

Externally Forced Changes in ENSO Oscillatory Behavior Driven by Zonal Shifts in Center of Action

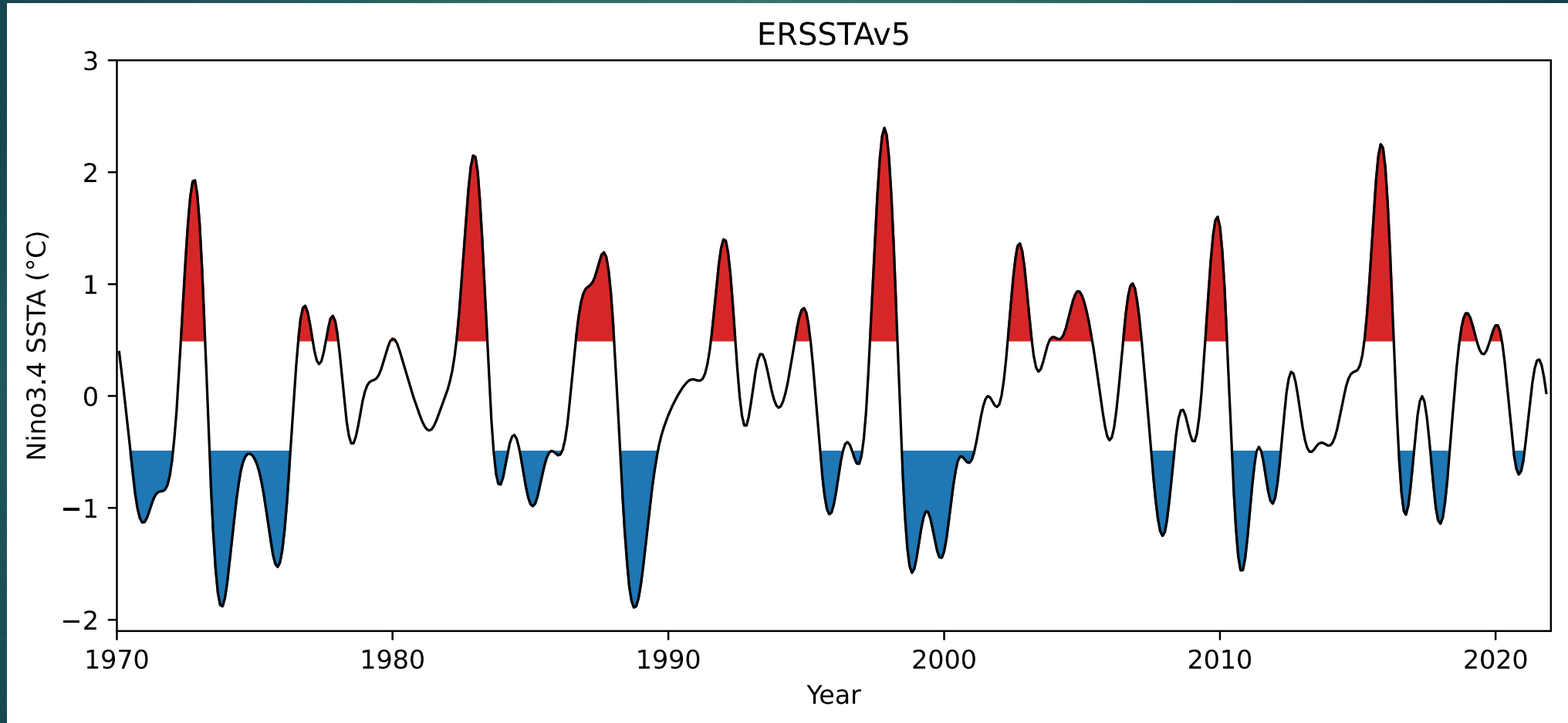
BRANDON MOLINA & PEDRO DINEZIO



El Niño events are rarely preceded by La Niña

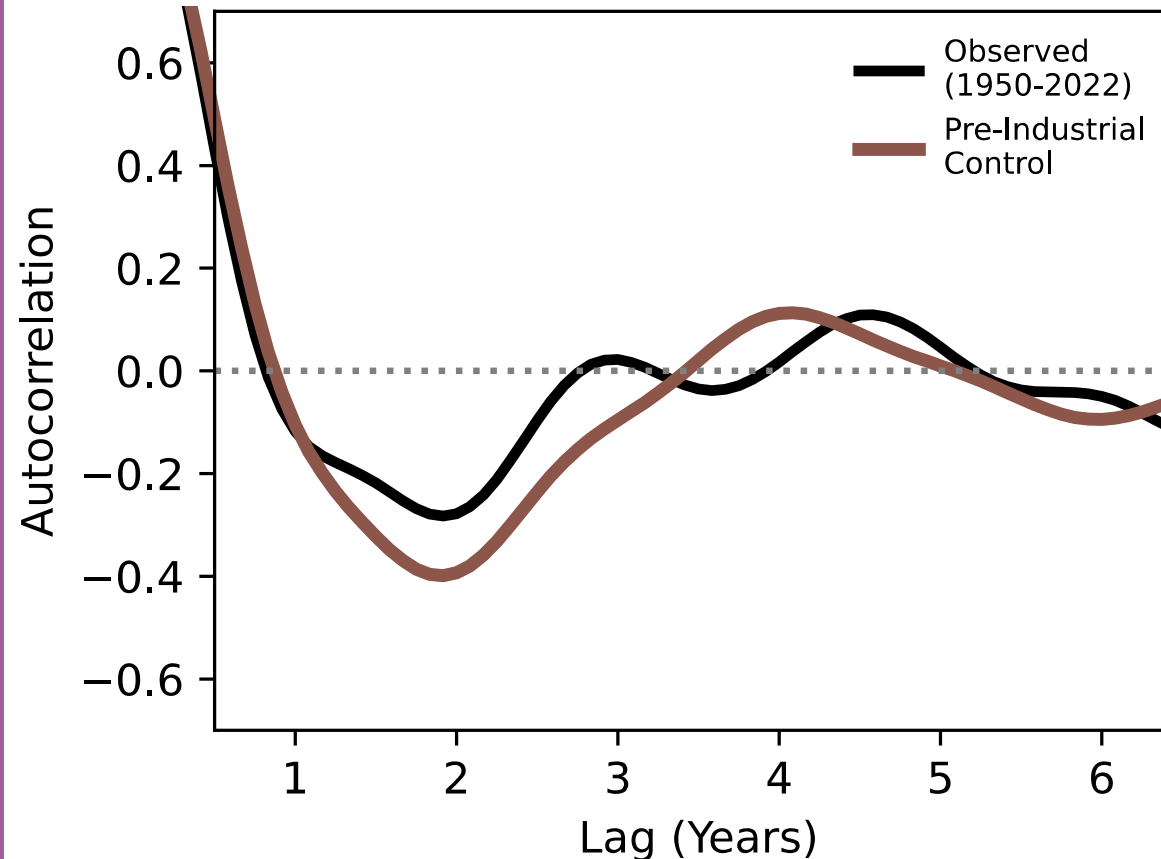
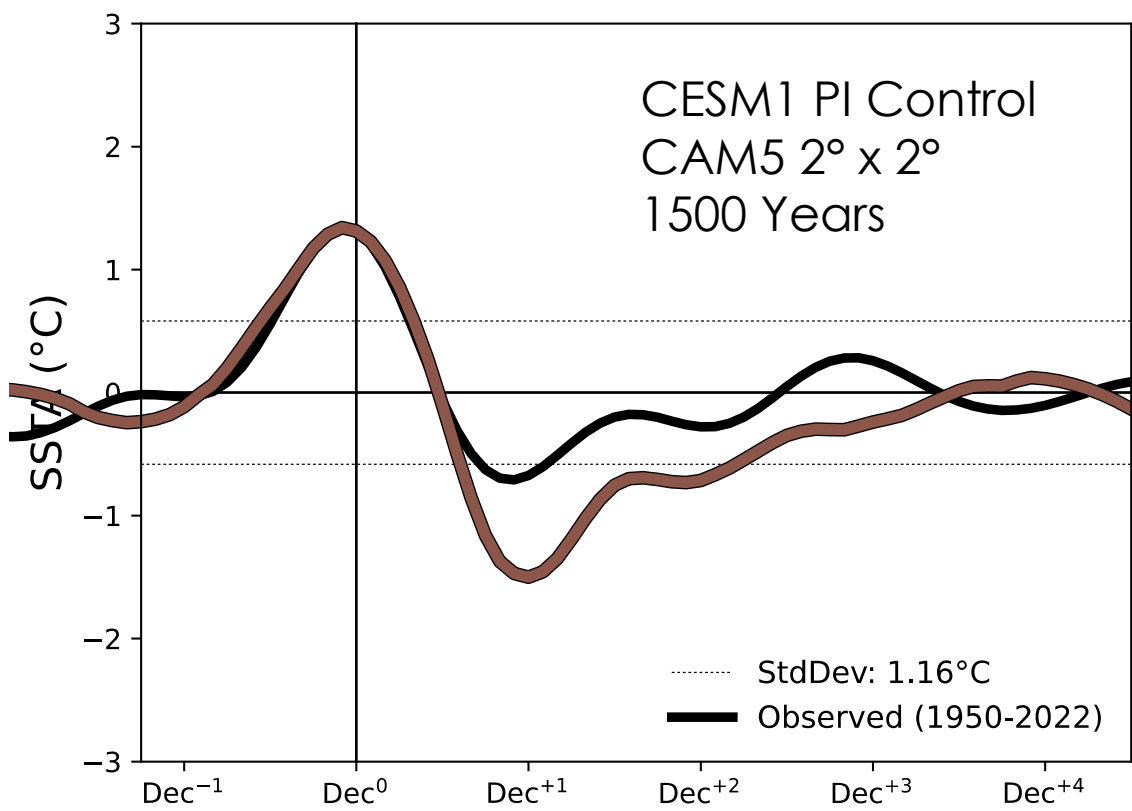
Could this change?

