



Center for Western Weather
and Water Extremes

SCRIPPS INSTITUTION OF OCEANOGRAPHY
AT UC SAN DIEGO

CW3E Subseasonal Outlook: 2 December 2025

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UC San Diego



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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 2–4
 - 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*

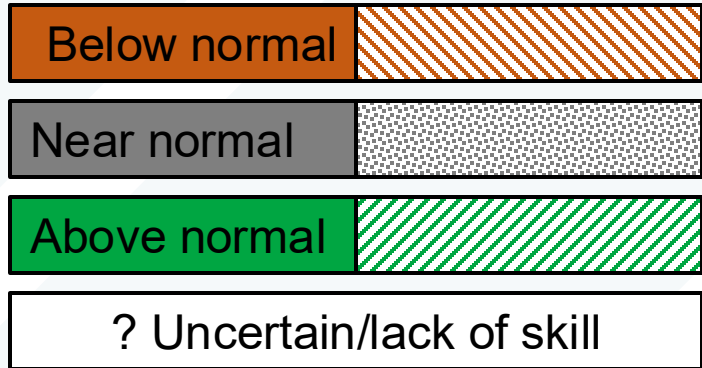
Summary: Subseasonal Precipitation Outlook by Model

This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 1 Dec 2025

Region	Week 2 (8–14 Dec)				Week 3 (15–21 Dec)				Week 4 (22–28 Dec)			
	NCEP ^{1,2,3,4}	ECCC ¹	ECMWF ^{1,2}	Multi-Model Forecast	NCEP ^{1,2,3,4}	ECCC ¹	ECMWF ^{1,2}	Multi-Model Forecast	NCEP ^{1,2,3,4}	ECCC ¹	ECMWF ^{1,2}	Multi-Model Forecast
WA/OR												
Northern CA												
Central CA												
Southern CA												

Higher Confidence | Lower Confidence



- Model forecasts lean towards below-normal precipitation in CA during Week 2
- High degree of uncertainty in expected precipitation over all of CA during Weeks 3–4

Subseasonal products included in this Outlook:

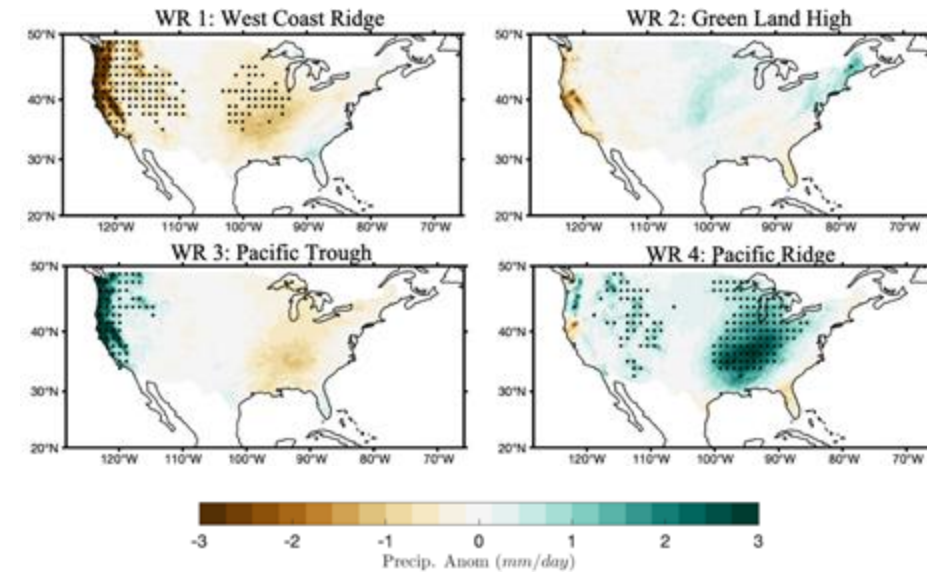
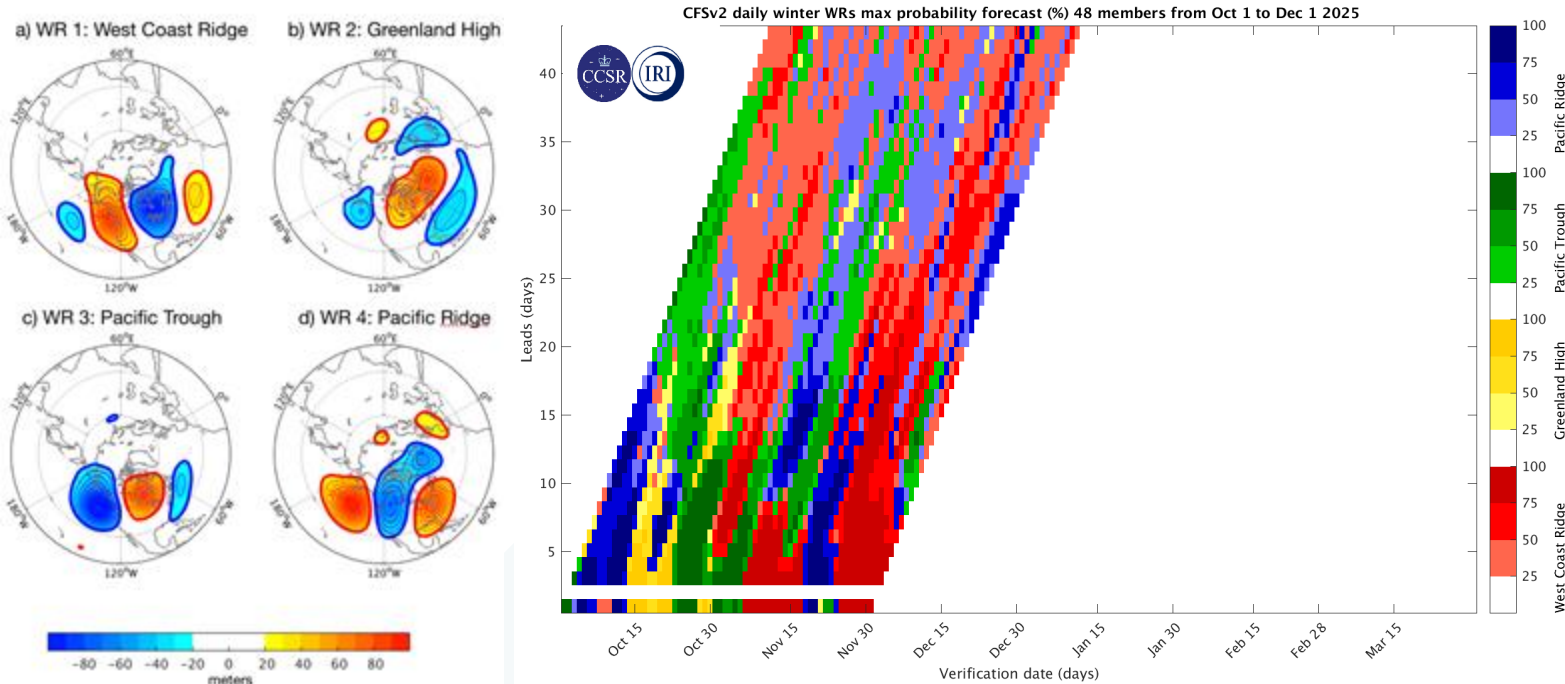
¹CW3E/JPL Atmospheric River Activity Forecasts ([DeFlorio et al. 2019](#), [Zhang et al. 2023](#))

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

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

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

Potential Regime Shifts and Persistence



- Potential regime shift from Pacific Trough (wet and warm pattern in CA) to West Coast Ridge (dry and warm pattern in CA) with low confidence during Week 2
- Potential for regime shift from West Coast Ridge to Pacific Ridge (cool pattern in CA) with moderate confidence in Week 3
- Potential for persistence of Pacific Ridge with moderate confidence during Week 4

Product	Week 2 (8–14 Dec)	Week 3 (15–21 Dec)	Week 4 (22–28 Dec)
IRI North American Weather Regime Forecasts	Uncertain	West Coast Ridge ↪ Pacific Ridge	Pacific Ridge

 Regime Persistence (Pacific Ridge)
 ↪ Regime Shift
 Uncertain

Summary

MJO/QBO Conditions

- Strong MJO convection is currently located over the Western Pacific (Phase 7); QBO is in the easterly phase
 - Without considering QBO/ENSO conditions, MJO in the Western Pacific is associated with an increase in moisture transport and extreme precipitation over California at lag times of 1–2 weeks
- NCEP is forecasting MJO convection to propagate eastward to the Central Pacific into Phase 8 during early Week 1, then becomes stationary and gradually weakens

Week 2 forecasts (8–14 Dec):

- Models generally agree on AR activity over Central and Southern CA during Week 2 (8–14 Dec)
 - Models are forecasting near-normal to slightly below-normal AR activity over Central and Southern CA
 - NCEP is forecasting near-normal to slightly above-normal AR activity over Northern CA, and ECCO and ECMWF are forecasting slightly below-normal AR activity
- Models agree on a moderate likelihood of West-ridge activity during Weeks 1–2 (1–15 Dec)
 - Both models are forecasting above-normal West-ridge activity with moderate confidence (62% ensemble agreement of NCEP and 72 % ensemble agreement of ECMWF)
 - NCEP is also forecasting above-normal South-ridge activity with moderate confidence (62% ensemble agreement), whereas ECMWF is forecasting slightly above-normal South-ridge activity with low confidence
- IRI weather regime tool shows low likelihood (25–50% ensemble agreement) of transition from Pacific Trough to West Coast Ridge in Weeks 2

Summary

Week 3 Forecasts (15–21 Dec):

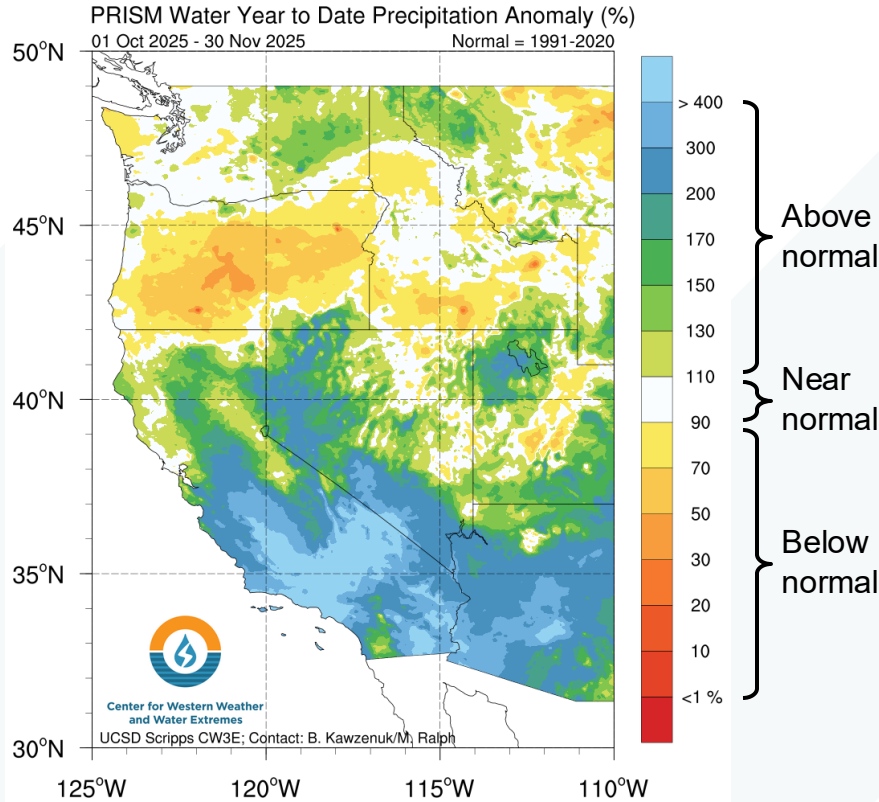
- Models disagree on AR activity over CA
 - ECCC and ECMWF are forecasting near-normal AR activity over Central and Southern CA, whereas NCEP is forecasting near-normal to slightly below-normal AR activity
 - Over Northern CA, NCEP and ECMWF are forecasting slightly below-normal to below-normal AR activity, whereas ECCC is forecasting near-normal AR activity
- Models agree on a moderate likelihood of West-ridge activity during Weeks 3–4
 - Both models are forecasting above-normal West-ridge activity with moderate confidence (56% ensemble agreement of NCEP and 52% ensemble agreement of ECMWF)
 - Both models are forecasting near-normal North-ridge and South-ridge activity
- IRI weather regime tool shows moderate likelihood (50–75% ensemble agreement) of transition from West Coast Ridge to Pacific Ridge in Week 3

