Fact-Checked Science

EVIDENCE REVIEW · S0 NEWS RESEARCH NOTE

S0's 'air shift' note: numbers reproduce, but the shift seen at stations is the known SAM

S0 News's research note 010 averages surface pressure over latitude bands in three reanalyses, and reports that polar pressure falls and tropical pressure rises in all three over their full records [1 Abstract]. Its reanalysis numbers reproduce from the public files (our analysis) [4] [6] [7]. But the three agree on a significant polar fall only in windows that start before 1973, when R1's Antarctic pressures ran too high [9 p. 3944] and JRA-55's fell faster than the stations'; since 1979, JRA-55 and 20CRv3 fall less than the stations (our analysis). Coastal Antarctic stations record a real fall, about 0.35 hPa a decade at 65°S: the Southern Annular Mode's known shift of air from Antarctica toward the middle latitudes [10] [16 §3.7.2]. The note's global trends and its "dry-air" fall measure the reanalyses' mass budgets, and its Eureka trend is inflated by a change in how the archive stores station pressure (our analysis).

By Fact-Checked Science · Published November 15, 2026

OUR ANALYSIS marks our own reasoning and calculations: our rebuild of the note's numbers from the public reanalysis files; the tests of its years, of the reanalyses against stations, of the global mean against the gas records and of the Southern Annular Mode; and our reading of what the note does and doesn't show. "Exploratory" marks checks added after we had seen results. The verdicts are our assessment. Everything else comes from the numbered sources. For the note [1], locators are its own section names. hPa is the hectopascal: each hectopascal of surface pressure is about 10 kg of air above each square metre.

The numbers reproduce, but all three polar falls are significant only with pre-1973 years, and the stations' fall is the SAM's

OUR ASSESSMENT

31 of 31

of the note's reanalysis and ASL numbers reproduce, once R1 is read from PSL's T62 Gaussian file; its six South Pole numbers do too, and its Eureka numbers come close (our analysis) [4] [6] [7] [20]

0 of 105

windows of 30 years or more, within 1958–2015, that start in 1973 or later and in which all three reanalyses' polar intervals lie below zero. Of those starting in 1958–1966, 222 of 225 do (our analysis; this split by first year is exploratory)

3×

how fast R1's sea-level pressure fell at six coastal stations near 65°S, read at their sites, compared with the stations themselves, 1957–2025: −1.14 against −0.37 hPa a decade (our analysis, exploratory) [4] [10]

THE NOTE'S CLAIMS

MISLEADING

"Earth Air Shift: Polar Surface Pressure Falls as Tropical Pressure Rises"

The note's title [1 Title]

The trends behind it reproduce, but the title leaves out what drives them. The three reanalyses agree on a significant polar fall only in windows that start before 1973. Early on, R1's Antarctic pressures ran too high [9 p. 3944] and JRA-55's fell faster than the stations'; since 1979, JRA-55 and 20CRv3 fall less than the stations (our analysis). Coastal Antarctic stations record a real fall, about 0.35 hPa a decade at 65°S over 1957–2025 and since 1979 alike, while stations near 40°S rise: the Southern Annular Mode's north–south shift of air [10] [16 §3.7.2] (our analysis). Since 1979 no tropical rise is significant [1 Claims ¶2], and in 20CRv3 two-thirds of the full-record polar fall is Arctic, which this page doesn't explain (our analysis). See sections 3, 4 and 6.

TRUE

"Combined-polar surface pressure falls in all three weather reconstructions over their full available records, while tropical surface pressure rises."

The note's abstract [1 Abstract], with the trends in its first paragraph of claims [1 Claims ¶1]

All twelve full-record trends reproduce to the note's last digit, and so does every statement about which intervals exclude zero. Over the poles they are −0.655, −0.360 and −0.117 hPa a decade, and over the tropics +0.090, +0.040 and +0.076 (our analysis) [4] [6] [7]. The claim is limited to the full records, and the note itself says no polar interval lies wholly below zero over 1979–2015 [1 Methods]. What the trends mean is the title's question. See section 2.

TRUE

"The global average does not show a shared decline. Since 1979, the products diverge: NCEP/NCAR R1 falls globally, while JRA-55 and 20CRv3 rise."

The note's abstract [1 Abstract]

It reproduces: −0.0295, +0.0737 and +0.0358 hPa a decade, with the note's own intervals [1 Claims ¶2] (our analysis). We rate it True because the note only describes the products and itself says they diverge. As a change in the air, none of the three holds up: averaged over the globe, pressure moves only as the air gains or loses mass [11 p. 864]. Our bound allows −0.010 to +0.022 hPa a decade since 1979; JRA-55 lies wholly above it, and R1 below, though R1's interval reaches it. 20CRv3's model holds its dry air fixed [7], so its trend is its water vapour, a little above the range we allow for that (our analysis). See section 5.

MISLEADING

"In R1, the 1979–2025 global decline sits entirely in the dry-air component"

The note's second paragraph of claims [1 Claims ¶2]

The arithmetic reproduces: dry air −0.0536 hPa a decade, water vapour +0.0241 (our analysis) [4]. But dry air can only have lost 0.015–0.023 hPa a decade: the measured decline of oxygen, mostly from burning fossil fuels, less the carbon dioxide that stays in the air [23] [24] (our analysis). R1's dry air fell 2.4 to 3.5 times that on the note's file, and most of it comes in 1979–2001. The note doesn't say that reanalyses fail to conserve dry air [11 pp. 864, 867] [12 §5]. See section 5.

MISLEADING

"Station-pressure trends are Eureka −0.346 [−0.540, −0.151] (1951–2024; 63 valid years)"

The note's Methods [1 Methods]

NOAA's records give about that, −0.330 hPa a decade by our rules [22] (our analysis). But before 1977 the series isn't a station pressure. In 1956–1976 Eureka's "station pressure" equals its sea-level pressure, which a barometer about 10 m up can't read; from 1 January 1977, in the middle of one data file, it sits 1.4 hPa lower, while the elevation in the reports stays 9 m. So the note's −0.346 is inflated by a change in how the archive stores station pressure. The sea-level series gives −0.11 [−0.29, +0.07]. Whether it is itself homogeneous across 1977 can't be settled from the reanalyses; with a 0.2–0.5 hPa step in it, Eureka's trend would be about −0.14 to −0.20 (our analysis, exploratory). See section 7.

TRUE

"the Amundsen Sea Low −0.614 [−0.856, −0.372] hPa/decade, 1959–2025, from the public ERA5-derived index"

The note's Methods [1 Methods]

It reproduces from the British Antarctic Survey's index, version 3: −0.614 [−0.856, −0.371]. That is the index's sector pressure, the mean sea-level pressure over 60–80°S, 170°E–62°W [20] (our analysis). The low's depth against its surroundings shows no significant trend. As the note says, the index measures a regional low. Our check of note 008 looks at the same index before 1979. See section 7.

1 · WHAT THE NOTE COMPUTED

Three reanalyses, five latitude bands and a straight line through each

S0 News's research note 010 averages monthly surface pressure over the polar caps, the tropics and the globe in three reanalyses, which rebuild the weather of the past from old observations [1 Abstract]. It reports a straight-line trend for each over each product's full record and since 1979 [1 Claims ¶1] [1 Claims ¶2]. S0 News linked the note from the YouTube page of its November 15, 2026 episode [3].

STEP 1

Three products

NCEP/NCAR R1, 1948–2025 [4]; JRA-55, 1958–2023, from a mirror kept by JAMSTEC [1 References] [6]; and 20CRv3, 1806–2015, whose file names surface pressures from the International Surface Pressure Databank as its observations [7].

STEP 2

Bands

The note averages around each latitude circle and weights the circles by the cosine of latitude. Its bands are the Arctic beyond 60°N, the Antarctic beyond 60°S, both together, the tropics within 23.5° and the globe [1 Methods].

STEP 3

Trends

It takes annual means of complete years and fits a straight line. Its 95% intervals allow for each year's departure echoing the last's [1 Methods], as Santer and colleagues' method does [8].

STEP 4

R1's air budget

It subtracts R1's water vapour, at 0.0980665 hPa per kilogram per square metre, to leave the pressure of dry air [1 Methods] [11 pp. 865–866].

