

New Perspectives in Climate Science

What the EPA Isn't Telling Us



INDEPENDENT POLICY REPORT

Introduction

Tomorrow, July 29, 2003, the Senate Environment and Public Works Committee, chaired by Senator James Inhofe (R-OK), will hold a landmark hearing examining recent developments in climate change science.

While the Senate Committee will address new findings about the history of climate change, there have been additional, remarkable breakthroughs in the area of global atmospheric change since the publication of the widely-cited *Third Assessment Report* (TAR) of the United Nations Intergovernmental Panel on Climate Change (IPCC) in 2001. This document provides an overview of new and important work published in the refereed scientific literature. In addition, it provides insight into politically-driven climate science at the United Nations and in the U.S. Environmental Protection Agency.

The scientific discussion centers around three areas:

- New work on surface temperature histories and their implications for future warming,
- Reconciliation of satellite and balloon-measured temperatures that increase confidence in a modest warming while undermining the credibility of climate models predicting dramatic warming, and
- Recently published findings on mortality and climate change that strongly argue against lurid scenarios of enhanced urban deaths under forecasts of warming.

Together, these studies increasingly integrate the notion that climate change will be modest and easily adapted by free and vibrant economies.

Previous research has demonstrated that the Kyoto Protocol to the United Nations Framework Convention on Climate Change would have no measurable effect on planetary warming rates. This finding, along with the three areas noted above, prompts an obvious question: Why should there be any remaining scientific credibility for the Protocol? As a corollary, why should the Environmental Protection Agency (EPA), in this or any other Administration, continue to push the policy envelope on climate change? While EPA may have “ignored” climate change in its 2003 *State of the Environment Report*, the agency has a clear recent history of precisely the opposite, as detailed in a later section of this paper.

Recent Developments in Climate Change Science

Recent Research Counters United Nations and Environmental Protection Agency Claims of Anomalous Warmth of Recent Decades

For nearly fifty years, and through literally thousands of research papers presented in the refereed scientific literature, scientists established that climate since the termination of the last glacial stage, some 12,000 years ago, has hardly been stable or constant. Between four and seven thousand years ago, the earth's mean surface temperature was some 1–2°C higher than it is today, for largely unknown reasons. It is noteworthy that climate texts through 1980, written prior to the current concern about global warming, referred to such a period as the “climatic optimum,” because the warming accompanied the flowering of agriculture and civilization.

On a somewhat shorter time scale, hundreds of research studies documented two relatively recent climatic excursions, namely the “Little Ice Age” (LIA), a cold period ending in the late nineteenth century in which global or hemispheric temperatures were thought to be approximately 1°C beneath the average for the twentieth century, and a “Medieval Warm Period” (MWP) prior to the LIA that was 0.5°C warmer than the last century.

In 1999 Michael Mann, now an Assistant Professor at University of Virginia, and several colleagues attempted what can best be characterized as a meta-analysis of a rather small sample of paleoclimate indicators that gave rise to a temperature history known as the “hockey stick,” shown in **FIGURE I**.

Given the literally hundreds of other publications on millennial climate change, the attention afforded to the “hockey stick” by the United Nations Intergovernmental Panel on Climate Change (IPCC) was inordinate. It was prominently featured in the important “Policymakers Summary” of the 2001 *Third Assessment Report* (TAR) of the IPCC, with no appropriate text indicating that, while interesting, the Mann study, by finding no LIA or MWP, is a clear outlier in a sea of climate studies indicating otherwise. It has been used for repeated citation that the recent decade is the “warmest in 1000 years.”

In fact, a close inspection of **FIGURE I** reveals that the expected error ranges given by Mann et al. (1999) are in fact quite large, and could indeed accommodate the LIA and the MWP, particularly the former (the latter is at the extreme range of the error, but there are very few data points that make up any global estimate 1000 years ago). Rather, it is the average of the indicators (shown by the bold blue line) that drew inordinate attention. Scientifically speaking, an average is a meaningless figure unless the errors about that average, resulting from statistical

