

Fig. 1. Monthly global temperature anomalies relative to 1880-1920 average.

May 2021 Global Temperature Update

14 June 2021

James Hansen and Makiko Sato

Global temperature in May was $+1.07^{\circ}\text{C}$ (relative to the 1880-1920 base period, which is a best estimate of preindustrial temperature). The temperature was well below a year earlier (Fig. 1), as expected due to the La Nina that peaked in November 2020. Global temperature anomalies are correlated with ENSO (El Nino Southern Oscillation), with global temperature lagging the Nino 3.4 index by 5 months on average (Fig. 1 in our [April 2021 Temperature Update](#)).

The 12-month running-mean global temperature (blue line in Fig. 2) at $+1.13^{\circ}\text{C}$ is now near the 1970-2015 trend line. This 12-month mean should continue to fall during the next six months, reaching a minimum in November, as discussed in the April 2021 Temperature update.

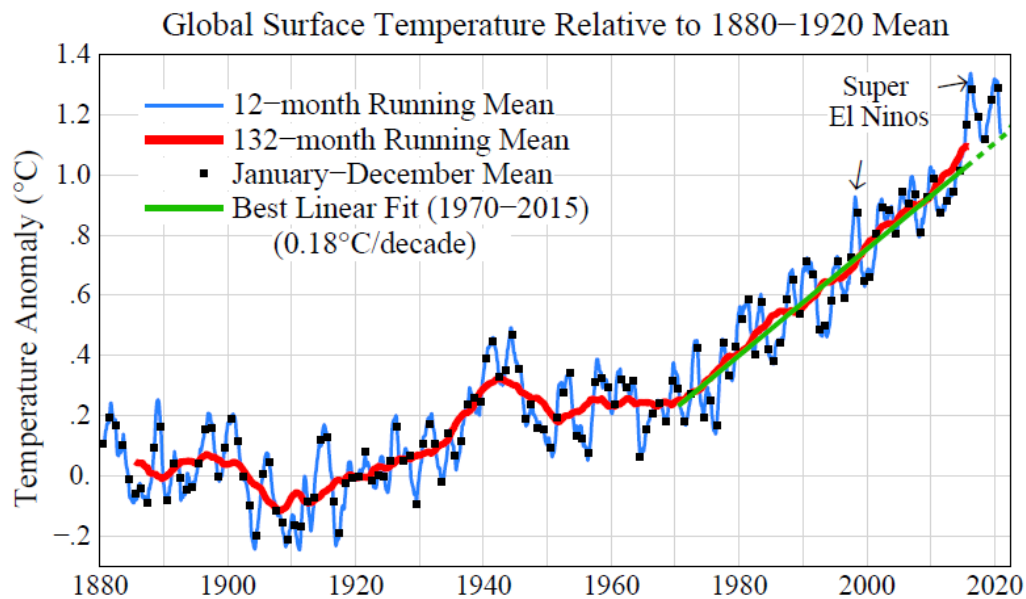


Fig. 2. Global surface temperature relative to 1880-1920 average.

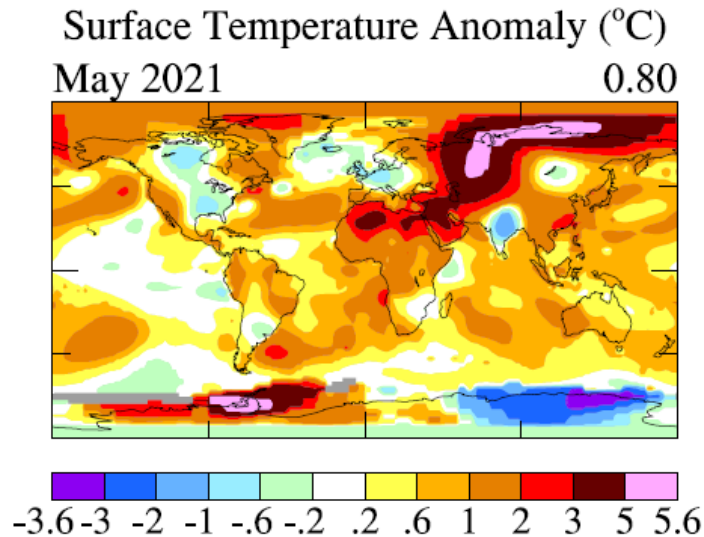


Fig. 3. May 2021 surface temperature anomaly relative to the 1951-1980 base period.

On the longer run, global temperature will increase in response to the present large planetary energy imbalance (absorbed solar energy exceeds thermal emission to space by about $+1 \text{ W/m}^2$)¹ and the continuing growth of human-made greenhouse gases. In addition, solar irradiance reached the minimum of the present solar cycle during 2019, so for about the next six years solar irradiance will add a small positive (warming) forcing (global temperature response to solar cycle forcing lags the solar cycle by 1-2 years due to the climate system's thermal inertia).

Global temperature should reach about $+1.5^\circ\text{C}$ in conjunction with the next El Nino.

Local monthly temperature anomalies routinely exceed global mean warming. Much of North America, Western Europe, India and Eastern Antarctica experienced negative temperature anomalies in May relative to the 1951-1980 average (Fig. 3). The largest positive anomalies were in Central Asia, the Arctic and Western Antarctica.

¹ von Schuckmann, K., et al.: [Heat stored in the Earth system: where does the energy go?](#), *Earth System Science Data* **12**, 2013-2041, 2020.