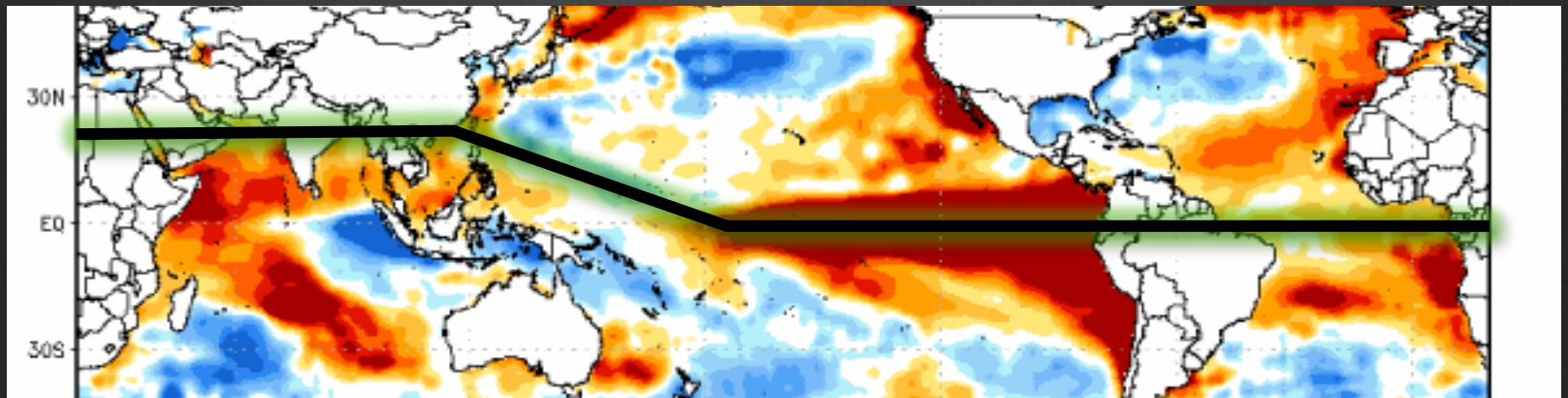


Is Global Warming enhancing ENSO precursors in the Western North Pacific?

- S.-Y. Simon Wang Utah State University
- Michelle L'Heureux NOAA CPC
- Jin-Ho Yoon DOE PNNL

Is Global Warming enhancing ENSO precursors in the Western North Pacific?

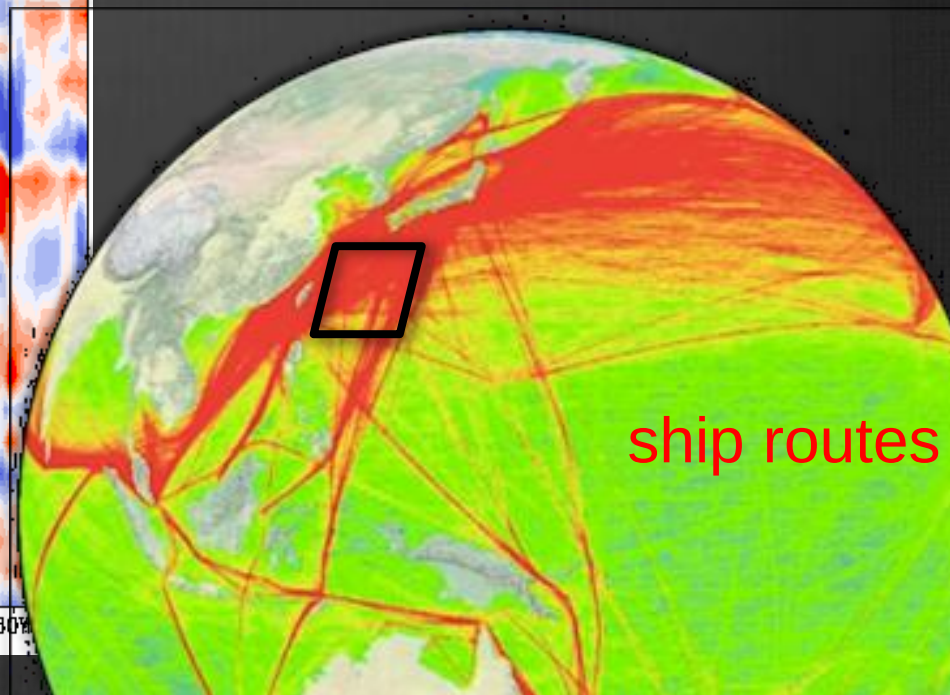
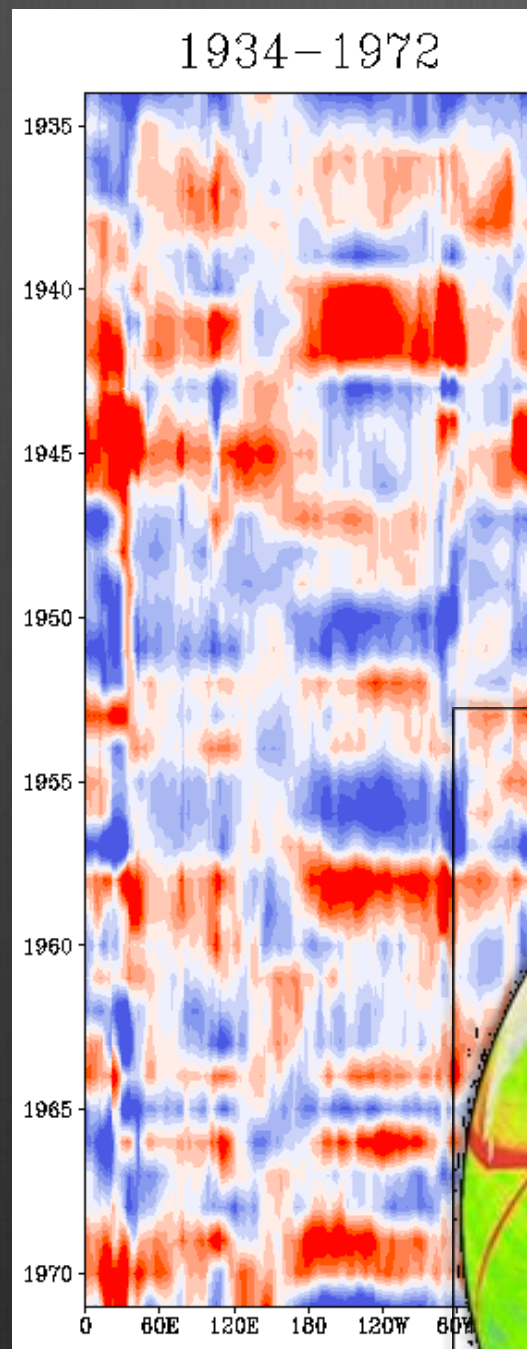


ENSO evolution:

(Wang and An 2002; Guan and Nigam 2008)

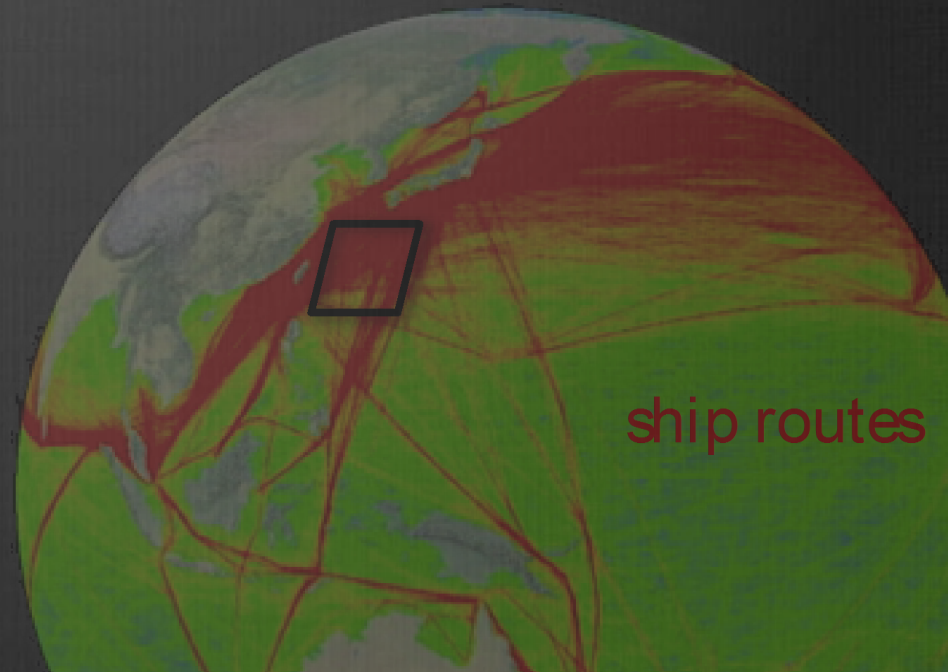
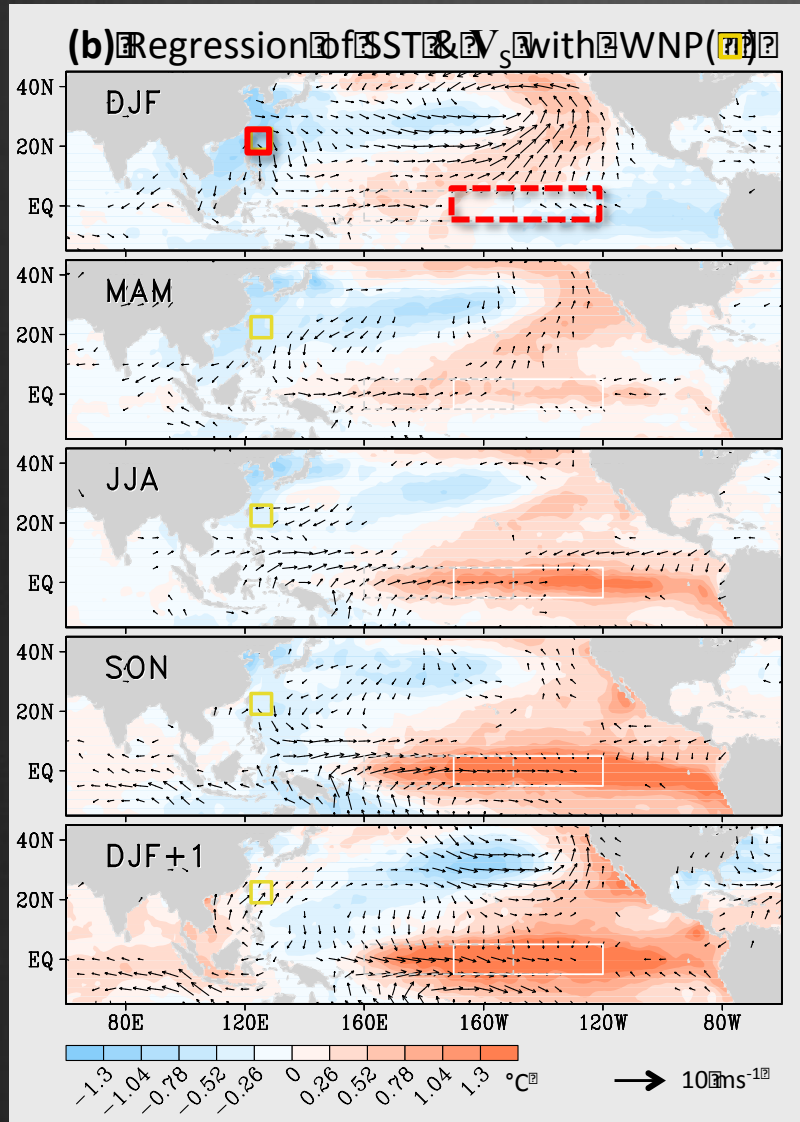
Longitude-time diagram

