10 July 2023

Vol. 34, No. 3

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Global Temperature Report: June 2023

Global climate trend since Dec. 1 1978: +0.13 C per decade* [see note at end]

Jun Temperatures (preliminary)

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

Northern Hemisphere: +0.47 C (+0.85°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

May Temperatures (final)

Global composite temp: +0.37 C (+0.67°F) above the seasonal average

Northern Hemisphere: +0.30 C (+0.54°F) above seasonal average

Southern Hemisphere: +0.44 C (+0.79°F) above seasonal average

Tropics: +0.39 C (+0.68°F) above seasonal average

Notes on data released July 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 in June was essentially unchanged from May as the southern hemisphere cooled as much as the northern hemisphere warmed. In the tropics however, the June departure from average jumped again, this time by +0.16 C from May's +0.39 C to +0.55 C (+0.99 F). While month-to-month shifts in the tropics have a large

natural variability component, this rise is consistent with the El Niño or warm tropical Pacific conditions that began a few months ago.

To repeat last month's discussion, what is unusual is that this jump occurred at this time of year rather than during northern winter, though this is not unprecedented. Since the global atmosphere is naturally warmest in NH summer, one of the next couple of months could produce the warmest "absolute" temperature we've measured by satellite. At present the warmest absolute monthly temperature was 265.80 K in July 1998. The current month's temperature for June 2023 is 265.48 K with July coming up with a "normal" temperature of 265.42 K. So, if the July anomaly is greater than +0.38 K (i.e. tying the June 2023 anomaly and which when added to 265.42 K gives 265.80 K) then we will have a record warm global absolute monthly temperature.

The atmosphere takes about 2 to 5 months to reflect major changes induced by the tropical sea water temperatures, so we can expect generally rising air temperature anomalies from now through the boreal winter in 2024 since the tropical Pacific sea water temperatures are still warming. It will be fascinating to see if this El Niño steps out of convention and peaks at a different time of the calendar year than is typical.

As indicated, the Pacific tropical sea temperatures are expected to warm more as NOAA has declared an El Niño Advisory (upgraded from a "Watch"), indicating high confidence that a warm phase tropical Pacific event is occurring. The latest on the evolution of the El Niño and its anticipated evolution over the next year is provided by NOAA here: https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf.

The planet's warmest spot in June occurred over northern Ontario Canada with a departure from average of +3.4 °C (+6.2 °F). Warmer than average temperatures were felt over northern Europe, far eastern Russia, Mexico, Kyrgyzstan, Chile and westward, and regions in the southern oceans.

With a reading of -3.0 °C (-5.3 °F) the coolest departure from average could be found over the southeastern Pacific west of Chile. Other cool regions were found over the southwestern and northeastern US, NW Russia, western Australia and northeast of New Zealand.

The conterminous US was below average in the SW and NE with an overall average for the 48-states of -0.36 °C (-0.65 °F). Alaska was just as cool as the lower 48, so that with Alaska, the 49-state average was also -0.36°C (-0.65°F). [We don't include Hawaii in the US results because its land area is less than that of a 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 (it's at +0.1341 now). In all likelihood we will see that threshold between 0.134 and 0.135 crossed soon, and we shall indicate the global trend is +0.14 °C/decade by rounding up. In truth, the shift will be very slight.

