Fact-Checked Science

PAPER CHECK · OCEANS

An upwelling index off Vietnam rose as the sea outran its cold spot; 1999 is less certain

Three researchers in Taipei report that an index of the summer upwelling off southern Vietnam, the gap between the South China Sea's mean surface temperature and the coldest water off the coast, fell until about 1999 and has risen since [1 p. 1]. Its SST numbers reproduce from public data, and its caution holds: a rising index needn't mean stronger upwelling, though SST alone can't rule that out [1 p. 10][4]. The year is less secure: it was read off a smoothed curve, with no test in the paper's text, and in our re-run the fall rests on the record's first three summers and much of the rise on a step in 2011 [4]. The paper's explanation, the Pacific, the Indian Ocean and the monsoon, rests on patterns and correlations, with no model experiment, heat budget or attribution test [1 p. 1][1 p. 8].

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OUR ANALYSIS marks our own reasoning and calculations: the index we rebuild from NOAA's public sea-surface temperatures, our tests of one trend against two and our scan of the break year, the years we leave out, the shapes we compare after looking at the data (marked post hoc), the water beside the cold box, the links we test between winds and SST modes, the regional warming rates, the values we read off the paper's figures and our reading of what the paper does and does not show; the verdicts are our assessment. Everything else comes from the numbered sources. For the paper [1], read in full but without its Supporting Information, p. gives a page of the version of record, § a section, Eq. an equation and Fig. a figure; its key points, abstract and plain-language summary are on p. 1. Elsewhere p. gives a page and Abstract the part of a source we rely on.

The paper's SST sums hold, and so does its caution that a rising index needn't mean stronger upwelling; the year and the causes are less secure

OUR ASSESSMENT

0.995

the correlation between the index we rebuilt from NOAA's

+0.42 vs +0.17

°C a decade in 1999–2024, as straight lines: the basin and the

+0.02

°C a decade, ± 0.37: the index's trend from 1985 to 1998, the public sea-surface temperatures and the paper's, read off its Fig. 1a, partly by construction, since we chose Tref's area by fit to that series. The slopes weren't fitted and reproduce too, by our analysis [1 Fig. 1][4]

coldest spot, in our rebuild [4]. So a rising index needn't mean stronger upwelling, the paper's useful caution [1 p. 10]. But the water beside the box warmed as fast as the basin, so SST can't rule stronger upwelling out (our analysis, post hoc)

paper's B99 without its first three summers, a start year we set beforehand [4]. The fall before 1999 rests on 1982–84, and much of the rise on a step in 2011 that we found by looking (our analysis)

THE PAPER'S CLAIMS

PARTLY TRUE

"SCUI shifted markedly around 1999, weakening before 1999 (B99) and intensifying thereafter (A99)."

The paper's abstract [1 p. 1]

The slopes reproduce from public data, and a turn fits better than one straight line (p = 0.026, our analysis) [4]. The year and the steady trends hold up less well. 1999 was read off a smoothed curve, with no test in the paper's text; Figure S2, unread, is described as a sensitivity run for 1997–2001 [1 p. 3]. No fit favours 1999: the best is 1987–1990. For a continuous bend 1999 falls outside the range; for two separate lines, as the paper fits, it falls inside a wide one. And from 1985 the index shows no fall before 1999: +0.02 ± 0.37 °C a decade (our analysis) [4]. See sections 2, 4 and 5.

PARTLY TRUE

"The intensified SCUI during A99 is mainly due to the SCS warming rather than stronger local upwelling."

The paper's conclusions [1 p. 10]; its abstract says the same [1 p. 1]

Part holds. Tref's slope exceeds the index's, +0.42 ± 0.16 against +0.25 ± 0.22 °C a decade in 1999–2024, with the coldest cell at +0.17 ± 0.34 [4], and MUR, a separate analysis, gives the same split from 2002 [23]. So a rising index needn't mean stronger upwelling, which is the paper's useful caution. Part isn't shown. SST can't say the upwelling didn't strengthen: the water beside the box warmed as fast as the basin, so the rise lies between that water and the cold cell, and wind products disagree [7 pp. 6–8]. Drawn as a line and a step, the two parts warm alike and the step is in Tmin (our analysis, post hoc). See sections 3 and 5.

PARTLY TRUE

"the B99 weakening was dominated by a reduced southwesterly summer monsoon affecting Tmin"

The paper's abstract [1 p. 1]

The link is real. Before 1999 Tmin warmed faster than the basin, 0.09 against 0.04 °C a year [1 p. 3]; its ERA5 wind index weakened (−15 × 10^{-3} m^2/s a year, read off its figure) [1 Fig. 1]; and on the winds we could use, Tmin follows the south-westerly wind year to year (r ≈ −0.65) [26]. But the fall leans on 1982 and 1984, the two lowest Tmin of 43, and on those coarser winds about 70% of Tmin's rise remains with the wind taken out (our analysis). See sections 5 and 6.

OVERSTATED

"Empirical Orthogonal Function (EOF) analyses identify two key dynamical processes"

The paper's abstract [1 p. 1]; its text says "These outcomes confirm" part of the chain [1 p. 8]

UNSUPPORTED

"the warming trend observed in the Indo-Pacific mode is unlikely to be due to the global warming effect"

The paper's §3.4 [1 p. 8]

It has a basis: the modes reproduce, and the cross-equatorial winds it names do go with Tmin (our analysis). But EOF modes are patterns, not causes, and there is no model experiment or heat budget. Of the 31 trends the chain cites, 20 carry no star or have p > 0.2 in the paper's own numbers [1 p. 8][1 Fig. 1], though the mixed-layer, heat-content and EOF1 trends are significant. The mode it pairs with Tmin is said to "appear to match" [1 p. 6]; year to year the correlation is −0.13, where the mechanism needs a positive one (our analysis). See section 6.

The argument: the mode goes with a La Niña-like pattern, and global warming "has been proposed to result in an El Niño-like SST pattern", so warming is an unlikely cause [1 p. 8]. No attribution test is offered. The premise is disputed: Seager et al. argue the observed pattern is itself a forced response that models miss [15 Abstract], and the paper's own source finds the global-warming mode offsetting more than half of the Pacific oscillation's cooling in the eastern tropical Pacific [32 Abstract]. And the mode's warming isn't unusual: its domain +0.021 ± 0.006 °C a year, near-global SST +0.020 ± 0.003 (our analysis, post hoc) [4]. It isn't disproven; we found nothing that backs it. See section 7.

1 · THE PAPER

Three researchers in Taipei followed the contrast between the South China Sea and its coldest coastal water, 1982–2024

Mai-Han Ngo, Yi-Chia Hsin and Chau-Ron Wu, of Academia Sinica and National Taiwan Normal University, published this letter in *Geophysical Research Letters* in October 2026 [1 p. 1]. It is peer reviewed and open access. We read it in full, but not its Supporting Information, which isn't in the PDF [1]. SO News linked it in its episode of November 2, 2026 [2].

What the upwelling is

Each summer the south-westerly monsoon drives water away from the coast of southern Vietnam, and colder water rises in its place. The paper attributes the coastal part to offshore Ekman transport from the wind along the shore, helped by the wind's curl [1 p. 2]. It is a fishing ground and it shapes regional climate [1 p. 1]. In the summer of 1998, after the strong El Niño, the cold water spreading offshore never formed and the sea warmed across the basin [10 Abstract]; see also Kuo et al. [11]. A later paper, with two of this one's authors, calls the upwelling that year "almost absent" [9 p. 1].

STEP 1

The index

SCUI(t) = Tref(t) − Tmin(t), from OISST v2.1 daily temperatures "averaged for June–September"

STEP 2

The year

The last component of a Hilbert–Huang decomposition falls, "reached its minimum around 1999", and rises, [1 Eq. 1][1 p. 2]. Tmin “is the minimal SST in SCU”, a box at 107–110°E, 10–12.5°N [1 p. 2][1 Fig. 1]. Tref is the mean over an area shown only in the unread Figure S1 [1 p. 2].

