SOUTH FLORIDA WATER MANAGEMENT DISTRICT

ENSO Strength to Rainfall Outlook Tercile Probability Conversion

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Methodology

- Use historical SST Anomaly for ENSO region 3.4 (ONI) and rainfall information to convert ENSO into tercile probabilities
- For each of the 12 3-month seasons

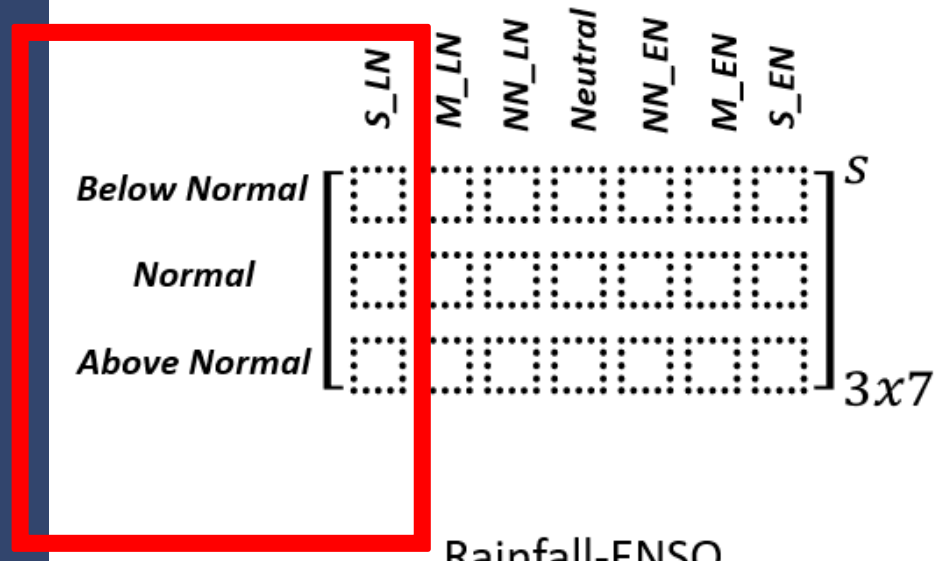
$$\begin{array}{c} \\ \textit{Below Normal} \\ \textit{Normal} \\ \textit{Above Normal} \end{array} \begin{bmatrix} \textit{S\_LN} & \textit{M\_LN} & \textit{NN\_LN} & \textit{Neutral} & \textit{NN\_EN} & \textit{M\_EN} & \textit{S\_EN} \end{bmatrix}^{S}_{3x7} \quad \begin{matrix} S \\ \begin{bmatrix} \textit{S\_LN} \\ \textit{M\_LN} \\ \textit{NN\_LN} \\ \textit{Neutral} \\ \textit{NN\_EN} \\ \textit{M\_EN} \\ \textit{S\_EN} \end{bmatrix}_{7x1} \end{matrix} = \begin{bmatrix} \\ \textit{Below Normal} \\ \textit{Normal} \\ \textit{Above Normal} \end{bmatrix}$$

ENSO-Rainfall conversion coefficient Matrix

ENSO Cat-Strength Probability Matrix

Rainfall Tercile Probability Matrix

Rainfall ENSO conversion coefficient Matrix



Rainfall-ENSO conversion coefficient Matrix

Note: each column of this matrix will/should add to 1

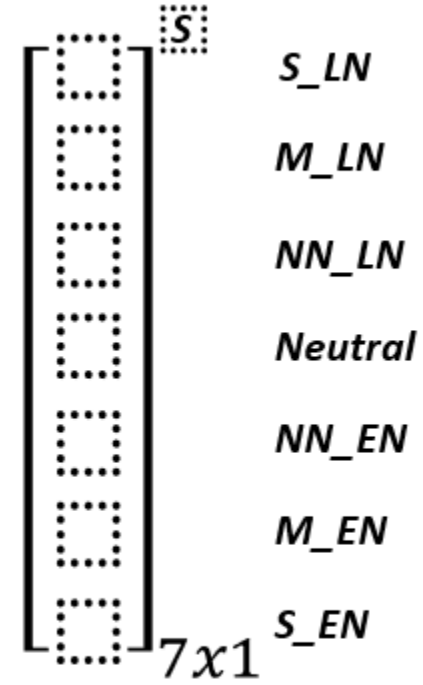
S_LN – Strong La Nina (ONI < -1.5 C)
M_LN – Moderate La Nina (-1.5C <= ONI < -1 C)
NN_LN – Near Neutral La Nina (-1 C <= ONI < -0.5 C)
NN_EN – Near Neutral El Nino (0.5 C < ONI <= 1 C)
M_EN – Moderate El Nino (1 C < ONI <= 1.5 C)
S_EN – Strong El Nino (1.5 C < ONI)
S – 3-month seasons {DJF, JFM, FMA, MAM, AMJ, MJJ, JJA, JAS, ASO, SON, OND, NDJ}

Step 1:
Classify SST Anomaly for Region 3.4 (ONI) into ENSO Categories for each 3-month season

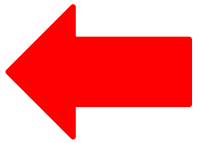
Step 2:
Calculate counts/probabilities of Below Normal, Normal, and Above Normal rainfall events for each ENSO category

Step 3:
Repeat steps 1 and 2 for each 3-month seasons

ENSO Strength Probability Vector



ENSO Cat-Strength Probability Matrix



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ENSO Strengths

This table shows the forecast probability (%) of Niño-3.4 index exceeding a certain threshold (in degrees Celsius).
For negative thresholds, the table shows the probability (%) of a Niño-3.4 index value that is less than (more negative) that value.
For positive thresholds, the table shows the probability (%) of a Niño-3.4 index value that is greater than (more positive) that value.
This tool supports the official ENSO Diagnostic discussion updated on the 2nd Thursday of each month.

