CW3E Subseasonal Outlook: 17 November 2023

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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 GFS (US Model): Weeks 2–3
  - 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*
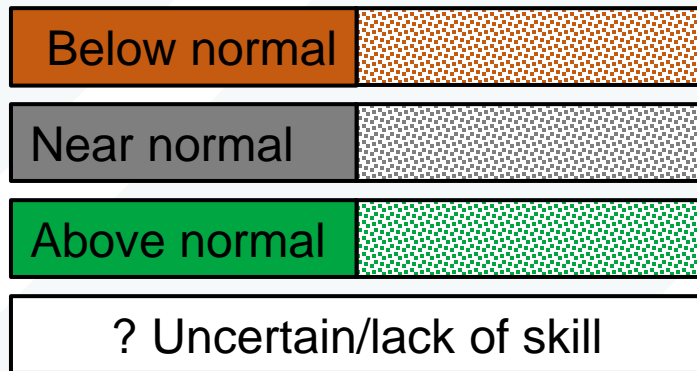
Summary: Subseasonal Precipitation Outlook by Model

This slide shows the CW3E synthesis of subseasonal products by model

Forecasts Initialized 16 Nov 2023

Region	Week 2 (24–30 Nov)				Week 3 (1–7 Dec)				Week 4 (7–13 Dec)		
	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[2,3]	ECMWF[2]	Multi-Model Forecast
WA/OR	Below normal (higher)	Below normal (lower)	Below normal (higher)	Below normal (lower)	Near normal (lower)	Near normal (lower)	Near normal (lower)	Near normal (lower)	Above normal (lower)	Near normal (lower)	
Northern CA	Below normal (higher)	Above normal (lower)	Below normal (lower)	Below normal (lower)	Near normal (lower)	Near normal (lower)	Below normal (lower)	Near normal (lower)	Above normal (lower)	Near normal (lower)	
Central CA	Below normal (higher)	Below normal (lower)	Below normal (higher)	Below normal (lower)	Near normal (lower)	Near normal (lower)	Below normal (lower)	Near normal (lower)	Near normal (lower)	Near normal (lower)	Near normal (lower)
Southern CA	Below normal (higher)	Below normal (lower)	Below normal (higher)	Below normal (lower)	Near normal (lower)	Near normal (lower)	Below normal (higher)	Near normal (lower)	Near normal (lower)	Near normal (lower)	Near normal (lower)

Higher Confidence | Lower Confidence

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

- Models agree on below-normal precipitation over Central and Southern CA during Week 2; less agreement over Northern CA
- Models agree show near-normal precipitation during Week 3; less agreement over Southern CA
- Week 4 forecasts show near-normal precipitation

Subseasonal products included in this Outlook:
[1]CW3E/JPL Atmospheric River Activity Forecasts (DeFlorio et al. 2019)
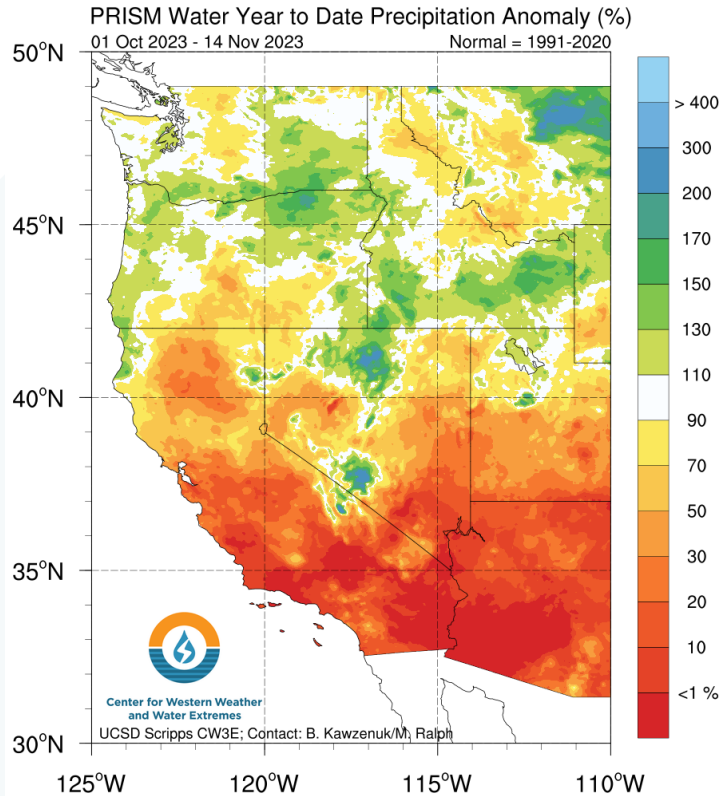[2]CW3E/JPL Ridging Forecasts (Gibson et al. 2020)
[3]IRI North American Weather Regime Forecasts (Robertson et al. 2020)

Center for Western Weather and Water Extremes
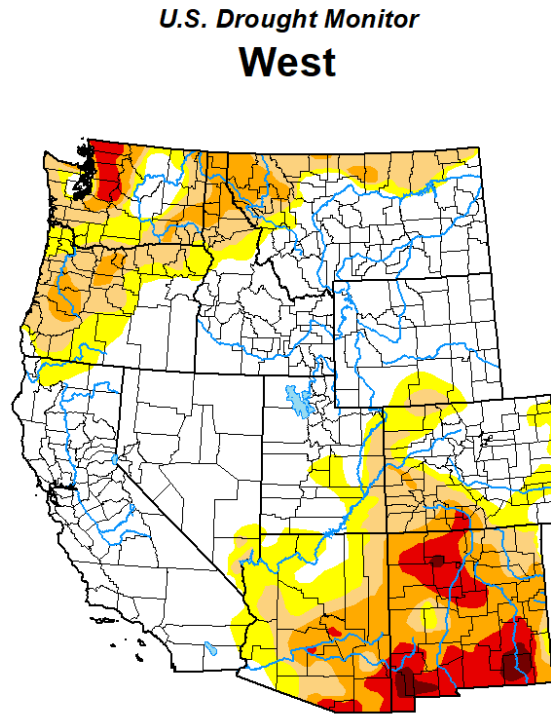SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

Summary

- **Week 2 forecasts (24–30 Nov):** Models generally agree on low likelihood (< 30% probability) of AR activity over Southern and Central CA

- Models show the MJO activity over the Indian Ocean during Week 2, with a considerable spread in the MJO forecasts, associated with an increased likelihood of wet extremes in Central and Southern CA at lag times of 1–4 weeks

- Ridging outlooks show high likelihood of persistent ridging activity near the US West Coast during Weeks 1–2, and IRI weather regime outlooks also show high likelihood of a West Coast Ridge

- **Week 3 forecasts (1–7 Dec):** NCEP and ECCC generally agree on predicted AR activity over CA, but ECMWF is predicting below-normal AR activity in CA, especially Southern CA
  – NCEP and ECCC are predicting near-normal AR activity in CA

- Uncertainty in frequency and location of ridging activity during Weeks 3–4

WY 2024 Hydrologic Summary

Precipitation

PRISM Water Year to Date Precipitation Anomaly (%)
01 Oct 2023 - 14 Nov 2023   Normal = 1991-2020

Center for Western Weather and Water Extremes
UCSD Scripps CW3E; Contact: B. Kawzenuk/M. Ralph

Drought Conditions

U.S. Drought Monitor
West

November 14, 2023
(Released Thursday, Nov. 16, 2023)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	56.87	43.13	29.99	16.54	5.75	0.73
Last Week 11-07-2023	57.24	42.76	30.28	17.67	5.69	0.76
3 Months Ago 08-15-2023	49.82	50.18	28.07	6.71	0.31	0.00
Start of Calendar Year 01-03-2023	12.08	87.92	62.42	38.84	12.41	0.27
Start of Water Year 09-26-2023	55.99	44.01	31.24	17.70	6.09	0.70
One Year Ago 11-15-2022	5.84	94.16	69.18	45.53	18.57	2.02

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:
Brad Rippey
U.S. Department of Agriculture

USDA   NDMC   NOAA

droughtmonitor.unl.edu

Reservoir Storage
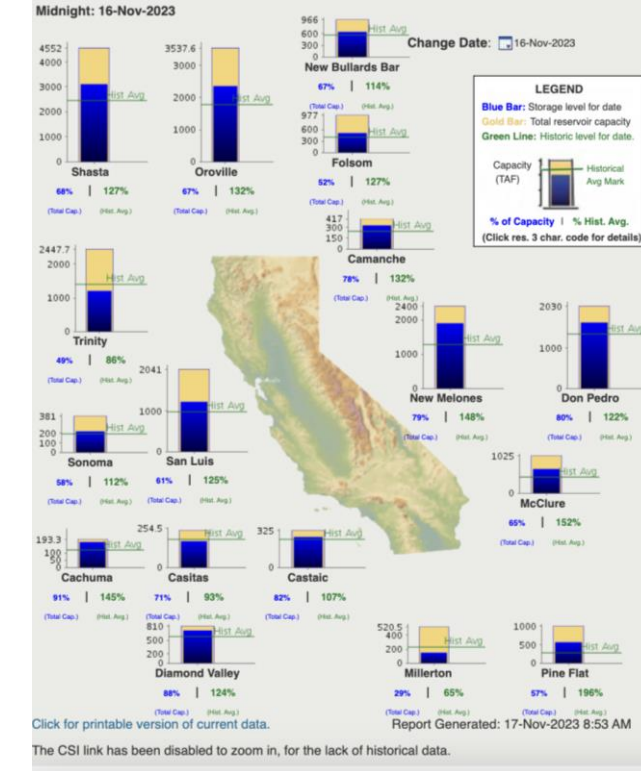
Source: California DWR