“indicating a transitional year of 1999” [1 p. 3]. Periods B99 (1982–1998) and A99 (1999–2024) follow, with a straight line through each [1 p. 3].

STEP 3

The two parts

Tmin warmed faster than Tref in B99, 0.09 against 0.04 °C a year; in A99 Tref kept rising at 0.04 while Tmin’s 0.02 was not significant [1 p. 3][1 p. 5].

STEP 4

The causes

ERA5 winds and ORAS5 ocean fields [1 p. 3], and EOF modes of summer SST [1 p. 5] and wind [1 p. 9]. It credits a La Niña-like pattern, stronger trades, an anticyclone over the northern sea and a weaker throughflow, and a contrast between the hemispheres driving cross-equatorial winds [1 p. 1].

The paper’s key points, in the authors’ words

SCS is the South China Sea; NSCS its northern part; AAC an anomalous anticyclone.

> *“Vietnamese Southern Coastal Upwelling index (SCUI) shifted from a weakening trend before 1999 to a marked intensification thereafter”*
>
> Ngo et al. (2026), Key Points [1 p. 1]

> *“Pre-1999 weakening mainly resulted from local minimum SST warming, while post-1999 intensification was related to basin-wide South China Sea (SCS) warming”*
>
> Ngo et al. (2026), Key Points [1 p. 1]

> *“The shift was driven by combined effect of persistent enhanced trade winds and NSCS AAC, and multidecadal change in cross-equatorial winds”*
>
> Ngo et al. (2026), Key Points [1 p. 1]

WHAT WE READ

The full text

13 pages with four figures, supplied by the site’s owner; not the Supporting Information with Figures S1–S5 [1]

STATUS

Peer reviewed

received September 14, accepted October 7, published October 25, 2026; “The authors declare no conflicts of interest relevant to this study” [3][1 p. 11]

LICENCE

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so its figures may be adapted, with credit, for non-commercial use; we draw our own charts from public data and mark what is read off its Fig. 1a [1 p. 1][3]

Its hedges, and its firmer words

The authors say the series “visually seems to have multidecadal tendencies” [1 p. 3], that Tref “may become more important after 1999” [1 p. 5], that the EOF trends “appear to match” Tref and Tmin and “can provide clues” [1 p. 6], that EOF1 and the wider mode “may be driven by the same dynamical mechanism”, that EOF1 “may also be linked” to the La Niña-like trend and that EOF2 “can be interpreted as” reflecting the cross-equatorial winds [1 p. 8], that those winds “cannot fully account for” the trends, and “Our analysis suggests” for the winds [1 p. 9]. Beside these stand

OUR ANALYSIS

What the paper does not give

In its text, a test of the break year, or of two trends against one; any allowance for year-to-year persistence in its significance tests, which are Student’s t at 80, 90 and 95% [1 Fig. 1]; any note on OISST’s changing inputs, on cloud or on sensors; or any word on the 1997–98 El Niño or the missing upwelling of 1998 beside its remark on Tref’s “abrupt drop in 1999” [1 p. 5]. It has no section on limitations. Its data statement lists public products and no copy of the SCUI series [1 p. 11].

"attributable" [1 p. 1], "These outcomes confirm" and "driven" [1 p. 8], and "can cause" [1 p. 9]. We judge each sentence by the words it uses.

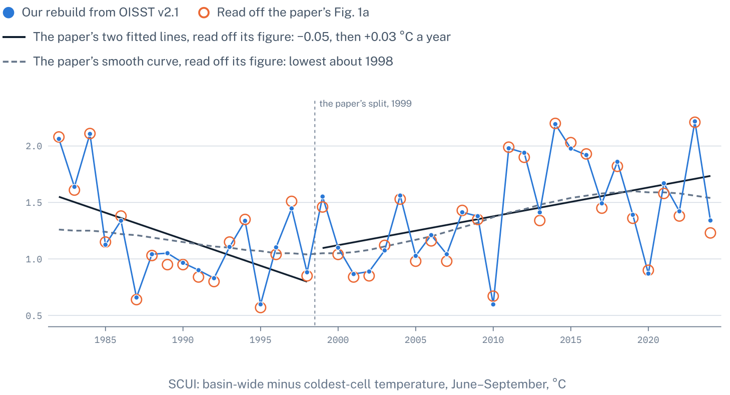
2 · THE NUMBERS

First, what holds: the paper's index and its slopes reproduce from public data

From NOAA's OISST v2.1 alone, we get its index year by year, its slopes for all three quantities to within 0.003 °C a year of its Fig. 1 bars, its smooth curve and its EOF percentages (our analysis) [4]. On these SST numbers its arithmetic is sound. The wind index, curl, transports, mixed layer and heat content need an account, so we couldn't repeat them.

The paper's index, rebuilt from public data

OUR ANALYSIS



Our analysis of NOAA OISST v2.1 [4]. Rings, lines and curve are values we read off the image of Fig. 1a of [1] with a script (accuracy about 0.02 °C), from a paper under CC BY-NC 4.0, shown here with credit for non-commercial use. Hover or tap a mark for its value.

The paper beside our rebuild

QUANTITY	THE PAPER	OUR REBUILD
SCUI, 1982–2024	+0.01 °C/yr, $p < 0.1$	+0.011, $p = 0.043$
SCUI, B99	−0.05, $p < 0.05$	−0.046, $p = 0.026$
SCUI, A99	+0.03, $p < 0.05$	+0.025, $p = 0.026$
Tref, 1982–2024	+0.02, $p < 0.05$	+0.024, $p < 0.001$

Tref, B99	+0.04, $p < 0.1$	+0.046, $p = 0.051$
Tref, A99	+0.04, $p < 0.05$	+0.042, $p < 0.001$
Tmin, 1982–2024	+0.01, $p < 0.2$	+0.013, $p = 0.11$
Tmin, B99	+0.09, $p < 0.05$	+0.092, $p = 0.010$
Tmin, A99	+0.02, not significant	+0.017, $p = 0.31$
EOF1	62.1%; slopes 0.07, 0.08, 0.06 a year	63.1%; 0.073, 0.080, 0.056
EOF2	10.7%; slopes 0.01, −0.05, −0.03 a year	10.4%; 0.008, −0.047, −0.025
EOFPac2	22.8%; R 0.92 in space, 0.89 in time	22.1%; R 0.92, 0.88, on a 1° sample
The smooth curve	minimum “around 1999”	minimum 1998; within 0.01 °C (rms) of the curve in Fig. 1a, run on the values read off that figure

The paper’s values are from pp. 3 and 5 [1 p. 3][1 p. 5], from p. 8 for EOFPac2 [1 p. 8], and from its Figs. 1 and 3. Ours use its method, ordinary least squares and Student’s t, with its periods (our analysis) [4]. EOF slopes are for B99, A99 and the whole record. Two small differences: Tref’s B99 slope rounds to 0.05 where the paper prints 0.04 (its Fig. 1b bar reads 0.043), and SCUI’s whole-record p, 0.043 on our rebuild, is 0.058 on the series read off Fig. 1a, in line with the paper’s. The curve from the series as we rebuilt it lies within 0.034 °C [29].

OUR ANALYSIS

What we had to infer

Figure S1, which shows Tref’s area, is in the unread Supporting Information. We tried several areas, set the rules for choosing among them before running them, and took the best fit to the series read off Fig. 1a: water at least 500 m deep inside a polygon around the South China Sea. Against that series the correlation is 0.995, partly by construction since the area was chosen by that fit, and the typical difference 0.05 °C, a little above the reading error; the slopes were not part of the fit. The paper names no bathymetry; we used ETOPO1 [27]. A stand-in we fixed before we had the paper, June–August with each month’s coldest cell, tracks this index ($r = 0.97$) and reached the same conclusions.

OUR ANALYSIS

The 500 m rule

“In the calculation, waters with depth <500 m are excluded to minimize land influences” [1 p. 2]. The published series can’t have applied that to Tmin: with it, mean SCUI would be 0.61 °C, against about 1.3 as published. In our rebuild Tmin sits in cells at the shore, in two places for 38 of the 43 years. So the rule seems to apply to Tref alone. That is our inference until Figure S1 is seen.

