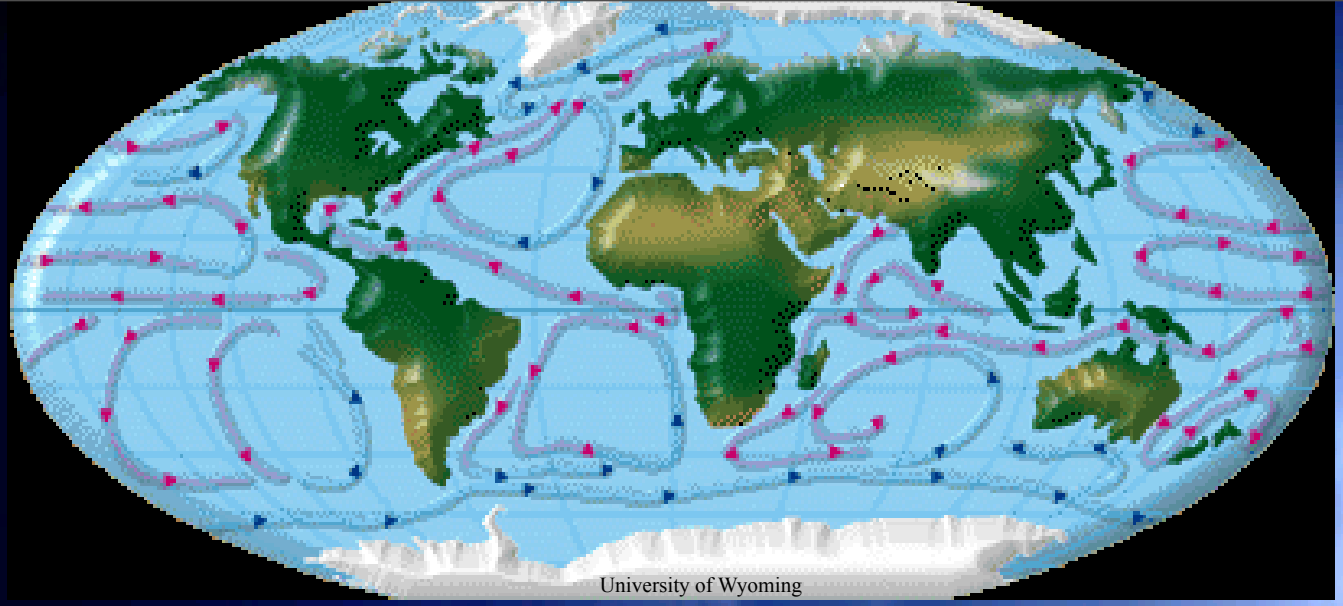


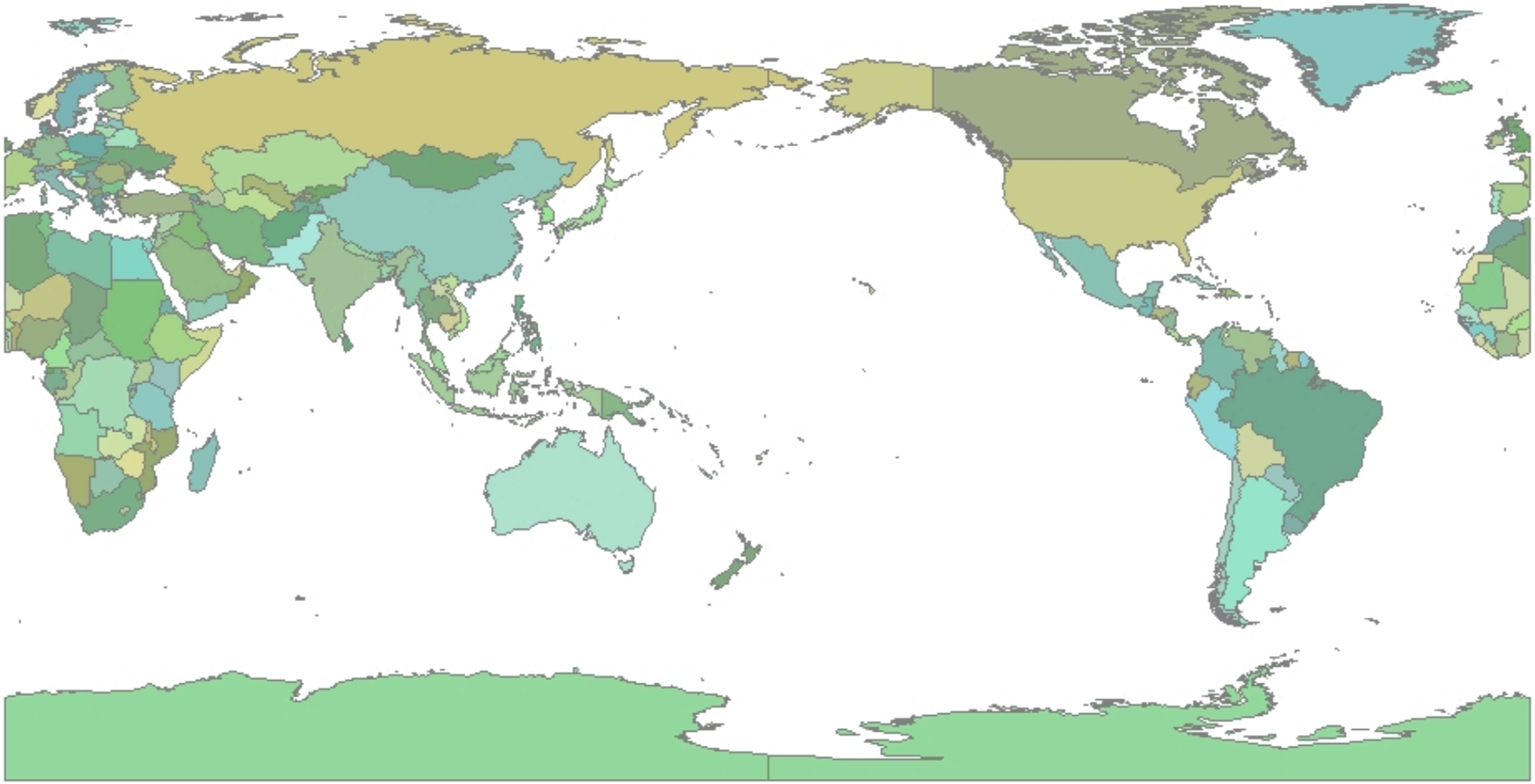
Ocean – Atmosphere Interactions: Their Affect on Western U.S. Precipitation

- Sea Surface Temperature Anomalies
- Long Term Climate Indices

Greg Smith – Hydrometeorologist

Colorado Basin River Forecast Center/NWS/NOAA

Influence of Ocean Surface Temperatures on Western U.S. Winter Precipitation



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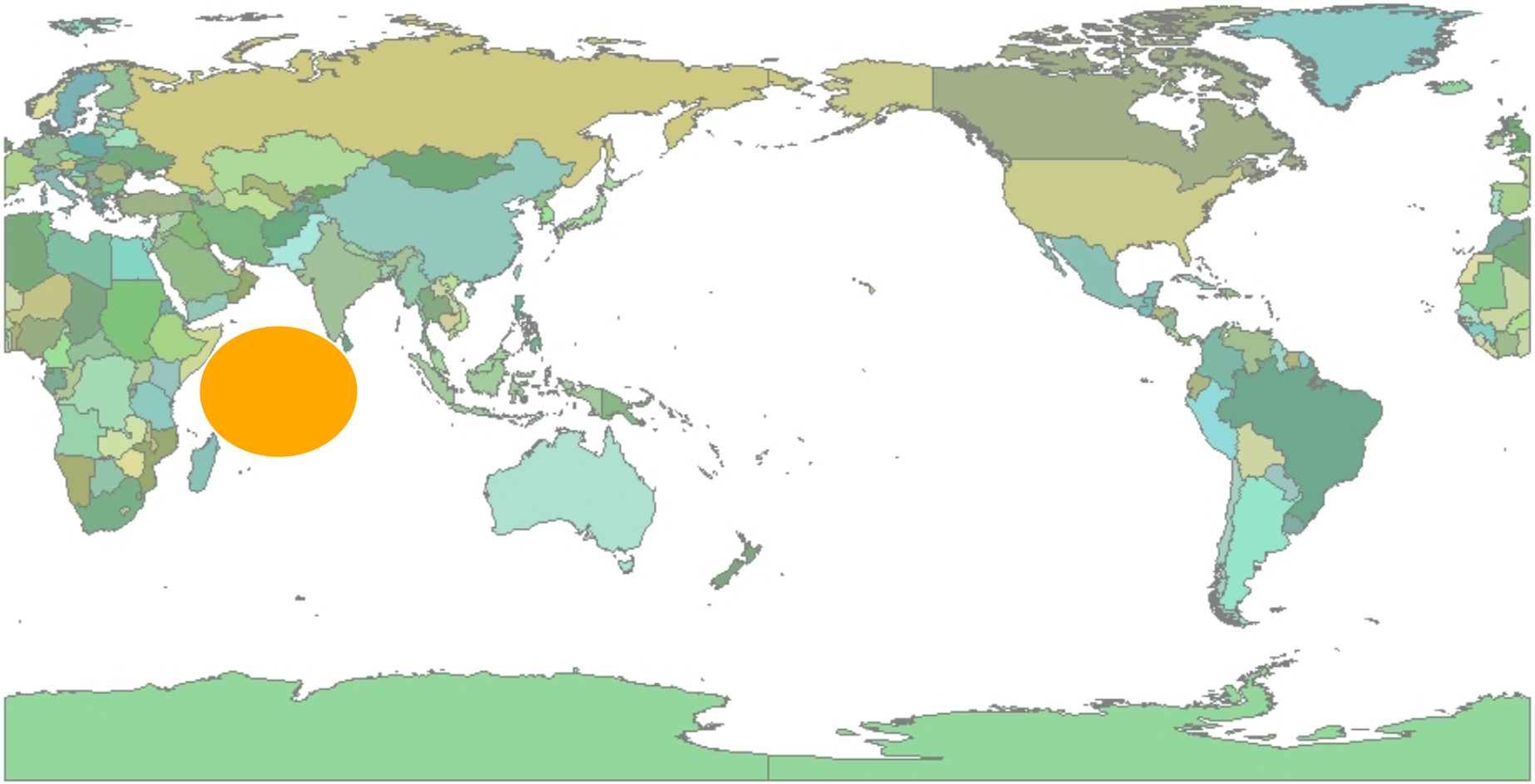

