



Center for Western Weather
and Water Extremes

SCRIPPS INSTITUTION OF OCEANOGRAPHY
AT UC SAN DIEGO

CW3E Subseasonal Outlook: 25 February 2025

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

UC San Diego



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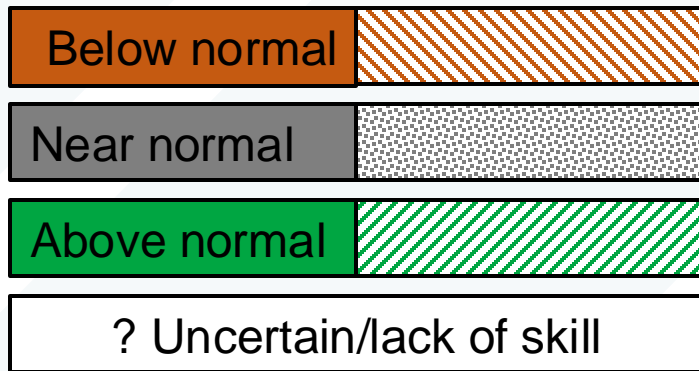
Summary: Subseasonal Precipitation Outlook by Model

This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 24 Feb 2025

Region	Week 2 (3–9 Mar)				Week 3 (10–16 Mar)				Week 4 (10–16 Mar)			
	NCEP ^{1,2,3}	ECMWF ^{1,2}	ECMWF ^{1,2}	Multi-Model Forecast	NCEP ^{1,2,3}	ECMWF ^{1,2}	ECMWF ^{1,2}	Multi-Model Forecast	NCEP ^{1,2,3}	ECMWF ^{1,2}	ECMWF ^{1,2}	Multi-Model Forecast
WA/OR	Below normal	Below normal	Below normal	Below normal	Above normal	Near normal	Above normal	Above normal	Above normal	Below normal	Above normal	Above normal
Northern CA	Uncertain	Near normal	Uncertain	Uncertain	Above normal	Near normal	Uncertain	Uncertain	Above normal	Below normal	Uncertain	Uncertain
Central CA	Uncertain	Above normal	Uncertain	Uncertain	Uncertain	Near normal	Uncertain	Uncertain	Above normal	Near normal	Uncertain	Uncertain
Southern CA	Below normal	Near normal	Below normal	Below normal	Uncertain	Near normal	Below normal	Uncertain	Above normal	Near normal	Below normal	Uncertain

Higher Confidence | Lower Confidence



- Models lean towards below-normal precipitation in Southern CA during Week 2; more uncertainty in Northern and Central CA
- Uncertain precipitation conditions in all of CA during Weeks 3-4

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

MJO/QBO Conditions

- MJO is currently in weak condition over Africa (Phase 1); QBO is in the westerly phase
- Models are forecasting MJO convection to intensify over Africa in Week 1 and propagate to the Indian Ocean (Phase 2) in Week 2

Week 2 forecasts (3–9 Mar):

- Models disagree somewhat on AR activity over CA during Week 2
 - In Northern CA, NCEP and ECCO are forecasting near-normal AR activity, but ECMWF is forecasting slightly above-normal AR activity
 - In Central CA, NCEP is forecasting slightly above-normal to above-normal AR activity, but ECCO and ECMWF are forecasting near-normal to slightly above-normal AR activity
 - In Southern CA, ECCO and ECMWF are forecasting near-normal AR activity, but NCEP is forecasting above-normal AR activity
- Ridging outlooks show very high likelihood of above-normal ridging activity near the US West Coast during Weeks 1–2
 - NCEP and ECMWF are both forecasting a very high likelihood of above-normal North-ridge activity (dry conditions over all of CA) and above-normal South-ridge activity (wet conditions over far Northern CA; dry conditions over Southern CA)
- IRI weather regime tool shows high likelihood of West Coast Ridge (below-normal precipitation in CA) during Week 2

Summary

Week 3 Forecasts (10–16 Mar):

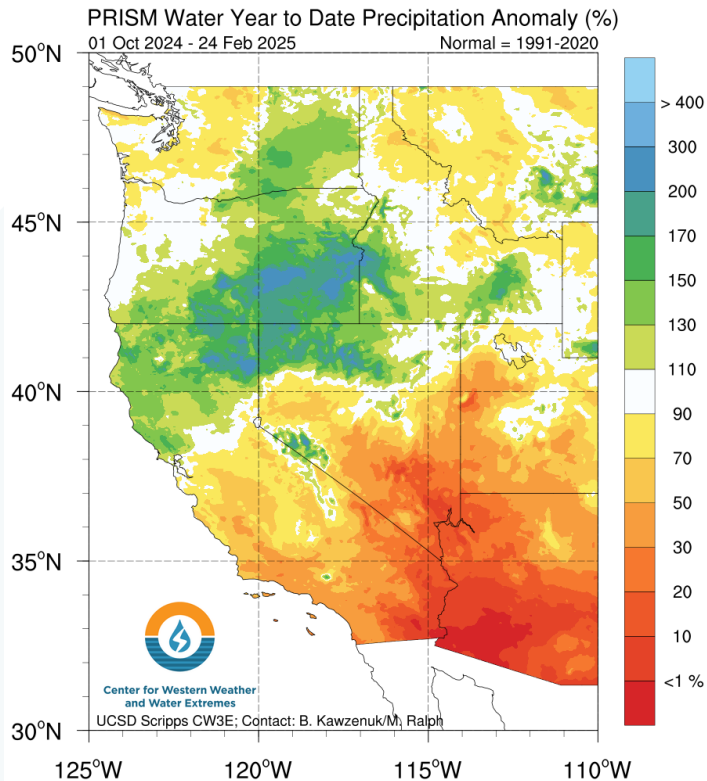
- Models disagree somewhat on AR activity over CA during Week 3
 - NCEP is forecasting above-normal AR activity over all of CA
 - ECCC and ECMWF are forecasting near-normal AR activity over nearly all of CA
- Ridging outlooks show moderate likelihood of above-normal South-ridge activity (wet conditions 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 moderate likelihood of regime shift from West Coast Ridge (below-normal precipitation in CA) to Pacific Ridge (near-normal precipitation in CA) during Week 3

Week 4 Forecasts (17–23 Mar):

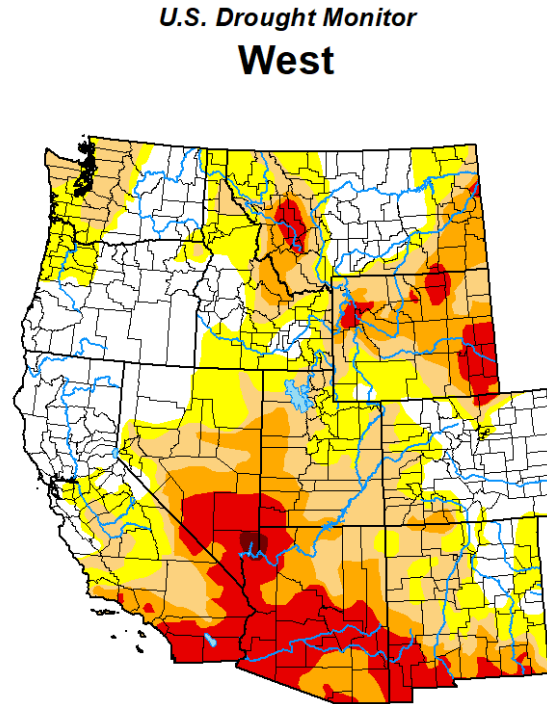
- Models disagree somewhat on AR activity over CA during Week 4
 - In Northern CA, NCEP is forecasting above-normal AR activity, ECCC is forecasting slightly below-normal AR activity, and ECMWF is forecasting near-normal AR activity
 - In Central CA, NCEP is forecasting above-normal AR activity, while ECCC and ECMWF are forecasting near-normal AR activity
 - In Southern CA, NCEP is forecasting slightly above-normal AR activity, while ECCC and ECMWF are forecasting near-normal AR activity
- IRI weather regime tool shows low likelihood of regime shift from Pacific Ridge (near-normal precipitation in CA) to Pacific Trough (above-normal precipitation in CA) during Week 4

Hydrologic Summary

Precipitation



Drought Conditions



February 18, 2025

(Released Thursday, Feb. 20, 2025)

