



## **IEAGHG Information Paper: 2017-IP3; Has Global Warming Slowed Over the Last Decade or Not?**

A new debate has started in the scientific literature regarding the rate of warming that has occurred over the first 15 years of this century.

The Intergovernmental Panel on Climate Change (IPCC) in its Fifth Assessment Report<sup>1</sup> introduced the concept that global surface temperature “has shown a much smaller increasing linear trend over the past 15 years [1998–2012] than over the past 30 to 60 years.” The more recent trend was “estimated to be around one-third to one-half of the trend over 1951–2012.” The apparent slowdown was termed a “hiatus”.

However important aspects of the “hiatus” related to observational biases in global surface temperature data have not been well researched it seems. Scientists from the National Oceanographic and Atmospheric Administration (NOAA) of the USA have raised concerns that, residual data biases in the modern era could well have muted recent warming, and as stated by IPCC, the trend period itself was short and commenced with a strong El Niño in 1998.

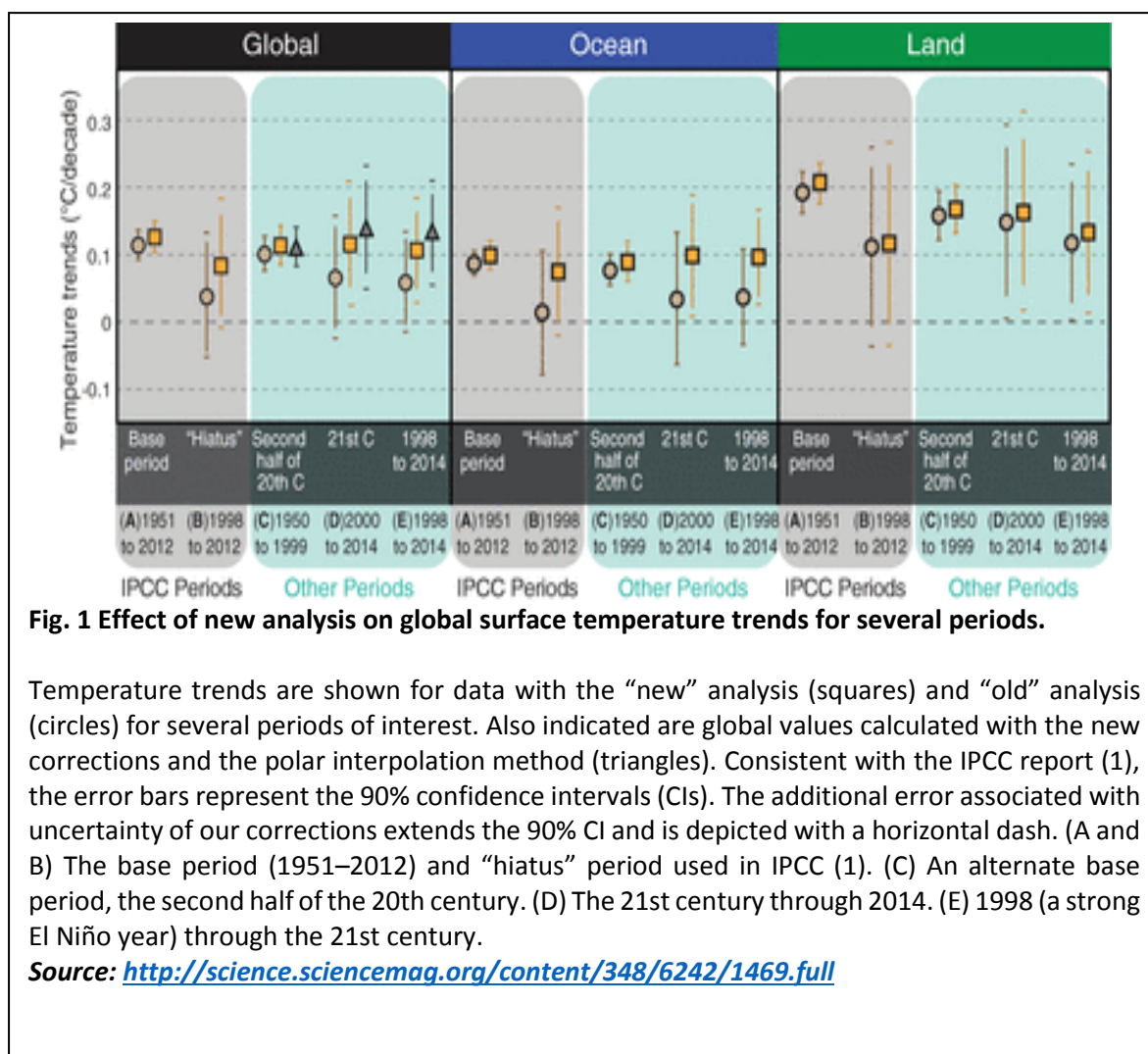
As a result, the NOAA scientists revisited the global data records and their research was published in the *Journal Science* in June 2015<sup>2</sup>. In their research they suggest that the temperatures of the oceans were being consistently underestimated by the main global climate models. In the 1990s, ship measurements made up the vast majority of the data, whereas now the more accurate and consistent buoys account for 85% of measurements. The ocean buoys now used to measure sea temperatures tend to report slightly cooler temperatures than the older ship-based systems. They also list a series of improvements in ocean temperature that have taken place in the last decade. In addition, since the IPCC report, new analyses have revealed that incomplete coverage over the Arctic has led to an underestimate of recent (since 1997) warming in the Hadley Centre/Climate Research Unit data used in the IPCC report). They surmise that the incomplete Arctic coverage also affects the trends in the analysis as reported by IPCC in AR5.

