

# Climate Change Reconsidered

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# Climate Change Reconsidered

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## Preface

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Before facing major surgery, wouldn't you want a second opinion?

When a nation faces an important decision that risks its economic future, or perhaps the fate of the ecology, it should do the same. It is a time-honored tradition in science to set up a "Team B," which examines the same original evidence but may reach a different conclusion. The Nongovernmental International Panel on Climate Change (NIPCC) was set up to examine the same climate data used by the United Nations-sponsored Intergovernmental Panel on Climate Change (IPCC).

In 2007, the IPCC released to the public its three-volume Fourth Assessment Report titled *Climate Change 2007* (IPCC-AR4, 2007). Its constituent documents were said by the IPCC to comprise "the most comprehensive and up-to-date reports available on the subject," and to constitute "the standard reference for all concerned with climate change in academia, government and industry worldwide." But are these characterizations correct?

On the most important issue, the IPCC's claim that "most of the observed increase in global average temperatures since the mid-twentieth century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations [emphasis in the original]," NIPCC reaches the opposite conclusion—namely, that natural causes are very likely to be the dominant cause. Note: We do not say anthropogenic greenhouse gases (GHG) cannot produce some warming or has not in the past. Our conclusion is that the evidence shows they are not playing a *substantial* role.

Almost as importantly, on the question of what effects the present and future warming might have on human health and the natural environment, the IPCC says global warming will "increase the number of people suffering from death, disease and injury from heatwaves, floods, storms, fires and droughts." The NIPCC again reaches the opposite conclusion: A warmer world will be a safer and healthier world for humans and wildlife alike. Once again, we do not say global warming won't occur or have any effects (positive or negative) on human health and wildlife.

Rather, our conclusion is that the evidence shows the *net* effect of continued warming and rising carbon dioxide concentrations in the atmosphere will be beneficial to humans, plants, and wildlife.

We have reviewed the materials presented in the first two volumes of the Fourth Assessment—*The Physical Science Basis* and *Impacts, Adaptation and Vulnerability*—and we find them to be highly selective and controversial with regard to making future projections of climate change and discerning a significant human-induced influence on current and past climatic trends. Although the IPCC claims to be unbiased and to have based AR4 on the best available science, such is not the case. In many instances conclusions have been seriously exaggerated, relevant facts have been distorted, and key scientific studies have been omitted or ignored.

We present support for this thesis in the body of this volume, where we describe and reference thousands of peer-reviewed scientific journal articles that document scientific or historical facts that contradict the IPCC's central claims, that global warming is man-made and that its effects will be catastrophic. Some of this research became available after the AR4's self-imposed deadline of May 2006, but much of it was in the scientific record that was available to, and should have been familiar to, the IPCC's editors.

Below, we first sketch the history of the IPCC and NIPCC, which helps explain why two scientific bodies could study the same data and come to very different conclusions. We then explain the list of 31,478 American scientists that appears in Appendix 4, and end by expressing what we hoped to achieve by producing this report.

### A Brief History of the IPCC

The rise in environmental consciousness since the 1970s has focused on a succession of 'calamities': cancer epidemics from chemicals, extinction of birds and other species by pesticides, the depletion of the

ozone layer by supersonic transports and later by freons, the death of forests ('Waldsterben') because of acid rain, and finally, global warming, the "mother of all environmental scares" (according to the late Aaron Wildavsky).

The IPCC can trace its roots to World Earth Day in 1970, the Stockholm Conference in 1971-72, and the Villach Conferences in 1980 and 1985. In July 1986, the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC) as an organ of the United Nations.

The IPCC's key personnel and lead authors were appointed by governments, and its Summaries for Policymakers (SPM) have been subject to approval by member governments of the UN. The scientists involved with the IPCC are almost all supported by government contracts, which pay not only for their research but for their IPCC activities. Most travel to and hotel accommodations at exotic locations for the drafting authors is paid with government funds.

The history of the IPCC has been described in several publications. What is not emphasized, however, is the fact that it was an activist enterprise from the very beginning. Its agenda was to justify control of the emission of greenhouse gases, especially carbon dioxide. Consequently, its scientific reports have focused solely on evidence that might point toward human-induced climate change. The role of the IPCC "is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of *the risk of human-induced climate change*, its observed and projected impacts and options for adaptation and mitigation" [emphasis added] (IPCC 2008).

The IPCC's three chief ideologues have been (the late) Professor Bert Bolin, a meteorologist at Stockholm University; Dr. Robert Watson, an atmospheric chemist at NASA, later at the World Bank, and now chief scientist at the UK Department of Environment, Food and Rural Affairs; and Dr. John Houghton, an atmospheric radiation physicist at Oxford University, later head of the UK Met Office as Sir John Houghton.

Watson had chaired a self-appointed group to find evidence for a human effect on stratospheric ozone and was instrumental in pushing for the 1987 Montreal Protocol to control the emission of chlorofluorocarbons (CFCs). Using the blueprint of

the Montreal Protocol, environmental lawyer David Doniger of the Natural Resources Defense Council then laid out a plan to achieve the same kind of control mechanism for greenhouse gases, a plan that eventually was adopted as the Kyoto Protocol.

From the very beginning, the IPCC was a political rather than scientific entity, with its leading scientists reflecting the positions of their governments or seeking to induce their governments to adopt the IPCC position. In particular, a small group of activists wrote the all-important Summary for Policymakers (SPM) for each of the four IPCC reports (McKittrick *et al.*, 2007).

While we are often told about the thousands of scientists on whose work the Assessment reports are based, the vast majority of these scientists had no direct influence on the conclusions expressed by the IPCC. Those policy summaries were produced by an inner core of scientists, and the SPMs were revised and agreed to, line-by-line, by representatives of member governments. This obviously is not how real scientific research is reviewed and published.