What else the note reports

The note also gives a trend for the Amundsen Sea Low index and trends at two named stations, Eureka in the Canadian Arctic and the South Pole. It adds a summary of 21 stations, which it doesn't name, and warns that this summary "mixes actual station pressure and pressure adjusted to sea level" [1 Methods]. It says what it lacks: "MERRA-2 and direct global ERA5 surface fields are unavailable in this build" [1 Methods]. It credits an "internal GrokBot Team 010" [1 Credit]. It offers no cause for any trend.

What we could and couldn't read

We read the note in full, with its two figures [1]. Its data folder, with its tables, scripts and station files, asked for a Google sign-in, so we haven't read it [2]. Every number on this page is rebuilt from public files instead. No licence is given for the note, so we quote it and link to it, and redraw none of its figures.

The note's own caveats

> *"The global average does not show a shared decline."*
>
> [1 Abstract]

> *"Over the common 1979–2015 period, no combined-polar interval lies wholly below zero"*
>
> [1 Methods]

> *"All three tropical intervals now include zero."*
>
> Since 1979 [1 Claims ¶2]

2 · THE NUMBERS REPRODUCE

The note's reanalysis numbers come out of the public files, from the right R1 file

We rebuilt the bands with our own code, using the note's stated definitions, from PSL's R1 and 20CRv3 files and from JAMSTEC's JRA-55 files [4] [6] [7]. Every slope reproduces to the note's last digit, and so do the four intervals it prints for reanalysis trends (our analysis). With the ASL index's three, all 31 of its reanalysis and ASL numbers reproduce, the ASL's upper bound to within 0.001, and so do its six South Pole numbers. Its Eureka numbers come close but not exactly (section 7).

FULL-RECORD SLOPES

OUR ANALYSIS

12 of 12

Polar, tropical, Antarctic and Arctic, in all three products, to the note's third decimal [1 Claims ¶1]

PRINTED INTERVALS

OUR ANALYSIS

4 of 4

The four intervals the note prints for reanalysis trends reproduce exactly. They identify its method: a lag-1 Pearson correlation of the residuals, floored at zero (exploratory)

R1, THE OTHER FILE

OUR ANALYSIS

−0.0185

hPa a decade: R1's global trend since 1979 on PSL's 2.5° file, against −0.0295 on the note's file; its interval includes zero

The note's trends beside ours, hPa a decade

OUR ANALYSIS

Band, years	The note: R1 / JRA-55 / 20CRv3	Ours: R1	JRA-55	20CRv3
Polar caps, full records	−0.655 / −0.360 / −0.117	−0.6545 [−0.799, −0.510]	−0.3596 [−0.517, −0.203]	−0.1174 [−0.157, −0.078]
Tropics, full records	+0.090 / +0.040 / +0.076	+0.0897 [+0.037, +0.142]	+0.0404 [+0.013, +0.068]	+0.0758 [+0.067, +0.085]
Antarctic, full records	−1.148 / −0.589 / −0.074	−1.1476 [−1.416, −0.880]	−0.5892 [−0.819, −0.360]	−0.0739 [−0.192, +0.044]
Arctic, full records	−0.161 / −0.130 / −0.161	−0.1614 [−0.269, −0.054]	−0.1300 [−0.274, +0.014]	−0.1608 [−0.188, −0.134]
Globe, 1979 to the end	−0.0295 [−0.0576, −0.0014] / +0.0737 [+0.0503, +0.0972] / +0.0358 [+0.0271, +0.0444]	−0.0295 [−0.0576, −0.0014]	+0.0737 [+0.0503, +0.0972]	+0.0358 [+0.0271, +0.0444]
Globe, 1979–2015	−0.0357 / +0.0626 / +0.0358	−0.0357	+0.0626	+0.0358
R1's dry air, 1979–2025	−0.0536 [−0.0759, −0.0313]	−0.0536 [−0.0759, −0.0313]	–	–
R1's water vapour, 1979–2025	+0.0241	+0.0241 [+0.012, +0.036]	–	–

The note's numbers from its Claims and Methods [1 Claims ¶1] [1 Claims ¶2] [1 Methods]. Ours from PSL's files [4] [7] and JAMSTEC's [6] (our analysis). The full records are R1 1948–2025, JRA-55 1958–2023 and 20CRv3 1806–2015, and "the end" is each record's last year. Intervals are 95%. In the first four rows they are ours, computed by the method we registered before seeing any result. The intervals in the last rows are computed the note's way, identified afterwards; for these four the two ways differ by at most 0.0008, and for the polar intervals by up to 0.004. Elsewhere the page uses our registered way.

OUR ANALYSIS

Which R1 file

NOAA's Physical Sciences Laboratory serves R1's monthly surface pressure twice. One file is on a 2.5° grid and the other on the model's own T62 Gaussian grid [4]. The note doesn't say which it used. Its numbers come out of the Gaussian file exactly, and the 2.5° file gives slightly different ones. On the 2.5° file the polar trend is −0.649, and the global trend since 1979 is −0.0185 [−0.0512, +0.0142], which is not significant. So whether "R1 falls globally" depends on which of NOAA's two R1 files is used. We tried the Gaussian file after our first run, under rules we wrote down before trying it, and the page reports both. On the 2.5° file R1's dry-air trend is −0.0426 [−0.0648, −0.0203], so the "2.4 to 3.5 times" of section 5 holds for the note's file; on this one the interval just reaches the range the gas records allow.

OUR ANALYSIS

The note's interval and 20CRv3's first years

The note's intervals widen each trend's uncertainty for years that echo the year before. They come out exactly when that echo is measured as the ordinary correlation between each year's departure and the next. We had registered the closely related estimator of Santer and colleagues [8], and use it here. For the note's printed intervals the two differ by at most 0.0008 hPa a decade, and for the polar intervals by up to 0.004. Our 435 windows they disagree about zero in two polar and two tropical windows (288 against 286; 145 against 143). NOAA's 20CRv3 file starts in 1806. Its history notes that its first 30 years were joined on from a separate run [7], and JAMSTEC's mirror lists 20CRv3 from 1836 [6]. From 1836 its polar trend is −0.186 hPa a decade and its Antarctic one −0.221.

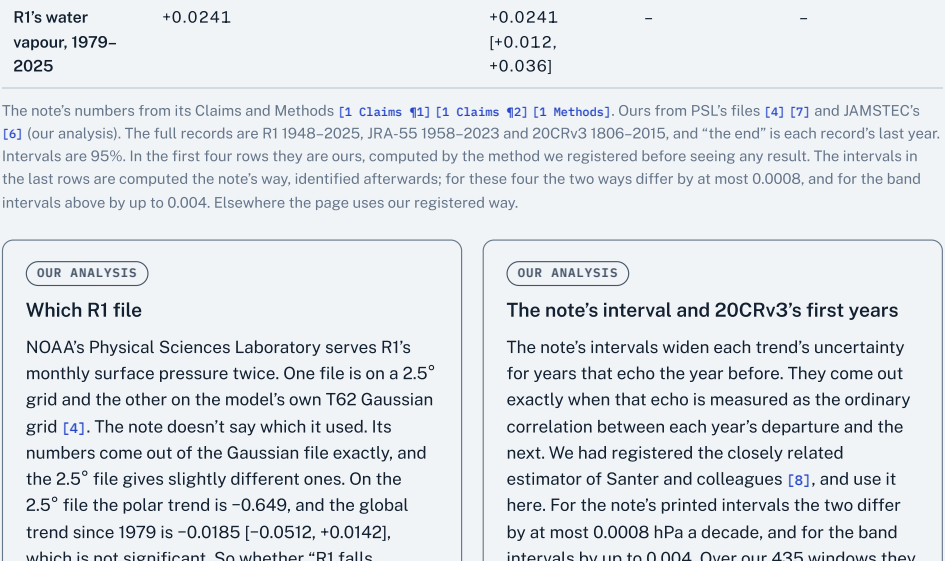
3 · WHICH YEARS

"All three fall" is significant only when years before 1973 are in the window

The three full records cover different years, and the note itself says the polar fall isn't significant over the years all three share since 1979 [1 Methods]. We fixed in advance a test of every window of 30 years or more within 1958–2015, the years all three cover, and how to read it (our analysis). The split by first year was added after we saw the counts (exploratory).

