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

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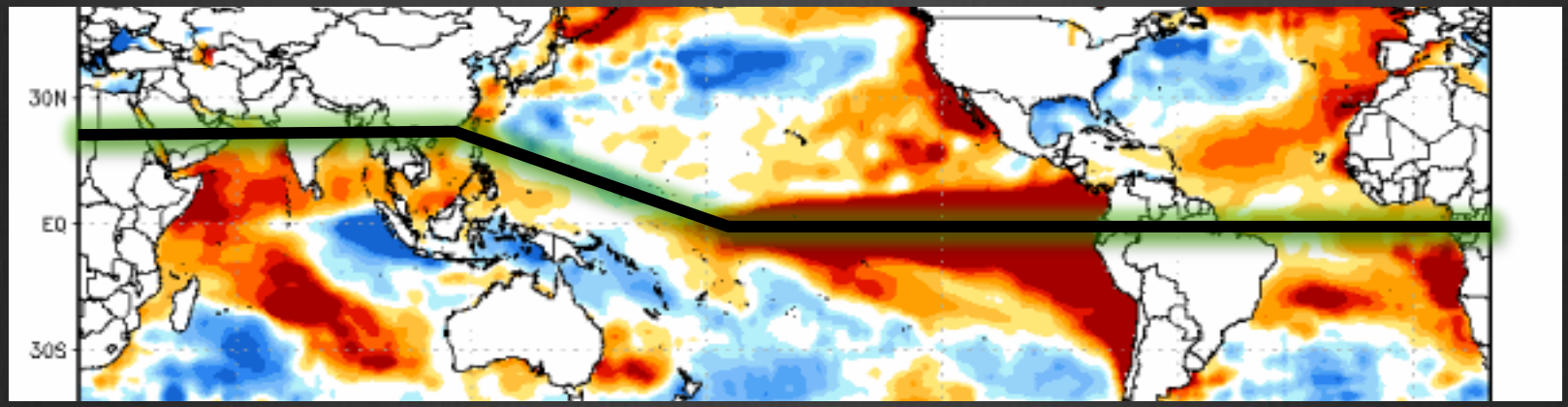
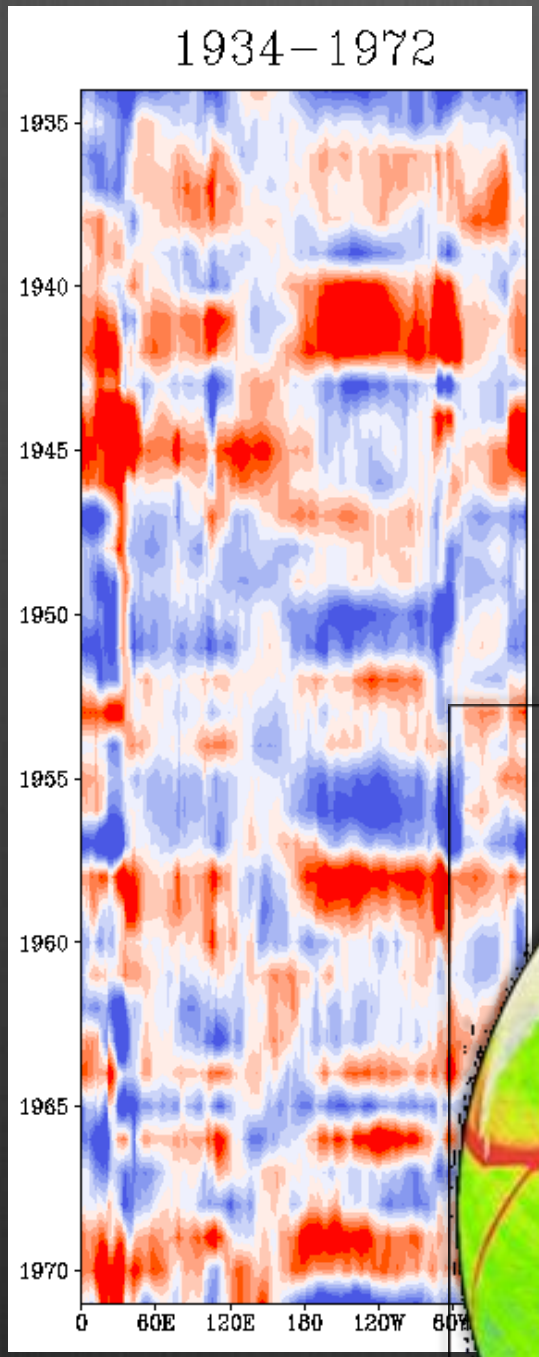


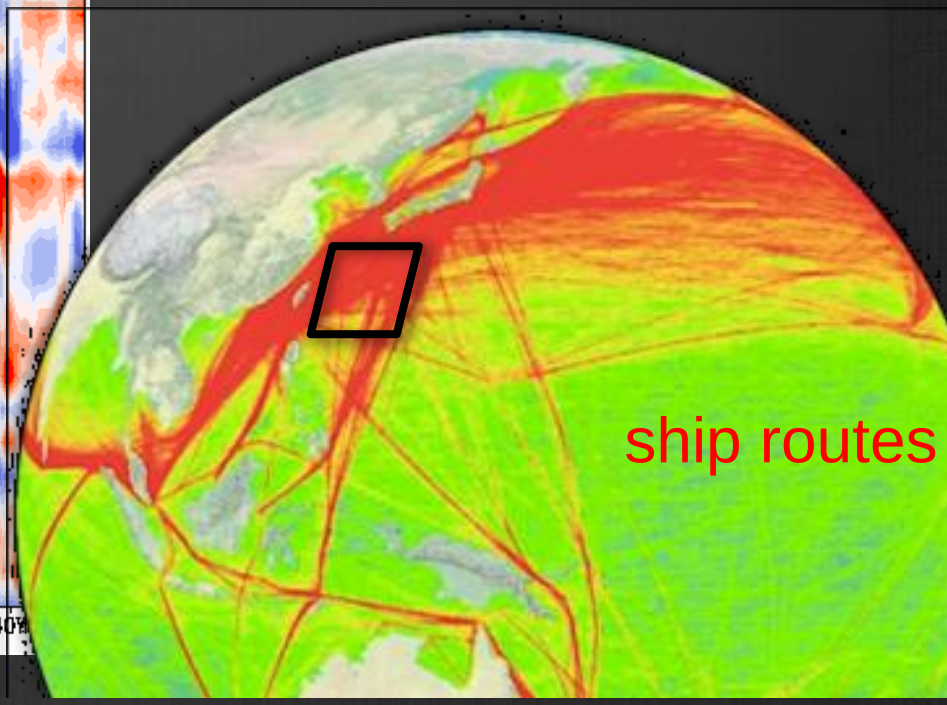
ENSO evolution:

(Wang and An 2002; Guan and Nigam 2008)

