



Center for Western Weather
and Water Extremes

SCRIPPS INSTITUTION OF OCEANOGRAPHY
AT UC SAN DIEGO

CW3E Subseasonal Outlook: 17 January 2024

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

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/s2s_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*

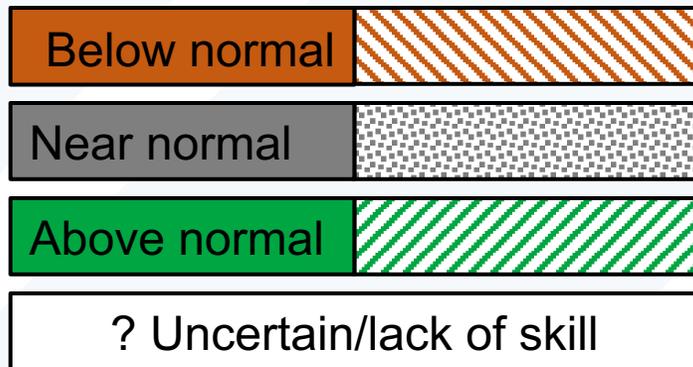
Summary: Subseasonal Precipitation Outlook by Model

This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 15 Jan 2024

Region	Week 2 (23–29 Jan)			Week 3 (30 Jan – 5 Feb)			Week 4 (6–12 Feb)		
	NCEP ^{2,3}	ECMWF ^{1,2}	Multi-Model Forecast	NCEP ^{2,3}	ECMWF ^{1,2}	Multi-Model Forecast	NCEP ^{2,3}	ECMWF ²	Multi-Model Forecast
WA/OR	Diagonal Green	Diagonal Orange	White	White	Solid Orange	White	White	Diagonal Orange	White
Northern CA	Diagonal Green	Solid Orange	White	White	White	White	White	Diagonal Orange	White
Central CA	Diagonal Green	Solid Orange	White	White	White	White	Diagonal Orange	Diagonal Orange	Diagonal Orange
Southern CA	Diagonal Green	Solid Orange	White	Diagonal Orange	White	White	Diagonal Orange	Diagonal Orange	Diagonal Orange

Higher Confidence | Lower Confidence



- Models disagree on precipitation outlook over CA during Week 2; NCEP products lean towards above-normal precipitation, whereas ECMWF products are more confident in below-normal precipitation
- Week 3 forecasts are uncertain due to lack of agreement between forecast products over CA
- NCEP and ECWMF agree on below-normal precipitation in Central and Southern CA during Week 4, but with lower confidence

Subseasonal products included in this Outlook:

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

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

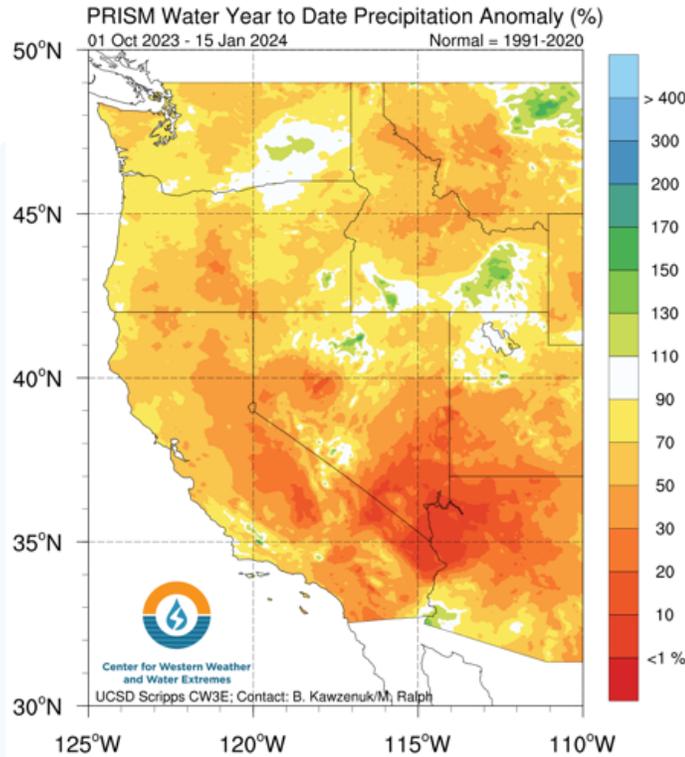
³IRI North American Weather Regime Forecasts ([Robertson et al. 2020](#))

Summary

- **Week 2 forecasts (23–29 Jan):** ECMWF is showing low likelihood (< 40% probability) of AR activity over CA
 - NCEP AR activity forecasts are not available for Week 2
- MJO convection in the Maritime Continue is forecast move into the Western Pacific during Week 2
 - MJO activity over the Maritime Continent during JFM is associated with a decreased likelihood of wet extremes in Central CA at lag times of 1–4 weeks
- Ridging outlooks show uncertainty in ridging activity near the US West Coast during Weeks 1–2
 - ECMWF is showing moderate confidence in above-normal North-ridge activity, which is typically associated with dry conditions in CA
- **Week 3 forecasts (30 Jan – 5 Feb):** ECMWF is predicting near-normal AR activity over CA
- Models show potential for persistent ridging near the US West Coast during Weeks 3–4, but disagree on the location of the center of ridging activity
 - NCEP is showing moderate confidence in above-normal South-ridge activity (wet conditions over Pacific Northwest and Northern CA; dry conditions over Southern CA)
 - ECMWF is showing moderate confidence in above-normal North-ridge activity
- IRI weather regime tool shows high likelihood of Pacific Trough (wet conditions over CA) in Week 2, followed by a possible transition to prolonged West Coast Ridge (dry conditions over CA) through Week 4