Windows in which all three polar trends fall significantly, by first year

OUR ANALYSIS



First year of the window; each bar is every window of 30 years or more that starts that year and ends by 2015

Our analysis of the band means rebuilt from PSL's R1 (the note's T62 Gaussian file) and 20CRv3 files [4] [7] and JAMSTEC's JRA-55 files [6]. A window counts when the 95% intervals of all three combined-polar trends lie wholly below zero; the split by first year is exploratory. Each product's satellite era differs. JRA-55 took satellite soundings from 1973 [5 §6.3]. R1 didn't use those 1973–1978 soundings, and its satellite data are mainly from 1979 on [10 pp. 4136, 4145] [11 p. 866]. 20CRv3's only observations are surface pressures, so it has none [7].

ALL WINDOWS

OUR ANALYSIS

288 of 435

common windows in which all three polar intervals lie below zero, 66%. By the reading we fixed in advance, "partly robust"

THE TROPICS

OUR ANALYSIS

145 of 435

windows in which all three tropical intervals lie above zero, 33%: "depends on the period"

JRA-55 SINCE 1979

OUR ANALYSIS

−0.07

hPa a decade over the poles, 1979–2023, interval −0.28 to +0.15. Over 1979–2015 it is +0.04

OUR ANALYSIS

By the reading we fixed in advance, a polar fall in all three is "partly robust": significant in 288 of the 435 windows. Split by first year (exploratory), the pattern is sharp. Of the windows that start in 1958–1966, 222 of 225 show a significant polar fall in all three reanalyses; of the 105 that start in 1973 or later, none does. Fixed 30-year windows give the same break: every start from 1960 to 1972 qualifies, and none from 1973 to 1986. The slopes themselves are all negative in 377 of the 435 windows, 47 of the late 105 among them; what needs the early years is significance in all three. Run from 1973 to their ends, neither JRA-55 nor 20CRv3 has a polar interval below zero; R1 still does. In 30-year windows R1's polar trend runs from −1.29 hPa a decade (1950–1979) to +0.09 (1985–2014), and JRA-55's from −1.23 to +0.33. So the agreement the note reports needs years before 1973. Part of that is R1's and JRA-55's early high bias, and part is JRA-55 and 20CRv3 falling less than the stations since 1979 (sections 4 and 6).

Since 1979, hPa a decade

OUR ANALYSIS

Band	R1, to 2025	JRA-55, to 2023	20CRv3, to 2015
Polar caps	−0.32 [−0.53, −0.11]	−0.07 [−0.28, +0.15]	−0.14 [−0.42, +0.15]
Antarctic	−0.49 [−0.81, −0.17]	−0.10 [−0.42, +0.21]	−0.28 [−0.73, +0.17]
Arctic	−0.15 [−0.42, +0.12]	−0.03 [−0.33, +0.26]	+0.00 [−0.41, +0.42]
Tropics	−0.03 [−0.08, +0.02]	+0.04 [−0.02, +0.09]	+0.04 [−0.03, +0.11]

R1 from the note's file [4]; JRA-55 [6]; 20CRv3 [7] (our analysis).

4 · STATIONS BEFORE SATELLITES

Before satellites, JRA-55's and R1's Antarctic pressures fall faster than the stations'

Before weather satellites, few observations reached the reanalyses from the Southern Ocean and Antarctica. Hines and colleagues trace R1's high early pressures to its model's own climate and to Antarctic observations it didn't use or retain, not simply to a lack of observations, and find its spurious fall continuing into the 1990s [9 pp. 3944–3945, 3950]. Marshall finds the same at 65°S [10 p. 4142]. 20CRv3's early drifts against the stations are negative but mostly not significant (our analysis).

What the literature reports

- R1's surface pressure falls south of 45°S, most near 65°S, at about 0.2 hPa a year over 1949–1998, a trend Antarctic stations don't support. Few Antarctic observations entered R1 before about 1968 [9 p. 3940]. Near the circumpolar trough it was too high, by about 8 hPa in the 1950s, 6 in the 1960s, 4 in the 1970s and 2 in the 1980s, probably from its model's climate [9 p. 3944]. Hines and colleagues conclude that "the large amplitude decrease in reanalysis surface pressure is spurious" [9 p. 3948].
- Marshall averaged six stations near 40°S and six near 65°S. Over 1958–2000 the pressure difference between the two rose, significant at the 10% level [10 pp. 4137, 4142]. R1's trend in it is "approximately 3 times larger", and R1 exaggerates the Southern Annular Mode's trend about twofold. R1's largest seasonal trend is in winter, the stations' in summer [10 pp. 4141–4142].
- In the pre-satellite era, JRA-55's Southern Hemisphere forecast scores tend to worsen even as the number of observations it used rose. Its authors say this "may indicate" that the assimilation "did not perform well during this period" [5 §6.3].
- In austral summer, three earlier century-long reanalyses have early pressures over the circumpolar trough that are too high, then a spurious drop around 1950 as observations arrive (paraphrased) [13]. 20CRv3's authors list time-varying biases in southern high-latitude pressure among its remaining problems (paraphrased) [7].

OUR ANALYSIS

The test we fixed in advance

We compared each reanalysis with 14 Antarctic stations from SCAR's READER archive [21] and with Eureka [22]. For each, we measured the trend of the reanalysis minus the station before 1979 and after. Our rule says a product has an artificial pre-1979 trend if the median of that drift is negative and is detected at more than half the stations. **JRA-55 meets it:** −1.80 hPa a decade, detected at 8 of 12 stations, all negative. **R1 doesn't**, at −0.85, with 2 of 12 on the 2.5° file and 3 of 12 on the note's file), though Faraday's −1.97 [−2.56, −1.37] is clear. **20CRv3 doesn't**, at −0.51, with 4 of 12. With 10 to 28 pre-1979 years per station, the test was weak.

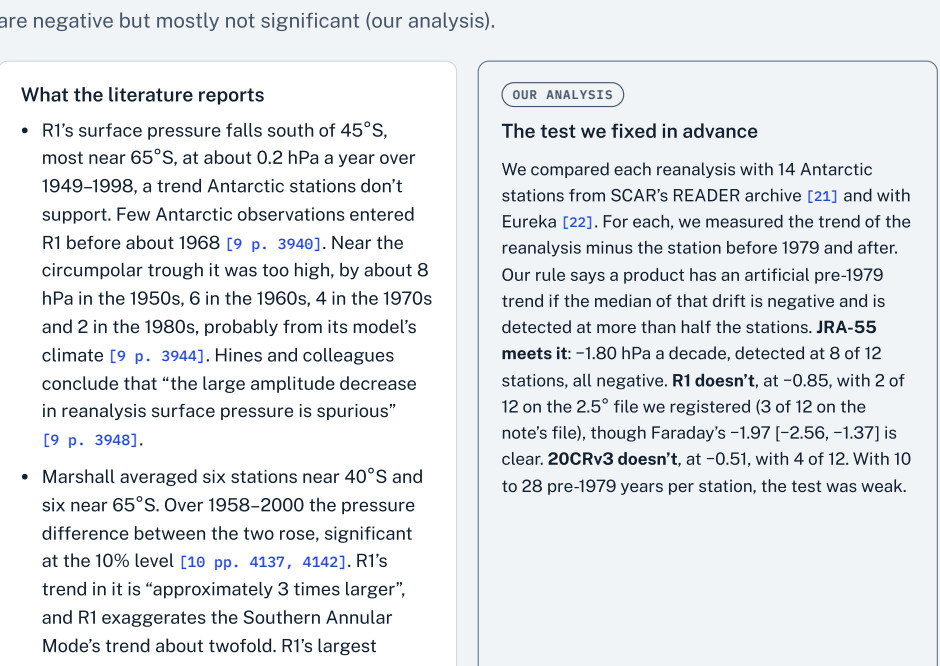
OUR ANALYSIS · EXPLORATORY

What the stations themselves show

Since 1979, 8 of the 12 READER stations with 30 or more valid years since then fall significantly, from −0.40 hPa a decade at Mawson to −0.90 at Casey; the two inland stations, the South Pole and Vostok, don't [21]. Marshall's six-station mean at 65°S trends −0.34 [−0.63, −0.04] since 1979, close to its −0.37 for 1957–2025 [10]. Before 1979 alone the records are short and noisy: at 65°S, 1957–1978 gives +0.27 [−0.79, +1.32]. So the stations show a real fall over their records and since 1979, about 0.35 hPa a decade at 65°S, which the reanalyses should match. Since 1979 JRA-55 and 20CRv3 drift upward against the stations, falling less than they do (table below).

