

NASA -- warming driven by humans, not sun

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A new NASA study shows that even during a time of minimal energy from the sun, planet Earth continued to retain more solar radiation than it emitted back into space.

It's a powerful addition to an already strong body of evidence pointing to human greenhouse-gas emissions as the main driver of global warming.

Researchers led by James Hansen, director of NASA's Goddard Institute for Space Studies, used data from thousands of free-floating instruments scattered across Earth's oceans to make some of the most precise calculations to date of the planet's "energy imbalance."

The total amount of energy from the sun that strikes the top of the Earth's atmosphere measurably declines during the "solar minimum," a cyclical drop in solar activity, occurring about every 11 years, that is caused by shifts in the sun's magnetic field.

Between 2005 and 2010, the solar minimum, typically lasting no more than year, continued for two years longer than normal — the longest solar minimum to be seen since the advent of orbital satellites.

But Earth, the NASA team showed, held on to more energy than it released during the six-year period — in fact, half a watt more per square meter of the top of the atmosphere.

The imbalance, 0.58 watts per square meter, is more than twice the 0.25-watt reduction in energy that is the difference between solar minimum and solar maximum.

Some climate-change critics contend that the sharp upward trend in global average temperature over decades is due to solar activity, not to the release of carbon dioxide and other greenhouse gases, which help prevent heat from solar energy from escaping.

If so, some guessed, temperatures might drop during an extended solar minimum.

But in a statement released by NASA, Hansen said the new finding "provides unequivocal evidence that the sun is not the dominant driver of global warming."

"The extended solar minimum is keeping the sun at a low level," said UC Irvine Professor Michael Prather, a specialist in climate-modeling who was not involved in Hansen's study. "Without having that burst of warmth, we're still pumping heat into the ocean at the rate we were before. The temperature is not suddenly dropping."

The new assessment of the energy imbalance is a bit lower than earlier estimates, which might mean adjustments will be needed for computer models of climate, NASA said.

It suggests that most models could be overestimating the mixing of heat into the oceans, and underestimating the effects of tiny particles known as aerosols, which can sometimes help cool the atmosphere.

The study was published last month in *Atmospheric Chemistry and Physics*, an open-access science journal.