Hydrologic Summary

Precipitation

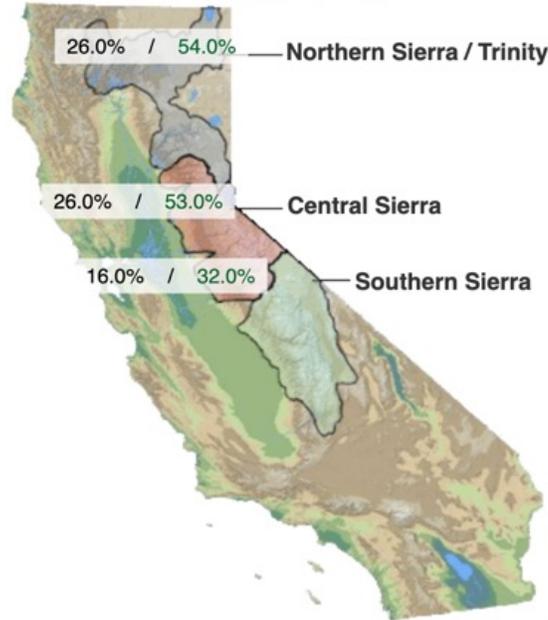


Snowpack Conditions

Provided by the California Cooperative Snow Surveys

Data For: 16-Jan-2024

% Apr 1 Avg. / % Normal for this Date

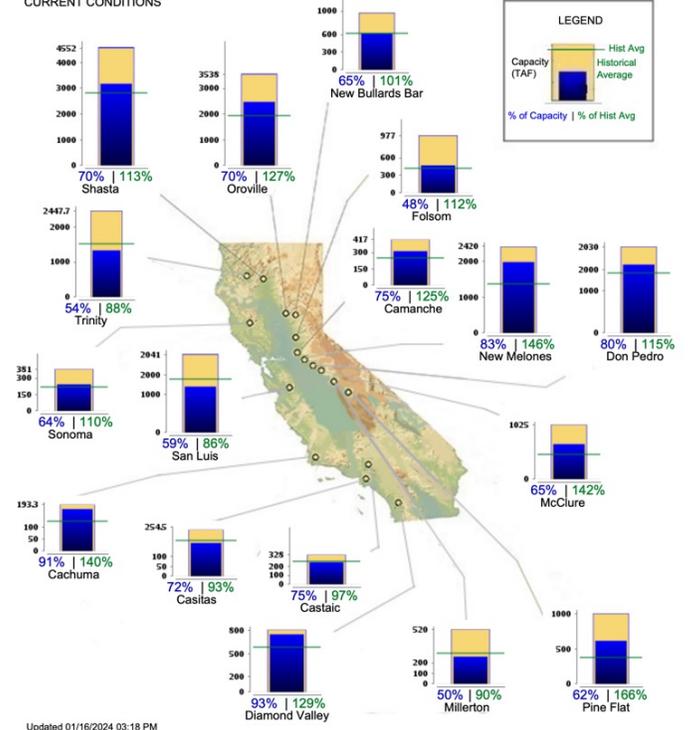


Source: California DWR

Reservoir Storage

CALIFORNIA MAJOR WATER SUPPLY RESERVOIRS
CURRENT CONDITIONS

Midnight - January 15, 2024



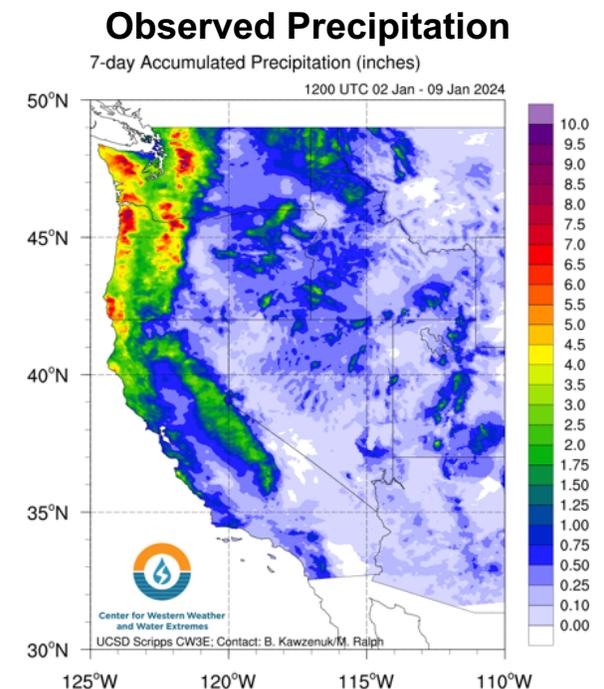
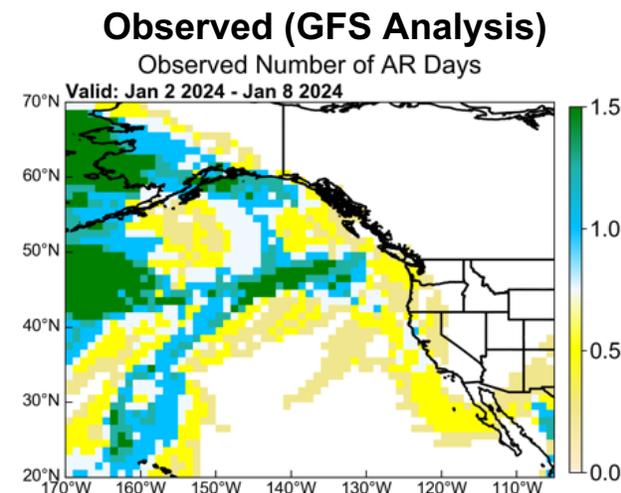
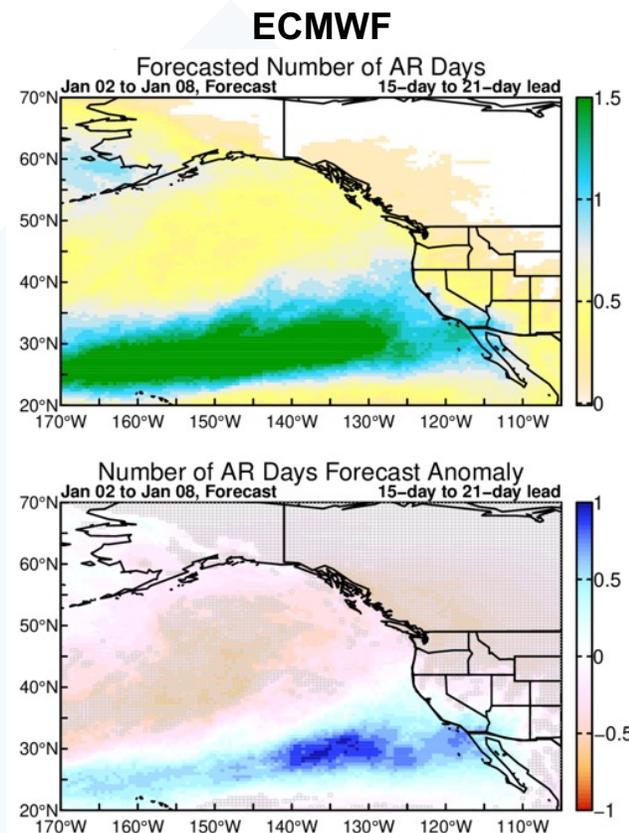
Source: California DWR

- As of 15 Jan, water-year-to-date precipitation continues to be below-normal throughout CA
- Large portions of Central and Southern CA have received < 50% of normal precipitation since 1 Oct 2023
- Statewide snowpack is also running below-normal for this time of year, especially in the Southern Sierra Nevada
- Most large reservoirs in CA are still operating at greater than 60% storage capacity and near- or above-normal storage for this time of year