These SPMs turn out, in all cases, to be highly selective summaries of the voluminous science reports—typically 800 or more pages, with no indexes (except, finally, the Fourth Assessment Report released in 2007), and essentially unreadable except by dedicated scientists.

The IPCC's First Assessment Report (IPCC-FAR, 1990) concluded that the observed temperature changes were "broadly consistent" with greenhouse models. Without much analysis, it gave the "climate sensitivity" of a 1.5 to 4.5° C rise for a doubling of greenhouse gases. The IPCC-FAR led to the adoption of the Global Climate Treaty at the 1992 Earth Summit in Rio de Janeiro.

The FAR drew a critical response (SEPP, 1992). FAR and the IPCC's style of work also were criticized in two editorials in *Nature* (Anonymous, 1994, Maddox, 1991).

The IPCC's Second Assessment Report (IPCC-SAR, 1995) was completed in 1995 and published in 1996. Its SPM contained the memorable conclusion, "the balance of evidence suggests a discernible human influence on global climate." The SAR was again heavily criticized, this time for having undergone significant changes in the body of the report to make it 'conform' to the SPM—*after* it was finally approved by the scientists involved in writing the report. Not only was the report altered, but a key graph was also doctored to suggest a human

influence. The evidence presented to support the SPM conclusion turned out to be completely spurious.

There is voluminous material available about these text changes, including a *Wall Street Journal* editorial article by Dr. Frederick Seitz (Seitz, 1996). This led to heated discussions between supporters of the IPCC and those who were aware of the altered text and graph, including an exchange of letters in the *Bulletin of the American Meteorological Society* (Singer *et al.*, 1997).

SAR also provoked the 1996 publication of the Leipzig Declaration by SEPP, which was signed by some 100 climate scientists. A booklet titled *The Scientific Case Against the Global Climate Treaty* followed in September 1997 and was translated into several languages. (SEPP, 1997. All these are available online at [www.sepp.org](http://www.sepp.org).) In spite of its obvious shortcomings, the IPCC report provided the underpinning for the Kyoto Protocol, which was adopted in December 1997. The background is described in detail in the booklet *Climate Policy—From Rio to Kyoto*, published by the Hoover Institution (Singer, 2000).

The Third Assessment Report of the IPCC (IPCC-TAR 2001) was noteworthy for its use of spurious scientific papers to back up its SPM claim of “new and stronger evidence” of anthropogenic global warming. One of these was the so-called “hockey-stick” paper, an analysis of proxy data, which claimed the twentieth century was the warmest in the past 1,000 years. The paper was later found to contain basic errors in its statistical analysis (McIntyre and McKittrick, 2003, 2005; Wegman *et al.*, 2006). The IPCC also supported a paper that claimed pre-1940 warming was of human origin and caused by greenhouse gases. This work, too, contained fundamental errors in its statistical analysis. The SEPP response to TAR was a 2002 booklet, *The Kyoto Protocol is Not Backed by Science* (SEPP, 2002).

The Fourth Assessment Report of the IPCC (IPCC-AR4 2007) was published in 2007; the SPM of Working Group I was released in February; and the full report from this Working Group was released in May—after it had been changed, once again, to “conform” to the Summary. It is significant that AR4 no longer makes use of the hockey-stick paper or the paper claiming pre-1940 human-caused warming. Once again controversy ensued, however, this time when the IPCC refused to publicly share comments submitted by peer-reviewers, then sent all the reviewers’ comments in hard copy to a library that

was closed for renovation, and then finally, but only under pressure, posted them online. Inspection of those comments revealed that the authors had rejected more than half of all the reviewers’ comments in the crucial chapter attributing recent warming to human activities.

AR4 concluded that “most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations” (emphasis in the original). However, as the present report will show, it ignored available evidence against a human contribution to current warming and the substantial research of the past few years on the effects of solar activity on climate change.

Why have IPCC reports been marred by controversy and so frequently contradicted by subsequent research? Certainly its agenda to find evidence of a human role in climate change is a major reason; its organization as a government entity beholden to political agendas is another major reason; and the large professional and financial rewards that go to scientists and bureaucrats who are willing to bend scientific facts to match those agendas is yet a third major reason.

Another reason for the IPCC’s unreliability is the naive acceptance by policymakers of “peer-reviewed” literature as necessarily authoritative. It has become the case that refereeing standards for many climate-change papers are inadequate, often because of the use of an “invisible college” of reviewers of like inclination to a paper’s authors (Wegman *et al.*, 2006). Policy should be set upon a background of demonstrable science, not upon simple (and often mistaken) assertions that, because a paper was refereed, its conclusions must be accepted.

## **Nongovernmental International Panel on Climate Change (NIPCC)**

When new errors and outright falsehoods were observed in the initial drafts of AR4, SEPP set up a “Team B” to produce an independent evaluation of the available scientific evidence. While the initial organization took place at a meeting in Milan in 2003, Team B was activated after the AR4 SPM appeared in February 2007. It changed its name to the Nongovernmental International Panel on Climate Change (NIPCC) and organized an international climate workshop in Vienna in April 2007.

The present report stems from the Vienna workshop and subsequent research and contributions by a larger group of international scholars. For a list of those contributors, see page ii. Craig Idso then made a major contribution to the report by tapping the extensive collection of reviews of scientific research he helped collect and write, which is available on the Web site of the Center for the Study of Carbon Dioxide and Global Change ([www.CO2science.org](http://www.CO2science.org)). A Summary for Policymakers, edited by S. Fred Singer, was published by The Heartland Institute in 2008 under the title *Nature, Not Human Activity, Rules the Planet* (Singer, 2008). Since the summary was completed prior to a major expansion and completion of the full NIPCC report, the two documents now stand on their own as independent scholarly works and substantially agree.