1

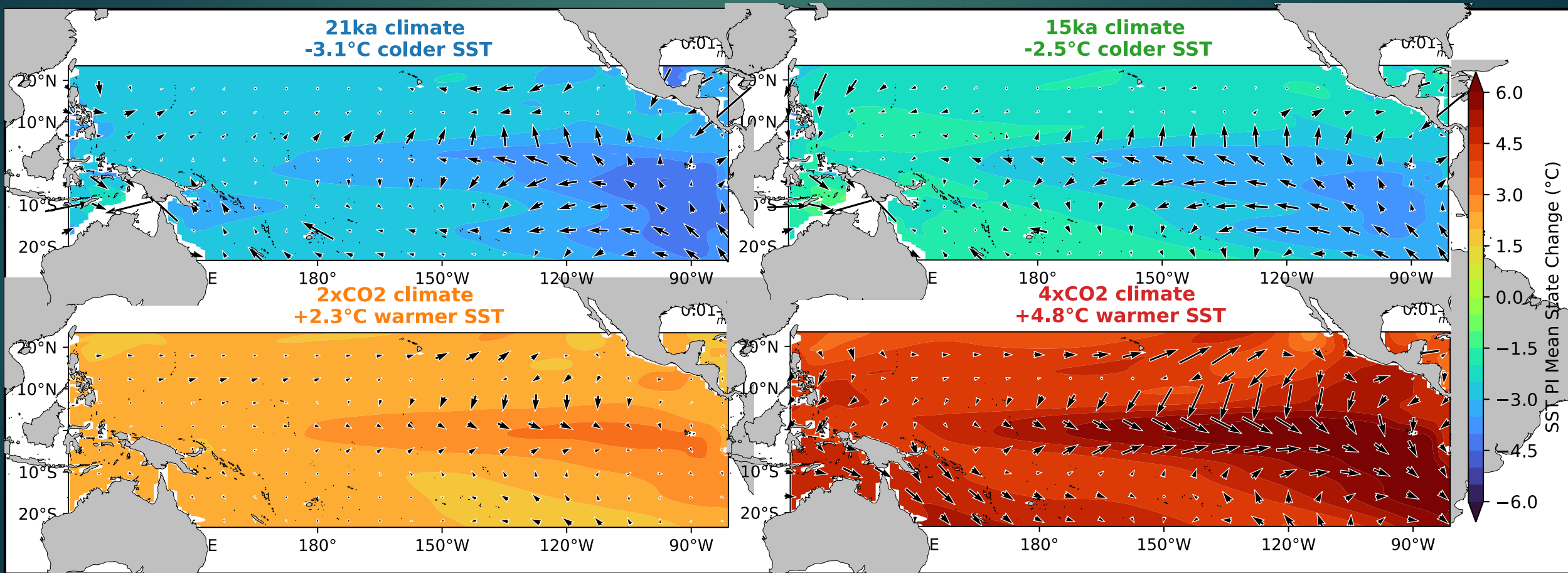


CESM1 can realistically simulate the asymmetric evolution of El Niño/La Niña

2



Simulations of altered climatic states are used to study the mechanisms governing changes in ENSO event transition.