Looking Back: Week 3 AR Activity Forecasts

Forecasts Initialized 18 Dec 2023; Valid: 2–8 Jan 2024

NCEP
Unavailable



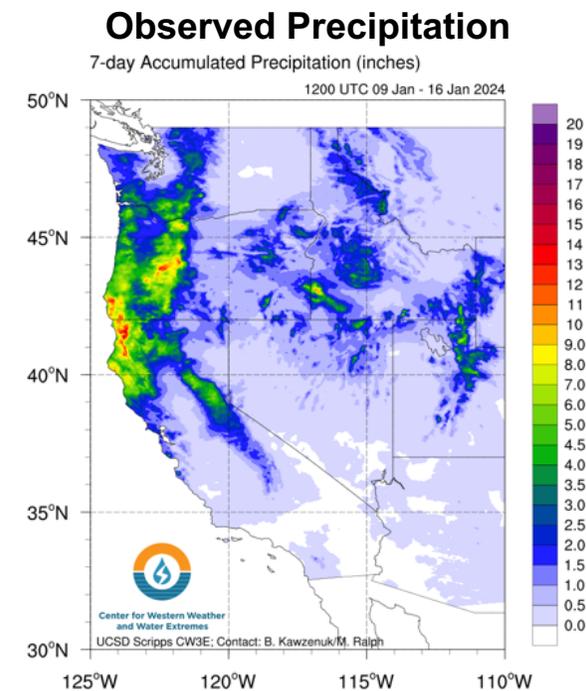
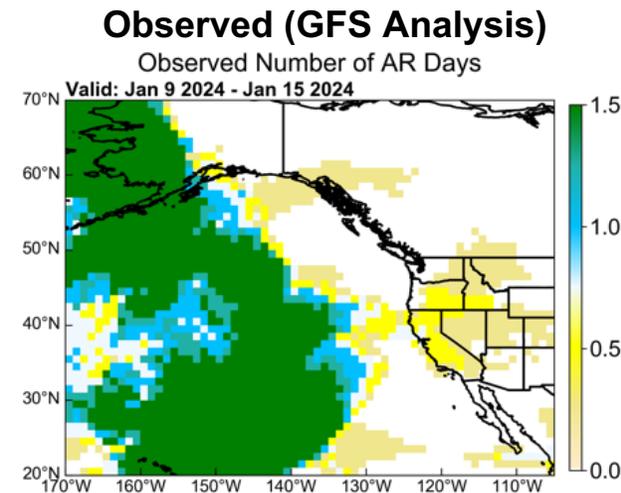
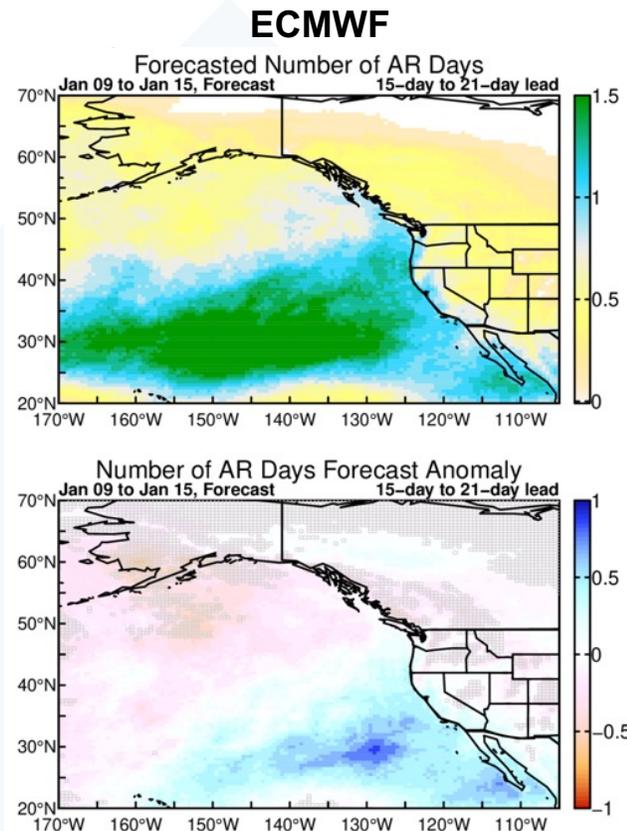
Shading: Fractional # of AR days over a 7-day period (top) and forecast minus model climatology (bottom)
Grey cells: >75% of ensemble members agree on sign of anomaly

- ECMWF incorrectly forecasted the main region of AR activity to be over the subtropical Northeast Pacific and overestimated AR activity over Southern CA
- Observed AR activity primarily extended from Hawaii northeastward into the Gulf of Alaska
- Multiple short-lived ARs and low-pressure systems brought precipitation to the US West Coast on 2–3 Jan, 4 Jan, and 5–6 Jan
- These storms produced > 5 inches of total precipitation in the Coast Ranges and Cascades in WA and OR, as well as 2–5 inches of precipitation in the Northern CA Coast Ranges and Sierra Nevada

Looking Back: Week 3 AR Activity Forecasts

Forecasts Initialized 25 Dec 2023; Valid: 9–15 Jan 2024

NCEP
Unavailable

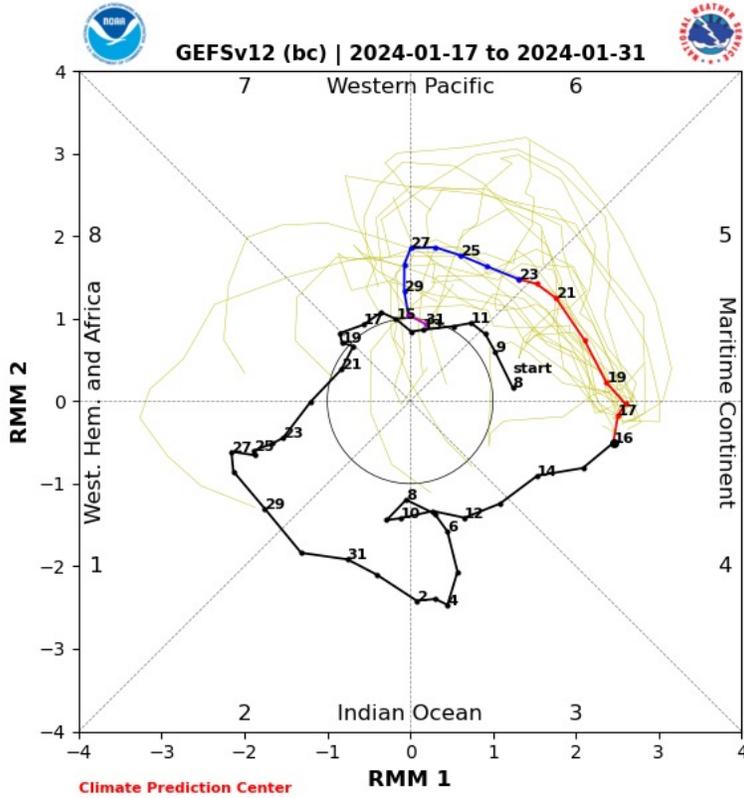


Shading: Fractional # of AR days over a 7-day period (top) and forecast minus model climatology (bottom)
Grey cells: >75% of ensemble members agree on sign of anomaly

