

The extraordinary Atlantic Niño of 2019/2020

Ingo Richter¹, Hiroki Tokinaga², Yuko Okumura³

¹ JAMSTEC, ² Kyushu University, ³ University of Texas at Austin

PIRATA-24/TAV

12 May 2021

Background

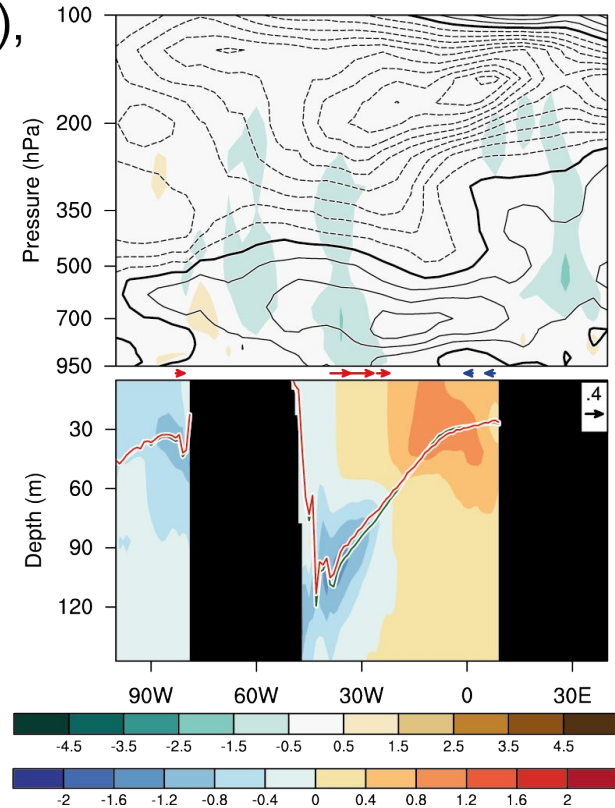
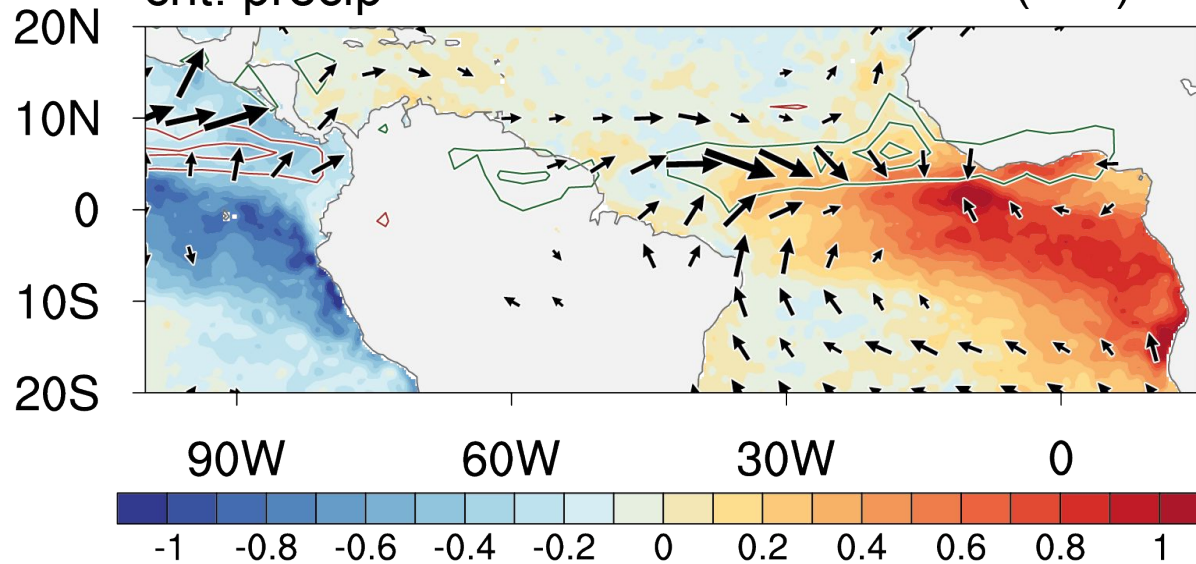
Composite Atlantic Niño from ERA5

criterion: 0.75 std dev of JJA ATL3

composite **AZM+** JUL

shd: SST, vect: sfc winds
cnt: precip

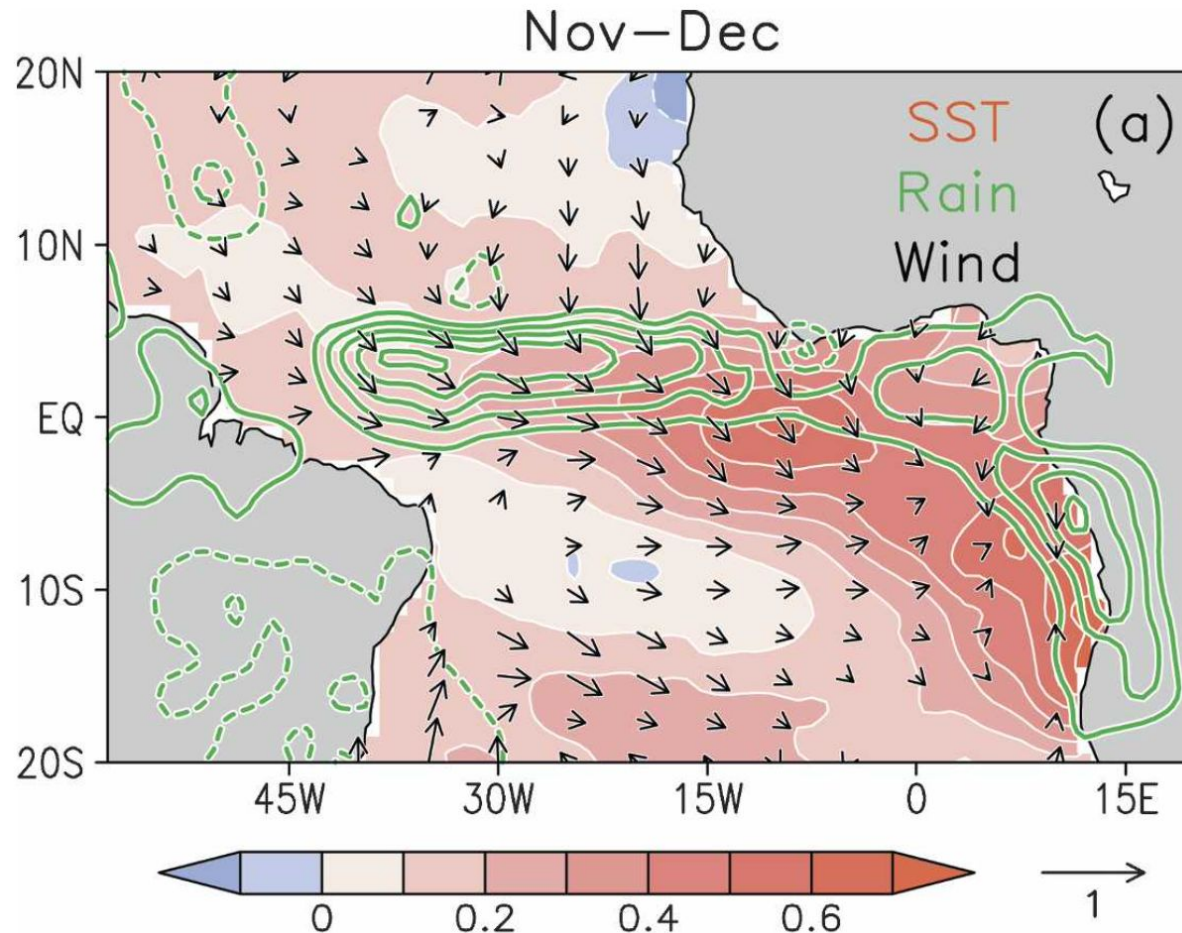
upper: omega (shd),
zonal u (cnt);
lower:
ocean T (shd)



from Richter and Tokinaga (2021)

