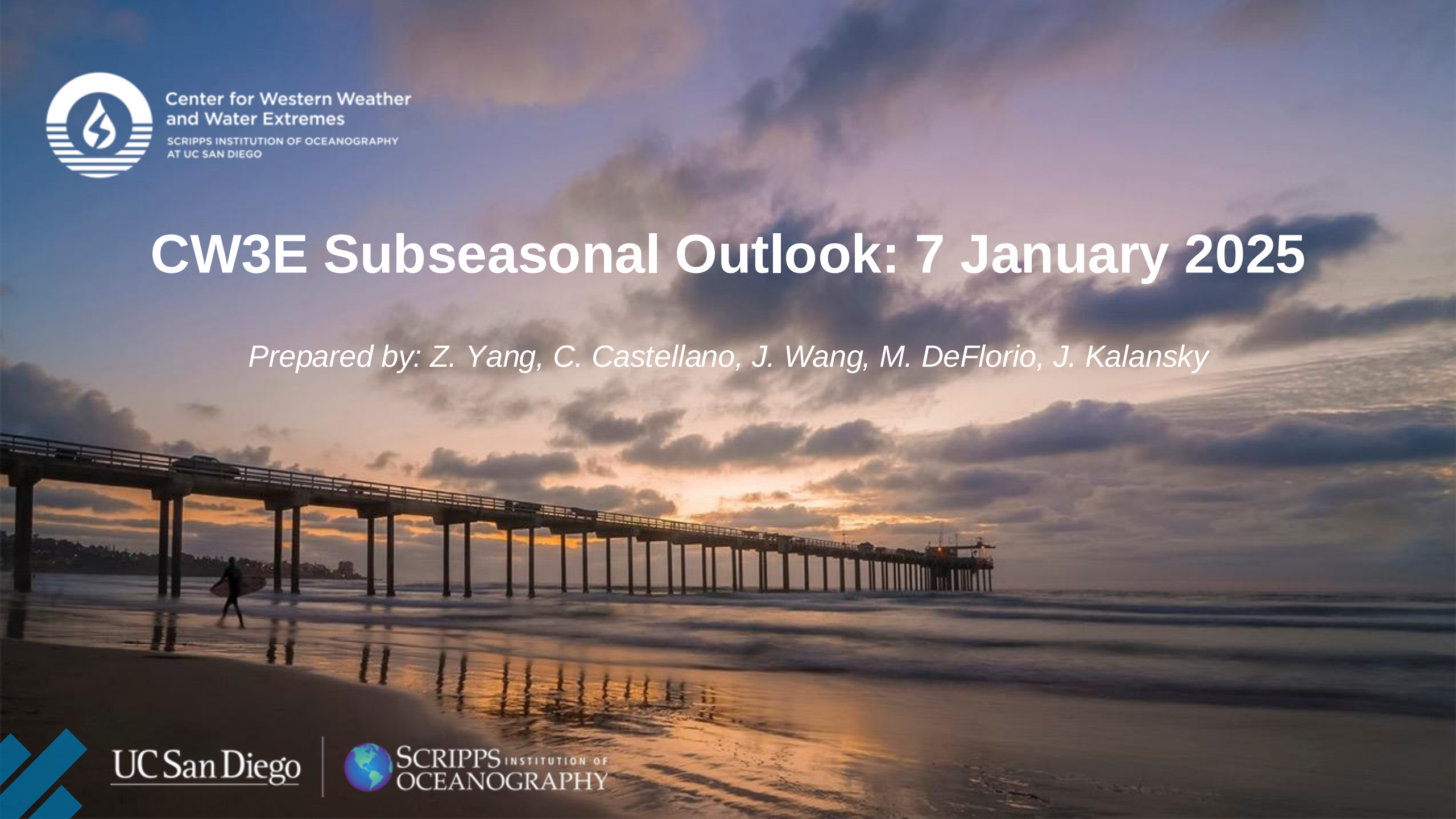
Center for Western Weather
and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY
AT UC SAN DIEGO
CW3E Subseasonal Outlook: 7 January 2025
Prepared by: Z. Yang, C. Castellano, J. Wang, M. DeFlorio, J. Kalansky
UC San Diego
SCRIPPS INSTITUTION OF
OCEANOGRAPHY

Summary: Subseasonal Precipitation Outlook by Model

This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 6 Jan 2025

Region	Week 2 (13–19 Jan)				Week 3 (20–26 Jan)				Week 4 (27 Jan–2 Feb)			
	NCEP[1,2,3]	ECCC[1]	ECMWF[1,2]	Multi-Model Forecast	NCEP[1,2,3]	ECCC[1]	ECMWF[1,2]	Multi-Model Forecast	NCEP[1,2,3]	ECCC[1]	ECMWF[1,2]	Multi-Model Forecast
WA/OR												
Northern CA												
Central CA												
Southern CA												

Higher Confidence | Lower Confidence

- Below normal
- Near normal
- Above normal
- ? Uncertain/lack of skill

- Models agree on below-normal precipitation over all of CA during Week 2
- Models lean towards above-normal precipitation over Northern and Central CA (with low-to-moderate confidence) during Weeks 3–4

Subseasonal products included in this Outlook:

[1]CW3E/JPL Atmospheric River Activity Forecasts (DeFlorio et al. 2019, Zhang et al. 2023)
[2]CW3E/JPL Ridging Forecasts (Gibson et al. 2020)
[3]IRI North American Weather Regime Forecasts (Robertson et al. 2020)

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Summary

Regime Shift for CA from Week 2 to Weeks 3–4

- Models generally agree on regime shift from dry conditions to wet conditions over CA from Week 2 to Weeks 3–4
- Although the models indicate a regime shift during Weeks 3–4, the precise details of the evolution of the circulation fields, including the troughing/ridging centers, can have large impacts on the resulting AR and precipitation potential for California

MJO/QBO Conditions

- MJO convection is currently weak and located over the Western Hemisphere and Africa (Phase 8); QBO is in the easterly phase

- Models forecast MJO will remain over the Western Hemisphere and Africa during Weeks 1–2 (7–15 Jan) before transitioning to the Indian Ocean toward the end of Week 2 (18–20 Jan)
  - Without considering QBO/ENSO conditions, MJO activity over the Western Hemisphere and Africa during JFM is associated with statistically significant decrease in wet extremes in Southern CA at lag times of 3 weeks

Week 2 forecasts (13–19 Jan):

- Models agree on slightly below-normal AR activity over Central and Southern CA
  - In Northern CA, NCEP is forecasting near-normal AR activity, while ECCC and ECMWF are forecasting below-normal AR activity

- Ridging outlooks show high likelihood of above-normal North-ridge activity (dry conditions over all of CA) during Weeks 1–2

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

Summary

Week 3 Forecasts (20–26 Jan):

- Models agree on above-normal AR activity over Central and Southern CA
  - In Central and Southern CA, NCEP is forecasting above-normal AR activity, and ECCC and ECMWF are forecasting slight above-normal AR activity
  - In Northern CA, NCEP is forecasting above-normal AR activity, ECCC is forecasting slight above-normal AR activity, and ECMWF is forecasting near-normal AR activity

- Models disagree on ridging activity over the Pacific Northwest and CA during Weeks 3–4
  - NCEP is forecasting a moderate likelihood of above-normal South-ridge activity and a moderate likelihood of above-normal West-ridge activity
  - ECMWF is forecasting near-normal ridging activity overall, but there is poor ensemble agreement on the exact location of ridging activity

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

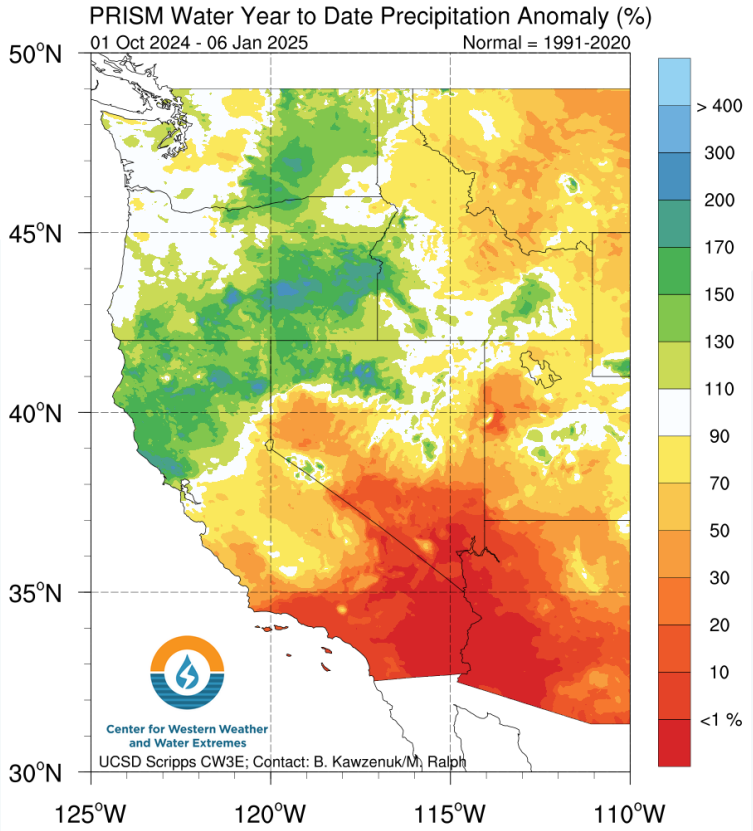
Week 4 Forecasts (27 Jan – 2 Feb):