- WY 2024 is off to a dry start in most of CA, particularly Central and Southern CA
- As of 14 Nov, nearly all of California was drought-free, but portions of the Pacific Northwest and
- interior Southwest were experiencing severe, extreme, or exceptional drought conditions
- As of 16 Nov, most large reservoirs in CA were operating at greater than 60% storage capacity and higher-than-normal storage

Forecasts Initialized 19 Oct 2023; Valid: 3–9 Nov 2023
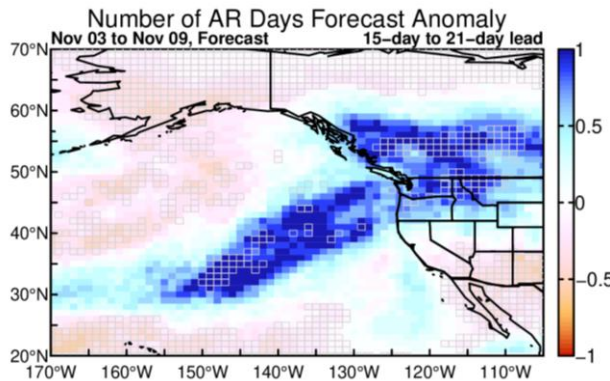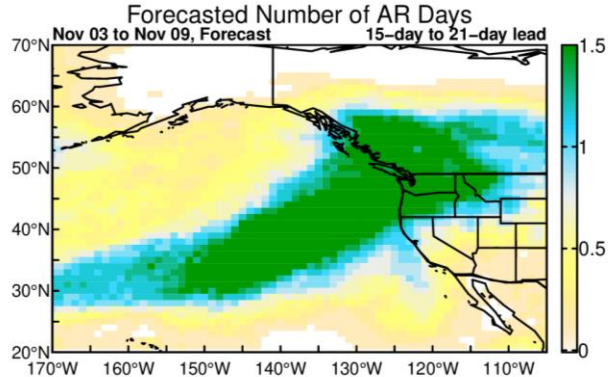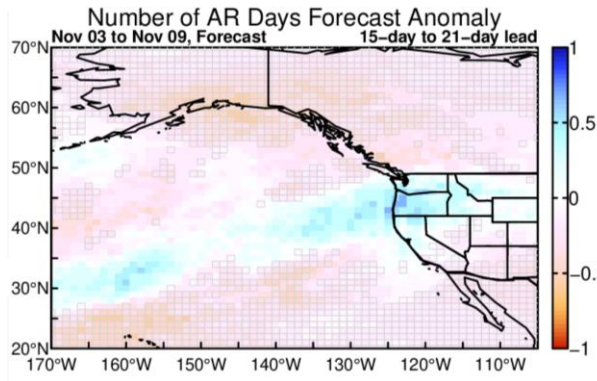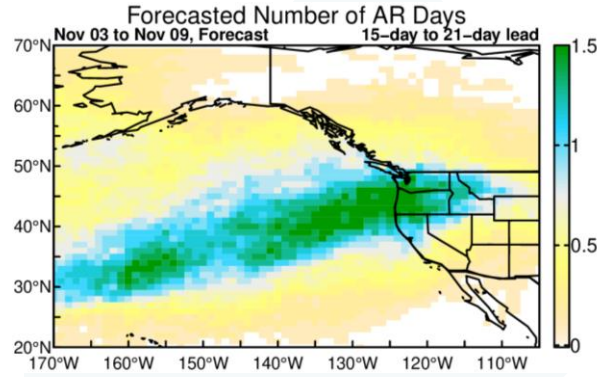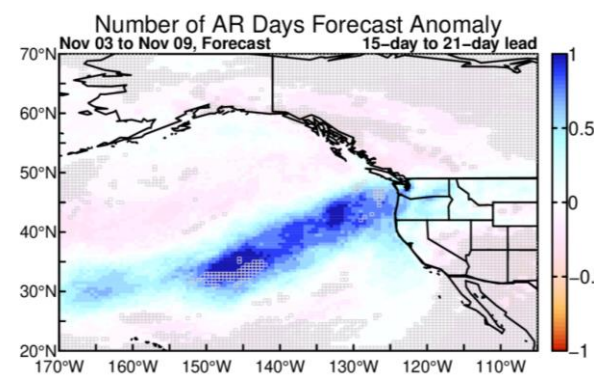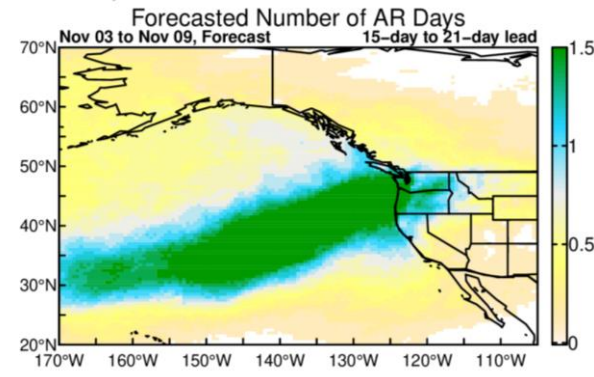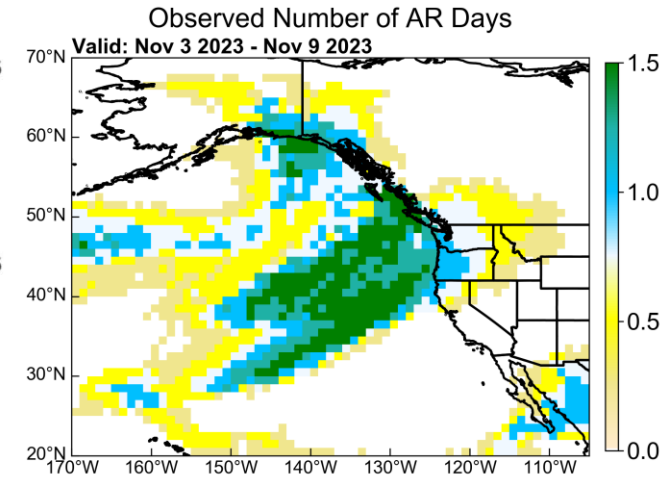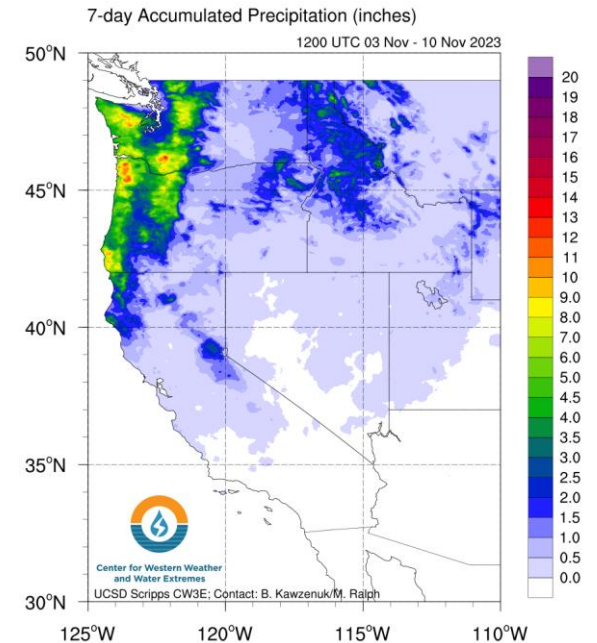

Shading: Fractional # of AR days over a 7-day period (top) and forecast minus model climatology (bottom)
Grey cells: >75% of ensemble members agree on sign of anomaly

- All models captured the AR activity near the Pacific Northwest, but over-predicted AR activity inland, especially NCEP; observed AR activity was primarily well offshore
- A strong AR produced heavy precipitation in western OR and WA during 3–4 Nov
- A weak low-pressure system produced moderate precipitation over western OR/WA and light precipitation over Northern CA on 5–7 Nov

