



Center for Western Weather
and Water Extremes

SCRIPPS INSTITUTION OF OCEANOGRAPHY
AT UC SAN DIEGO

CW3E Subseasonal Outlook: 9 December 2025

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UC San Diego



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 2–4
 - ECCO (Canadian Model): Weeks 2–4
 - ECMWF (European model): Weeks 2–4
- *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

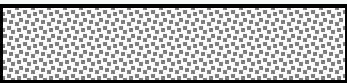
This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 8 Dec 2025

Region	Week 2 (15–21 Dec)				Week 3 (22–28 Dec)				Week 4 (29 Dec–4 Jan)			
	NCEP ^{1,2,3,4}	ECMWF ¹	ECMWF ^{1,2}	Multi-Model Forecast	NCEP ^{1,2,3,4}	ECMWF ¹	ECMWF ^{1,2}	Multi-Model Forecast	NCEP ^{1,2,3,4}	ECMWF ¹	ECMWF ^{1,2}	Multi-Model Forecast
WA/OR	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Lower Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Lower Confidence Above normal	Lower Confidence Above normal	Higher Confidence Above normal	Lower Confidence Above normal
Northern CA	Lower Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Lower Confidence Above normal	Lower Confidence Above normal	Lower Confidence Above normal	Lower Confidence Above normal	Lower Confidence Above normal	Lower Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal
Central CA	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Lower Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal
Southern CA	Higher Confidence Above normal	Lower Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Uncertain/lack of skill	Higher Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal	Lower Confidence Above normal	Higher Confidence Above normal	Higher Confidence Above normal

Higher Confidence | Lower Confidence

Below normal 

Near normal 

Above normal 

? Uncertain/lack of skill

- Models show high confidence in above-normal precipitation in Northern CA during Week 2
- Models also lean towards above-normal precipitation in Northern CA during Week 3
- High degree of uncertainty in expected precipitation over Central and Southern CA during Weeks 2–4

Subseasonal products included in this Outlook:

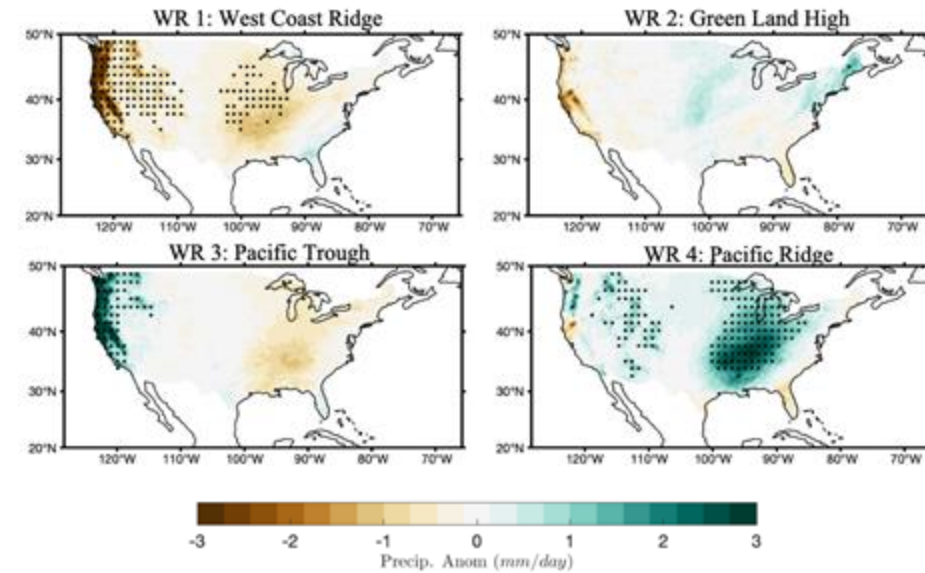
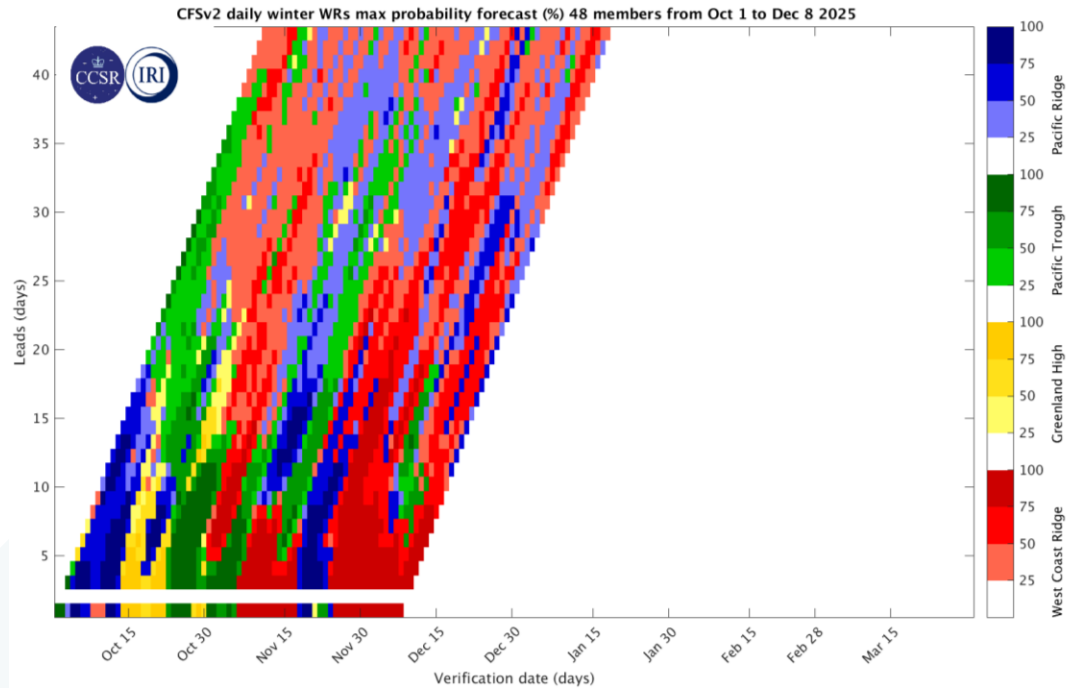
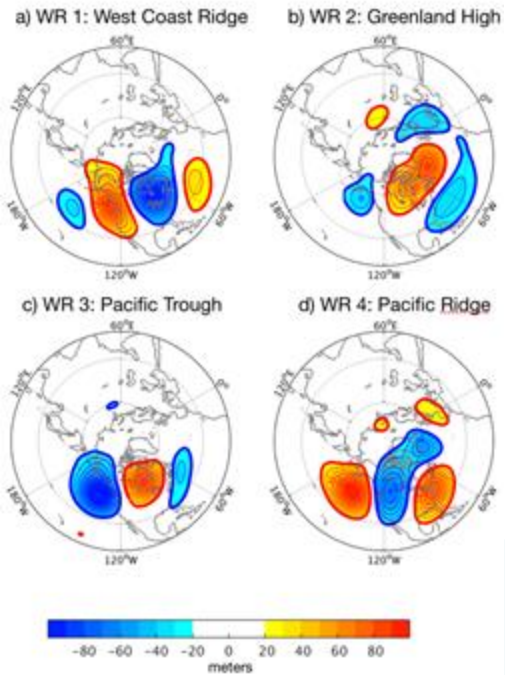
¹CW3E/JPL Atmospheric River Activity Forecasts ([DeFlorio et al. 2019](#), [Zhang et al. 2023](#))

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

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

⁴Daily Weather Regimes Forecasts (Guirguis et al. [2023a](#) and [2023b](#))

Potential Regime Shifts and Persistence



Product	Week 2 (15–21 Dec)	Week 3 (22–28 Dec)	Week 4 (29 Dec–4 Jan)
IRI North American Weather Regime Forecasts	West Coast Ridge ↪ Pacific Ridge	Pacific Ridge	Pacific Ridge

Regime Persistence (Pacific Ridge)
 Regime Shift
 Uncertain

- Potential regime shift from West Coast Ridge (dry and warm conditions in CA) to Pacific Ridge (cold conditions in CA) with low-to-moderate confidence during Week 2
- Potential for persistence of Pacific Ridge with low-to-moderate confidence through Weeks 3-4

Summary

MJO/QBO Conditions

- Weak MJO is currently located over the Western Pacific (Phase 7)
 - Weak MJO has limited impacts on mid-latitude weather and climate
- NCEP is forecasting MJO convection to propagate slightly eastward to the Central Pacific into Phase 8 during early Week 1, then become stationary and gradually strengthen afterwards through the end of Week 2
- CW3E MJO/QBO forecasts are not available due to the weak MJO activity

Week 2 forecasts (15–21 Dec):

- Models agree on above-normal AR activity over CA
- Models agree on a very high likelihood of both South-ridge and West-ridge activity during Weeks 1–2
 - These ridging patterns are associated with dry conditions over Southern CA
- IRI weather regime tool shows moderate likelihood (50-75% ensemble agreement) of transition from West Coast Ridge to Pacific Ridge in Week 2
- CW3E Hybrid Weather Regime tool favors patterns associated with above-normal precipitation in Northern CA and below-normal precipitation over Southern CA during Week 2

Summary

Week 3 Forecasts (22–28 Dec):

- Models agree on above-normal AR activity over much of CA
- Models agree on a moderate likelihood of South-ridge activity during Weeks 3–4
 - This ridging pattern is associated with wet conditions over Northern CA and dry conditions over Southern CA
- IRI weather regime tool shows low-to-moderate likelihood (25-75% ensemble agreement) of persistence of Pacific Ridge regime during Weeks 3-4
- CW3E Hybrid Weather Regime tool favors patterns associated with above-normal precipitation over Northern CA and below-normal precipitation over Southern CA during the first half of Week 3, and is more uncertain during the latter half of Week 3

Week 4 Forecasts (29 Dec–4 Jan):