Longitude-time diagram

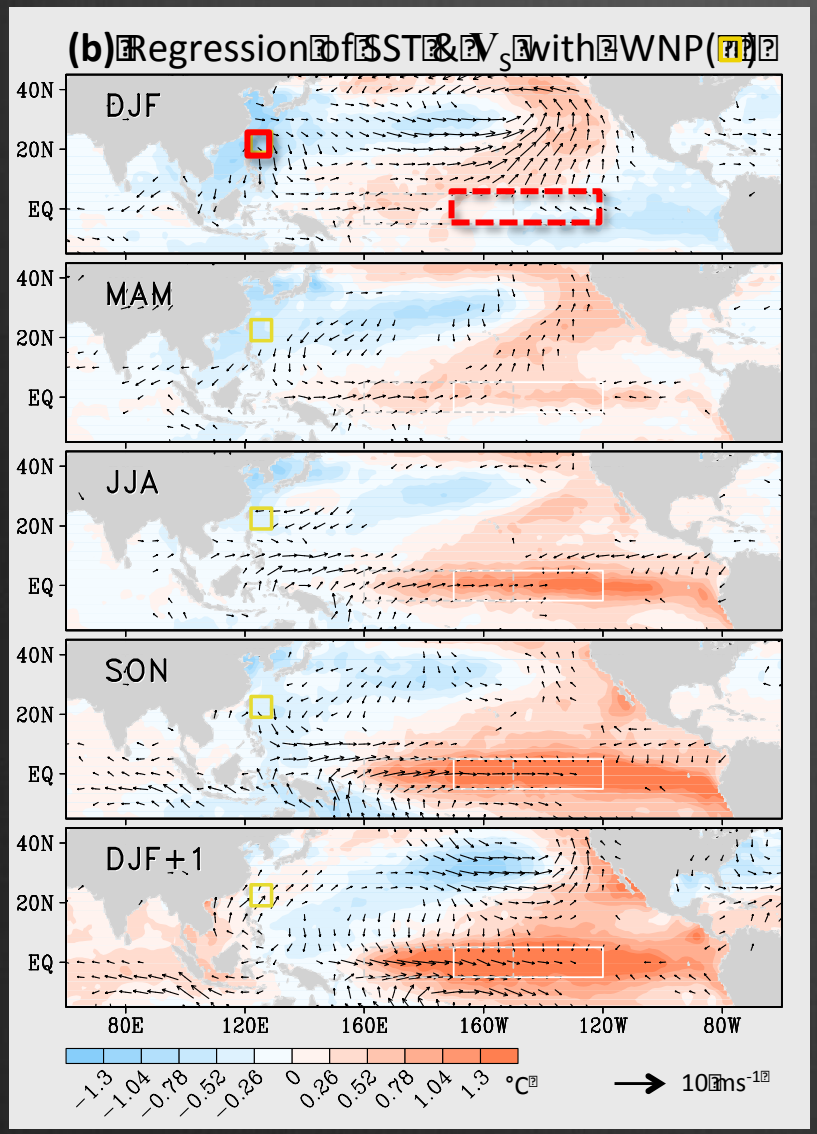
earlier

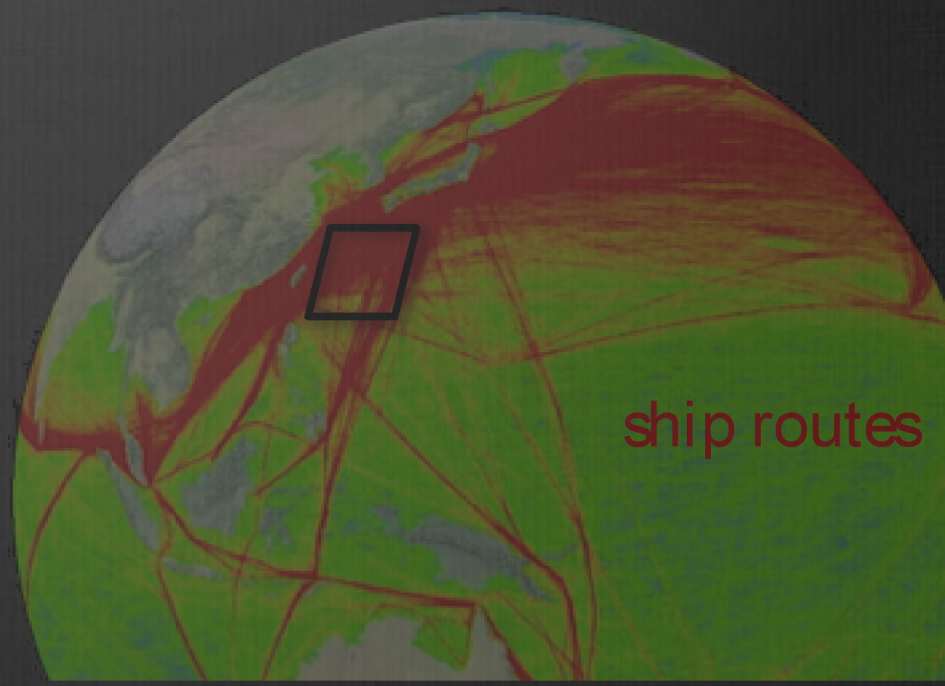




ENSO precursor: WNP

Western North Pacific





ENSO precursor: WNP

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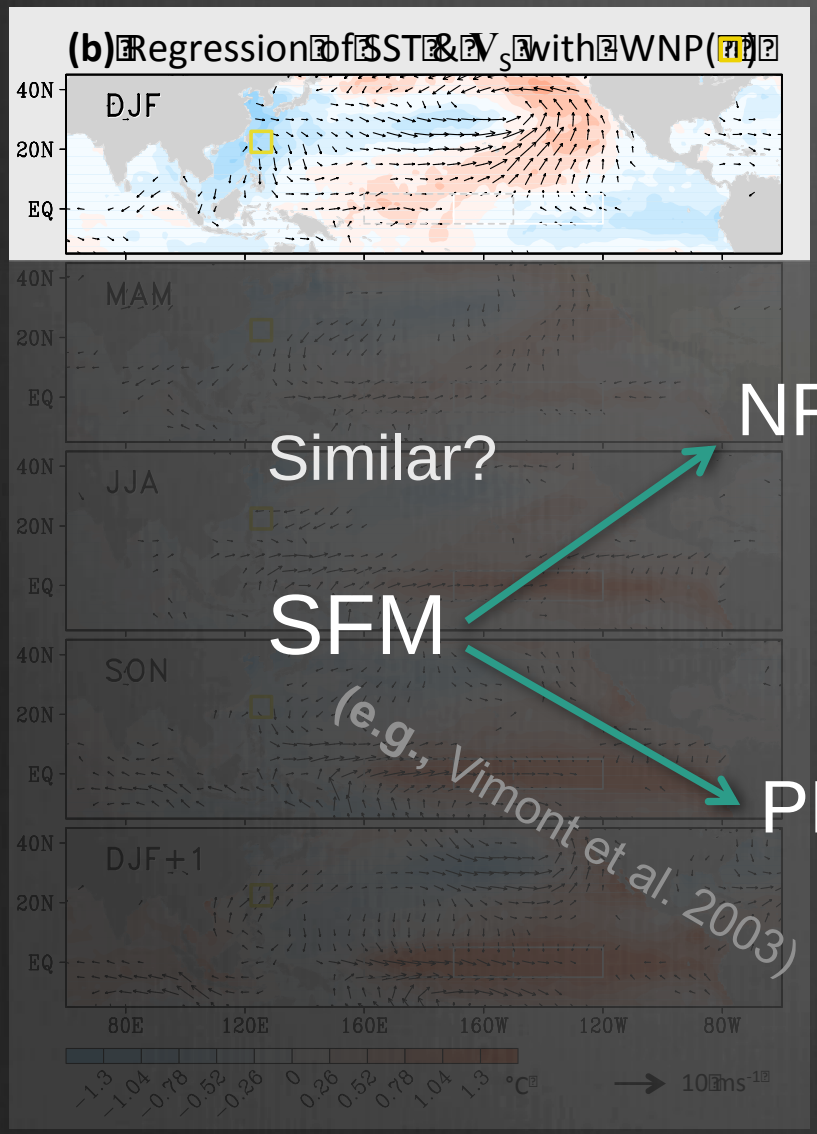
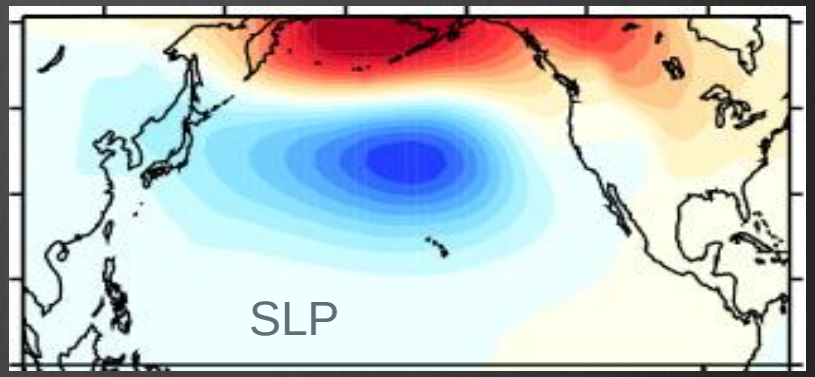


Similar?

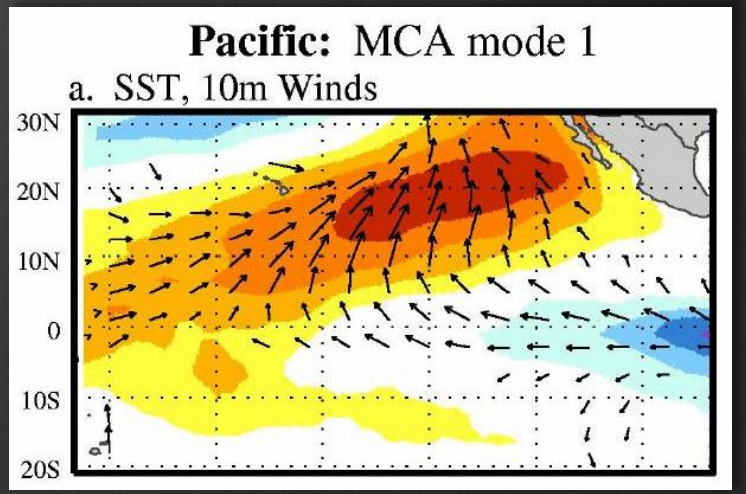
SFM

(e.g., Vimont et al. 2003)