The Atlantic Niño II

SST (shd), 10m wind (vect), precip (cnt) during **ND**



from Okumura and Xie 2006

Decreasing variability in recent decades

LETTERS

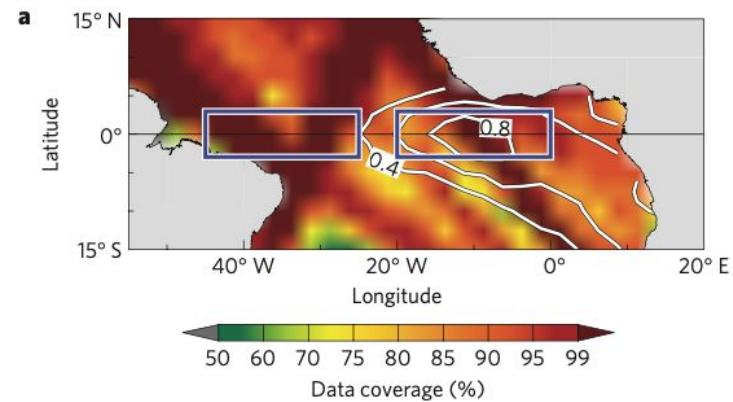
PUBLISHED ONLINE: 6 FEBRUARY 2011 | DOI:10.1038/NCEO1078

nature
geoscience

Weakening of the equatorial Atlantic cold tongue over the past six decades

Hiroki Tokinaga^{1*} and Shang-Ping Xie^{1,2}

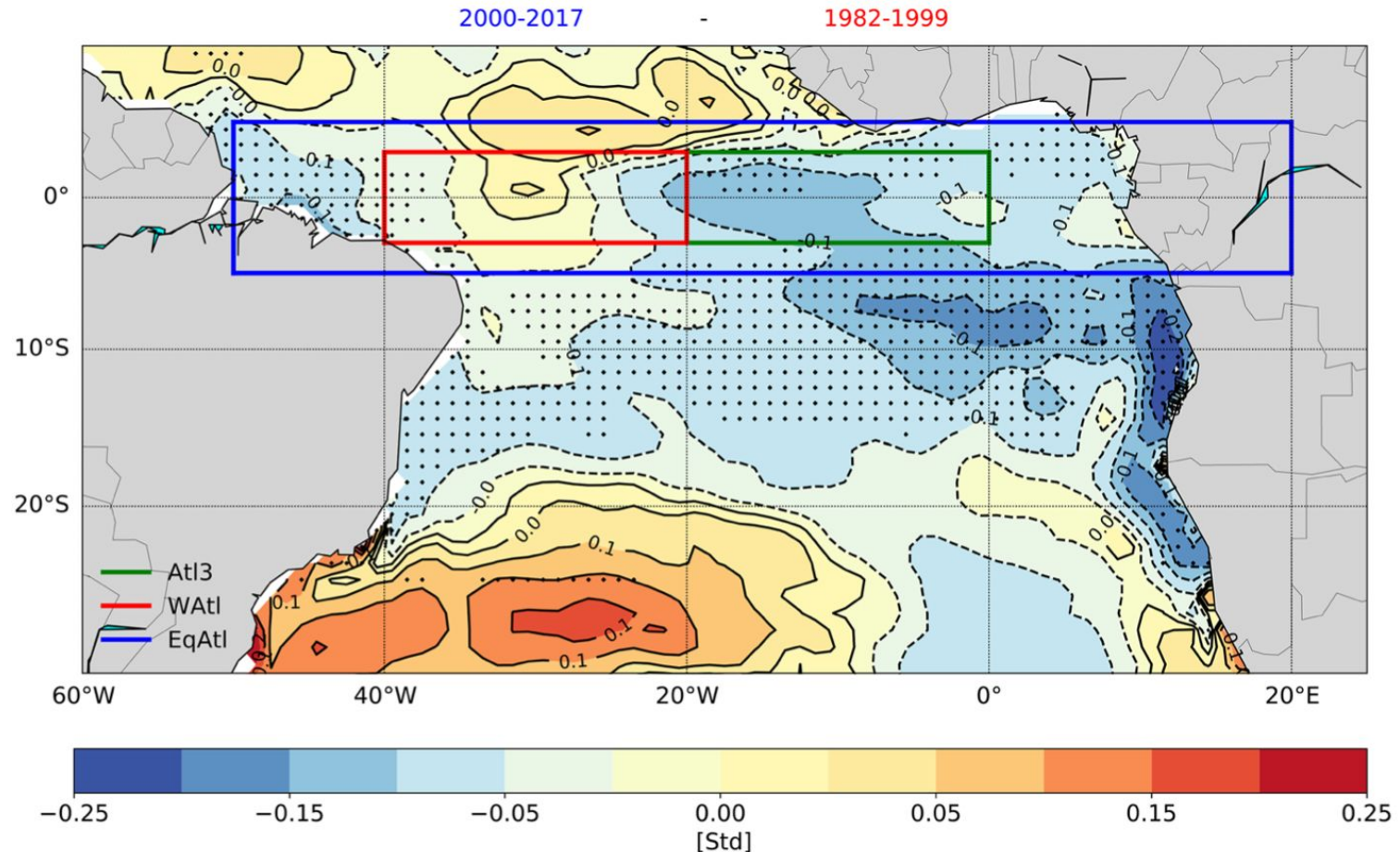
Seasonal and interannual variations of the equatorial cold tongue are defining features of the tropical Atlantic Ocean, with significant climatic¹⁻³ and biogeochemical⁴ effects. However, its long-term changes are poorly understood owing to biases in observations and climate models⁵. Here we use a suite of bias-corrected observations, and find that cold-tongue variability has weakened during the past six decades. We find that sea surface temperature has increased across the basin, with a local enhancement over the eastern equatorial Atlantic. This warming pattern of the sea surface is most pronounced during boreal summer, reducing the annual cycle through a positive ocean-atmosphere feedback. Specifically, the eastward-intensified warming leads to enhanced atmo-



