

# Pacific warming pattern modulate future hydroclimatic changes across the Americas

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University of Colorado  
Boulder



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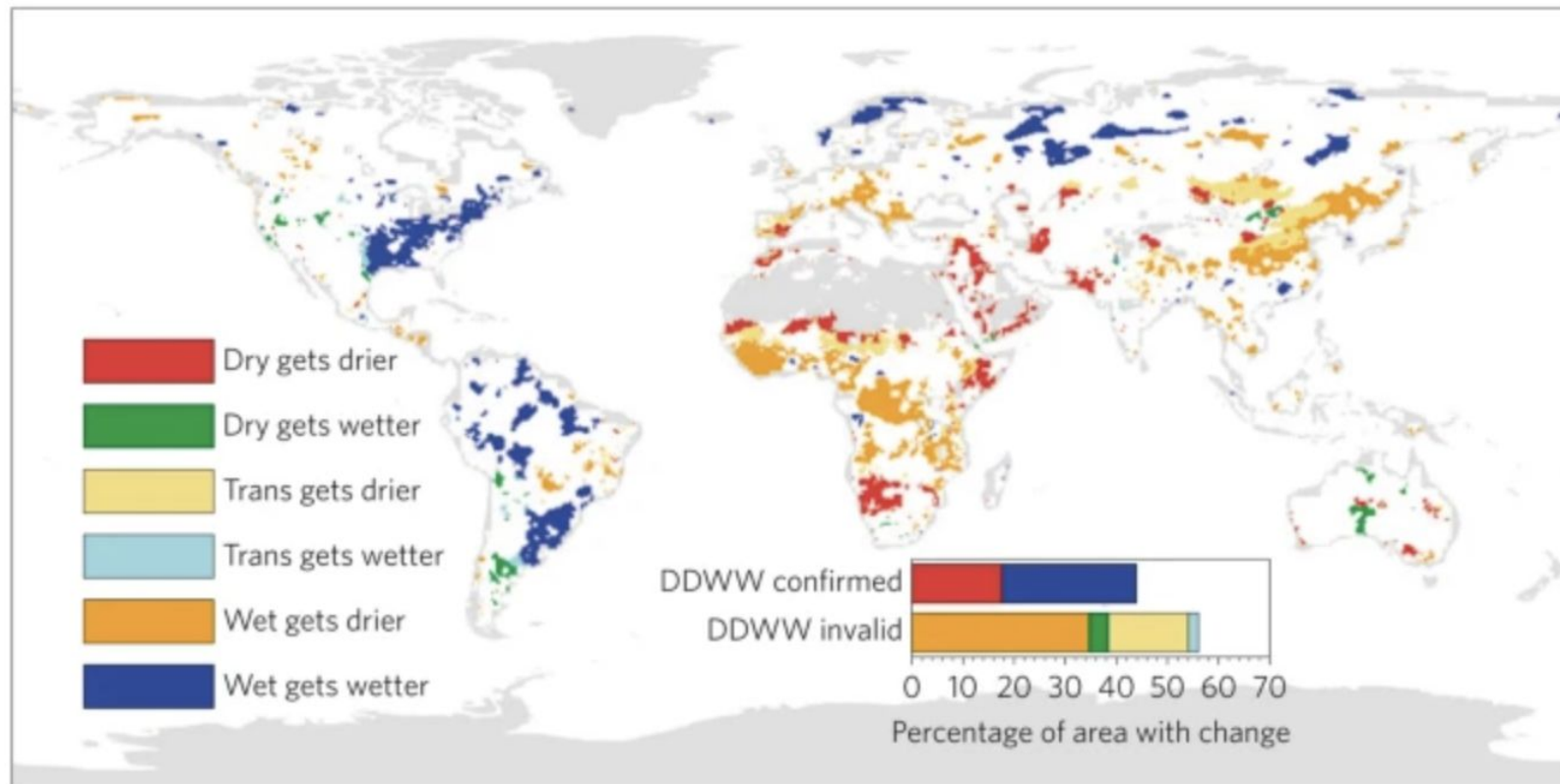
# Outline

- Motivation: The problem with precipitation projections
- The issue of ocean warming patterns
- Using A-GCM ‘warming pattern sensitivity’ experiments

# Motivation

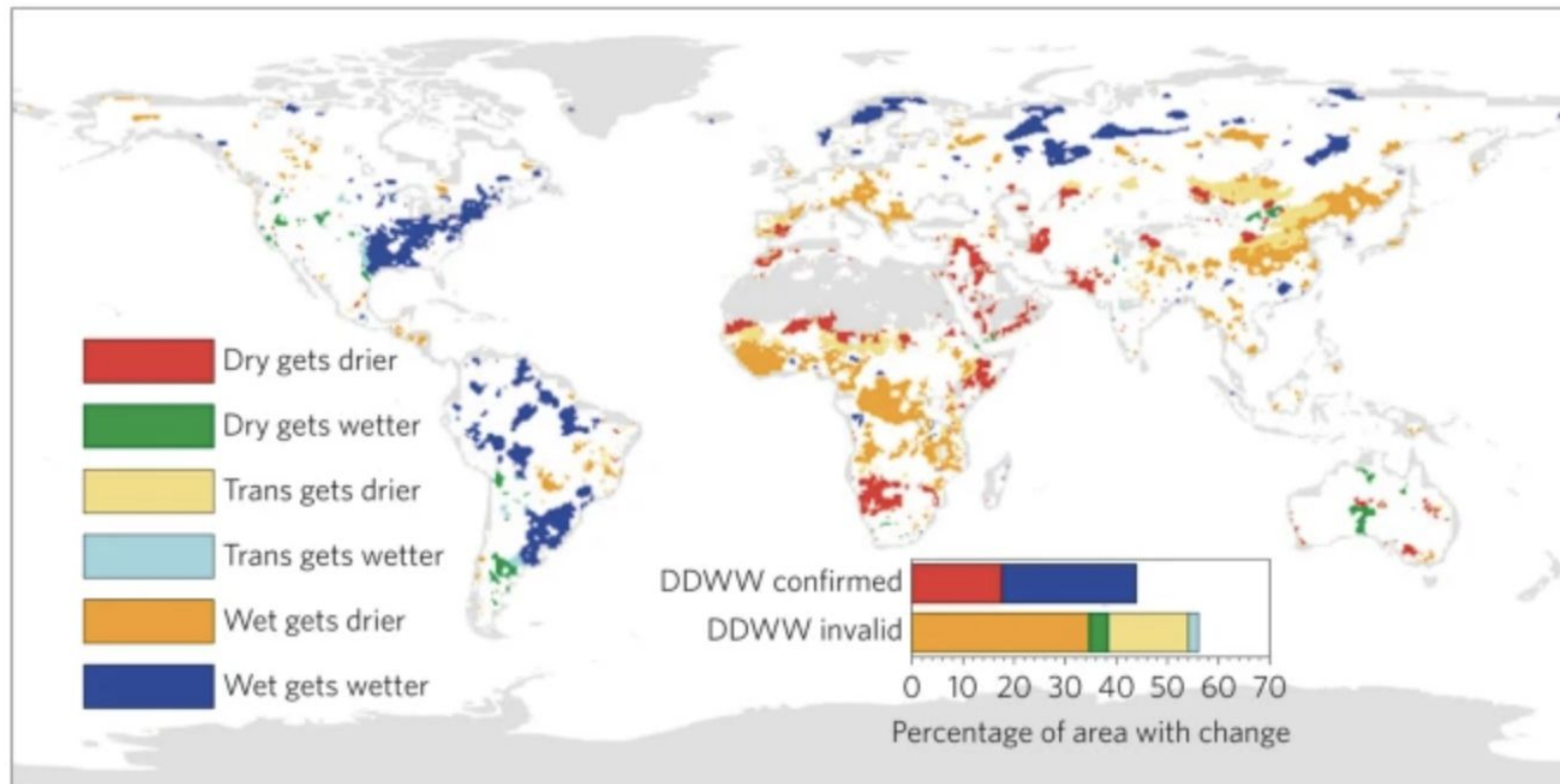
- Precipitation is one of the most important but most difficult aspects of climate change to predict
- A huge obstacle for adaptation as precipitation is linked to many key Earth and human systems
- Both long term trends and variability is uncertain
- **More work is needed to link large-scale ocean warming patterns to dynamical atmospheric changes to precipitation**

# Wet gets wetter doesn't work over land



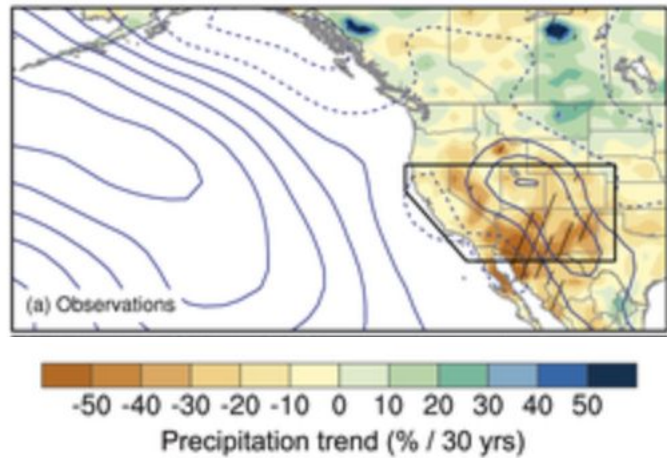
# Wet gets wetter doesn't work over land

“Only 10.8% of the global land area shows a robust ‘dry gets drier, wet gets wetter’ pattern, compared to 9.5% of global land area with the opposite pattern, that is, dry gets wetter, and wet gets drier. We conclude that aridity changes over land, **where the potential for direct socio-economic consequences is highest**, have not followed a simple intensification of existing patterns.”