- Models agree on above-normal AR activity over CA during Week 4

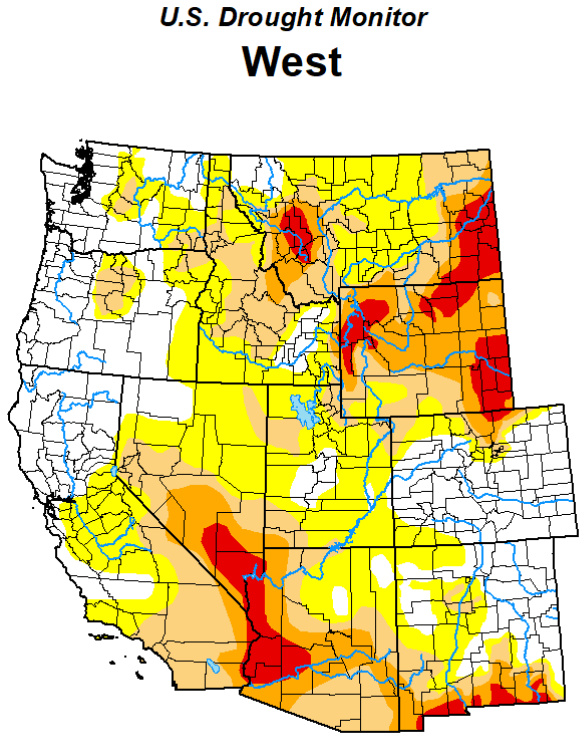
- IRI weather regime tool shows low-to-moderate likelihood of Pacific Ridge (near-normal precipitation in CA) during Week 4

Hydrologic Summary

Precipitation



Drought Conditions



December 31, 2024
(Released Wednesday, Jan. 1, 2025)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	29.66	70.34	39.86	19.17	6.85	0.00
Last Week 12-24-2024	29.66	70.34	35.75	18.84	6.56	0.00
3 Months Ago 10-01-2024	20.06	79.94	37.38	9.85	2.47	0.11
Start of Calendar Year 01-02-2024	51.19	48.81	25.08	13.17	4.67	0.66
Start of Water Year 10-01-2024	20.06	79.94	37.38	9.85	2.47	0.11
One Year Ago 01-02-2024	51.19	48.81	25.08	13.17	4.67	0.66

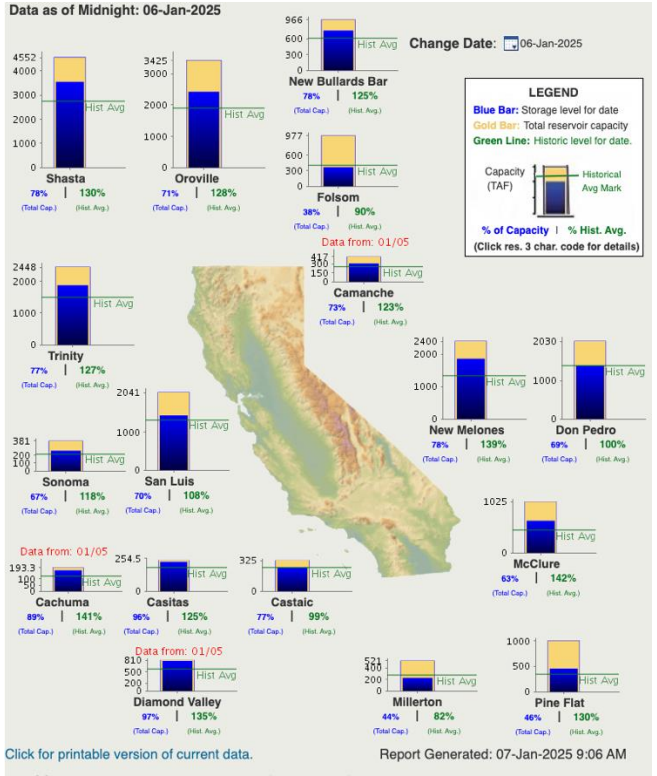
Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:
Rocky Bilotta
NCEI/NOAA

droughtmonitor.unl.edu

Reservoir Storage



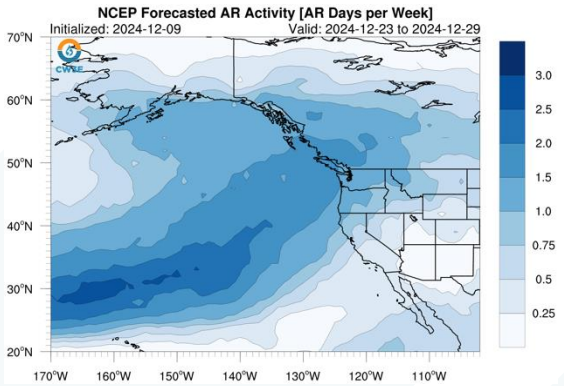
Source: California DWR

- As of 6 Jan 2025, water-year-to-date precipitation is **above normal (> 130% of normal)** in Northern CA, **slightly below-normal (50–90% of normal)** in Central CA, and **well-below normal (< 20% of normal)** in Southern CA
- The most recent drought monitor update is showing **abnormally dry conditions (D0)** over the San Joaquin Basin and the expansion of **moderate drought (D1)** into a large portion of Southern CA (including the coastal zone)
- Most large reservoirs in CA are still operating at **near or above-normal storage** for this time of year

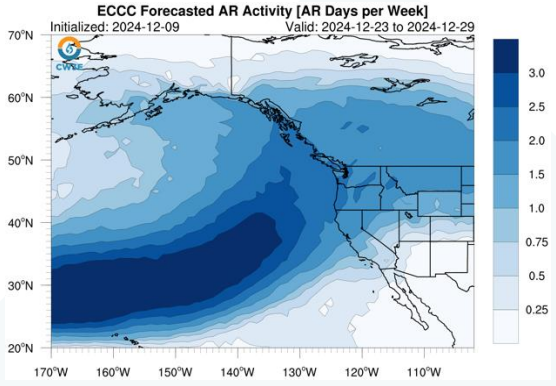
Looking Back: Week 3 AR Activity Forecasts

