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Global Temperature Report: August 2023

Global climate trend since Dec. 1 1978: +0.14 C per decade [see note at end]

August Temperatures (preliminary)

Global composite temp: +0.69 C (+1.24°F) above the seasonal average

Northern Hemisphere: +0.88 C (+1.58°F) above seasonal average

Southern Hemisphere: +0.51 C (+0.92°F) above seasonal average

Tropics: +0.86 C (+1.55°F) above seasonal average

July Temperatures (Final)

Global composite temp: +0.64 C (+1.15°F) above the seasonal average

Northern Hemisphere: +0.73 C (+1.31°F) above seasonal average

Southern Hemisphere: +0.58 C (+1.00°F) above seasonal average

Tropics: +0.87 C (+1.57°F) above seasonal average

Notes on data released September 5, 2023 (v6.0, with 1991-2020 reference base)

[Please note that we provide these data out of our own initiative, and are only able to produce these updates at times convenient to our working schedules.]

The global atmospheric temperature anomaly increased slightly in August to +0.69°C (+1.24°F) above the 30-year average. As was the case in July, this was the warmest August in the 45 years of satellite observations and was, for all practical purposes, tied with February 2016 (+0.71°C, 1.28°F)* as the warmest departure from average. The tropics continue to remain warm with an anomaly of +0.86°C (+1.55°F), which was essentially the same as July's +0.87°C (+1.57°F).

As discussed last month, this past July was the warmest global "absolute" monthly temperature (since July is already on average the hottest month each year) with a temperature 266.06 K. Because August is on average a little cooler than July, the absolute temperature this month was a little cooler too at 265.92 K even though the anomaly was larger (+0.69 K vs. +0.64 K). The continued warmer atmospheric temperatures are expected with the ongoing El Niño event through at least the boreal winter in 2024 since the tropical Pacific seawater temperatures are still warm.

Part of the exceptional warming during the last two months was likely due to the loss of heat content from the tropical Pacific Ocean between mid-June and late-July. A portion of that heat-loss was likely fluxed into the atmosphere, causing the substantial warming in these two months, leading to their warmest values in the 45 years of record. Despite this heat loss, there is still a significant El Niño affecting the Tropical Pacific waters. See NOAA's El Niño updates here https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf.

As mentioned last month, along with the natural warming of the current El Niño event, we are analyzing the potential (and natural) warming impacts of the 2022 eruption of the Hunga Tonga submarine volcano and its injection of water vapor into the stratosphere. Normally, a major tropical eruption would send large amounts of gasses such as sulfur dioxide up that high which form sun-reflecting aerosols leading to a cooling of the Earth's lower atmosphere. However, the Hunga Tonga submarine volcano eruption injected large amounts of water vapor into the stratosphere which may be overriding any aerosol cooling effects and lead to a net warming of the atmosphere. At this point, it appears this influence will be minor, perhaps a few hundredths of degree.

The planet's warmest spot in June occurred over the Barents Sea poleward of the NW Russian mainland at +4.5 °C (+8.1 °F). Warmer than average conditions spread southward from there to the Black Sea and southeastward to Japan. West central South America was warm as were the far southeast Atlantic Ocean, southern Australia and western Canada.

With a reading of -4.6°C (-8.3°F), the coolest departure from average could be found over Marie Byrd Land in West Antarctica while a similarly cool region appeared over East Antarctica. Other cooler than average temperature were few and far between; northern and southeast Pacific Ocean, the Canadian Maritimes and Kazakhstan fell into this category.

The conterminous US was much above average at +0.94°C (+1.69°F), lead by heat in the southcentral states, but still quite short of the hottest August value of +1.41 °C (+2.54 °F) in 1995. Alaska was even warmer than the lower 48, so with Alaska, the 49-state average was +1.01°C (+1.82°F). [We don't include Hawaii in the US results because its land area is less than that of one satellite grid square, so it would have virtually no impact on the overall national results.]

A note about the global temperature trend. For several years now, the trend has been extremely close to +0.135 °C/decade. This past July, the threshold of 0.135 was crossed at +0.1352 °C/decade. The global trend is now +0.14 °C/decade by rounding up.