earlier



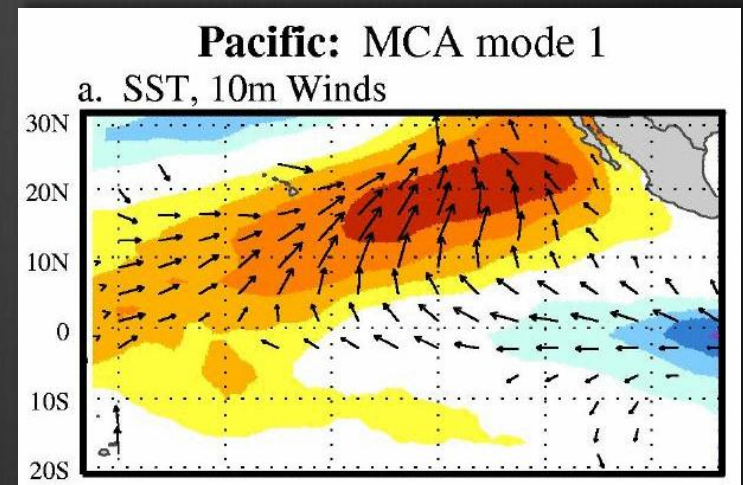
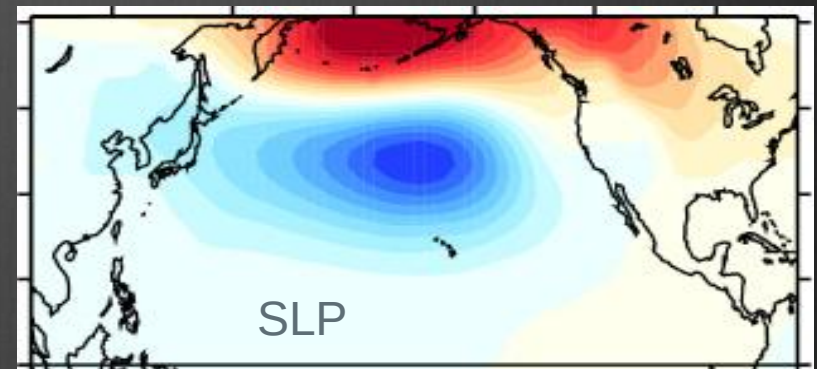
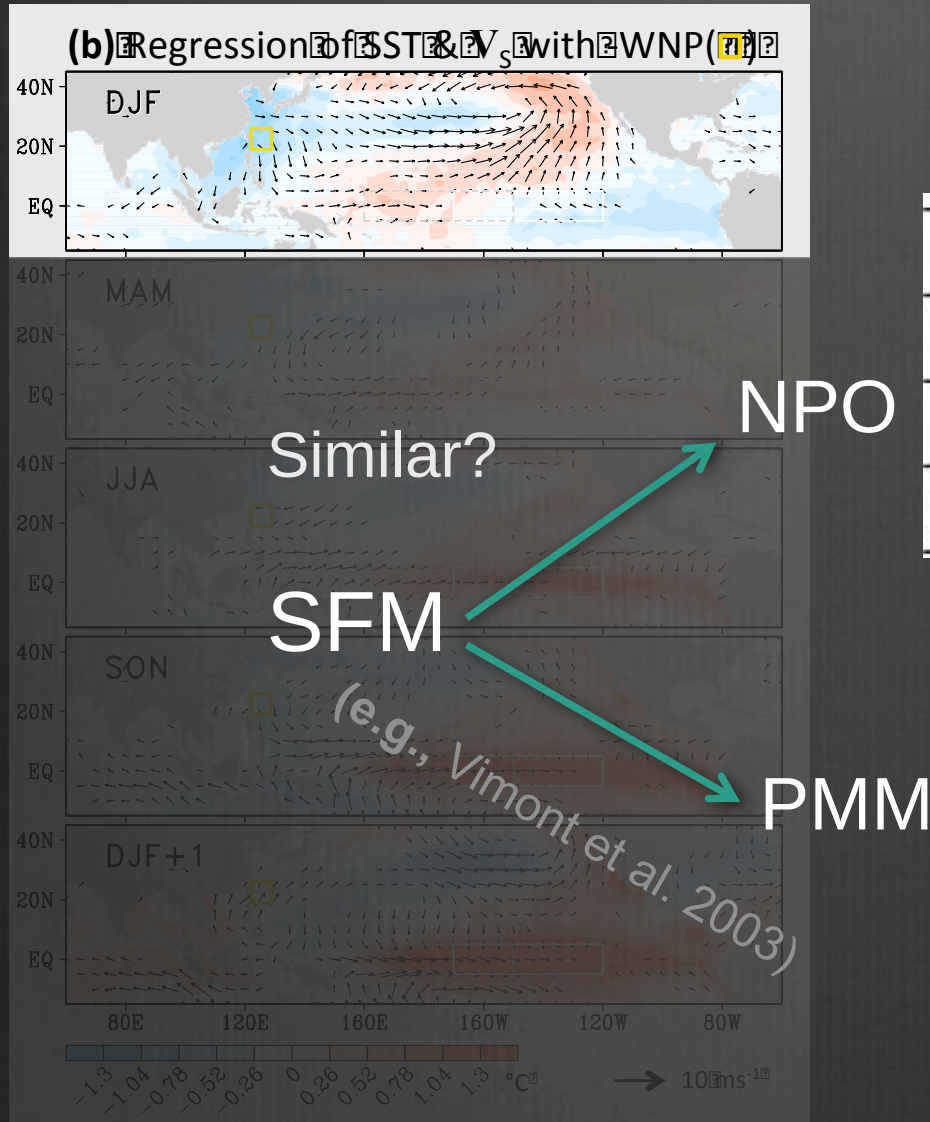
ENSO precursor: WNP

Western North Pacific



ENSO precursor: WNP

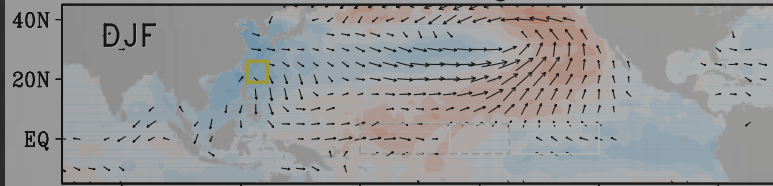
Western North Pacific



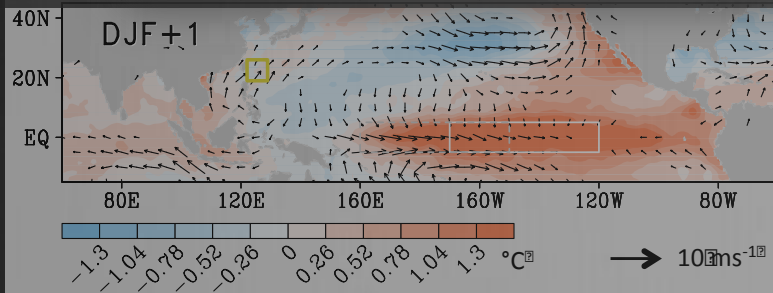
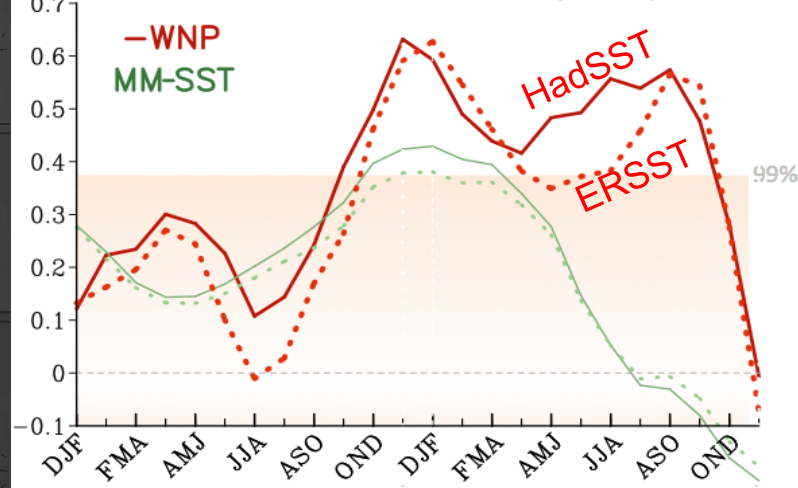
ENSO precursor: WNP