- Models disagree somewhat on AR activity over CA
 - NCEP and ECCO are predicting slightly above-normal to above-normal AR activity over Northern and Central CA, whereas ECMWF is predicting slightly below-normal to slightly above-normal AR activity
 - ECCO and ECMWF are forecasting slightly above-normal AR activity in Southern CA, whereas NCEP is forecasting near-normal AR activity
- CW3E Hybrid Weather Regime tool shows high uncertainty in Week 4

Looking Back: Week 3 AR Activity Forecasts

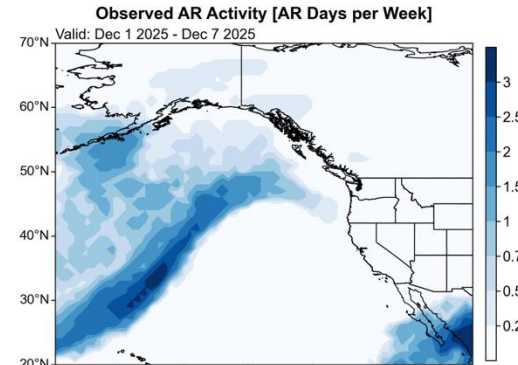
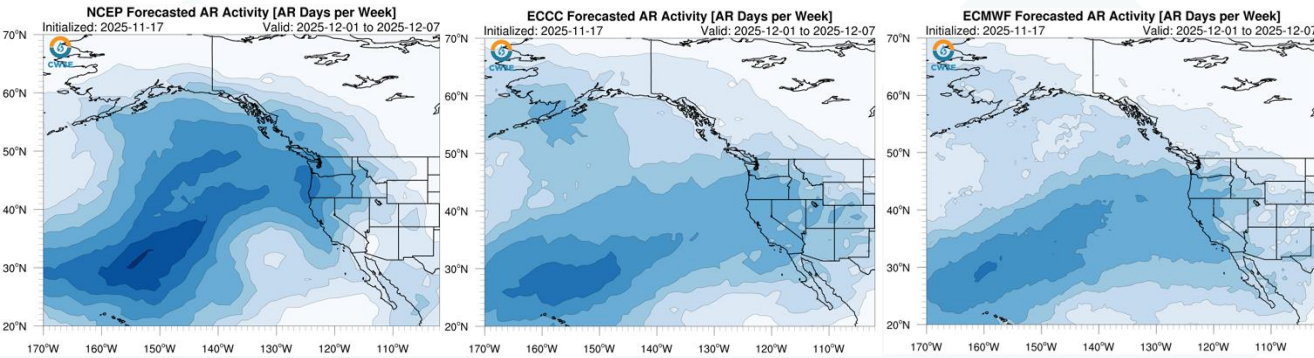
Forecasts Initialized 17 Nov 2025; Valid: 1-7 Dec 2025

NCEP

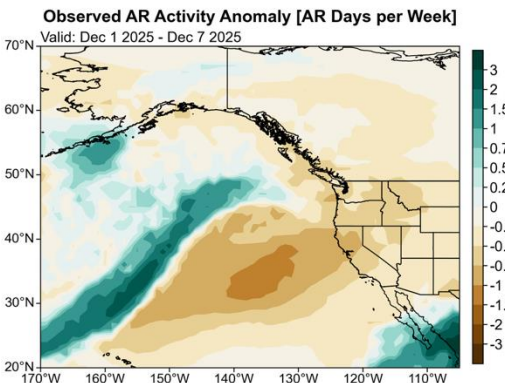
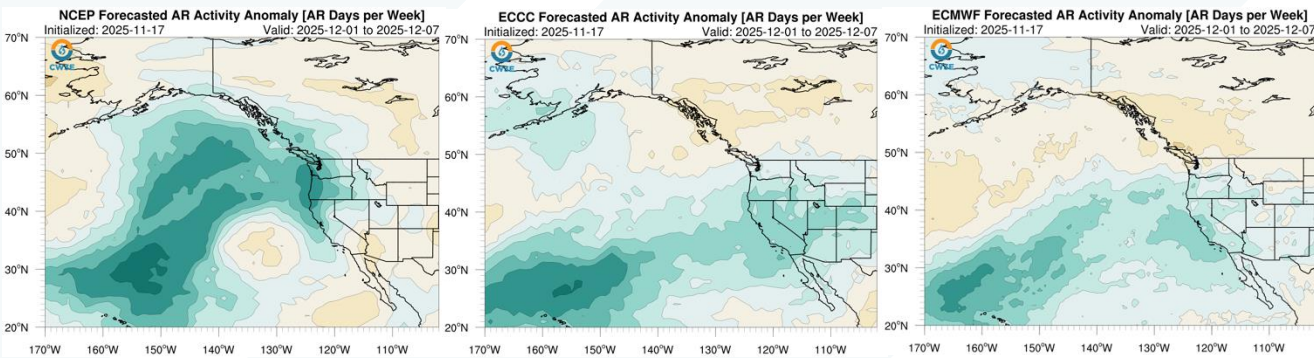
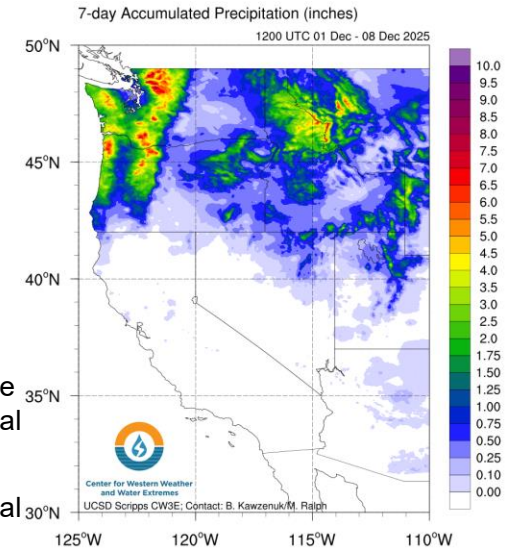
ECCE

ECMWF

Observed (CFSv2 Analysis)



Observed Precipitation



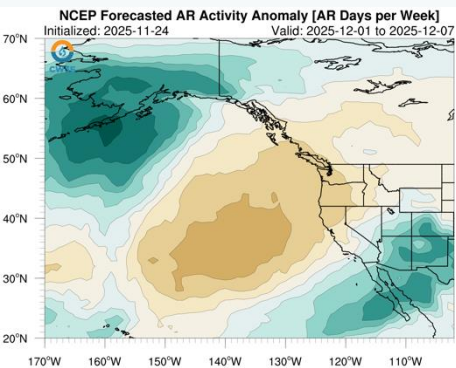
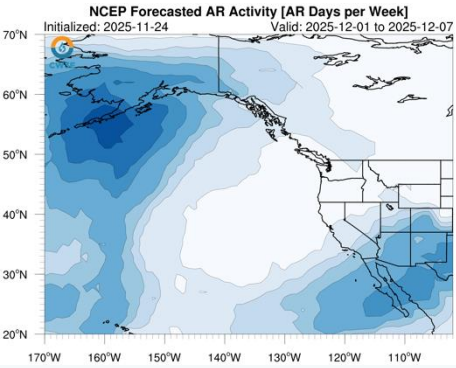
Shading: Fractional # of AR days forecast over a 7-day period (top) and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

- At 3-week lead times, NCEP predicted the general AR axis, ECCE and ECMWF predicted more zonally oriented AR activity
- Models overestimated the AR activity over the southwestern US
- An AR brought 4–7 inches of precipitation over the Coastal WA/OR during 4-7 Dec (which was not captured by the AR detection algorithm used in the observed maps)

Looking Back: Week 2 AR Activity Forecasts

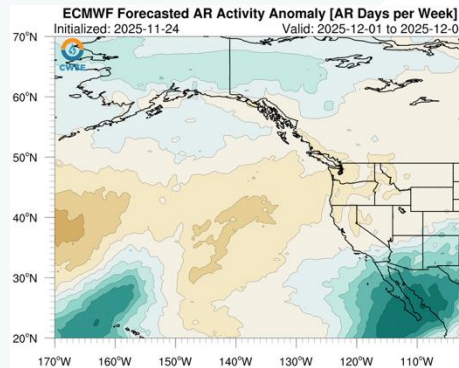
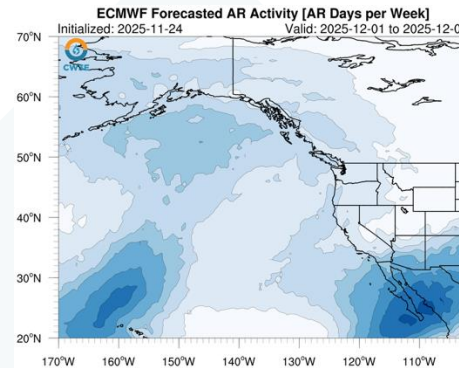
Forecasts Initialized 24 Nov 2025; Valid: 1-7 Dec 2025

NCEP

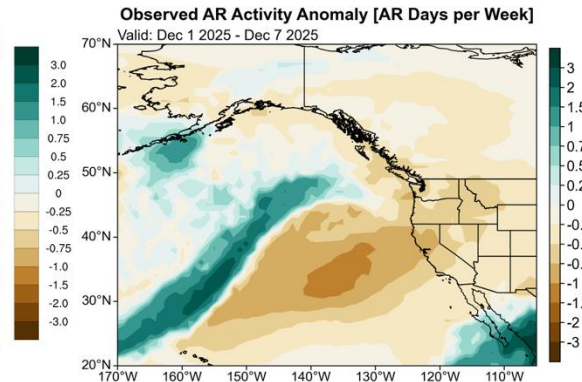
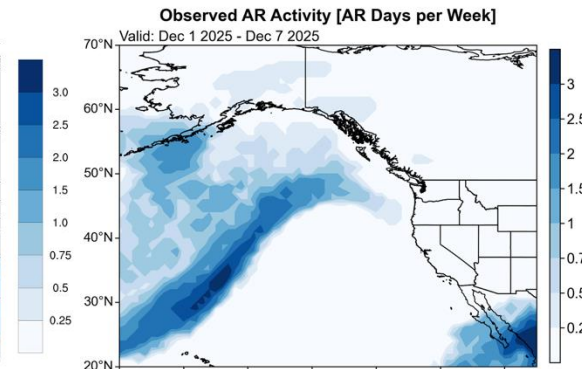