Forecasts Initialized 9 Dec 2024; Valid: 23-29 Dec 2024

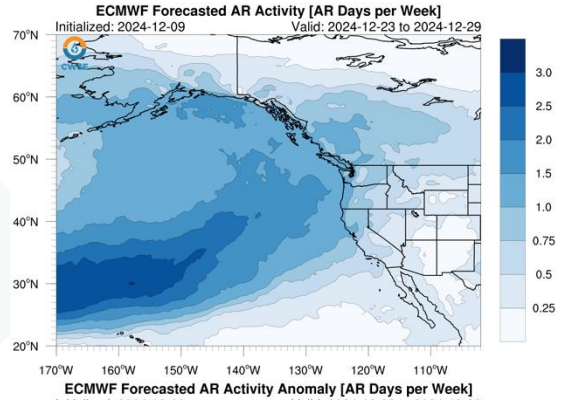
NCEP



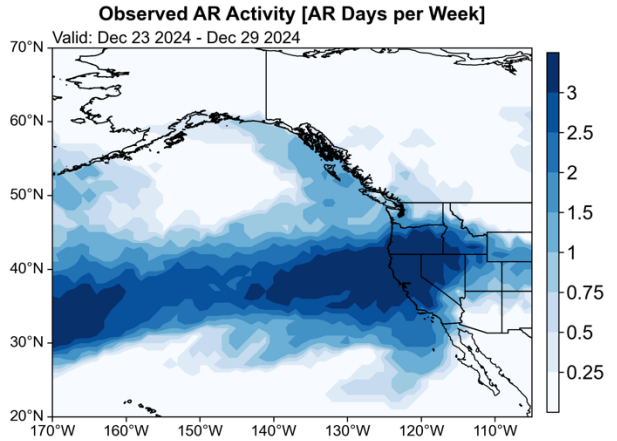
ECCC



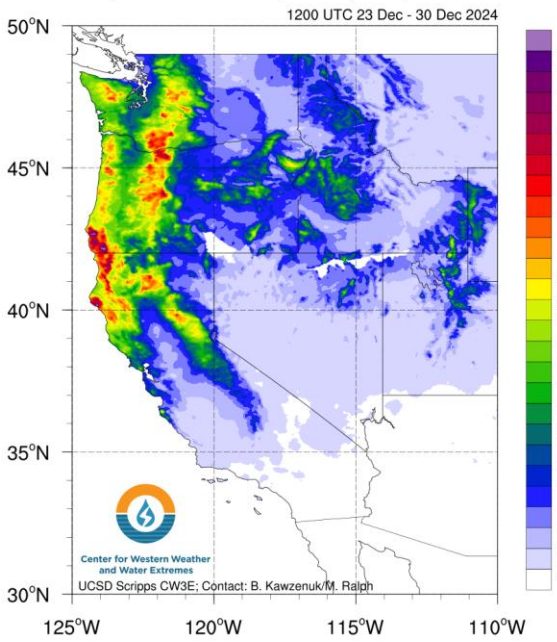
ECMWF



Observed (GFS Analysis)



Observed Precipitation

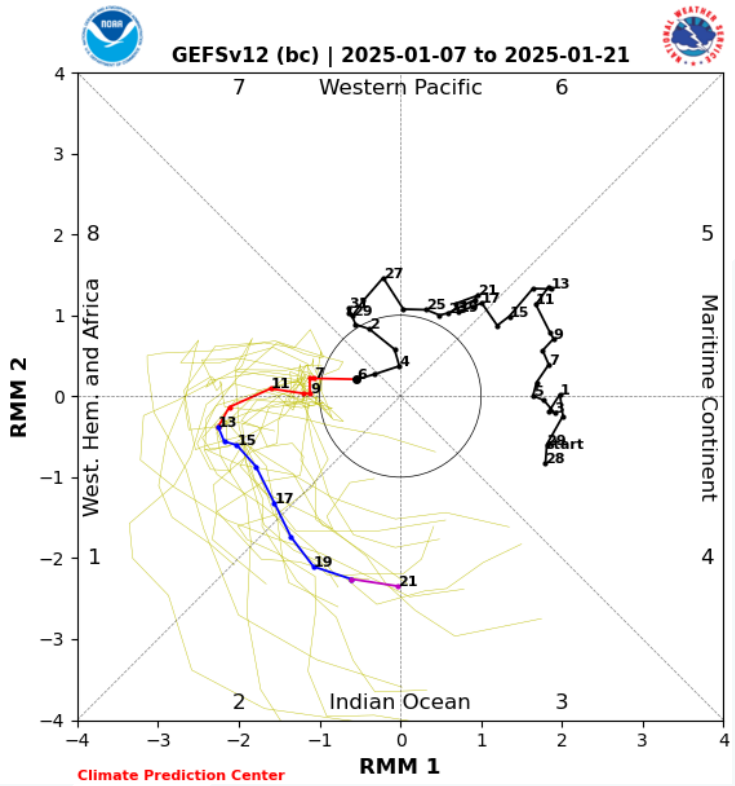


Shading: Fractional # of AR days forecast over a 7-day period (top) and forecast minus model climatology (bottom; green/blue = higher than climatology; brown = lower than climatology)

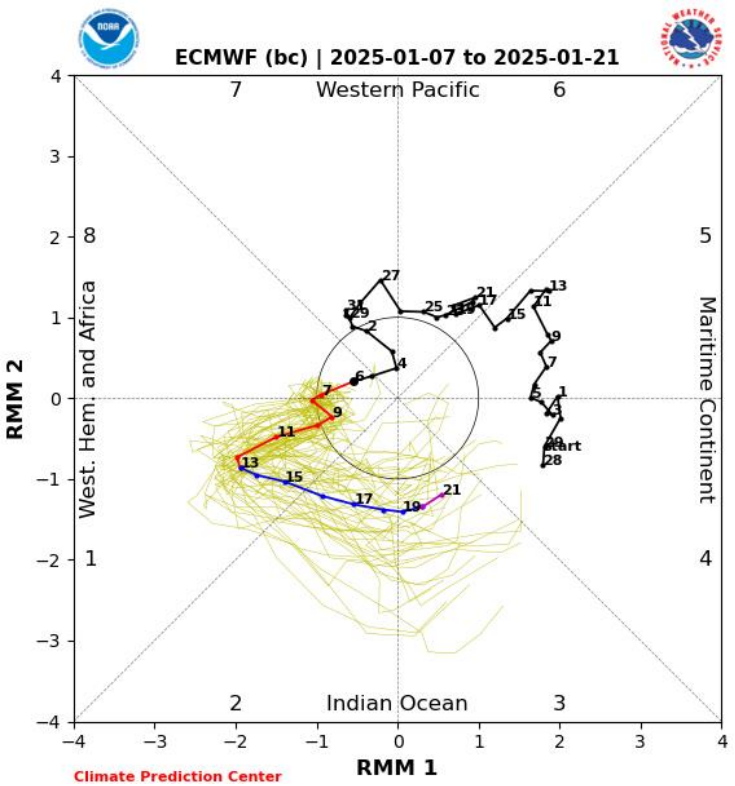
- All three models skillfully captured above-normal AR conditions over the open ocean, but failed to resolve finer-scale details of AR activity such as precise landfall location and extent of AR inland penetration
- NCEP and ECMWF largely underestimated AR activity over the US West Coast
- While ECCC did forecast more AR activity over Northern CA than the other models, it significantly underestimated the amount of AR activity
- Multiple ARs and a low-pressure system produced 10+ inches of precipitation over the Olympic Mountains, Cascades, and Southern OR/Northern CA Coast Ranges, and 5+ inches over the Northern Sierra Nevada during 23–29 Dec

Dynamical Model MJO Forecasts (NCEP vs. ECMWF)

NCEP



ECMWF



Black: Last 40 days of observations (28 Dec-6 Jan); Red: Week 1 (7-13 Jan) ensemble mean; Blue: Week 2 (14-20 Jan) ensemble mean; Yellow: Ensemble members

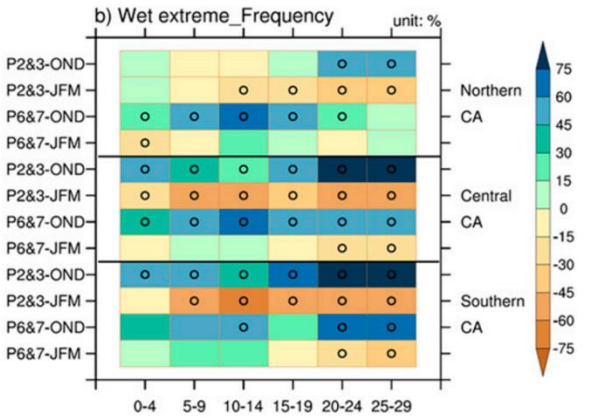


Figure 8 from Wang et al. (2023)

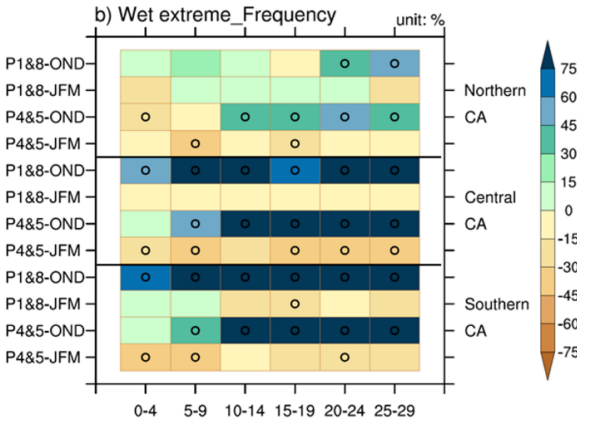


Figure S6 from Wang et al. (2023)

- As of 6 Jan 2025, weak MJO convection is located over the Western Hemisphere and Africa (Phase 8) and is forecasted to strengthen in Weeks 1–2 (7–15 Jan) over the Western Hemisphere and Africa and propagate to Indian Ocean at the end of Week 2 (18-20 Jan)