from Tokinaga and Xie 2011

Decreasing variability in recent decades

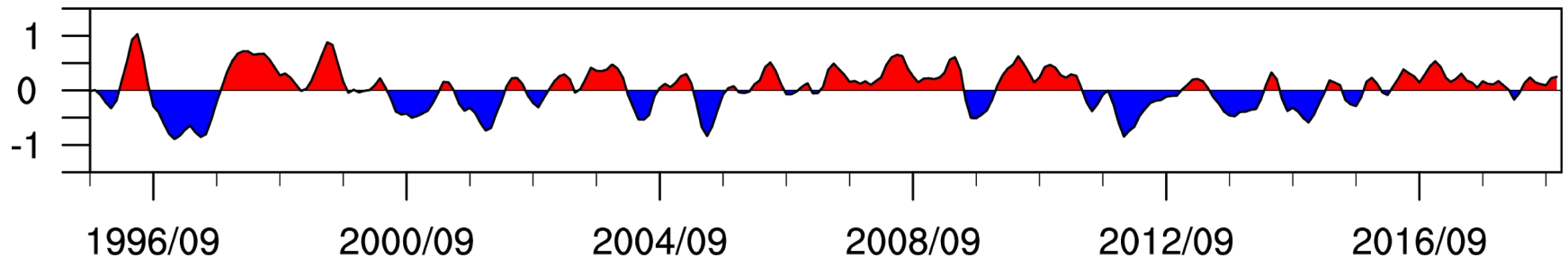
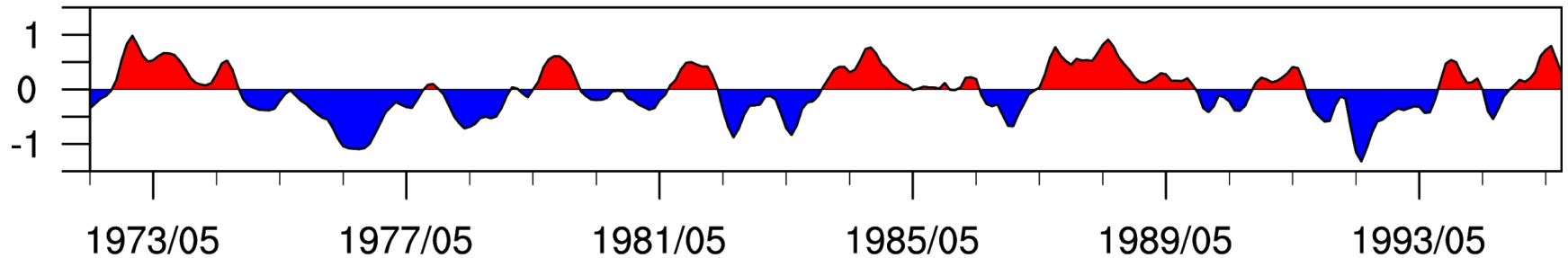
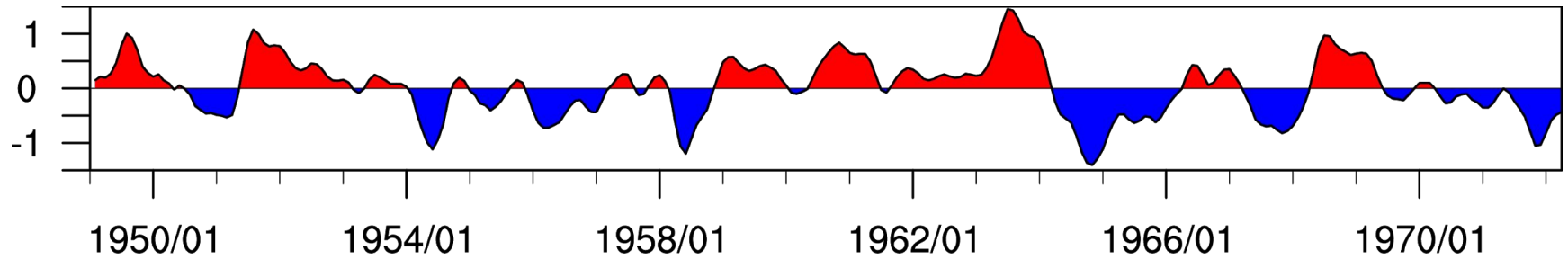
ORAS4 SST std dev (K): 2000–2017 minus 1982–1999



from Prigent et al. 2020

ATL3 time series 1948-2018

NCEP/NCAR Reanalysis

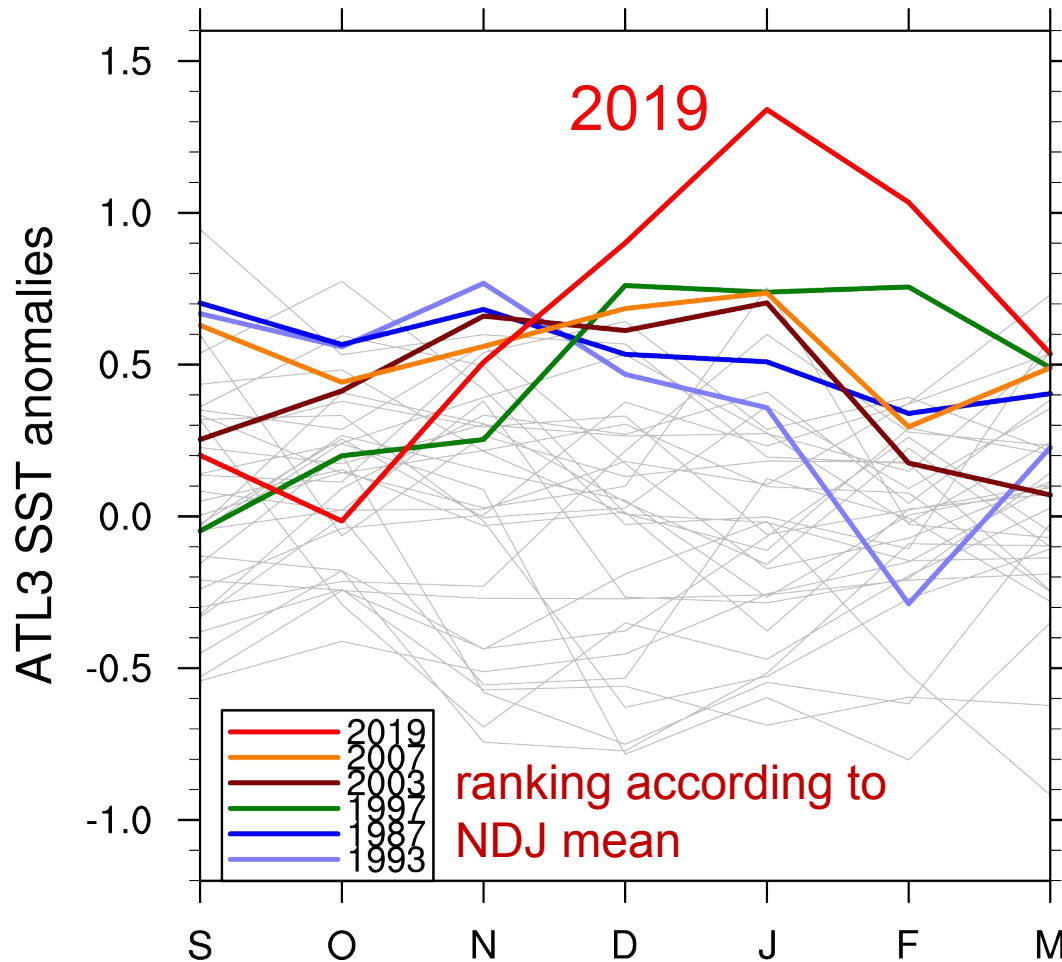


from Richter and Tokinaga (2021)