*In the July 2023 GTR we reported the February 2016 anomaly as +0.70 °C. As the intercalibrations between satellites are recalculated with each month's new data, there is the possibility of tiny changes in the base annual cycle (< 0.01 °C), and thus the anomalies calculated therefrom. This is the reason for the February 2016 value being +0.71 °C this month.

Background notes.

New Reference Base Jan 2021 and forward. As noted in the Jan 2021 GTR, the situation comes around every 10 years when the reference period or "30-year normal" that we use to calculate the departures is redefined. With that, we have averaged the absolute temperatures over the period 1991-2020, in accordance with the World Meteorological Organization's guidelines, and use this as the new base period. This allows the anomalies to relate more closely to the experience of the average person, i.e. the climate of the last 30 years. Due to the rising trend of global and regional temperatures, the new normals are a little warmer than before, i.e. the global average temperature for Januaries for 1991-2020 is 0.14 °C warmer than the average for Januaries during 1981-2010. So, the new departures from this now warmer average will appear to be cooler, but this is an artifact of simply applying a new base period. It is important to remember that changes over time periods, such as a trend value or the relative difference of one year to the next, will not change. Think about it this way, all we've done is to take the *entire* time series and shifted it down a little.

To-Do List: There has been a delay in our ability to utilize and merge the new generation of microwave sensors (ATMS) on the NPP and JPSS satellites. As of now, the calibration equations applied by the agency have changed at least twice, so that the data stream contains inhomogeneities which obviously impact the type of measurements we seek. We are hoping this is resolved soon with a dataset that is built with a single, consistent set of calibration equations. In addition, the current non-drifting satellite operated by the Europeans, MetOP-B, has not yet been adjusted or "neutralized" for its seasonal peculiarities related to its unique equatorial crossing time (0930). While these MetOP-B peculiarities do not affect the long-term global trend, they do introduce error within a particular year in specific locations over land.

As part of an ongoing joint project between UAH, NOAA and NASA, Christy and Dr. Roy Spencer, an ESSC principal scientist, use data gathered by advanced microwave sounding units on NOAA, NASA and European satellites to produce temperature readings for almost all regions of the Earth. This includes remote desert, ocean and rain forest areas where reliable climate data are not otherwise available. Drs. Danny Braswell and Rob Junod assist in the preparation of these reports.

The satellite-based instruments measure the temperature of the atmosphere from the surface up to an altitude of about eight kilometers above sea level. Once the monthly temperature data are collected and processed, they are placed in a "public" computer file for immediate access by atmospheric scientists in the U.S. and abroad.

The complete version 6 lower troposphere dataset is available here:

http://www.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt

Archived color maps of local temperature anomalies are available on-line at:

http://nsstc.uah.edu/climate/

Neither Christy nor Spencer receives any research support or funding from oil, coal or industrial companies or organizations, or from any private or special interest groups. All of their climate research funding comes from federal and state grants or contracts.