- Without considering QBO/ENSO conditions, MJO activity over the Western Hemisphere and Africa during JFM is associated with statistically significant decrease in wet extremes in Southern CA at lag times of 3 weeks

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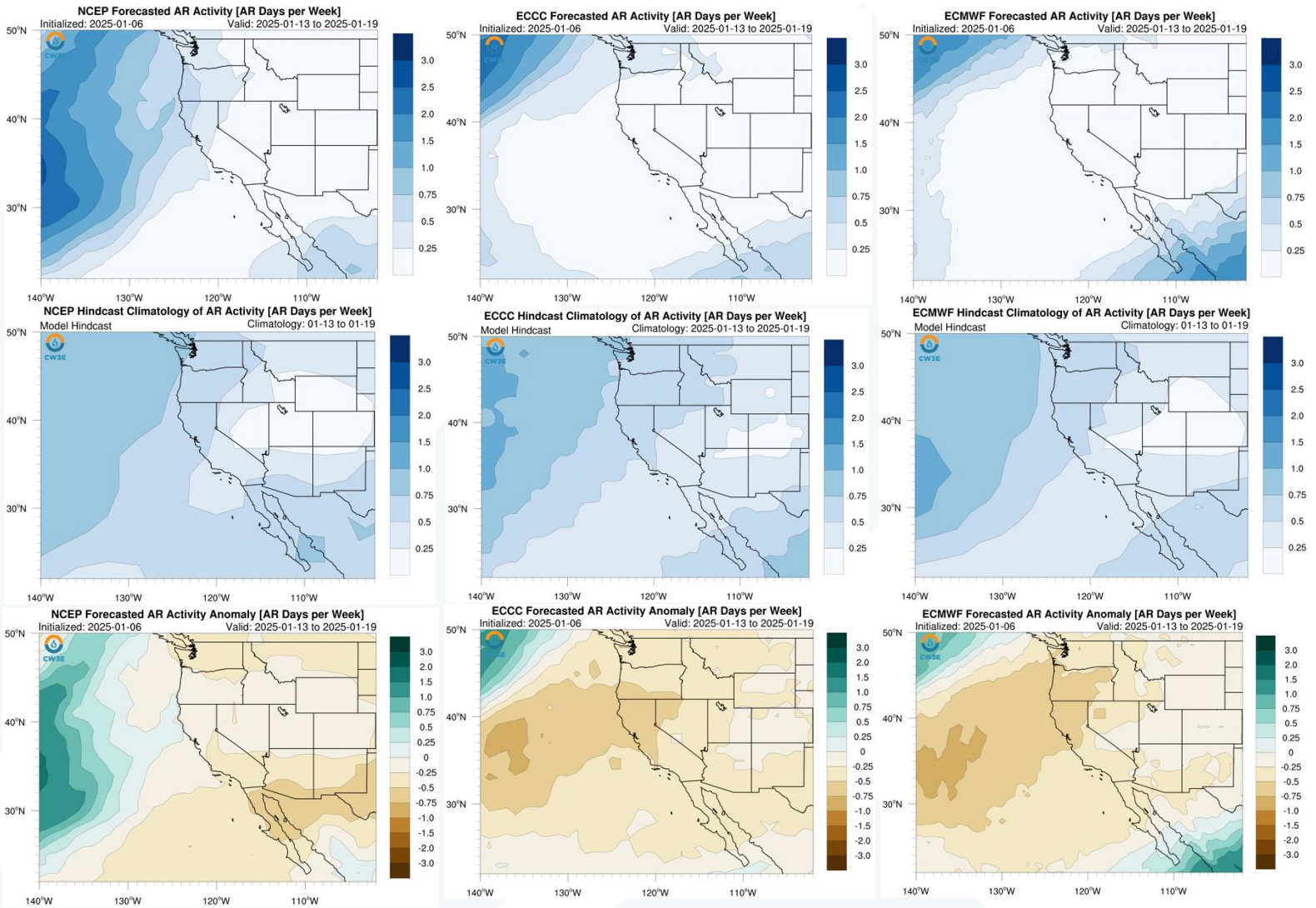
AR Activity Forecasts: Week 2 (NCEP vs. ECCC vs. ECMWF)

Forecasts Initialized 6 Jan 2025



- All models agree on slight below-normal AR activity over Central and Southern CA during Week 2 (13–19 Jan)
- In Northern CA, NCEP is forecasting near-normal AR activity, while ECCC and ECMWF are forecasting below-normal AR activity

Models agree on slight below-normal AR activity over Central and Southern CA during Week 2 (13–19 Jan)

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)

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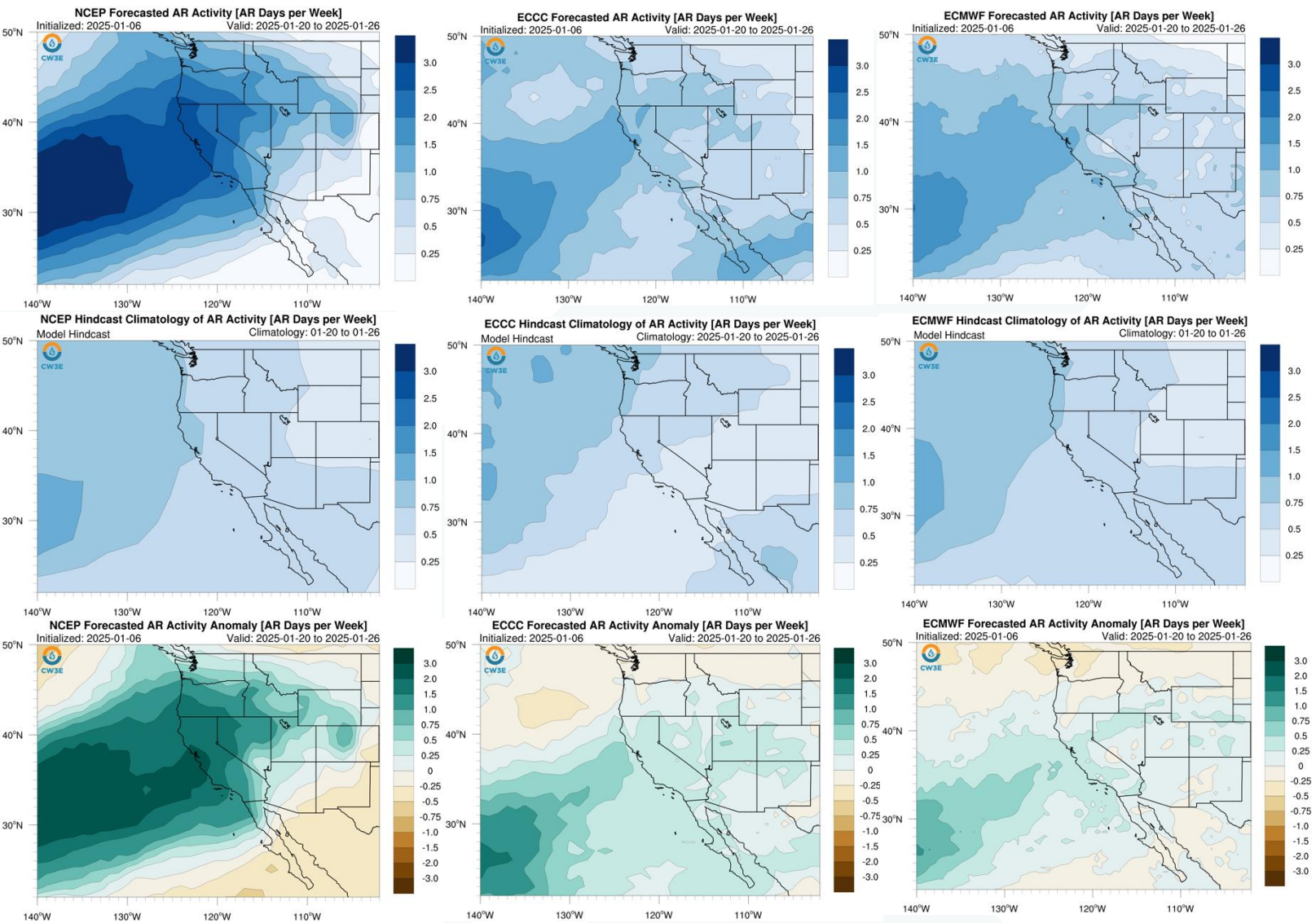
AR Activity Forecasts: Week 3 (NCEP vs. ECCC vs. ECMWF)

