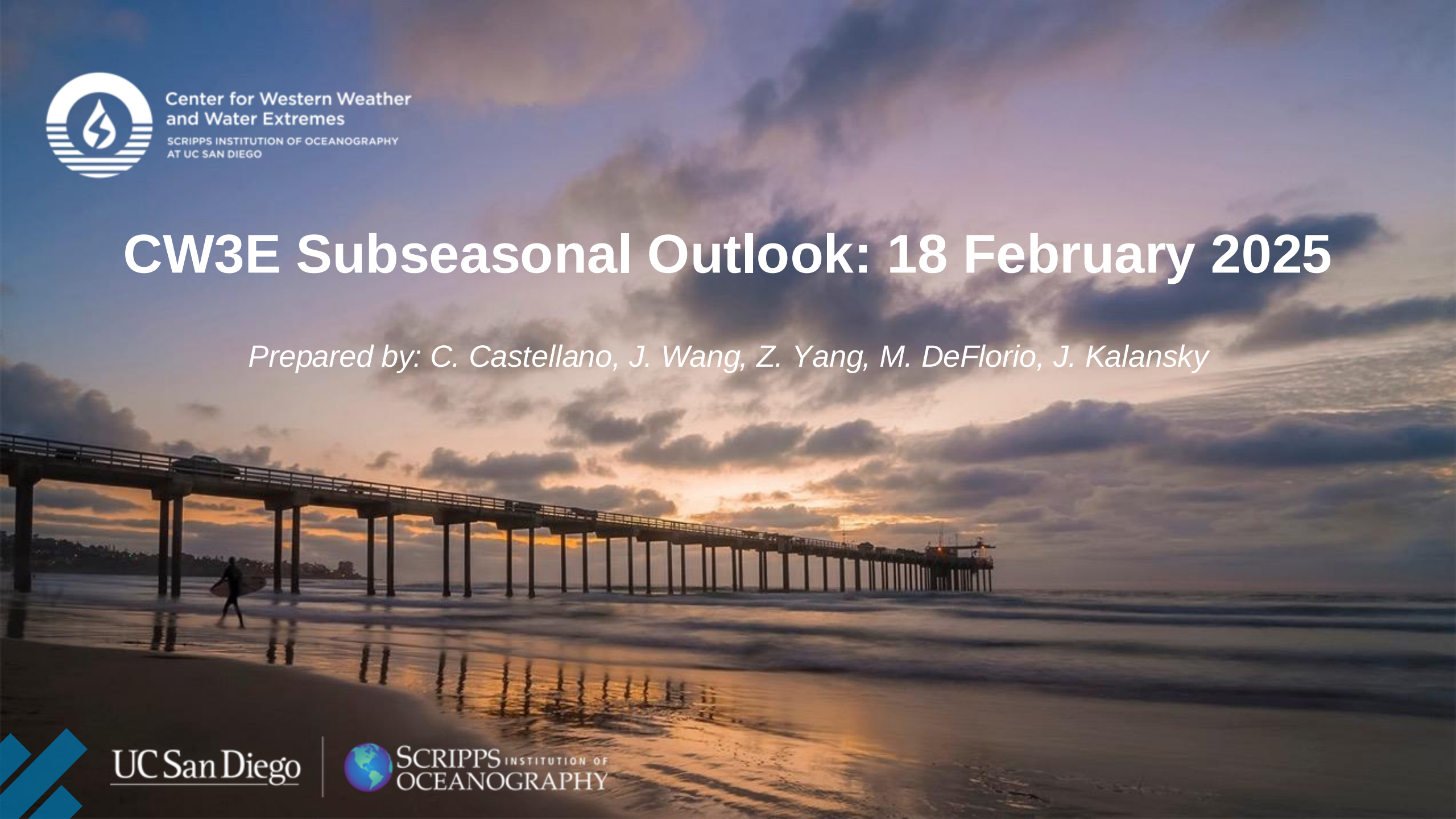

CW3E Subseasonal Outlook: 18 February 2025

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

Summary: Subseasonal Precipitation Outlook by Model

This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 17 Feb 2025

Region	Week 2 (24 Feb – 2 Mar)				Week 3 (3–9 Mar)				Week 4 (10–16 Mar)			
	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 below-normal precipitation in Central and Southern CA during Week 2; more uncertainty in Northern CA
- Models lean towards below-normal precipitation in Southern CA during Week 3; more uncertainty in Northern and Central CA
- Models lean towards above-normal precipitation in Central CA during Week 4; more uncertainty in Northern and Southern CA

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 Western Hemisphere (Phase 8); QBO is in the westerly phase
  - Without considering QBO/ENSO conditions, MJO in Phases 1&8 during JFM is associated with decreases in wet extremes in Southern CA at a lag time of 3 weeks

- NCEP is forecasting MJO convection to propagate eastward during Week 1 and weaken during Week 2, while ECMWF is forecasting MJO convection to weaken at the beginning of Week 1

Week 2 forecasts (24 Feb – 2 Mar):

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

- Ridging outlooks show high likelihood of above-normal ridging activity near the US West Coast during Weeks 1–2
  - NCEP and ECMWF are both forecasting a high likelihood of above-normal West-ridge activity (dry conditions over Central and Southern CA) and above-normal South-ridge activity (wet conditions over far Northern CA; dry conditions over Southern CA)
  - NCEP is also forecasting a high likelihood of above-normal North-ridge activity (dry conditions over all of CA)

- IRI weather regime tool shows high likelihood of West Coast Ridge (below-normal precipitation in CA) during Week 2

Summary

Week 3 Forecasts (3–9 Mar):

- NCEP and ECMWF generally agree on near- to slightly below-normal AR activity over CA during Week 3; ECCC favors near- to slightly above-normal AR activity

- Ridging outlooks show moderate likelihood of above-normal South-ridge activity (wet conditions over far Northern CA; dry conditions over Southern CA) during Weeks 3–4
  - ECMWF is also forecasting a moderate likelihood of above-normal West-ridge activity (dry conditions over Central and Southern CA)

- IRI weather regime tool shows high likelihood of West Coast Ridge (below-normal precipitation in CA) during Week 3

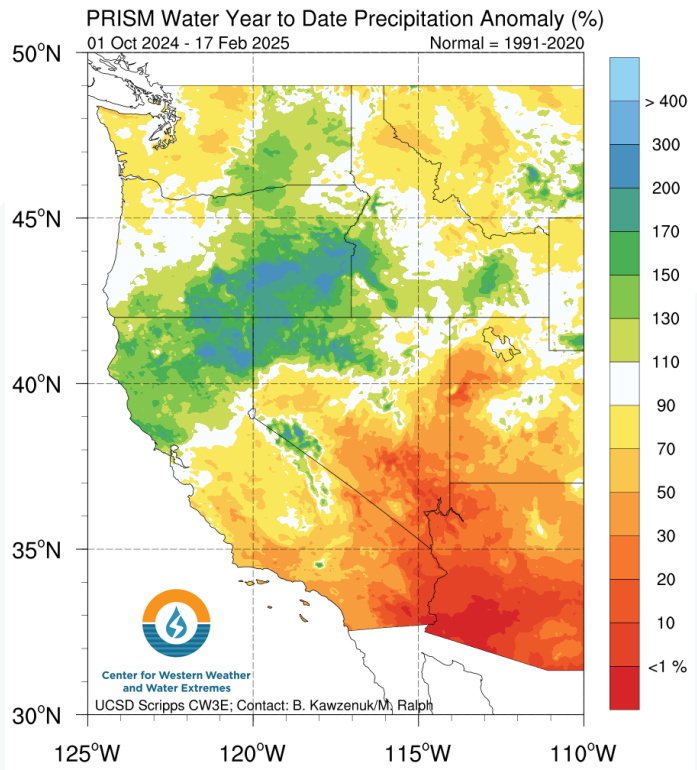
Week 4 Forecasts (10–16 Mar):

- Models disagree somewhat on AR activity over CA during Week 4 (10–16 Mar), with NCEP favoring above-normal AR activity, ECCC favoring slightly above-normal AR activity, and ECMWF favoring near-normal AR activity

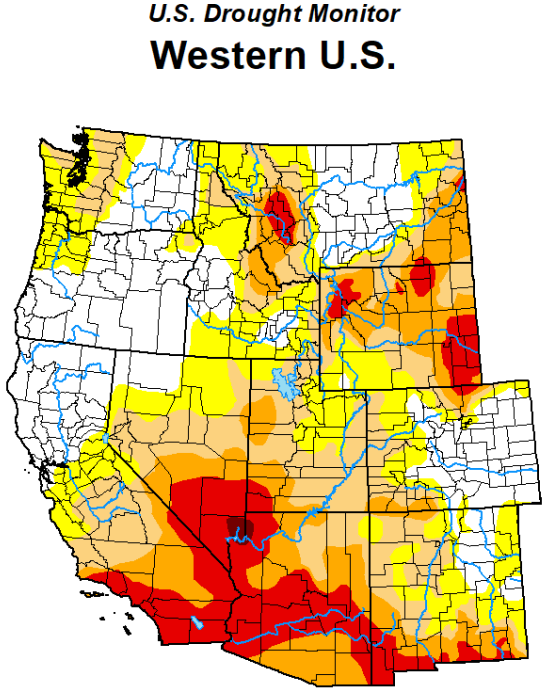
- IRI weather regime tool shows moderate likelihood of Pacific Ridge (near-normal precipitation in CA) during Week 4

Hydrologic Summary

Precipitation



Drought Conditions



February 11, 2025
(Released Thursday, Feb. 13, 2025)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	27.33	72.67	50.68	29.13	13.01	0.26
Last Week 02-04-2025	24.60	75.40	49.58	27.06	12.22	0.26
3 Months Ago 11-12-2024	17.35	82.65	43.17	18.70	5.28	0.11
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 02-13-2024	50.51	49.49	26.83	11.08	2.37	0.45

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:
Lindsay Johnson
National Drought Mitigation Center

