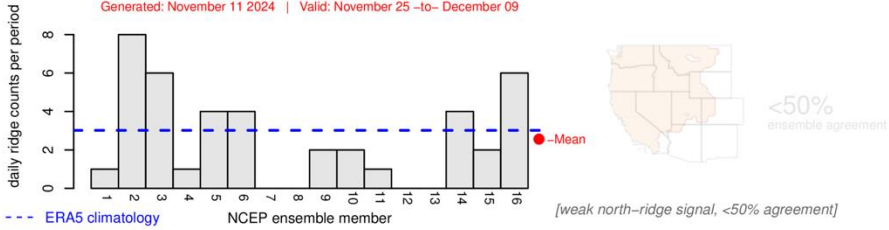
NCEP

CW3E Subseasonal Ridging Forecast

(Uses NCEP CFSv2 model)

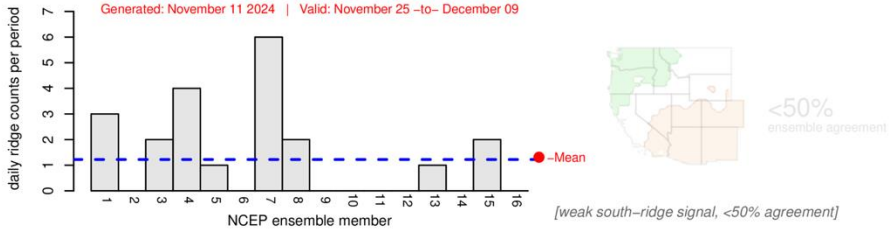
North-ridge type (lead time: weeks 3 & 4)

Generated: November 11 2024 | Valid: November 25 –to– December 09



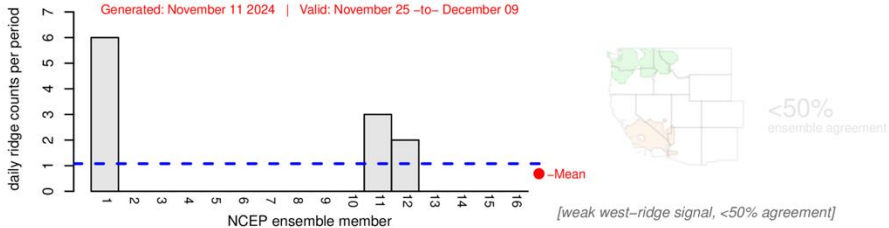
South-ridge type (Lead time: weeks 3 & 4)

Generated: November 11 2024 | Valid: November 25 –to– December 09



West-ridge type (Lead time: weeks 3 & 4)

Generated: November 11 2024 | Valid: November 25 –to– December 09



ECMWF
Unavailable

- NCEP is showing potential for persistent ridging near the US West Coast during Weeks 3–4 (25 Nov – 9 Dec) as all three ridge types show near-normal forecasts, but there is uncertainty in the location of ridging activity

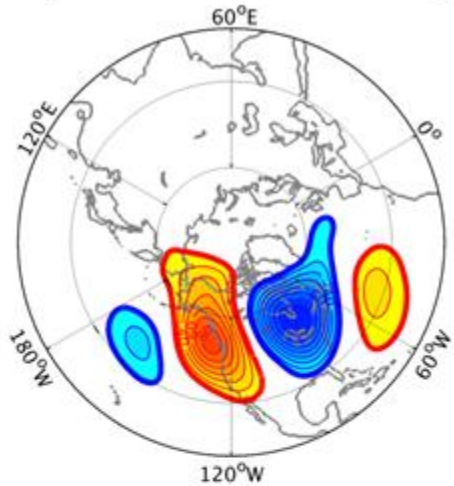


Uncertainty in location and frequency of ridging activity near US West Coast during Weeks 3–4 (25 Nov – 9 Dec)

