

# Item 7: 2023-2024 Winter Weather Update

*Chris Coleman* ERCOT Lead Meteorologist

**Board of Directors Meeting** 

ERCOT Public December 19, 2023

### **Overview**

### Purpose

To provide a summary of 2023-2024 winter weather expectations

### Voting Items / Requests

No action is requested of the Board; for discussion only

### Key Takeaways

- A very unusual collection of atmospheric drivers has little historical precedence
- An El Niño is in place but not all El Niños are alike
- Any winter season is capable of producing cold extremes; this winter is no exception



## **El Niño**

#### Mid-November 2023 IRI Model-Based Probabilistic ENSO Forecasts



#### Key Takeaways

- Coming off a La Niña in early-2023, this was the fastest, most aggressive change to El Niño since 1972 (1965 was the only other year that started as a La Niña and became an El Niño by spring)
- El Niño reached the "strong" threshold in late-August
- The current El Niño will continue through the upcoming winter (likely remaining strong)

#### The coldest winter since 2001 was during an El Niño -- but many more warm winters since 1991-92

Red = warmest third of all winters (1895-current) Blue = coldest third of all winters Black = middle third of all winters

### El Niño winters (**bold** = strong):

2019-20: 112<sup>th</sup> coldest 1991-92: 96th coldest 2018-19: 94<sup>th</sup> coldest 1987-88: 31<sup>st</sup> coldest 2015-16: 119<sup>th</sup> coldest 1986-87: 58<sup>th</sup> coldest 2014-15: 68<sup>th</sup> coldest **1982-83**: 44<sup>th</sup> coldest 1977-78: 4<sup>th</sup> coldest 2009-10: 8<sup>th</sup> coldest 2006-07: 44<sup>th</sup> coldest 1976-77: 12<sup>th</sup> coldest 2004-05: 108<sup>th</sup> coldest **1972-73:** 8<sup>th</sup> coldest 2002-03: 64<sup>th</sup> coldest 1969-70: 48th coldest 1997-98: 92<sup>nd</sup> coldest 1968-69: 81<sup>st</sup> coldest 1965-66: 24<sup>th</sup> coldest 1994-95: 115<sup>th</sup> coldest

- 1963-64: 5<sup>th</sup> coldest
- 1958-59: 26<sup>th</sup> coldest
- 1957-58: 35<sup>th</sup> coldest
- 1953-54: 93<sup>rd</sup> coldest
- 1951-52: 124<sup>th</sup> coldest



# **Unusual Pattern in 2023**

- Fast and aggressive turnover from prolonged La Niña to strong El Niño
- El Niño (especially strong cycles) occurring during a negative PDO (Pacific Decadal Oscillation) is very uncommon
  - A strong El Niño has never occurred during a strongly negative PDO (current)
  - A strong El Niño has only coincided twice with a negative PDO (2009-10, 1957-58)
- Texas went from the 80<sup>th</sup> driest April-June (2023) period to a very hot (#2) and dry (#7) summer (June-September)
  - 2011, 2022, and 1998 (the other three top 4 hottest summers) were all preceded by top 7 driest April-June periods
  - A dry spring is typically a good indicator of a hot summer (2023 was not a dry spring)
  - Texas has never experienced a flip this extreme

120°E 150°E 1805 150°W 120°W 30°W 30°E 90°F 60°W TORR 120°E 150°E 150°V  $^{-1}$ **Pacific Decadal Oscillation** positive phase negative phase 0.8 **Key Takeaway** 0.4 There is very little 0.2 • historical precedence for 0.0 what is occurring in 2023 -0.2 0.6

NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 3 Oct 2023

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# 2023 Year-to-Date

- January through October 2023 ranked as the #1 warmest Jan-Oct period for Texas (since 1895)
  - The six warmest Jan-Oct periods have all occurred this century: 2023, 2011, 2000, 2012, 2017, 2006
- January through October 2023 ranked as the 34<sup>th</sup> driest Jan-Oct period for Texas (since 1895)
  - Jan-Oct 2023 is the 4<sup>th</sup> driest this century: 2011, 2022, 2014, 2023
- This was also the #1 warmest Jan-Oct period globally

### Key Takeaway

 2023 has been a very warm year, which has become more common this century



Global Land and Ocean

**Texas Average Temperature** 



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## Why has 2023 been so warm?

#### **Volcanic Eruption**

 January 14, 2022 eruption of Hunga Tonga-Hunga Ha-apai, an underwater volcano near Tonga, in the South Pacific. 50 million tons of water vapor from Tonga's eruption could warm the earth for years. This was the most powerful eruption since Mount Pinatubo in 1991

#### Solar Max

 At the high point in this cycle, a surge in solar energy warms the Earth by around 0.09 degrees F (0.05 degrees C).