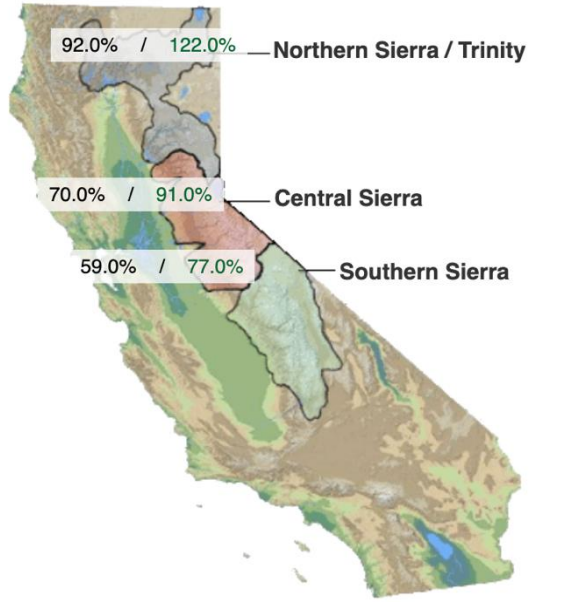
droughtmonitor.unl.edu

Snowpack Conditions

Provided by the California Cooperative Snow Surveys

Data For: **18-Feb-2025**

% Apr 1 Avg. / % Normal for this Date



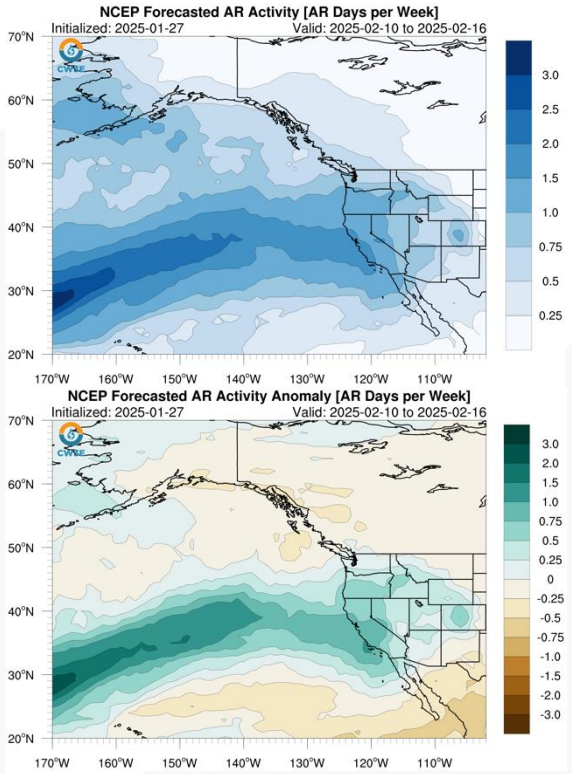
Source: California DWR

- As of 17 Feb, water-year-to-date precipitation is **above normal (> 110% of normal)** in Northern CA, **below-normal (50–90% of normal)** in Central CA, and **well-below normal (<50% of normal)** in Southern CA
- The most recent drought monitor update from 13 Feb is showing **severe-to-extreme drought (D2–D3)** in Southern CA and **moderate drought (D1)** over much of Central CA
- Current snowpack is **above normal (122% of normal)** in the Northern Sierra Nevada/Trinity region, **near normal (91% of normal)** in the Central Sierra Nevada, and **below normal (77% of normal)** in the Southern Sierra Nevada
- Snowpack conditions have improved in the Central and Southern Sierra over the past week due to heavy snowfall associated with an AR on 12–14 Feb

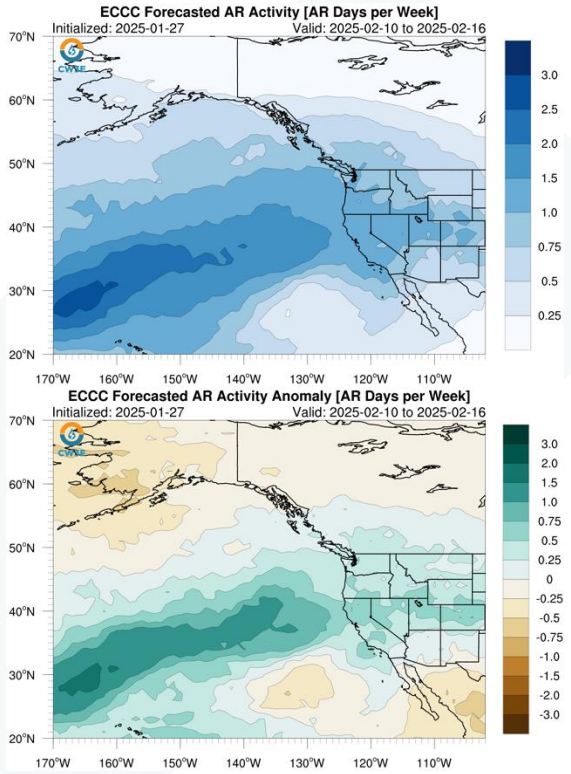
Looking Back: Week 3 AR Activity Forecasts

Forecasts Initialized 27 Jan 2025; Valid: 10–16 Feb 2025

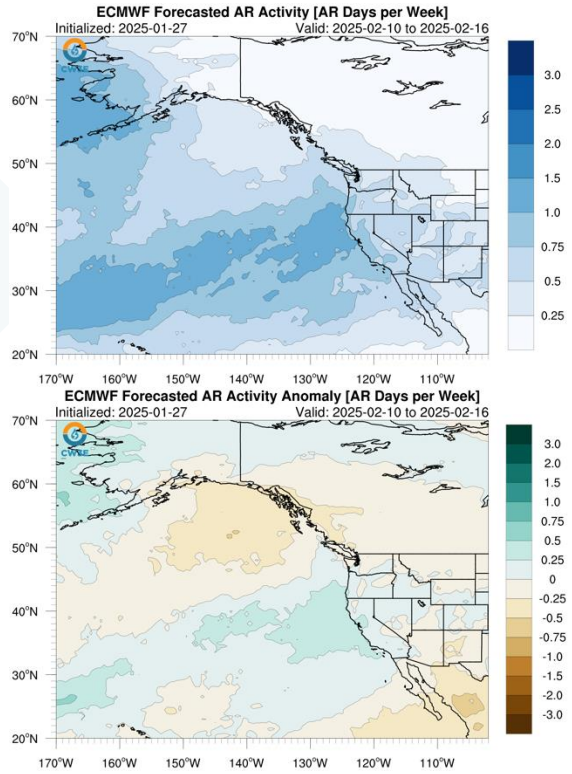
NCEP



ECCC

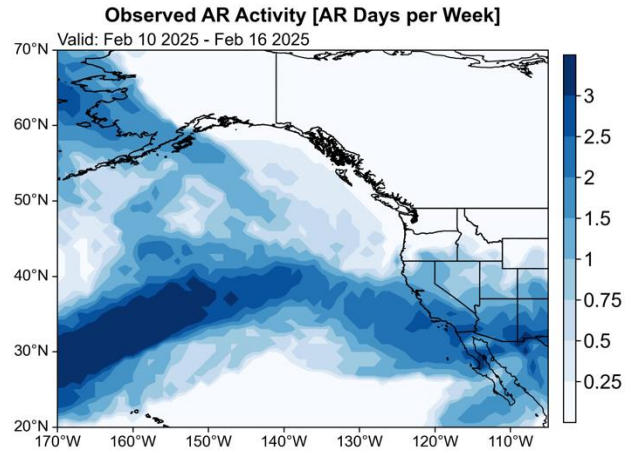


ECMWF

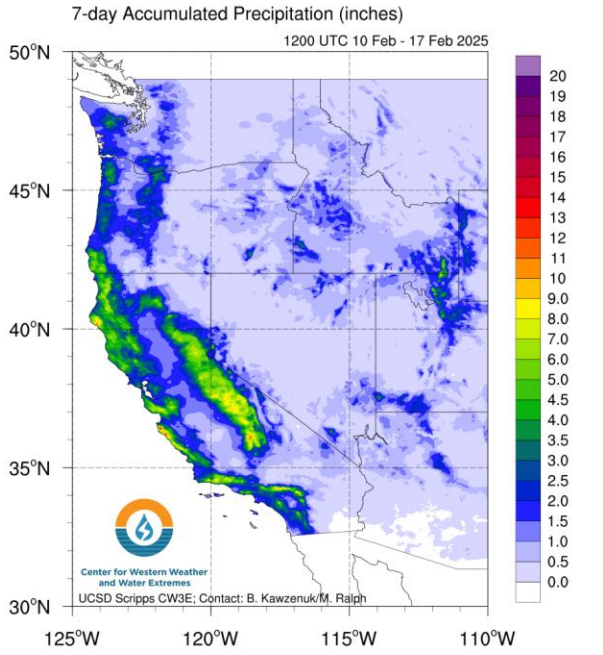


Shading: Fractional # of AR days forecast over a 7-day period (top) and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

Observed (GFS Analysis)



