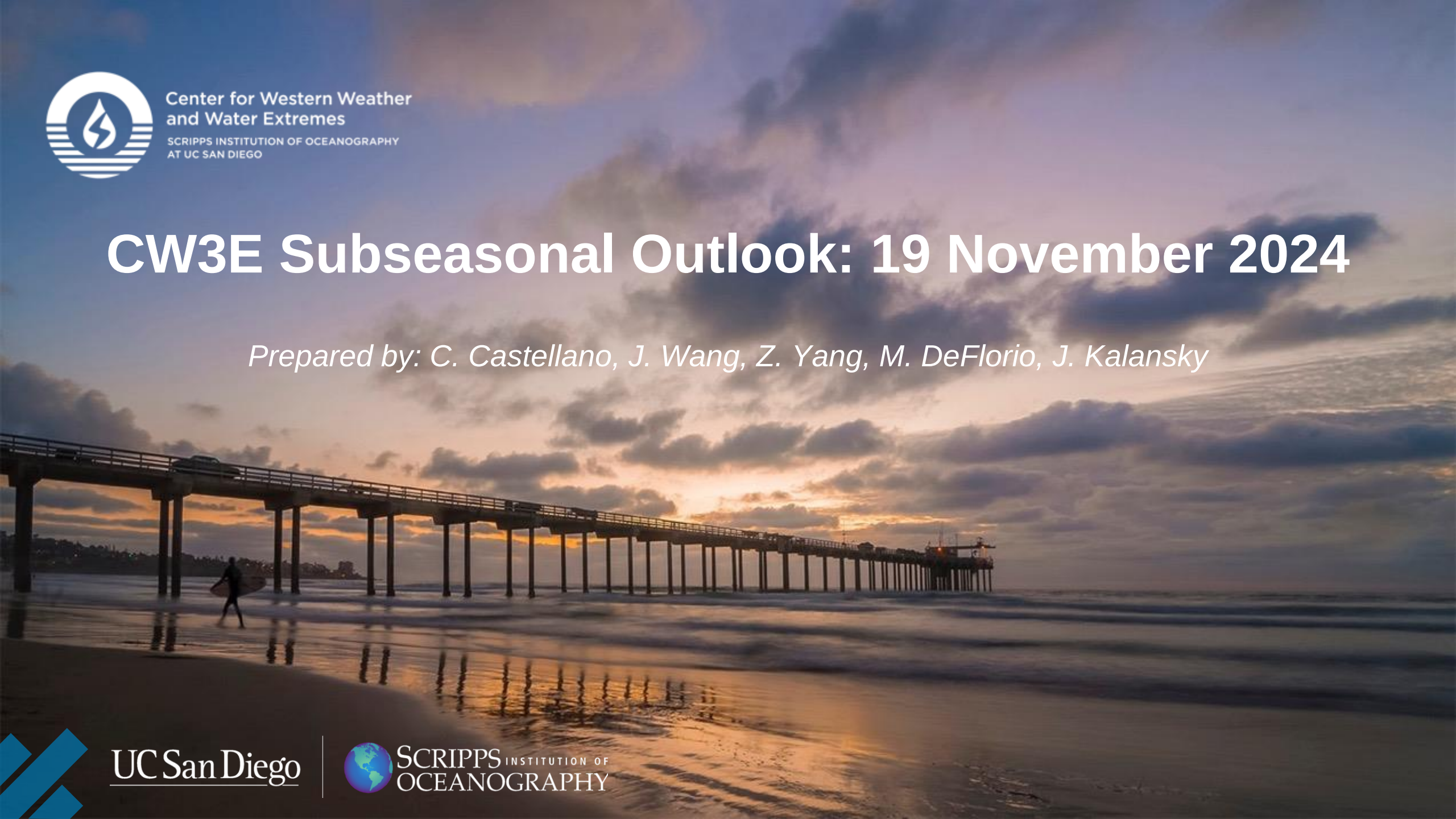

CW3E Subseasonal Outlook: 19 November 2024

Prepared by: C. Castellano, J. Wang, Z. Yang, M. DeFlorio, J. Kalansky

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
  - ECCC (Canadian Model): Weeks 2–4
  - 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 18 Nov 2024

Region	Week 2 (25 Nov – 1 Dec)				Week 3 (2–8 Dec)				Week 4 (9–15 Dec)			
	NCEP[1,2,3]	ECCC[1]	ECMWF[1,2]	Multi-Model Forecast	NCEP[1,2,3]	ECCC[1]	ECMWF[1,2]	Multi-Model Forecast	NCEP[1,2,3]	ECCC[1]	ECMWF[1,2]	Multi-Model Forecast
WA/OR												
Northern CA												
Central CA												
Southern CA												

Higher Confidence | Lower Confidence

- Below normal
- Near normal
- Above normal
- ? Uncertain/lack of skill

- Models lean towards above-normal precipitation (with low confidence) in Northern CA during Weeks 2–4
- More uncertainty in precipitation over Central and Southern CA due to poor agreement between products and models

Subseasonal products included in this Outlook:

[1]CW3E/JPL Atmospheric River Activity Forecasts (DeFlorio et al. 2019, Zhang et al. 2023)
[2]CW3E/JPL Ridging Forecasts (Gibson et al. 2020)
[3]IRI North American Weather Regime Forecasts (Robertson et al. 2020)

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Summary

MJO/QBO Conditions

- MJO convection is currently located over the Indian Ocean (Phase 2); QBO is in the westerly phase
  - MJO in Phase 2 and westerly QBO during OND is associated with a high likelihood of below-normal AR activity in Northern CA at lag times of 2 weeks
  - MJO in Phases 2&3 during OND is also associated with increases in wet extremes in Central and Southern CA at lag times of 1–4 weeks and in Northern CA at lag times of 4 weeks

- Models forecast MJO to propagate eastward, reaching the Maritime Continent (Phase 4) by Week 2

Week 2 forecasts (25 Nov – 1 Dec):

- Models agree on above-normal AR activity in Southern and Central CA during Week 2, but disagree somewhat on AR activity in Northern CA
  - NCEP and ECCC are forecasting above-normal AR activity over Northern CA
  - ECMWF is forecasting near-normal AR activity over Northern CA

- NCEP and ECMWF ridging outlooks show high likelihood of above-normal South-ridge activity (dry conditions in Southern CA) during Weeks 1–2

- IRI weather regime tool shows moderate likelihood of Pacific Ridge (near-normal precipitation in CA) during Week 2

Summary

Week 3 Forecasts (2–8 Dec):

- Models disagree somewhat on AR activity in CA during Week 3
  - NCEP and ECCC agree on above-normal AR activity over Northern and Central CA during Week 3
  - ECCC is also forecasting above-normal AR activity over Southern CA, whereas NCEP is forecasting near-normal AR activity
  - ECMWF is forecasting near-normal AR activity over all of CA

- NCEP ridging outlook shows moderate likelihood of above-normal South-ridge activity during Weeks 3–4
  - ECMWF also shows potential for persistent ridging activity near the US West Coast, but there is uncertainty in the location of ridging

- IRI weather regime tool shows high degree of uncertainty in regime type during Week 3, with low confidence in either Pacific Ridge or West Coast Ridge

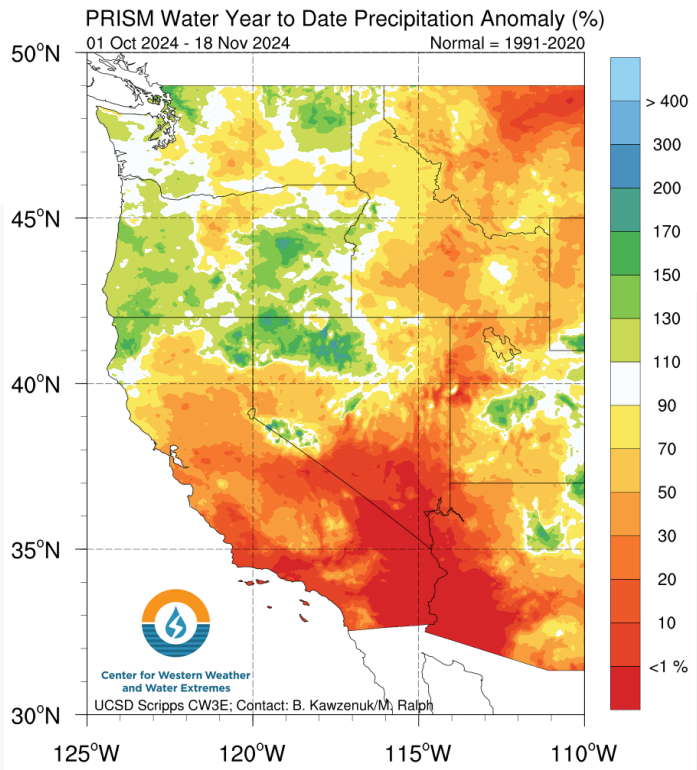
Weeks 4 Forecasts (9–15 Dec):

- Models disagree somewhat on AR activity in CA during Week 4
  - NCEP and ECCC agree on above-normal AR activity over all of CA
  - ECMWF is forecasting near-normal AR activity over all of CA

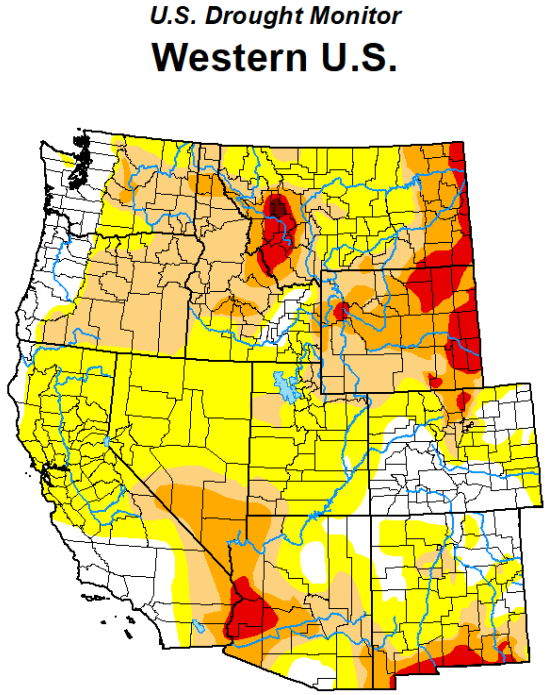
- IRI weather regime tool shows high degree of uncertainty in regime type during Week 4, with low confidence in either Pacific Ridge or West Coast Ridge

