

Geophysical Research Letters[®]

RESEARCH LETTER

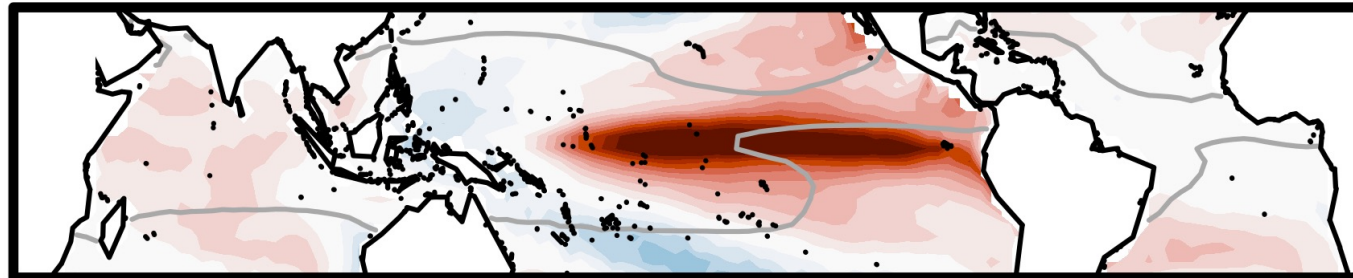
10.1029/2021GL095261

The El Niño–Southern Oscillation Pattern Effect

Paulo Ceppi^{1,2}  and Stephan Fueglistaler^{3,4} 

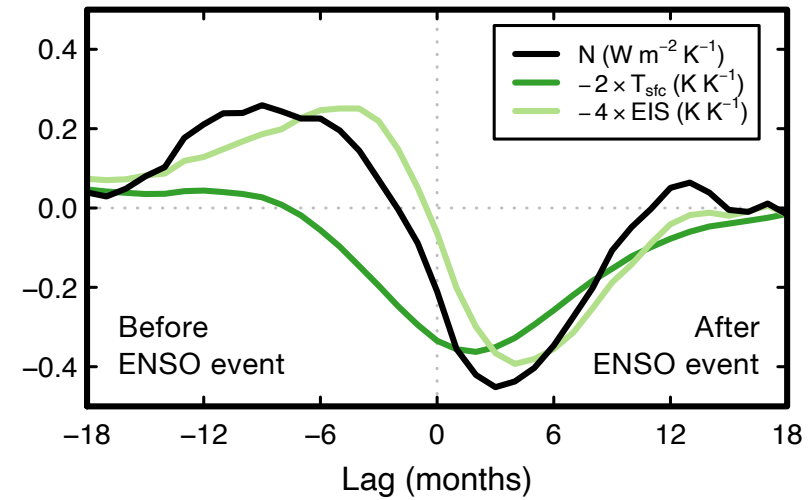
Key question:

How do the SST patterns associated with ENSO interact with the radiation budget?



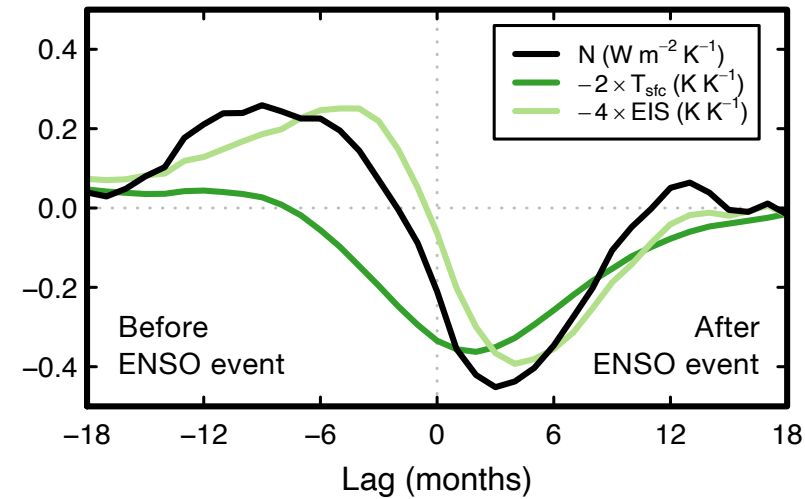
- Tropical-mean T anomalies mostly in phase with Niño-3.4
- EIS and N out of phase with Niño-3.4
- EIS and N anomalies suggestive of pattern effect, via low cloud changes

