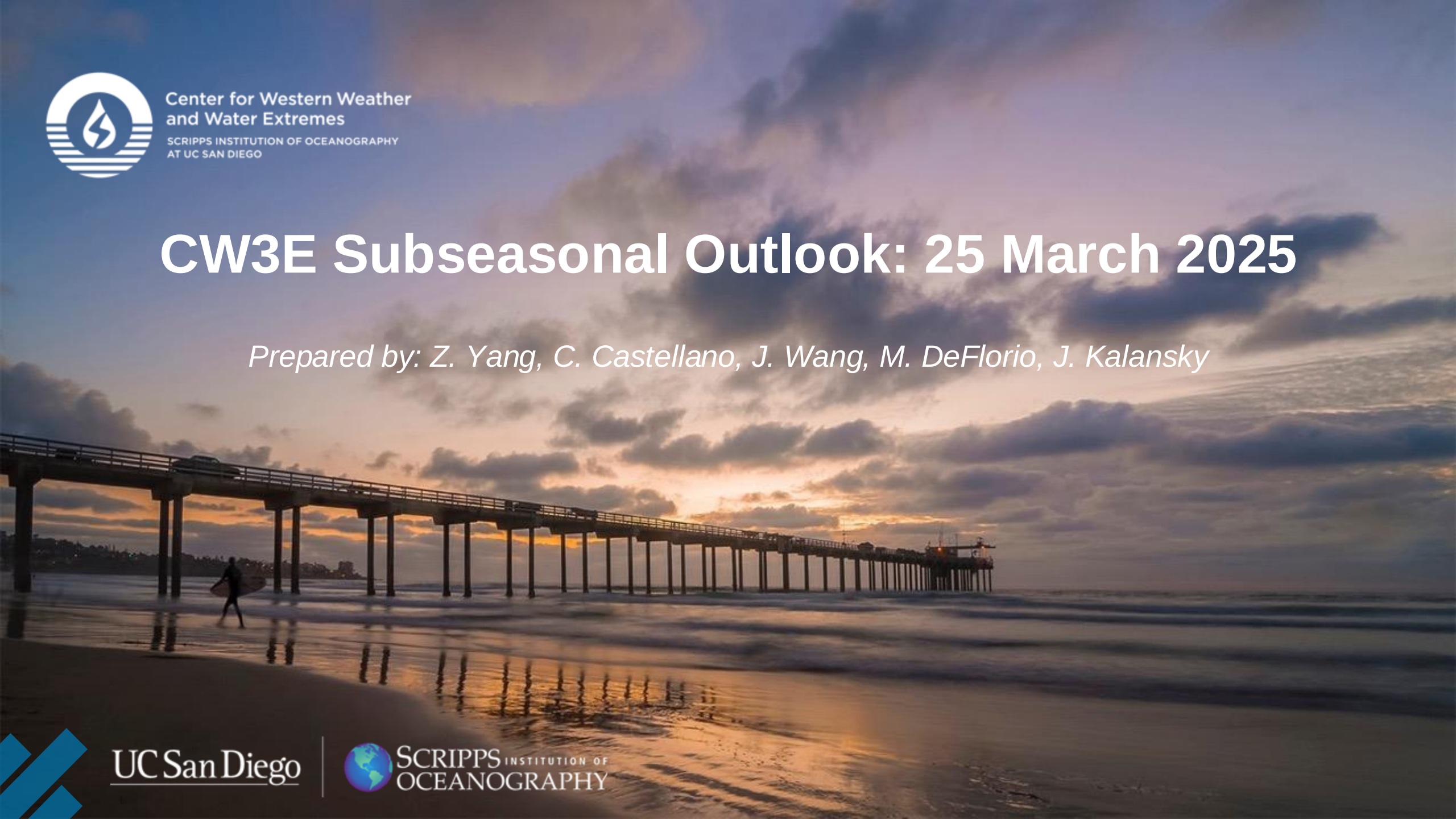

CW3E Subseasonal Outlook: 25 March 2025

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

Summary: Subseasonal Precipitation Outlook by Model

This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 24 Mar 2025

Region	Week 2 (31 Mar – 6 Apr)				Week 3 (7 – 13 Apr)				Week 4 (14 - 20 Apr)			
	NCEP[1,2]	ECCC[1]	ECMWF[1,2]	Multi-Model Forecast	NCEP[1,2]	ECCC[1]	ECMWF[1,2]	Multi-Model Forecast	NCEP[1,2]	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 show large uncertainty in precipitation over CA during Week 2
- Models lean towards below-normal precipitation over Northern and Southern CA during Week 3
- Models lean towards near-normal precipitation over CA during Week 4

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)

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Summary

MJO/QBO Conditions

- MJO convection is currently located over the Western Pacific (Phase 6&7); QBO is in the westerly phase
- Both models are forecasting MJO to be relatively stationary over the Western Pacific (Phases 6&7) and weaken during Week 1; both models are forecasting weak MJO during Week 2
  - Without considering QBO/ENSO conditions, MJO activity in Phases 6&7 during JFM is associated with a statistically significant decrease in wet extremes in Central and Southern CA at lag times of 4 weeks

Week 2 Forecasts (31 Mar – 6 Apr):

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

- Ridging outlooks show high likelihood of above-normal North-ridge (dry conditions over all of CA) during Weeks 1–2
  - NCEP is also forecasting a high likelihood of above-normal West-ridge activity (dry conditions over Central and Southern CA)
  - ECMWF is also forecasting a moderate likelihood of above-normal South-ridge activity (wet conditions in Northern CA and dry conditions in Southern CA)

- IRI weather regime tool forecasts are not available during Weeks 2-4 since the product only shows forecasts out to 31 Mar

Summary

Week 3 Forecasts (7 – 13 Apr):

- Models agree on near-normal to slightly below-normal AR activity over CA during Week 3

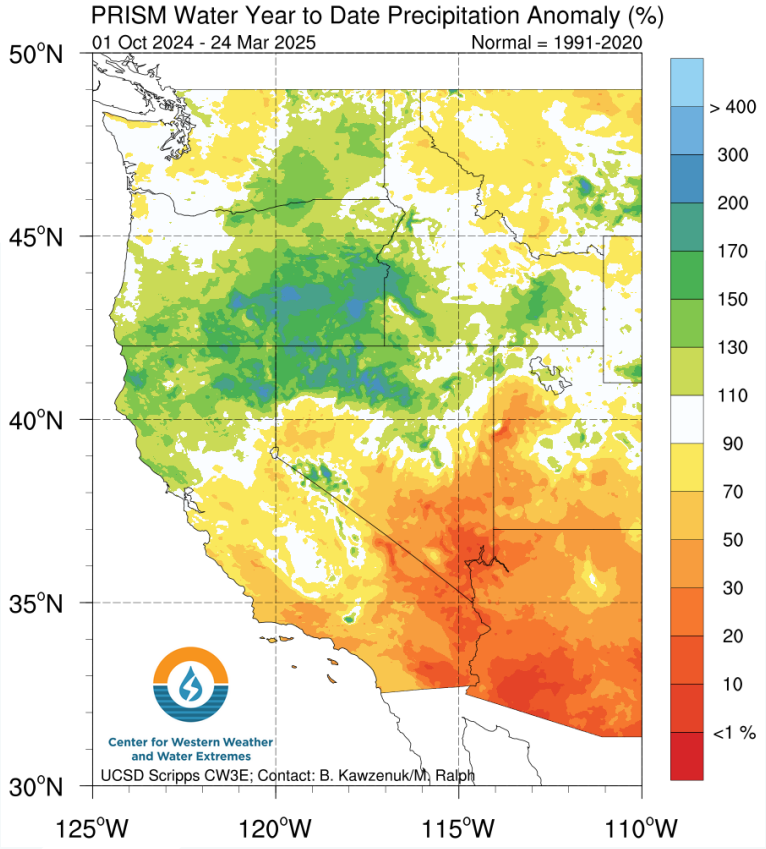
- Models show uncertainty in the location and amount of ridging activity near the US West Coast during Weeks 3–4
  - ECMWF is forecasting a moderate likelihood of above-normal North-ridge (dry conditions over all of CA) activity
  - Both models are forecasting near-normal West-ridge and South-ridge activity

Week 4 Forecasts (14 - 20 Apr):

