SOA Research INSTITUTE

Catastrophe and Climate

Weather Extremes Series: Quarterly Global Warming Report

MAY | 2026

Quarterly Global Warming Report

May 2026

AUTHORS Patrick Wiese, ASA

SPONSOR Catastrophe and Climate Strategic Research Program

Contents

Executive Summary **4**

Recent Data **6**

Global Air Temperature Trends: Point Estimates and Confidence Intervals **7**

Air and Ocean Temperature Trends **8**

Air Temperature Trends for Land Areas, by Latitude **10**

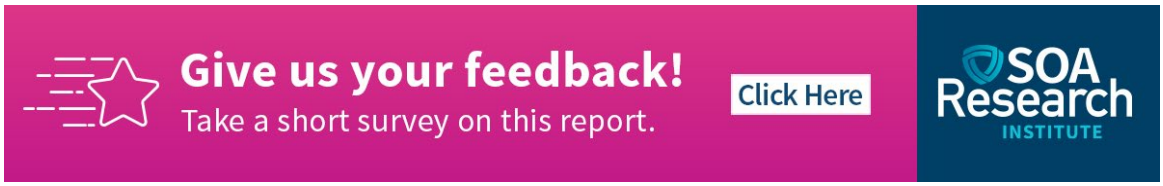
Air Temperature Trends for Land Areas, by Season **10**

Appendix **12**

Global Average Monthly Air Temperature 12

Spatial Averaging And Latitude Weighting 12

About The Society of Actuaries Research Institute **14**



Caveat and Disclaimer

The opinions expressed and conclusions reached by the authors are their own and do not represent any official position or opinion of the Society of Actuaries Research Institute, the Society of Actuaries, or its members. The Society of Actuaries Research Institute makes no representation or warranty to the accuracy of the information.

Copyright © 2026 by the Society of Actuaries Research Institute. All rights reserved.

Quarterly Global Warming Report

May 2026

Executive Summary

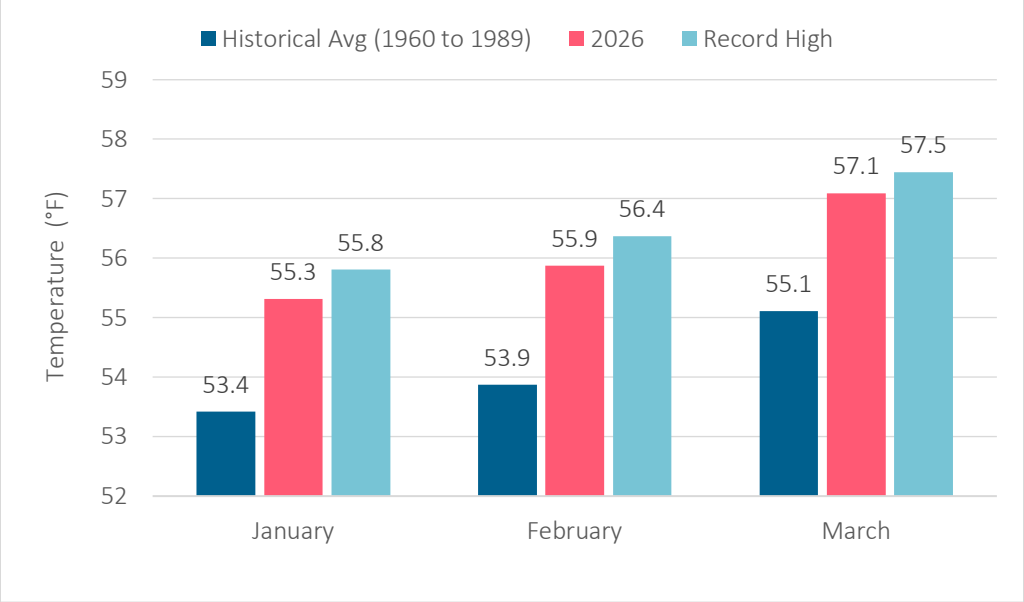
This report presents a statistical analysis of global warming trends and is updated quarterly to reflect the latest available air and sea surface temperature data. The previous edition analyzed data from January 1960 through December 2025; this update extends the analysis through March 2026. All results are based on the ERA5 reanalysis dataset produced by the European Centre for Medium-Range Weather Forecasts (ECMWF).

This report is divided into two parts: (1) an analysis of the most recent five years of data, with a focus on the latest quarter (January–March 2026), and (2) estimates of long-term warming trends based on data from 1960 through 2025. Because these long-term trends change little from one quarter to the next, they are updated annually rather than quarterly. The next update will occur in January 2027 and will reflect data through December 2026.

After reaching record-high levels from July 2023 through January 2025, the global-average air temperature has eased slightly from those peaks. In the most recent quarter, temperatures were roughly 2.0°F above their 1960–1989 baseline averages, but about 0.5°F below their record highs (see Figure 1).