What was our motivation? It wasn't financial self-interest: Except for a foundation grant late in the process to enable Craig Idso to devote the many hours necessary to assemble and help edit the final product, no grants or contributions were provided or promised in return for producing this report. It wasn't political: No government agency commissioned or authorized our efforts, and we do not advise or support the candidacies of any politicians or candidates for public office.

We donated our time and best efforts to produce this report out of concern that the IPCC was provoking an irrational fear of anthropogenic global warming based on incomplete and faulty science. Global warming hype has led to demands for unrealistic efficiency standards for cars, the construction of uneconomic wind and solar energy stations, the establishment of large production facilities for uneconomic biofuels such as ethanol from corn, requirements that electric companies purchase expensive power from so-called "renewable" energy sources, and plans to sequester, at considerable expense, carbon dioxide emitted from power plants. While there is nothing wrong with initiatives to increase energy efficiency or diversify energy sources, they cannot be justified as a realistic means to control climate. Neither does science justify policies that try to hide the huge cost of greenhouse gas controls, such as cap and trade, a "clean development mechanism," carbon offsets, and similar schemes that enrich a few at the expense of the rest of us.

Seeing science clearly misused to shape public policies that have the potential to inflict severe economic harm, particularly on low-income groups,

we choose to speak up for science at a time when too few people outside the scientific community know what is happening, and too few scientists who know the truth have the will or the platforms to speak out against the IPCC.

NIPCC is what its name suggests: an international panel of *nongovernment* scientists and scholars who have come together to understand the causes and consequences of climate change. Because we are not predisposed to believe climate change is caused by human greenhouse gas emissions, we are able to look at evidence the IPCC ignores. Because we do not work for any governments, we are not biased toward the assumption that greater government activity is necessary.

### The Petition Project

Attached as Appendix 4 to this report is a description of "The Petition Project" and a directory of the 31,478 American scientists who have signed the following statement:

We urge the United States government to reject the global warming agreement that was written in Kyoto, Japan in December, 1997, and any other similar proposals. The proposed limits on greenhouse gases would harm the environment, hinder the advance of science and technology, and damage the health and welfare of mankind.

There is no convincing scientific evidence that human release of carbon dioxide, methane, or other greenhouse gases is causing or will, in the foreseeable future, cause catastrophic heating of the Earth's atmosphere and disruption of the Earth's climate. Moreover, there is substantial scientific evidence that increases in atmospheric carbon dioxide produce many beneficial effects upon the natural plant and animal environments of the Earth.

This is a remarkably strong statement of dissent from the perspective advanced by the IPCC, and it is similar to the perspective represented by the NIPCC and the current report. The fact that more than *ten times* as many scientists have signed it as are alleged to have "participated" in some way or another in the research, writing, and review of IPCC AR4 is very significant. These scientists, who include among their number 9,029 individuals with Ph.D.s, actually *endorse* the statement that appears above. By contrast, fewer than 100 of the scientists (and nonscientists) who are listed in the appendices to the IPCC AR4

actually participated in the writing of the all-important Summary for Policymakers or the editing of the final report to comply with the summary, and therefore could be said to endorse the main findings of that report. Consequently, we cannot say for sure whether more than 100 scientists in the entire world actually endorse the most important claims that appear in the IPCC AR4 report.

We will not make the same mistake as the IPCC. We do not claim the 31,478 scientists whose names appear at the end of this report endorse all of the findings and conclusions of this report. As the authors of the petition say (in an introduction to the directory of signers in Appendix 4), “signatories to the petition have signed just the petition—which speaks for itself.” We append the list of their names to this report with the permission of the persons who maintain the list to demonstrate unequivocally the broad support within the scientific community for the general perspective expressed in this report, and to highlight one of the most telling differences between the NIPCC and the IPCC.

For more information about The Petition Project, including the text of the letter endorsing it written by the late Dr. Frederick Seitz, past president of the National Academy of Sciences and president emeritus of Rockefeller University, please turn to Appendix 4 or visit the project’s Web site at [www.petitionproject.org](http://www.petitionproject.org).

## Looking Ahead

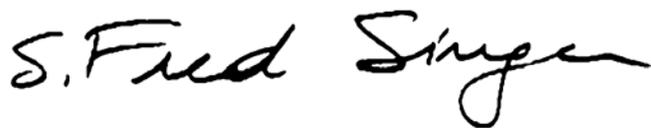
The public’s fear of anthropogenic global warming, despite almost hysterical coverage of the issue by the mainstream media, seems to have hit a ceiling and is falling. Only 34 percent of Americans polled (Rasmussen Reports, 2009) believe humans are causing global warming. A declining number even believe the Earth is experiencing a warming trend (Pew Research Center, 2008). A poll of 12,000 people in 11 countries, commissioned by the financial institution HSBC and environmental advocacy groups, found only one in five respondents—20 percent—said they would be willing to spend any extra money to reduce climate change, down from 28 percent a year earlier (O’Neil, 2008).

While the present report makes it clear that the scientific debate is tilting away from global warming alarmism, we are pleased to see the political debate also is not over. Global warming “skeptics” in the policy arena include Vaclav Klaus, president of the

Czech Republic and 2009 president of the Council of the European Union; Helmut Schmidt, former German chancellor; and Lord Nigel Lawson, former United Kingdom chancellor of the exchequer. There is some evidence that policymakers world-wide are reconsidering the wisdom of efforts to legislate reductions in greenhouse gas (GHG) emissions.