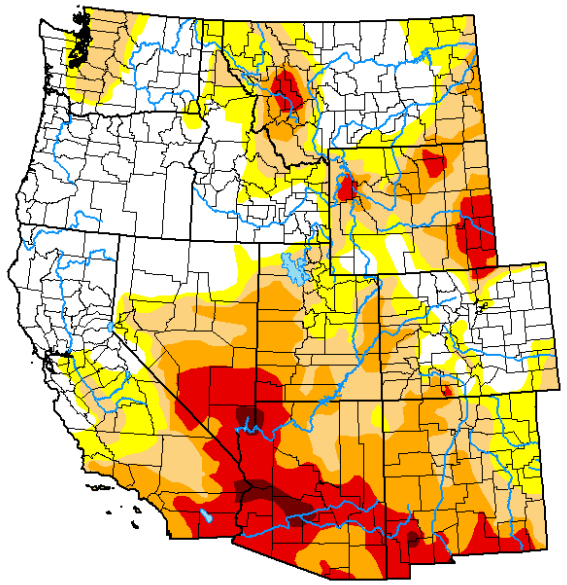
- Models agree on near-normal AR activity over CA

Hydrologic Summary

Precipitation



Drought Conditions



March 18, 2025
(Released Thursday, Mar. 20, 2025)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	34.21	65.79	49.14	29.31	12.54	1.03
Last Week 03-11-2025	33.53	66.47	48.57	29.43	13.07	1.03
3 Months Ago 12-17-2024	30.42	69.58	34.63	18.13	6.26	0.00
Start of Calendar Year 01-07-2025	32.22	67.78	39.02	20.30	6.87	0.00
Start of Water Year 10-01-2024	20.06	79.94	37.38	9.85	2.47	0.11
One Year Ago 03-19-2024	50.55	49.45	24.21	8.98	2.23	0.36

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:
Brad Rippey
U.S. Department of Agriculture

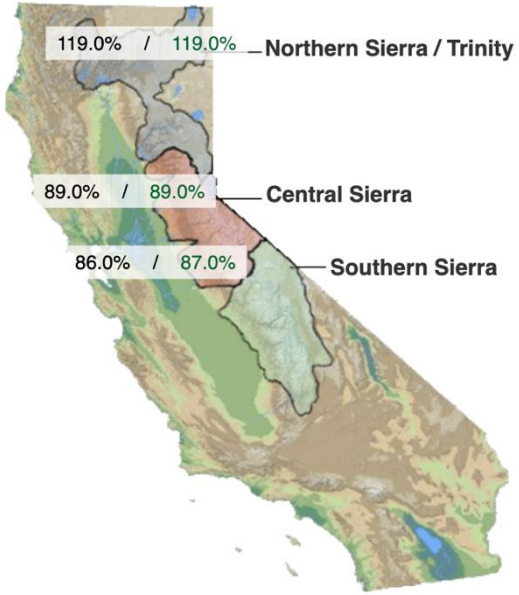
droughtmonitor.unl.edu

Snowpack Conditions

Provided by the California Cooperative Snow Surveys

Data For: **25-Mar-2025**

% Apr 1 Avg. / % Normal for this Date



Change Date : 25-Mar-2025

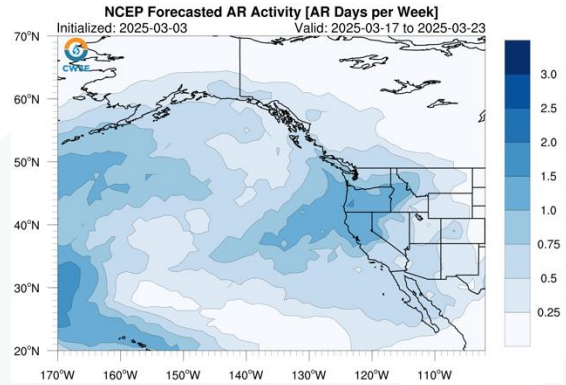
Source: California DWR

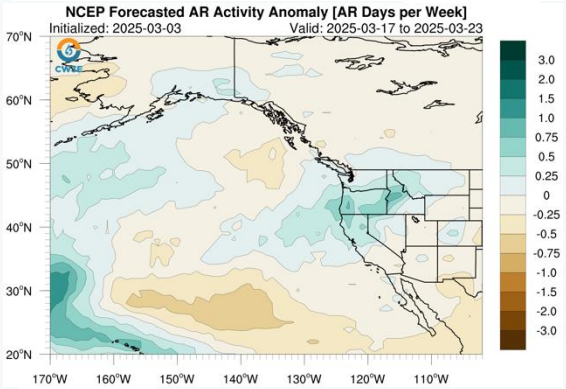
- As of 24 Mar, water-year-to-date precipitation is **above-normal (> 110% of normal)** in Northern CA, **slightly below-normal (70-90% of normal)** in Central CA, and **well-below normal (<70% of normal)** in Southern CA
- The most recent drought monitor update from 18 Mar is showing a continuation of **moderate-to-extreme drought (D1–D3)** in Southern CA and **abnormally dry (D0) to moderate drought (D1)** conditions over much of Central CA
- Current snowpack is **slightly above-normal (119% of normal)** in the Northern Sierra Nevada/Trinity region and **slightly below-normal** in the Central Sierra Nevada **(89% of normal)** and Southern Sierra Nevada **(87% of normal)**

Looking Back: Week 3 AR Activity Forecasts

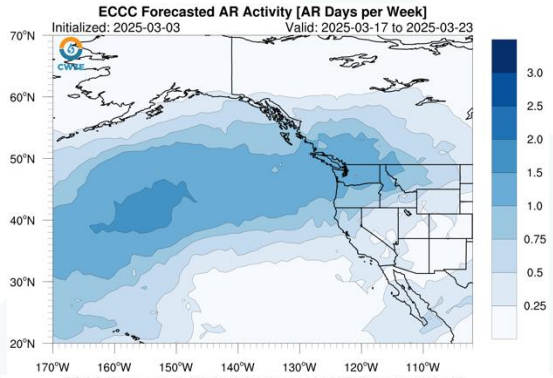
Forecasts Initialized 3 Mar 2025; Valid: 17-23 Mar 2025