Valid 7 a.m. EST

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	29.93	70.07	48.78	27.72	12.78	0.26
Last Week 02-11-2025	27.33	72.67	50.88	29.13	13.01	0.26
3 Months Ago 11-19-2024	19.56	80.44	40.91	18.03	5.81	0.10
Start of Calendar Year 01-01-2025	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 02-20-2024	49.39	50.61	26.17	10.88	2.32	0.36

Intensity:

None	D2 Severe Drought
D0 Abnormally Dry	D3 Extreme Drought
D1 Moderate 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



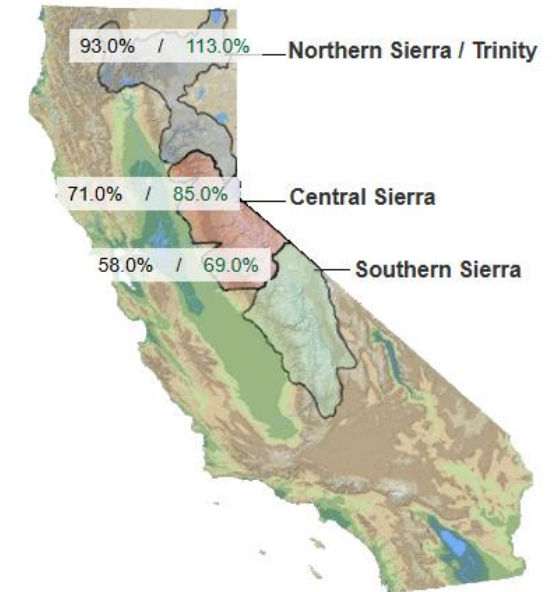
droughtmonitor.unl.edu

Snowpack Conditions

Provided by the California Cooperative Snow Surveys

Data For: 24-Feb-2025

% Apr 1 Avg. / % Normal for this Date



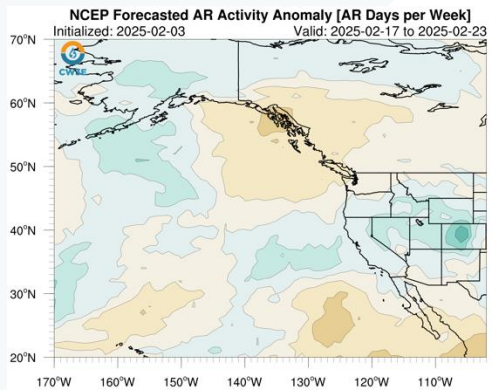
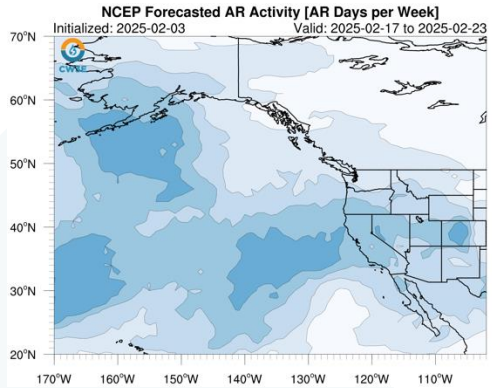
Source: California DWR

- As of 24 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 20 Feb is showing **moderate-to-extreme drought (D1–D3)** in Southern CA and **abnormally dry-to-moderate drought (D0-D1)** over much of Central CA
- Current snowpack is **slightly above normal (113% of normal)** in the Northern Sierra Nevada/Trinity region, **slightly below normal (85% of normal)** in the Central Sierra Nevada, and **below normal (69% of normal)** in the Southern Sierra Nevada

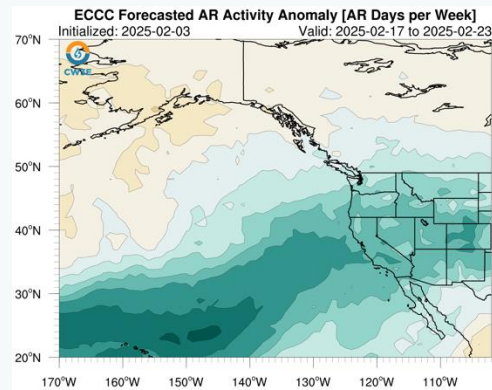
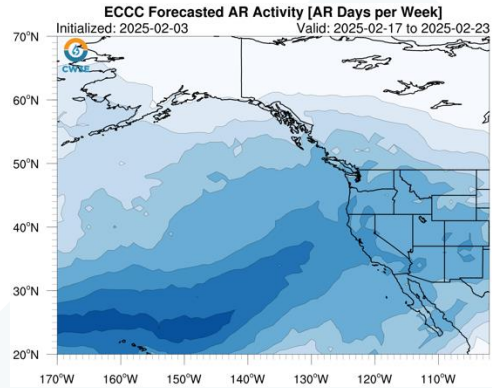
Looking Back: Week 3 AR Activity Forecasts

Forecasts Initialized 3 Feb 2025; Valid: 17–23 Feb 2025

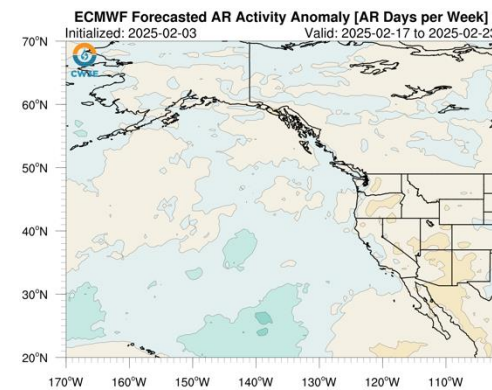
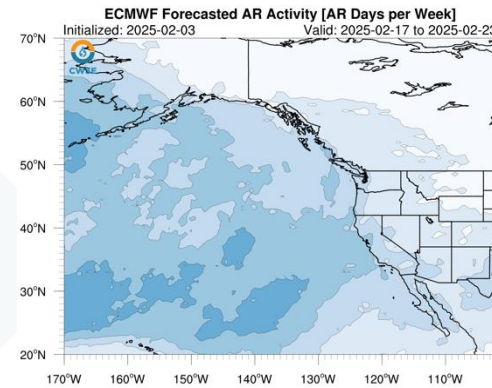
NCEP



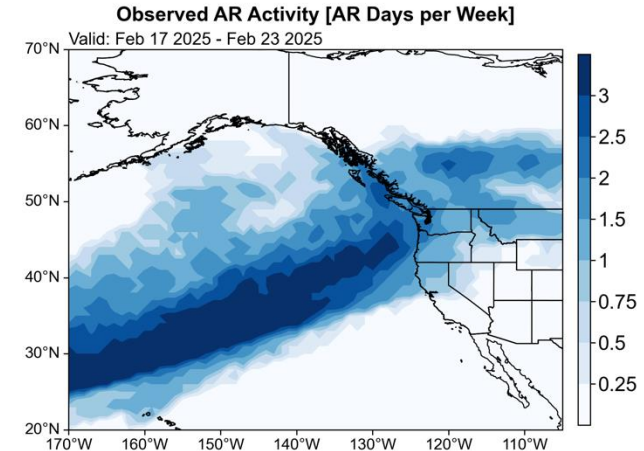
EC3C



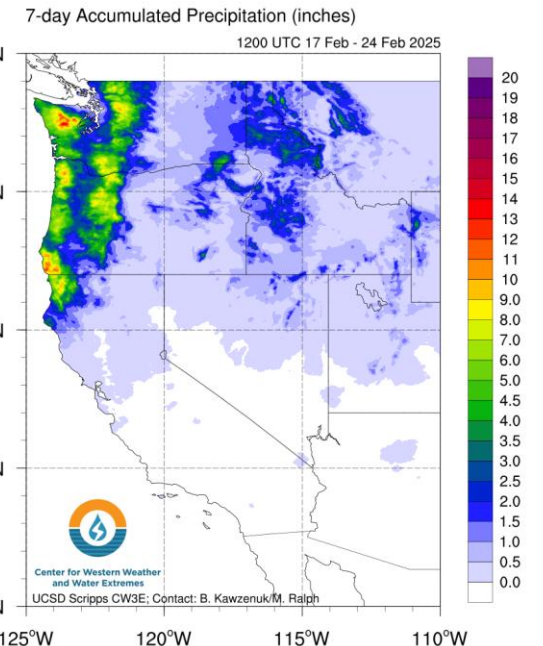
ECMWF



Observed (GFS Analysis)