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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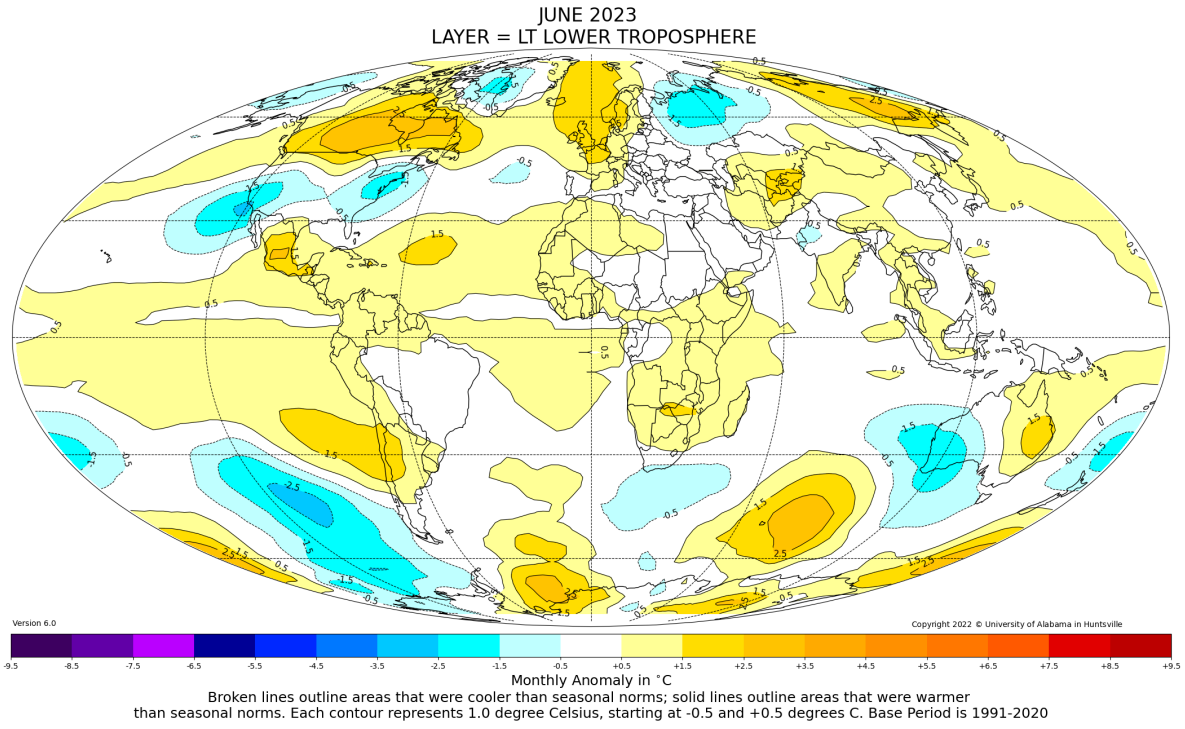

Figure. Lower tropospheric temperature anomalies for June 2023

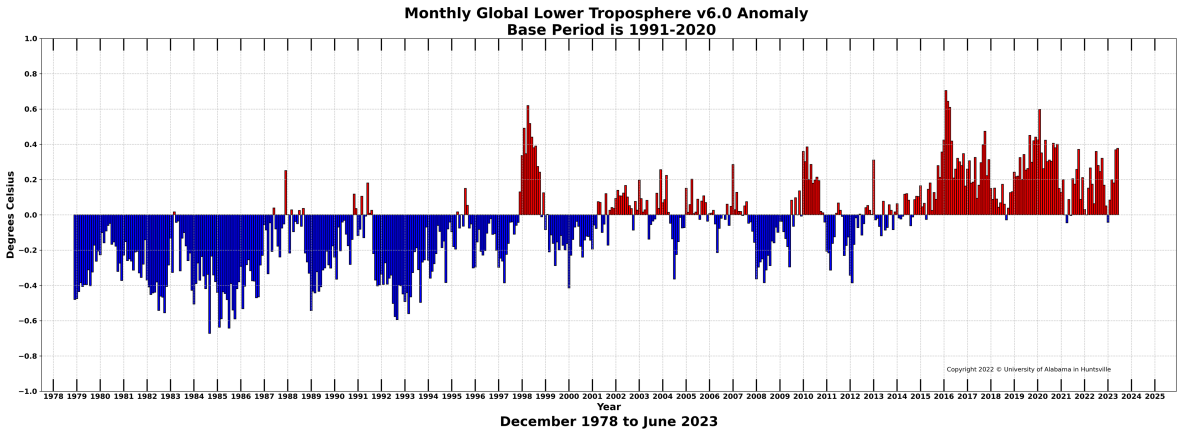

Figure. Bar chart of global monthly lower tropospheric temperature anomalies.