Hydrologic Summary

Precipitation



Drought Conditions



November 12, 2024
(Released Thursday, Nov. 14, 2024)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	17.35	82.65	43.17	18.70	5.28	0.11
Last Week 11-05-2024	15.80	84.20	44.34	18.50	4.99	0.11
3 Months Ago 08-13-2024	23.26	76.74	33.25	8.40	1.83	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 11-14-2023	56.87	43.13	29.99	16.54	5.75	0.73

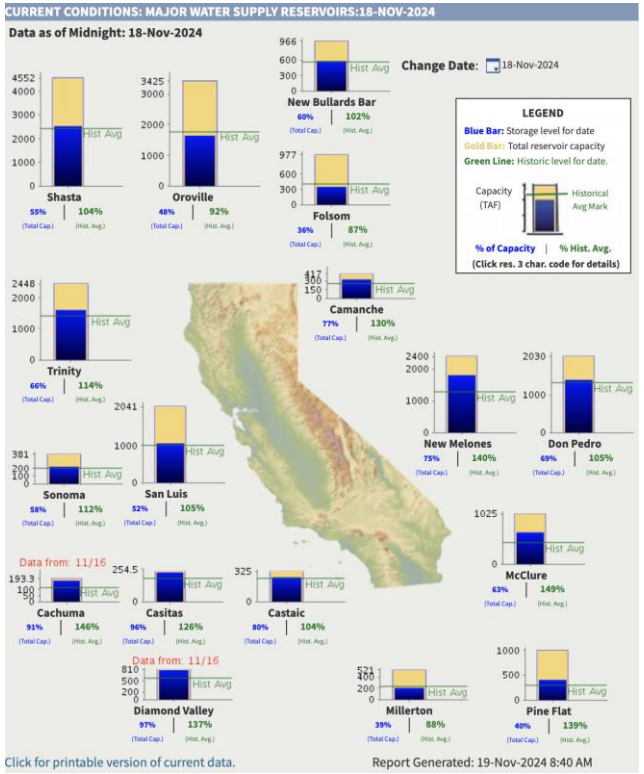
Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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:
Richard Tinker
CPC/NOAA/NWS/NCEP

droughtmonitor.unl.edu

Reservoir Storage

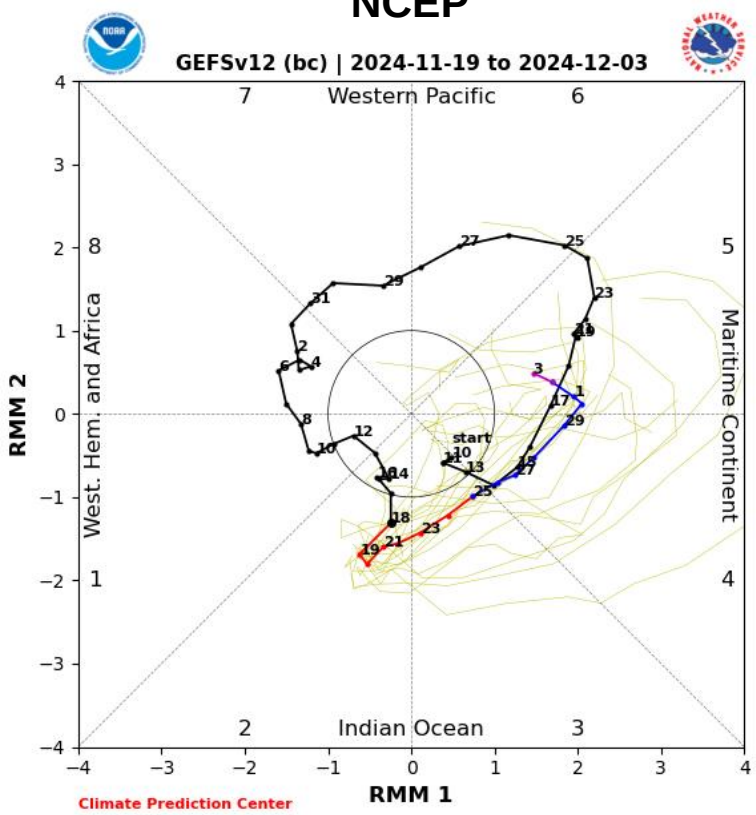


Source: California DWR

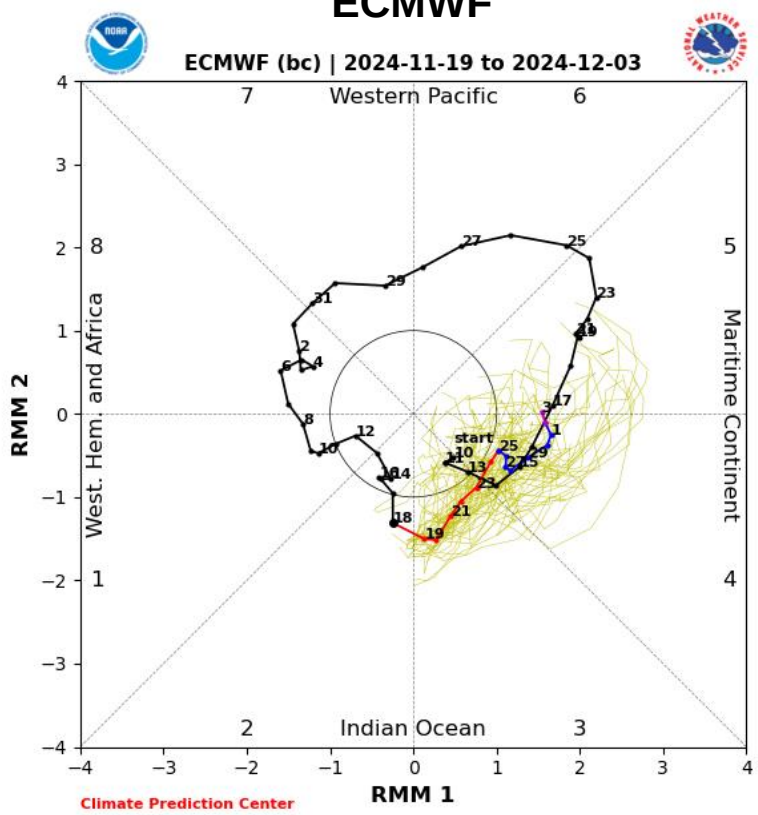
- As of 18 Nov, water-year-to-date precipitation is running below normal (< 70% of normal) over much of CA, especially in Central and Southern CA
- The most recent drought monitor update is showing abnormally dry conditions (D0) over much of Northern and Central CA, and moderate drought-to-severe drought (D1–D2) in southeastern CA
- Most large reservoirs in CA are still operating at near or above-normal storage for this time of year

Dynamical Model MJO Forecasts (NCEP vs. ECMWF)

NCEP



ECMWF



Black: Last 40 days of observations (10 Oct – 18 Nov); Red: Week 1 (19–25 Nov) ensemble mean; Blue: Week 2 (26 Nov – 2 Dec) ensemble mean; Yellow: Ensemble members

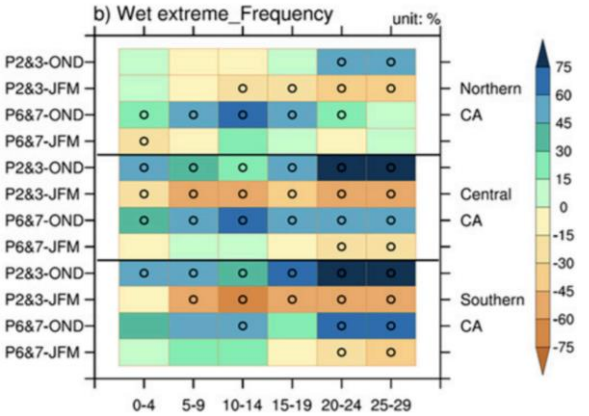


Figure 8 from Wang et al. (2023)

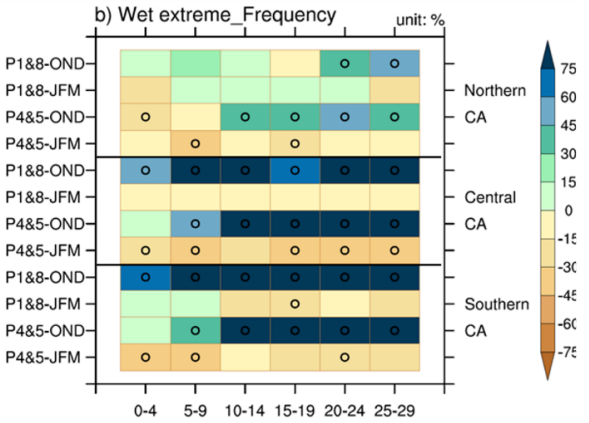


Figure S6 from Wang et al. (2023)

- MJO convection is currently located over the Indian Ocean (Phase 2)
- Both NCEP and ECMWF models are forecasting MJO convection to propagate eastward, reaching the Maritime Continent (Phase 4) by Week 2
- MJO activity over the Indian Ocean during OND is associated with statistically significant increases in wet extremes in Central and Southern CA at lag times of 1–4 weeks and in Northern CA at lag times of 4 weeks