At 65°S, R1 against six coastal stations

OUR ANALYSIS · EXPLORATORY



Annual mean sea-level pressure, hPa, each relative to its own 1979–2025 mean

The six stations' mean at 65°S from Marshall's files [10], and R1's mean sea-level pressure on its 2.5° file read at the same six sites, as Marshall compared them [10 p. 4138] [4]. 1957–2025 (our analysis, exploratory). Each line is drawn from its own 1979–2025 mean. Over 1957–2025 the stations' trend is −0.37 hPa a decade [−0.53, −0.22] and R1's −1.14 [−1.47, −0.82], three times as steep, and before 1979 R1 sits 3.5 hPa higher on these baselines. Since 1979 the trends are −0.34 [−0.63, −0.04] and −0.54 [−0.89, −0.19]; their difference, −0.20 [−0.77, +0.36], isn't significant. R1's whole 65°S circle falls faster since 1979 (−0.72), but in R1 the six sites average 3.7 hPa above the circle [10 p. 4138], 4.1 over 1957–2025 by our count, so the circle isn't like for like. At 40°S the two agree: +0.16 a decade each.

OUR ANALYSIS · EXPLORATORY

Each record's Antarctic band shows where its trend comes from. R1's drops 3.7 hPa from 1948–1957 to 1958–1967, the years Hines and colleagues flagged [9 pp. 3944–3945], then falls 1.7 hPa more from 1979–1989 to 2010–2025. JRA-55's drops 2.3 hPa between 1968–1978 and 1979–1989, as satellite data arrive, and is flat after. 20CRv3's rises by 3.3 hPa from its first 30 years to 1880–1919 and then falls about 4 hPa to 2000–2015, through decades with almost no Antarctic observations. Our check of note 008 weighs the same question for the ERA5-based Amundsen Sea Low index before 1979.

5 · THE GLOBAL MEAN

The air's dry mass barely changes, so the global trends measure the reanalyses, not the air

Surface pressure is the weight of the air overhead. Averaged over the globe it can change only if the air gains or loses mass. The dry air's mass is nearly constant, so the global mean moves mainly with water vapour [11 p. 864]. We fixed in advance how to bound the two (our analysis).

STEP 1

Dry air

The air is losing oxygen, mostly to the burning of fossil fuels, and some of the carbon dioxide made stays. Scripps's oxygen records fall 21.5–22.3 per meg a year over 1993–2025 [23], and NOAA's carbon dioxide rises 2.1 ppm a year [24]. Together that is −0.018 hPa a decade, and −0.015 to −0.023 over 1979–2025 (our analysis).

STEP 2

Water vapour

R1's own water vapour rises +0.024 hPa a decade [+0.012, +0.036] over 1979–2025 [4]. Warm air holds 6–7.5% more water per degree, and the world warmed 0.21 °C a decade [25], which gives +0.029 to +0.037 (our analysis).

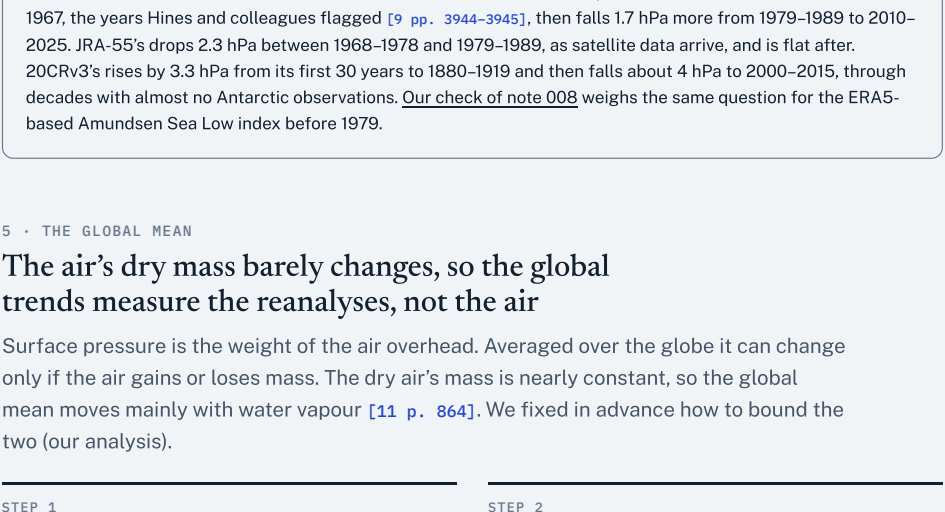
STEP 3

The bound

Adding the two, the global mean can have changed by −0.010 to +0.022 hPa a decade over 1979–2025. Over the 1979–2015 years of 20CRv3, the range is −0.023 to +0.016 (our analysis).

The reanalyses' global trends against what physics allows

OUR ANALYSIS



Global-mean surface-pressure trend, hPa a decade

Trends from the band means [4] [6] [7]; the bound from Scripps's oxygen [23], NOAA's carbon dioxide [24], R1's water vapour [4] and GISTEMP's warming [25], for each product's years since 1979 (our analysis). The intervals are by our registered method, so they differ slightly from the note's printed ones in section 2.

OUR ANALYSIS

JRA-55's +0.074 [+0.051, +0.097] and 20CRv3 (+0.036 [+0.027, +0.044]) lie wholly above what physics allows. R1's −0.0295 lies below it, though its interval just reaches it. R1's dry air alone, at −0.0536 [−0.0752, −0.0321] is wholly below the −0.023 to −0.015 that the gas records allow, 2.4 to 3.5 times as much. It comes out of the years 1979–2001, when R1's dry air fell −0.094 a decade. Since 1993, R1's dry air trend (−0.0040 [−0.0074, −0.0005]) is consistent with the gas records, though not over 2001–2025 (−0.066 [−0.105, −0.028]). So the note's "dry-air component" is mostly R1 losing air it shouldn't. 20CRv3's forecast model holds its dry air mass fixed (paraphrased) [7], so its global trend is its water vapour and can't show the oxygen loss. Against the water-vapour part of the bound alone, +0.002 to +0.030 over 1979–2015, its +0.036 is still above, though its interval reaches in.

What the literature reports

Trenberth and Smith, the note's reference [4], test reanalyses by whether the global mass of dry air stays constant. In ERA-40 its monthly means vary with a standard deviation of 0.065 hPa over 1979–2001, while R1's get "progressively noisier prior to the mid-1990s, much more so before 1979" [11 p. 867]. Both break the constraint more and more before satellite data, especially over the Southern Ocean [11 pp. 864, 874–875]. NASA's modellers found no mechanism in four recent reanalyses, JRA-55 among them, that keeps dry mass constant [12 §1], and conclude that "most of the trend in total surface pressure comes from a spurious trend in the dry mass" [12 §5].

Trenberth and Smith base their estimate that the dry mass is constant within 0.01 hPa on fossil fuels, as other gases change it even less. The mass that burning them adds, the carbon dioxide made less the oxygen used, would be about 0.03 hPa, but the oceans and the biosphere take up roughly half the carbon dioxide. The net "is likely to be less than 0.01 hPa in surface pressure and is more likely a net loss than a gain in mass" [11 p. 865]. It is a running total, not a rate. The gas records give a loss of about 0.03 hPa over 1979–2001 alone (our analysis) [23] [24]. Both are small beside R1's dry-air fall of about 0.2 hPa over the same years, and nothing here depends on the difference.

6 · THE SOUTHERN ANNULAR MODE

Lower pressure over Antarctica and higher at middle latitudes is a known pattern, the Southern Annular Mode

The Southern Annular Mode (SAM) is the main swing of the Southern Hemisphere's weather. The IPCC describes it as a north–south redistribution of air around Antarctica [16 §3.7.2]. Its positive phase means lower pressure over Antarctica, higher pressure at middle latitudes and stronger westerly winds between them.