The 2019/2020 event in context

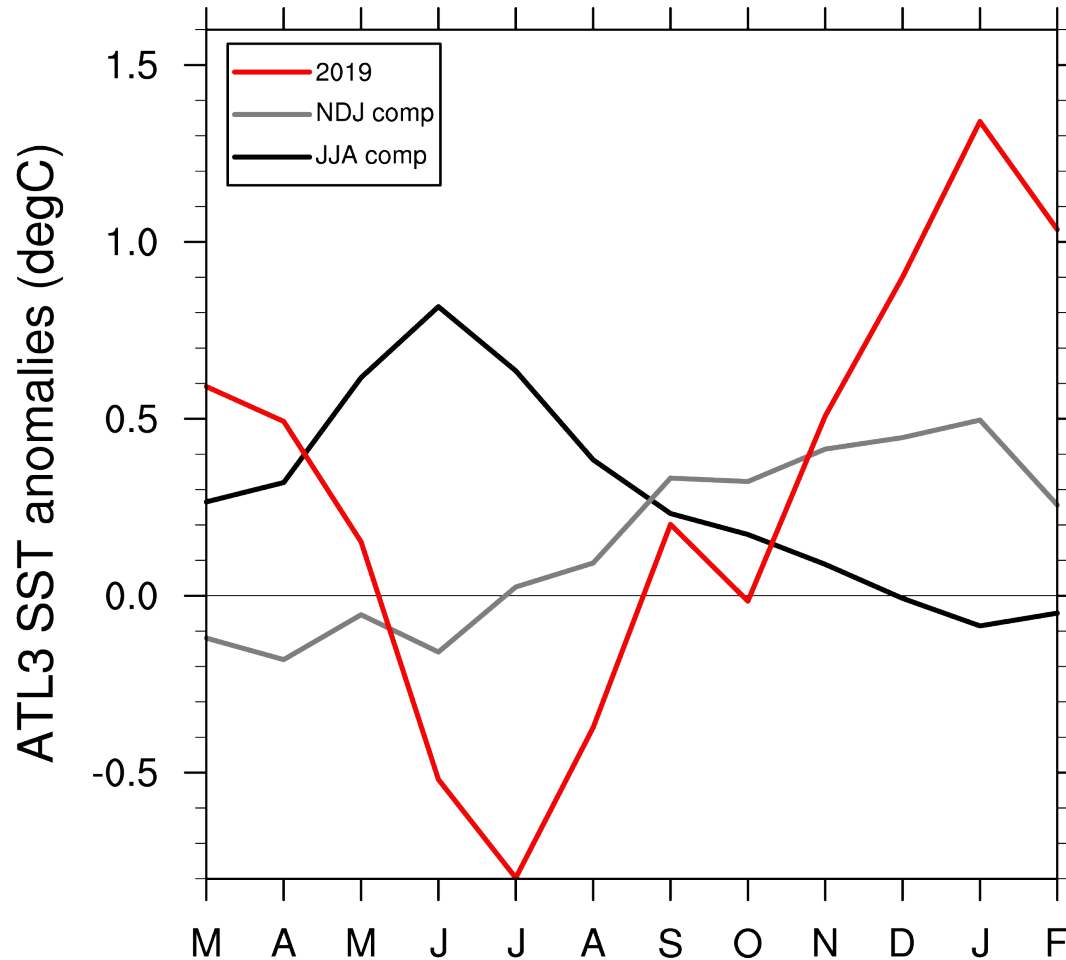
OISST ATL3 for all years since 1982

time series linearly detrended



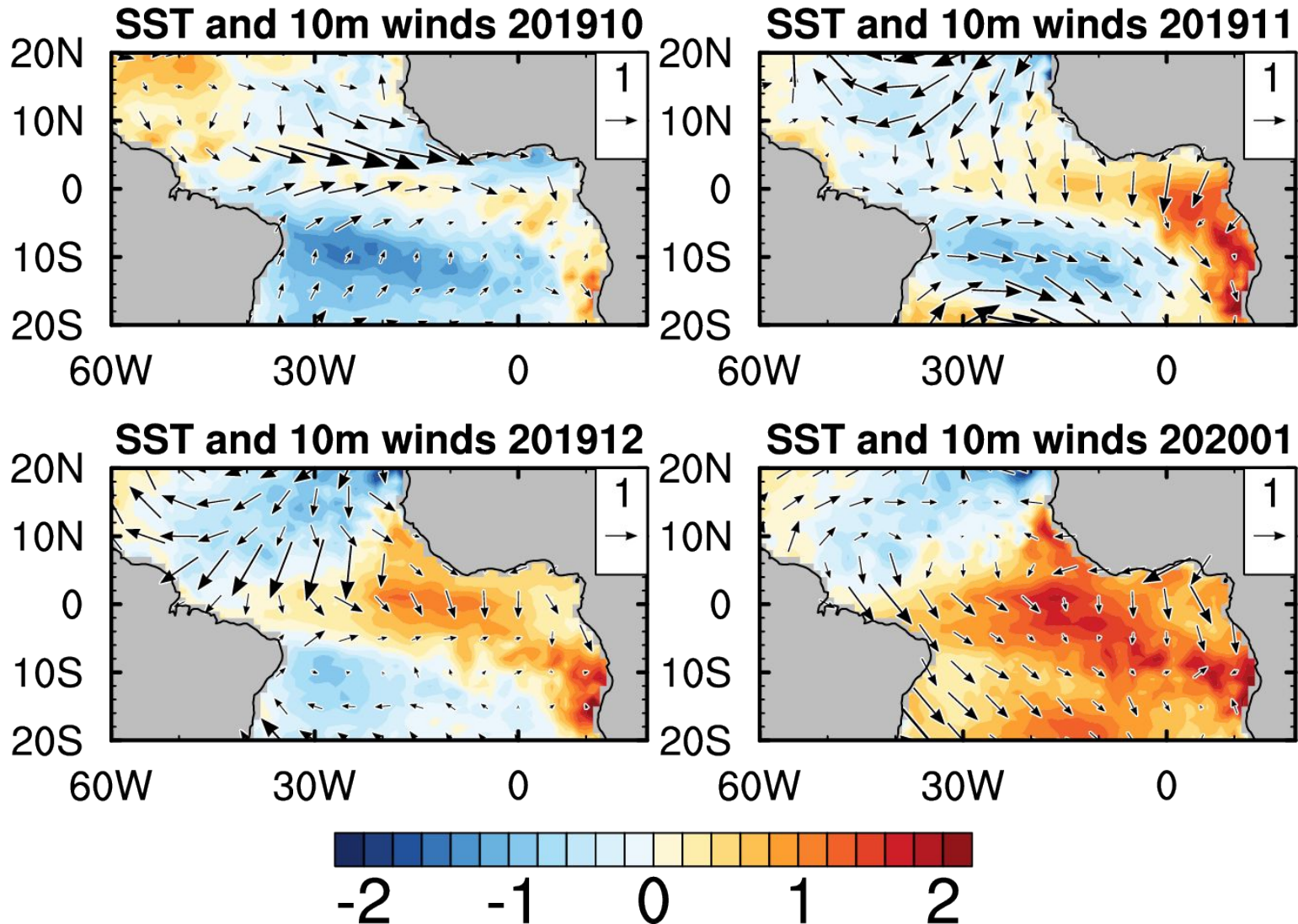
More context