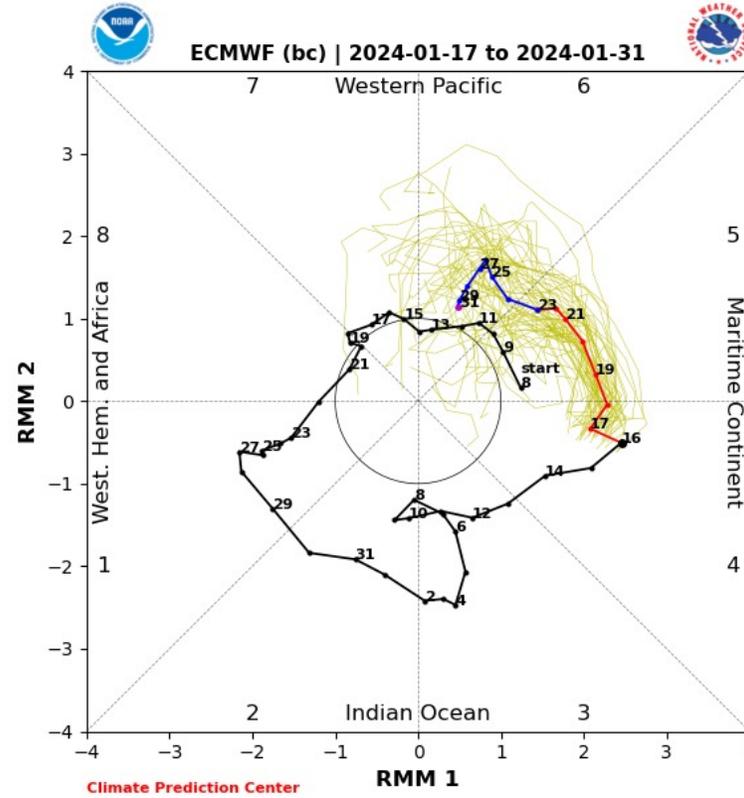
- ECMWF incorrectly forecasted the main region of AR activity to be over the subtropical Northeast Pacific and overestimated AR activity along the CA coast
- Observed AR activity primarily remained offshore and extended from Hawaii northward to western Alaska
- A of low-pressure systems and decaying ARs brought heavy precipitation to parts of the US West Coast during 9–13 Jan
- These storms produced > 8 inches of total precipitation in the OR Cascades, Southern OR Coast Ranges, and Northern CA Coast Ranges

Dynamical Model MJO Forecasts (NCEP vs. ECMWF)

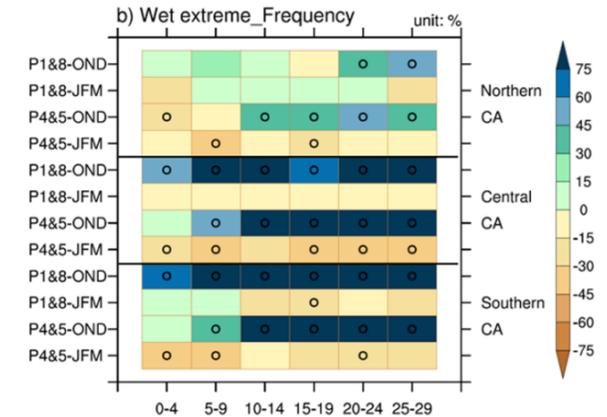
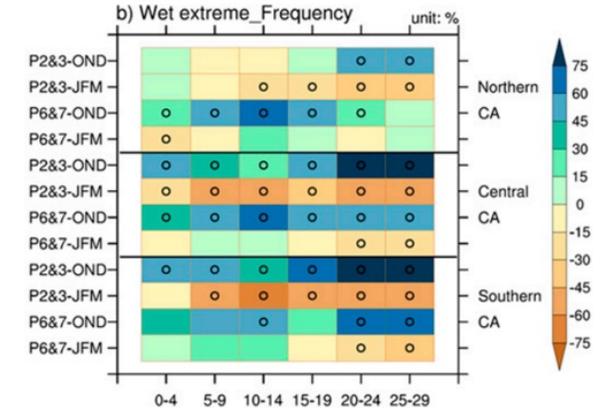
NCEP



ECMWF



Black line: Last 40 days of observations; Yellow lines: Ensemble members
Forecast: (Red: Week 1, Blue: Week 2, Purple: > Week 2)

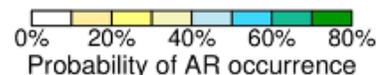
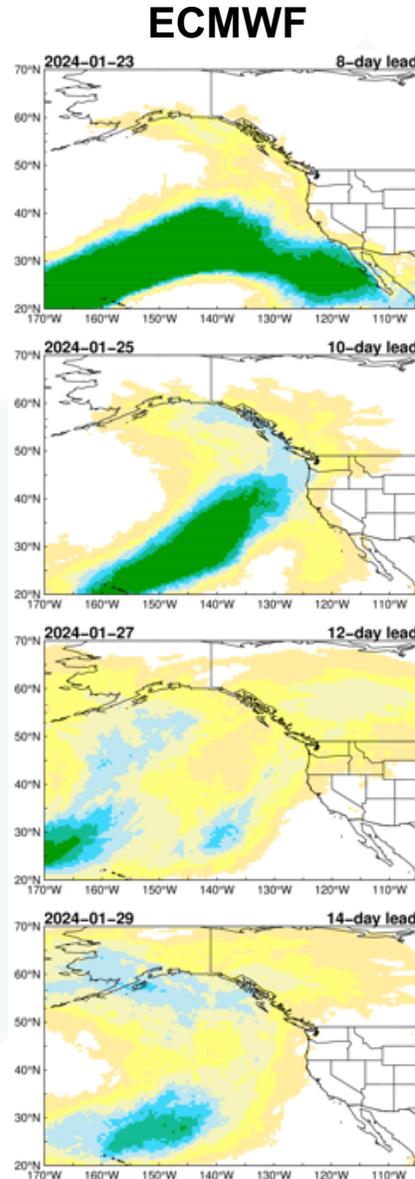


- Strong MJO convection is currently located over the Maritime Continent
- NCEP and ECMWF are both forecasting MJO convection to propagate eastward through the Maritime Continent and reach the Western Pacific by Week 2
- MJO activity over the Maritime Continent during JFM is associated with a decreased likelihood of wet extremes in Central CA at lag times of 1–4 weeks

Subseasonal Outlooks: Week 2 AR Activity (NCEP vs. ECMWF)

Forecasts Initialized 15 Jan 2024

NCEP
Unavailable

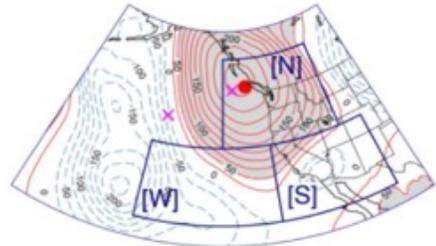


- ECMWF is showing a low likelihood of AR activity (< 40% probability) over all of CA during Week 2 (23–29 Jan), with a high likelihood of AR activity (> 70% probability) just south of CA on 23 Jan
- ECMWF is also showing low likelihood of AR activity over WA/OR, except on 25–26 Jan