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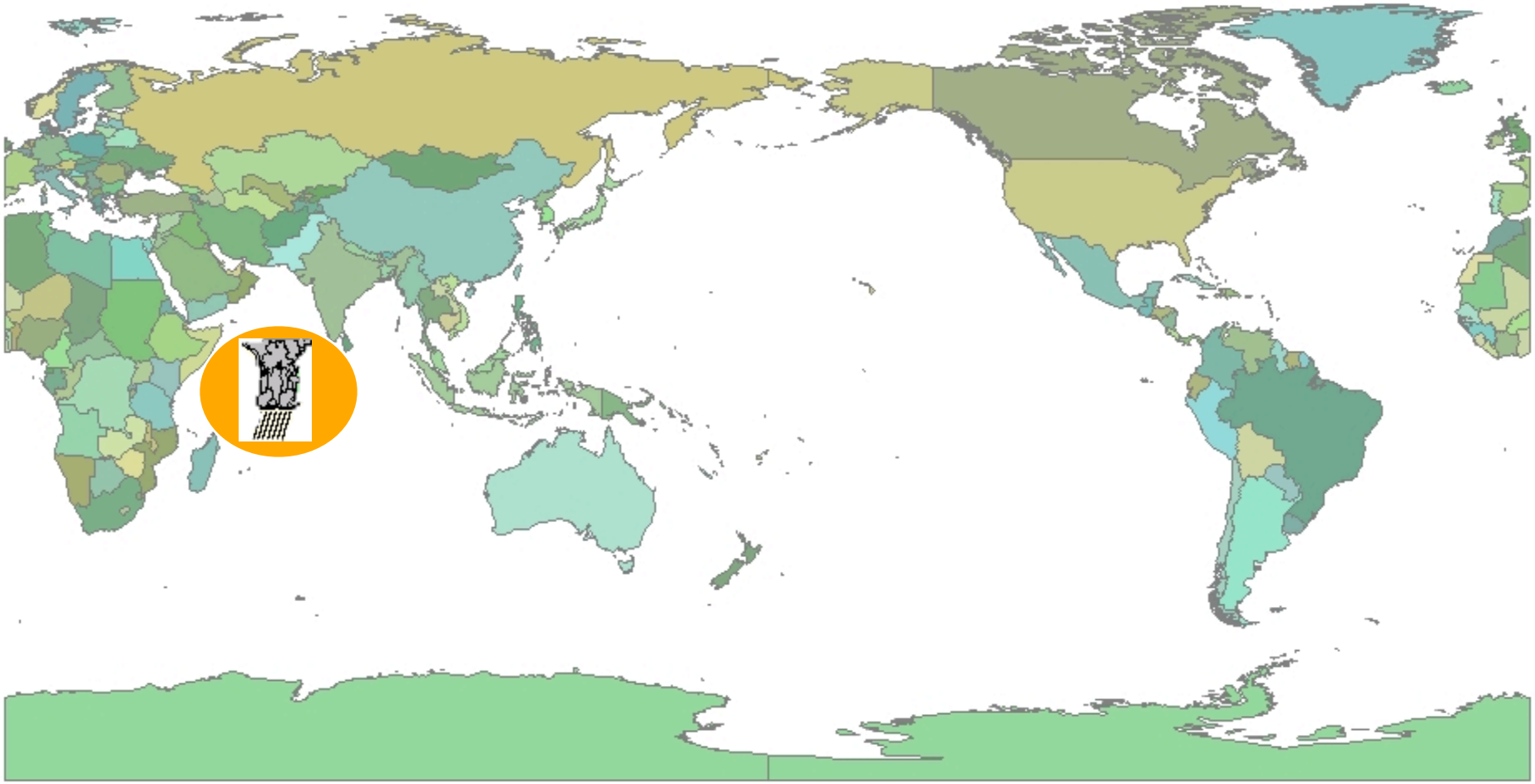

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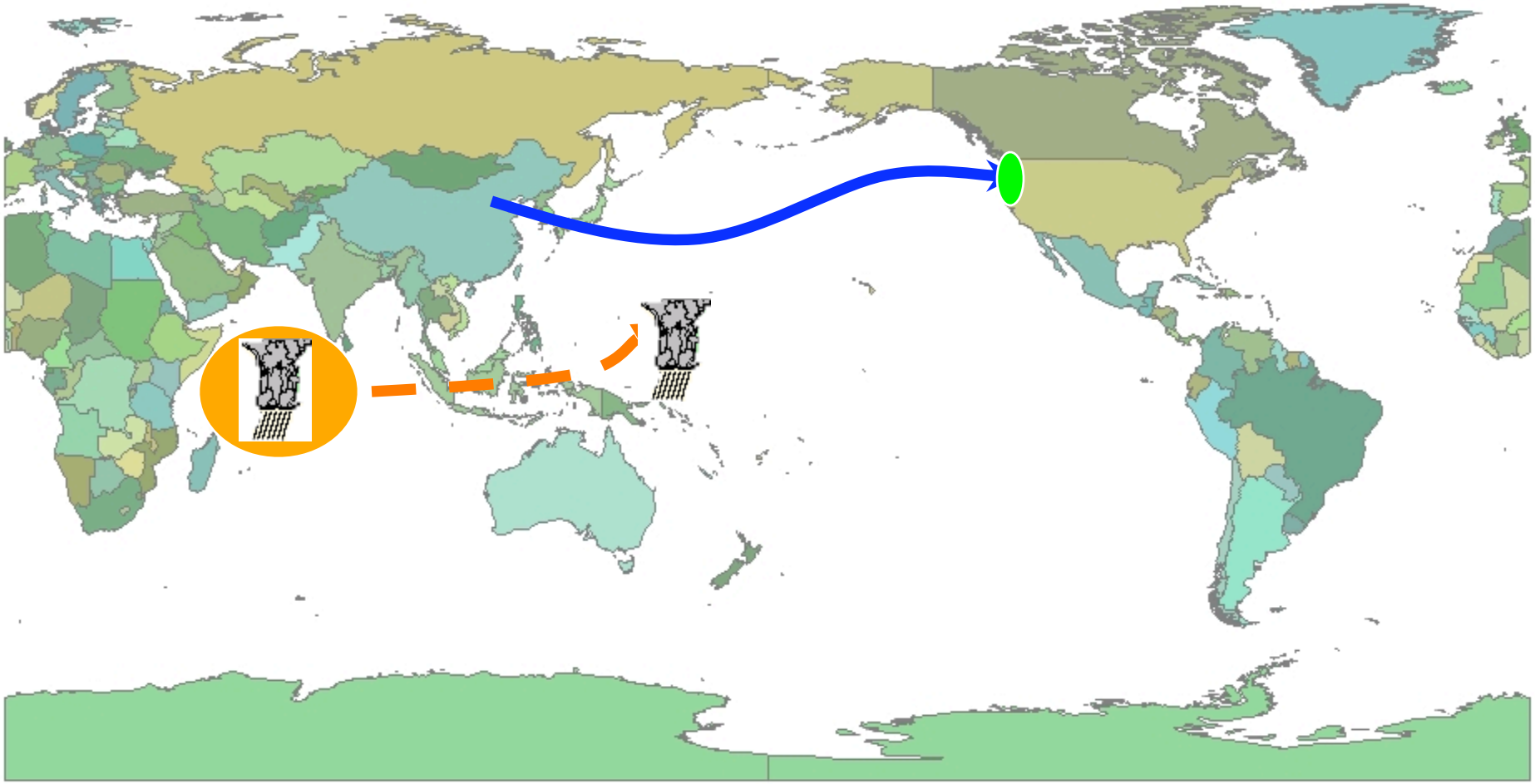

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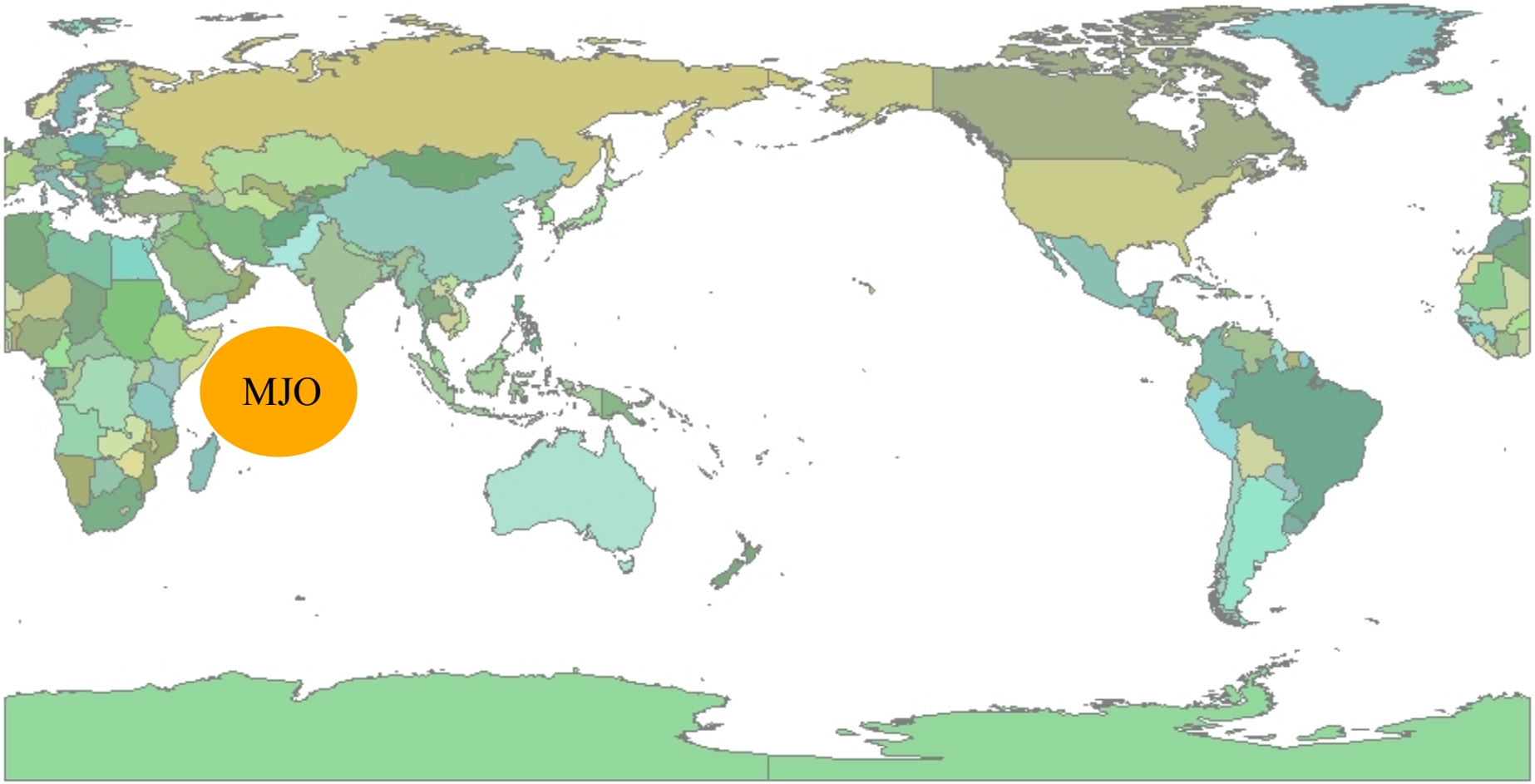