NCEP | **ECCC** | **ECMWF**



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

Forecasts Initialized 6 Jan 2025

- All models generally agree on above-normal AR activity over Central and Southern CA during Week 3 (20-26 Jan)
- In Central and Southern CA, NCEP is forecasting much above-normal AR activity, and ECCC and ECMWF are forecasting slightly above-normal AR activity
- In Northern CA, NCEP is forecasting much above-normal AR activity, ECCC is forecasting slightly above-normal AR activity, and ECMWF is forecasting near-normal AR activity

Models agree on above-normal AR activity over Central and Southern CA during Week 3 (20–26 Jan)

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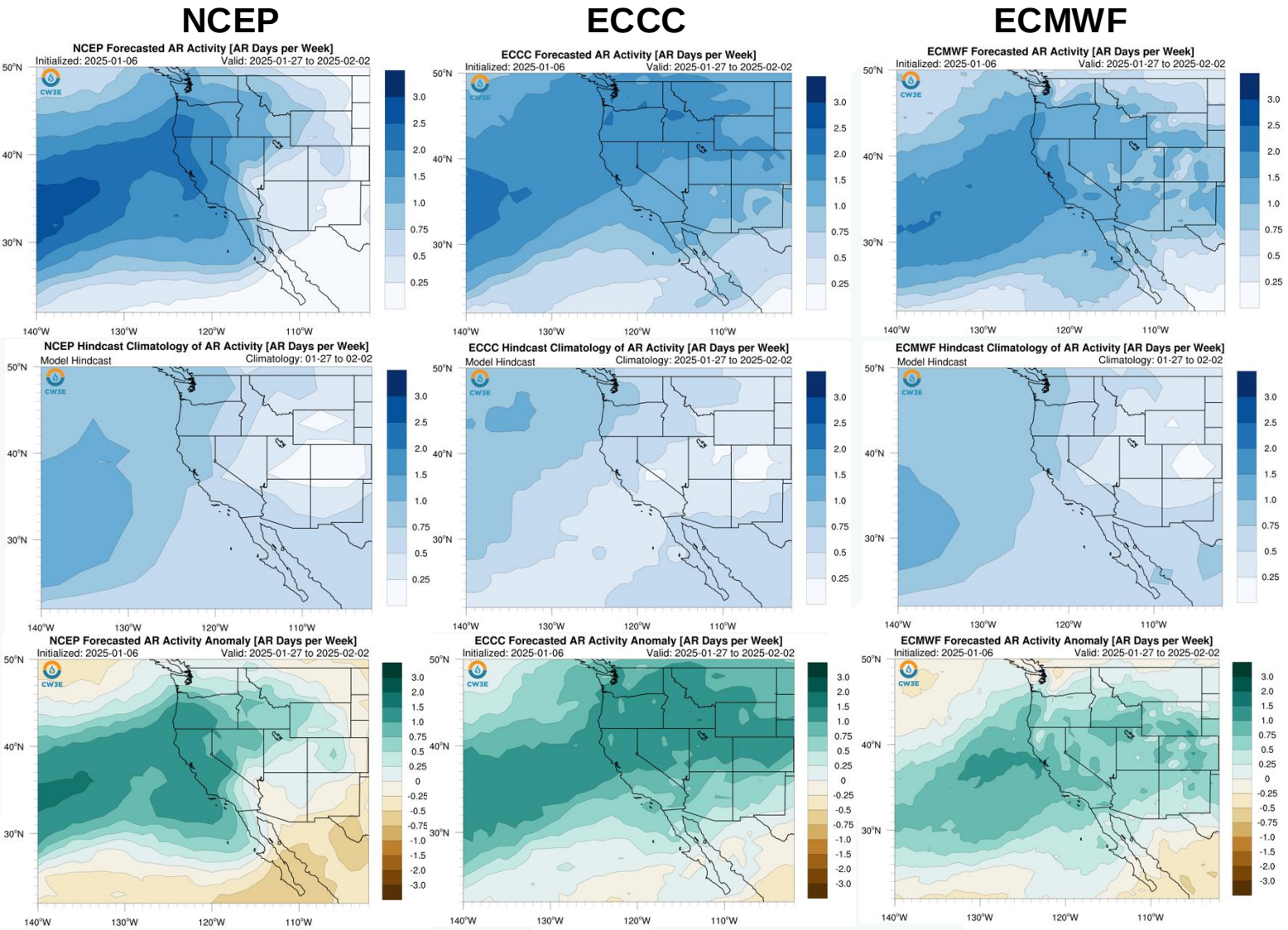
AMBASSADOR™ WRN WEATHER-READY NATION

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

Forecasts Initialized 6 Jan 2025



- All models agree on above-normal AR activity over CA during Week 4 (27 Jan – 2 Feb)
- All models suggest a regime shift over the Northeast Pacific region that will support a transition from dry conditions in CA during Week 2 to wet conditions during Weeks 3–4

Models agree on above-normal AR activity over CA during Week 4 (27 Jan – 2 Feb)

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)

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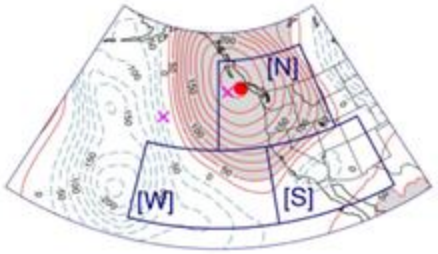
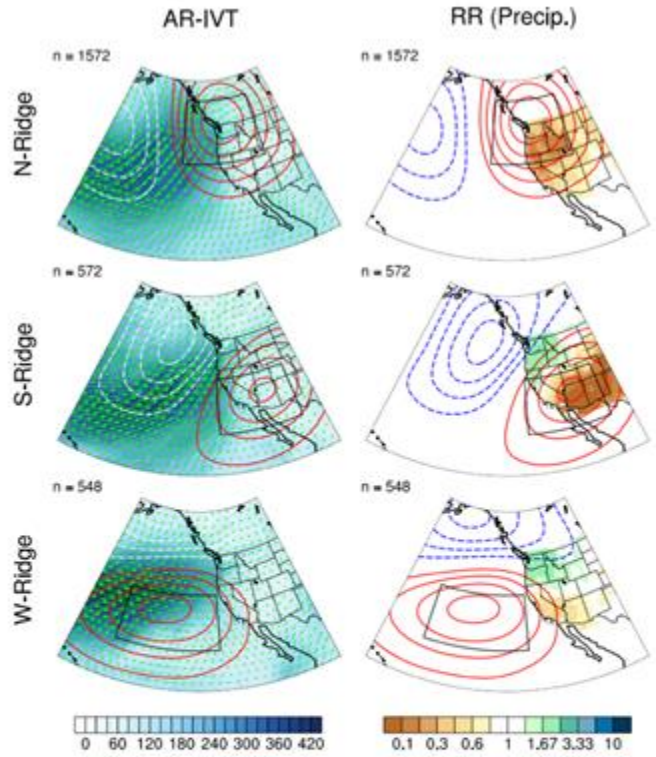
Background Info: Subseasonal Ridging Outlooks



N = North Ridge
S = South Ridge
W = West Ridge

This slide contains background information about the three different ridge types in CW3E's subseasonal ridging outlook tool



How each ridge type typically influences precipitation
Left: Maps showing the average influence of each ridge type (red contours) on integrated vapor transport (IVT, blue shading indicates greater moisture transport, arrows indicate direction) during atmospheric river events
Right: Maps showing the 'Relative Risk' (RR) of precipitation under each ridge type. Brown shading indicates a reduced chance of precipitation when ridging occurs. For example, a RR value of 0.2 indicates a 5-fold reduction in the likelihood of precipitation

- The North-Ridge type is typically associated with widespread dry conditions across the entire western US
- The South-Ridge type is typically associated with dry conditions in Southern CA and the Colorado River Basin and wet conditions in the Pacific Northwest
- The West-Ridge type is typically associated with dry conditions over Central and Southern CA and wet conditions over the Pacific Northwest

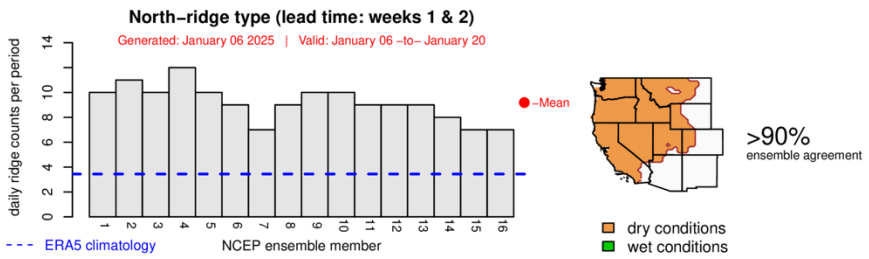
Jet Propulsion Laboratory
California Institute of Technology

