The 2023/2024 El Niño:

Monitoring Global Impacts on Agriculture

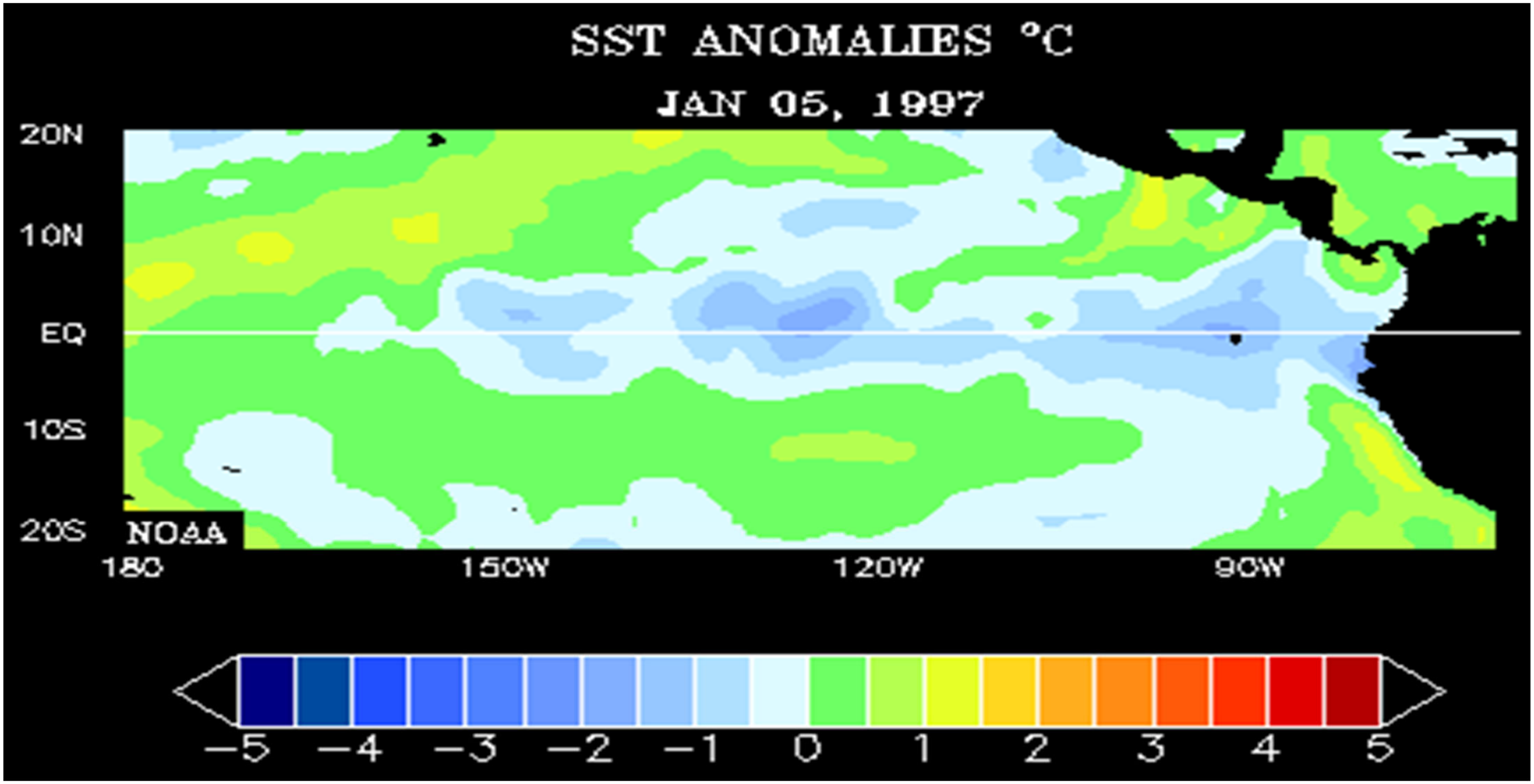
Mark D. Brusberg
Chief Meteorologist
USDA Office of the Chief Economist / World Agricultural Outlook Board

Presented to

2024 USDA Agricultural Outlook Forum

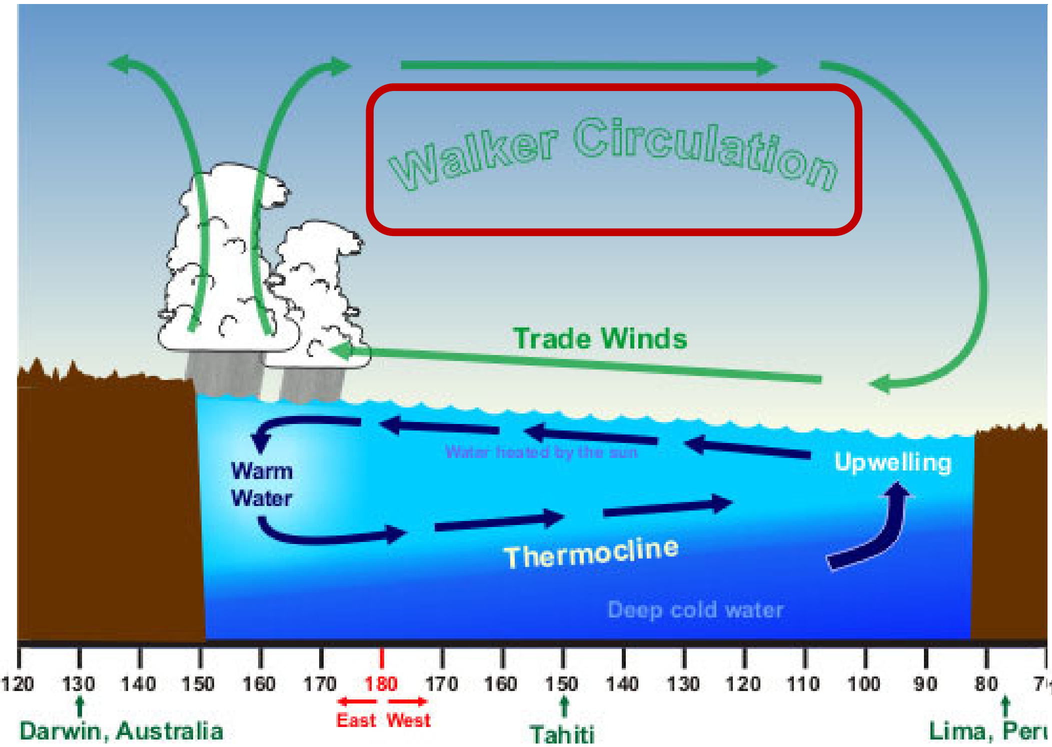
Grain and Oilseeds Outlook

February 16, 2024

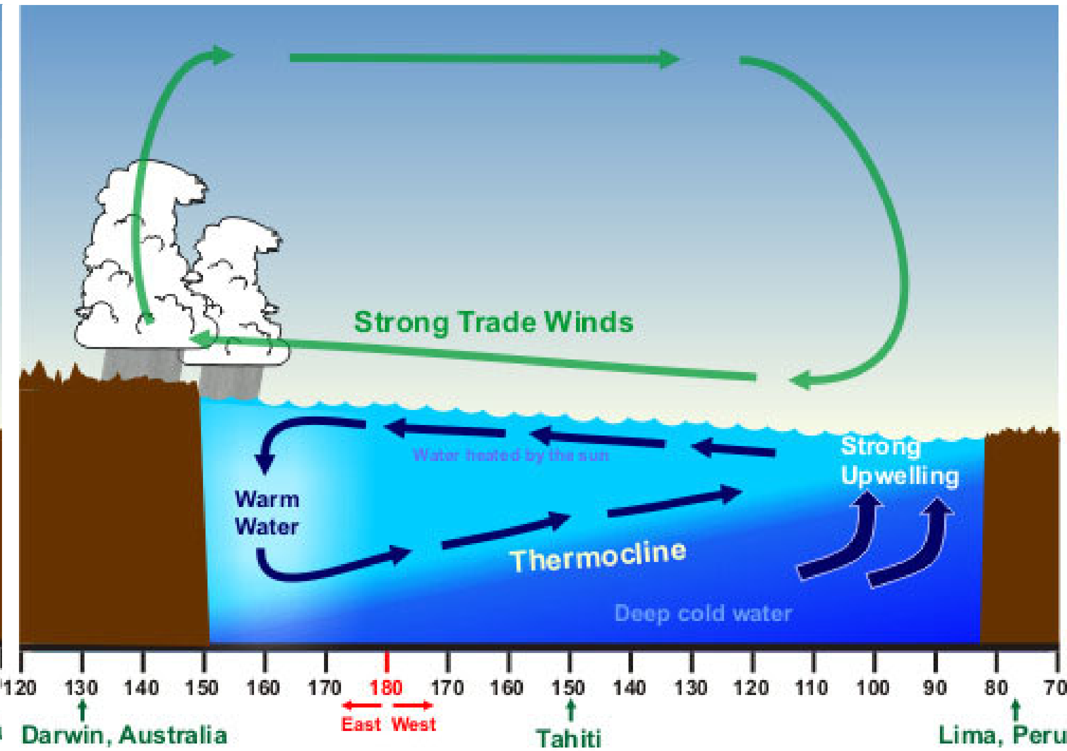

SST ANOMALIES °C
JAN 05, 1997
20N
10N
EQ
10S
20S
NOAA
180
150W
120W
90W
−5
−4
−3
−2
−1
0
1
2
3
4
5

SOURCE: NOAA

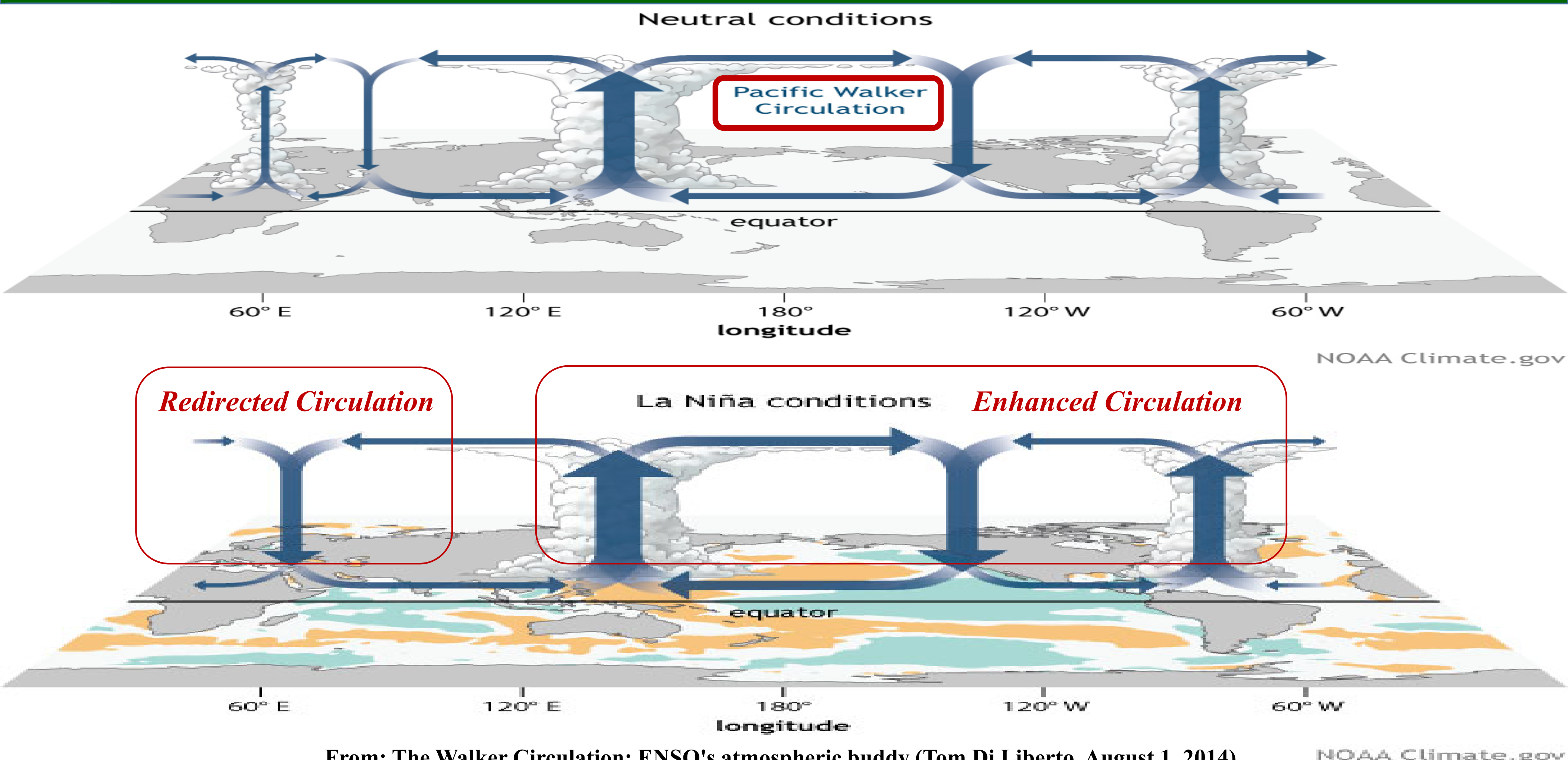
Normal Conditions



La Niña



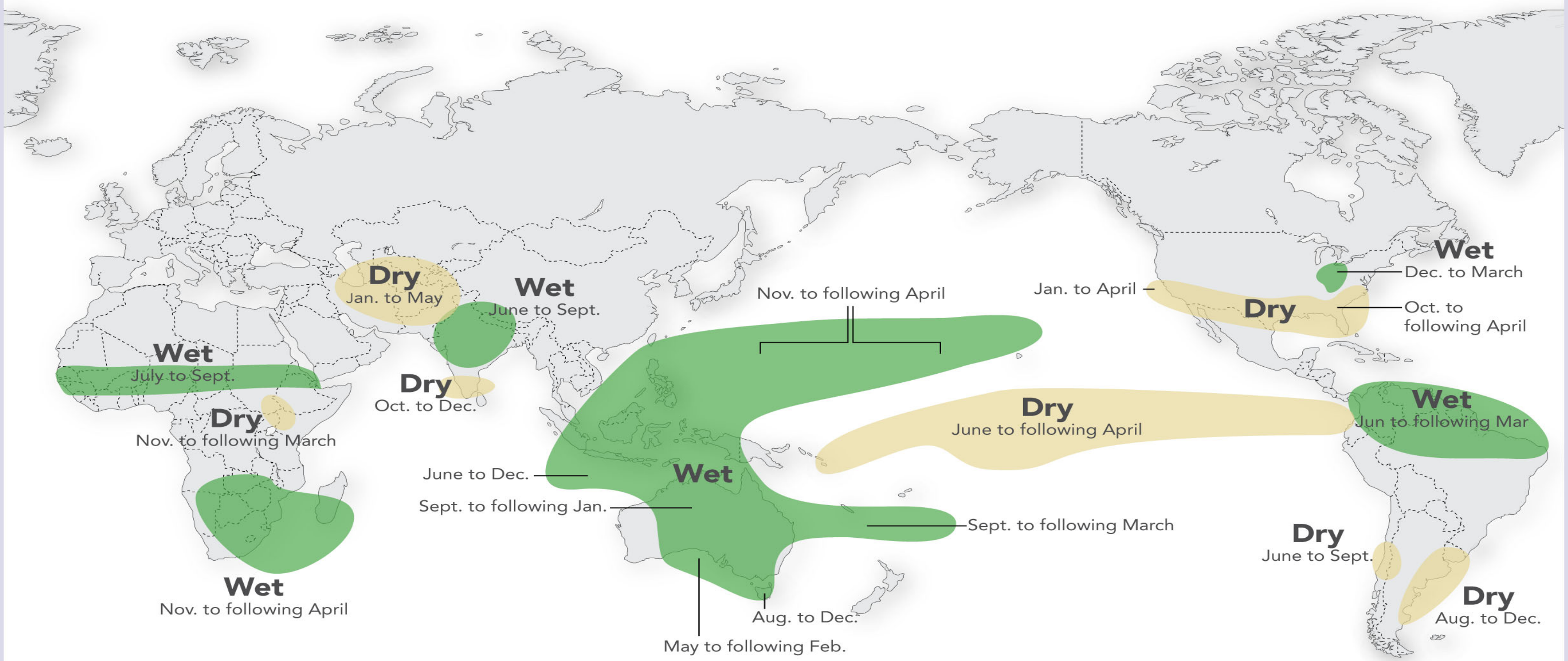
https://www.weather.gov/source/zhu/ZHU_Training_Page/tropical_stuff/enso/enso2.htm



From: The Walker Circulation: ENSO's atmospheric buddy (Tom Di Liberto, August 1, 2014)
https://www.climate.gov/news-features/blogs/enso/walker-circulation-ensos-atmospheric-buddy

La Niña and Rainfall

La Niña conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. Although they vary somewhat from one La Niña to the next, the strongest shifts remain fairly consistent in the regions and seasons shown on the map below.