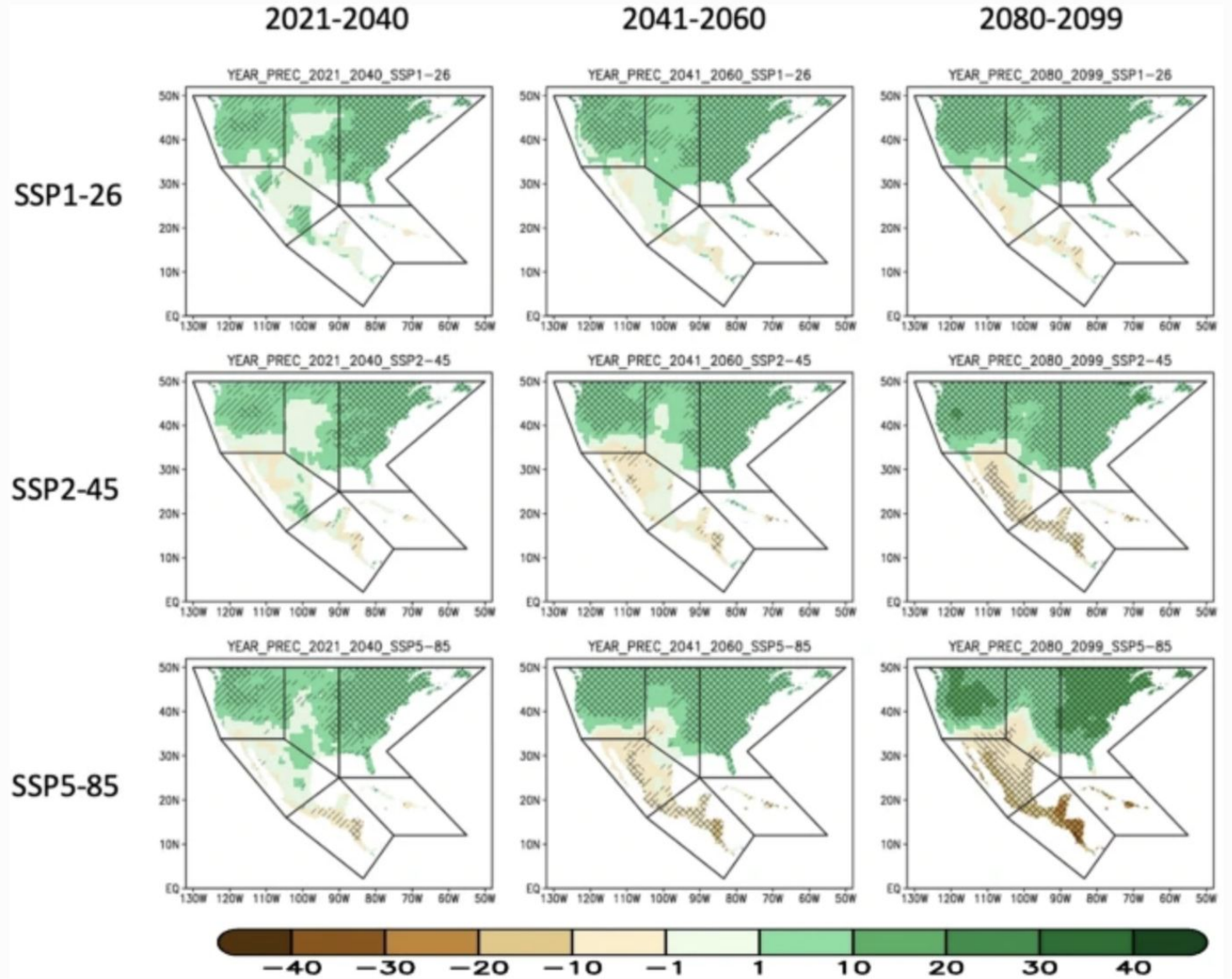
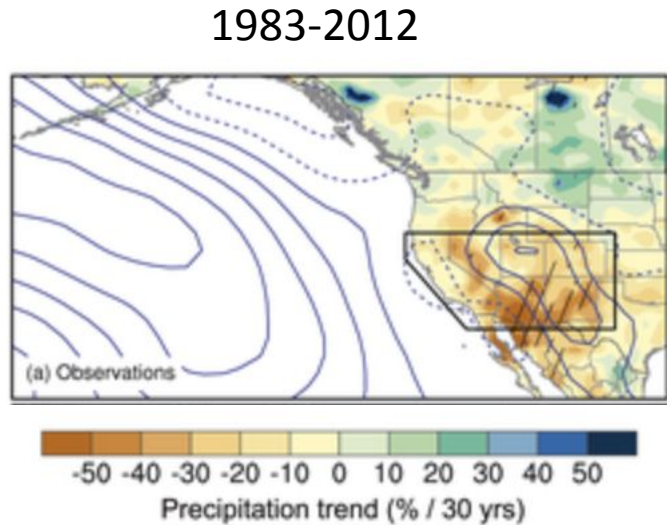