Target	< -1.5°C	< -1.0°C	< -0.5°C	> 0.5°C	> 1.0°C	> 1.5°C
JJA	~0	~0	~0	97	53	4
JAS	~0	~0	~0	96	70	25
ASO	~0	~0	~0	96	76	37
SON	~0	~0	~0	96	80	46
OND	~0	~0	~0	96	82	52
NDJ	~0	~0	~0	96	81	51
DJF	~0	~0	~0	93	73	41
JFM	~0	~0	~0	90	64	30
FMA	~0	~0	~0	85	52	17
	< -1.5°C	< -1.0°C	< -0.5°C	> 0.5°C	> 1.0°C	> 1.5°C

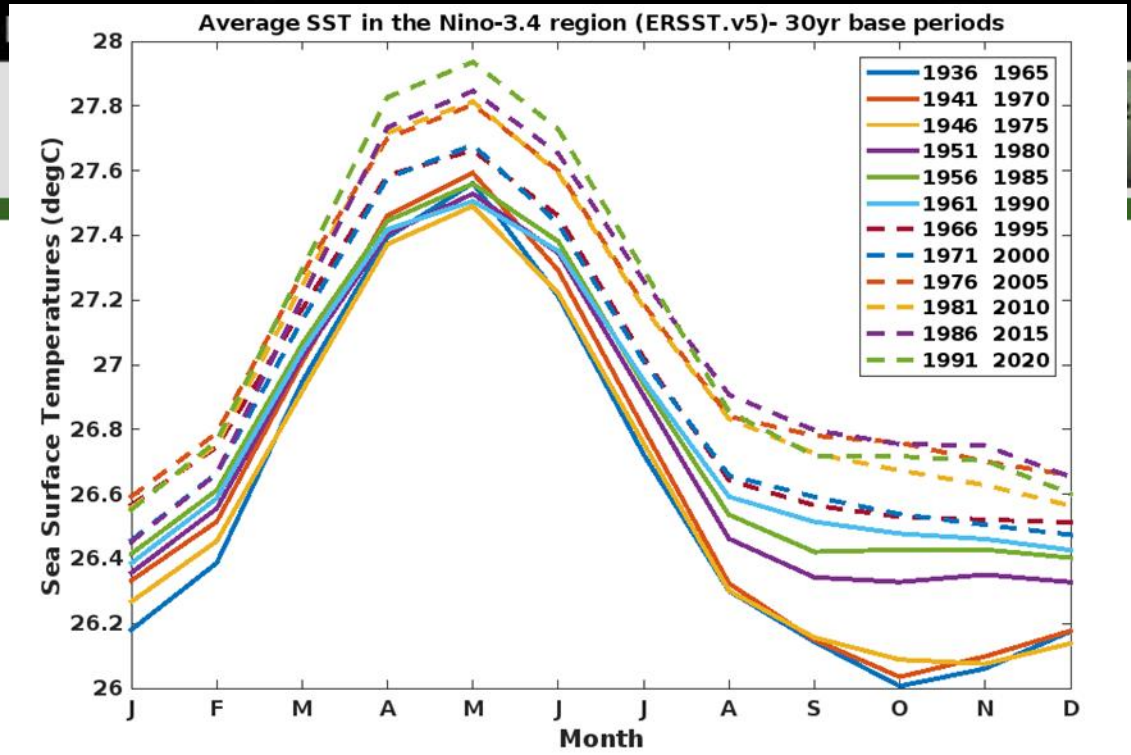
The values are based on the analysis published in:

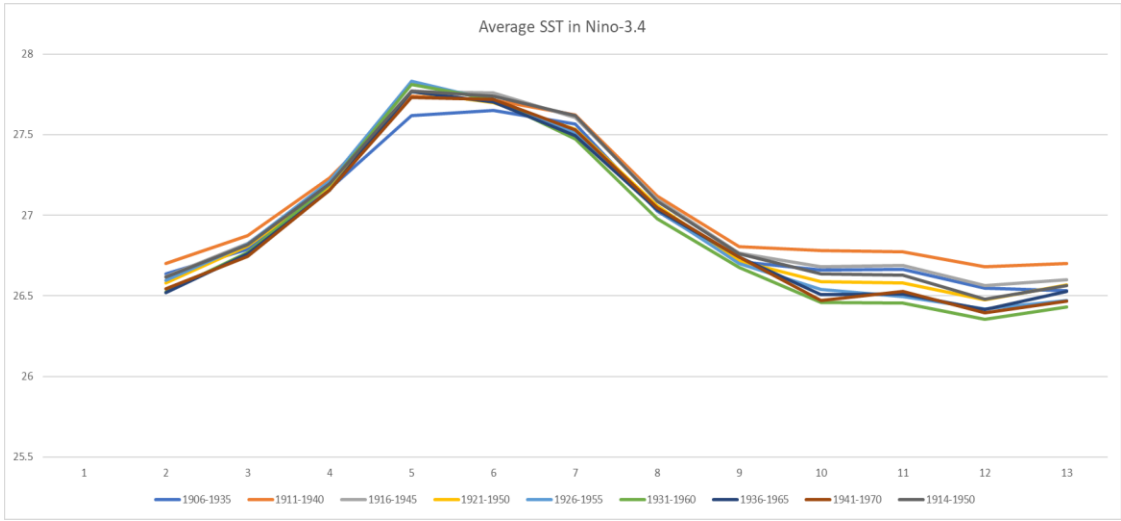
L'Heureux, M. L., Tippett, Michael K., Takahashi, Ken, Barnston, Anthony G., Becker, Emily J., Bell, Gerald D., Di Liberto, Tom E., Gottschalck, Jon, Halpert, Michael S., Hu, Zeng-Zhen, Johnson, Nathaniel C., Xue, Yan, and Wang, Wanqiu, 2019: Strength Outlooks for the El Niño-Southern Oscillation. Wea. Forecasting, 34, 165-175, https://doi.org/10.1175/WAF-D-18-0126.1.