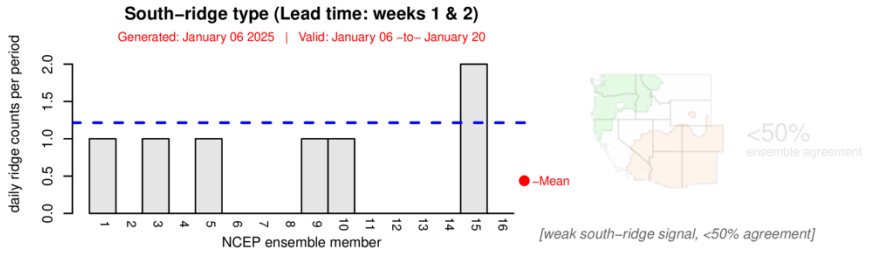
Center for Western Weather and Water Extremes
Scripps Institution of Oceanography at UC San Diego

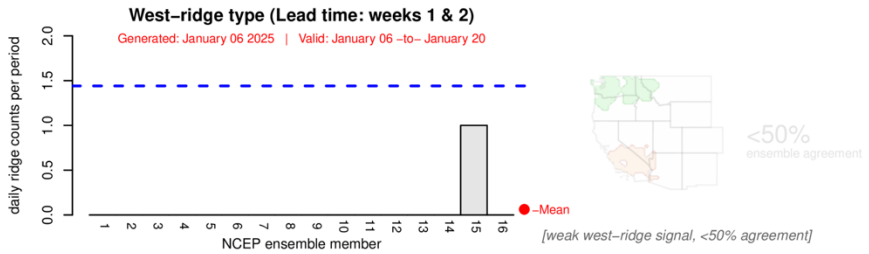
Contact: pgibson@ucsd.edu
Reference: Gibson et al. (2020) Journal of Climate

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

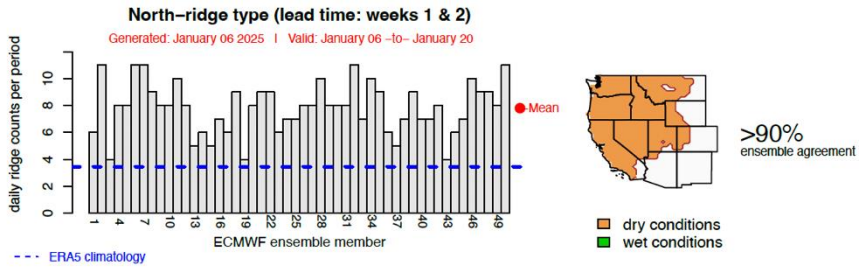
NCEP

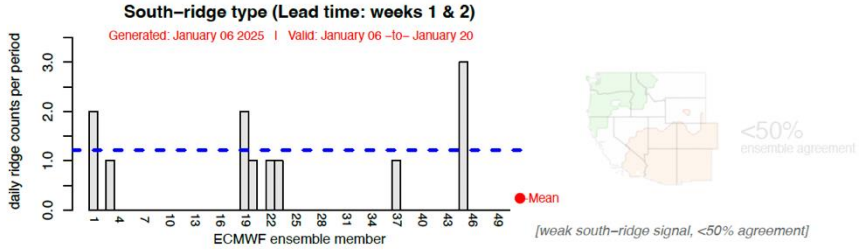


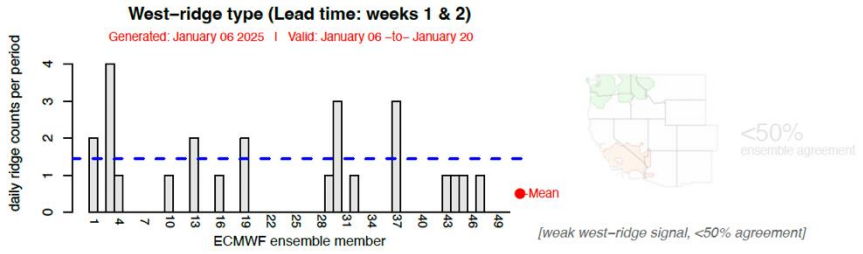




ECMWF







Forecasts Initialized 6 Jan 2025

- NCEP and ECMWF are forecasting a high likelihood (> 90% ensemble agreement) of above-normal North-ridge activity during Weeks 1–2 (6–20 Jan)
- Models are forecasting a low likelihood of West-ridge and South-ridge activity during Weeks 1–2

Models agree on high likelihood of above-normal North-ridge activity during Weeks 1–2 (6–20 Jan)

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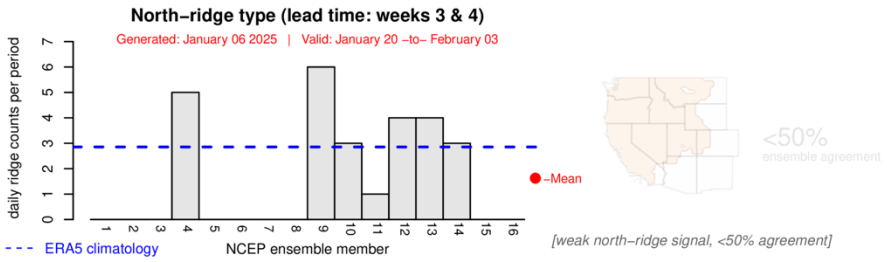
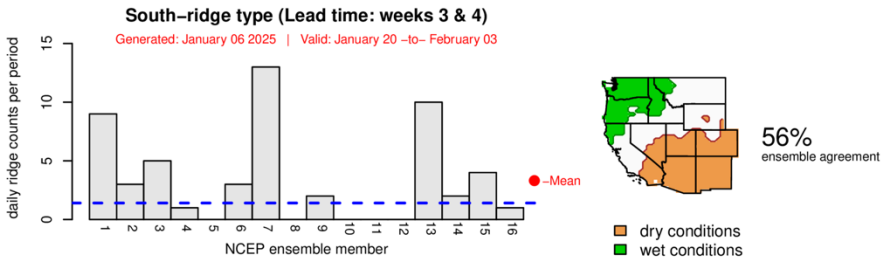
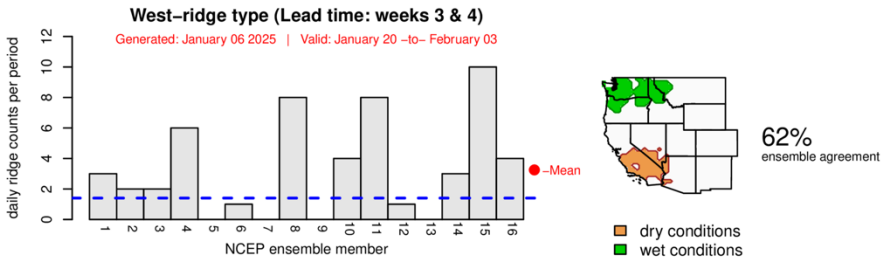
Ridging Forecasts: Weeks 3–4 (NCEP vs. ECMWF)