Week 4 Forecasts (22–28 Dec):

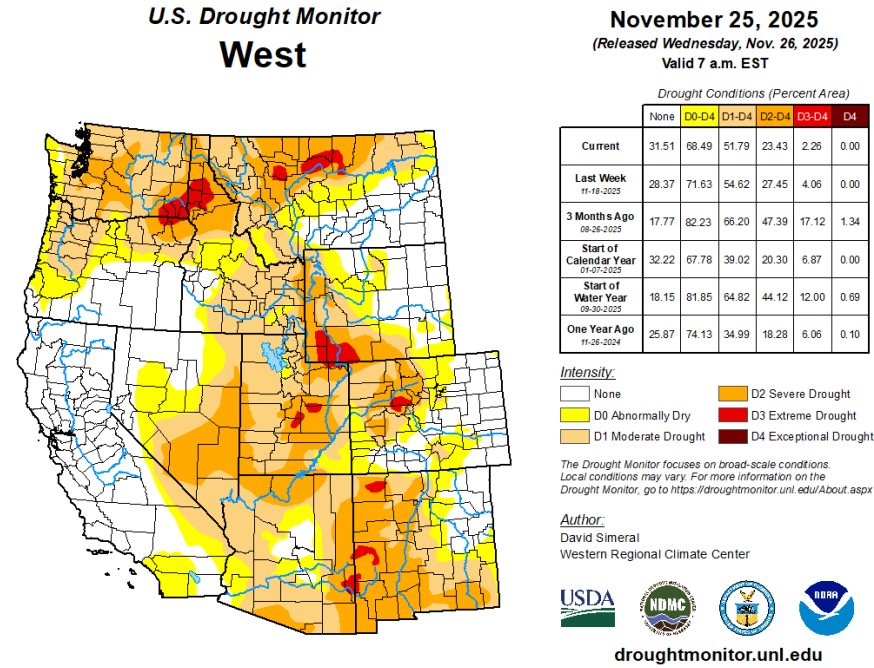
- Models generally agree on AR activity over Southern CA
 - Models are forecasting near-normal AR activity over Southern CA
 - In Northern and Central CA, NCEP and ECCC are forecasting near-normal to slightly above-normal AR activity, while ECMWF is forecasting near-normal to slightly below-normal AR activity
- IRI weather regime tool shows moderate likelihood (50–75% ensemble agreement) of persistence of Pacific Ridge in Week 4

Hydrologic Summary

Precipitation

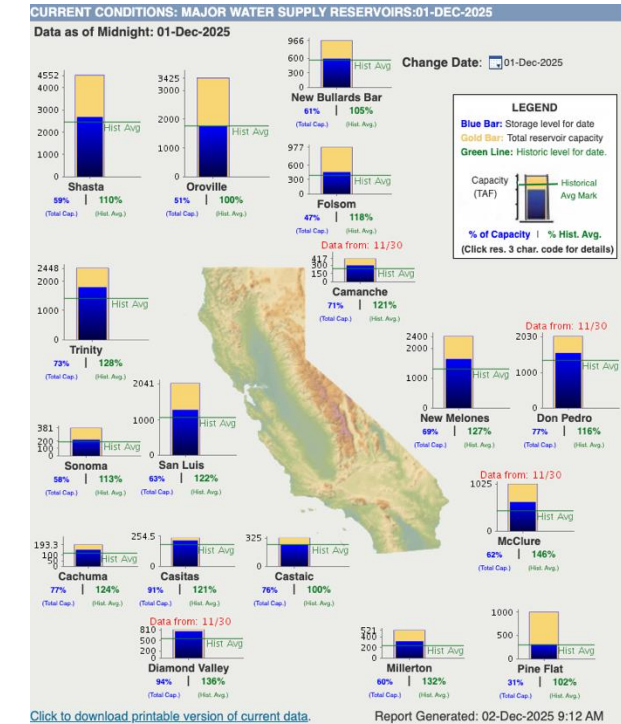


Drought Conditions



Disclaimer: In addition to climate indicators, the U.S. Drought Monitor also uses impact reports from local observers about crop failures or water restrictions to quantify drought.

Reservoir Conditions



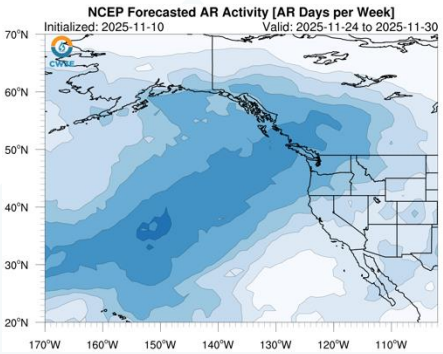
Source: California DWR

- As of 30 Nov, water-year-to-date precipitation is running **above-normal (>130% of normal)** in much of Northern CA and **well-above normal** in much of Central CA (**>200% of normal**) and Southern CA (**~400% of normal**)
- An unusually wet November substantially improved drought conditions in Southern CA; the most recent drought monitor update is now showing either no drought or abnormally dry conditions (D0)
- As of 1 Dec, most large reservoirs in California are operating at $\geq 50\%$ capacity and near or above-normal storage for this time of year

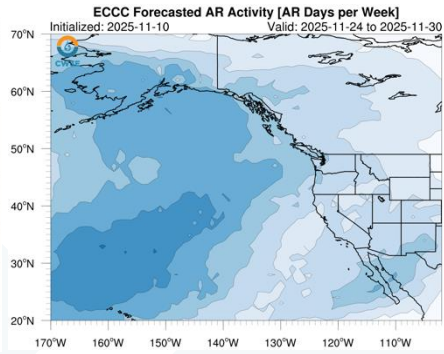
Looking Back: Week 3 AR Activity Forecasts

Forecasts Initialized 10 Nov 2025; Valid: 24–30 Nov 2025

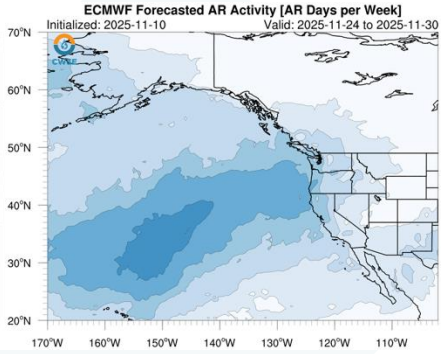
NCEP



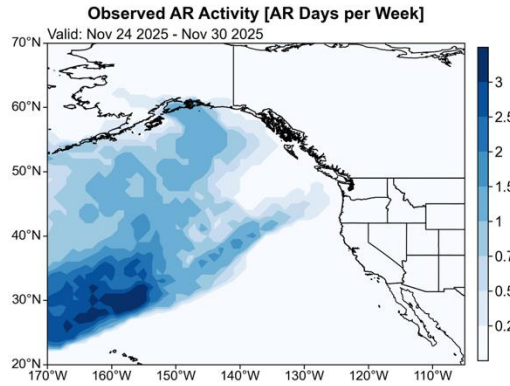
ECCC



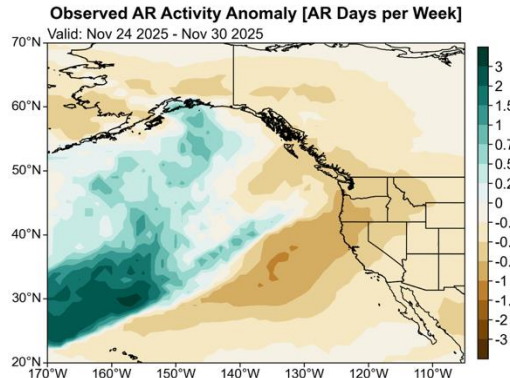
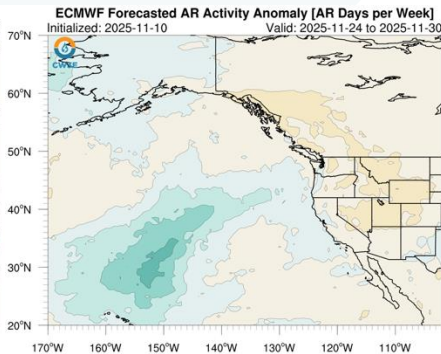
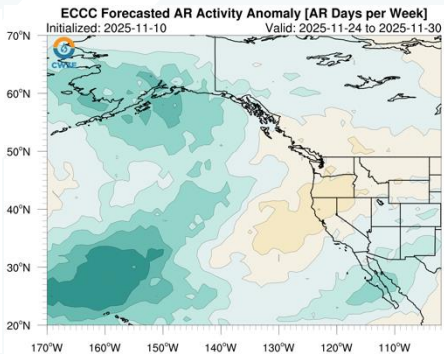
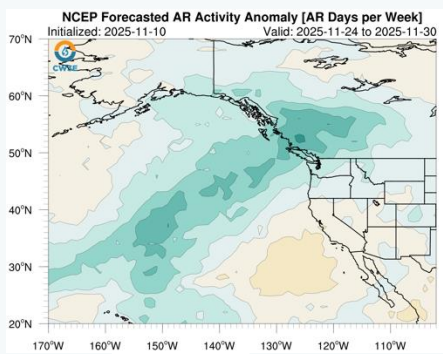
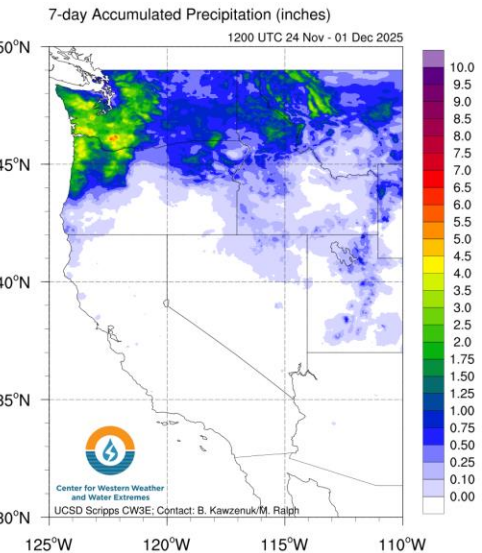
ECMWF



Observed (CFSv2 Analysis)