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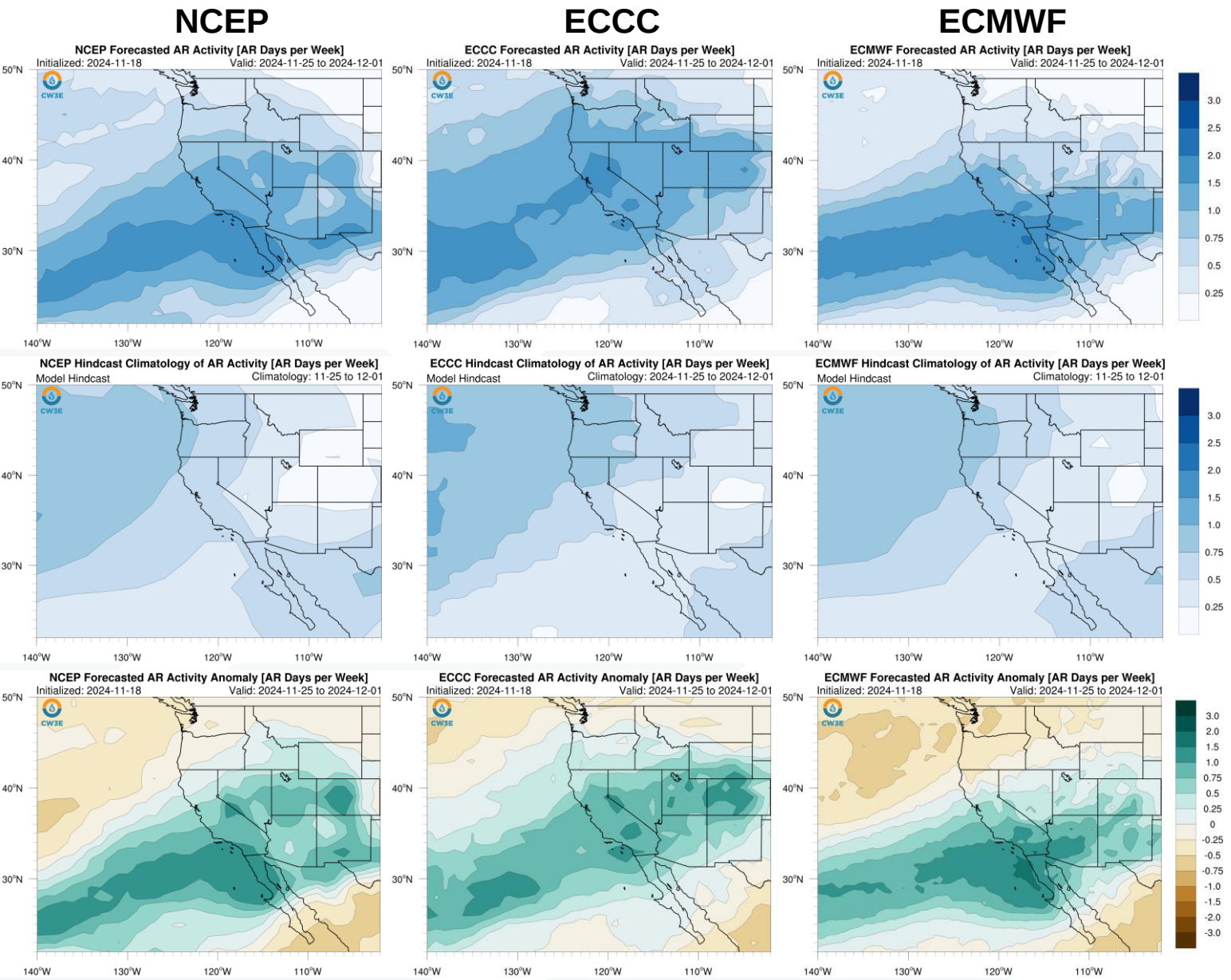
AR Activity Forecasts: Week 2 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 18 Nov 2024



- All models agree on above-normal AR activity over Central and Southern CA during Week 2 (25 Nov – 1 Dec)
- NCEP and ECCC are also forecasting above-normal AR activity over Northern CA, whereas ECMWF is forecasting near-normal AR activity

Models agree on above-normal AR activity in Southern and Central CA during Week 2 (25 Nov – 1 Dec), but disagree somewhat on AR activity in Northern 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)

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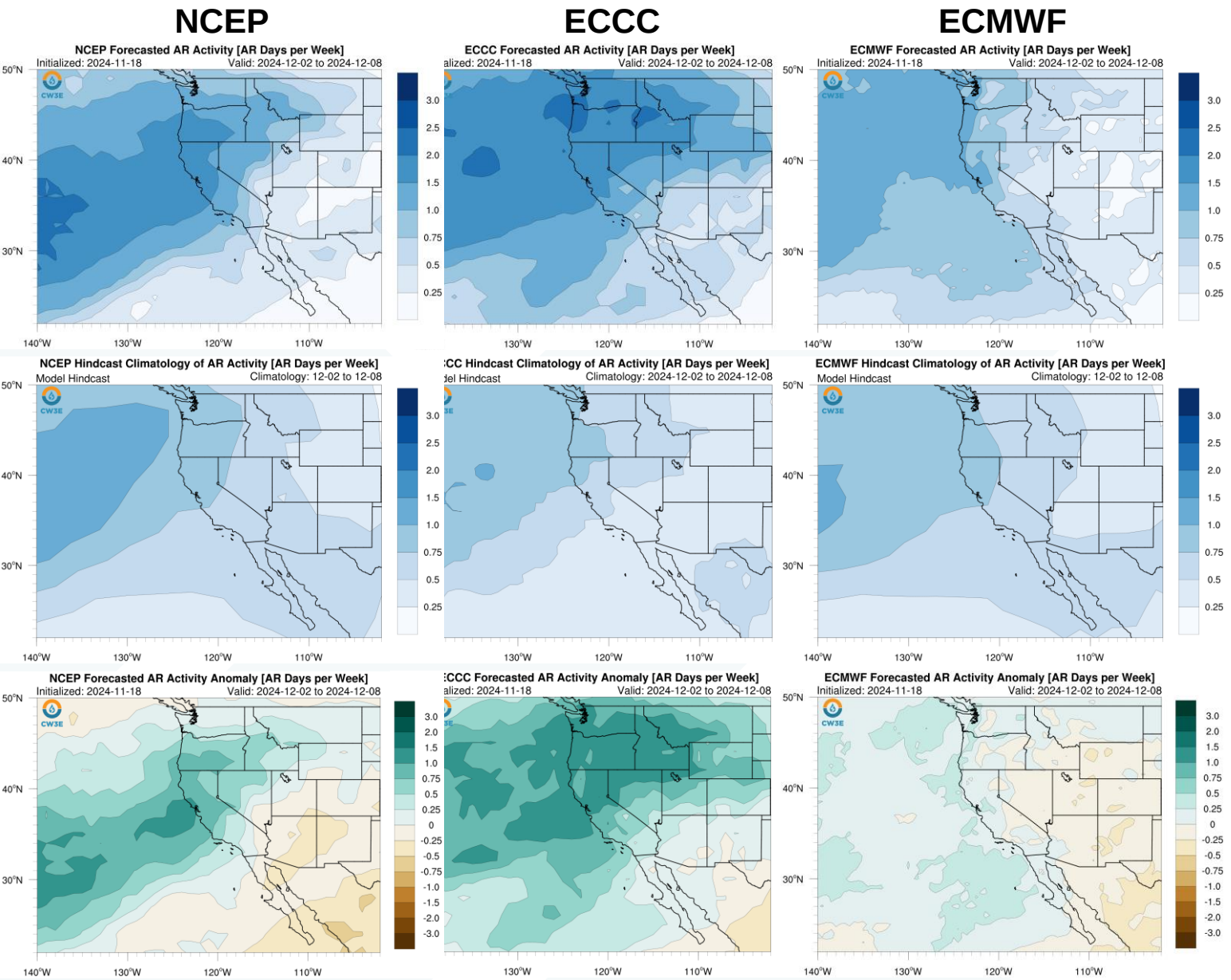
AR Activity Forecasts: Week 3 (NCEP vs. ECCC vs. ECMWF)



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)

Forecasts Initialized 18 Nov 2024

- NCEP and ECCC agree on above-normal AR activity over Northern and Central CA during Week 3 (2–8 Dec)
- ECCC is also forecasting above-normal AR activity over Southern CA, whereas NCEP is forecasting near-normal AR activity
- ECMWF is forecasting near-normal AR activity over all of CA

Models disagree somewhat on AR activity in CA during Week 3 (2–8 Dec)