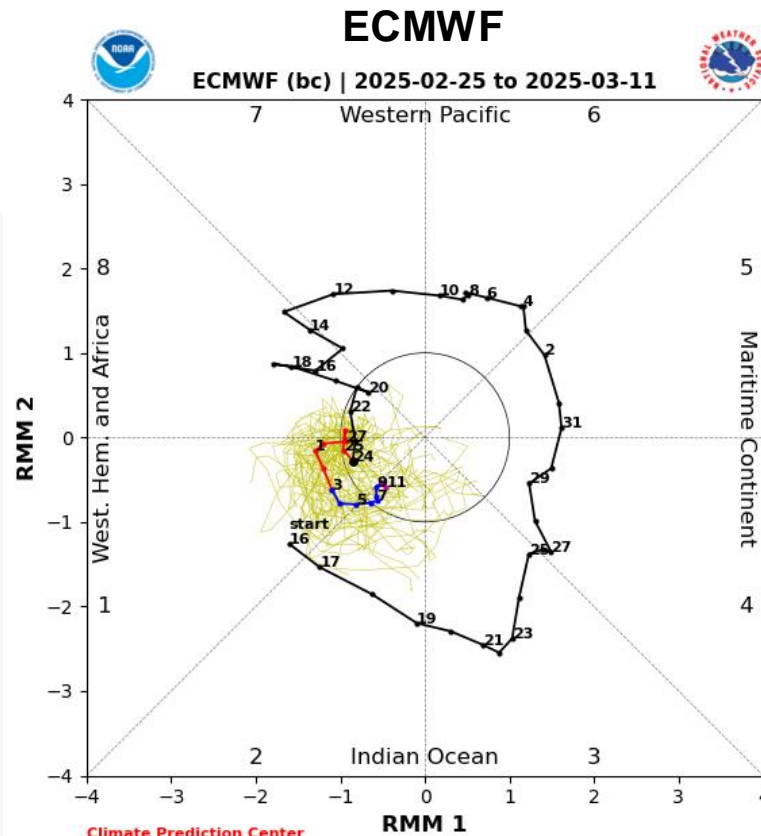
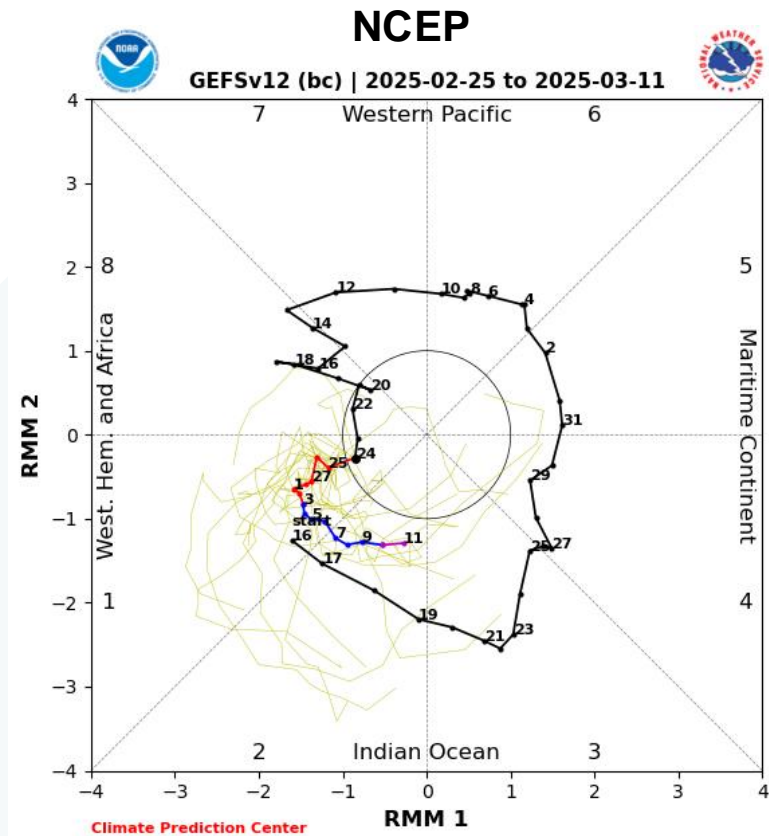
Observed Precipitation



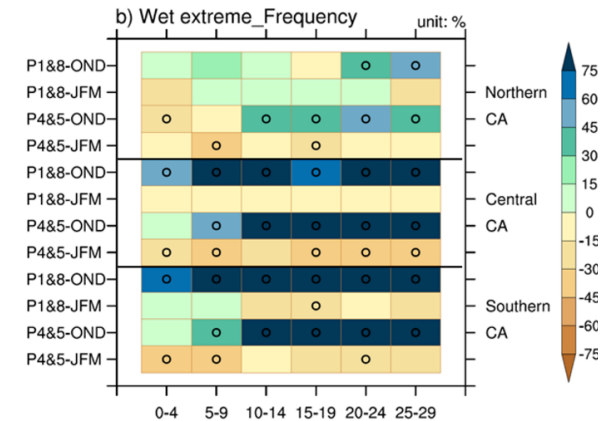
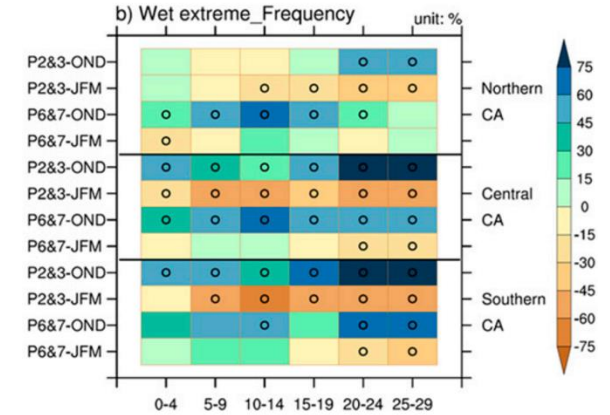
Shading: Fractional # of AR days forecast over a 7-day period (top) and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

- EC3C generally captured the AR activity over the Pacific Northwest and Northern California; NCEP and ECMWF also captured some AR activity over those regions with underestimated magnitude
- All models predicted the center of the AR activity too south and therefore overestimated the AR activity over Central and Southern California and some inland regions
- Multiple ARs produced heavy precipitation (>7 inches of precipitation) over the Olympic Peninsula, Washington and Oregon Coast Ranges and Cascades during much of the week

Dynamical Model MJO Forecasts (NCEP vs. ECMWF)