**ECCC
Unavailable**

ECMWF

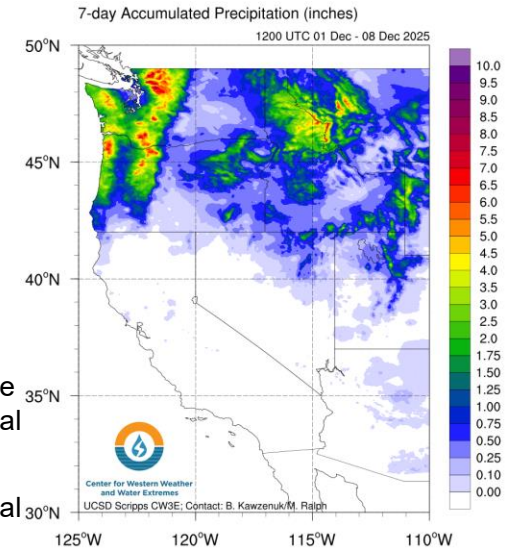


Observed (CFSv2 Analysis)



Above normal
 Near normal
 Below normal

Observed Precipitation

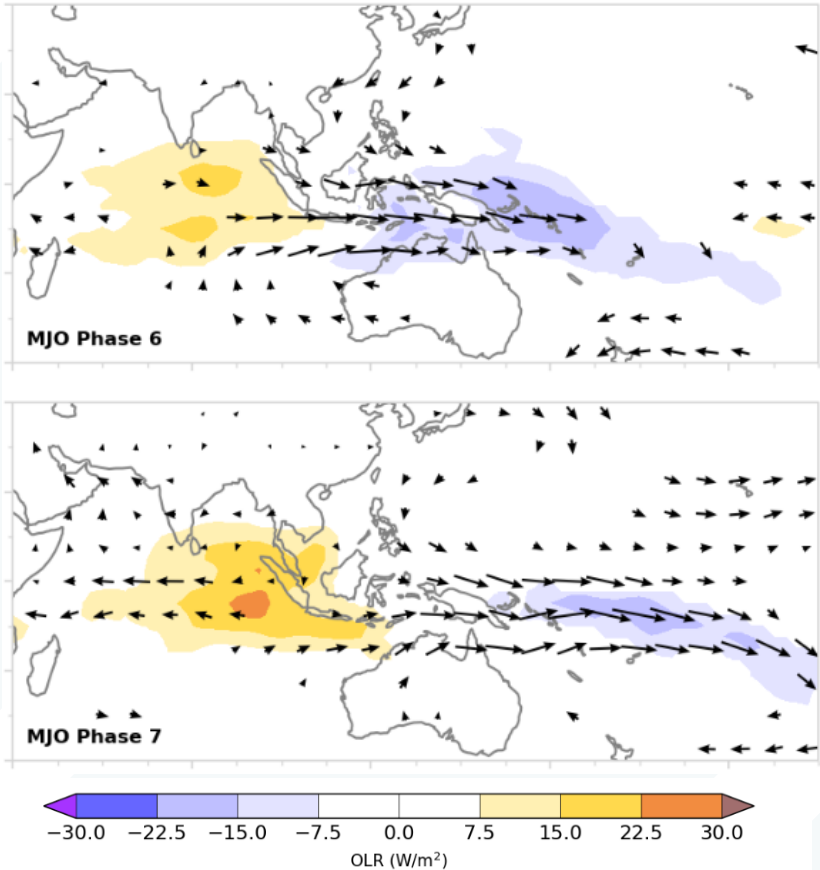


Shading: Fractional # of AR days forecast over a 7-day period (top) and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

- At 2-week lead times, NCEP and ECMWF struggled to predict the axis of enhanced AR activity extending from the subtropical Central Pacific to the northern side of the ridge and overestimated AR activity over Southern California, placing the AR farther north over Baja California than observed
- An AR brought 4–7 inches of precipitation over the Coastal WA/OR during 4-7 Dec (which was not captured by the AR detection algorithm used in the observed maps)

Dynamical Model MJO Forecasts (NCEP)

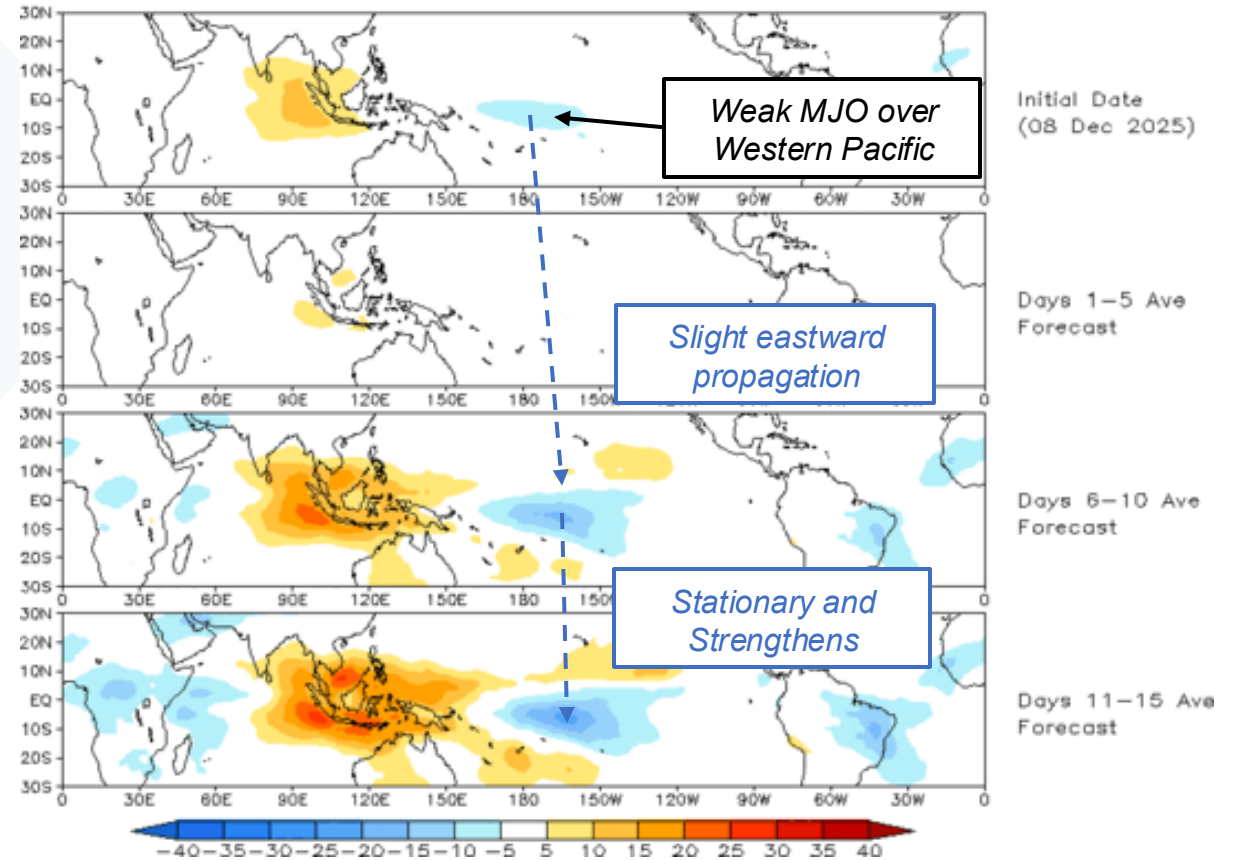
Observed MJO
Phases 6&7 (Western Pacific)



OLR = Outgoing longwave radiation

Weeks 1–2 MJO Prediction

Prediction of MJO-related anomalies using GEFS operational forecast
Initial date: 08 Dec 2025
OLR