ECMWF is predicting low likelihood of AR activity over CA during Week 2

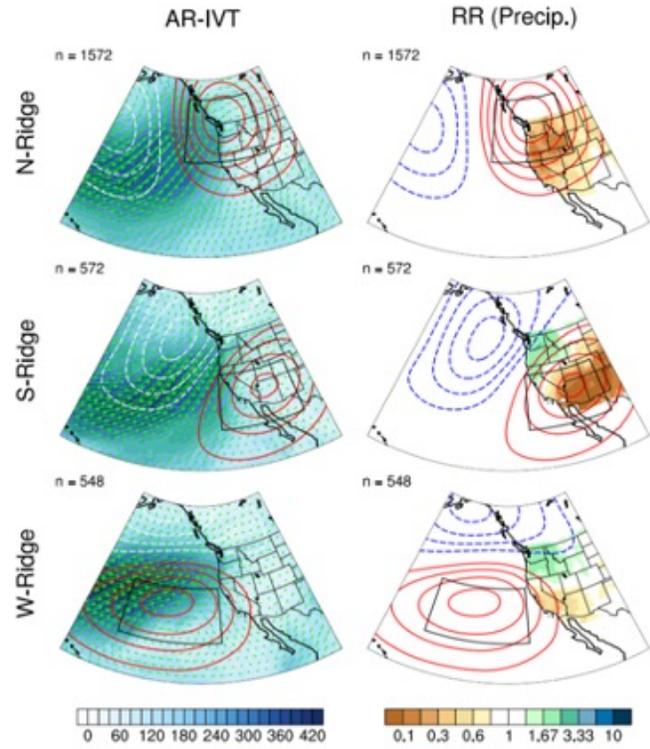
**Note that the probabilities of AR occurrence in the Week 2 AR activity plots may differ from the probabilities of AR conditions in the AR landfall tool. These discrepancies exist due to the use of different models (e.g., GEFS vs. CFSv2), model configurations (S2S models are coupled between ocean, land, and atmosphere), and methods for AR detection.*

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



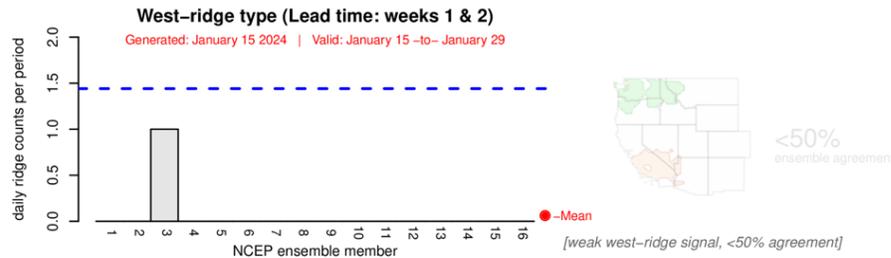
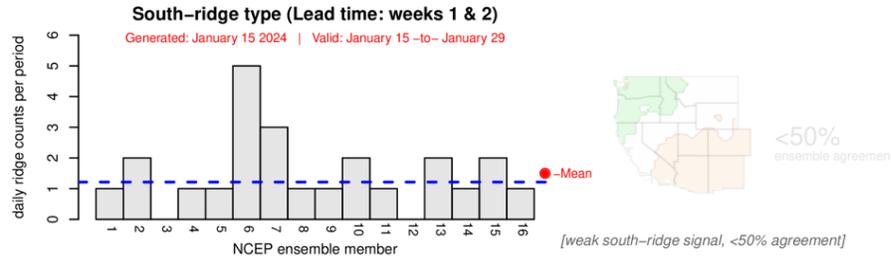
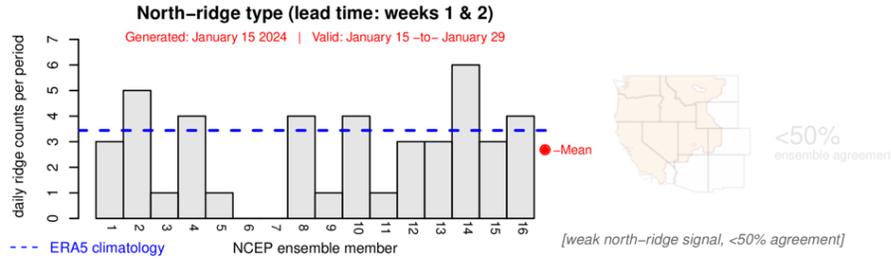
Contact: pgibson@ucsd.edu
Reference: Gibson et al. (2020) Journal of Climate

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

Forecasts Initialized 15 Jan 2024

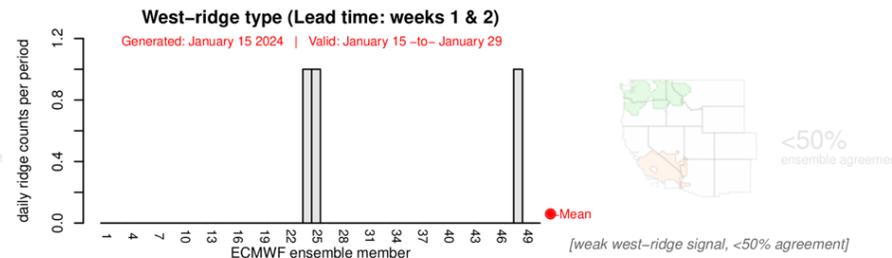
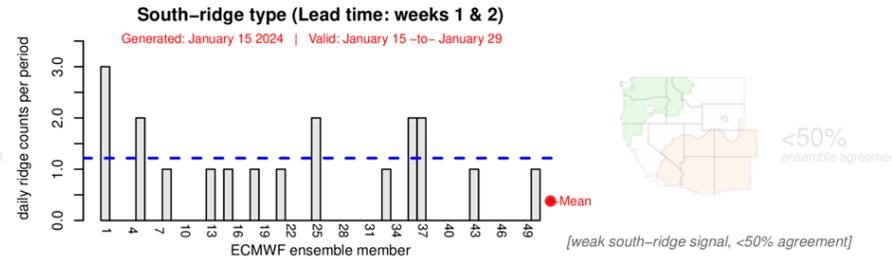
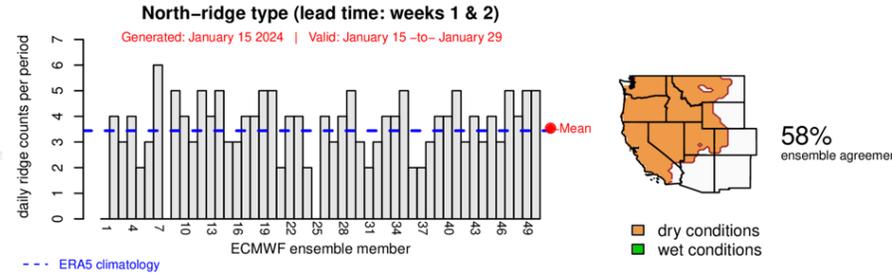
NCEP

CW3E Subseasonal Ridging Forecast (Uses NCEP CFSv2 model)



ECMWF

CW3E Subseasonal Ridging Forecast (Uses ECMWF model)



- Overall, NCEP is predicting below-normal ridging activity near the US West Coast during Weeks 1–2 (11–25 Jan)
- NCEP is showing potential for ridging activity over the Pacific Northwest and Southwest, but there is uncertainty regarding the center of ridging activity
- ECMWF is showing a moderate likelihood (58% ensemble agreement) of above-normal North-ridge activity
- Both models are predicting very low West-ridge activity