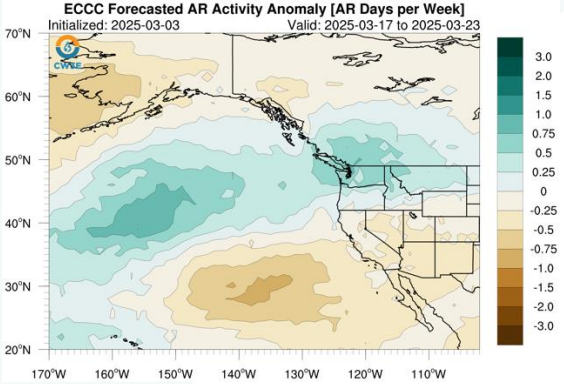
NCEP



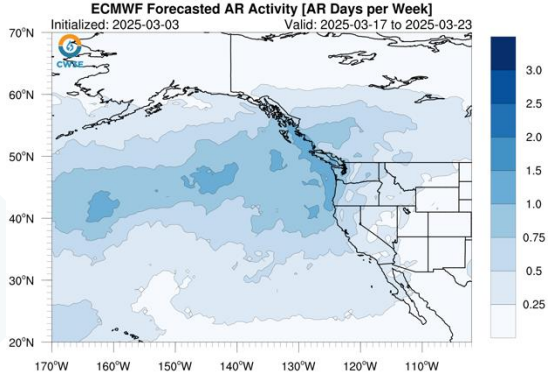


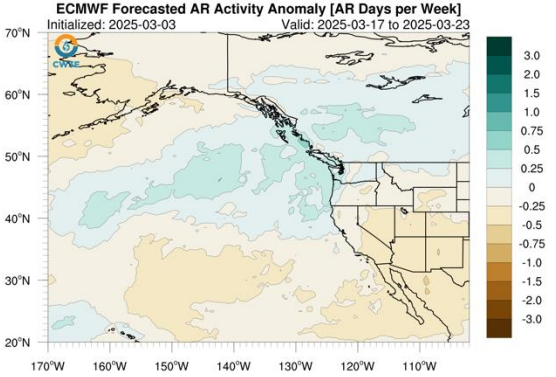
ECCC



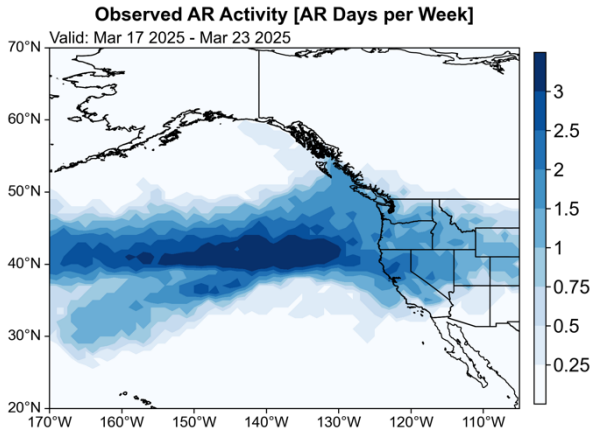


ECMWF

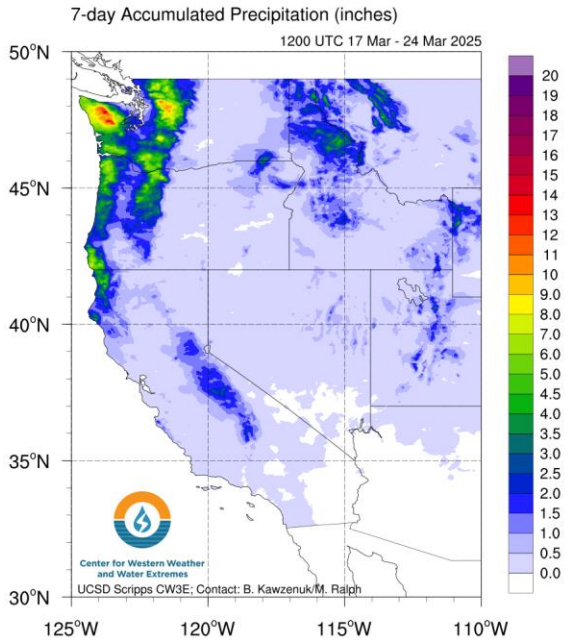




Observed (GFS Analysis)



Observed Precipitation

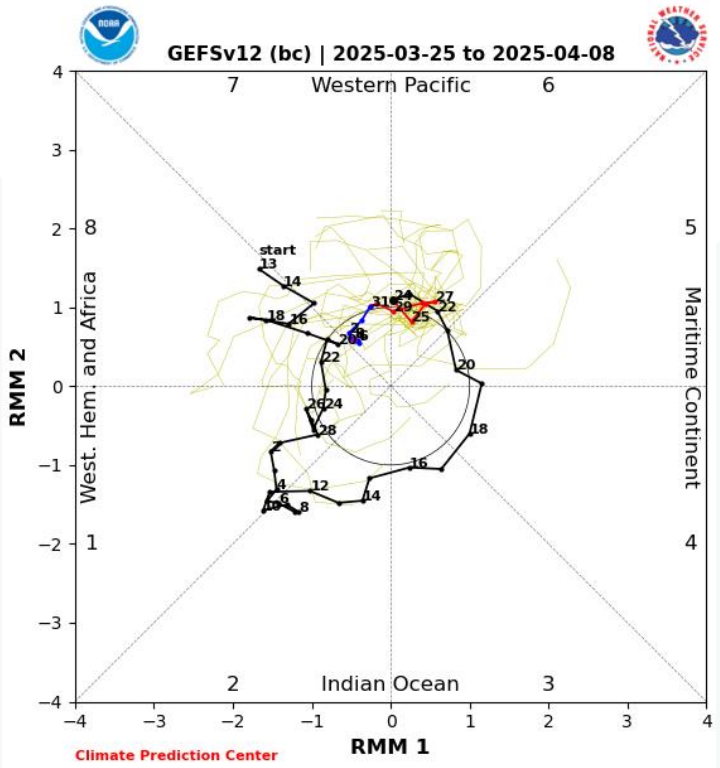


Shading: Fractional # of AR days forecast over a 7-day period (top) and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

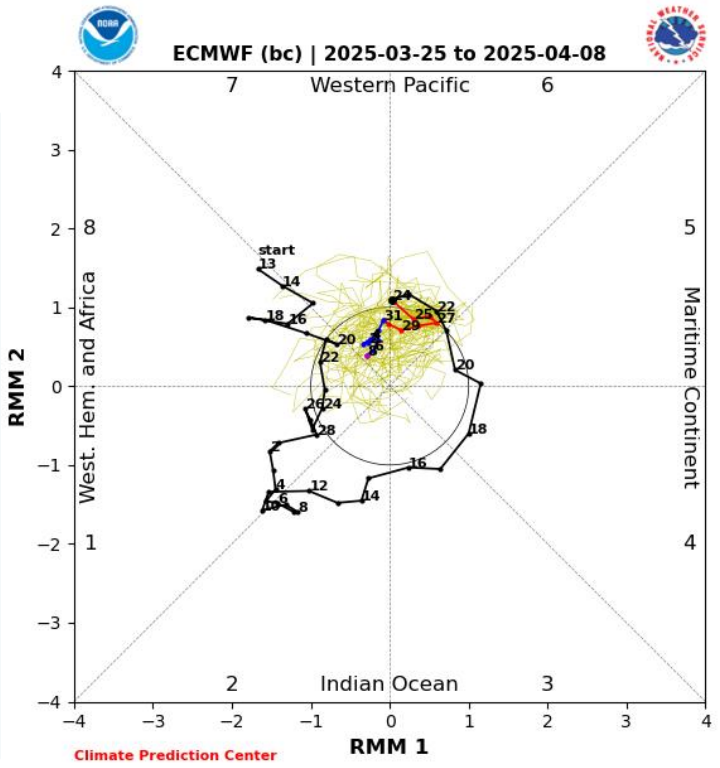
- All models captured some AR activity over the northwestern US but underestimated the inland penetration
- ECCC and ECMWF better predicted the large-scale circulation pattern and orientation of AR activity over the Northeast Pacific, but underestimated AR activity over CA
- NCEP better predicted the amount of AR activity over WA/OR and Northern CA
- An AR produced 2–4 inches of precipitation in coastal CA and Sierra Nevada during 17-18 Mar
- Multiple weak ARs produced 2-4 inches of precipitation over western WA/OR and far Northern CA on 20-22 Mar
- A stronger AR produced >4 inches of precipitation over the Olympic Mountains and WA Cascades on 23-24 Mar

Dynamical Model MJO Forecasts (NCEP vs. ECMWF)

NCEP



ECMWF



Black: Last 40 days of observations (13 Feb – 24 Mar); Red: Week 1 (25-31 Mar) ensemble mean; Blue: Week 2 (1-7 Apr) ensemble mean; Yellow: Ensemble members

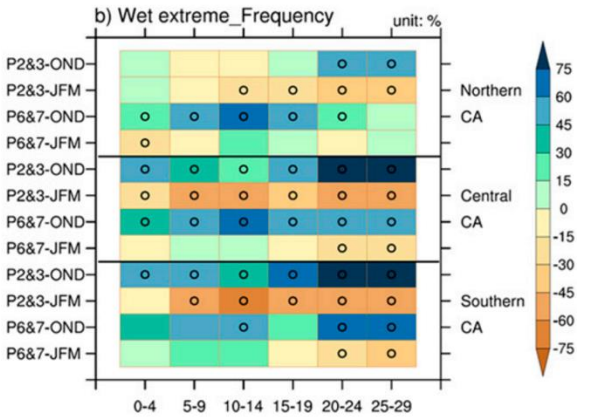


Figure 8 from Wang et al. (2023)

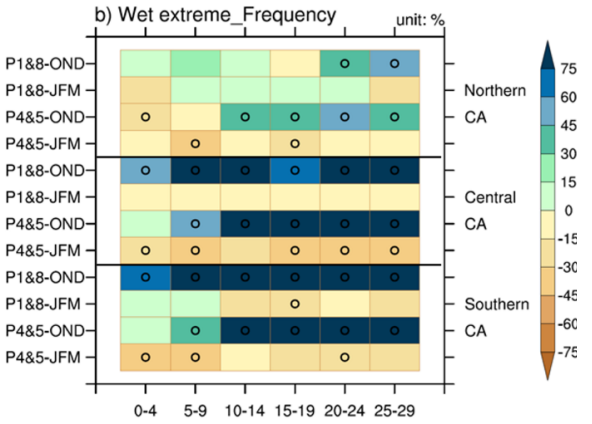


Figure S6 from Wang et al. (2023)

- MJO convection is currently located over the Western Pacific (Phases 6&7)
- Both models are forecasting MJO to be relatively stationary over the Western Pacific (Phases 6&7) and weaken during Week 1
- Both models are forecasting weak MJO during Week 2
- Without considering QBO/ENSO conditions, MJO activity in Phases 6&7 during JFM is associated with a statistically significant decrease in wet extremes in Central and Southern CA at lag times of 4 weeks