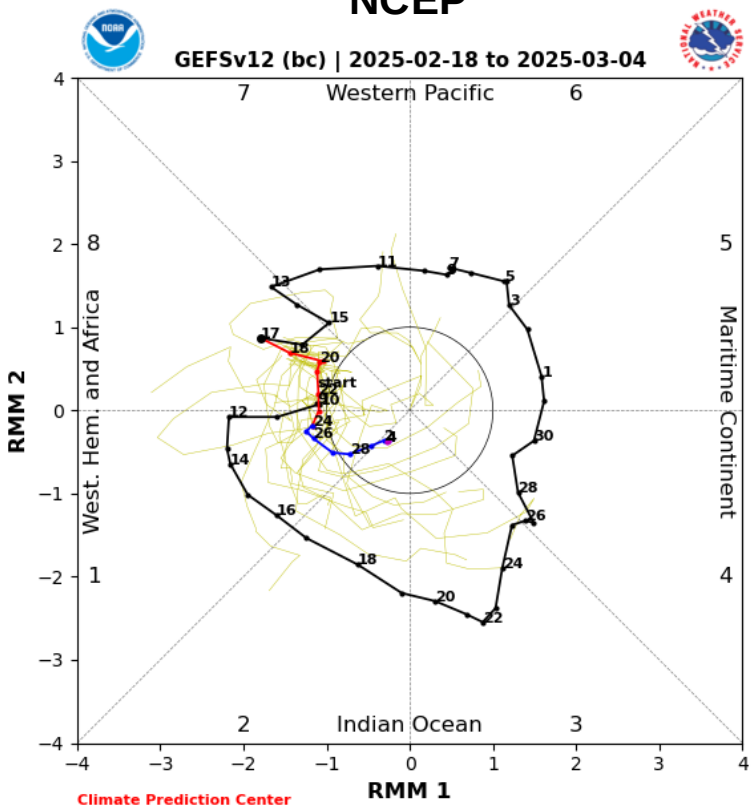
Observed Precipitation



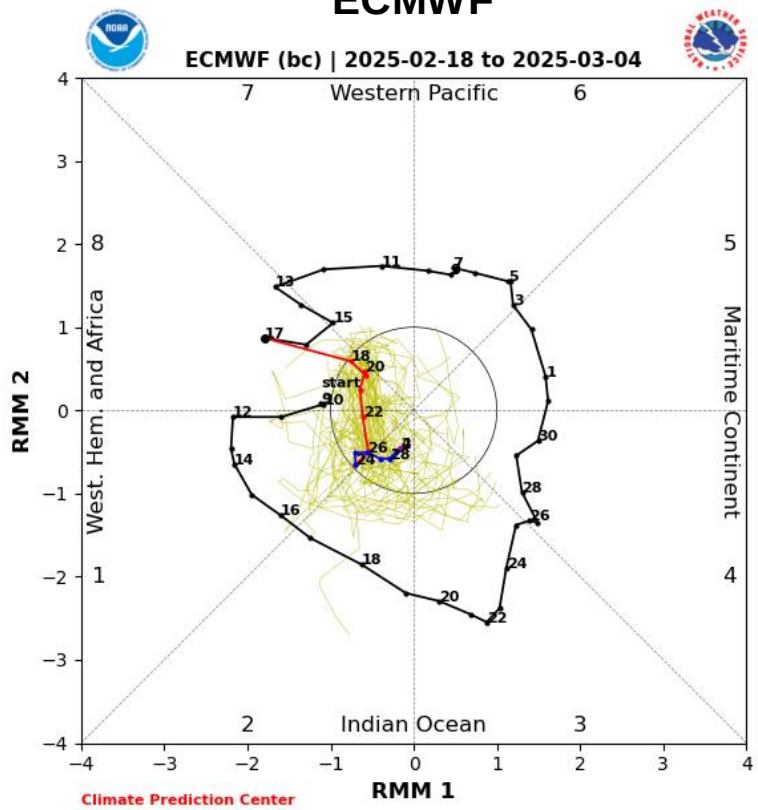
- NCEP and ECCC generally captured the axis of higher AR activity extending from the subtropical North Pacific to California, but ECCC predicted the center of AR activity too far north, and both models underestimated AR activity over Southern CA
- ECMWF significantly underestimated AR activity over the Northeast Pacific and Central/Southern CA
- An AR and a low-pressure system produced >4 inches of precipitation over the California Coast Ranges and Transverse Ranges, as well as 3+ feet of snow over the Sierra Nevada during 12–14 Feb

Dynamical Model MJO Forecasts (NCEP vs. ECMWF)

NCEP



ECMWF



Black: Last 40 days of observations (10 Jan – 17 Feb); Red: Week 1 (18–24 Feb) ensemble mean; Blue: Week 2 (25 Feb – 3 Mar) ensemble mean; Yellow: Ensemble members

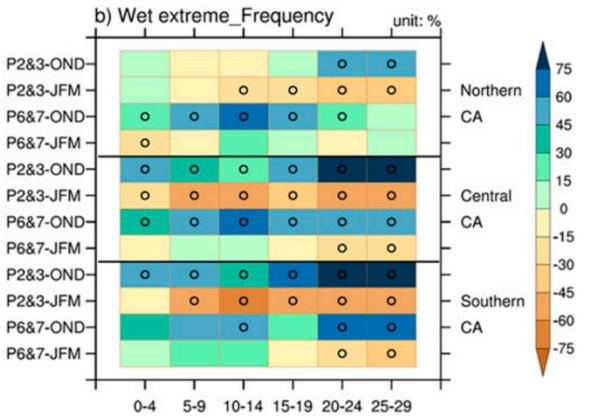


Figure 8 from Wang et al. (2023)

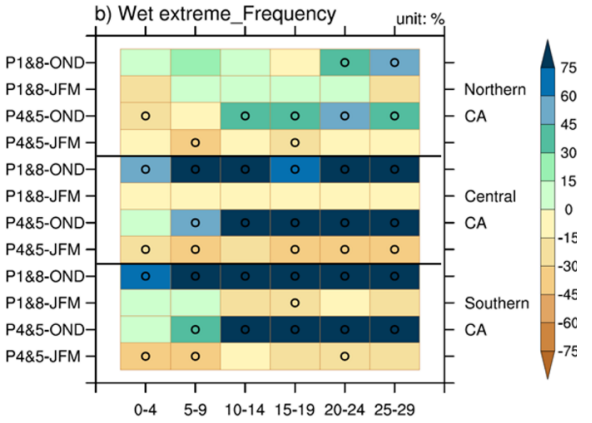


Figure S6 from Wang et al. (2023)

- Strong MJO convection is currently located over the Western Hemisphere (Phase 8)
- NCEP is forecasting MJO convection to propagate eastward into Africa (Phase 1) during Week 1 and weaken toward the end of Week 2
- ECMWF is forecasting MJO convection to weaken at the beginning of Week 1 and remain weak through the end of Week 2
- Without considering QBO/ENSO conditions, MJO activity in Phases 1&8 during JFM is associated with a statistically significant decrease in wet extremes in Southern CA at a lag time of 3 weeks

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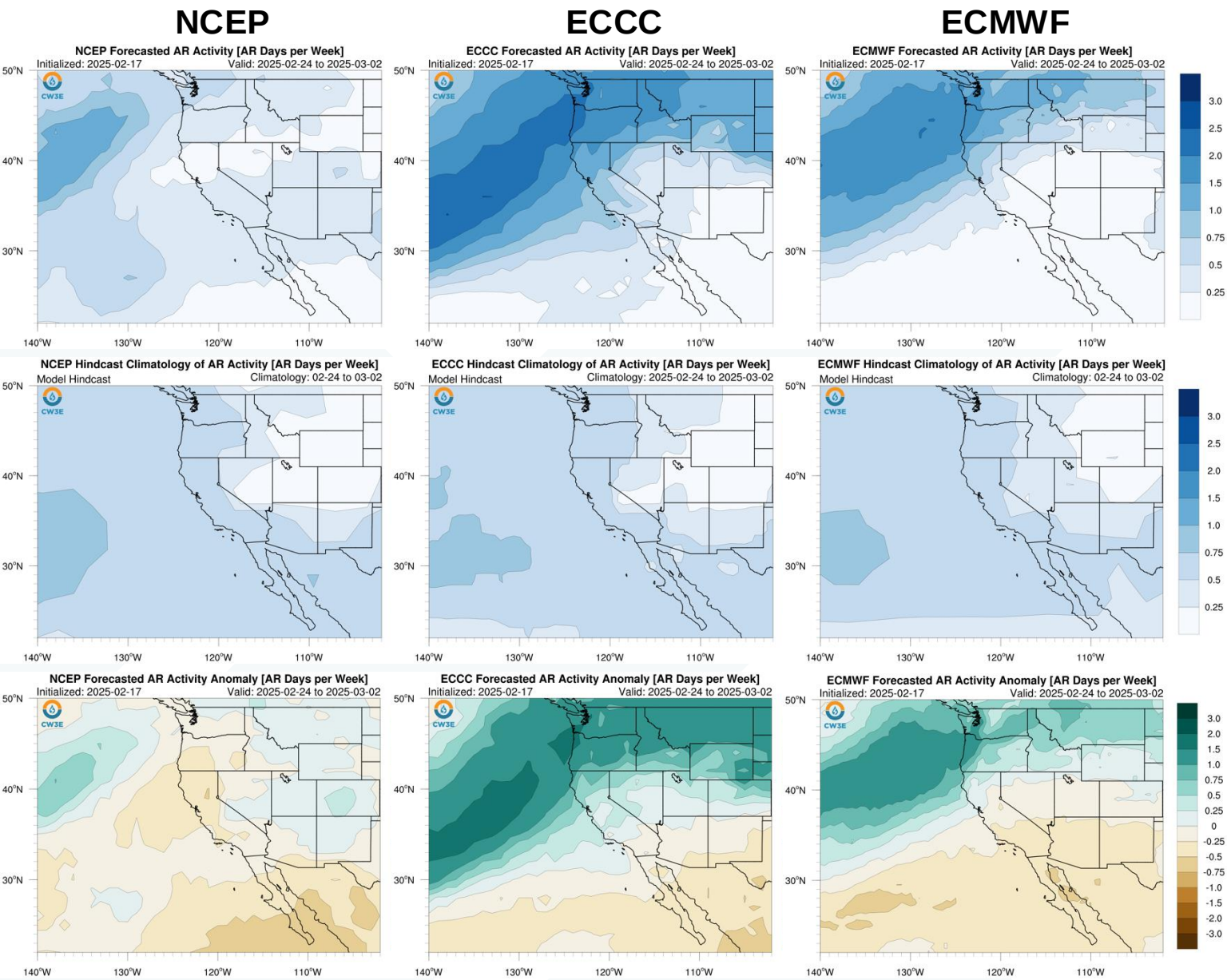
AR Activity Forecasts: Week 2 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 17 Feb 2025



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)

- NCEP is forecasting slightly below-normal AR activity in Northern CA, near- to slightly below-normal AR activity in Central CA, and near-normal AR activity in Southern CA during Week 2 (24 Feb – 2 Mar)
- ECCC is forecasting above-normal AR activity in Northern CA and near-normal AR activity in Central and Southern CA
- ECMWF is forecasting near-normal AR activity in Northern CA, near- to slightly below-normal AR activity in Central CA, and slightly below-normal AR activity in Southern CA

Models disagree somewhat on AR activity over CA during Week 2 (24 Feb – 2 Mar). A northward or southward shift in forecast AR activity could have large impacts on precipitation in Northern and Central CA.