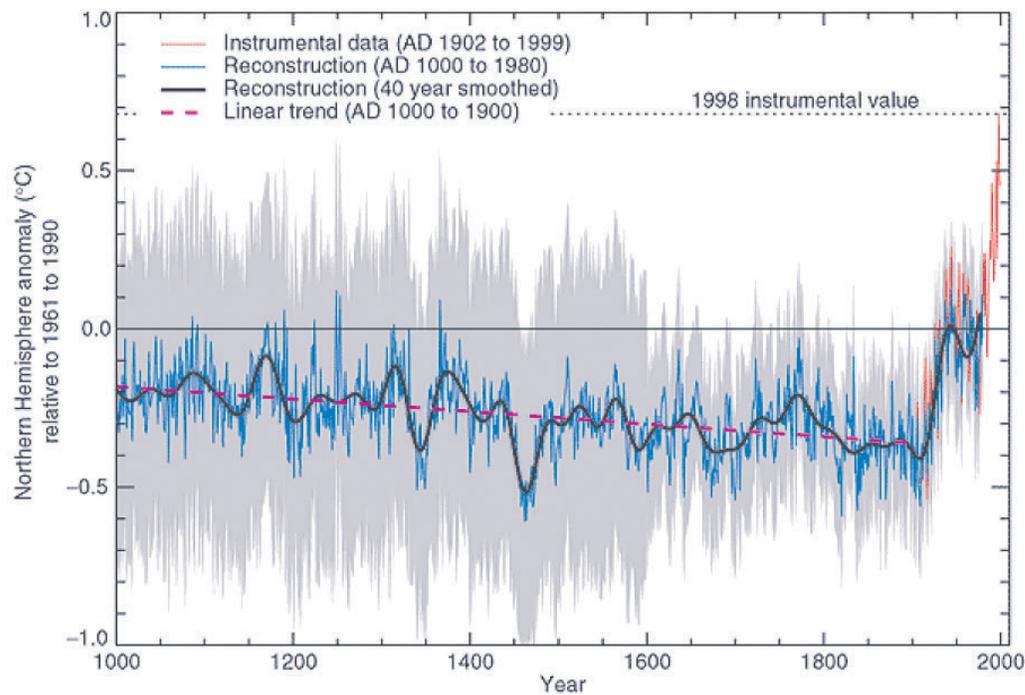


FIGURE 1: Mann et al.'s Northern Hemisphere temperature reconstruction for the past 1,000 years based upon proxy measurements (also known as the “hockey stick”). The gray region represents the range of uncertainty in the reconstructed temperatures (blue line).

sampling, measurement errors, and data manipulation, are explicitly given, which in fact was the case with the 1999 Mann study.

The Mann study was notable in that it represented a collation of several other paleoclimatic studies, although the sample size was severely limited, with only 12 proxy indicators forming the average and error terms for the very long period from 1000 to 1400 AD.

Recently, Willie Soon and Sallie Baliunas, of Harvard University, published a comprehensive study examining a much larger sample of climate histories than were covered in the early portions of the Mann et al. reconstructed temperature series. Their research asked whether an indicator of the LIA or the MWP existed in these records. They looked for a fifty-year warm or cold period in the MWP and LIA “windows” that significantly departs from the average conditions of the respective period. Under these criteria, Soon and Baliunas find strong evidence for the existence of both the MWP and the LIA. The core results are shown in Figures 2A and B. There are more than 100 paleo-records in the Soon and Baliunas study, many times more than the average number used in the Mann et al. study.