Western North Pacific

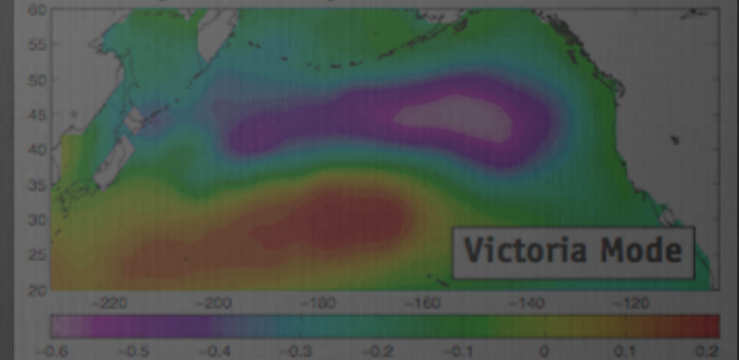
(b) Regression of SST & V_s with WNP (77°E)



Cross correlation w/ Nino-3.4(DJF+1)

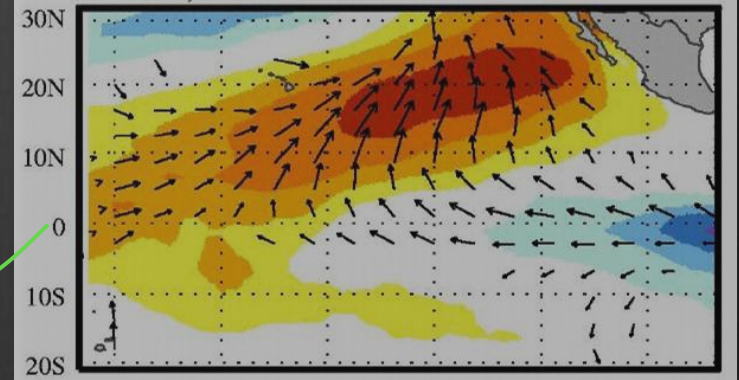


SSTa (detrended) EOF 2



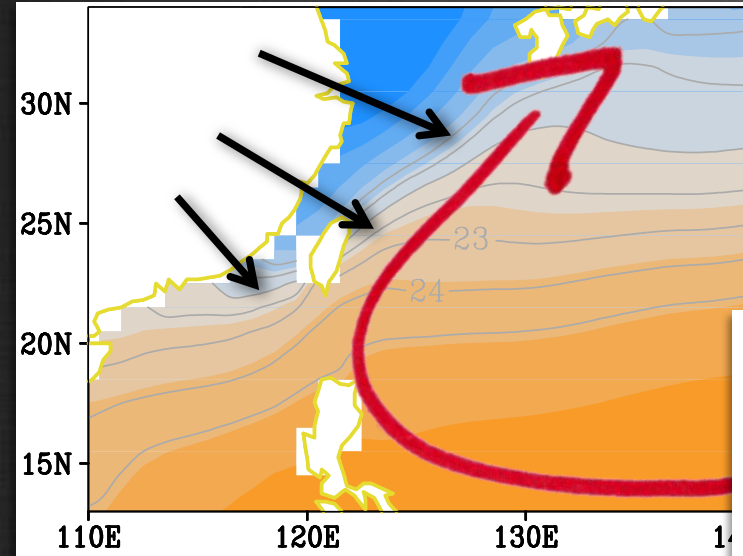
Pacific: MCA mode 1

a. SST, 10m Winds

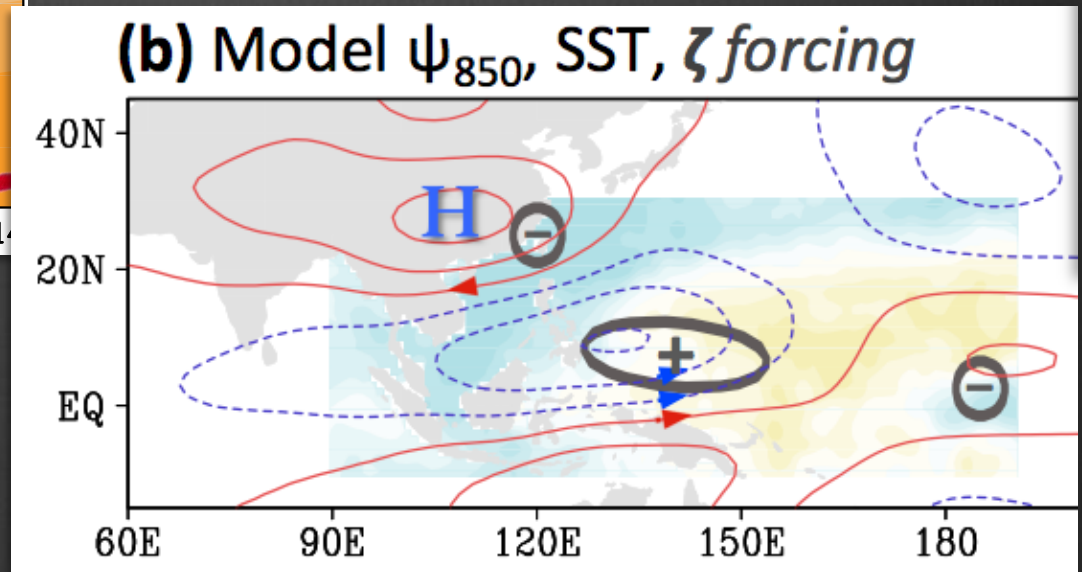


Why WNP?