NPO

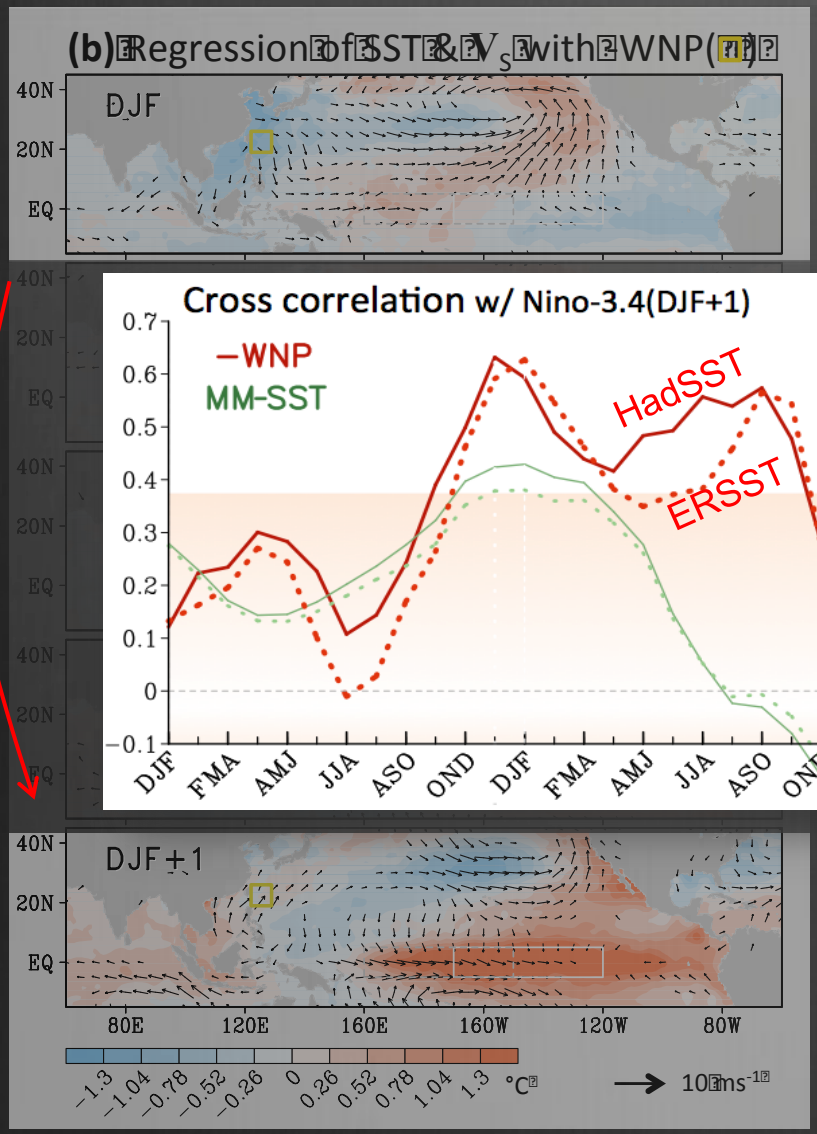


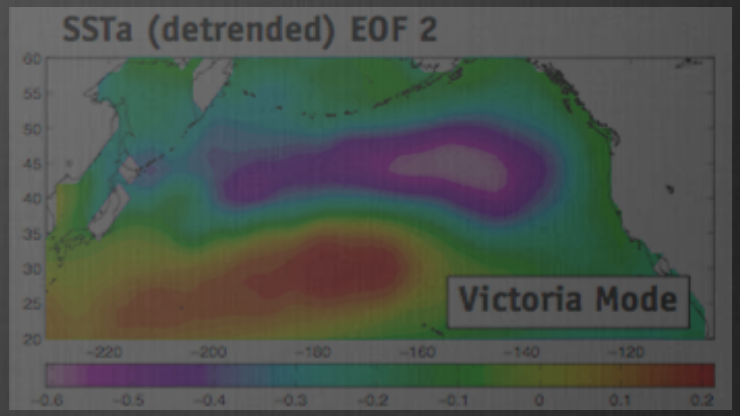
PMM

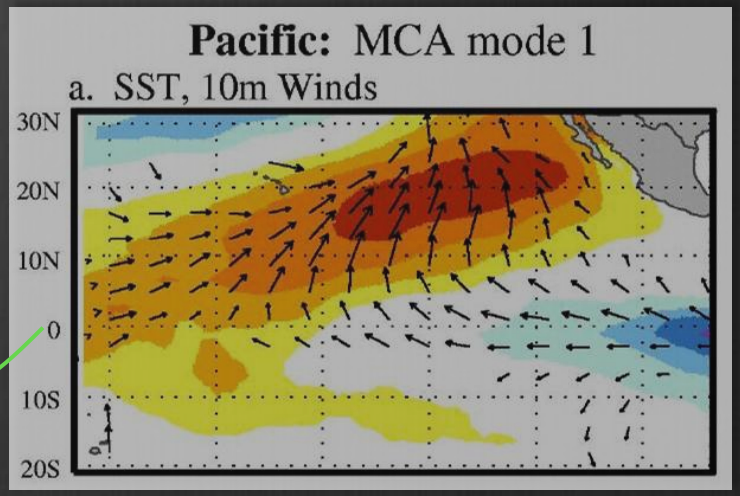


ENSO precursor: WNP

Western North Pacific

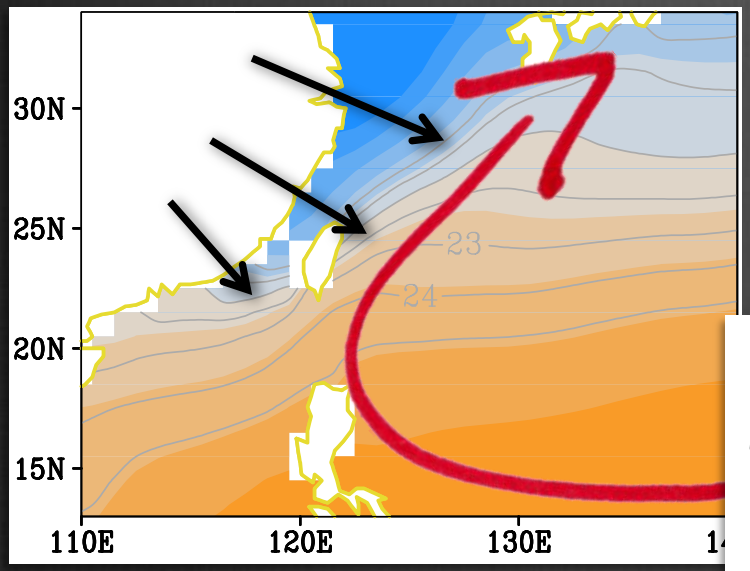




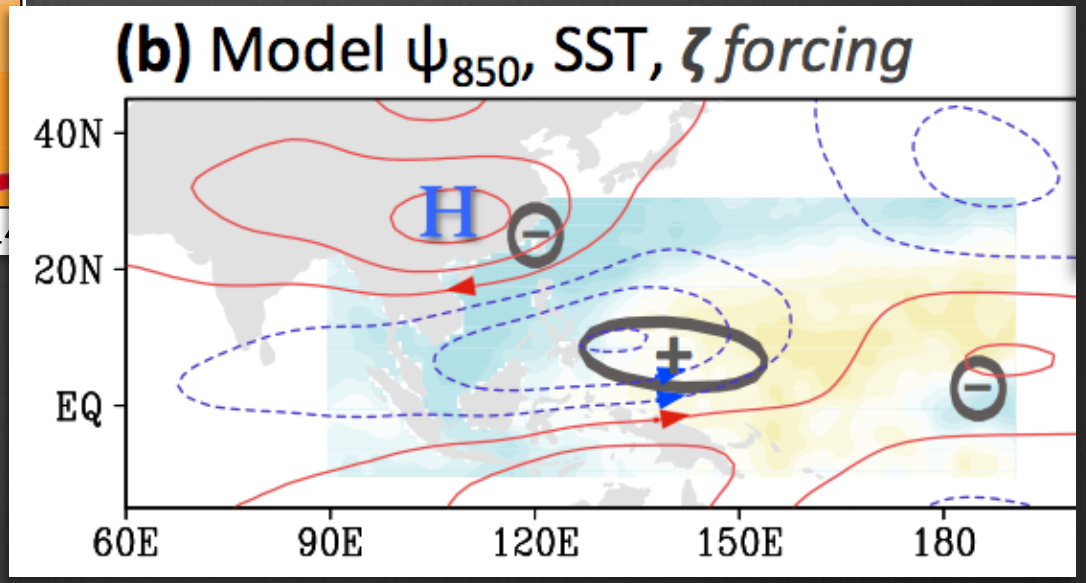


Why WNP?

SST DJF Mean

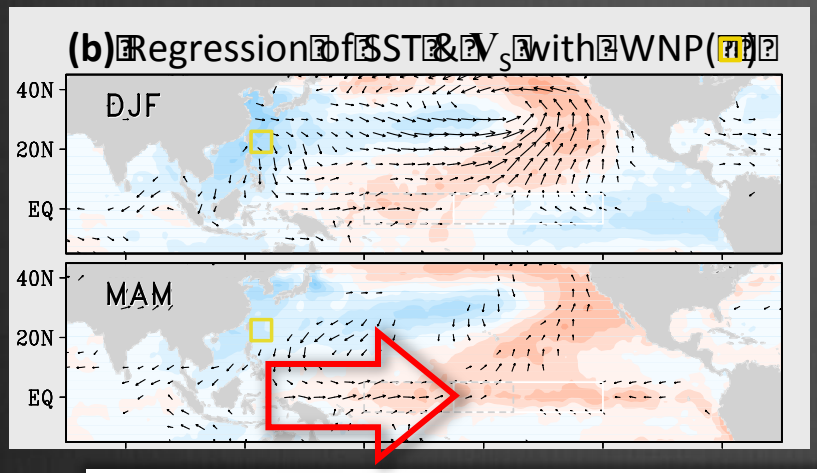


(1) East Asian Winter Monsoon impac



Barotropic model w/ composite WNP heat source/sink

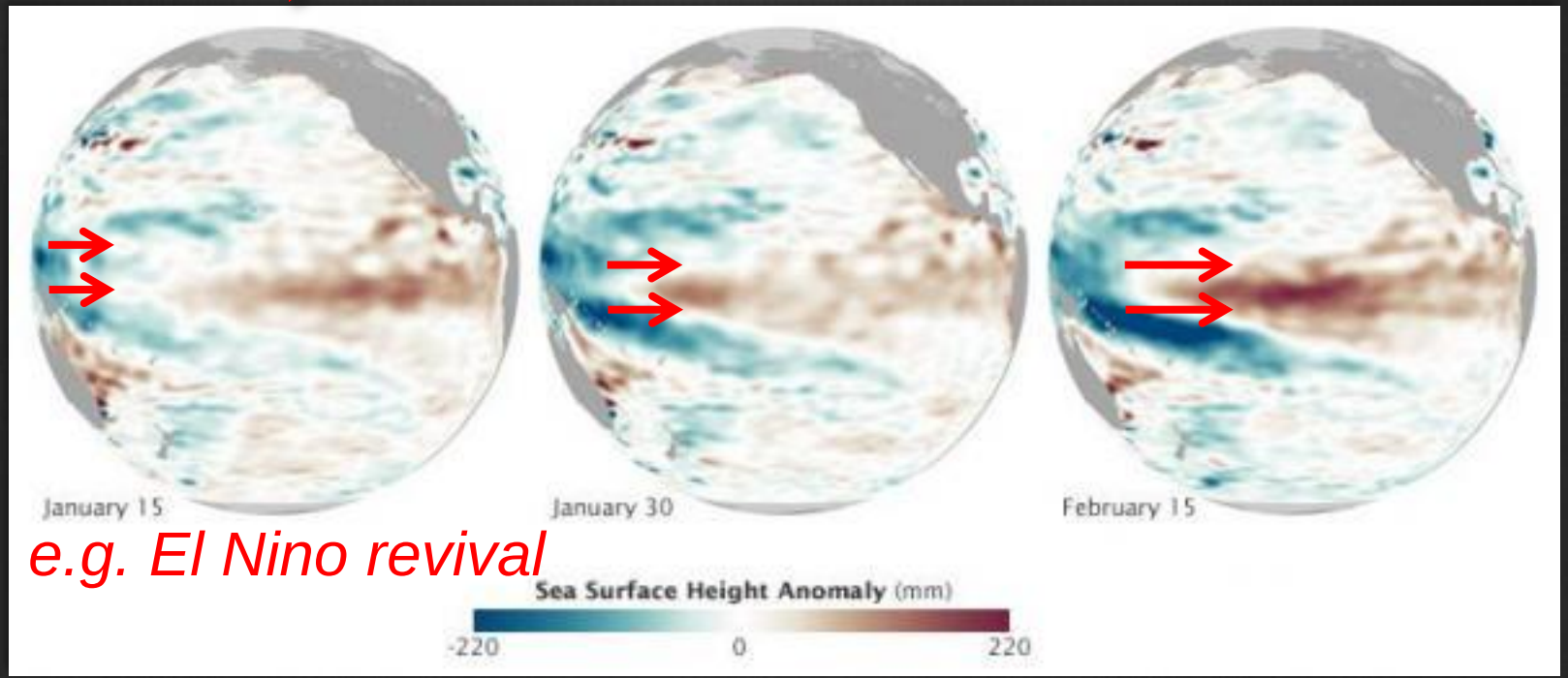
Why WNP?