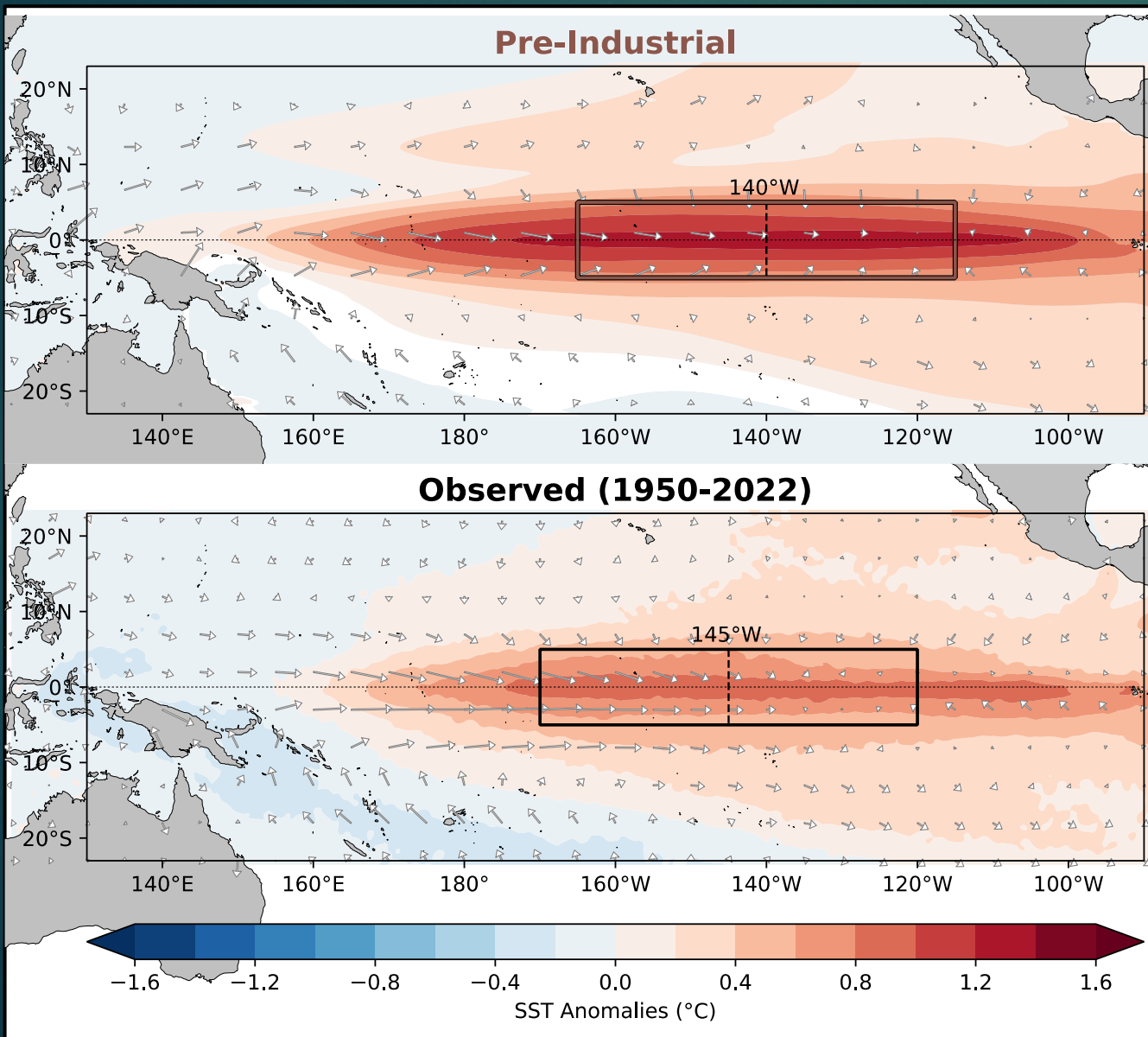


Identifying the ENSO Center of Action

4

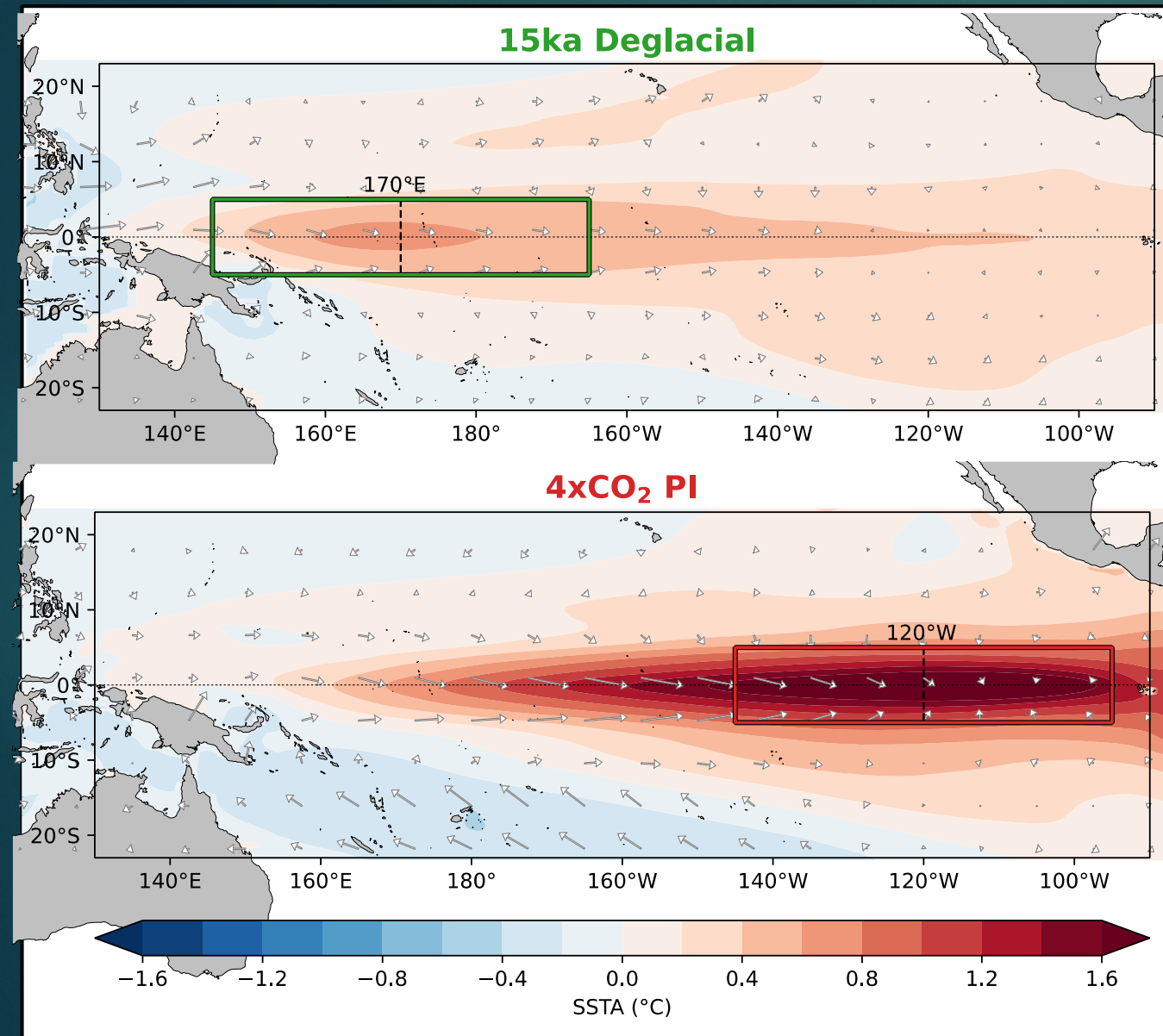
Area of strongest wind sensitivity to sea-surface temperature variability

Computed as the SSTA pattern that is most correlated with the