

Understanding the Earth's Climate Warming Hiatus: Putting the Pieces Together

Plenary Session US CLIVAR summit

Organizers: Janet Sprintall (SIO) and
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Introduction

- ◆ Despite continuing increases in atmospheric greenhouse gases, the rate of global mean surface temperature warming over past 15 years has been less than in earlier decades or than simulated by many climate models.
- ◆ Possible explanations for this “hiatus” are varied, ranging from internally generated climate variability, where different ocean basins play a dominant role, to changes in solar radiation, atmospheric water vapor, aerosols, and observing systems.
- ◆ Some example “hiatus” studies include ...

Is there a slowdown?

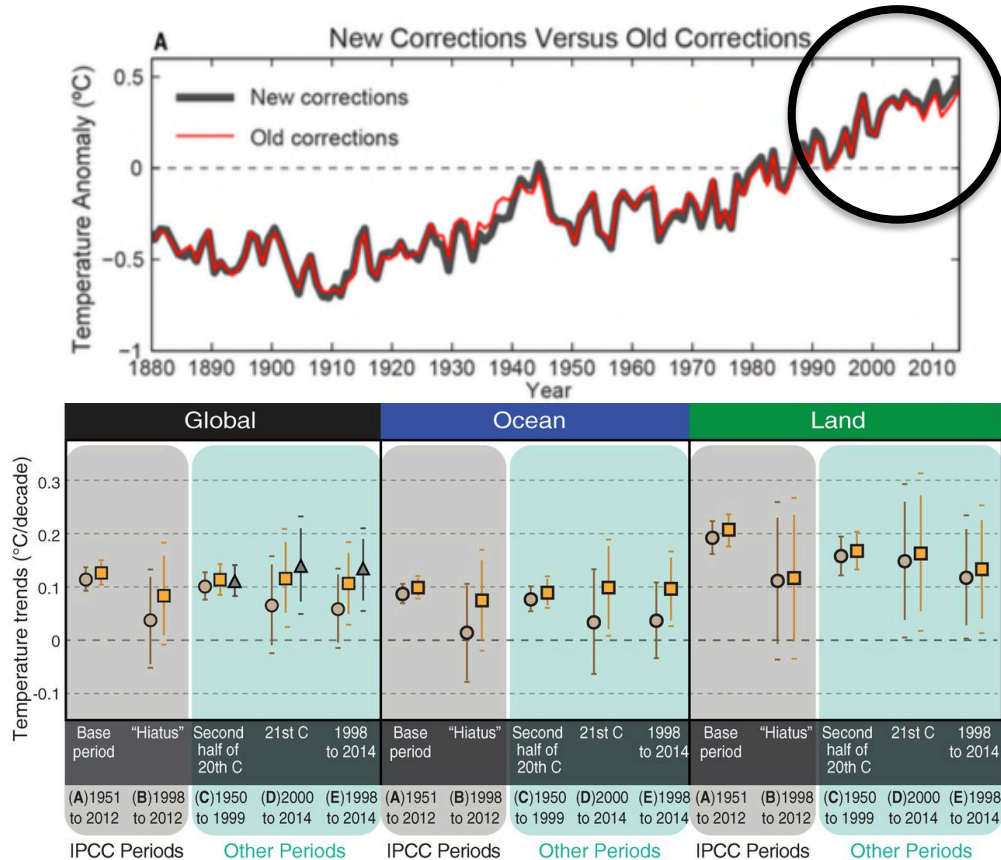
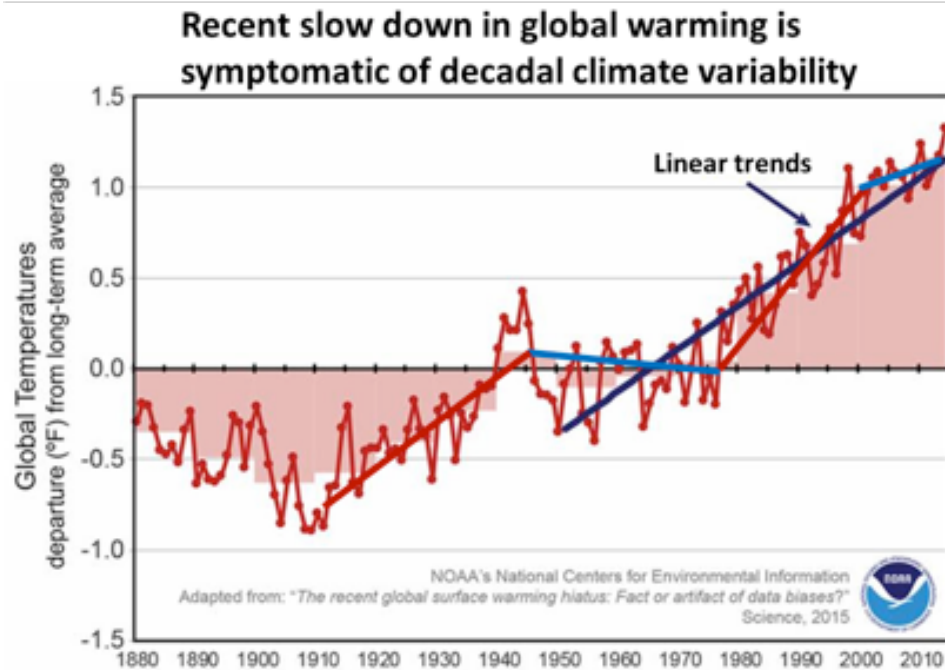