(2) Oceanic Kelvin wave

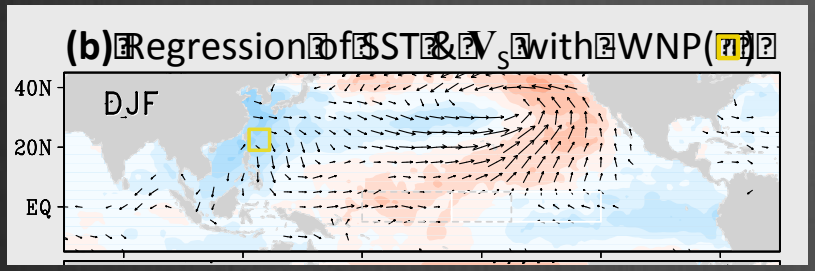
-

zonal wind triggered



e.g. El Nino revival

Why WNP?

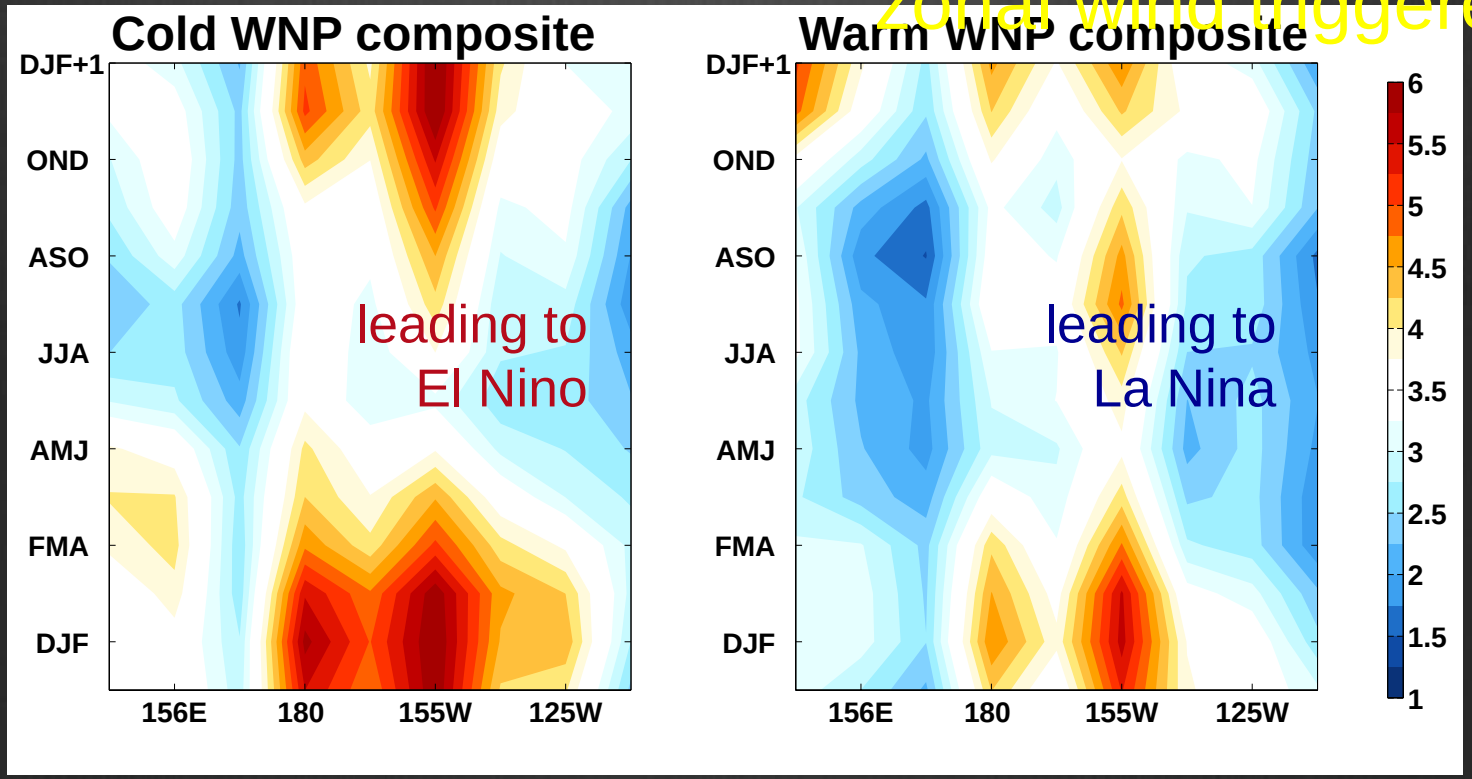


KW dynamic height composite

(2) Oceanic Kelvin wave

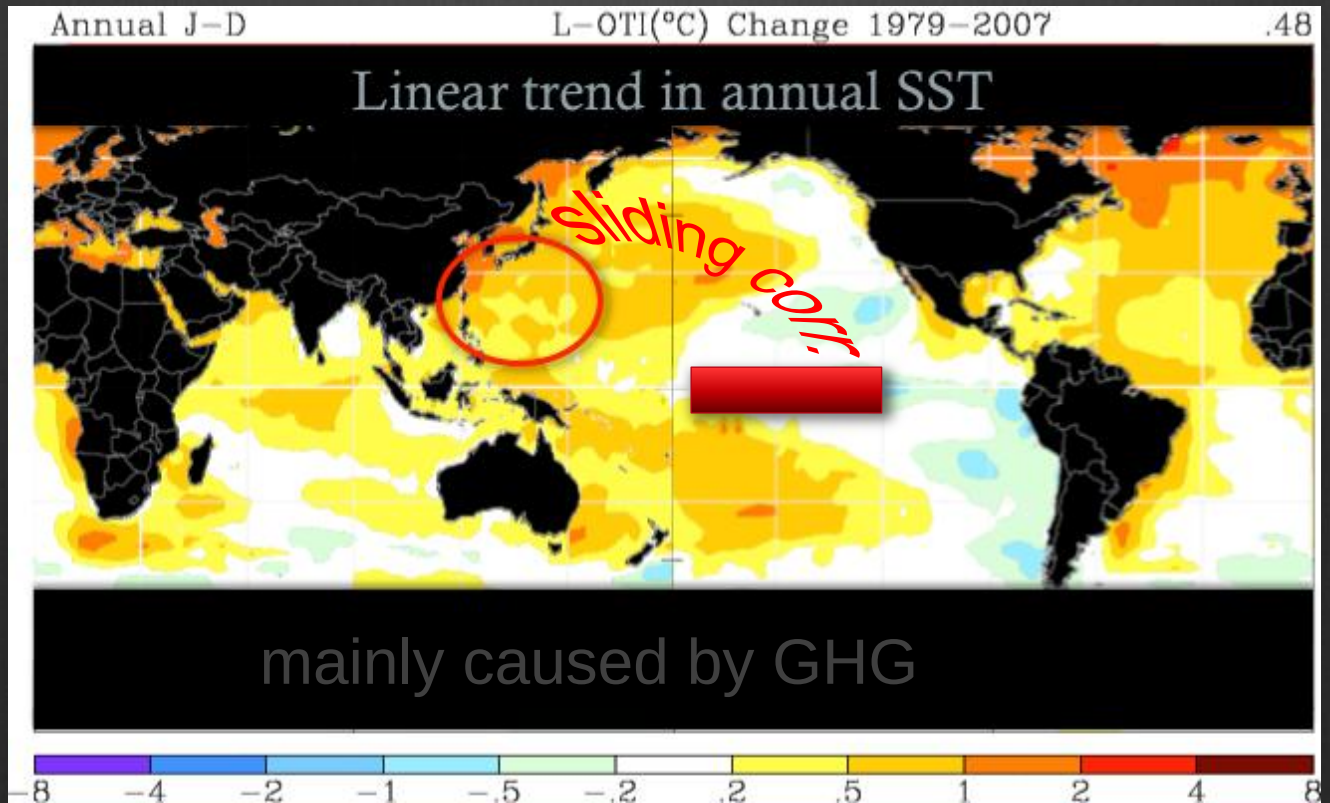
-

zonal wind triggered

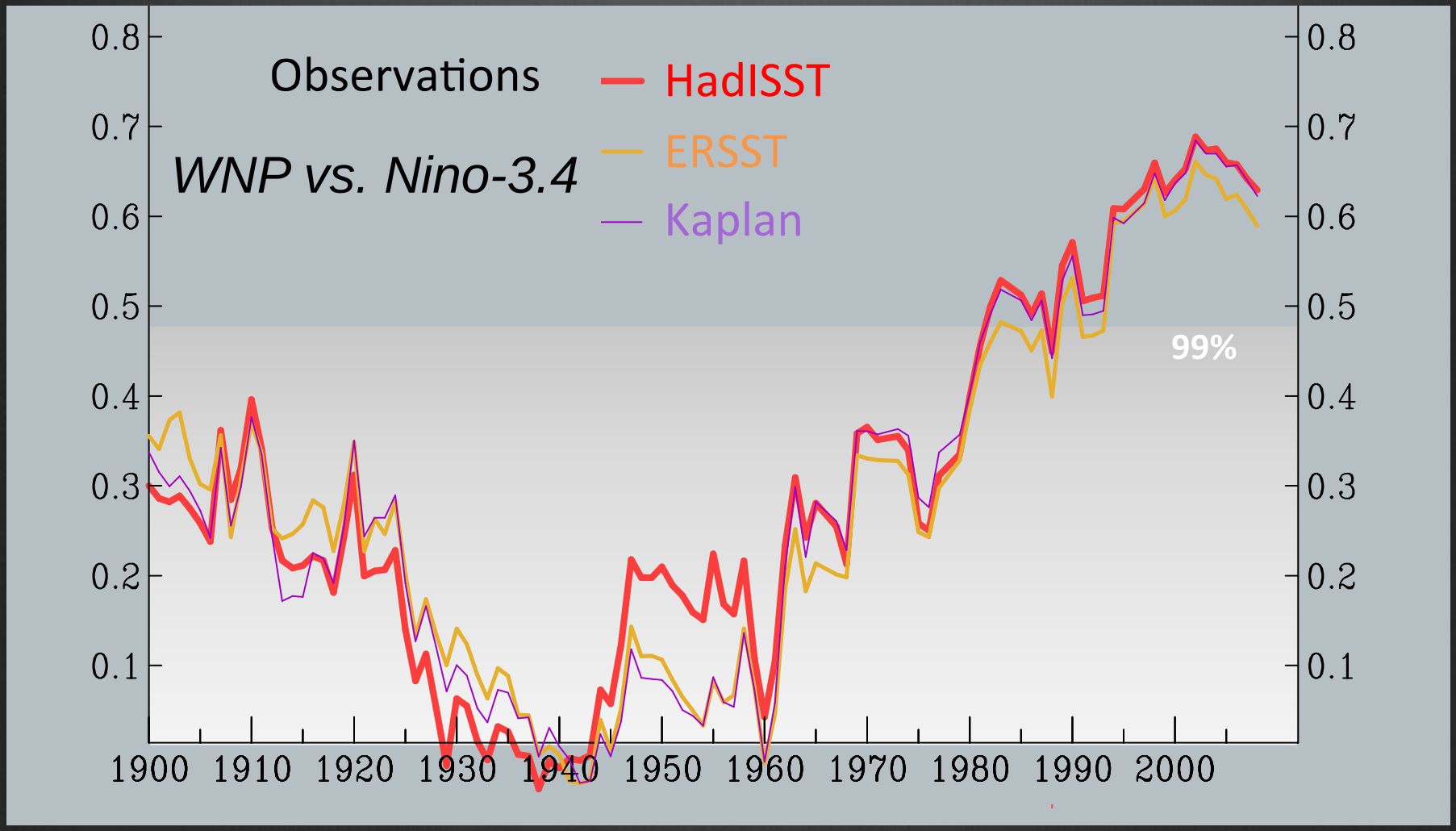


GHG forcing