3 · WHAT THE INDEX CAN SHOW

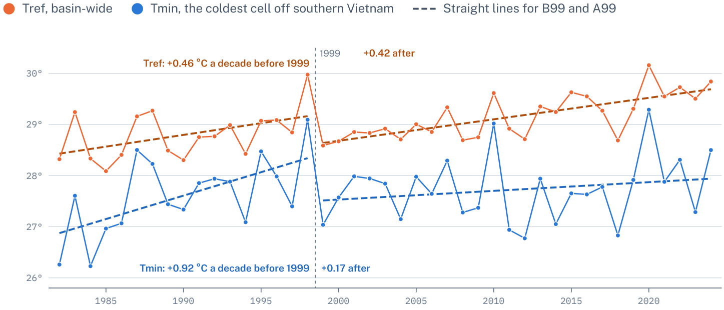
The paper’s useful caution: a rising index needn’t mean stronger upwelling, though SST alone can’t rule that out

SCUI is a difference. It rises if the upwelling cell gets colder, or if the basin warms while the cell doesn’t. The abstract’s last clause says that after 1999 it was the second:

“attributable to Tref warming … rather than enhanced local upwelling itself” [1 p. 1]. The arithmetic supports the caution. It doesn’t settle the “rather than”.

The two parts of the index

OUR ANALYSIS



June–September sea-surface temperature, °C. The gap between the two is the index

Our analysis of NOAA OISST v2.1 [4], by the paper’s definition. Slopes in °C a decade, from straight lines in each period; the paper gives the same split in °C a year [1 p. 3][1 p. 5]. Hover or tap a dot for its value.

THE ARITHMETIC, 1999–2024

OUR ANALYSIS

+0.25

°C a decade (± 0.22) for SCUI, which is Tref’s +0.42 ± 0.16 minus Tmin’s +0.17 ± 0.34 [4]. As straight lines, Tref’s slope exceeds the whole rise; that alone doesn’t say why the cell lagged.

A SEPARATE ANALYSIS

OUR ANALYSIS

r = 0.88

MUR 4.1 against OISST, 2002–2024. Its slopes: SCUI +0.30 ± 0.22, Tref +0.46 ± 0.22, Tmin +0.16 ± 0.37 °C a decade, the same split [23]. It repeats the arithmetic; it doesn’t decide the cause.

THE WIND

OUR ANALYSIS

Flat

On NCEP R1 and R2 the wind-based upwelling index has no trend in A99 (p ≈ 0.7), as in the paper’s ERA5 [26][1 Fig. 1]. SCUI’s A99 rise is unchanged with the south-westerly wind regressed out [26]. But these are coarse grids read at one point, and other wind products differ [7 pp. 6–8].

Where the rise lies (post hoc)

TREND, °C A YEAR	OISST, 1982–1998	OISST, 1999–2024	MUR, 2002–2024
Tref, the basin	+0.046 ± 0.046	+0.042 ± 0.016	+0.046 ± 0.022
The water beside the box, 110–113°E, 10–12.5°N (in MUR, to 112°E)	+0.053 ± 0.052	+0.042 ± 0.023	+0.044 ± 0.030
Tmin, the coldest cell	+0.092 ± 0.066	+0.017 ± 0.034	+0.016 ± 0.037
Tref minus that water	−0.008 ± 0.013	+0.000 ± 0.009	+0.001 ± 0.011

That water minus Tmin	−0.038 ± 0.055	+0.025 ± 0.023 (p = 0.012)	+0.028 ± 0.018 (p = 0.003)
Strongest local contrast in the box, against 5 × 5 cells, about 140 km	−0.013 ± 0.011	+0.008 ± 0.006 (p = 0.011)	+0.009 ± 0.005 (p = 0.002)
The same, against 7 × 7 cells, about 195 km	−0.022 ± 0.019	+0.012 ± 0.009 (p = 0.014)	+0.012 ± 0.008 (p = 0.004)

Our analysis, found after we saw the data [4][23]. That water warmed with the basin, so the rise lies between it and the cold cell: the difference is 98% of SCUI's slope in 1999–2024, 84% in B99 and 90% over the record, and goes with SCUI at r = 0.94. The local contrast is the kind of index Liu et al. use, taken each year at the cell of the box that stands furthest below the water around it. At 195 km its levels are 0.78, 0.45 and 0.70 °C in 1982–84, 1985–2010 and 2011–24, the index's own shape. Over Liu et al.'s years, 1982–2020, it gives +0.04 ± 0.07 °C a decade on OISST's June–September grid, so it neither repeats nor rules out their result.

What it changes

The paper first puts it gently, that Tref "may become more important after 1999" [1 p. 5], and concludes that Tmin went "from significant warming during B99 to neutral during A99" [1 p. 10]. So, as straight lines, Tmin went from warming fast to no clear trend, and only the index went from falling to rising. The Key Points' "marked intensification" [1 p. 1] describes the index. This qualifies how SST-difference indices have been read: Ngo & Hsin "identified an intensifying tendency" over 1982–2019, in the new paper's words [1 p. 2][5 Abstract]. Liu et al. reach a different result with a different index. Their local contrast over 150 km, built to exclude basin warming [7 p. 3], strengthens by up to about 0.2 °C a decade off southern Vietnam in June–July 1982–2020 in OSTIA [7 p. 5], and CCMP and ORAS5 winds favour stronger upwelling there while ERA5 doesn't [7 pp. 6–8]; they say the disagreement makes a direct conclusion on the mechanism difficult [7 p. 9]. Their record isn't split at 1999, so it doesn't test the later period directly, but the new paper cites them as similar and doesn't reconcile the two; it also cites a sediment core read as intensification [1 p. 2].

OUR ANALYSIS

Set against another measure

Wang & Wu, with this paper's third author, list six weak-upwelling summers since 1982: 1983, 1987, 1988, 1995, 1998 and 2015 [8 p. 2], from a box mean at 109–113°E, 9–13°N of 1° HadISST [8 p. 1][8 p. 6], a grid too coarse for the cold tongue, as section 5's products table says. SCUI is below its 1.34 °C mean in four of the six, with 1995 and 1987 second- and third-lowest of 43, so the two often agree. It differs in 1983 and 2015, at 1.64 and 1.98 °C, and stays high through 2014–2016, at 2.19, 1.98 and 1.92 °C [4]. And 1998, when upwelling "was almost absent" [9 p. 1], is only the seventh-lowest SCUI, at 0.88 °C, because Tref and Tmin were both high.

OUR ANALYSIS

Two readings, and SST can't choose

The sea did warm, right up to the box, and the cold cell lagged it. That fits unchanged upwelling of water that warms more slowly, which would agree with the paper's reading. It fits stronger upwelling too, holding the cell back as the sea warms. Nothing on this page separates the two. SCUI isn't meaningless, since it measures contrast, but it can't say which; and no clear trend in Tmin still allows anything from −0.17 to +0.51 °C a decade. The direct measure would be vertical velocity. Two of the authors have a way to get it, the omega equation applied to an ocean reanalysis, for 1994–2015 [6 Abstract]; this letter doesn't use it.

The year was read off a smoothed curve; a scan of the break year points earlier

The words breakpoint, change point and Pettitt don't occur in the paper, and its text has no test of the year; Figure S2, unread, is described as a sensitivity run for 1997–2001. The year comes from the low point of a curve; two lines are then fitted either side, "As expected" [1 p. 3].

What the paper did

The series "visually seems to have multidecadal tendencies". By applying the Hilbert–Huang Transform, "the final intrinsic mode function … decreased since 1982, reached its minimum around 1999, and increased thereafter, indicating a transitional year of 1999" [1 p. 3]. "Sensitivity analysis using alternative transition years (1997–2001) confirms the robustness of the trends identified for 1999", in Figure S2 [1 p. 3], which we haven't seen.