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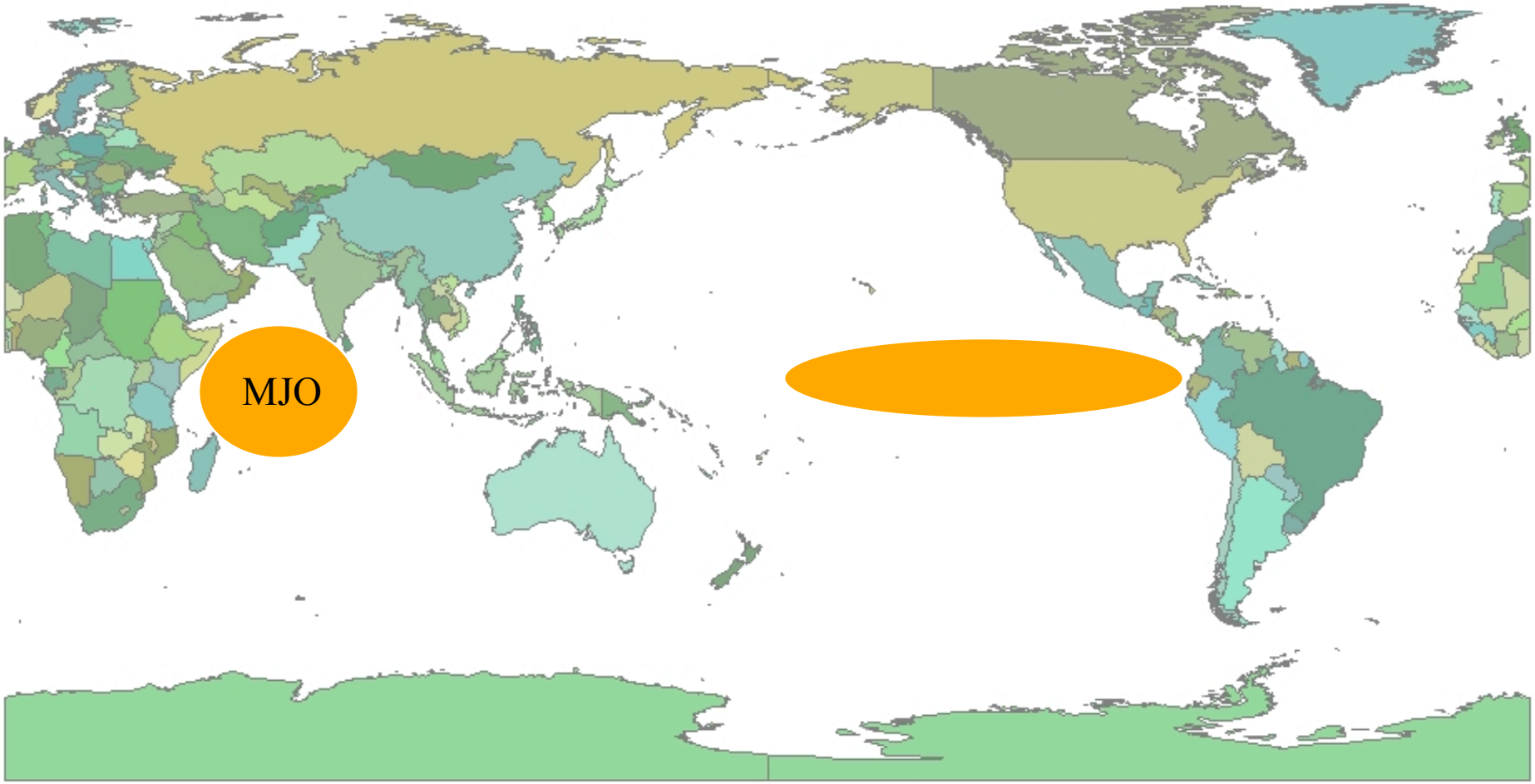

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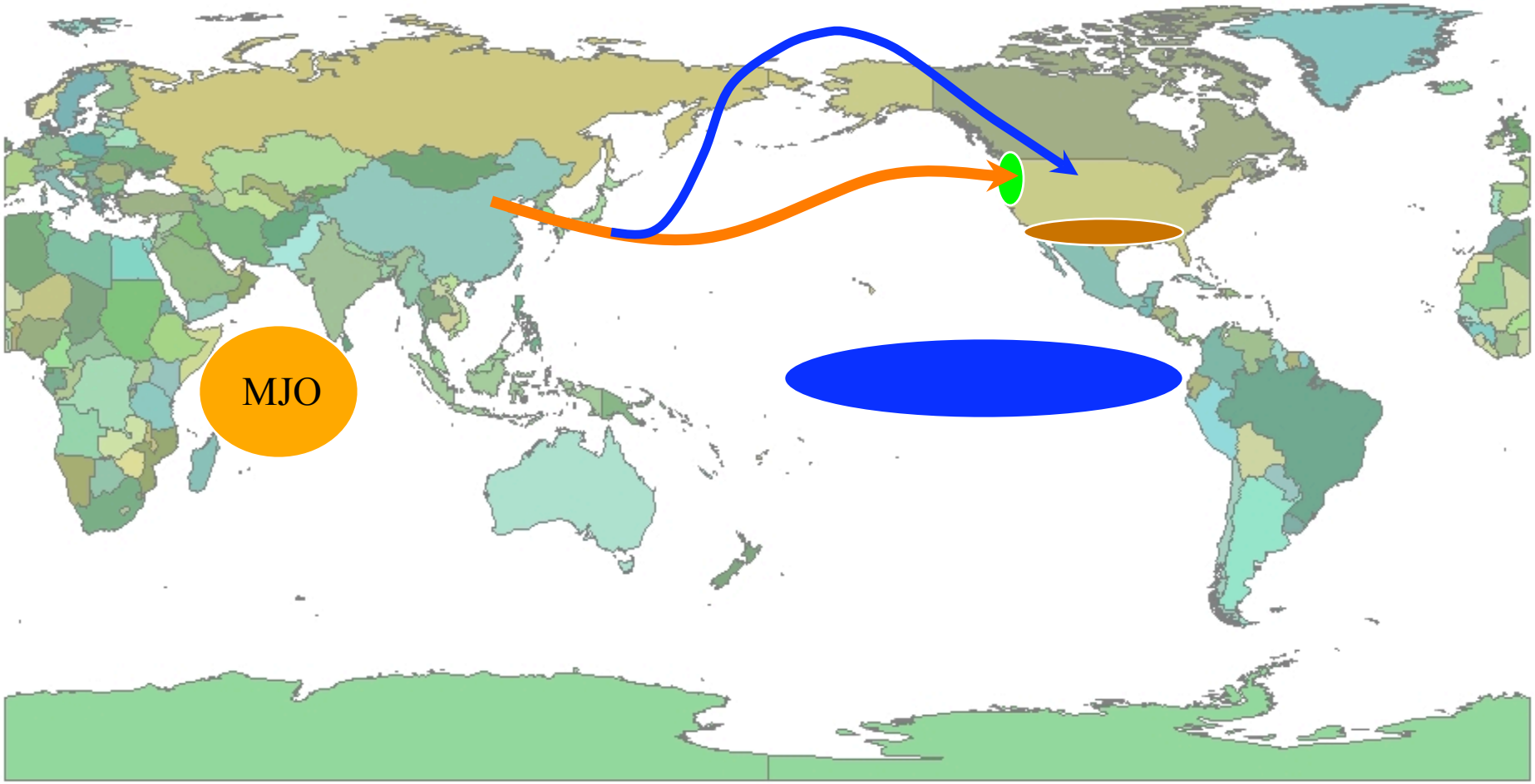

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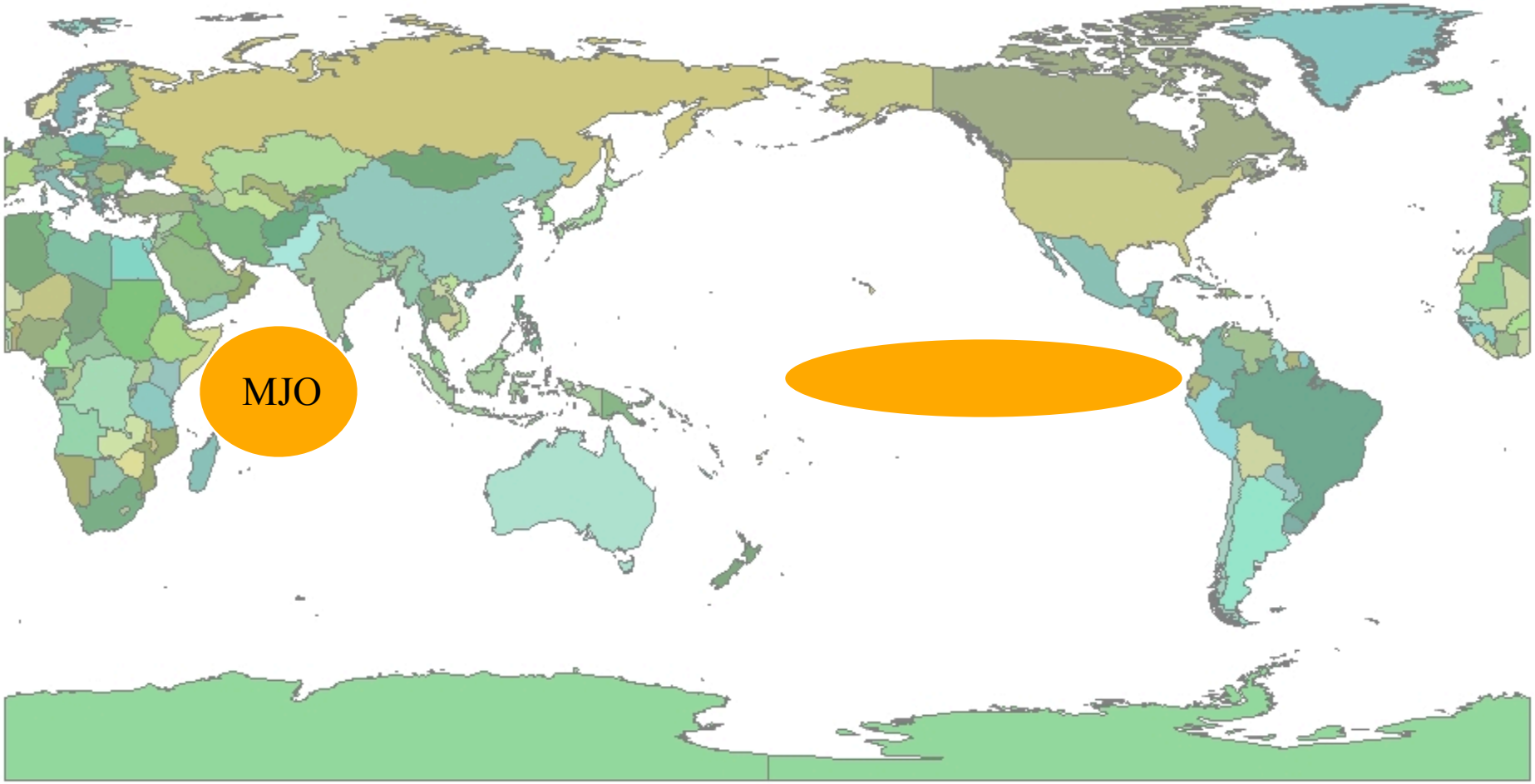