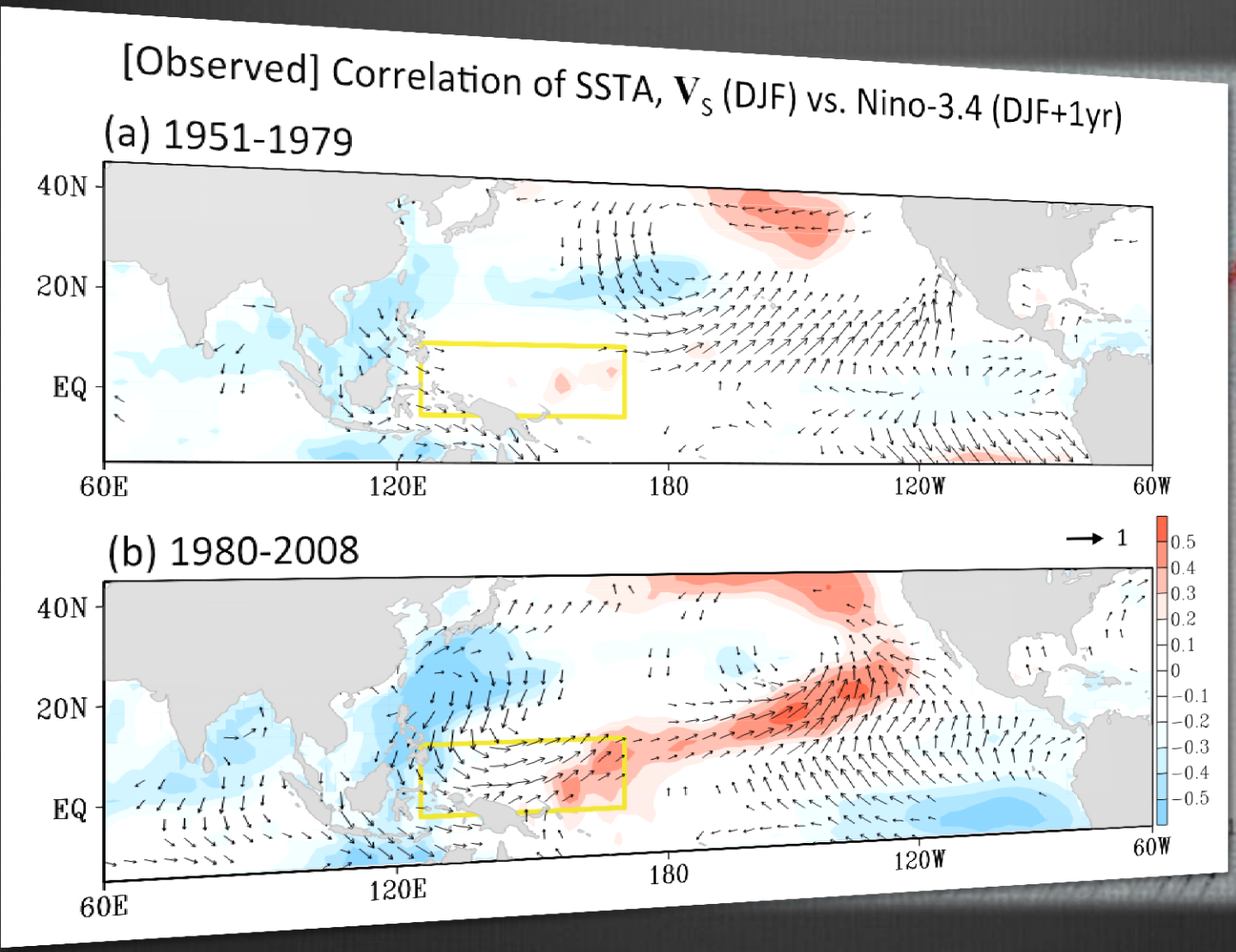
Is ~~Global Warming~~ enhancing ENSO precursors in the Western North Pacific?



25-yr sliding correlation of SSTA



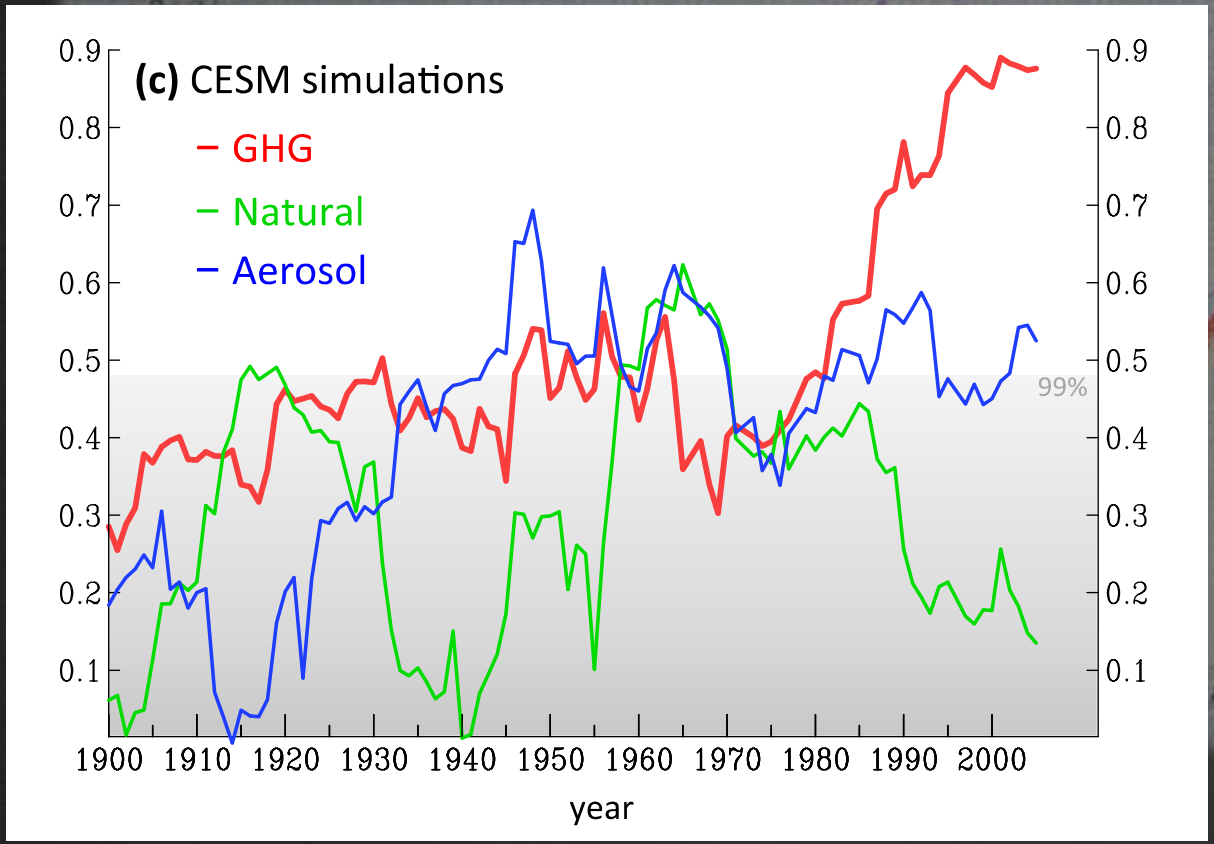
Correlation for ENSO precursors



25-yr sliding correlation of SSTA

Community Earth System Model

Historical forcing experiments (1850-2005):