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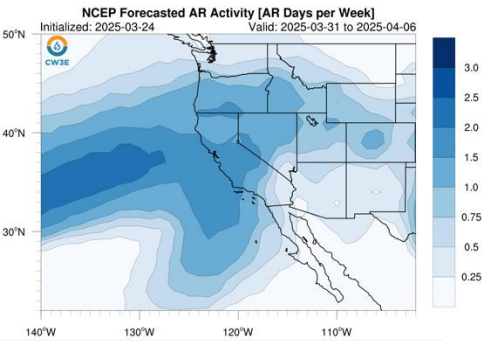
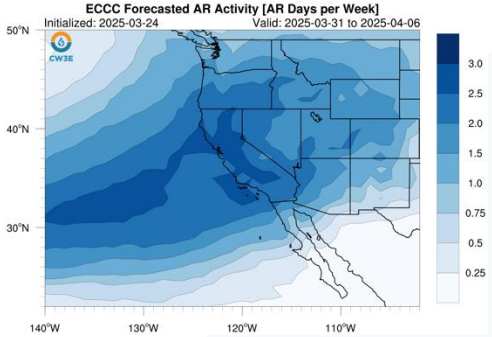
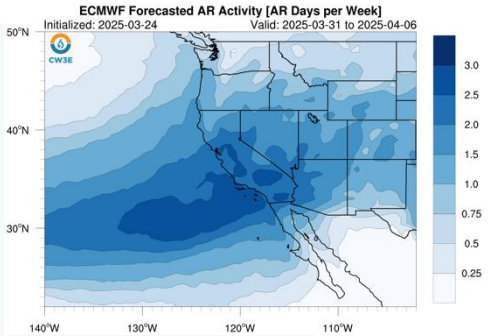
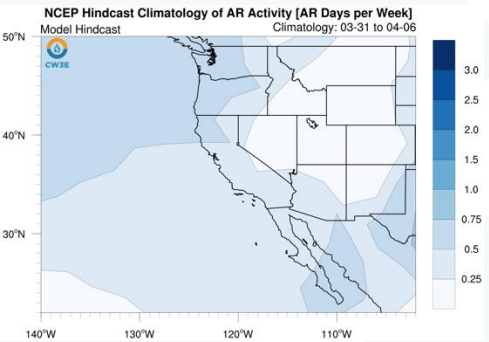
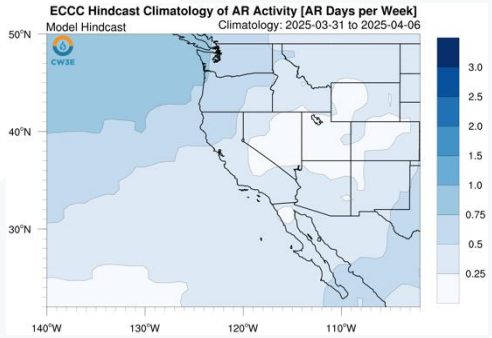
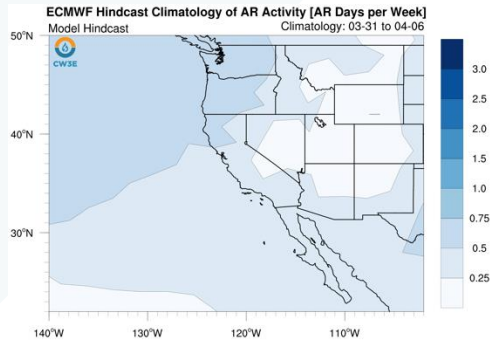
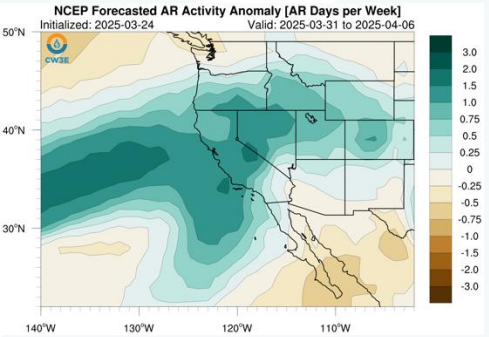
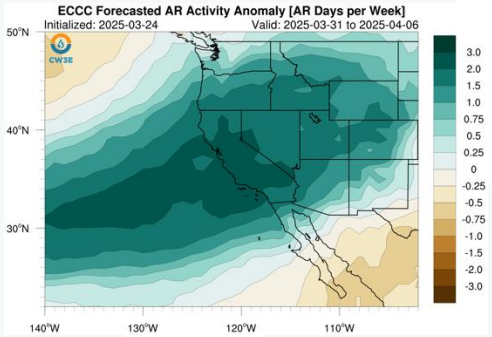
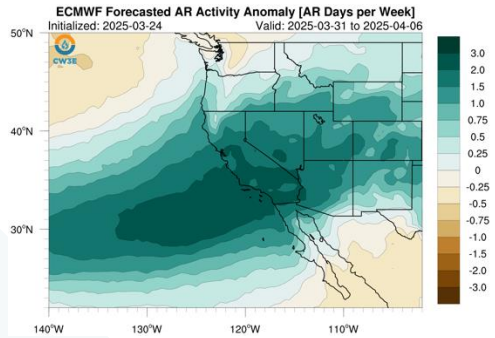
AR Activity Forecasts: Week 2 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 24 Mar 2025

NCEP	ECCC	ECMWF
		
		
		

- Models agree on above-normal AR activity in Northern and Central CA during Week 2 (31 Mar-6 Apr)
- ECCC and ECMWF are also forecasting above-normal AR activity in Southern CA, whereas NCEP is forecasting near-normal to slightly above-normal AR activity

Models agree on above-normal AR activity over Northern and Central CA, but slightly disagree on AR activity over Southern CA during Week 2 (31 Mar-6 Apr)

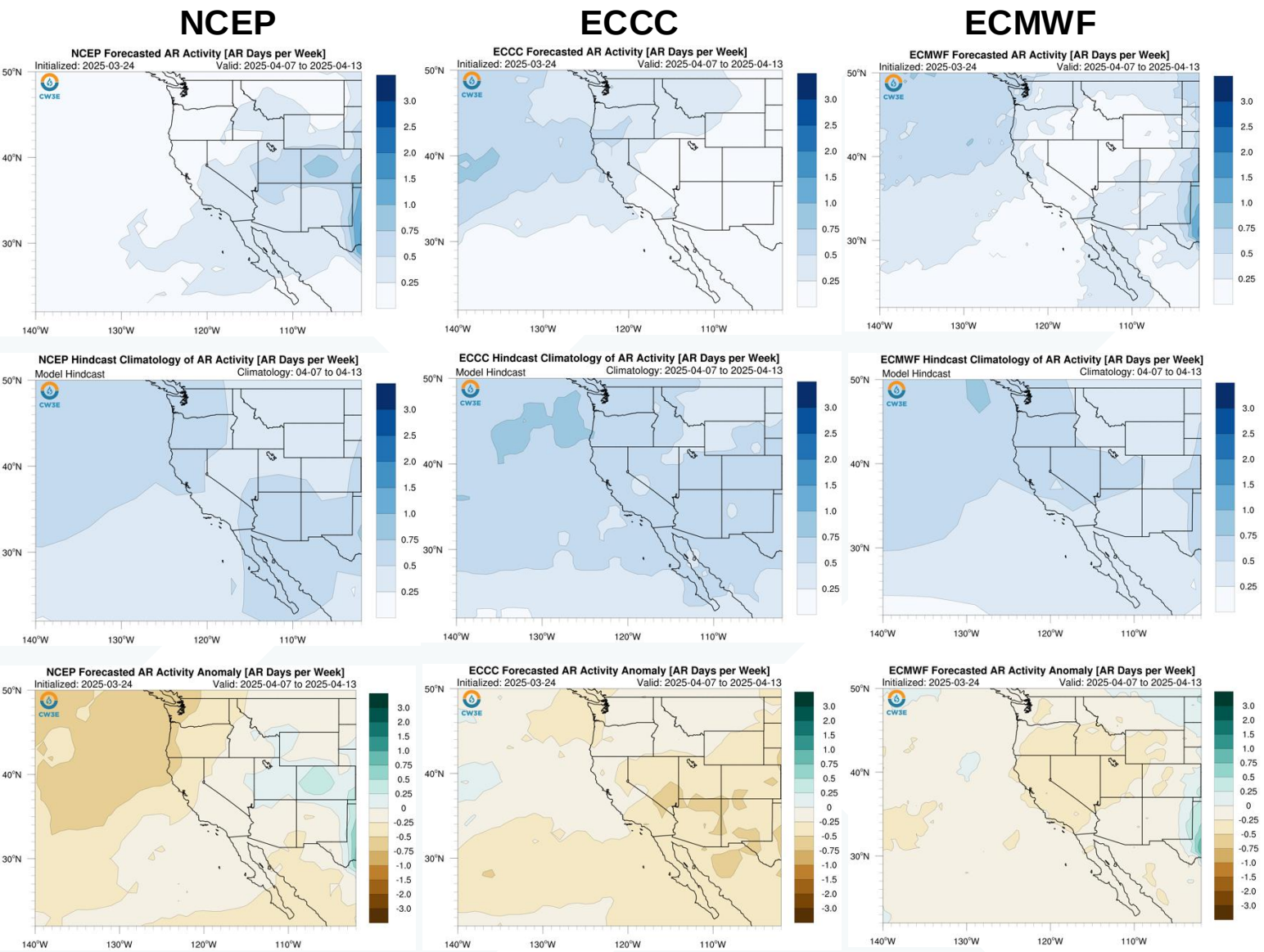
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