For more information on El Niño and La Niña, go to: http://iri.columbia.edu/enso

Sources:

1. Ropelewski, C. F. and M. S. Halpert, 1989: Precipitation patterns associated with the high index phase of the Southern Oscillation. J. Climate., 2, 268 284,
2. Mason and Goddard, 2001. Probabilistic precipitation anomalies associated with ENSO. Bull. Am. Meteorol. Soc. 82, 619-638

International Research Institute for Climate and Society
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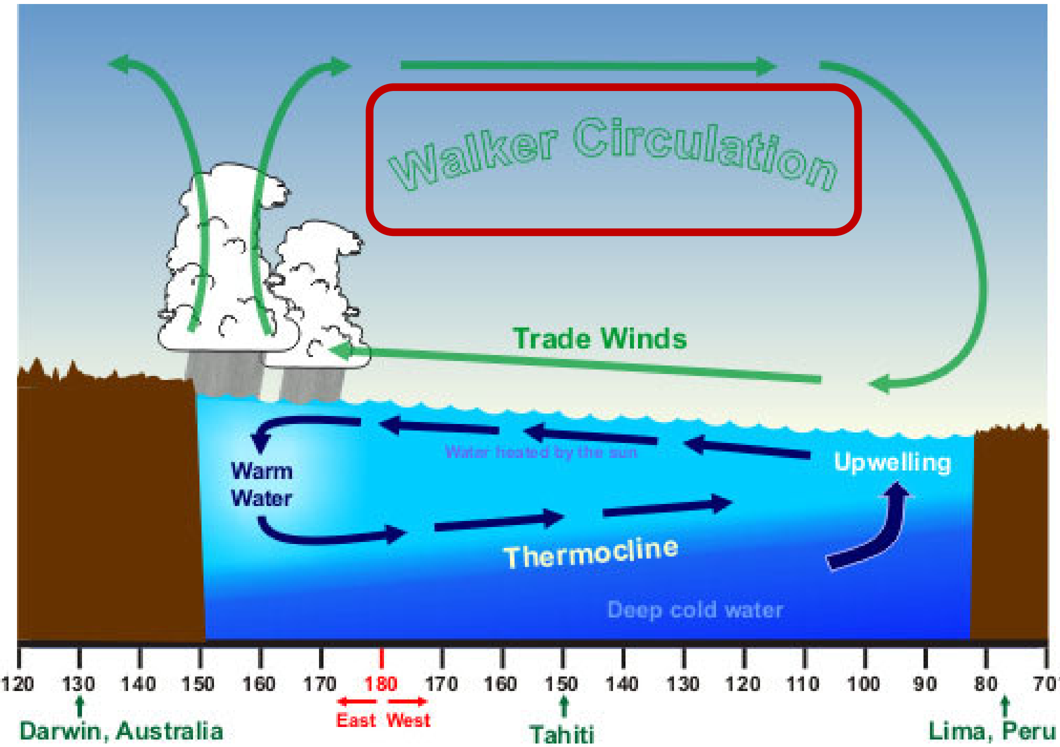
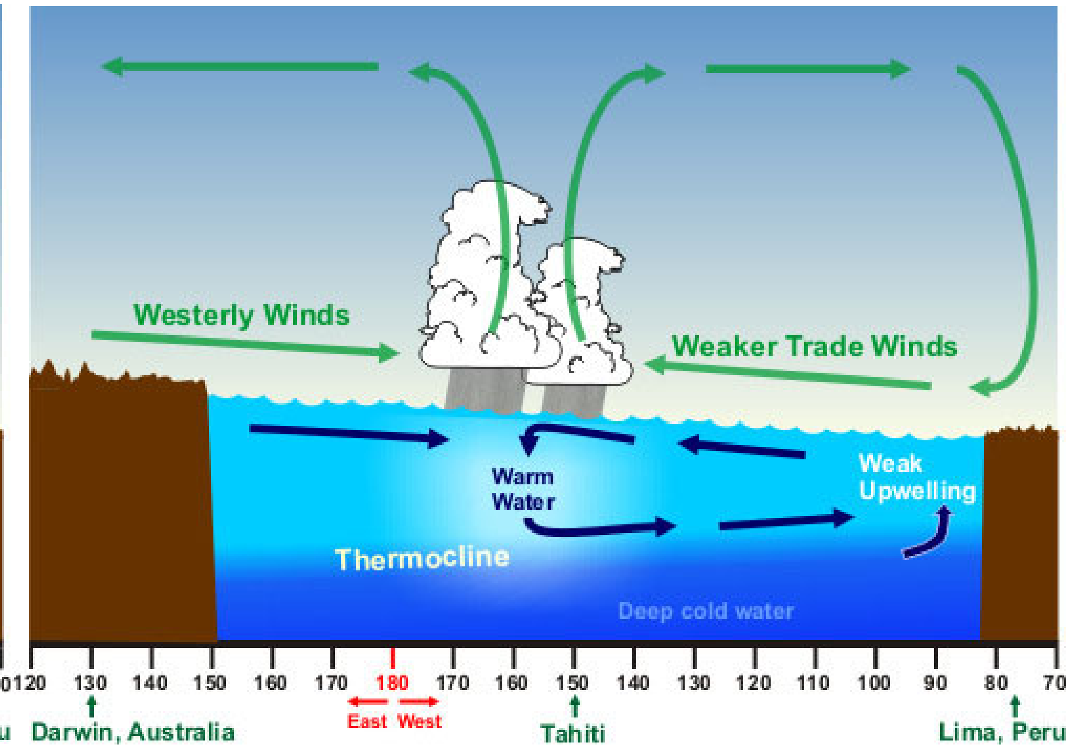


El Niño



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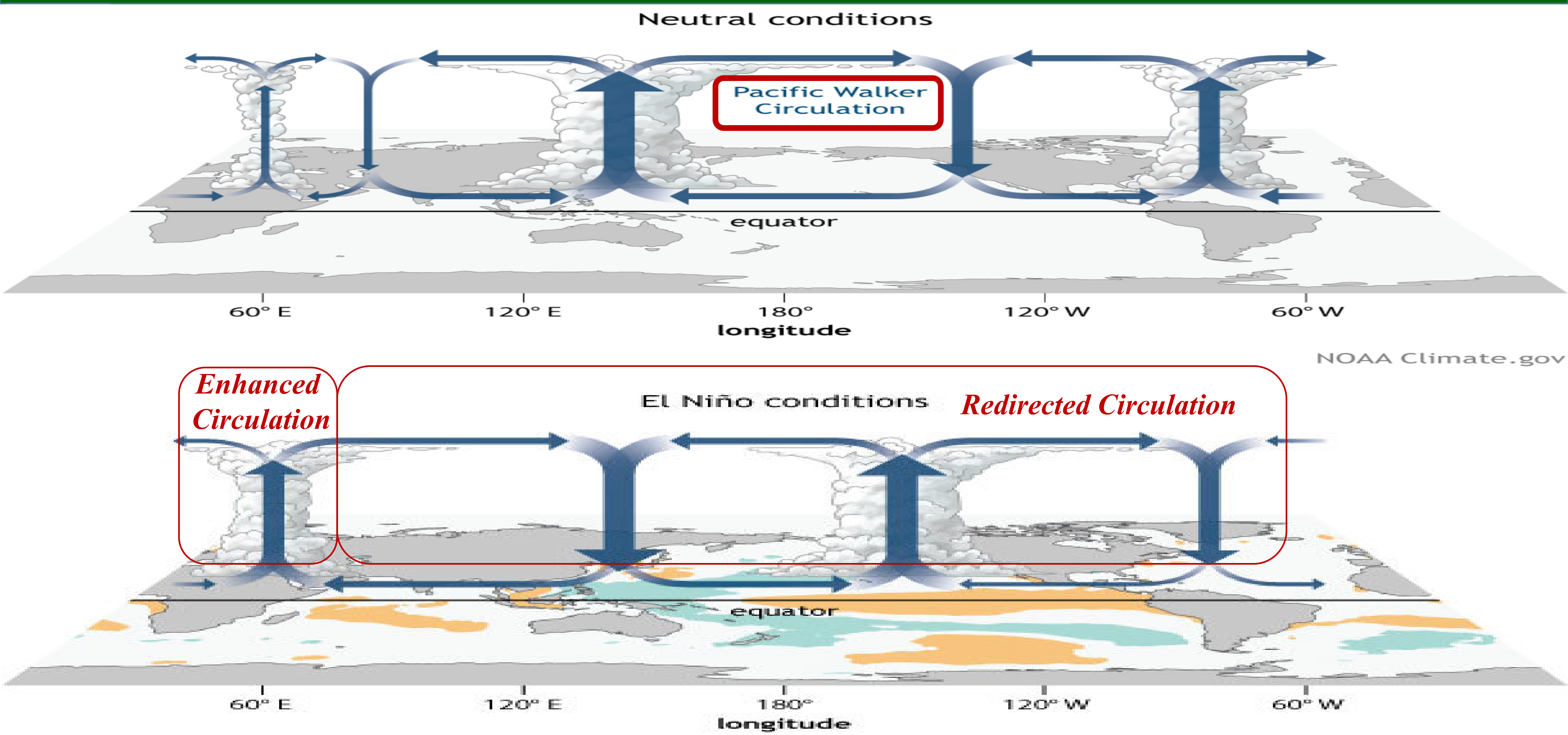

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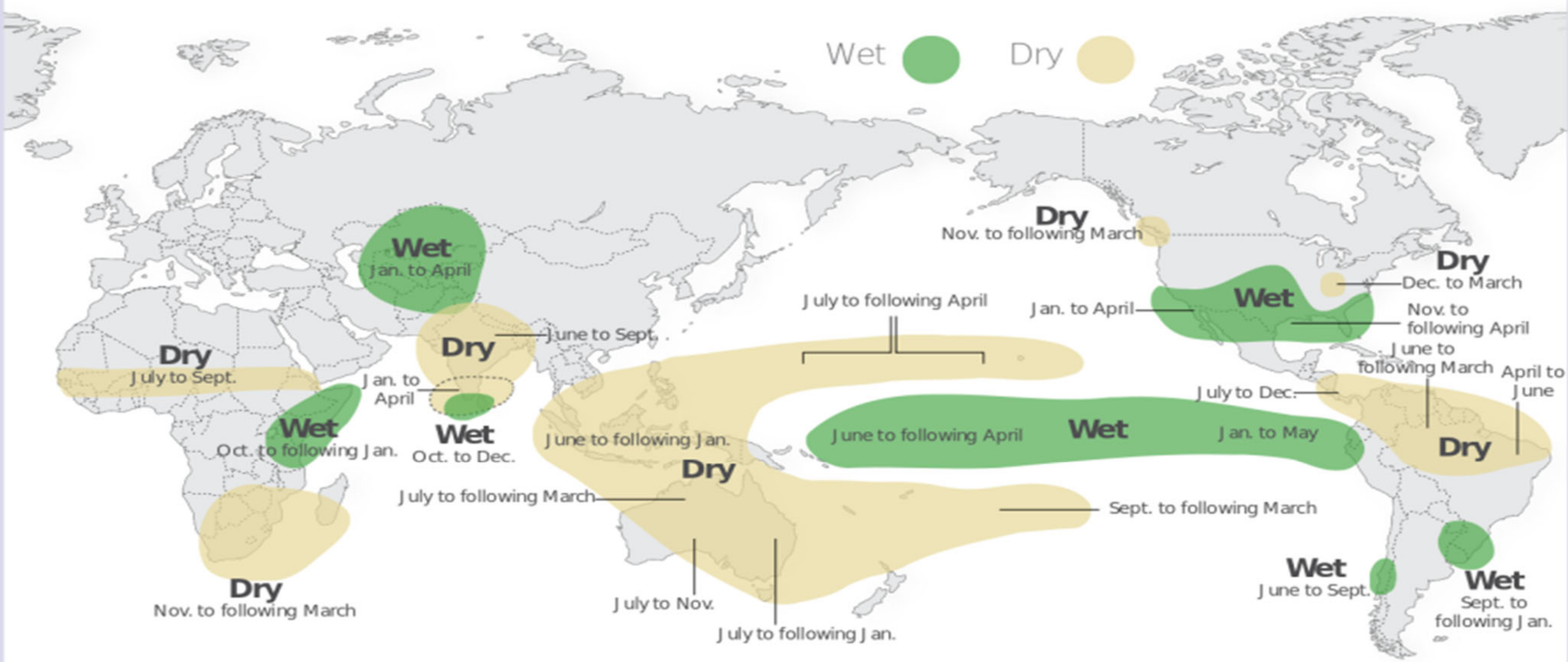

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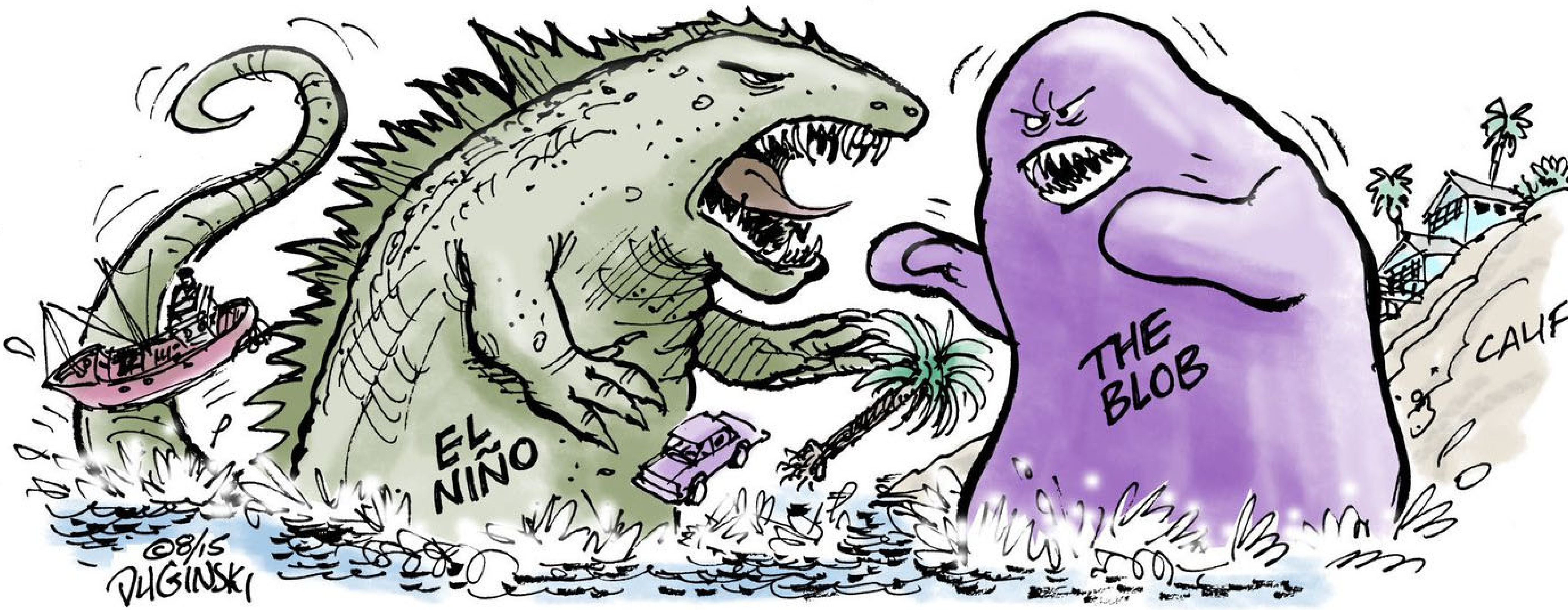
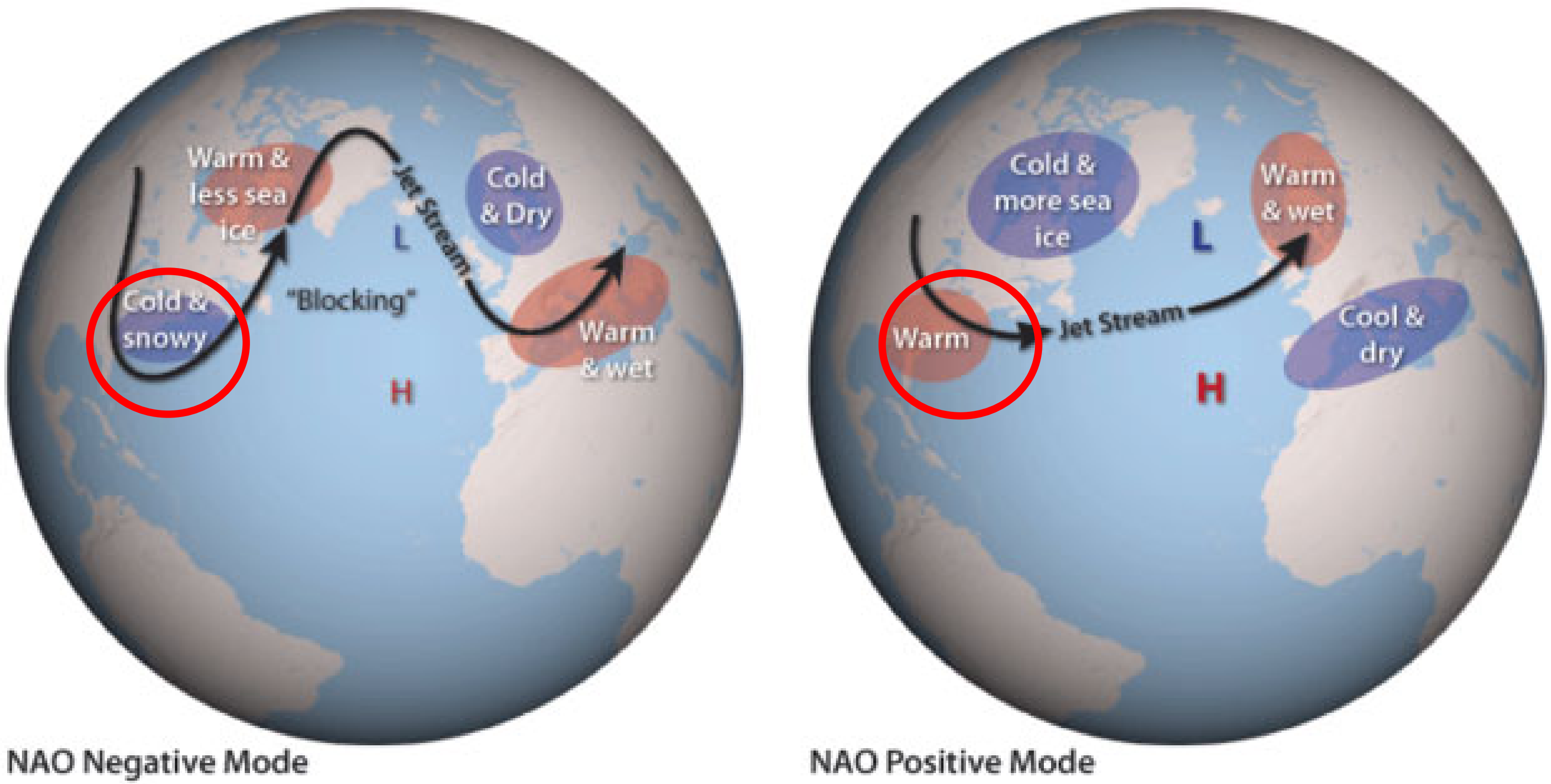
El Niño and His Friends