leading mode of equatorial zonal wind variability



Pronounced Zonal Shifts in the Center of Action

5

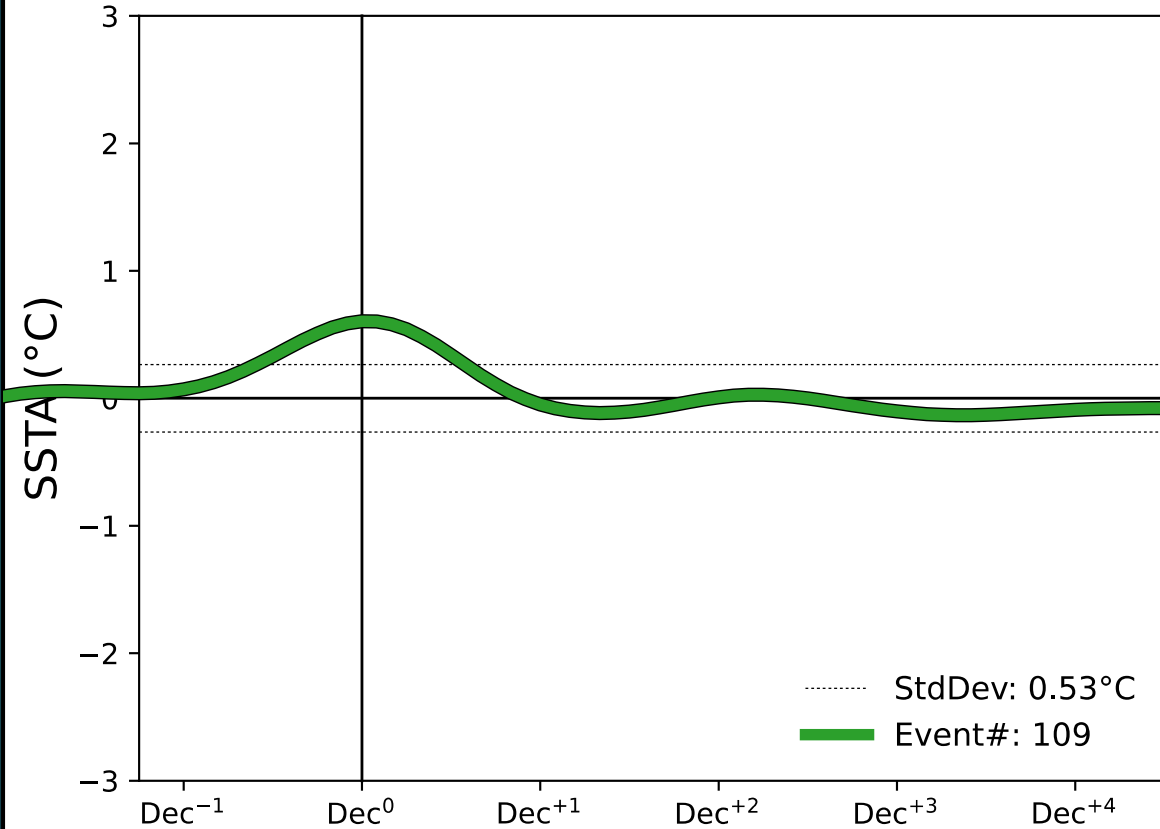


Externally-forced changes in the mean climate of the tropical Pacific drive zonal shifts in the center of action.