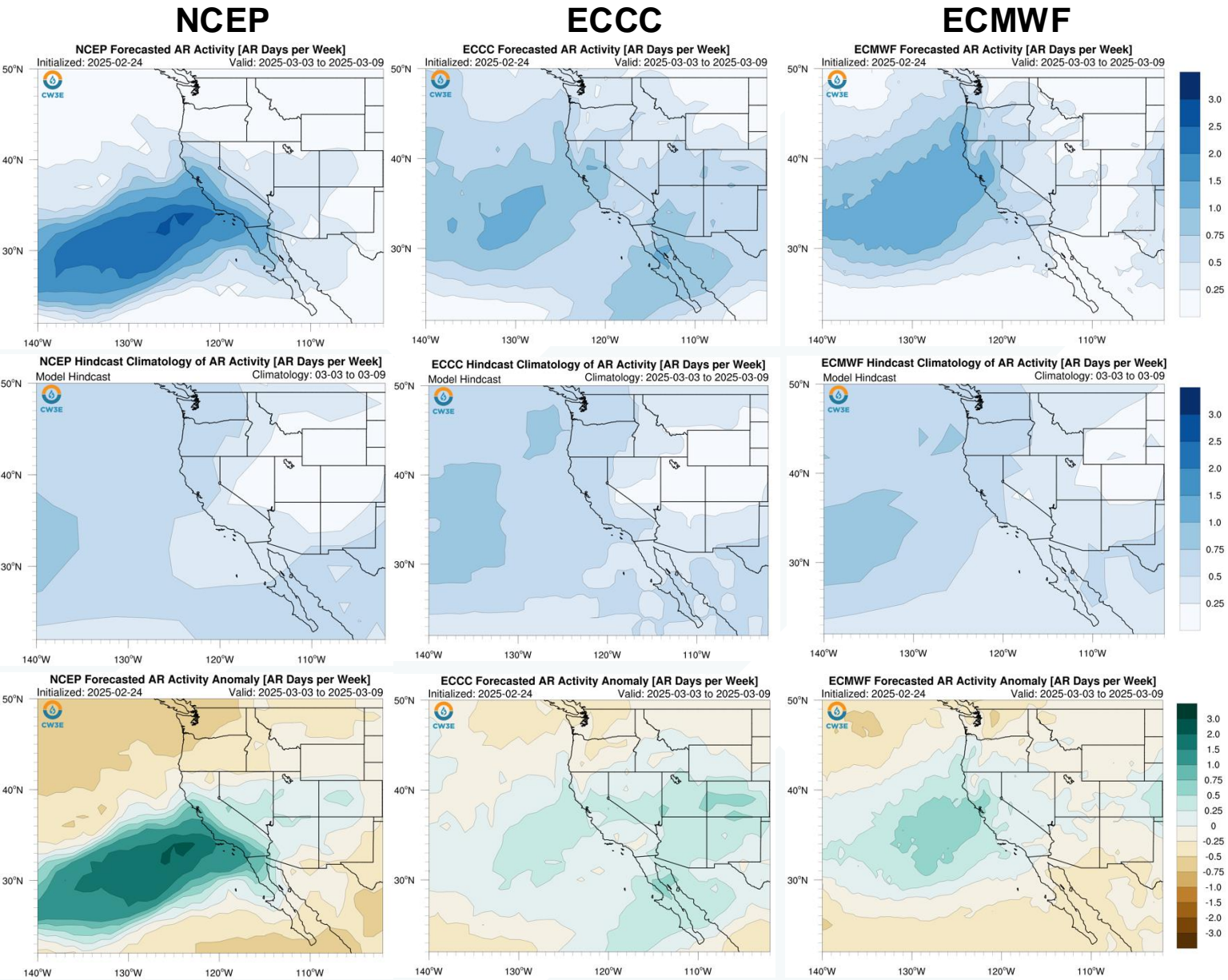
Black: Last 40 days of observations (16 Jan – 24 Feb); Red: Week 1 (25 Feb–3 Mar) ensemble mean; Blue: Week 2 (4–10 Mar) ensemble mean; Yellow: Ensemble members



- MJO is currently in weak condition over Africa (Phase 1)
- NCEP and ECMWF are forecasting MJO convection to intensify over Africa in Week 1 and propagate to the Indian Ocean (Phase 2) in Week 2
- ECMWF is also predicting MJO to weaken at the end of Week 2
- MJO impacts on wet extremes are only valid when MJO convection is strong

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

Forecasts Initialized 24 Feb 2025



- Over Northern CA, NCEP and ECCC are forecasting near-normal AR activity, but ECMWF is forecasting slightly above-normal AR activity during Week 2 (3–9 Mar)
- Over Central CA, NCEP is forecasting slightly above-normal to above-normal AR activity, but ECCC and ECMWF are forecasting near-normal to slightly above-normal AR activity
- Over Southern CA, ECCC and ECMWF are forecasting near-normal AR activity, but NCEP is forecasting above-normal AR activity

Models disagree somewhat on AR activity over CA during Week 2 (3–9 Mar)

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)

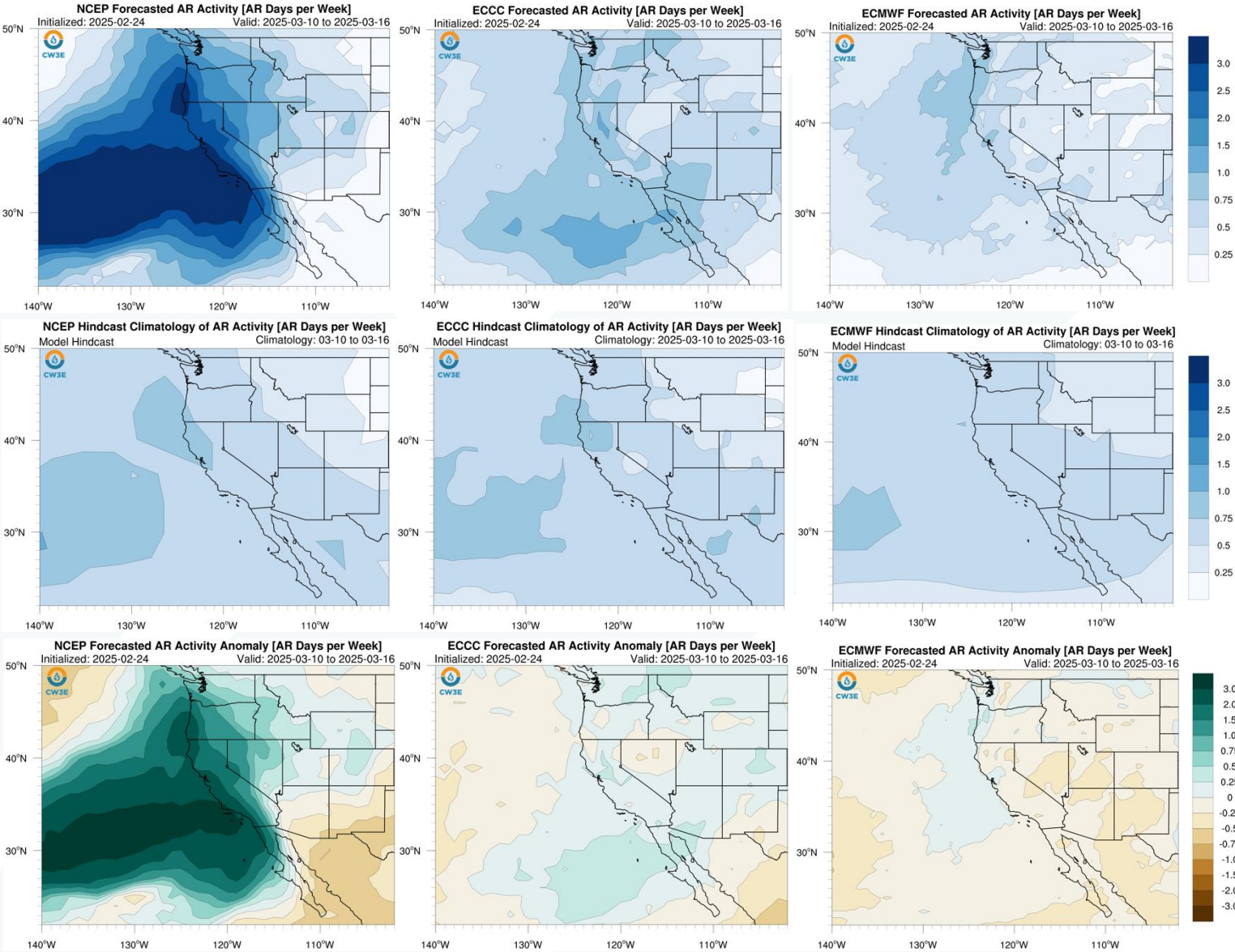
AR Activity Forecasts: Week 3 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 24 Feb 2025

NCEP

ECCC

ECMWF



- NCEP is forecasting above-normal AR activity over all of CA during Week 3 (10–16 Mar)
- ECCC and ECMWF are forecasting near-normal AR activity over nearly all of CA

Models disagree somewhat on AR activity over CA during Week 3 (10–16 Mar)

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)