Observed Precipitation



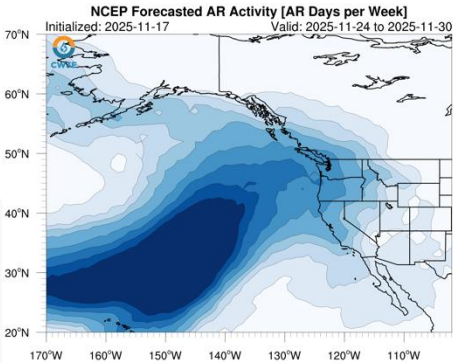
Shading: Fractional # of AR days forecast over a 7-day period (top) and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

- At 3-week lead times, models generally predict the AR axis but largely overestimate the AR activity over the Western US
- NCEP overestimated AR activity over WA/OR, placing the AR farther northeast than observed
- A frontal system produced 2–4 inches of precipitation over the WA/OR during 24–27 Nov

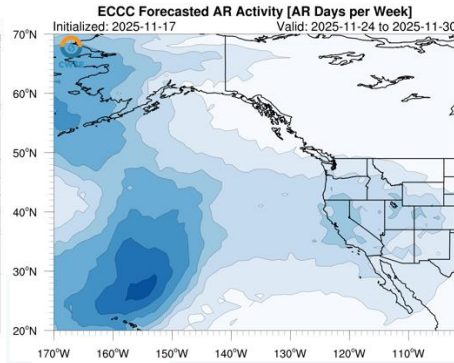
Looking Back: Week 2 AR Activity Forecasts

Forecasts Initialized 17 Nov 2025; Valid: 24–30 Nov 2025

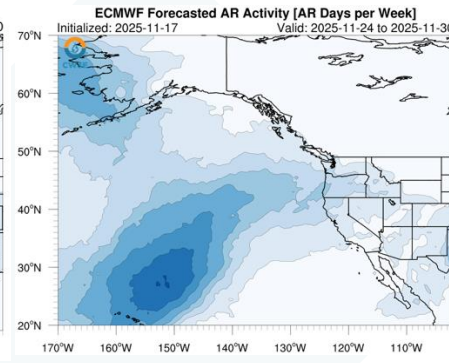
NCEP



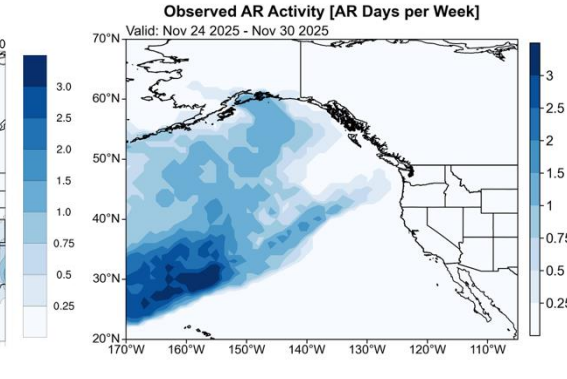
ECDC



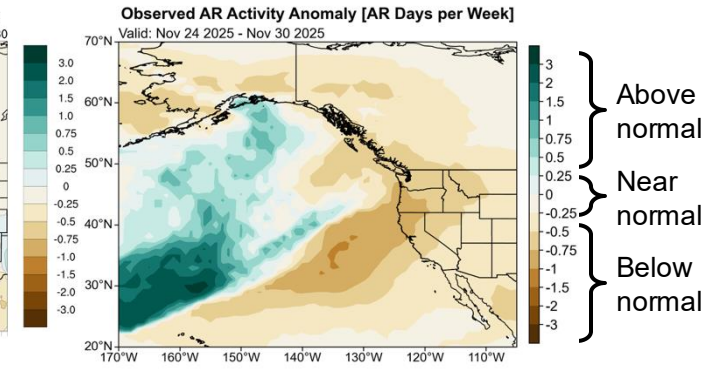
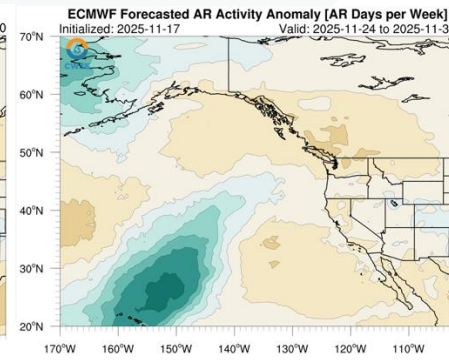
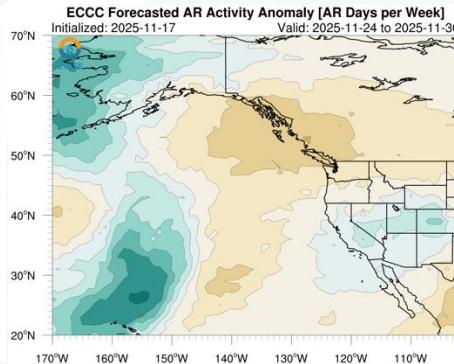
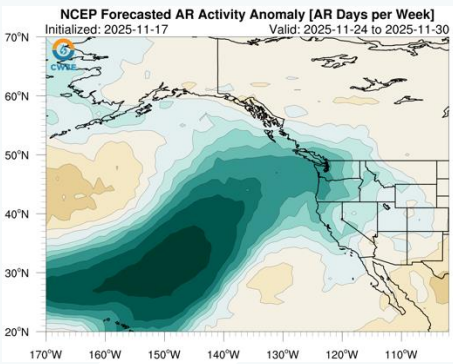
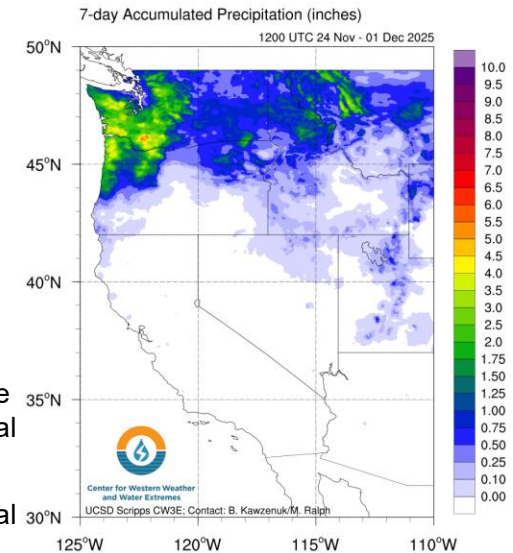
ECMWF



Observed (CFSv2 Analysis)



Observed Precipitation

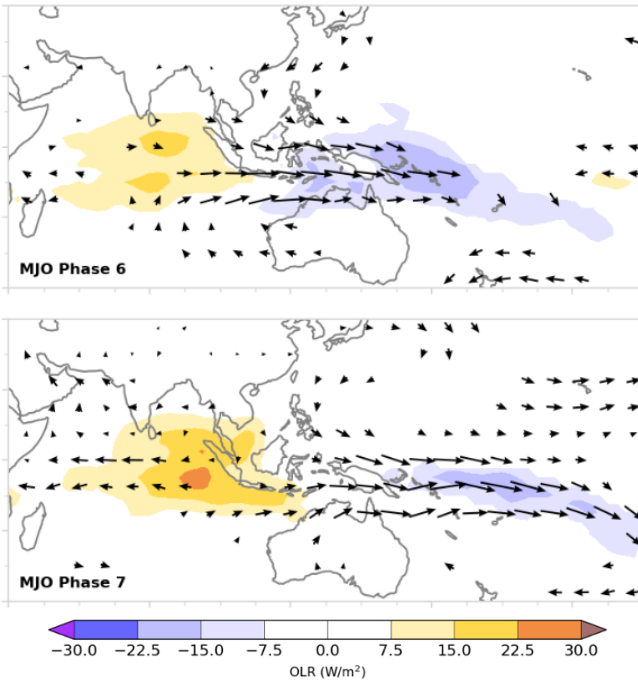


Shading: Fractional # of AR days forecast over a 7-day period (top) and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

- At 2-week lead times, models captured the AR activity over the central North Pacific but still exhibit strong biases over the Western US
- NCEP overestimated AR activity over WA/OR and Northern CA, placing the AR farther east than observed
- A frontal system produced 2–4 inches of precipitation over the WA/OR during 24–27 Nov

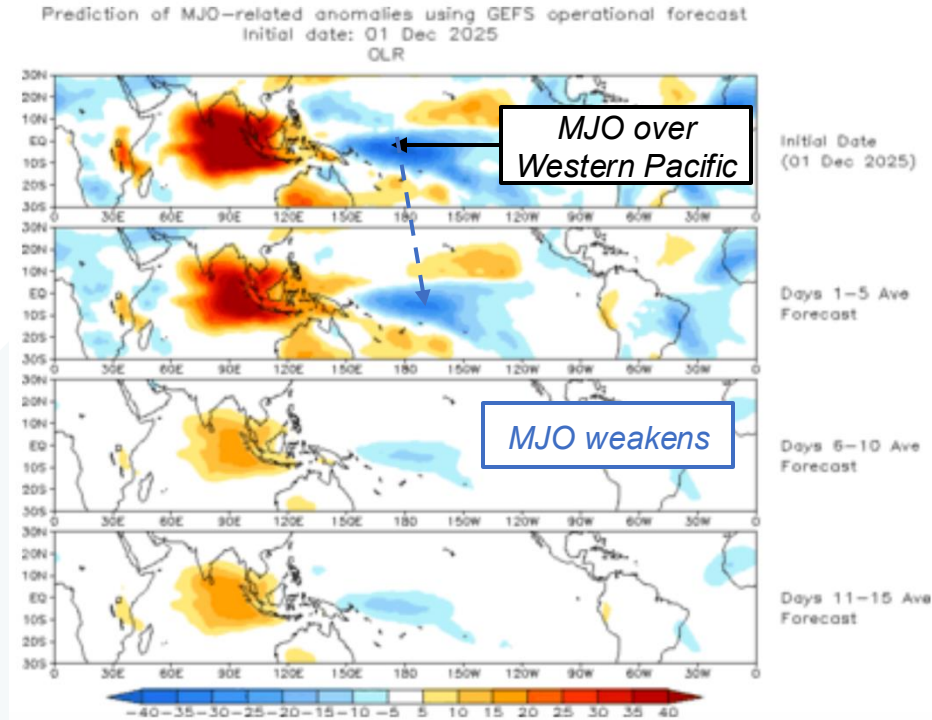
Dynamical Model MJO Forecasts (NCEP)

Observed MJO Phases 6&7 (Western Pacific)



OLR = Outgoing longwave radiation

Weeks 1–2 MJO Prediction



Circulation and Moisture Transport Anomalies

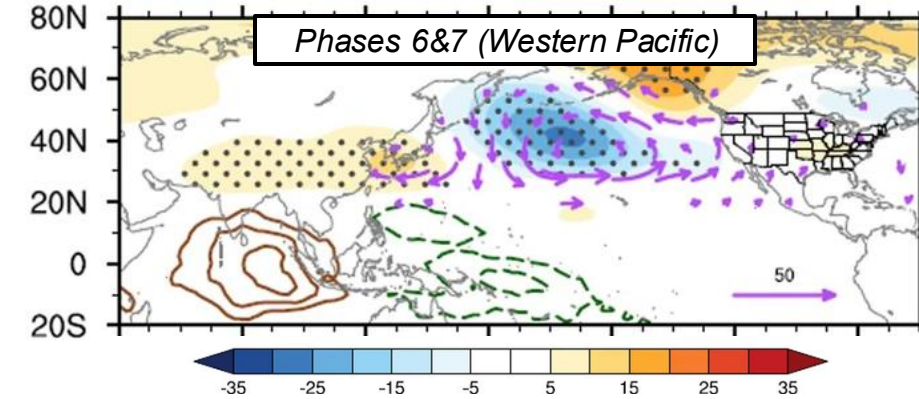


Figure 5 from Wang et al. (2024)