# Are the future projections robust?

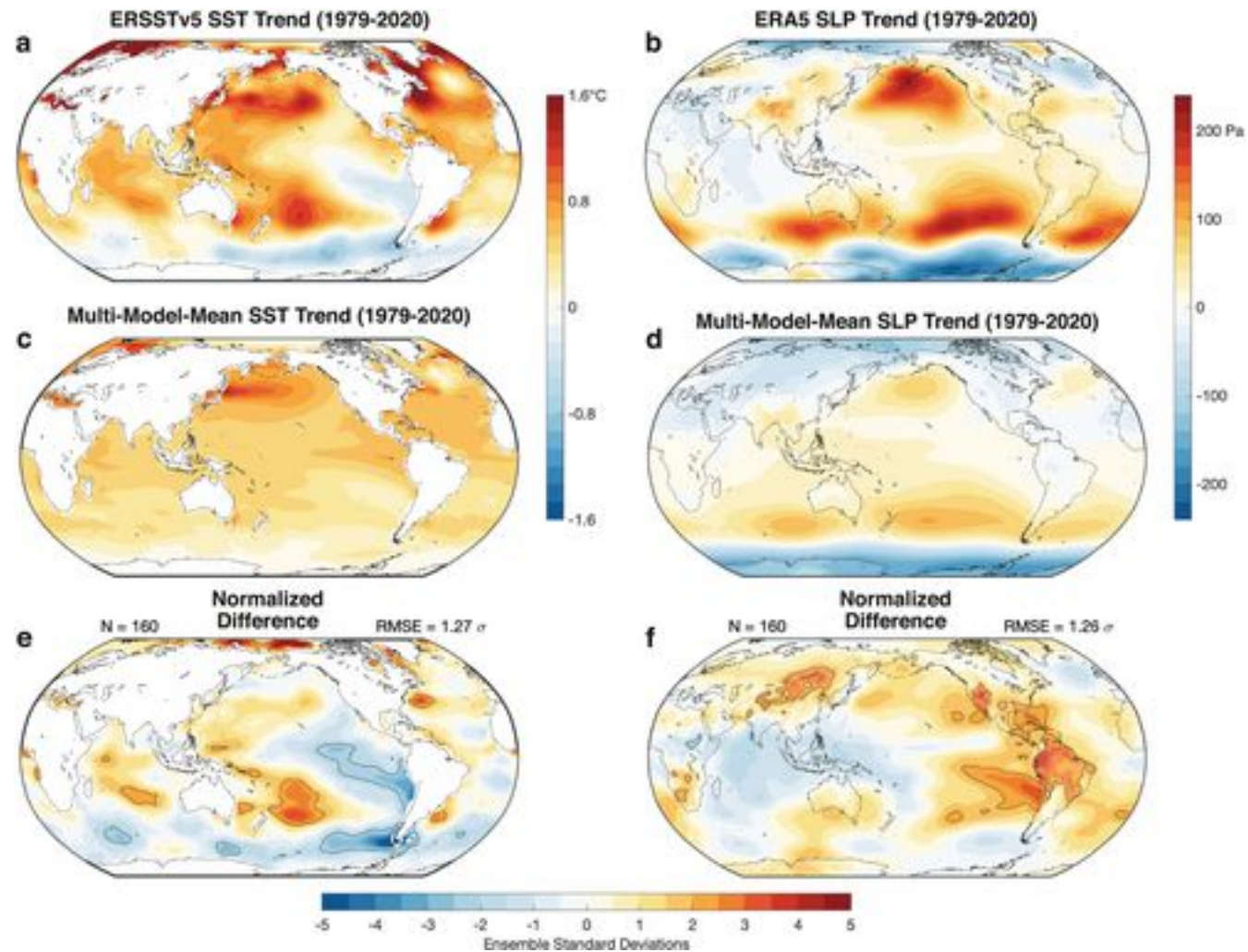
1983-2012



# Are the future projections robust?



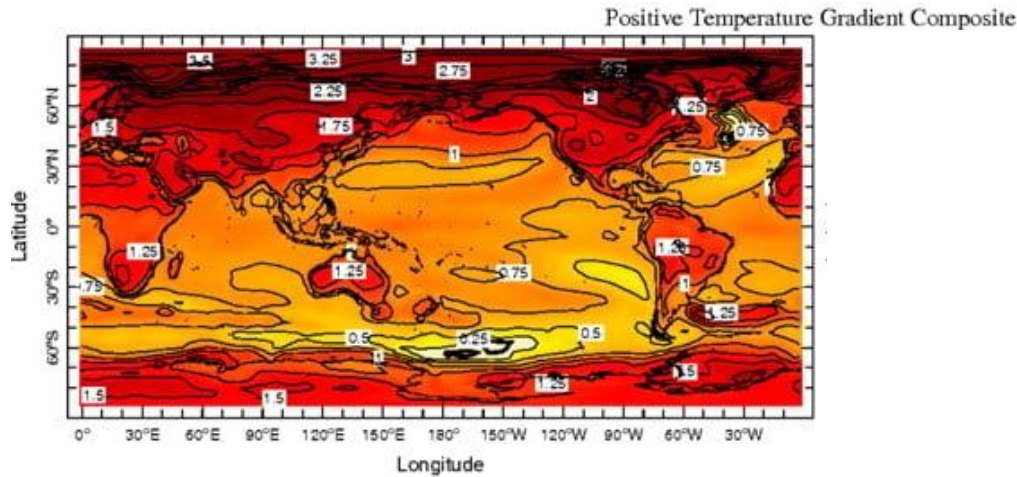
# Systematic bias in modelled historic trends