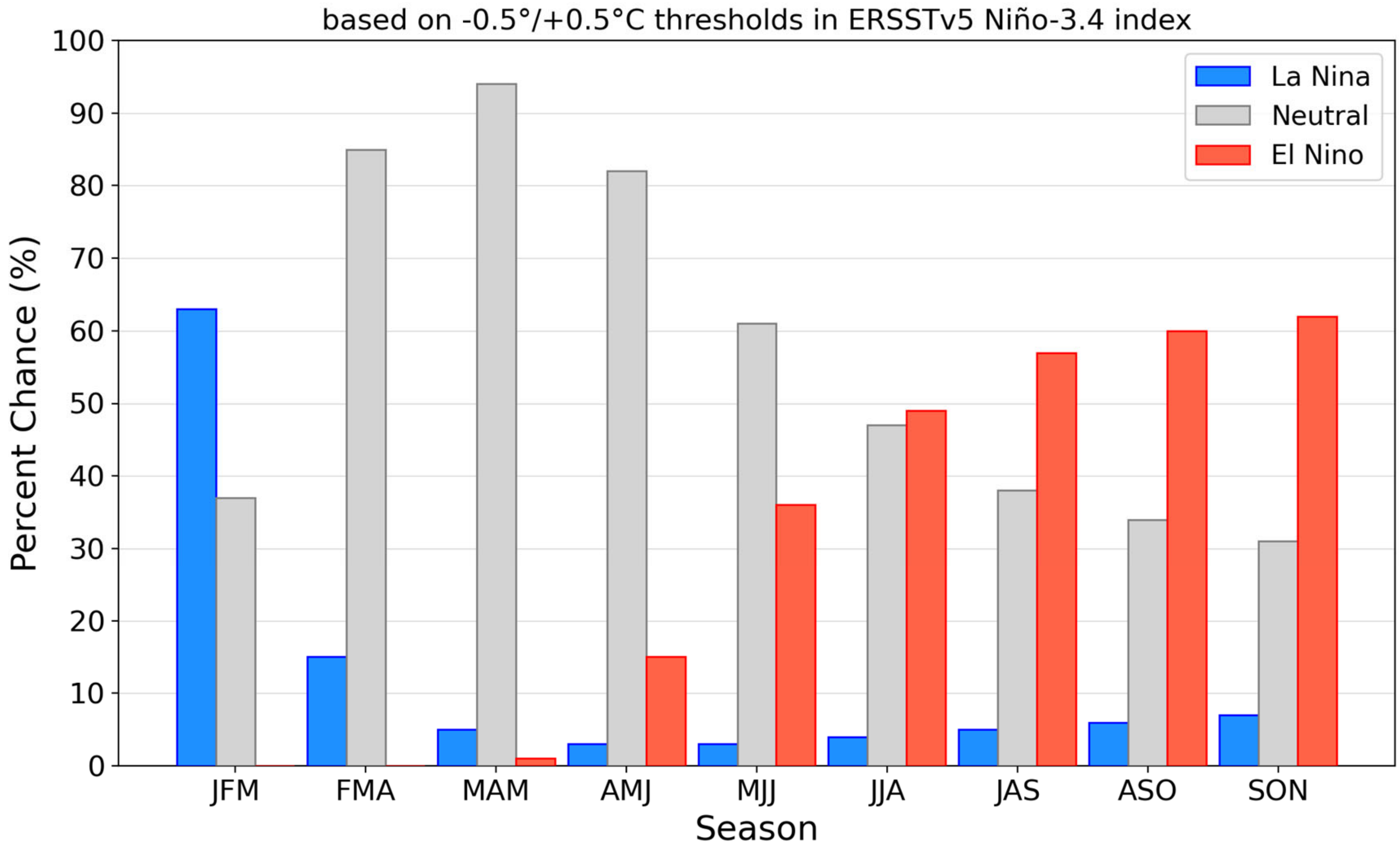


The North Atlantic Oscillation



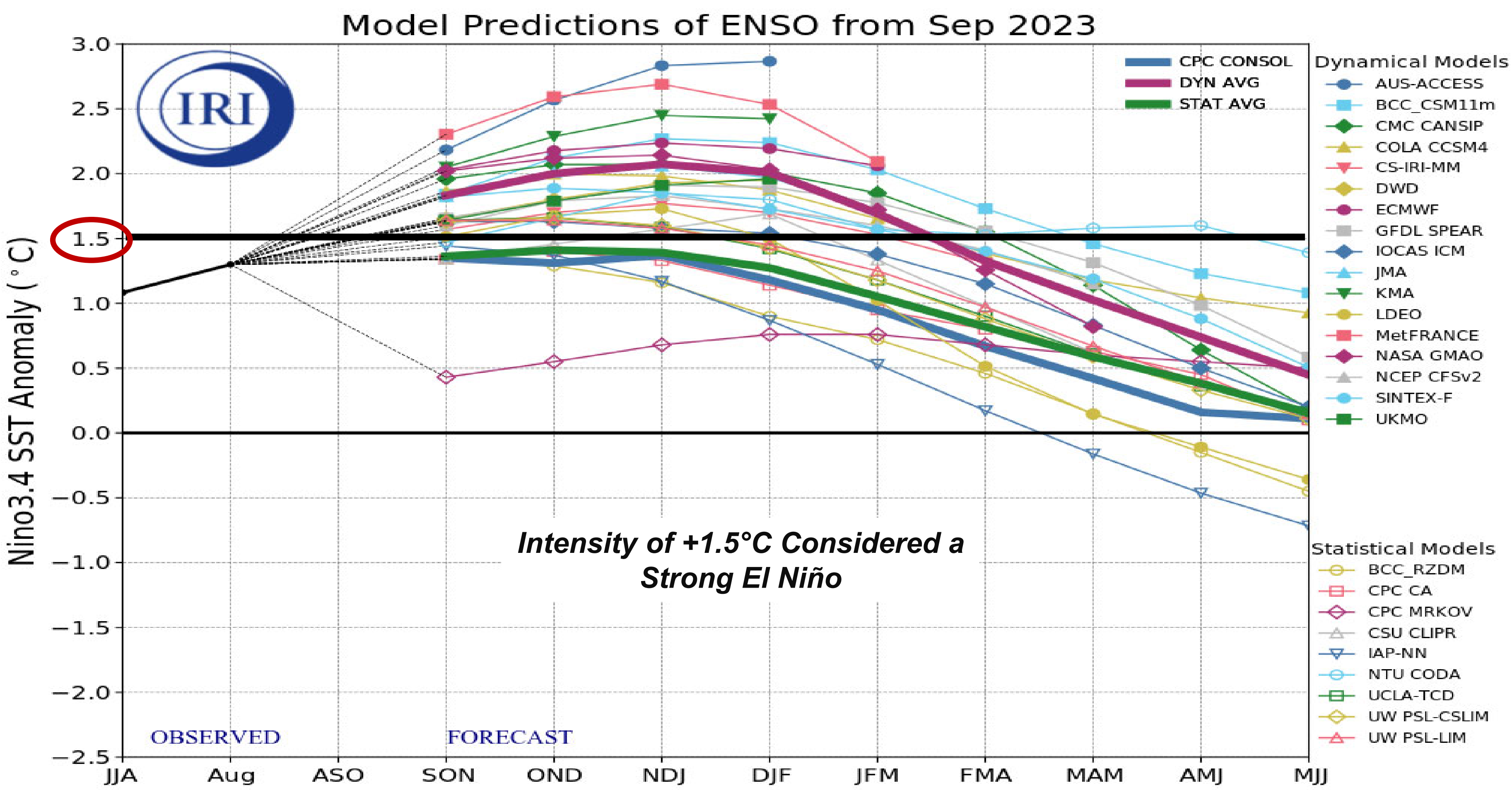
https://www.climate.gov/news-features/understanding-climate/climate-variability-north-atlantic-oscillation

Official NOAA CPC ENSO Probabilities (issued Feb. 2023)



https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

USDA **Agricultural Weather Assessments**
OCE/World Agricultural Outlook Board



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OCE/World Agricultural Outlook Board

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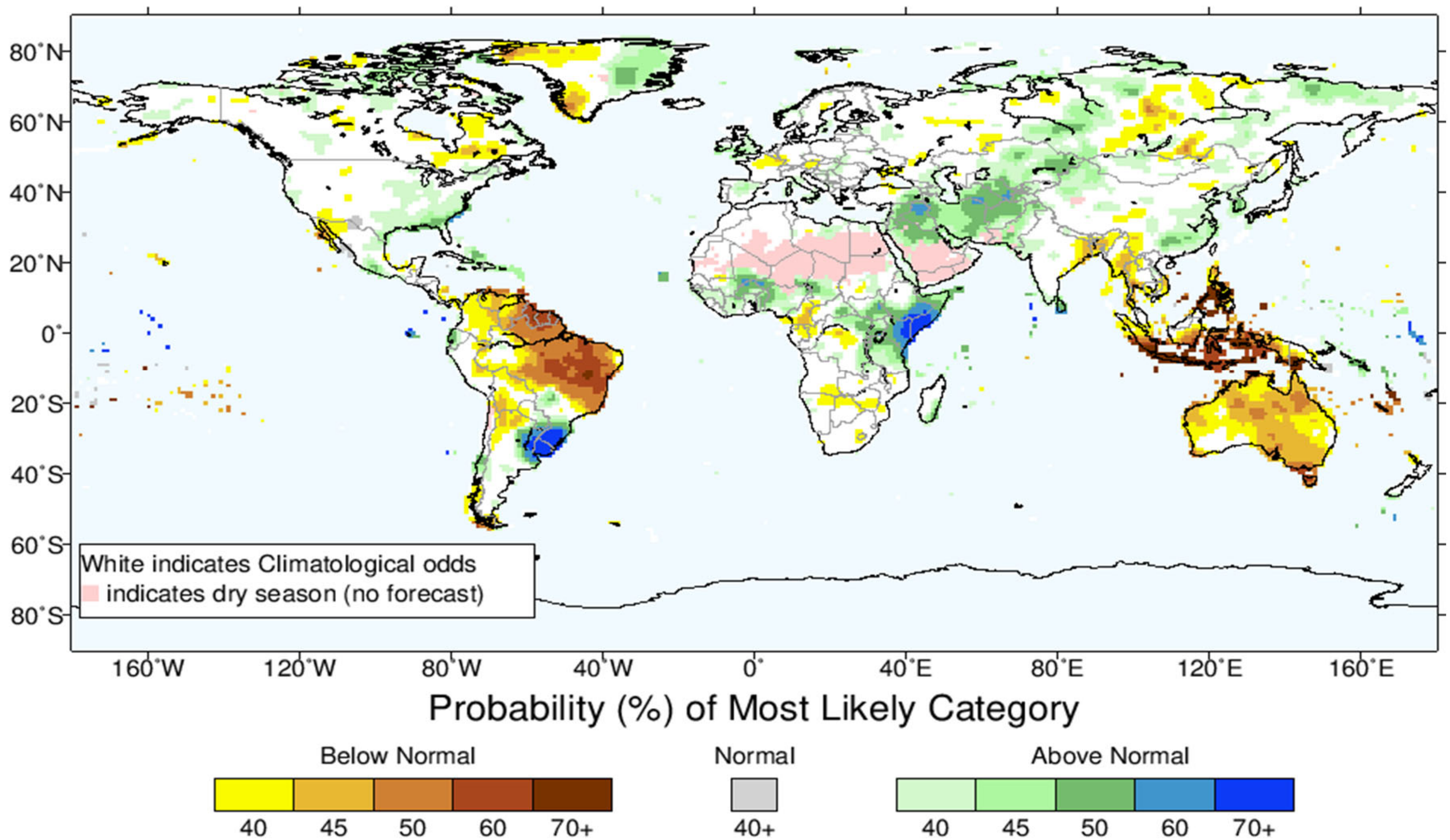

https://iri.columbia.edu/our-expertise/climate/forecasts/#Seasonal_Climate_Forecasts

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Current Event

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2020	0.5	0.5	0.4	0.2	-0.1	-0.3	-0.4	-0.6	-0.9	-1.2	-1.3	-1.2
2021	-1.0	-0.9	-0.8	-0.7	-0.5	-0.4	-0.4	-0.5	-0.7	-0.8	-1.0	-1.0
2022	-1.0	-0.9	-1.0	-1.1	-1.0	-0.9	-0.8	-0.9	-1.0	-1.0	-0.9	-0.8
2023	-0.7	-0.4	-0.1	0.2	0.5	0.8	1.1	1.3	1.6	1.8	1.9	2.0

Strong El Niño (>= 1.5)

Red Value: Departure >= +0.5°C (6 months or longer)

Blue Value: Departure <= -0.5°C (6 months or longer)

El Niño Event

Sea Surface Temperature Anomalies (°C)

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1990	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.4	0.4
1991	0.4	0.3	0.2	0.3	0.5	0.6	0.7	0.6	0.6	0.8	1.2	1.5
1992	1.7	1.6	1.5	1.3	1.1	0.7	0.4	0.1	-0.1	-0.2	-0.3	-0.1
1993	0.1	0.3	0.5	0.7	0.7	0.6	0.3	0.3	0.2	0.1	0.0	0.1
1994	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.6	0.7	1.0	1.1
1995	1.0	0.7	0.5	0.3	0.1	0.0	-0.2	-0.5	-0.8	-1.0	-1.0	-1.0
1996	-0.9	-0.8	-0.6	-0.4	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5
1997	-0.5	-0.4	-0.1	0.3	0.8	1.2	1.6	1.9	2.1	2.3	2.4	2.4
1998	2.2	1.9	1.4	1.0	0.5	-0.1	-0.8	-1.1	-1.3	-1.4	-1.5	-1.6
1999	-1.5	-1.3	-1.1	-1.0	-1.0	-1.0	-1.1	-1.1	-1.2	-1.3	-1.5	-1.7
2000	-1.7	-1.4	-1.1	-0.8	-0.7	-0.6	-0.6	-0.5	-0.5	-0.6	-0.7	-0.7
2001	-0.7	-0.5	-0.4	-0.3	-0.3	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3
2002	-0.1	0.0	0.1	0.2	0.4	0.7	0.8	0.9	1.0	1.2	1.3	1.1
2003	0.9	0.6	0.4	0.0	-0.3	-0.2	0.1	0.2	0.3	0.3	0.4	0.4
2004	0.4	0.3	0.2	0.2	0.2	0.3	0.5	0.6	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.4	0.4	0.3	0.1	-0.1	-0.1	-0.1	-0.3	-0.6	-0.8
2006	-0.9	-0.8	-0.6	-0.4	-0.1	0.0	0.1	0.3	0.5	0.8	0.9	0.9
2007	0.7	0.2	-0.1	-0.3	-0.4	-0.5	-0.6	-0.8	-1.1	-1.3	-1.5	-1.6
2008	-1.6	-1.5	-1.3	-1.0	-0.8	-0.6	-0.4	-0.2	-0.2	-0.4	-0.6	-0.7
2009	-0.8	-0.8	-0.6	-0.3	0.0	0.3	0.5	0.6	0.7	1.0	1.4	1.6
2010	1.5	1.2	0.8	0.4	-0.2	-0.7	-1.0	-1.3	-1.6	-1.6	-1.6	-1.6
2011	-1.4	-1.2	-0.9	-0.7	-0.6	-0.4	-0.5	-0.6	-0.8	-1.0	-1.1	-1.0
2012	-0.9	-0.7	-0.6	-0.5	-0.3	0.0	0.2	0.4	0.4	0.3	0.1	-0.2
2013	-0.4	-0.4	-0.3	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.5	-0.3	0.0	0.2	0.2	0.0	0.1	0.2	0.5	0.6	0.7
2015	0.5	0.5	0.5	0.7	0.9	1.2	1.5	1.9	2.2	2.4	2.6	2.6
2016	2.5	2.1	1.6	0.9	0.4	-0.1	-0.4	-0.5	-0.6	-0.7	-0.7	-0.6
2017	-0.3	-0.2	0.1	0.2	0.3	0.3	0.1	-0.1	-0.4	-0.7	-0.8	-1.0
2018	-0.9	-0.9	-0.7	-0.5	-0.2	0.0	0.1	0.2	0.5	0.8	0.9	0.8
2019	0.7	0.7	0.7	0.7	0.5	0.5	0.3	0.1	0.2	0.3	0.5	0.5
2020	0.5	0.5	0.4	0.2	-0.1	-0.3	-0.4	-0.6	-0.9	-1.2	-1.3	-1.2
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2023	-0.7	-0.4	-0.1	0.2	0.5	0.8	1.1	1.3	1.6	1.8	1.9	2.0

1991-92 — *Strong (1991-92)*
1994-95
1997-98 — *Strong (1997-98)*
2002-03
2004-05
2006-07
2009-10 — *Strong (2009-10)*
2014-16 — *Strong (2015-16)*
2018-19
2023-24 — *Strong (2023-24)*

https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php

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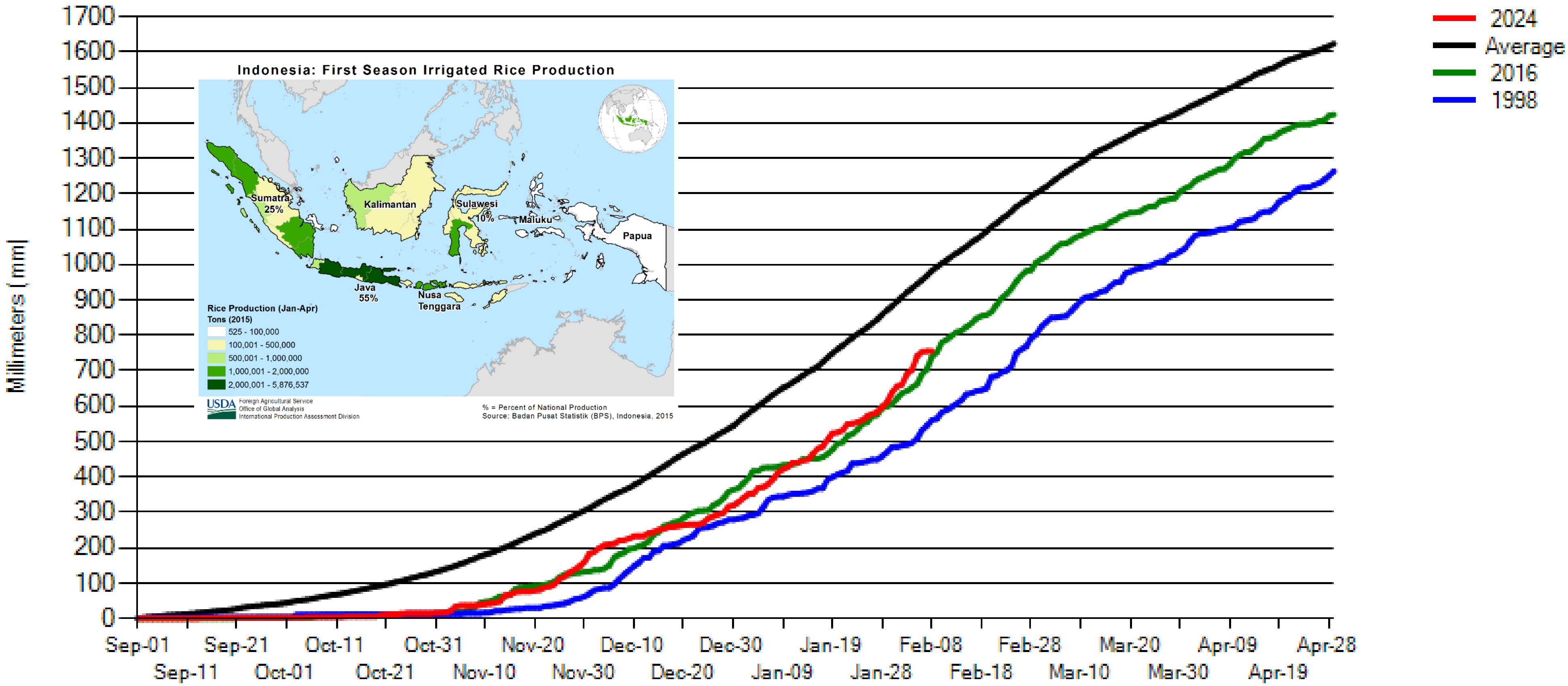
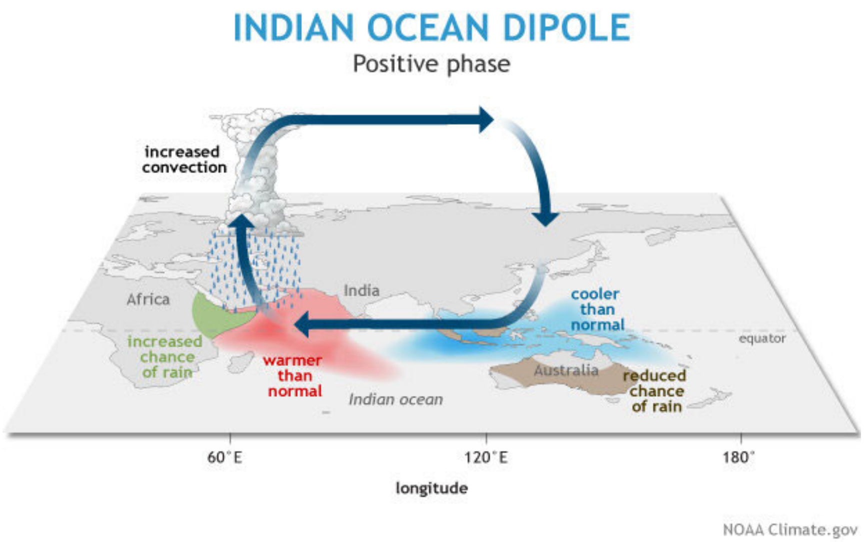
Java, Indonesia

Cumulative Precipitation (mm)

(Source: World Meteorological Organization)

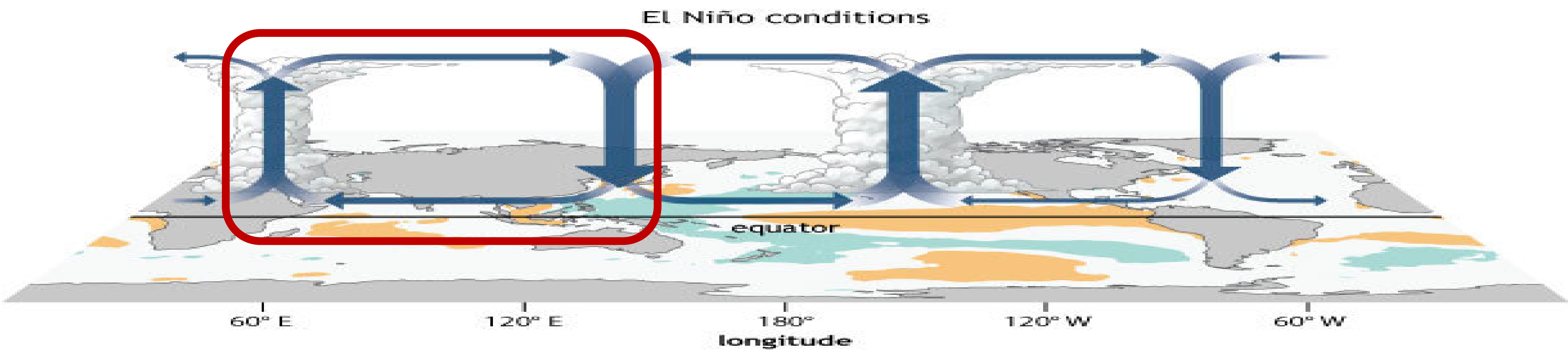




"Because of this close connection, it becomes challenging to determine how much IOD variability is separate from ENSO variability

…

A few studies even suggest that the IOD may influence the evolution of ENSO (citation), and so the ENSO/IOD connection might be a two-way street."