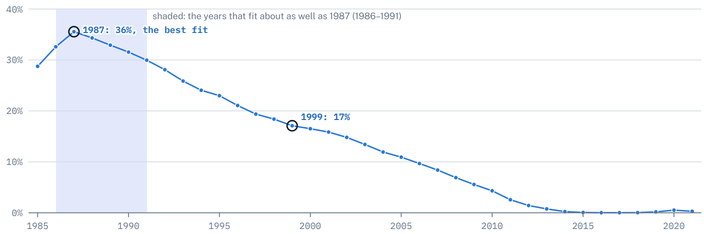
OUR ANALYSIS

The curve is real, but it isn't a test

We reproduced it with PyEMD at default settings [29]. Its minimum is in 1998, nearly flat from 1997 to 1999, so "around 1999" fairly describes it. In 2,000 series with one straight trend plus noise, so no change of trend at all, such a curve has a low point inside the record about 60% of the time, and in 1996–2002 about 8–10%, but only about 4% dip as deep as this one, so the dip itself is more than chance. A U-shape bottoms out near the middle of its two high ends: here about 1983 and 2014, whose midpoint is about 1999. Starting the record in 1983 moves the minimum to 1997; starting in 1985 removes it.

How much a single bend helps, by the year of the bend

OUR ANALYSIS



Year of the bend. Share of the scatter about one straight line that a line with a bend removes

Our analysis of the rebuilt index, a continuous line with one bend [4]. The range scanned here, 1985–2021, is post hoc: the scan we fixed beforehand, 1990–2014, had its best fit at its edge, 1990.

The test we set before running it

A BREAK AT 1999 PASSES ONLY IF ALL FOUR HOLD	RESULT

What the paper's recipe can tell apart (post hoc)

SERIES MADE FROM	CURVE'S LOW POINT IN 1996–2002	FALL THEN RISE, BOTH $P < 0.05$	BOTH

A bend at 1999 beats one line	Yes, p = 0.026
Some bend beats one line, allowing for the search	Yes, p = 0.006
The best bend lies within 1996–2002	No: 1990, at the scan's edge; 1987 in a wider scan, range 1985–1992
The slope before is clearly negative, and after clearly positive	After yes (+0.32 ± 0.19); before no (−0.27 ± 0.30 °C a decade)

Our analysis [4]. Written down before the run, with a parametric AR(1) bootstrap; the wider scan in the third row came after. Two separate lines at 1999 give −0.46 ± 0.45 and +0.25 ± 0.23 (p = 0.041); with each period's own persistence, as in section 5's windows, those ranges are ± 0.49 and ± 0.22, and the fall's then just spans zero. So something beyond a straight line is there, on every test.

One straight line	10%	0.2%	0.2%
A bend at 1999	35%	20.3%	8.8%
Two steps, 1985 and 2011, nothing at 1999	67%	50.6%	33.8%

Our analysis, 2,000 simulated series each, with the noise of the rebuilt index [4][29]. The recipe fairly rejects a straight line. It can't tell a turn in 1999 from two level shifts with nothing at 1999, and it favours the second.

The break year, four ways

SHAPE	YEARS SCANNED	BEST YEAR	95% BOOTSTRAP RANGE	DRAWS IN 1996–2002	YEARS THAT FIT ABOUT AS WELL
A continuous bend	1990–2014, set first	1990	1990–1998	3.7%	1990–1993
A continuous bend	1985–2021, post hoc	1987	1985–1992	0.5%	1986–1991
Two separate lines, as the paper fits	1990–2014, set first	1990	1990–2004	12.2%	1990–1994, 1996, 2011
Two separate lines, as the paper fits	1985–2021, post hoc	1987	1985–2000	5.3%	1985–1993, 2011

Our analysis [4]. No fit favours 1999: the best is 1987–1990. For a continuous bend 1999 falls outside the range; for two separate lines, as the paper fits, it falls inside a wide one, though outside the years that fit about as well.

5 · THE FIRST THREE SUMMERS, AND 1998

The fall before 1999 rests on 1982–84, not on 1998

Summer 1998 looks like the obvious lever, but it doesn't move the SCUI trend. The first three summers do. From 1985 to 2010, a window we chose after looking, the index has no trend (our analysis) [4].

Leaving years out

LEFT OUT	A BEND AT 1999: BEFORE; AFTER, °C A DECADE	BEATS ONE LINE? P	SCUI'S B99 SLOPE, STUDENT'S P
Nothing	**−0.27 ± 0.30; +0.32 ± 0.19**	**0.026**	**−0.046 °C/yr, p = 0.026**
1998	−0.26 ± 0.33; +0.32 ± 0.21	0.043	−0.047 °C/yr, p = 0.041
1997–1999	−0.34 ± 0.33; +0.38 ± 0.21	0.018	−0.064 °C/yr, p = 0.010
The 15 summers after a winter	−0.29 ± 0.34; +0.36 ± 0.23	0.030	−0.043 °C/yr, p = 0.10

with ONI ≥ +0.5			
Nothing, but the winter's ONI regressed out	−0.30 ± 0.35; +0.34 ± 0.22	0.033	−0.043 °C/yr, p = 0.030
1982	−0.17 ± 0.31; +0.31 ± 0.18	0.059	−0.033 °C/yr, p = 0.11
1984	−0.18 ± 0.30; +0.31 ± 0.18	0.042	−0.035 °C/yr, p = 0.070
1982 and 1984	−0.04 ± 0.30; +0.29 ± 0.17	0.127	−0.015 °C/yr, p = 0.38
1982–84	**+0.08 ± 0.33; +0.27 ± 0.17**	**0.374**	**+0.002 °C/yr, p = 0.93**

Our analysis [4]. ONI is NOAA's El Niño index for the winter before the summer [28].

OUR ANALYSIS

1998: no lever on the index, but on its parts

Leaving out 1997–99 makes the turn slightly stronger. 1998 isn't among the six most influential years; 1982 and 1984 lead that list. It was hot everywhere that summer, so Tref and Tmin rose together and the difference hides it. It does move the parts. Without 1998, Tref's B99 slope falls from +0.046 (p = 0.051) to +0.026 °C a year (p = 0.24), about its whole-period rate, and EOF1's from 0.073 to 0.031 (p = 0.36). That is what lies behind the paper's "Simpson's Paradox" and its "abrupt drop in 1999" [1 p. 5]: Tref goes from 29.98 °C in 1998, second warmest of the 43, to 28.59 °C in 1999.

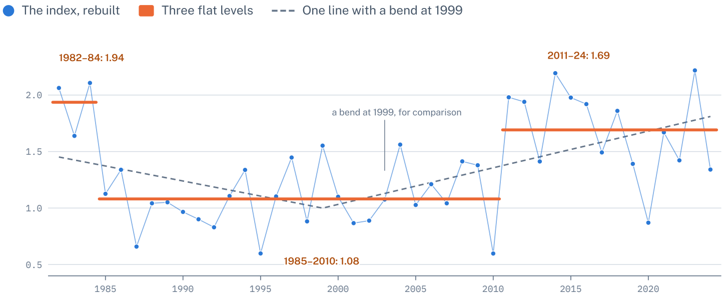
OUR ANALYSIS

1982–84: we can't tell whether they're real

In 1982 and 1984 Tmin is the coldest of the record, 26.26 and 26.23 °C, against a 1985–2010 mean of 27.78 (sd 0.58). Nothing independent at this scale reaches back that far. R1 and R2 rank 1982's south-westerly wind 1st and 3rd of 43, which favours it; they rank 1984's 23rd and 27th, which doesn't. Pathfinder also has SCUI above its later mean in all three summers, 2.88 °C against 2.41 for 1985–2006, about half OISST's gap, with 1982's Tmin third-lowest of 41 [24]; but it is OISST's own input to 2006, so it isn't independent [20 p. 168]. All three summers come from one satellite, NOAA-7, whose stretch of the record ended in January 1985 [20 p. 168], just when the index drops; that is a coincidence in time, not evidence of a cause. We can't say whether 1982–84 is real, only that the "weakening" depends on it.