We regret that many advocates in the debate have chosen to give up debating the science and focus almost exclusively on questioning the motives of “skeptics,” name-calling, and *ad hominem* attacks. We view this as a sign of desperation on their part, and a sign that the debate has shifted toward climate realism.

We hope the present study will help bring reason and balance back into the debate over climate change, and by doing so perhaps save the peoples of the world from the burden of paying for wasteful, unnecessary energy and environmental policies. We stand ready to defend the analysis and conclusion in the study that follows, and to give further advice to policymakers who are open-minded on this most important topic.



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[www.heartland.org](http://www.heartland.org)

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# Executive Summary

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The Fourth Assessment Report of the Intergovernmental Panel on Climate Change's Working Group-1 (Science) (IPCC-AR4 2007), released in 2007, is a major research effort by a group of dedicated specialists in many topics related to climate change. It forms a valuable compendium of the current state of the science, enhanced by having an index which had been lacking in previous IPCC reports. AR4 also permits access to the numerous critical comments submitted by expert reviewers, another first for the IPCC.

While AR4 is an impressive document, it is far from being a reliable reference work on some of the most important aspects of climate change science and policy. It is marred by errors and misstatements, ignores scientific data that were available but were inconsistent with the authors' pre-conceived conclusions, and has already been contradicted in important parts by research published since May 2006, the IPCC's cut-off date.

In general, the IPCC fails to consider important scientific issues, several of which would upset its major conclusion—that “most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations [emphasis in the original].” The IPCC defines “very likely” as at least 90 percent certain. They do not explain how they derive this number. The IPCC also does not define the word “most,” nor do they provide any explanation.

The IPCC does not apply generally accepted methodologies to determine what fraction of current warming is natural, or how much is caused by the rise in greenhouse gases (GHG). A comparison of “fingerprints” from best available observations with the results of state-of-the-art GHG models leads to the conclusion that the (human-caused) GHG contribution is minor. This fingerprint evidence, though available, was ignored by the IPCC.

The IPCC continues to undervalue the overwhelming evidence that, on decadal and century-long time scales, the Sun and associated atmospheric

cloud effects are responsible for much of past climate change. It is therefore highly likely that the Sun is also a major cause of twentieth-century warming, with anthropogenic GHG making only a minor contribution. In addition, the IPCC ignores, or addresses imperfectly, other science issues that call for discussion and explanation.

These errors and omissions are documented in the present report by the Nongovernmental International Panel on Climate Change (NIPCC). The report is divided into nine chapters that are briefly summarized here, and then more fully described in the remainder of this summary.

Chapter 1 describes the limitations of the IPCC's attempt to forecast future climate conditions by using computer climate models. The IPCC violates many of the rules and procedures required for scientific forecasting, making its “projections” of little use to policymakers. As sophisticated as today's state-of-the-art models are, they suffer deficiencies and shortcomings that could alter even the very *sign* (plus or minus, warming or cooling) of earth's projected temperature response to rising atmospheric CO<sub>2</sub> concentrations. If the global climate models on which the IPCC relies are not validated or reliable, most of the rest of the AR4, while it makes for fascinating reading, is irrelevant to the public policy debate over what should be done to stop or slow the arrival of global warming.

Chapter 2 describes feedback factors that reduce the earth's temperature sensitivity to changes in atmospheric CO<sub>2</sub>. Scientific studies suggest the model-derived temperature sensitivity of the earth for a doubling of the pre-industrial CO<sub>2</sub> level is much lower than the IPCC's estimate. Corrected feedbacks in the climate system reduce climate sensitivity to values that are an order of magnitude smaller than what the IPCC employs.

Chapter 3 reviews empirical data on past temperatures. We find no support for the IPCC's claim that climate observations during the twentieth century are either unprecedented or provide evidence of an anthropogenic effect on climate. We reveal the

methodological errors of the “hockey stick” diagram of Mann *et al.*, evidence for the existence of a global Medieval Warm Period, flaws in the surface-based temperature record of more modern times, evidence from highly accurate satellite data that there has been no net warming over the past 29 years, and evidence that the distribution of modern warming does not bear the “fingerprint” of an anthropogenic effect.

Chapter 4 reviews observational data on glacier melting, sea ice area, variation in precipitation, and sea level rise. We find no evidence of trends that could be attributed to the supposedly anthropogenic global warming of the twentieth century.

Chapter 5 summarizes the research of a growing number of scientists who say variations in solar activity, not greenhouse gases, are the true driver of climate change. We describe the evidence of a solar-climate link and how these scientists have grappled with the problem of finding a specific mechanism that translates small changes in solar activity into larger climate effects. We summarize how they may have found the answer in the relationships between the sun, cosmic rays and reflecting clouds.

Chapter 6 investigates and debunks the widespread fears that global warming might cause more extreme weather. The IPCC claims global warming will cause (or already is causing) more droughts, floods, hurricanes, storms, storm surges, heat waves, and wildfires. We find little or no support in the peer-reviewed literature for these predictions and considerable evidence to support an opposite prediction: That weather would be *less* extreme in a warmer world.

Chapter 7 examines the biological effects of rising CO<sub>2</sub> concentrations and warmer temperatures. This is the largely unreported side of the global warming debate, perhaps because it is unequivocally good news. Rising CO<sub>2</sub> levels increase plant growth and make plants more resistant to drought and pests. It is a boon to the world’s forests and prairies, as well as to farmers and ranchers and the growing populations of the developing world.

Chapter 8 examines the IPCC’s claim that CO<sub>2</sub>-induced increases in air temperature will cause unprecedented plant and animal extinctions, both on land and in the world’s oceans. We find there little real-world evidence in support of such claims and an abundance of counter evidence that suggests ecosystem biodiversity will *increase* in a warmer and CO<sub>2</sub>-enriched world.