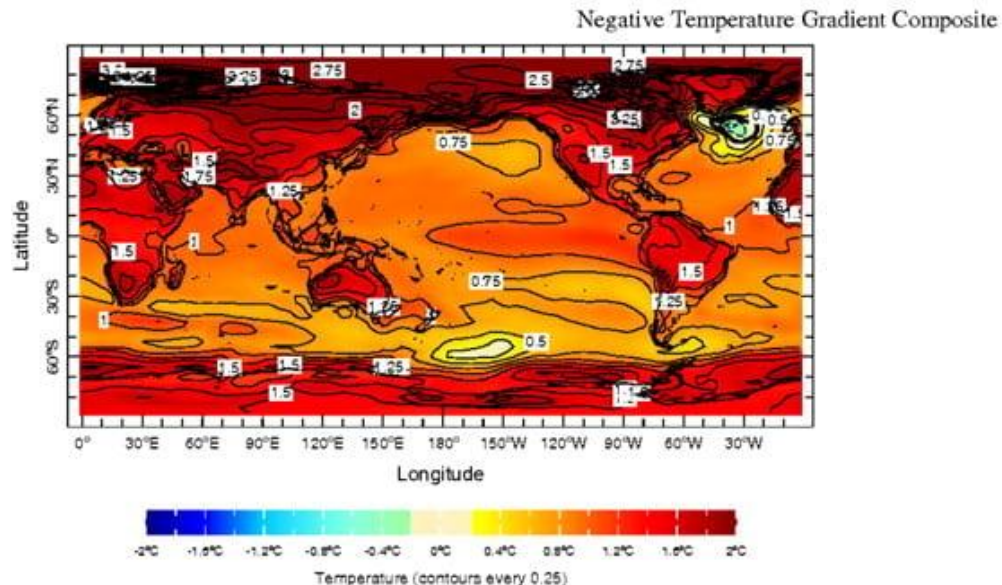


# Implications of enhanced tropical Pacific warming for precipitation

La Niña-like Warming

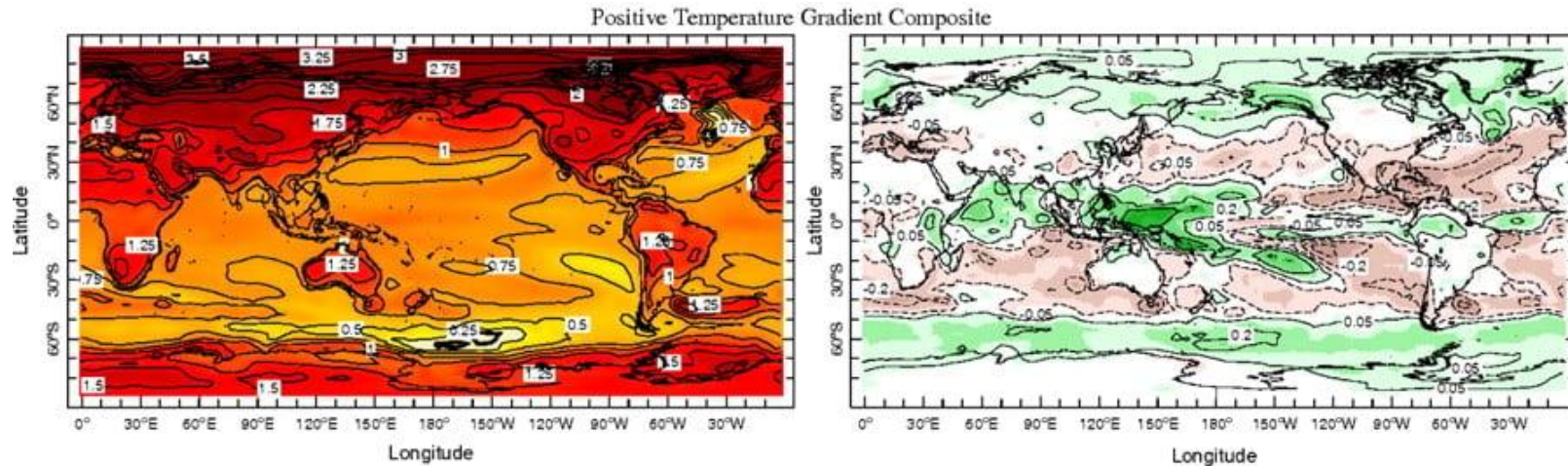


El Niño-like Warming

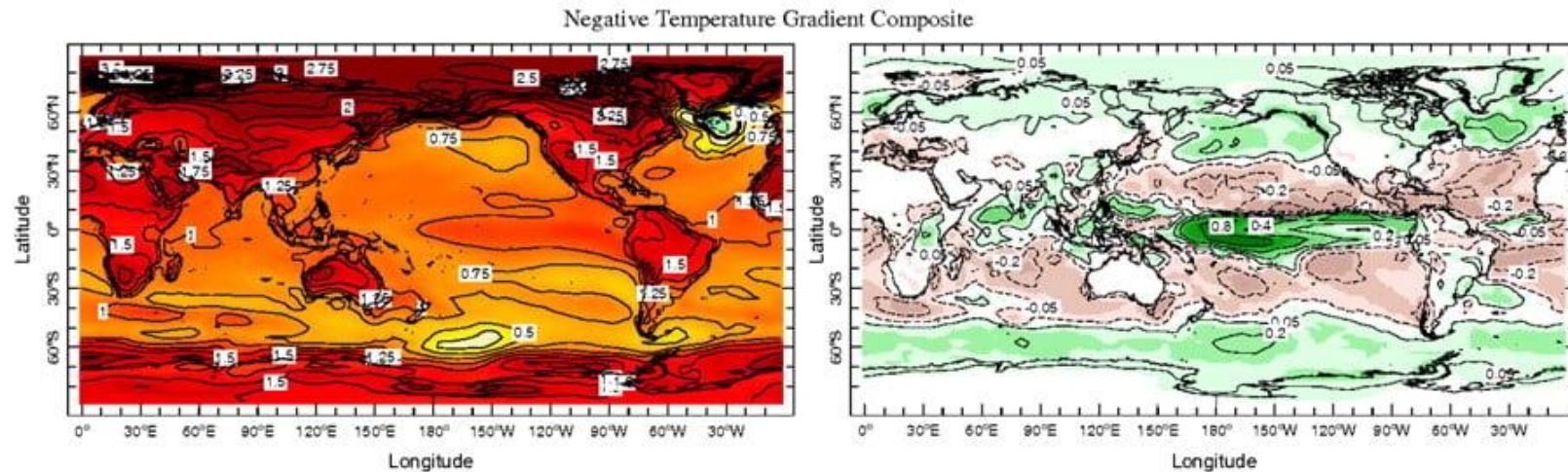


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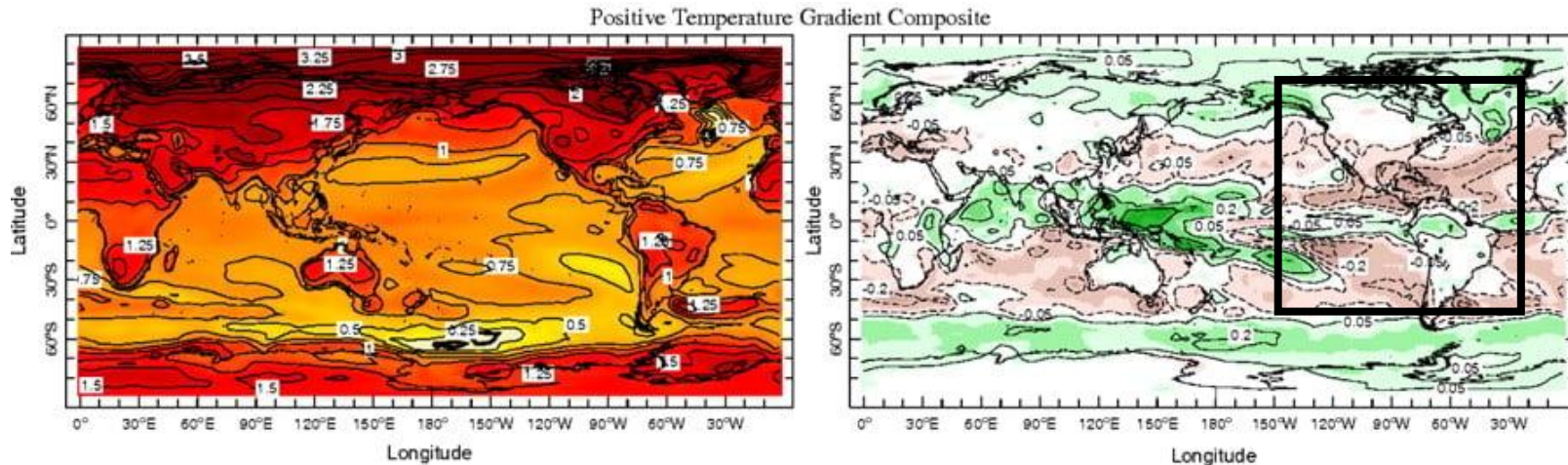


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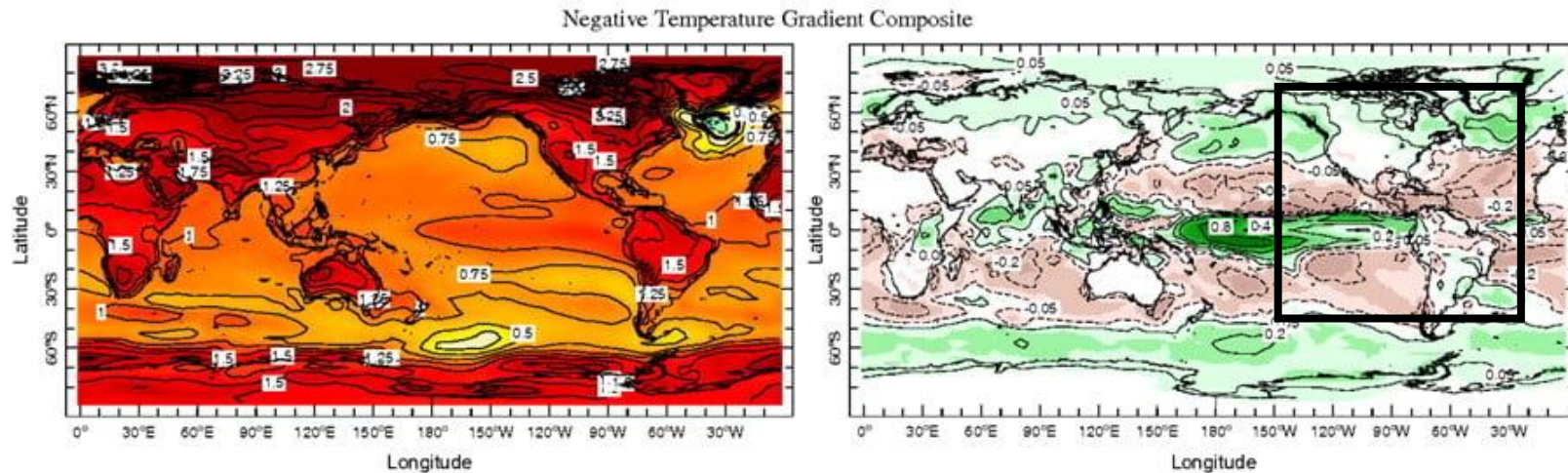


# Implications of enhanced tropical Pacific warming

La Niña-like Warming



El Niño-like Warming



# Research Questions

- How does the pattern of tropical Pacific warming influence terrestrial precipitation trends and variability?
- How does the SST warming pattern influence ENSO teleconnections?
- How does the SST warming pattern influence the occurrence of extreme wet/dry seasons?

# Experimental setup

**CESM2-CAM6 AMIP (Prescribed monthly SSTs)**

# Experimental setup

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### Future Simulations (5x 2015-2100, SSP585)

SST Forcing is the sum of:

- 1) Idealized ENSO pattern
- 2) Linear warming (other than Tropical Pacific)
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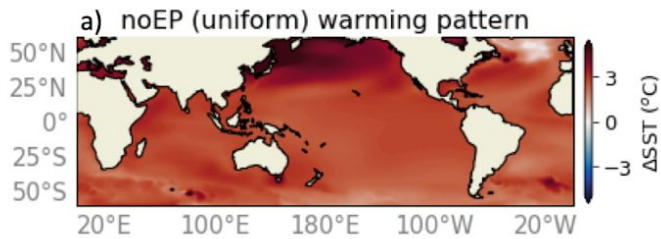
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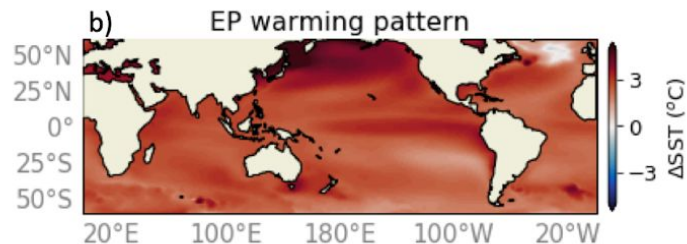
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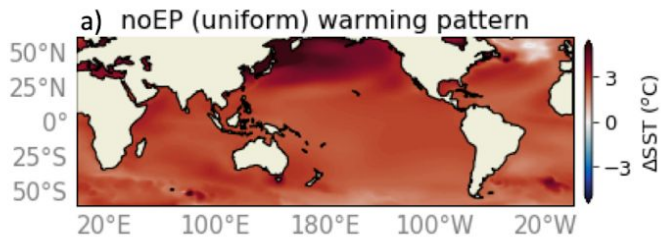
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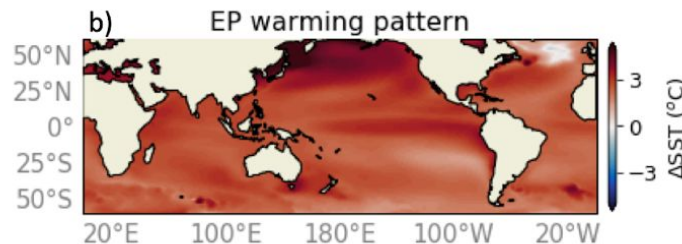
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### Control Simulation