Forecasts Initialized 26 Oct 2023; Valid: 10–16 Nov 2023
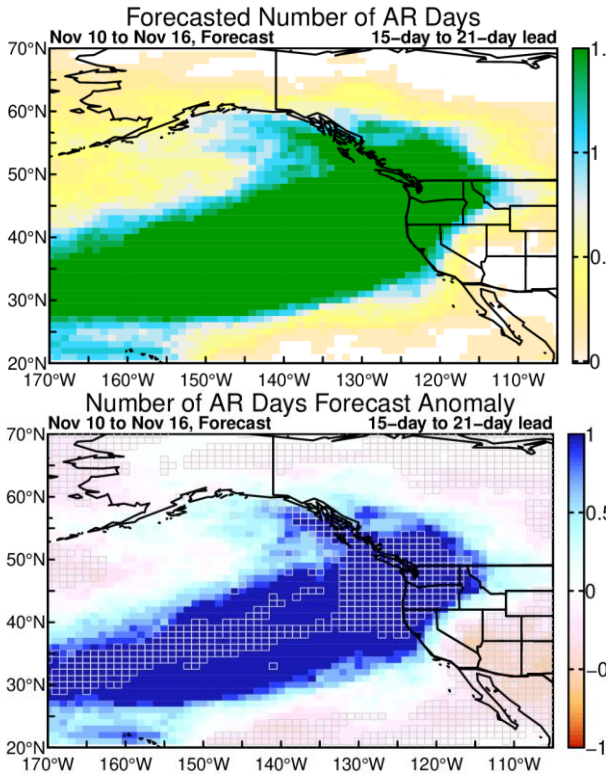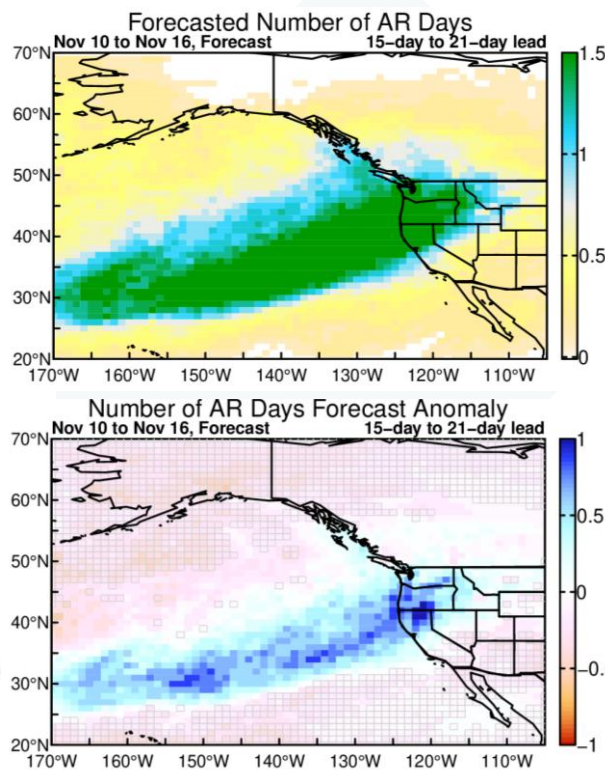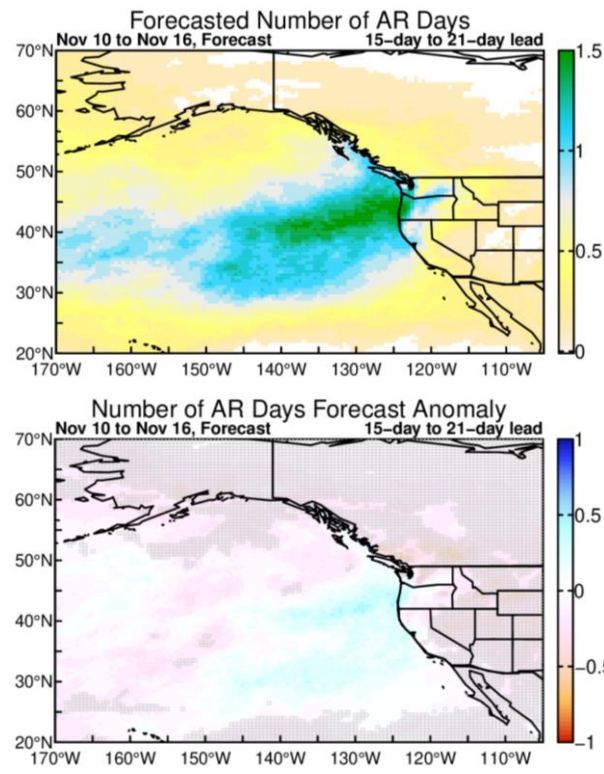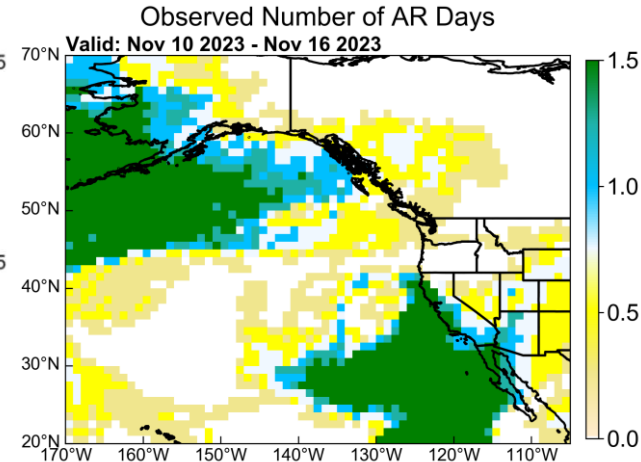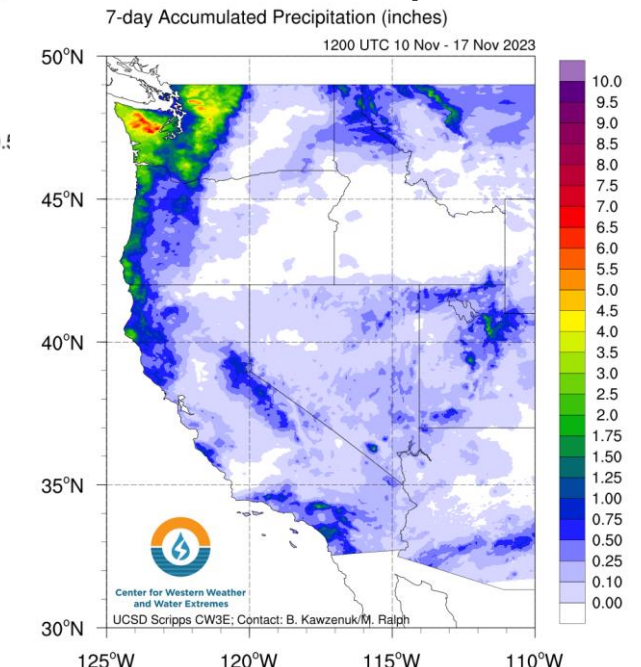
Shading: Fractional # of AR days over a 7-day period (top) and forecast minus model climatology (bottom)
Grey cells: >75% of ensemble members agree on sign of anomaly

- All models incorrectly predicted the highest AR activity to occur over the Pacific Northwest
- Observed AR activity was primarily over coastal CA
- Multiple ARs produced 3–7 inches of precipitation to western OR and WA on 10–13 Nov
- A weak low-pressure system brought light precipitation to CA on 15–16 Nov

NCEP

ECMWF

Figure 8 from Wang et al. (2023)
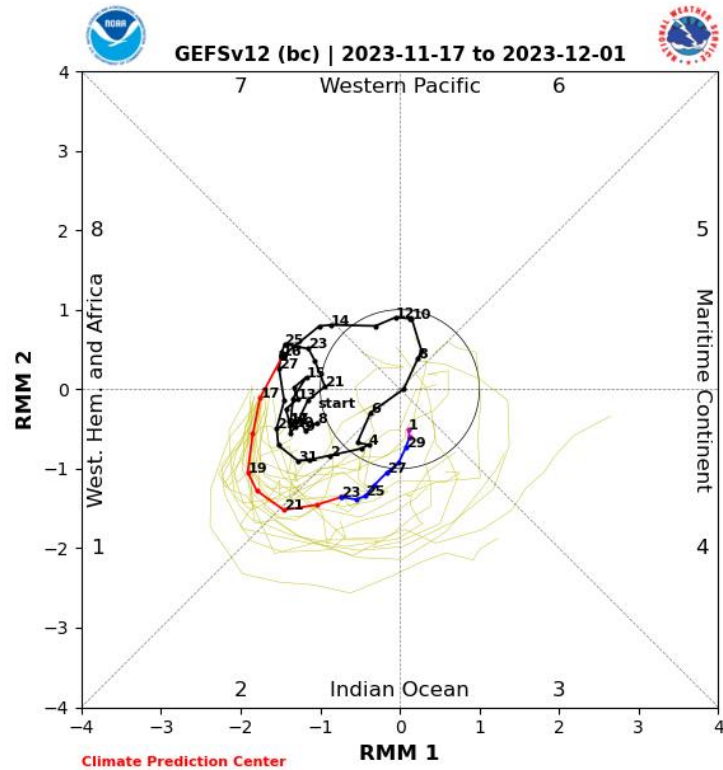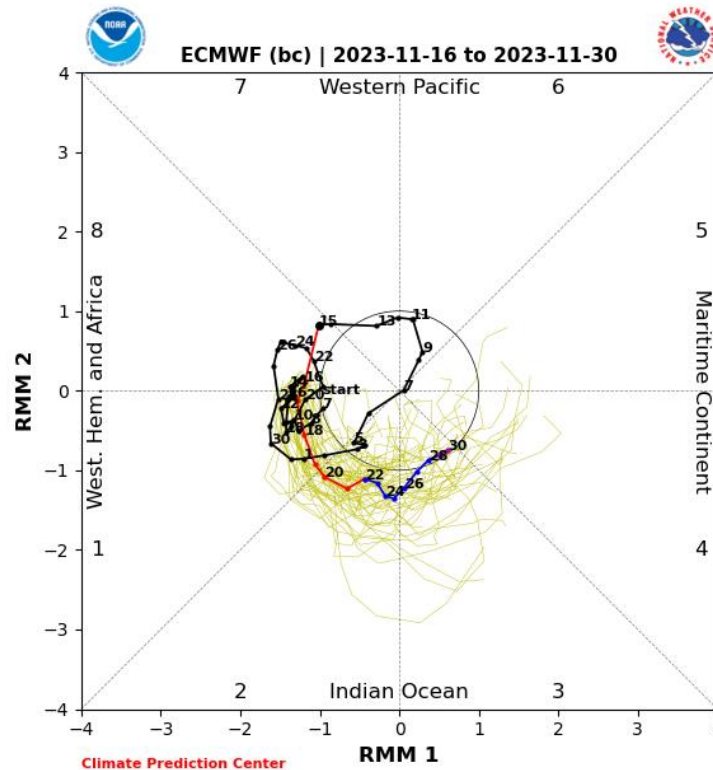
Black line: Last 40 days of observations; Yellow lines: Ensemble members
Forecast: (Red: Week 1, Blue: Week 2, Purple: > Week 2)