One description among several: three levels, with nothing at 1999 (post hoc)

OUR ANALYSIS



SCUI, June–September, °C

Our analysis [4]. We found these two steps by looking at the data, and we don't claim they are true. The point is narrower: the data don't single out 1999, and a shape with nothing at 1999 describes them better. The same caution about satellites applies to the second step: one of OISST's two AVHRR inputs changed, NOAA-18 to NOAA-19, on 16 August 2011 [20 p. 168], in that summer. MUR, whose inputs only partly overlap OISST's, shows that step too [23].

Where the 2011 step lies (post hoc)

FIT	YEARS	SCUI'S STEP, °C	TREF'S STEP	TMIN'S STEP
A line, its own level for 1982–84, a step at 2011 (the second-best shape below)	1982–2024	+0.61 ± 0.37	+0.04 ± 0.46	−0.56 ± 0.74
A line and a step at 2011	1999–2024	+0.88 ± 0.54	−0.23 ± 0.49	−1.12 ± 0.92
The same on MUR	2002–2024	+0.64 ± 0.50	−0.31 ± 0.55	−0.94 ± 0.86
Plain means, 2003–10 to 2011–18		+0.68	+0.19	−0.50
Plain means, 1985–2010 to 2011–24		+0.61	+0.53	−0.09

Our analysis, found after we saw the data [4][23]. The two descriptions answer the paper's question differently. As straight lines, Tref carries the rise. As a line and a step, the two parts warm alike, +0.024 °C a year each in the first row, and the step is in Tmin. So whether the cold spot got colder depends on the shape; plain means fold Tref's steady trend into the step.

Rival shapes, post hoc

SHAPE	AICC
Two steps, 1985 and 2011	−89.2
One line, its own level for 1982–84 and a step at 2011	−86.3
A line with a bend at its best year, 1987	−81.7
One line, with its own level for 1982–84	−81.5
A bend at 1999, with its own level for 1982–84	−79.7
One step at its best year, 2011	−76.8
A line with a bend at 1999	**−73.5**
Two separate lines at 1999	−73.1
A smooth curve (quadratic)	−71.9
One straight line	−67.9
One step at 1999	−66.9

Our analysis [4]. Lower is better, and a difference of 10 is large; searched years count as parameters. If a bend at 1999 were the truth, two steps would beat it by the observed 15.7 in under 0.2% of simulated records.

Plain windows, °C a decade

YEARS	SCUI	TREF
1982–1998	−0.46 ± 0.49	+0.46 ± 0.46
1985–1998	+0.02 ± 0.37	+0.64 ± 0.64
1985–2010 (post hoc)	+0.06 ± 0.15	+0.19 ± 0.21
1999–2010 (post hoc)	−0.12 ± 0.57	+0.47 ± 0.48
1999–2024	+0.25 ± 0.22	+0.42 ± 0.16
2011–2024 (post hoc)	−0.34 ± 0.54	+0.61 ± 0.54
1985–2024	+0.21 ± 0.10	+0.26 ± 0.10

Our analysis [4]. The paper's two periods and the 1985 start were set beforehand. The windows marked post hoc end or start on the two steps we found by looking, so a flat trend between them is close to built in. Mean SCUI: 1.94 °C in 1982–84, 1.08 in 1985–2010, 1.69 in 2011–2024. As straight lines since 1985, Tmin has barely warmed while Tref has.

The same index on other products

PRODUCT	WHAT IT SHOWS	HOW WE READ IT
MUR 4.1, multi-sensor, from June 2002 [23]	r = 0.88 with OISST. 2002–2024: SCUI +0.030 ± 0.022, Tref +0.046 ± 0.022, Tmin +0.016 ± 0.037. Mean SCUI 1.02 °C in 2002–10, 1.54 in 2011–24.	Repeats the later rise, its timing and its split. Can't reach back before 2002.

Pathfinder 5.3, AVHRR at 4 km, monthly composites [24]	r = 0.17 with OISST: noisy, with at least one implausible value (Tmin 24.76 °C in 2010, when OISST has 29.02). SCUI 1982–1998 −0.012 ± 0.056; 1999–2022 −0.009 ± 0.050; a bend at 1999, p = 0.95. In 1999–2022, Tref +0.042 ± 0.030, as in OISST, and Tmin +0.051 ± 0.053.	No turn, but it is too noisy to exclude the paper's slopes. Weak evidence either way.
HadISST, COBE-SST2 at 1°, ERSSTv5 at 2° [25]	r = 0.25, 0.41, 0.13 with OISST. A bend at 1999 doesn't beat one line: p = 0.17, 0.53, 0.16. Tref +0.016, +0.021, +0.017 over the record, and +0.024, +0.031, +0.033 in 1999–2024, against OISST's +0.042. Their regional Tmin keeps warming after 1999: +0.023, +0.027, +0.026.	These grids don't resolve the coastal cold tongue, so they can't test the index. They support the warming, at lower rates.
OISST, with Tmin kept in deeper water (post hoc)	At any depth, as the paper's series implies: −0.046, +0.025. At least 100 m: B99 −0.027 (p = 0.071), A99 +0.017 (p = 0.10). At least 200 m: B99 −0.018 (p = 0.13), A99 +0.011 (p = 0.18). At least 500 m: B99 −0.004 (p = 0.70), A99 +0.009 (p = 0.27).	The turn lives in a few cells at the shore. That suits a coastal process, and it is also where an analysis is least sure.

Our analysis, by the paper's definition as far as each product allows; slopes in °C a year.

6 · WHAT THE PAPER SAYS CAUSED IT

EOF modes are patterns, not causes: some links hold, and the one tying EOF2 to Tmin doesn't

The chain rests on two-period slopes compared by eye and on correlations. There is no experiment, no model run, no heat budget [1]. Read as what it is, a proposed explanation, parts of it fit well.

The paper's chain

For Tref: EOF1, warming of one sign across the Indo-Pacific, matches a La Niña-like mode of the wider tropics; the pattern strengthens the trades and an anticyclone over the northern South China Sea and weakens the throughflow [1 p. 10]; those warm the basin: "These outcomes confirm that the continuous warming over the SCS basin is driven by the weakened SCSTF and the enhanced AAC" [1 p. 8]. **For Tmin:** EOF2, a contrast between the northern sea and the southern Maritime Continent, shifts cross-equatorial winds through the local Hadley circulation; stronger trades and weaker cross-equatorial winds add up to a weaker monsoon before 1999, and offset each other after it [1 p. 9][1 Fig. 4].

The trends behind it, by the paper's own stars

QUANTITY, UNIT OF SLOPE	B99	A99	1982–2024
Wind-based upwelling index, 10^{-3} m^2/s a year	−15.0 ***	−2.0	−1.0
Positive wind-stress curl in the SCU, 10^{-9} N/m^3 a year	−9.5	−3.5	−1.8
Curl anomaly, northern South China Sea, 10^{-10} N/m^3 a year	−4.7 (p > 0.2)	−6.4 * (p < 0.2)	−2.1 (p > 0.2)
Zonal wind, trade-wind region, 10^{-3} m/s a year	−0.4	−5.5	−10.5 *
Zonal wind, South China Sea, 10^{-2} m/s a year	−4.3 *	−1.6	−0.4

Zonal wind, SCU, 10^{-2} m/s a year	−4.0	−1.3	−0.3
Luzon Strait transport, weakening, Sv a year			0.02 ($p > 0.2$; period not stated)
Kuroshio east of Luzon, strengthening, Sv a year			0.02 ($p > 0.2$; period not stated)
Mixed-layer depth, South China Sea, thickening, m a year			1.4×10^{-4} *** ($p < 0.05$; period not stated; on its unit, see section 10)
Ocean heat content, 0–300 m, South China Sea, kJ/m^2 a year			50.3 *** ($p < 0.05$; period not stated; on its unit, see section 10)
EOF1 time series, a year	0.07 **	0.08 ***	0.06 ***
EOF2 time series, a year	0.01	−0.05 **	−0.03 ***
EOF of meridional wind, a year	−0.05	−0.02	−0.008

*, **, *** mark the paper's 80, 90 and 95% levels, by Student's t [1 Fig. 1]. From its text where it gives them, on pp. 5 and 9 [1 p. 5][1 p. 9] and p. 8 [1 p. 8], otherwise read off Fig. 1c, d and Fig. 3 of [1] with a script. The transports, mixed layer and heat content are from ORAS5 and the curl from ERA5, which need an account, so we couldn't reproduce them.