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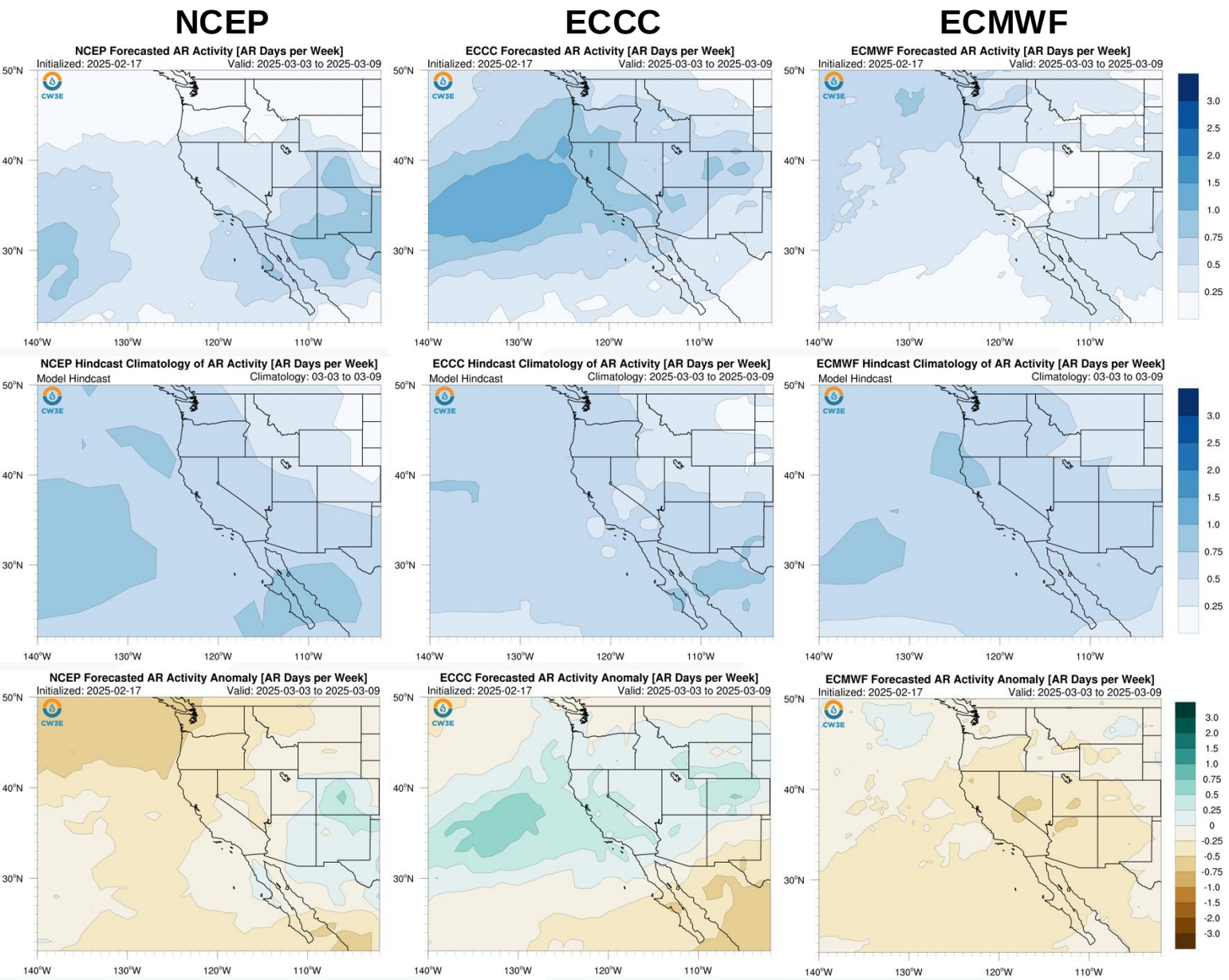
AMBASSADOR WRN WEATHER-READY NATION

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

Forecasts Initialized 17 Feb 2025



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)

- NCEP is forecasting slightly below-normal AR activity in Northern CA and near-normal AR activity in Central and Southern CA during Week 3 (3–9 Mar)
- ECCC is forecasting near-normal AR activity in Northern and Southern CA, and slightly above-normal AR activity in Central CA
- ECMWF is forecasting slightly below-normal AR activity over all of CA

NCEP and ECMWF generally agree on near- to slightly below-normal AR activity over CA during Week 3 (3–9 Mar); ECCC favors near- to slightly above-normal AR activity

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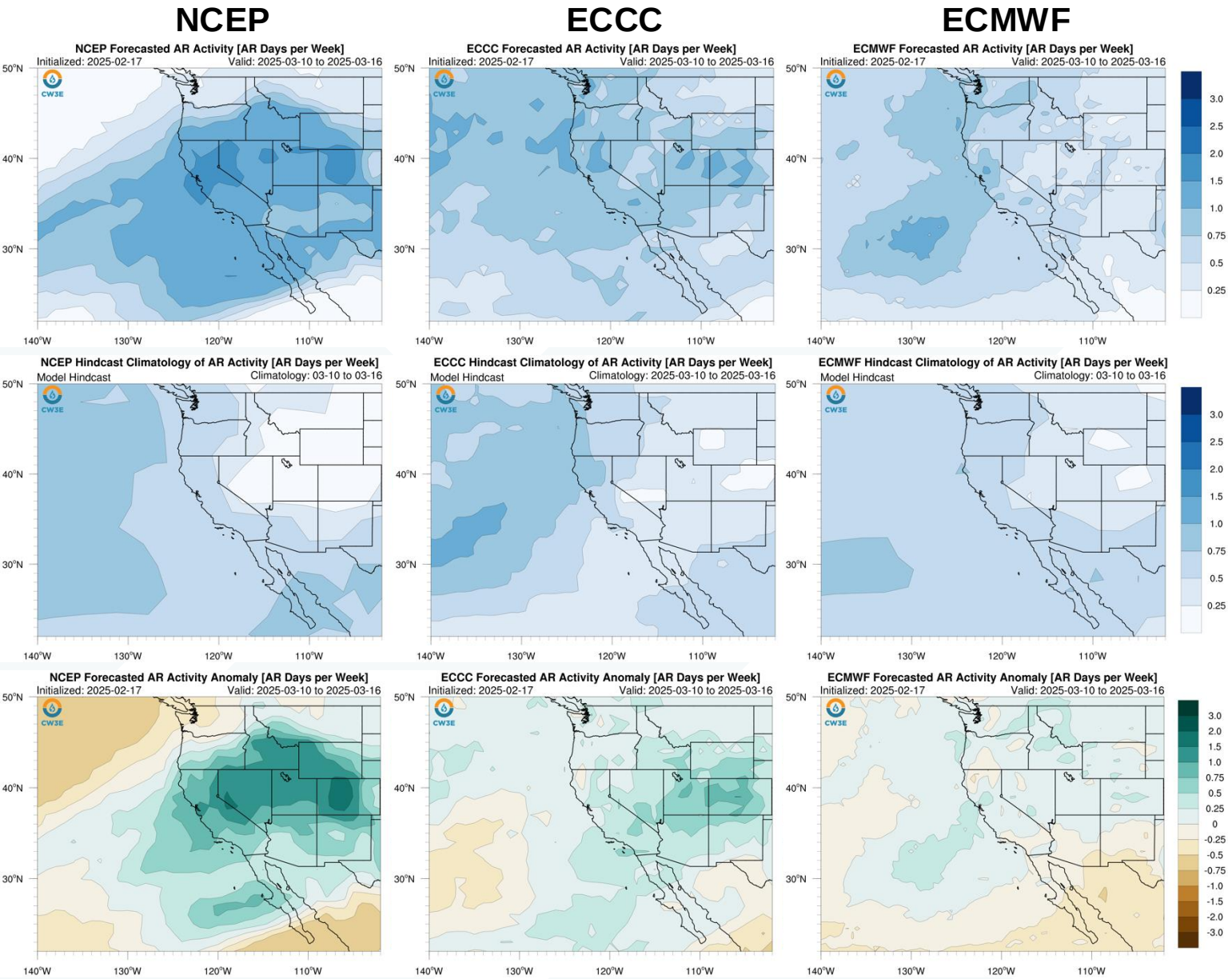
AMBASSADOR™ WRN WEATHER-READY NATION

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 17 Feb 2025

- NCEP is forecasting above-normal AR activity over all of CA during Week 4 (10–16 Mar)
- ECCC is forecasting near- to slightly above-normal AR activity in Northern CA and slightly above-normal AR activity in Central and Southern CA
- ECMWF is forecasting near-normal AR activity over all of CA

Models disagree somewhat on AR activity over CA during Week 4 (10–16 Mar). NCEP favors above-normal AR activity, ECCC favors slightly above-normal AR activity, and ECMWF favors near-normal AR activity

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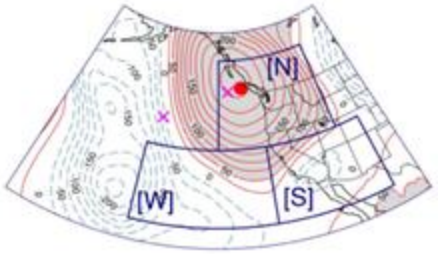
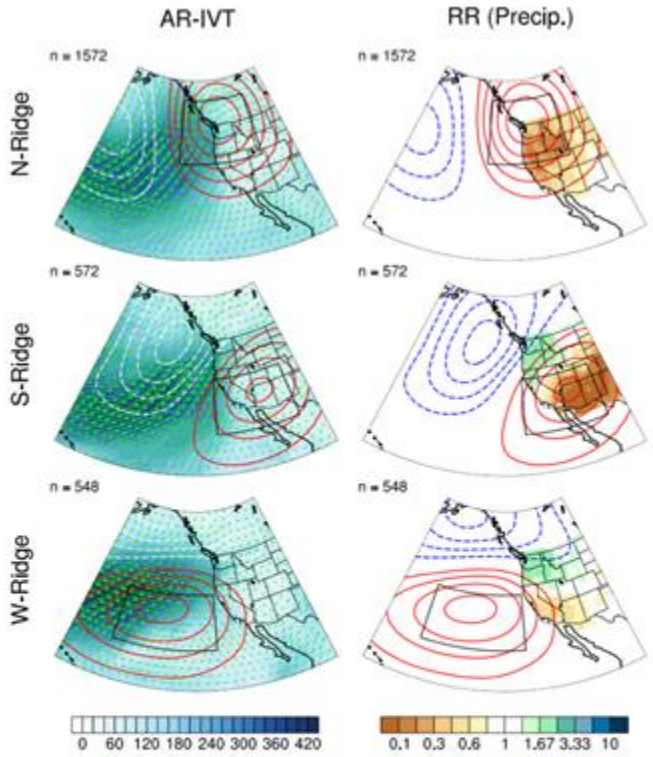
Background Info: Subseasonal Ridging Outlooks