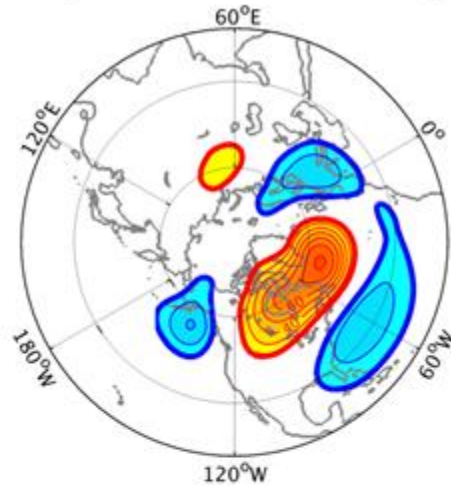


Background Info: IRI Subseasonal Weather Regime Forecasts

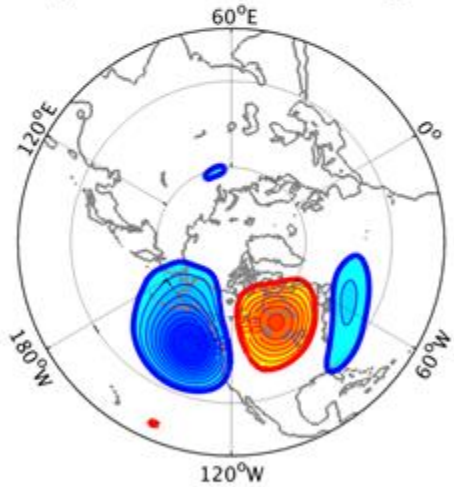
a) WR 1: West Coast Ridge



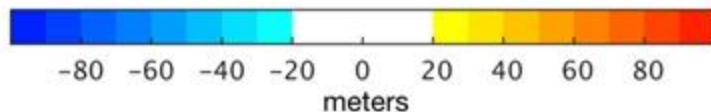
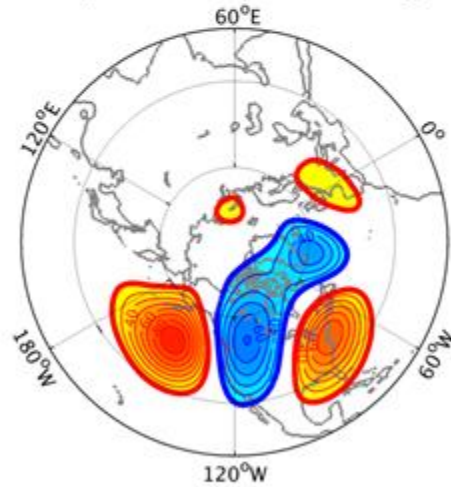
b) WR 2: Greenland High



c) WR 3: Pacific Trough



d) WR 4: Pacific Ridge



This slide contains background information about IRI's North American weather regime forecast product

- Four dominant weather regimes identified using cluster analysis on daily 500-hPa geopotential height anomalies from MERRA data (1981–2015)