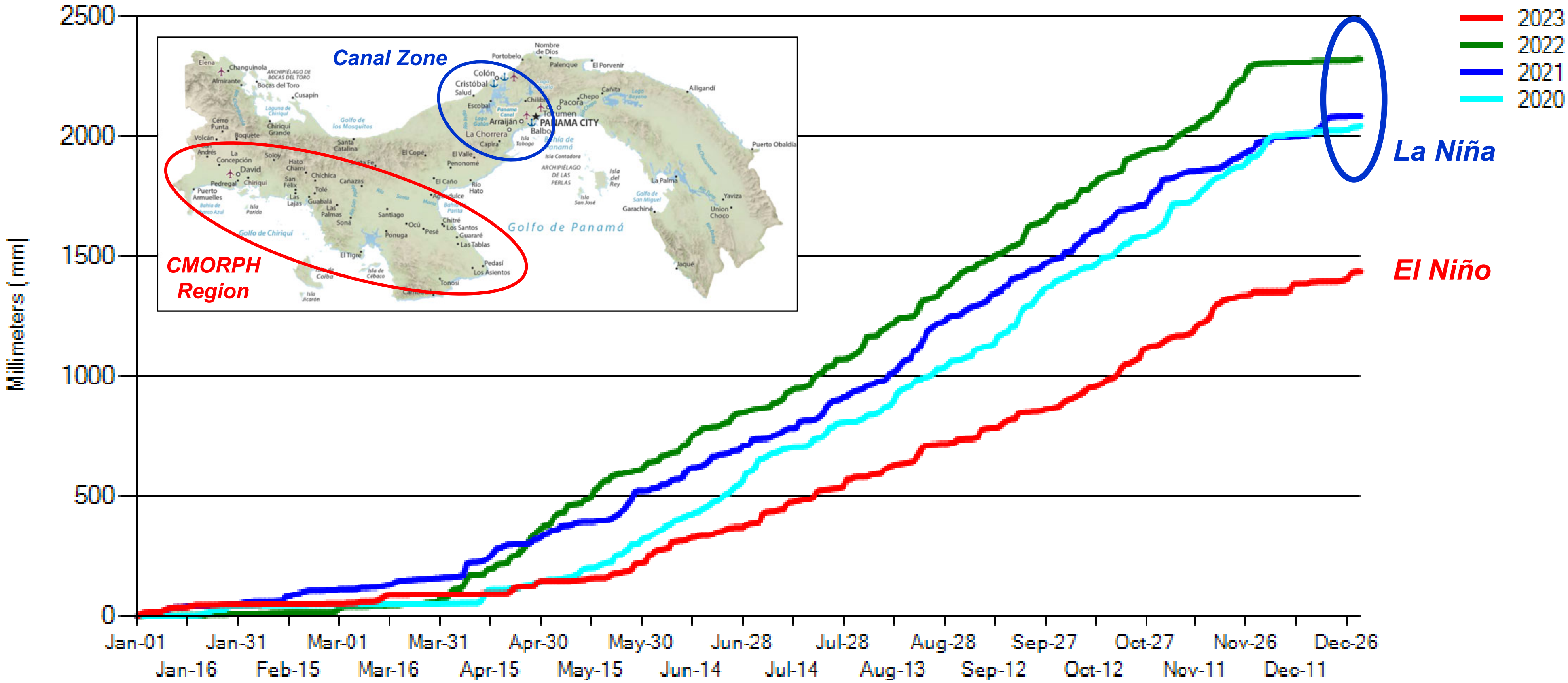


https://www.climate.gov/news-features/blogs/enso/meet-enso%E2%80%99s-neighbor-indian-ocean-dipole

Panama

Cumulative Precipitation (mm)

(Source: Climate Prediction Center/CMORPH)



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To Mitigate Effects of "El Niño"

pancanal.com/en/to-mitigate-effects-of-el-nino-phenomenon-the-panama-canal-announces-draft-restrictions-to-transiting-vessels/

Search

CANAL DE PANAMÁ

EN ES

22 March 2016

To Mitigate Effects of "El Niño" Phenomenon, the Panama Canal Announces Draft Restrictions to Transiting Vessels

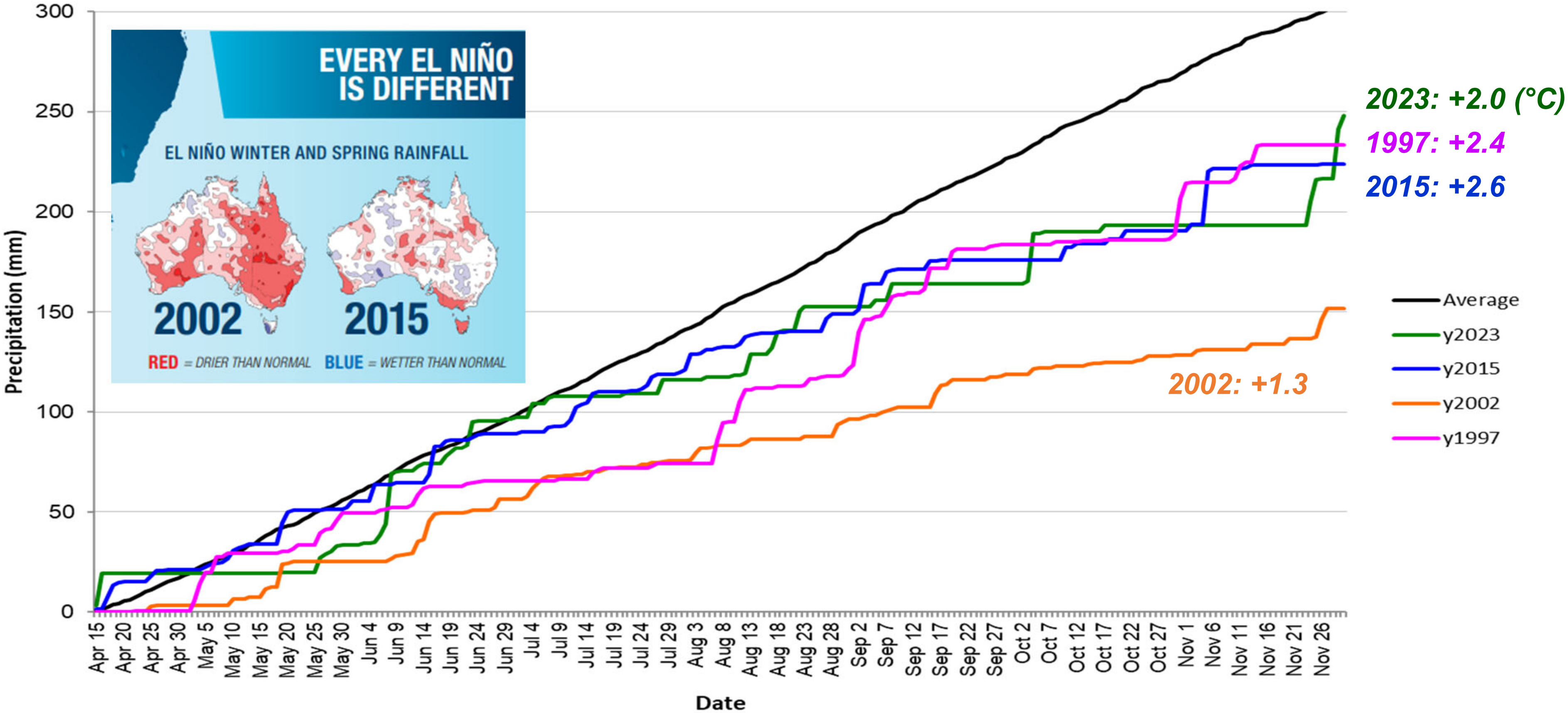
Restrictions Implemented as Preventative Measures to Safeguard the Canal and its Customers; Effects on Canal Operations Expected to be Minimal

PANAMA CITY, Panama, August 7, 2015 – The Panama Canal Authority (ACP) has issued an Advisory to Shipping, which sets a draft restriction for all shipping agents, owners and operators working with the Canal.

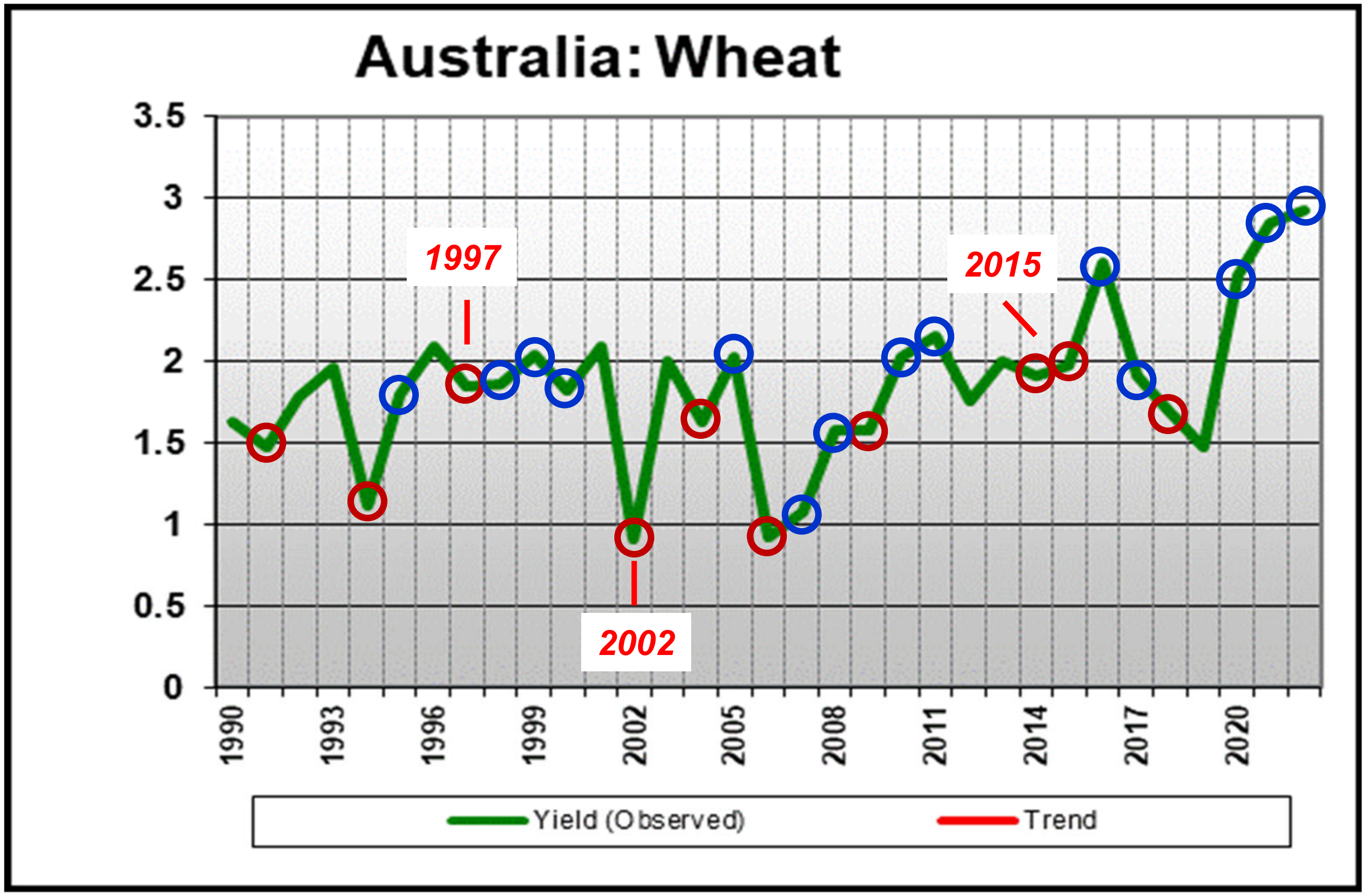
Northwestern Victoria

Cumulative Precipitation (mm)

(Source: World Meteorological Organization)



Graphic: http://www.bom.gov.au/climate/updates/articles/a008-el-nino-and-australia.shtml



El Niño

La Niña

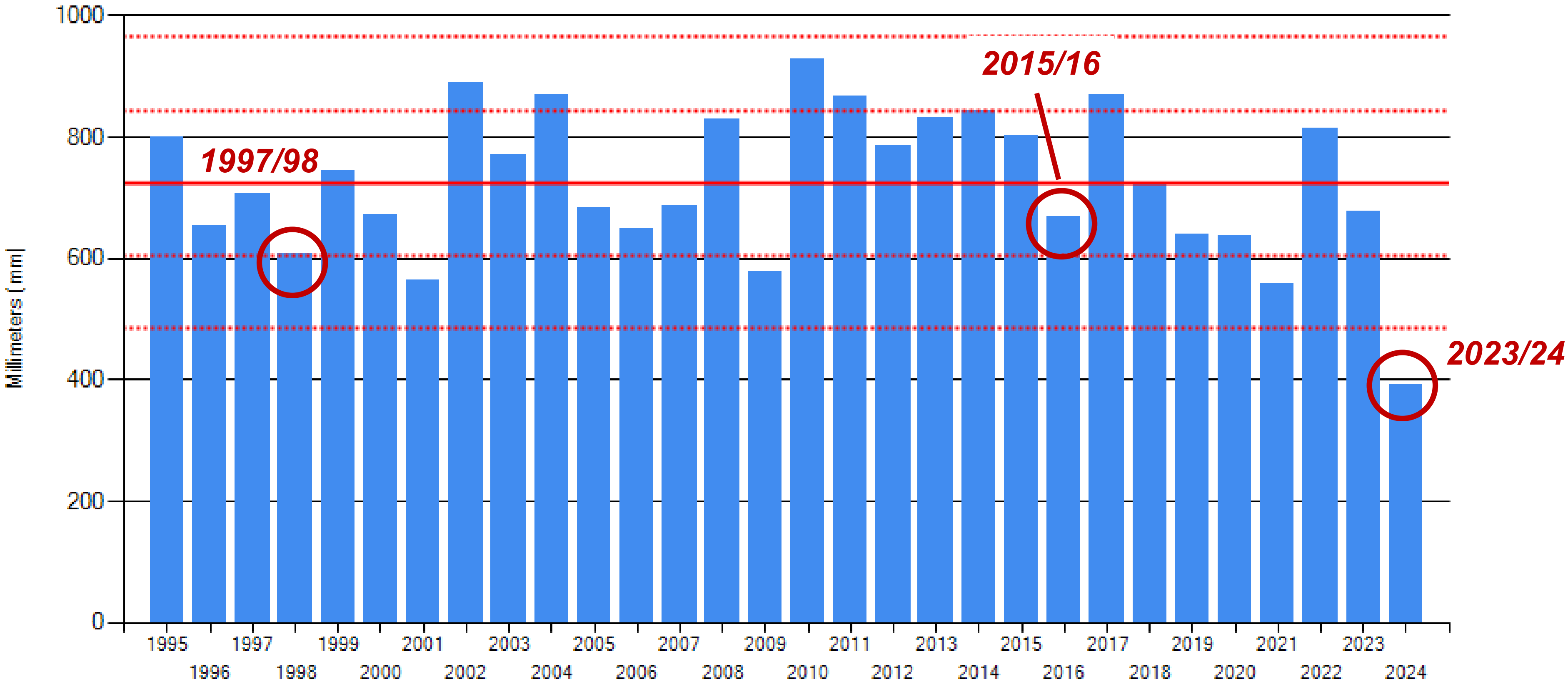
More variability in yields, though many El Niño seasons have been marked by drought.

Source: PSD-Online (https://apps.fas.usda.gov/psdonline/app/index.html#/app/downloads)

Mato Grosso, Brazil

Total Precipitation (mm): November 1 - January 31

(Source: World Meteorological Organization)