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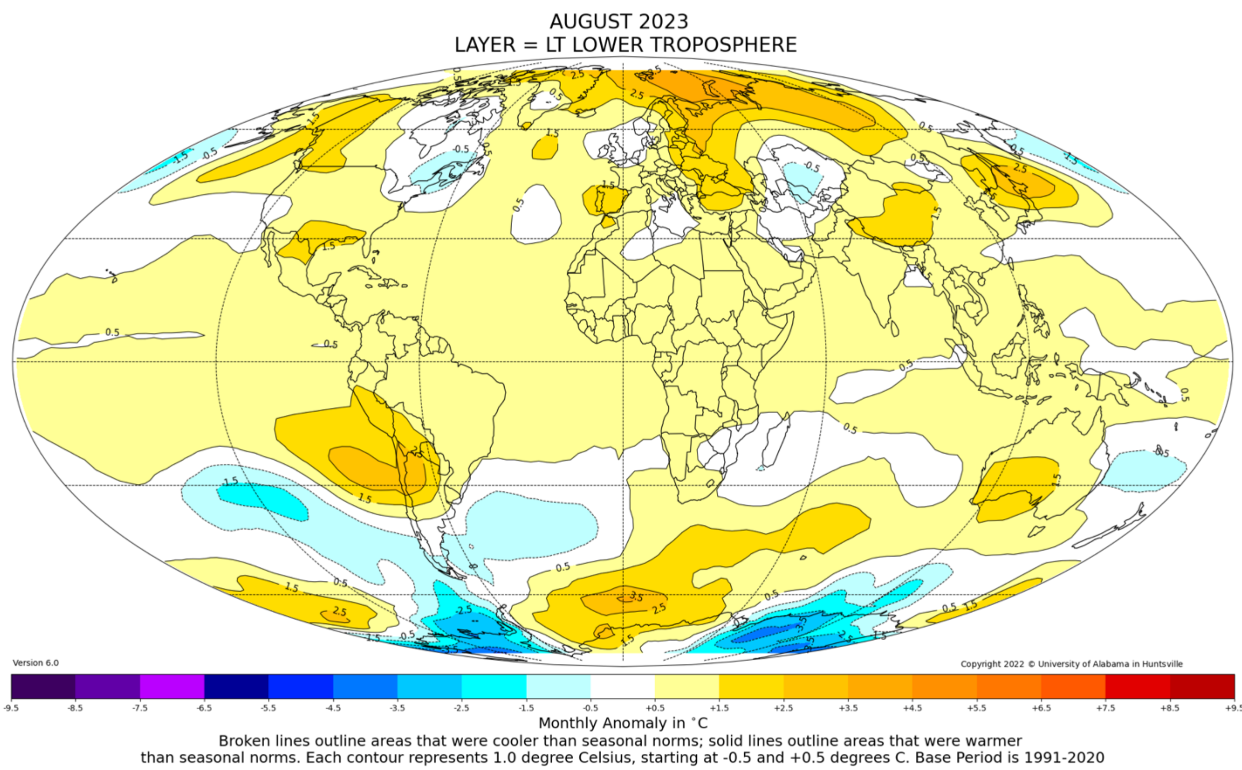

Figure. Lower tropospheric temperature anomalies for August 2023

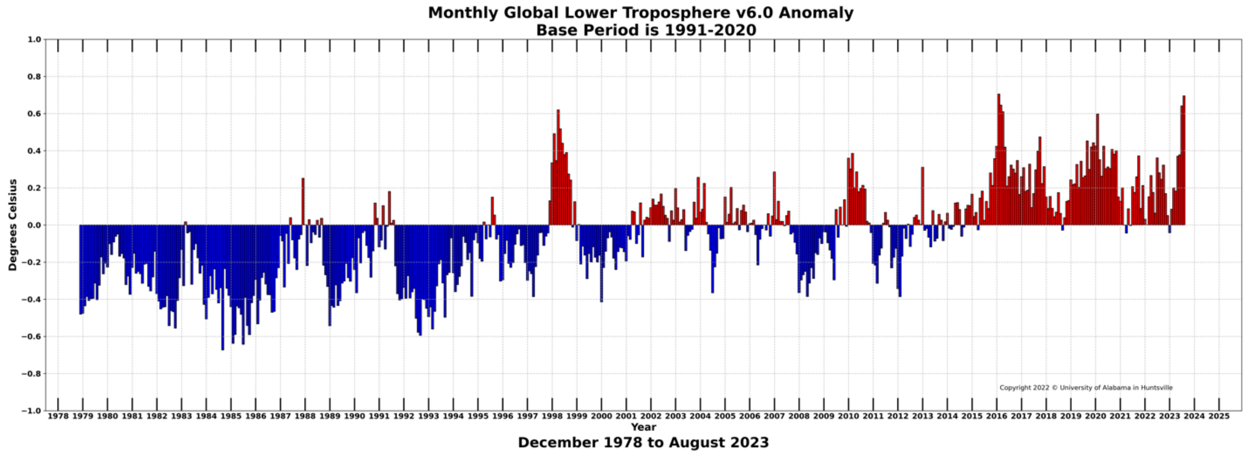

Figure. Bar chart of global monthly lower tropospheric temperature anomalies.