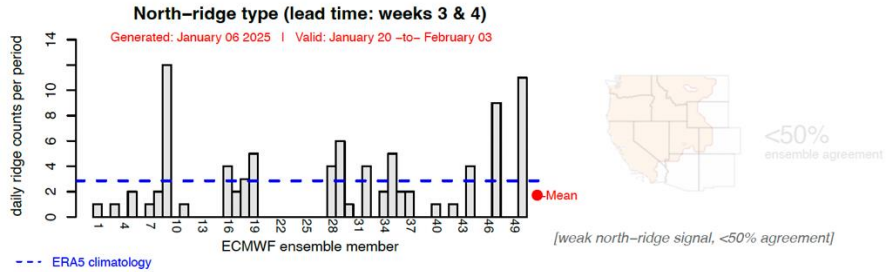
NCEP

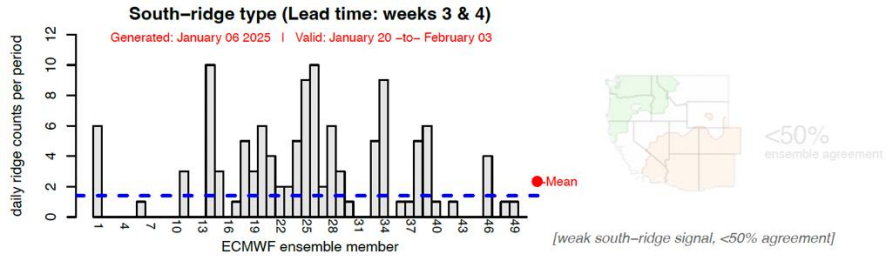


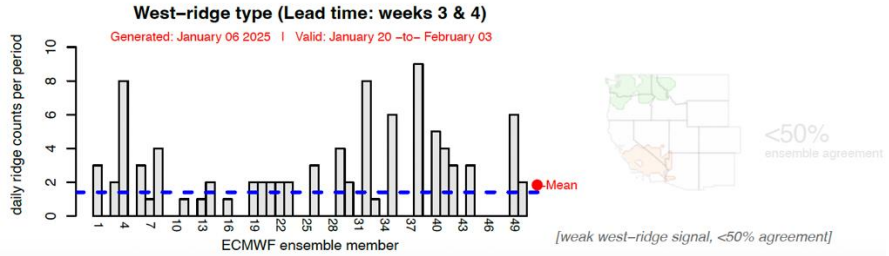




ECMWF







Forecasts Initialized 6 Jan 2025

- NCEP is forecasting a moderate likelihood (56% ensemble agreement) of above-normal South-ridge activity during Weeks 3–4 (20 Jan – 3 Feb)
- NCEP is also forecasting moderate likelihood (62% ensemble agreement) of above-normal West-ridge activity
- ECMWF is forecasting near-normal ridging activity overall, but there is poor ensemble agreement on the exact location of ridging activity

Models disagree on the location of ridging activity near the US West Coast during Weeks 3–4 (20 Jan – 3 Feb)

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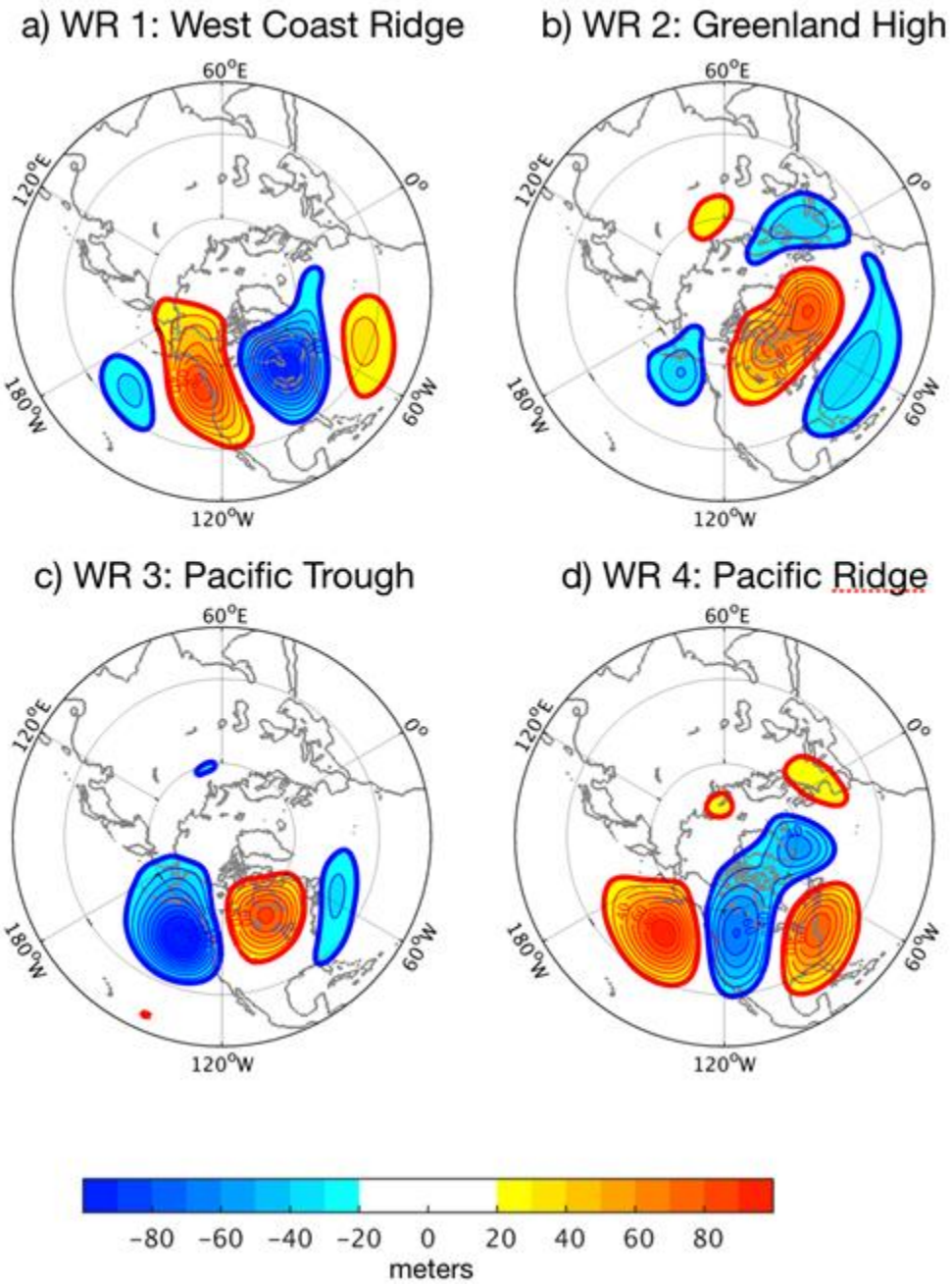
Background Info: IRI Subseasonal Weather Regime Forecasts



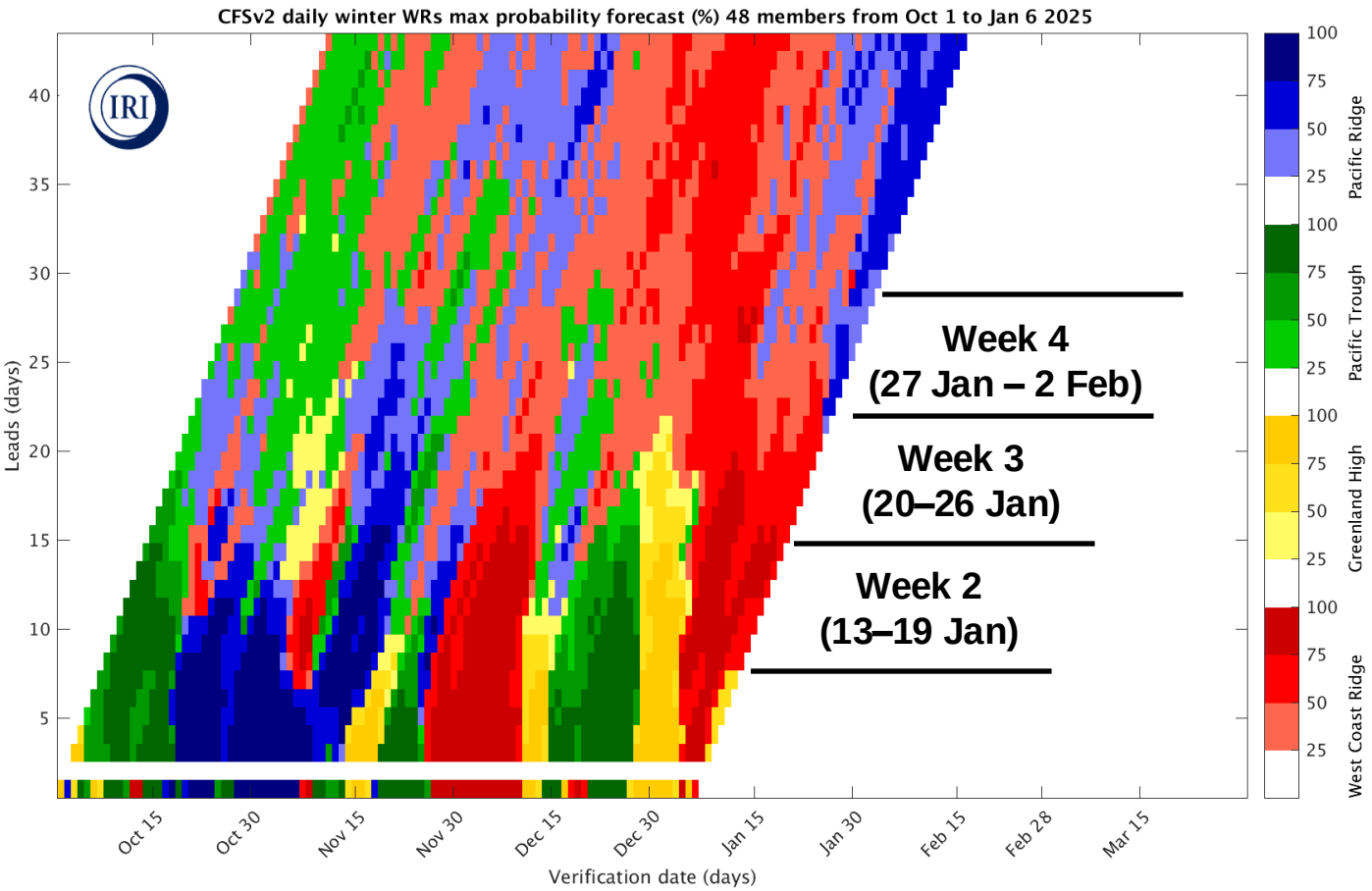
This slide contains background information about IRI's North American weather regime forecast product