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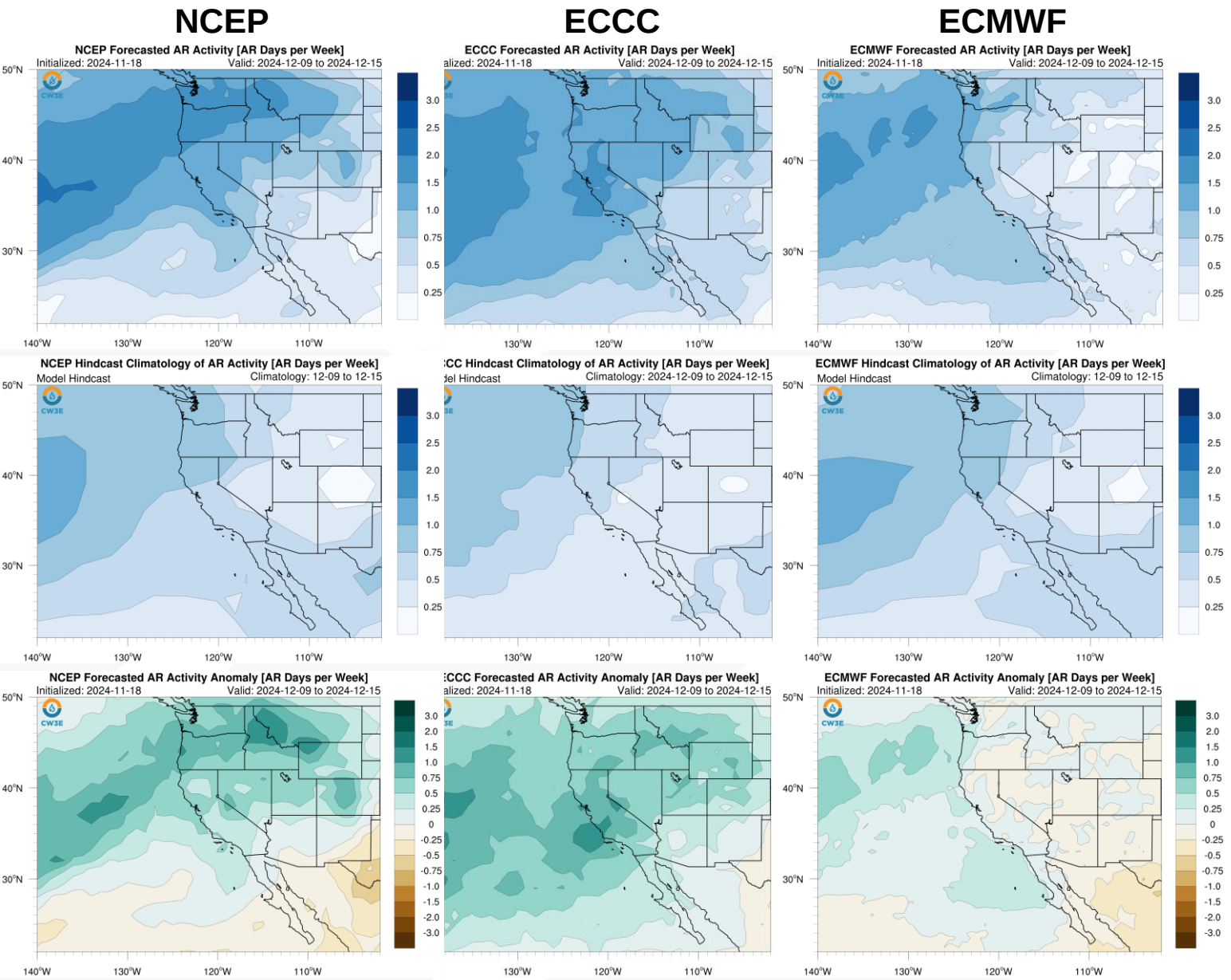
AR Activity Forecasts: Week 4 (NCEP vs. ECCC vs. ECMWF)



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)

Forecasts Initialized 18 Nov 2024

- NCEP and ECCC agree on above-normal AR activity over all of CA during Week 4 (9–15 Dec), but the primary axis of AR activity is father north in NCEP
- ECMWF is forecasting near-normal AR activity over all of CA

Models disagree somewhat on AR activity in CA during Week 4 (9–15 Dec)

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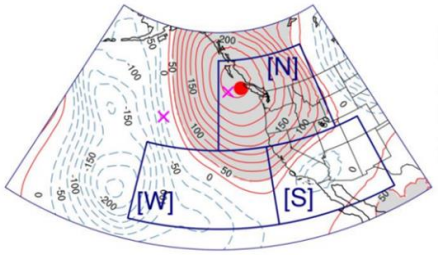
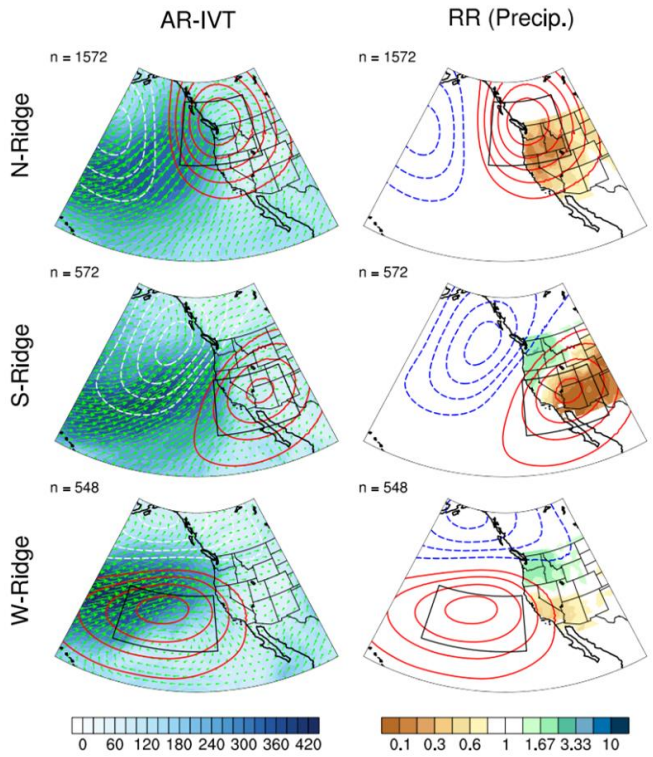
Background Info: Subseasonal Ridging Outlooks



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

Jet Propulsion Laboratory
California Institute of Technology

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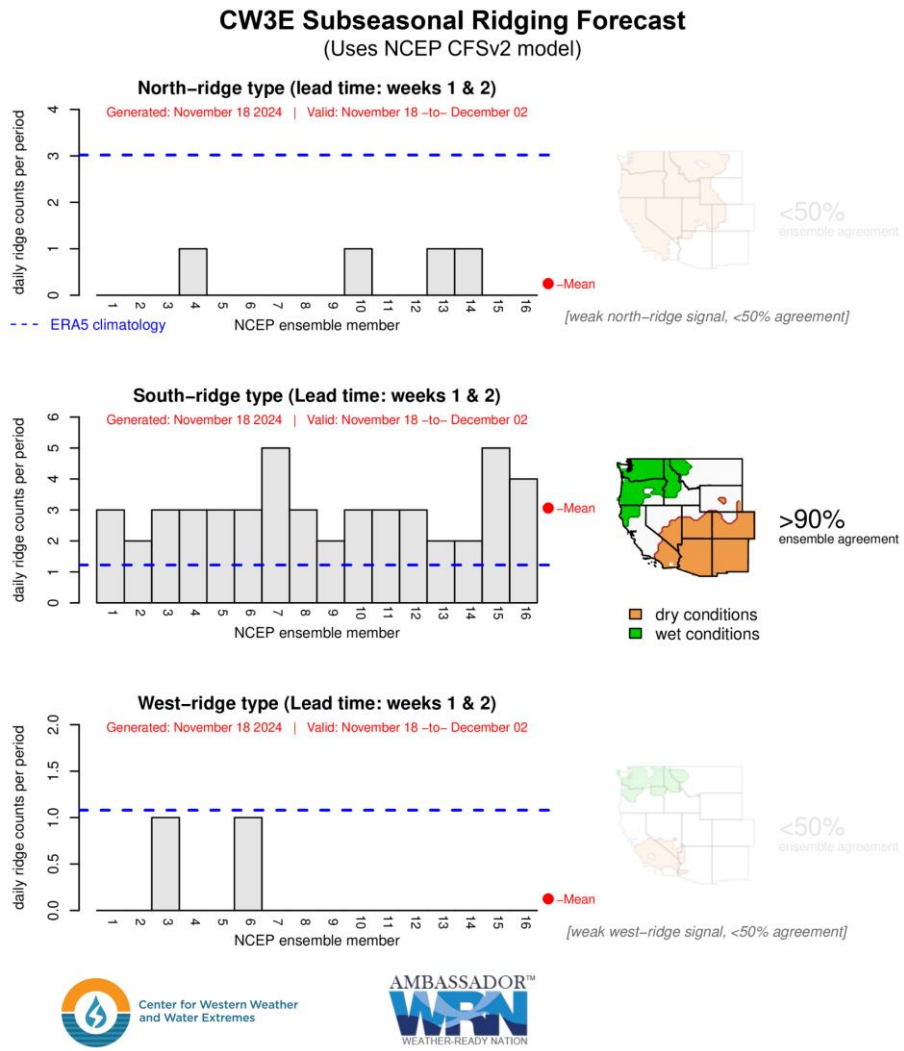
Contact: pgibson@ucsd.edu
Reference: Gibson et al. (2020) Journal of Climate

Ridging Forecasts: Weeks 1–2 (NCEP vs. ECMWF)

NCEP



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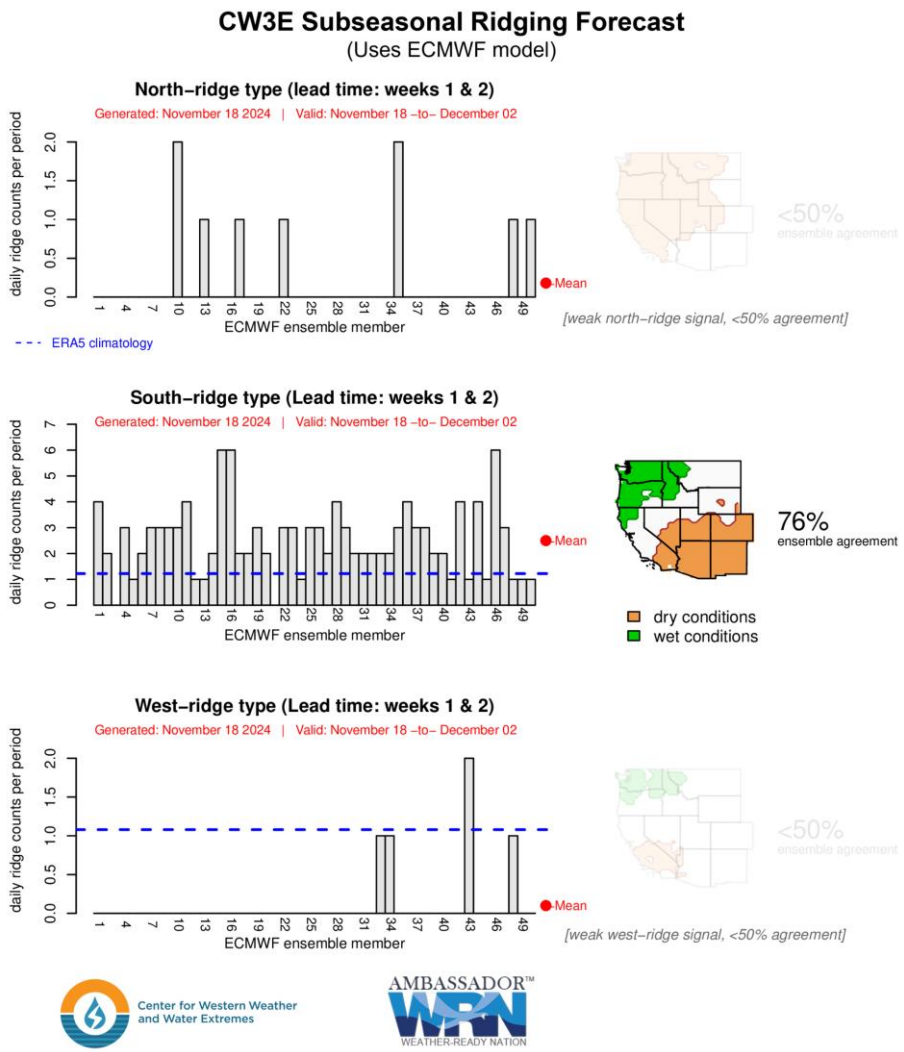
ECMWF