425 years of CAM-6 AMIP

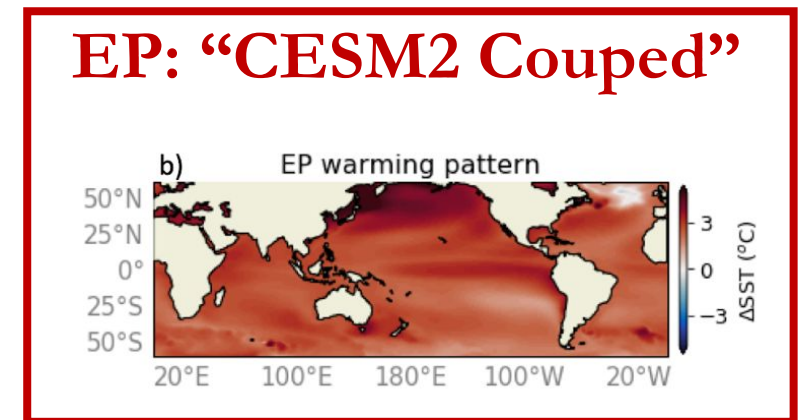
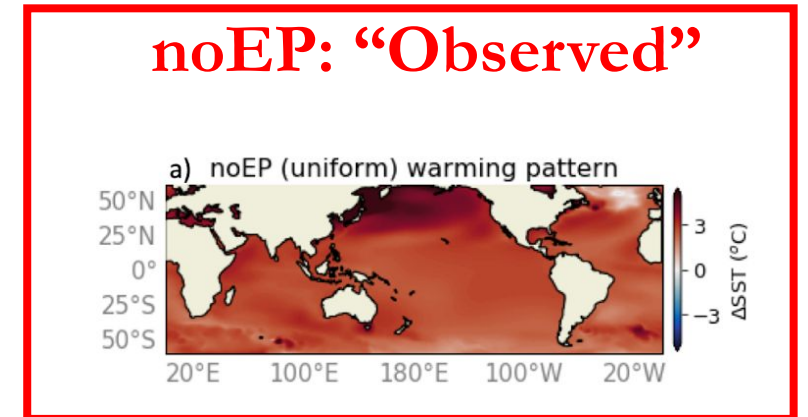
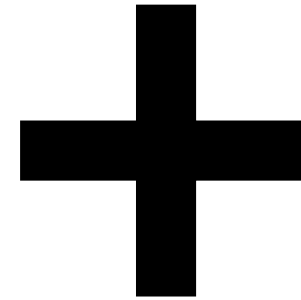
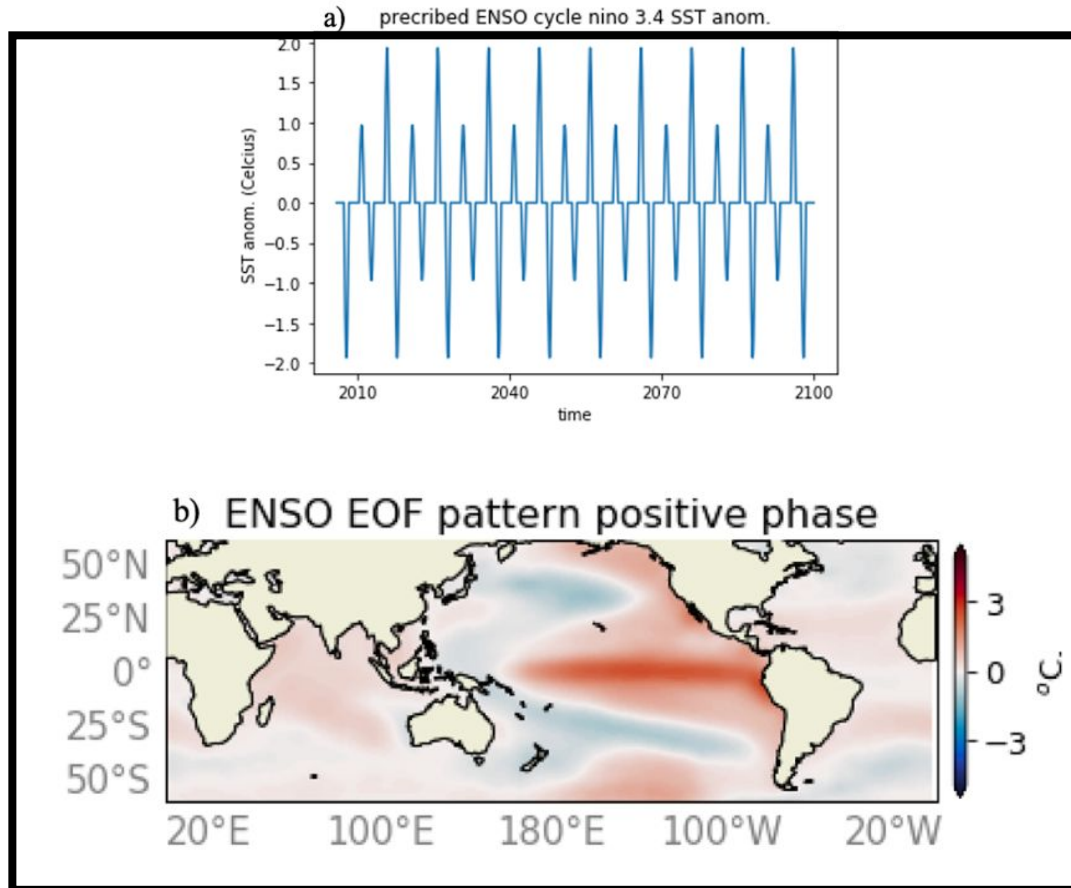
SST Forcing is the sum of:

1. Observed monthly means in 2000
2. Idealized ENSO pattern



2015-2100 SST Forcing is the sum of:

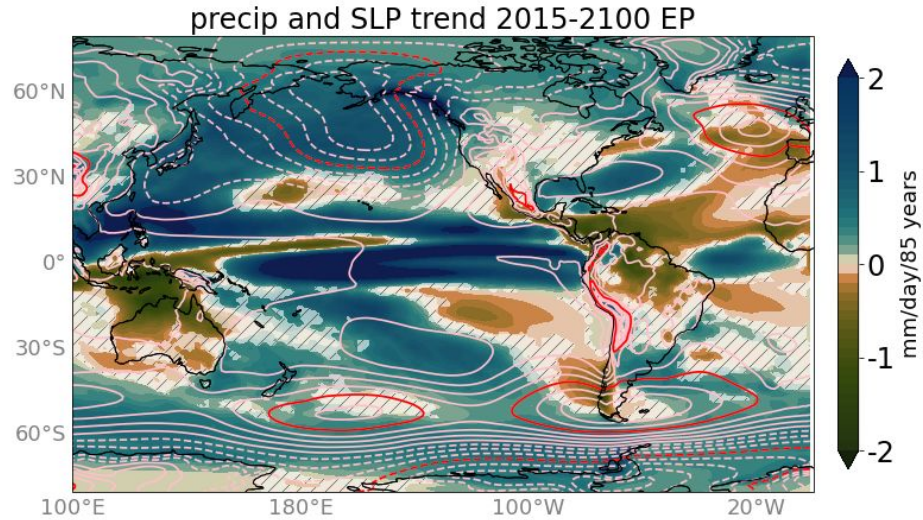
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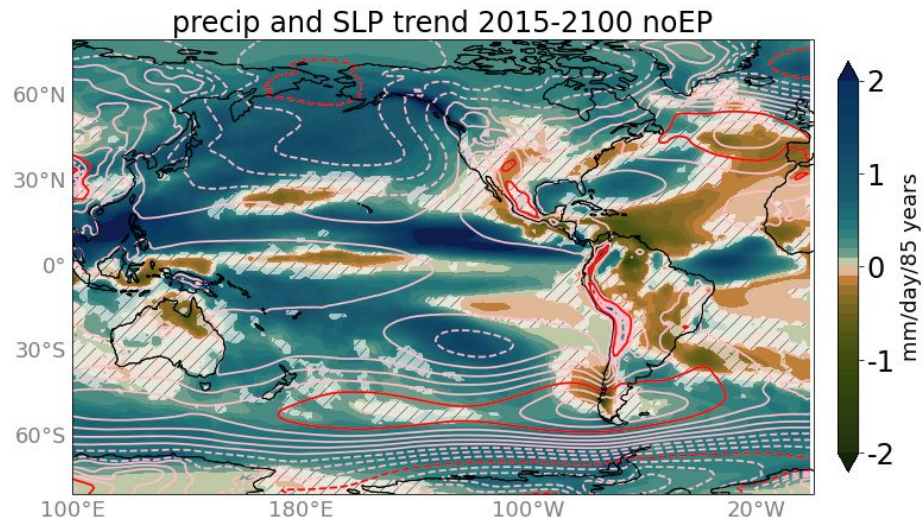
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Warming