Figure 1

GLOBAL-AVERAGE AIR TEMPERATURE (°F), JAN TO MAR 2026, WITH COMPARISON TO 1960–1989 BASELINE AND HISTORICAL RECORDS



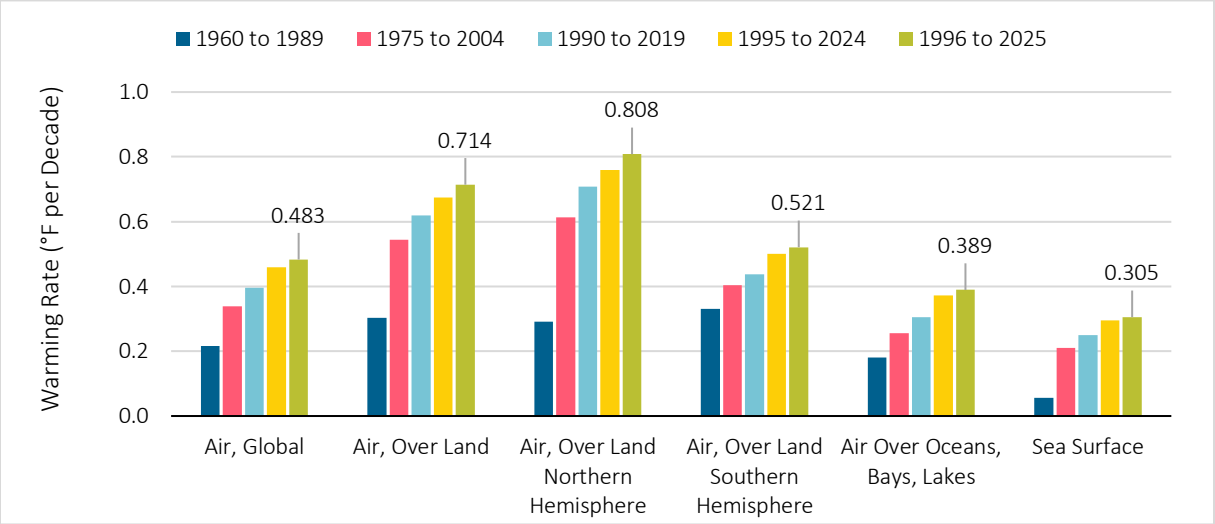
Note: January's record high occurred in 2025, while those for February and March occurred in 2024.

Copyright © 2026 Society of Actuaries Research Institute

While quarterly data provides a useful snapshot of recent conditions, a broader perspective is needed to assess underlying climate trends. To this end, this report also examines long-run temperature changes. A key metric in this analysis is the estimated temperature trend, expressed in degrees Fahrenheit per decade and calculated using linear regression over rolling 30-year periods. Thirty years is widely regarded as sufficient to smooth the effects of short-term climate variability—such as El Niño and La Niña events—that can temporarily influence global temperatures. Figure 2 summarizes estimated trends across successive 30-year periods for global-air temperature (average across Earth's entire surface), air temperature over land, and sea surface temperature. Confidence intervals associated with these results are presented in the main body of the report.

Figure 2

TEMPERATURE TRENDS ESTIMATED USING LINEAR REGRESSION ACROSS 30-YEAR PERIODS



Trend Unit = Degrees Fahrenheit Increase per Decade

Key observations from Figure 2 include:

- Estimated warming rates have increased across successive 30-year periods, consistent with an acceleration in global warming. For the most recent 30-year period, the estimated trend in global air temperature is approximately 0.48°F per decade.
- The warming rate over land exceeds that of sea surface temperature, consistent with the greater heat capacity of water (relative to air) and the vertical mixing of heat within the ocean.
- Due in part to hemispheric differences in land-ocean distribution, land areas in the Northern Hemisphere are warming at a faster rate than those in the Southern Hemisphere.

Later sections of this report show that, within the Northern Hemisphere, warming rates are strongly correlated with latitude, with the fastest warming observed in the Arctic region.

This report is accompanied by a downloadable Excel file containing the data and an interactive graph for visualizing temperature trends.