CALCULATION DETAILS

Step 1: ONI calculation

- Currently CPC uses a 30-year base period of SST that is used to define an anomaly. The base periods are used for 5-year periods then updated. [Climate Prediction Center - Monitoring & Data: Ocean Niño Index Changes Description (noaa.gov)]
- For example, "*ONI values during 1950-1955 will be based on the 1936-1965 base period, ONI values during 1956-1960 will be based on the 1941-1970 base period, and so on and so forth.*"
- This method for ONI calculation is used due to a warming trend in the Nino-3.4 area.
- We considered 3 methods to calculate SST anomalies and settled on using a base period of 1914-1950.
- psl.noaa.gov/gcos_wgsp/Timeseries/Data/nino34.long.data





Step 1: ENSO Classification

- **After calculating ONI values from 1915-1949 we classified the values into ENSO categories using 3-month averages.**

S_LN – Strong La Nina (ONI < -1.5 C)
M_LN – Moderate La Nina (-1.5C <= ONI < -1 C)
NN_LN – Near Neutral La Nina (-1 C <= ONI < -0.5 C)
NN_EN – Near Neutral El Nino (0.5 C < ONI <= 1 C)
M_EN – Moderate El Nino (1 C < ONI <= 1.5 C)
S_EN – Strong El Nino (1.5 C < ONI)
S – 3-month seasons {DJF, JFM, FMA, MAM, AMJ, MJJ, JJA, JAS, ASO, SON, OND, NDJ}

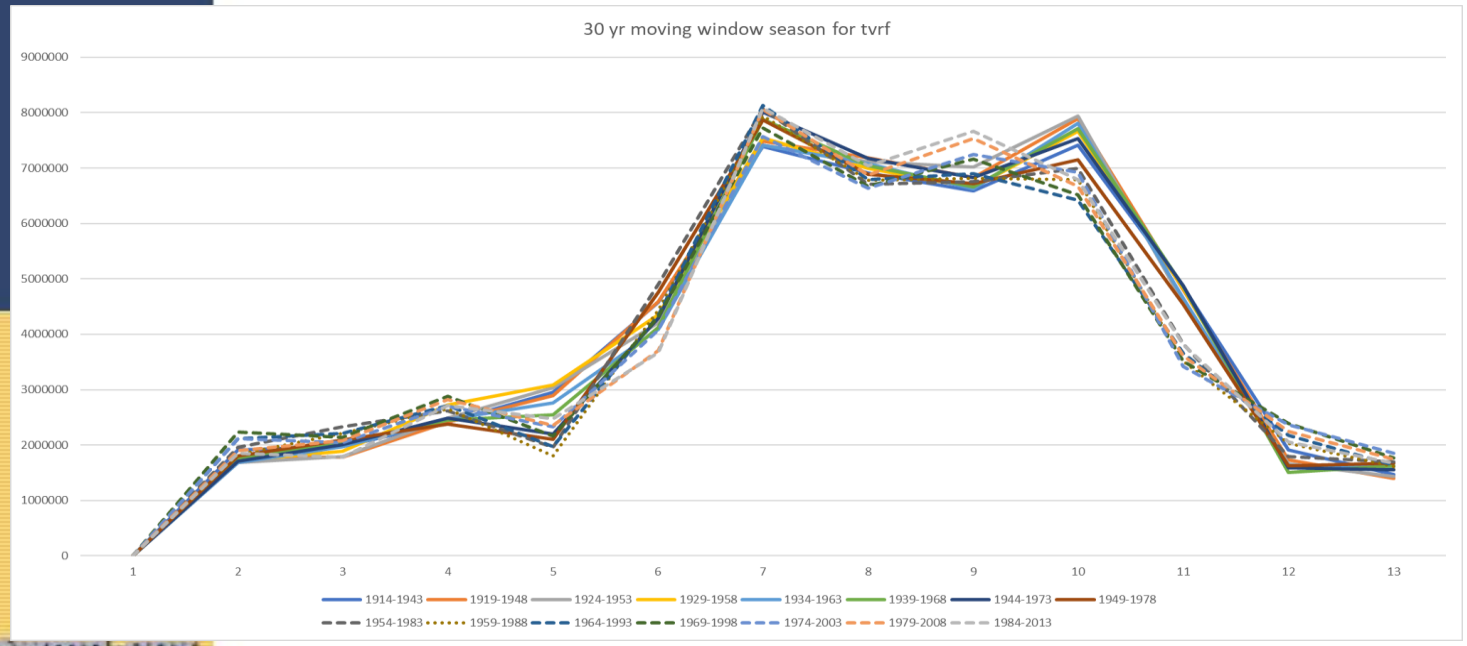
ANOM 1915-1949 and 3 month season ave from ANOM