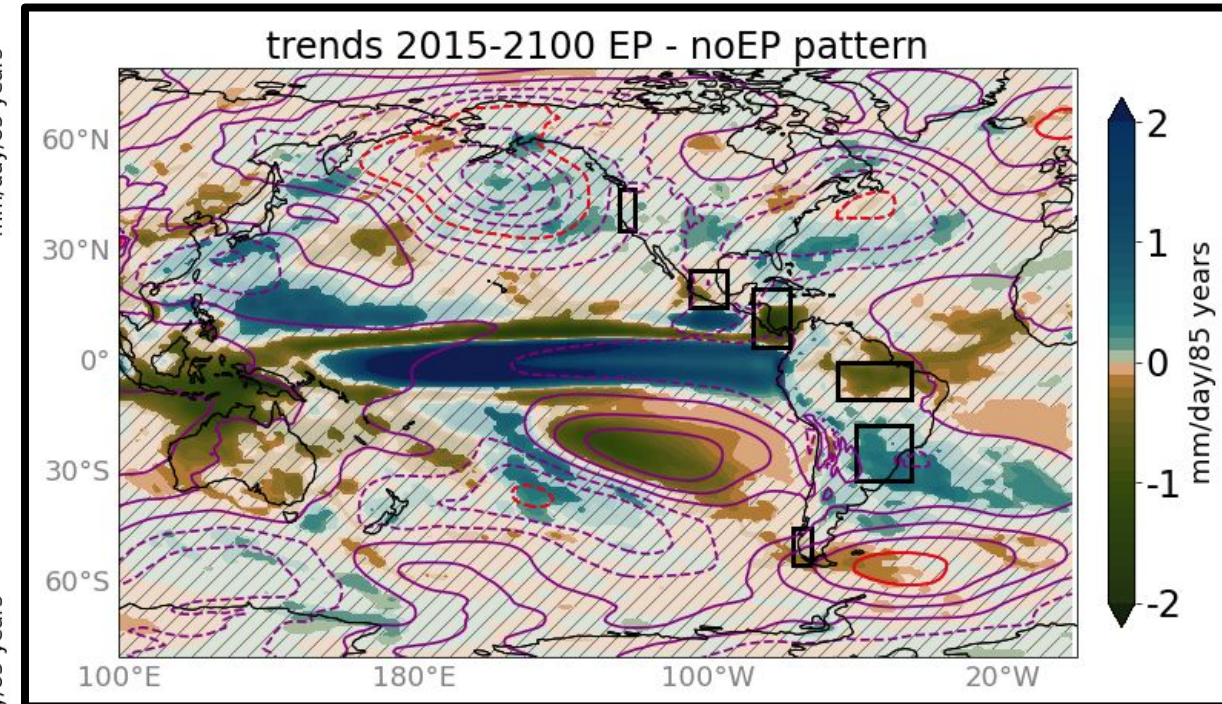
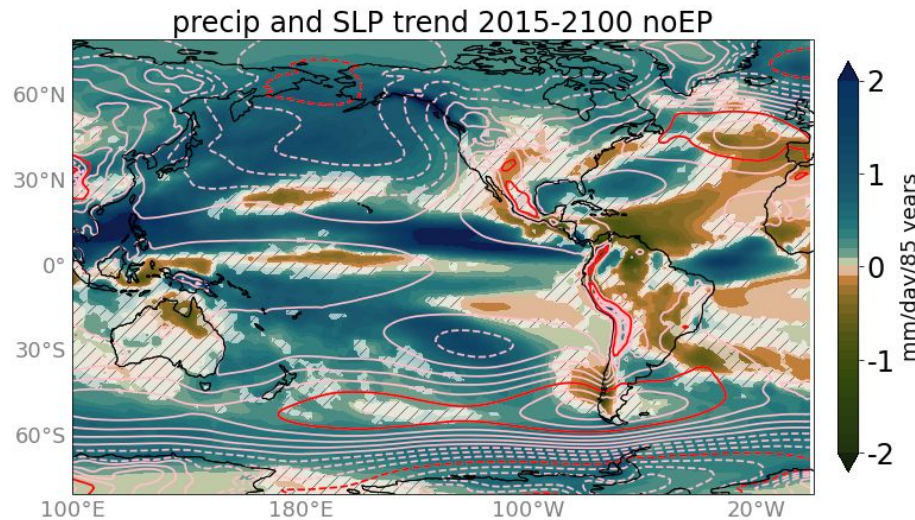
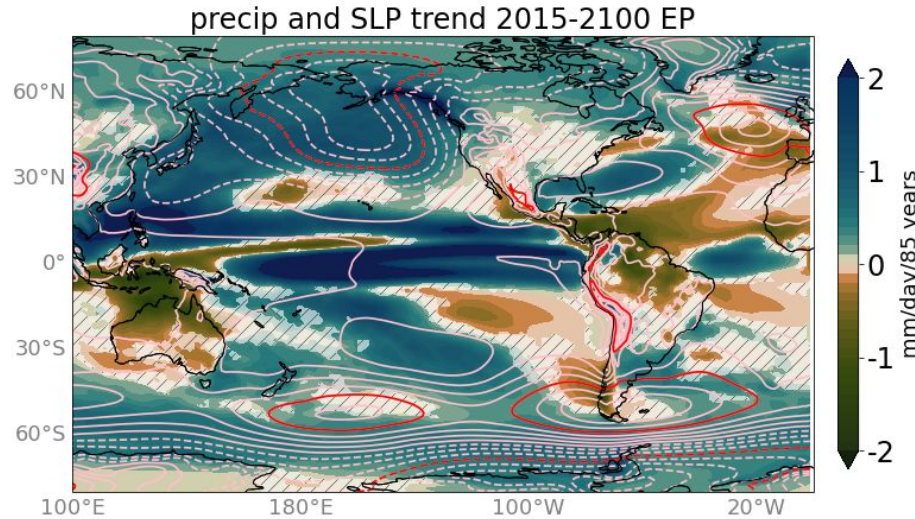
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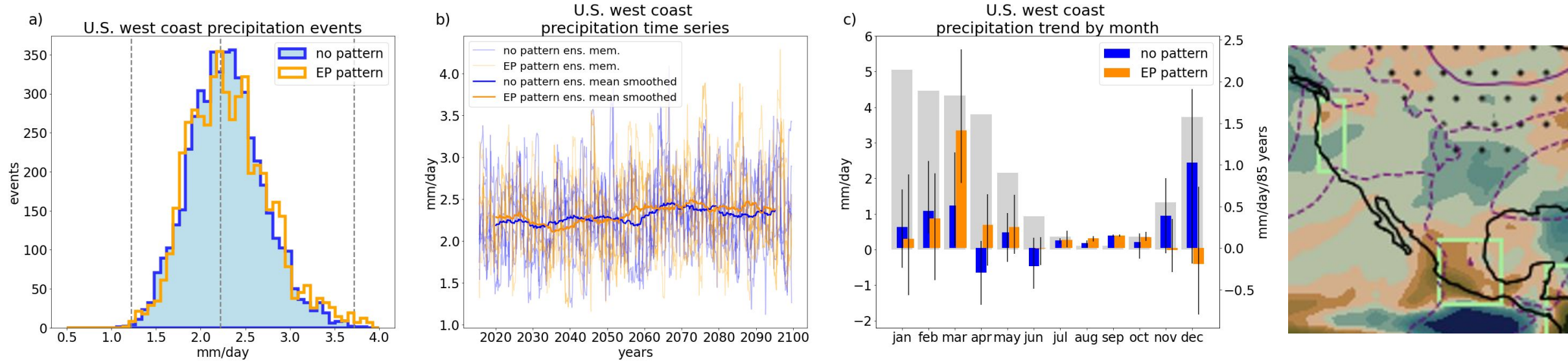
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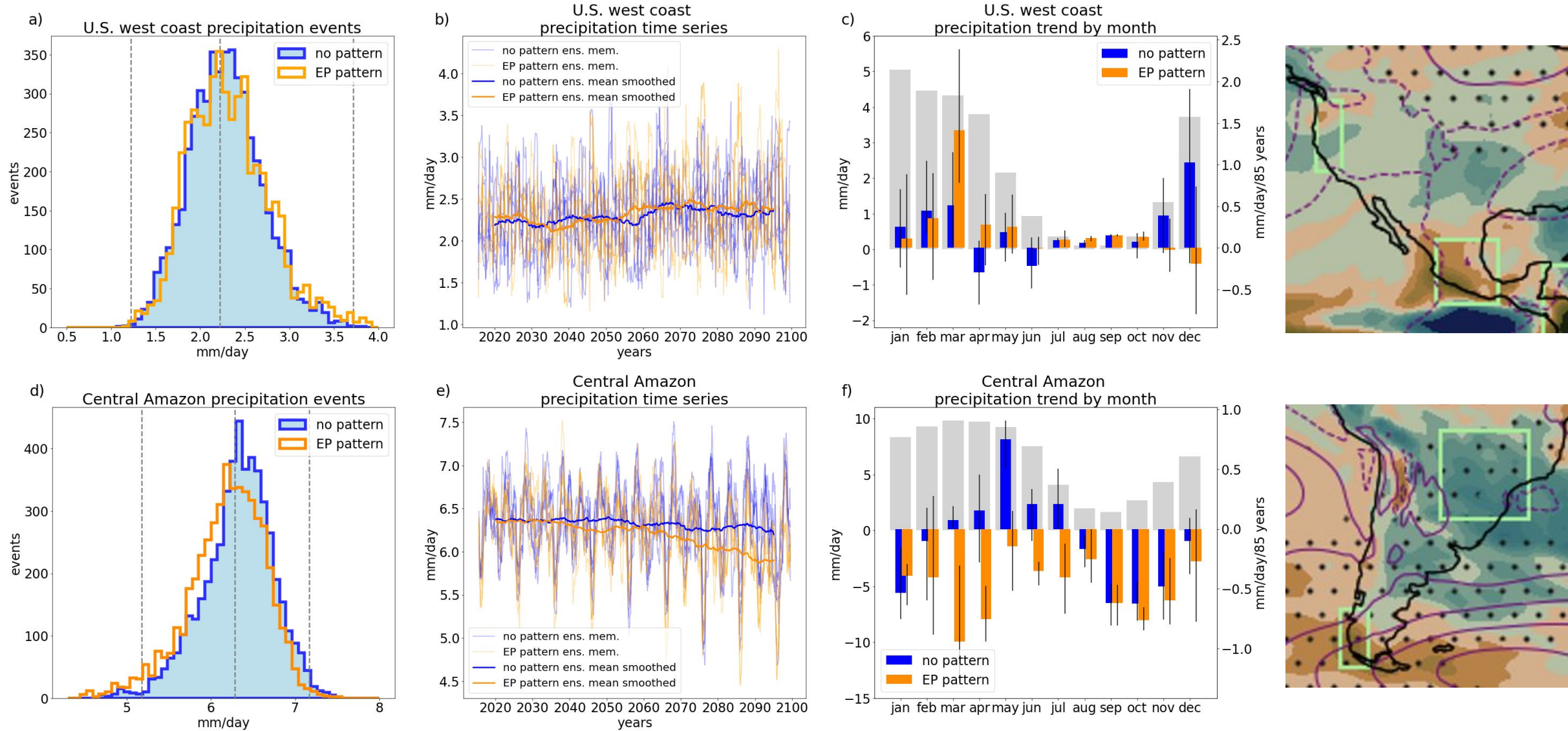