Chapter 9 challenges the IPCC’s claim that CO<sub>2</sub>-induced global warming is harmful to human health.

The IPCC blames high-temperature events for increasing the number of cardiovascular-related deaths, enhancing respiratory problems, and fueling a more rapid and widespread distribution of deadly infectious diseases, such as malaria, dengue and yellow fever. However, a thorough examination of the peer-reviewed scientific literature reveals that further global warming would likely do just the opposite and actually reduce the number of lives lost to extreme thermal conditions. We also explain how CO<sub>2</sub>-induced global warming would help feed a growing global population without major encroachment on natural ecosystems, and how increasing production of biofuels (a strategy recommended by the IPCC) damages the environment and raises the price of food.

The research summarized in this report is only a small portion of what is available in the peer-reviewed scientific literature. To assist readers who want to explore information not contained between the covers of this volume, we have included Internet hyperlinks to the large and continuously updated databases maintained by the Center for the Study of Carbon Dioxide and Global Change at [www.co2science.org](http://www.co2science.org).

## Key Findings by Chapter

### Chapter 1. Global Climate Models and Their Limitations

- The IPCC places great confidence in the ability of general circulation models (GCMs) to simulate future climate and attribute observed climate change to anthropogenic emissions of greenhouse gases.
- The forecasts in the Fourth Assessment Report were not the outcome of validated scientific procedures. In effect, they are the opinions of scientists transformed by mathematics and obscured by complex writing. The IPCC’s claim that it is making “projections” rather than “forecasts” is not a plausible defense.
- Today’s state-of-the-art climate models fail to accurately simulate the physics of earth’s radiative energy balance, resulting in uncertainties “as large as, or larger than, the doubled CO<sub>2</sub> forcing.”
- A long list of major model imperfections prevents models from properly modeling cloud formation and cloud-radiation interactions, resulting in large

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differences between model predictions and observations.

- Computer models have failed to simulate even the correct sign of observed precipitation anomalies, such as the summer monsoon rainfall over the Indian region. Yet it is understood that precipitation plays a major role in climate change.

### Chapter 2. Feedback Factors and Radiative Forcing

- Scientific research suggests the model-derived temperature sensitivity of the earth accepted by the IPCC is too large. Corrected feedbacks in the climate system could reduce climate sensitivity to values that are an order of magnitude smaller.
- Scientists may have discovered a connection between cloud creation and sea surface temperature in the tropics that creates a “thermostat-like control” that automatically vents excess heat into space. If confirmed, this could totally compensate for the warming influence of all anthropogenic CO<sub>2</sub> emissions experienced to date, as well as all those that are anticipated to occur in the future.
- The IPCC dramatically underestimates the total cooling effect of aerosols. Studies have found their radiative effect is comparable to or larger than the temperature forcing caused by all the increase in greenhouse gas concentrations recorded since pre-industrial times.
- Higher temperatures are known to increase emissions of dimethyl sulfide (DMS) from the world’s oceans, which increases the albedo of marine stratus clouds, which has a cooling effect.
- Iodocompounds—created by marine algae—function as cloud condensation nuclei, which help create new clouds that reflect more incoming solar radiation back to space and thereby cool the planet.
- As the air’s CO<sub>2</sub> content—and possibly its temperature—continues to rise, plants emit greater amounts of carbonyl sulfide gas, which eventually makes it way into the stratosphere, where it is transformed into solar-radiation-reflecting sulfate aerosol particles, which have a cooling effect.
- As CO<sub>2</sub> enrichment enhances biological growth, atmospheric levels of biosols rise, many of which

function as cloud condensation nuclei. Increased cloudiness diffuses light, which stimulates plant growth and transfers more fixed carbon into plant and soil storage reservoirs.

- Since agriculture accounts for almost half of nitrous oxide (N<sub>2</sub>O) emissions in some countries, there is concern that enhanced plant growth due to CO<sub>2</sub> enrichment might increase the amount and warming effect of this greenhouse gas. But field research shows that N<sub>2</sub>O emissions fall as CO<sub>2</sub> concentrations and temperatures rise, indicating this is actually another negative climate feedback.
- Methane (CH<sub>4</sub>) is a potent greenhouse gas. An enhanced CO<sub>2</sub> environment has been shown to have “neither positive nor negative consequences” on atmospheric methane concentrations. Higher temperatures have been shown to result in reduced methane release from peatbeds. Methane emissions from cattle have been reduced considerably by altering diet, immunization, and genetic selection.

### Chapter 3. Observations: Temperature Records

- The IPCC claims to find evidence in temperature records that the warming of the twentieth century was “unprecedented” and more rapid than during any previous period in the past 1,300 years. But the evidence it cites, including the “hockey-stick” representation of earth’s temperature record by Mann *et al.*, has been discredited and contradicted by many independent scholars.
- A corrected temperature record shows temperatures around the world were warmer during the Medieval Warm Period of approximately 1,000 years ago than they are today, and have averaged 2-3°F warmer than today’s temperatures over the past 10,000 years.
- Evidence of a global Medieval Warm Period is extensive and irrefutable. Scientists working with a variety of independent methodologies have found it in proxy records from Africa, Antarctica, the Arctic, Asia, Europe, North America, and South America.
- The IPCC cites as evidence of modern global warming data from surface-based recording stations yielding a 1905-2005 temperature increase of 0.74°C +/- 0.18°C. But this temperature record is known to be positively

biased by insufficient corrections for the non-greenhouse-gas-induced urban heat island (UHI) effect. It may be impossible to make proper corrections for this deficiency, as the UHI of even small towns dwarfs any concomitant augmented greenhouse effect that may be present.