Copyright © 2026 Society of Actuaries Research Institute

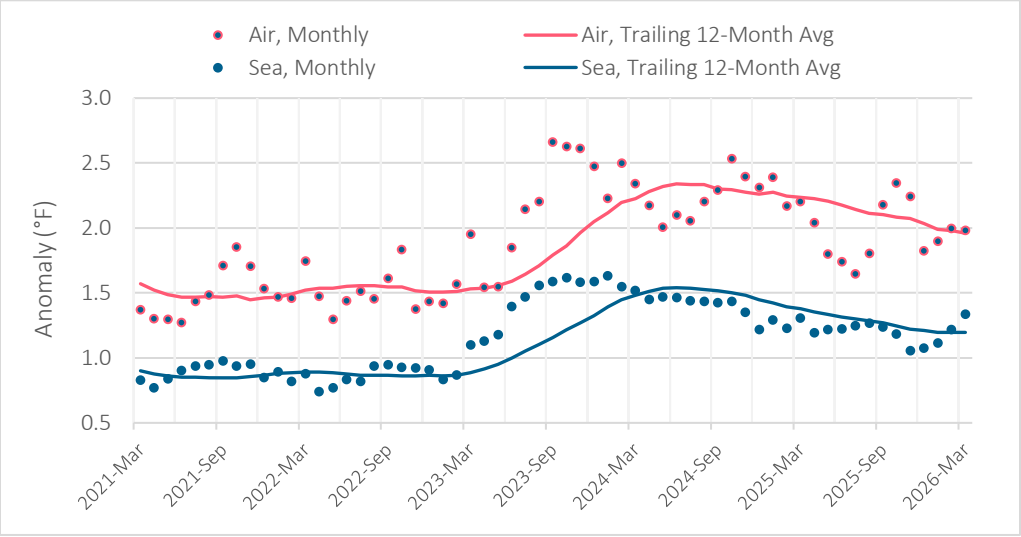
Recent Data

In climate science, temperatures defined relative to their corresponding long-term averages are referred to as "temperature anomalies." For example, using the period from 1960 to 1989 as a baseline, the anomaly for March 2026 is 1.98°F, equal to 57.09°F (the average temperature in March 2026) minus 55.11°F (the March average for the period from 1960 to 1989).

Figure 3 presents air and sea surface temperature anomalies for the most recent five years, using 1960 to 1989 as the historical reference period. The figure shows both monthly anomalies and their averages across trailing 12-month periods. To provide a sense of how the most recent five years compare to data from prior decades, Figure 4 expands the time horizon from five years to 65 years.

Figure 3

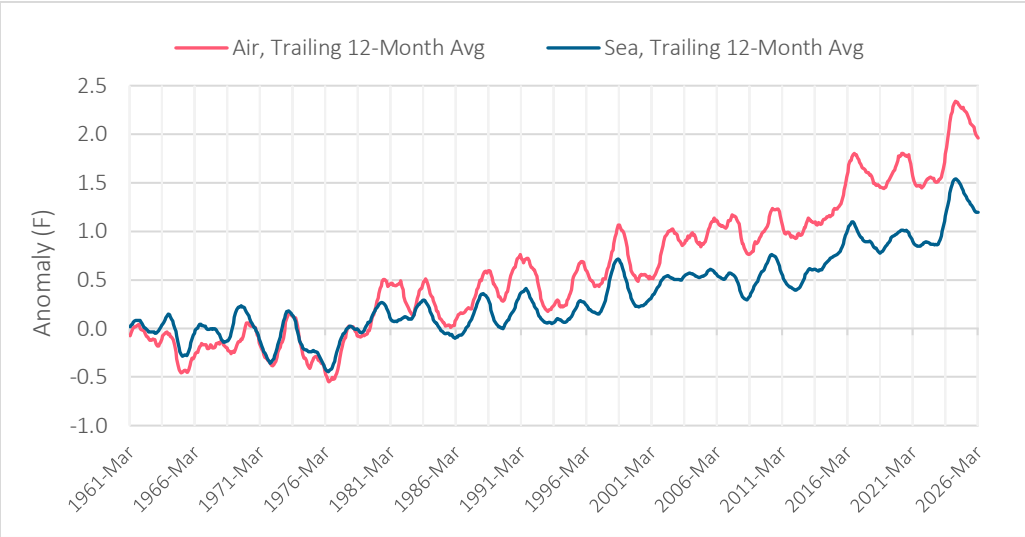
AIR AND SEA SURFACE TEMPERATURE ANOMALIES (°F) ACROSS MOST RECENT 5 YEARS



Each data represents a monthly data point. The final three data points (on the right side of graph) represent January, February and March of 2026.

Figure 4

AIR AND SEA SURFACE TEMPERATURE ANOMALIES (°F), 1961 TO 2026



Copyright © 2026 Society of Actuaries Research Institute

Key observations from these figures are as follows:

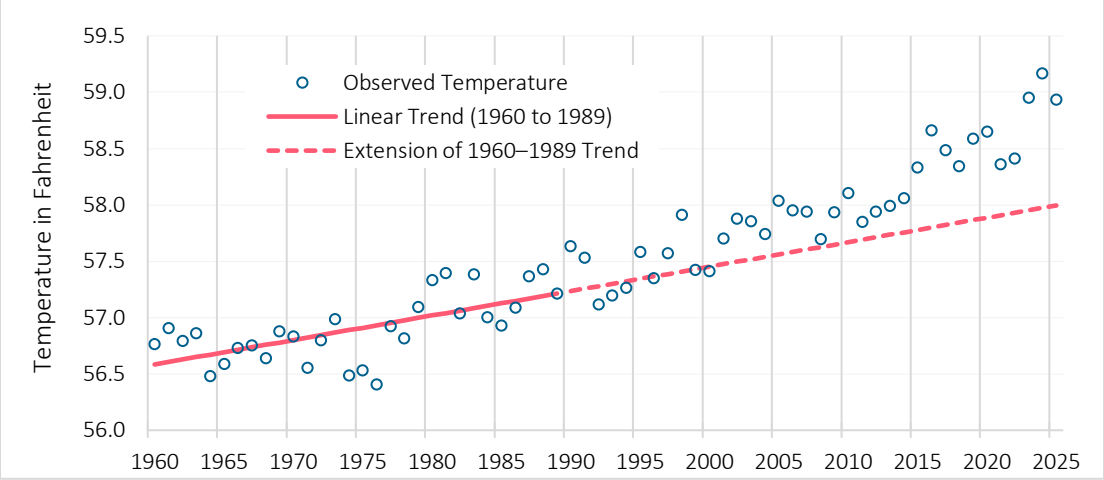
- Air temperature has increased more than sea surface temperature, relative to the historical reference period. This is expected because the ocean has a much higher heat capacity than land and air, and because heat absorbed at the sea surface is mixed into deeper ocean layers and partly offset by evaporative cooling—both of which slow the rate of sea surface warming.
- For both air temperature and sea surface temperature, the 12-month trailing average anomalies peaked in July 2024, followed by a slight easing.
- Anomalies have increased slightly across the last quarter (Jan-Mar 2026), but this uptick is not yet indicative of a meaningful upward trend.

Global Air Temperature Trends: Point Estimates and Confidence Intervals

Figure 5 shows changes in Earth's global-average air temperature over time. The overall pattern indicates a warming trend, but temperatures also rise and fall naturally from year to year. This natural variability can obscure the underlying long-term trend and make precise estimation more challenging. In addition, the rate of warming may vary over time. The solid line in Figure 5 shows the linear trend (estimated using linear regression) over 1960–1989, with the dotted extension illustrating how temperatures would have evolved if that earlier trend had continued. Observed temperatures from 2001 onward lie above this extension, providing a visual indication that warming in recent decades has been higher than expected based on the earlier trend. Because warming trends cannot be precisely quantified and may change over time, this report estimates temperature trends over successive 30-year periods and shows the associated uncertainty around each estimate (Figure 6).

Figure 5

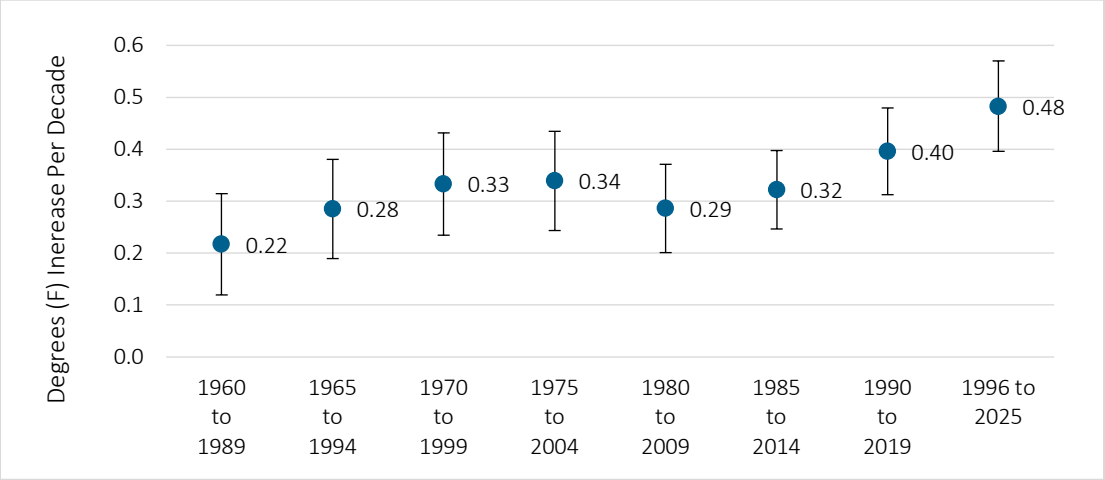
ANNUAL AVERAGE GLOBAL TEMPERATURE WITH ILLUSTRATIVE 30-YEAR TREND AND EXTENSION



Copyright © 2026 Society of Actuaries Research Institute

Figure 6

GLOBAL AIR TEMPERATURE: WARMING TREND ESTIMATES WITH 95% CONFIDENCE INTERVALS



Trend Unit = Degrees Fahrenheit Increase per Decade. The vertical bars represent 95% confidence intervals derived from linear regression, while dots indicate the corresponding point estimates.

The confidence intervals shown in Figure 6 overlap substantially. This overlap is expected because the trend estimates are based on successive 30-year periods that share many of the same underlying temperature observations. As a result, adjacent trend estimates are correlated rather than independent. Overlap among the confidence intervals should not be interpreted as evidence that warming trends are unchanged or statistically indistinguishable; instead, the estimates should be viewed collectively as describing the evolution of warming rates over time.