SST DJF Mean

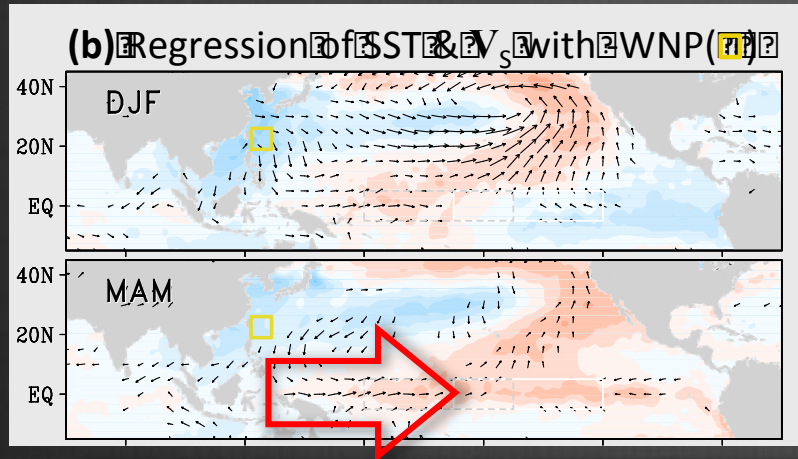


(1) East Asian Winter Monsoon impact

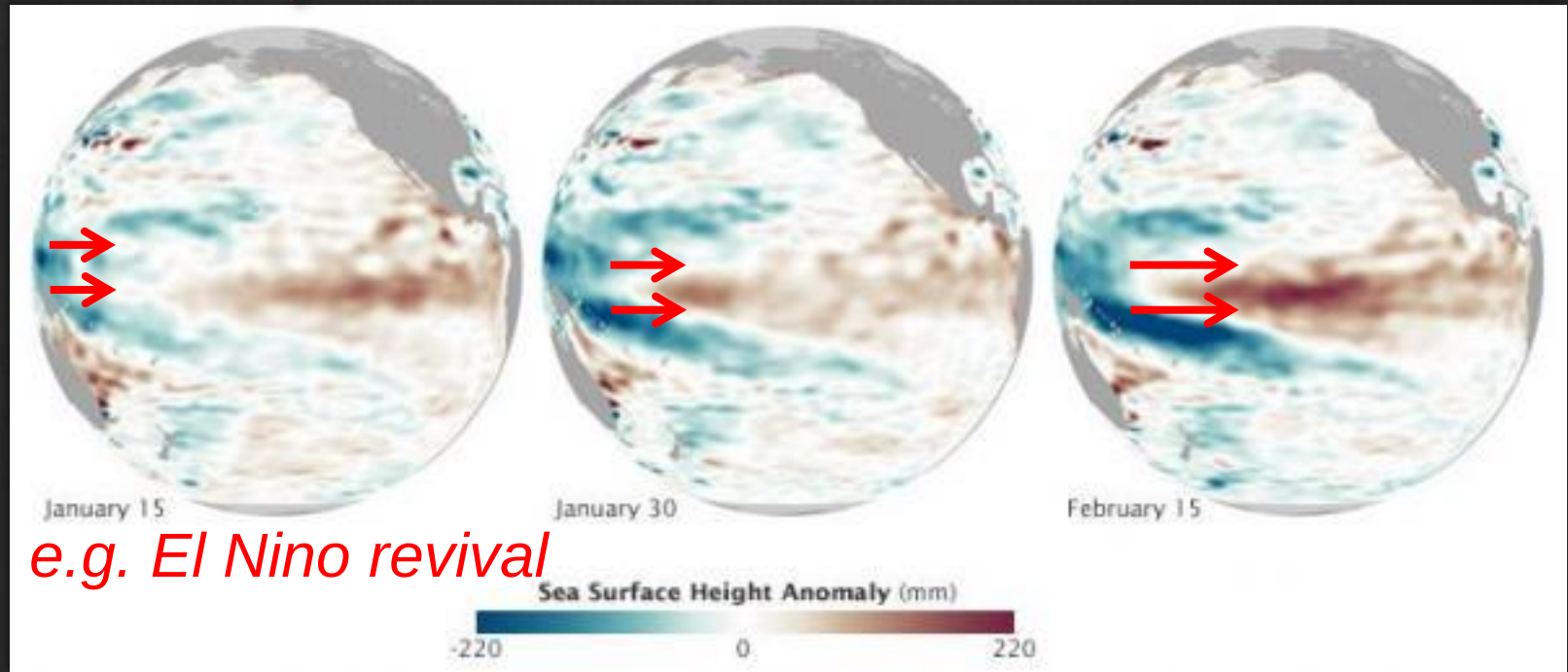


Barotropic model w/ composite WNP heat source/sink

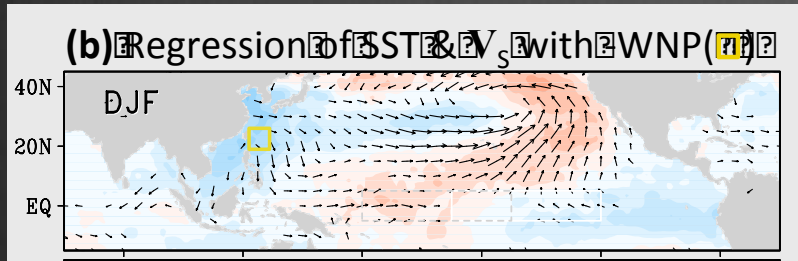
Why WNP?



(2) Oceanic Kelvin wave
- zonal wind triggered



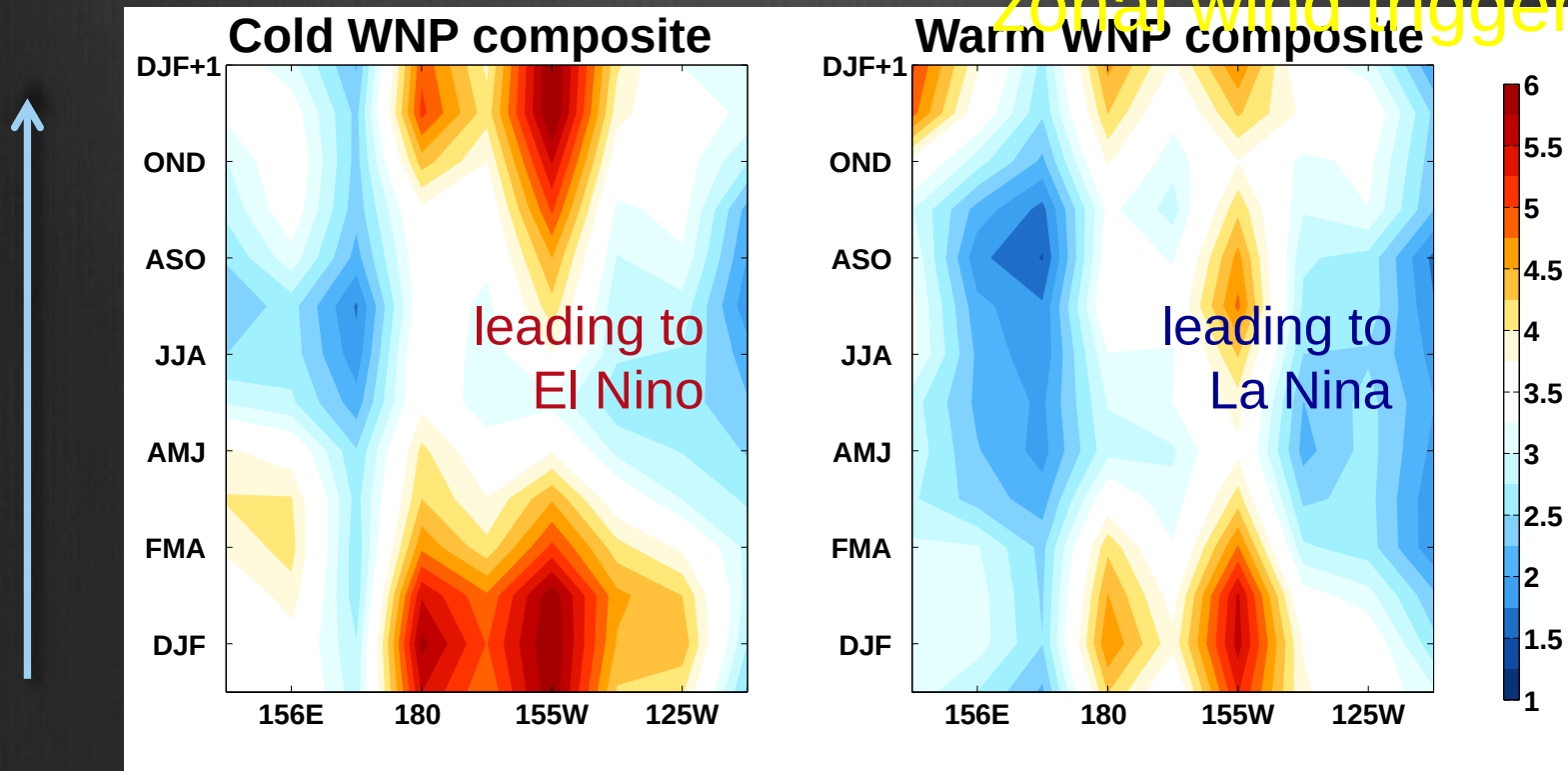
Why WNP?