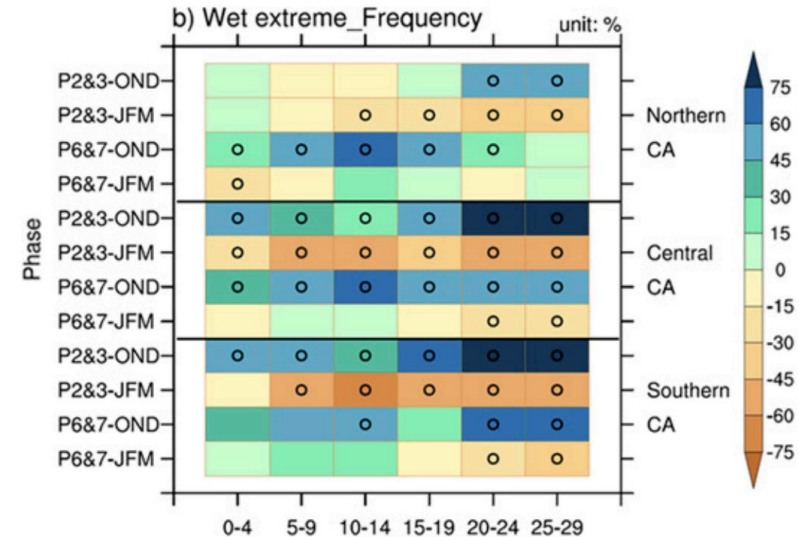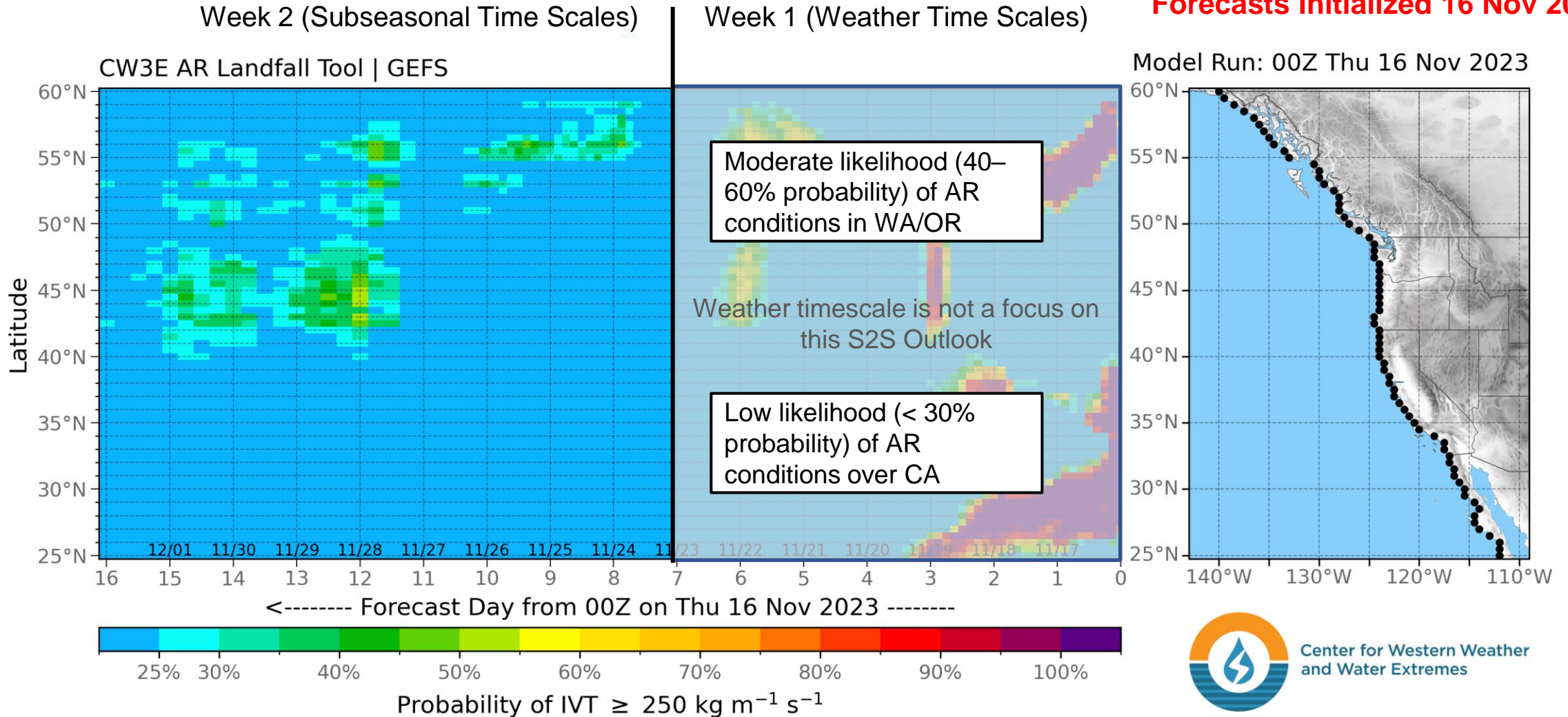- Strong MJO activity is expected during Week 1-2
- NCEP and ECMWF are forecasting MJO activity to strengthen over the Central Pacific (RMM Phase 1) during Week 1, and over Indian Ocean (RMM Phase 2) during Week 2
- MJO activity in the Indian Ocean during OND is associated with an increased likelihood of wet extremes in Central and Southern CA at lag times of 1–4 weeks

NCEP GEFS AR Landfall Tool: Valid 00Z 16 Nov – 00Z 2 Dec

Week 2 (Subseasonal Time Scales)
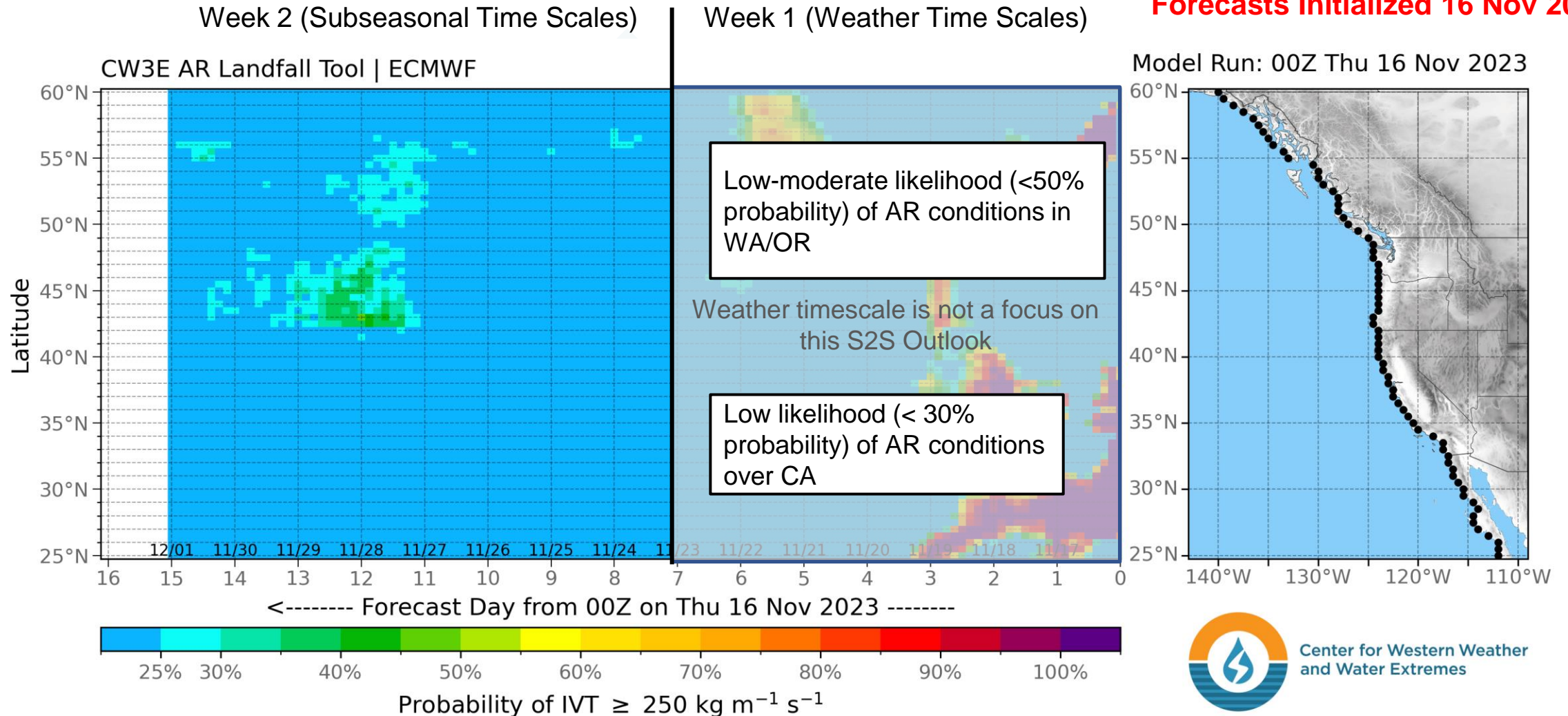
Week 1 (Weather Time Scales)

Forecasts Initialized 16 Nov 2023

CW3E AR Landfall Tool | GEFS

Model Run: 00Z Thu 16 Nov 2023

Moderate likelihood (40–60% probability) of AR conditions in WA/OR

Weather timescale is not a focus on this S2S Outlook

Low likelihood (< 30% probability) of AR conditions over CA

<-------- Forecast Day from 00Z on Thu 16 Nov 2023 --------

Probability of IVT ≥ 250 kg m^{-1} s^{-1}

25% 30% 40% 50% 60% 70% 80% 90% 100%

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Forecasts support FIRO/CA-AR Program and NSF #2052972 | Intended for research purposes only

- NCEP is forecasting low likelihood of AR conditions over California during Week 2

ECMWF EPS AR Landfall Tool: Valid 00Z 16 Nov – 00Z 2 Dec

Week 2 (Subseasonal Time Scales) | Week 1 (Weather Time Scales)