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

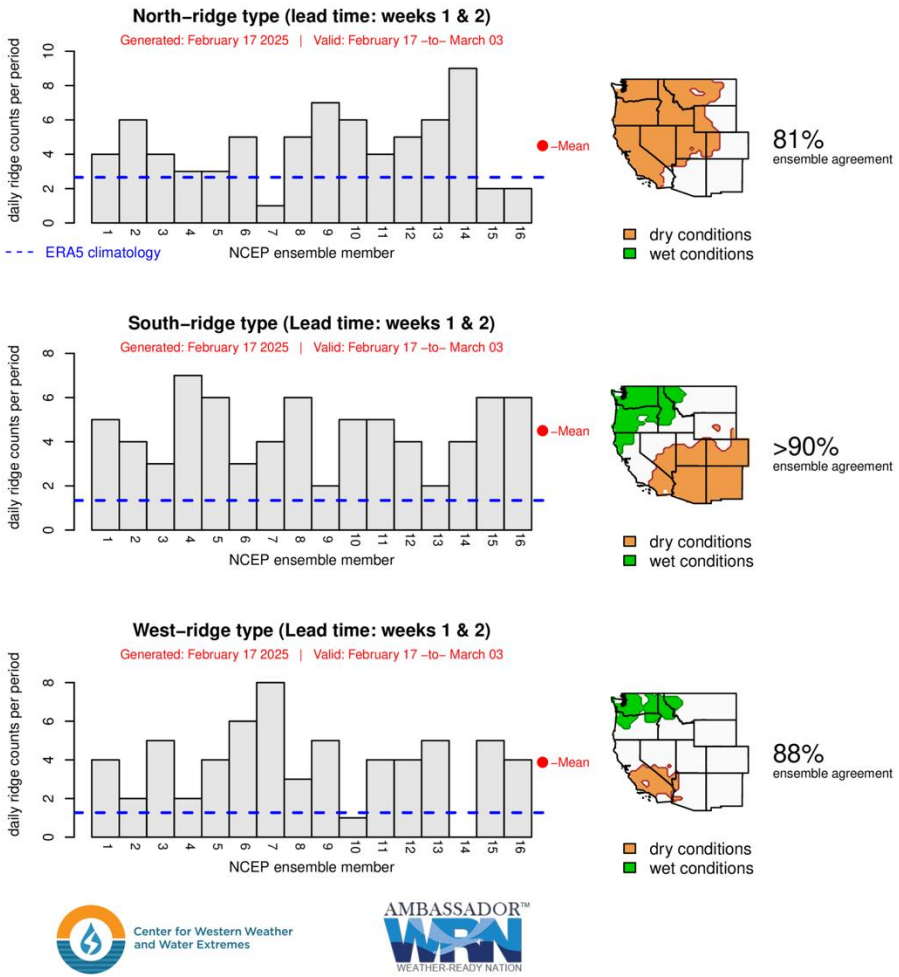
Center for Western Weather and Water Extremes
Scripps Institution of Oceanography at UC San Diego

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

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

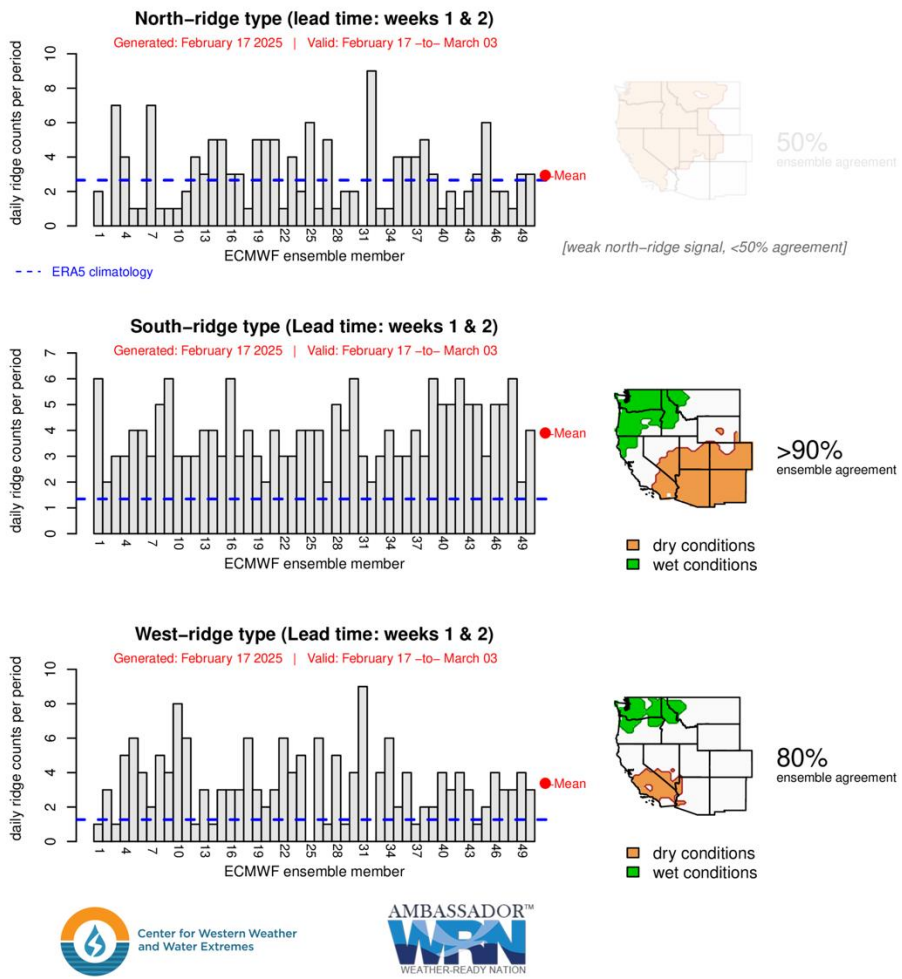
NCEP

CW3E Subseasonal Ridging Forecast
(Uses NCEP CFSv2 model)



ECMWF

CW3E Subseasonal Ridging Forecast
(Uses ECMWF model)



Forecasts Initialized 17 Feb 2025

- NCEP and ECMWF are both forecasting a high likelihood (≥80% ensemble agreement) of above-normal South-ridge and West-ridge activity during Weeks 1–2 (17 Feb – 3 Mar)
- NCEP is also forecasting a high likelihood of above-normal North-ridge activity, whereas ECMWF is forecasting near-normal North-ridge activity

Models show high likelihood of above-normal ridging activity near the US West Coast during Weeks 1–2 (17 Feb – 3 Mar)

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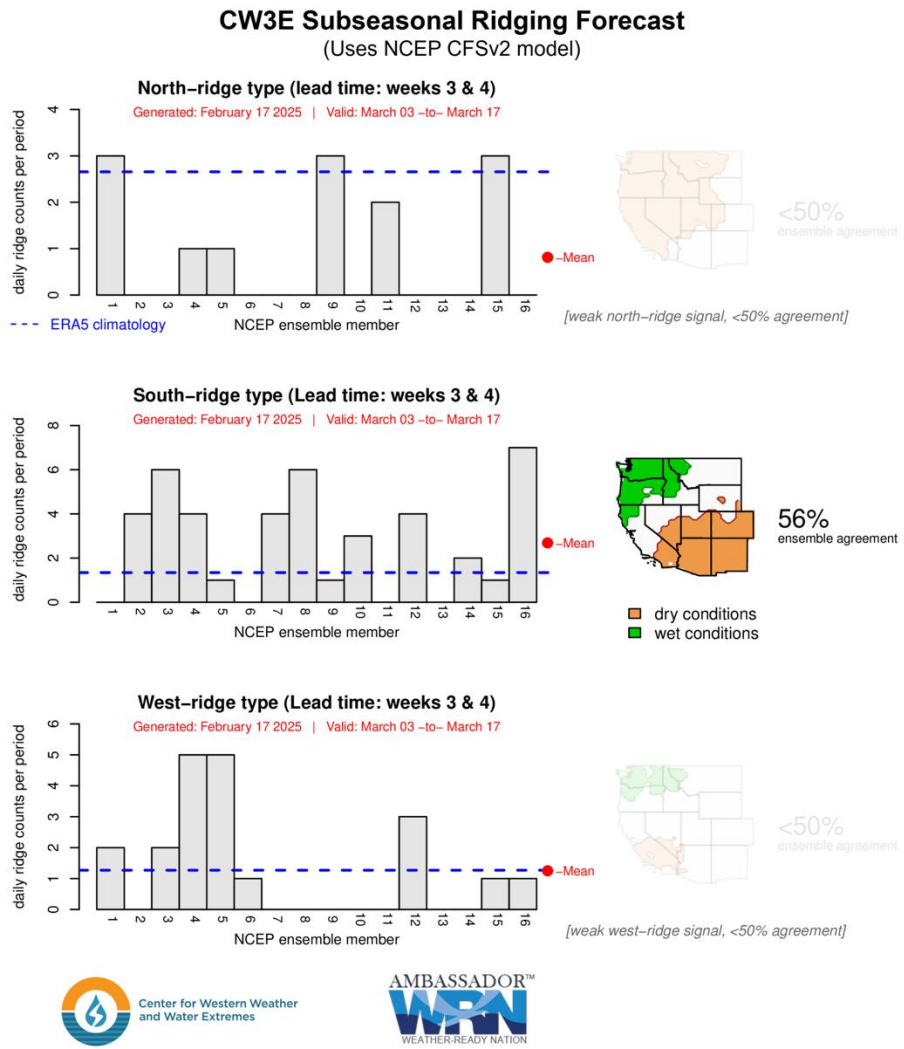
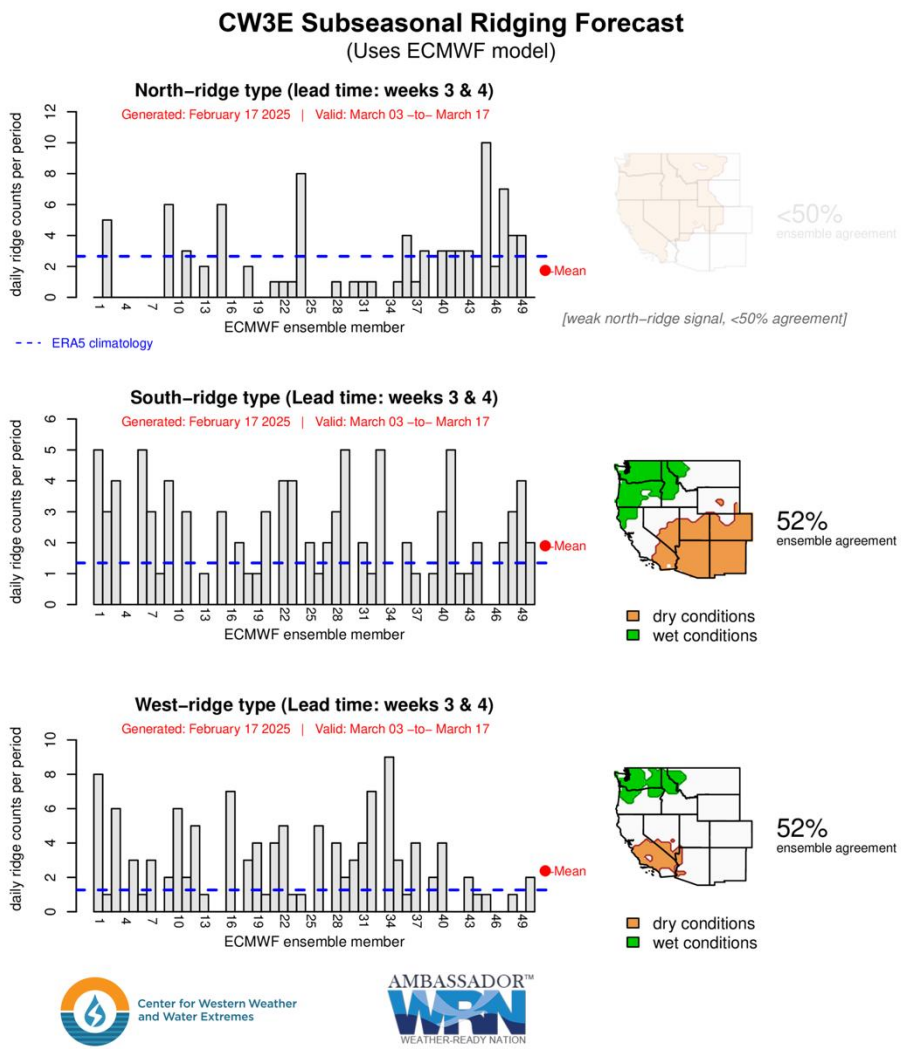
Ridging Forecasts: Weeks 3–4 (NCEP vs. ECMWF)