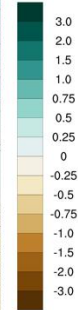
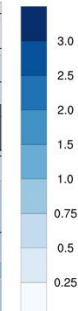
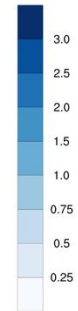
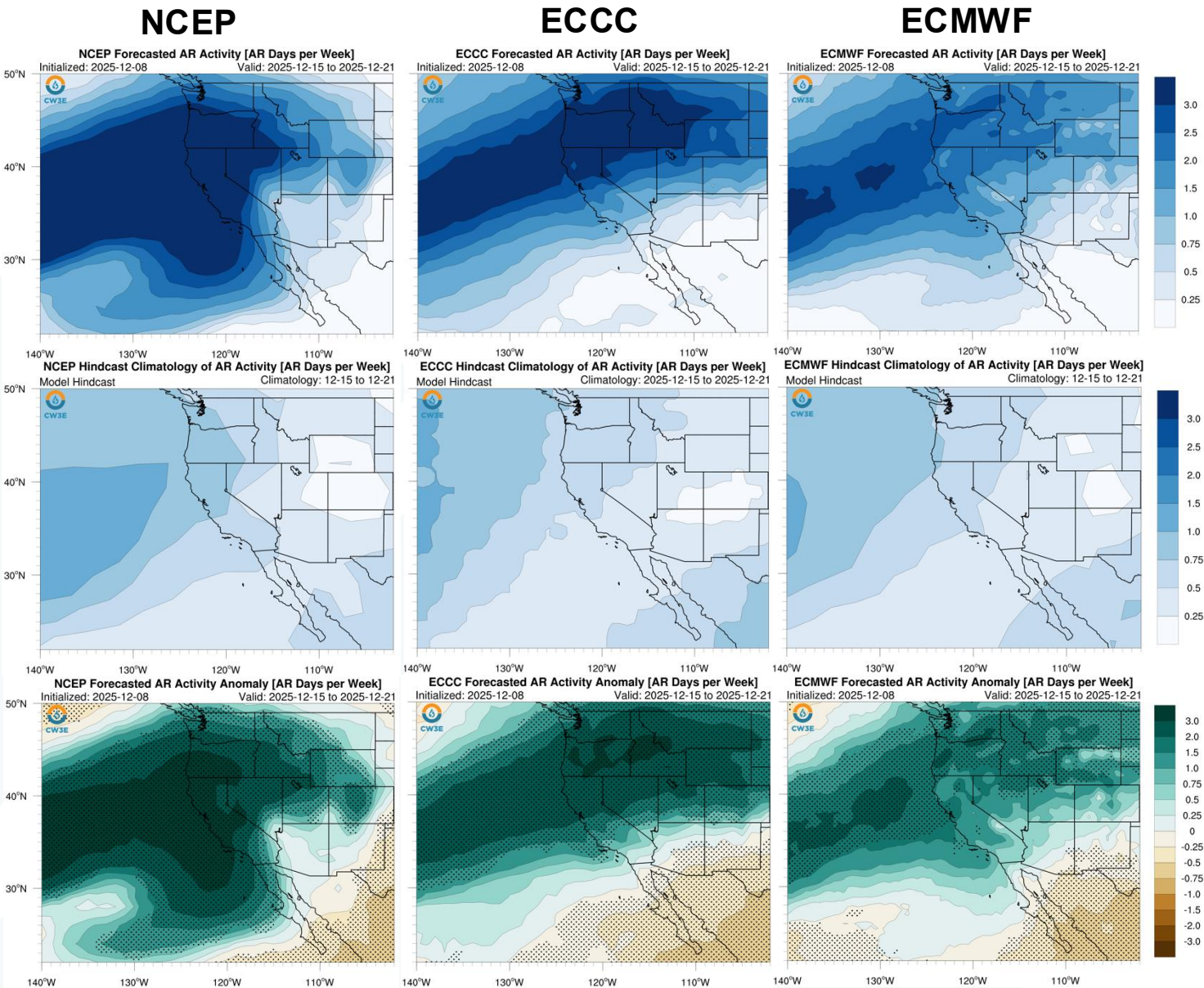
- As of 8 Dec, MJO convection is currently weak over the Western Pacific (Phase 7)
- MJO is predicted to propagate slightly eastward to the Central Pacific into Phase 8 during early Week 1, then become stationary and gradually strengthen afterwards through the end of Week 2
- Weak MJO has limited impacts on the mid-latitude weather and climate

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

Forecasts Initialized 8 Dec 2025

- Models agree on above-normal AR activity over CA during Week 2, with high confidence in NCEP and ECCC over Central and Northern CA and lower confidence in ECMWF (15-21 Dec)

Models agree on above-normal AR activity over CA during Week 2 (15-21 Dec)



} Above normal
 } Near normal
 } Below normal

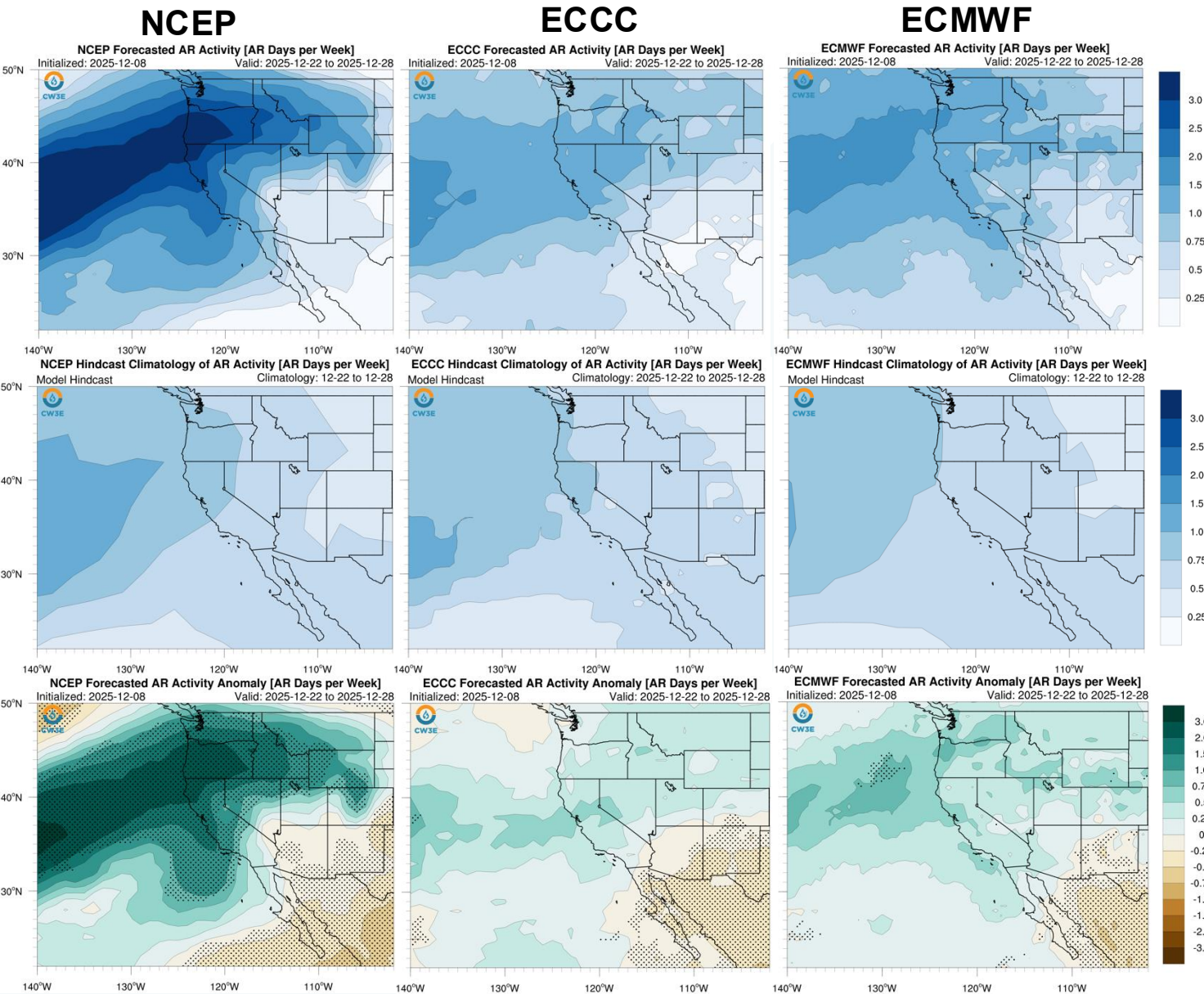
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom)
 Black dots: Regions of >75% ensemble agreement

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

Forecasts Initialized 8 Dec 2025

- Models agree on slightly above-normal to above-normal AR activity over Northern and Central CA, with high confidence and much stronger magnitude in NCEP and lower confidence in ECCC and ECMWF during Week 3 (22-28 Dec)
- Models also agree on near-normal to slightly above-normal AR activity over Southern CA with lower confidence

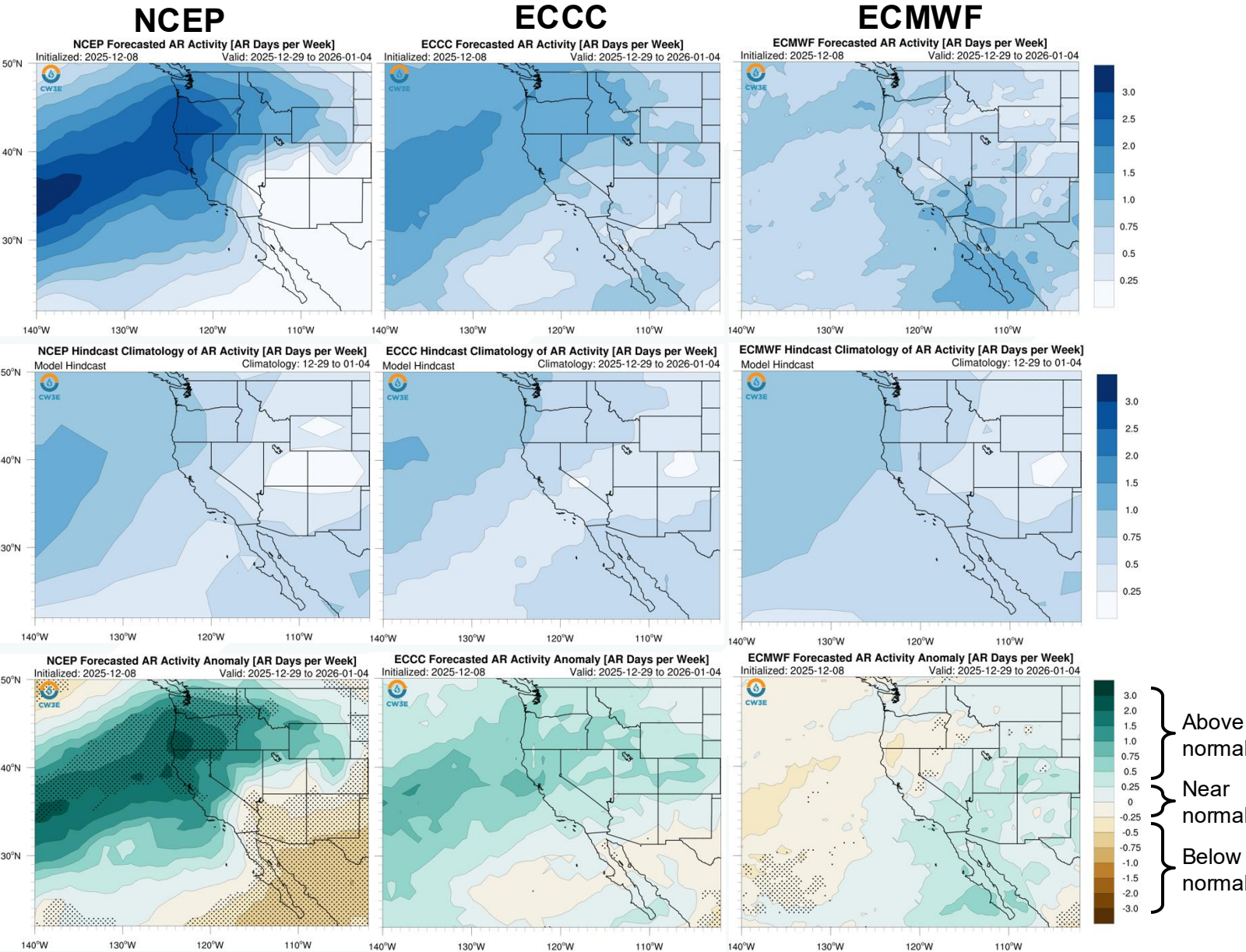
Models agree on above-normal AR activity over much of CA during Week 3 (22-28 Dec)



Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom)
 Black dots: Regions of >75% ensemble agreement

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

Forecasts Initialized 8 Dec 2025

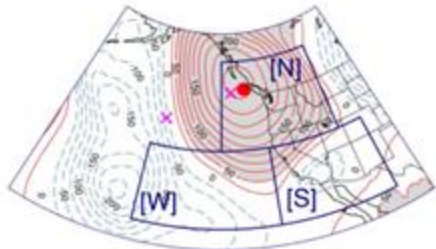


- In Northern and Central CA, NCEP and ECCC are predicting slightly above-normal to above-normal AR activity, with high confidence and much stronger magnitude in NCEP and lower confidence in ECCC during Week 4 (29 Dec-4 Jan), whereas ECMWF is predicting slightly below-normal to slightly above-normal AR activity
- In Southern CA, ECCC and ECMWF are forecasting slightly above-normal AR activity with lower confidence, whereas NCEP is forecasting near-normal AR activity

Models disagree somewhat on AR activity over CA during Week 4 (29 Dec-4 Jan)

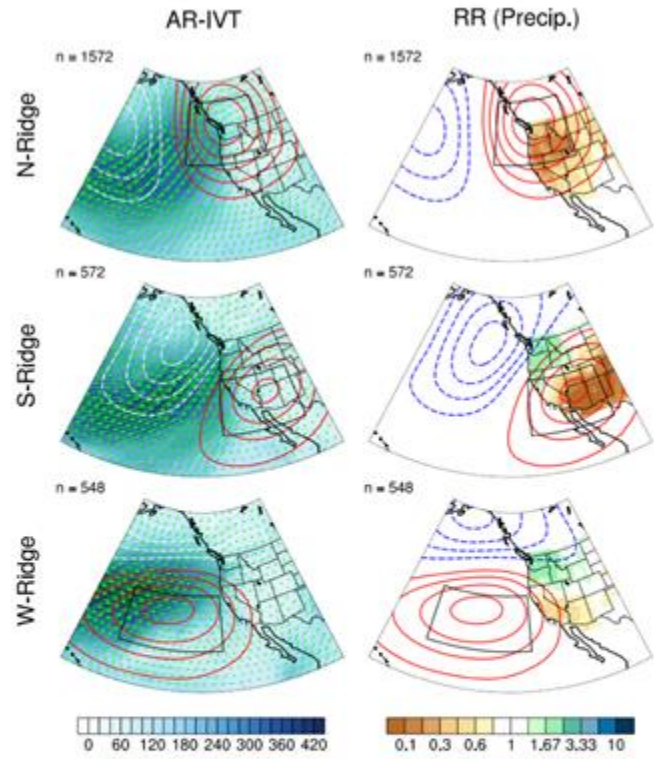
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom)
 Black dots: Regions of >75% ensemble agreement

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



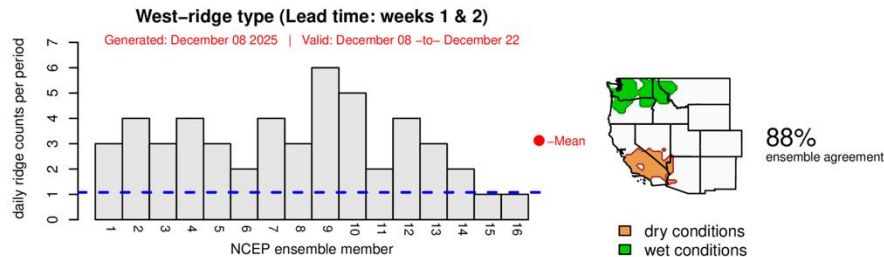
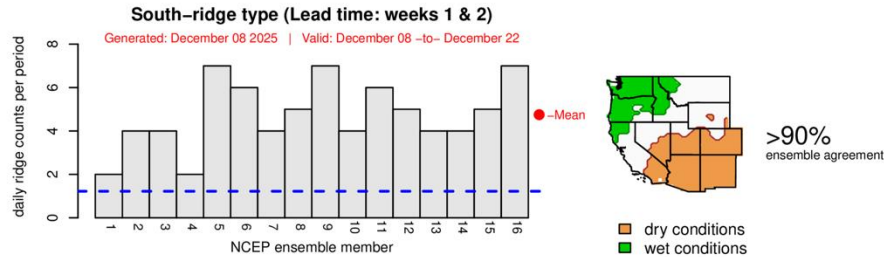
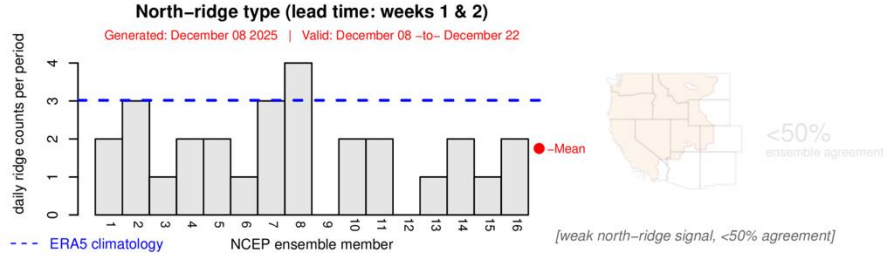
Contact: pgibson@ucsd.edu
Reference: Gibson et al. (2020)
Journal of Climate

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

Forecasts Initialized 8 Dec 2025

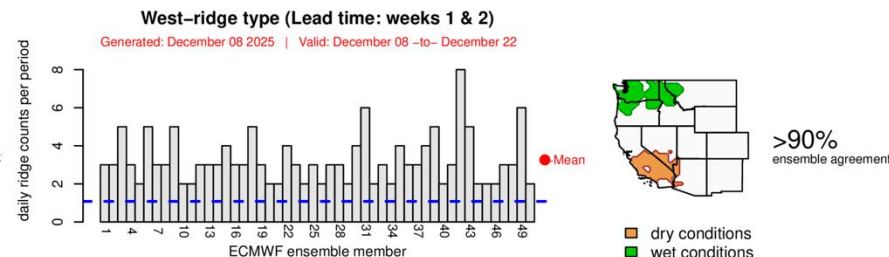
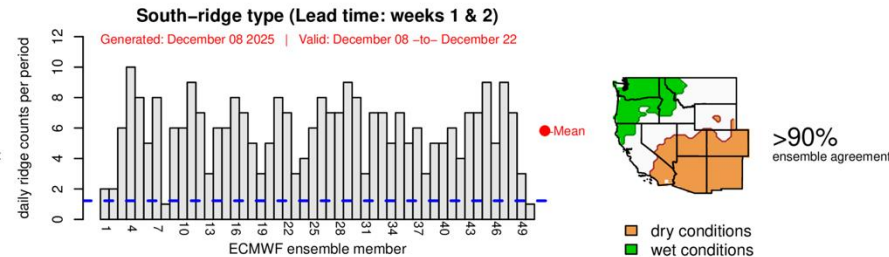
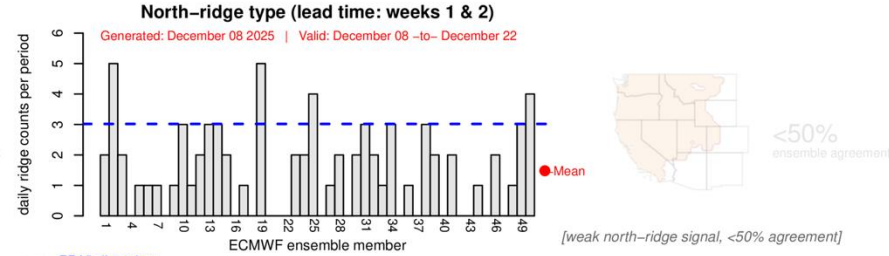
NCEP

CW3E Subseasonal Ridging Forecast (Uses NCEP CFSv2 model)



ECMWF

CW3E Subseasonal Ridging Forecast (Uses ECMWF model)



- Both models are forecasting above-normal South-ridge and West-ridge activity with very high confidence (at least 88% ensemble agreement) during Weeks 1–2 (8-22 Dec)
- Both models are forecasting below-normal North-ridge activity

Models agree on a very high likelihood of ridging activity near California during Weeks 1–2 (8-22 Dec)

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

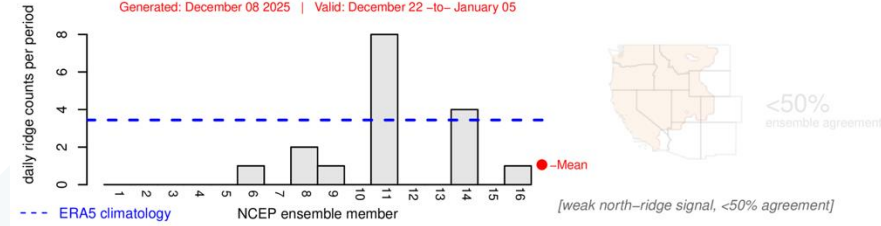
Forecasts Initialized 8 Dec 2025

NCEP

CW3E Subseasonal Ridging Forecast (Uses NCEP CFSv2 model)