What the assessments say

> *"a robust positive trend in the SAM index, particularly since 1950 and for the austral summer"*
>
> IPCC AR6, high confidence [15 §2.4.1.2]

> *"very likely that human influence has contributed to the observed trend towards the positive phase of the Southern Annular Mode (SAM) since the 1970s"*
>
> IPCC AR6 [16 Executive Summary]

> *"Antarctic ozone depletion caused expansion of the tropics and a poleward shift of the jet stream and storm tracks in the Southern Hemisphere"*
>
> WMO/UNEP 2022 [17 Executive Summary]

What else the literature reports

- Thompson and Solomon argue that the summer trend toward the SAM's high phase can be traced largely to ozone loss in the stratosphere (paraphrased) [14]. Ozone's part has been small since about 2000, and the SAM's trend has weakened [16 Executive Summary] [15 §2.4.1.2].
- Reconstructions put recent SAM values outside the range of the last millennium (paraphrased) [19].
- **The Arctic:** winter NAM/NAO indices rose from the 1960s to the early 1990s and "have become less positive or even negative thereafter" [15 §2.4.1.1]. The cause of the rise "is not well understood" [16 Executive Summary]. Central Arctic pressure fell over 1979–1994, made up by rises over the subpolar oceans (paraphrased) [18]. Long-term Arctic ozone loss has had no detectable effect on surface climate [17 Executive Summary].

OUR ANALYSIS

The test we fixed in advance

Marshall's SAM index is built from the same 40°S and 65°S station pressures [10 p. 4137], so regressing a band on it mainly tests whether the band follows those stations. The index rose +0.52 index units a decade over 1957–2025 [+0.33, +0.71] [10]. Since 1979, a regression on it accounts for 89% of R1's Antarctic fall, and what is left, −0.05 [−0.27, +0.16], is not significant: by our rule, the SAM's trend. From 1957, 0.35 hPa a decade is left beyond the SAM, which fits R1's early bias. JRA-55 from 1958 passes as the SAM's by the rule (71%), although its station test finds an artificial pre-1979 fall: its residual, −0.17 [−0.42, +0.08], is negative but not significant, so our full records this test can't separate an early artefact from the SAM. 20CRv3 from 1957 passes too (81%). Since 1979 JRA-55 and 20CRv3 both fall less than the SAM implies, by +0.28 [+0.12, +0.44] and +0.21 [+0.04, +0.37]. No Arctic band trend since 1979 is significant in any product.

Where the polar air goes, hPa a decade of global-mean pressure

OUR ANALYSIS · EXPLORATORY

Product and years	Polar caps	Middle latitudes	Tropics	Globe
R1, 1948–2025	−0.082	+0.012	+0.035	−0.035
R1, 1979–2025	−0.040	+0.020	−0.010	−0.030
JRA-55, 1958–2023	−0.044	+0.027	+0.016	−0.001
JRA-55, 1979–2023	−0.008	+0.067	+0.015	+0.074
20CRv3, 1806–2015	−0.015	−0.013	+0.030	+0.002

Each band's trend times its share of the globe's area, so the bands add up to the global trend (our analysis) [4] [6] [7]. In R1 over 1948–2025, only 57% of the polar caps' loss reappears elsewhere; the rest leaves R1's atmosphere. Since 1979 the polar caps' loss reappears mainly at middle latitudes; over the full records R1 and 20CRv3 put more of it into the tropics. Hines and colleagues suggest that R1's spurious Southern Ocean fall may be a large part of wider changes in its global pressure, which include a slight rise in the tropics [9 p. 3950].

7 · THE NOTE'S STATIONS AND THE ASL

The South Pole and the ASL reproduce; Eureka's fall is inflated by a change in the archive

The note gives trends for two named stations and for the Amundsen Sea Low (ASL) index [1 Methods]. We rebuilt each from the public records (our analysis).

SOUTH POLE, 1957–2025

OUR ANALYSIS

−0.137

hPa a decade [−0.309, +0.035], as the note gives. It comes from READER's station pressure with plain 12-month means, and is not significant [21]

EUREKA, SEA LEVEL

OUR ANALYSIS

−0.11

hPa a decade [−0.29, +0.07], 1951–2024, from the sea-level values of the NOAA reports whose station pressure gives −0.33; it assumes that series has no step of its own (exploratory) [22]

ASL, 1959–2025

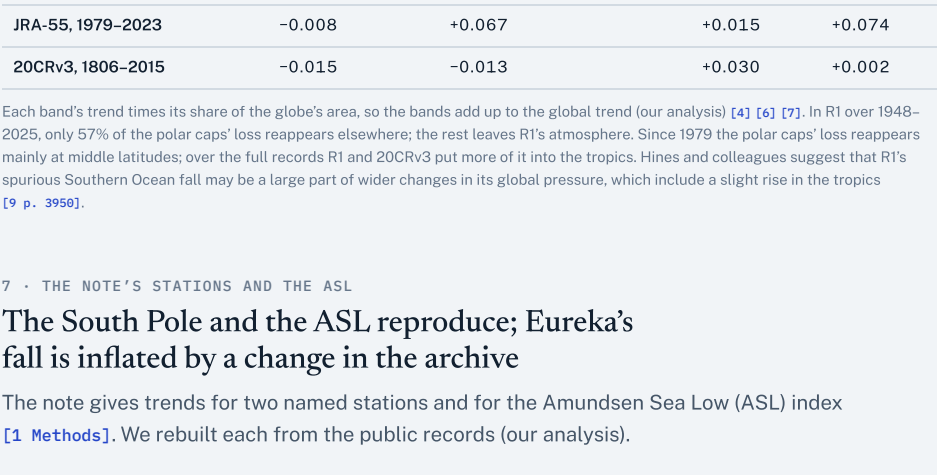
OUR ANALYSIS

−0.614

hPa a decade, from the index's sector pressure; the low's own centre falls −0.670, and its depth against the sector −0.056, not significant [20]

Eureka: station pressure minus sea-level pressure, in the same reports

OUR ANALYSIS · EXPLORATORY



Yearly mean of station pressure minus sea-level pressure in the same reports, hPa

Every report in NOAA's Integrated Surface Database for Eureka that carries both values, 1951–2025 [22] (our analysis, exploratory). No files exist for 1969–1972 or 2005, and the 1968 value rests on two reports.

OUR ANALYSIS · EXPLORATORY

Why Eureka's fall is inflated

The reports themselves show the change. In 1956–1976 Eureka's "station pressure" equals its sea-level pressure, and in 1973–1976, when the altimeter setting is reported too, all three agree within 0.1 hPa. A barometer about 10 m up can't read that: in Eureka's cold air it reads about 1.3–1.5 hPa below sea level. From 1 January 1977, in the middle of one data file, the station value sits 1.4 hPa below sea level, with the seasonal swing physics requires, and the altimeter setting 1.2–1.3 hPa above it. The elevation written in the reports stays 9 m from 1975 to 1983, so the station didn't move, and its number in the archive changed six months later, in July 1977. Resolute Bay, about 600 km south, shows no such change: its station pressure sits 8–9.5 hPa below sea level throughout 1976–1978, as its 67 m requires [22]. So the station-pressure series drops about 1.4 hPa in 1977 for a reason in the archive, which puts about −0.2 hPa a decade into a 1951–2024 trend: −0.330 against −0.109 for the sea-level series.

The 1977 step at Eureka, against each reanalysis, hPa

OUR ANALYSIS · EXPLORATORY

Reference at Eureka	Station series, before against after	Station series, with a drift	Sea-level series, before against after	Sea-level series, with a drift
R1 sea-level pressure	−0.55	−0.84 [−1.63, −0.05]	+0.85	+0.57 [−0.14, +1.28]
R1 surface pressure, 2.5° file	−1.19	−0.38 [−1.14, +0.39]	+0.21	+0.98 [+0.20, +1.76]
R1 surface pressure, the note's file	−1.27	−0.58 [−1.19, +0.04]	+0.13	+0.80 [+0.17, +1.43]
JRA-55 surface pressure	−1.05	−0.85 [−1.18, −0.51]	+0.30	+0.51 [+0.15, +0.87]
20CRv3 surface pressure	−1.42	−1.02 [−1.61, −0.43]	−0.06	+0.40 [−0.15, +0.96]

The step is the change in 1977 of each ISD series minus the reanalysis at Eureka, with the reanalysis scaled to the station's pressure; negative means the ISD series dropped. "Before against after" compares the 1977–2024 mean with the 1951–1976 mean. "With a drift" fits a straight line and the step together; its 95% interval allows for one year echoing the last. ISD [22]; reanalyses [4] [6] [7] (our analysis, exploratory).