Forecasts Initialized 16 Nov 2023

CW3E AR Landfall Tool | ECMWF

Model Run: 00Z Thu 16 Nov 2023

Low-moderate likelihood (<50% probability) of AR conditions in WA/OR

Weather timescale is not a focus on this S2S Outlook

Low likelihood (< 30% probability) of AR conditions over CA

<-------- Forecast Day from 00Z on Thu 16 Nov 2023 --------

Probability of IVT ≥ 250 kg m^{-1} s^{-1}

Forecasts support FIRO/CA-AR Program and NSF #2052972 | Intended for research purposes only

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- ECMWF is forecasting low likelihood of AR conditions over California during Week 2

EPS Minus GEFS AR Landfall Tool: Valid 00Z 16 Nov – 00Z 2 Dec

Week 2 (Subseasonal Time Scales) | Week 1 (Weather Time Scales)

CW3E AR Landfall Tool | ECMWF-GEFS

Model Run: 00Z Thu 16 Nov 2023

Lower probabilities of AR conditions over WA/OR compared to NCEP

Weather timescale is not a focus on this S2S Outlook

<-------- Forecast Day from 00Z on Thu 16 Nov 2023 --------

Probability of IVT ≥ 250 kg m^{-1} s^{-1}

Center for Western Weather and Water Extremes
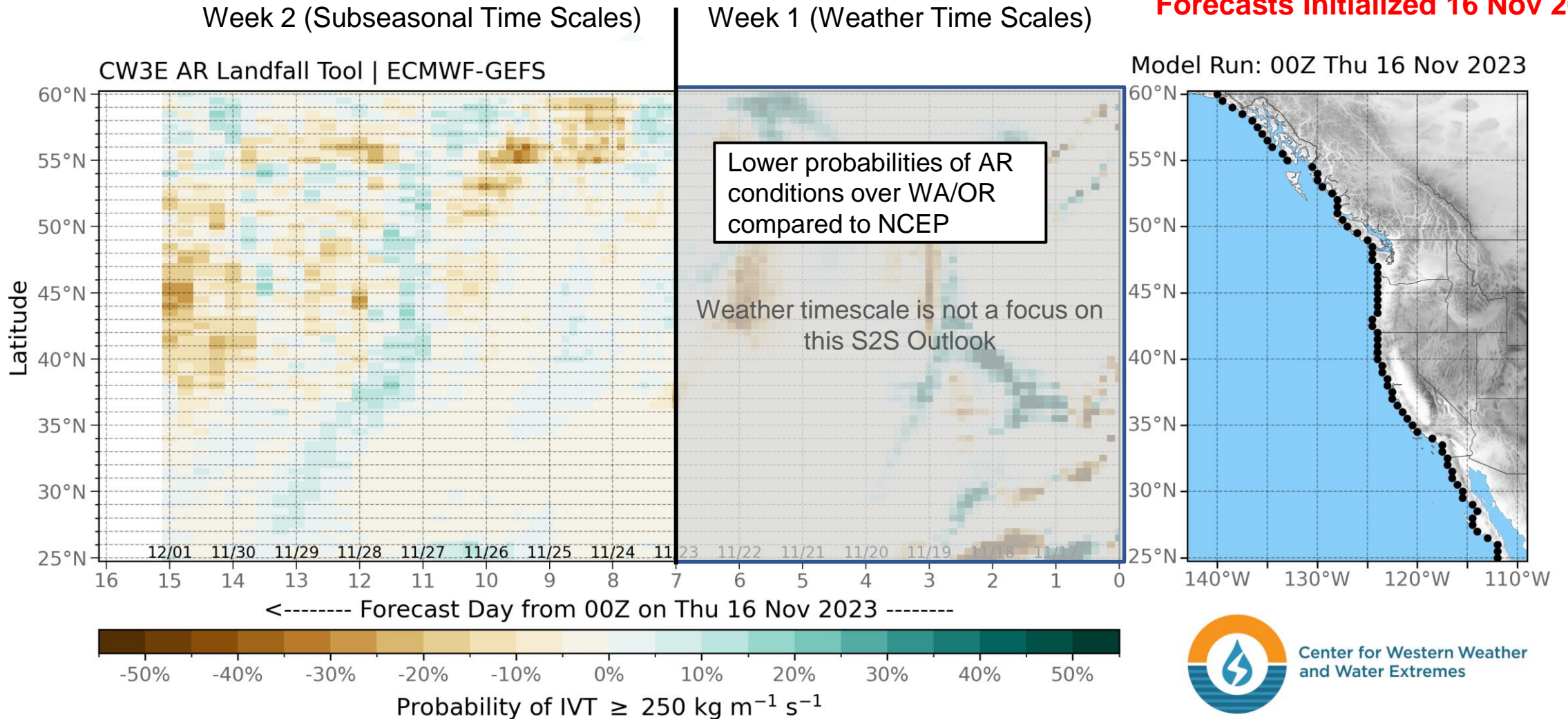
Forecasts support FIRO/CA-AR Program and NSF #2052972 | Intended for research purposes only

- ECMWF is forecasting lower likelihood of AR conditions over WA/OR during end of Week 2
- Models generally agree on low likelihood of AR conditions over CA

Forecasts Initialized 16 Nov 2023
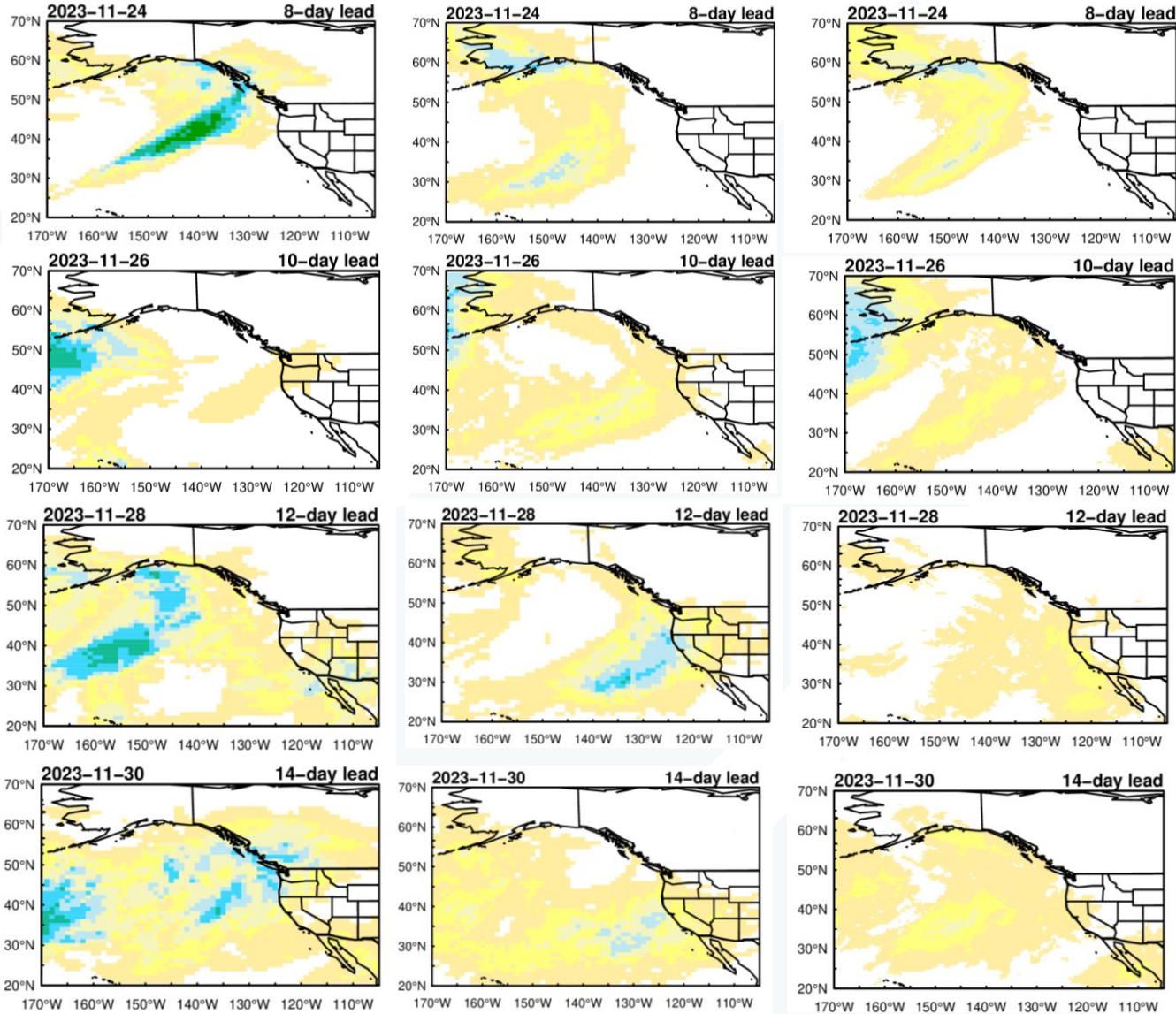
- NCEP and ECMWF are showing low likelihood (< 30%) of AR activity over CA during Week 2 (24–30 Nov)

- ECCC is showing low likelihood of AR activity over CA during most of the week, and moderate likelihood (40–60%) of AR activity in Northern CA on 28 Nov

Models generally agree on low likelihood of AR activity over CA

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

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

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

- The North-Ridge type is typically associated with widespread dry conditions across the entire western US

- The South-Ridge type is typically associated with dry conditions in Southern California 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 California and wet conditions over the Pacific Northwest