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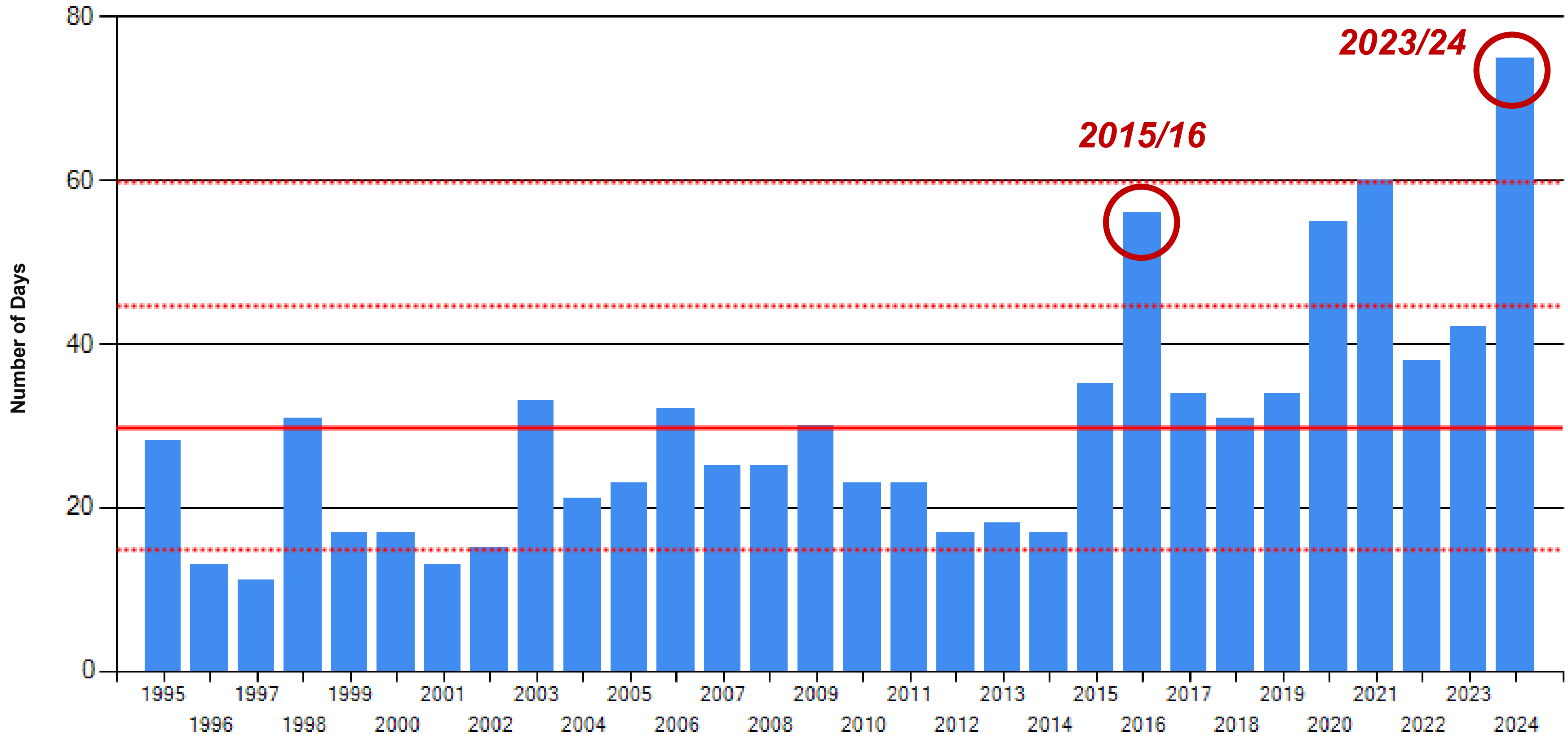
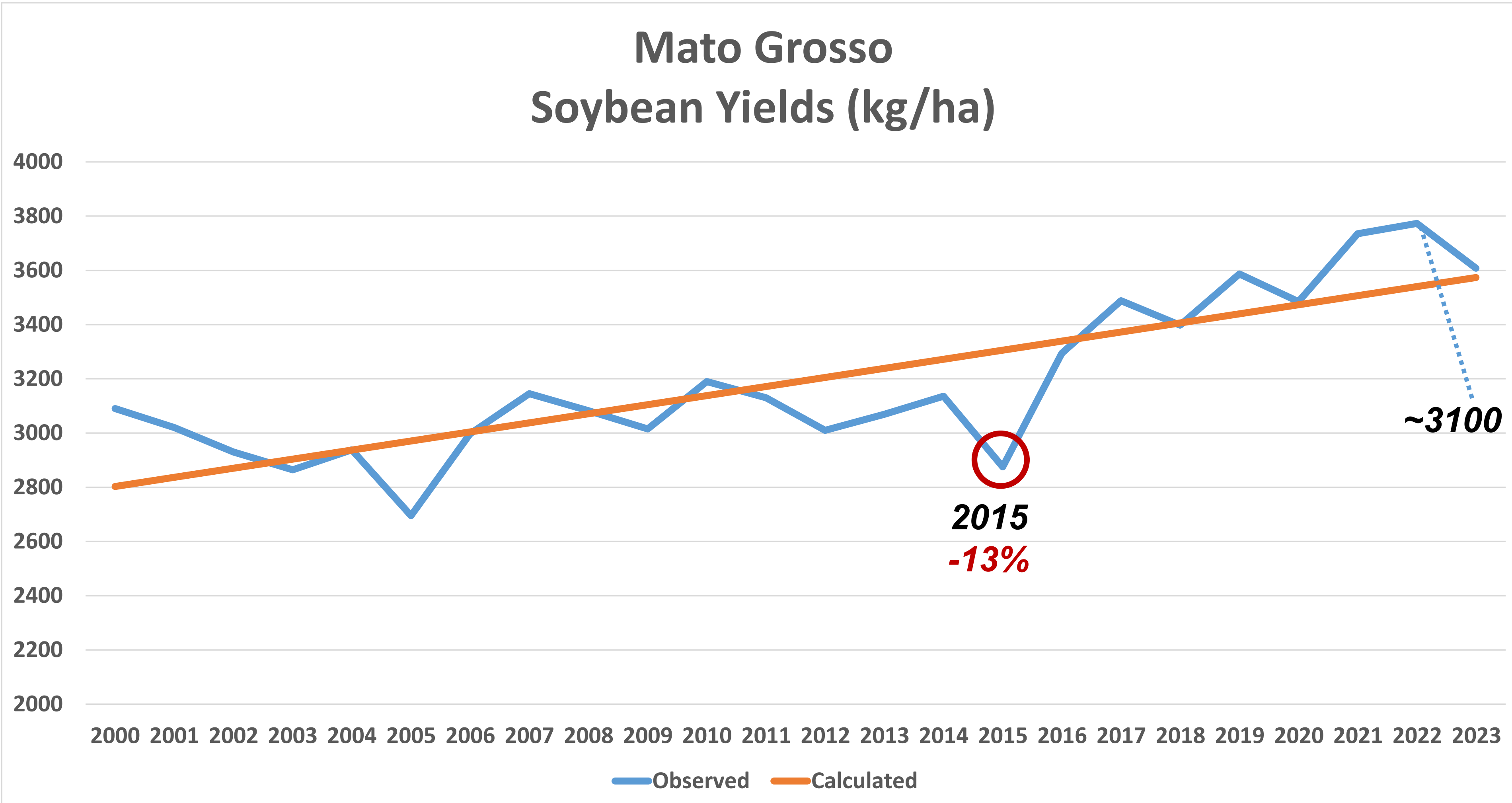
Mato Grosso, Brazil

Number of Days Max T >= 35°C: November 1 - January 31

(Source: World Meteorological Organization)





Source for yield data: CONAB

December 24, 2015

GAIN Report: BR2015-1517

2015/16 Soybean Crop Lowered to 98 Million Metric Tons

Post lowered its forecast for Brazil's 2015/16 soybean production to a record **98 million metric tons (mmt)**. Area planted for soybeans is estimated at 33 million hectares (ha). The dry and hot conditions in Mato Grosso and other states in central and northeast Brazil are expected to impact yields.

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The southern states of Brazil, mainly Paraná and Rio Grande do Sul, have experience too much rain due to the weather phenomenon El Niño. The result has been some planting delays and has created concerns about potential yield losses. However, officials in both states have reported that most of the crop is in good conditions and it is too early to assess potential yield problems.

March 4, 2016

GAIN Report: BR2016-1499

2015/16 Soybean Crop Forecast Increased to 100 Million Metric Tons

Post increased its forecast for Brazil's 2015/16 soybean production to a record **100 million metric tons (mmt)**. The higher production is a result of an increase (by 200,000 hectares) in Post's estimate for planted area, to a total of 33.2 million hectares (ha). The higher plated area is based on the latest estimate by the Brazilian Food Supply Company (CONAB). The higher production forecast is also supported by the good rains through February in the Center-West, which is expected to help yields.

In general, yields for 2015/16 are expected to be better than what was anticipated back in December 2015. The states of Parana, Rio Grande do Sul, Bahia, Goais, and Mato Grosso do Sul are all expected to have better yields compared to the 2014/15 season. In contrast, Mato Grosso and states in the northeast (Piaui, Maranho, and Tocantins) are expected to have lower yields compared to last year due to the dry and hot conditions early in the season. However, the national yield is forecast to better than last year and reach 3.01 metric tons per ha.

Home | Global Agricultural Information Network (usda.gov)

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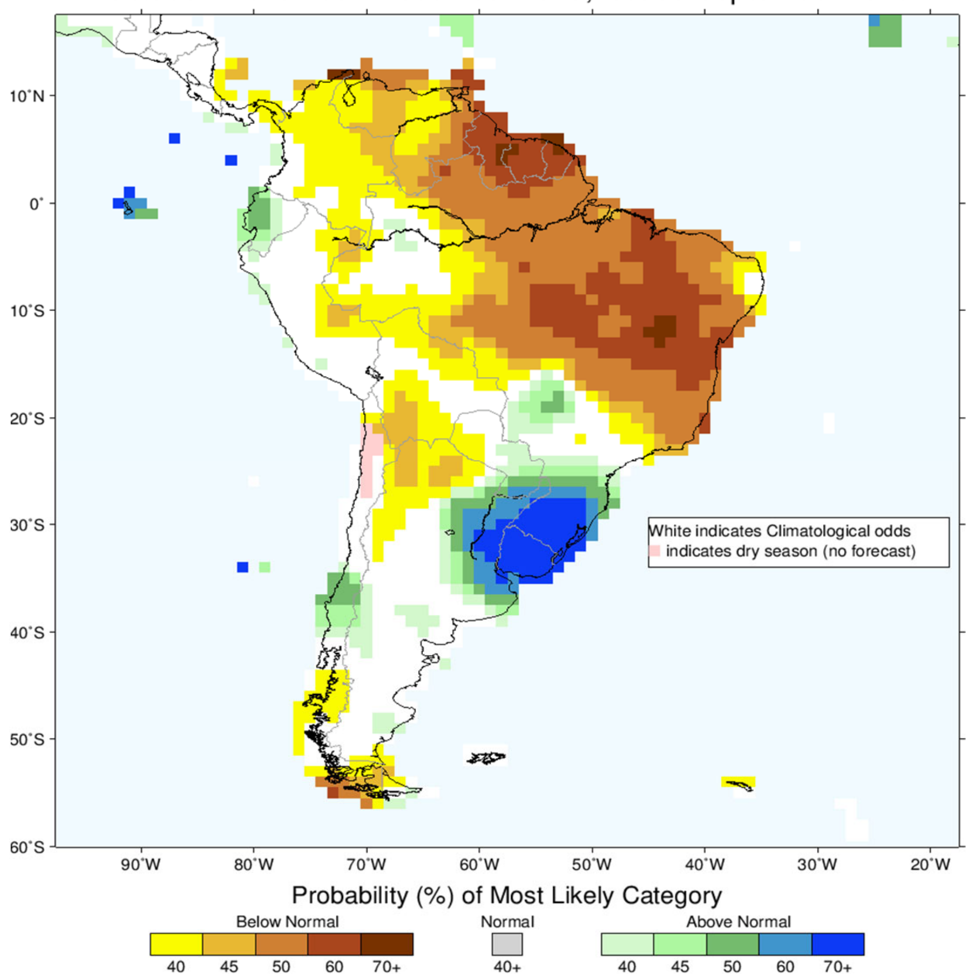
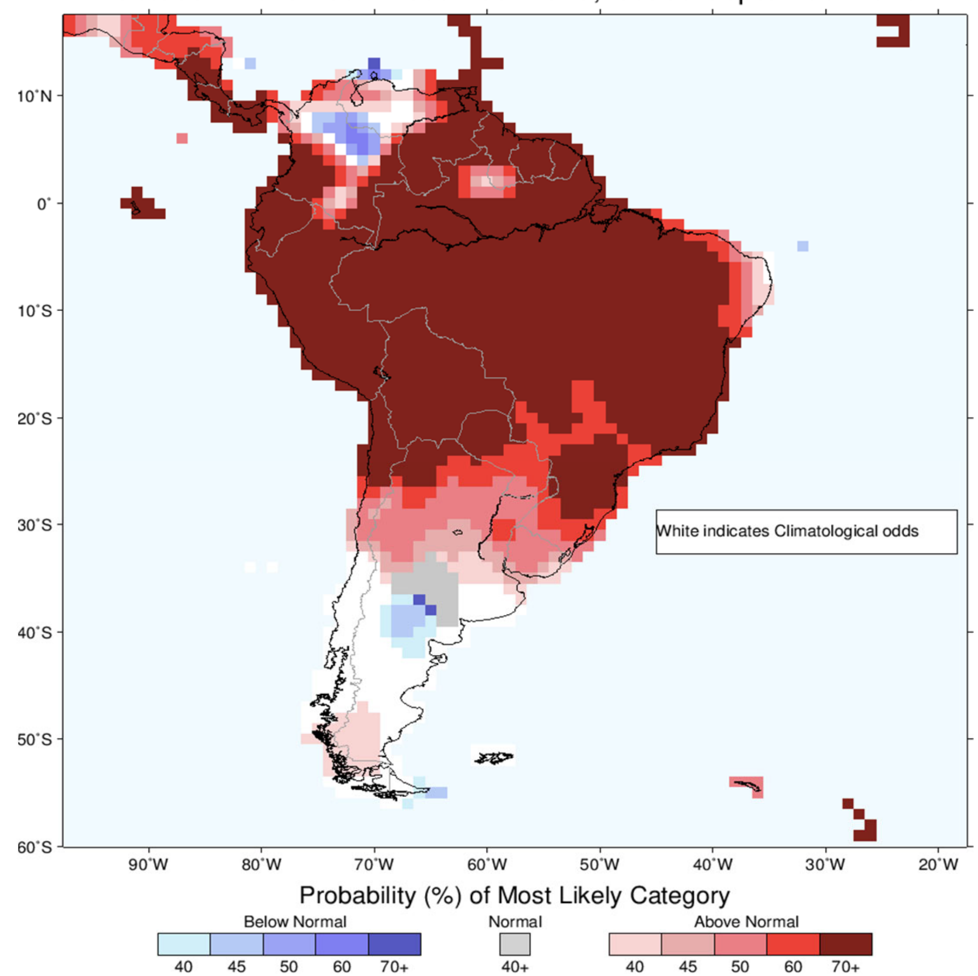
IRI Multi–Model Probability Forecast for Precipitation for October–November–December 2023, Issued September 2023



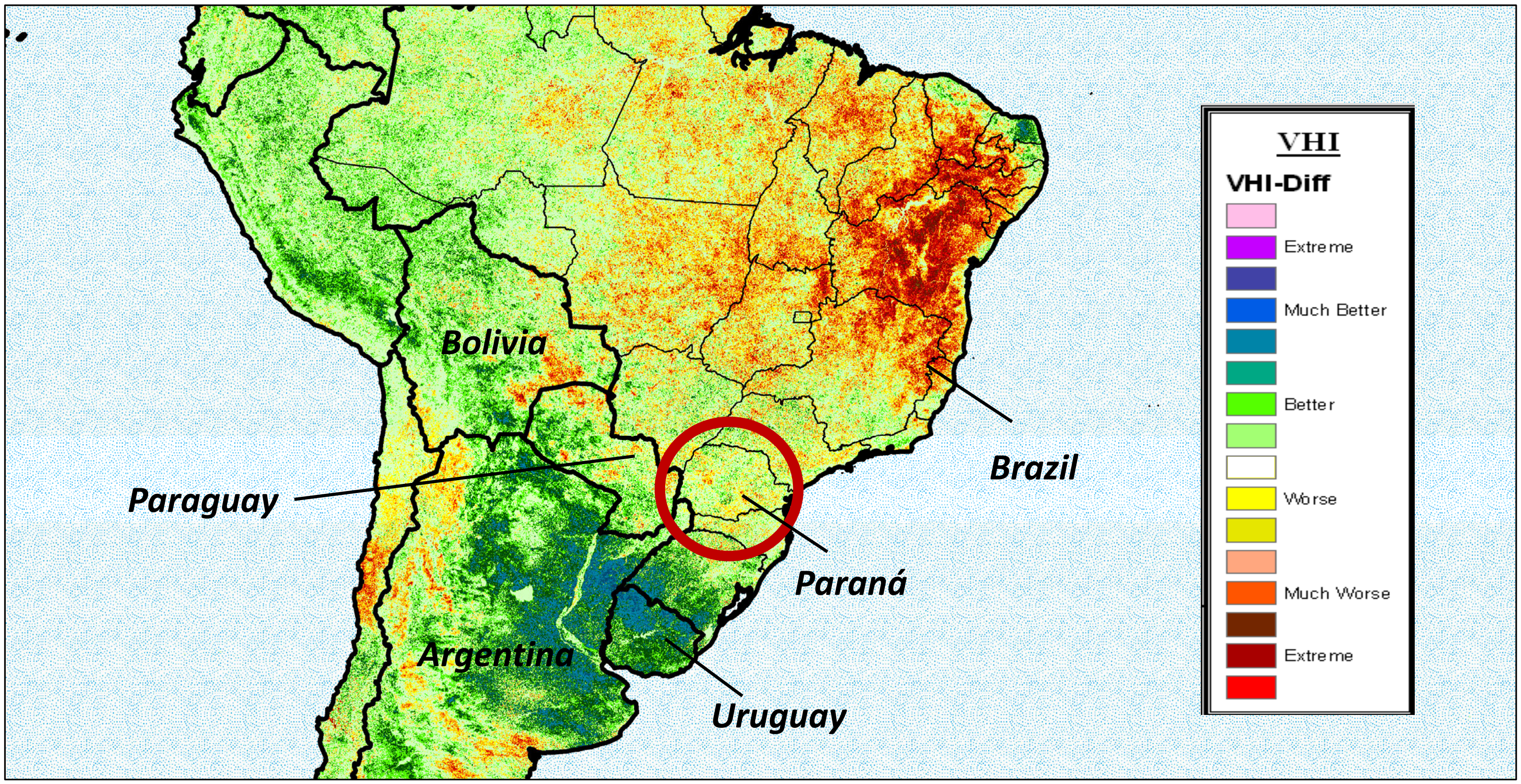
IRI Multi–Model Probability Forecast for Temperature for October–November–December 2023, Issued September 2023



https://iri.columbia.edu/our-expertise/climate/forecasts/#Seasonal_Climate_Forecasts

*Vegetative Health Index

Week 52 Difference (2023 versus 2022)