ATL3 index for 2019/2020, NDJ composite, and JJA composite



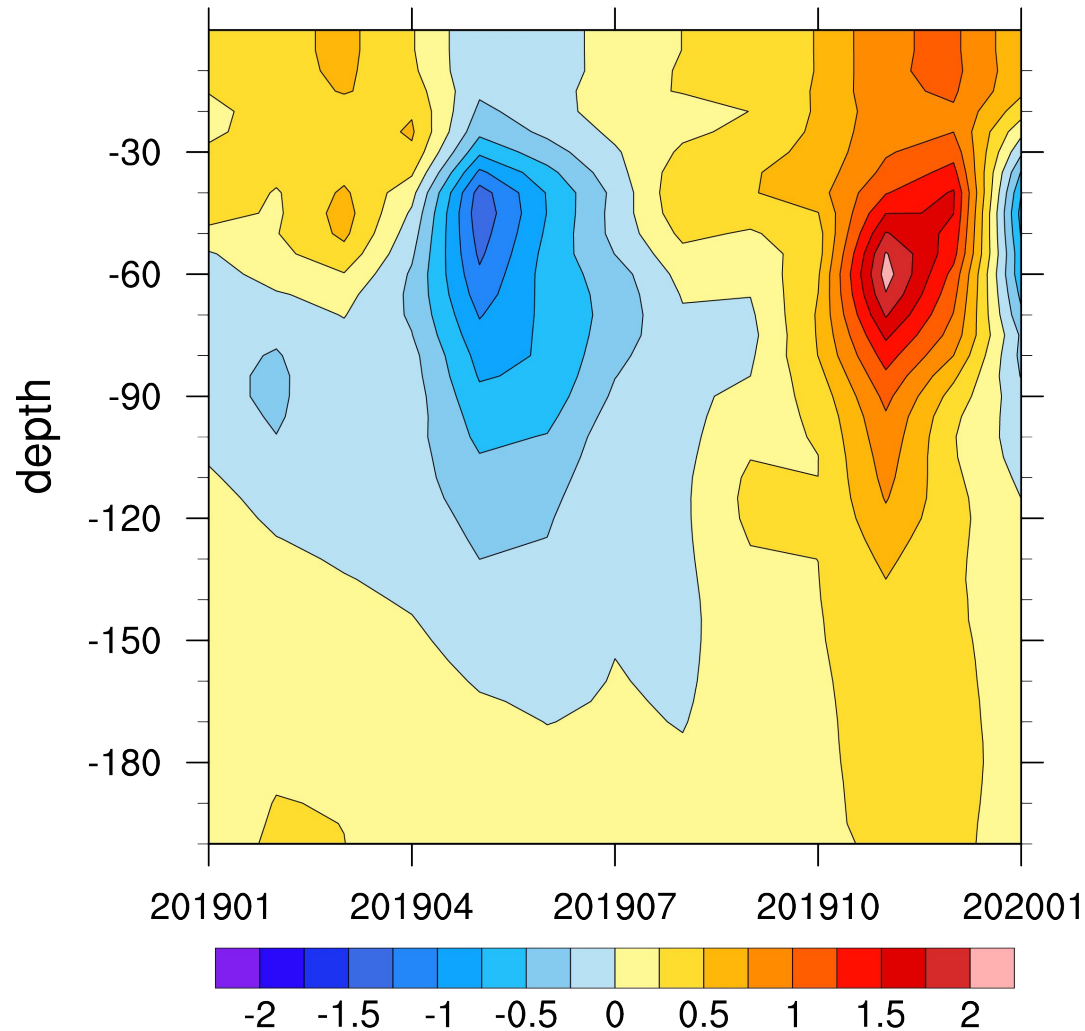
Evolution of the 2019/2020 event

SST (shd) and 10m winds (vect) in ERA-5

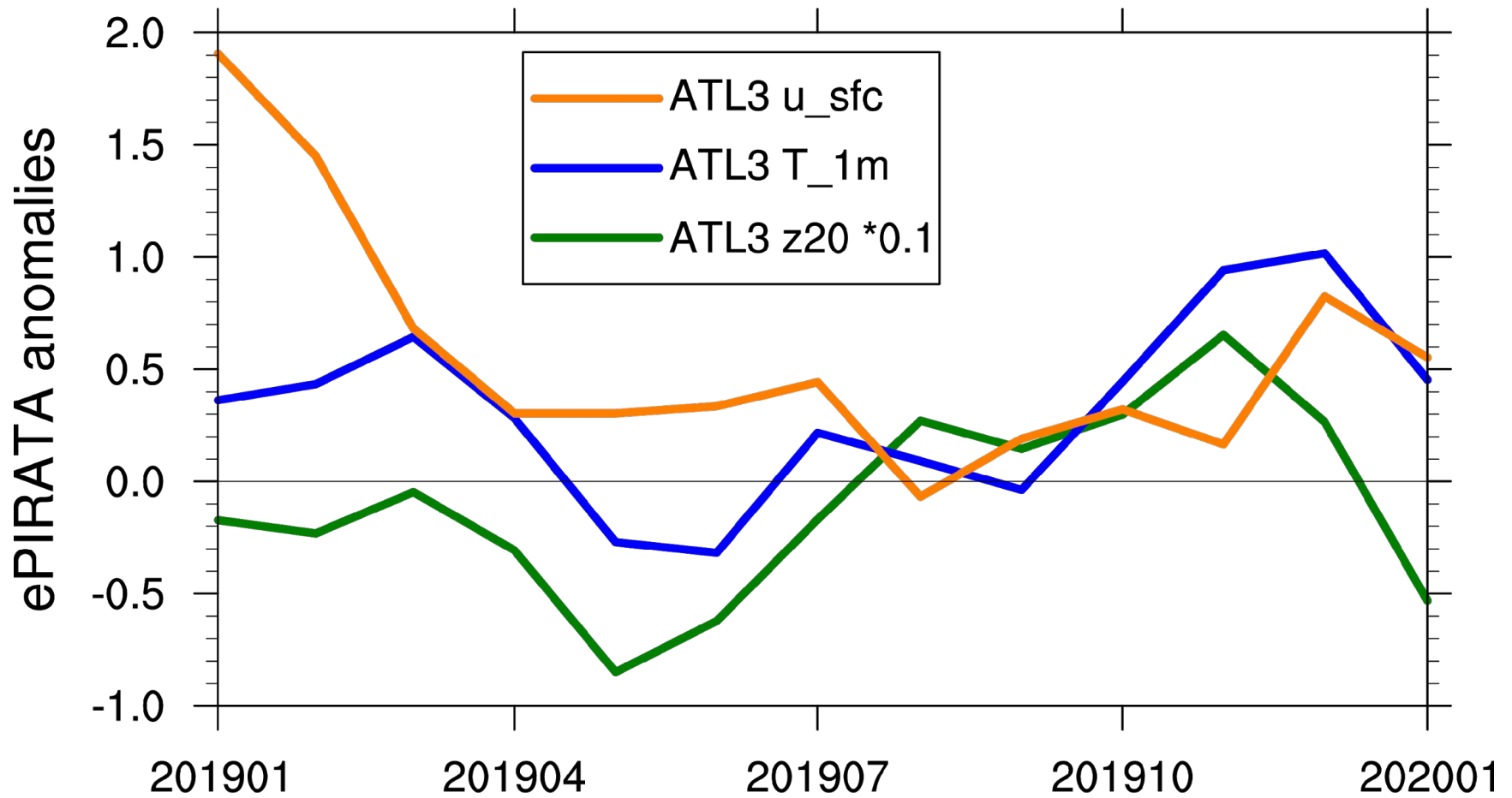


ePIRATA temp anomalies (K)