(2) Oceanic Kelvin wave

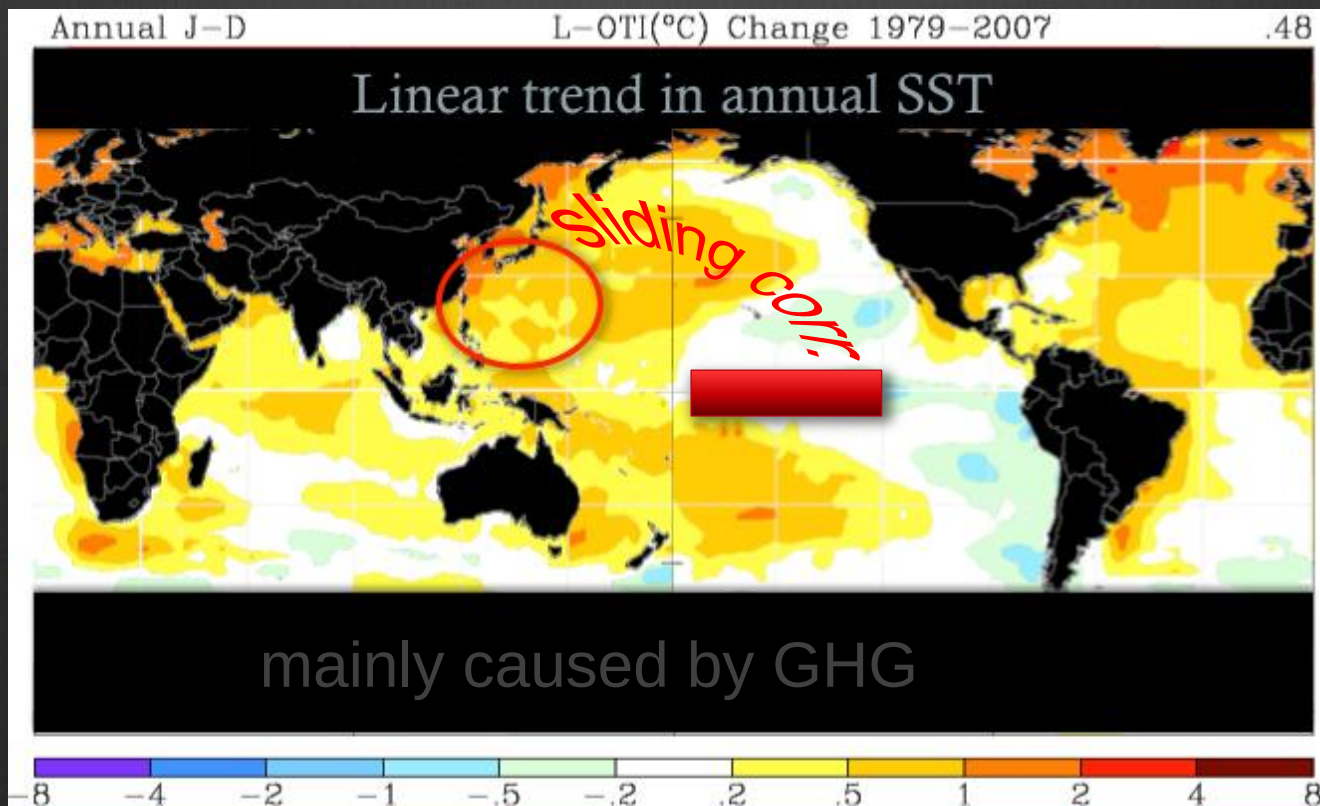
KW dynamic height composite

zonal wind triggered

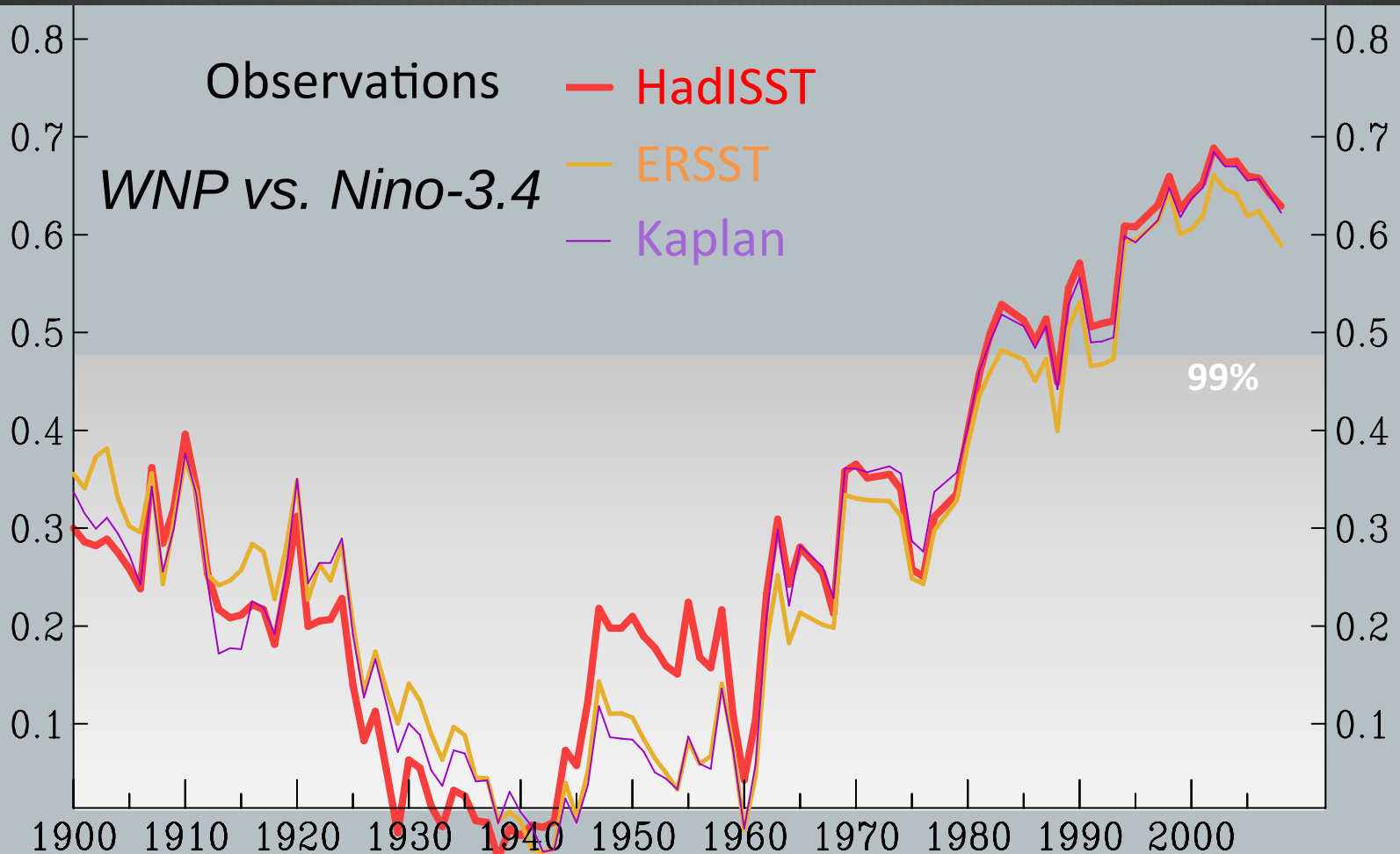


GHG forcing

Is ~~Global Warming~~ enhancing
ENSO precursors in the
Western North Pacific?



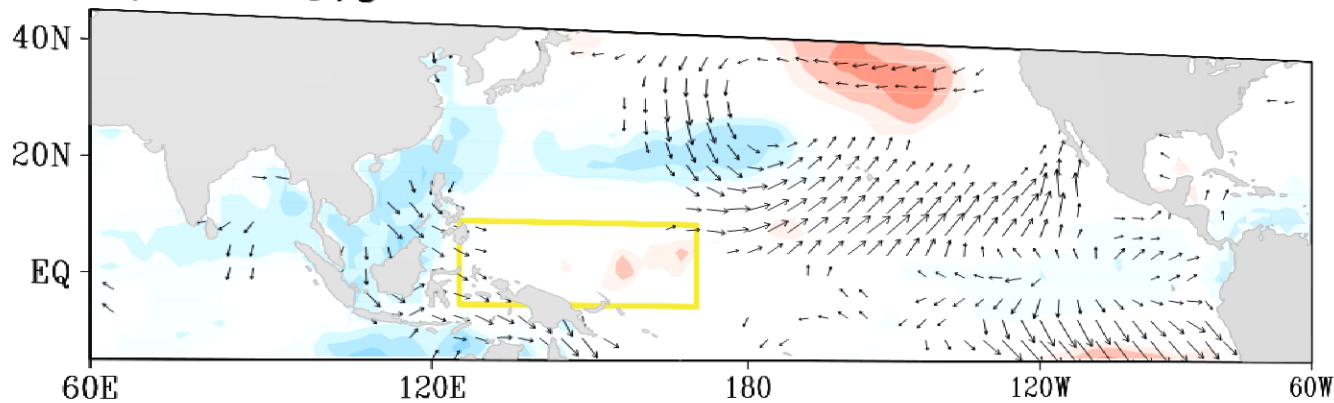
25-yr sliding correlation of SSTA



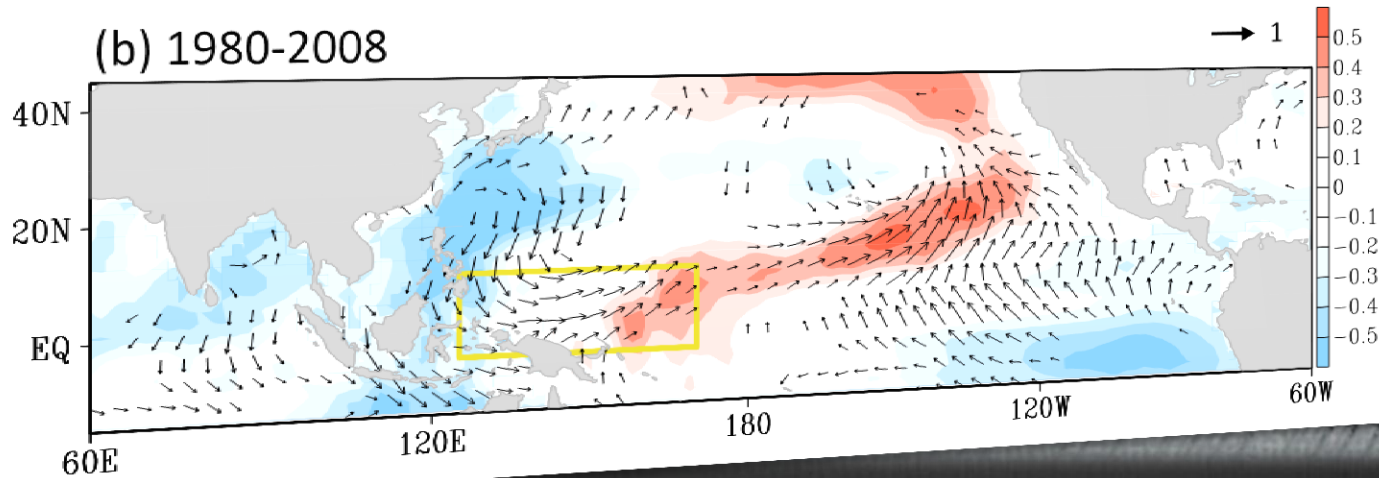
Correlation for ENSO precursors

[Observed] Correlation of SSTA, V_s (DJF) vs. Nino-3.4 (DJF+1yr)

(a) 1951-1979



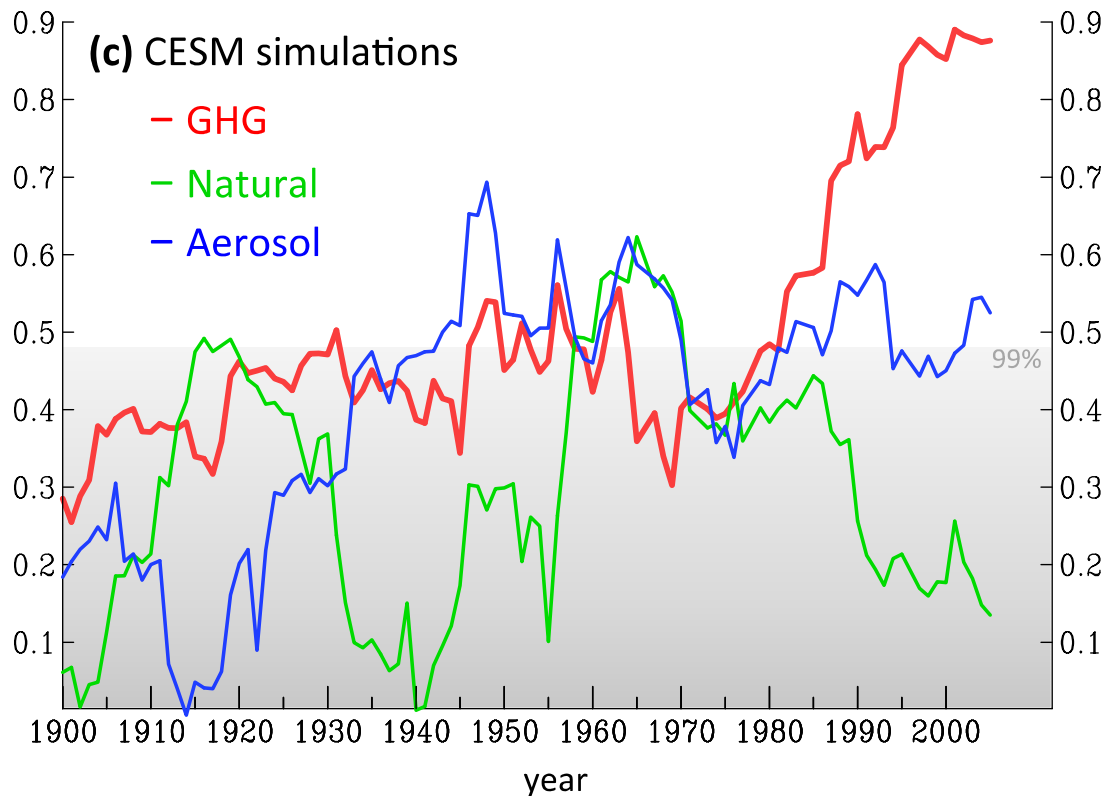
(b) 1980-2008



25-yr sliding correlation of SSTA

Community Earth System Model

Historical forcing experiments (1850-2005):