Air and Ocean Temperature Trends

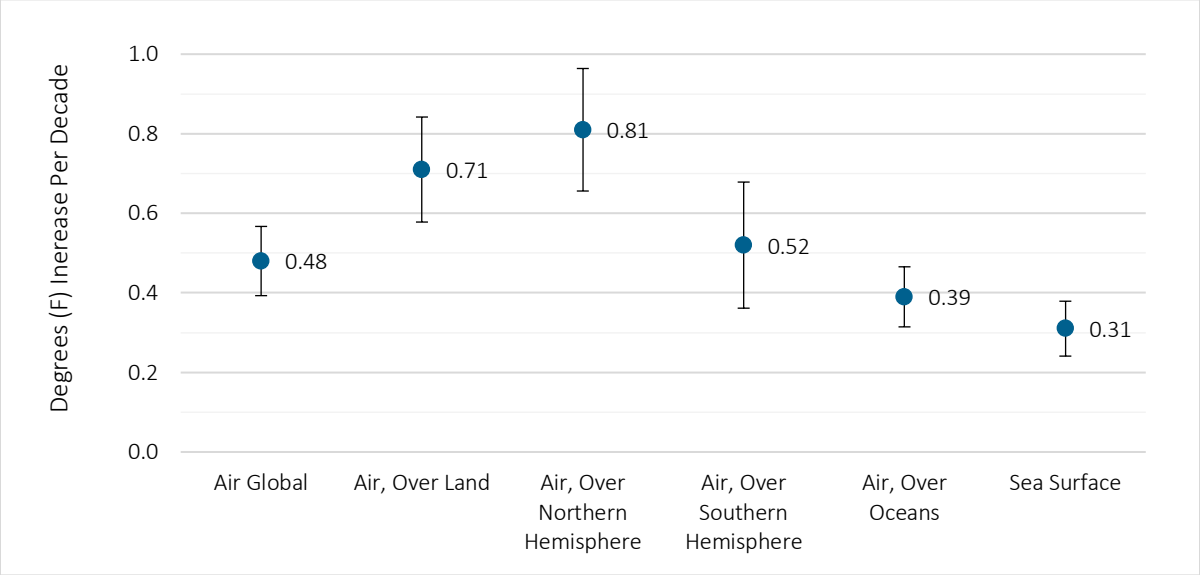
The previous section focused on average air temperature across Earth's entire surface. However, warming is not uniform across locations; some broad zones are warming more rapidly than others. For the 30-year period from 1996 to 2025, Figure 7 presents linear-regression-based temperature trend estimates for the following zones:

- Air temperature over land (representing approximately 30% of Earth's surface)
- Air temperature over land in the Northern Hemisphere (about 20% of Earth's surface)
- Air temperature over land in the Southern Hemisphere (about 10% of Earth's surface)
- Air temperature over water (oceans, seas, bays, and lakes), representing approximately 70% of Earth's surface
- Sea surface temperature

Copyright © 2026 Society of Actuaries Research Institute

Figure 7

TEMPERATURE TREND ESTIMATES AND 95% CONFIDENCE INTERVALS BY SURFACE TYPE AND REGION (1996-2025)



Trend Unit = Degrees Fahrenheit Increase per Decade. The vertical bars represent 95% confidence intervals derived from linear regression, while dots indicate the corresponding point estimates.

The results in Figure 7 indicate that average air temperature is increasing at a significantly faster rate than sea surface temperature (SST). In addition, air temperature over land is increasing at a faster rate than air temperature over water. Lastly, with respect to air temperature over land, the Northern Hemisphere is warming at a faster rate than the Southern Hemisphere.

A key reason these zones exhibit different warming rates is the fundamental difference in how land and water respond to incoming energy from the sun and changes in Earth's energy balance. Land surfaces warm more quickly than oceans because water has a much higher heat capacity and can absorb and mix heat more deeply, whereas land warms and cools more rapidly for the same energy input, which in turn drives faster warming of the air above land surfaces. Because of water's high heat capacity and vertical mixing, a greater share of incoming energy increases ocean heat content rather than surface temperature, while land's lower heat capacity leads to larger surface temperature changes for a given amount of energy. This basic thermal contrast is a robust feature of both observations and climate model simulations of global warming and contributes to the land–ocean warming contrast seen in Figure 7.

The Northern Hemisphere warms faster than the Southern Hemisphere in part because it contains a much larger fraction of land (nearly 40% of the Northern Hemisphere is land, versus less than 20% in the Southern Hemisphere). With more land area subject to the same global radiative forcing, the Northern Hemisphere exhibits a stronger averaged surface warming signal relative to the more ocean-dominated Southern Hemisphere. Studies of hemispheric temperature differences suggest that land–ocean distribution and associated climate feedbacks are among the factors that influence this asymmetry in warming trends.