- Highly accurate satellite data, adjusted for orbit drift and other factors, show a much more modest warming trend in the last two decades of the twentieth century and a dramatic decline in the warming trend in the first decade of the twenty-first century.
- The “fingerprint” or pattern of warming observed in the twentieth century differs from the pattern predicted by global climate models designed to simulate CO<sub>2</sub>-induced global warming. Evidence reported by the U.S. Climate Change Science Program (CCSP) is unequivocal: All greenhouse models show an increasing warming trend with altitude in the tropics, peaking around 10 km at roughly twice the surface value. However, the temperature data from balloons give the opposite result: no increasing warming, but rather a slight cooling with altitude.
- Temperature records in Greenland and other Arctic areas reveal that temperatures reached a maximum around 1930 and have decreased in recent decades. Longer-term studies depict oscillatory cooling since the Climatic Optimum of the mid-Holocene (~9000-5000 years BP), when it was perhaps 2.5° C warmer than it is now.
- The average temperature history of Antarctica provides no evidence of twentieth century warming. While the Antarctic peninsula shows recent warming, several research teams have documented a cooling trend for the interior of the continent since the 1970s.

### **Chapter 4. Observations: Glaciers, Sea Ice, Precipitation, and Sea Level**

- Glaciers around the world are continuously advancing and retreating, with a general pattern of retreat since the end of the Little Ice Age. There is no evidence of a increased rate of melting overall since CO<sub>2</sub> levels rose above their pre-industrial levels, suggesting CO<sub>2</sub> is not responsible for glaciers melting.

- Sea ice area and extent have continued to increase around Antarctica over the past few decades. Evidence shows that much of the reported thinning of Arctic sea ice that occurred in the 1990s was a natural consequence of changes in ice dynamics caused by an atmospheric regime shift, of which there have been several in decades past and will likely be several in the decades to come, totally irrespective of past or future changes in the air’s CO<sub>2</sub> content. The Arctic appears to have recovered from its 2007 decline.
- Global studies of precipitation trends show no net increase and no consistent trend with CO<sub>2</sub>, contradicting climate model predictions that warming should cause increased precipitation. Research on Africa, the Arctic, Asia, Europe, and North and South America all find no evidence of a significant impact on precipitation that could be attributed to anthropogenic global warming.
- The cumulative discharge of the world’s rivers remained statistically unchanged between 1951 and 2000, a finding that contradicts computer forecasts that a warmer world would cause large changes in global streamflow characteristics. Droughts and floods have been found to be less frequent and severe during the Current Warm Period than during past periods when temperatures were even higher than they are today.
- The results of several research studies argue strongly against claims that CO<sub>2</sub>-induced global warming would cause catastrophic disintegration of the Greenland and Antarctic Ice Sheets. In fact, in the case of Antarctica, they suggest just the opposite—i.e., that CO<sub>2</sub>-induced global warming would tend to buffer the world against such an outcome.
- The mean rate of global sea level rise has not accelerated over the recent past. The determinants of sea level are poorly understood due to considerable uncertainty associated with a number of basic parameters that are related to the water balance of the world’s oceans and the meltwater contribution of Greenland and Antarctica. Until these uncertainties are satisfactorily resolved, we cannot be confident that short-lived changes in global temperature produce corresponding changes in sea level.

## Chapter 5. Solar Variability and Climate Cycles

- The IPCC claims the radiative forcing due to changes in the solar output since 1750 is  $+0.12 \text{ Wm}^{-2}$ , an order of magnitude smaller than its estimated net anthropogenic forcing of  $+1.66 \text{ Wm}^{-2}$ . A large body of research suggests that the IPCC has got it backwards, that it is the sun's influence that is responsible for the lion's share of climate change during the past century and beyond.
- The total energy output of the sun changes by only 0.1 percent during the course of the solar cycle, although larger changes may be possible over periods of centuries. On the other hand, the ultraviolet radiation from the sun can change by several percent over the solar cycle – as indeed noted by observing changes in stratospheric ozone. The largest changes, however, occur in the intensity of the solar wind and interplanetary magnetic field.
- Reconstructions of ancient climates reveal a close correlation between solar magnetic activity and solar irradiance (or brightness), on the one hand, and temperatures on earth, on the other. Those correlations are much closer than the relationship between carbon dioxide and temperature.
- Cosmic rays could provide the mechanism by which changes in solar activity affect climate. During periods of greater solar magnetic activity, greater shielding of the earth occurs, resulting in less cosmic rays penetrating to the lower atmosphere, resulting in fewer cloud condensation nuclei being produced, resulting in fewer and less reflective low-level clouds occurring, which leads to more solar radiation being absorbed by the surface of the earth, resulting (finally) in increasing near-surface air temperatures and global warming.
- Strong correlations between solar variability and precipitation, droughts, floods, and monsoons have all been documented in locations around the world. Once again, these correlations are much stronger than any relationship between these weather phenomena and  $\text{CO}_2$ .
- The role of solar activity in causing climate change is so complex that most theories of solar forcing must be considered to be as yet unproven. But it would also be appropriate for climate scientists to admit the same about the role of

rising atmospheric  $\text{CO}_2$  concentrations in driving recent global warming.