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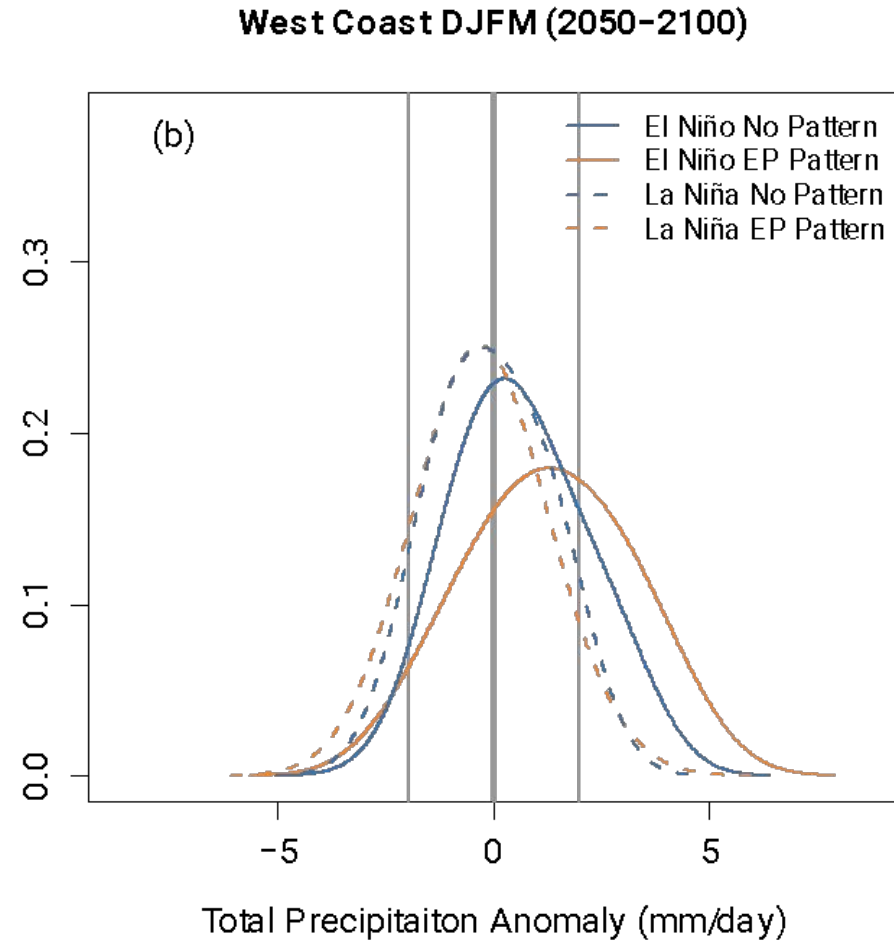
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Differences in  
dry extremes