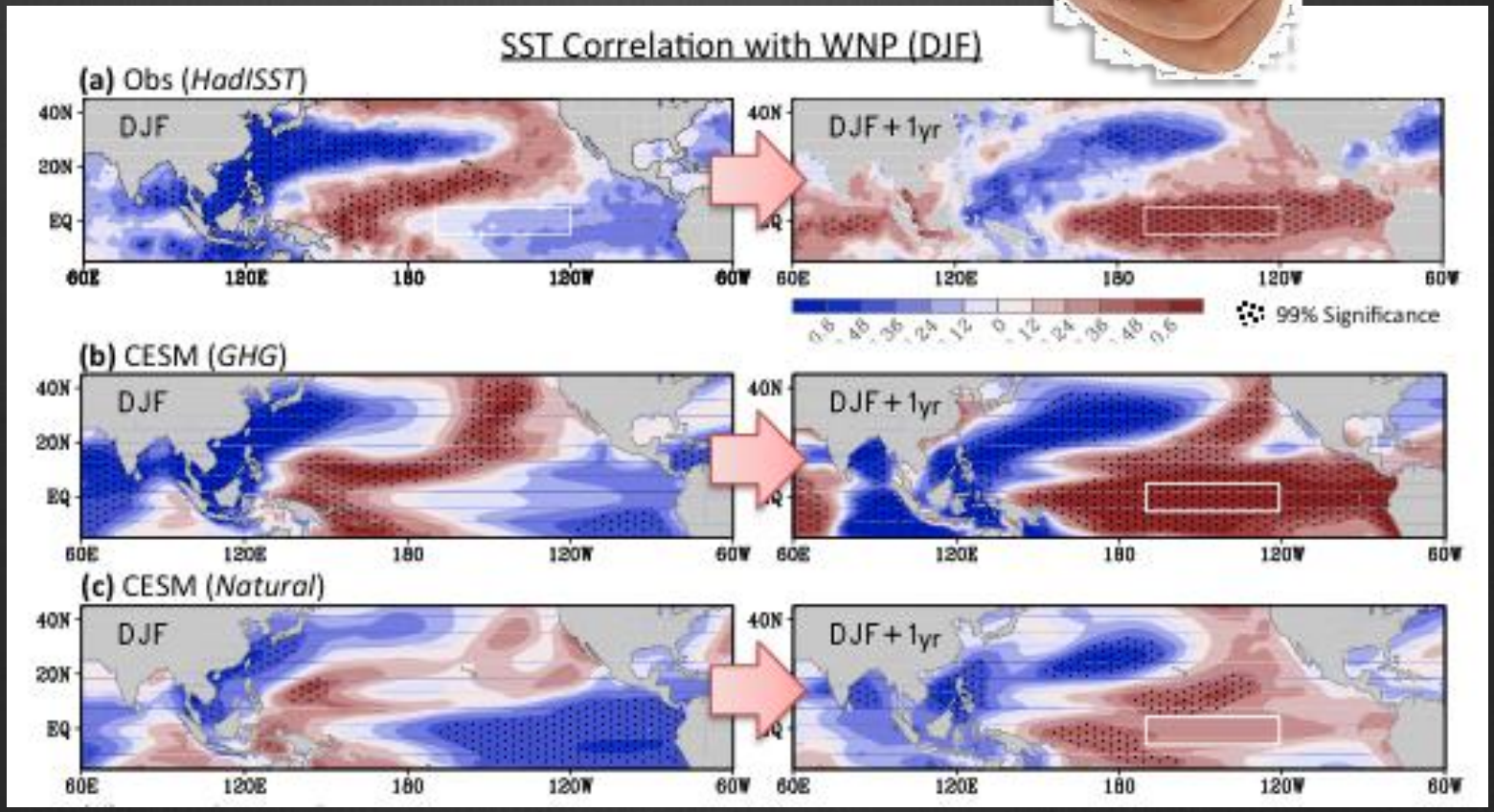
← holy cow

How good is CES

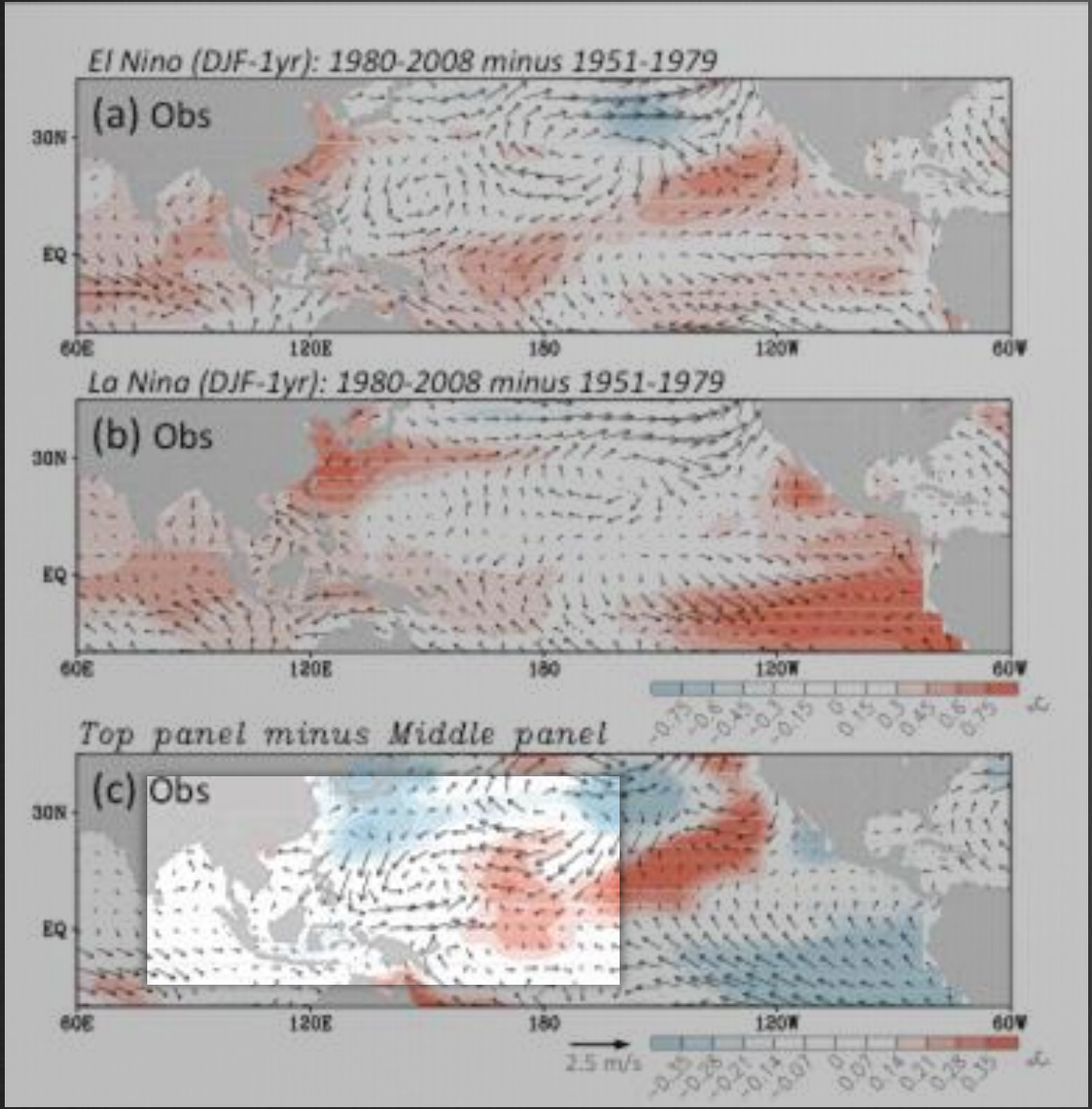
Realistic ENSO pre-cor

OBS➔

CESM➔



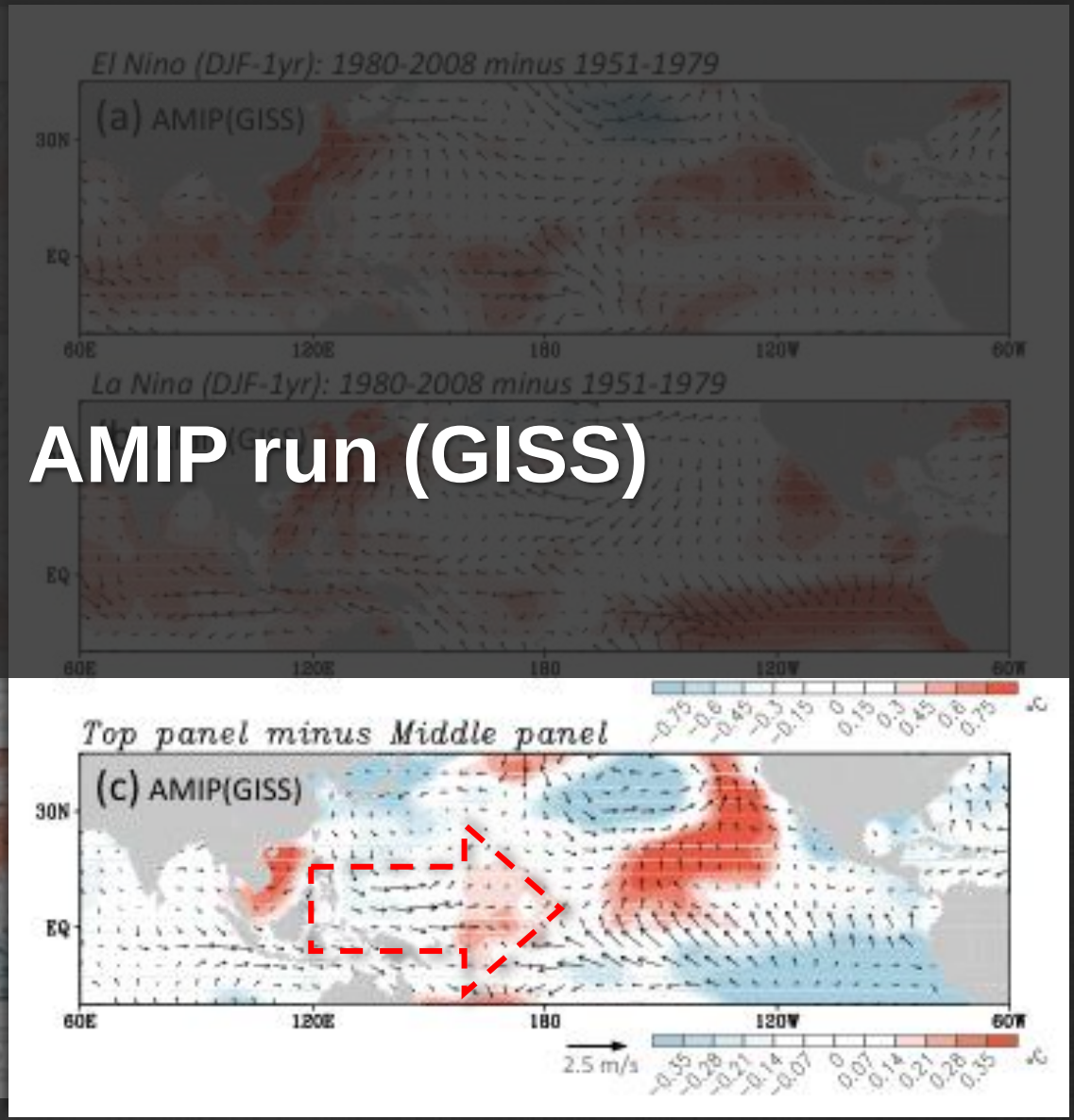
WNP warming & dynamics



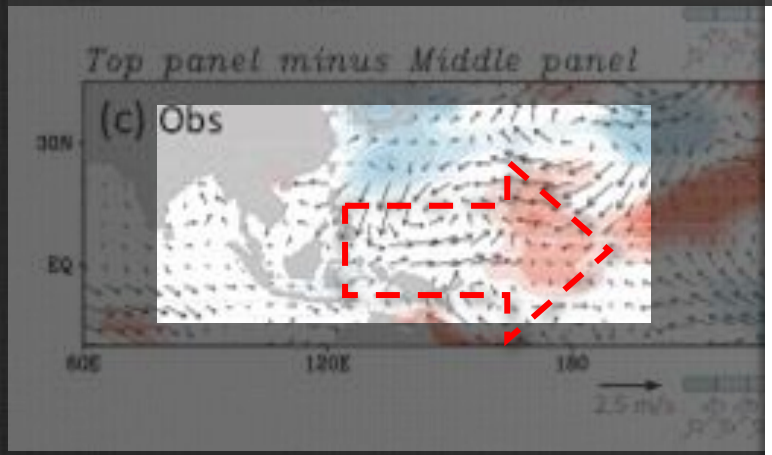
Composite analysis:

NCEP + 20CR
& HadSST

WNP warming & dynamics



AMIP run (GISS)

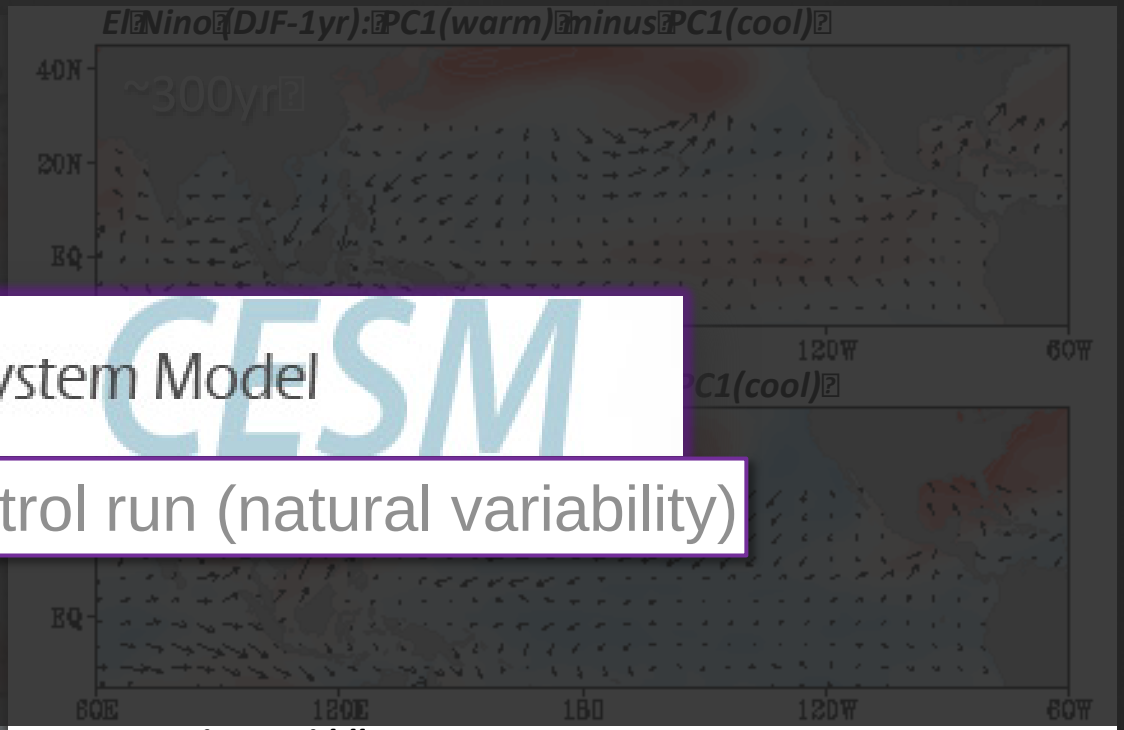


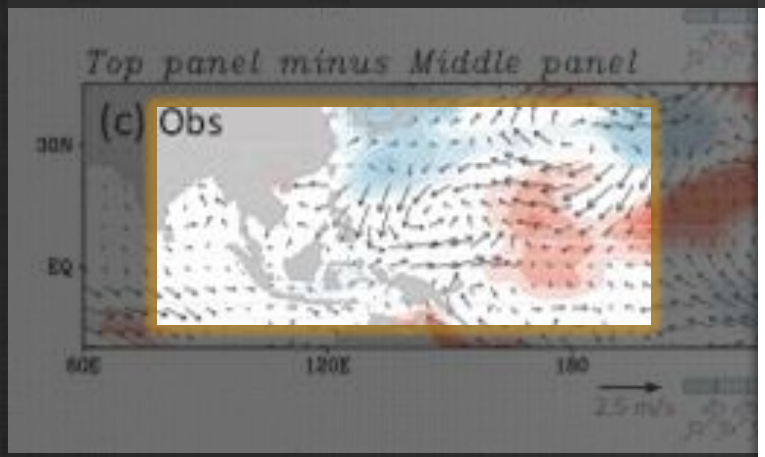
WNP warming & dynamics

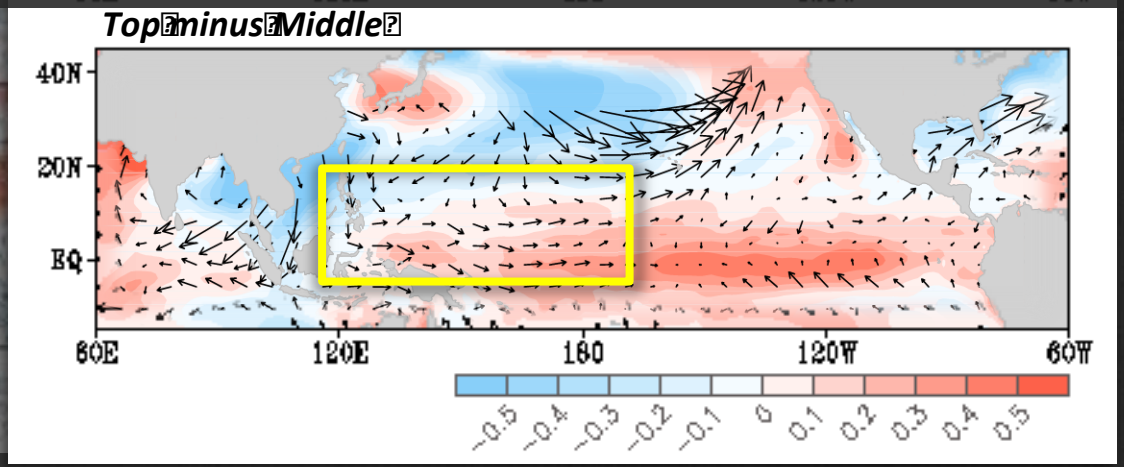
CESM free run

Community Earth System Model

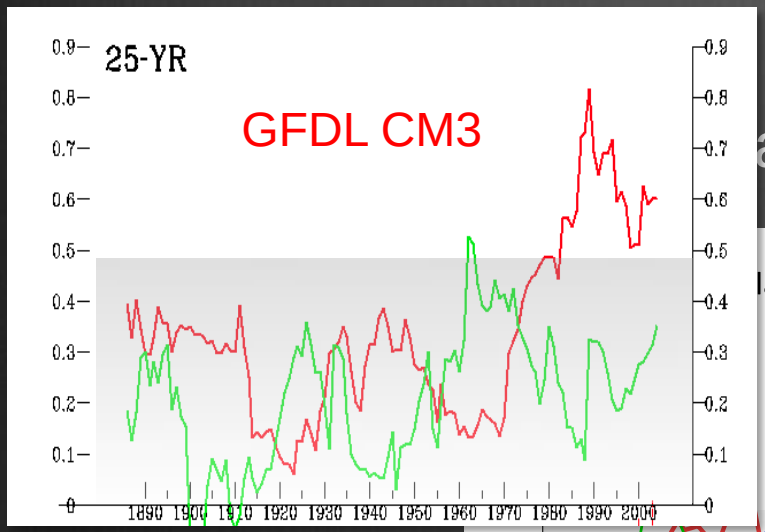
CESM 350-year control run (natural variability)