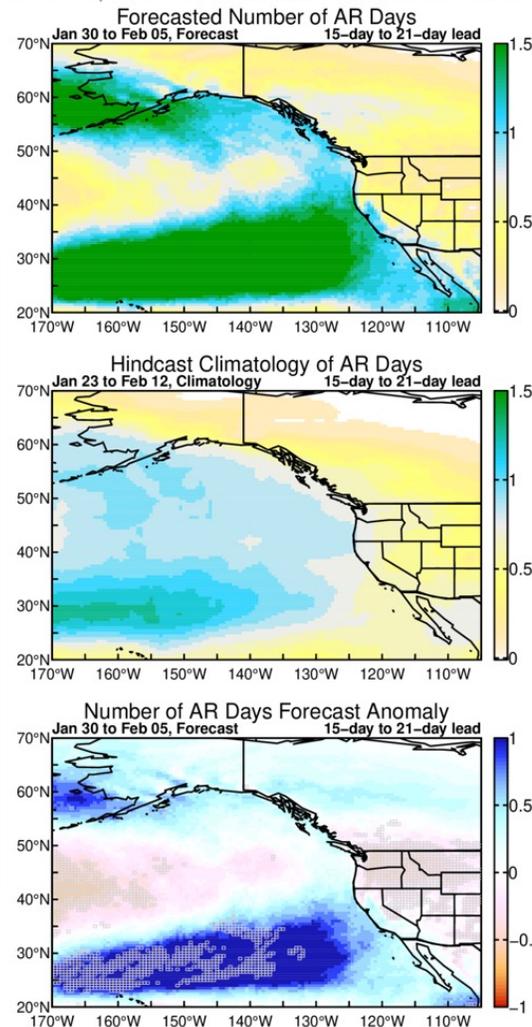
Model uncertainty regarding both the likelihood of persistent ridging near the US West Coast and the center of ridging activity during Weeks 1–2



Subseasonal Outlooks: Week 3 AR Activity (NCEP vs. ECCO vs. ECMWF)

Forecasts Initialized 15 Jan 2024

ECMWF



NCEP
Unavailable

- ECMWF is predicting near-normal AR activity over CA during Week 3 (30 Jan – 5 Feb)
- ECMWF is also predicting below-normal AR activity over WA/OR with high confidence

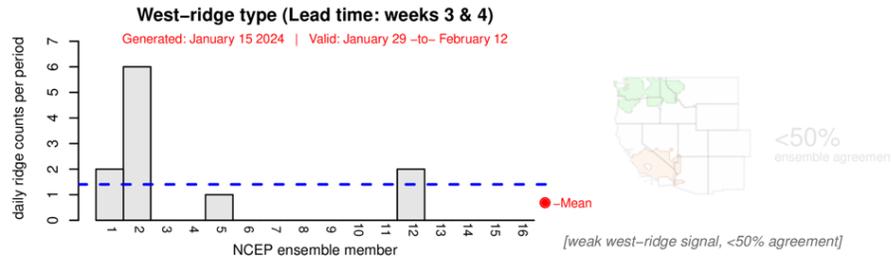
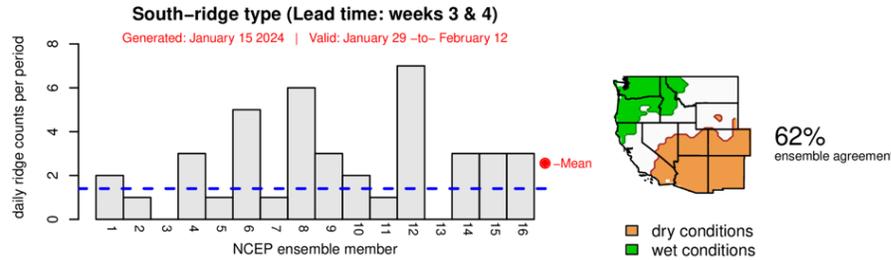
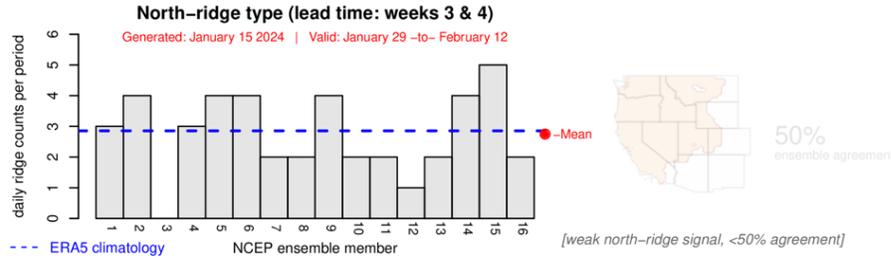
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom)
Grey cells: >75% of ensemble members agree on sign of anomaly

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

Forecasts Initialized 15 Jan 2024

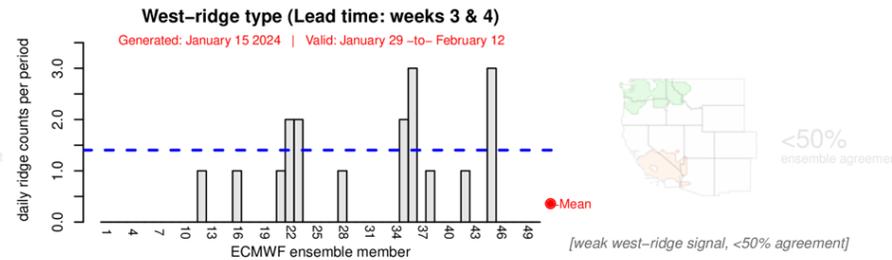
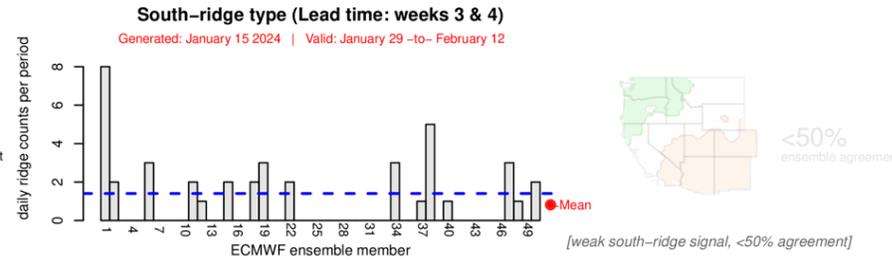
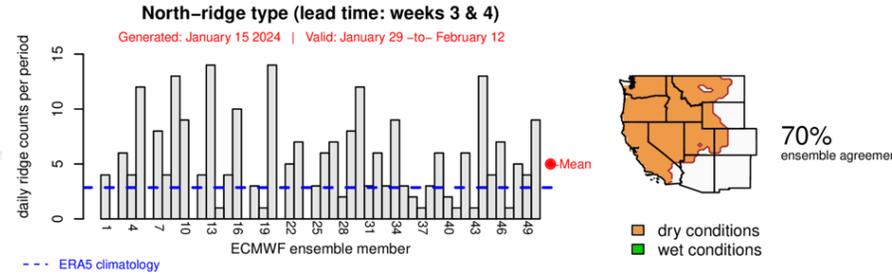
NCEP

CW3E Subseasonal Ridging Forecast (Uses NCEP CFSv2 model)



ECMWF

CW3E Subseasonal Ridging Forecast (Uses ECMWF model)