Lagged regressions onto Niño-3.4
ERA5 and CERES data, 2000–2020



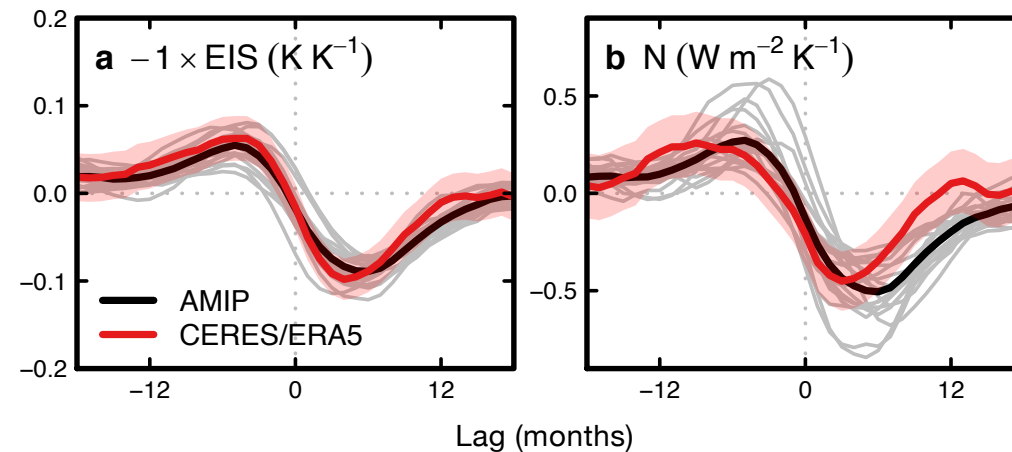
- Tropical-mean T anomalies mostly in phase with Niño-3.4
- EIS and N out of phase with Niño-3.4
- EIS and N anomalies suggestive of pattern effect, via low cloud changes

Lagged regressions onto Niño-3.4
ERA5 and CERES data, 2000–2020



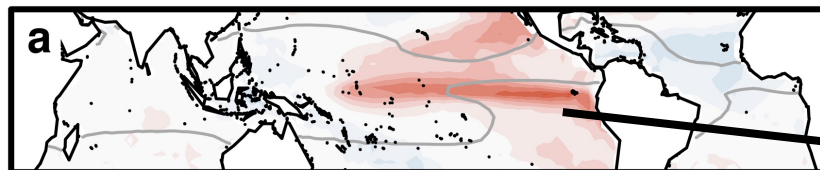
- GCMs reproduce the out-of-phase evolution of EIS and N relative to the ENSO cycle

Black: AMIP simulations, 1995–2014

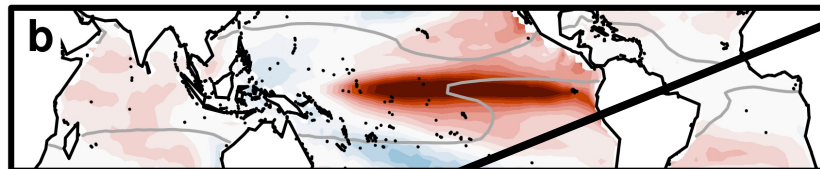


SST ($K K^{-1}$)

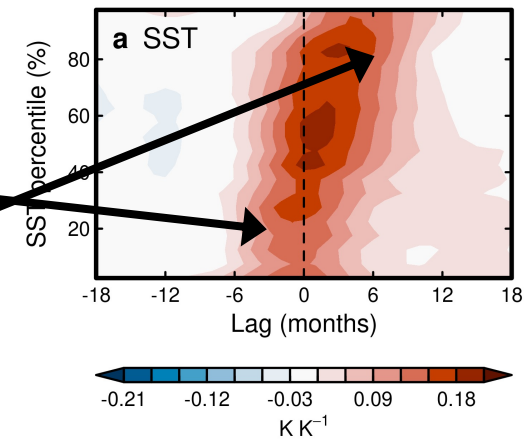
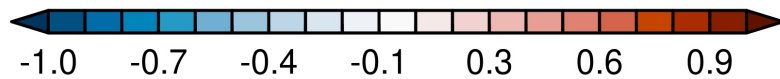
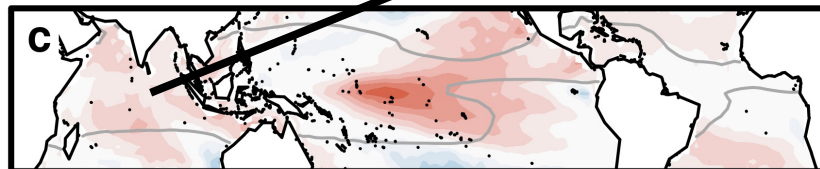
Lag = -5 months