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

NCEP

ECMWF

Forecasts Initialized 16 Nov 2023
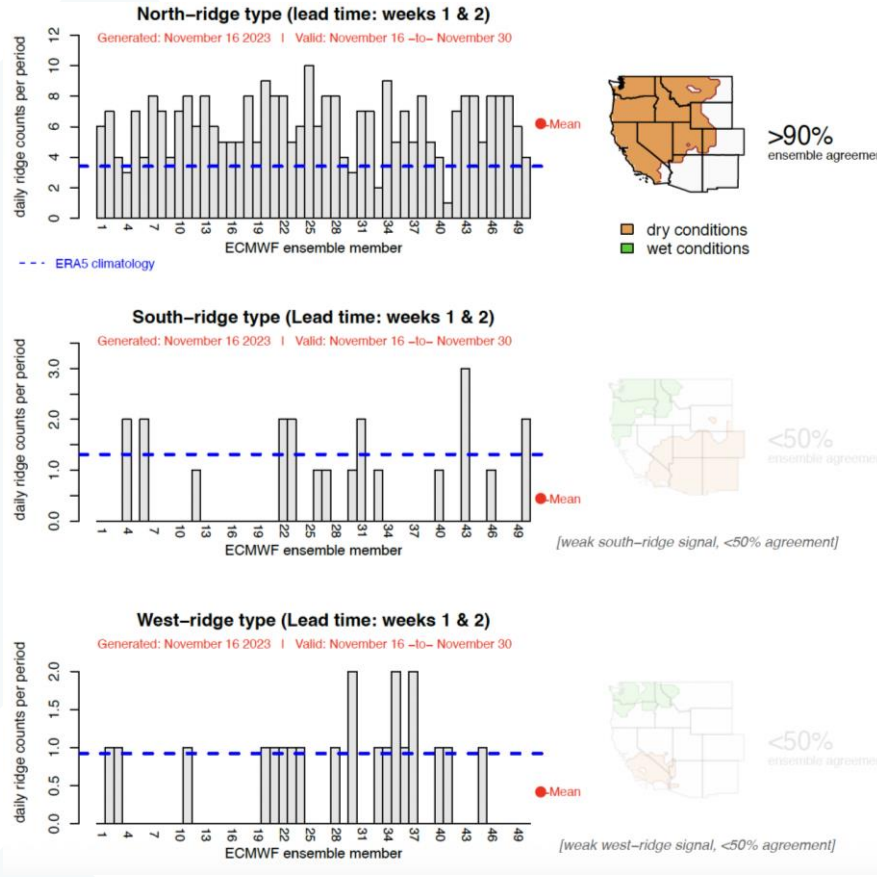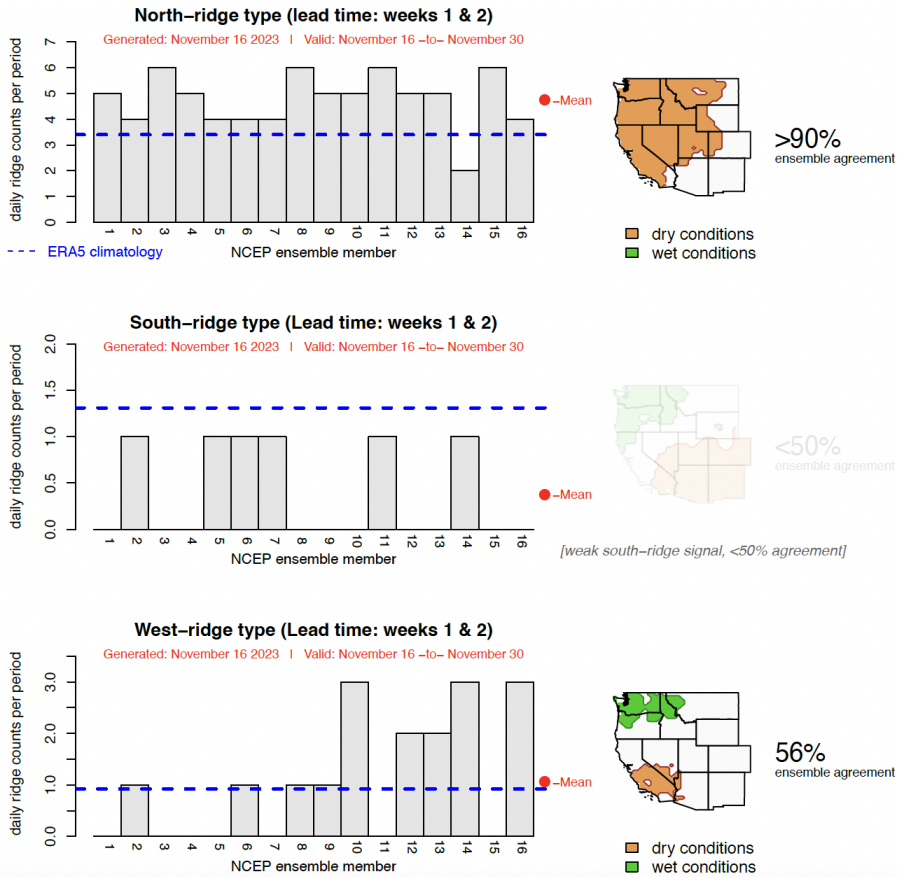
- Both NCEP and ECMWF are showing high likelihood (> 90% ensemble agreement) in persistent North Ridge activity during Weeks 1–2 (16–30 Nov)

- NCEP is predicting moderate likelihood (56% ensemble agreement) in persistent West Ridge activity

Models generally agree on high likelihood in persistent North Ridge activity during Weeks 1–2

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NCEP

ECCC

ECMWF

- NCEP and ECCC are predicting near-normal AR activity in CA during Week 3 (1–7 Dec) with low confidence

- ECMWF is predicting below-normal AR activity in CA, especially Southern CA with high confidence

Models show uncertainty in forecast AR activity over CA during Week 3
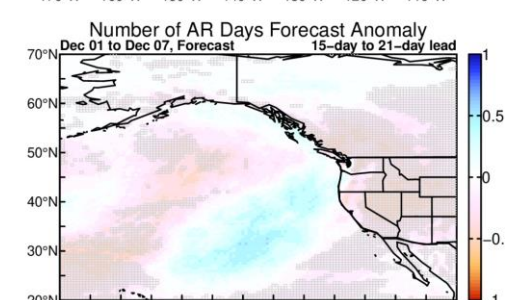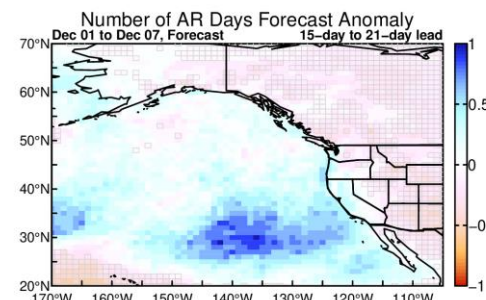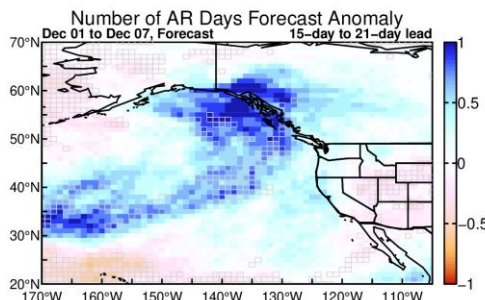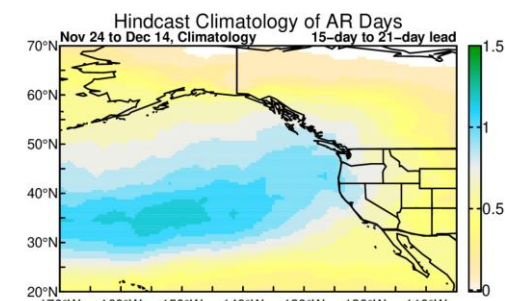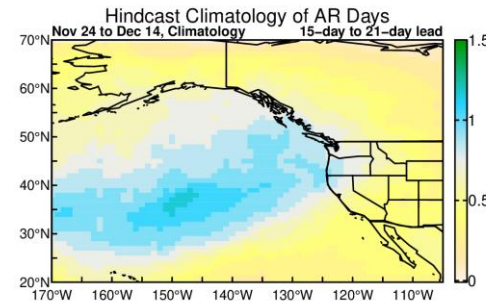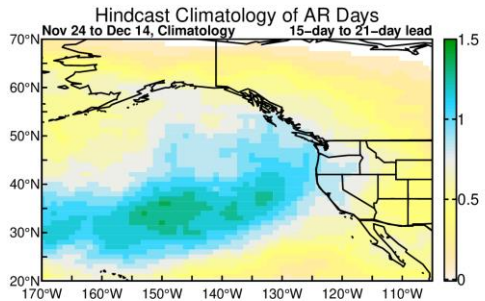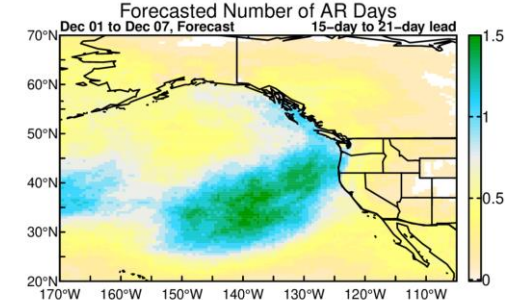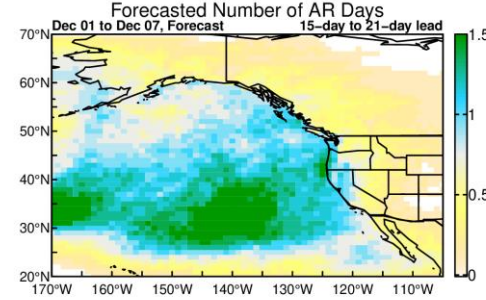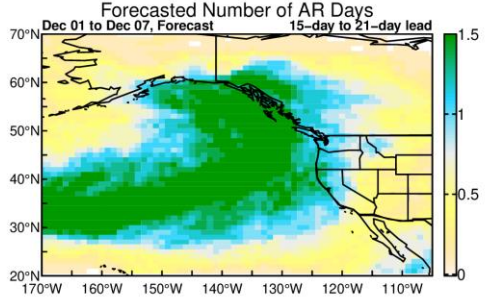
Shading: Fractional # of AR days forecast over a 7-day period (top), model climatology (middle), and forecast minus model climatology (bottom)
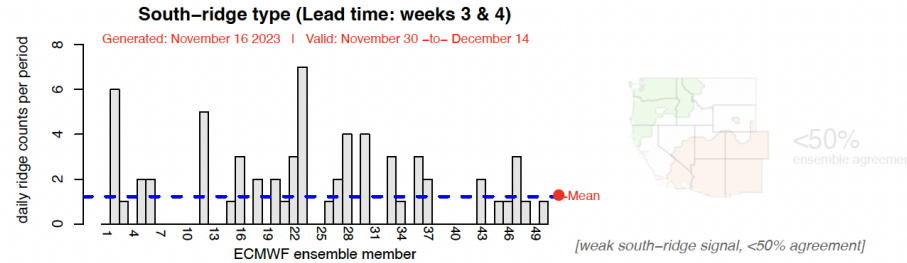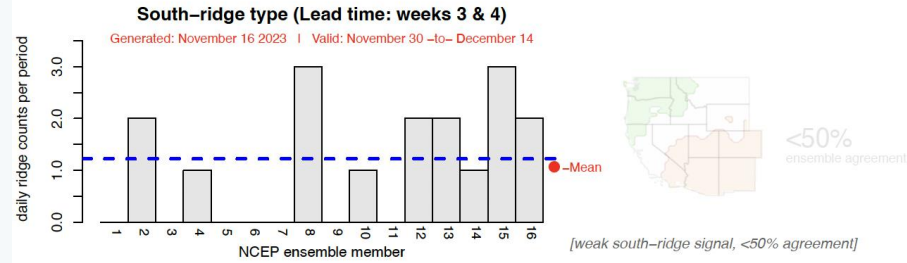Grey cells: >75% of ensemble members agree on sign of anomaly