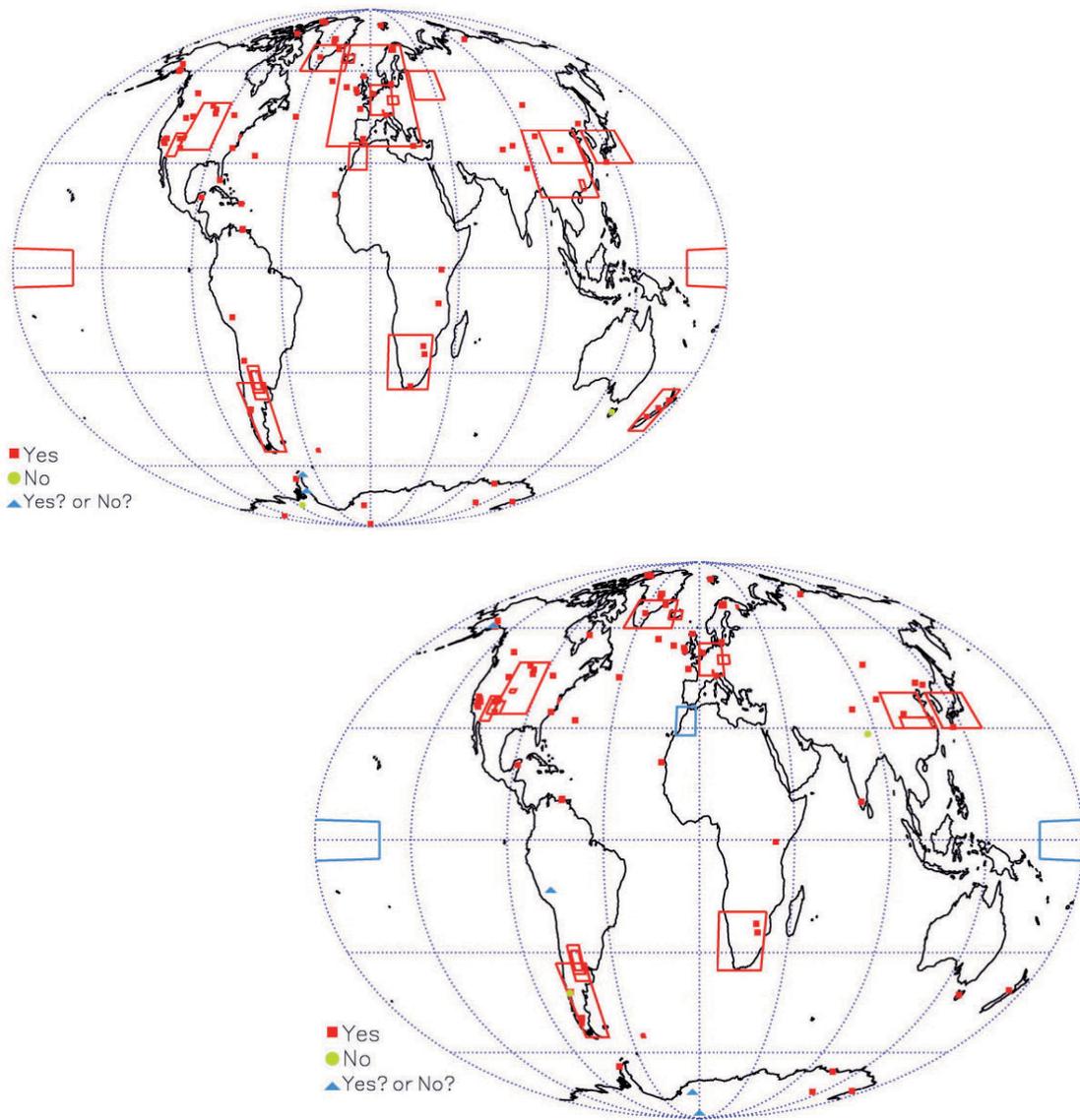


FIGURE 2A: The Soon and Baliunas (2003) answer to their question “Is there an objectively discernible climate anomaly during the Little Ice Age period (1300–1900) in this proxy record?” Red squares or boxes indicate regions where the answer was ‘Yes,’ green circles or boxes indicate regions where the answer was ‘No.’ Proxy records from around the world overwhelmingly contained a signature of the Little Ice Age.

FIGURE 2B: The Soon and Baliunas (2003) answer to their question “Is there an objectively discernible climate anomaly during the Medieval Warm Period (800–1300) in this proxy record?” Red squares or boxes indicate regions where the answer was ‘Yes,’ green circles or boxes indicate regions where the answer was ‘No,’ blue triangles or boxes indicated regions equivocal results. Proxy records from around the world overwhelmingly contained a signature of the Medieval Warm Period.

Despite the apparent differences, the Mann et al. (1999) and Soon and Baliunas (2003) studies can be reconciled. Given that the range of errors in the Mann study is so large, it can accommodate both an LIA and MWP as defined by Soon and Baliunas.

The Mann/Soon debate is going to last some time. Recently (July 8, 2003), Mann and several coauthors published a defense of their work in the *Transactions* of the American Geophysical Union, but the rebuttal article, which is in preparation, has yet to be published.

The United Nations' choice to overemphasize the Mann et al. study and to ignore a tremendous volume of other work has had serious consequences, as it was the first "governmental" sanction for the use of one climate history over many others. The "hockey stick" was featured prominently in the influential 2000 report *Climate Change Impacts on the United States* (National Assessment Synthesis Team 2000), known colloquially as the *National Assessment* of climate change which published the "hockey stick" without the accompanying error range, an egregious example of scientific misconduct. This was then translated into the 2001 *Climate Action Report* from the U.S. Environmental Protection Agency, whose Chapter 6, "Impacts and Adaptations," was based upon the *National Assessment*.

EPA's use of the *National Assessment* was made in full knowledge that the document contained egregious scientific errors, including the use of climate models whose performance was known by the National Assessment Synthesis Team to perform worse than a table of random numbers when applied to United States 10-year mean temperatures; see section below on EPA misuse of science.