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Forecasts Initialized 18 Nov 2024

- NCEP and ECMWF are both forecasting a high likelihood (≥ 75% probability) of above-normal South-ridge activity during Weeks 1–2 (18 Nov – 2 Dec)
- Both models are also forecasting very low North-ridge and West-ridge activity

Models agree on high likelihood of above-normal ridging activity over the southwestern US during Weeks 1–2 (18 Nov – 2 Dec)

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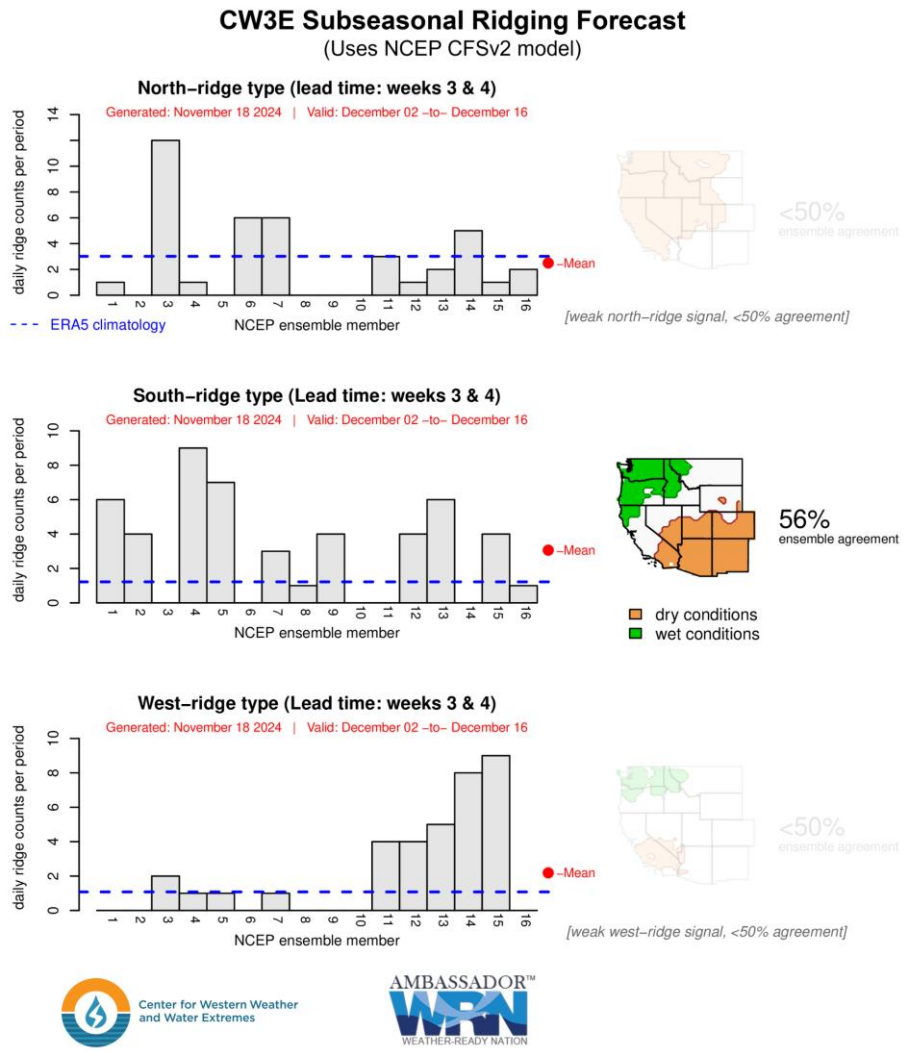
Ridging Forecasts: Weeks 3–4 (NCEP vs. ECMWF)

NCEP



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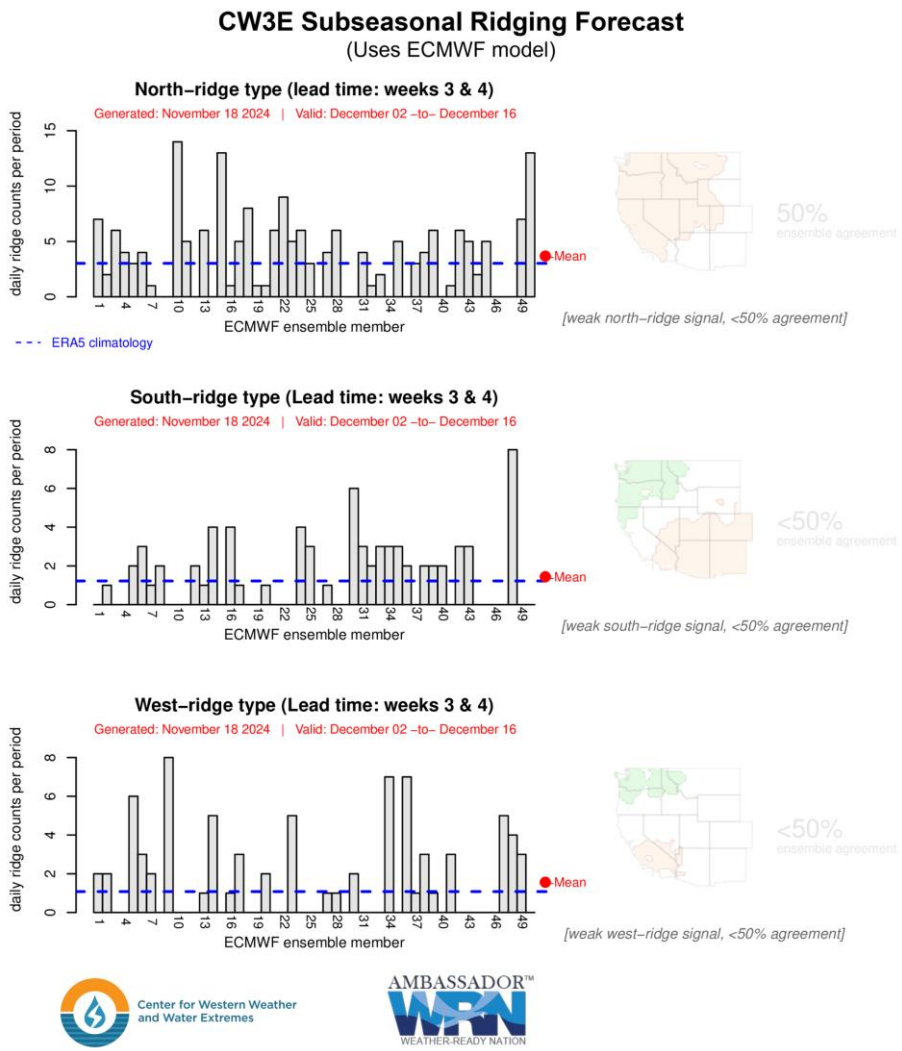
AMBASSADOR™ WRN WEATHER-READY NATION

ECMWF



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Forecasts Initialized 18 Nov 2024

- NCEP is forecasting a moderate likelihood (56% ensemble agreement) of above-normal South-ridge activity during Weeks 3–4 (2–16 Dec)
- NCEP is also forecasting near-normal North-ridge activity and above-normal West-ridge activity, but with low confidence (< 50% ensemble agreement)
- ECMWF is forecasting near-normal ridging activity in the vicinity of the US West Coast, but there is uncertainty in the exact location of ridging

Uncertainty in location and frequency of ridging activity near US West Coast during Weeks 3–4 (2–16 Dec)