Differences in  
wet extremes

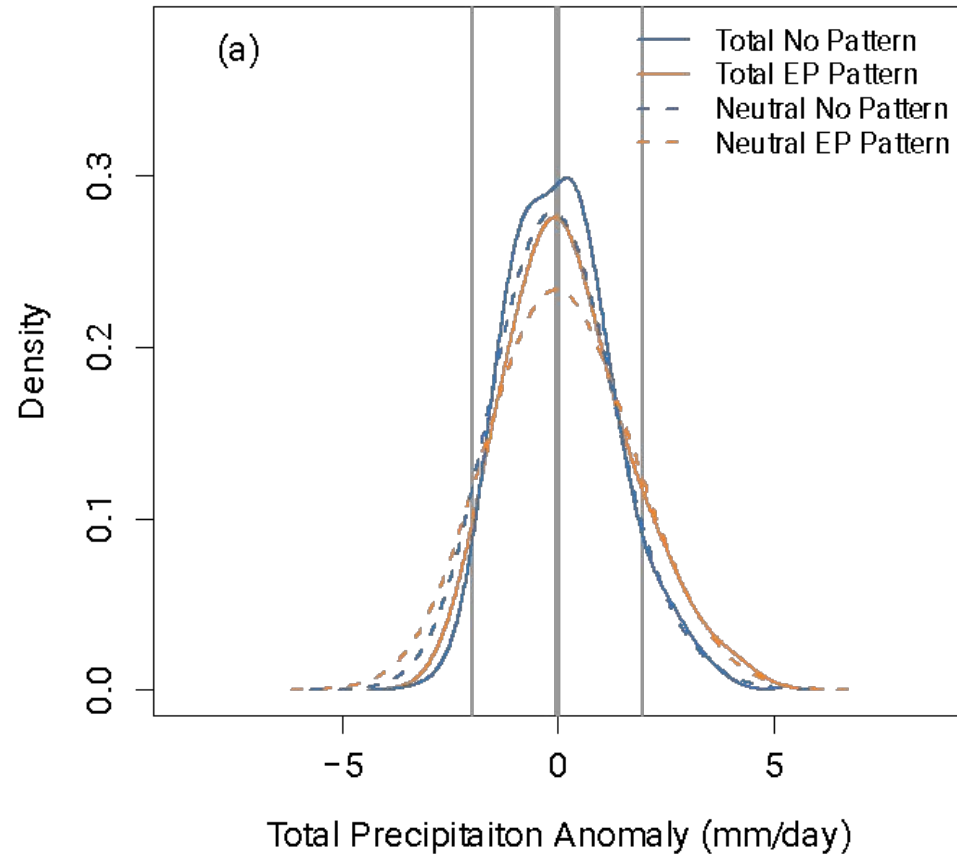


# U.S. West Coast ENSO Precipitation

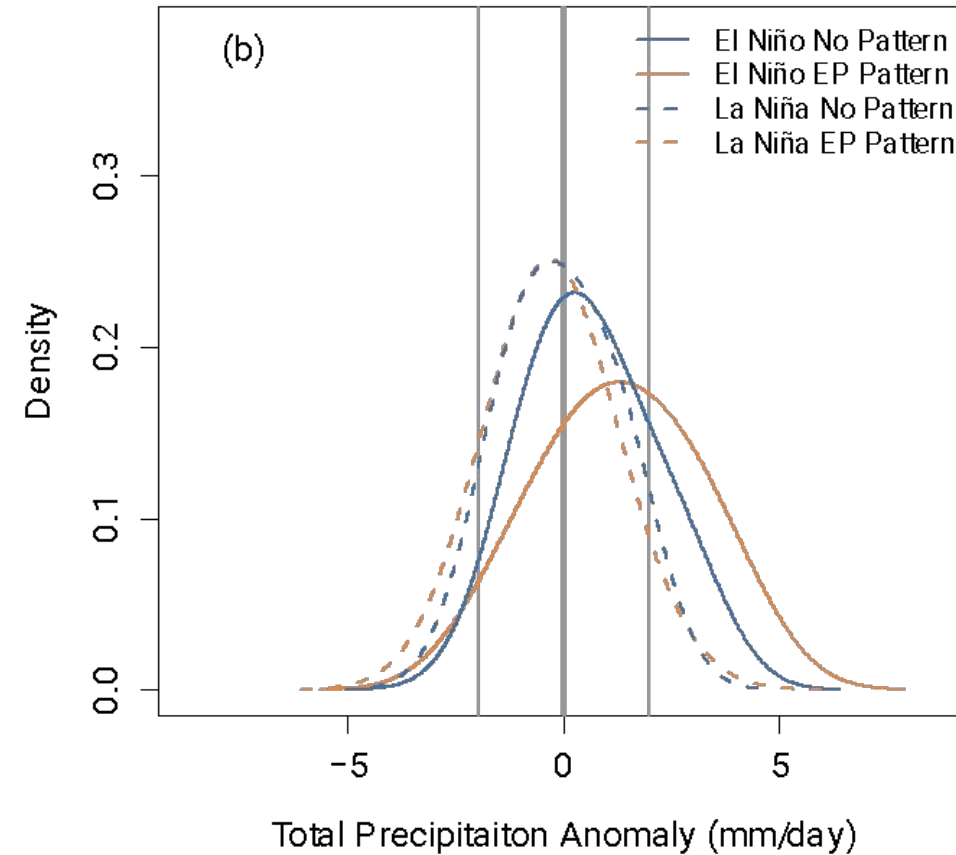


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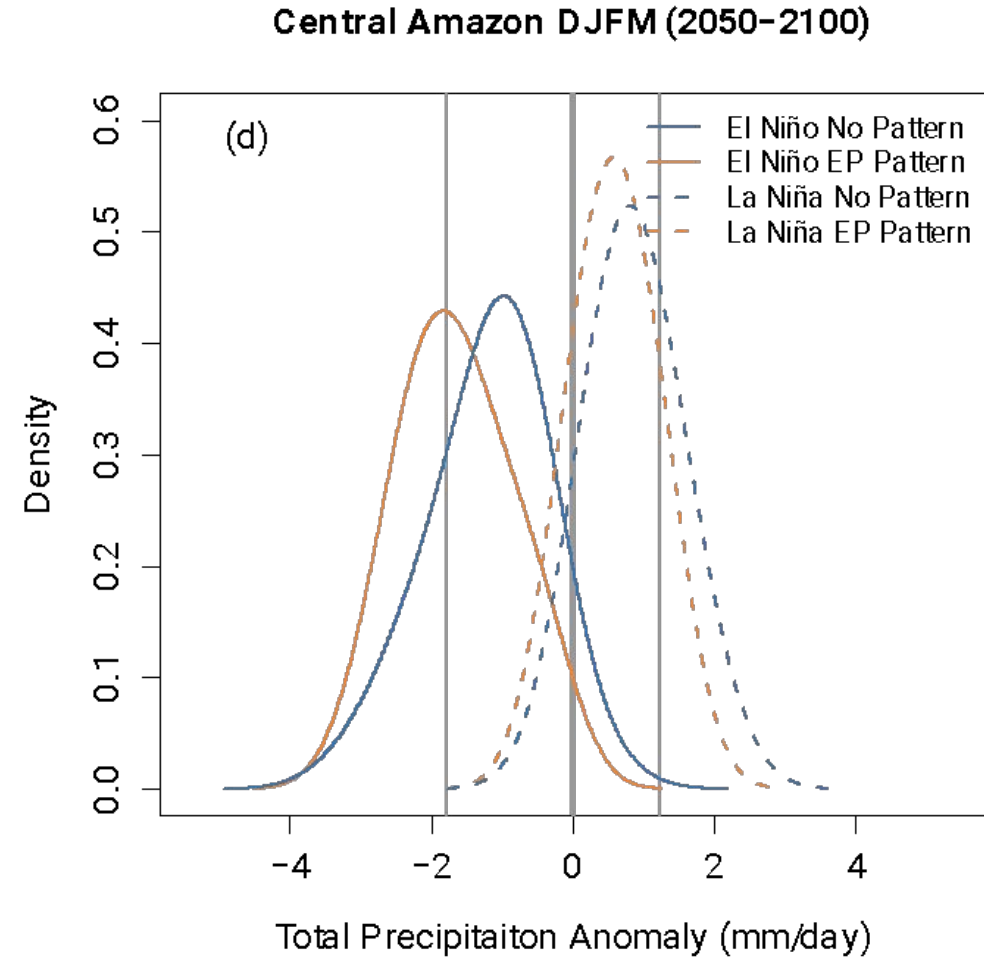
West Coast DJFM (2050-2100)



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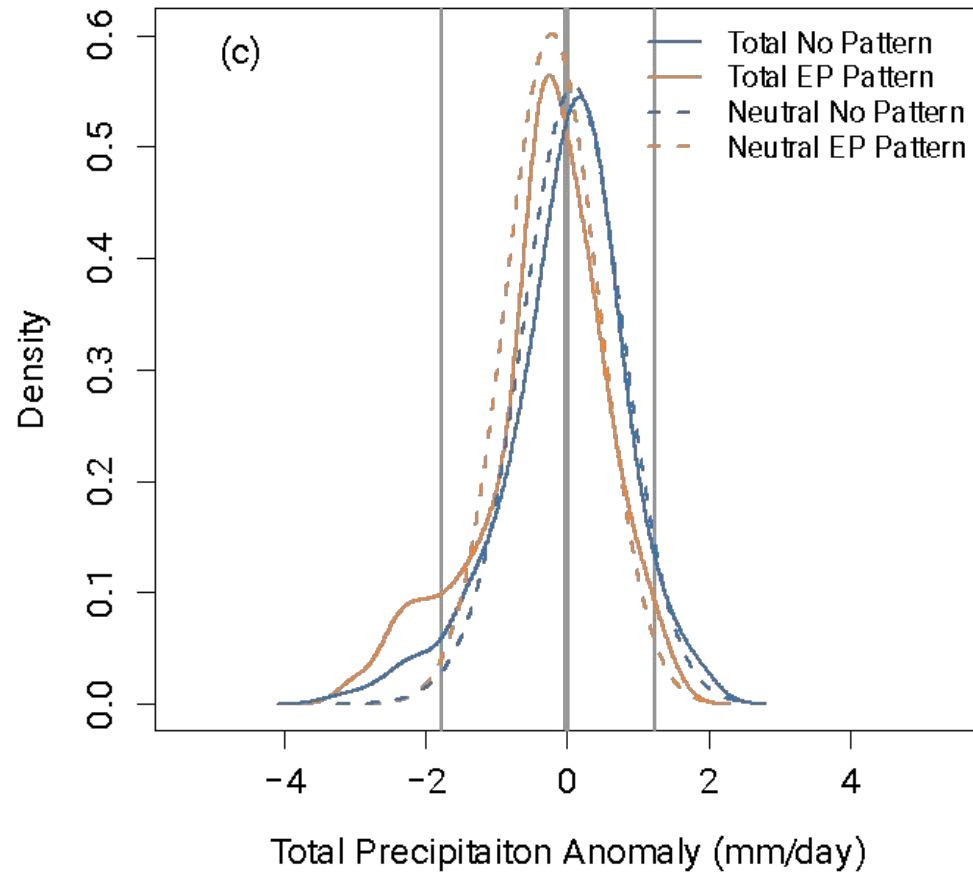


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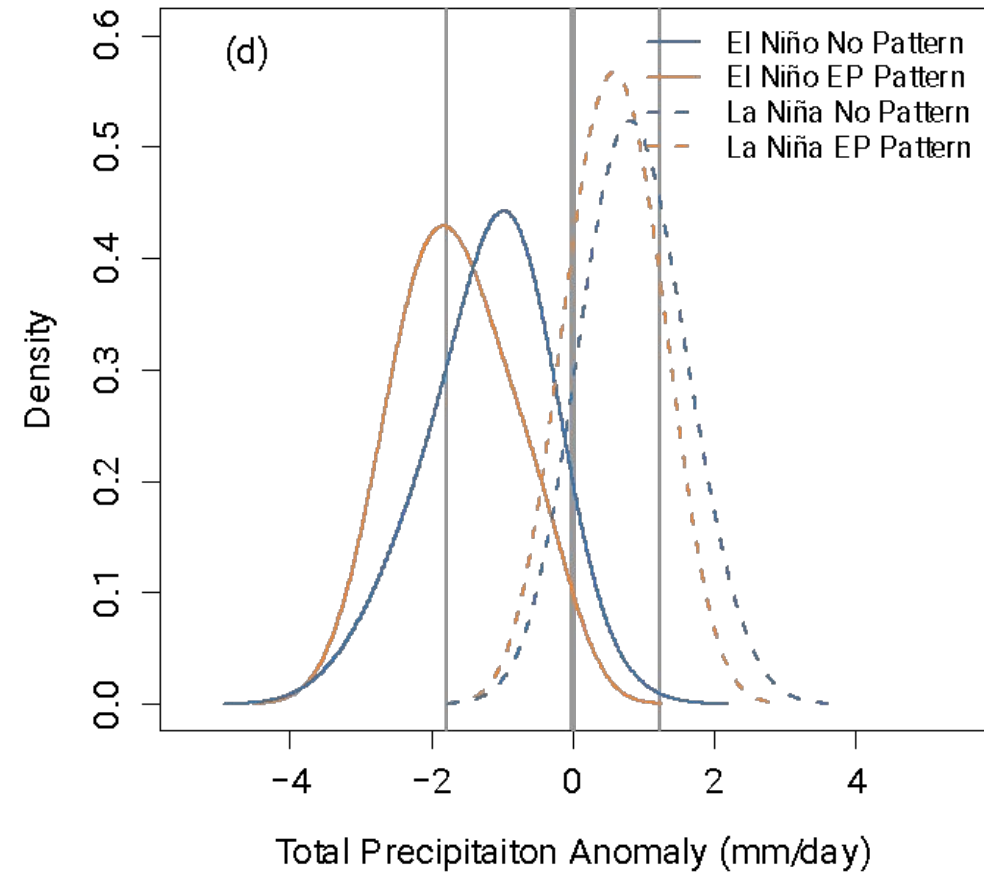


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