Link by link, on the winds we could use (post hoc)

LINK	RESULT
Wind → Tmin	**Holds.** Tmin with the wind-based index r = −0.69, −0.68 (R1, R2), and −0.70 detrended; with the south-westerly wind −0.65, −0.64. But taking the south-westerly wind out only lowers Tmin's B99 slope from +0.092 to +0.068 and +0.062 °C a year. ERA5 might do better.
The wind's trend in B99	**Holds in sign.** −23.5 and -23.8×10^{-3} m^2/s a year (p = 0.22, 0.11), against the paper's −15.0.
Cross-equatorial wind → monsoon, Tmin	**Holds.** r = +0.63, +0.69 with the south-westerly; −0.52, −0.52 with Tmin. It fits earlier work by the same group [9 Abstract].
EOF2 ↔ thermal contrast → cross-equatorial wind	**Holds year to year.** r = +0.90 with the contrast between the paper's two boxes; r = −0.38, −0.49 with the wind.
EOF2 → Tmin	**Fails.** r = −0.13, and −0.25, −0.26, −0.17, −0.07, +0.06 for 3-, 5-, 7-, 9-and 11-year means; the mechanism needs positive. EOF2 with the south-westerly wind: r = −0.07, −0.09. Tmin regressed on EOF1 and EOF2 together: EOF2's coefficient −0.09 (p = 0.26), and the fit's slopes, +0.032 in B99 and +0.040 in A99, run the wrong way against Tmin's +0.092 and +0.017. The paper's support is "appear to match" [1 p. 6].
EOF1 ↔ Tref	**Holds,** r = +0.88 (+0.78 detrended), partly by construction, since the South China Sea lies inside the EOF's domain. EOF1 also goes with Tmin, r = +0.66, which the paper's pairing leaves out.
Trades → monsoon	**Year to year, mostly ENSO.** R = 0.60, 0.58 in the paper [1 p. 9]; R1 0.56, 0.54 and R2 0.45, 0.37 for us, falling to 0.31, 0.25 and 0.14, −0.01 with same-summer Niño 3.4 and the trend removed. On trends it doesn't fit by itself: the trade region barely moves in B99, when the monsoon falls most, and strengthens in A99, when that fall slows. The authors read this as the cross-equatorial wind offsetting it [1 p. 9].
The meridional-wind reversal	**Rests on one chosen component.** Its linear trends are both negative and unstarred; "clearly exhibit" a turn refers to that series' third intrinsic mode function, one component of the curve method, not its trend [1 p. 9][1 Fig. 3].

Our analysis, June–September, from NCEP/NCAR R1 and NCEP-DOE R2 [26] and from the OISST EOFs [4]. These reanalyses are coarser than the paper's ERA5 and don't resolve the Annam Cordillera's wind jet `[10 Abstract]`; the wind index and the south-westerly here are at 11.25°N, 108.5°E, since these grids can't resolve the paper's 1.5° coastal band `[1 Fig. 1]`, and the cross-equatorial wind is 10°S–10°N, 100–120°E. The paper's schematic draws a "Negative SST trend" over one of its two boxes in each period `[1 Fig. 4]`; in OISST both warmed in both periods (Maritime Continent +0.040, northern sea +0.032 in B99; +0.025, +0.045 °C a year in A99), so that contrast is relative.

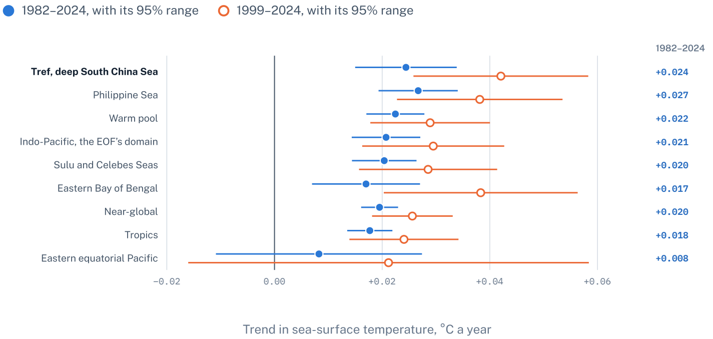
7 · IS THE SEA SPECIAL?

The Indo-Pacific warmed about as the world's oceans did; the South China Sea matches over the record but ran faster after 1999

The rated sentence is about the Indo-Pacific mode, so the fair test is that mode's domain, which needs no South China Sea: it warmed about as fast as near-global SST in both periods (our analysis, post hoc) `[4]`. The paper's own account spans the sea, the Maritime Continent and the western Pacific `[1 p. 5]``[1 p. 8]`, so wide sharing is part of it.

June–September warming, the South China Sea and elsewhere (post hoc)

OUR ANALYSIS



Our analysis of NOAA OISST v2.1, June–September `[4]`. The boxes: Philippine Sea 125–140°E, 5–20°N; warm pool 130–170°E, 5°S–10°N; Indo-Pacific 90–140°E, 15°S–25°N; Sulu and Celebes Seas 118–126°E, 2–11°N; eastern Bay of Bengal 90–97°E, 6–18°N; near-global 60°S–60°N; tropics 30°S–30°N; eastern equatorial Pacific 150–90°W, 5°S–5°N. Those reaching beyond 90–140°E are sampled every 1° or 2°. Numbers at the right are for 1982–2024. Hover or tap a dot for its value.

The paper's argument, set out fairly

"Given the continuous warming trends" in EOF1 and

OUR ANALYSIS

Why that doesn't get there

Tref, it says, “one may straightforwardly attribute this warming to global warming”. To test that it runs an EOF over the whole tropical Pacific, and finds EOF1 tied to a mode with a “La Niña-like SST trend”. Then: “Because the global warming effect has been proposed to result in an El Niño-like SST pattern ..., the warming trend observed in the Indo-Pacific mode is unlikely to be due to the global warming effect” [1 p. 8]. It credits natural modes instead, and cites studies giving them the main role in that decadal pattern [1 p. 8].

A La Niña-like *pattern* can be partly natural without the *warming* being natural; the two get run together. EOF1 is warming of one sign, half of its variance a straight line in time, and the matching tropical mode is 70% a straight line. That mode’s domain warmed +0.021 ± 0.006 and +0.029 ± 0.013 °C a year, over the record and in 1999–2024, against near-global +0.020 ± 0.003 and +0.026 ± 0.007. Tref tracks near-global SST (r = 0.71, or 0.45 detrended). In raw June–September numbers the eastern Pacific shows no clear trend in OISST (+0.008 ± 0.019). No attribution test is offered, and we found no evidence for excluding warming. Natural swings may well shape the pattern.

The premise is contested

Models’ expected El Niño-like response is the point in dispute. Seager et al. find the observed strengthening of the east–west contrast at or beyond the range of modelled internal variability, and argue it is itself a response to radiative forcing that the latest models fail to simulate [15 Abstract]. Wills et al. find the gap between observed and modelled patterns very unlikely to be internal variability, and point to model biases as part of it [16 Abstract]. The paper’s own sources are less one-sided than its sentence. Dong & Zhou do find the Pacific oscillation dominating the eastern Pacific’s cooling, but with the global-warming mode offsetting more than half of it [32 Abstract]. Luo et al. tie the La Niña-like state to Indian Ocean warming, and their forced model runs suggest that warming could modulate the Pacific’s changes [33 Abstract].

The throughflow

The physics is plausible: Qu et al. describe the throughflow as a heat conveyor out of the sea [19 Abstract]. But Yu & Qu tie Luzon Strait transport to the phase of the Pacific Decadal Oscillation [17 Abstract]; Nan et al. find a fall of about 0.24 Sv a year in 1993–2010 in one model, twelve times the paper’s rate [18 Abstract]; and Zeng et al. report enhanced transport after 2012 [22 Abstract]. So a “persistent weakening” over four decades [1 p. 10], not significant in ORAS5 (p > 0.2) [1 p. 8], sits oddly with the literature. The direction for about 1999–2012 is supported. Jiang et al. find the sea’s warming all but stopped in 1999–2010, through a stronger winter monsoon they link to a La Niña-like pattern [35 Abstract]; that runs against the paper’s La Niña-like warming, though it isn’t a summer-only result.

