• **Week 2 forecasts (18–24 Nov):** Models agree on the likelihood of AR activity over California
  — NCEP is forecasting higher probabilities (40–60%) of AR activity over CA than ECCC and ECMWF

• **Week 3 forecasts (25 Nov–01 Dec):** Models continue to show agreement of above-normal AR activity over California
  — NCEP is predicting more significant above-normal AR activity over CA than ECCC and ECMWF

• NCEP GEFS model predicts the MJO will be in the western Pacific in week-2, which is consistent with above-normal probability of AR activity over CA in week-3

• Both NCEP and ECMWF show large uncertainty in the occurrence of ridging activity during Weeks 1–2; Both models show moderate confidence in the occurrence of the South-Ridge type during Weeks 3–4, which is typically associated with dry conditions over Southern California and wet conditions over Northern California

• **Seasonal forecasts (Nov-Jan):** Models agree on the drier than normal conditions over Southern CA but disagree on the conditions over far Northern CA
  — Statistical (Machine Learning) model is predicting drier (wetter) than normal conditions over Northern CA

• **Seasonal forecasts (Jan-Mar):** Statistical model predicts wetter than normal conditions in Northern CA and drier than normal conditions in Southern CA
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 California and wet conditions over the Pacific Northwest.

N = North Ridge
S = South Ridge
W = West Ridge
Looking Back: Week 3 AR Activity Forecasts

Valid: 28 Oct – 3 Nov 2022

- All forecasts verified over OR and WA; ECCC verified over Northern CA
  - Above-normal AR activity over WA and OR
  - Above-normal AR activity over CA in ECCC

Valid: 4 – 10 Nov 2022

- NCEP and ECCC forecasts verified over CA
  - Above-normal AR activity over CA
A strong AR produced heavy precipitation (at least 5-10 inches) over portions of western WA and northwestern OR and some precipitation over Northern CA during 3-5 Nov.

Another moderate strength AR brought heavy rain and snow throughout CA during 7-8 Nov; Precipitation totals in the Transverse Ranges of Southern CA exceeded 8 inches with totals around the state exceeding 2 inches; Much of the Sierra Nevada received more than 2 feet of snow.

Observed precipitation in most of CA during the past two weeks was consistent with model week-3 forecasts of AR activity.
• Above-normal precipitation over the western US especially CA (Southern CA received >400% of the normal precipitation) during the past two weeks

• Consistent with previous model week-3 AR forecasts
NCEP GEFS AR Landfall Tool: Valid 00Z 11–27 Nov

- Low-to-moderate probability (25–60%) of AR conditions over Washington, Oregon, and Northern California
- Low probability (< 25%) of AR conditions over Southern California

NCEP is forecasting a low-to-moderate probability of AR conditions over California in Week 2 with weak MJO in week 1 and ridging activity during weeks 1-2.
Low-to-moderate probability (25–55%) of AR conditions over Washington, Oregon, and Northern California

Low probability (< 25%) of AR conditions over Southern California

ECMWF is forecasting a low-to-moderate probability of AR conditions over California in Week 2 with weak MJO in week 1 and ridging activity during weeks 1-2
EPS Minus GEFS AR Landfall Tool: Valid 00Z 11–26 Nov

Week 2 (Subseasonal Time Scales)
EPS minus GEFS Prob of IVT>250 kg/(ms)

Week 1 (Weather Time Scales)
Model Run: 00Z Fri 11 Nov 2022

Weather timescale is not a focus on this S2S Outlook

Higher probability of AR conditions over California
Subseasonal Outlooks: Week 2 AR Activity (NCEP vs. ECCC vs. ECMWF)

• All models are showing low-to-moderate probabilities (20-60%) of AR activity in California during 22-24 Nov with the highest probability predicted by NCEP