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

Reference: Robertson et al. (2020)
For more information about the forecast product:
https://wiki.iri.columbia.edu/index.php?n=Climate.S2S-WRs

IRI North American Weather Regime Forecasts

Forecast Initialized 6 Jan 2025



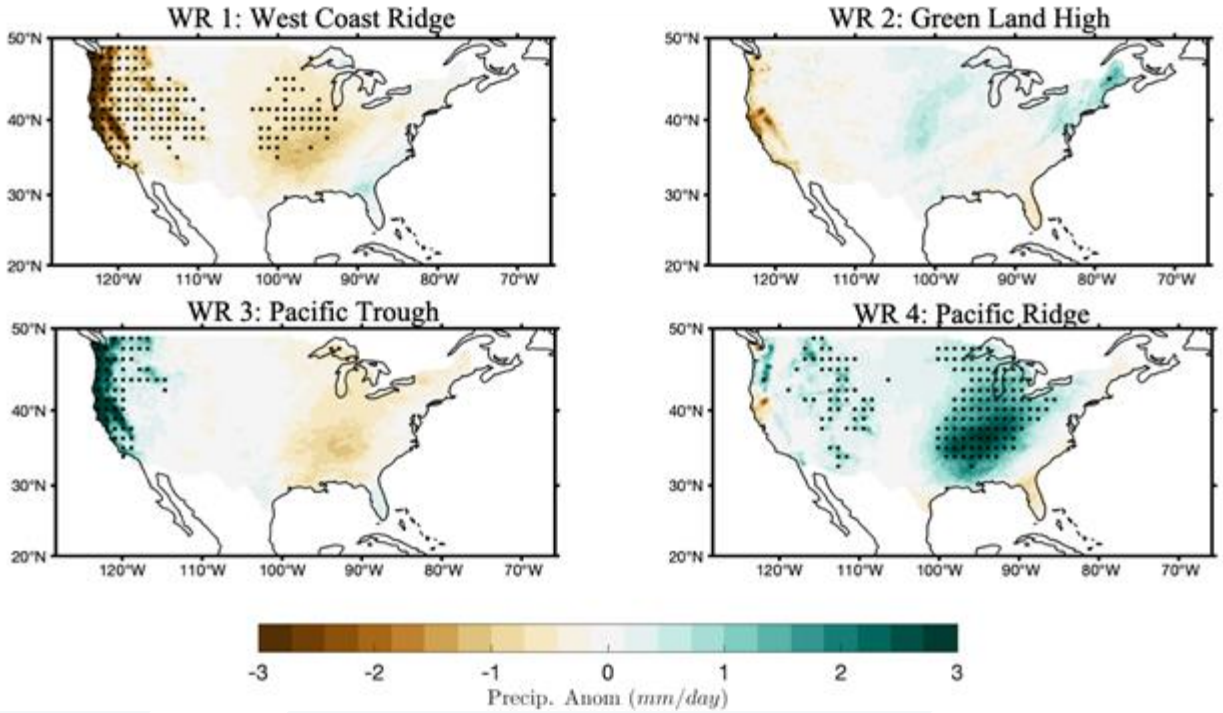
- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble
- Moderate likelihood (50–75% ensemble agreement) of West Coast Ridge during Weeks 2–3 (13–26 Jan)
- Low-to-moderate likelihood (25–75% ensemble agreement) of Pacific Ridge during Week 4 (27 Jan – 2 Feb)
- IRI is forecasting a regime shift from West Coast Ridge to Pacific Ridge, which favors a shift from dry conditions to near-normal conditions over CA

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

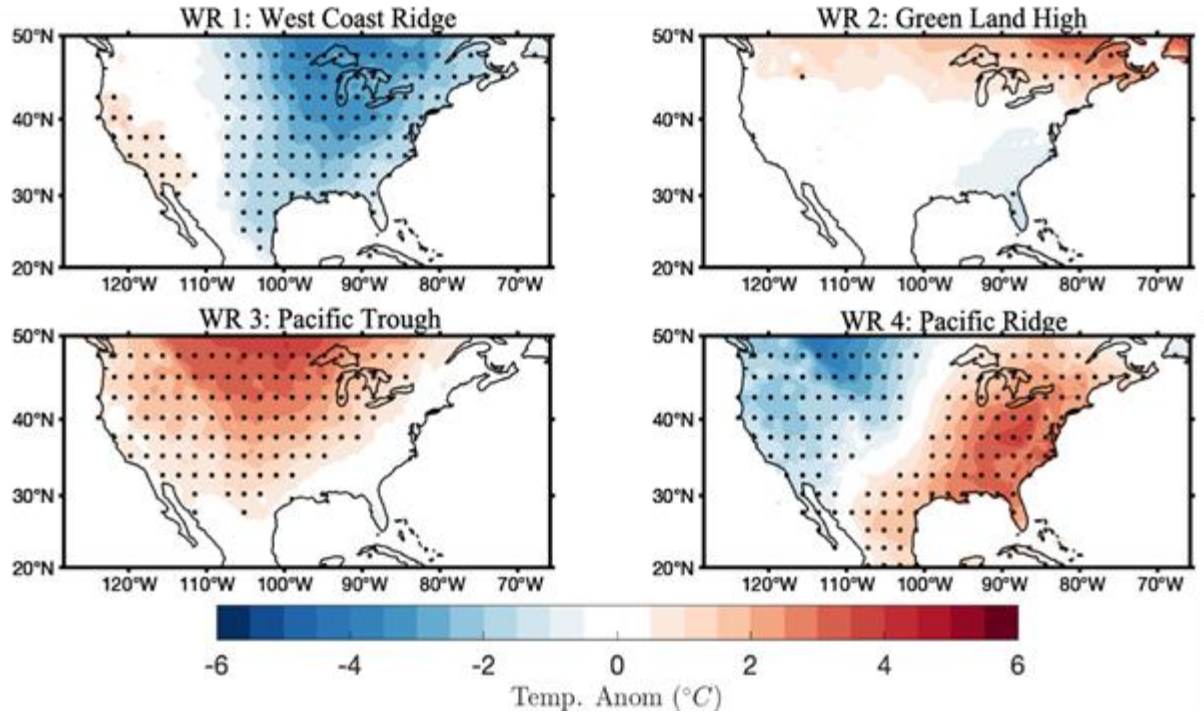
For more information about the forecast product: https://wiki.iri.columbia.edu/index.php?n=Climate.S2S-WRs

IRI North American Weather Regime Forecasts

Precipitation



Temperature



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

- Below-normal precipitation and above-normal temperature predicted over CA during Weeks 2–3 (13–26 Jan) with moderate confidence
- Near-normal precipitation and below-normal temperature predicted over CA in Week 4 (27 Jan – 2 Feb) with low-to-moderate confidence

CW3E Subseasonal Outlooks: Glossary & Context

- **The outlooks are based on CW3E subseasonal forecast products that can be found here:**
  https://cw3e.ucsd.edu/s_and_s_forecasts/

- **CW3E subseasonal (2–6 weeks lead time) atmospheric river, ridging, and circulation regime products use three different global ensemble prediction systems to create these products:**
  - NCEP CFSv2 (US Model): Weeks 2–6
  - ECCC (Canadian Model): Weeks 2–3
  - ECMWF (European model): Weeks 2–6

- ***On the following slides, the term confidence refers to the forecasters' interpretation of the magnitude of the anomalies, the level of ensemble agreement, and the skill of the products used to generate the forecasts. All the tools used are shown in the outlook presentation.***

- ***The thresholds for below-normal, near-normal, and above-normal conditions are determined by forecast product and noted on each forecast product slide***