## Chapter 6. Observations: Extreme Weather

- The IPCC predicts that a warmer planet will lead to more extreme weather, characterized by more frequent and severe episodes of drought, flooding, cyclones, precipitation variability, storms, snow, storm surges, temperature variability, and wildfires. But has the last century – during which the IPCC claims the world experienced more rapid warming than any time in the past two millennia – experienced significant trends in any of these extreme weather events?
- Droughts have not become more extreme or erratic in response to global warming. Real-world evidence from Africa, Asia, and other continents find no trend toward more frequent or more severe droughts. In most cases, the worst droughts in recorded meteorological history were much milder than droughts that occurred periodically during much colder times.
- Floods were more frequent and more severe during the Little Ice Age than they have been during the Current Warm Period. Flooding in Asia, Europe, and North America has tended to be less frequent and less severe during the twentieth century.
- The IPCC says “it is likely that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increase of tropical sea surface temperatures.” But despite the supposedly “unprecedented” warming of the twentieth century, there has been no increase in the intensity or frequency of tropical cyclones globally or in any of the specific oceans.
- A number of real-world observations demonstrate that El Niño-Southern Oscillation (ENSO) conditions during the latter part of the twentieth century were not unprecedented in terms of their frequency or magnitude. Long-term records suggest that when the earth was significantly warmer than it is currently, ENSO events were substantially reduced or perhaps even absent.
- There is no support for the model-based projection that precipitation in a warming world becomes more variable and intense. In fact, some

observational data suggest just the opposite, and provide support for the proposition that precipitation responds more to cyclical variations in solar activity.

- As the earth has warmed over the past 150 years, during its recovery from the global chill of the Little Ice Age, there has been no significant increase in either the frequency or intensity of stormy weather.
- Between 1950 and 2002, during which time the air's CO<sub>2</sub> concentration rose by 20 percent, there was no net change in either the mean onset date or duration of snow cover for the continent of North America. There appears to have been a downward trend in blizzards.
- Storm surges have not increased in either frequency or magnitude as CO<sub>2</sub> concentrations in the atmosphere have risen. In the majority of cases investigated, they have tended to decrease.
- Air temperature variability almost always *decreases* when mean air temperature *rises*, be it in cases of temperature change over tens of thousands of years or over mere decades, or even between individual cooler and warmer years when different ENSO states are considered. The claim that global warming will lead to more extremes of climate and weather, including more extremes of temperature itself, is not supported by real-world data.
- Although one can readily identify specific parts of the planet that have experienced both significant increases and decreases in land area burned by wildfires over the last two to three decades of the twentieth century, for the globe as a whole there was no relationship between global warming and total area burned over this period.

### Chapter 7. Biological Effects of Carbon Dioxide Enhancement

- A 300-ppm increase in the air's CO<sub>2</sub> content typically raises the productivity of most herbaceous plants by about one-third; and this positive response occurs in plants that utilize all three of the major biochemical pathways (C<sub>3</sub>, C<sub>4</sub>, CAM) of photosynthesis. For woody plants, the response is even greater. The productivity benefits of CO<sub>2</sub> enrichment are also experienced by aquatic plants, including freshwater algae and

macrophytes, and marine microalgae and macroalgae.

- The amount of carbon plants gain per unit of water lost—or water-use efficiency—typically rises as the CO<sub>2</sub> content of the air rises, greatly increasing their ability to withstand drought. In addition, the CO<sub>2</sub>-induced percentage increase in plant biomass production is often greater under water-stressed conditions than it is when plants are well watered.
- Atmospheric CO<sub>2</sub> enrichment helps ameliorate the detrimental effects of several environmental stresses on plant growth and development, including high soil salinity, high air temperature, low light intensity and low levels of soil fertility. Elevated levels of CO<sub>2</sub> have additionally been demonstrated to reduce the severity of low temperature stress, oxidative stress, and the stress of herbivory. In fact, the percentage growth enhancement produced by an increase in the air's CO<sub>2</sub> concentration is often even greater under stressful and resource-limited conditions than it is when growing conditions are ideal.
- As the air's CO<sub>2</sub> content continues to rise, plants will likely exhibit enhanced rates of photosynthesis and biomass production that will not be diminished by any global warming that might occur concurrently. In fact, if the ambient air temperature rises, the growth-promoting effects of atmospheric CO<sub>2</sub> enrichment will likely also rise, becoming more and more robust.
- The ongoing rise in the air's CO<sub>2</sub> content likely will not favor the growth of weedy species over that of crops and native plants.
- The growth of plants is generally not only enhanced by CO<sub>2</sub>-induced increases in net photosynthesis during the light period of the day, it is also enhanced by CO<sub>2</sub>-induced decreases in respiration during the dark period.
- The ongoing rise in the air's CO<sub>2</sub> content, as well as any degree of warming that might possibly accompany it, will not materially alter the rate of decomposition of the world's soil organic matter and will probably enhance biological carbon sequestration. Continued increases in the air's CO<sub>2</sub> concentration and temperature will not result in massive losses of carbon from earth's peatlands. To the contrary, these environmental

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changes—if they persist—would likely work together to enhance carbon capture.

- Other biological effects of CO<sub>2</sub> enhancement include enhanced plant nitrogen-use efficiency, longer residence time of carbon in the soil, and increased populations of earthworms and soil nematodes.
- The aerial fertilization effect of the ongoing rise in the air's CO<sub>2</sub> concentration (which greatly enhances vegetative productivity) and its anti-transpiration effect (which enhances plant water-use efficiency and enables plants to grow in areas that were once too dry for them) are stimulating plant growth across the globe in places that previously were too dry or otherwise unfavorable for plant growth, leading to a significant greening of the Earth.
- Elevated CO<sub>2</sub> reduces, and nearly always overrides, the negative effects of ozone pollution on plant photosynthesis, growth and yield. It also reduces atmospheric concentrations of isoprene, a highly reactive non-methane hydrocarbon that is emitted in copious quantities by vegetation and is responsible for the production of vast amounts of tropospheric ozone.