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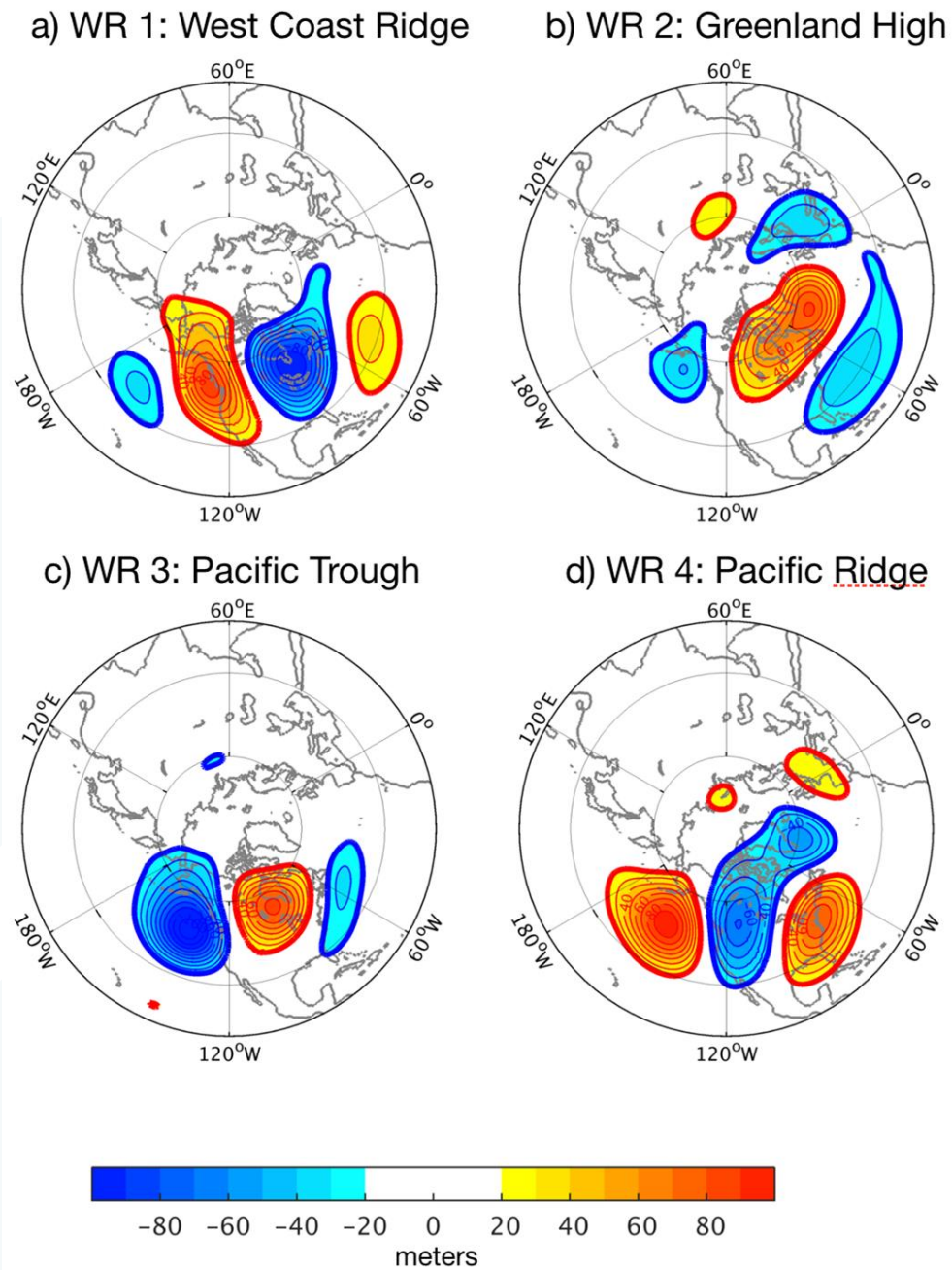
Background Info: IRI Subseasonal Weather Regime Forecasts

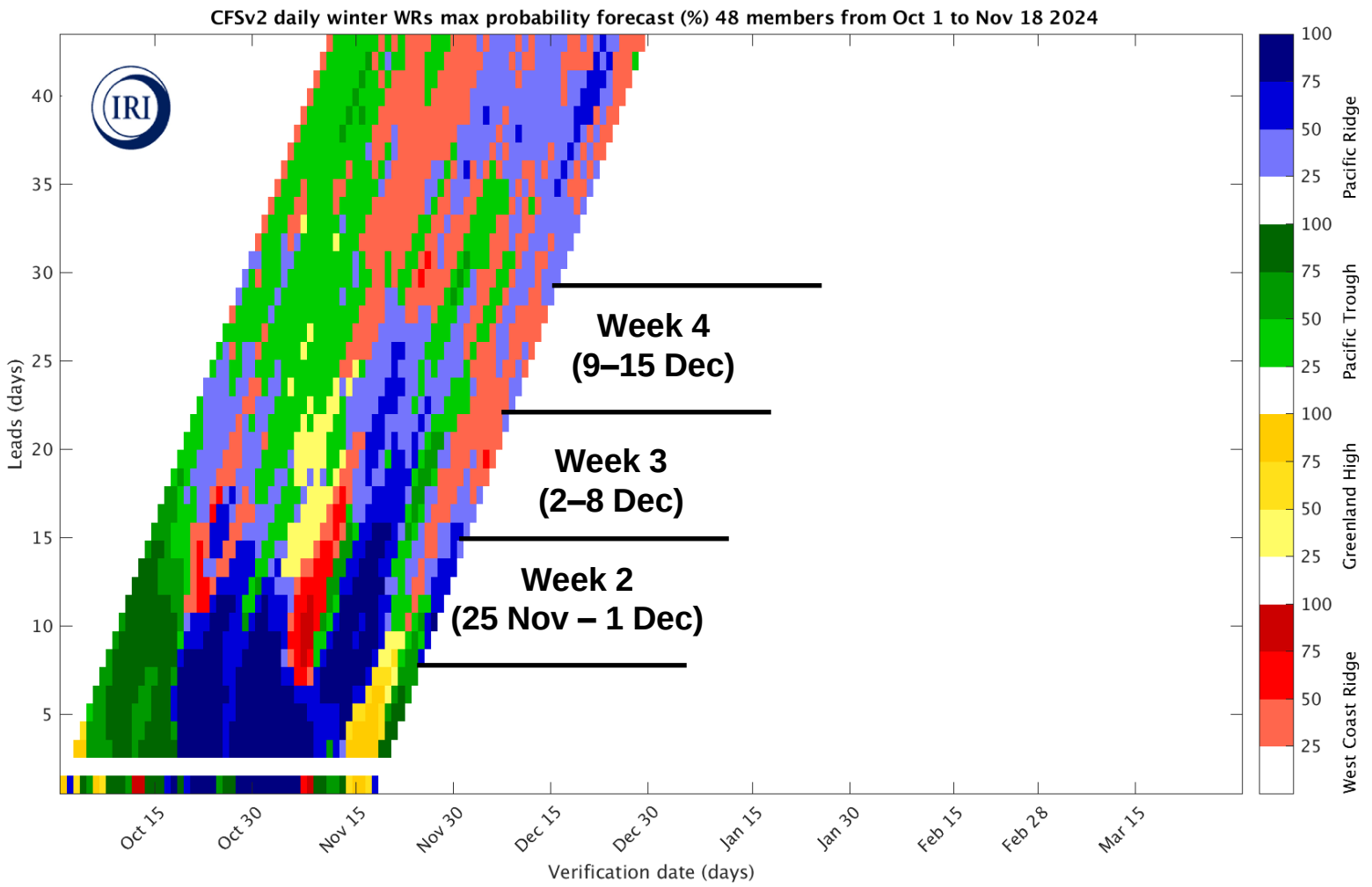


This slide contains background information about IRI's North American weather regime forecast product

- 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

IRI North American Weather Regime Forecasts



Forecast Initialized 18 Nov 2024

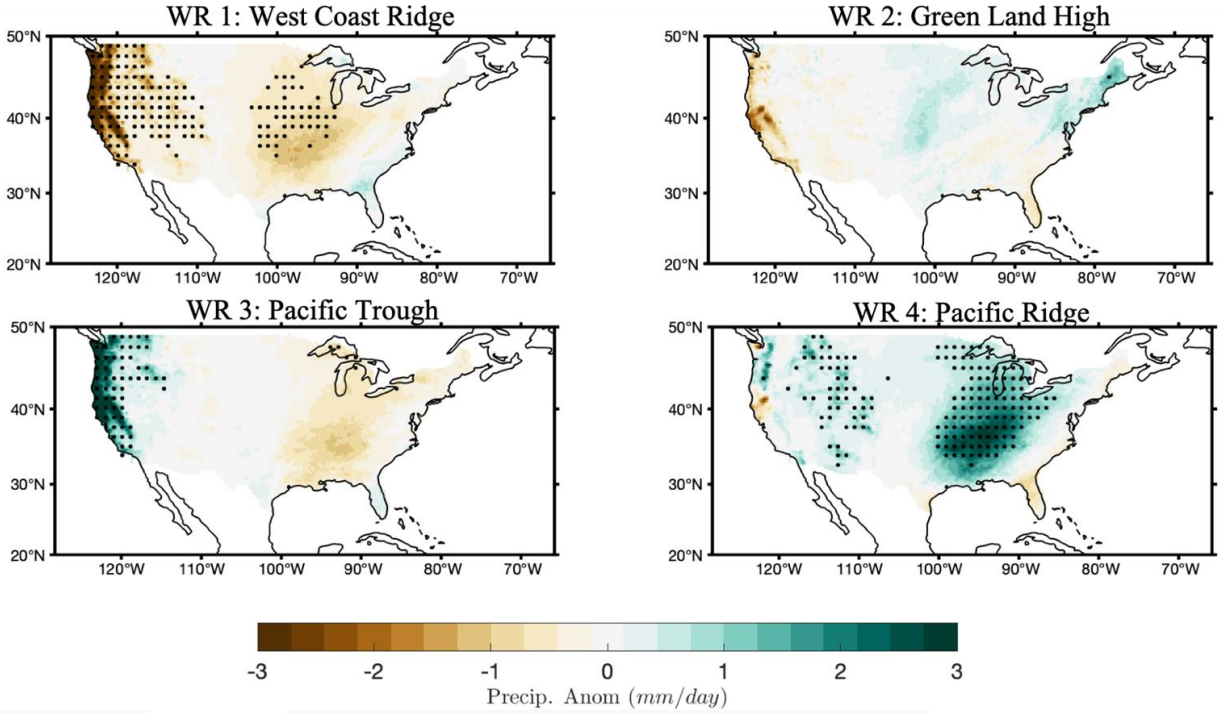
- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble
- Moderate likelihood (≥ 50% ensemble agreement) of Pacific Ridge during Week 2 (25 Nov – 1 Dec)
- High degree of uncertainty in regime type during Weeks 3–4 (2–15 Dec)
- Plurality of ensemble members are predicting either Pacific Ridge or West Coast Ridge during Weeks 3–4, which suggests that ridging is likely between the Northeast Pacific and western North America (but uncertainty in the location)

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.