#### **El Niño**

 The last strong El Niño raised global temperatures by 0.25 degrees F

### Key Takeaway

 The alignment of a volcanic eruption, a solar max, and an El Niño have likely all contributed to warming the planet in 2023







# Winter 2022-23 Review

Last winter ranked 6<sup>th</sup> warmest for the state of Texas, based on both mean and minimum temperatures



2<sup>nd</sup> warmest winter this century (behind only 2016-17, which was the warmest winter on record back to 1895)



December 22-24 extreme cold – 2<sup>nd</sup> coldest period since Dec 1989 for much of Texas

- Austin fell to 15° the morning of 12/23
  - Coldest non-February 2021 period since Dec 1989
- Houston reached 15° on 12/23
  - Coldest non-February 2021 period since Dec 1989
- Brownville recorded 27° on 12/23
  - Coldest non-February 2021 period since Dec 1989
- Dallas dropped to 11° on 12/22 and 12/23
  - Coldest non-February 2021 period since Feb 1996
- Less extreme over West Texas. Abilene recorded 10° on 12/22-23
  - That's happened in 6 previous winters since 2005

### **Key Takeaway**

Last winter was a perfect example of the ٠ message stated prior to each winter: Even warm winters can have a period with extreme cold temperatures

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# **2023-24 Winter Temperature Outlook**

A below normal winter has become uncommon this century

Only 3 of the past 22 winters have fallen in the coldest third of all winters (2020-21, 2013-14, 2009-10)

Keep in mind the global factors (Tonga volcano, solar cycle) that could continue an overall warm influence

This winter has a greater-than-typical lack of historical matches (analogs)

2015-16, 2022-23, and 2021-22 are the best matches

- 2015-16 was the last strong El Nino
- The past two winters match well with all but El Nino
- All 3 of these winters were warmer than normal
- 2009-10 (cold winter) has some similarities worth monitoring



### **Key Takeaways**

- This winter's forecast is normal to above normal temperatures for most of Texas, averaged over a threemonth period (December-February)
- There is a lack of historical similarities to 2023



Item 7

### Winter 2023-24 Precipitation Outlook vs Drought

U.S. Drought Monitor

Texas

#### November 21, 2023 (Released Wednesday, Nov. 22, 2023) Valid 7 a.m. EST





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

<u>Author:</u> Brad Rippey U.S. Department of Agriculture



Key Takeaways

or worse

80-100% normal to slightly below normal

Tyler

Houston

Brownsville

90-120% sligthly above normal

50-70% much below normal

Waco

Austin

San Antonio

Corpus Christi

McAllen

aredo

60-90% below normal

Wichita Falls

**Dallas-Fort Worth** 

Lubbock

Midland

Winter 2023 - 2024

(December to February)

Precipitation Outlook

 While El Niño is commonly associated with above normal precipitation in Texas, that is not always the case. The last strong El Niño (2015-16) did not bring a wet winter to most of Texas

Current Drought (as of 11/21/2023):

74% of the state's area in moderate drought

- The precipitation outlook for this winter suggests some regions will see the drought continue and potentially worsen
- Lake Travis was at 38% of capacity as of 11/29/23. It's been below 40% since 8/17. Prior to this year, the last time Lake Travis was below 40% was May 2015





# Winter Weather Outlook Summary

#### Key Takeaways

- The 2023-24 winter weather outlook calls for mostly normal to above normal temperatures and mostly below normal precipitation
- Very unusual pattern of atmospheric drivers; very little historical precedence
- Regardless of the outlook for the entire winter, one or more periods of weather extremes can occur in any winter



(December to February) Precipitation Outlook

### Additional forecast discussion is available on the ERCOT website

→ C A https://www.ercot.com/gridmktinfo/dashboards/weath

Weather Forecast Details

#### General Discussion:

Most of the ERCOT region will continue to see highs in the mid-80s to low-90s over the next seven days; however, cooler temperatures on Saturday. This will be felt mostly in North and West Texas. And a cooler scenario for most this period will be brief as temperatures will return warmer Sunday and into early next week. Beginning next Wedn There's still quite a bit of disagreement among the computer models, however, so more time is needed to determi

#### Today

Scattered to isolated showers and thunderstorms will again impact the Panhandle and portions of the Far West zthunderstorms will spread into the Rio Grande Valley late tonight, mostly after midnight. The rest of the state will I large metropolitan areas should top out around 90 this afternoon. High will near 90 in Abilene as well . Low-90s w range from the mid-70s north to the mid-80s south.

#### Tomorrow

FRCOT

A cold front will move into North and West Texas during the day on Friday. This will result in those regions being c today. 91 in Houston tomorrow afternoon. The Rio Grande Valley will see more clouds and scattered rain opportur

#### 7-Day Temperature Forecast by City

Low and high temperatures forecast for the next seven days for major cities within the ERCOT system.

Forecast Variability Report

Weather Seasonal Updates A seasonal forecast for the ERCOT rec

encounter of the potential for load, wind, and solar conditions to vary between forecasts and actuals

#### From the website:

While the mostly mild forecast is for the winter season as a whole, expect some cold, below normal periods to impact the ERCOT region. Mid-to-late winter has more support for cold outbreaks than December, with a bit of a lean toward keeping an eye on January. With this very unusual pattern, the polar vortex has greater-than-average potential for impacts to Texas this winter and thus, a period of cold extremes is certainly possible.

https://www.ercot.com/files/docs/2023/11/22/seasonal-updates.pdf