NCEP



ECMWF



Forecasts Initialized 17 Feb 2025

- NCEP and ECMWF are both forecasting a moderate likelihood (≥50% ensemble agreement) of above-normal South-ridge activity during Weeks 3–4 (3–17 Mar)
- ECMWF is also forecasting a moderate likelihood of above-normal West-ridge activity, whereas NCEP is forecasting near-normal West-ridge activity
- Both models are also forecasting below-normal North-ridge activity

Models show moderate likelihood of above-normal ridging activity over the southwestern US during Weeks 3–4 (3–17 Mar)

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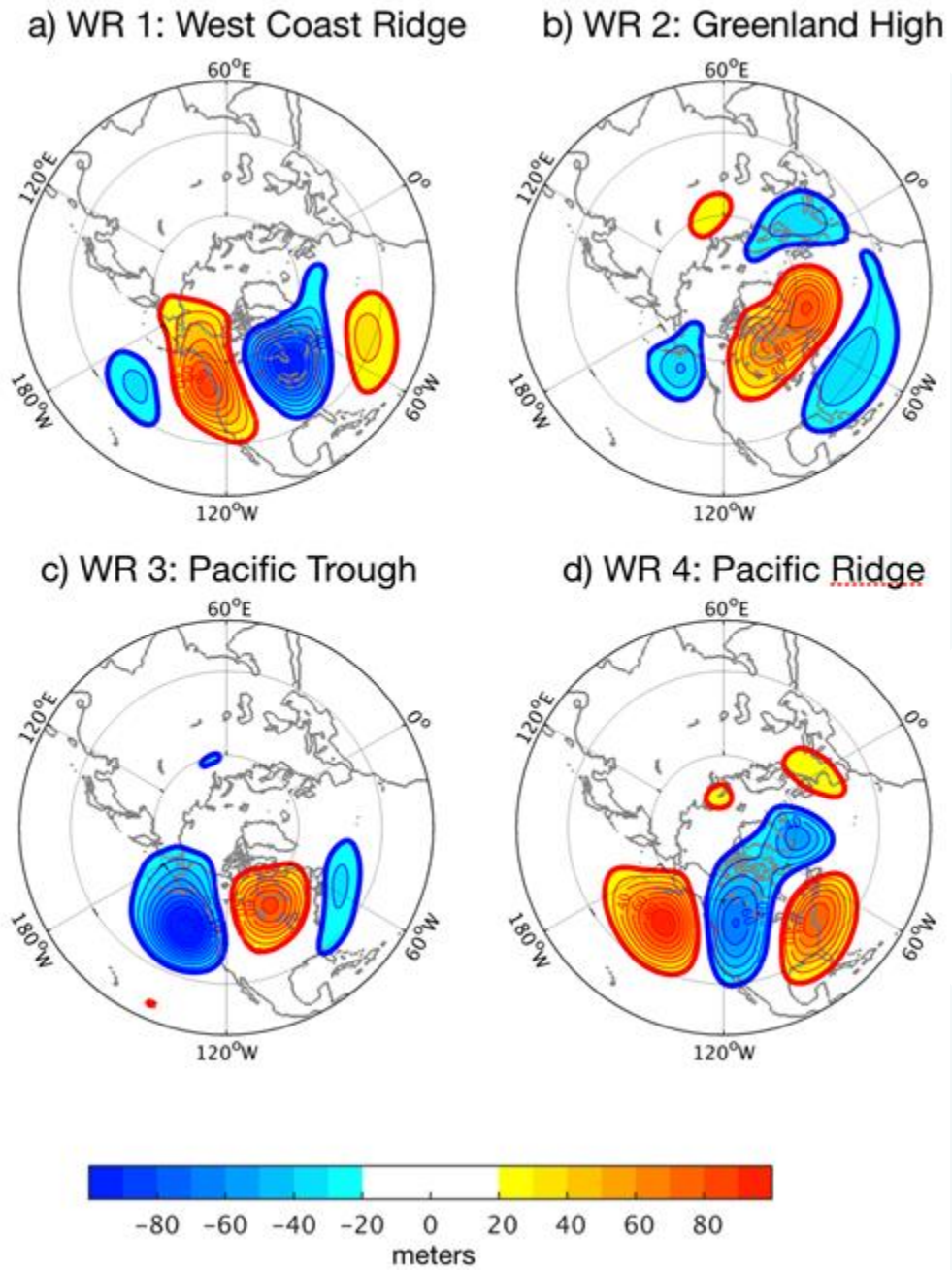
Background Info: IRI Subseasonal Weather Regime Forecasts

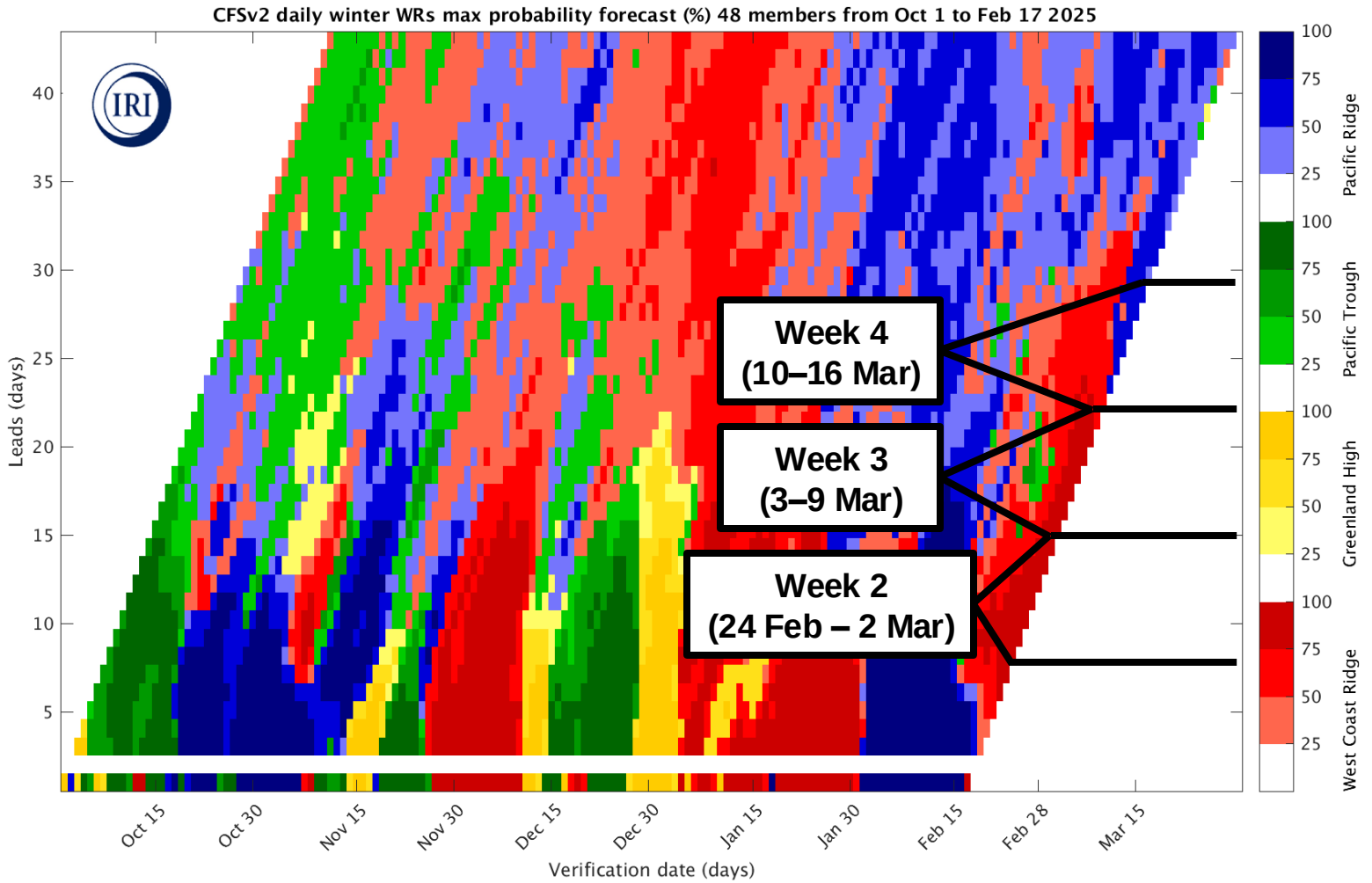


This slide contains background information about IRI's North American weather regime forecast product