	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1915		0.66	0.54	0.55	0.76	0.67	0.51	0.22	0.26	0.22	0.06	-0.11
1916	-0.3	-0.4	-0.6	-0.4	-0.3	-0.5	-0.9	-1.2	-1.3	-1.4	-1.5	-1.6
1917	-1.5	-1.1	-0.7	-0.3	-0.1	0.0	0.1	0.2	0.2	0.0	-0.3	-0.6
1918	-0.8	-0.9	-0.8	-0.5	-0.1	0.2	0.2	0.3	0.6	1.0	1.3	1.4
1919	1.4	1.2	0.9	0.8	0.7	0.7	0.7	0.6	0.5	0.2	0.1	0.3
1920	0.5	0.6	0.3	0.1	0.0	0.2	0.3	0.3	0.4	0.4	0.2	0.2
1921	-0.1	-0.5	-0.8	-0.9	-0.5	-0.4	-0.2	-0.1	0.0	-0.3	-0.4	-0.6
1922	-0.4	-0.2	-0.2	0.0	-0.2	-0.1	-0.4	-0.4	-0.4	-0.2	-0.3	-0.4
1923	-0.6	-0.7	-0.7	-0.5	-0.2	-0.1	0.1	0.3	0.7	0.9	1.0	0.8
1924	0.7	0.5	0.3	-0.1	-0.4	-0.7	-0.7	-0.8	-0.6	-0.7	-0.6	-0.9
1925	-0.7	-0.7	-0.5	-0.4	-0.3	0.1	0.4	0.8	0.9	1.0	1.3	1.4
1926	1.5	1.3	1.2	1.1	0.9	0.8	0.6	0.4	0.0	-0.1	-0.2	-0.1
1927	0.0	0.0	-0.1	-0.3	-0.3	-0.2	-0.1	-0.1	0.1	0.2	0.3	0.3
1928	0.3	0.1	-0.1	-0.1	-0.1	0.0	-0.1	0.0	-0.1	0.0	0.0	-0.1
1929	-0.1	-0.1	-0.1	-0.1	0.0	0.1	0.2	0.3	0.4	0.4	0.5	0.4
1930	0.4	0.3	0.4	0.3	0.3	0.4	0.6	1.0	1.1	1.5	1.5	1.6
1931	1.4	1.3	1.2	1.0	0.8	0.6	0.4	0.2	-0.1	-0.2	-0.2	-0.3
1932	-0.3	-0.1	0.1	0.3	0.3	0.2	0.2	0.1	0.2	0.1	0.0	-0.2
1933	-0.3	-0.2	-0.1	-0.1	-0.4	-0.5	-0.7	-0.7	-0.8	-0.8	-1.0	-1.0
1934	-1.0	-0.9	-0.7	-0.6	-0.4	-0.3	-0.3	-0.3	-0.3	-0.2	-0.1	-0.2
1935	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.2	0.0	0.2	0.3	0.3	0.4
1936	0.4	0.4	0.3	0.1	0.0	-0.1	-0.2	-0.1	0.1	0.2	0.4	0.2
1937	0.2	0.1	0.3	0.1	-0.1	-0.1	0.0	0.1	0.1	0.2	0.2	0.1
1938	0.1	0.0	0.1	0.0	-0.3	-0.6	-0.8	-0.6	-0.5	-0.5	-0.7	-0.7
1939	-0.8	-0.8	-0.7	-0.4	-0.1	0.1	0.2	0.4	0.1	0.2	0.1	0.6
1940	0.8	1.2	1.1	0.8	0.6	0.5	0.6	0.5	0.5	0.5	0.9	1.2
1941	1.3	1.4	1.4	1.4	1.3	1.1	0.9	0.9	0.9	1.1	1.2	1.1
1942	0.8	0.5	0.5	0.3	0.0	-0.3	-0.6	-0.8	-1.0	-1.2	-1.3	-1.3
1943	-1.2	-1.2	-1.0	-0.6	-0.3	-0.1	0.1	0.0	-0.1	-0.3	-0.4	-0.4
1944	-0.3	-0.2	0.0	0.1	0.2	0.2	0.1	0.0	-0.1	-0.2	-0.2	-0.3
1945	-0.4	-0.6	-0.7	-0.6	-0.5	-0.4	-0.6	-0.6	-0.7	-0.6	-0.5	-0.4
1946	-0.4	-0.4	-0.4	-0.3	-0.2	0.0	0.0	-0.1	-0.1	0.0	0.0	0.1
1947	0.1	0.2	0.0	0.0	-0.1	-0.2	-0.1	-0.5	-0.6	-0.7	-0.4	-0.1
1948	0.2	0.3	0.4	0.5	0.3	0.2	0.1	0.1	-0.1	-0.2	-0.1	-0.1
1949	0.0	-0.3	0.0	-0.1	-0.1	-0.3	-0.4	-0.3	-0.5	-0.8	-1.0	-1.1