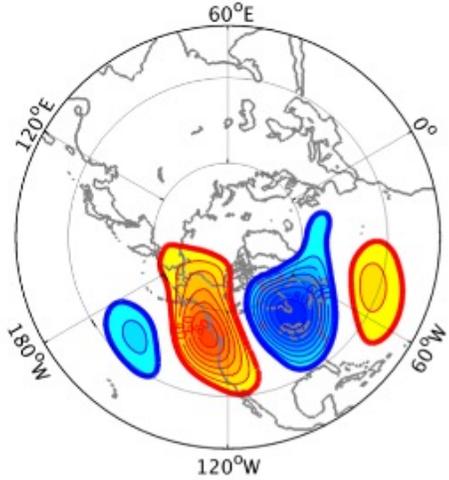
- NCEP is showing a moderate likelihood (62% ensemble agreement) of above-normal South-ridge activity during Weeks 3–4 (29 Jan – 12 Feb)
- NCEP is also predicting near-normal occurrence of the North-ridge type
- ECMWF is showing a moderate likelihood (70% ensemble agreement) of above-normal North-ridge activity
- Both models are predicting below-normal West-ridge activity

Models show potential for persistent ridging activity near the US West Coast but disagree on center of ridging activity during Weeks 3–4

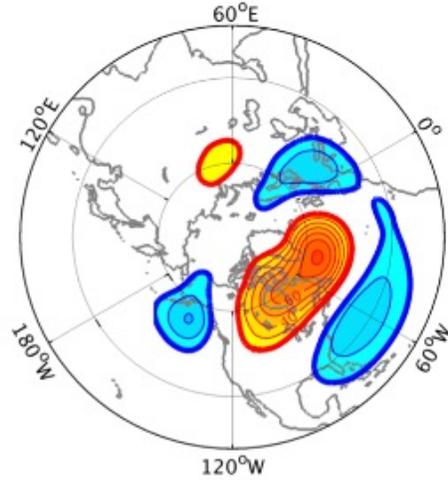


Background Info: IRI Subseasonal Weather Regime Forecasts

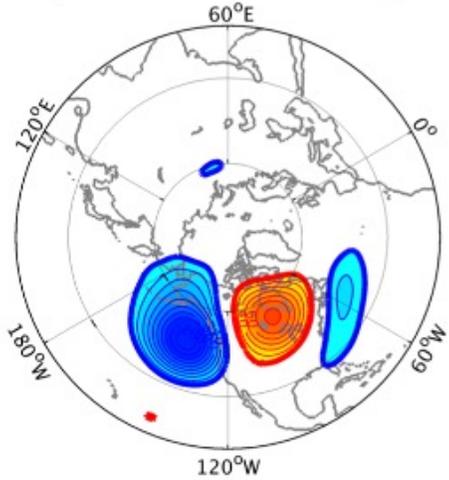
a) WR 1: West Coast Ridge



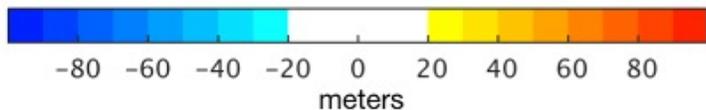
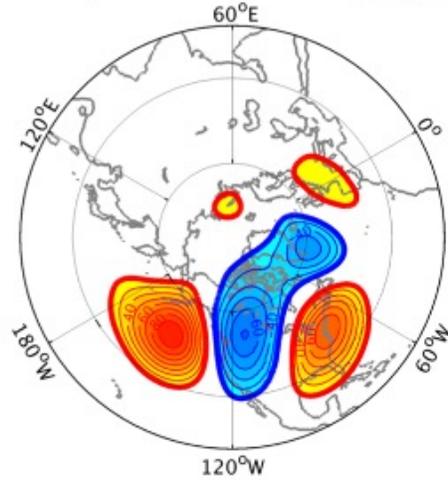
b) WR 2: Greenland High



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)

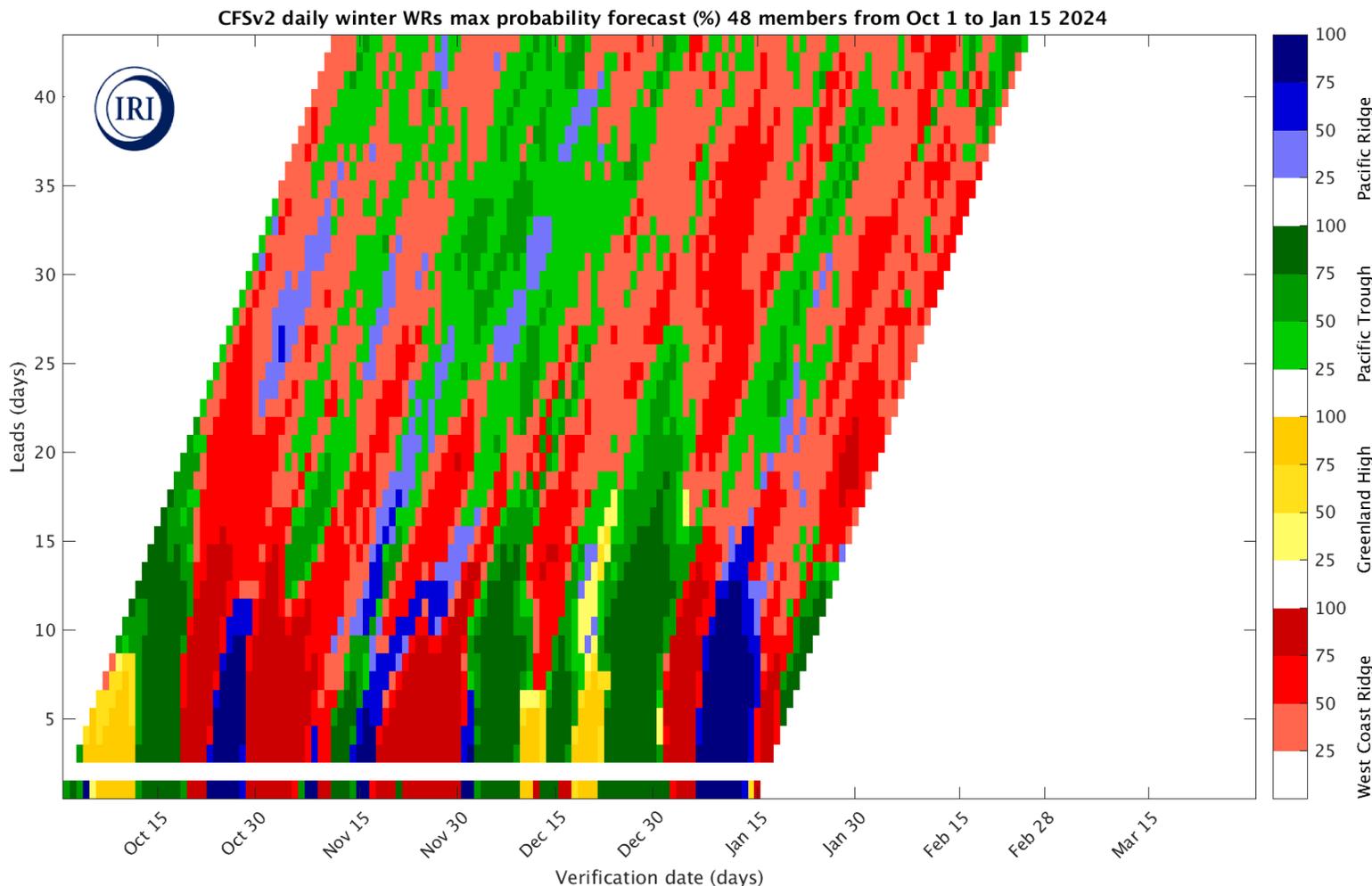
Reference: [Robertson et al. \(2020\)](#)