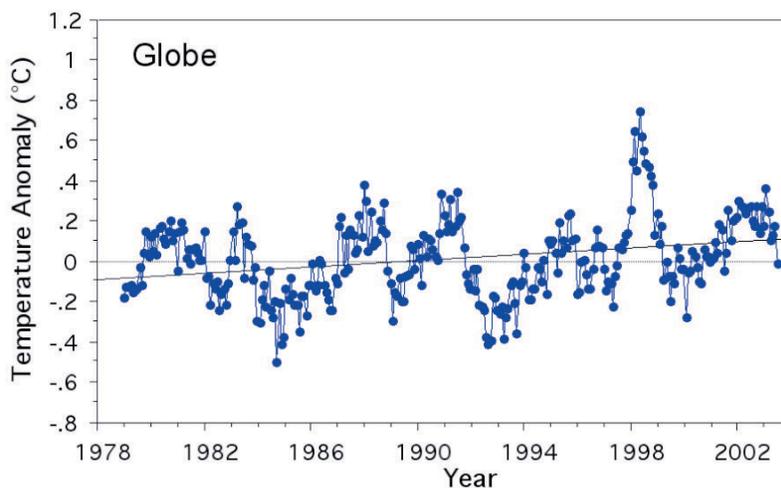


FIGURE 3: Globally averaged lower tropospheric temperature anomalies as measured by NASA satellites, December 1978 through June 2003.

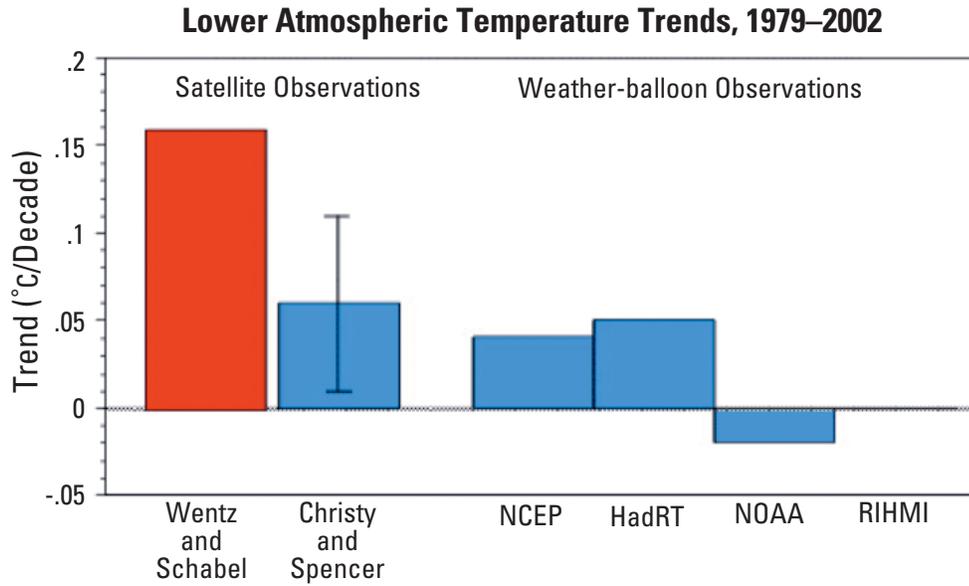


FIGURE 4: A comparison of trends in satellite-measured temperatures (two columns on left) and weather balloon-measured temperatures (four columns on right, including one equal to zero).