- 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 17 Feb 2025

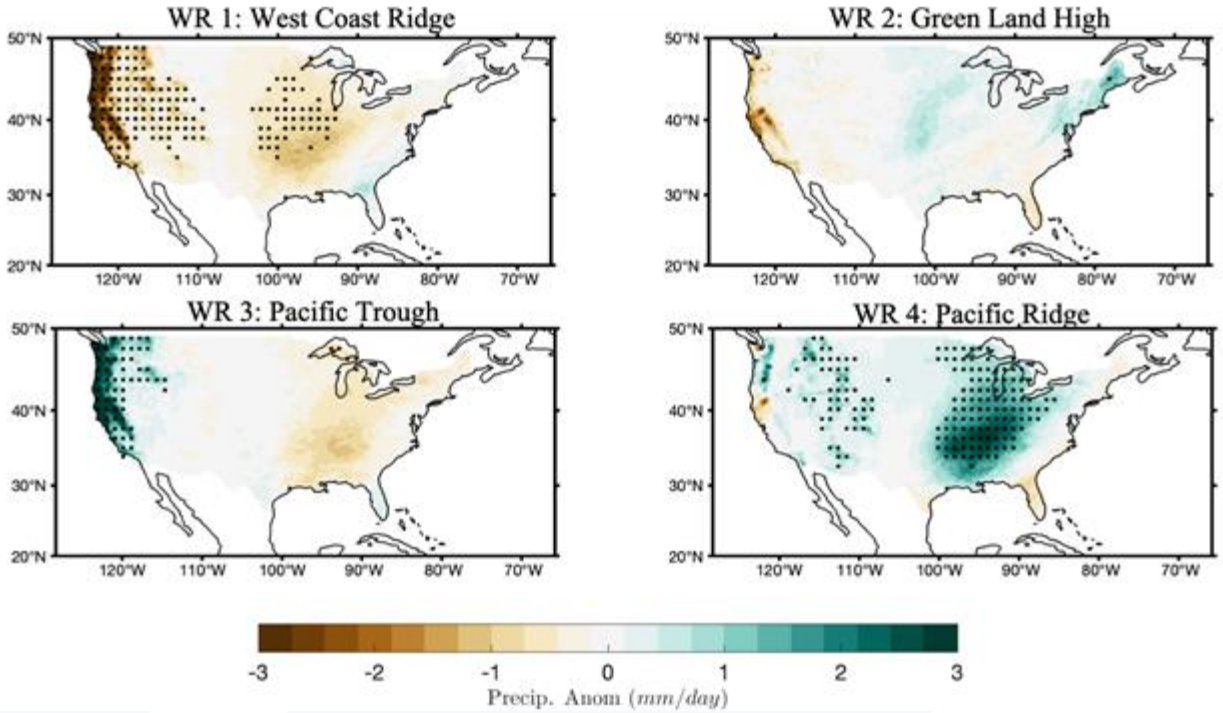
- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble
- High likelihood (≥75% ensemble agreement) of West Coast Ridge during Weeks 2–3 (24 Feb – 9 Mar)
- Moderate likelihood (50–75% ensemble agreement) of transition to Pacific Ridge during Week 4 (10–16 Mar)

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.

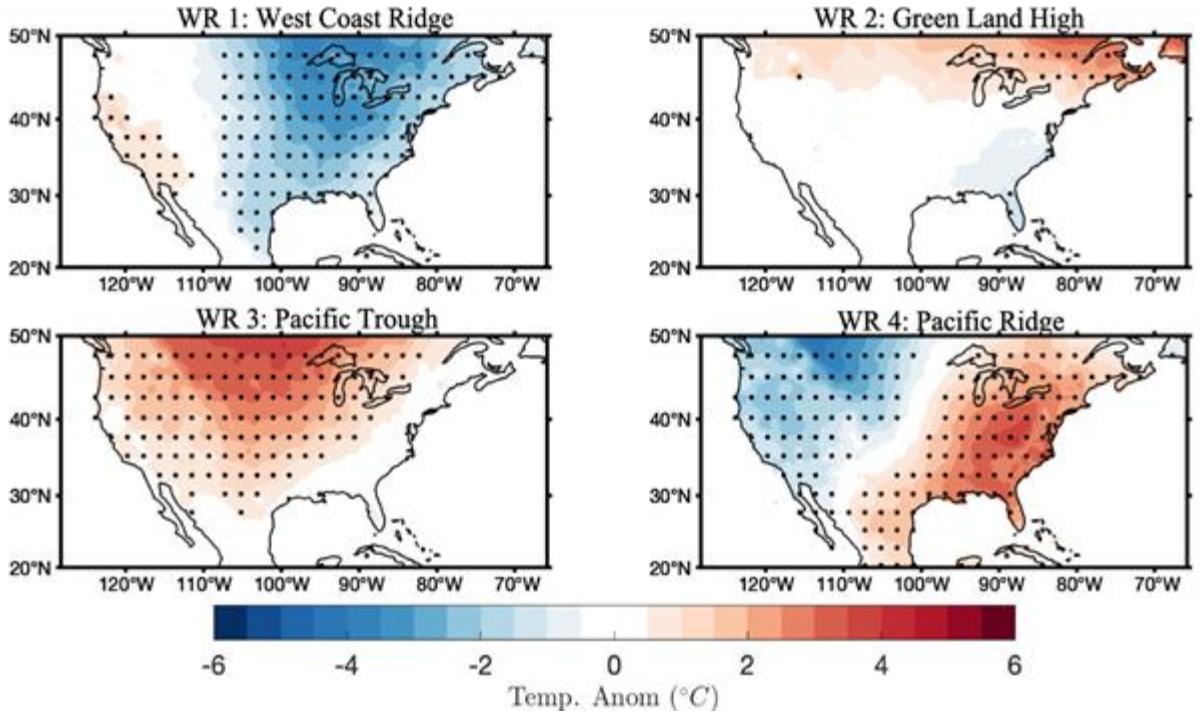
For more information about the forecast product: https://wiki.iri.columbia.edu/index.php?n=Climate.S2S-WRs

IRI North American Weather Regime Forecasts

Precipitation



Temperature

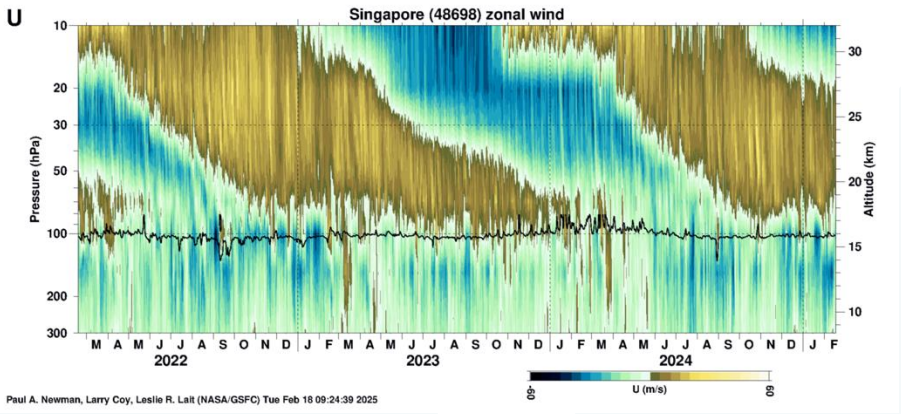


This graphic shows composite mean precipitation (left) and temperature (right) anomalies associated with each weather regime. Stippling (black dots) indicate statistically significant anomalies.

- Below-normal precipitation and above-normal temperature predicted over CA during Weeks 2–3 (24 Feb – 9 Mar) with high confidence in West Coast Ridge regime
- Near-normal precipitation and below-normal temperature predicted over CA during Week 4 (10–16 Mar) with moderate confidence in Pacific Ridge regime

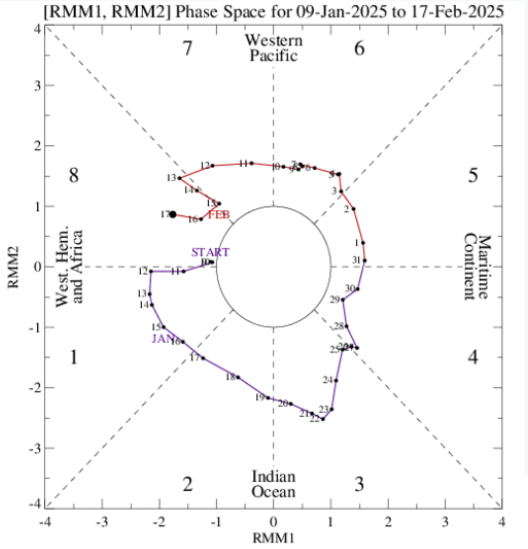
Background Info: AR Activity and Precipitation Based on MJO and QBO