Composite Z500 anomalies (shading; orange = positive; blue = negative), IVT anomalies (vectors); and OLR anomalies (brown = suppressed convection; green = enhanced convection)

Extreme Precipitation Frequency

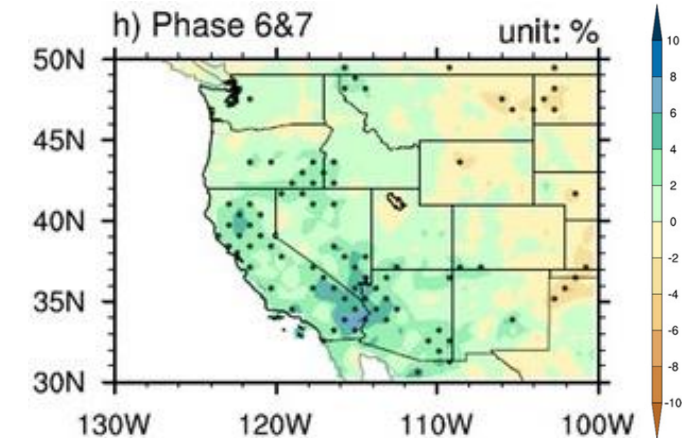


Figure 3 from Wang et al. (2023)

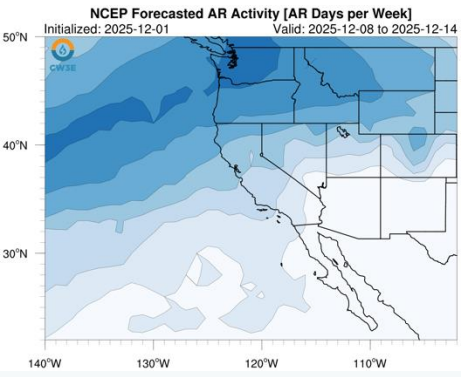
Percent Change in frequency of extreme precipitation (brown = decreased frequency; green/blue = increased frequency)

- As of 1 Dec, strong MJO convection is currently located over the Western Pacific (Phase 7)
- MJO propagates eastward to the Central Pacific into Phase 8 during early Week 1, then becomes stationary and gradually weakens.
- MJO activity over the Western Pacific is associated with an anomalous trough over the North Pacific at lag times of 1–2 weeks, leading to increased moisture transport and an increase in extreme precipitation frequency over California

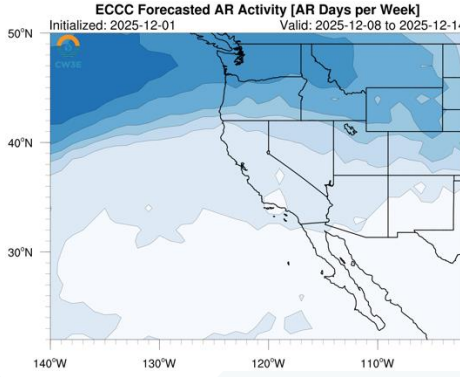
AR Activity Forecasts: Week 2 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 1 Dec 2025

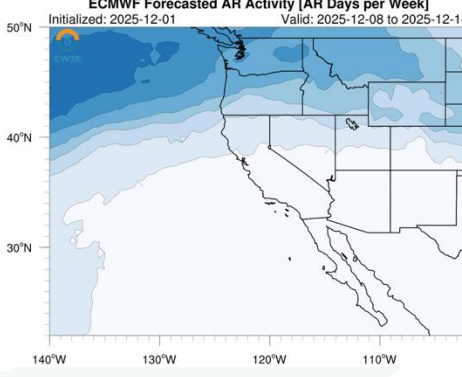
NCEP



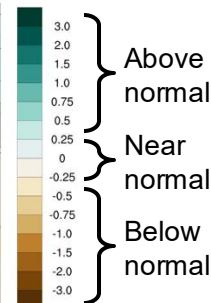
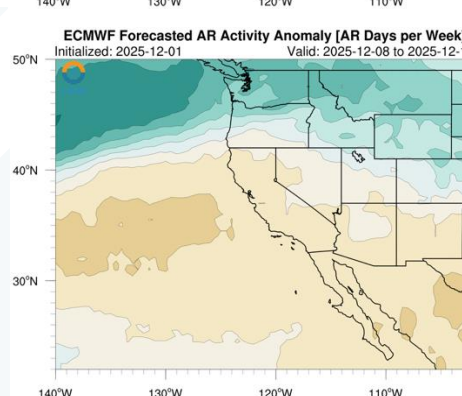
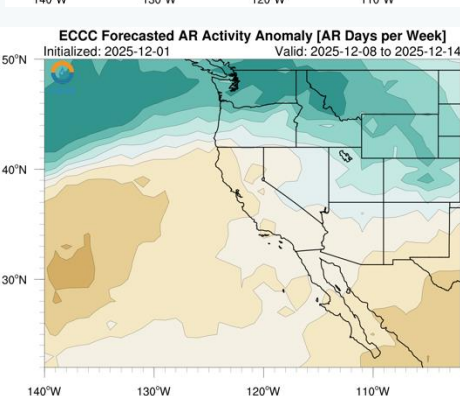
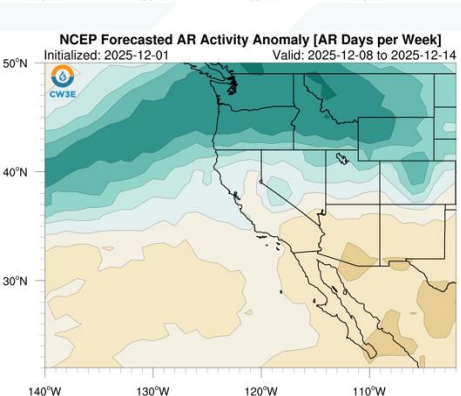
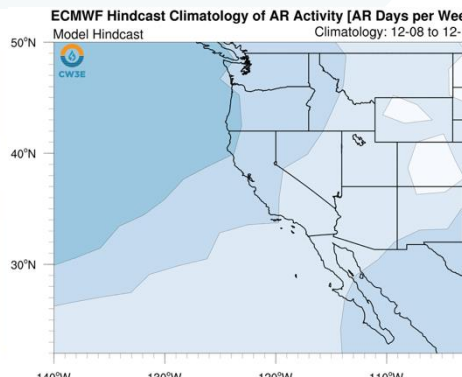
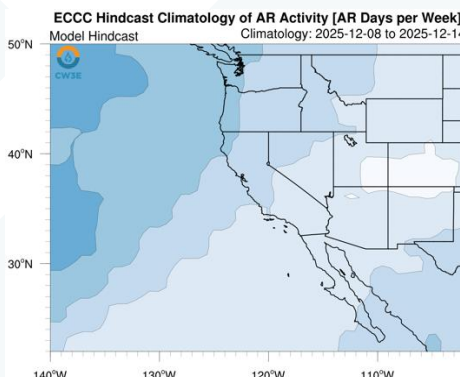
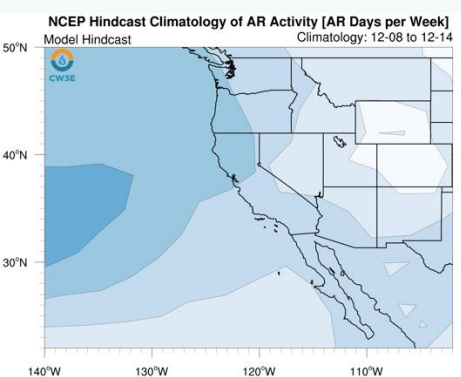
ECCC



ECMWF



- Models are forecasting near-normal to slightly below-normal AR activity over Central and Southern CA during Week 2 (8–14 Dec)
- NCEP is forecasting near-normal to slightly above-normal AR activity over Northern CA, and ECCC and ECMWF are forecasting slightly below-normal AR activity



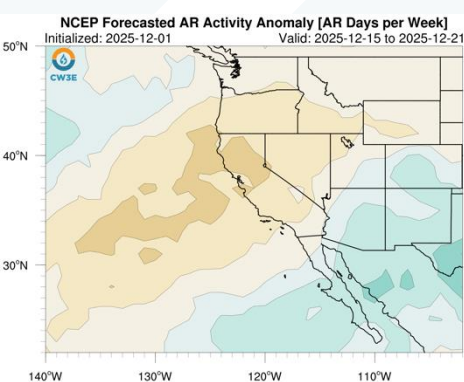
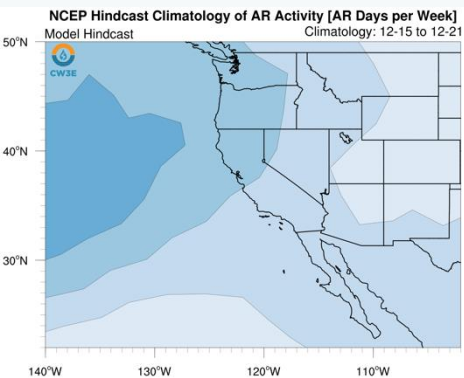
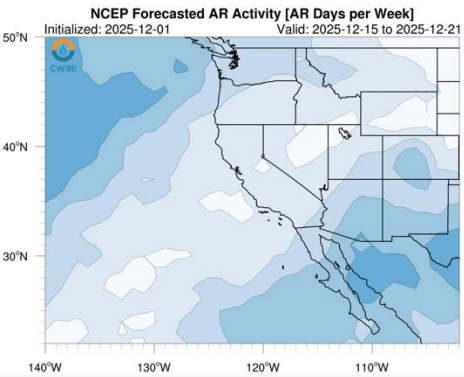
Models generally agree on AR activity over Central and Southern CA during Week 2 (8–14 Dec)

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)

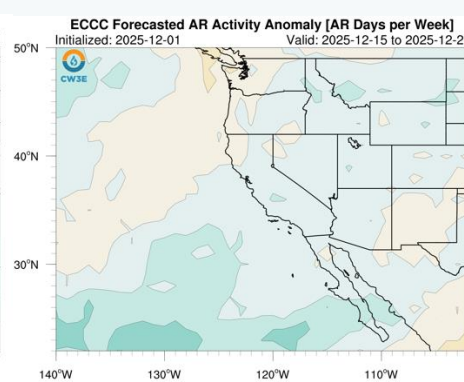
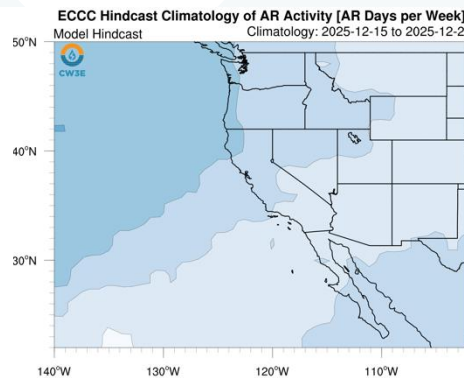
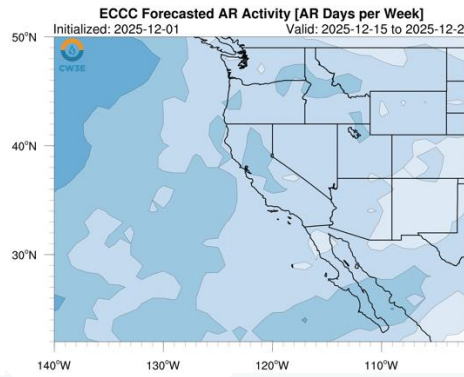
AR Activity Forecasts: Week 3 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 1 Dec 2025