OUR ANALYSIS

The South China Sea against near-global SST: +0.005 ± 0.009 °C a year over the record, +0.016 ± 0.016 in 1999–2024 (p = 0.04). Against the Philippine Sea: −0.002 ± 0.008 and +0.004 ± 0.017.

Over the record the sea matches the global rate. After 1999 it ran faster, +0.042 ± 0.016 against +0.026 ± 0.007, the fastest of the regions charted, with the Philippine Sea and the eastern Bay of Bengal close behind. A weaker throughflow and an anticyclone over the northern sea may contribute, and the paper’s mechanisms are physically reasonable. But the warming is shared widely, so these sea-specific mechanisms aren’t needed to explain most of it. This doesn’t refute them.

8 · THE PACIFIC AROUND 1999

The Pacific did shift about then, but as a phase

that later reversed, not as a turn in a trend

So 1999 is a reasonable year to look at. Chavez et al. describe a shift in the Pacific in the middle to late 1990s `[12 Abstract]`, and Minobe's 2002 paper is about "concurrent 1998/99 changes" over the North Pacific `[13]`. The new paper doesn't cite either, and treats the Pacific's indices as "progressive multidecadal evolution" `[1 p. 8]`; but it does cite Dong & Zhou, who date the oscillation's phase change to about 1998/99 `[32 Abstract]`, and Chen et al., whose title points to the late 1990s over this sea `[34]`.

Mean annual index by period

YEARS	PDO	TRIPOLE INDEX
1982–1998	+0.28	+0.30
1999–2013	−0.94	−0.40
2014–2019	+0.25	+0.04
2020–2024	−2.00	−0.83

Our averages of NOAA's monthly files `[28]`. PDO in 1997, 1998 and 1999: +1.32, −0.48, −1.84. Tripole Index: +1.07, +0.06, −1.23.

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What that does and doesn't explain

"Persistent" La Niña-like conditions hold as a whole-record trend, not throughout: both Pacific indices were near zero or positive in 2014–2019. England et al. describe the trade winds' strengthening over the two decades to about 2012 `[14 Abstract]`. SCUI goes with these indices only weakly: PDO r = −0.14, Tripole +0.04, AMO +0.16, Niño 3.4 +0.24 (June–September). Longer means have too few independent values to test, and SCUI's step at 2011 matches neither flip of the Pacific, in 1998–99 or 2014.

In the paper's favour

A late-1990s change in this upwelling has earlier support. Using another index, a box mean of SST, Wang & Wu find few weak-upwelling events in 1999–2013 against more in 1978–1998 and after 2014, and link that to the regime shift of the PDO and AMO since the late 1990s `[8 p. 2]``[8 p. 4]`. That is from the same group, and it describes the frequency of weak events rather than a trend.

9 · REPEAT OUR NUMBERS

One script fetches the public data and recomputes almost everything we derive

It reads OISST v2.1 from NOAA PSL, the source the paper's data statement names `[1 p. 11]`, and the other products by URL, and rebuilds the index and the tests on this page. It doesn't repeat our search over Tref's areas, the check of PSL against NCEI's daily files, the count of CoastWatch's days, the reading of values off the figures, or our test of how liberal the bootstraps run. The paper's own values, and those we read off its figures, come from the paper `[1]`.

PY

scui_rerun.py

The index, the tests of one trend against two, the scans, the years left out, the paper's curve and recipe, the water beside the box, the split of the 2011 step, the EOFs, regional warming, winds and other SST products · 61 KB

CSV

scui-reproduced.csv

Tref, Tmin and SCUI by year as we rebuilt them, with the values we read off the paper's Fig. 1a · 1 KB

JSON

scui-numbers.json

The script's output: the numbers on this page, with the address of every input; derived numbers only · 60 KB

Run it

`python3 scui_rerun.py` needs numpy, scipy and netCDF4; it fetches about 240 MB into a folder beside itself, or into one you name: `python3 scui_rerun.py <folder>`. From an empty folder it took us between about three and five and a half minutes, depending on its retries when a server paused. The paper's curve also needs PyEMD (`pip install EMD-signal`); without it those steps are skipped, and `--no-recipe` skips the simulations. If a server is down, the other SST products are skipped for that run, and the output says so. Simulated percentages can move in the last digit with library versions.

The data and their terms

OISST v2.1 is NOAA NCEI's, free to use and redistribute [4]. Monthly means from PSL differ from means of NCEI's daily files by at most 0.002 °C in SCUI. The other products are public, with the credits and terms given in the sources list. HadISST's file limits it to academic research use and marks it Crown copyright; we use it only for derived numbers, on a non-commercial site [25]. We host only derived numbers. The values read off the paper's figures are from a CC BY-NC 4.0 paper, for non-commercial use with credit [1].

10 · LIMITS

What this check could and couldn't see

The Supporting Information

We couldn't read Figures S1–S5: Wiley's site puts a human-verification check in front of automated readers, which we don't attempt, and they aren't in the PDF [1]. Tref's area and the depth rule are our inference; Figure S2 wasn't seen, so section 4's last table is our guess at it.

ERA5 and ORAS5

Both need an account, which we don't create. So the paper's wind index, curl, transports, mixed layer and heat content aren't reproduced, and our wind tests use coarser reanalyses [26]. On ERA5 the wind may explain more of Tmin's rise.

Ngo & Hsin (2021)

The index's source paper was read only as its abstract, for the same reason [5 Abstract].

Post hoc tests

The tests in section 4's first table were set before running them, apart from the wider scan in its third row. The wider scan, the two steps, the windows ending in 2010, the simulated recipe, the depth test, the water beside the box and the local contrast, the split of the 2011 step, the links in section 6 and the regional comparison came after we saw the data, and should be read that way. On test series of this length with r1 = 0.3, these bootstrap tests gave 7–9% false positives at a nominal 5%, so p-values near 0.05 deserve caution.

OISST’s changing inputs

Satellites and in situ sources change through the record [20 p. 168][31 Abstract], and an analysis can resolve a small cold cell better or worse as they do [21 Abstract]; where cloud limits infrared data, as in a monsoon, small features are less sure [30 Abstract]. Anyone re-running this should know that CoastWatch’s aggregated OISST lacks about half the days of 1993–98, so we used PSL’s and NCEI’s.

Values read off figures

Fig. 1’s series, lines, curve and bars were read from the image with a script, to about 0.02 °C for the series; the paper deposits no index [1 p. 11]. Three small numbers on pp. 8–9 look like per-day values labelled per year: a mixed-layer deepening, a heat-content trend and the thermal contrast, whose slope we get as 0.008 and −0.019 °C a year. It doesn’t affect the results.

What would change these verdicts

01

A formal test of the break year on this index, in Figure S2 or elsewhere, that singles out 1999 against 1987 and 2011, or independent records showing the cold cell of 1982–84 was as cold as OISST has it, with a steady fall after; those would move claim 1 toward True.

02

A heat budget or a model experiment that isolates the throughflow, the anticyclone, the trades and the cross-equatorial wind; that would move claim 4 toward True, and an attribution study would settle claim 5 either way. Vertical velocity across the whole record would settle claim 2.

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Bottom line: careful arithmetic and a useful caution, with a year and a causal story that are firmer in the wording than in the evidence.

The paper’s SST numbers reproduce from public data, and its caution is right and useful: a rising index needn’t mean stronger upwelling [1 p. 10][23]. Its stronger statement, that the rise wasn’t stronger upwelling, goes beyond what SST can show. That the index changed shape is more than chance; that it turned in 1999, after a steady fall, isn’t shown, since the fall rests on three early summers we can’t verify and much of the rise on a step in 2011 [4]. The winds and the South China Sea’s warming are real; the modes as causes, and the case against global warming, go beyond what the evidence supports.