Center for Western Weather and Water Extremes

AMBASSADOR™ WRN WEATHER-READY NATION

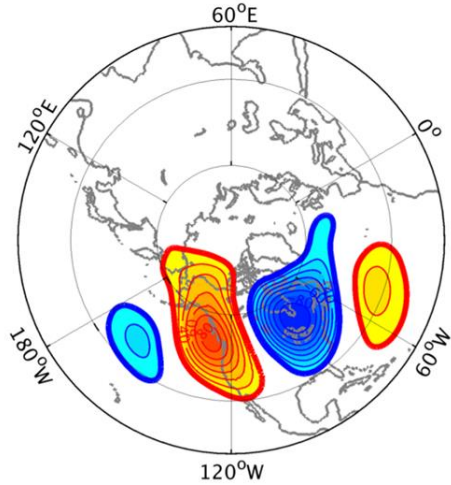**NCEP**　　　　　**ECMWF**　　　　　**Forecasts Initialized 16 Nov 2023**

- Both NCEP and ECMWF show potential for persistent ridging activity near the US West Coast during Weeks 3-4 (30 Nov – 14 Dec), but there is considerable uncertainty in the location of the center of ridging activity
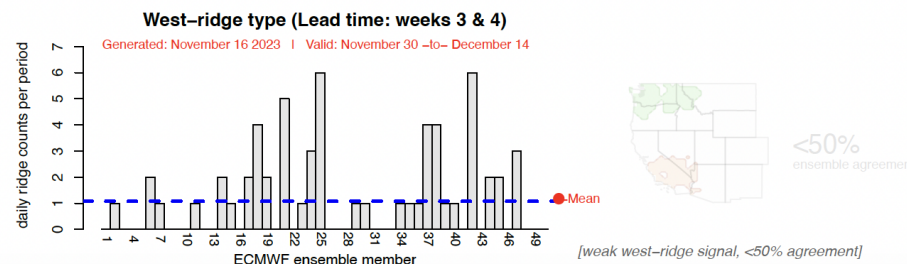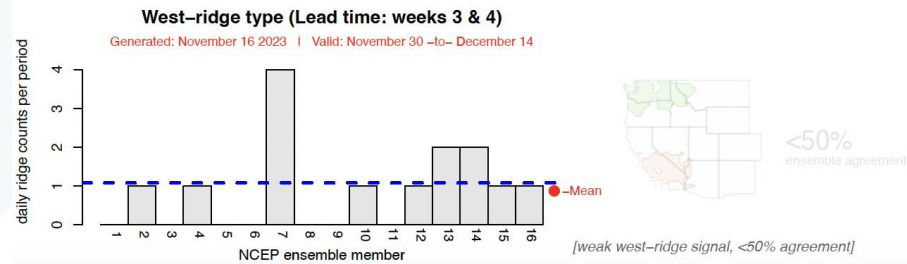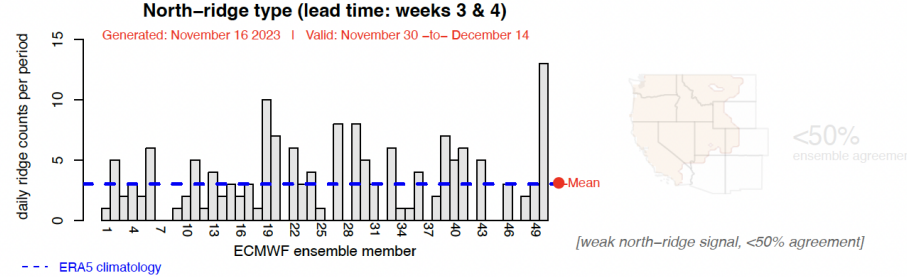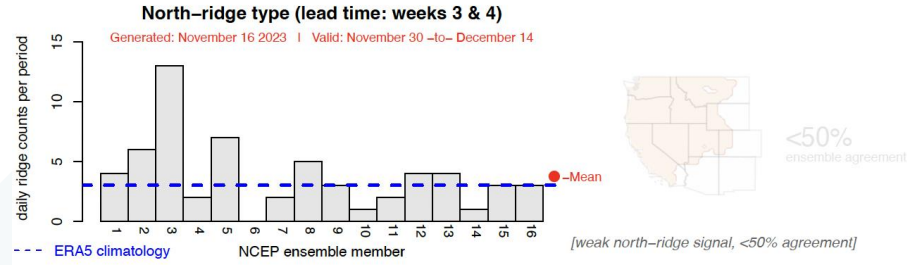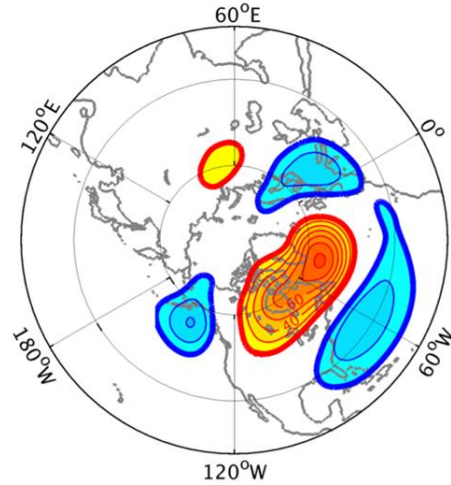
Uncertainty in frequency and location of ridging activity near the US West Coast during Weeks 3–4

Center for Western Weather and Water Extremes

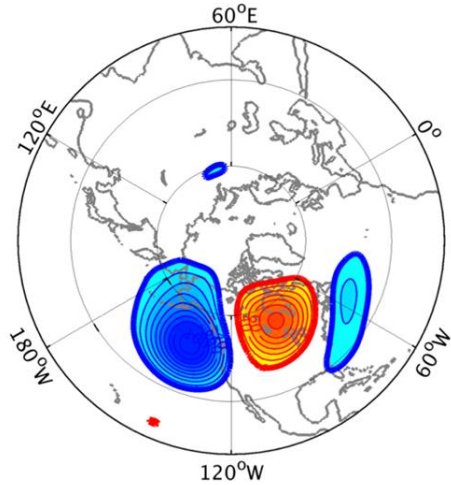SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO
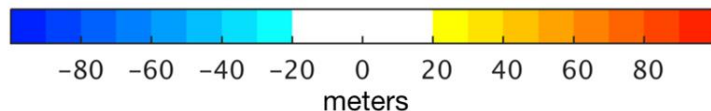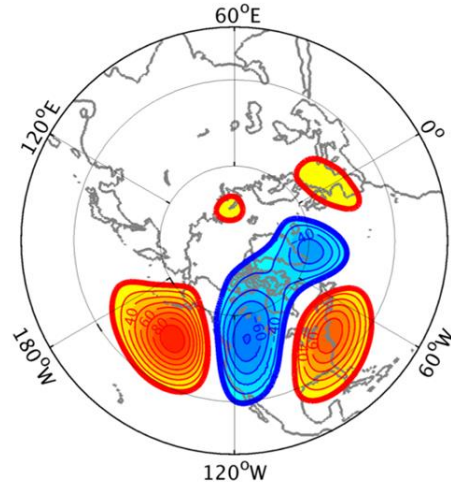
a) WR 1: West Coast Ridge
b) WR 2: Greenland High
c) WR 3: Pacific Trough
d) WR 4: Pacific Ridge

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)