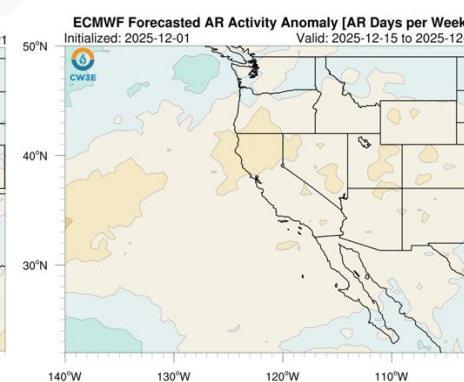
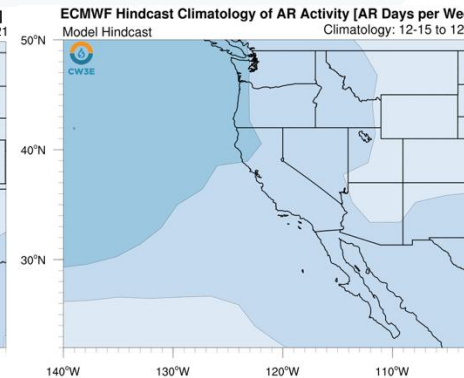
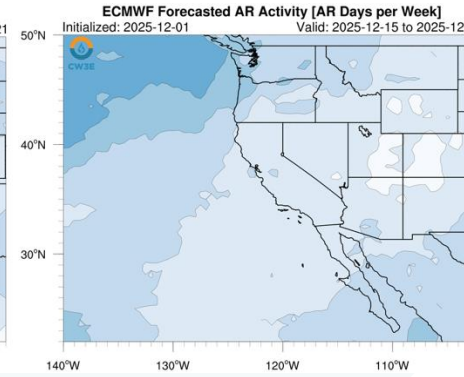
NCEP



ECCC



ECMWF



- ECCC and ECMWF are forecasting near-normal AR activity over Central and Southern CA during Week 3 (15–21 Dec), whereas NCEP is forecasting near-normal to slightly below-normal AR activity
- Over Northern CA, NCEP and ECMWF are forecasting slightly below-normal to below-normal AR activity, whereas ECCC is forecasting near-normal AR activity

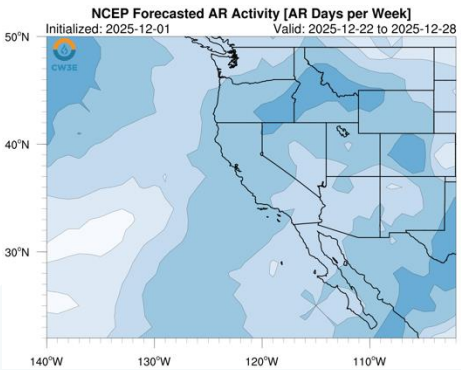
Models disagree on AR activity over CA during Week 3 (15–21 Dec)

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)

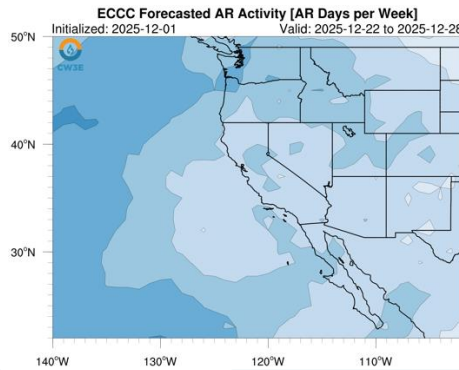
AR Activity Forecasts: Week 4 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 1 Dec 2025

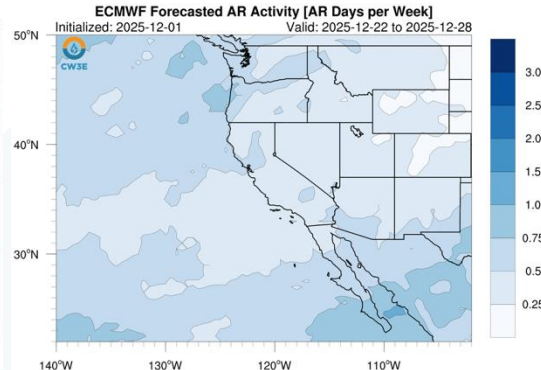
NCEP



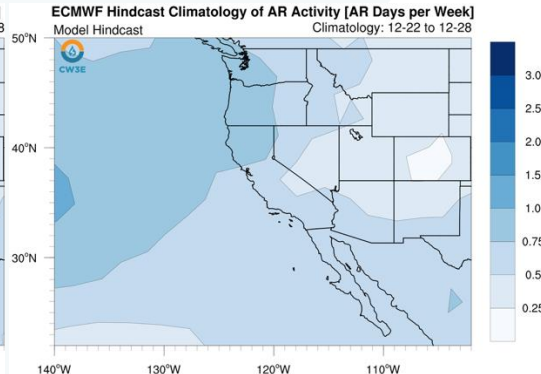
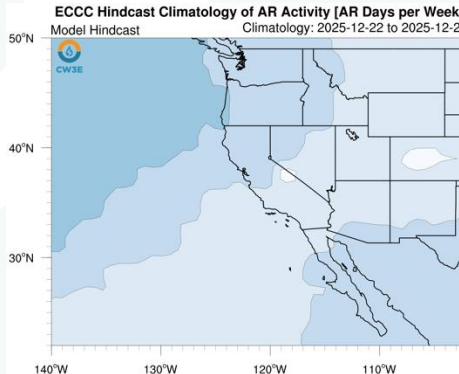
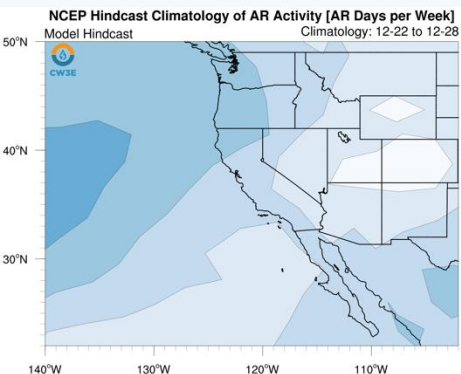
ECCC



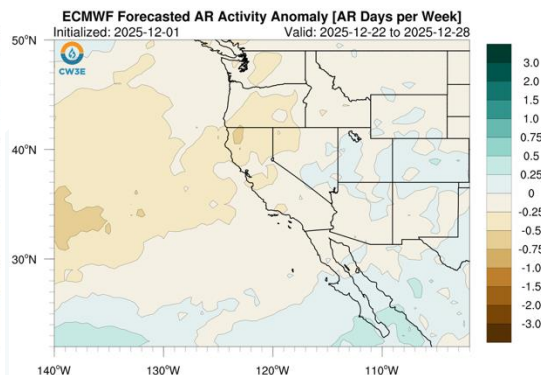
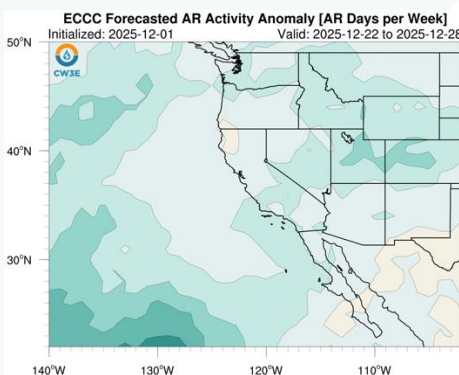
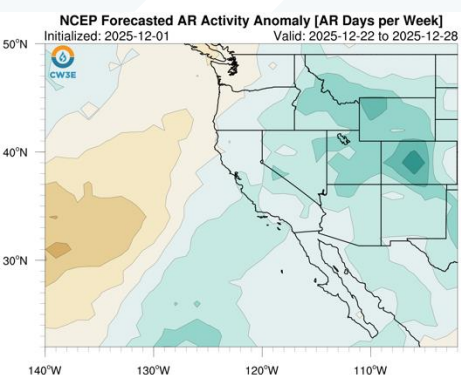
ECMWF



- Models are forecasting near-normal AR activity over Southern CA during Week 4 (22–28 Dec)



- In Northern and Central CA, NCEP and ECCC are forecasting near-normal to slightly above-normal AR activity, while ECMWF is forecasting near-normal to slightly below-normal AR activity

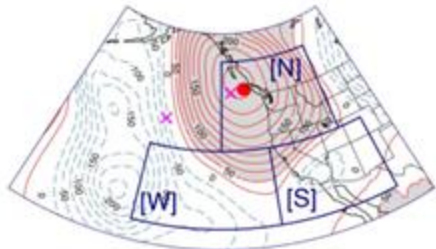


Above normal
Near normal
Below normal

Models generally agree on AR activity over Southern CA during Week 4 (22–28 Dec)

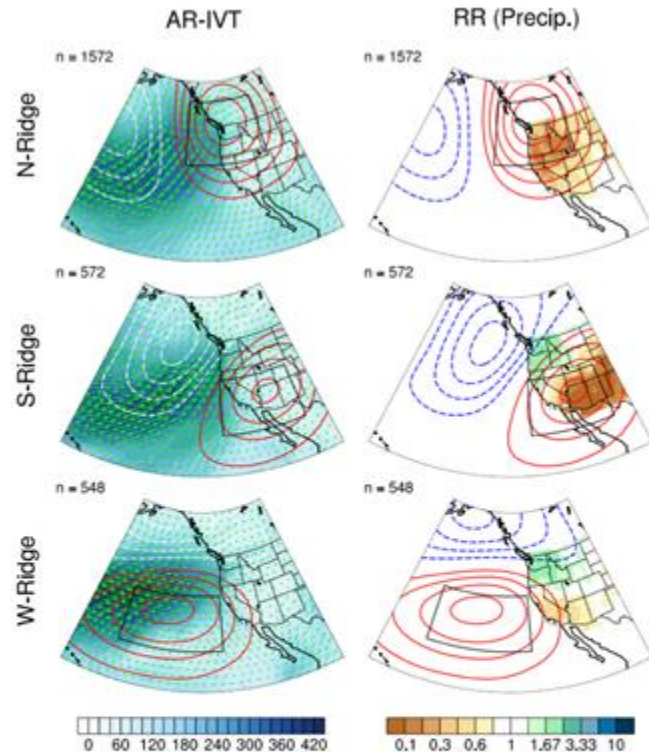
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

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



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
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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

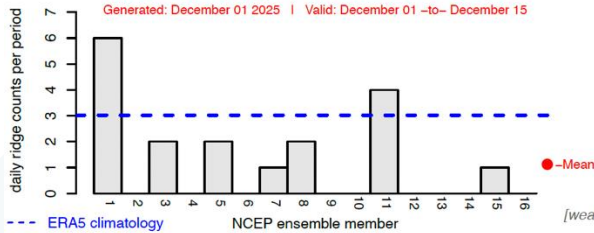
Forecasts Initialized 1 Dec 2025

- Both models are forecasting above-normal West-ridge activity with moderate confidence (62% ensemble agreement of NCEP and 72% ensemble agreement of ECMWF) during Weeks 1–2 (1–15 Dec)
- NCEP is also forecasting above-normal South-ridge activity with moderate confidence (62% ensemble agreement), whereas ECMWF is forecasting slightly above-normal South-ridge activity with low confidence
- Both models are forecasting below-normal North-ridge activity

