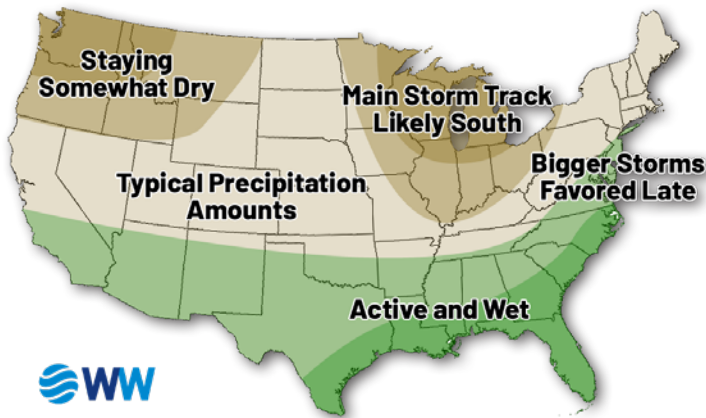


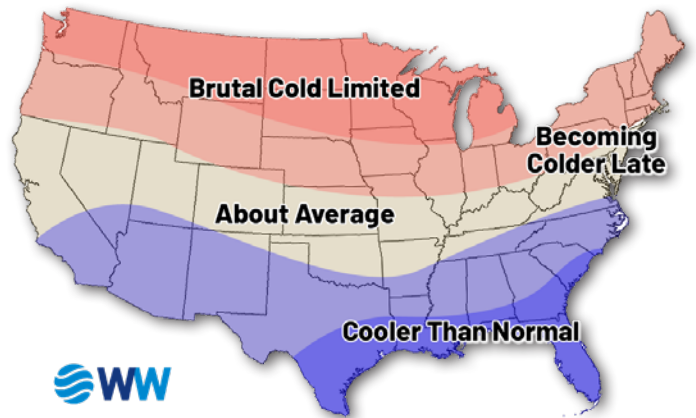
Winter Outlook

Preview #1 - 2023 - 2024

First Call on Winter 2023 - 24



U.S. Precipitation Outlook



U.S. Temperature Outlook

Precipitation Trends



- Strong and active sub-tropical jet stream focuses precipitation in the southern U.S., reaching up into the mid-Atlantic at times.
- Increased big storm potential relative to recent years for the East Coast.
- The polar (northern) jet stream still carries disturbances, bringing lighter snows & mixed events to the Upper Plains & Great Lakes.
- Watching the Southern Rockies, Southern Appalachians, the Tennessee Valley, and interior mid-South for a snowy year.

Temperature Trends

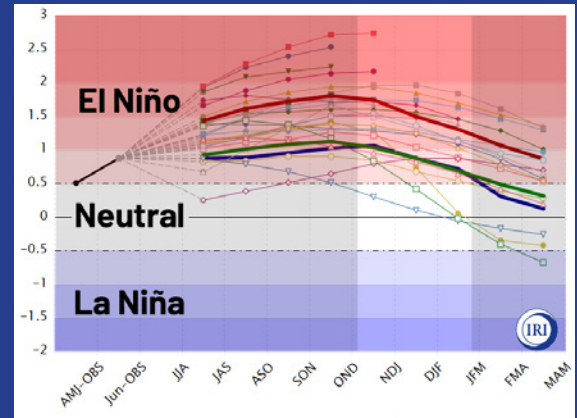


- Compared to normal, the coldest readings will be in the South.
- Highest likelihood for consistently colder than normal temperatures in the Midwest & Northeast comes mid-to-late winter.
- In the Upper Plains/Pacific Northwest, temperatures will be less harsh than usual, but still supportive of snow.
- The gradient between above / below normal may be very sharp. A couple swings likely in areas that prove to be "about average."

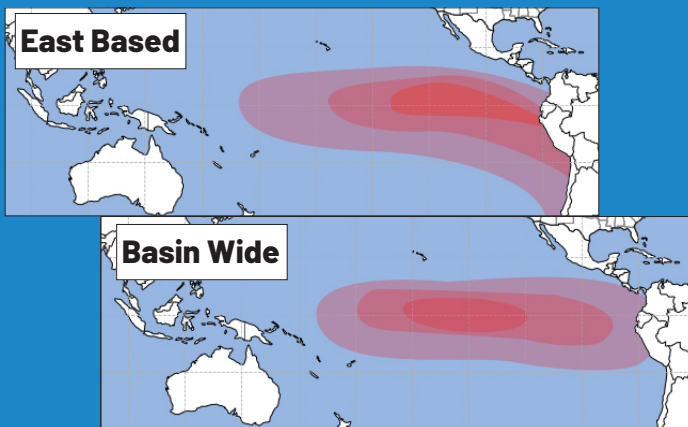
Major Pattern Drivers for Winter 2023-24

Significant El Niño Is Developing

- La Niña from the last few years has been replaced by a weak El Niño (warmer than normal waters in the tropical Pacific) this summer.
- All current guidance suggests that El Niño will continue to strengthen into the fall.
- It's becoming more likely that a strong El Niño will occur, but it's too soon to discount a higher-end moderate event.