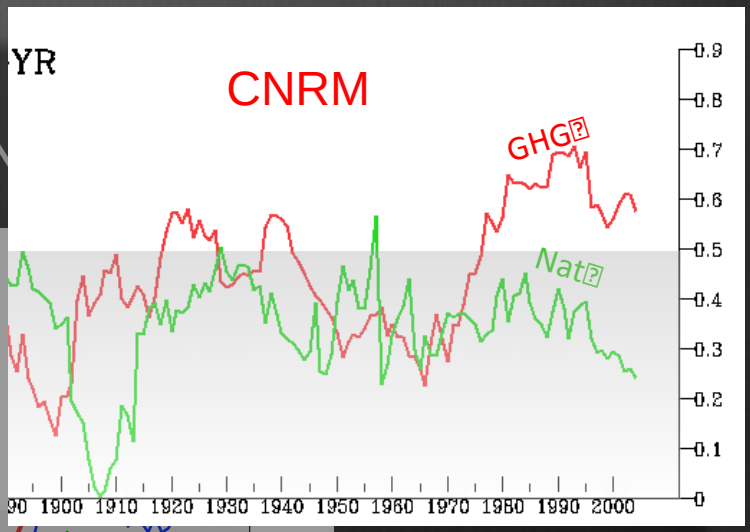


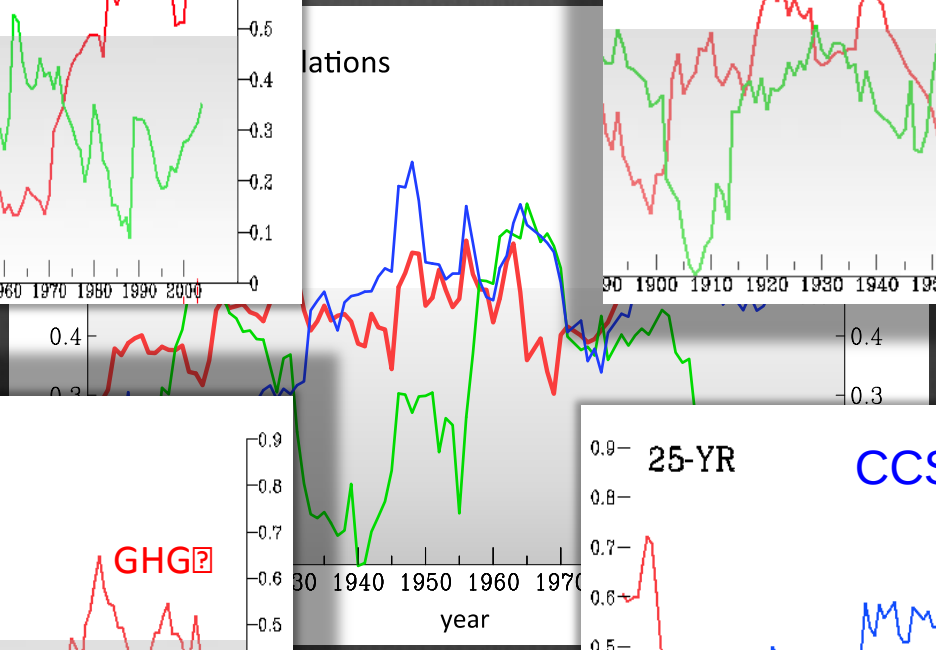


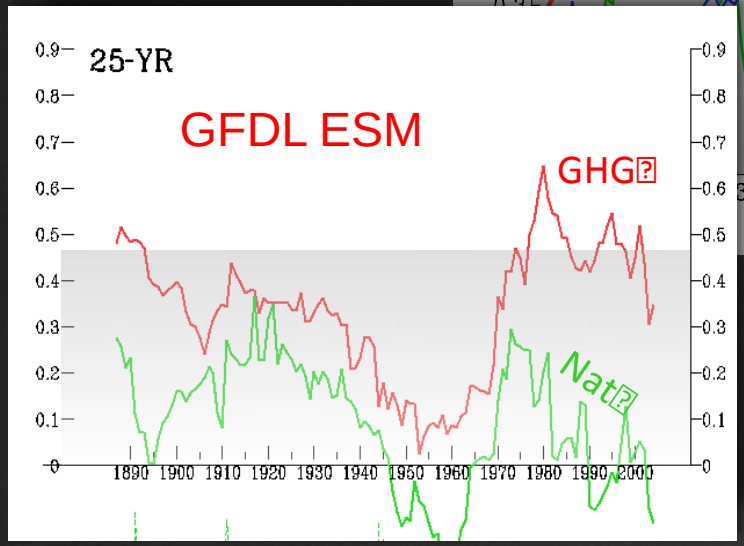


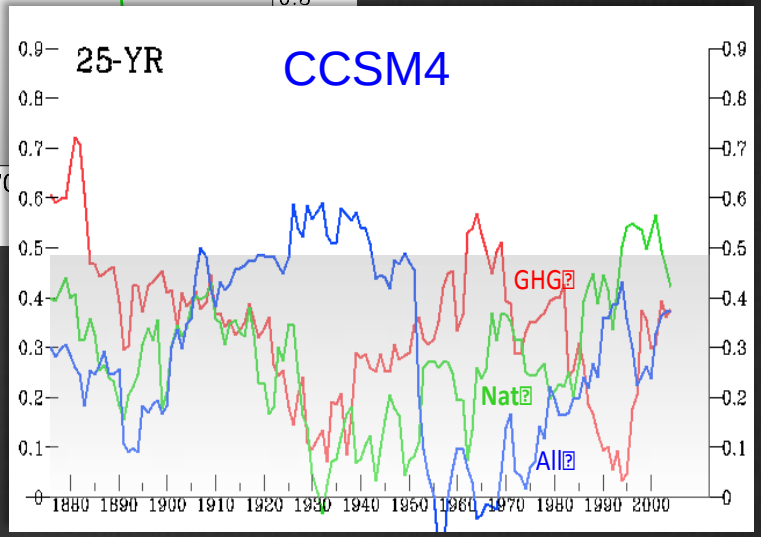
Other models? (CMIP5)







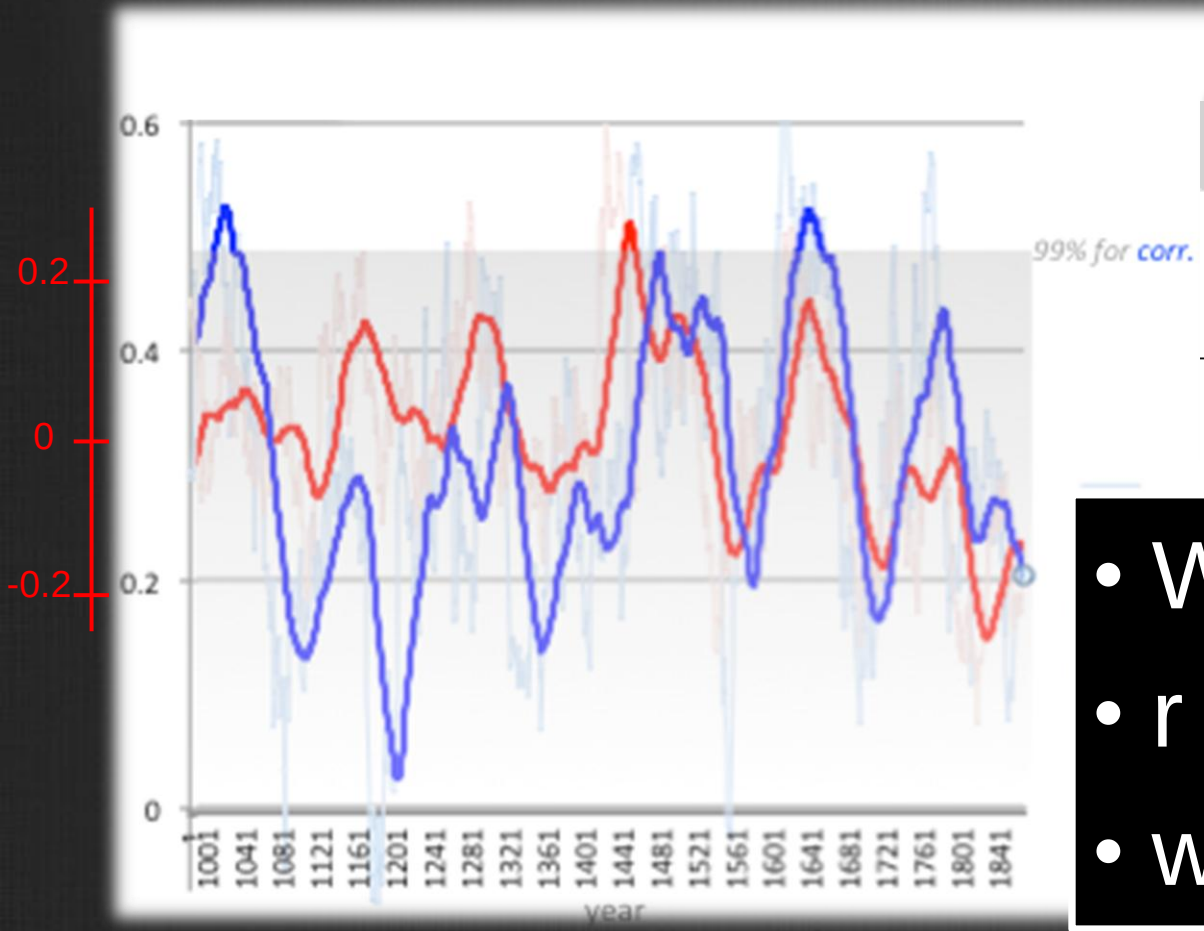


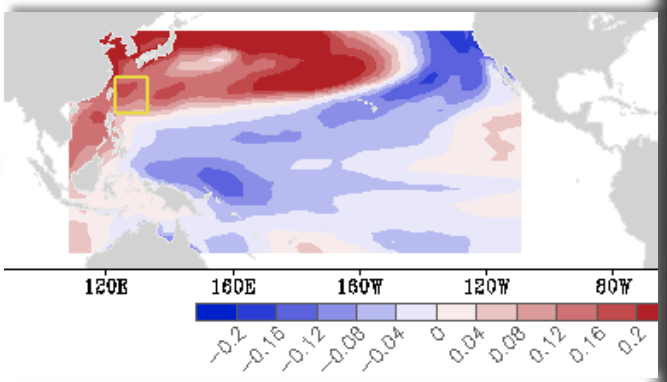


Natural variability?

GFDL CM2.1 3000-yr free run cutting off the first 2000

(Thomas Reichler, UU)

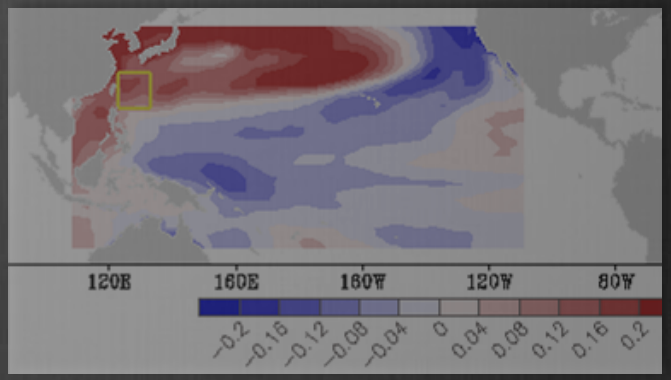




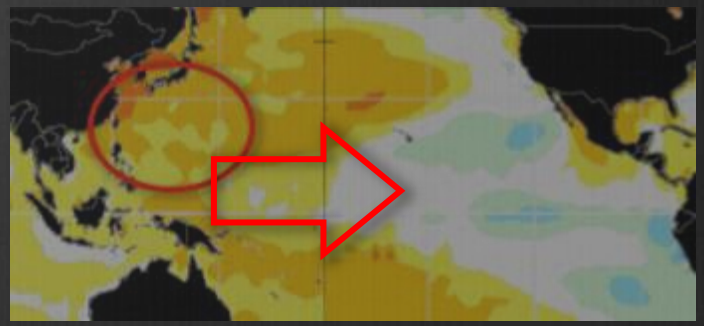
- WNP up 1.2°C
- r > 0.7
- within 40 years

Summary

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



- GHG appears to enhance (accelerate) this process



And it’s only half the story!