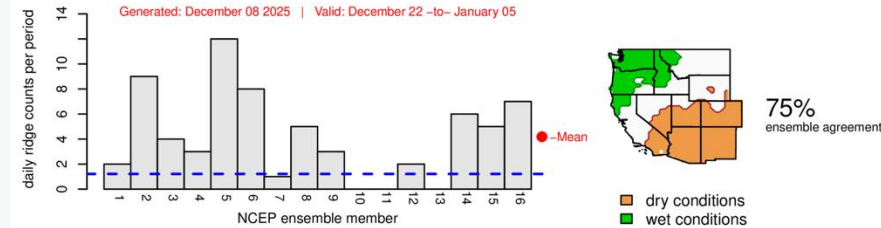
North-ridge type (lead time: weeks 3 & 4)

Generated: December 08 2025 | Valid: December 22 –to– January 05



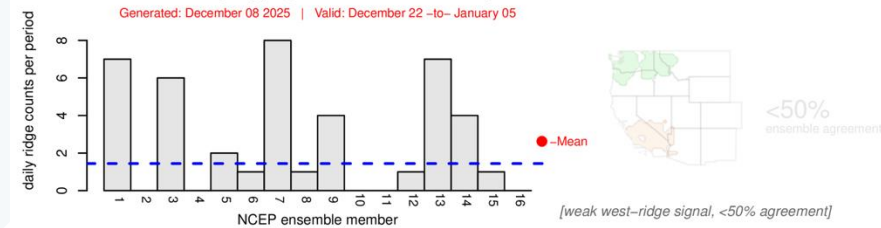
South-ridge type (Lead time: weeks 3 & 4)

Generated: December 08 2025 | Valid: December 22 –to– January 05



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

Generated: December 08 2025 | Valid: December 22 –to– January 05

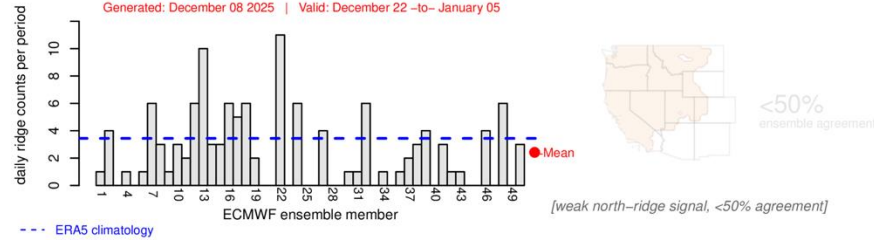


ECMWF

CW3E Subseasonal Ridging Forecast (Uses ECMWF model)

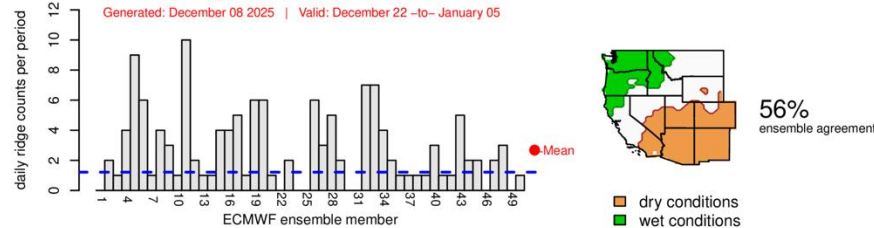
North-ridge type (lead time: weeks 3 & 4)

Generated: December 08 2025 | Valid: December 22 –to– January 05



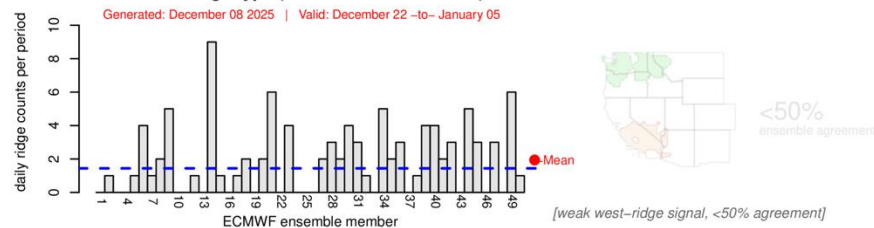
South-ridge type (Lead time: weeks 3 & 4)

Generated: December 08 2025 | Valid: December 22 –to– January 05



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

Generated: December 08 2025 | Valid: December 22 –to– January 05

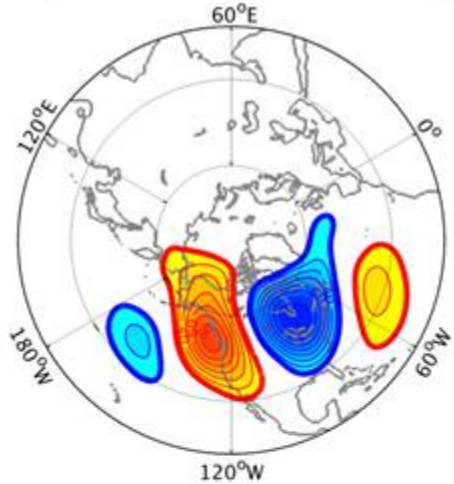


- Both models are forecasting above-normal South-ridge activity with moderate confidence (75% ensemble agreement of NCEP and 56% ensemble agreement of ECMWF) during Weeks 3–4 (22 Dec-5 Jan)
- Both models are forecasting slightly above-normal to above-normal West-ridge activity with low confidence
- Both models are also forecasting slightly below-normal to below-normal North-ridge activity

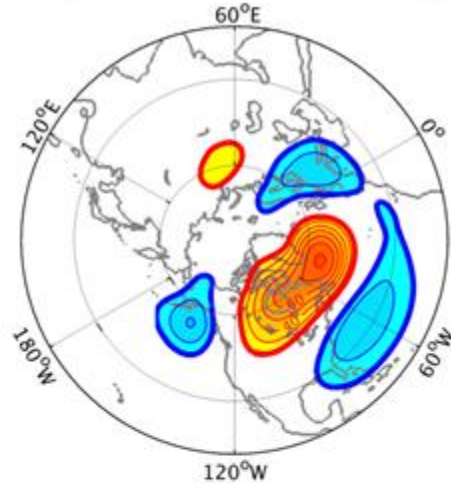
Models agree on a moderate likelihood of ridging activity over the southwestern US during Weeks 3–4 (22 Dec-5 Jan)

Background Info: IRI Subseasonal Weather Regime Forecasts

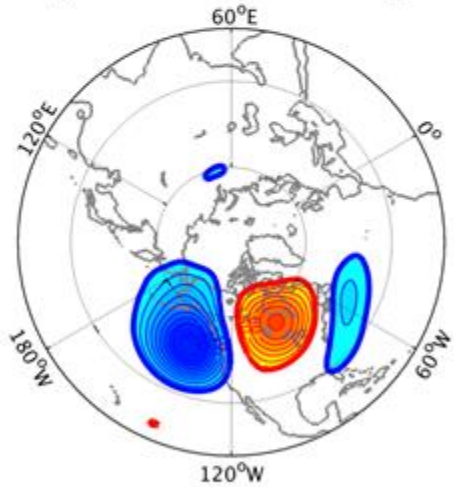
a) WR 1: West Coast Ridge



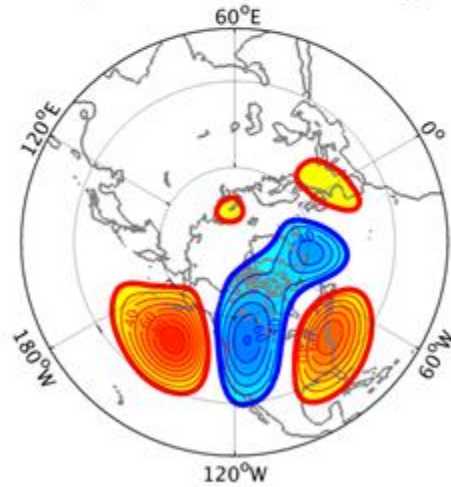
b) WR 2: Greenland High



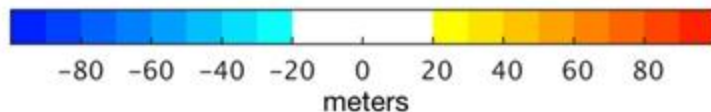
c) WR 3: Pacific Trough



d) WR 4: Pacific Ridge



Geopotential Height Anomaly



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. \(2020\)](#)