For more information about the forecast product:

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

Subseasonal Outlooks: IRI North American Weather Regime Forecasts

Forecast Initialized 15 Jan 2024

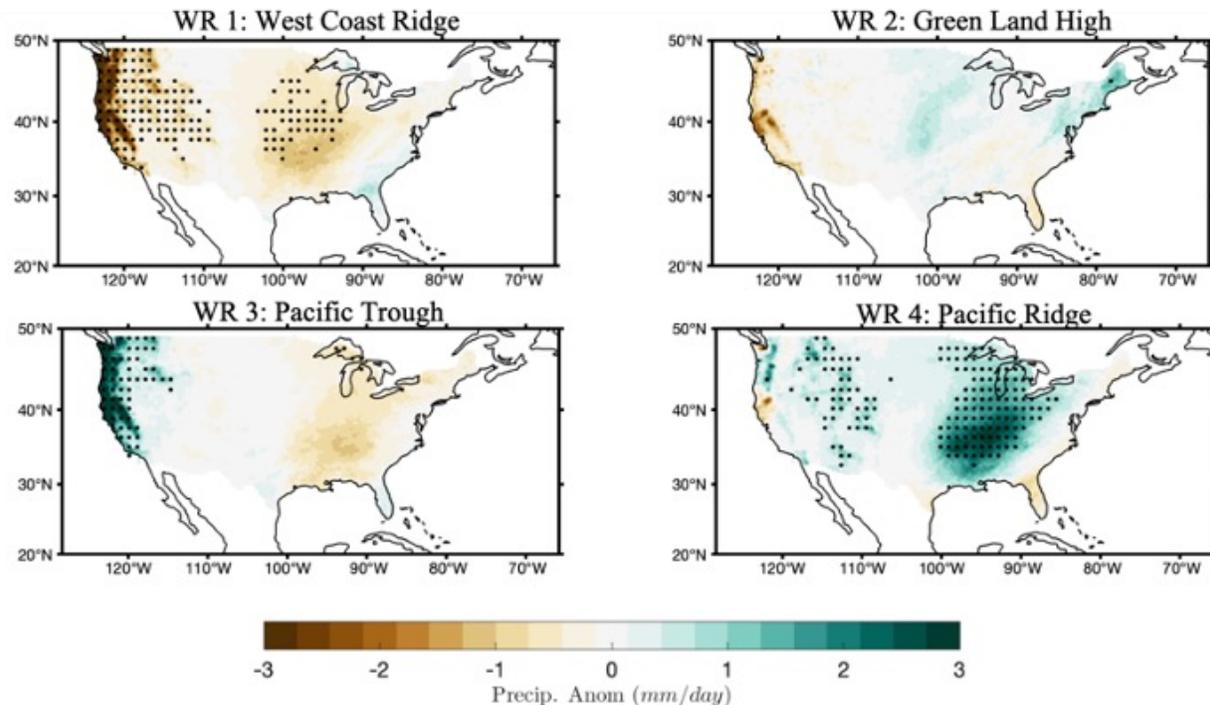


- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble
- High likelihood (>75% ensemble agreement) of Pacific Trough conditions the first half of Week 2 (23–29 Jan)
- Low-to-moderate likelihood (25-75% ensemble agreement) of transition to West Coast Ridge conditions in Week 3 (30 Jan – 5 Feb)
- Low-to-moderate likelihood of West Coast Ridge conditions continuing through Weeks 4 and 5 (6–19 Feb)

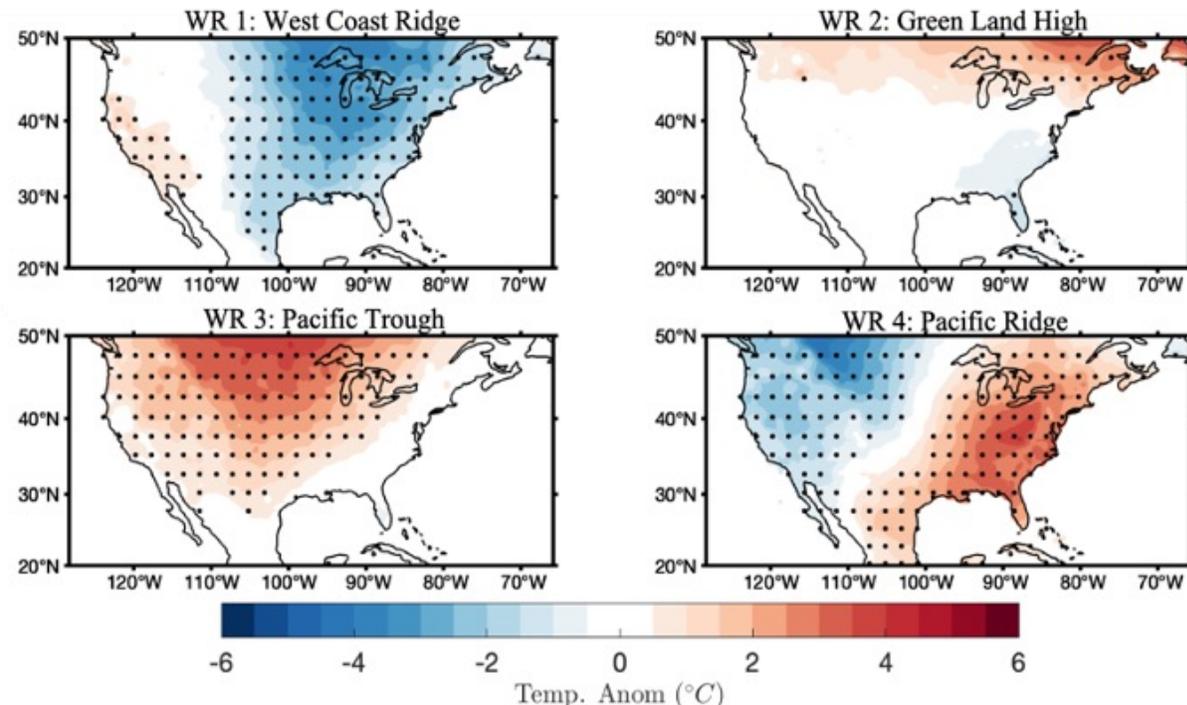
This graphic shows the which of the four North American weather regimes (different colors) is most likely to occur over the next 45 days. Darker (lighter) shading denotes higher (lower) probability of a particular regime. See the next slide for temperature/precipitation implications.

Subseasonal Outlooks: IRI North American Weather Regime Forecasts

Precipitation



Temperature



Historical precipitation (left) and temperature (right) composites associated with each regime

- Warm and wet conditions are predicted over CA in late Jan with high confidence
- Warm and dry conditions are predicted over CA during the first half February with low-to-moderate confidence