QBO Conditions



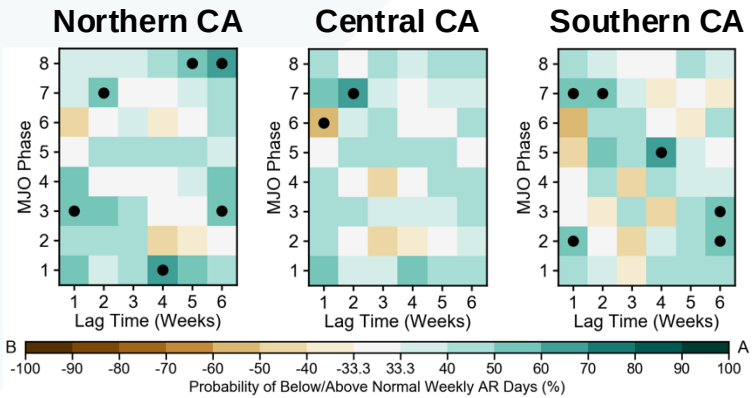
QBO is in the westerly phase at 50-hPa

MJO Conditions

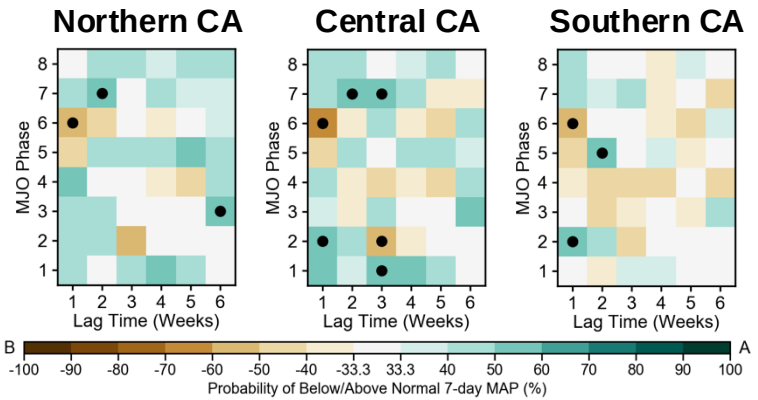


MJO convection is currently located over the Western Hemisphere (Phase 8)

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



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

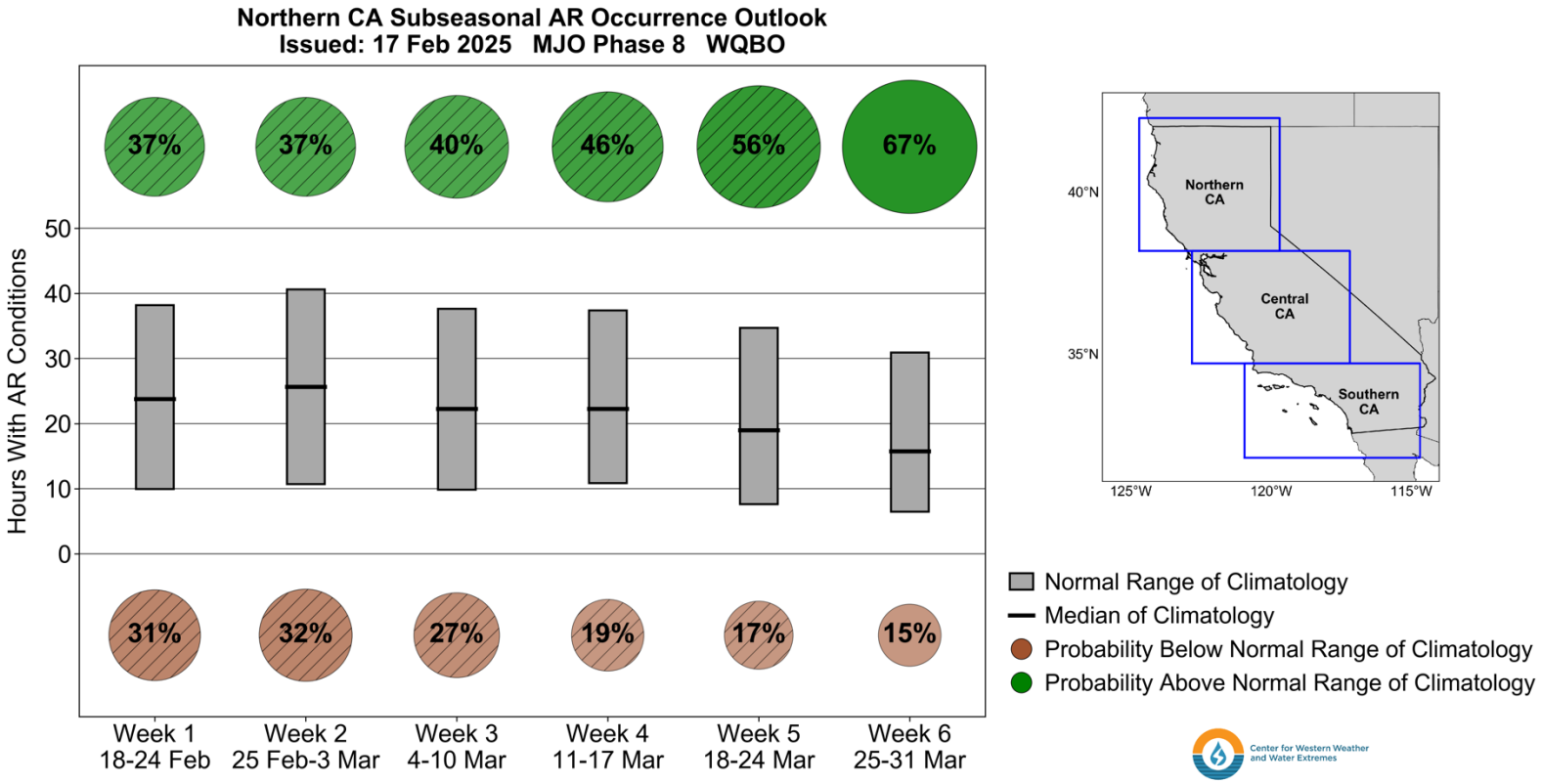


Probability matrices illustrating the weeks 1–6 lagged probability of below-normal (brown shading) or above-normal (green shading) AR occurrence and precipitation for all MJO phases when the QBO is in the westerly phase during JFM in Northern CA (left), Central CA (middle), and Southern CA (right). White 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 17 Feb 2025

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

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)

- 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 Weeks 4–5 (11–24 Mar) and high likelihood (>60% probability) of above-normal AR occurrence during Week 6 (25–31 Mar) in Northern CA**
- Moderate likelihood of above-normal AR occurrence in Central CA during Week 3 (4–10 Mar), Week 5 (18–24 Mar), and Week 6
- Moderate likelihood of above-normal AR occurrence in Southern CA during Week 5

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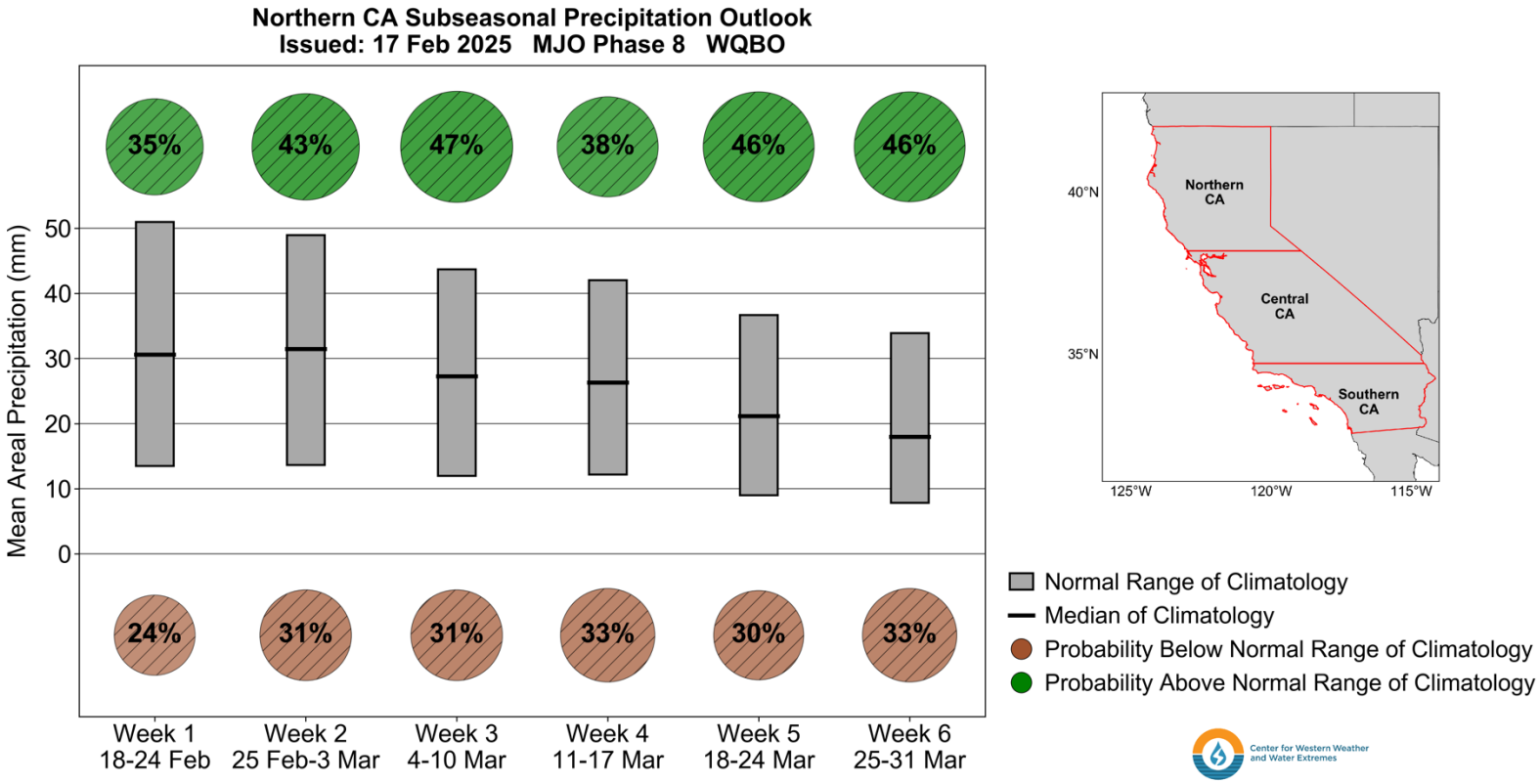
AR Activity and Precipitation Based on MJO and QBO

Forecasts Initialized 17 Feb 2025

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 above-normal precipitation in Northern CA during Weeks 2–3 (4–17 Mar) and Weeks 5–6 (18–31 Mar)**
- Moderate likelihood of above-normal precipitation in Central CA during Week 2 (25 Feb – 3 Mar) and Week 5

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***