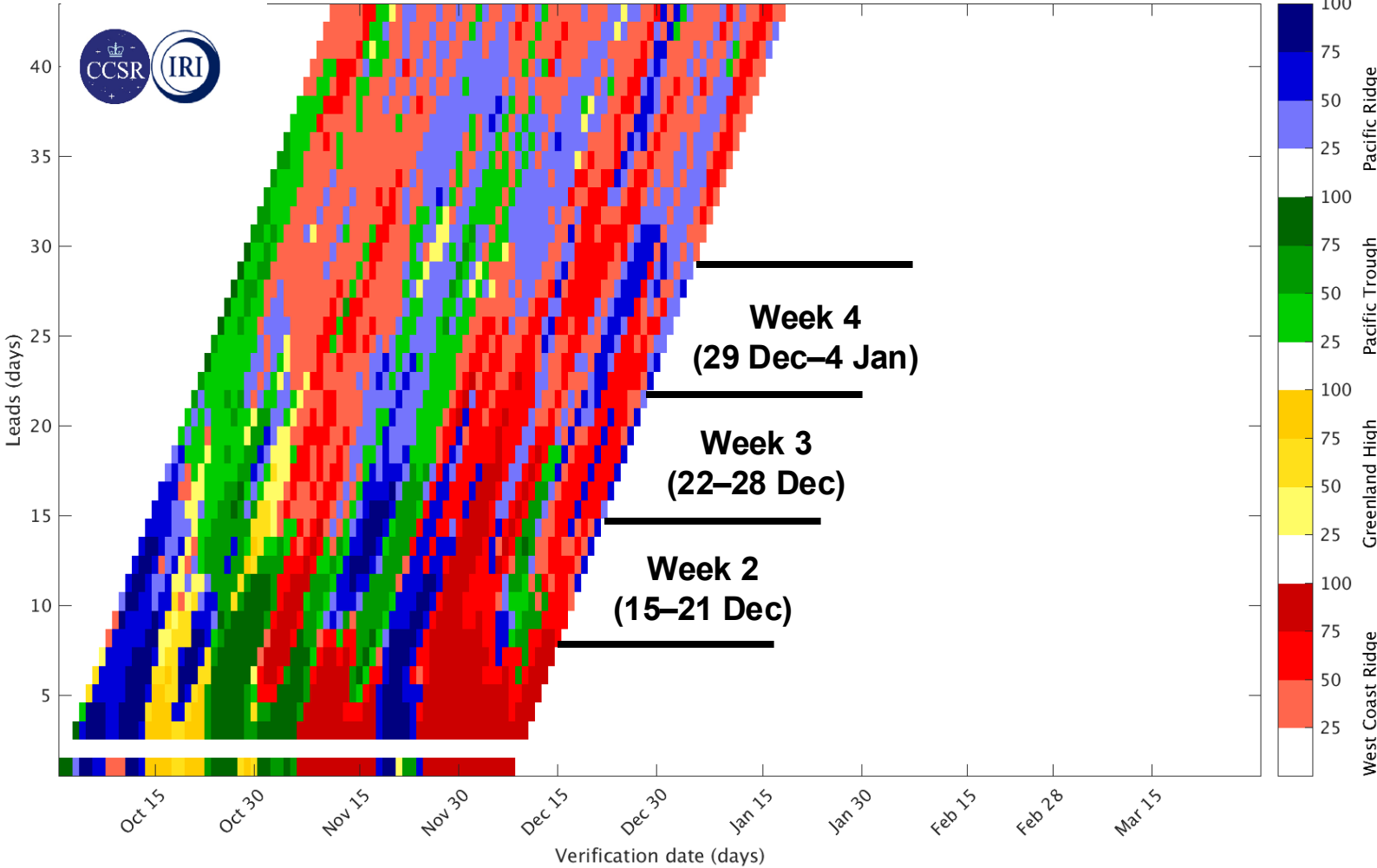
For more information about the forecast product:

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

IRI North American Weather Regime Forecasts

Forecasts Initialized 8 Dec 2025

CFSv2 daily winter WRs max probability forecast (%) 48 members from Oct 1 to Dec 8 2025

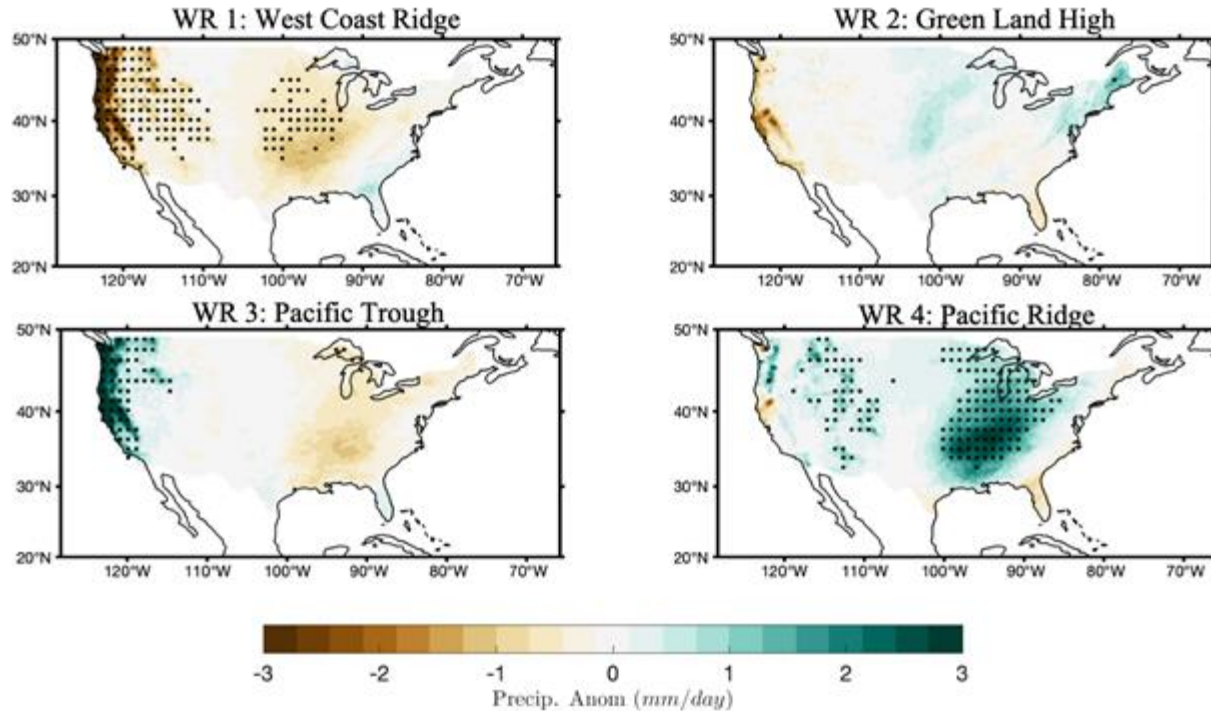


- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble
- Moderate likelihood (50-75% ensemble agreement) of transition from West Coast Ridge to Pacific Ridge in Week 2 (15–21 Dec)
- Low-to-moderate likelihood (25–75% agreement) of persistence of Pacific Ridge through the end of Week 4 (22 Dec–4 Jan)

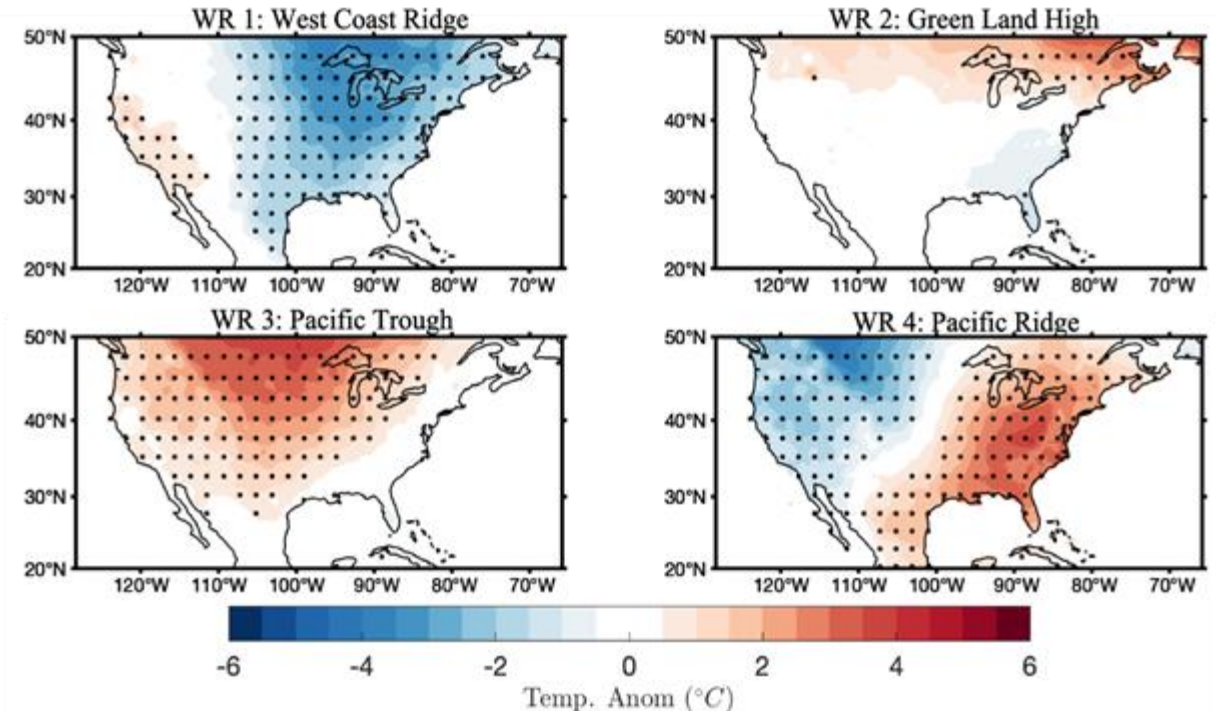
This graphic shows the which of the four North American weather regimes (different colors) is most likely to occur over the next 45 days. Darker (lighter) shading denotes higher (lower) probability of a particular regime. See the next slide for temperature/precipitation implications.

IRI North American Weather Regime Forecasts

Precipitation Anomalies



Temperature Anomalies



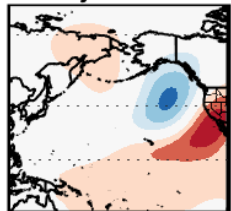
This graphic shows composite mean precipitation (left) and temperature (right) anomalies associated with each weather regime. Stippling (black dots) indicate statistically significant anomalies.

- Transition from below-normal precipitation and above-normal temperature to near-normal precipitation and below-normal temperature predicted over CA during Week 2 (15–21 Dec) with moderate confidence from West Coast Ridge to Pacific Ridge transition.
- Near-normal precipitation and below-normal temperature predicted over CA during Weeks 3-4 (22 Dec–4 Jan) with low-to-moderate confidence in persistent Pacific Ridge regime.