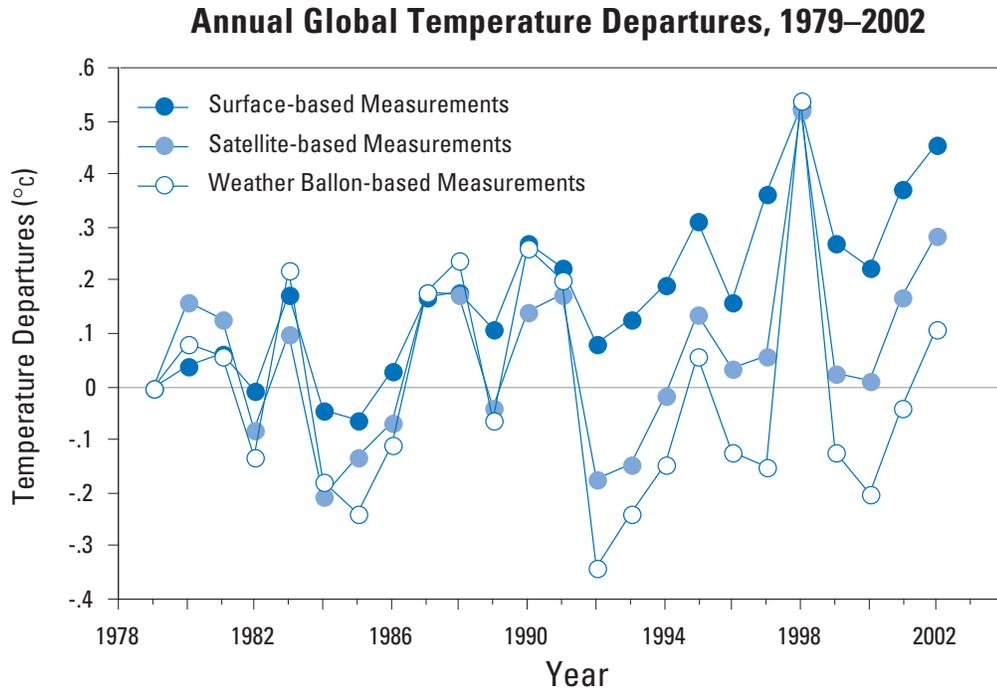


FIGURE 5: Global averaged annual satellite, weather balloon (5,000–30,000 ft.), and surface temperature anomalies since 1979, the beginning of the satellite record.

While the controversy about UN and EPA overemphasis on the Mann history and the subsequent work of Soon and Baliunas is currently prominent, a number of other recent developments in climate change science are also worth noting.

The Importance of Satellite-Sensed Temperatures and Climate Change

Since their first publication in 1990 (Spencer and Christy 1990), tropospheric temperatures sensed by satellites have shown considerably less warming than surface histories, which is opposite to what is predicted by climate models that also project dramatic warming in the coming century.

The satellite record, which begins in late 1978, is approaching a quarter-century in length, as shown in **FIGURE 3**, adjusted by John Christy for orbital decay and other drifts. In his most recent summarization of the satellite data, published in the *Journal of Atmospheric and Oceanic Technology* (Christy et al. 2003) shows a net global temperature trend of +0.06°C/decade, which is several *times* less than what was forecast by computer models that served as the basis for the original 1992 Framework Convention on Climate Change.

The trend, based upon monthly readings, is statistically significant. However, the trend, if based upon annual readings, is not. Note that at the current trend and variance levels, the annual data have a 50/50 chance of showing a significant warming by the end of 2007. However, the rate, noted above, is very low and it is doubtful that such a modest warming rate could have possibly provoked such an onerous treaty as the UN's Framework Convention on Climate Change; instead, that Convention was based upon lurid model results that are now known to be dramatic overestimations of human influence on the atmosphere.

In their recent paper, Christy and colleagues (2003) checked the accuracy of the satellite by comparing their record with a totally independent measurement of lower-atmosphere temperature, taken from daily weather balloons, and found the two to be in strong agreement.

Weather balloons are launched twice daily from sites around the world; as they ascend through the atmosphere, they radio back observations of temperature, humidity, and pressure that are used to initialize models of daily weather forecasts. Balloon observations can be compiled into a record of lower-atmospheric temperatures that can then be compared with the satellite measurements.

It is important to realize that the way the weather-balloon data are collected is completely different from how we obtain satellite observations, and thus represent an independent measurement of the same quantity (atmospheric temperature). Of course, as is the case with any measurement, there are complications that must be considered when compiling the raw data.

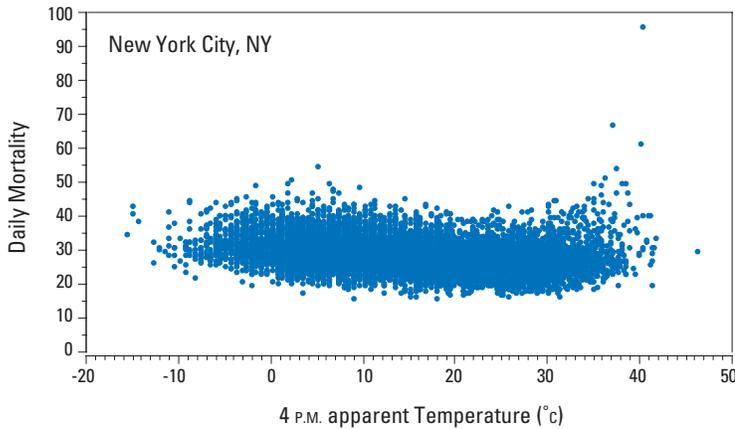
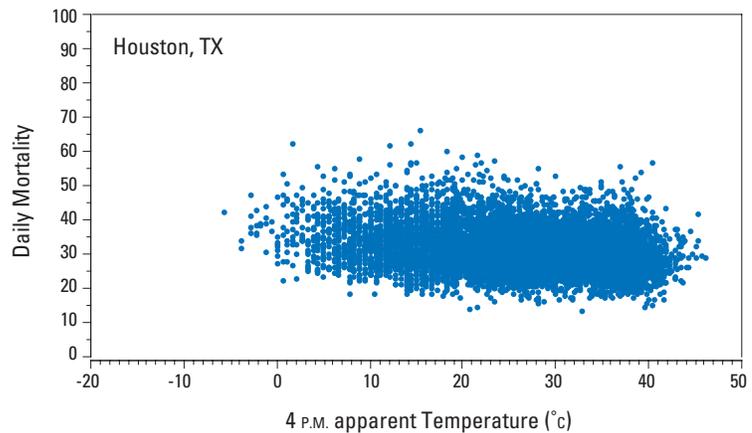