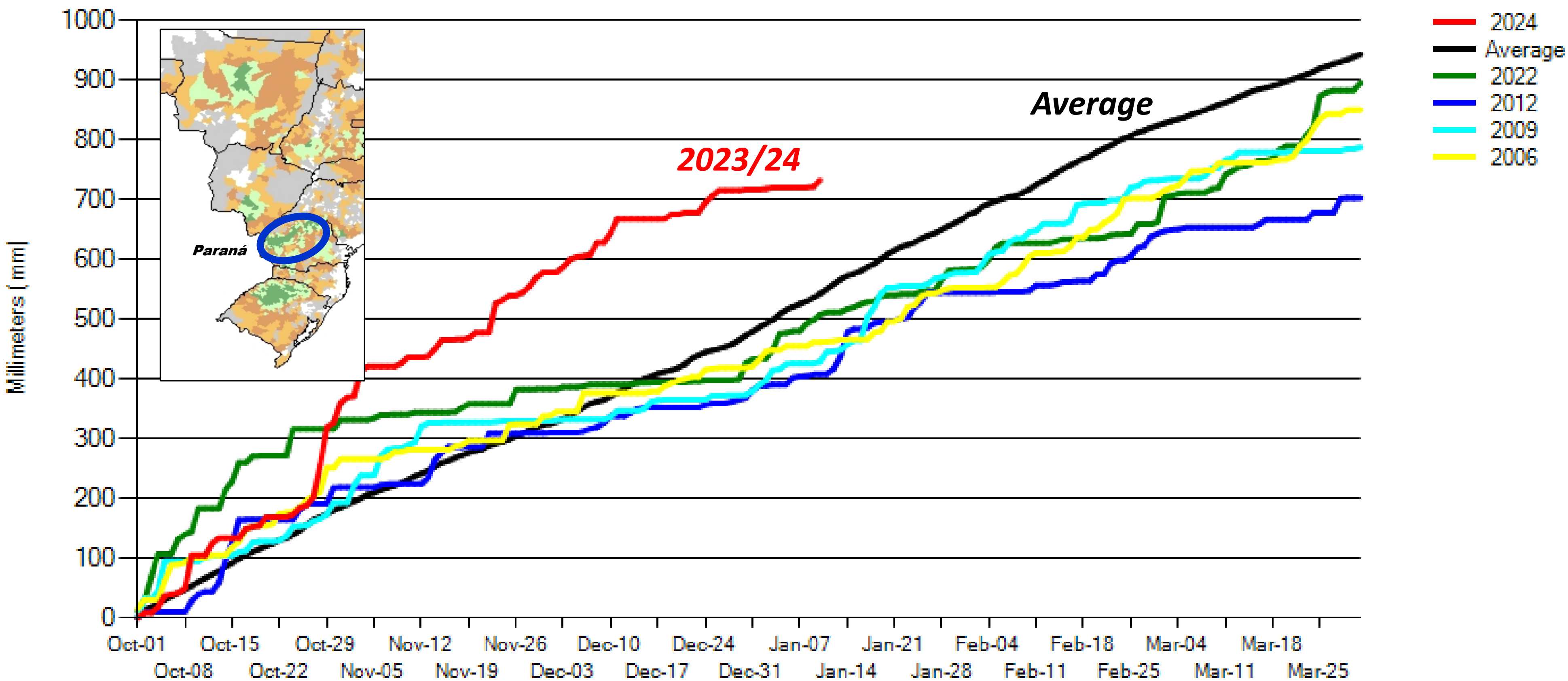


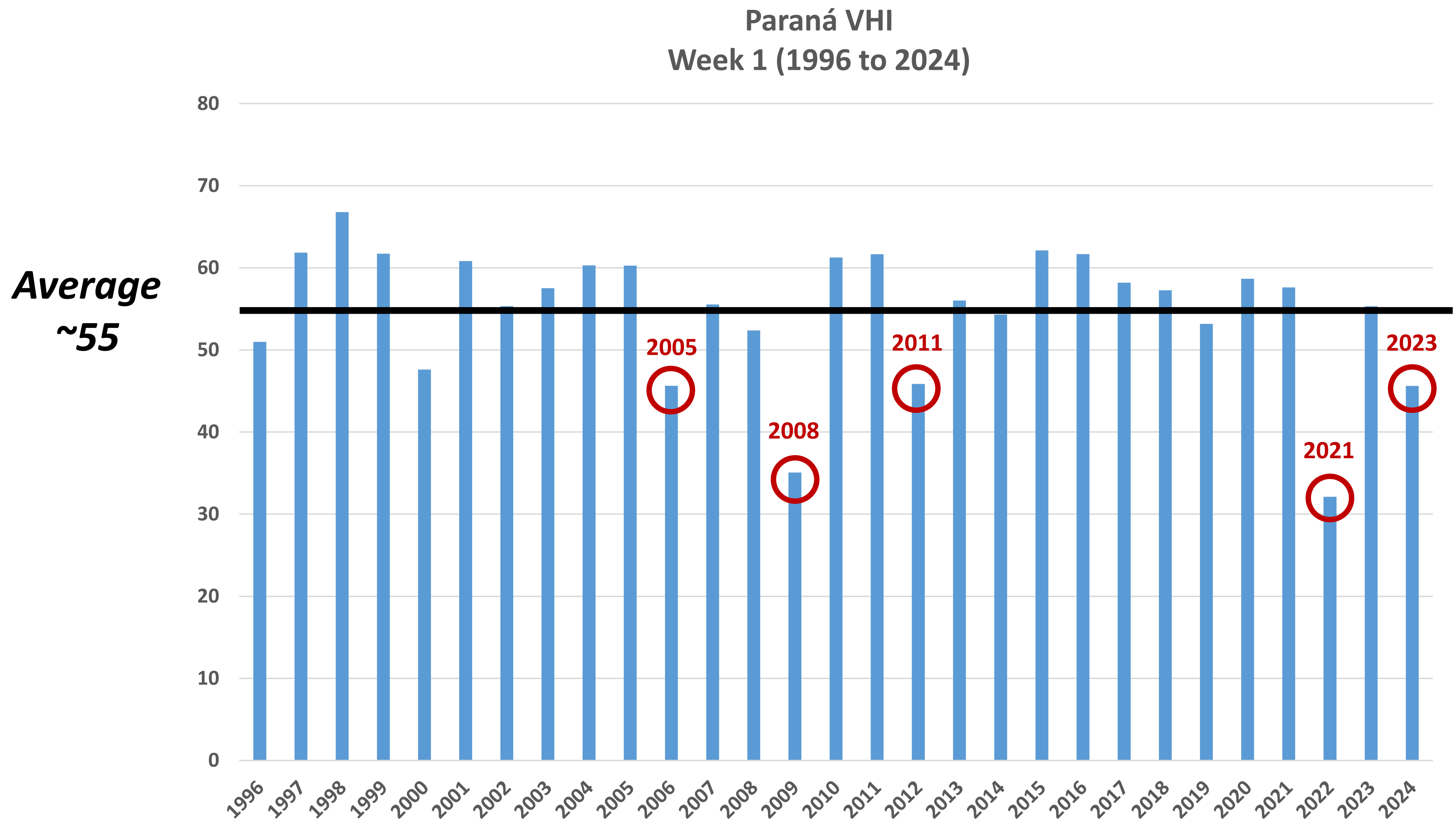
*Source: NESDIS

Paraná, Brazil

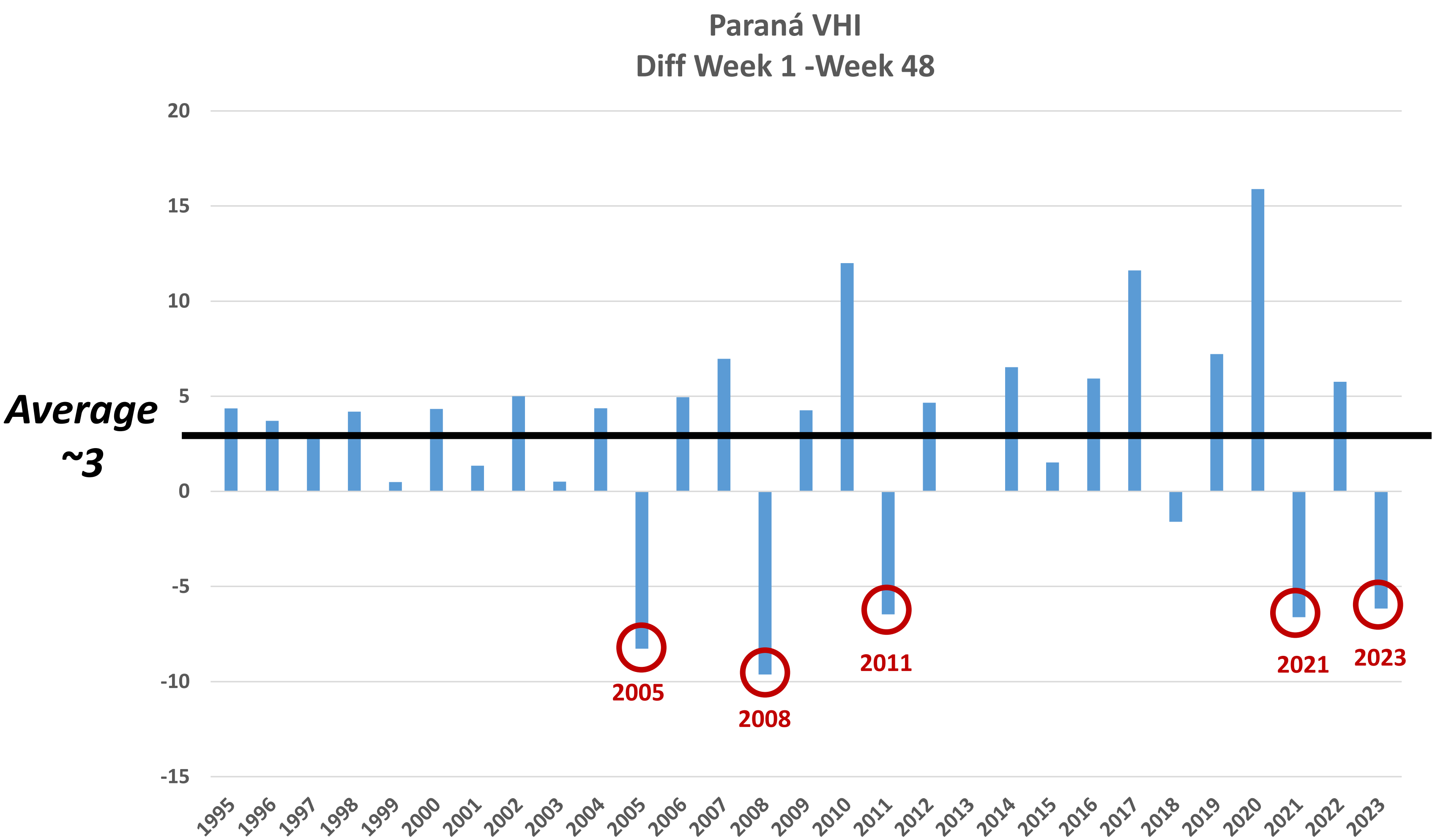
Cumulative Precipitation (mm)

(Source: World Meteorological Organization)





Source: NESDIS



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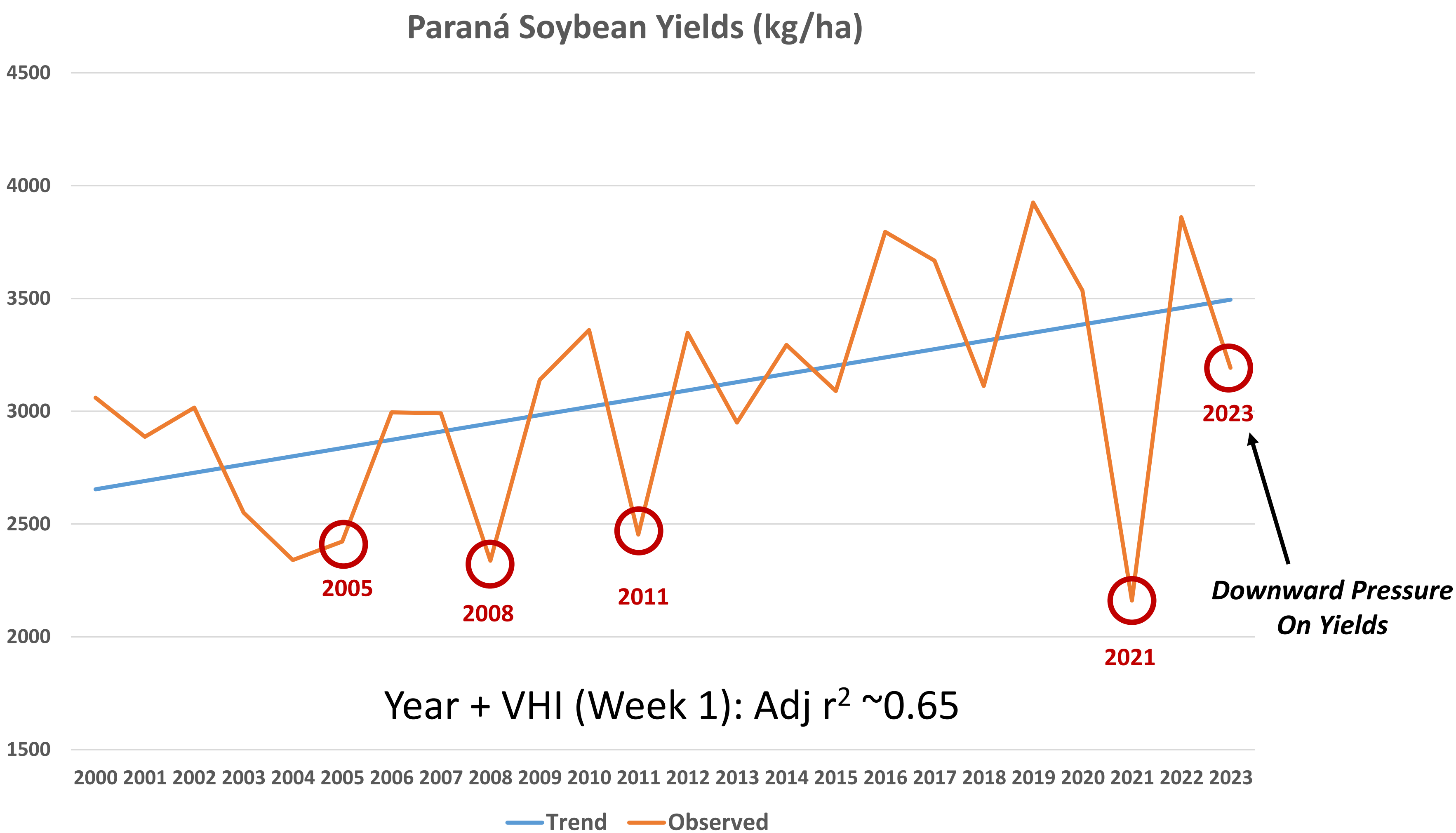

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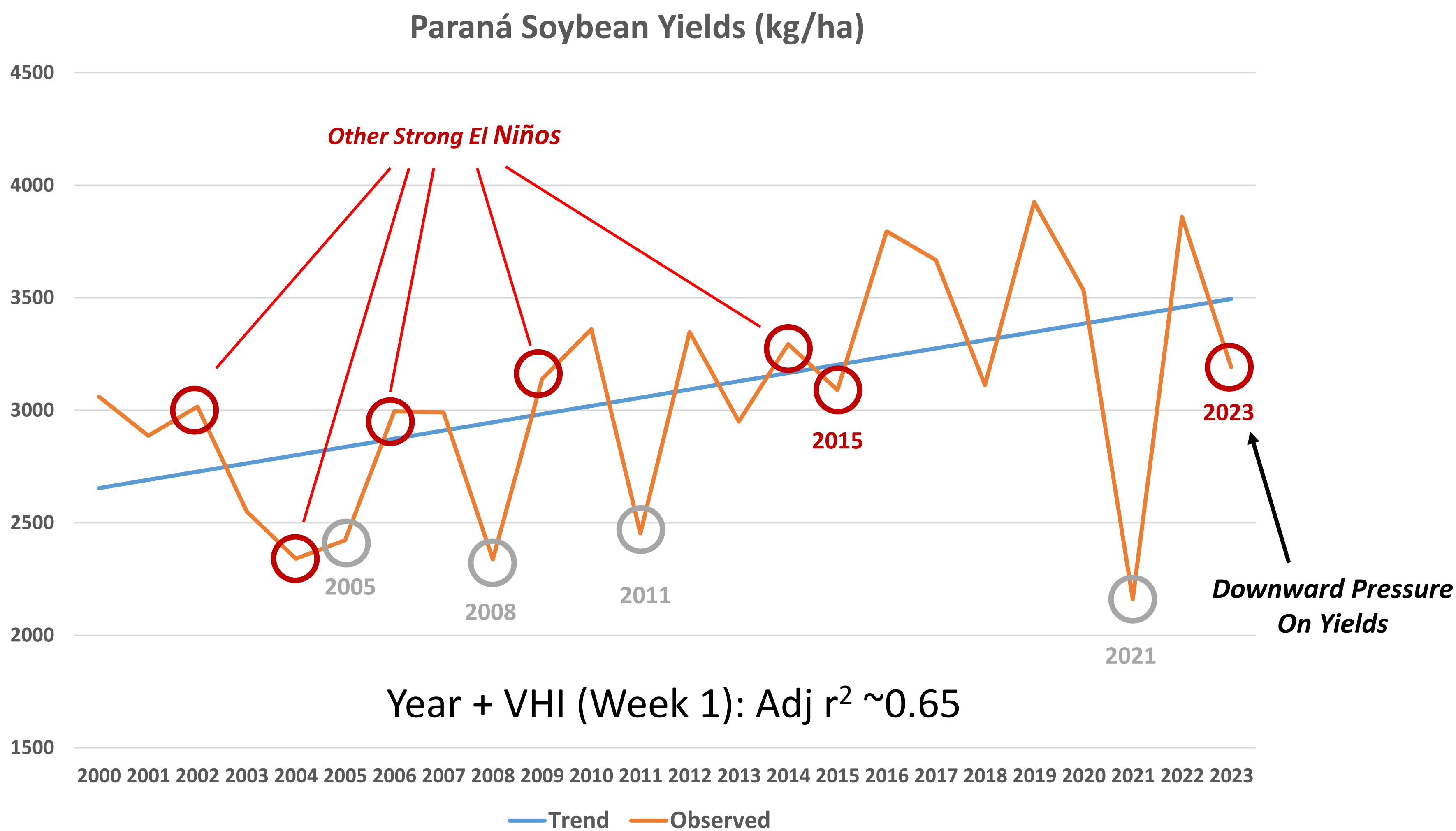

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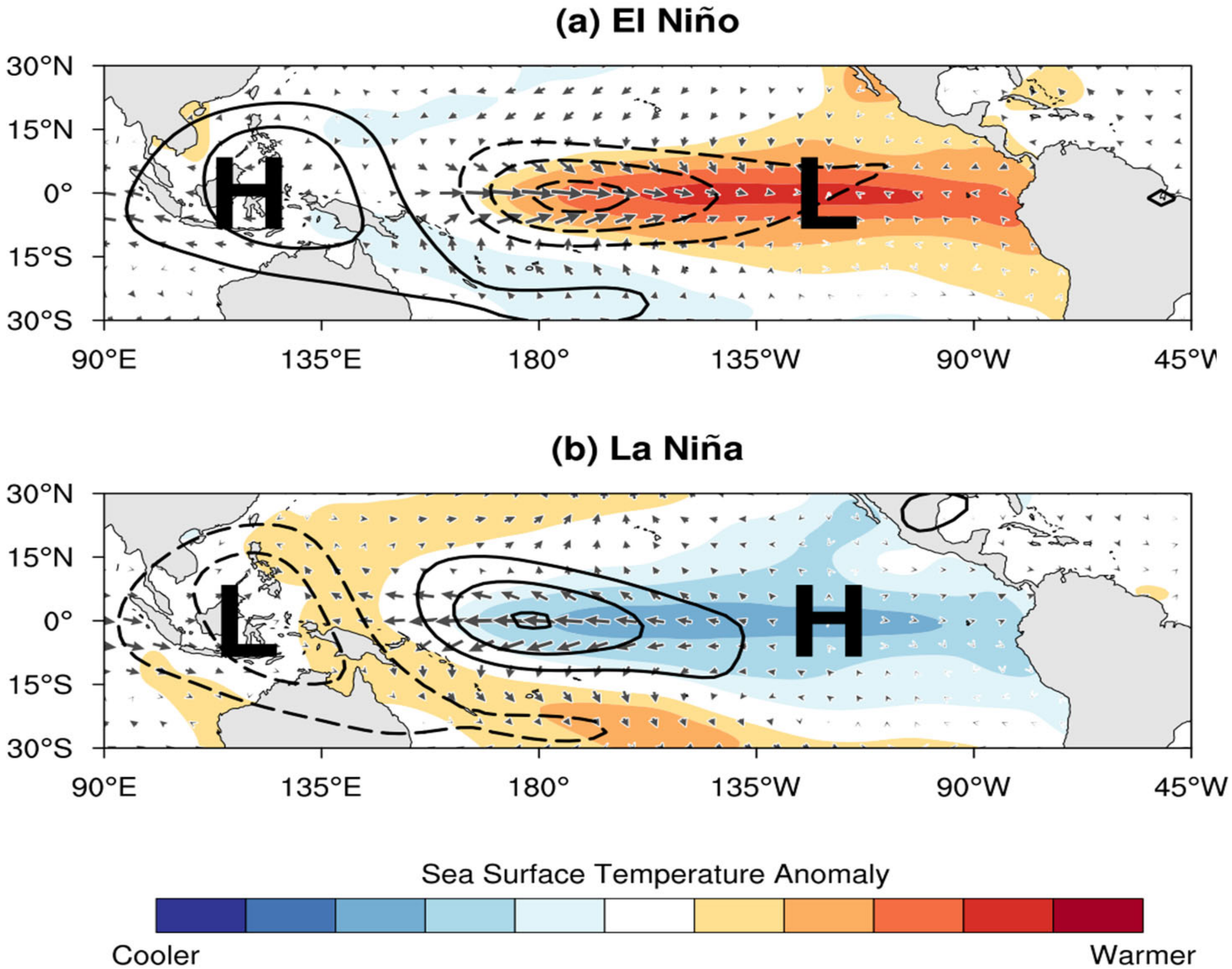