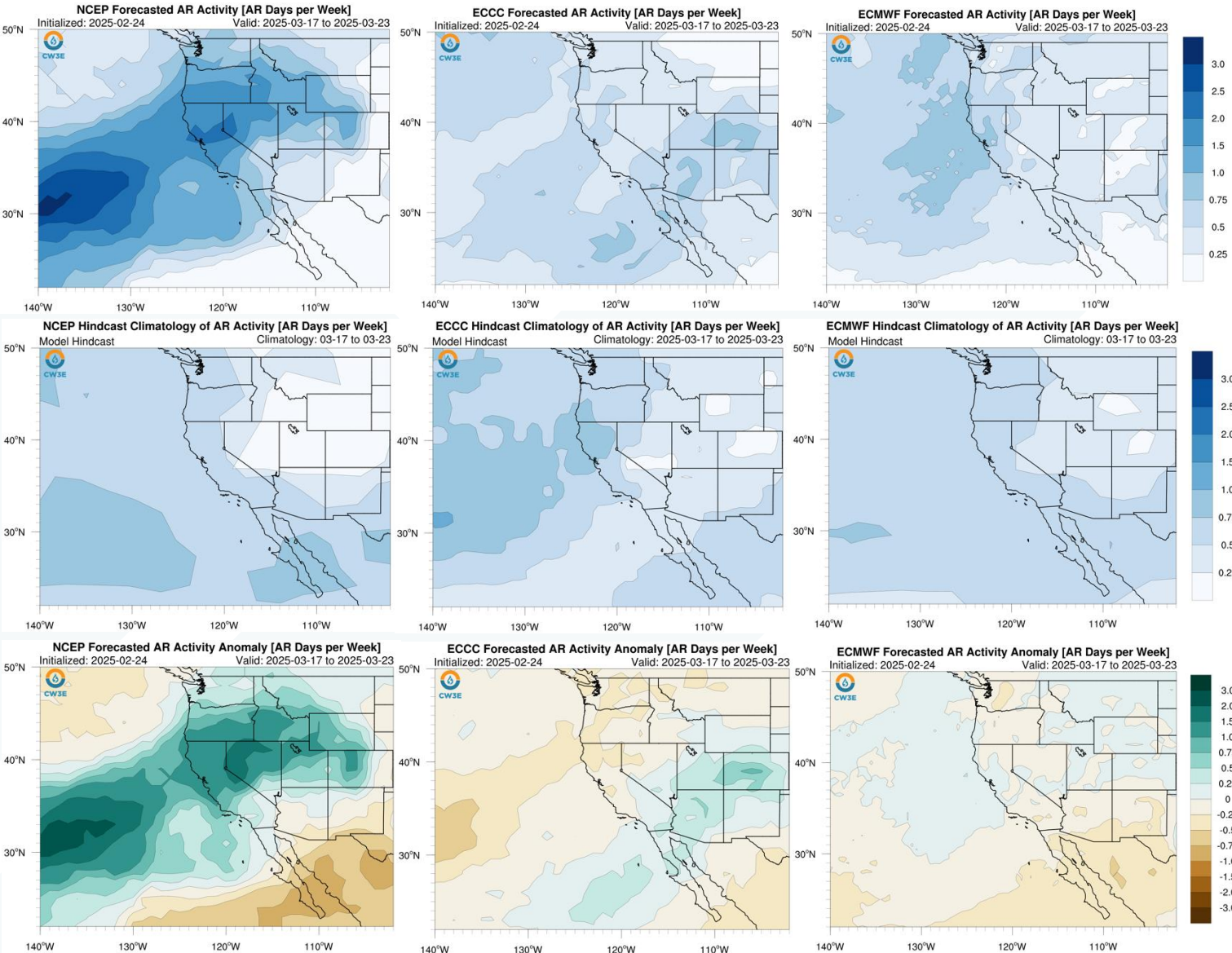
AR Activity Forecasts: Week 4 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 24 Feb 2025

NCEP

ECCC

ECMWF

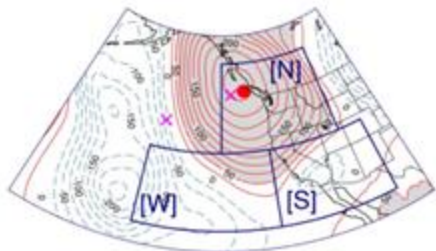


- Over Northern CA, NCEP is forecasting above-normal AR activity, ECCC is forecasting slightly below-normal AR activity, and ECMWF is forecasting near-normal AR activity during Week 4 (17–23 Mar)
- Over Central CA, NCEP is forecasting above-normal AR activity, while ECCC and ECMWF are forecasting near-normal AR activity
- Over Southern CA, NCEP is forecasting slightly above-normal AR activity, while ECCC and ECMWF are forecasting near-normal AR activity

Models disagree somewhat on AR activity over CA during Week 4 (17–23 Mar)

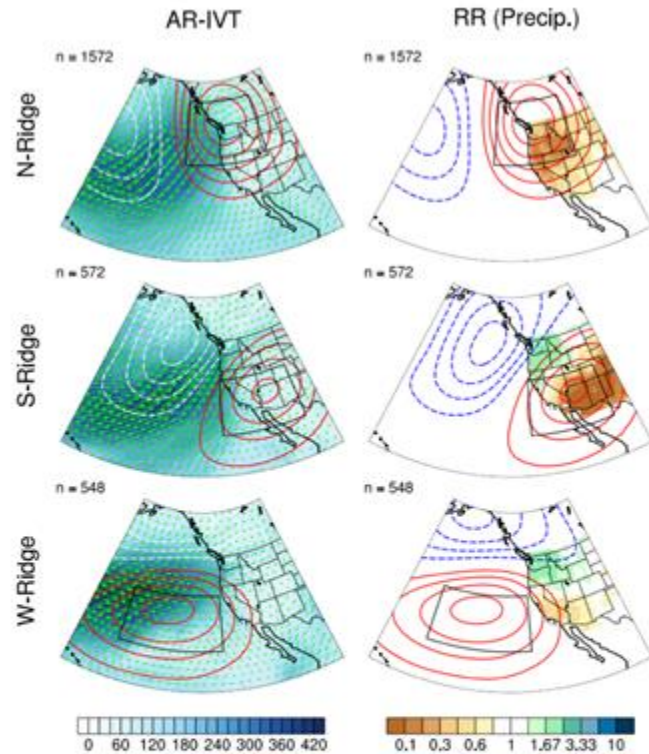
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

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



- 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

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



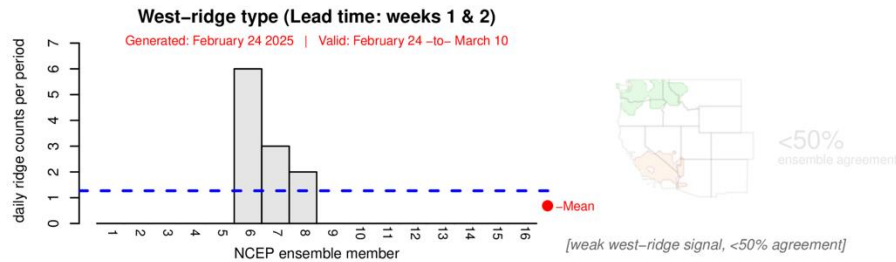
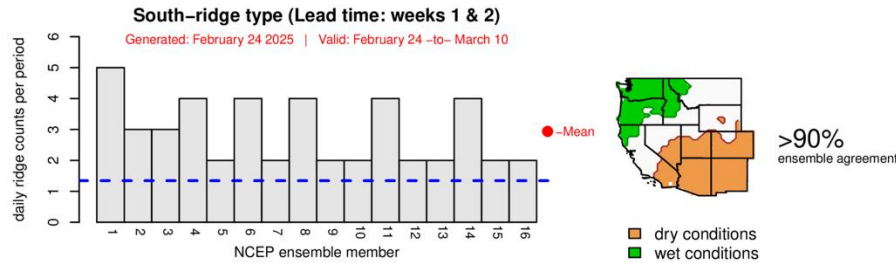
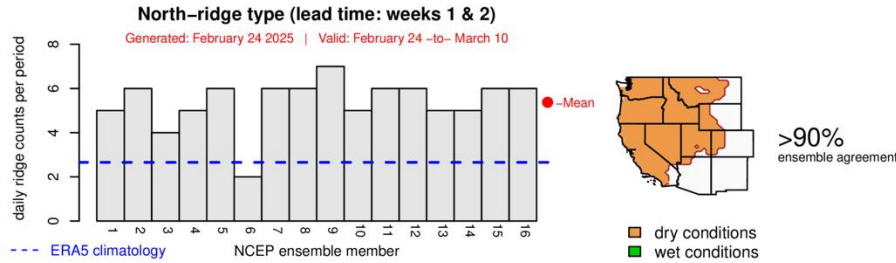
Contact: pgibson@ucsd.edu
Reference: Gibson et al. (2020)
Journal of Climate