Pronounced changes in oscillatory behavior

6

Colder 15ka Climate

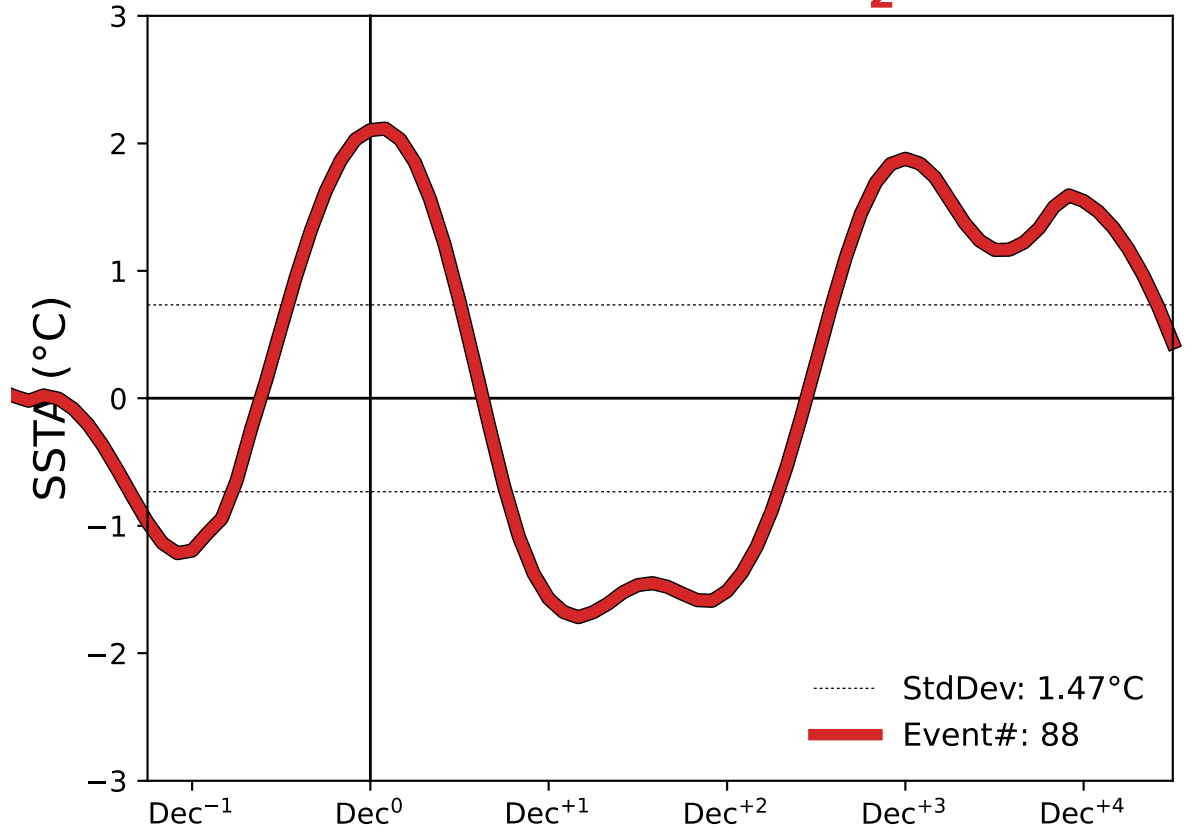


Non-oscillatory

Less consistent

El Niño to La Niña transition

Warmer 4xCO₂



