

Navigating the Causes of Modern Climate Change

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Climate change detection and attribution have proven unexpectedly challenging during the 21st Century thus far. Earth's global surface temperature increased less rapidly from 2000 to 2015 than during the last half of the 20th Century, even though greenhouse gas concentrations continued to increase. Simulations made with state-of-the-art general circulation climate models did not replicate this lack of global surface temperature increase, which in 2013 the IPCC termed a "global warming hiatus". This motivated over a decade of climate change research focused on elucidating the causes of a so-called "pause". Amplified by media commentary, the suggestion that "missing" mechanisms are influencing climate exacerbated confusion among policy makers, the public and other stakeholders about the causes and reality of modern climate change. Did global warming really pause during the beginning of the twenty-first century and does record-breaking warmth in recent years signify its resumption? How well do observations track Earth's global temperature changes and how reliable are physical climate models at replicating these changes? A statistical analysis of surface temperature observations suggests answers to these questions and provides quantitative interpretation of modern climate change as a mix of both anthropogenic and natural influences, including the Sun's irradiance cycle. Plausible climate change scenarios in future decades are explored using a range of anthropogenic and natural projections. Understanding and communicating the causes of climate change in the next 20 years may be more challenging than in the recent past, in part because predictions of the modulation of projected anthropogenic warming by natural processes have limited skill and in part because of emerging feedbacks and tipping points that even the most sophisticated physical climate models do not yet replicate, nor statistical models based on past observations include.

Based on "Observation-based detection and attribution of 21st century climate change", J. Lean, WIREs, 2016.