Copyright © 2026 Society of Actuaries Research Institute

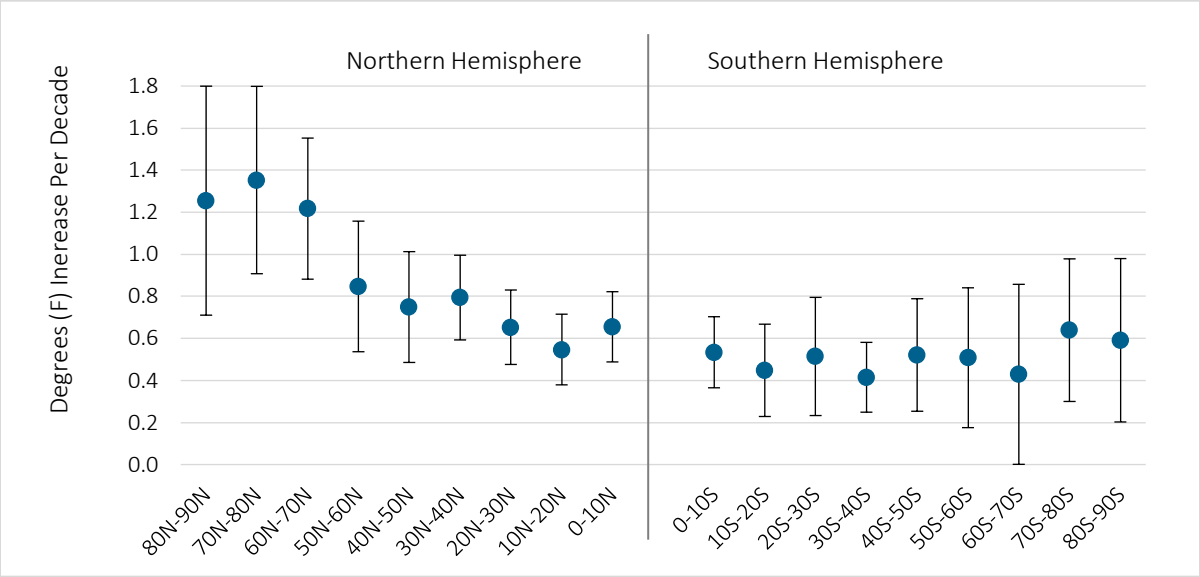
Air Temperature Trends for Land Areas, by Latitude

As discussed in the prior section of the report, the Northern Hemisphere is warming at a faster rate than the Southern Hemisphere. To examine more closely the relationship between latitude and the rate of warming, this analysis partitions the Earth's land surface into 10-degree latitude bands. The first band covers latitudes from 80°N to 90°N, the second from 70°N to 80°N, and so on, resulting in nine latitude bands in each hemisphere. For each latitude band, a linear regression was applied to estimate the band's average air temperature (over land areas) from 1996 to 2025; results are shown in Figure 8.

Figure 8

TEMPERATURE TREND ESTIMATES AND 95% CONFIDENCE INTERVALS FOR LAND AREAS, BY LATITUDE BAND (1996-2025)

(Trend Unit = Degrees Fahrenheit Increase per Decade)



Trend Unit = Degrees Fahrenheit Increase per Decade. The vertical bars represent 95% confidence intervals derived from linear regression, while dots indicate the corresponding point estimates.

Figure 8 reveals a strong gradient in warming rates across the Northern Hemisphere, with the northernmost latitudes warming more rapidly than the mid-latitudes, and the mid-latitudes warming more rapidly than areas near the equator. By contrast, differences in warming rates across latitude bands in the Southern Hemisphere are less pronounced.

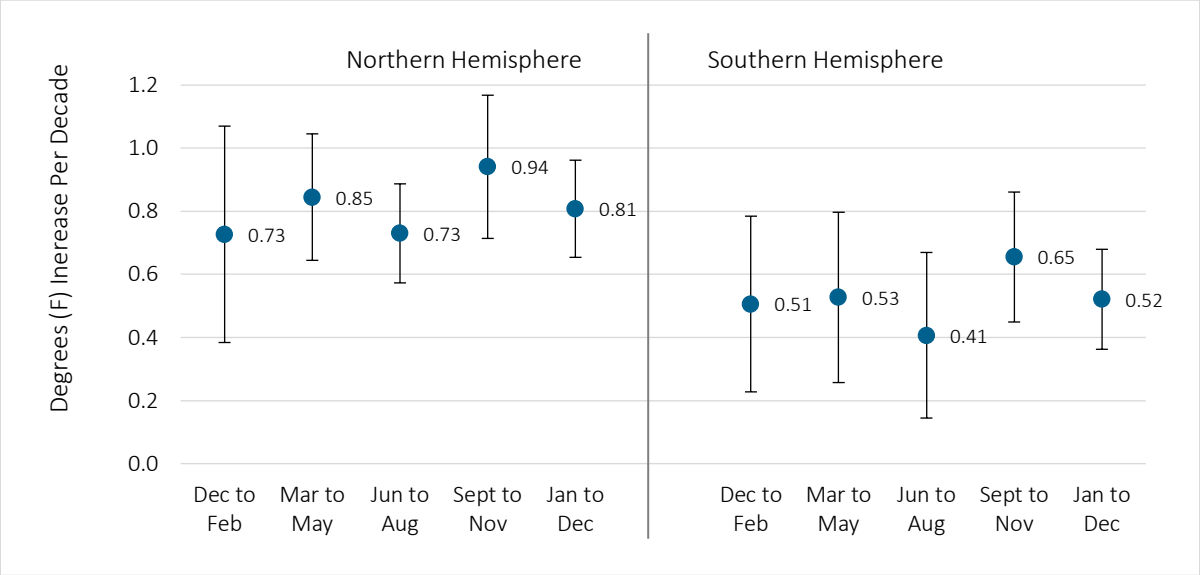
Air Temperature Trends for Land Areas, by Season