ave: 0N23W, 0N10W, 0N0E

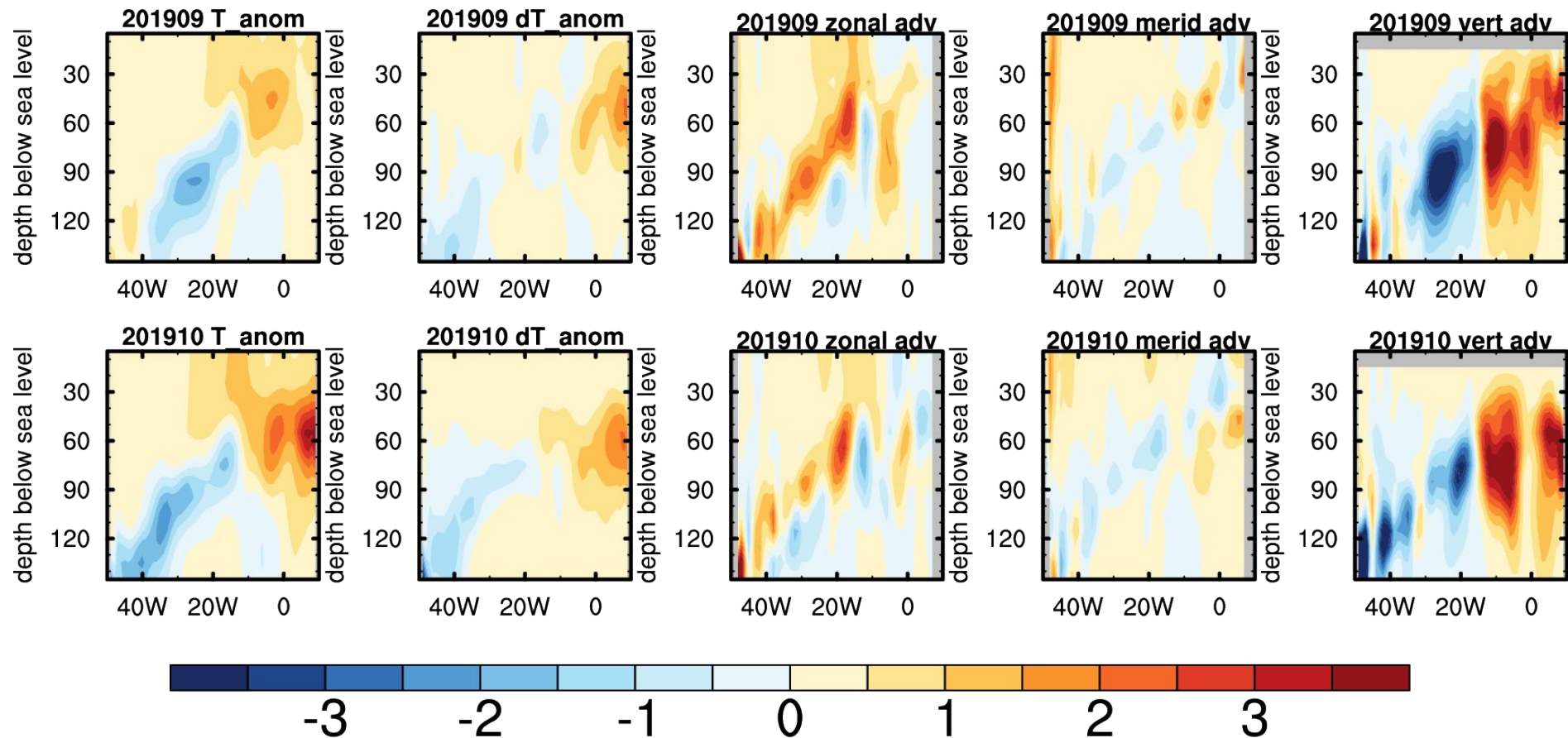


Evolution in the ePIRATA data



GODAS: Ion/depth sections of budget terms

godas: advection terms [K/mth] 3S - 3N

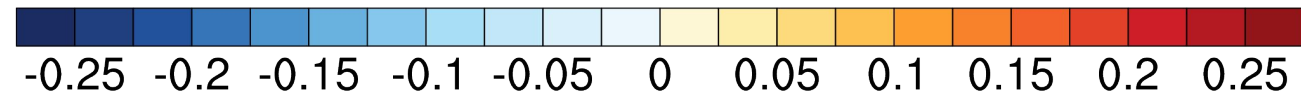
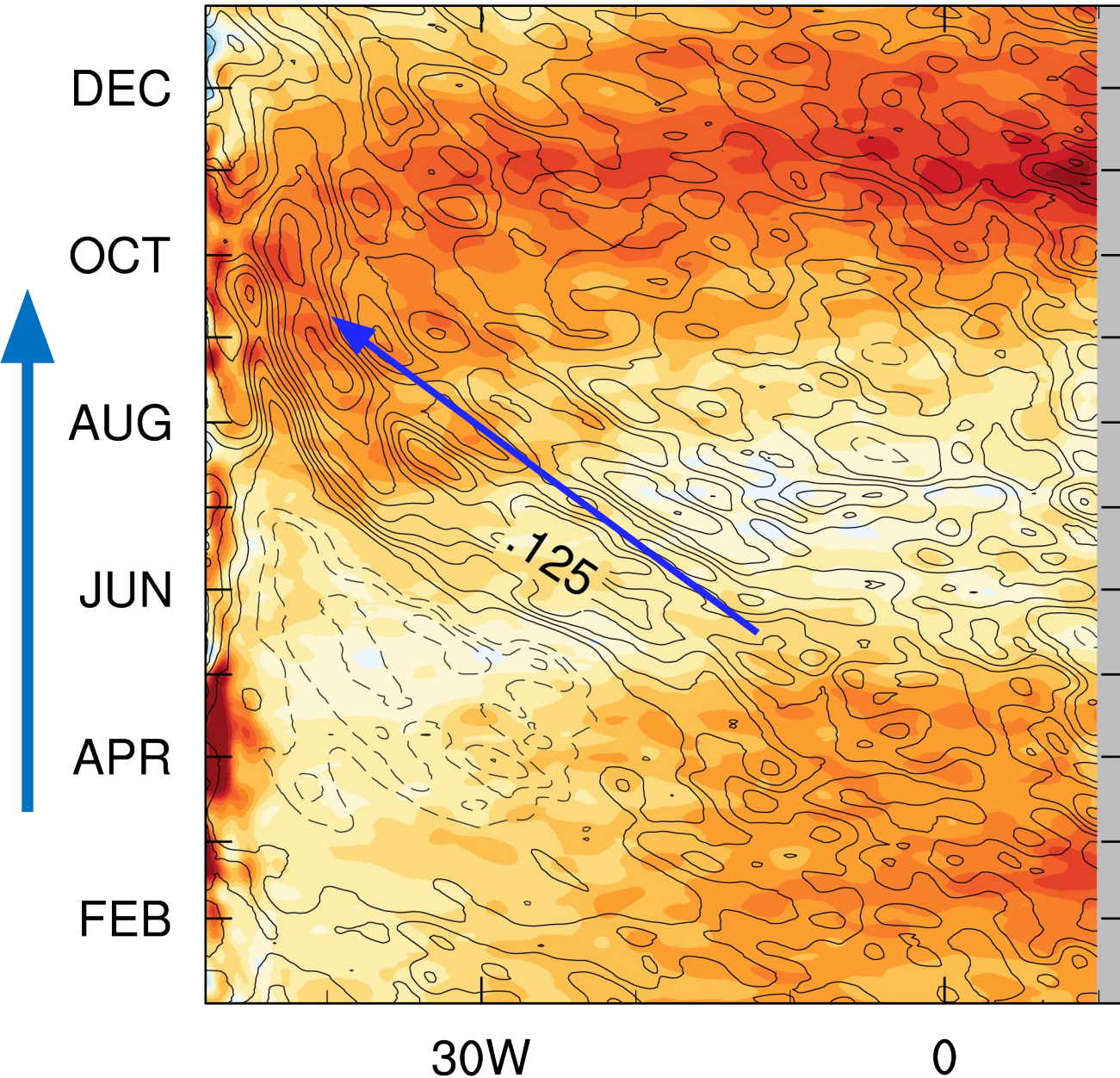