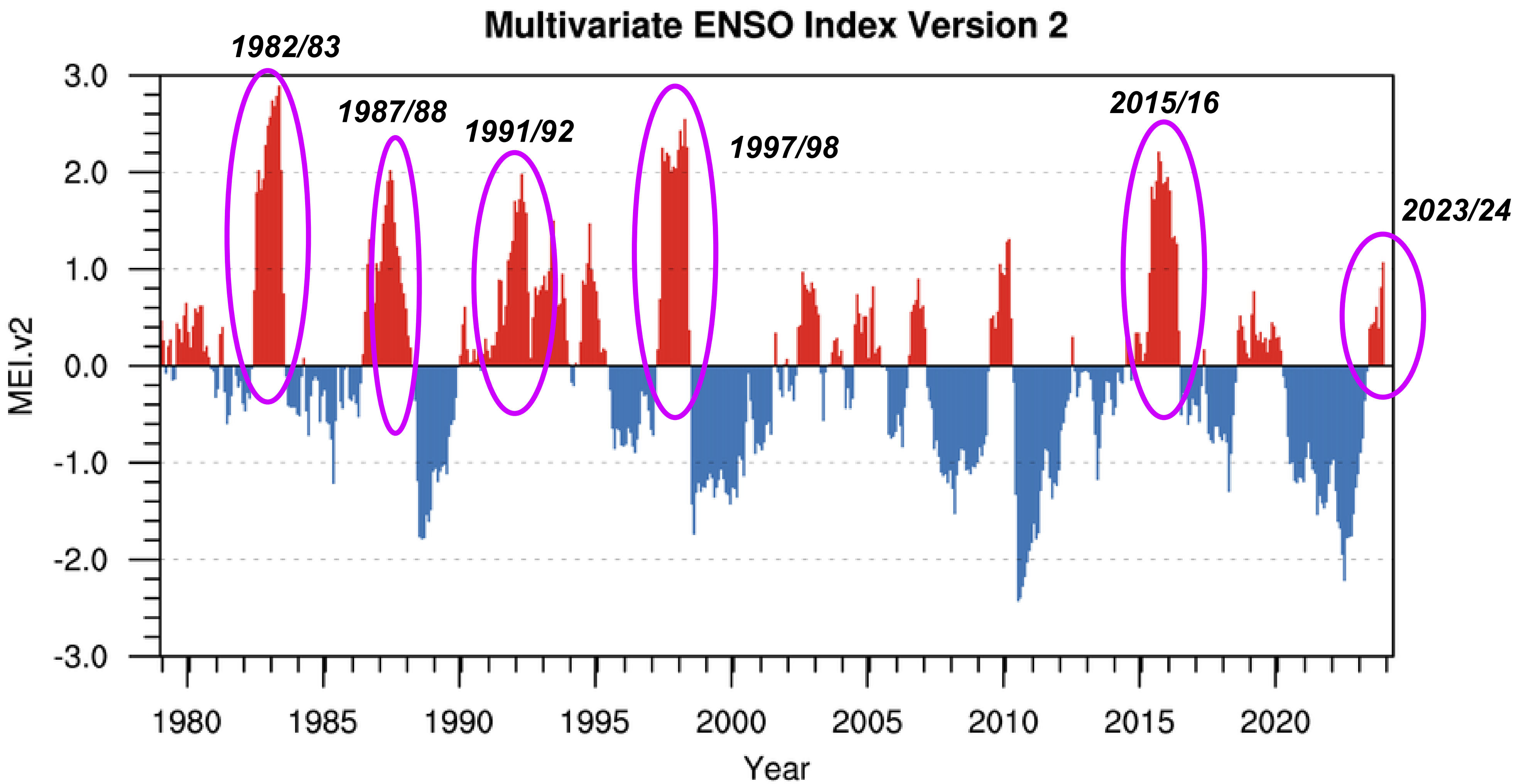
https://www.psl.noaa.gov/enso/mei/

Multivariate ENSO Index (MEI)

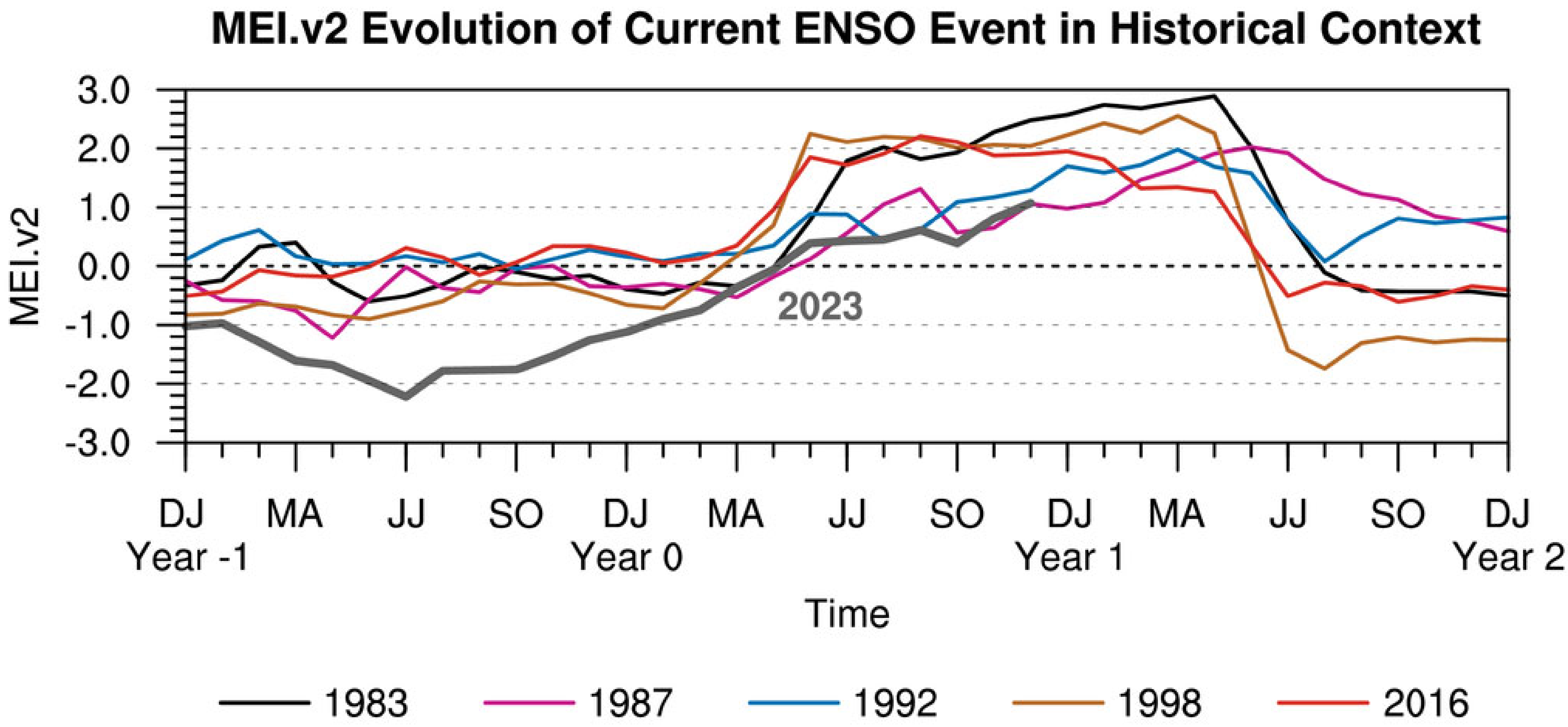
Estimates level of "coupling" between ENSO events with atmosphere.

Considers the Following:

- Sea Surface Temperatures;
- Sea Level Pressure;
- Surface Zonal Winds;
- Surface Meridional Winds; and
- Outgoing Longwave Radiation

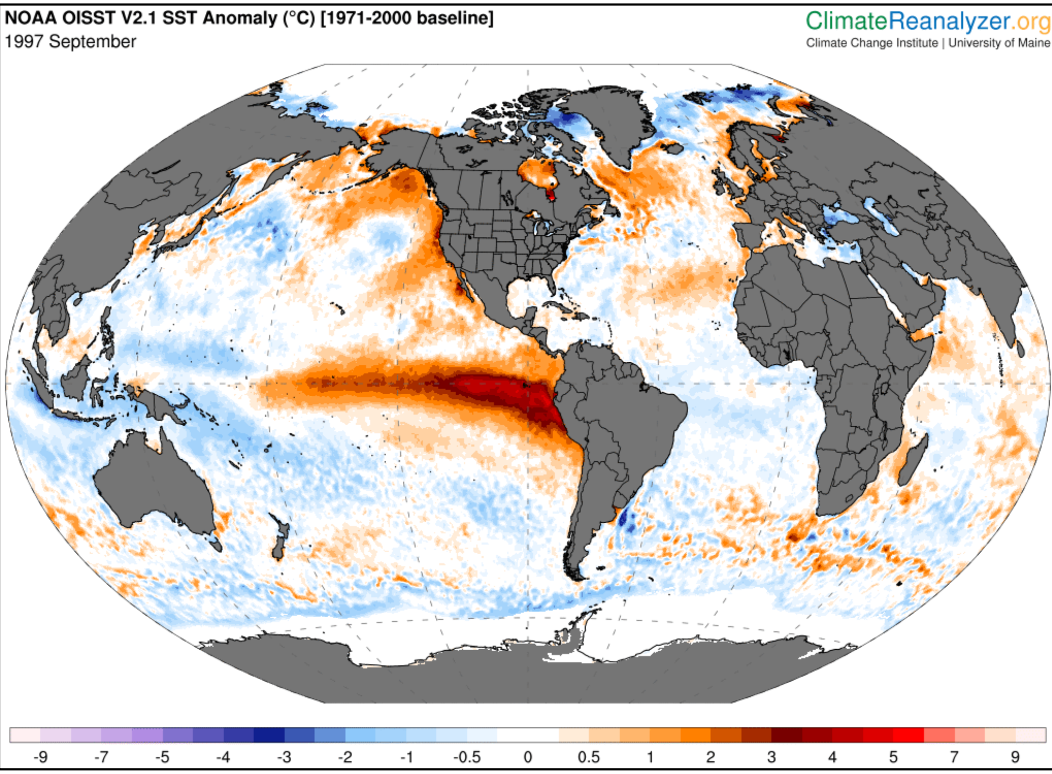


https://www.psl.noaa.gov/enso/mei/

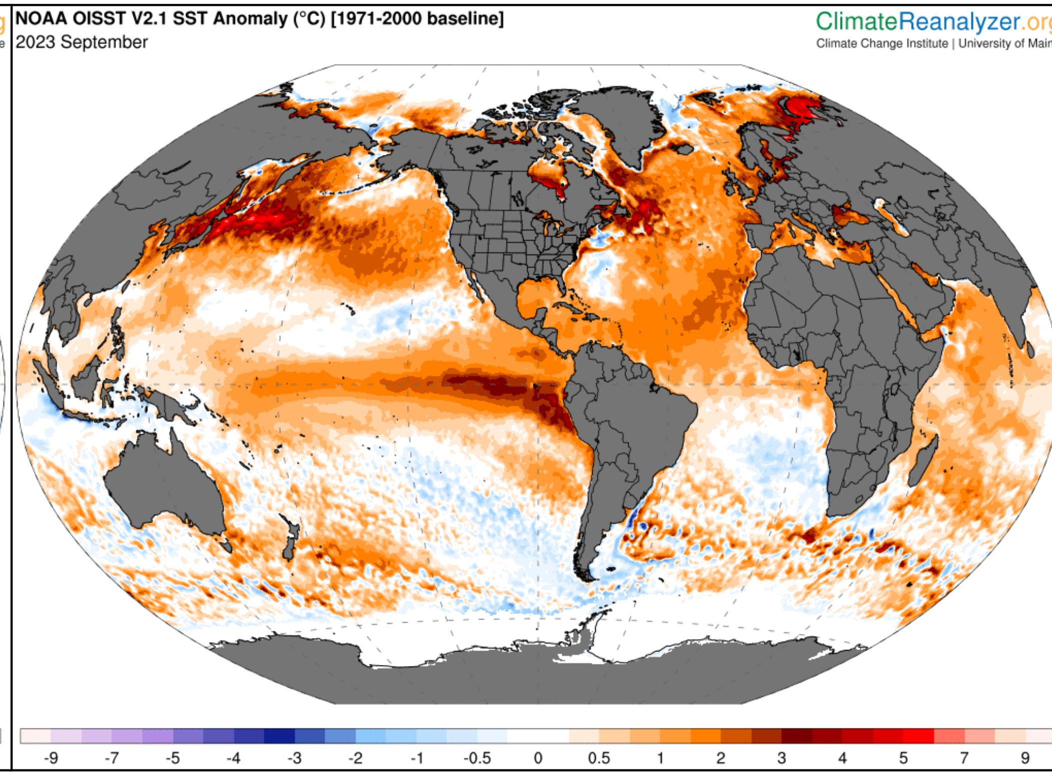


https://www.psl.noaa.gov/enso/mei/

Sea Surface Temperature Anomalies (°C)
September 1997



Sea Surface Temperature Anomalies (°C)
September 2023



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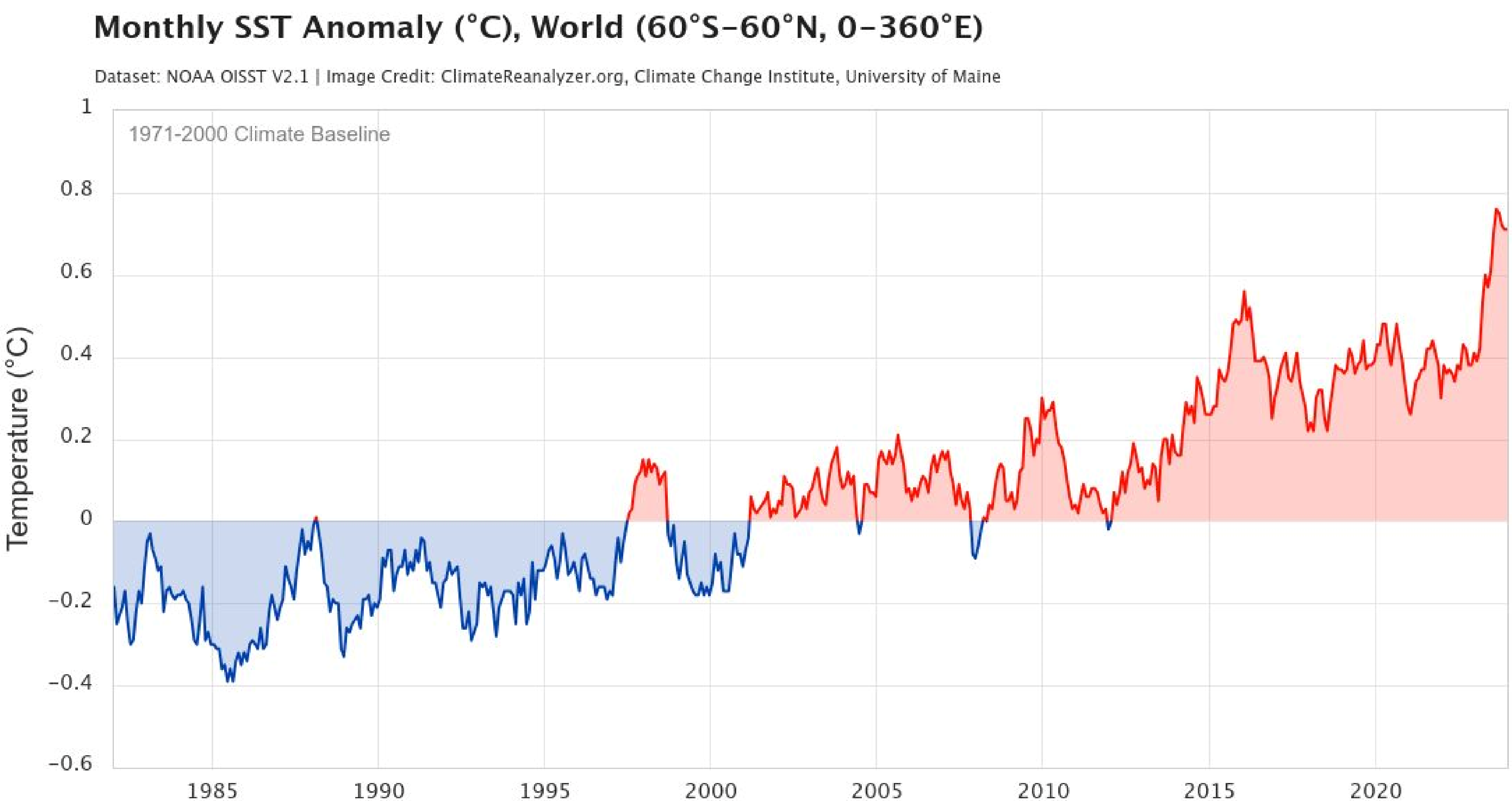
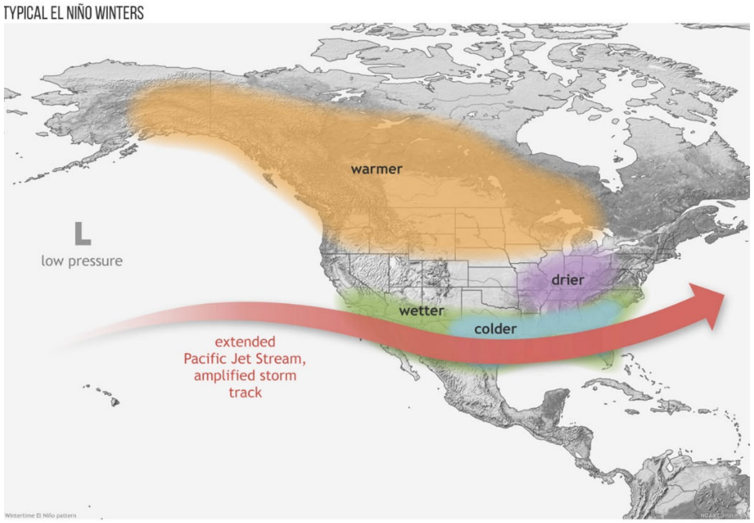
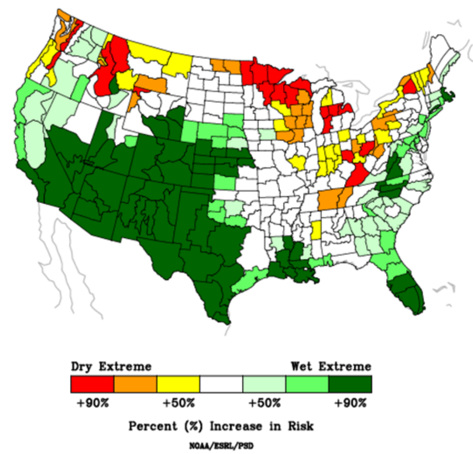