	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1915		NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	N	N	N	N	N
1916	N	N	NN_LN	N	N	N	NN_LN	M_LN	M_LN	M_LN	M_LN	S_LN
1917	M_LN	M_LN	NN_LN	N	N	N	N	N	N	N	N	NN_LN
1918	NN_LN	NN_LN	NN_LN	N	N	N	N	N	NN_EN	NN_EN	M_EN	M_EN
1919	M_EN	M_EN	NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	N	N	N
1920	NN_EN	NN_EN	N	N	N	N	N	N	N	N	N	N
1921	N	NN_LN	NN_LN	NN_LN	N	N	N	N	N	N	N	NN_LN
1922	N	N	N	N	N	N	N	N	N	N	N	N
1923	NN_LN	NN_LN	NN_LN	N	N	N	N	N	NN_EN	NN_EN	NN_EN	NN_EN
1924	NN_EN	N	N	N	N	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN
1925	NN_LN	NN_LN	NN_LN	N	N	N	N	NN_EN	NN_EN	M_EN	M_EN	M_EN
1926	M_EN	M_EN	M_EN	M_EN	NN_EN	NN_EN	NN_EN	N	N	N	N	N
1927	N	N	N	N	N	N	N	N	N	N	N	N
1928	N	N	N	N	N	N	N	N	N	N	N	N
1929	N	N	N	N	N	N	N	N	N	N	NN_EN	N
1930	N	N	N	N	N	N	NN_EN	NN_EN	M_EN	S_EN	S_EN	S_EN
1931	M_EN	M_EN	M_EN	NN_EN	NN_EN	NN_EN	N	N	N	N	N	N
1932	N	N	N	N	N	N	N	N	N	N	N	N
1933	N	N	N	N	N	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN	M_LN	M_LN
1934	M_LN	NN_LN	NN_LN	NN_LN	N	N	N	N	N	N	N	N
1935	N	N	N	N	N	N	N	N	N	N	N	N
1936	N	N	N	N	N	N	N	N	N	N	N	N
1937	N	N	N	N	N	N	N	N	N	N	N	N
1938	N	N	N	N	N	NN_LN	NN_LN	NN_LN	NN_LN	N	NN_LN	NN_LN
1939	NN_LN	NN_LN	NN_LN	N	N	N	N	N	N	N	N	NN_EN
1940	NN_EN	M_EN	M_EN	NN_EN	NN_EN	N	NN_EN	N	N	N	NN_EN	M_EN
1941	M_EN	M_EN	M_EN	M_EN	M_EN	M_EN	NN_EN	NN_EN	NN_EN	M_EN	M_EN	M_EN
1942	NN_EN	N	N	N	N	N	NN_LN	NN_LN	M_LN	M_LN	M_LN	M_LN
1943	M_LN	M_LN	NN_LN	NN_LN	N	N	N	N	N	N	N	N
1944	N	N	N	N	N	N	N	N	N	N	N	N
1945	N	NN_LN	NN_LN	NN_LN	NN_LN	N	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN	N
1946	N	N	N	N	N	N	N	N	N	N	N	N
1947	N	N	N	N	N	N	N	N	NN_LN	NN_LN	N	N
1948	N	N	N	N	N	N	N	N	N	N	N	N
1949	N	N	N	N	N	N	N	N	N	NN_LN	NN_LN	M_LN

Step 2: Rainfall classification

- Rainfall data was converted into 3-month season just as ENSO values are.
- The seasonal values were then classified as either below normal, normal or above normal using.
- Tercile thresholds ranges were 1914-1980 and 1981-2022.



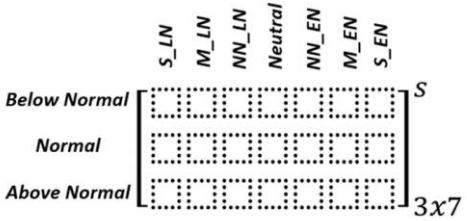
	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1915	Above	Above	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Above	Above	Above
1916	Below	Below	Below	Normal	Normal	Normal	Normal	Below	Normal	Normal	Above	Normal
1917	Below	Below	Normal	Below	Below	Below	Below	Above	Above	Above	Below	Normal
1918	Normal	Normal	Normal	Normal	Below	Below	Below	Below	Normal	Normal	Normal	Normal
1919	Above	Above	Above	Above	Above	Above	Normal	Below	Below	Below	Normal	Above
1920	Normal	Normal	Above	Above	Normal	Above	Normal	Above	Normal	Above	Above	Above
1921	Normal	Normal	Normal	Normal	Below	Below	Below	Below	Normal	Above	Above	Normal
1922	Below	Below	Below	Normal	Above	Above	Above	Above	Above	Above	Above	Normal
1923	Below	Below	Below	Above	Above	Above	Above	Normal	Below	Below	Below	Normal
1924	Above	Above	Normal	Normal	Below	Below	Below	Normal	Above	Above	Above	Above
1925	Above	Above	Normal	Above	Above	Above	Normal	Below	Below	Below	Above	Above
1926	Above	Above	Normal	Normal	Normal	Normal	Above	Above	Normal	Normal	Below	Below
1927	Below	Below	Normal	Below	Below	Below	Below	Normal	Normal	Below	Below	Below
1928	Below	Normal	Normal	Normal	Normal	Normal	Above	Above	Above	Above	Below	Below
1929	Below	Below	Below	Normal	Above	Above	Normal	Above	Above	Above	Above	Above
1930	Above	Above	Above	Above	Above	Above	Above	Normal	Normal	Normal	Normal	Above
1931	Above	Above	Above	Above	Below	Below	Below	Below	Normal	Below	Below	Below
1932	Below	Normal	Below	Above	Above	Normal	Normal	Below	Above	Normal	Above	Normal
1933	Below	Normal	Above	Above	Normal	Normal	Above	Above	Above	Above	Above	Below
1934	Normal	Normal	Above	Above	Above	Above	Normal	Normal	Below	Below	Below	Below
1935	Below	Below	Normal	Below	Normal	Below	Below	Above	Above	Above	Normal	Above
1936	Above	Above	Above	Normal	Above	Above	Above	Below	Below	Normal	Normal	Above
1937	Normal	Above	Above	Normal	Normal	Below	Normal	Normal	Normal	Above	Normal	Normal
1938	Below	Below	Below	Below	Below	Normal	Below	Below	Below	Normal	Normal	Below
1939	Below	Below	Normal	Normal	Above	Above	Above	Above	Above	Normal	Normal	Normal
1940	Above	Above	Above	Below	Below	Below	Normal	Above	Above	Normal	Below	Above
1941	Above	Above	Above	Above	Normal	Normal	Normal	Normal	Below	Normal	Normal	Above
1942	Above	Above	Above	Above	Above	Normal	Normal	Below	Below	Below	Below	Normal
1943	Below	Below	Normal	Normal	Normal	Normal	Normal	Normal	Below	Below	Below	Below
1944	Below	Below	Below	Normal	Below	Below	Below	Below	Below	Below	Below	Below
1945	Below	Below	Below	Below	Below	Below	Above	Above	Above	Above	Normal	Below
1946	Normal	Normal	Below	Normal	Normal	Above	Normal	Normal	Below	Below	Below	Normal
1947	Normal	Above	Above	Above	Above	Above	Above	Above	Above	Above	Above	Above
1948	Normal	Normal	Below	Below	Below	Below	Below	Above	Above	Above	Below	Below
1949	Below	Below	Below	Below	Normal	Normal	Above	Above	Above	Normal	Normal	Normal
1950	Normal	Below	Below	Below	Below	Below	Below	Below	Above	Normal	Above	Below
1951	Below	Below	Normal	Below	Below	Below	Below	Normal	Normal	Normal	Above	Below
1952	Normal	Above	Above	Below	Below	Below	Below	Normal	Above	Above	Above	Normal
1953	Normal	Normal	Above	Normal	Normal	Normal	Above	Above	Above	Above	Above	Normal
1954	Normal	Normal	Above	Above	Above	Above	Above	Normal	Below	Normal	Normal	Normal
1955	Below	Below	Below	Below	Normal	Normal	Normal	Below	Below	Below	Below	Below
1956	Normal	Below	Below	Below	Below	Below	Below	Below	Normal	Normal	Normal	Below
1957	Above	Above	Above	Above	Above	Normal	Normal	Above	Normal	Normal	Above	Above
1958	Above	Above	Above	Above	Above	Normal	Below	Below	Below	Below	Above	Above
1959	Above	Above	Above	Above	Above	Above	Above	Above	Above	Above	Above	Normal
1960	Normal	Normal	Above	Above	Normal	Above	Above	Above	Above	Above	Normal	Normal
1961	Normal	Normal	Below	Normal	Below	Below	Below	Below	Below	Below	Below	Below
1962	Below	Normal	Normal	Below	Normal	Normal	Above	Above	Normal	Normal	Below	Normal