FIGURE 6A: Population-adjusted daily mortality vs. 4 P.M. apparent temperature for New York City.

FIGURE 6B: Same as in (A) except for Houston. Notice that on the very hottest of days, the daily mortality in New York City rises rapidly, while the mortality in Houston shows no change.



For that reason, there are several different research groups that have released their own versions of the weather-balloon temperature history. To protect against any accusation of picking only the particular data set that best matches their satellite observations, Christy et al. (2003) compared the temperature trend during the past 24 years derived from their observations with the trend during the same period as calculated from four different manifestations of the global weather-balloon history.

FIGURE 4 shows the results. The trend in their satellite record, as noted above, is 0.06°C per decade. The trends from the various weather-balloon records range from -0.02°C per decade to 0.05°C per decade. In each case, the trend in the satellite record was slightly *greater* than that in the weather-balloon records, and the match with the two weather-balloon records with the most complete coverage of the globe was within 0.02°C . That close correspondence is remarkable and one of the great achievements in atmospheric science, as these are totally independent observations.

FIGURE 4 also shows another interpretation of the satellite data, by researchers Wentz and Schabel, that has yet to be published in the scientific literature. However, it is clear from the comparison with the independent weather balloon data that the Christy and Spencer trend is by far more reliable.

FIGURE 5 shows the entire concurrency for our three records of “global” temperature, which begins with the first complete year of the satellite MSU data, 1979. The record is now complete through its 24th year.

FIGURE 5 shows satellite temperatures, weather balloon temperatures roughly between 5,000 and 30,000 feet, and surface temperatures measured by thermometers. There is an increase in the surface record of 0.18°C/decade. Research by NASA scientists demonstrate that about 0.02°C/decade of this is a result of changes in the sun (Lean and Rind 1998), leaving a remaining 0.16°C/decade ascribable to human influence or other natural variation. The other two records show no statistically significant change.

The disparity between the surface, satellite and weather balloon readings is real (National Academy of Sciences 2000). The concordance between the satellites and balloons cannot be from chance, so there must be some process occurring in the lowest layers (below 5,000 feet) that is not being picked up in those two records.

Other Recent Climate Findings

Around the time of the publication of the IPCC TAR, a number of other findings were emerging in the refereed scientific literature that argued strongly against the alarmist view of climate change. These included:

- Discovery that observed surface warming is most consistent with a forecast at the low end of the 1.4–5.8°C range for global warming now projected by the United Nations (Michaels et al. 2002).
- Finding that the postwar ratio of winter-to-summer warming is greater than two-to-one (Balling et al. 1998).
- Over three-quarters of the cold half-year warming in the Northern Hemisphere since 1945 is confined to the very coldest airmasses. The warming outside of these airmasses is a minuscule 0.2°C per century (Michaels et al. 2000).
- The variation, or unpredictability, of regional temperatures has declined significantly on a global basis while there is no change for precipitation (Michaels et al. 1998).

- Maximum winds in hurricanes that affect the United States have significantly *declined* (IPCC 1996), and there is no evidence for a global increase in damaging storms (Landsea et al. 1996).
- The Kyoto Protocol to the United Nations Framework Convention on Climate Change will have no discernable impact on global climate within any reasonable policy timeframe (Wigley 1998).

Together, these findings—serious questioning of Mann’s “hockey stick,” validation of the satellite data, and the plethora of other reports documenting benign warming—should be sufficient to remove climate change as a viable political issue.