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

Forecasts Initialized 24 Feb 2025

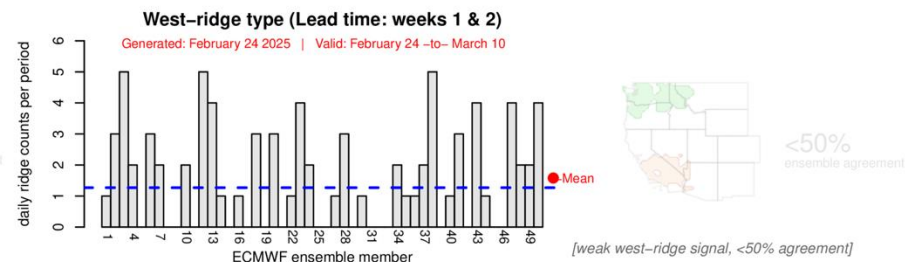
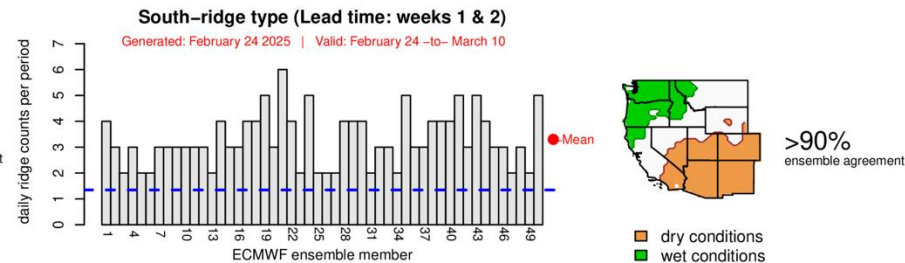
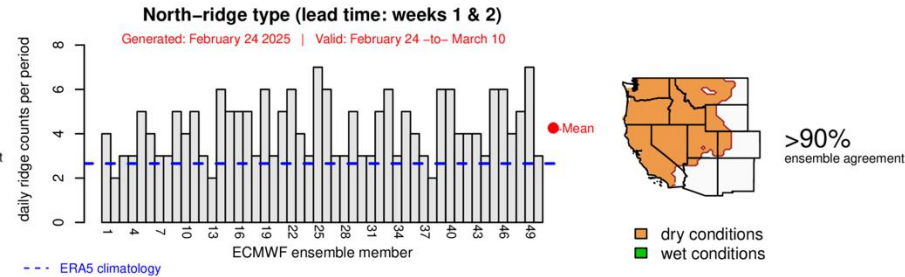
NCEP

CW3E Subseasonal Ridging Forecast (Uses NCEP CFSv2 model)



ECMWF

CW3E Subseasonal Ridging Forecast (Uses ECMWF model)



- NCEP and ECMWF are both forecasting a very high likelihood (>90% ensemble agreement) of above-normal North-ridge and South-ridge activity during Weeks 1–2 (24 Feb – 10 Mar)
- ECMWF is also forecasting slightly above-normal West-ridge activity with low confidence (<50% ensemble agreement)

Models show very high likelihood of above-normal ridging activity near the US West Coast during Weeks 1–2 (24 Feb – 10 Mar)



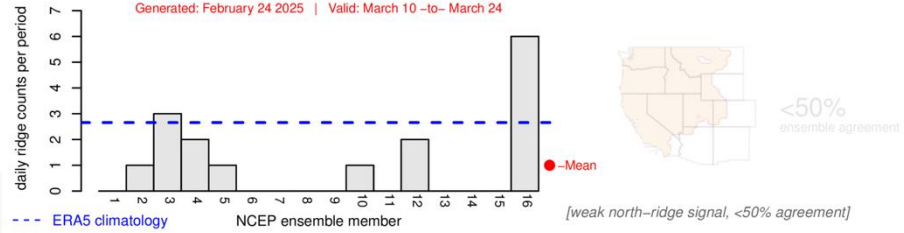
Ridging Forecasts: Weeks 3–4 (NCEP vs. ECMWF)

Forecasts Initialized 24 Feb 2025

NCEP

CW3E Subseasonal Ridging Forecast (Uses NCEP CFSv2 model)

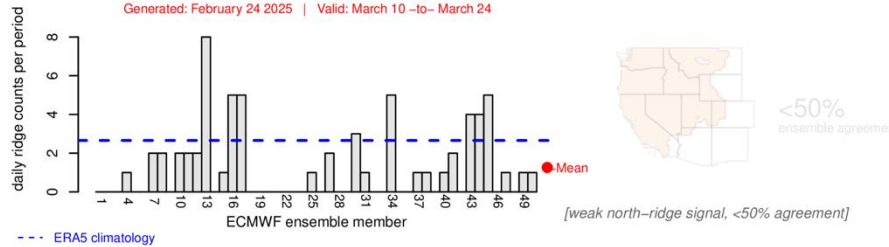
North-ridge type (lead time: weeks 3 & 4)
Generated: February 24 2025 | Valid: March 10 –to– March 24



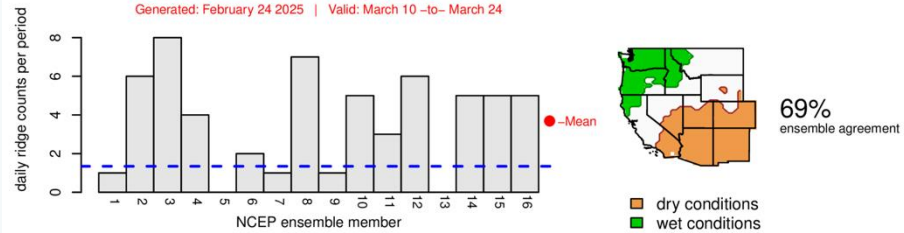
ECMWF

CW3E Subseasonal Ridging Forecast (Uses ECMWF model)

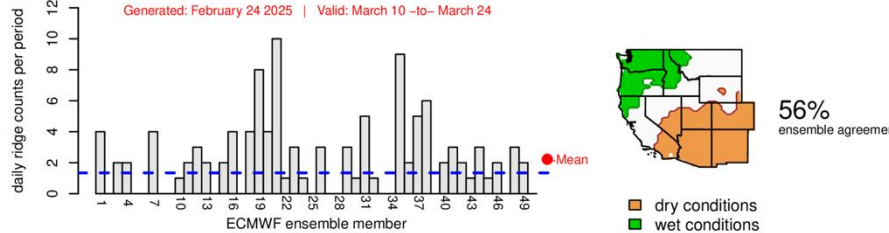
North-ridge type (lead time: weeks 3 & 4)
Generated: February 24 2025 | Valid: March 10 –to– March 24



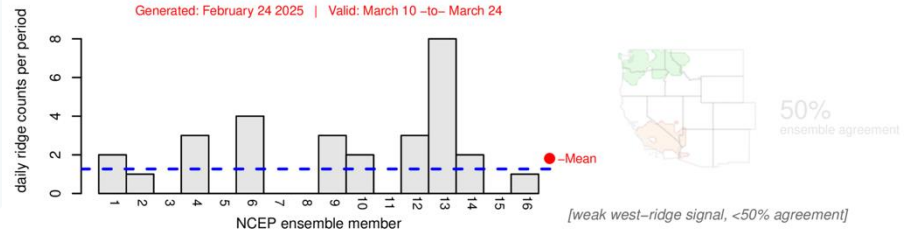
South-ridge type (Lead time: weeks 3 & 4)
Generated: February 24 2025 | Valid: March 10 –to– March 24



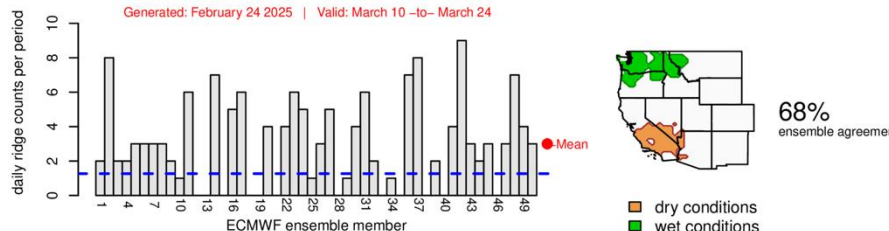
South-ridge type (Lead time: weeks 3 & 4)
Generated: February 24 2025 | Valid: March 10 –to– March 24