https://climatereanalyzer.org/

TYPICAL EL NIÑO WINTERS

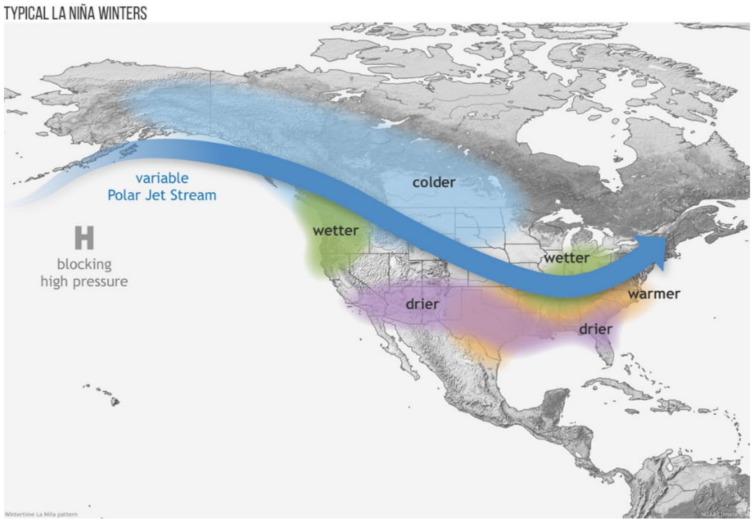


FMA Precipitation During El Nino
Increased Risk of Wet or Dry Extremes

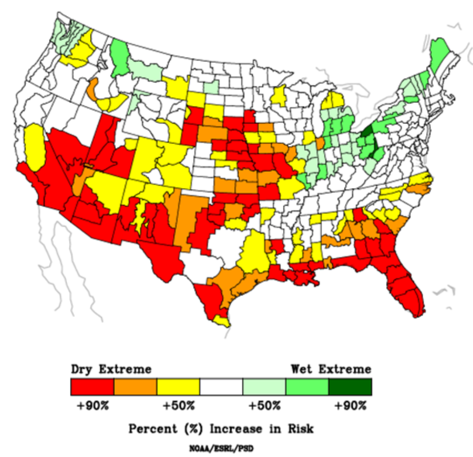


El Niño Winter

TYPICAL LA NIÑA WINTERS



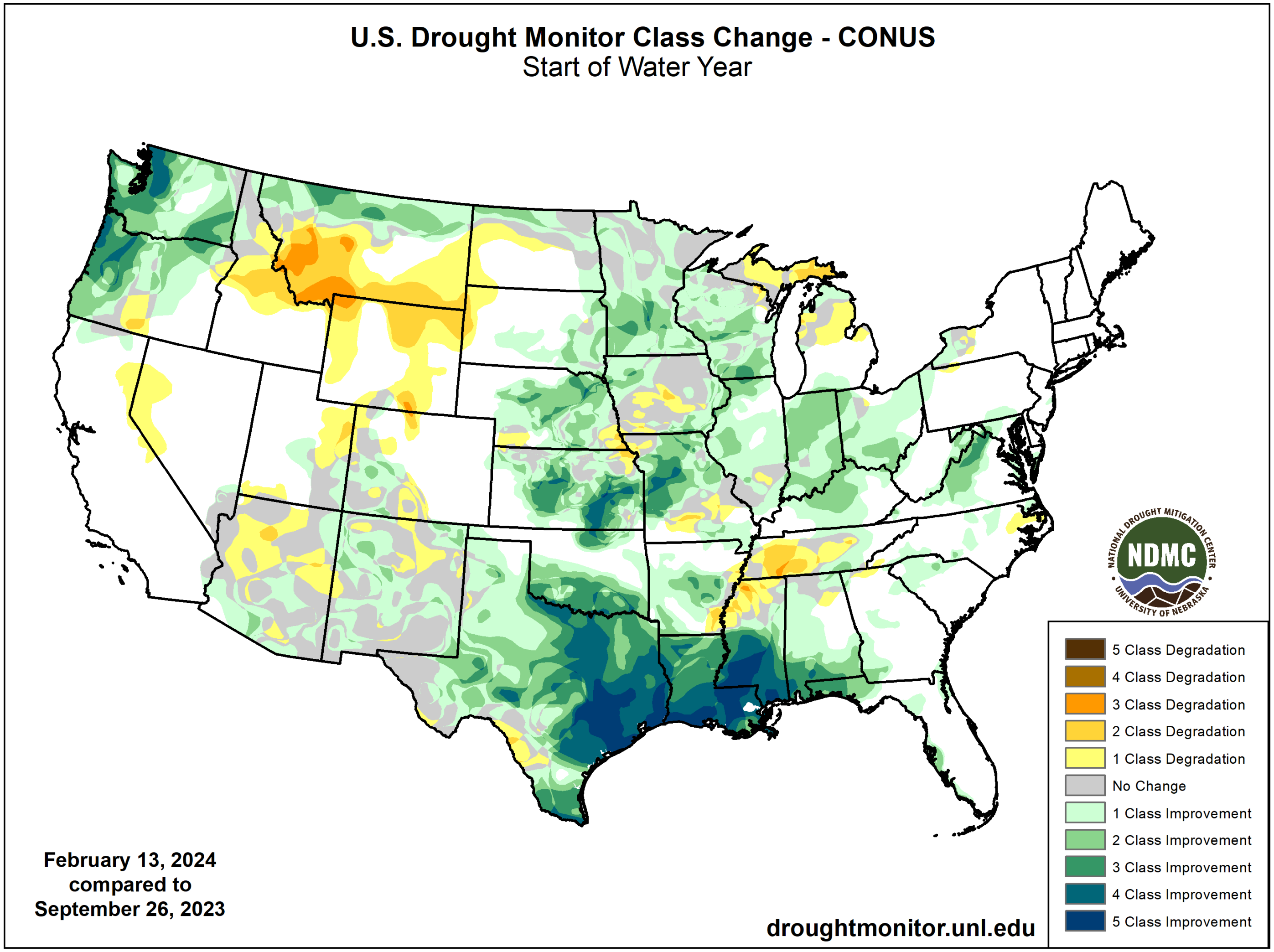
FMA Precipitation During La Nina
Increased Risk of Wet or Dry Extremes

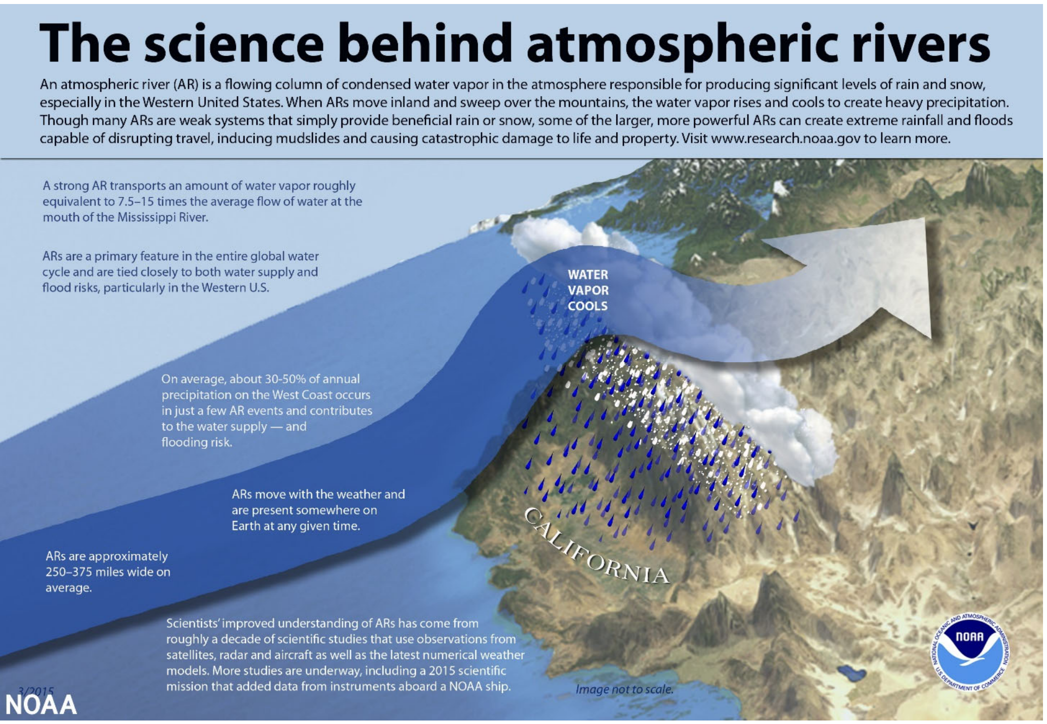


La Niña Winter

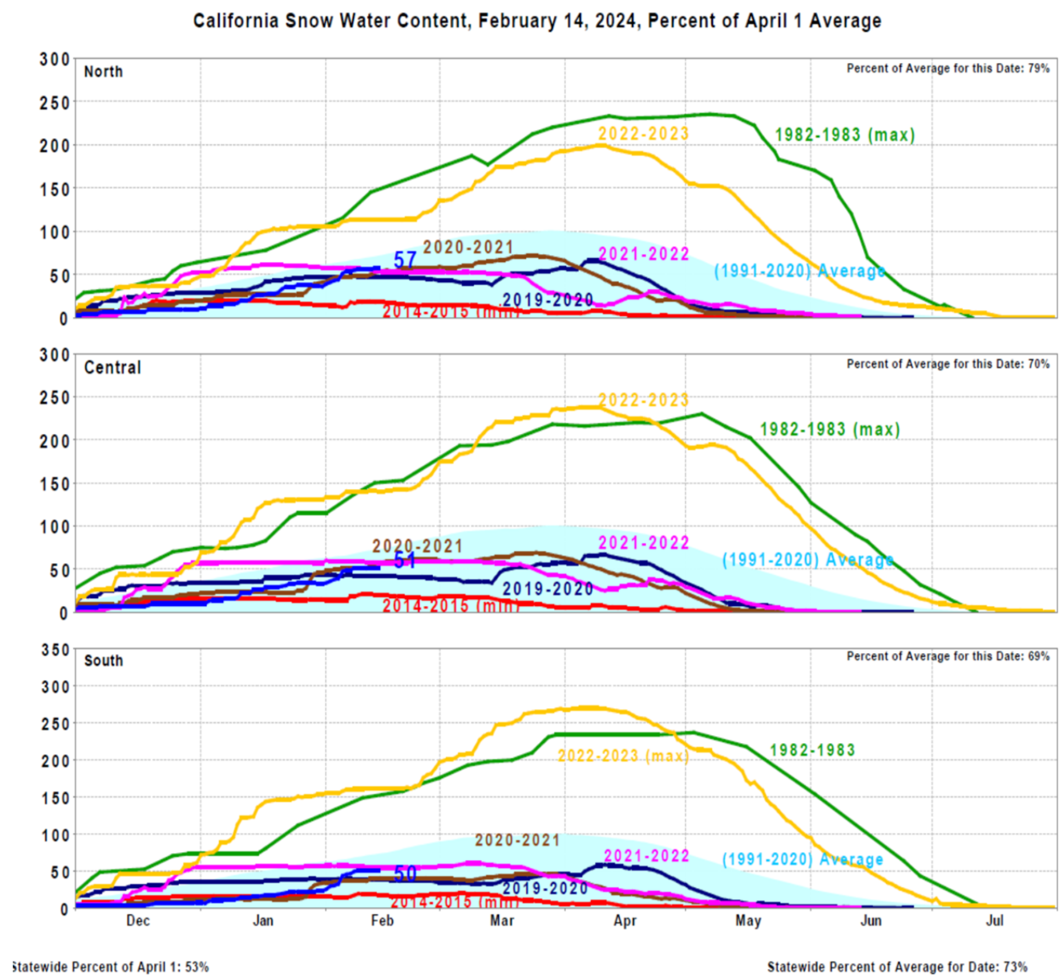
SOURCE: NOAA

USDA Agricultural Weather Assessments
OCE/World Agricultural Outlook Board



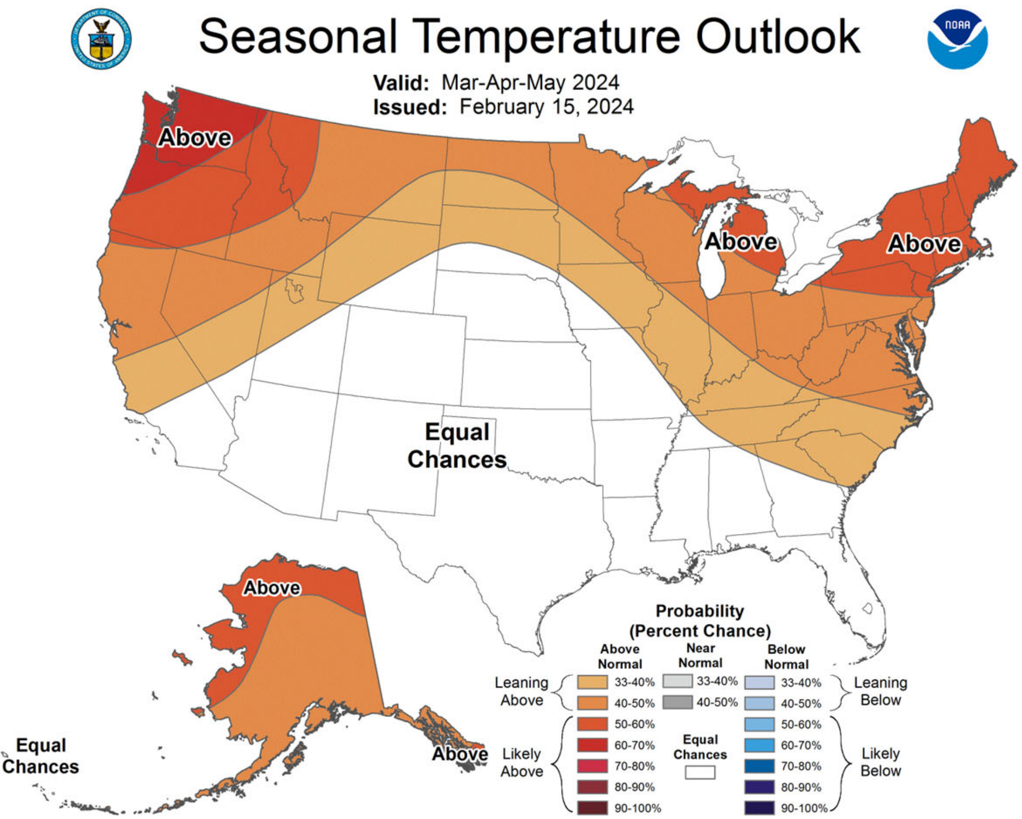


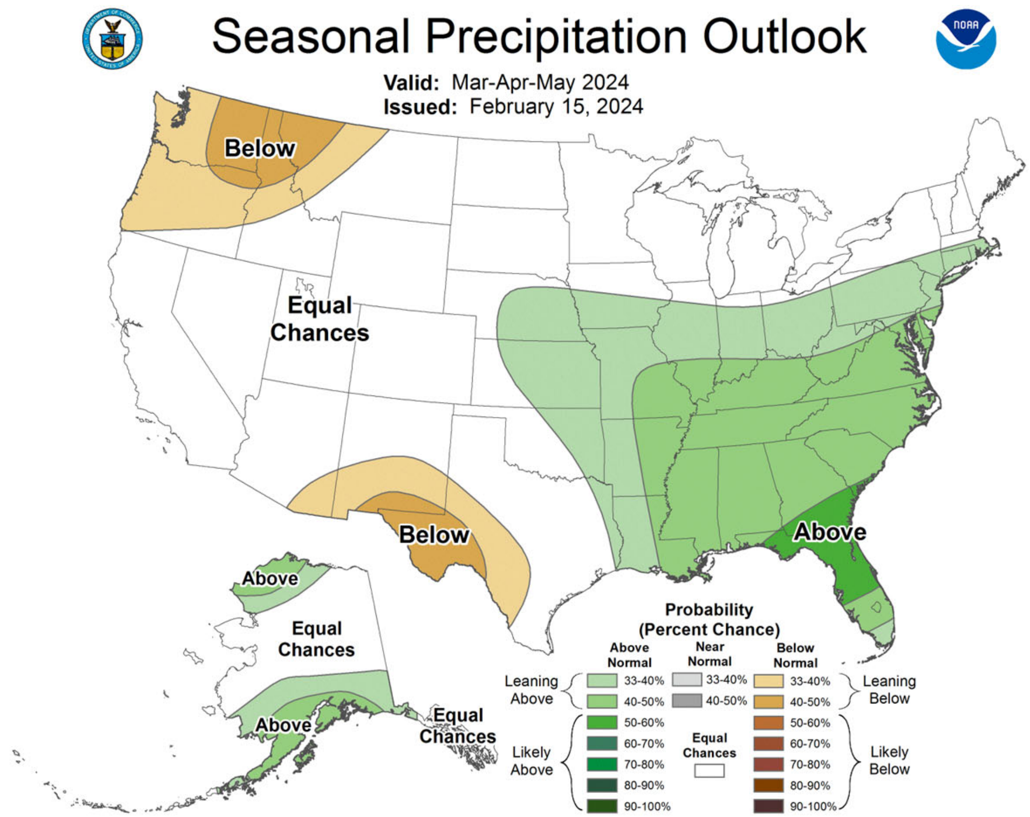
https://research.noaa.gov/article/ArtMID/587/ArticleID/2926/Atmospheric-Rivers-What-are-they-and-how-does-NOAA-study-them



https://cdec.water.ca.gov/reportapp/javareports?name=PLOT_SWC

Seasonal Outlooks: March, April, May 2024
Issued February 15, 2024





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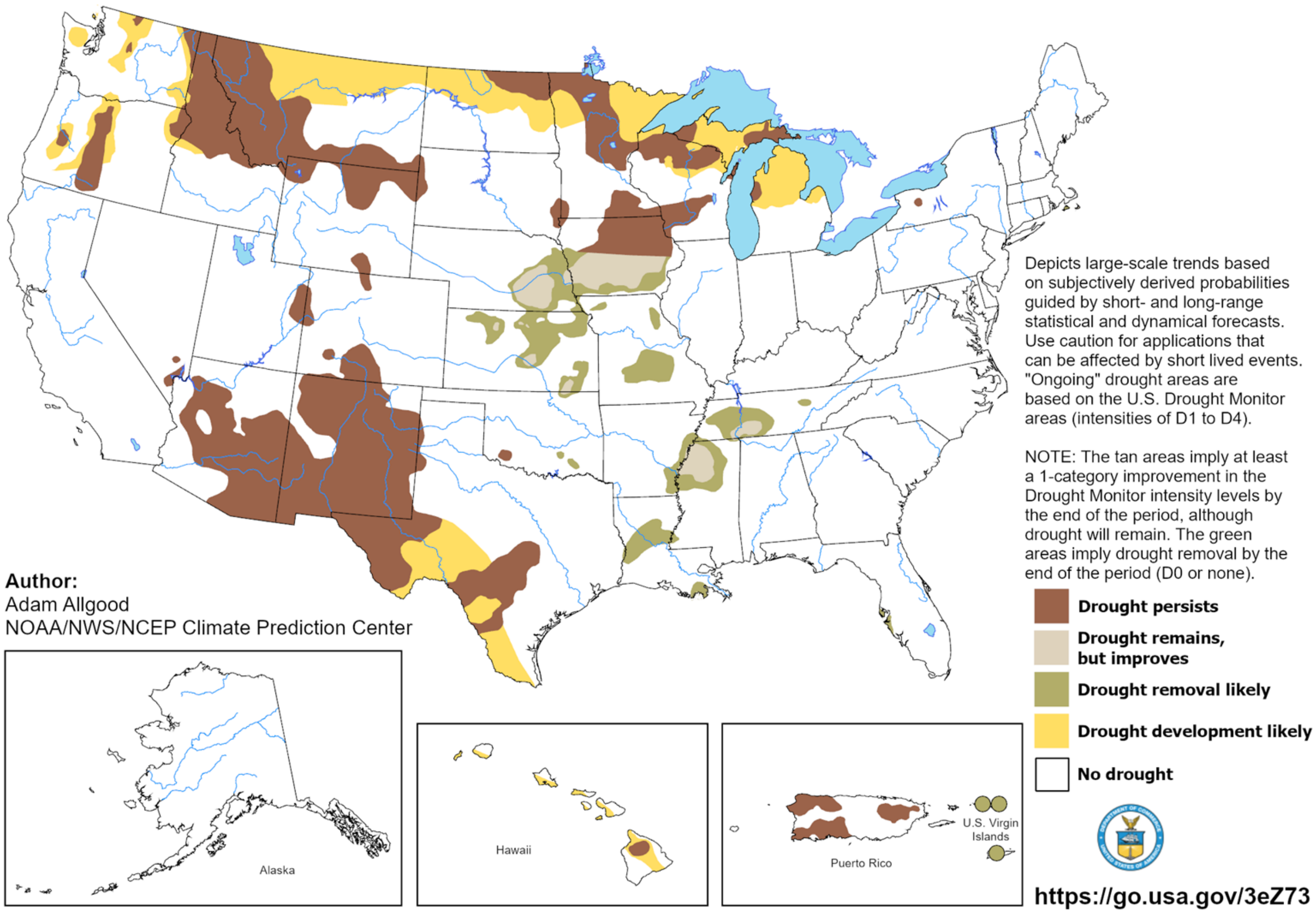
USDA **Agricultural Weather Assessments**
OCE/World Agricultural Outlook Board

U.S. Seasonal Drought Outlook
Drought Tendency During the Valid Period

Valid for February 15 - May 31, 2024
Released February 15, 2024



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Thanks!

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