Step 3: Rainfall-ENSO Matrix

- **Finally, we calculated the 3x7 matrix for each 3-month season using the Rainfall and ENSO tables.**

	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1915	Above	Above	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Above	Above	Above
1916	Below	Below	Below	Normal	Normal	Normal	Normal	Below	Normal	Normal	Above	Normal
1917	Below	Below	Normal	Below	Below	Below	Below	Above	Above	Above	Below	Normal
1918	Normal	Normal	Normal	Normal	Below	Below	Below	Below	Normal	Normal	Normal	Normal
1919	Above	Above	Above	Above	Above	Above	Normal	Below	Below	Below	Normal	Above
1920	Normal	Normal	Above	Above	Normal	Above	Normal	Above	Normal	Above	Above	Above
1921	Normal	Normal	Normal	Normal	Below	Below	Below	Below	Normal	Above	Above	Normal
1922	Below	Below	Below	Normal	Above	Above	Above	Above	Above	Above	Above	Normal
1923	Below	Below	Below	Above	Above	Above	Above	Normal	Below	Below	Below	Normal
1924	Above	Above	Normal	Normal	Below	Below	Below	Normal	Above	Above	Above	Above
1925	Above	Above	Normal	Above	Above	Above	Normal	Below	Below	Below	Above	Above
1926	Above	Above	Normal	Normal	Normal	Normal	Above	Above	Normal	Normal	Below	Below
1927	Below	Below	Normal	Below	Below	Below	Below	Normal	Normal	Below	Below	Below
1928	Below	Normal	Normal	Normal	Normal	Normal	Above	Above	Above	Above	Below	Below
1929	Below	Below	Below	Normal	Above	Above	Normal	Above	Above	Above	Above	Above
1930	Above	Above	Above	Above	Above	Above	Above	Normal	Normal	Normal	Normal	Above
1931	Above	Above	Above	Above	Below	Below	Below	Below	Normal	Below	Below	Below
1932	Below	Normal	Below	Above	Above	Normal	Normal	Below	Above	Normal	Above	Normal
1933	Below	Normal	Above	Above	Normal	Normal	Above	Above	Above	Above	Above	Below
1934	Normal	Normal	Above	Above	Above	Above	Normal	Normal	Below	Below	Below	Below
1935	Below	Below	Normal	Below	Normal	Below	Below	Above	Above	Above	Normal	Above
1936	Above	Above	Above	Normal	Above	Above	Above	Below	Below	Normal	Normal	Above
1937	Normal	Above	Above	Normal	Normal	Below	Normal	Normal	Normal	Above	Normal	Normal
1938	Below	Below	Below	Below	Below	Normal	Below	Below	Below	Normal	Normal	Below
1939	Below	Below	Normal	Normal	Above	Above	Above	Above	Above	Normal	Normal	Normal
1940	Above	Above	Above	Below	Below	Below	Normal	Above	Above	Normal	Below	Above
1941	Above	Above	Above	Above	Normal	Normal	Normal	Normal	Below	Normal	Normal	Above
1942	Above	Above	Above	Above	Above	Normal	Normal	Below	Below	Below	Below	Normal
1943	Below	Below	Normal	Normal	Normal	Normal	Normal	Normal	Below	Below	Below	Below
1944	Below	Below	Below	Normal	Below	Below	Below	Below	Below	Below	Below	Below
1945	Below	Below	Below	Below	Below	Below	Above	Above	Above	Above	Normal	Below
1946	Normal	Normal	Below	Normal	Normal	Above	Normal	Normal	Below	Below	Below	Normal
1947	Normal	Above	Above	Above	Above	Above	Above	Above	Above	Above	Above	Above
1948	Normal	Normal	Below	Below	Below	Below	Below	Above	Above	Above	Below	Below
1949	Below	Below	Below	Below	Normal	Normal	Above	Above	Above	Normal	Normal	Normal