Center for Western Weather and Water Extremes

AMBASSADOR WRN WEATHER-READY NATION

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

Forecasts Initialized 24 Mar 2025



- Models agree on near-normal to slightly below-normal AR activity over CA during Week 3 (7-13 Apr)

Models agree on near-normal to slightly below-normal AR activity over CA during Week 3 (7-13 Apr)

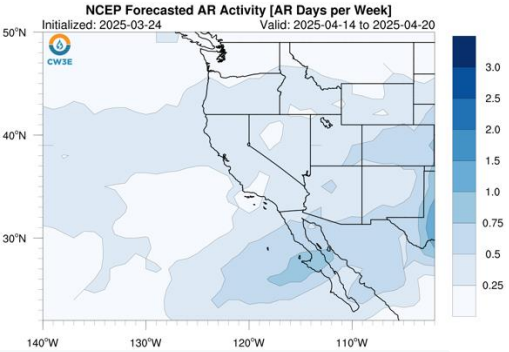
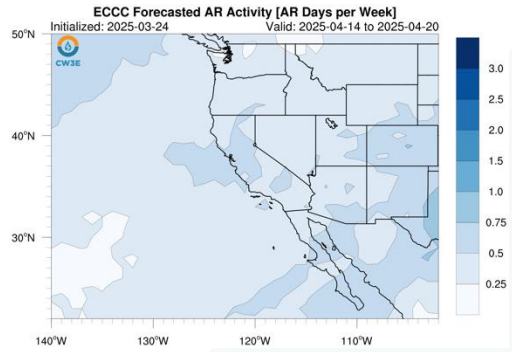
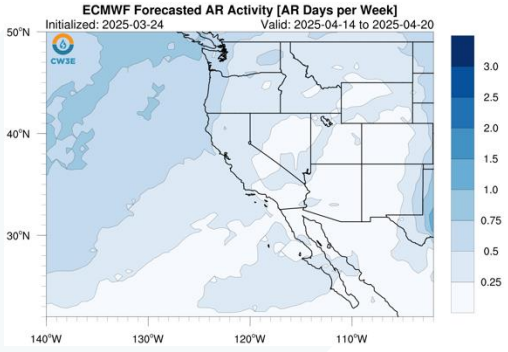
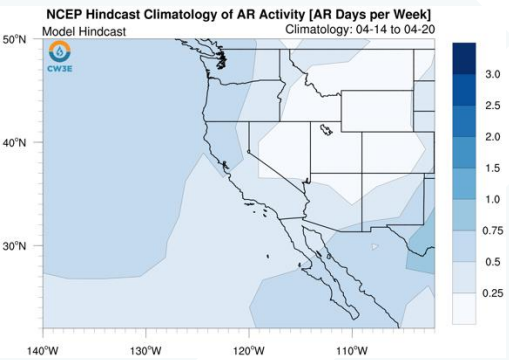
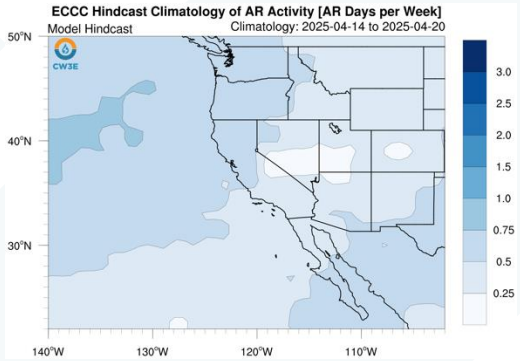
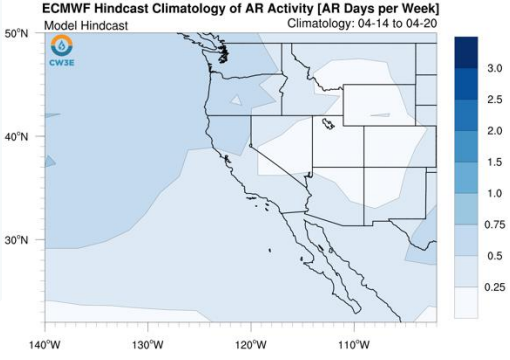
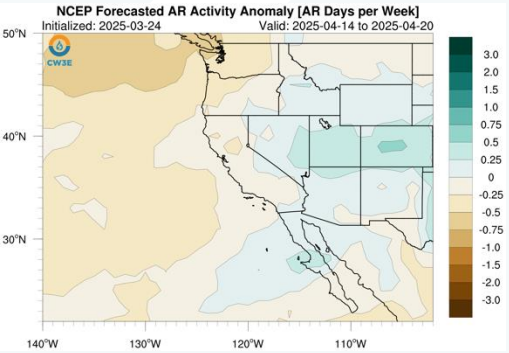
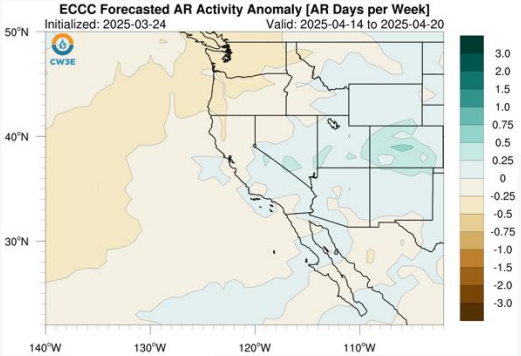
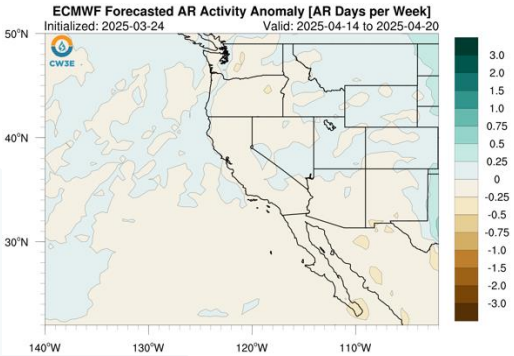
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

Center for Western Weather and Water Extremes

AMBASSADOR WRN WEATHER-READY NATION

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

Forecasts Initialized 24 Mar 2025

NCEP	ECCC	ECMWF
		
		
		

- Models agree on near-normal AR activity over CA during Week 4 (14-20 Apr)

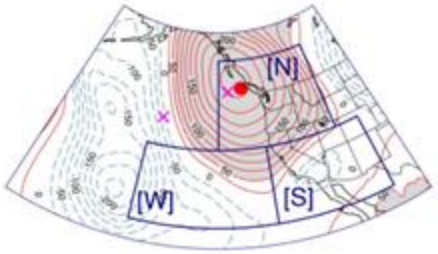
Models agree on near-normal AR activity over CA during Week 4 (14-20 Apr)

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)