Models agree on a moderate likelihood of West-ridge activity during Weeks 1–2 (1–15 Dec)

North-ridge type (lead time: weeks 1 & 2)

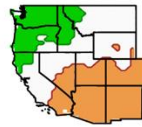
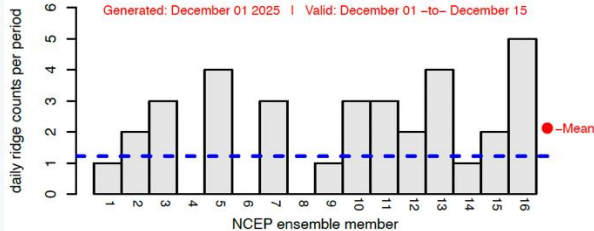
Generated: December 01 2025 | Valid: December 01 –to– December 15



<50%
ensemble agreement

South-ridge type (Lead time: weeks 1 & 2)

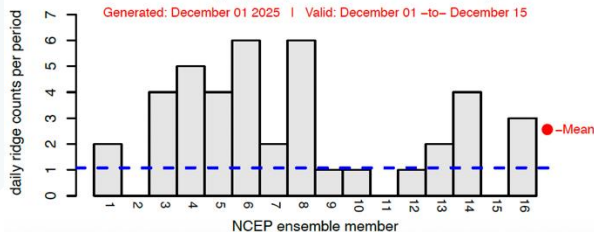
Generated: December 01 2025 | Valid: December 01 –to– December 15



62%
ensemble agreement

West-ridge type (Lead time: weeks 1 & 2)

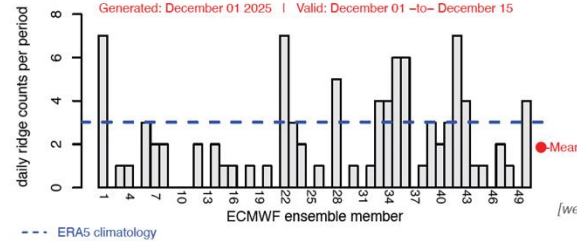
Generated: December 01 2025 | Valid: December 01 –to– December 15



62%
ensemble agreement

North-ridge type (lead time: weeks 1 & 2)

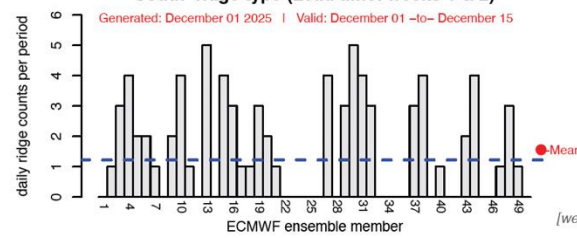
Generated: December 01 2025 | Valid: December 01 –to– December 15



<50%
ensemble agreement

South-ridge type (Lead time: weeks 1 & 2)

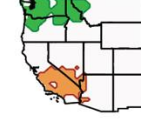
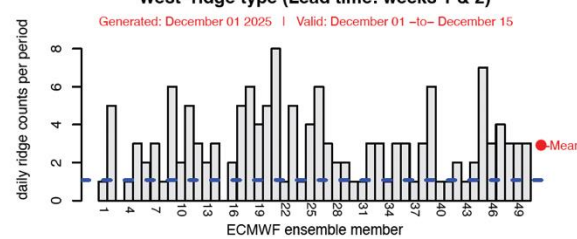
Generated: December 01 2025 | Valid: December 01 –to– December 15



<50%
ensemble agreement

West-ridge type (Lead time: weeks 1 & 2)

Generated: December 01 2025 | Valid: December 01 –to– December 15



72%
ensemble agreement

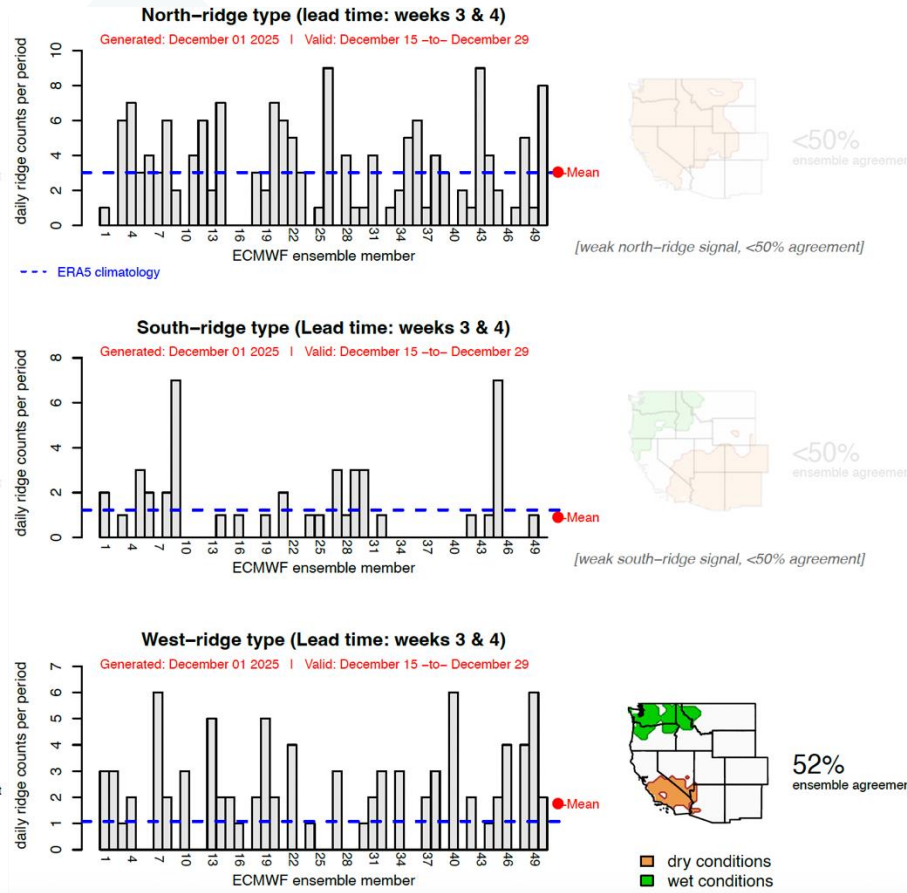
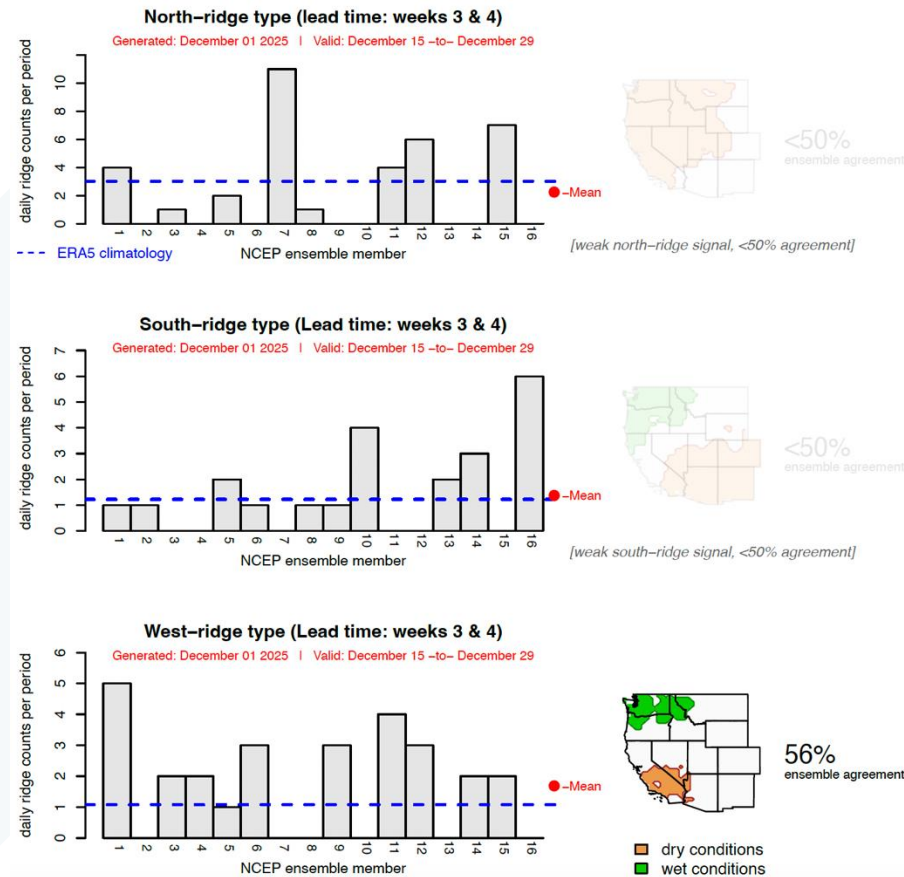
Ridging Forecasts: Weeks 3–4 (NCEP vs. ECMWF)

NCEP

ECMWF

Forecasts Initialized 1 Dec 2025

- Both models are forecasting above-normal West-ridge activity with moderate confidence (56% ensemble agreement of NCEP and 52% ensemble agreement of ECMWF) during Weeks 3–4 (15–29 Dec)
- Both models are forecasting near-normal North-ridge and South-ridge activity

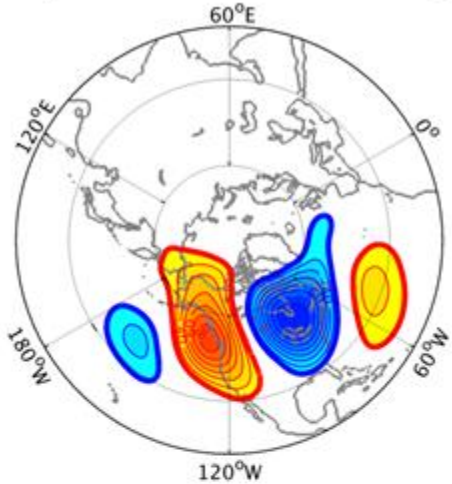


Models agree on a moderate likelihood of West-ridge activity during Weeks 3–4 (15–29 Dec)

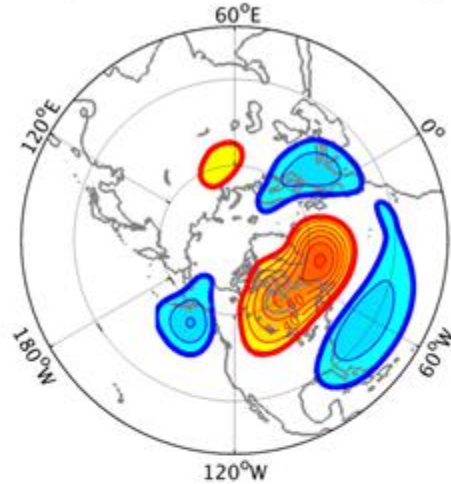
Background Info: IRI Subseasonal Weather Regime Forecasts