	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1915		NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	N	N	N	N	N
1916	N	N	NN_LN	N	N	N	NN_LN	M_LN	M_LN	M_LN	M_LN	S_LN
1917	M_LN	M_LN	NN_LN	N	N	N	N	N	N	N	N	NN_LN
1918	NN_LN	NN_LN	NN_LN	N	N	N	N	N	NN_EN	NN_EN	M_EN	M_EN
1919	M_EN	M_EN	NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	NN_EN	N	N	N
1920	NN_EN	NN_EN	N	N	N	N	N	N	N	N	N	N
1921	N	NN_LN	NN_LN	NN_LN	N	N	N	N	N	N	N	NN_LN
1922	N	N	N	N	N	N	N	N	N	N	N	N
1923	NN_LN	NN_LN	NN_LN	N	N	N	N	N	NN_EN	NN_EN	NN_EN	NN_EN
1924	NN_EN	N	N	N	N	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN
1925	NN_LN	NN_LN	NN_LN	N	N	N	N	NN_EN	NN_EN	M_EN	M_EN	M_EN
1926	M_EN	M_EN	M_EN	M_EN	NN_EN	NN_EN	NN_EN	N	N	N	N	N
1927	N	N	N	N	N	N	N	N	N	N	N	N
1928	N	N	N	N	N	N	N	N	N	N	N	N
1929	N	N	N	N	N	N	N	N	N	N	NN_EN	N
1930	N	N	N	N	N	N	NN_EN	NN_EN	M_EN	S_EN	S_EN	S_EN
1931	M_EN	M_EN	M_EN	NN_EN	NN_EN	NN_EN	N	N	N	N	N	N
1932	N	N	N	N	N	N	N	N	N	N	N	N
1933	N	N	N	N	N	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN	M_LN	M_LN
1934	M_LN	NN_LN	NN_LN	NN_LN	N	N	N	N	N	N	N	N
1935	N	N	N	N	N	N	N	N	N	N	N	N
1936	N	N	N	N	N	N	N	N	N	N	N	N
1937	N	N	N	N	N	N	N	N	N	N	N	N
1938	N	N	N	N	N	NN_LN	NN_LN	NN_LN	NN_LN	N	NN_LN	NN_LN
1939	NN_LN	NN_LN	NN_LN	N	N	N	N	N	N	N	N	NN_EN
1940	NN_EN	M_EN	M_EN	NN_EN	NN_EN	N	NN_EN	N	N	N	NN_EN	M_EN
1941	M_EN	M_EN	M_EN	M_EN	M_EN	M_EN	NN_EN	NN_EN	NN_EN	M_EN	M_EN	M_EN
1942	NN_EN	N	N	N	N	N	NN_LN	NN_LN	M_LN	M_LN	M_LN	M_LN
1943	M_LN	M_LN	NN_LN	NN_LN	N	N	N	N	N	N	N	N
1944	N	N	N	N	N	N	N	N	N	N	N	N
1945	N	NN_LN	NN_LN	NN_LN	NN_LN	N	NN_LN	NN_LN	NN_LN	NN_LN	NN_LN	N
1946	N	N	N	N	N	N	N	N	N	N	N	N
1947	N	N	N	N	N	N	N	N	NN_LN	NN_LN	N	N
1948	N	N	N	N	N	N	N	N	N	N	N	N
1949	N	N	N	N	N	N	N	N	N	NN_LN	NN_LN	M_LN



Rainfall-ENSO conversion coefficient Matrix

RESULTS

Counts (108 years of data)

DJF	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	3	5	11	16	1	0	0
Normal	3	4	6	14	7	1	1
Above	0	0	2	10	10	8	5

JFM	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	1	8	14	13	0	0	0
Normal	1	1	6	20	7	0	1
Above	0	0	2	16	4	10	4

FMA	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0	5	15	16	0	0	0
Normal	0	1	9	19	5	1	1
Above	0	1	1	20	6	7	1

MAM	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0	2	9	22	2	1	0
Normal	0	2	4	21	7	2	0
Above	0	0	2	27	6	1	0

AMJ	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0	1	9	22	4	0	0
Normal	0	0	5	24	5	2	0
Above	0	1	3	24	7	1	0

MJJ	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0	0	6	22	6	2	0
Normal	0	1	7	19	6	3	0
Above	0	1	3	28	4	0	0

JJA	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0	0	6	23	3	1	2
Normal	0	2	7	19	5	2	1
Above	0	3	4	23	6	0	0

JAS	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0	1	7	21	4	2	1
Normal	0	3	6	18	6	1	2
Above	0	3	5	24	2	1	1

ASO	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0	3	4	16	8	2	3
Normal	1	5	3	18	4	2	3
Above	0	2	8	22	4	0	0

SON	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	2	3	5	17	5	3	1
Normal	0	3	3	17	4	4	5
Above	0	4	10	17	4	1	0

OND	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	5	1	6	17	7	0	0
Normal	0	1	7	16	3	6	3
Above	0	7	6	9	4	5	4

NDJ	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	3	4	9	17	2	0	1
Normal	4	3	7	14	7	1	0
Above	1	1	2	10	6	8	8

Probabilities

DJF	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.50	0.56	0.58	0.40	0.06	0.00	0.00
Normal	0.50	0.44	0.32	0.35	0.39	0.11	0.17
Above	0.00	0.00	0.11	0.25	0.56	0.89	0.83

JJA	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.33	0.00	0.35	0.35	0.21	0.33	0.67
Normal	0.33	0.40	0.41	0.29	0.36	0.67	0.33
Above	0.33	0.60	0.24	0.35	0.43	0.00	0.00

JFM	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.50	0.89	0.64	0.27	0.00	0.00	0.00
Normal	0.50	0.11	0.27	0.41	0.64	0.00	0.20
Above	0.00	0.00	0.09	0.33	0.36	1.00	0.80