El Niño Forecast (Winter Highlighted) IRI/Columbia



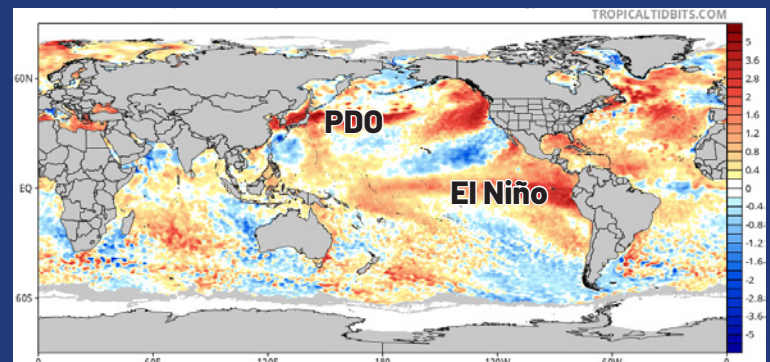
Typical El Niño Sea Surface Temperature Anomalies

El Niño: Location Matters!

- Although attention is on the strength of El Niño, placement is even more important.
- Most El Niños are either east based, west based, or more "basin wide".
- Each has distinct impacts on U.S. weather, and there's some uncertainty on which we'll see this winter.
- While the El Niño is east based currently, we're favoring a shift towards a basin wide event, which often leads to colder and wetter conditions across the mid-Atlantic.

Ocean Temperatures Elsewhere

- Besides El Niño in the tropical Pacific, we're watching the North Pacific's PDO (Pacific Decadal Oscillation).
- Currently, the PDO is strongly negative, but is expected to become neutral. This should allow for blasts of cold air into the Eastern U.S., especially mid and late winter.
- Water temperatures in the Atlantic are very warm, which can provide added fuel for coastal storms that develop.

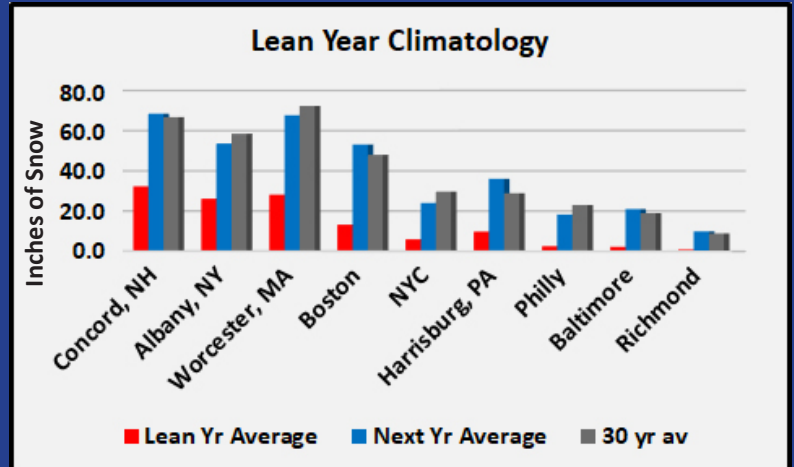


Map of Current Sea Surface Temperature Departures around the Globe

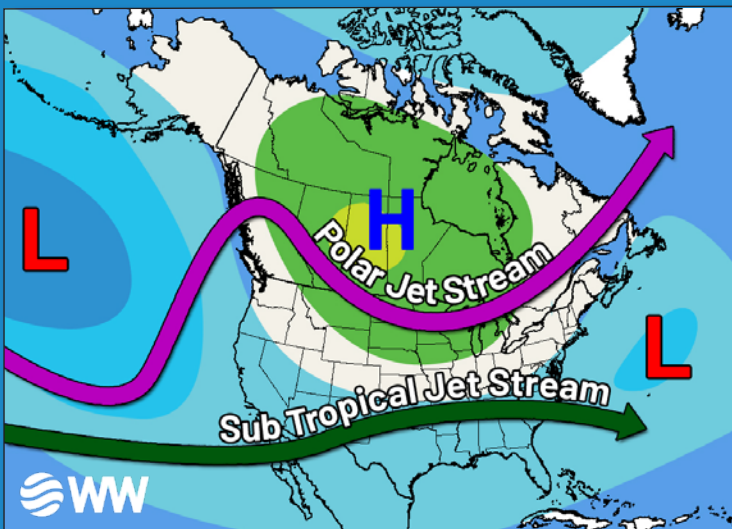
Clues from Lean Winters & Analogs

What Happens after a Lean Winter?

- Following a lean winter (the 10 least snowy out of the last 100 winters), over 95% of the time, the next season features an increase in snowfall for these cities.
- The next season's average snowfall (not accounting for El Niño) tends to be near the 30-year normal, exceeding it approximately 40% of the time.
- Given the El Niño, cities from NYC to Richmond likely see the greatest rebound in snowfall. In northern New England and the Midwest, a softer response is possible, but it can still be near the 30 year average.



Preliminary Winter Pattern Map



Analog Analysis

- Regardless of El Niño's strength, the overall pattern will be different than the last few winters.
- The sub-tropical jet stream should be quite active, resulting in frequent precipitation in the southern U.S., and the risk of a bigger East Coast storm or two increases.
- As colder air becomes more favored during mid and late winter, and with the assistance of Greenland blocking, the potential for higher impact snow events increases, especially in the Ohio Valley & mid-Atlantic.

Next Update: On or Around September 18th