← holy cow

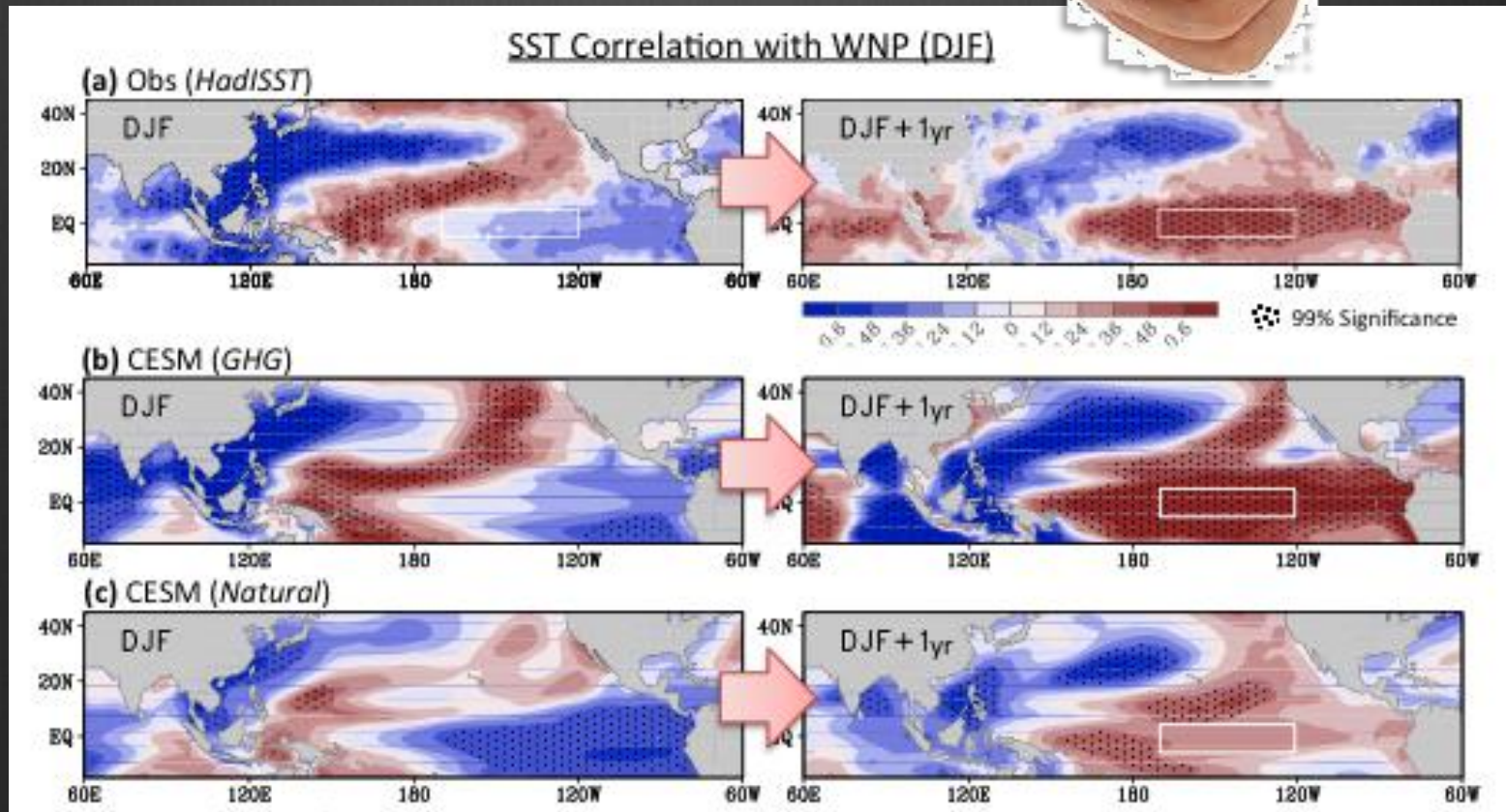
How good is CESM

Realistic ENSO pre-condition

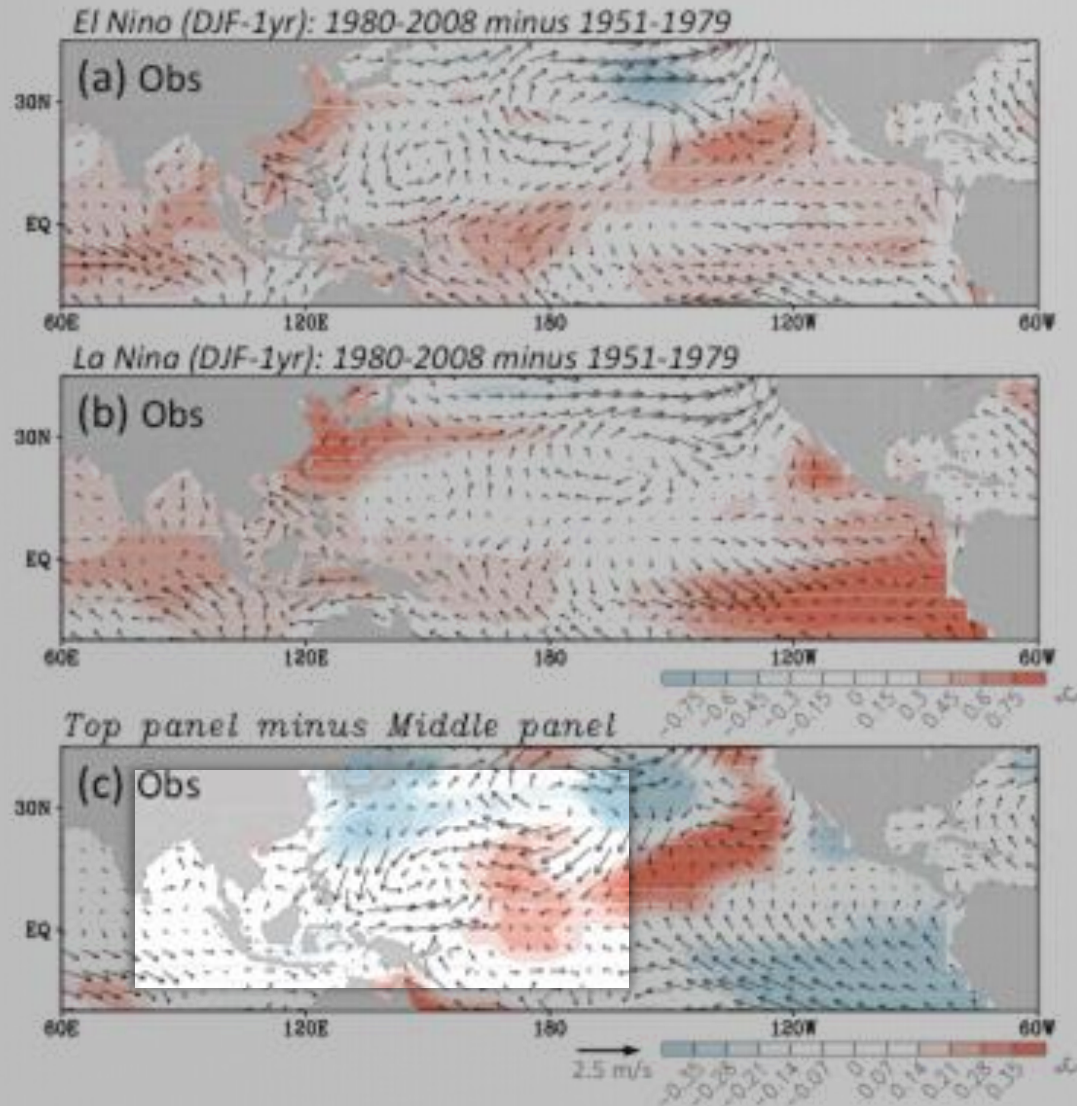


OBS →

CESM →



WNP warming & dynamics



Composite analysis:

NCEP + 20CR
& HadSST

WNP warming & dynamics

El Nino (DJF-1yr): 1980-2008 minus 1951-1979

(a) Obs



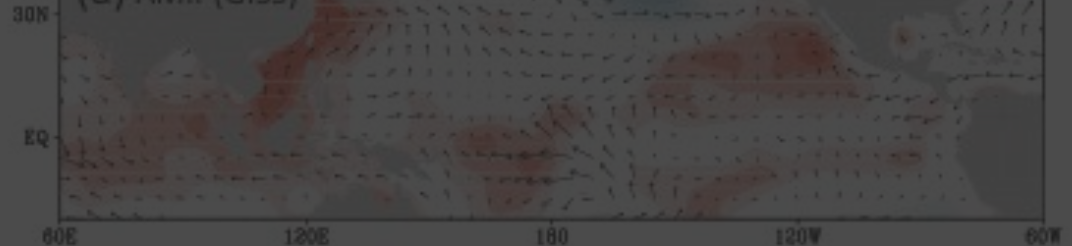
La Nina (DJF-1yr): 1980-2008 minus 1951-1979

(b) Obs

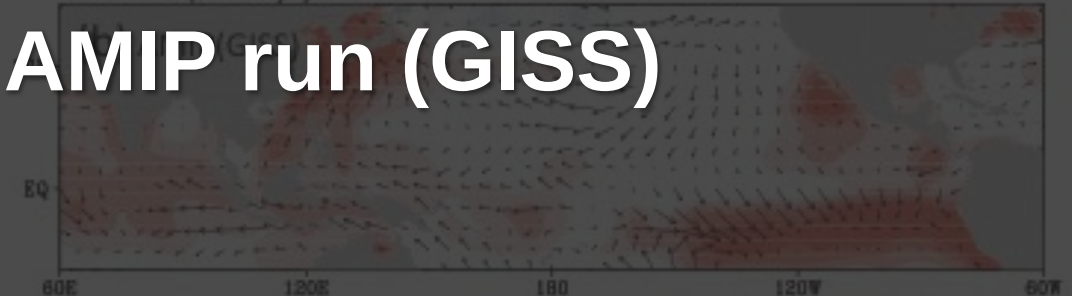


El Nino (DJF-1yr): 1980-2008 minus 1951-1979

(a) AMIP(GISS)



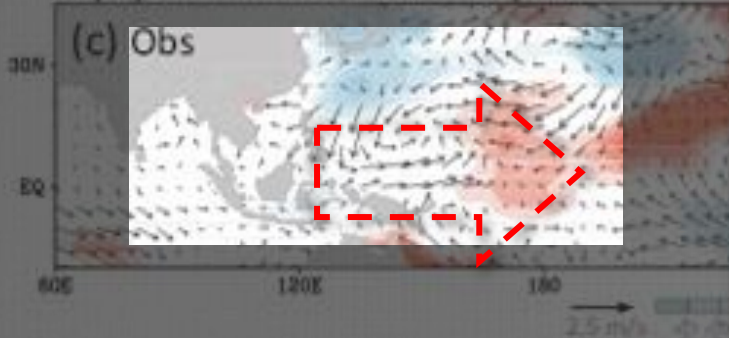
La Nina (DJF-1yr): 1980-2008 minus 1951-1979



AMIP run (GISS)

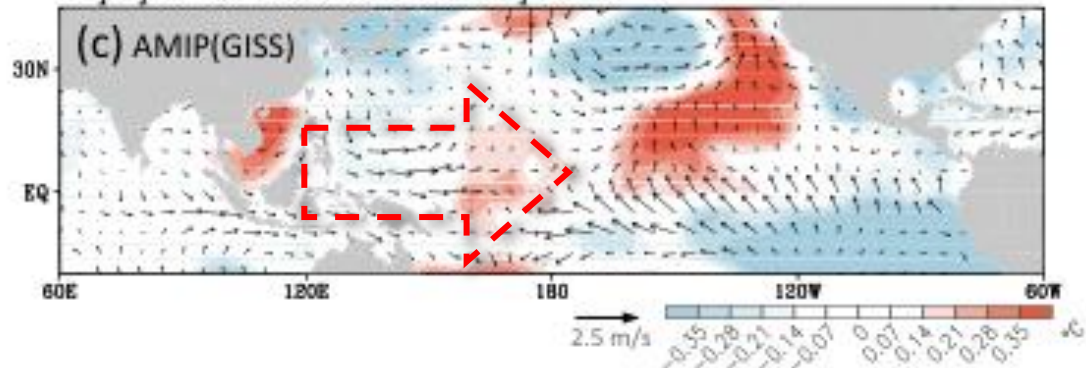
Top panel minus Middle panel

(c) Obs



Top panel minus Middle panel

(c) AMIP(GISS)



WNP warming & dynamics

CESM free run

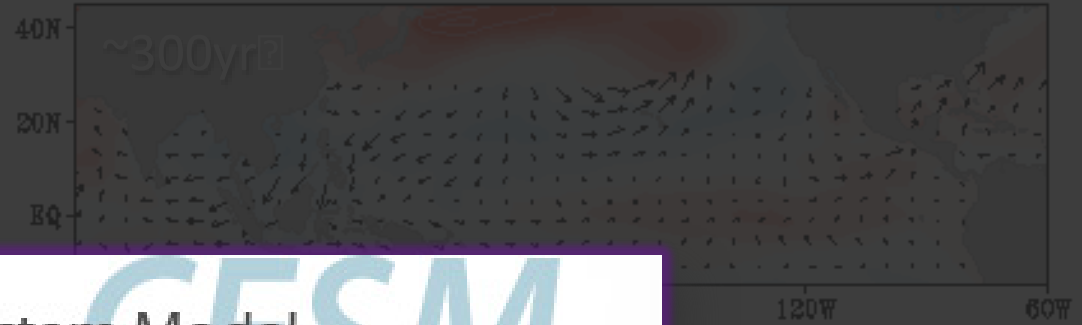
Community Earth System Model

CESM 350-year control run (natural variability)

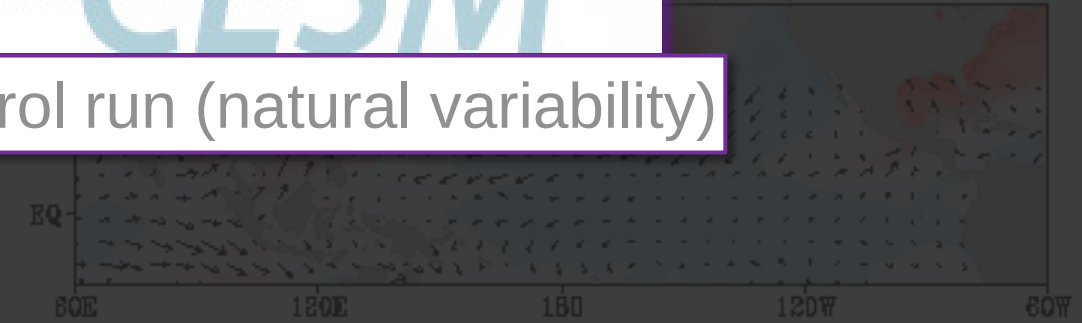
El Nino (DJF-1yr): 1980-2008 minus 1951-1979

(a) Obs

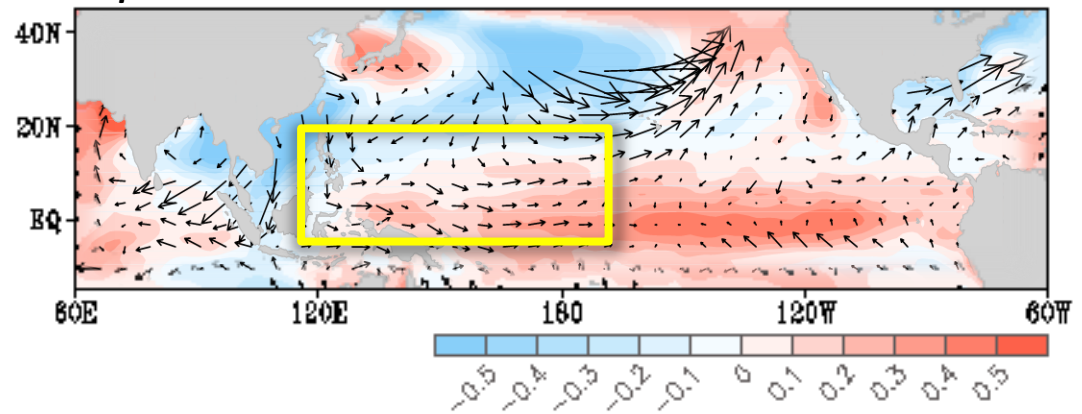
El Nino (DJF-1yr): PC1(warm) minus PC1(cool)



PC1(warm) minus PC1(cool)