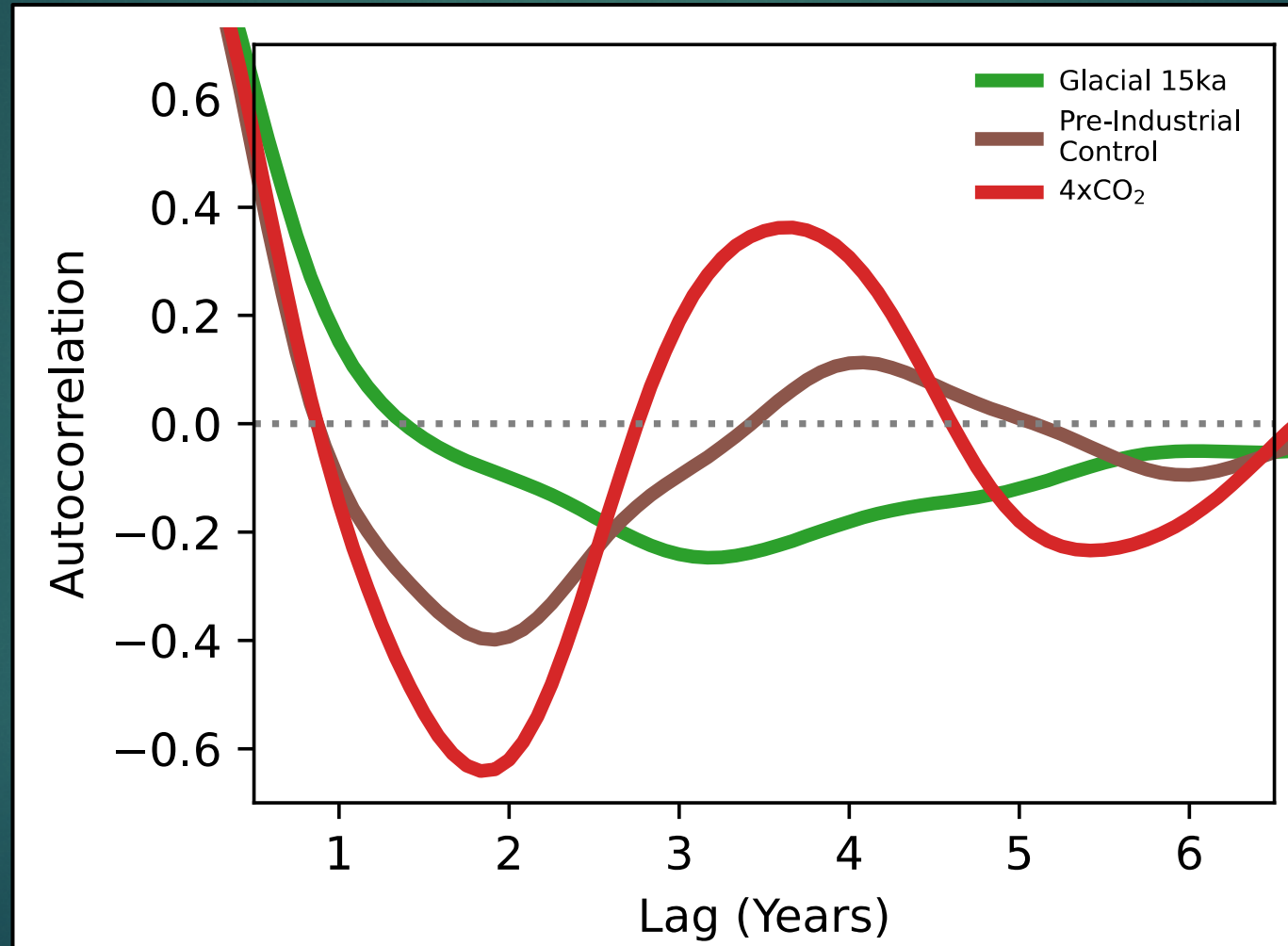
Fully oscillatory

More consistent

La Niña to El Niño transition

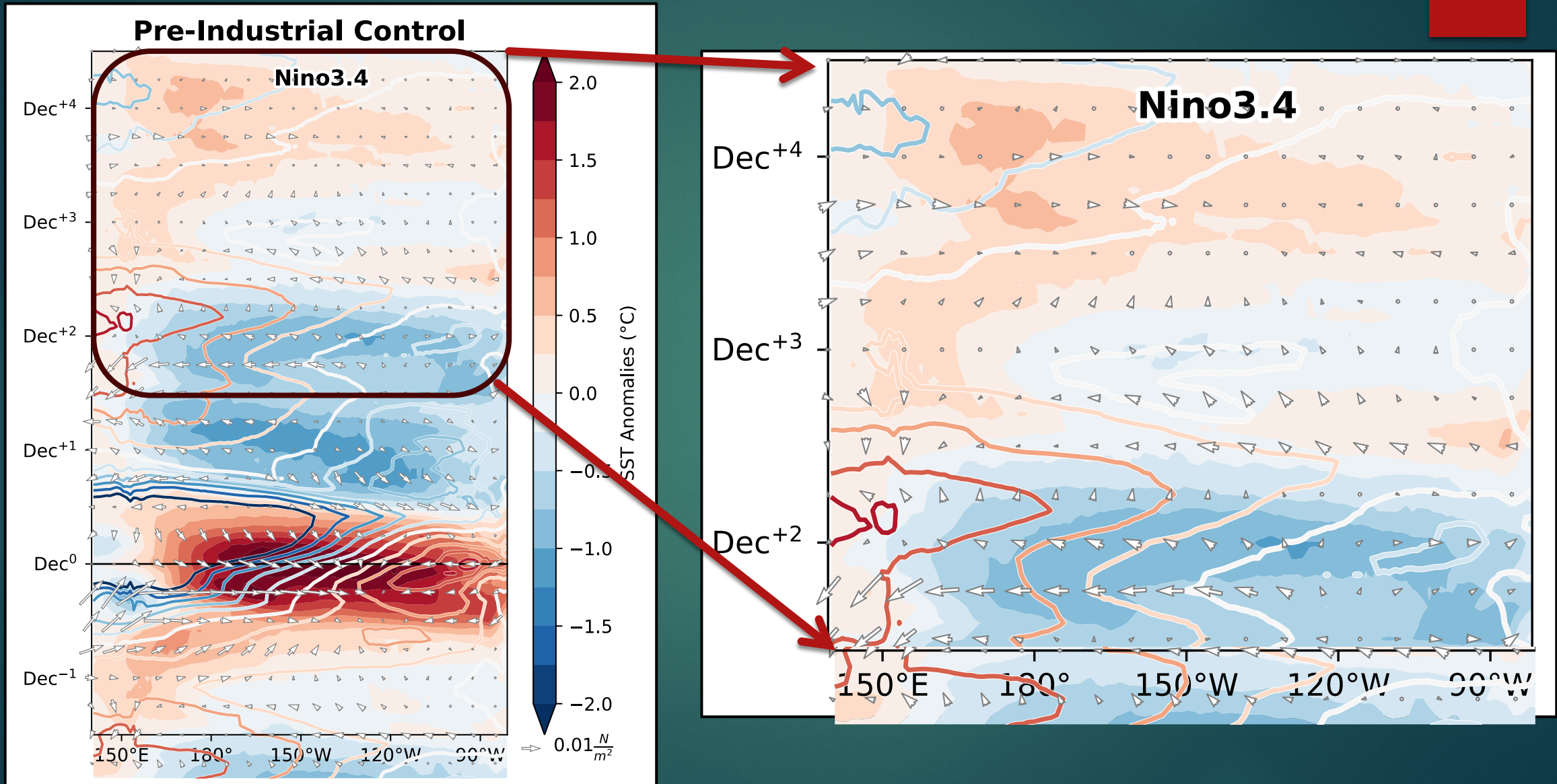
ACF also shows the pronounced changes in oscillatory behavior