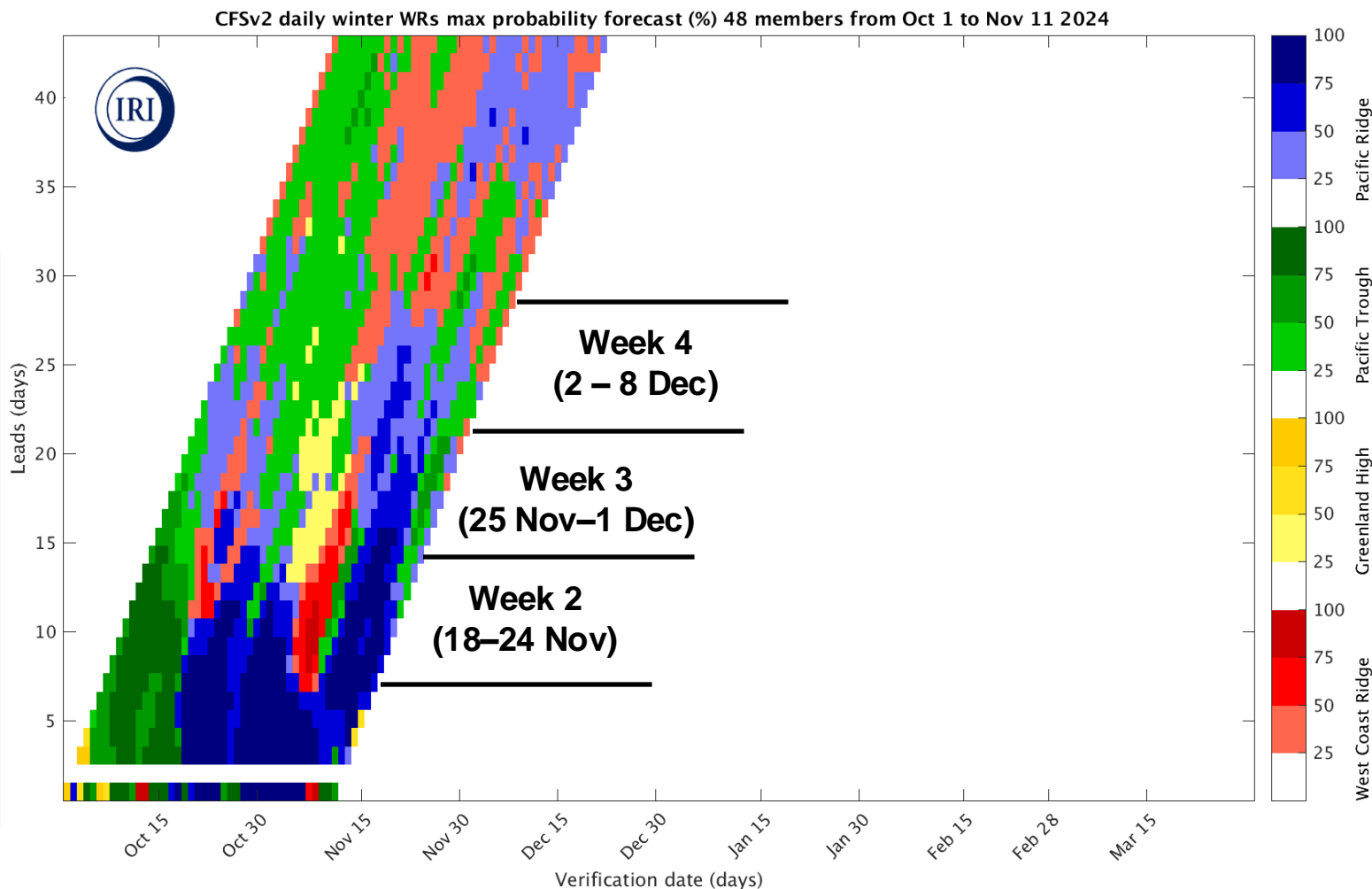
Reference: [Robertson et al. \(2020\)](#)

For more information about the forecast product:

<https://wiki.iri.columbia.edu/index.php?n=Climate.S2S-WRs>

Subseasonal Outlooks: IRI North American Weather Regime Forecasts

Forecast Initialized 11 Nov 2024



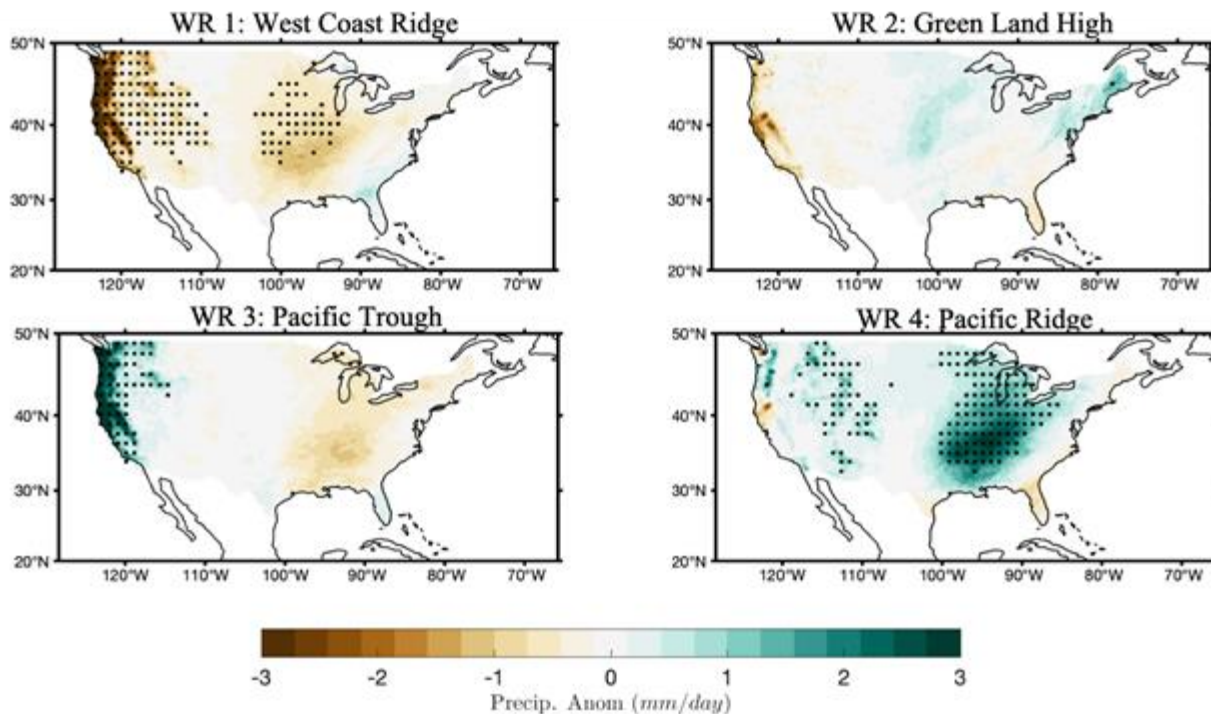
- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble
- High likelihood (> 75% ensemble agreement) of Pacific Ridge in the beginning of Week 2 (18–20 Nov)
- Uncertain weather regimes in late Week 2 through early Week 4 (21 Nov – 4 Dec)
- Possible transition to West Coast Ridge in Week 4 (2 – 8 Dec), but ensemble agreement is low (< 50%)

This graphic shows the which of the four North American weather regimes (different colors) is most likely to occur over the next 45 days. Darker (lighter) shading denotes higher (lower) probability of a particular regime. See the next slide for temperature/precipitation implications.

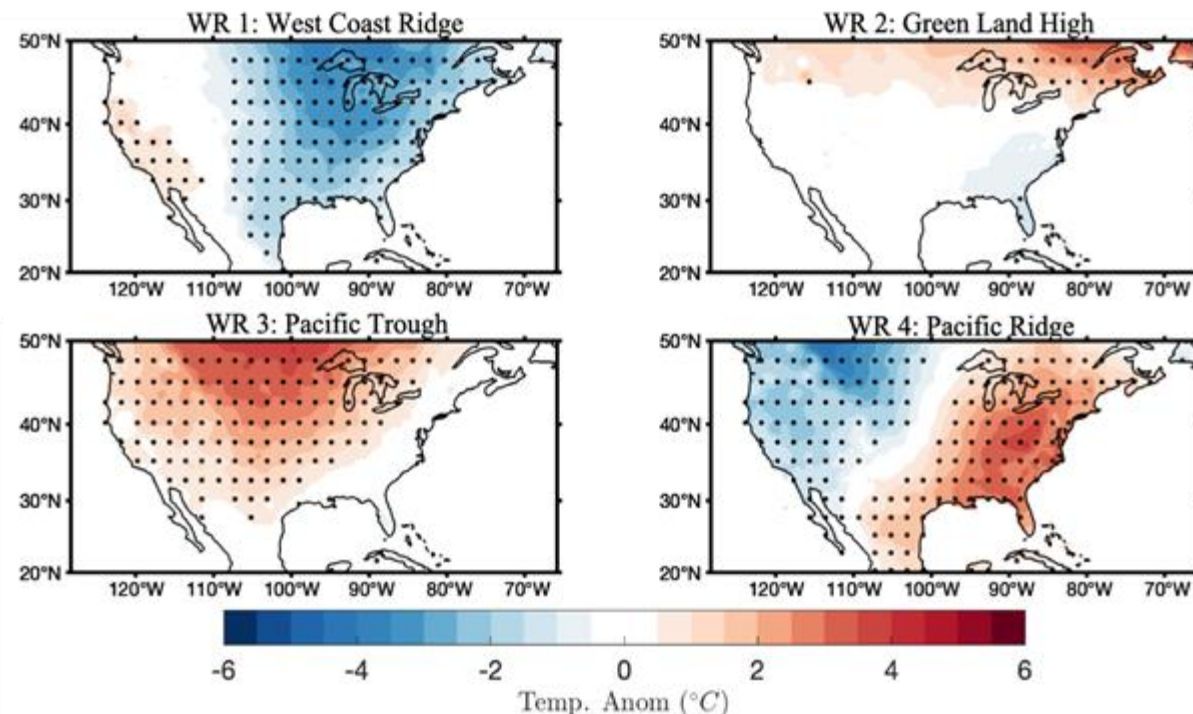
For more information about the forecast product: <https://wiki.iri.columbia.edu/index.php?n=Climate.S2S-WRs>