Lag = 0 months

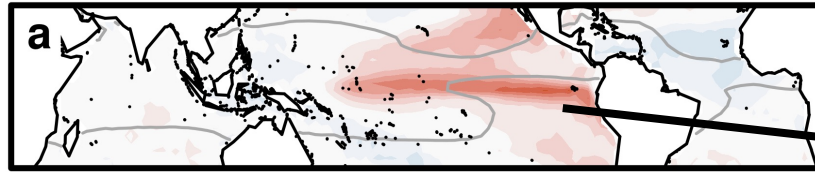


Lag = +5 months

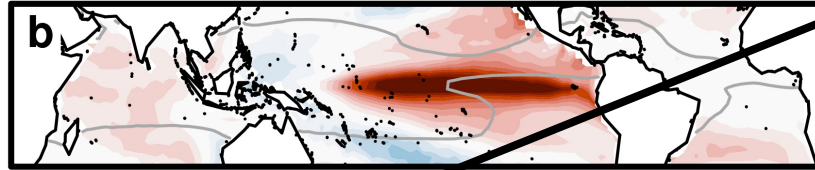


SST ($K K^{-1}$)

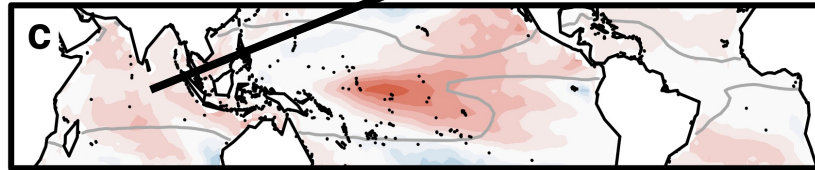
Lag = -5 months



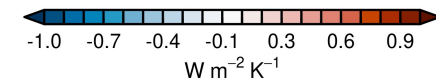
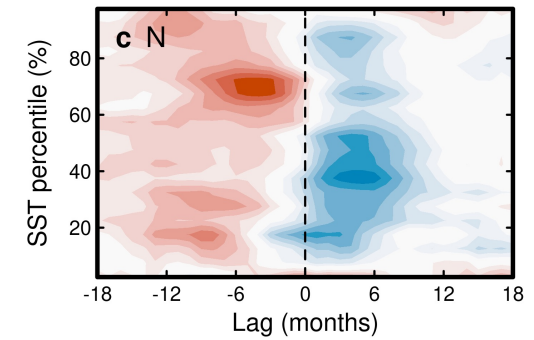
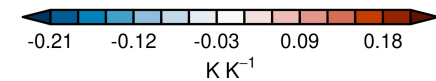
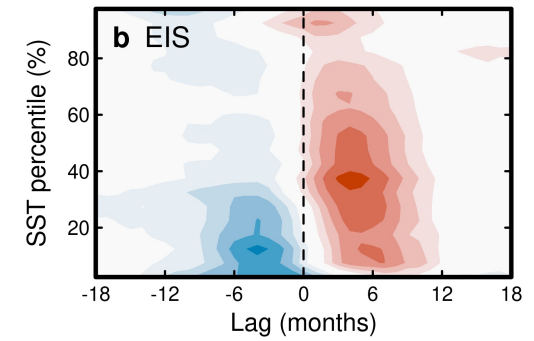
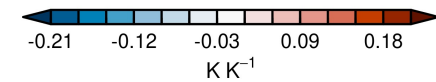
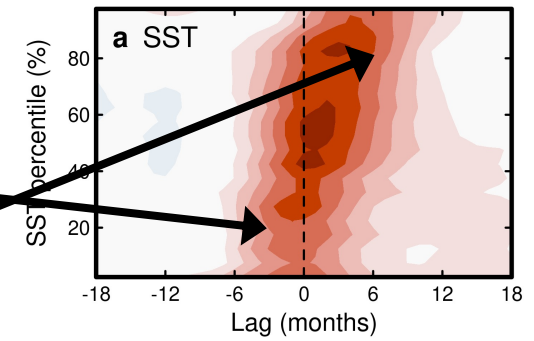
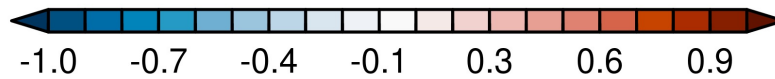
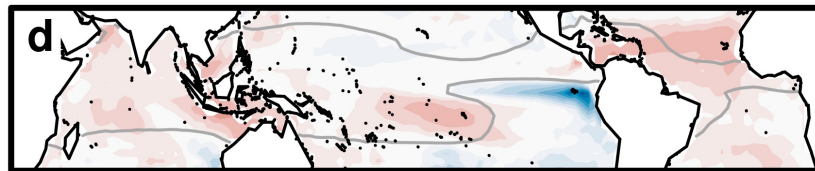
Lag = 0 months



Lag = +5 months



(c) minus (a)



- Warm SST anomalies migrate towards warm pool
- EIS and N change sign across ENSO cycle

Take-home points

- Tropical-mean radiative anomalies are **~90° out of phase with the ENSO cycle**
- These radiative anomalies reflect an **SST pattern effect** associated with the growth and decay of ENSO
- The findings suggest a possible two-way coupling between SST variability and the radiation budget