aviso

AVISO SSH anomalies in 2019

lon/time sections
shading: 0.5S-0.5N
contours: 3-4N

evidence for
off-equatorial
Rossby wave



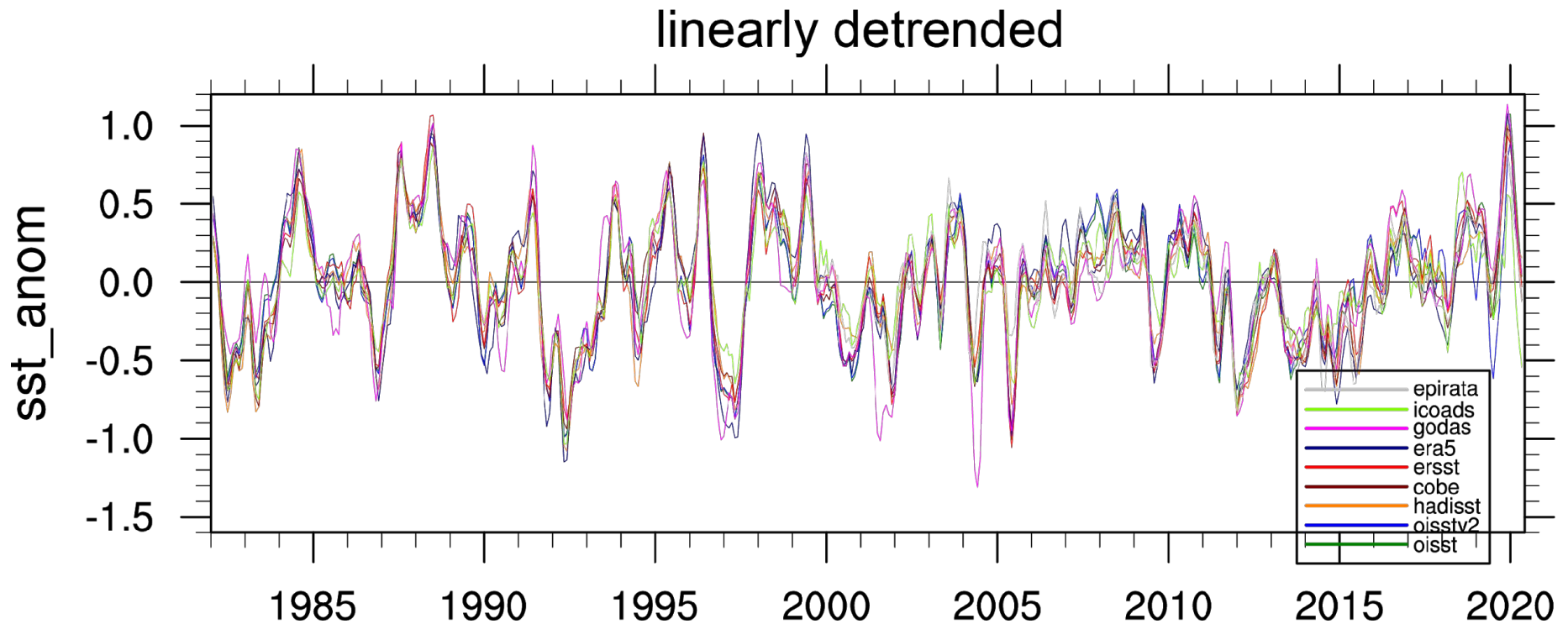
Summary

- pronounced Atlantic Niño occurred in 2019/2020
- strongest event in 20 years, and possibly last 40
- vertical advection dominated the warming
- preceded by moderately strong eq. westerlies
- likely contribution from off-equatorial wind stress curl -> off-equatorial Rossby waves
- possibly other factors played a role too
- is AZM activity picking up again?

Extra slides

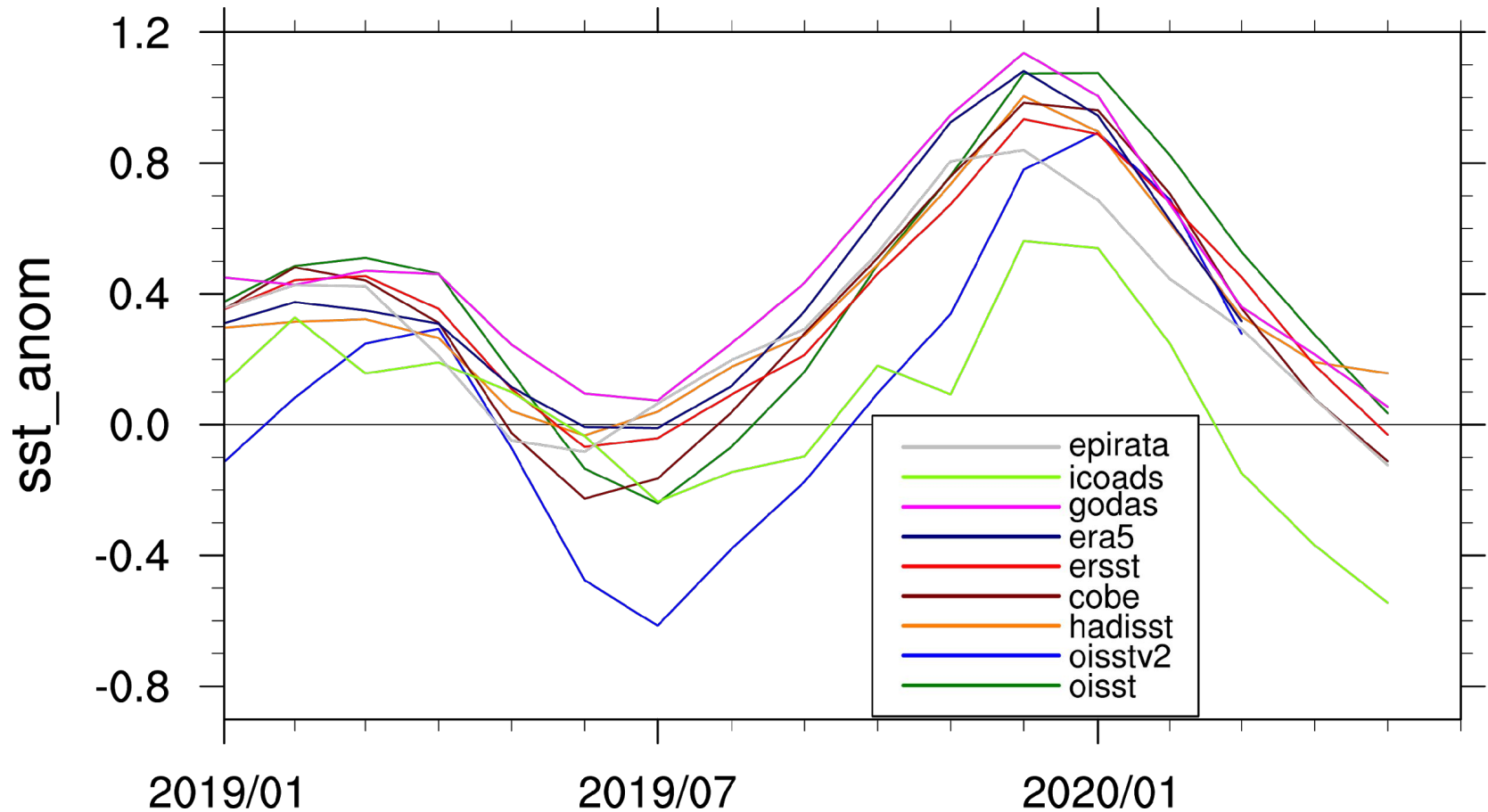
Detrended ATL3 index in 9 data sets

ePIRATA, ICOADS, GODAS, ERA-5, ERSST, COBE, HadISST, OISST v2, OISST (v2+v2.1)