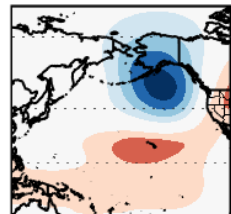
Background Info: Hybrid Weather Regime Impacts Forecast

a) NP4 Mode

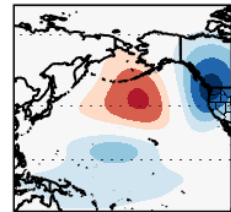
Patterns



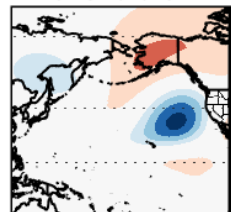
Alaskan-Pacific



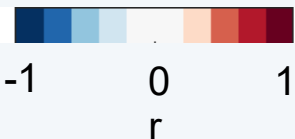
Canadian-Pacific



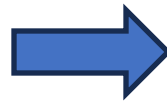
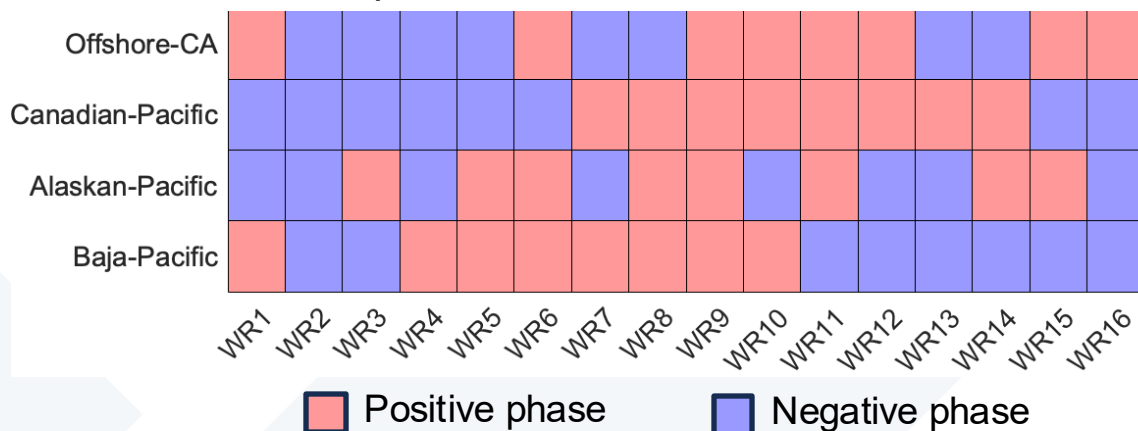
Offshore-CA



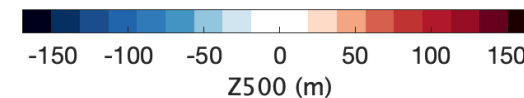
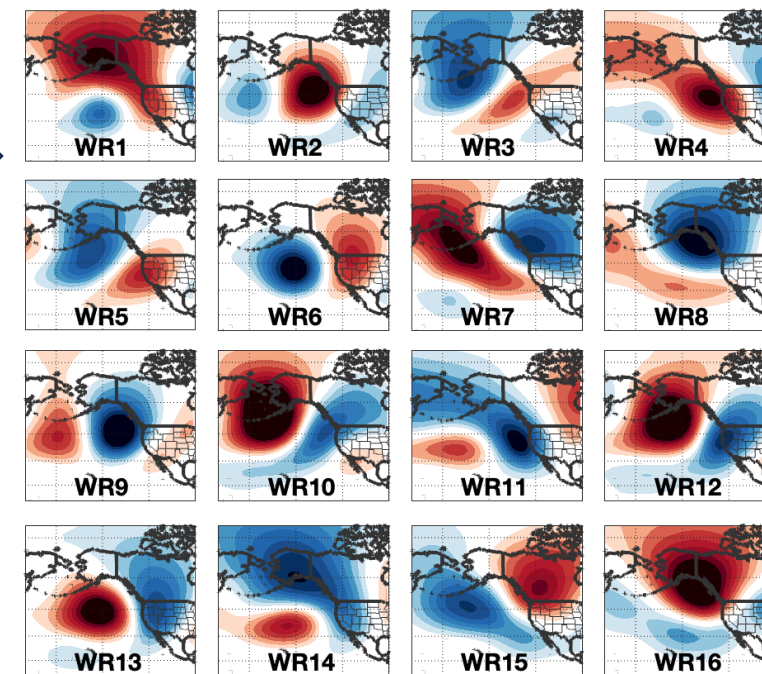
Z500 rEOFs



b) NP4 Mode Phase Combinations



c) Daily Weather Regimes



a) NP4 Mode Patterns

Four key modes of atmospheric variability over the North Pacific (called the “NP4 Modes”, shown in the positive phase) capture most of the variance in atmospheric circulation in this region.

b) NP4 Mode Phase Combinations

The day-to-day changes in the amplitude and phase of the NP4 modes control ridge-trough positioning over the West Coast.

c) Daily Weather Regimes

Sixteen daily weather regimes are defined by the joint phase state of the four NP4 modes. These represent short-duration daily weather patterns.

Relevance to West Coast Weather

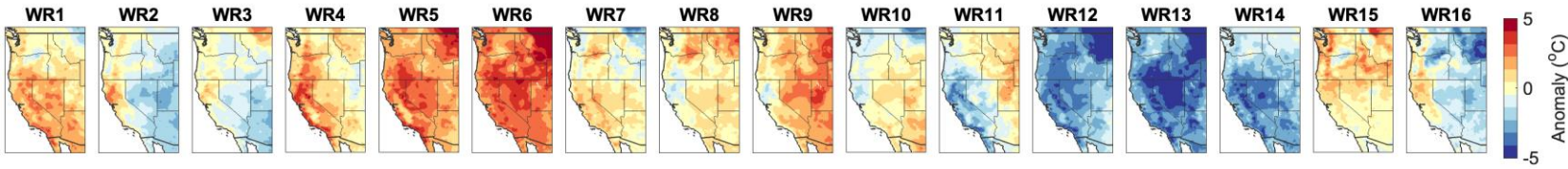
These regimes are historically linked to impactful West Coast weather, including AR landfalls, precipitation and flooding, temperature extremes, Santa Ana winds, and wildfire conditions.

This slide contains background information about CW3E’s hybrid weather regimes forecast product.
Reference:
 Guirguis et al. [2023a](#) and [2023b](#)

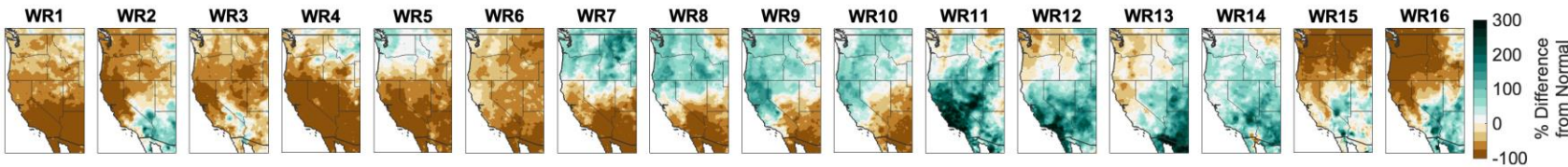
Hybrid Weather Regime Impacts Forecast

Forecasts Initialized 8 Dec 2025

a) Temperature Anomaly Associated With Each Weather Regime



b) Precipitation Anomaly Associated With Each Weather Regime

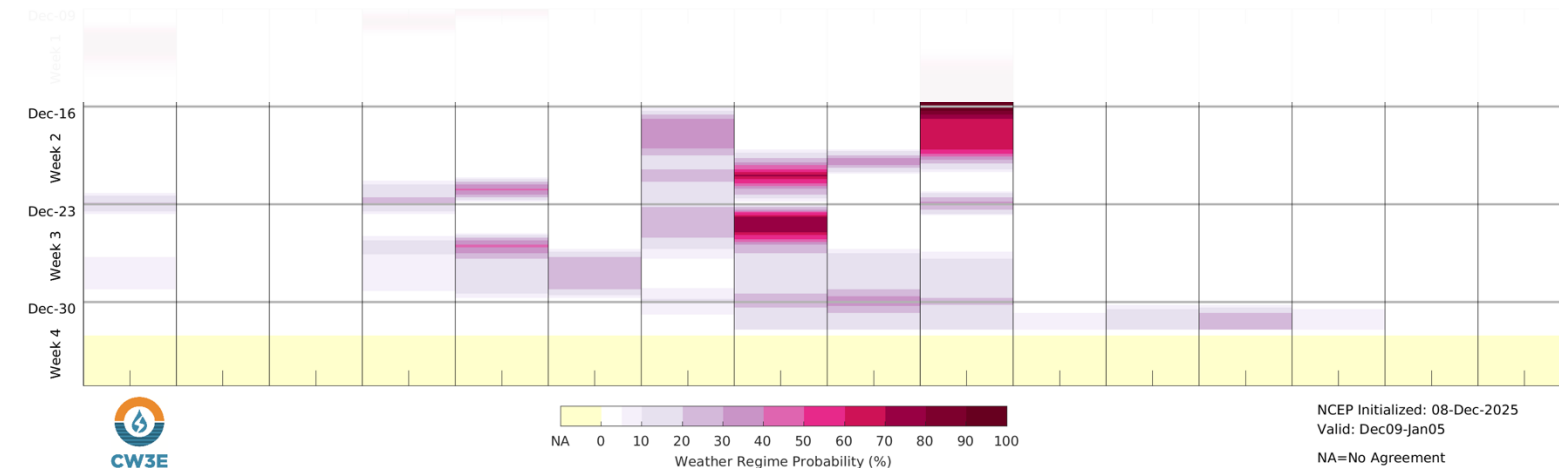


Week 2: Dominated by WR8 and WR10, which both feature a trough over British Columbia and a ridge offshore over the Aleutian Islands. These regimes are associated with wet conditions and elevated AR activity in Northern CA and dry conditions in Southern CA. Temperatures associated with these regimes are typically above-normal over Central and Southern CA.

Valid 9 Dec – 5 Jan

c) Weather Regime Forecast

WR1 WR2 WR3 WR4 WR5 WR6 WR7 WR8 WR9 WR10 WR11 WR12 WR13 WR14 WR15 WR16



Week 3: Potential continuation of wet conditions in Northern CA and dry conditions in Southern CA (high probability of WR8) during the first half of Week 3. The conditions are more uncertain during the latter half of Week 3.

Week 4: Uncertain



NA 0 10 20 30 40 50 60 70 80 90 100
Weather Regime Probability (%)

NCEP Initialized: 08-Dec-2025
Valid: Dec09-Jan05
NA=No Agreement

NA=No Agreement/Uncertain

a-b: Weather regime impacts based on historical relationships
c: Forecast weather regime probability based on the NCEP dynamical model