But this has not been the case, largely because of two additional factors. These include the spectre of dramatically increased urban mortality caused by global warming and the institutional culture of federal agencies, especially the Environmental Protection Agency, as demonstrated by the infamous *National Assessment* of global warming.

Global Warming and Urban Mortality

According to the *National Assessment*, “populations in urban areas are most vulnerable to adverse heat-related health outcomes. Heat indices and heat-related mortality rates are higher in the urban core than in surrounding areas.” In the *Second Assessment Report* of the IPCC, we read that, based upon data from several North American cities, “the annual number of heat-related deaths would approximately double by 2020 and would increase several-fold by 2050.”

Together these statements provide national and international authority on the relationship between heat and mortality, with the obvious implication that warming of our cities will lead to increasing heat-related death.

In reality, without assistance from global warming, an experiment has been run in our cities for decades, as they warmed up from the well known “urban effect” on temperature. Bricks and buildings retain the heat of the day and impede ventilating winds. Most major urban core regions in the United States have warmed 1–2°C (Washington, DC being a prime example) as a result of simple urbanization. Consequently, large North American cities allow us to test whether increased temperature creates increased mortality.

On the surface, the arguments of the *National Assessment* and the IPCC seem absurd, implying no compensatory adaptation fueled by changing technology. To test hypotheses about warming and urban mortality, Davis et al. (2003) examined changes in the relationships between human mortality and hot, humid weather for 28 US cities with populations greater

than one million on a decadal time scale. Twenty-nine years of daily total mortality rates (1964–1998 with some years missing in the early 1970s), standardized to account for changes in death rates related to inherent variations in the age of the population, were organized by decade for each city. Daily mortality rates were related to afternoon apparent temperatures—an index that combines temperature and humidity that serves as the basis of the summer Heat Index used by the National Weather Service. Davis et al. calculated the annual excess mortality on days when apparent temperatures exceeded a threshold value for 28 major metropolitan areas in the United States.

FIGURE 6A shows daily mortality and apparent temperature for New York City. While mortality actually declines with heating, there are a number of clear excursions in death rates at the highest temperatures. These were simply extrapolated by the *National Assessment* and the IPCC to form future mortality expectations.

Yet, at the same time, it is very clear that infrastructure is very important. FIGURE 6B shows the same for Houston, a more modern city built near the very warm Gulf of Mexico. There is no excursion in the death rate on the hottest days.

Obviously, there is some personal and economic incentive to survive, so Davis et al. (2003) hypothesized that adaptation should lead to a general decline in urban heat-related mortality, and this is what the data show.

Contrary to the implied hypothesis in the *National Assessment* and the explicit assertion by the United Nations' IPCC, Davis et al. (2003) found that heat-related mortality rates declined over time in 22 of the 28 cities. For the 28-city average, there were 53 excess heat-related deaths per year (per standard million population) in the 1960s–70s, 25 in the 1980s, and 15 in the 1990s. In the 1960s–1970s, almost all study cities exhibited significantly above normal death rates on hot and humid days. During the 1980s, many cities, particularly those in the southern United States, exhibited no excess mortality. In the 1990s, this effect spread northward across interior cities.

The overall decadal decline in mortality in most cities is probably because of adaptations: increased air conditioning usage, improved health care, and heightened public awareness of the biophysical impacts of heat exposure. This finding of a more muted mortality response of the US populace to high apparent temperatures over time raises doubts about the validity of projections of future US mortality increases linked to potential greenhouse warming.

What could prompt such authoritative bodies such as the *National Assessment* “Synthesis Team” and the IPCC hypothesize and assert facts on warming and urban-related death that turn out to be so obviously false? Perhaps the answer lies in the culture of science.

Institutional Bias on Global Warming

The prominence of the Mann et al. record in the recent IPCC report, in the face of hundreds of other studies in the scientific literature is *prima facie* evidence of some type of political bias, as the obvious (and predictable) effect of emphasizing that history was to create a demand for climate intervention policy.

Public Choice theory offers a theoretical concept explaining patterns of behavior in such cases. Scientists maintain the crucial characteristics of any interest group. Environmental Science is an exclusive, small community, and over 99.5 percent of its research funding comes from the federal budget. Climate scientists know that there are many other scientific communities (cancer, heart disease, etc.) competing for that money. Climate scientists define themselves as providing “good” in the political sphere, which is the technical information required to save ourselves from impending climatic doom.