Sources

Bracketed numbers refer to this list. For the paper [1], read in full but without its Supporting Information, p. gives a page of the version of record, § a section, Eq. an equation and Fig. a figure; its key points, abstract and plain-language summary are on p. 1. Values we read off its figures say so. For the other sources, p. gives a page and Abstract the abstract of the cited work; where only an abstract or a record was read, the entry says so. Trends are in °C a decade or °C a year; ± is a 95% range that allows for year-to-year persistence, and r is a correlation. SST is sea-surface temperature, and the paper’s summer is June–September. Links checked November 2, 2026.

1 Ngo, M.-H., Hsin, Y.-C., and Wu, C.-R. (2026). A Shift of Multidecadal Trend in Coastal Upwelling Off Southern Vietnam in the South China Sea Around 1999. *Geophysical Research Letters* 53, e2026GL126805.

2 SpaceWeatherNews (S0) (November 2, 2026). Pole Shift Changes Reported, Solar Coronal Hole | S0 News Nov.2.2026. YouTube video, https://www.youtube.com/watch?v=bSJbUC5WIgU,

Received September 14, accepted October 7, published online October 25, 2026. Peer reviewed; open access, CC BY-NC 4.0. Its acknowledgments (p. 11) list as funders Academia Sinica (AS-GCP-112-M02, AS-KPQ-112-NETZ-03) and Taiwan's National Science and Technology Council (NSTC 113-2611-M-003-003). Read in full: the version of record, 13 pages, which the site's owner downloaded from Wiley in a browser and supplied on November 2, 2026; the publisher's site puts a human-verification check in front of automated readers, which we do not attempt, and we found no other copy. Its Supporting Information (Figures S1–S5) is not in that PDF and was not read. p. gives a page of the version of record, § a section, Eq. an equation and Fig. a figure. Quoted with the publisher's hyphen characters printed as ordinary hyphens.

published at 12:02 UT. No transcript was available.

3 Crossref. Metadata record for doi:10.1029/2026GL126805. Retrieved November 2, 2026: the abstract as the publisher deposited it, with its symbols lost; the received, accepted and published dates; the licence, CC BY-NC 4.0 from October 25, 2026; the funders and affiliations; and 63 references, whose titles we read through Crossref's records where they have them.

4 NOAA NCEI. Daily Optimum Interpolation Sea Surface Temperature (OISST), version 2.1, doi:10.25921/RE9P-PT57, free to use and redistribute. Read as monthly means from NOAA PSL, the source the paper's data statement names, and as daily files from NCEI, retrieved November 2, 2026. The two give SCUI within 0.002 °C of each other. Every calculation from them on this page is our analysis.

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25 Coarse SST products: HadISST (Met Office Hadley Centre; Rayner et al. 2003, doi:10.1029/2002JD002670; Crown copyright. The file's comment says "for academic research use only", though the server's licence field is looser; we use it only for derived numbers, on a non-commercial site), ERSSTv5 (NOAA NCEI), both through CoastWatch ERDDAP, and COBE-SST2 (Japan Meteorological Agency, through NOAA PSL), public. Retrieved November 2, 2026. Our calculation.

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METHOD

How this was checked

The verdicts on this page

OVERSTATED	Has some basis but claims much more than the evidence supports.
UNSUPPORTED	No evidence we could find backs it up, though it hasn't been strictly disproven.
PARTLY TRUE	Part of the claim holds up and part doesn't.

All ten verdicts, and how we check

On November 2, 2026, we checked every statement on this page about the paper against its full text, the version of record, which the site's owner downloaded from Wiley in a browser: its index, data, methods, slopes, significance levels, EOF modes, wind and ocean diagnostics, caveats, data statement and declaration of interests. Its Fig. 1a series, fitted lines and curve, and its Fig. 1b–d bars, were read off the image with a script; its Figures S1–S5 are in Supporting Information that we did not read, because Wiley's site puts a human-verification check in front of automated readers, which we do not attempt. The page also rests on the paper's Crossref record, with its dates, licence, funders and 63 references [3]; four other papers read in full, 20 read as abstracts or records; and NOAA's OISST v2.1 with other public SST, wind, bathymetry and index data: the 35 sources listed. Every quotation was checked word for word against its saved source; the publisher's hyphen characters are printed as ordinary hyphens.

The verdicts and the items tagged "Our analysis" are our own assessment, built on the cited sources. They include the index we rebuild from OISST and how we chose Tref's area, unseen in Figure S1; our tests of one trend against two, set before running them; our scan of the break year; the years we leave out; the wider scan, the rival shapes, the windows ending in 2010, the simulated runs of the paper's recipe, the depth test, the water beside the box, the local contrast, the split of the 2011 step, the wind and EOF links and the regional warming comparison, all post hoc and marked so; the same index on MUR, Pathfinder and coarser products; the values we read off the paper's figures; and our reading of what the paper does and does not show. The two steps in section 5 were found by looking at the data, and we do not claim they are true.

Our script, hosted on this page, fetches every input from its source and recomputes almost everything we derive; its output, also hosted, holds only derived numbers. It doesn't repeat our search over Tref's areas, the check of PSL against NCEI's daily files, the count of CoastWatch's days, the reading of values off the figures, or our test of how liberal the bootstraps run. It reproduces the paper's SCUI, Tref and Tmin slopes to within 0.003 °C a year of its Fig. 1 bars, its EOF percentages to about one point, and its smooth curve. We could not recompute anything that depends on ERA5 or ORAS5, which need an account: the paper's wind index, wind-stress curl, Luzon Strait and Kuroshio transports, mixed-layer depth and heat content. We tested the winds on coarser public reanalyses instead, and say so. We could not check whether the first three summers of the record are real, since no independent data at this scale reach back that far. A fresh review of the built page, by a reader who hadn't seen the drafting, then moved what is now claim 2 from True to Partly true, with the title and description, because SST alone can't exclude stronger upwelling; it also led us to add the water beside the box, the split of the 2011 step and the break year for both shapes, and to correct our account of Liu et al.

On November 6, 2026, the page was revised to review the paper on its own. No transcript of the S0 News episode that linked it was available, and without one the site no longer comments on how an episode presented a paper. The verdict on the link's label was removed, as were the section on the episode and the other remarks on it; the paper's claims, numbered 2–6 before, are now 1–5, the last two sections are now 9 and 10, the summary at the top ends on the paper's explanation, and a line in section 1 notes the link. No verdict on the paper's claims, no number and no other source changed.

This page was researched and written with Claude, an AI assistant made by Anthropic, and then re-checked against its sources in a separate verification pass.

CORRECTIONS

Corrections and changes

If we get something wrong, we fix it and record the change below with the date. If a correction changes a verdict, the log says what the old verdict was.

Change log

Nov 6, 2026	Revised to review the paper on its own. No transcript of the S0 News episode that linked it was available, and without one the site no longer comments on how an episode presented a paper. The verdict on the link’s label is removed, so the paper’s claims, 2–6 before, are now 1–5; the section on the episode and the other remarks on it are removed, so Repeat our numbers and Limits become sections 9 and 10; the summary at the top now ends on the paper’s explanation; a line in section 1 notes the link; and the verdicts on the paper’s claims are unchanged.
Nov 5, 2026	The hosted script, scui_rerun.py, now fetches under a plain client name, factchecked-research/1.0, rather than a browser-like one. Nothing else on this page changes.
Nov 2, 2026	Published on factchecked.science after a full check against the sources, the paper’s full text among them but not its Supporting Information. Built from the paper, which the site’s owner supplied because its publisher’s site puts a human-verification check in front of automated readers, with the episode’s title and description (no transcript was available), the literature on the upwelling and the Pacific, and our own analysis of NOAA’s OISST and other public data, whose script is hosted on the page: six claims rated on the site’s scale, one the episode’s and five the paper’s. Before publication, a fresh review moved claim 3 from True to Partly true, with the title and description, because SST alone can’t exclude stronger upwelling; it also added the water beside the box, the split of the 2011 step and the break year for both shapes, and corrected our account of Liu et al. and of why the episode’s label is only partly true.

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