03 August 2023

Vol. 34, No. 4

For Additional Information:
Dr. John Christy, (256) 961-7763
christy@nsstc.uah.edu
Dr. Roy Spencer, (256) 961-7960
spencer@nsstc.uah.edu

Global Temperature Report: July 2023

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

July Temperatures (preliminary)

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

June Temperatures (final)

Global composite temp: +0.38 C (+0.68°F) above the seasonal average

Northern Hemisphere: +0.47 C (+0.84°F) above seasonal average

Southern Hemisphere: +0.29 C (+0.52°F) above seasonal average

Tropics: +0.55 C (+0.99°F) above seasonal average

Notes on data released August 1, 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 quite a bit in July to +0.64°C (+1.15°F) above the 30-year average. The tropics continue to warm up from the ongoing El Niño with the atmospheric temperature anomaly increasing there from -0.03°C (April) to 0.87°C (July).

As discussed in last month's report, this July had the potential to record the warmest global "absolute" monthly temperature (since July is already on average the hottest month each year). Sure enough, this July set the global "absolute" temperature record at 266.06 K in the 45 years of satellite data, overtaking the previous record of 265.80 K in July 1998. However, this July did not reach the warmest monthly anomaly on record; that record is held by February 2016 with +0.70°C during the last El Niño event. July 2023 is essentially tied with March 2016 and February 1998 as the 2nd warmest monthly anomaly. 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 warming.

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 to that altitude which may be overriding any aerosol cooling effects and lead to a net warming of the atmosphere. These natural warming effects, which come and go somewhat irregularly, add to the warming influence of the gradually increasing greenhouse gas concentrations.

The planet's warmest spot in June occurred over Wilkes Land in East Antarctica with a departure from average of +4.2°C (+7.5°F). Warmer than average temperatures were felt over the Labrador Sea, Alaska, Northwest Canada, the SW United States, Mexico, areas around Chile, southern Europe, Kazakhstan, central Russia, SW Australia, and regions in the Southern Ocean.

With a reading of -2.6°C (-4.6°F), the coolest departure from average could be found over the Ross Sea, off the coast of Antarctica. Other cool regions were observed over Northern Europe, central Canada, and off the southern coast of Chile.

The conterminous US was above average in the SW, NE, and parts of the SE with an overall average for the 48-states of +0.53°C (+0.95°F). Alaska was even warmer than the lower 48, so with Alaska, the 49-state average was +0.68°C (+1.22°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.

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.

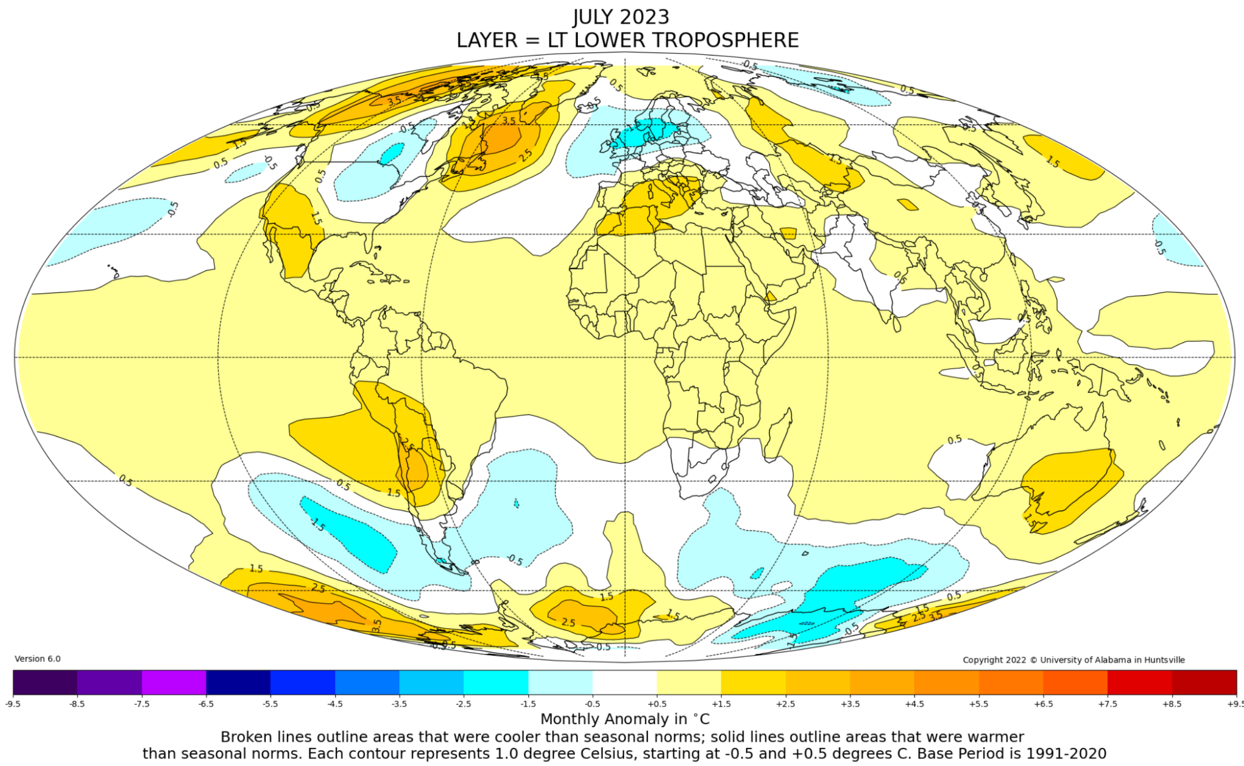

Figure. Lower tropospheric temperature anomalies for July 2023

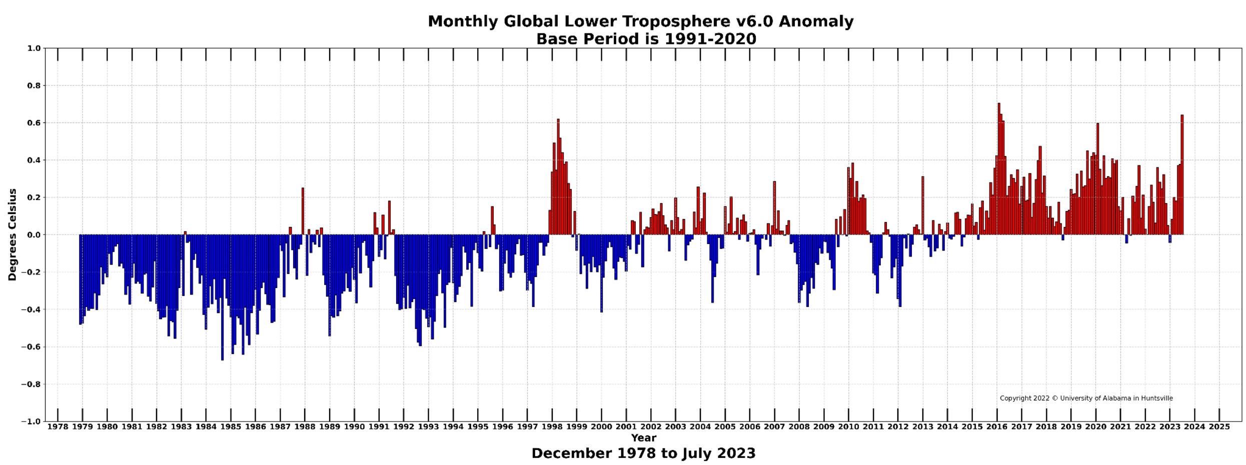

Figure. Bar chart of global monthly lower tropospheric temperature anomalies.