Center for Western Weather and Water Extremes

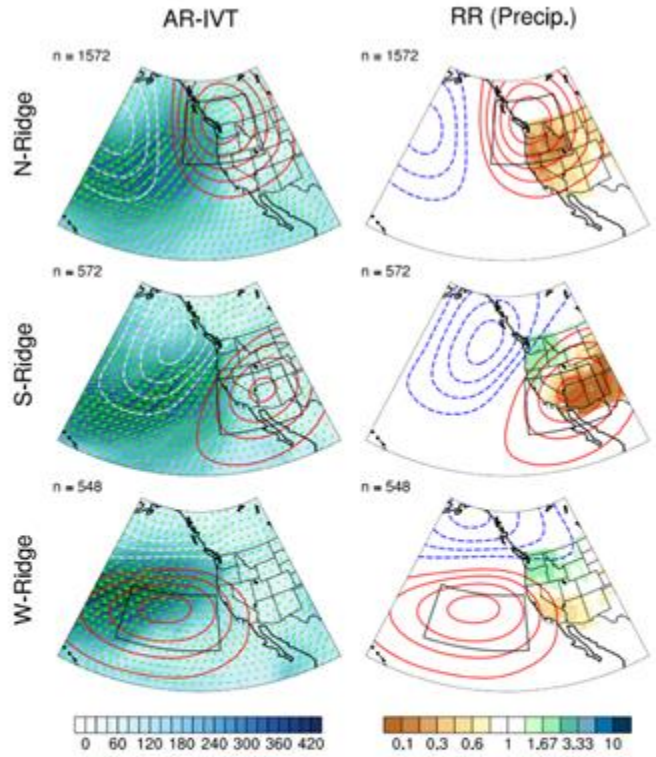
AMBASSADOR WRN WEATHER-READY NATION

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

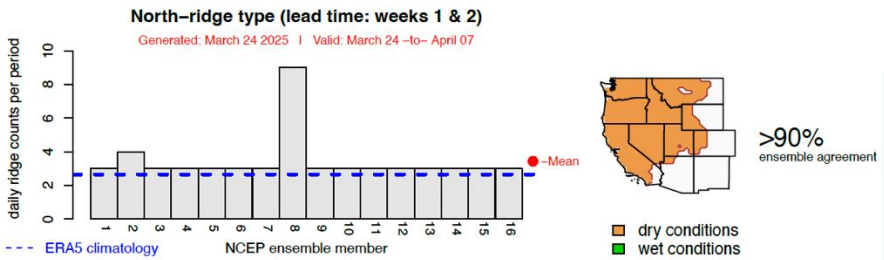
Jet Propulsion Laboratory
California Institute of Technology

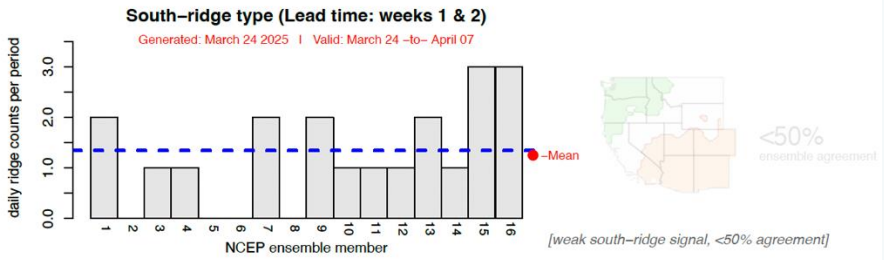
Center for Western Weather and Water Extremes
Scripps Institution of Oceanography at UC San Diego

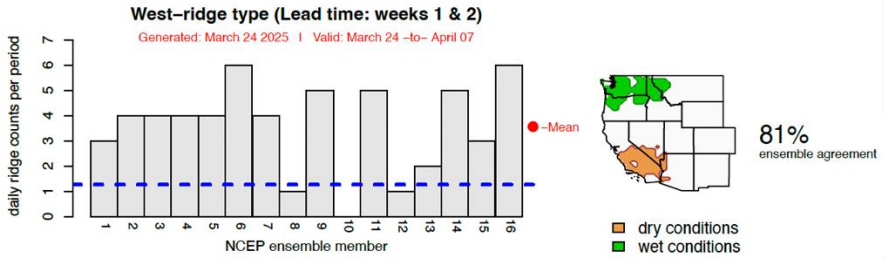
Contact: pgibson@ucsd.edu
Reference: Gibson et al. (2020) Journal of Climate

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

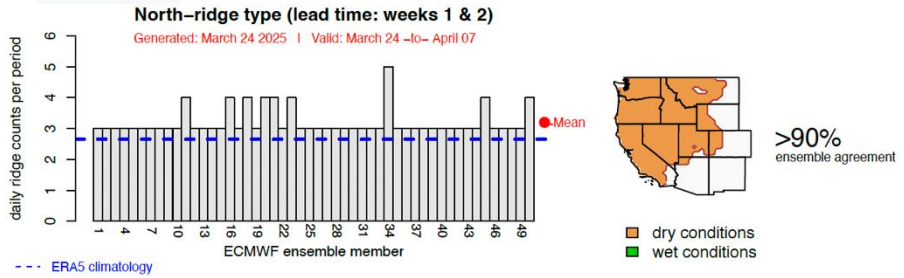
NCEP

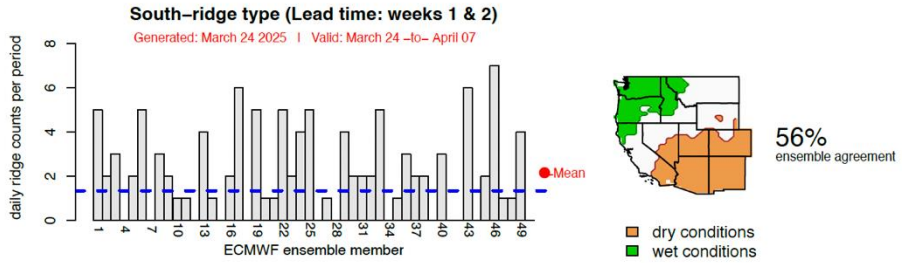


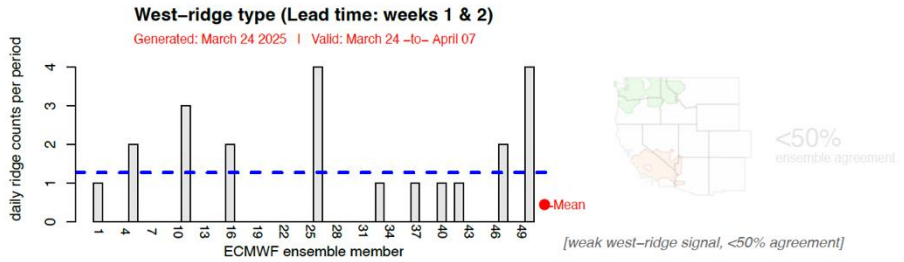




ECMWF







Forecasts Initialized 24 Mar 2025

- NCEP and ECMWF are forecasting high likelihood (>90% ensemble agreement) of above-normal North-ridge activity during Weeks 1–2 (24 Mar-7 Apr) (*Note: the high likelihood of North-ridge type may reflect more the Week 1 condition)
- NCEP is also forecasting a high likelihood (81% ensemble agreement) of above-normal West-ridge activity, while ECMWF is forecasting below-normal West-ridge activity
- ECMWF is also forecasting a moderate likelihood (56% ensemble agreement) of above-normal South-ridge activity

Models agree on above-normal ridging activity near the Pacific Northwest during Weeks 1–2 (24 Mar-7 Apr) and show potential for above-normal ridging activity over the Southwest and west of CA

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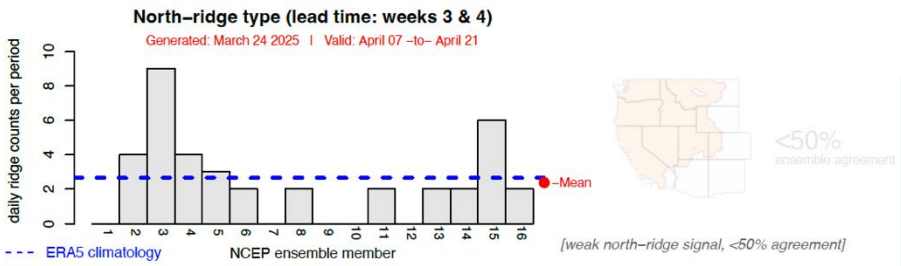
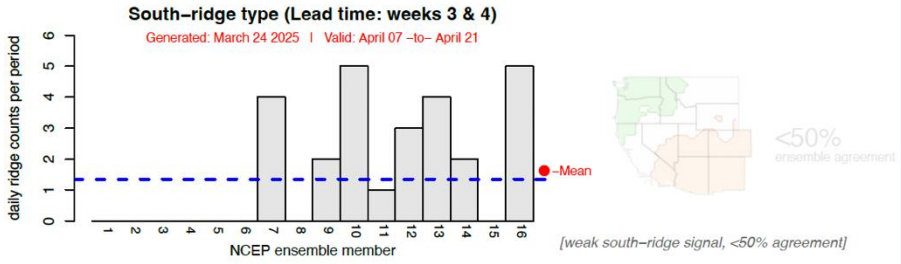
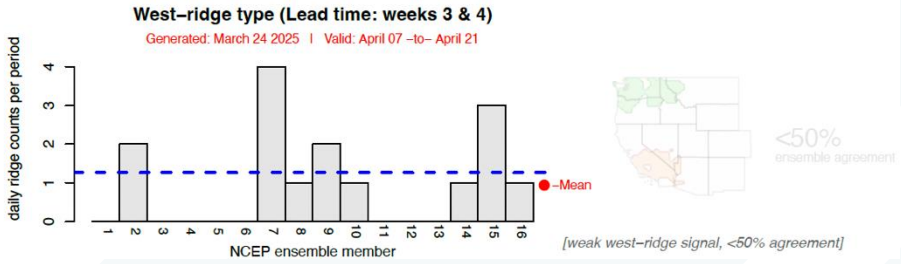
Ridging Forecasts: Weeks 3–4 (NCEP vs. ECMWF)