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

Subseasonal Outlooks: IRI North American Weather Regime Forecasts

CFSv2 daily winter WRs max probability forecast (%) 48 members from Oct 1 to Nov 16 2023
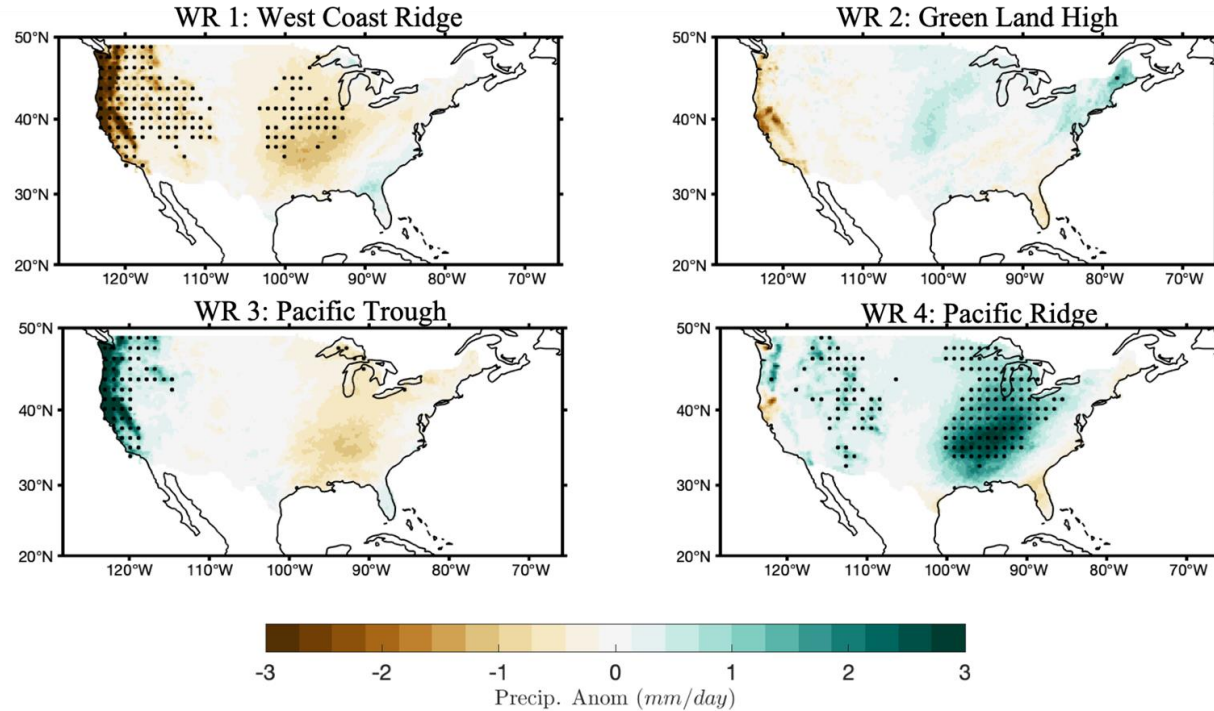

Forecast Initialized 16 Nov 2023
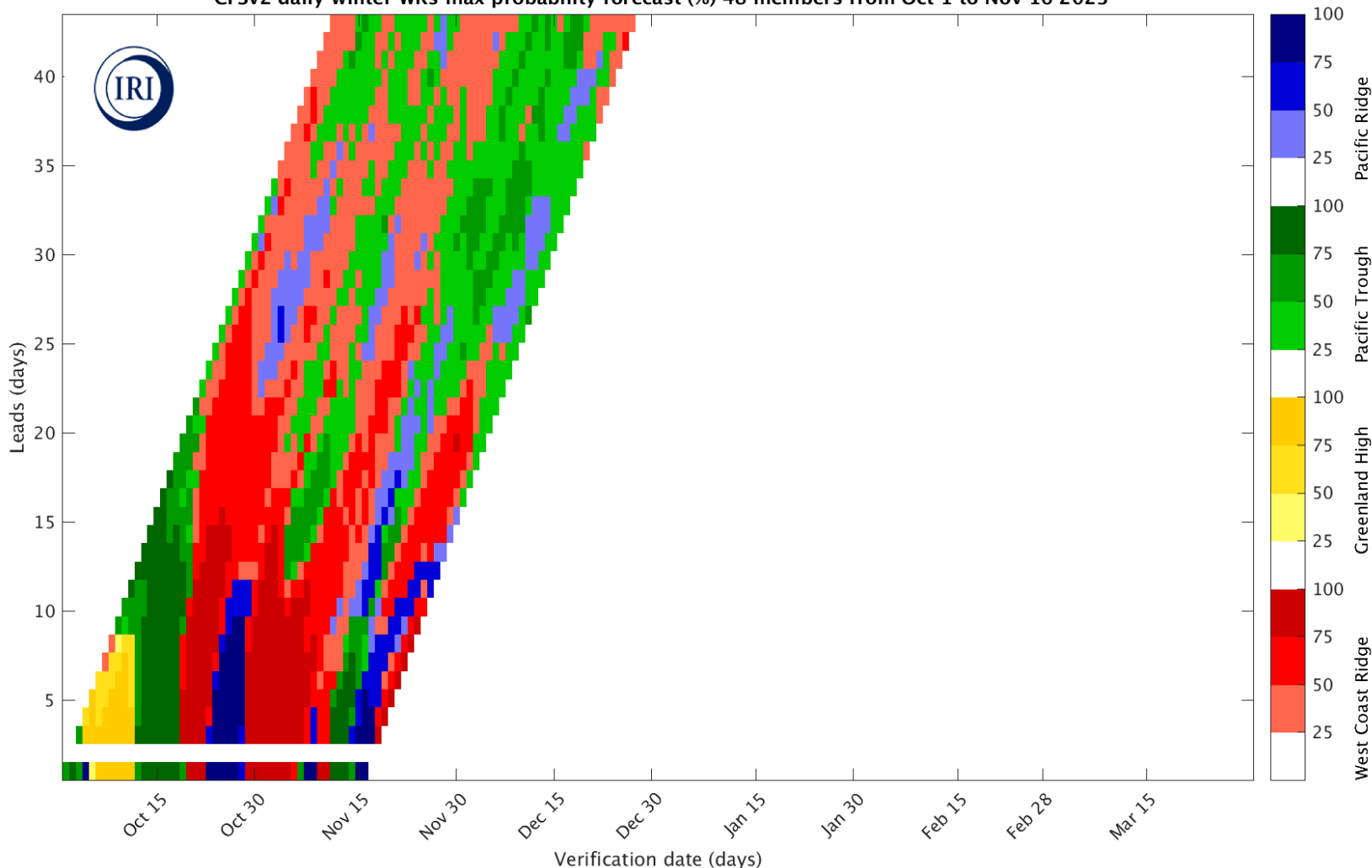
- Daily forecast out to 45-day lead time based on NCEP CFSv2 ensemble

- High likelihood (> 75% ensemble agreement) of West Coast Ridge continuing into Week 2, with a moderate likelihood (50–75% ensemble agreement) of a transition to Pacific Ridge later in Week 2

- Low likelihood (25–50% ensemble agreement) of Pacific Trough developing during Week 3 and persisting through Week 4
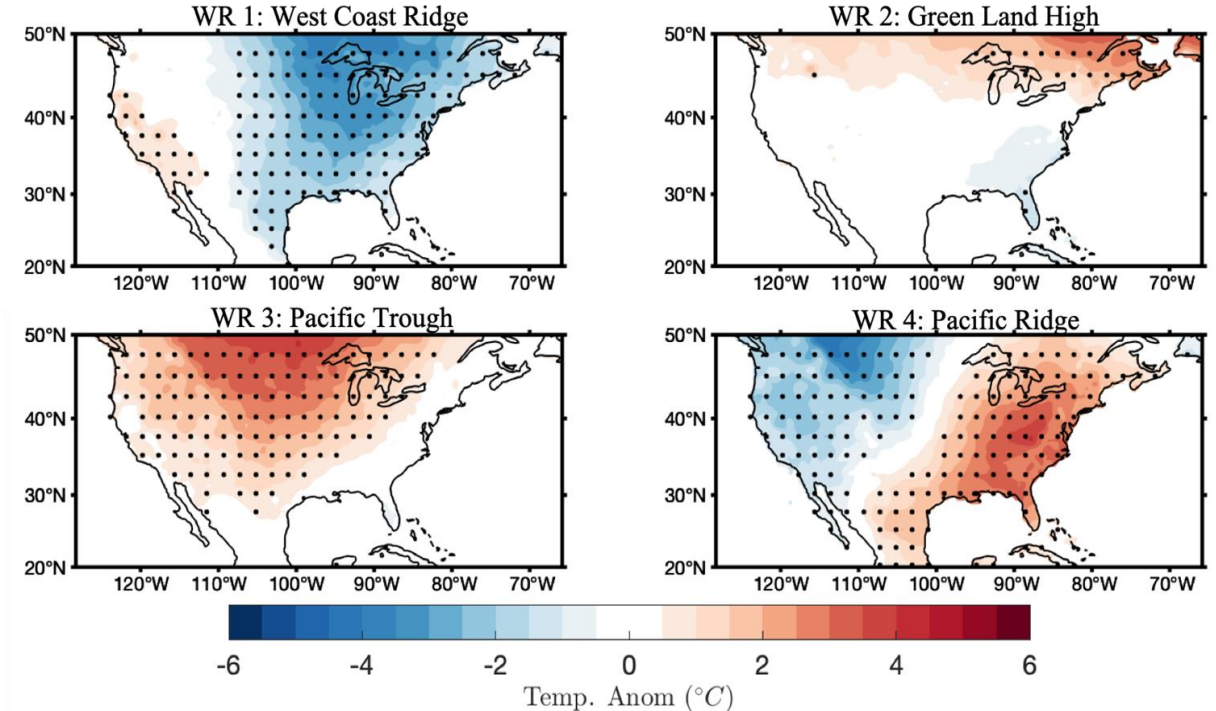
This graphic shows the which of the four North American weather regimes (different colors) is most likely to occur over the next 45 days. Darker (lighter) shading denotes higher (lower) probability of a particular regime.

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

Precipitation

Temperature

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

- Warm and dry conditions are predicted over CA at the end of November with high confidence and transition to cold conditions with a moderate likelihood
- Cold conditions are predicted over CA in the beginning of December with low confidence
- Wet and warm conditions are predicted over CA in middle of December with low confidence