JAS	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.33	0.14	0.39	0.33	0.33	0.50	0.25
Normal	0.33	0.43	0.33	0.29	0.50	0.25	0.50
Above	0.33	0.43	0.28	0.38	0.17	0.25	0.25

FMA	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.33	0.71	0.60	0.29	0.00	0.00	0.00
Normal	0.33	0.14	0.36	0.35	0.45	0.13	0.50
Above	0.33	0.14	0.04	0.36	0.55	0.88	0.50

ASO	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.00	0.30	0.27	0.29	0.50	0.50	0.50
Normal	1.00	0.50	0.20	0.32	0.25	0.50	0.50
Above	0.00	0.20	0.53	0.39	0.25	0.00	0.00

MAM	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.33	0.50	0.60	0.31	0.13	0.25	0.33
Normal	0.33	0.50	0.27	0.30	0.47	0.50	0.33
Above	0.33	0.00	0.13	0.39	0.40	0.25	0.33

SON	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	1.00	0.30	0.28	0.33	0.38	0.38	0.17
Normal	0.00	0.30	0.17	0.33	0.31	0.50	0.83
Above	0.00	0.40	0.56	0.33	0.31	0.13	0.00

AMJ	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.33	0.50	0.53	0.31	0.25	0.00	0.33
Normal	0.33	0.00	0.29	0.34	0.31	0.67	0.33
Above	0.33	0.50	0.18	0.34	0.44	0.33	0.33

OND	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	1.00	0.11	0.32	0.40	0.50	0.00	0.00
Normal	0.00	0.11	0.37	0.38	0.21	0.55	0.43
Above	0.00	0.78	0.32	0.21	0.29	0.45	0.57

MJJ	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.33	0.00	0.38	0.32	0.38	0.40	0.33
Normal	0.33	0.50	0.44	0.28	0.38	0.60	0.33
Above	0.33	0.50	0.19	0.41	0.25	0.00	0.33

NDJ	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.38	0.50	0.50	0.41	0.13	0.00	0.11
Normal	0.50	0.38	0.39	0.34	0.47	0.11	0.00
Above	0.13	0.13	0.11	0.24	0.40	0.89	0.89

EXAMPLE CALCULATIONS
NOV 2023

ENSO Strengths

This table shows the forecast probability (%) of Niño-3.4 index exceeding a certain threshold (in degrees Celsius).
For negative thresholds, the table shows the probability (%) of a Niño-3.4 index value that is less than (more negative) that value.
For positive thresholds, the table shows the probability (%) of a Niño-3.4 index value that is greater than (more positive) that value.
This tool supports the official ENSO Diagnostic discussion updated on the 2nd Thursday of each month.

Target	< -1.5°C	< -1.0°C	< -0.5°C	> 0.5°C	> 1.0°C	> 1.5°C
SON	~0	~0	~0	~100	~100	83
OND	~0	~0	~0	~100	99	77
NDJ	~0	~0	~0	~100	97	75
DJF	~0	~0	~0	99	92	62
JFM	~0	~0	~0	97	81	42
FMA	~0	~0	~0	91	59	19
MAM	~0	~0	~0	80	37	6
AMJ	~0	~0	1	61	20	2
MJJ	~0	~0	6	41	11	1
	< -1.5°C	< -1.0°C	< -0.5°C	> 0.5°C	> 1.0°C	> 1.5°C

The values are based on the analysis published in:

L'Heureux, M. L., Tippett, Michael K., Takahashi, Ken, Barnston, Anthony G., Becker, Emily J., Bell, Gerald D., Di Liberto, Tom E., Gottschalck, Jon, Halpert, Michael S., Hu, Zeng-Zhen, Johnson, Nathaniel C., Xue, Yan, and Wang, Wanqiu, 2019: Strength Outlooks for the El Niño-Southern Oscillation. Wea. Forecasting, 34, 165-175, https://doi.org/10.1175/WAF-D-18-0126.1.

NDJ	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.38	0.50	0.50	0.41	0.13	0.00	0.11
Normal	0.50	0.38	0.39	0.34	0.47	0.11	0.00
Above	0.13	0.13	0.11	0.24	0.40	0.89	0.89

$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0.03 \\ 0.22 \\ 0.75 \end{bmatrix}_{7x1}^{NDJ} \Rightarrow \begin{bmatrix} 0.0864 \\ 0.0383 \\ 0.8753 \end{bmatrix}$$

AMJ	S_LN	M_LN	NN_LN	N	NN_EN	M_EN	S_EN
Below	0.33	0.50	0.53	0.31	0.25	0.00	0.33
Normal	0.33	0.00	0.29	0.34	0.31	0.67	0.33
Above	0.33	0.50	0.18	0.34	0.44	0.33	0.33

$$\begin{bmatrix} 0 \\ 0 \\ 0.01 \\ 0.38 \\ 0.41 \\ 0.18 \\ 0.02 \end{bmatrix}_{7x1}^{AMJ} \Rightarrow \begin{bmatrix} 0.2339 \\ 0.3880 \\ 0.3781 \end{bmatrix}$$

Nov 2023 PrefScen for CPA

```
1  // Run name
2  PrefSce
3  // Current Month
4  11
5  // Outlook Probability for Nov 2023 Precipitation from CPC Map, Oct 24
6  0.225
7  0.450
8  // Outlook Probability 12 3-monthly seasons based on ENSO Strength Forecasts and ENSO to Rain Probability Conversion
9  //NDJ    DJF    JFM FMA MAM AMJ MJJ JJA JAS   ASO   SON    OND
10 0.087   0.008   0.008   0.026   0.218   0.234   0.201   0.333   0.333   0.333   0.333   0.333
11 0.126   0.175   0.206   0.348   0.653   0.622   0.433   0.667   0.667   0.667   0.667   0.667
12
```