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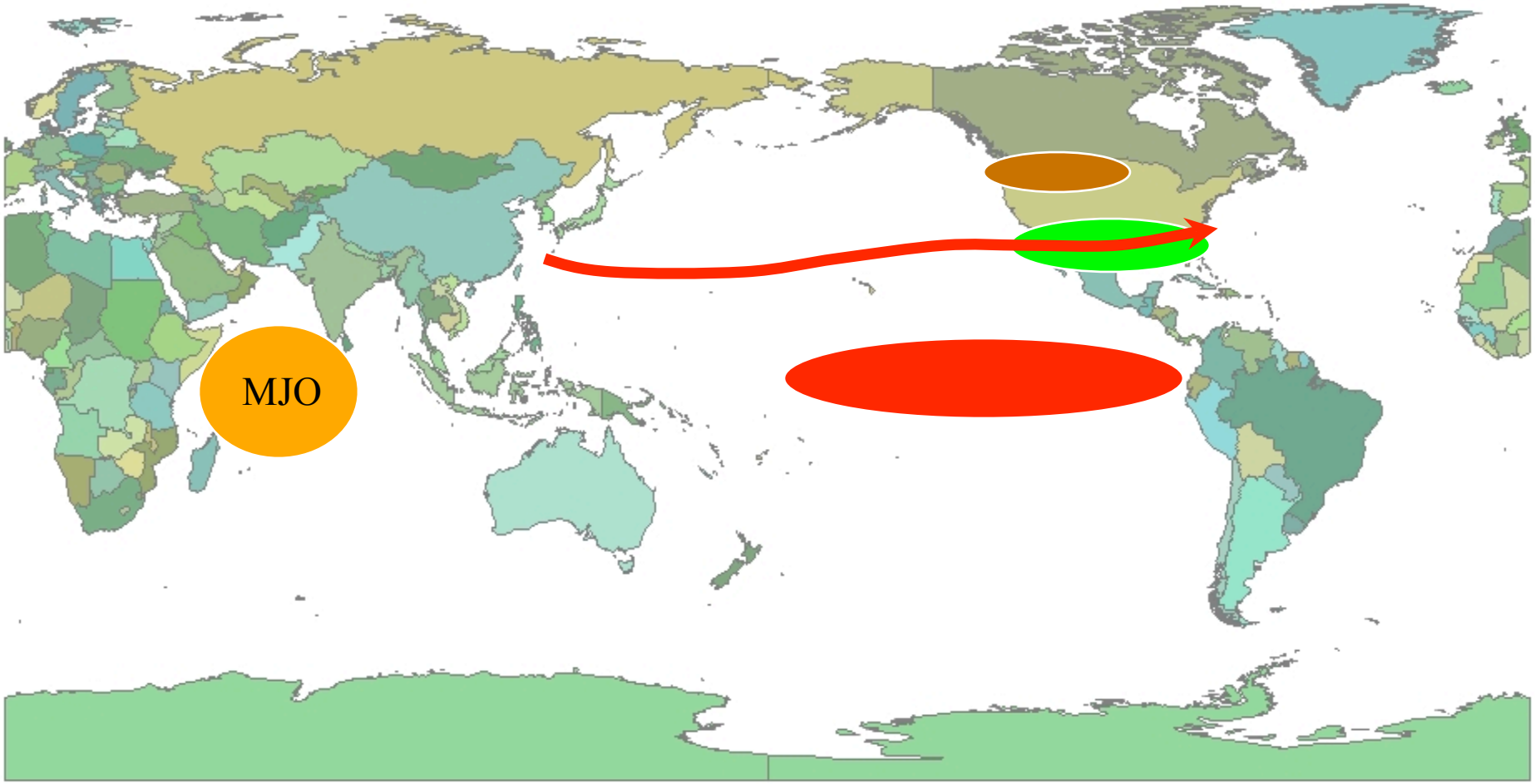

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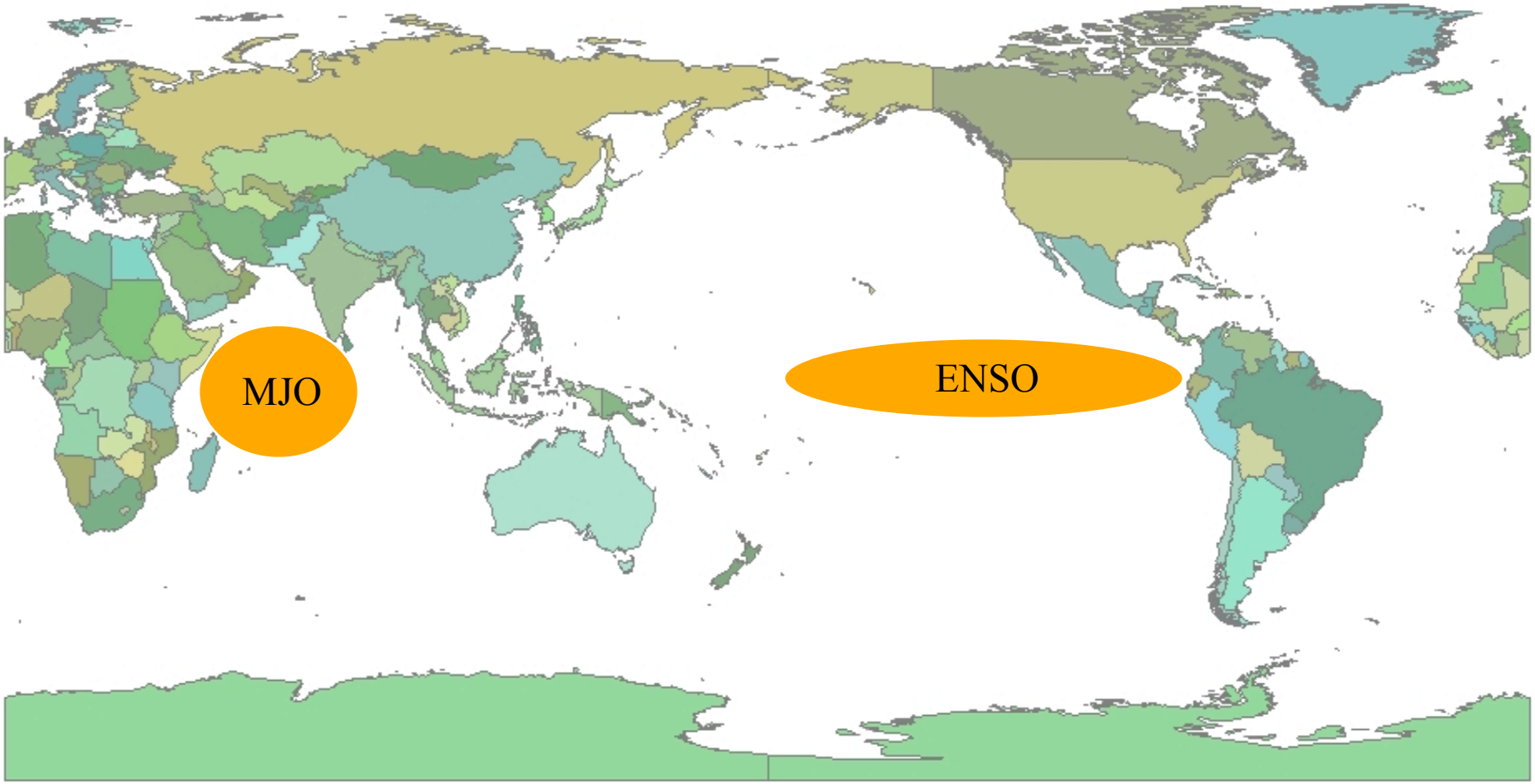

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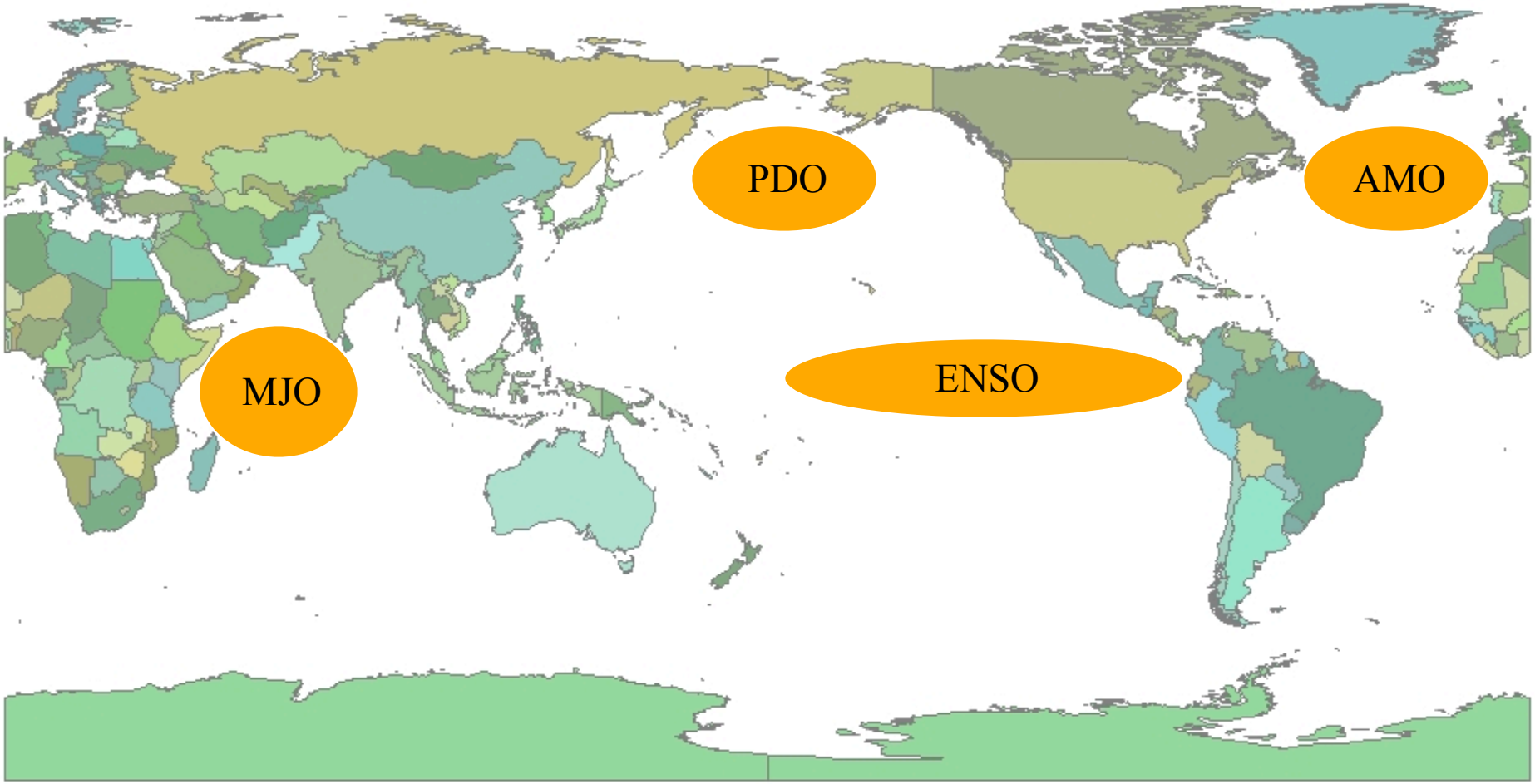