OUR ANALYSIS · EXPLORATORY

What the reanalyses can't settle

Against five reanalysis series at Eureka, comparing the years before 1977 with those after puts −1.0 to −1.4 hPa of the step into the station-pressure series and −0.1 to +0.3 into the sea-level series, except against R1's sea-level pressure (+0.85; table above). Eureka's cold air is a poor reference here. R1's ground at Eureka is about 670 m up, where its surface pressure averages about 930 hPa, so its sea-level value is extrapolated through the model's temperatures: over 1951–2024 its trend is −0.31 hPa a decade, while R1's own surface pressure there trends −0.10 [4]. If each reanalysis may also drift steadily, 0.4–1.0 hPa of the step moves into the sea-level series, and the reanalyses may themselves use Eureka's reports. So whether the sea-level series, −0.11 [−0.29, +0.07], is homogeneous across 1977 can't be settled from them. If it carried a 0.2–0.5 hPa step, Eureka's trend would be about −0.14 to −0.20, significant at the upper end. The note's own trend since 1979, −0.111 [−0.501, +0.280], comes from after the change [1 Methods]. Its further 21 stations aren't named, so we can't tell whether the change touches any of them.

The ASL index

The British Antarctic Survey's index tracks the low-pressure centre over the Amundsen Sea in ERA5. It gives the low's central pressure, the mean sea-level pressure over its sector, and the difference between the two [20]. The note's −0.614 is the sector mean, a regional average that overlaps the Antarctic band. The file flags a known ERA5 problem in May–October 1996. Leaving those months out gives −0.612 (our analysis). Our check of note 008 reproduces the same file.

8 · HOW BIG A SHIFT

A few kilograms of air per square metre a decade, and nothing sudden

A catastrophist reading might take an "Earth air shift" as a sign of something large or abrupt: air draining from the poles, or a planet losing its atmosphere. The numbers don't support either reading (our reading).

R1'S POLAR FALL

OUR ANALYSIS

0.07%

of the air above the polar caps a decade: about 7 kg on each square metre, out of about 9,500 kg [1 Claims ¶1]

THE NOTE'S RANGE

OUR ANALYSIS

0.01–0.1%

a decade: what 0.1–1 hPa is against a column of about 1,000 hPa

AIR ACTUALLY LOST

OUR ANALYSIS

−0.016

hPa a decade, over 1979–2025: the measured oxygen decline, mostly from burning fossil fuels, less the carbon dioxide kept, about 8 Gt of air a year [23] [24]

OUR ANALYSIS

Nothing sudden

Every trend here is a slow line through decades of annual means. In the steepest, R1's Antarctic band, more than half the fall comes before 1979, in the decades flagged as biased [9 p. 3944]. At 65°S, the stations' real fall is 0.37 hPa a decade. For the polar caps as a whole, R1's fall comes to 5 hPa over 1948–2025, about five times the year-to-year scatter of its annual means (their standard deviation about the trend is 1.0 hPa), and much of it is R1's documented early drift.

OUR ANALYSIS

No cause, and none tied to the Sun or the field

The note offers no cause, and we don't supply one for it. The published attribution of the Southern Hemisphere pattern is ozone depletion and greenhouse gases [16 Executive Summary] [17 Executive Summary]. Nothing in the note ties these trends to the Sun or to Earth's magnetic field. The one real loss of air is the slow decline of oxygen, mostly from burning fossil fuels, less the carbon dioxide that stays: about 0.016 hPa a decade.

9 · REPEAT OUR NUMBERS

The rules, the scripts and our derived numbers; the reanalysis files are fetched, not hosted

Each rules file was written, and its hash logged, before the tests it governs first ran; the two amendments say what prompted them. Checks marked "exploratory" were added after we had seen results. One script, in Python's standard library alone, recomputes the main statistics from small public files and our derived series: the note's numbers, the window counts, the global bound, the ASL, the SAM test, the station trends and drifts, Eureka's series and its 1977 step, and the 65°S comparison. The rest, such as the band budget, the period means and the sizes in section 8, come from the numpy scripts below.

PY **fetch_inputs.py and input_sha256.txt**

Fetches every input by URL under a plain client name and compares it with the hash of the copy we used. `--small` fetches the 104 files the checker needs (19 MB); `--all` adds the reanalysis files (about 520 MB, plus 793 JRA-55 files) · 5 KB and 127 KB

PY **polar_pressure_check.py and its output**

Standard library only. It recomputes the note's trends and intervals, the windows, the bound, the ASL, the SAM test, the station trends and drifts, Eureka's series, reports and step, and the 65°S comparison; its section 9 holds the checks added after a fresh review · 34 KB and 15 KB

CSV **annual_bands_r1g.csv, _r1, _jra55 and _c20v3**

Our annual band means for each product (R1 on the note's Gaussian file and on the 2.5° file), with R1's dry-air and 2.5° budget · 27 KB in all

CSV **station_points_annual_r1g.csv, _r1, _jra55 and _c20v3**

Each reanalysis at each station, annual means; with R1's sea-level pressure at 65°S and 40°S, R1 at Marshall's twelve sites and at Eureka and Eureka's two ISD series · 76 KB in all

PY **extract_fields.py, export_derived.py and ppt_lib.py**

The reduction of the reanalysis files to zonal means and station values, and our shared functions. They need numpy, scipy, netCDF4 and cftime · 15 KB in all

PY **reproduce.py, periods.py, stations.py, globalmass.py, sam.py and asl.py**

The registered tests as run, with numpy and scipy. Outputs: reproduce, periods (and with the 2.5° file, every window, every start), stations, drifts, bound (first run), SAM, ASL · 40 KB of code, 593 KB of outputs

PY **interval_match.py, eureka_check.py, eureka_check2.py, l65_check.py, band_budget.py, period_means.py, southpole_equal.py and fixround_checks.py**

The exploratory checks, each saying in its header that it was added after results; the last holds those a fresh review asked for. Outputs: intervals, Eureka, Eureka's step, 65°S, band budget, period means, South Pole, the review's checks (JSON) · 40 KB of code, 119 KB of outputs

CSV **lat_profile_r1g.csv, _r1, _jra55 and _c20v3**

The trend at every latitude, full record and since 1979 · 23 KB in all

TXT **RULES_reproduce.txt, RULES_periods.txt, RULES_stations.txt, RULES_globalmass.txt, RULES_sam.txt and RULES_asl.txt**

The rules, all hashed at 19:18 UTC on November 15, 2026, before any result existed, with the two amendments, R1's file and the bound's range · 19 KB in all

TXT **analysis_log.md, HASHES.txt and DATA_TERMS.txt**

The log of every run, with the hash of each rules file, input and output; the hash of every file here; and each data source's terms and credit · 30 KB in all

Run it

`python3 -I fetch_inputs.py inputs --small`, then `python3 -I polar_pressure_check.py inputs`, recomputes the main statistics in under a minute with Python 3.9 or later. To rebuild our derived series from the reanalyses, use `--all`. Then run `extract_fields.py inputs out r1 r1g r1_pzwtc c20v3 jra55`, `reproduce.py out r1 r1g c20v3 jra55` and `export_derived.py inputs out`, and the tests after them; their headers give the order. Several providers update their files, so a changed hash is reported, and results may move slightly.

The data and their terms

NOAA PSL's R1 and 20CRv3: "data provided by the NOAA PSL, Boulder, Colorado, USA, from their website at https://psl.noaa.gov" [4] [7]. **JRA-55:** the RID, which was produced by the Japan Agency for Marine-Earth Science and Technology, is used in this study (https://www.jamstec.go.jp/ridinfo/). Its terms allow research use only, forbid commercial use and are attached in DATA_TERMS.txt; this site is non-commercial, and we host only numbers derived from it [6]. **BAS's ASL index:** by J. S. Hosking, British Antarctic Survey, computed from ERA5; contains modified Copernicus Climate Change Service information 2026. The file states no licence, so we host only numbers derived from it [20]. **Marshall's SAM index and station means:** British Antarctic Survey; their page states no licence, and we host only numbers derived from them [10]. **READER:** Open Government Licence v3.0 [21]. **Scripps O_2:** CC BY 4.0, Scripps Institution of Oceanography at UC San Diego [23]. **NOAA GML and NASA GISTEMP:** cited as each asks [24] [25]. **NOAA NCEI's ISD:** US government data [22]. **S0 News's note:** no licence is given, so we quote it, link to it and host nothing of it [1].