NCEP







ECMWF

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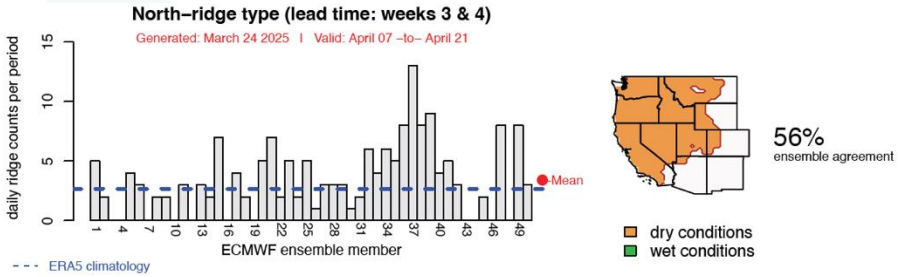

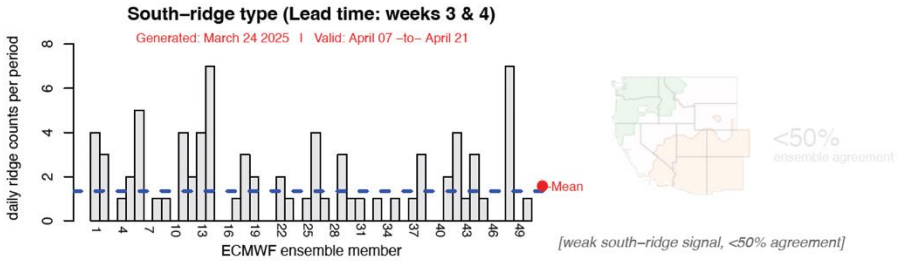

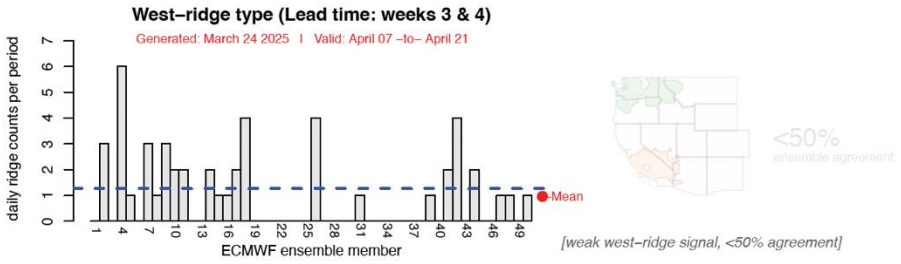

- ECMWF is forecasting a moderate likelihood (56% ensemble agreement) of above-normal North-ridge activity during Weeks 3–4 (7-21 Apr)
- Both models are also forecasting near-normal West-ridge and South-ridge activity

Models show uncertainty in the location and amount of ridging activity near the US West Coast during Weeks 3-4 (7-21 Apr)

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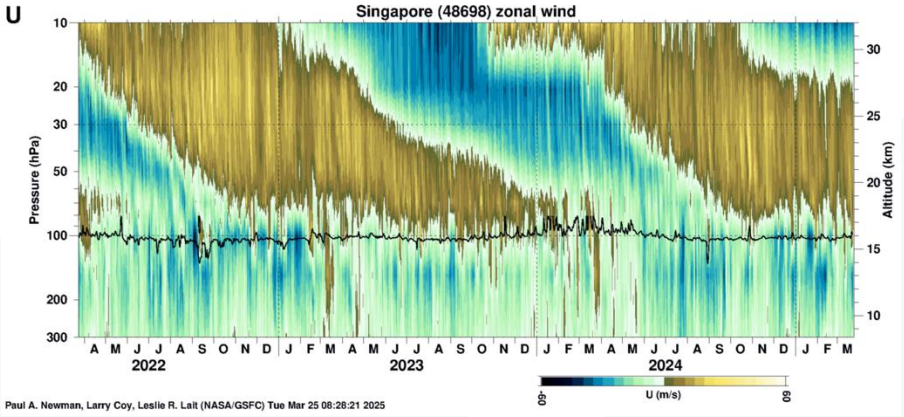
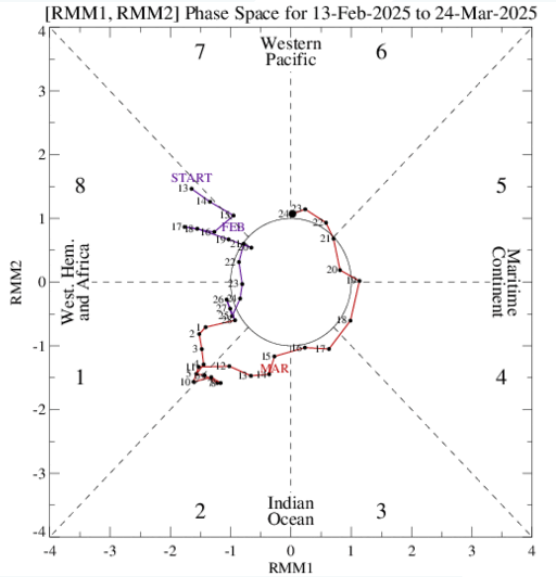
Background Info: AR Activity and Precipitation Based on MJO and QBO

QBO Conditions



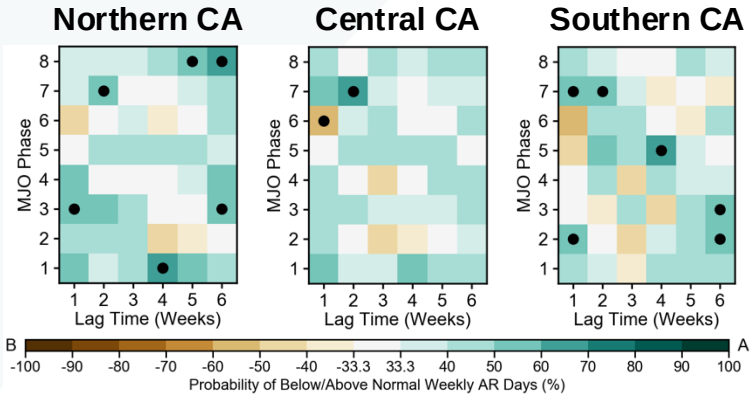
QBO is in the westerly phase at 50-hPa

MJO Conditions

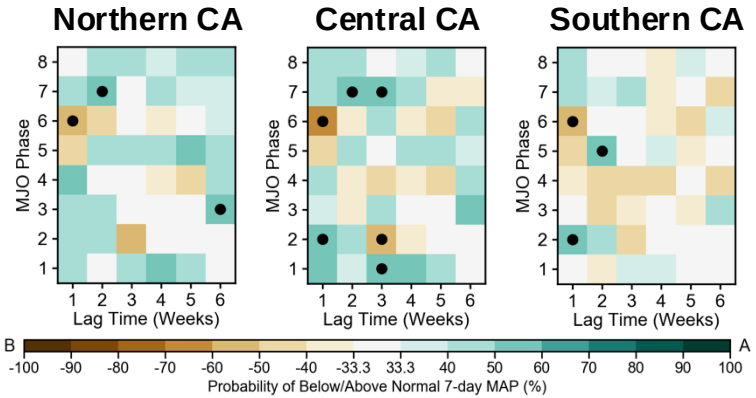


MJO convection is currently located over the Western Pacific (Phase 6&7)

Probability of Above/Below-Normal AR Occurrence (WQBO in JFM)



Probability of Above/Below-Normal Precipitation (WQBO in JFM)