All models show low-to-moderate probabilities (20-60%) of AR activity over California in Week 2 (18-24 Nov)
NCEP and ECMWF both show large uncertainty (<50% ensemble agreement) in the occurrence of ridging activity near the US West Coast during Weeks 1–2 (10 – 24 Nov 2022)

There is low confidence in the ridging forecasts during 10 – 24 Nov 2022
Subseasonal Outlooks: Week 3 AR Activity (NCEP vs. ECCC vs. ECMWF)

- NCEP model is predicting significantly above-normal AR activity over CA during Week 3 (25 Nov–1 Dec)
- ECCC and ECMWF models are predicting slightly above-normal AR activity over CA

There is a likelihood of AR activity over CA in week-3 (25 Nov–1 Dec) with the highest probability in NCEP due to active MJO convection over the western Pacific during Weeks 2-3.
Both models show moderate confidence (54% and 62% ensemble agreement) in the occurrence of the South-Ridge type during Weeks 3–4 (24 Nov – 8 Dec).

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.

Both models show low confidence (< 50% ensemble agreement) in the occurrence of the North- and West-Ridge types.

There is moderate confidence between models in the South-Ridge type during 24 Nov – 8 Dec which is typically associated with dry conditions in Southern CA.
New tool: IRI Subseasonal Weather Regime Forecast

- Daily forecast out to 45-day lead time shown on CW3E S2S website
- Uses NCEP CFSv2 ensemble
- Latest forecast favors West Coast Ridge conditions for weeks 1-3, then Pacific Trough into mid-December and West Coast Ridge in late December
New tool: IRI Subseasonal Weather Regime Forecasts

- Four dominant weather regimes identified using $k$-means cluster analysis on daily Z500 anomalies from MERRA data (1981-2015)

New tool: IRI Subseasonal Weather Regime Forecasts

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

- Dry and warm conditions over CA are predicted in late November with high confidence and late December with low confidence
- Wet and warm conditions over CA are predicted in early December with low confidence
The North American Multi-Model Ensemble and CW3E machine learning models based on October SST/global weather patterns are predicting drier than normal conditions for Southern CA and wetter than normal conditions for Northern CA during Nov–Jan with moderate confidence.

**CW3E Machine Learning Models: Nov–Jan Forecast**

55% chance for wet North and dry South

Skill assessment: Gibson et al. 2021
Seasonal CCA Outlooks: Nov 2022 – Jan 2023 Precipitation

- CW3E statistical model based on October SST is predicting below-normal Nov–Jan precipitation over CA
- La Niña conditions are expected to continue into winter

Context regarding historical skill:
- For both the NDJ and JFM forecasts, skill is highest over the desert SW and Southern CA compared to Northern and Central CA
- The domain-averaged skill for the JFM forecast is generally higher than that of the NDJ forecast
Seasonal CCA Outlooks: Jan – Mar 2023 Precipitation

- CW3E statistical model based on October SST is predicting significantly above-normal precipitation over Northern CA and below-normal precipitation over CA during Jan - Mar 2023

- La Niña conditions are expected to continue into spring

Context regarding historical skill:
- For both the NDJ and JFM forecasts, skill is highest over the desert SW and Southern CA compared to Northern and Central CA
- The domain-averaged skill for the JFM forecast is generally higher than that of the NDJ forecast
As of 1 Nov 2022, total water-year-to-date (WYTD) precipitation was running below the climatological normal in Northern and Central CA, and running well above the climatological normal in Southern CA.

Based on historical precipitation data, the probability of reaching normal WY precipitation by the end of Sep 2023 is less than 50% in CA.

The observed precipitation anomalies are largely the result of persistent North-Ridge or West-Ridge type during October that lead to dry conditions across much of the western US.
As of 11 Nov, water-year-to-date precipitation is above normal across Southern CA

Total water year precipitation in the Northern Sierra Nevada is now 85% of normal for this date (12 Nov) which is currently below average

As of 13 Nov, Sierra Nevada snowpack is well above of normal