7



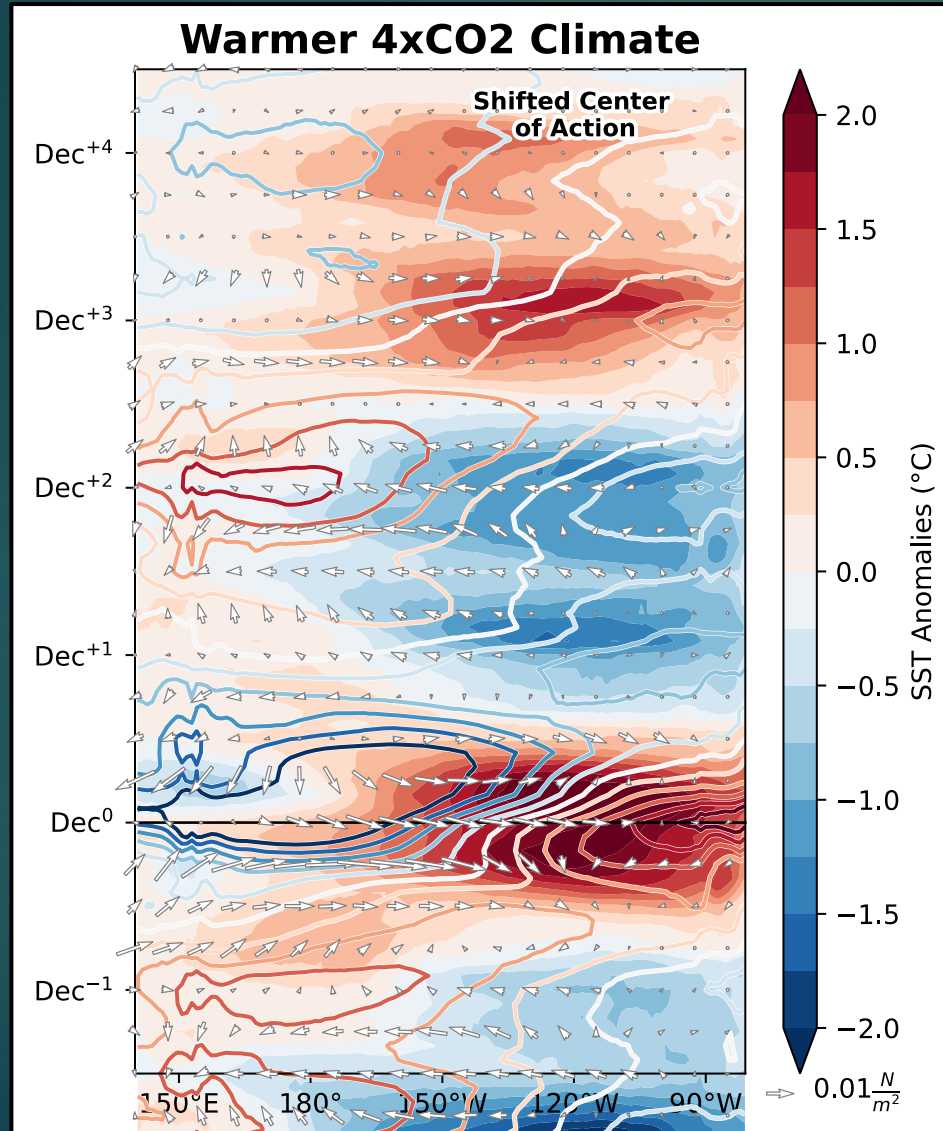
Spatiotemporal evolution of the composite El Niño

8



ENSO oscillatory regimes are highly sensitive to the zonal location of the center of action