Fig. 2. Global (land and ocean) surface temperature anomaly time series with new analysis, old analysis, and with and without time-dependent bias corrections. (A) The new analysis (solid black) compared to the old analysis (red). (B) The new analysis (solid black) versus no corrections for time-dependent biases (cyan).

When temperature measurements are “corrected”, there is no slowdown!

Linear trends and decadal variability



Meehl, *U.S. Clivar Variations*, 13:3, 2015

(time series from Karl paper)

- ◆ Karl et al (2015) suggested trend from 1998-2014 same as from 1950-99 (black line) 0.11C/decade but Meehl says this averages across two decadal regimes of IPO – no fair!
- ◆ Linear trends for **positive phases of IPO** (1971-1995) were 0.18C/decade.
- ◆ During the Hiatus (2000-2013), linear trend of 0.10C/decade when **negative phase of the IPO**
- ◆ Clearly the slowdown in rate of global warming in early 21st century is not an artifact of the data.

Motivation

- ◆ The intensity of scientific (and public) discussion surrounding the existence and varied mechanisms responsible for the current Hiatus in global warming suggests an opportune time to review the current understanding of these mechanisms.

OPINION & COMMENT | FOCUS

COMMENTARY:

Pause for thought

Ed Hawkins, Tamsin Edwards and Doug McNeall

The recent slowdown (or 'pause') in global surface temperature rise and the wider public. We discuss how climate scientists have tried to suggest that 'many-to-many' communication offers a key opportunity.

COMMENTARY:

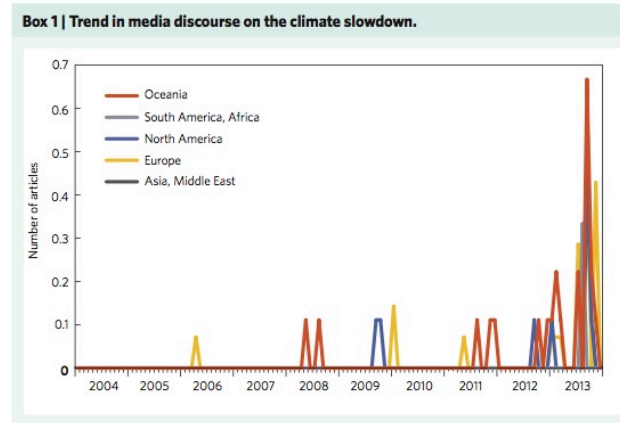
Media discourse on the climate slowdown

Maxwell T. Boykoff

We must not fall victim to decontextualized and ahistorical media accounting of climate trends.

Motivation

- ◆ This plenary session aims to facilitate discussion of the dominant mechanistic processes thought to govern the hiatus period, identify scientific gaps in our knowledge of these processes, and suggest an integrated strategy and coordinated effort towards improving our understanding of these processes.



Boykoff, Nature, 2014

Relevance to U.S. CLIVAR and relationship to panel and strategic plan goals

- Errors and uncertainties in ocean heat content estimates require improvements to existing observing systems.**
- Integrated strategy and coordinated effort towards improving monitoring and modeling efforts.**
- Interpretation and improvements to CMIP model projections and future scenarios.**
- Relevance to critical societal questions pertaining to economic and environmental implications.**

**Understanding the Earth's
Climate Warming Hiatus:
Putting the pieces together**

Guest Editors:
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The slowdown in the rate of global mean surface temperature warming over the past 15 years or so has arguably led to one of the most contentious debates in the climate community. This phenomenon is so singular that it has developed proper noun status and is referred to as the "Hiatus." In fact, there have been other slowdowns in the past, but they have received nowhere near as much attention.