10 · LIMITS

What this check could and couldn't see

The note's own files

Its tables, scripts and station files are behind a Google sign-in [2]. We rebuilt its numbers from public files, but couldn't check its 21-station summary or its rule for Eureka's 63 valid years.

A weak station test

Our registered station test had 10 to 28 pre-1979 years per station. It finds JRA-55's early drift by its rule but not R1's. The comparison with Marshall's six 65°S stations, which does show R1's, was added after we saw the station results.

Exploratory checks

Eureka's step and its reports, the 65°S comparison, the stations' trends since 1979, the band budget, the period means, the interval formula and the South Pole's plain means were added after results; so was the split of the windows by first year. They are labelled so, and their scripts are hosted.

The Arctic part

In 20CRv3 two-thirds of the full-record polar fall is Arctic (our analysis). Neither the early Antarctic bias nor the SAM explains that part, and this page doesn't test it.

Abstracts only

Of Slivinski and colleagues, Schneider and Fogt, Thompson and Solomon, Walsh and colleagues, Fogt and Marshall, Kalnay and colleagues, Hosking and colleagues, and Martineau and colleagues we read only the abstracts, and paraphrase them; of Santer and colleagues, only the record. Kobayashi and colleagues, Takacs and colleagues, the IPCC chapters and the ozone assessment were read in full. So were Hines and colleagues, Marshall, and Trenberth and Smith, from copies the site's owner downloaded after the journal's site had refused our client.

Not ERA5's own fields

We didn't use ERA5's own fields or MERRA-2, whose assimilation was changed to conserve dry mass [12 §2] [12 §4]. The ASL index we reproduce is BAS's, derived from ERA5 [20]. Our physical bound comes from gas records instead.

What would change these verdicts

01

A polar fall significant in all three reanalyses over windows starting after 1973, or a station record that showed the pre-satellite fall the reanalyses show.

02

Evidence that the atmosphere's dry mass is falling faster than the oxygen and carbon dioxide records allow.

03

A homogeneous record of Eureka's station pressure, from Environment Canada, that showed a significant fall over 1951–2024.

OUR ANALYSIS

Bottom line: the note computes its trends correctly, but the three reanalyses agree on a significant polar fall only with years before 1973, and the fall that stations record is the known SAM.

R1's and JRA-55's early high bias helps that agreement, and since 1979 JRA-55 and 20CRv3 fall less than the stations. Coastal Antarctic stations record a real fall, about 0.35 hPa a decade at 65°S over their records and since 1979: the Southern Annular Mode's slow shift of air from Antarctica toward the middle latitudes, attributed to the ozone hole and greenhouse gases. In 20CRv3 most of the full-record polar fall is Arctic, which this page doesn't explain. The note's global trends and its "dry-air" fall measure the reanalyses' mass budgets, and its Eureka trend is inflated by a change in how the archive stores station pressure. Nothing here points to a sudden change.

Sources

Bracketed numbers refer to this list. For S0 News's research note (1), which has no page numbers, locators are its own section names: Title, Credit (the line under the title), Abstract, Claims ¶1 and ¶2 (its two paragraphs of claims), Methods and References. For papers and reports read in full, § is a section and p. a page; for the IPCC chapters it is the report's own section number, and Executive Summary is the chapter's or the assessment's. Where only an abstract or a record was read, the entry says so, and abstracts are paraphrased. Numbers marked "our analysis" are ours, not the sources'. Links checked November 15, 2026.

1 S0 News (Space Weather News), "internal GrokBot Team 010" (undated). Earth Air Shift: Polar Surface Pressure Falls as Tropical Pressure Rises. A Space Weather News research note, a public Google Doc headed "SPACE WEATHER NEWS & RESEARCH PUBLICATIONS 2026". The note is undated; S0 News linked it from the YouTube page of its November 15, 2026 episode [3]. Retrieved November 15, 2026, at 18:54 UTC, as a text export (SHA-256 3d188772f4c1ad79d974856248d9fac977e9aa03a2b0d013f4b15ae72d3655f2) and as an HTML export with its two figures. Read in full. Not peer reviewed. No licence is given, so it is linked, not hosted, and none of its figures is redrawn.

2 S0 News (undated). The note's CSV folder, with its tables, scripts and provenance files. When checked at 18:55 UTC on November 15, 2026, Google asked for a sign-in ("You must sign in to access this content"). We don't sign in, so we haven't read it; every number on this page is rebuilt from public files instead.

3 SpaceWeatherNews (S0) (November 15, 2026). Solar Electromagnetic Earth Dance | S0 News Nov.15.2026. YouTube video, https://www.youtube.com/watch?v=gzYwpyefO5g. Linked the source; no transcript was available, so nothing it says is rated here.

4 Kalnay, E., Kanamitsu, M., Kistler, R., et al. (1996). The NCEP/NCAR 40-year reanalysis project. Bulletin of the American Meteorological Society 77(3), 437–471. Abstract only (OpenAlex); paraphrased. With the data: NOAA PSL's NCEP/NCAR Reanalysis 1 monthly means, surface pressure on the T62 Gaussian grid (the file the note's numbers come from), and surface pressure, precipitable water and sea-level pressure on the 2.5° grid, January 1948 to February 2026, retrieved November 15, 2026. "Data provided by the NOAA PSL, Boulder, Colorado, USA, from their website at https://psl.noaa.gov." We host only numbers derived from them.

5 Kobayashi, S., Ota, Y., Harada, Y., et al. (2015). The JRA-55 reanalysis: general specifications and basic characteristics. Journal of the Meteorological Society of Japan 93(1), 5–48. Read in full, on J-STAGE (© 2015 Meteorological Society of Japan); quoted briefly.

6 Japan Agency for Marine-Earth Science and Technology (JAMSTEC). RID: Reanalysis Intercomparison Dataset. JRA-55 monthly surface pressure on the common 2.5° grid, 793 files from January 1958 to January 2024, from its THREDDS server, retrieved November 15, 2026; its data table lists 20CRv3 from January 1836. The RID asks users to cite Martineau, P., Wright, J. S., Zhu, N., and Fujiwara, M. (2018). Zonal-mean data set of global atmospheric reanalyses on pressure levels. Earth System Science Data 10, 1925–1941 (CC BY 4.0; abstract read), the note's "common-grid processing". The RID is provided "for research purposes only", forbids commercial use and may be redistributed only with its terms attached (in DATA_TERMS.txt); JRA-55 is the Japan Meteorological Agency's. We host only numbers derived from it.

7 Slivinski, L. C., Compo, G. P., Whitaker, J. S., et al. (2019). Towards a more reliable historical reanalysis: improvements for version 3 of the Twentieth Century Reanalysis system. Quarterly Journal of the Royal Meteorological Society 145(724), 2876–2908. Abstract only (Crossref); paraphrased. With the data: NOAA PSL's 20CRv3 monthly surface pressure (version 3si, January 1806 to December 2015; the file names its observations as the International Surface Pressure Databank, version 4.7, and its history attribute shows the first 30 years joined from a separate run), retrieved November 15, 2026. "Data provided by the NOAA PSL, Boulder, Colorado, USA, from their website at https://psl.noaa.gov." We host only numbers derived from them.

8 Santer, B. D., Wigley, T. M. L., Boyle, J. S., et al. (2000). Statistical significance of trends and trend differences in layer-average atmospheric temperature time series. Journal of Geophysical Research: Atmospheres 105(D6), 7337–7356. Record only (Crossref); cited for the method of widening trend intervals for autocorrelation.

9 Hines, K. M., Bromwich, D. H., and Marshall, G. J. (2000). Artificial surface pressure trends in the NCEP–NCAR reanalysis over the Southern Ocean and Antarctica. Journal of Climate 13(22), 3940–3952. Read in full, from a copy the site's owner downloaded; the journal's site had refused our client. © 2000 American Meteorological Society; quoted for review, cited by page.