The prior sections of this report presented temperature trends estimated from annual time series in which each observation reflects temperature averaged across all 12 calendar months. However, seasonal differences may exist in warming rates. To investigate this possibility, the underlying monthly data were compiled into seasonal time series with each observation equal to the temperature averaged across a three-month period. Seasons were defined as follows: December to February, March to May, June to August, and September to November. Separate seasonal time series for 1996 to 2025 were compiled for the Northern and Southern Hemispheres, and only land areas were included. Each seasonal time series was analyzed using linear regression, and the results are shown in Figure 9.

Copyright © 2026 Society of Actuaries Research Institute

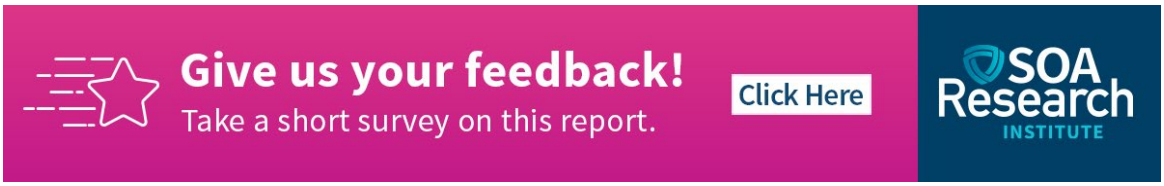
Figure 9

TEMPERATURE TREND ESTIMATES AND 95% CONFIDENCE INTERVALS FOR LAND AREAS, BY SEASON (1996–2025)



Trend Unit = Degrees Fahrenheit Increase per Decade. The vertical bars represent 95% confidence intervals derived from linear regression, while dots indicate the corresponding point estimates.

Figure 9 shows that seasonal land temperature warming rates vary across the year in both hemispheres, with higher estimated trends observed during late-year and spring seasons. Across all seasons, warming rates are consistently higher in the Northern Hemisphere than in the Southern Hemisphere, and this hemispheric difference is evident in both the central estimates and their associated confidence intervals. While estimated warming rates vary across seasons, the associated confidence intervals overlap, indicating that seasonal differences should be interpreted as descriptive patterns rather than statistically distinct estimates.



Copyright © 2026 Society of Actuaries Research Institute

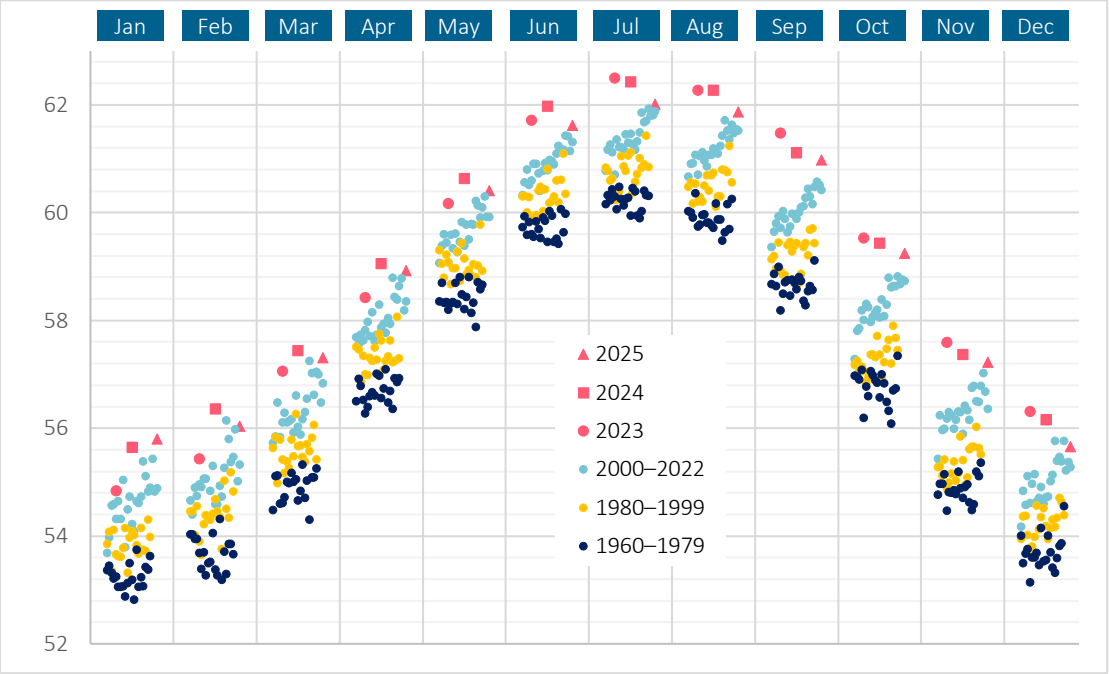
Appendix

GLOBAL AVERAGE MONTHLY AIR TEMPERATURE

Figure A1 is provided for context, illustrating the seasonal variability present in the underlying temperature data.