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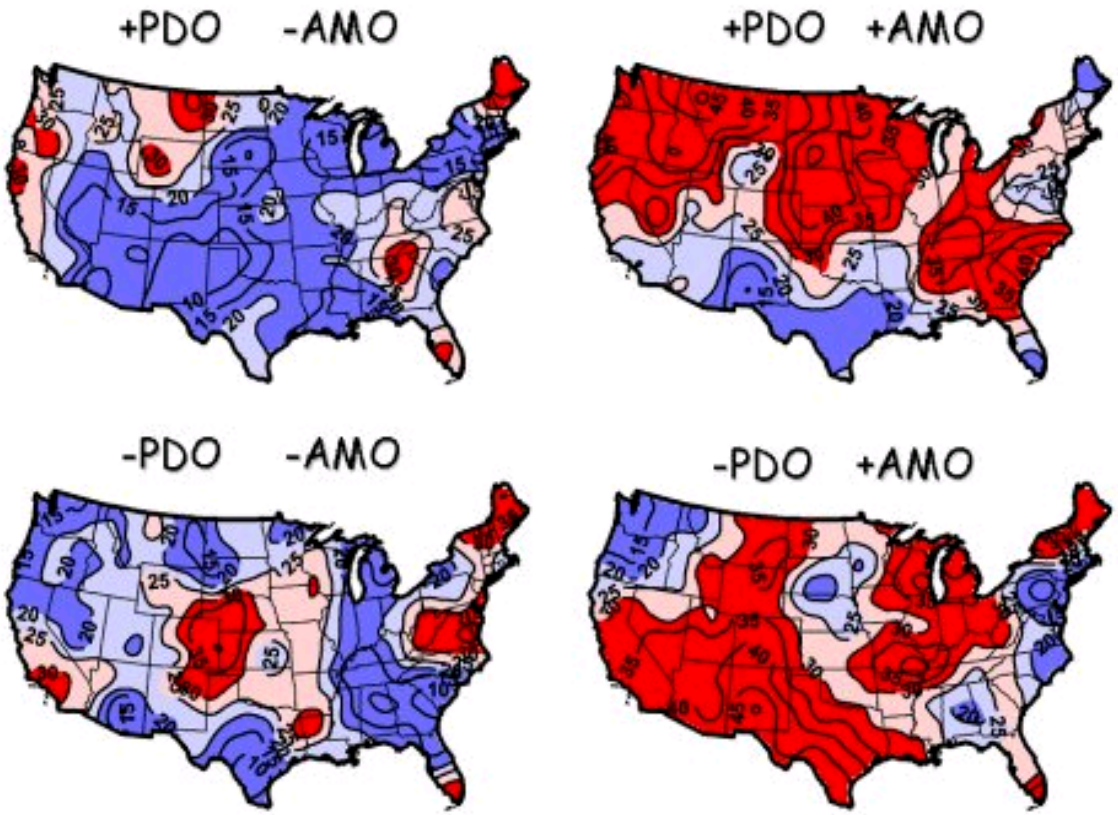
Pacific Decadal (PDO) / Atlantic Multi-Decadal (AMO): 20-60 yrs => Long term drought frequency

AMO / PDO Relationship to Rainfall Frequency over North America



25% = normal drought frequency

Areas of high (red > 25%) and low (blue < 25%) drought frequencies associated with complimentary modes of the PDO and AMO. Note the greater extent of U.S. drought associated with warming in the North Atlantic Ocean.

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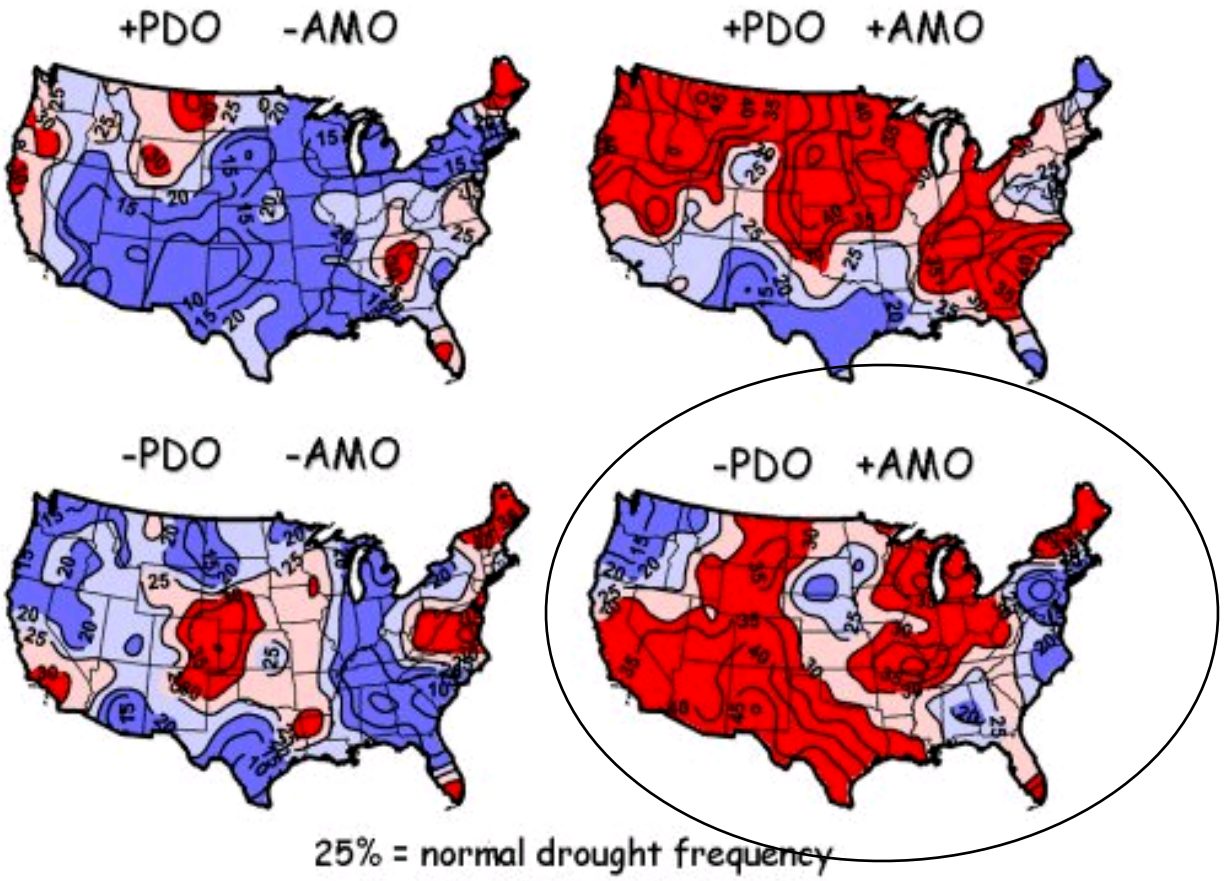

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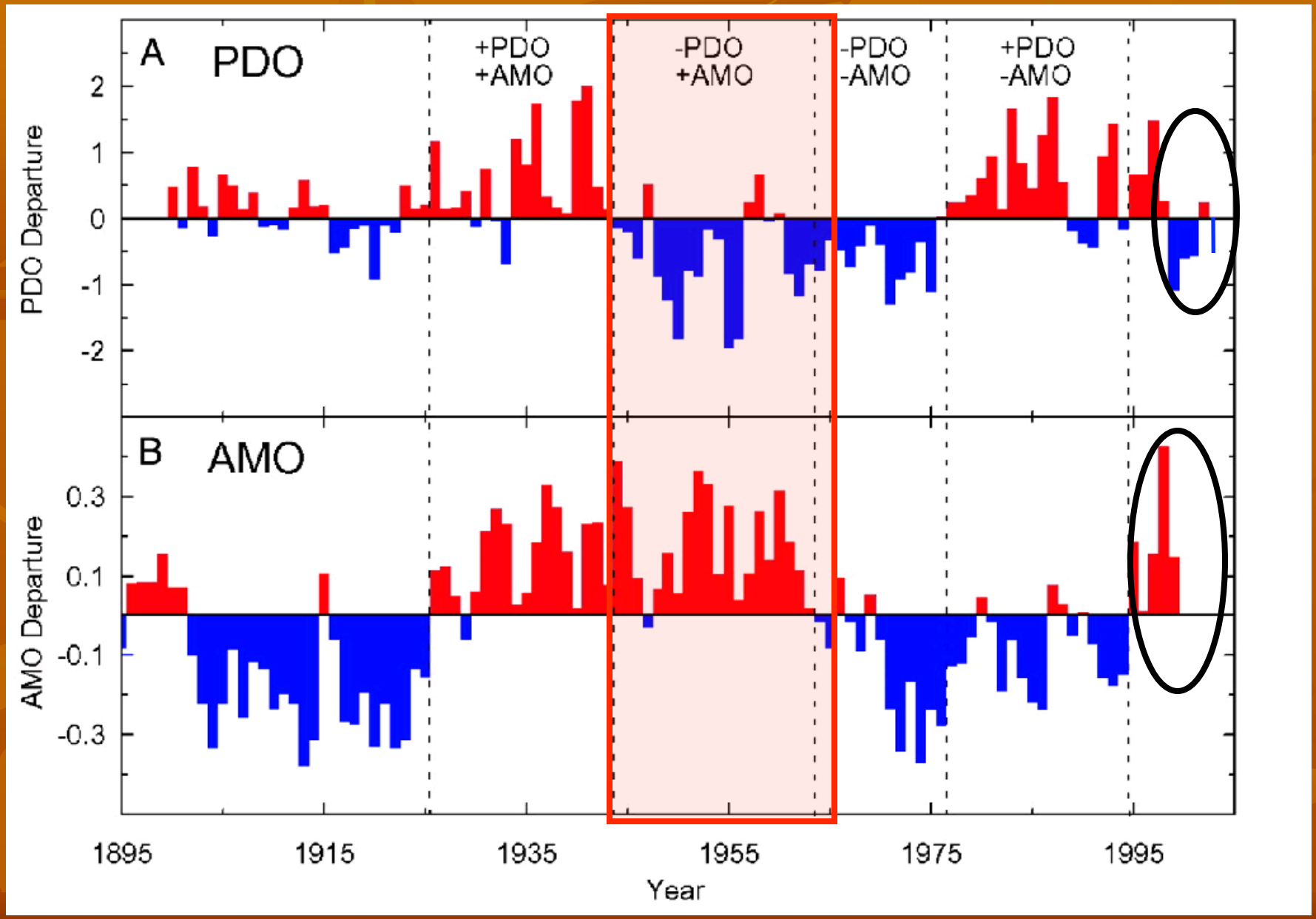
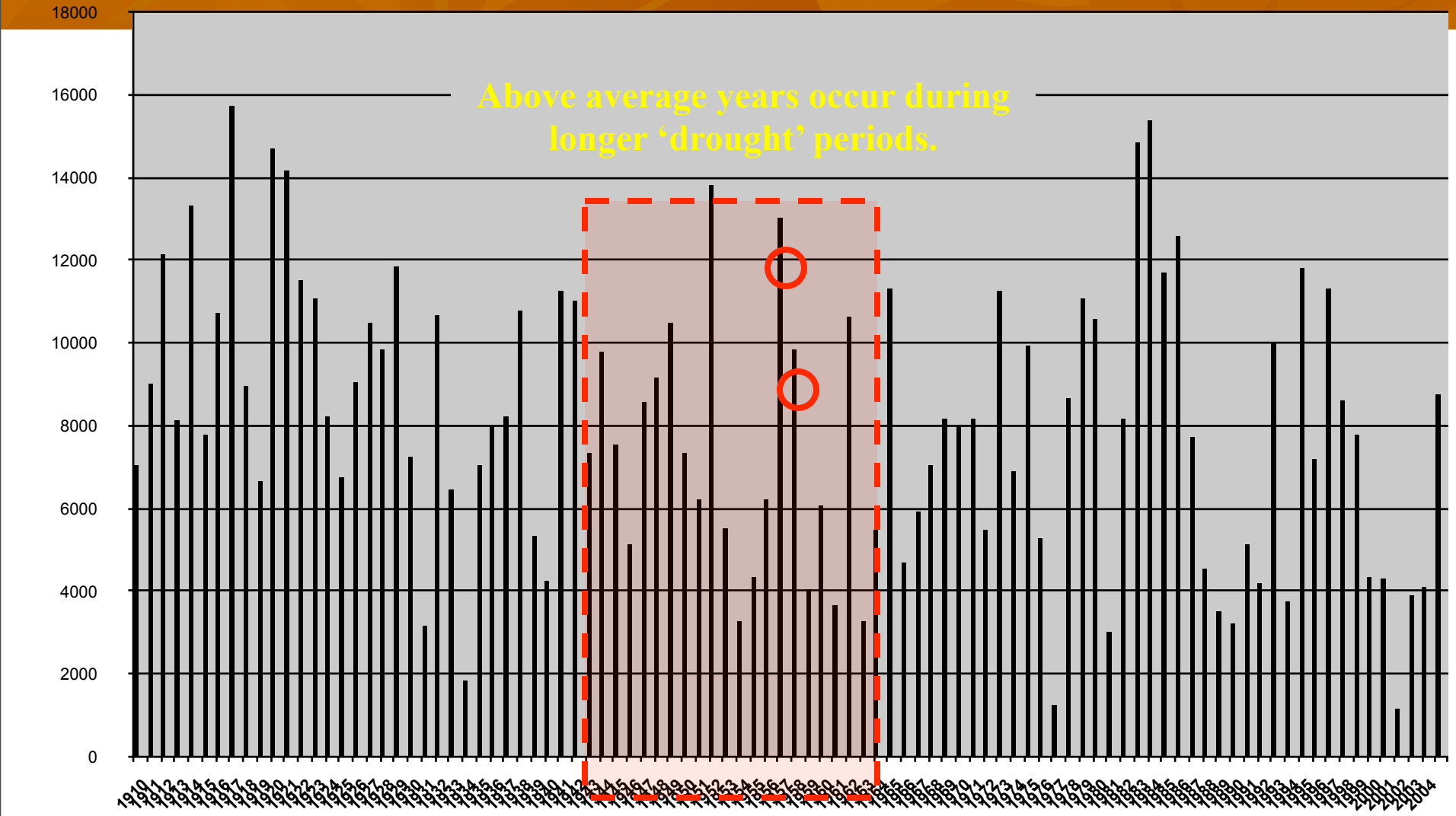
Historical PDO / AMO Time Series