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

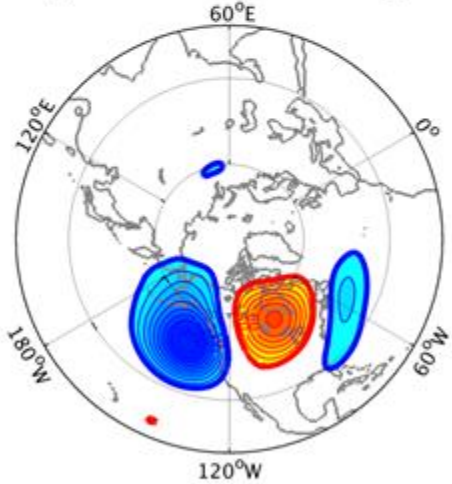
a) WR 1: West Coast Ridge



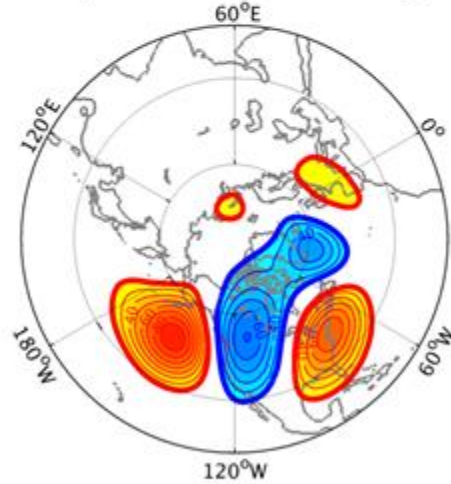
b) WR 2: Greenland High



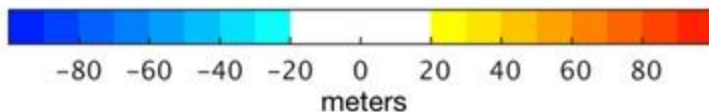
c) WR 3: Pacific Trough



d) WR 4: Pacific Ridge



Geopotential Height Anomaly



- Four dominant weather regimes identified using cluster analysis on daily 500-hPa geopotential height anomalies from MERRA data (1981–2015)

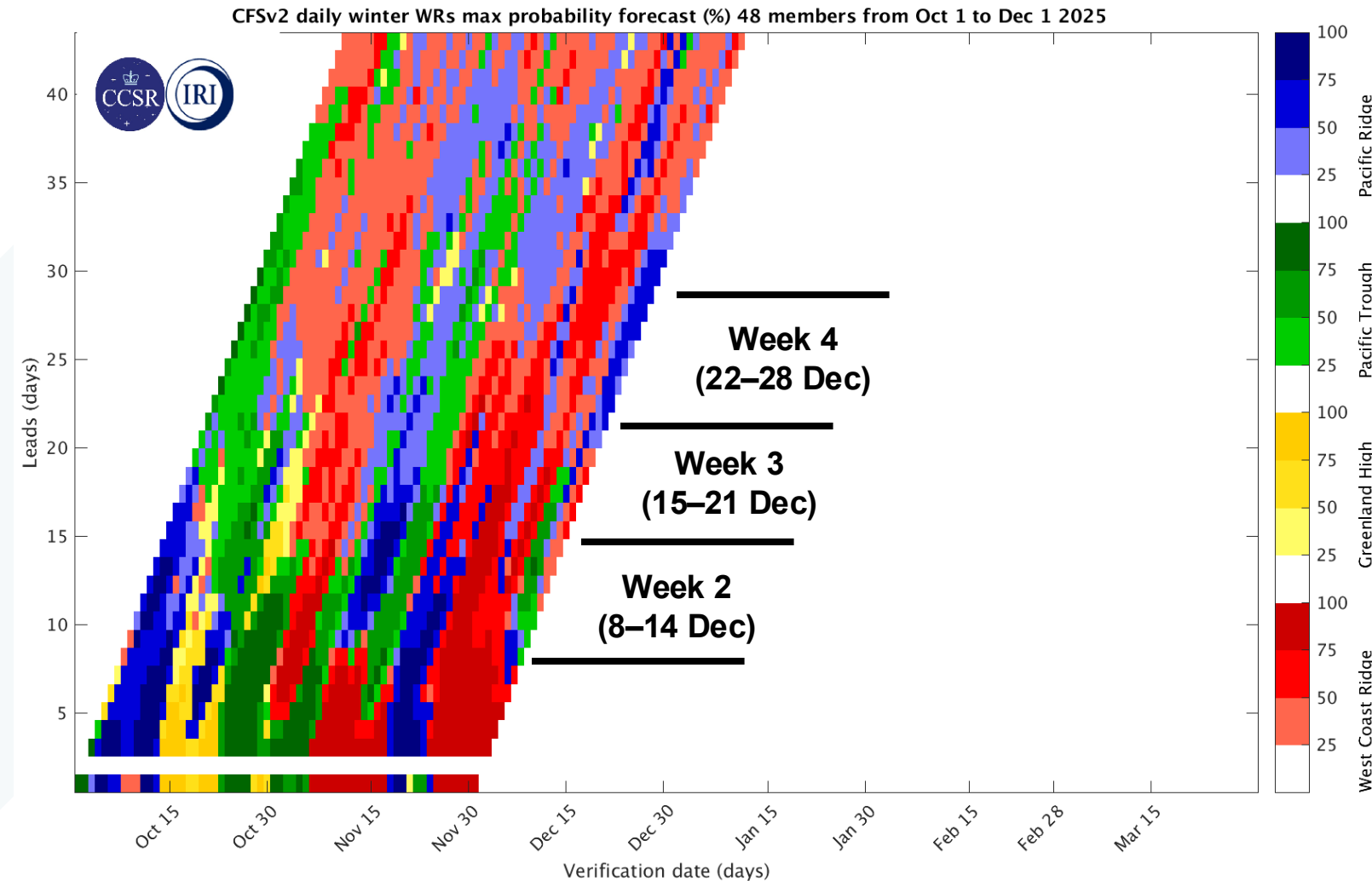
Reference: [Robertson et al. \(2020\)](#)

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 1 Dec 2025

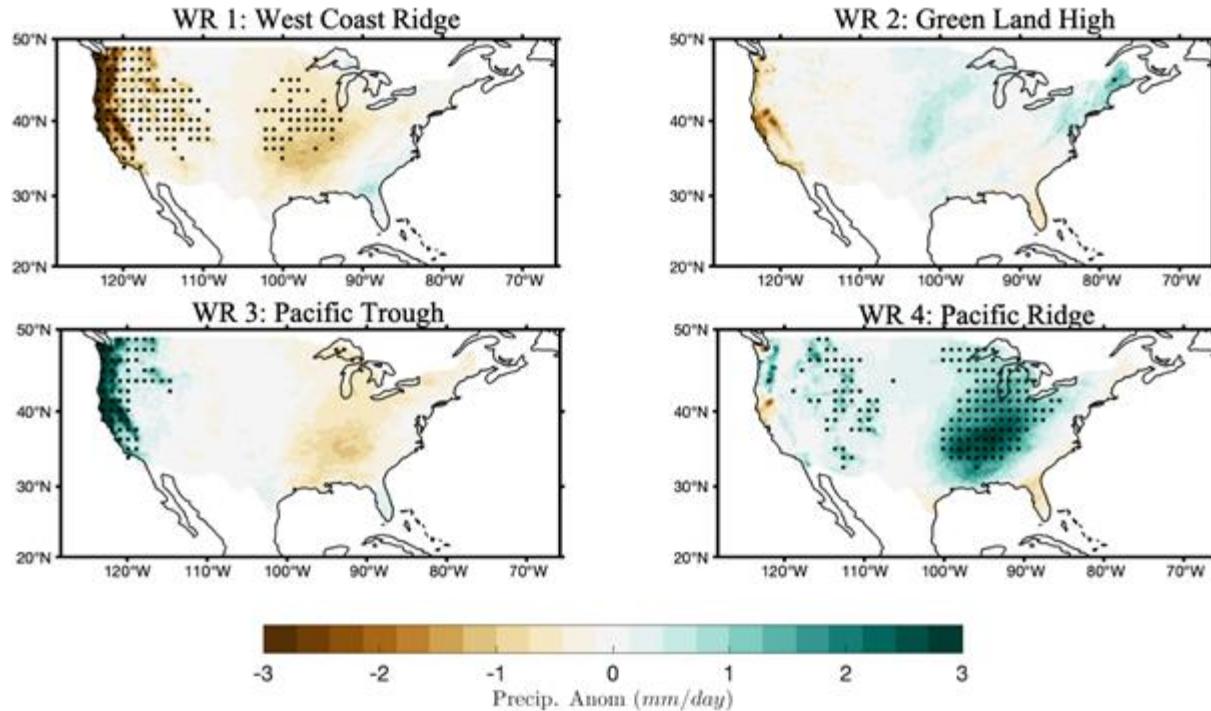


- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble
- Low likelihood (25-50% ensemble agreement) of transition from Pacific Trough to West Coast Ridge in Week 2 (8–14 Dec)
- Moderate likelihood (50–75% agreement) of transition from West Coast Ridge to Pacific Ridge in second half of Week 3 (15–21 Dec)
- Moderate likelihood (50–75% agreement) of persistence of Pacific Ridge through the end of Week 4 (22–28 Dec)

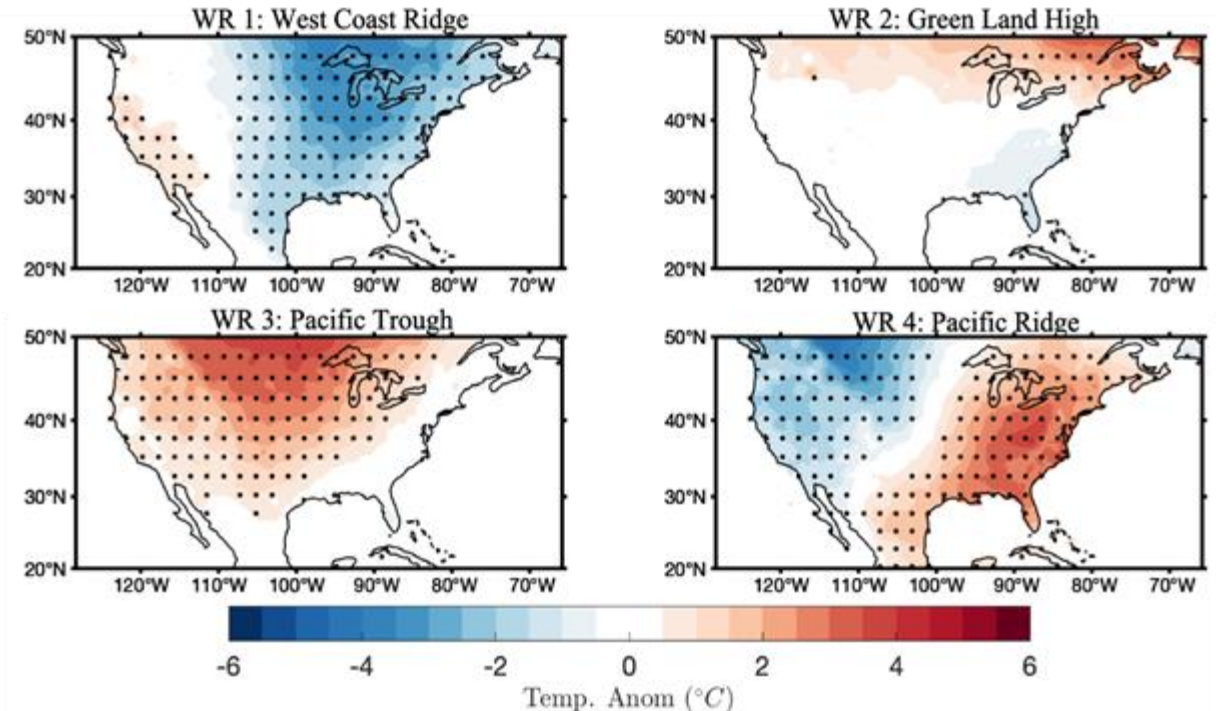
This graphic shows the which of the four North American weather regimes (different colors) is most likely to occur over the next 45 days. Darker (lighter) shading denotes higher (lower) probability of a particular regime. See the next slide for temperature/precipitation implications.