West-ridge type (Lead time: weeks 3 & 4)
Generated: February 24 2025 | Valid: March 10 –to– March 24



West-ridge type (Lead time: weeks 3 & 4)
Generated: February 24 2025 | Valid: March 10 –to– March 24



- NCEP and ECMWF are both forecasting a moderate likelihood (50-70% ensemble agreement) of above-normal South-ridge activity during Weeks 3–4 (10–24 Mar)
- ECMWF is also forecasting a moderate likelihood (68% ensemble agreement) of above-normal West-ridge activity
- Both models are forecasting below-normal North-ridge activity

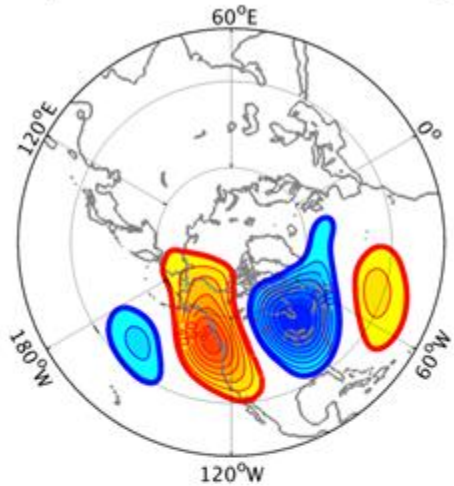


Models show moderate likelihood of above-normal ridging activity over the southwestern US during Weeks 3–4 (10–24 Mar)

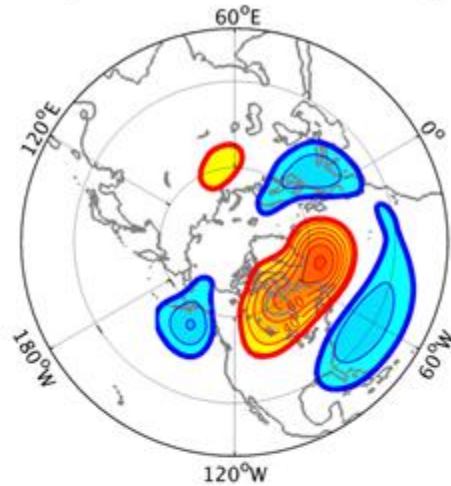


Background Info: IRI Subseasonal Weather Regime Forecasts

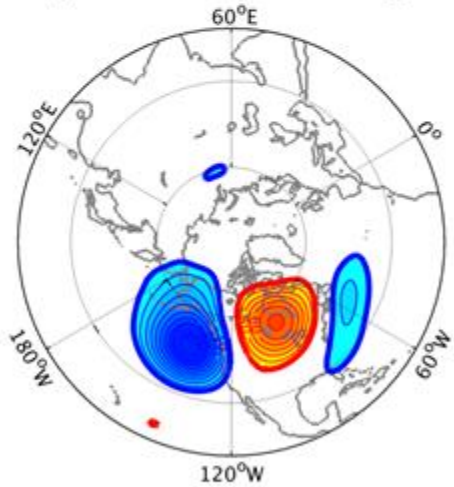
a) WR 1: West Coast Ridge



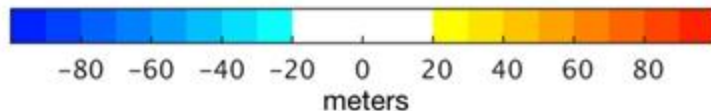
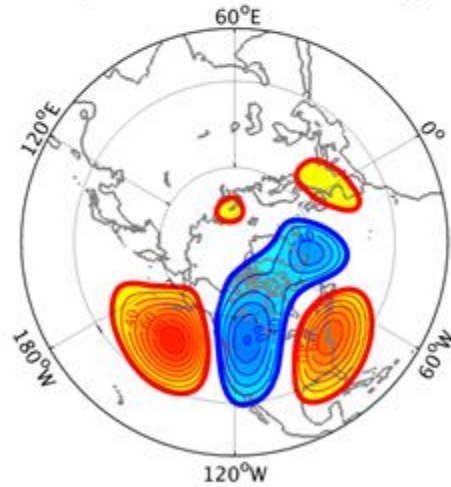
b) WR 2: Greenland High



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)

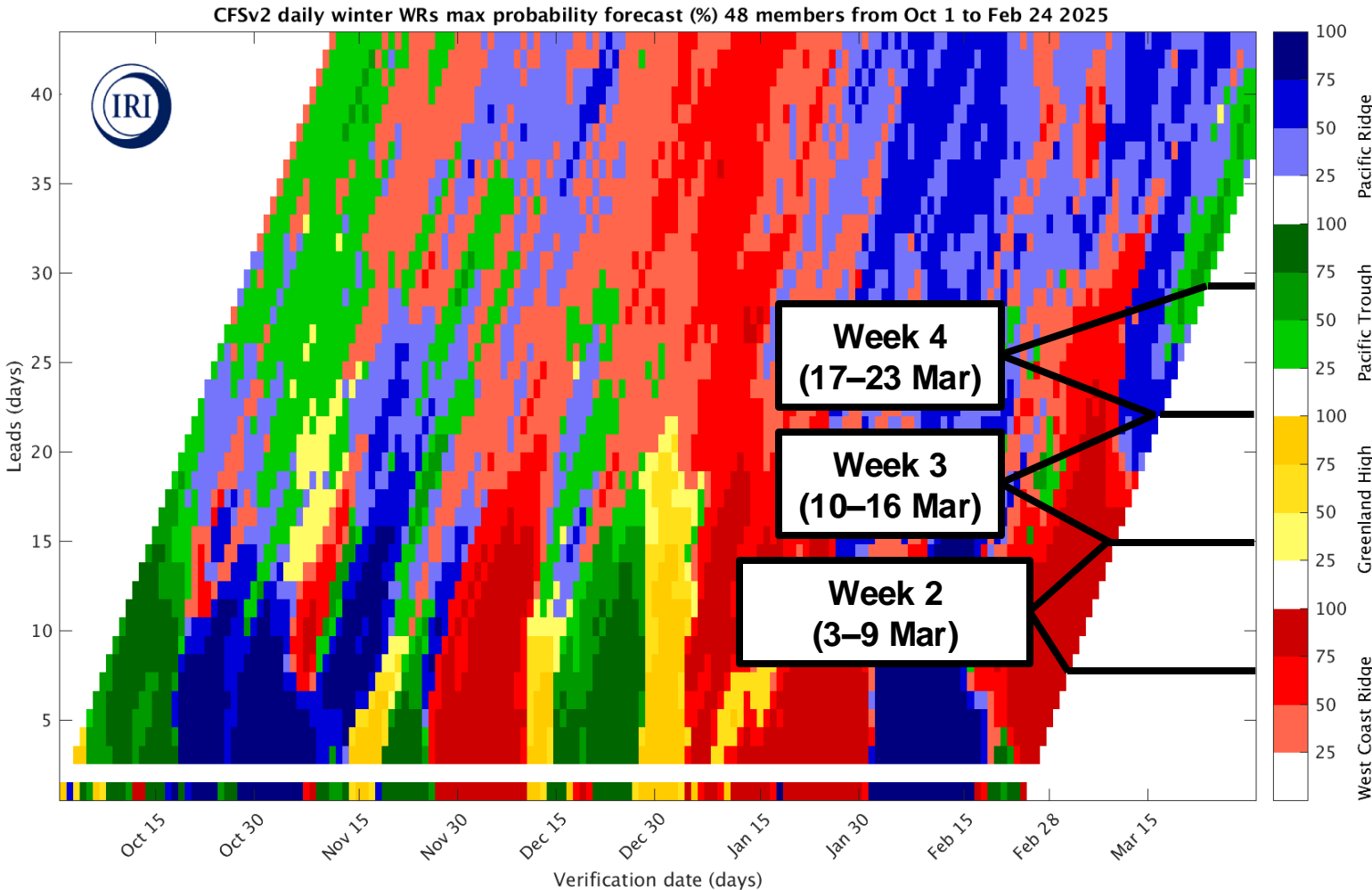
Reference: [Robertson et al. \(2020\)](#)

For more information about the forecast product:

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

IRI North American Weather Regime Forecasts

Forecast Initialized 24 Feb 2025



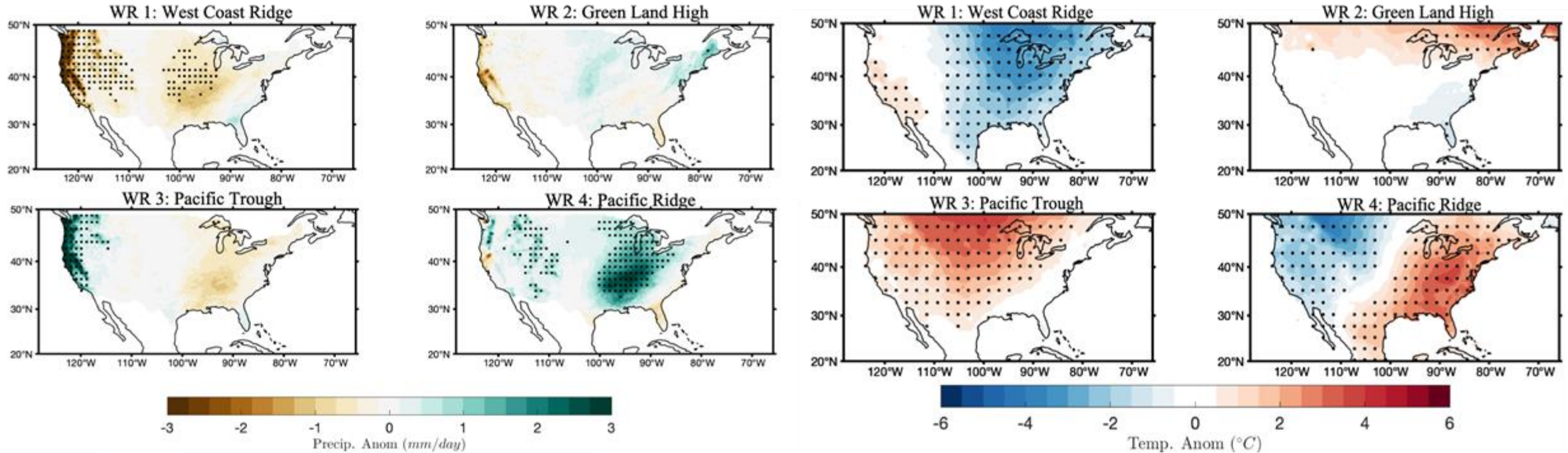
- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble
- High likelihood ($\geq 75\%$ ensemble agreement) of West Coast Ridge during Week 2 (3–9 Mar)
- Moderate likelihood (50-75% ensemble agreement) of transition to Pacific Ridge during Week 3 (10–16 Mar)
- Low likelihood (25-50% ensemble agreement) of transition to Pacific Trough during Week 4 (17-23 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.

IRI North American Weather Regime Forecasts

Precipitation

Temperature



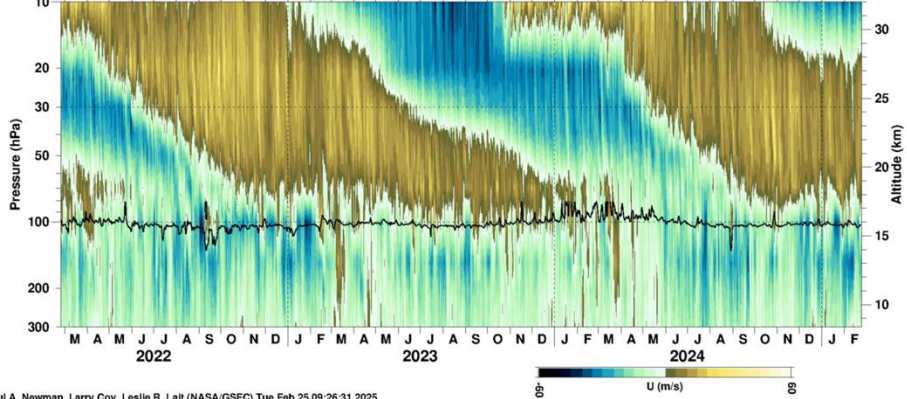
This graphic shows composite mean precipitation (left) and temperature (right) anomalies associated with each weather regime. Stippling (black dots) indicate statistically significant anomalies.

- Below-normal precipitation and above-normal temperature predicted over CA during Week 2 (3–9 Mar) with high confidence in West Coast Ridge regime
- Moderate likelihood of regime transition to near-normal precipitation and below-normal temperature over CA (Pacific Ridge regime) during Week 3 (10–16 Mar)
- Low likelihood of regime transition to above-normal precipitation and above-normal temperature over CA (Pacific Trough regime) during Week 4 (17-23 Mar)

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

QBO Conditions

Singapore (48698) zonal wind



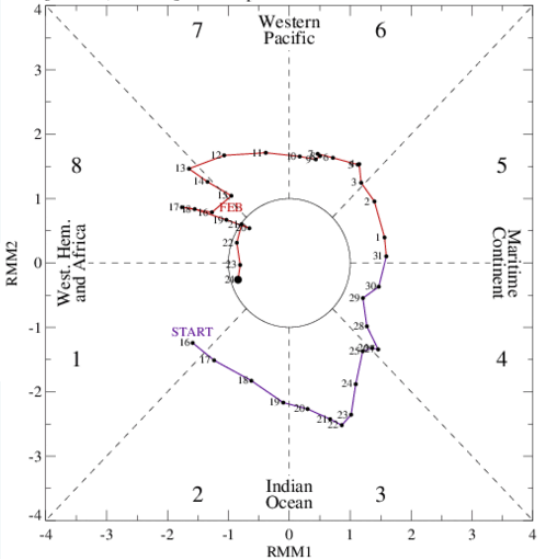
Paul A. Newman, Larry Coy, Leslie R. Lait (NASA/GSFC) Tue Feb 25 09:26:31 2025

QBO is in the westerly phase at 50-hPa

Forecasts unavailable due to weak MJO conditions

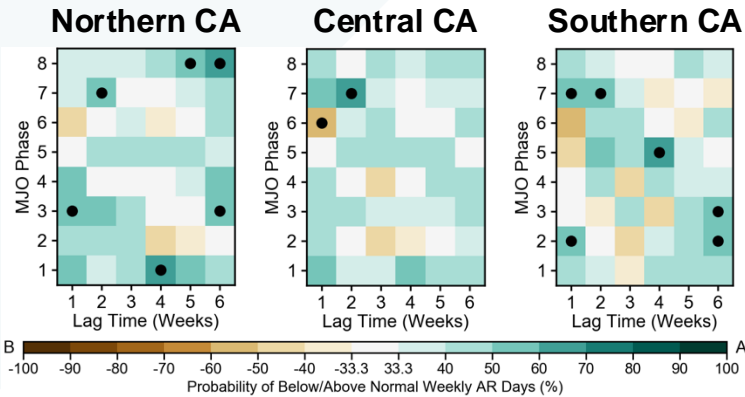
MJO Conditions

[RMM1, RMM2] Phase Space for 16-Jan-2025 to 24-Feb-2025

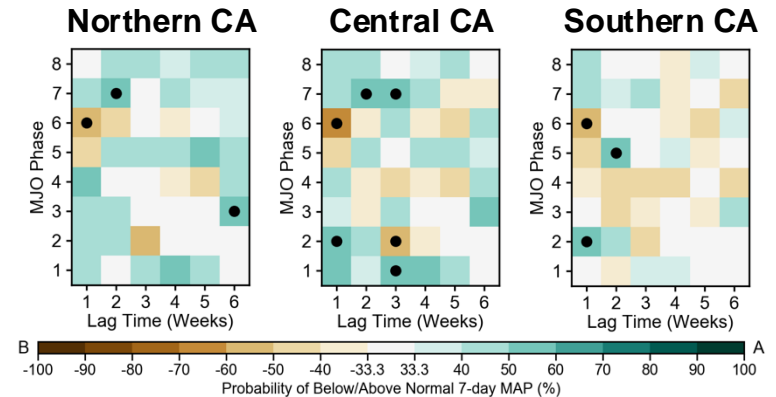


MJO convection is currently in weak condition over Africa (Phase 1)

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.

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*