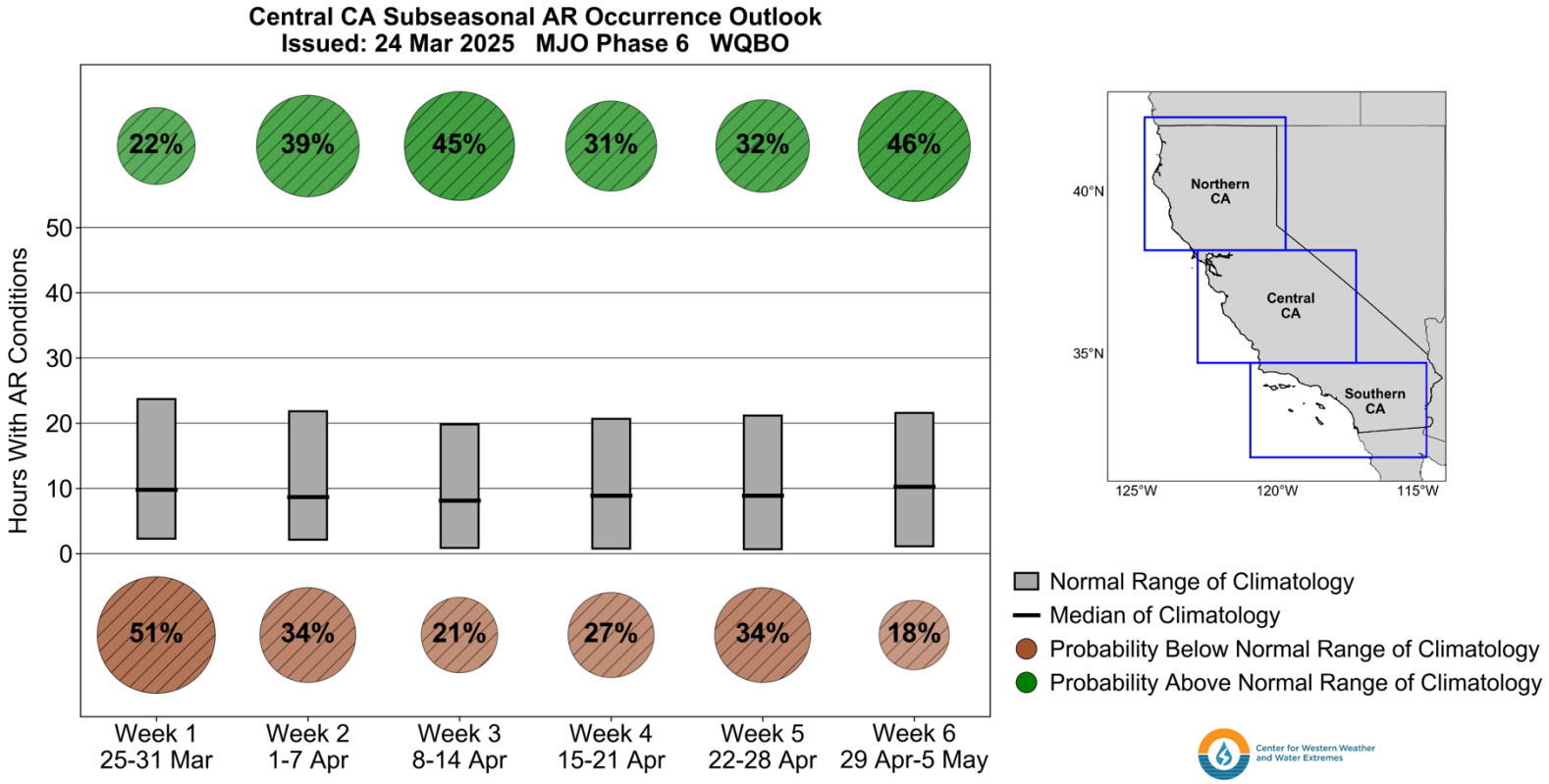


Probability matrices illustrating the weeks 1–6 lagged probability of below-normal (brown shading) or above-normal (green shading) AR occurrence and precipitation for all MJO phases when the QBO is in the westerly phase during JFM in Northern CA (left), Central CA (middle), and Southern CA (right). White 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

Forecasts Initialized 24 Mar 2025

AR Occurrence: Central CA



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

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- CW3E's probabilistic AR occurrence forecast based on current MJO and QBO conditions (see forecast for all regions here)
- Moderate likelihood (≥40% probability) of above-normal AR occurrence during Week 3 (8-14 Apr) in Northern CA
- **Moderate likelihood of above-normal AR occurrence in Central CA during Week 3 (8-14 Apr)**
- Moderate likelihood of above-normal AR occurrence in Southern CA Weeks 2-3 (1-14 Apr)

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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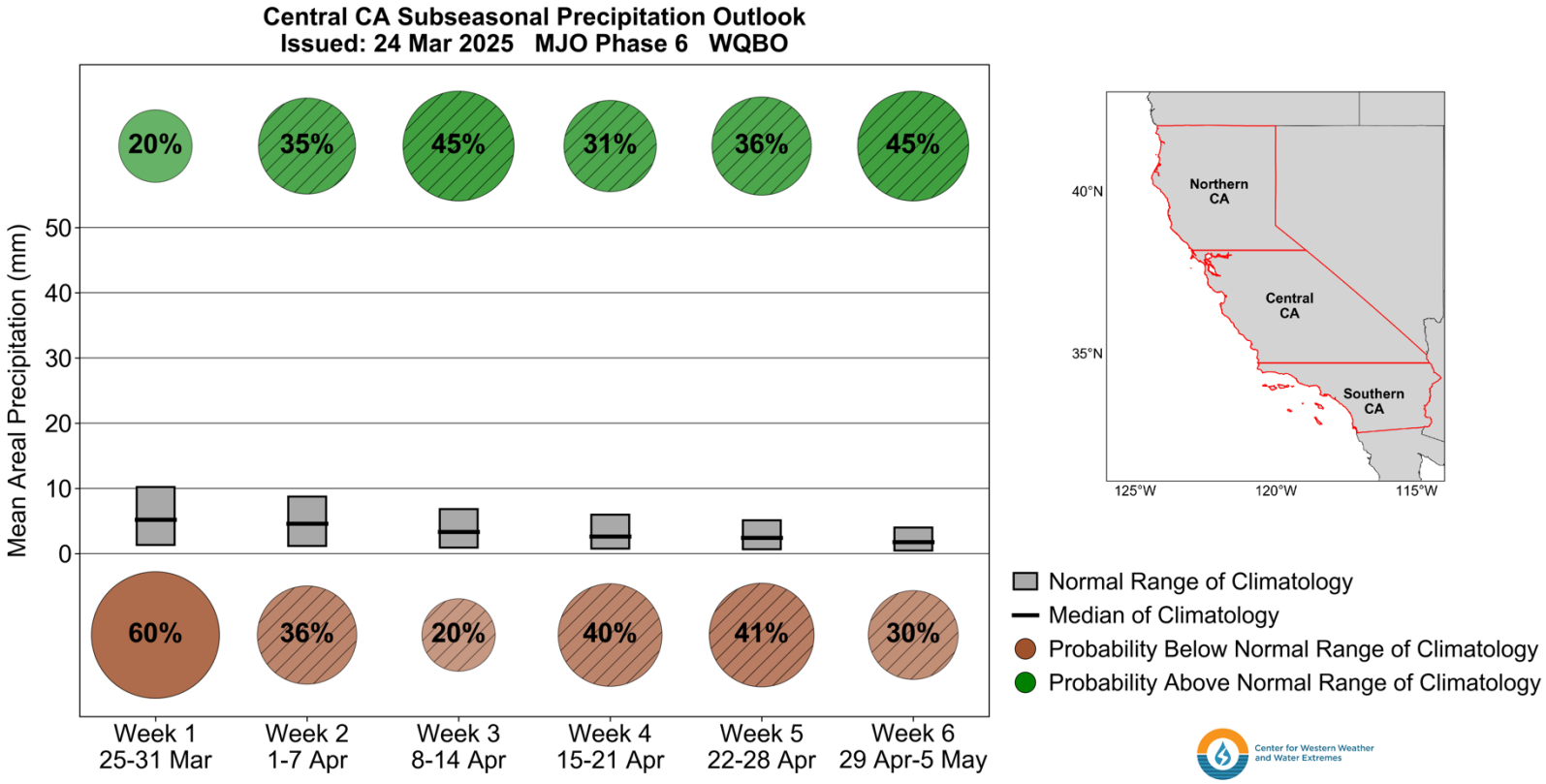
AR Activity and Precipitation Based on MJO and QBO

Forecasts Initialized 24 Mar 2025

Precipitation: Central 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 above-normal precipitation in Central CA during Week 3 (8-14 Apr)**

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)

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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
  - ECCC (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***