IRI North American Weather Regime Forecasts

Precipitation Anomalies



Temperature Anomalies

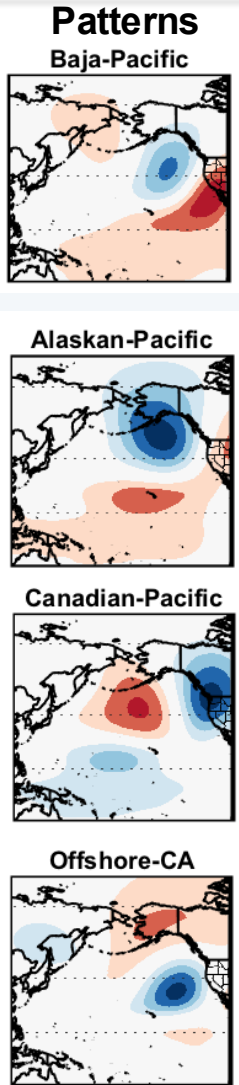


This graphic shows composite mean precipitation (left) and temperature (right) anomalies associated with each weather regime. Stippling (black dots) indicate statistically significant anomalies.

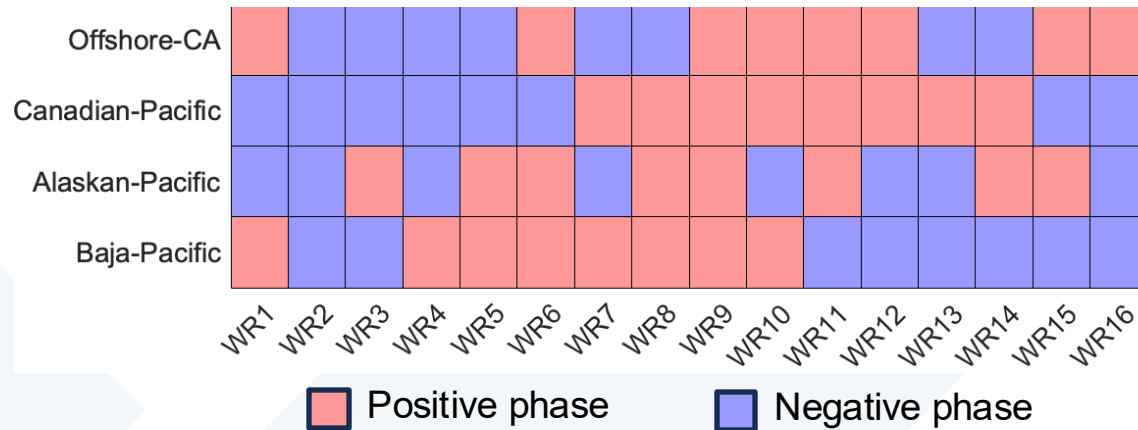
- Above-normal precipitation and above-normal temperature predicted over CA during early Week 2 (8–10 Dec) with low confidence in Pacific Trough regime.
- Below-normal precipitation and above-normal temperature during remainder of Week 2 and most of Week 3 (11–20 Dec) with moderate confidence in West Coast Ridge regime.
- Near-normal precipitation and below-normal temperature predicted over CA during Week 4 (22–28 Dec) with moderate confidence in Pacific Ridge regime.

Background Info: Hybrid Weather Regime Impacts Forecast

a) NP4 Mode



b) NP4 Mode Phase Combinations



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.

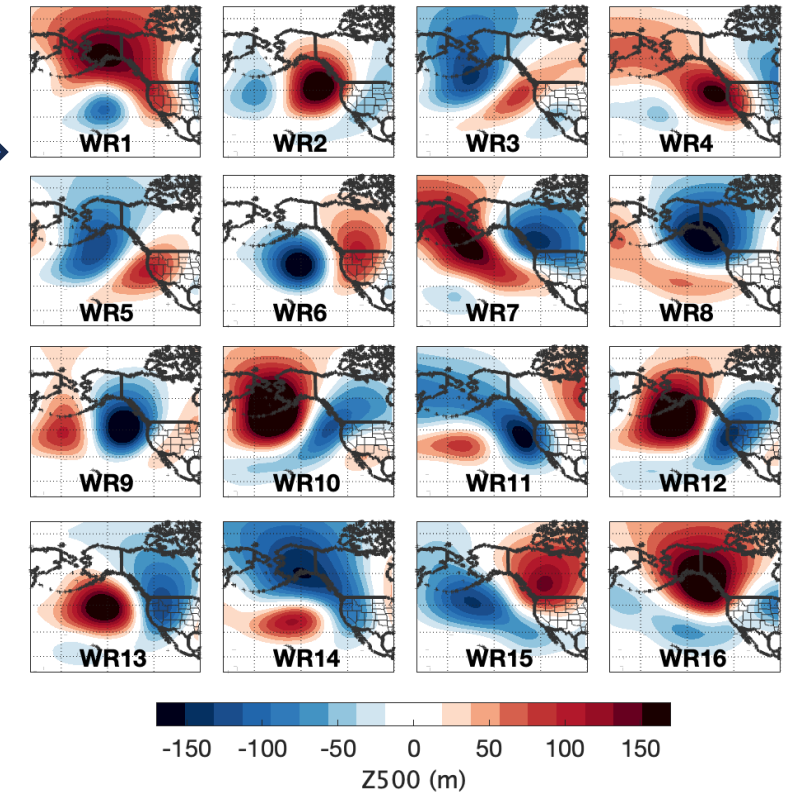
c) Daily Weather Regimes

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.

c) Daily Weather Regimes



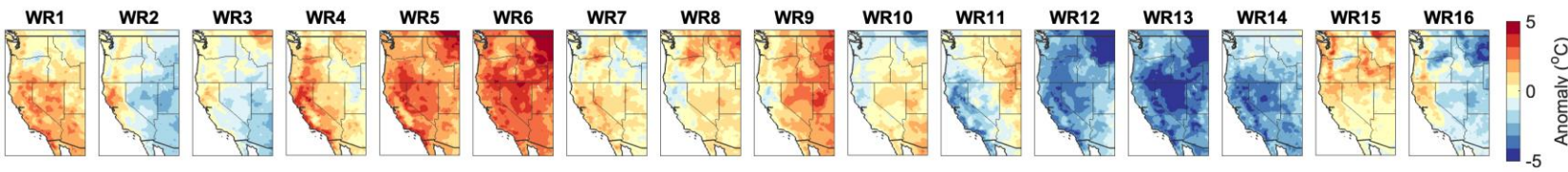
This slide contains background information about CW3E's hybrid weather regimes forecast product.

Reference:

Guirguis et al. [2023a](#) and [2023b](#)

Hybrid Weather Regime Impacts Forecast

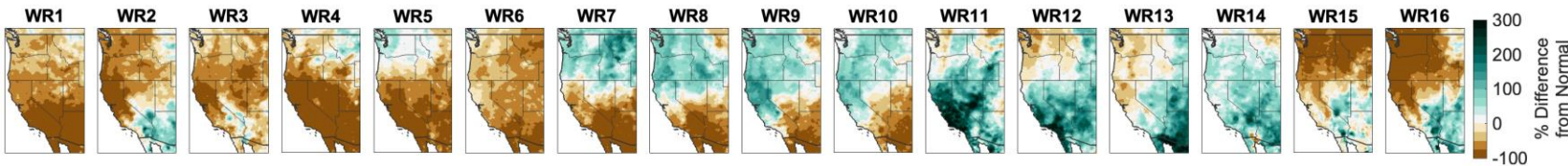
a) Temperature Anomaly Associated With Each Weather Regime



Forecasts Initialized 1 Dec 2025

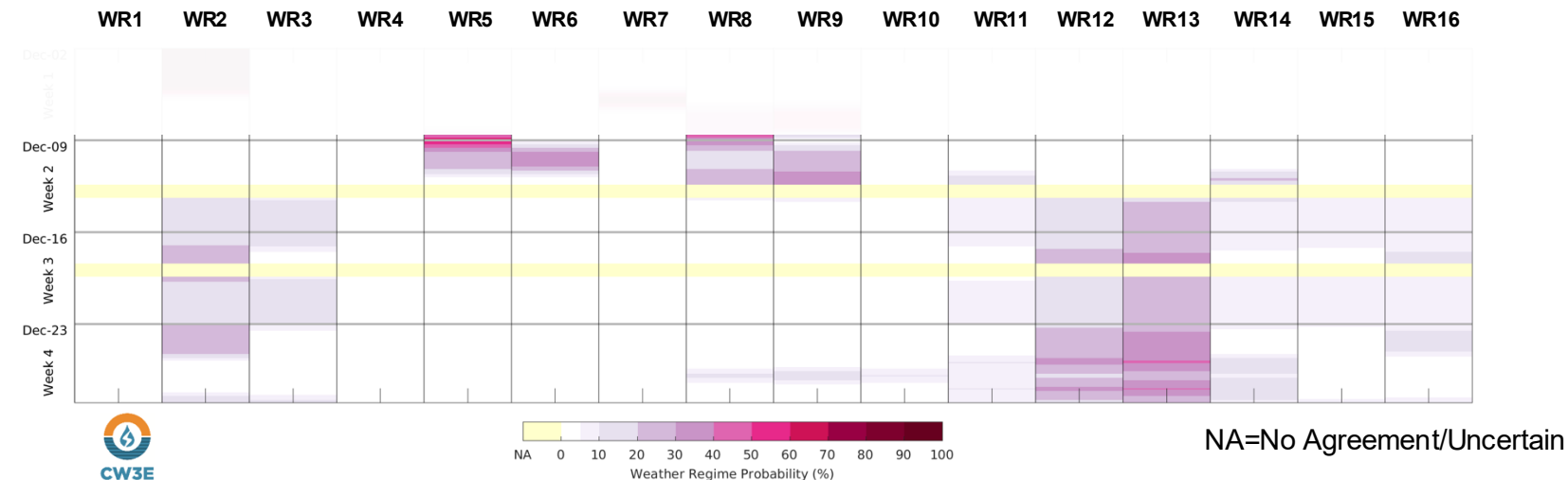
Weeks 2–4 are the focus of this outlook.

b) Precipitation Anomaly Associated With Each Weather Regime



Initialized 01-Dec-2025
Valid Dec02-Dec29

c) Weather Regime Forecast



Week 2: There is much uncertainty among ensemble members, but the forecast generally suggests a transition approximately mid-week. Early in the week, drier conditions in Southern CA and uncertainty in Northern/Central CA (WRs 5,6,8,9). Later in the week, a transition would bring wetter conditions to the interior Southwest and Southern CA (we 13). Temperatures show a transition from warmer to cooler during week 2.

Weeks 3–4: Show a continuation of wetter conditions favored in the interior Southwest and Southern CA and uncertainty for Northern and Central CA (WRs 12,13). Temperatures are forecast to be cooler than average.



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

NA=No Agreement/Uncertain

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