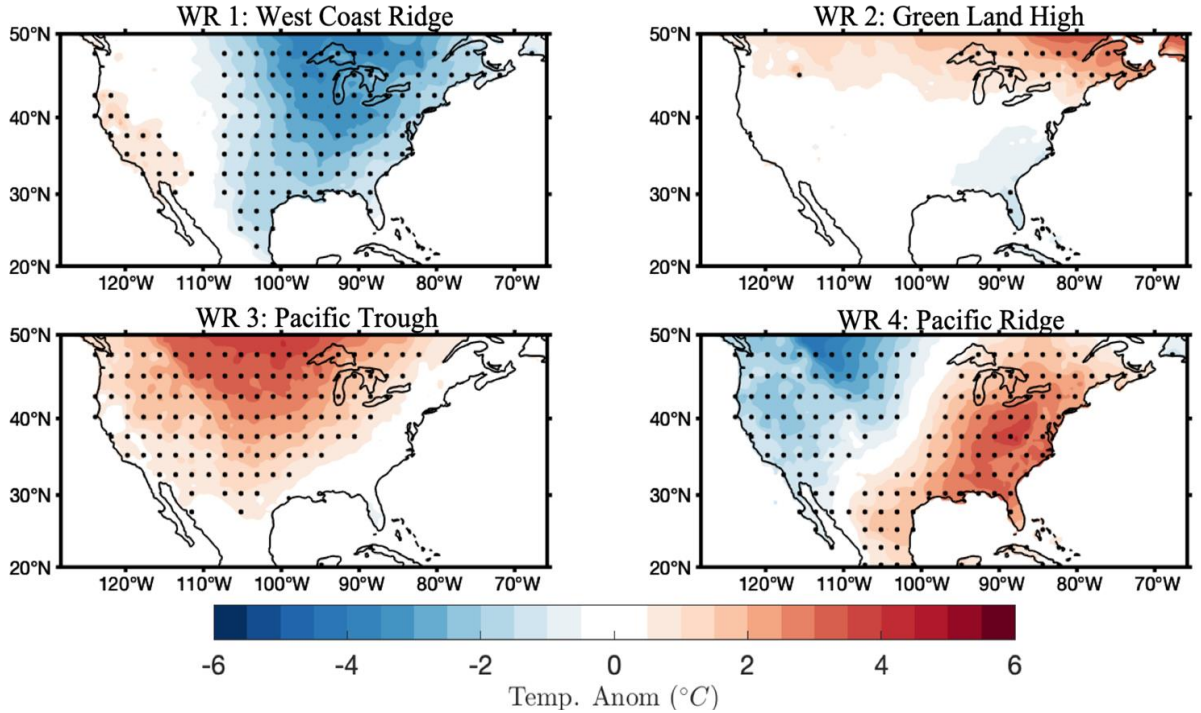
For more information about the forecast product: https://wiki.iri.columbia.edu/index.php?n=Climate.S2S-WRs

IRI North American Weather Regime Forecasts

Precipitation



Temperature

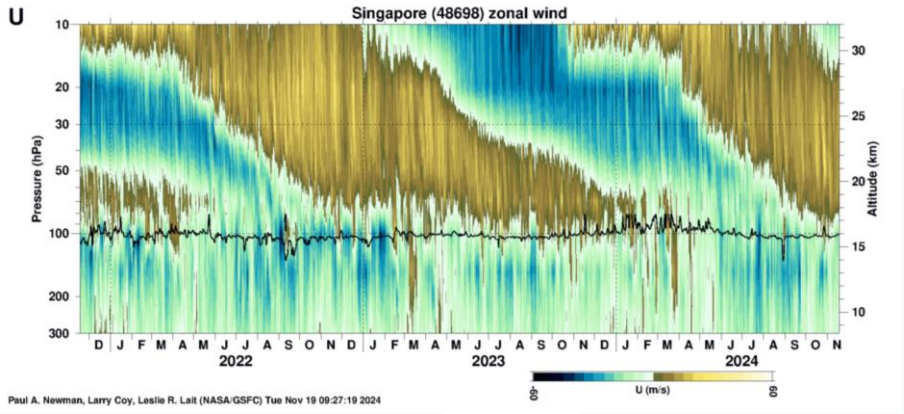


This graphic shows composite mean precipitation (left) and temperature (right) anomalies associated with each weather regime. Stippling (black dots) indicate statistically significant anomalies.

- Below-normal temperatures and near-normal precipitation predicted over CA during Week 2 (25 Nov – 1 Dec) with moderate confidence in Pacific Ridge regime
- High degree of uncertainty in temperature and precipitation anomalies over CA during Weeks 3–4 (2–15 Dec), with low confidence in either Pacific Ridge or West Coast Ridge regime

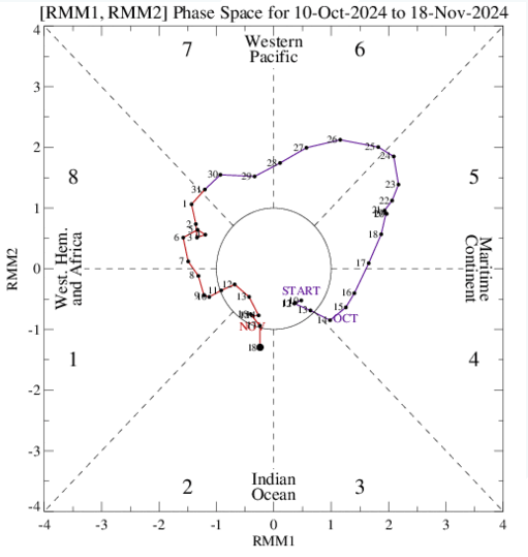
Background Info: AR Activity and Precipitation Based on MJO and QBO

QBO Conditions



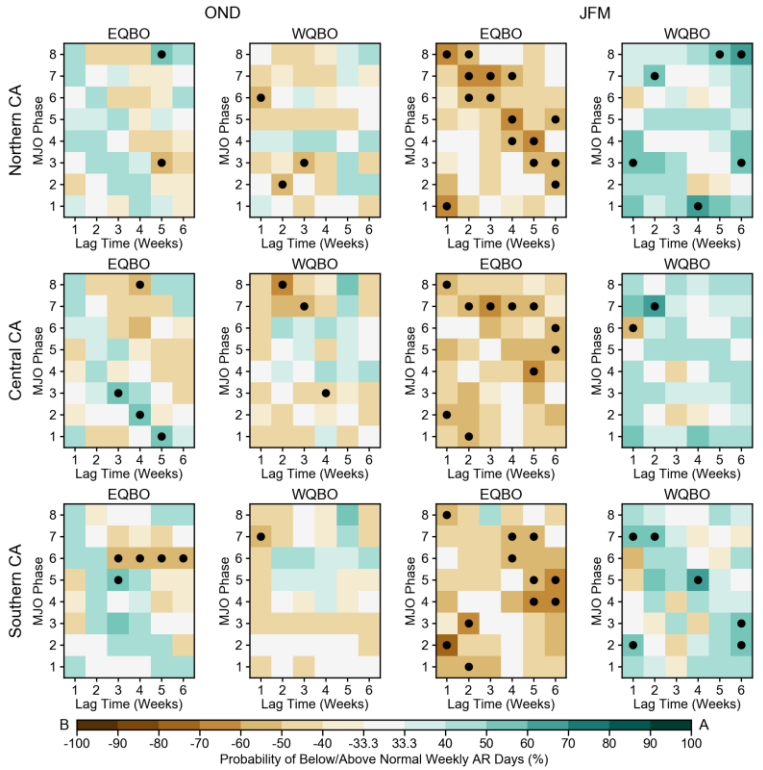
QBO is in the westerly phase at 50-hPa

MJO Conditions

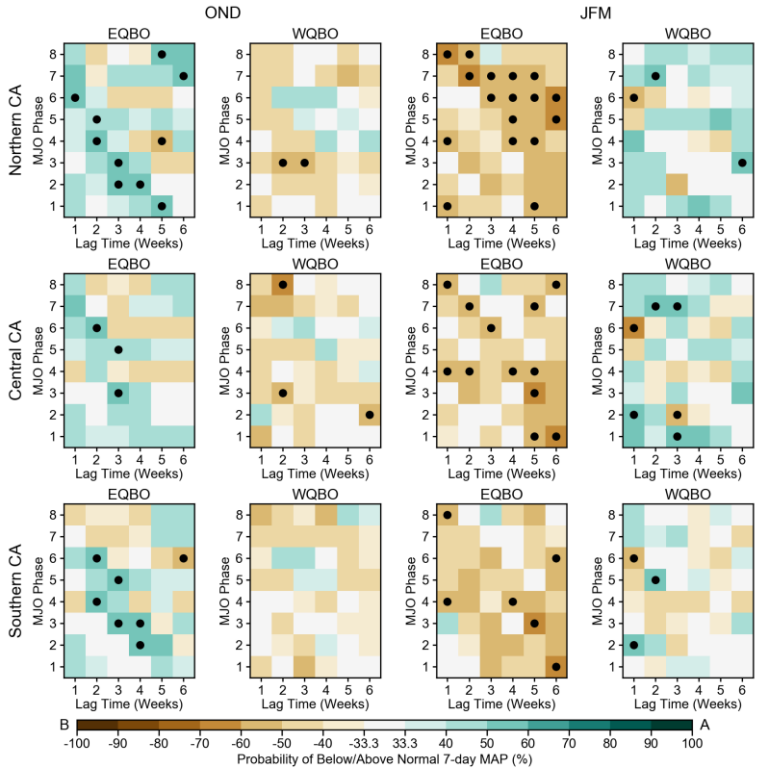


MJO convection is currently located over the Indian Ocean (Phase 2)