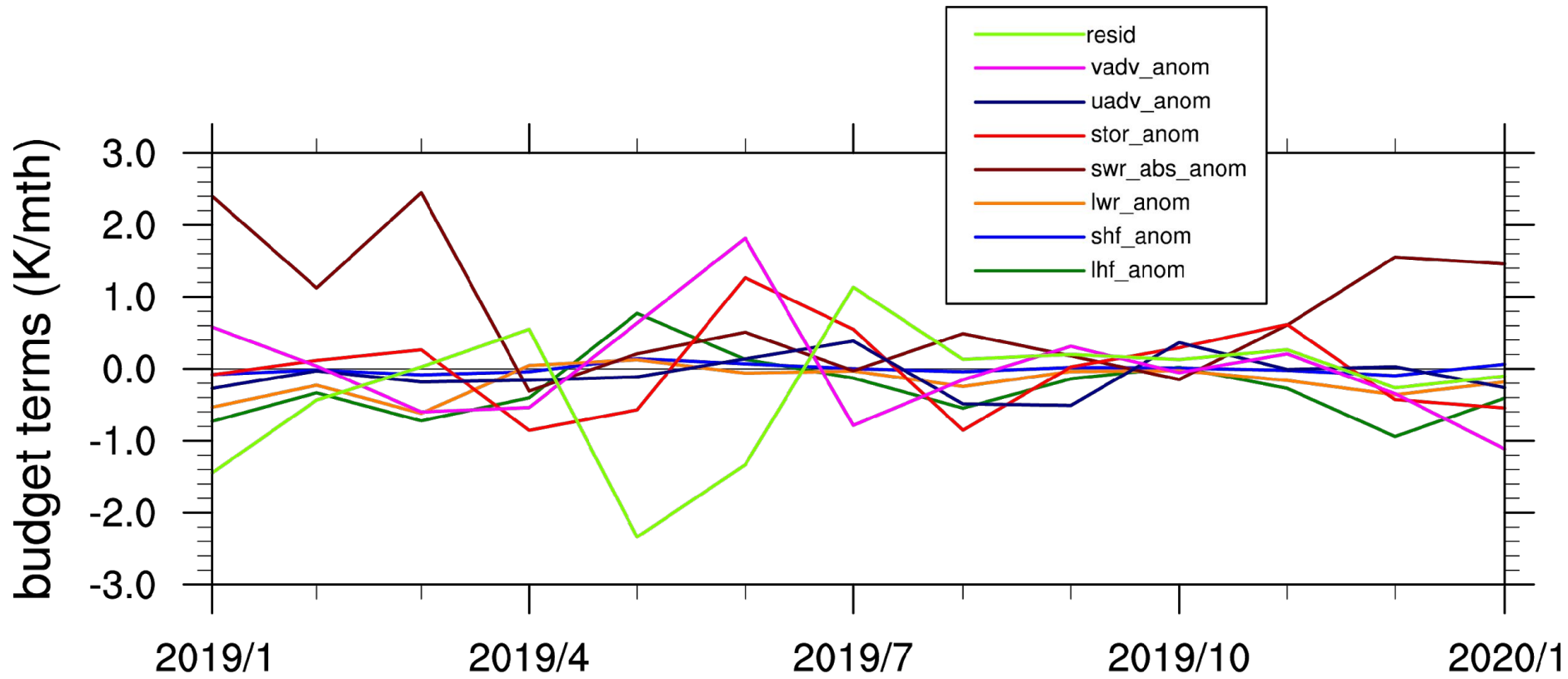


Detrended ATL3 index in 9 data sets

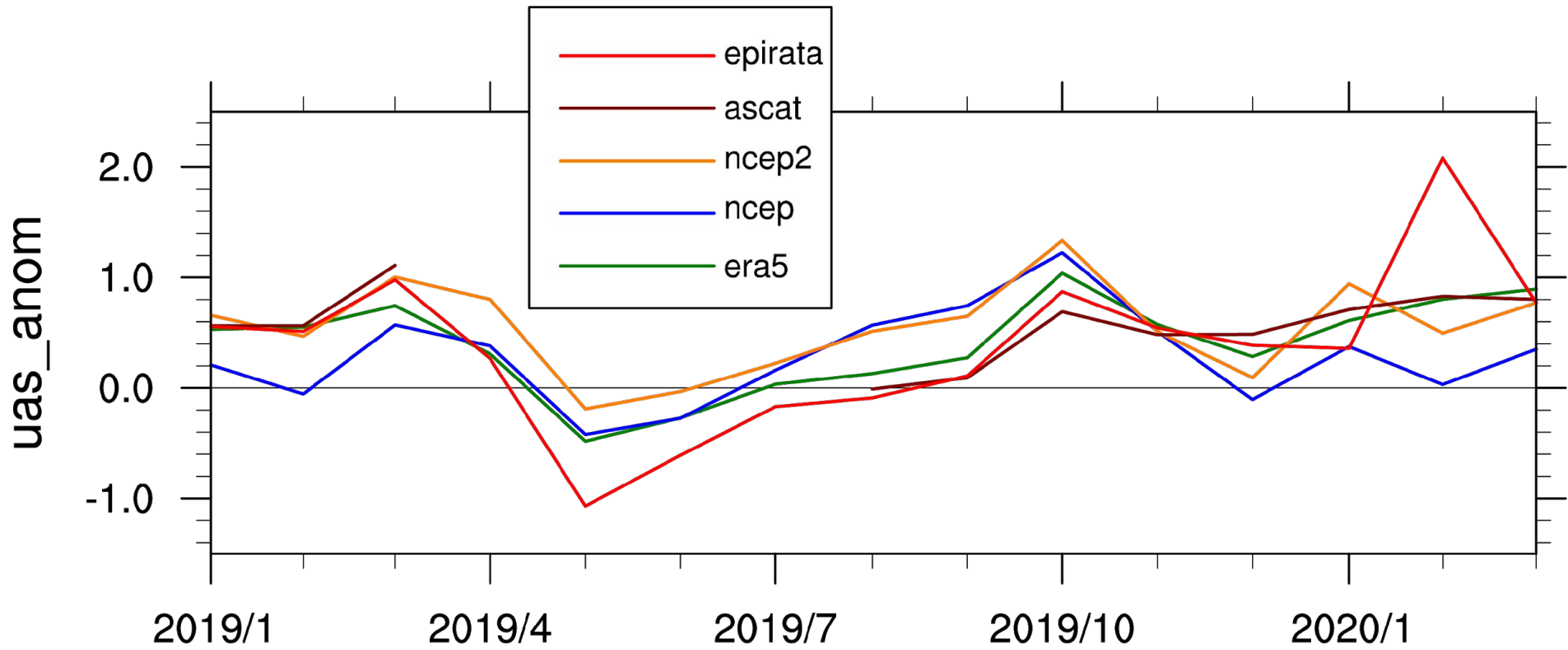
ePIRATA, ICOADS, GODAS, ERA-5, ERSST, COBE, HadISST, OISST v2, OISST (v2+v2.1)



ePIRATA mixed layer heat budget



ATL4 u10 in reanalyses and obs



u10 (40-10W,3-8N) in reanalyses and obs