10 Marshall, G. J. (2003). Trends in the Southern Annular Mode from observations and reanalyses. Journal of Climate 16(24), 4134–4143. Read in full, from a copy the site's owner downloaded; the journal's site had refused our client. © 2003 American Meteorological Society; quoted for review, cited by page. With the data, from the British Antarctic Survey's observation-based SAM index: the monthly and seasonal index and the six-station zonal means at 40°S and 65°S, retrieved November 15, 2026. Their page states no licence; we host only numbers derived from them.

11 Trenberth, K. E., and Smith, L. (2005). The mass of the atmosphere: a constraint on global analyses. Journal of Climate 18(6), 864–875. The note's reference [4]. Read in full, from a copy the site's owner downloaded; the journal's site refused our client (HTTP 403), and NCAR's repository showed a bot check, which we didn't attempt. © 2005 American Meteorological Society; quoted for review, cited by page.

12 Takacs, L. L., Suarez, M., and Todling, R. (2015). Maintaining atmospheric mass and water balance within reanalysis. NASA Technical Report Series on Global Modeling and Data Assimilation, NASA/TM–2014-104606, Vol. 37. Read in full. US government work.

13 Schneider, D. P., and Fogt, R. L. (2018). Artifacts in century-length atmospheric and coupled reanalyses over Antarctica due to historical data availability. Geophysical Research Letters 45, 964–973. Abstract only (OpenAlex).

14 Thompson, D. W. J., and Solomon, S. (2002). Interpretation of recent Southern Hemisphere climate change. Science 296(5569), 895–899. Abstract only (Crossref); paraphrased.

15 Gulev, S. K., Thorne, P. W., Ahn, J., et al. (2021). Changing state of the climate system. In Climate Change 2021: The Physical Science Basis, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, pp. 287–422. Read on the IPCC's site.

16 Eyring, V., Gillett, N. P., Achuta Rao, K. M., et al. (2021). Human influence on the climate system. In Climate Change 2021: The Physical Science Basis, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, pp. 423–552. Read on the IPCC's site.

17 World Meteorological Organization (2022). Executive Summary. Scientific Assessment of Ozone Depletion: 2022, GAW Report No. 278, WMO, Geneva. Read in full, on NOAA's Chemical Sciences Laboratory site.

18 Walsh, J. E., Chapman, W. L., and Shy, T. L. (1996). Recent decrease of sea level pressure in the central Arctic. Journal of Climate 9(2), 480–486. Abstract only (OpenAlex); paraphrased.

19 Fogt, R. L., and Marshall, G. J. (2020). The Southern Annular Mode: variability, trends, and climate impacts across the Southern Hemisphere. WIREs Climate Change 11, e652. Abstract only (OpenAlex); paraphrased.

20 Hosking, J. S., British Antarctic Survey (2026). Amundsen Sea Low (ASL) Index, version 3 (product version 3.20240813, file asli_3.20240813_20261110, created November 10, 2026), January 1959 to August 2026, computed with BAS's asli software (version 0.2.8) from ERA5 (Copernicus Climate Change Service, doi:10.24381/cds.adbb2d47); retrieved November 15, 2026. The file states no licence; we host only numbers derived from it. Contains modified Copernicus Climate Change Service information 2026. With Hosking, J. S., Orr, A., Bracegirdle, T. J., and Turner, J. (2016). Future circulation changes off West Antarctica: sensitivity of the Amundsen Sea Low to projected anthropogenic forcing. Geophysical Research Letters 43, 367–376, the note's reference [5] (abstract only).

21 Scientific Committee on Antarctic Research and British Antarctic Survey. READER: monthly surface station data. Station-level pressure at 13 Antarctic stations and Faraday/Vernadsky's mean sea-level pressure, tables produced November 2, 2026, retrieved November 15, 2026; Open Government Licence v3.0.

22 NOAA National Centers for Environmental Information. Integrated Surface Database (ISD): the reports of Eureka, Nunavut (719170-99999, 1947–2025, and 729170-99999, 1973–1977), with the station history file, retrieved November 15, 2026; and, for comparison, Resolute Bay's for 1976–1978 (729240-99999 and 719240-99999). US government data.

23 Scripps O_2 Program, Scripps Institution of Oceanography at UC San Diego. Atmospheric O_2/N_2 data: monthly values at Alert, La Jolla and Cape Grim (SIO2023 scale), retrieved November 15, 2026; CC BY 4.0.

24 NOAA Global Monitoring Laboratory (2026). Global annual mean CO_2, 1979–2025, file created October 9, 2026, retrieved November 15, 2026. Cited as GML asks: Lan, X., Tans, P., and Thoning, K. W., Trends in globally-averaged CO_2 determined from NOAA Global Monitoring Laboratory measurements, version 2026-10.

25 GISTEMP Team (2026). GISS Surface Temperature Analysis (GISTEMP), version 4. NASA Goddard Institute for Space Studies: global annual means, dataset accessed November 15, 2026. With, as GISTEMP asks, Lenssen, N., Schmidt, G. A., Hendrickson, M., Jacobs, P., Menne, M. J., and Ruedy, R. (2024). A NASA GISTEMPv4 observational uncertainty ensemble. Journal of Geophysical Research: Atmospheres 129(17), e2023JD040179 (record only).

METHOD

How this was checked

On November 15, 2026, we checked S0 News's research note 010 [1]: its title, its abstract, both paragraphs of claims, its two figures and the numbers in its methods. We checked them against the public files of the three reanalyses it uses, NOAA PSL's R1 and 20CRv3 and JAMSTEC's mirror of JRA-55 [4] [6] [7], from which we rebuilt the 28 reanalysis numbers we compared; with the ASL index's three, all 31 reproduce, and so do its six South Pole numbers, while its Eureka numbers come close but not exactly. We also checked them against 14 Antarctic stations [21], the reports of Eureka and Resolute Bay [22], the SAM and ASL indices [10] [20], the oxygen, carbon dioxide and temperature records [23] [24] [25], and 15 papers and assessments. Every other statement on this page was checked against its source, 193 references to 25 sources in all.

The verdicts and the items tagged "Our analysis" are our own assessment, built on the cited sources. No transcript of the episode that linked the note was available, so this page reviews the note on its own [3]. The rules of our six tests were written, and hashed, before any result existed; two amendments, each registered before it was used, say what prompted them. The checks marked "exploratory" were added after we had seen results.

We rebuilt the note's numbers with numpy, scipy and netCDF4, and recomputed the main statistics again with a second script in Python's standard library alone; section 9 lists what it covers. The two agree, except that one station's interval touches zero. The note's own tables, scripts and station files are behind a Google sign-in [2], so we couldn't compare them, or check its 21 unnamed stations. The journal's site had refused our client, so the papers of Hines and colleagues, Marshall, and Trenberth and Smith were read in full later the same day, from copies the site's owner downloaded, and are cited by page. Eight other papers were read as abstracts only, and are paraphrased, as the list says. We didn't use ERA5's own fields or MERRA-2.

A fresh reviewer then read the built page and reproduced every number on it in separate code. We followed their review: we reworded the reading of the polar fall, adding the stations' own trends since 1979 and each product's satellite era; compared R1 with Marshall's stations at their sites; led the Eureka section with the evidence in its reports, Resolute Bay's among them; and corrected the smaller points. No verdict 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.

The verdicts on this page

MISLEADING	Contains something true but leaves a false impression, usually by leaving out key context.
TRUE	The evidence supports the claim.

All ten verdicts, and how we check

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 15, 2026 Published on factchecked.science after a full check against the sources. The reanalysis and ASL numbers of S0 News's research note 010 reproduce from the public files, and its Eureka trend comes close. With rules fixed in advance, we tested the note's years, the reanalyses against stations, the global mean against the oxygen and carbon dioxide records, and the Southern Annular Mode. Exploratory checks found a change in how the archive stores Eureka's station pressure. The rules, scripts and derived numbers are hosted; none of the note's figures is redrawn, and none of its data is hosted.

Fact-Checked Science is independent. It isn't affiliated with the channels, presenters or authors whose claims it checks.

Last updated Nov 15, 2026