In the ethic of the environmental science community, the price of this “good” is now \$4.2 billion per year (the proposed current federal budget for research on global environmental change). Competition requires that this community prove that “their” problem is much bigger, more urgent and needs more financial support than problems other interest groups want to solve by providing their own “good.” This competition is not just limited to other science and technology enterprises, but includes all federal discretionary spending, such as housing for the homeless, a new federal facility in West Virginia, or fixing the space shuttle. Portraying climate change as a benign issue is a clear threat to the well-being of its scientific community, and there is logically a great resistance to this view.

Public Choice theory does not judge someone’s honesty or dishonesty. It simply implies that the structure of incentives scientists face must create a bias of distortion, in which problems must be exaggerated in order to garner funding. Public Choice is a political process—based upon rhetoric as much as fact—and it provides mutual virtue for the scientists and the responsive politicians, an advantage to both, and a powerful adversary force against moderation on climate science or policy.

Consequently, there is an institutional bias towards drama and climate threat. Perhaps the most glaring recent example of EPA bias on global warming concerned its publication of the *2001 Climate Action Report* (2001CAR), a public document detailing global warming science, projections, and possible policies.

The critical chapter of 2001CAR, Chapter 6 (“Impacts and Adaptation”) relies heavily on the 2000 *National Assessment* of global warming, a Clinton Administration product that was

based upon true miscarriages of science: It is predicated upon two models for future projections of climate that perform worse than a table of random numbers when applied to ten-year moving averages of US temperatures since 1900, and it removed the error bars from Mann's "hockey stick".

Here is an excerpt of a formal review of the 2001CAR by University of Virginia Professor of Environmental Sciences Patrick J. Michaels, and sent to the senior authorship of 2001CAR:

The essential problem with the USCAR [2001CAR] is that it is based upon the USNA [The *National Assessment*]. That report is based largely on two climate models, neither one of which, when compared with the 10-year smoothed behavior of the lower 48 states (a very lenient comparison), reduces the residual variance below the raw variance of the data. The one that generates the most lurid warming scenarios—the Canadian Climate Centre (CCC) Model—produces much larger errors than are inherent in the natural noise of the data. That is a simple test of whether or not a model is valid . . . and both of the models used in the USNA fail. All implied effects, including the large temperature rise, are therefore based upon a multiple scientific failure. The USNA's use of those models and that approach is a willful choice to disregard the most fundamental of scientific rules. (And that they did not find and eliminate such an egregious error is testimony to grave bias). For that reason alone, the USCAR should be withdrawn from the public sphere until it becomes scientifically based.

EPA's 2001CAR, based upon the *National Assessment*, employed two climate models that were themselves outliers. One of them, the Canadian Climate Center (CCC) model, predicted the most extreme temperature changes, while the other, the UK model predicted the most extreme precipitation changes of all the models considered for inclusion. The CCC model forecasts the average temperature in the United States to rise 8.1°F (4.5°C) by the year 2100, more than twice the rise of 3.6°F (2.0°C) forecast by the UK model (the second model used in the USNA). Compare this with what has actually occurred during the past century. The CCC model predicted a warming of 2.7°F (1.5°C) in the United States over the course of the twentieth century, but the observations published by the U.S. National Climatic Data Center show that the increase was about 0.5°F (0.3°C), or about 5 times less than the forecast.

If the observed ratio continues into the future, the US temperature increase by the year 2100 will be around 1°F and hardly noticeable. The UK forecast of precipitation changes across

the United States is nearly as extreme. Of all the models reviewed for inclusion in the USNA (and, consequently, for 2001CAR), the UK model predicted more than twice the precipitation change than the second most extreme model, which was the CCC model. The CCC model itself forecast twice the change of the average of the remaining, unselected models. Therefore, along with the fact that climate models in general cannot accurately forecast climate change at regional levels, the climate models selected as the basis for the USNA conclusions do not even fairly represent the collection of available climate models.

What is remarkable is that EPA went forward with 2001CAR in full knowledge of these problems.

Conclusion

As the Senate Environment and Public Works Committee prepares for an important hearing on new developments in the ongoing debate about past climate change, it is important to recognize that there have been a number of additional advances in climate science, many of which were concurrent or after the publication of the most recent (2001) *Assessment of Climate Change By the United Nations Intergovernmental Panel on Climate Change*, and the 2000 *National Assessment of U.S. Climate Change*. This latter document was used extensively by the U.S. Environmental Protection agency in its 2001 *Climate Action Report*.

As shown in this paper, critical portions of science in all of these reports are misleading, inaccurate, unreliable, or simply wrong. However, that is not an indictment of the individuals involved, but is rather more symptomatic of the nature of science when funded by a government leviathan.

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