There has been little shortage in the number of mechanisms proposed as responsible for this Hiatus, ranging from internally generated climate variability related to various climate modes to changes in solar radiation, atmospheric water vapor, and aerosols, where the different ocean basins play a dominant role. In fact, some studies have suggested that there is no

Decadal climate variability and the early-2000s hiatus

Gerald A. Meehl

National Center for Atmospheric Research

There have been recent claims that the early-2000s hiatus (or more accurately a slowdown; the term "hiatus" will be used here to denote that slowdown), when the rate of global warming slowed compared to the previous two decades, was an artifact of problematic sea surface temperature (SST) data (Karl et al. 2015), lack of Arctic data (Cowtan and Way 2014), or both. Such claims indicate that when corrections are made to SST data, by taking into account various measurement methods that introduce biases in the data, then "there was no 'hiatus' in temperature rise... [and] a presumed pause in the rise of Earth's average global surface temperature might never have happened" (Wendel 2015). Often there are issues with observed data that need adjusting - in this case such claims of "no hiatus" are artifacts of questionable interpretation of decadal timescale variability and externally forced response - not problems with the data. Thus, the hiatus is symptomatic of the much broader and very compelling problem of decadal timescale variability of the climate system. Recent research has shown that decadal variability in the Pacific associated with the Interdecadal Pacific Oscillation (IPO) plays a major role in driving naturally-occurring global decadal timescale climate fluctuations that are superimposed on the long term warming trend from increasing greenhouse gases (GHG) emissions throughout the 20th and early 21st centuries.

Linear trends and decadal variability

It has long been known that long term trends (50 years or longer) in observed globally averaged surface air temperature reflect mainly increases in human-produced GHGs (e.g., Bindoff et al. 2013). However, superimposed on this long-term forced trend are decadal timescale fluctuations of global climate (Figure 1). The climate science fields of climate change detection/attribution

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Article Contributors

- ◆ Jerry Meehl (*NCAR*) – **Decadal variability**
- ◆ Grant Foster (*Tempo Analytics*) and John Abraham (*U. St. Thomas*) – **Statistical testing of Hiatus trend**
- ◆ Yu Kosaka (*U. Tokyo*) and Shang-Ping Xie (*SIO*) – **Pacific influence**
- ◆ Sarah Purkey (*LDEO*), Damien Desbruyeres (*NOC*) and Nathalie Zilberman (*SIO*) – **Deep ocean warming**
- ◆ Ka-Kit Tung (*UW*) and Xianyao Chen (*OUC*) – **An energy perspective**
- ◆ Kate Marvel (*Columbia*), Gavin A. Schmidt (*Columbia*), Kostas Tsigaridis (*Columbia/NASA Goddard*) and Benjamin I. Cook (*NASA Goddard*) – **Sensitivity factors**

Invited Talks

- ◆ John Abraham: Lack of evidence for a slowdown in global temperature
- ◆ Shang-Ping Xie: Pacific causes of Climate Warming Hiatus
- ◆ Sarah Purkey: Deep ocean warming
- ◆ K.K. Tung: Atlantic/Southern Ocean perspective
- ◆ Kate Marvel: Sensitivity to factors underlying the hiatus
(remote presentation)

3. Facilitated Discussion: Panelists

- How might we develop a consensus about the cause of the Climate Warming Hiatus? In the light of some studies that show that there is no Hiatus, do we need to develop a consensus?
- How can we improve errors and uncertainties in our observational array, numerical models, and data assimilation efforts in order to better detect and predict changes in climate trends?
- How can we better inform the public of the difference between long-term global warming and interruptions such as the Hiatus?

3. Facilitated Discussion: U.S. CLIVAR Panels

- How can U.S. CLIVAR panels promote an improvement in errors and uncertainties in our observational array, modeling tools, and data assimilation infrastructure to better detect changes in climate trends?
- How can U.S. CLIVAR utilize climate model evaluation and development to inform the design of sustained climate observing systems for detection of changes in OHC?
- How can U.S. CLIVAR best participate in the dialogue to better inform the public the difference between long-term global warming and interruptions such as the Hiatus?