Historical PDO / AMO and Lake Powell Inflow

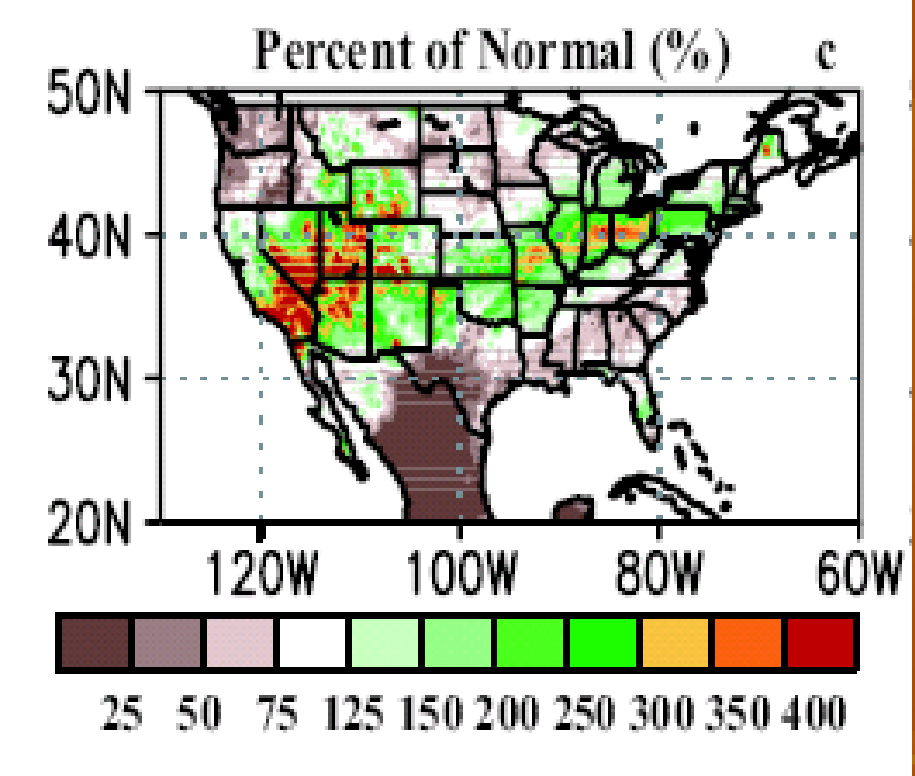


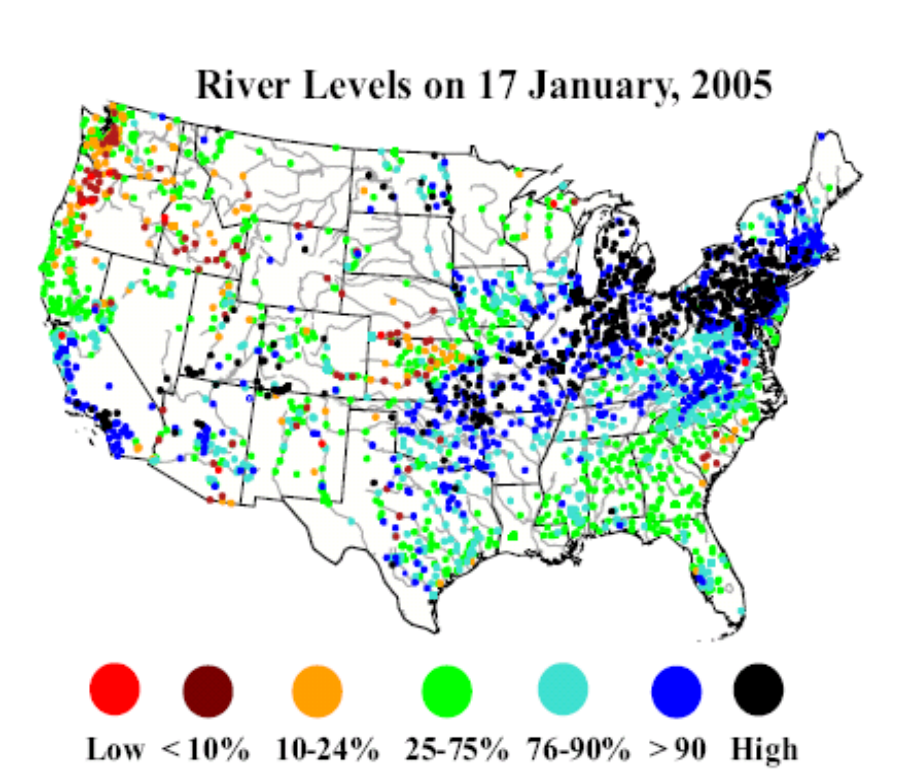
MJO Influenced Precipitation:

December 17 2004 – January 5th 2005 Western US Precipitation Event:

AMO In Positive Phase and PDO near neutral - trending toward negative by late 2005.
ENSO Neutral to weak El Niño

=> Heavy precipitation / snowfall attributed to MJO activity





Source: G. Bell / W. Higgens – CPC/NOAA/NWS

Figure: Courtesy USGS

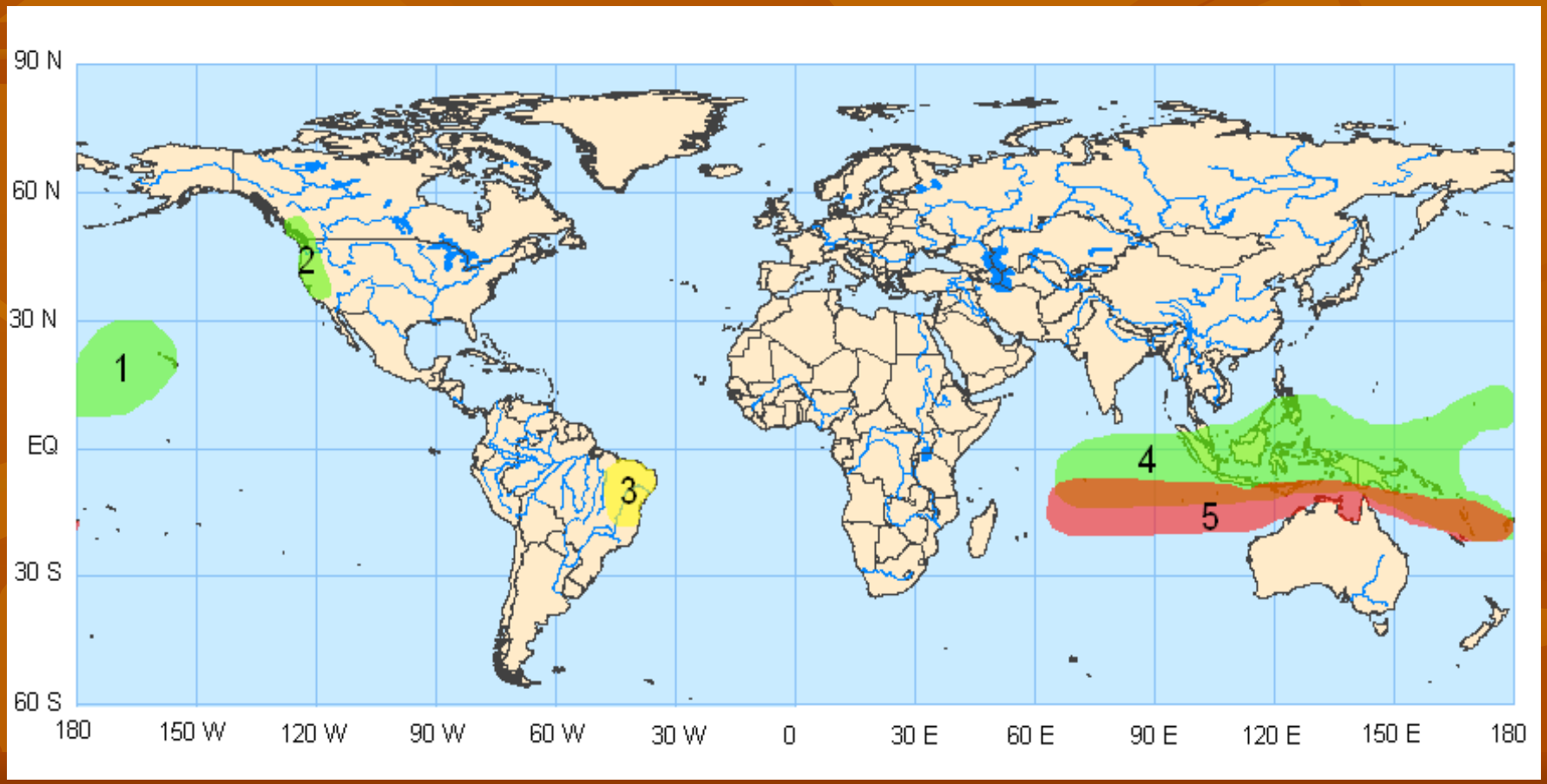
MJO Discussion: February 26 2006:

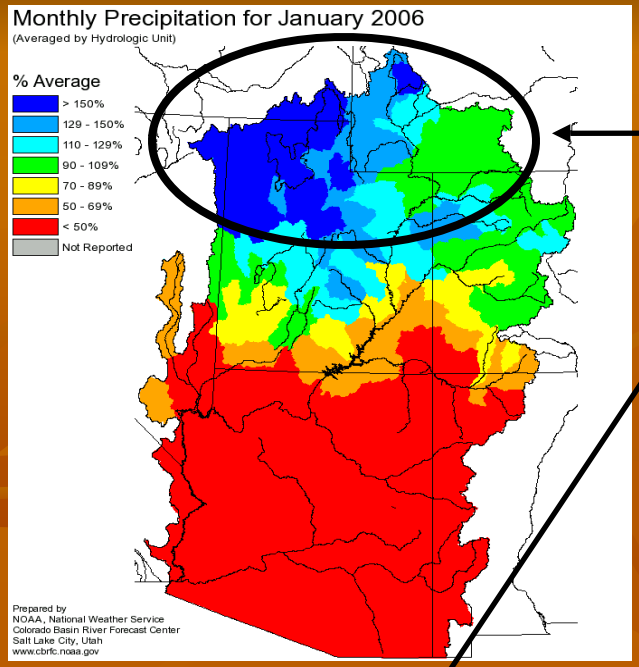
Weak to Moderate MJO Event with existing weak La Niña Conditions

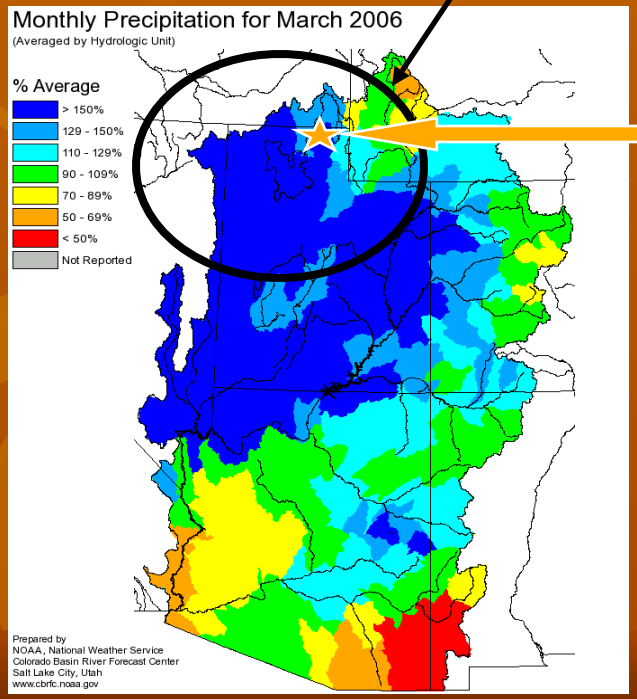
(AMO Positive / PDO Positive to Neutral)

Potential Benefits/Hazards Forecast

Valid February 28 – March 6, 2006







MJO Influenced Precipitation

January & March 2006

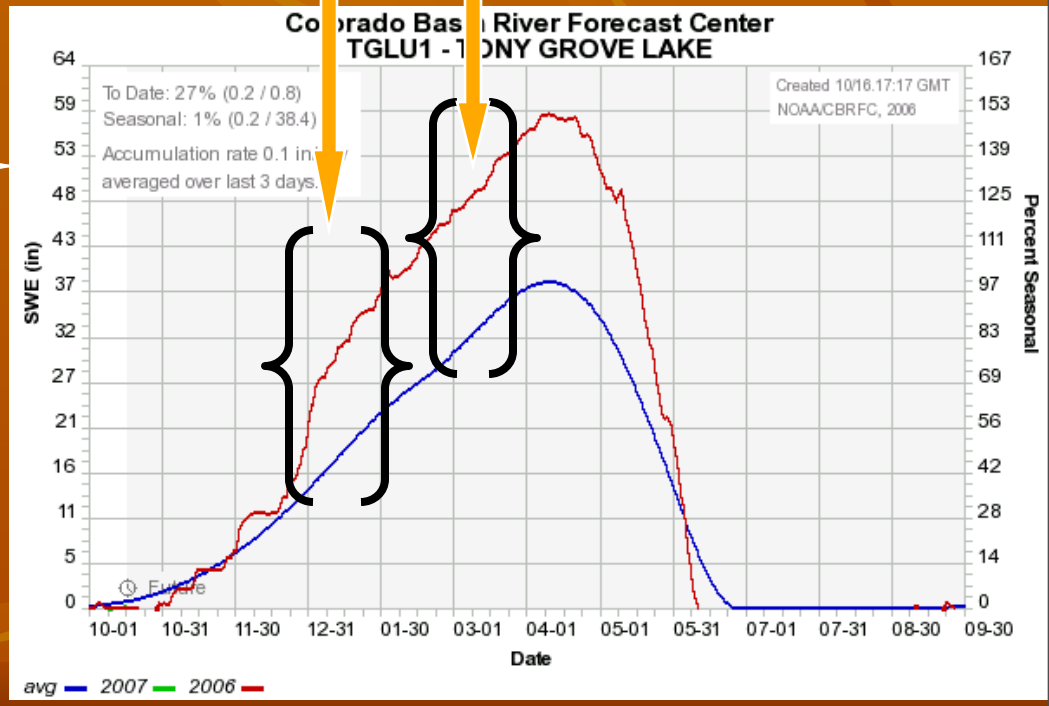
Enso: Neutral to very weak La Niña

Jan-2006

163 % Avg.

Mar-2006

120 % Avg.



What to make of long term climate trend information ?

Smaller scale atmospheric phenomena (intraseasonal MJO or interannual ENSO) may more directly influence and explain climate and streamflow volumes on a season by season basis.

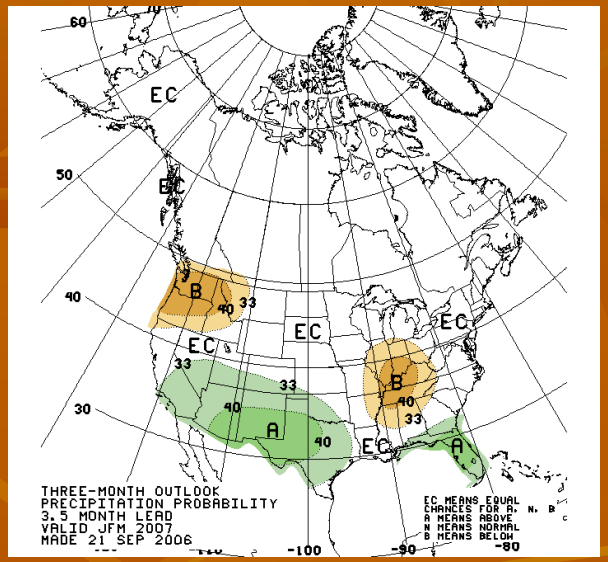
Large scale ocean temperature oscillations offer more value as a diagnostic versus prognostic tool.

Results are not always consistent with indices climate trends / patterns. They only offer a partial explanation of variation in weather and climate.

On a season by season basis a long term climatic trend, if one exists, may not hold at the spatial scale of the Colorado or smaller basin of interest. The time and spatial scale of the operations need to be considered when utilizing climate information.

Utilizing Climate Indices / Trends in Forecast:

CBRFC Operations Time Scale : Hourly to Annual



ENSO: Sea Surface Temperature Anomalies

MJO

➢ Near Term

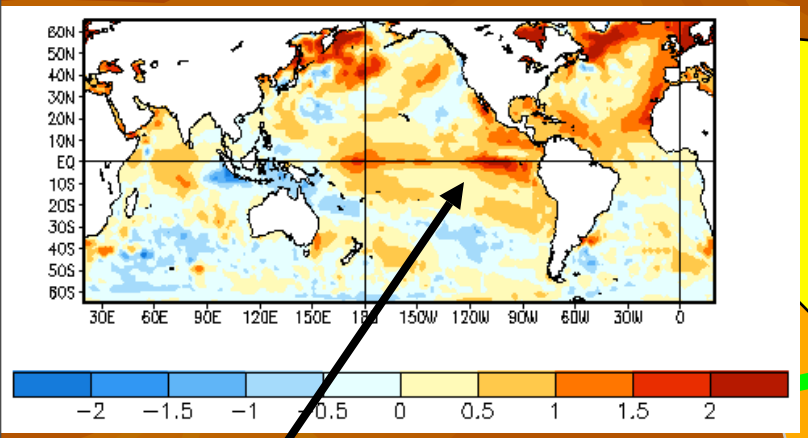
➢ Statistical Methods

➢ Extended Streamflow Ensemble

Colorado Basin Precipitation Patterns During El Niño

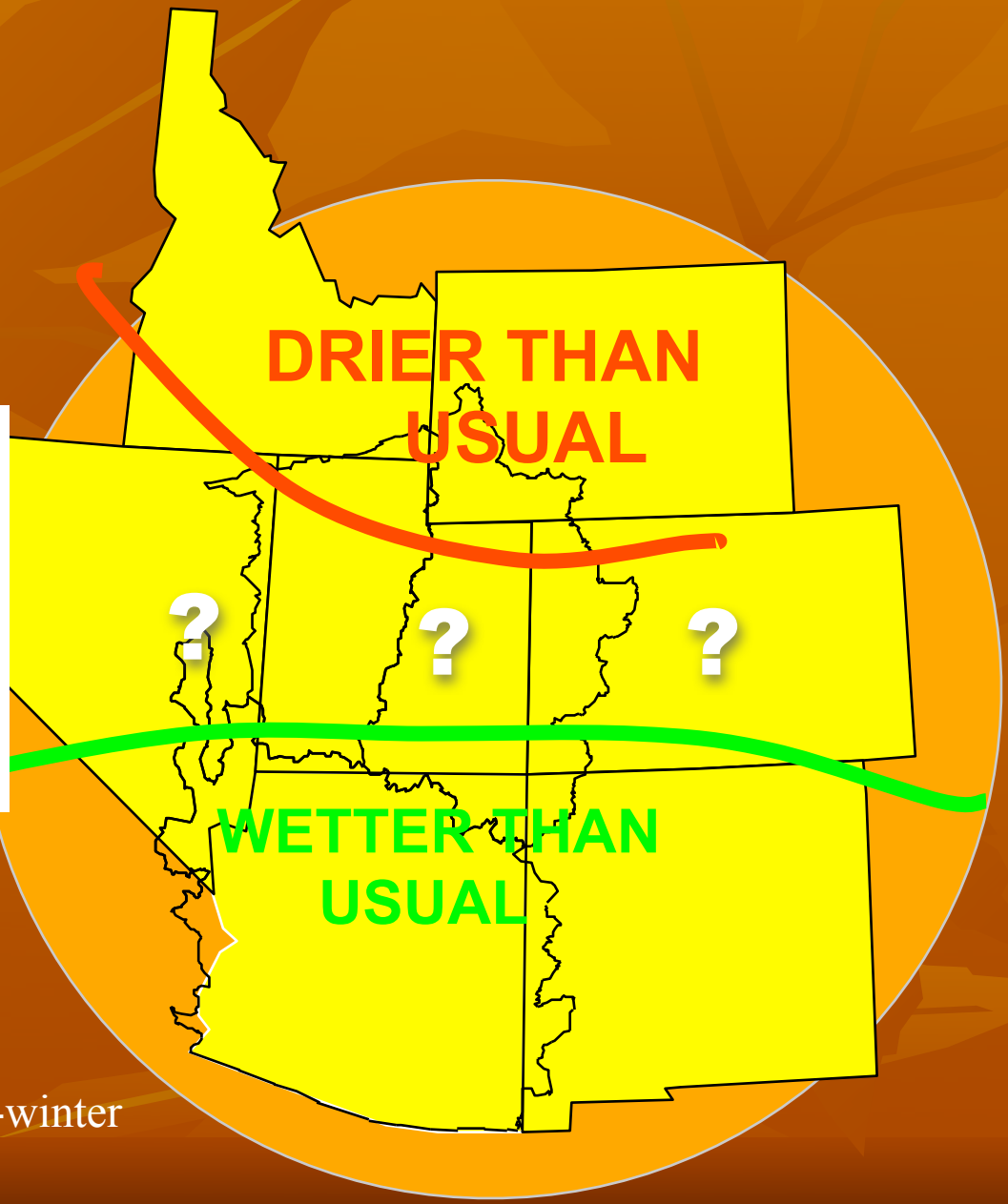
CURRENT CONDITION

Global SST Departures (Deg C):
17 September-14 October 2006

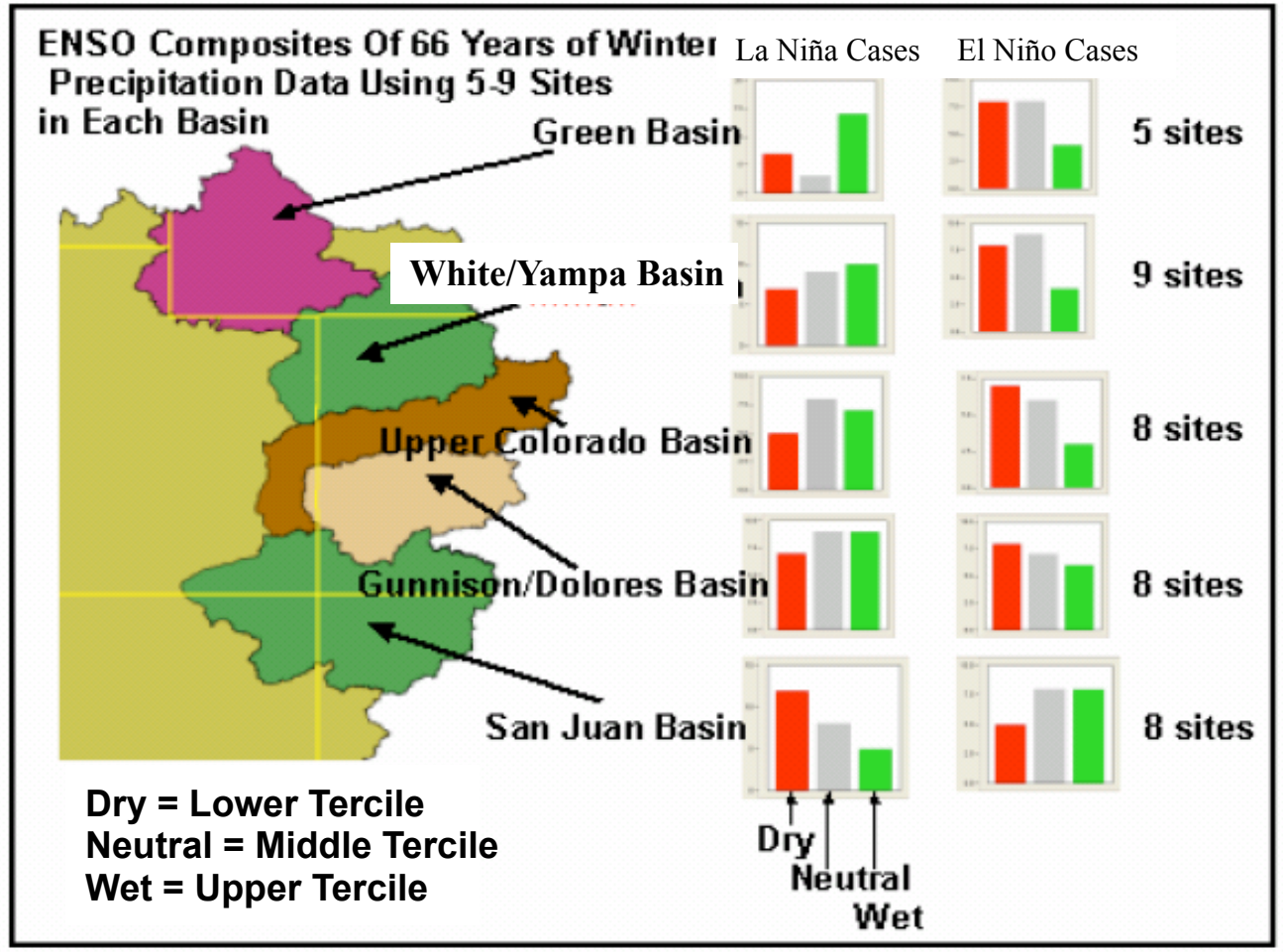


Weak El Nino Exists

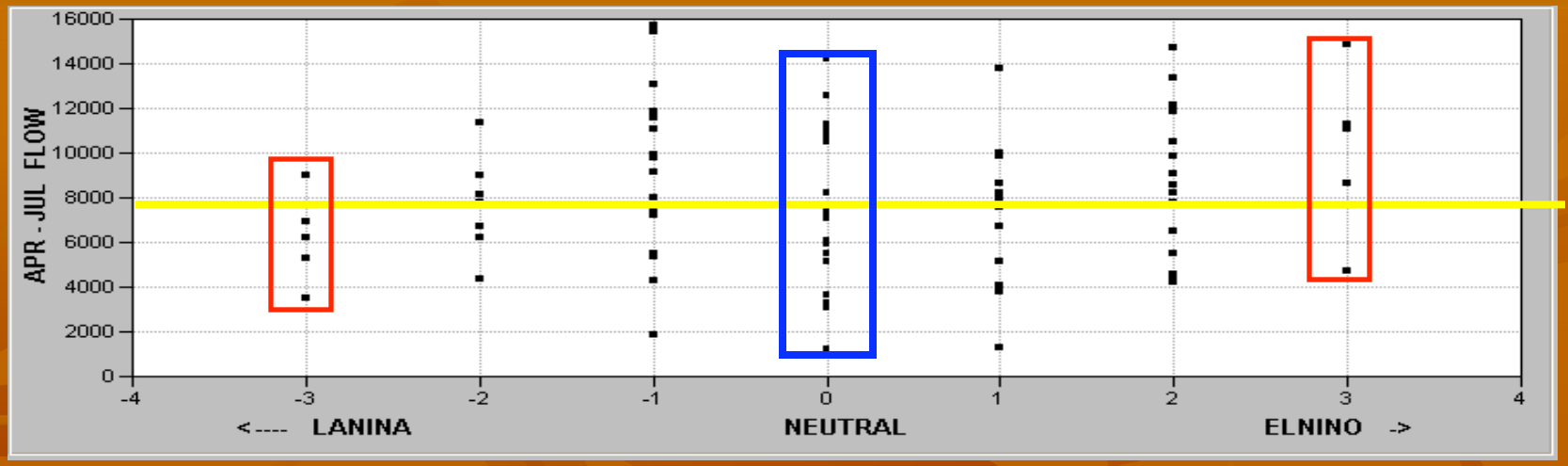
May become 'Moderate Event' by mid-winter



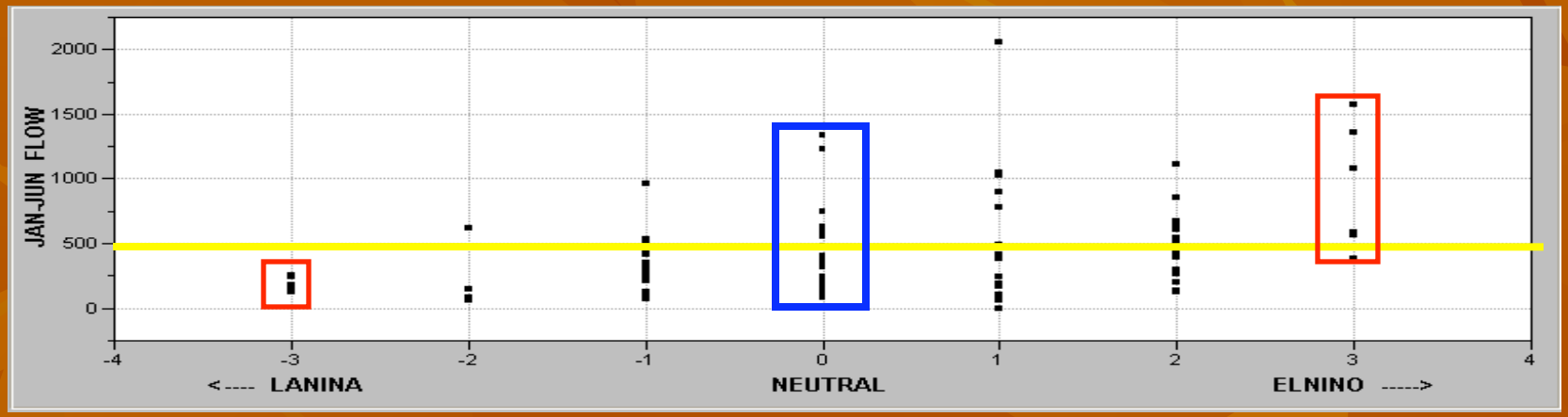
ENSO Composites In the Upper Colorado Basin



Upper Colorado – Lake Powell Inflow



Lower Colorado – Salt River Inflow



Oct/Nov/Dec Sea Surface Temperature Analysis 150 West to Date Line

Strong Warm(+3) /Cool Periods (-3)
Moderate Warm(+2)/Cool Periods (-2)
Weak Warm(+1)/Cool Periods (-1)
Neutral (0)