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Research Brief

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Debunking the Climate Hiatus

Background

On the eve of the 2015 global climate talks in Paris and a possible new international agreement on climate, claims of a recent hiatus in the warming of the global climate persist. The purported hiatus, or idea that global warming has paused or stalled during the period since 1998, has been the subject of intense scientific and public debate. For example, the “hiatus” was a main focus of the 2013 assessment of the Intergovernmental Panel on Climate Change (IPCC). Ultimately, the perception of a hiatus during a period of heightened carbon emissions has led to contradictory scientific conclusions and has created disputes regarding the relationship between climate change and anthropogenic global warming.

An alleged hiatus has important repercussions for public decision-making. Disagreements related to whether global warming has paused or slowed down, and whether models have overestimated the rate of warming, influence the perceived levels of mitigation and adaptation action that are needed to meet specific policy goals. With

About the Researchers

This research was led by Bala Rajaratnam, Assistant Professor of Statistics and of Earth System Science at Stanford University’s School of Earth, Energy & Environmental Sciences, and a Stanford Woods Institute affiliate; in partnership with Joseph Romano, Stanford Professor of Statistics and Economics; Michael Tsiang, a Stanford Earth System Science graduate student; and Noah Diffenbaugh, Associate Professor of Earth System Science with Stanford’s School of Earth, Energy & Environmental Sciences, and Senior Fellow of the Stanford Woods Institute.

2014 as the warmest year on record, Mexico getting hit by the largest hurricane ever recorded in the Western Hemisphere and nations already feeling the effects of climate change, reliable and accurate scientific evidence about the pace of global warming is a critical component of public decisions related to managing risks. This brief describes compelling evidence from recent research that claims of a “hiatus” in global warming lack sound statistical basis. It should be noted that the conclusions of





no hiatus are reached when using the older, uncorrected National Ocean and Atmospheric Administration's (NOAA) temperature dataset as well as the NOAA dataset corrected in Summer 2015.

Key Findings: No Hiatus, Pause or Slowdown in Global Warming

This brief examines four of the most frequently cited claims about a global warming hiatus during the 1998-2013 period: 1. that the steady increase in global surface temperature trend stopped, or “paused”; 2. that the rate in increase was lower during this period than in previous decades; 3. that the annual mean temperature did not rise during this period; and 4. that year-to-year temperature changes during the recent period differ from the previous period. The study is based on research that used statistical methods more appropriate for analyzing temperature trends than the “classical” methods that were used more prevalently in past studies. A key difference between the approaches is the ability to take time dependence into consideration when analyzing

temperature data, without having to assume convenient simple statistical models, which are often based on misspecified or unverifiable assumptions.

No Pause in Temperature Trend: The study examined the assertion that the increase in global surface temperature has stopped or “paused,” using a precise statistical test which takes the dependence of temperature on time into account. Using this method, there is “overwhelming evidence” against the claim that there has been no warming trend in global surface temperature during the 1998-2013 period, even without considering that 2014 was the warmest year on record globally. Furthermore, stronger evidence against a hiatus is found when 1999 or 2000 is used as the start year in the analysis. Choosing the year 1998 could be making special accommodations for the hiatus claim.

No Slowdown in Temperature Trends: The rate of warming during the 1998-2013 period was not appreciably different from the rate of warming in the previous period. By comparing the 1998-2013 period and

the 1950-1997 period, the researchers find no evidence of a difference in warming trends. Using a special sampling method, called “subsampling,” to compare the 16-year trend during 1998-2013 to all the previous 16-year trends observed between 1950-1997, the researchers found that the trend during 1998-2013 does not appear to be unusual in a historical context.

No Hiatus in the Mean Global Temperature:

Claims that the global mean temperature has remained constant since 1998 can also be tested using a statistical hypothesis. Using a series of four tests to examine the veracity of this claim, the researchers showed that it is in fact not supported by evidence. The results are further validated when the analysis is repeated using a 1999 or a 2000 start date, adding further weight to the argument that using 1998 as the start date amounts to “cherry picking.” Moreover, as 2014 was the warmest year on record, the conclusion against a hiatus in the mean global temperature is further strengthened.

No Difference in Year-to-Year Temperature Changes:

It is instructive to assess whether the distribution of year-to-year temperature changes is markedly different between the hiatus period and the prior periods. Such analysis is inherently less reliant on a linear model of temperature on time, and so makes fewer assumptions. The evidence finds that the distribution of annual changes in the global temperature was not statistically different during the past 15 years compared with earlier periods in the global temperature record.

The study’s increased sophistication in methodology presents more confidence in the results’ general validity. This is partially due to having fewer restrictive or unrealistic assumptions. This highlights the potential for past studies with improper statistical assumptions to yield improper (or much weaker) scientific conclusions.

Key Points for Policymakers

- The rigorous statistical analysis does not support the claim of a hiatus in global warming.
- The evolution of global surface temperature over the past decade and a half is not unusual or unexpected

within the context of the long-term record of variability and change.

- Without empirical evidence in support of the hiatus claims, any further conclusions stemming from the hiatus assumption are weakened.
- Research that employs valid statistical modeling without making strong assumptions about the underlying process can produce more confidence in the validity of the general results.

Conclusions

Our study yields strong evidence against the presence of a global warming hiatus during the period of 1998 to 2013. By analyzing the long-term data in a rigorous statistical framework, it is clear that even though climate varies annually and from decade to decade, global temperatures continue to rise in the long term, and the recent period does not stand out as being abnormal. In contrast to other work done in this area, our research uses a rigorous statistical analysis that incorporates temporal dependencies without making strong assumptions about the underlying process. The findings and methodologies should increase confidence in the climate models that form the basis for climate change predictions.

This brief is based on findings from the 2015 study, “*Debunking the climate hiatus.*” *Climatic Change* 133 (2) 129-140, 2015. B. Rajaratnam, J. Romano, M. Tsiang, and N. Diffenbaugh.

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