Probability of Above/Below-Normal AR Occurrence



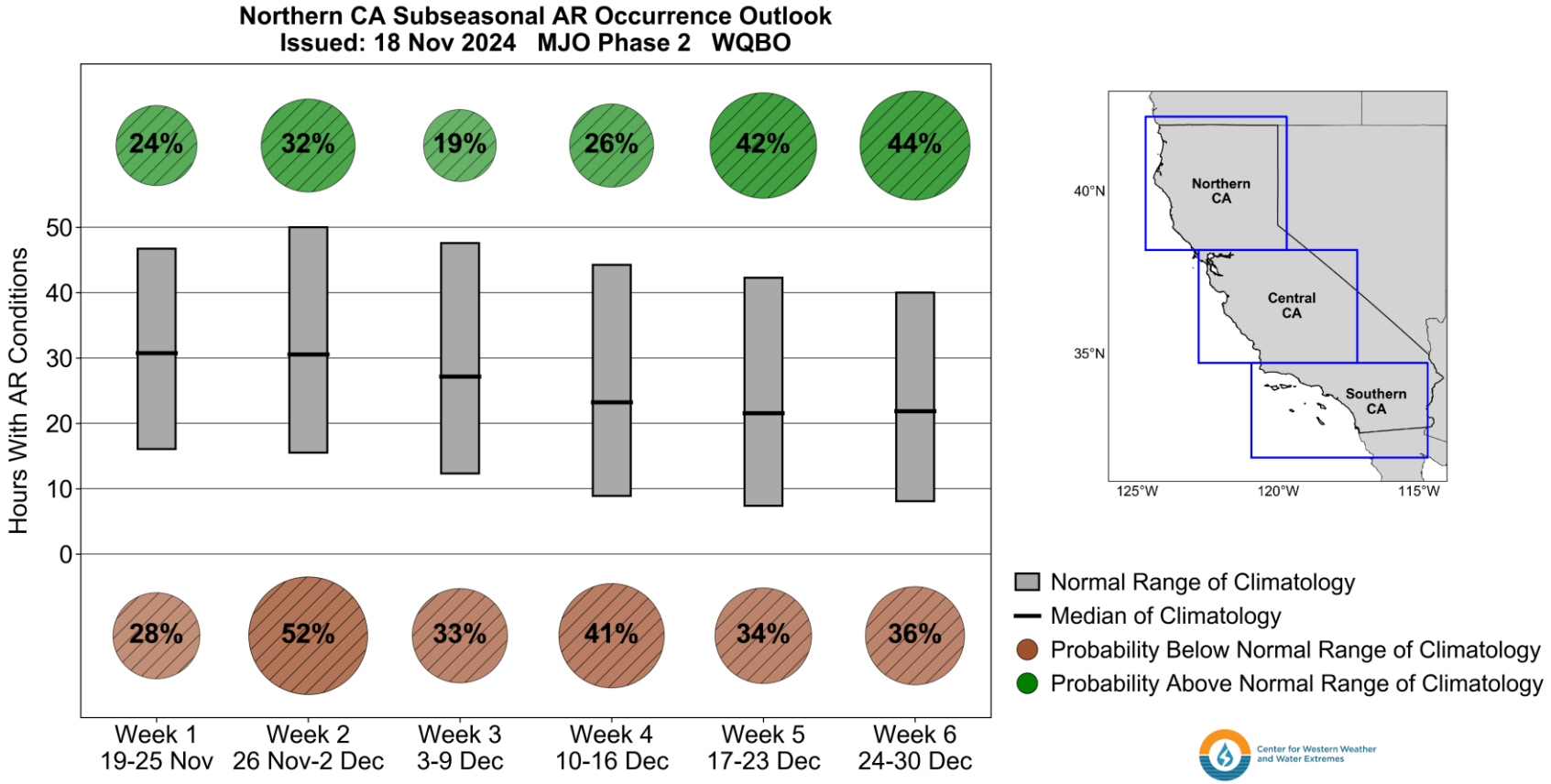
Probability of Above/Below-Normal Precipitation



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.

AR Activity and Precipitation Based on MJO and QBO

AR Occurrence: Northern CA



Normal Range of Climatology
Median of Climatology
Probability Below Normal Range of Climatology
Probability Above Normal Range of Climatology

Center for Western Weather and Water Extremes

Forecasts Initialized 18 Nov 2024

- CW3E's probabilistic AR occurrence forecast based on current MJO and QBO conditions (see forecast for all regions here)
- **High likelihood (≥ 50% probability) of below-normal AR occurrence in Northern CA during Week 2 (26 Nov – 2 Dec)**
- Moderate likelihood (≥ 40% probability) of below-normal AR occurrence in Central CA during Week 2
- Moderate likelihood of below-normal AR occurrence in Northern and Central CA during Week 4 (10–16 Dec)

This product shows weekly probabilities of above-normal and below-normal AR occurrence in California. These probabilities are calculated for lead times of 1–6 weeks based on the current season (i.e., OND or JFM) and phases of the Madden-Julian Oscillation (MJO) and Quasi-biennial Oscillation (QBO). If MJO convection is weak or the QBO is in a neutral phase, no probabilities will be displayed. Circles without hatching denote periods with high confidence based on the hindcast skill assessment in Castellano et al. (2023)

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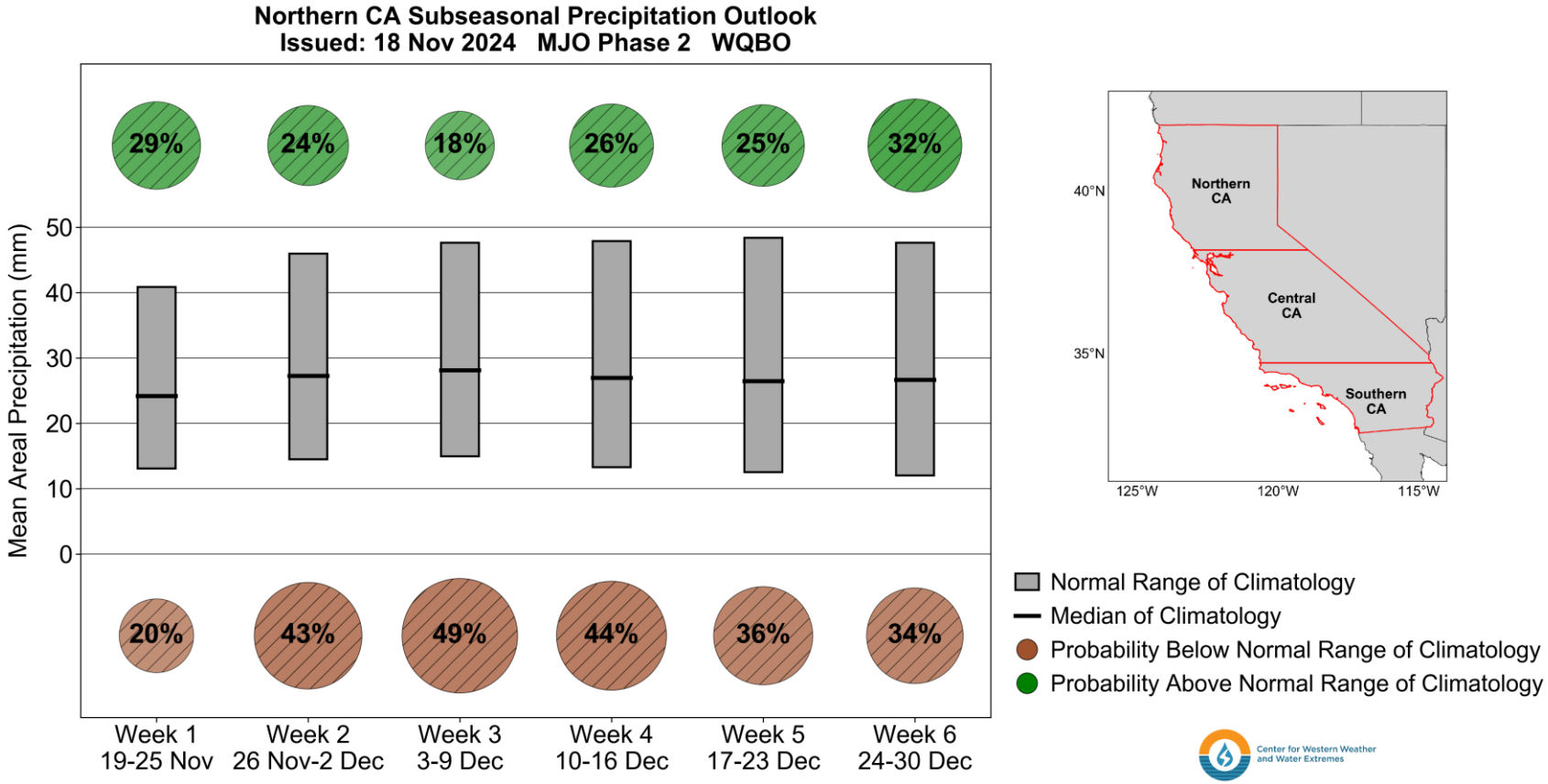
AR Activity and Precipitation Based on MJO and QBO

Forecasts Initialized 18 Nov 2024

Precipitation: Northern CA



Normal Range of Climatology
Median of Climatology
Probability Below Normal Range of Climatology
Probability Above Normal Range of Climatology

Center for Western Weather and Water Extremes

- CW3E's probabilistic precipitation forecast based on current MJO and QBO conditions (see forecast for all regions here)
- **Moderate likelihood of below-normal precipitation in Northern CA during Weeks 2–4 (26 Nov – 16 Dec)**
- Moderate likelihood of below-normal precipitation in Central and Southern CA during Week 2 (26 Nov – 2 Dec)

This product shows weekly probabilities of above-normal and below-normal precipitation in California. These probabilities are calculated for lead times of 1–6 weeks based on the current season (i.e., OND or JFM) and phases of the Madden-Julian Oscillation (MJO) and Quasi-biennial Oscillation (QBO). If MJO convection is weak or the QBO is in a neutral phase, no probabilities will be displayed. Circles without hatching denote periods with high confidence based on the hindcast skill assessment in Castellano et al. (2023)

Center for Western Weather and Water Extremes
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