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Recently, media outlets, politicians, and critics of mainstream climate science have stirred up controversy over the unexpectedly slow rise of global mean surface air temperature in the most recent 15-year period for which data are available, from 1998 to 2012. Though it is only one of many findings detailed in the 2013 report by Working Group I of the Intergovernmental Panel on Climate Change (IPCC), and the vast majority of those findings indicate that the danger of climate change has worsened or remained the same relative to previous assessments (IPCC 2013), this "pause" was highlighted in 41% of all mainstream media coverage of that report in the United States (Greenberg, Robbins & Theel 2013) and contributed to an increase in popular denial of climate change (cf. Bojanowski, Stampf & Traufetter 2013; Rose 2013; Ridley 2013; Lloyd 2013; Lewis 2013).

It is true that the trend of warming for this period, about 0.044 °C per decade (Met Office 2013), has been significantly lower than the 0.10-0.35 °C per decade predicted in 1990 by the IPPC for the period from 1990-2030 (IPCC 1990). However, two questions remain about these data. First, do they affect the need for action on climate change or the validity of climate science? Second, how can climate scientists learn from them to improve both their understanding of natural short-term climate variability and their ability to communicate their science effectively to policymakers and the public?

To the first of these questions, the answer according to 97% of the world's active climate scientists is a resounding "no" (Cook et al. 2013). The most obvious fault in the logic of extrapolating a 15-year period of slower warming to long-term climate changes is that 15 years is not enough time to average out the noise of short-term fluctuations that are significant on annual or semi-decadal scales but do not affect long term trends (IPCC 2013). Of particular significance as contributors to this noise are El Niño and La Niña events, which are periods of warming and cooling of the Pacific Ocean, respectively. Short periods that begin and end in abnormal years yield abnormal trends, and it is significant that the year 1998 included one of the most intense El Niño events of the 20th century and that the following 15 years have been dominated by strong La Niñas and weak El Niños (Held 2013). Indeed, other 15-year periods since 1990 have shown rates of warming that are actually in the high range of the IPCC estimates. For example, the rate of warming between 1992-2006 was approximately 0.28 °C per decade (Met Office 2013). From 1987 to 2012, the rate has been well within predictions at about 0.15 °C per decade (Met Office 2013). Finally, the 2013 IPCC report indicated that it is likely that the 30-year period from 1983-2012 was the warmest 30-year period of the last 1400 years (IPCC 2013). Saying that trends from 1992-2006 show that the long-term climate change situation is even worse than the IPCC expected, or that 1998-2012 shows that climate change has paused, reflects cherry-picking of data and poor understanding of climate science.

Even if the decadal rate of increase in global mean surface air temperature in the most recent 15-year period actually did reflect trends over a longer term, global mean surface air temperature would remain only one of many indicators of anthropogenic global climate change. In its 2013 report, the IPCC also expressed confidence (IPCC 2013) in significant trends of change in the following: sea level; ocean acidity; regional extremes of temperatures and precipitation; temperatures in the tropospheric and stratospheric layers of the atmosphere (which are warming and cooling, respectively); rates of ice loss in ice sheets in the Arctic, the Antarctic, and Greenland, as well as from glaciers; and thawing of global permafrost (soil frozen for more than two consecutive years), which currently contains roughly half of all organic materials in all soils around the world and is likely to release vast amounts of methane as it thaws (Zimov, Schuur & Chapin III 2006). The IPCC report also stated with high confidence that the oceans have absorbed more than 90% of the global energy surplus accumulated from 1971-2010, with much of the rest contributing to ice melt and stratospheric warming (IPCC 2013). Such a distribution of energy further diminishes the logic of placing great weight on short-term trends in decadal rates of warming of surface air, because warming of surface air as a whole has accounted for only a very small fraction of the planet's energy surplus in the last several decades.

Despite its unsuitability as a predictor of long-term trends in global climate change and the validity of the science as a whole, the recent 15-year slowdown in surface warming does have something positive to offer scientists: a chance to learn more about the natural variability of the Earth's climate, separate from the external factors known as "forcing" agents—chief among them, greenhouse gases and variations in solar activity. A better understanding of the climate's natural variability will aid climate science and the public in at least three ways. First, it will improve estimates of climate sensitivity (a measure of how strongly the climate responds to forcing agents), resulting in less variability among the

Image source: Druckenmiller 2008.

projections of future conditions produced by different climate models. Second, it will increase public and political trust in climate science, both by tightening the spread of projections and by reducing the appearance of contradiction between short-term climate fluctuations and long-term projections. Finally, it may allow better prediction of seasonal and regional changes in climate, which could help in preparing specific populations for extreme events such as floods, droughts, and heat waves. These changes, along with more accessible and more frequent communication of results by the IPCC, will help to reduce climate denial and increase humankind's willingness and ability to take action against climate change.

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