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<sup>1</sup>Climate Change 2013: The Physical Science Basis see <http://www.ipcc.ch/report/ar5/wg1/>

<sup>2</sup><http://science.sciencemag.org/content/348/6242/1469.full>

The results of their work are summarised in Fig1 in the box below.



In summary, the NOAA research reveals that global trends are higher than those reported by the IPCC, especially in recent decades, and that the central estimate for the rate of warming during the first 15 years of the 21<sup>st</sup> century is at least as great as the last half of the 20<sup>th</sup> century. These results therefore clearly state “do not support the notion of a “slowdown” in the increase of global surface temperature”.

The NOAA analysis is now supported by research published in the Journal Science Advances published in January 2017<sup>3</sup>. The research paper entitled “Assessing recent warming using instrumentally homogeneous sea surface temperature records” by Hausfather et al concludes that:

- Sea surface temperature (SST) records are subject to potential biases due to changing instrumentation and measurement practices.
- Significant differences exist between commonly used composite SST reconstructions from the National Oceanic and Atmospheric Administration’s Extended Reconstruction Sea Surface Temperature (ERSST), the Hadley Centre SST data set (HadSST3), and the Japanese Meteorological Agency’s Centennial Observation-Based Estimates of SSTs (COBE-SST) from 2003 to the present.

<sup>3</sup> <http://advances.sciencemag.org/content/3/1/e1601207>



- A recent update of ERSST resulted in an increase in the operational SST trend estimate during the last 19 years from 0.07° to 0.12°C per decade, indicating a higher rate of warming in recent years.
- The new ERSST data trends generally agree with largely independent, near-global, and instrumentally homogeneous SST measurements from floating buoys, Argo floats, and radiometer-based satellite measurements that have been developed and deployed during the past two decades.
- There was a large cooling bias in earlier versions of ERSST and smaller but significant cooling biases in HadSST3 and COBE-SST from 2003 to the present.

The results they conclude suggest that reported rates of SST warming in recent years have been underestimated in these three data sets. With the revised data, the apparent pause in temperature rises between 1998 and 2014 disappears. As a result, the authors said that the warming experienced in the first 15 years of the 21<sup>st</sup> Century was "virtually indistinguishable" from the rate of warming between 1950-99, a time generally acknowledged to have seen significant rates of warming from human emissions of CO<sub>2</sub>.

Taken together this new research with that of the NOAA work shows that the rate of warming in the last two decades is no different from the rate of warming since 1970 or from 1950.

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