Subseasonal Outlooks: IRI North American Weather Regime Forecasts

Precipitation



Temperature

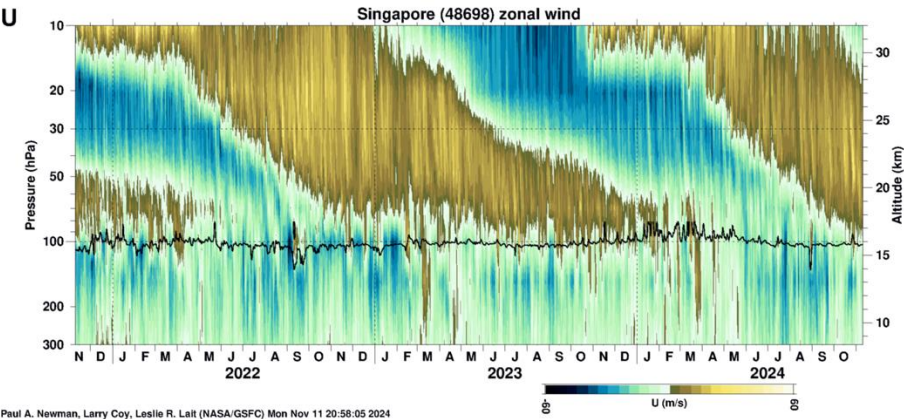


This graphic shows composite mean precipitation (left) and temperature (right) anomalies associated with each weather regime. Stippling (black dots) indicate statistically significant anomalies.

- Below-normal temperatures and near-normal precipitation predicted over CA during the beginning of Week 2 (18–20 Nov) with high confidence in Pacific Ridge regime
- Uncertain conditions in late November
- Above-normal temperatures and below-normal precipitation predicted over CA during most of Week 4 (2 – 8 Dec) with low confidence in West Coast Ridge regime

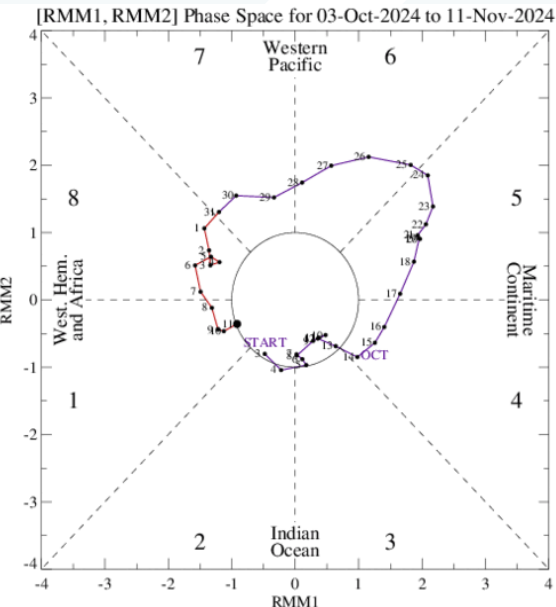
Background Info: AR Activity and Precipitation Based on MJO and QBO