Top minus Middle

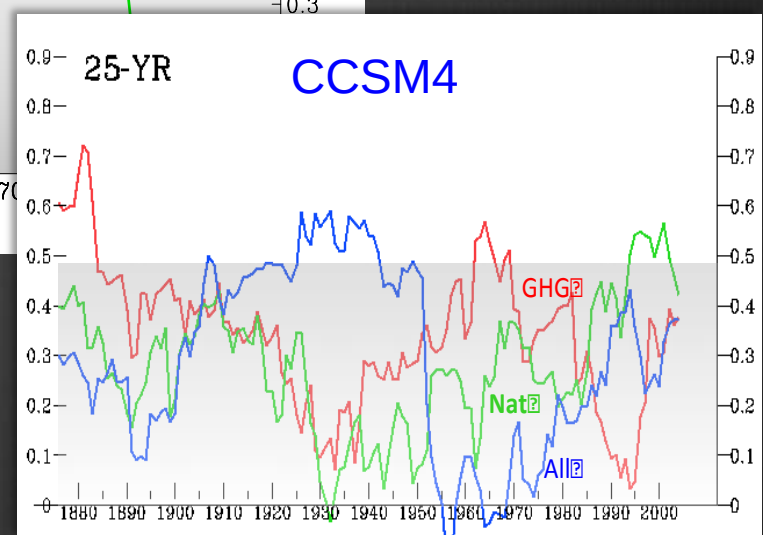
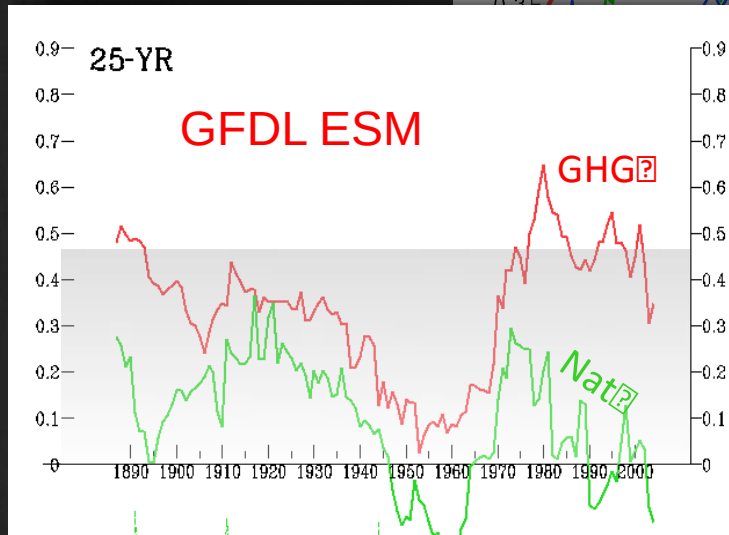
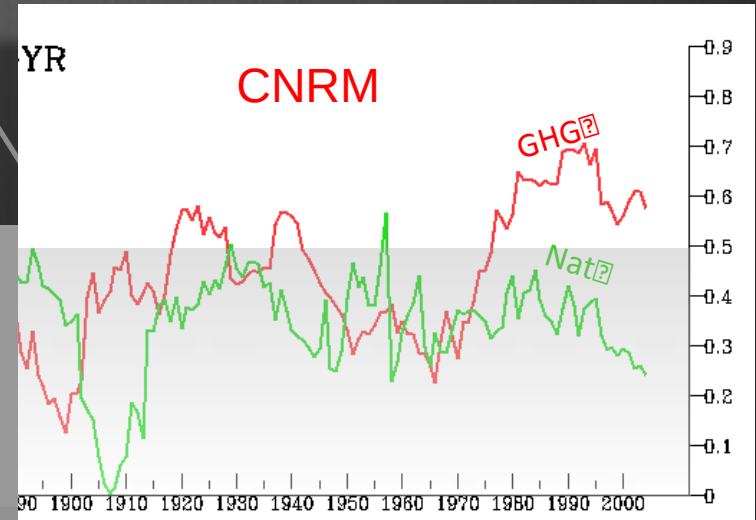
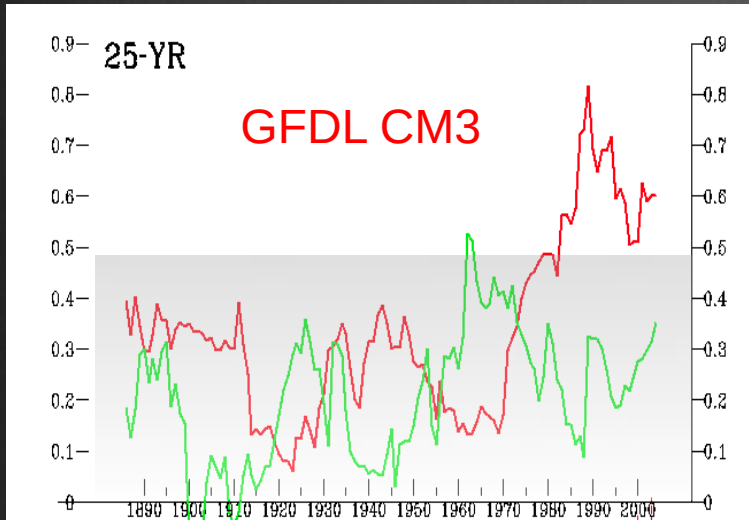


Top panel minus Middle panel

(c) Obs

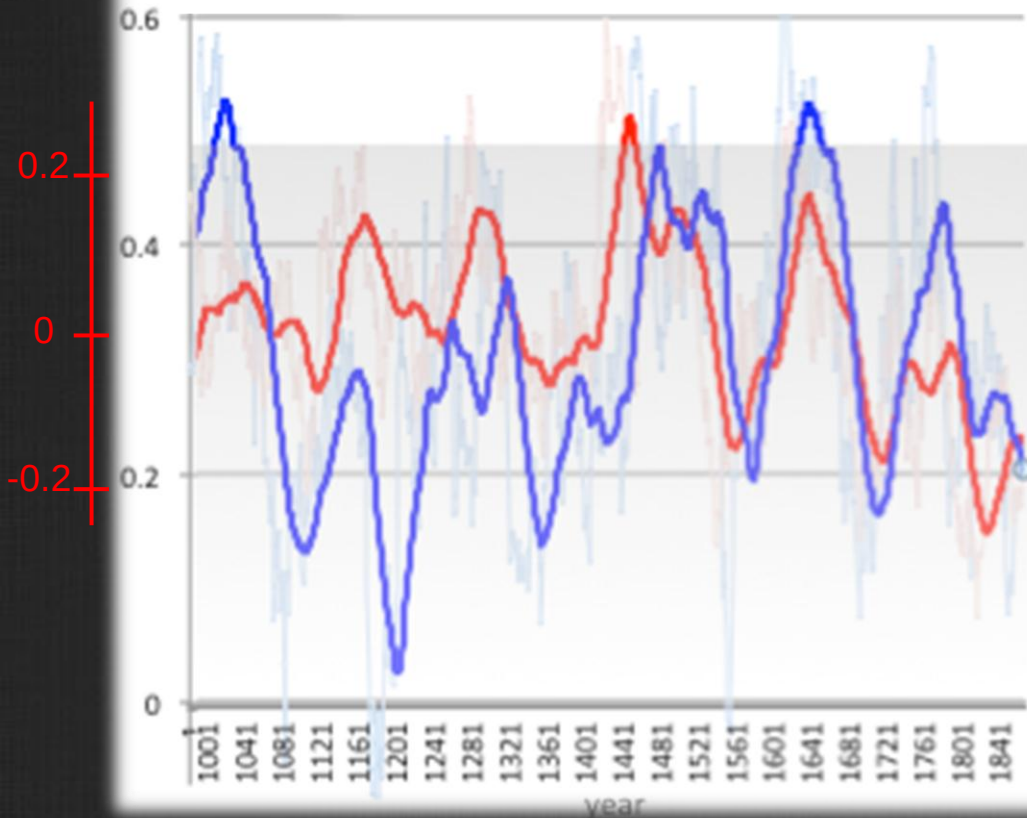


Other models? (CMIP5)

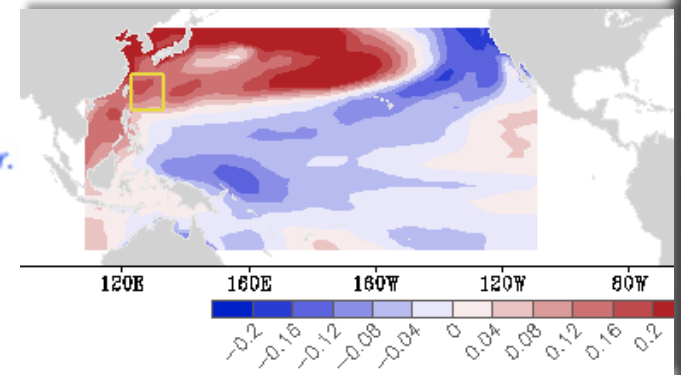


Natural variability?

GFDL CM2.1 3000-yr free run cutting off the first 2000
(Thomas Reichler, UU)



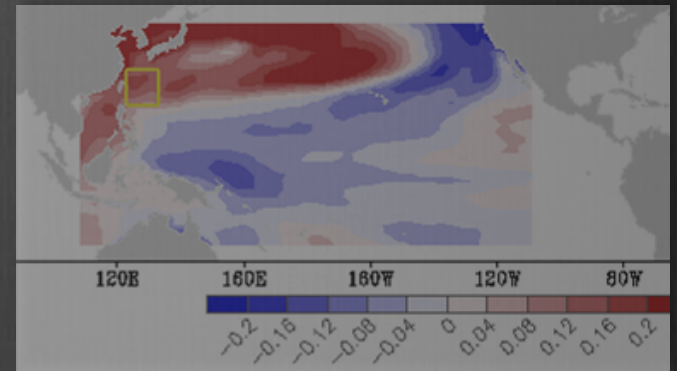
99% for corr.



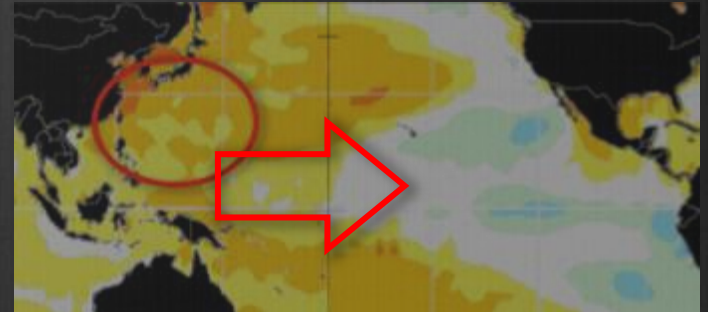
- WNP up 1.2°C
- $r > 0.7$
- within 40 years

Summary

- NPO-*like* mode leads WNP to trigger ENSO



- GHG appears to enhance (accelerate) this process



And it's only half the story!