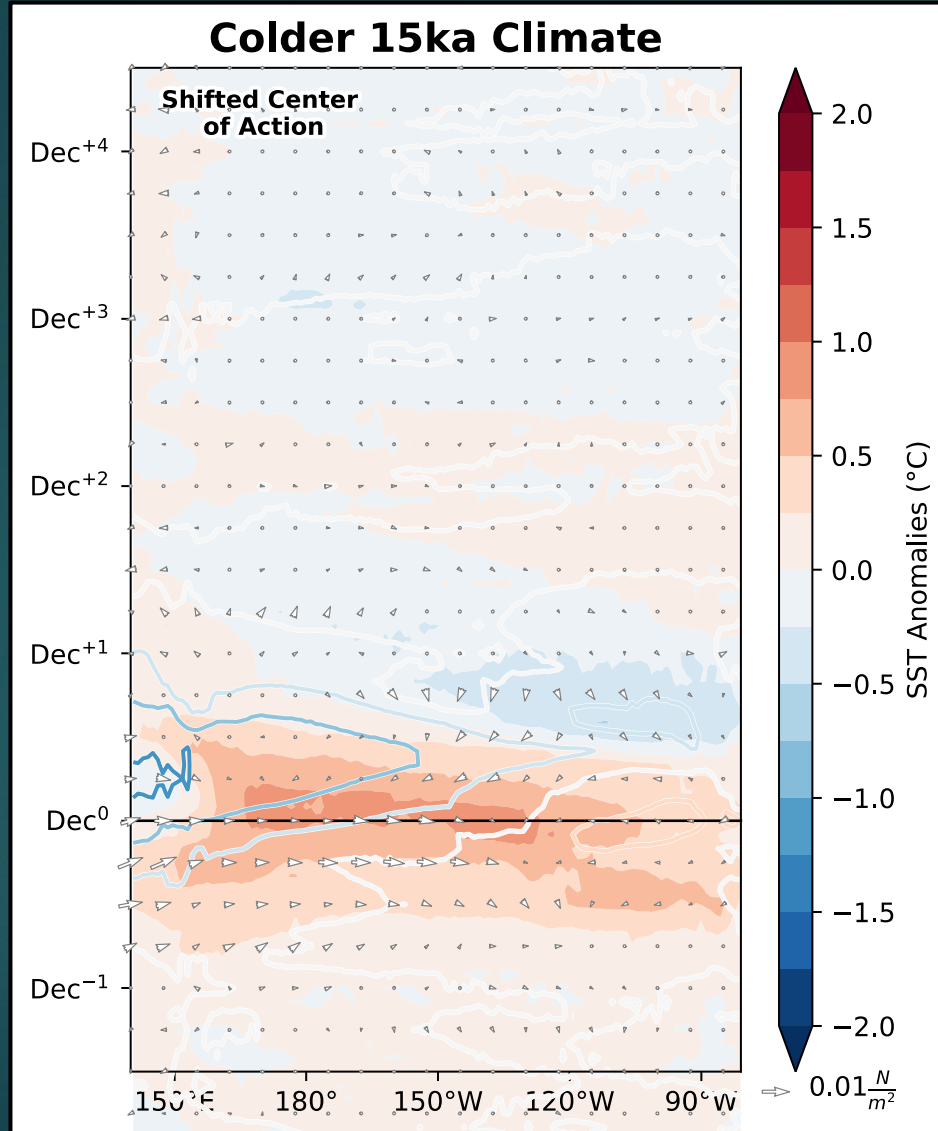
9



An eastward shift allows the thermocline variability to positively feedback on the atmosphere due to the shallower climatological thermocline in this part of the basin. This makes ENSO more oscillatory.

ENSO oscillatory regimes are highly sensitive to the zonal location of the center of action

9



A westward shift diminishes the influence of thermocline variability on the atmosphere making ENSO less oscillatory.

Conclusions

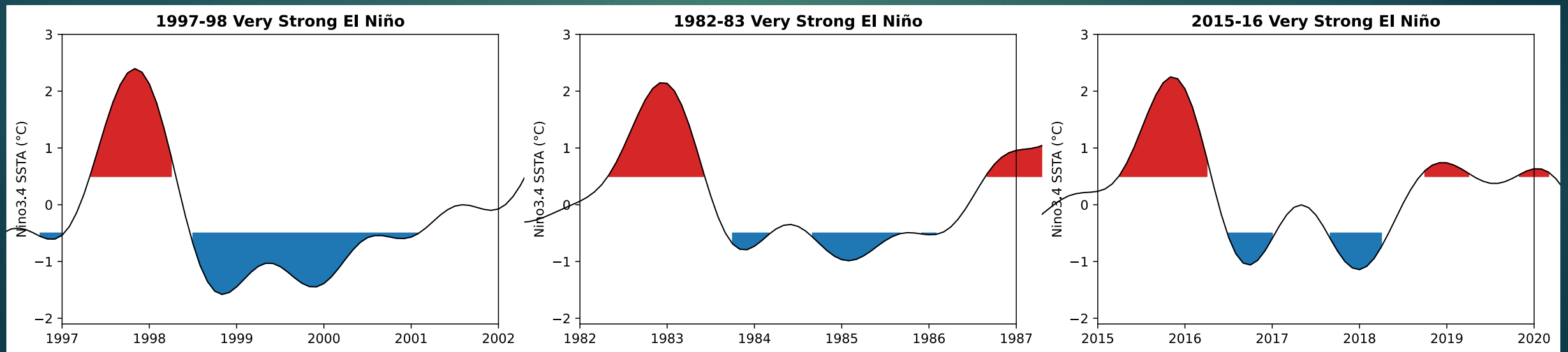
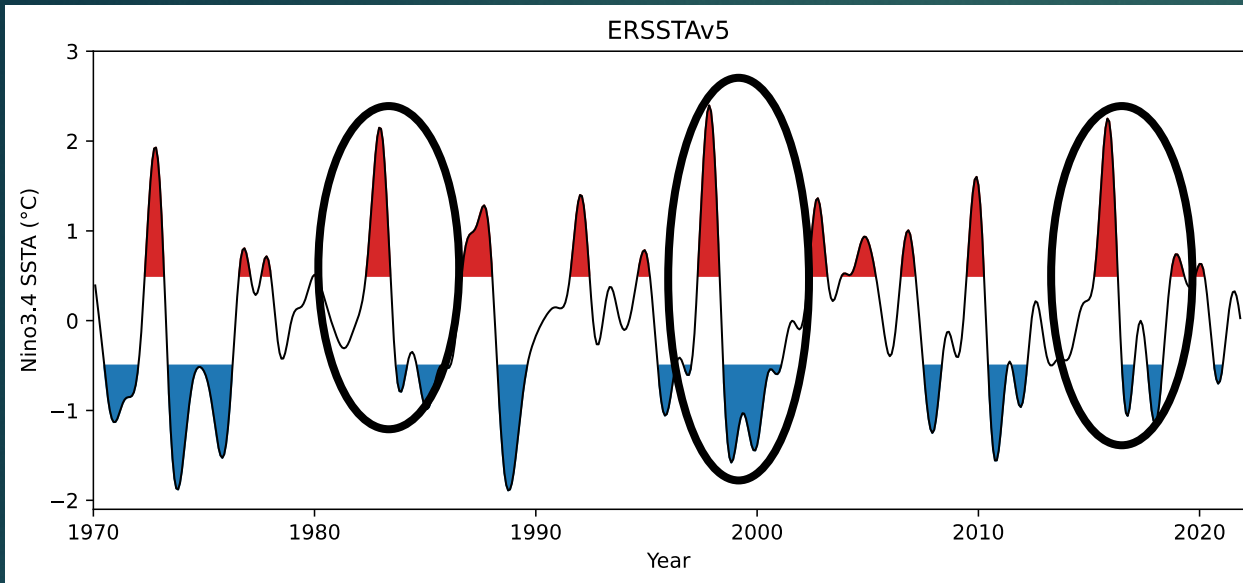
- ▶ **Zonal shifts in the center of action can affect the Oscillatory behavior of ENSO**
- ▶ It could be important for future predictability of El Niño events
- ▶ Can help us understand how ENSO is simulated in other coupled models.
- ▶ Is this a robust signal in the CMIP models?
- ▶ **These results depend on the pattern of warming of the Pacific**



Thank you!
Any questions?

Asymmetric transitions between El Niño and La Niña

La Niña events that do not consistently transition into El Niño in the same way that El Niño events transition into La Niña.



Changes in the mean state of the thermocline are important for ENSO transitions