### Chapter 8. Species Extinction

- The IPCC claims “new evidence suggests that climate-driven extinctions and range retractions are already widespread” and the “projected impacts on biodiversity are significant and of key relevance, since global losses in biodiversity are irreversible (very high confidence).” These claims are not supported by scientific research.
- The world's species have proven to be remarkably resilient to climate change. Most wild species are at least one million years old, which means they have all been through hundreds of climate cycles involving temperature changes on par with or greater than those experienced in the twentieth century.
- The four known causes of extinctions are huge asteroids striking the planet, human hunting, human agriculture, and the introduction of alien species (e.g., lamprey eels in the Great Lakes and pigs in Hawaii). None of these causes are connected with either global temperatures or atmospheric CO<sub>2</sub> concentrations.

- Real-world data collected by the United Nations Environmental Program (UNEP) show the rate of extinctions at the end of the twentieth century was the lowest since the sixteenth century—despite 150 years of rising world temperatures, growing populations, and industrialization. Many, and probably most, of the world's species benefited from rising temperatures in the twentieth century.
- As long as the atmosphere's CO<sub>2</sub> concentration rises in tandem with its temperature, most plants will not need to migrate toward cooler conditions, as their physiology will change in ways that make them better adapted to warmer conditions. Plants will likely spread poleward in latitude and upward in elevation at the cold-limited boundaries of their ranges, thanks to longer growing seasons and less frost, while their heat-limited boundaries will probably remain pretty much as they are now or shift only slightly.
- Land animals also tend to migrate poleward and upward, to areas where cold temperatures prevented them from going in the past. They follow earth's plants, while the heat-limited boundaries of their ranges are often little affected, allowing them to also expand their ranges.
- The persistence of coral reefs through geologic time—when temperatures were as much as 10°-15°C warmer than at present, and atmospheric CO<sub>2</sub> concentrations were two to seven times higher than they are currently—provides substantive evidence that these marine entities can successfully adapt to a dramatically changing global environment.
- The 18- to 59-cm warming-induced sea-level rise that is predicted for the coming century by the IPCC falls well within the range (2 to 6 mm per year) of typical coral vertical extension rates, which exhibited a modal value of 7 to 8 mm per year during the Holocene and can be more than double that value in certain branching corals. Rising sea levels should therefore present no difficulties for coral reefs.
- The rising CO<sub>2</sub> content of the atmosphere may induce very small changes in the well-buffered ocean chemistry (pH) that could slightly reduce coral calcification rates; but potential positive effects of hydrospheric CO<sub>2</sub> enrichment may more than compensate for this modest negative phenomenon. Real-world observations indicate

that elevated CO<sub>2</sub> and elevated temperatures are having a positive effect on most corals.

- Polar bears have survived changes in climate that exceed those that occurred during the twentieth century or are forecast by the IPCC's computer models.
- Most populations of polar bears are growing, not shrinking, and the biggest influence on polar bear populations is not temperature but hunting by humans, which historically has taken a large toll on polar bear populations.
- Forecasts of dwindling polar bear populations assume trends in sea ice and temperature that are counterfactual, rely on unvalidated computer climate models that are known to be unreliable, and violate most of the principles of scientific forecasting.

### Chapter 9. Human Health Effects

- The IPCC alleges that “climate change currently contributes to the global burden of disease and premature deaths” and will “increase malnutrition and consequent disorders.” In fact, the overwhelming weight of evidence shows that higher temperatures and rising CO<sub>2</sub> levels have played an indispensable role in making it possible to feed a growing global population without encroaching on natural ecosystems.
- Global warming reduces the incidence of cardiovascular disease related to low temperatures and wintry weather by a much greater degree than it increases the incidence of cardiovascular disease associated with high temperatures and summer heat waves.
- Mortality due to respiratory diseases decrease as temperatures rise and as temperature variability declines.
- Claims that malaria and tick-borne diseases are spreading or will spread across the globe as a result of CO<sub>2</sub>-induced warming are not supported in the scientific literature.
- Total heat-related mortality rates have been shown to be lower in warmer climates and to be unaffected by rising temperatures during the twentieth century.
- The historical increase in the air's CO<sub>2</sub> content has improved human nutrition by raising crop

yields during the past 150 years on the order of 70 percent for wheat, 28 percent for cereals, 33 percent for fruits and melons, 62 percent for legumes, 67 percent for root and tuber crops, and 51 percent for vegetables.

- The quality of plant food in the CO<sub>2</sub>-enriched world of the future, in terms of its protein and antioxidant (vitamin) contents, will be no lower and probably will be higher than in the past.
- There is evidence that some medicinal substances in plants will be present in significantly greater concentrations, and certainly in greater absolute amounts, than they are currently.
- The historical increase of the air's CO<sub>2</sub> content has probably helped lengthen human lifespans since the advent of the Industrial Revolution, and its continued upward trend will likely provide more of the same benefit.
- Higher levels of CO<sub>2</sub> in the air help to advance all three parts of a strategy to resolve the tension between the need to feed a growing population and the desire to preserve natural ecosystems: increasing crop yield per unit of land area, increasing crop yield per unit of nutrients applied, and increasing crop yield per unit of water used.
- Biofuels for transportation (chiefly ethanol, biodiesel, and methanol) are being used in growing quantities in the belief that they provide environmental benefits. In fact, those benefits are very dubious. By some measures, “the net effect of biofuels production ... is to increase CO<sub>2</sub> emissions for decades or centuries relative to the emissions caused by fossil fuel use.”
- Biofuels compete with livestock growers and food processors for corn, soybeans, and other feedstocks, leading to higher food prices. Rising food prices in 2008 led to food riots in several developing countries. The production of biofuels also consumes enormous quantities of water compared with the production of gasoline.
- There can be little doubt that ethanol mandates and subsidies have made both food and energy more, not less, expensive and therefore less available to a growing population. The extensive damage to natural ecosystems already caused by this poor policy decision, and the much greater destruction yet to come, are a high price to pay for refusing to understand and utilize the true science of climate change.