Figure A1

GLOBAL-AVERAGE AIR TEMPERATURE (°F) BY MONTH



In 2023 and 2024, record-high global temperatures occurred in 13 consecutive months. In 2025, global-average air temperature was slightly below its prior record-highs.

It is useful to briefly describe the seasonal cycle in global-average air temperature illustrated in Figure A1. At first glance, this seasonality may appear counterintuitive, as the Earth receives approximately the same total amount of solar energy each day over the course of a year. When the Northern Hemisphere experiences fall and winter, the Southern Hemisphere experiences spring and summer, and vice versa, suggesting that seasonal changes in one hemisphere should be offset by opposing changes in the other. However, because the Northern Hemisphere contains more than two-thirds of the Earth's land mas (and because land heats and cools more rapidly than water), global-average air temperature reflects a strong imprint of the Northern Hemisphere's seasonal temperature cycle.

SPATIAL AVERAGING AND LATITUDE WEIGHTING

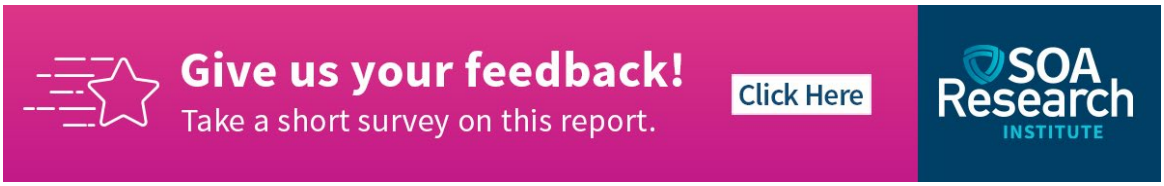
For this report, global air temperature was calculated by averaging data across Earth's entire surface. To calculate average sea surface temperature, latitudes north of 60°N and south of 60°S were excluded—a convention commonly used in climate analyses. This approach focuses on the open ocean and provides a more stable representation of long-term warming trends.

ERA5 grid points are evenly spaced with respect to degrees of latitude and longitude, but they are not evenly spaced when measured in miles or kilometers. As one approaches the poles, lines of longitude converge, reducing the distance between grid points. Consequently, an unweighted global average across grid points would result in the overweighting of data near the North and South Poles.

The standard remedy used by climate scientists—and the approach used for the analysis presented in this report—is to weight each data point by the cosine of its latitude. At the equator, the resulting weight is 1.0; at 45 degrees

Copyright © 2026 Society of Actuaries Research Institute

north or south, the weight is approximately 0.71; at 60 degrees north or south, the weight is 0.50, declining toward zero as latitude approaches either pole. This decline counterbalances the increasing density of grid points at high latitudes, resulting in an even spatial weighting across the surface of the Earth.



Copyright © 2026 Society of Actuaries Research Institute

About The Society of Actuaries Research Institute

Serving as the research arm of the Society of Actuaries (SOA), the SOA Research Institute provides objective, data-driven research bringing together tried and true practices and future-focused approaches to address societal challenges and your business needs. The Institute provides trusted knowledge, extensive experience and new technologies to help effectively identify, predict and manage risks.

Representing the thousands of actuaries who help conduct critical research, the SOA Research Institute provides clarity and solutions on risks and societal challenges. The Institute connects actuaries, academics, employers, the insurance industry, regulators, research partners, foundations and research institutions, sponsors, and non-governmental organizations, building an effective network which provides support, knowledge, and expertise regarding the management of risk to benefit the industry and the public.

Managed by experienced actuaries and research experts from a broad range of industries, the SOA Research Institute creates, funds, develops and distributes research to elevate actuaries as leaders in measuring and managing risk. These efforts include studies, essay collections, webcasts, research papers, survey reports, and original research on topics impacting society.

Harnessing its peer-reviewed research, leading-edge technologies, new data tools and innovative practices, the Institute seeks to understand the underlying causes of risk and the possible outcomes. The Institute develops objective research spanning a variety of topics with its strategic research programs: aging and retirement; actuarial innovation and technology; mortality and longevity; diversity, equity and inclusion; health care cost trends; and catastrophe and climate risk. The Institute has a large volume of topical research available, including an expanding collection of international and market-specific research, experience studies, models and timely research.

Society of Actuaries Research Institute
8770 W Bryn Mawr Ave, Suite 1000
Chicago, Illinois 60631
www.SOA.org

Copyright © 2026 Society of Actuaries Research Institute