QBO Conditions



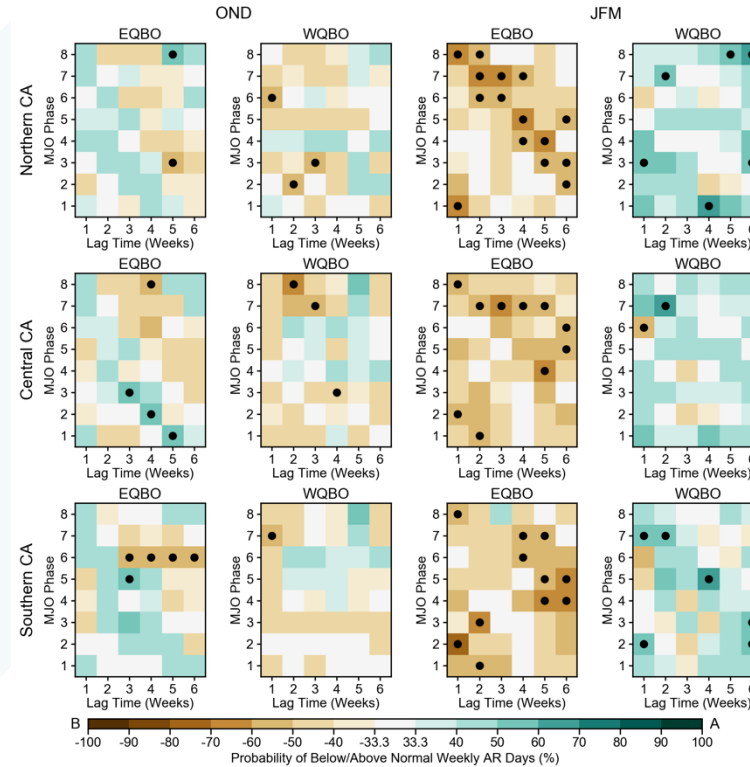
QBO is in the westerly phase at 50-hPa

MJO Conditions

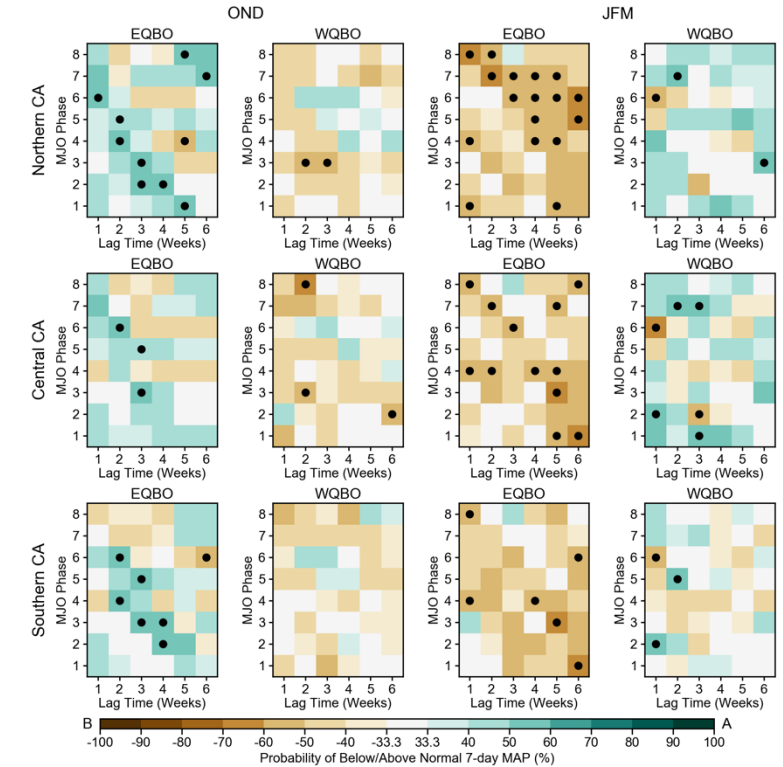


Forecasts unavailable due to weak MJO conditions

Probability of Above/Below-Normal AR Occurrence



Probability of Above/Below-Normal Precipitation



Probability matrices illustrating the weeks 1–6 lagged probability of below-normal (brown shading) or above-normal (green shading) AR occurrence and precipitation for all MJO/QBO phase configurations during OND (left) and JFM (right) in Northern CA (top), Central CA (middle), and Southern CA (bottom). White squares indicate that the near-normal category has the highest probability. The black dots denote statistically significant probabilities of below- or above-normal conditions based on a bootstrapping analysis. Historical observations less (more) than the lower (upper) tercile of climatology (1981–2019 period) are considered below (above) normal.